National Hydraulic Research Institute of Malaysia (NAHRIM)
Ministry of Water, Land and Natural Resources (KATS)



GUIDELINES

FOR INTEGRATED LAKE BASIN

MANAGEMENT PLAN

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National Hydraulic Research Institute of Malaysia (NAHRIM)
Ministry of Water, Land and Natural Resources (KATS)

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Foreword

Integrated Lake Management has been adopted in the National Water Resources Policies (NWRP), that was introduced in 2012, as an approach to manage lake basin sustainably. In line with this policy, the Strategies for the Sustainable Development and Management of Lakes and Reservoirs in Malaysia was tabled by National Hydraulic Research Institute of Malaysia (NAHRIM) with the support of the Ministry of Natural Resources and Environment Malaysia (NRE) and endorsed by the National Water Resources Council in 2012. Both NWRP and Strategic Plan promote basin management approach in managing inland water bodies or better known as Integrated Lake Basin Management (ILBM).

Since collaboration between NAHRIM Academy of Sciences Malaysia (ASM) in 2004 to evaluate the status of lake eutrophication, NAHRIM has been participating in various lake basin research and management. This publication is an on-going effort by NAHRIM to promote ILBM adoption in managing lake basin throughout the country by the various departments and agencies. The development of this guideline was carried out by NAHRIM in 2017 through the involvement of various experts and stakeholders in several series of multi-stakeholder consultations and workshops. The Guideline for Integrated Lake Basin Management Plan report has also been reviewed and supported by the International Lake Environment Committee (ILEC), Japan.

This research publication is an important output to support sustainable lake management. The work provides a document that aid lake owners, operators or managers in developing a management plan for their lakes. It can also be used by consultants and researchers to develop a baseline information of the ecosystem health of the studied lakes which can be used by managers and policy makers in monitoring the lakes to support the ecosystem services of the lakes.



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Preface

1. In line with national initiatives on lake research, this Guideline document was prepared to assist lake owners or lake managers in developing a management plan for their lakes.
2. This Guidelines simplifies the process of preparing a lake management plan, thus encouraging awareness regarding the management of lakes and, wetlands.
3. A basin management plan for a lake helps the owners and managers to determine a clear direction for their lakes. The tools available in this guideline assists in the preparation of management programs needed to gain the approval of relevant parties as well as raise project funds.
4. Hence, it is very important that the Guidelines should be used by all whose activities (e.g. Researchers) may benefit from or impact upon the use of lakes. The agencies can adopt the guidelines as a whole. These guidelines play a crucial role in coordinating the action programs of other sectors beyond "environmental" or "water" issues.
5. The intended readership, however, includes all government departments, ministry officials and agencies in the federal, state and district levels that act as authorities or custodians of the lakes. The guidelines also target managers of individual wetlands and lake areas, public or private properties, as some of its aspects relate specifically to site management.
6. It is important to have Integrated Lake Basin Management (ILBM) Plans in Malaysia that can be used as management and financial planning to improve the management and governance of lakes.
7. It is envisaged that this Guidelines is a useful reference for lake owners or managers in developing their own Lake Management Plans towards sustainable development and management.

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Format for the guidelines

1. The Guidelines for Integrated Lake Basin Management Plan is a detachable, stand-alone document for easy reference to users.
2. The Guidelines is a standard supervisory manuscript and an easy-to-use document for lake managers or lake custodians.
3. Volume 1 consists of 10 sections. Section I is the introduction. Sections II to V comprise of techniques involved in preparing the Chapters of a lake management plan (LMP). Other sections refer to topics, which further assist in the establishment of the plan.
4. The basis of preparing the lake management plan is summarized in illustrative diagrams for clear guidance. Important considerations that need to be included or avoided are clearly indicated.
5. The documentation of the processes involved in developing the Guidelines can be found in a separate report titled The Process of Developing the Guidelines for Integrated Lake Basin Management Plan.

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Executive Summary

Integrated lake basin management (ILBM) is an approach that have been approved in the National Water Resources Policy concerning lake management in Malaysia. ILBM is a way of thinking that assists lake basin managers and stakeholders in achieving sustainable management of lakes and their basins. It acknowledges that lakes have a great variety of resource values, which require special management aims in order to ensure their sustainable development and use. Good basin management of a lake, and continuous improvement of lake basin governance that integrates institution, policy, participation, science, technology and funding, can be realized through a proper ILBM plan.

The new ecohydrology approach in managing surface runoff (especially in urban areas) considers the functional interrelations between hydrology, aquatic ecosystem processes and their biota. It employs ecological processes as mechanism to meet targeted management goals including increasing natural nutrient retention ability to control excessive algal blooms. Incorporating ecosystem processes from ecohydrology principles into practical measures or programmes of a lake management plan will cover all the necessary concerns for a healthy ecosystem.

Lake management is a very challenging field as it requires understanding the lake basin processes and stakeholder management, which is currently not within the scope of the mainstream agencies. A well-defined process of developing a lake or wetland management system in this guideline will help in enhancing thes important ecosystems.

Why lakes need to be managed

People's actions within the lake, along its shorelines and within its basins (or watershed or catchment) will affect the characteristics of the lake. Even upstream areas can affect the lake through the water flow, which in turn, channels pollutants, sediments and nutrients into the lake.

With growing populations within a lake catchment and increasing demand for recreational use, lakes can suffer from small and large cumulative impacts. Insufficient details of lake conditions will also cause the inability to provide a healthy baseline information for subsequent monitoring. This will adversely affect the detection of changes in ecological character and hydrological attributes of the lake.

The degradation process may result in the failure of natural hydrological functions, biology and natural ecology of the lake. The damage can be caused by the inappropriate use of the site or unsustainable external activities surrounding the lake. The absence of integrated management plans for lakes, reservoir or wetlands has been identified as one of the major issues in the poor state of our ecosystem.

If we want to maintain the long-term health and viability of lakes, these have to be systematically managed over time. Lakes need help in order to maintain their beneficial uses (as what is desired in the first place). Thus, long-term lake management plans will help protect natural resource systems, including the water quality of the lake and the associated fish, vegetative and wildlife communities (in the case of a forested catchment).

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What is a Lake Management Plan?

A 'lake management plan' is a unique scope of work (as in any other management sense), which comprises of a series of working lists that will be implemented by a group of people to achieve certain decided outcomes. The work comprises of broad arrays of interrelated topics, disciplines and applications.

Firstly, the purpose of managing the lake should be taken into perspective. A lake requires management because of one of the following reasons:

a. Rehabilitation and/or restoration;

b. Enhancement of habitat or water quality; or

c. Overall protection of the lake.

To ensure that our use of land and natural resources is sustainable for present and future generations, we need to plan a proper management for our water body (such as lakes, wetlands and rivers). Lack of planning can result in poor decision-making and decreasing sustainability of natural resources.

Lake management plans help protect natural resource systems, including the water quality of the lake and the associated fish, and wildlife.

Developing the Lake Management Guidelines

Preparing an effective lake management plan involves activities that include identifying problems causing various lake symptoms; identifying and evaluating options for remediation; and planning and implementing that remediation. The management plan itself should be a technical document, which encourages dynamic processes. It should comprise of four Chapters as in the blocks shown in Figure X.1.

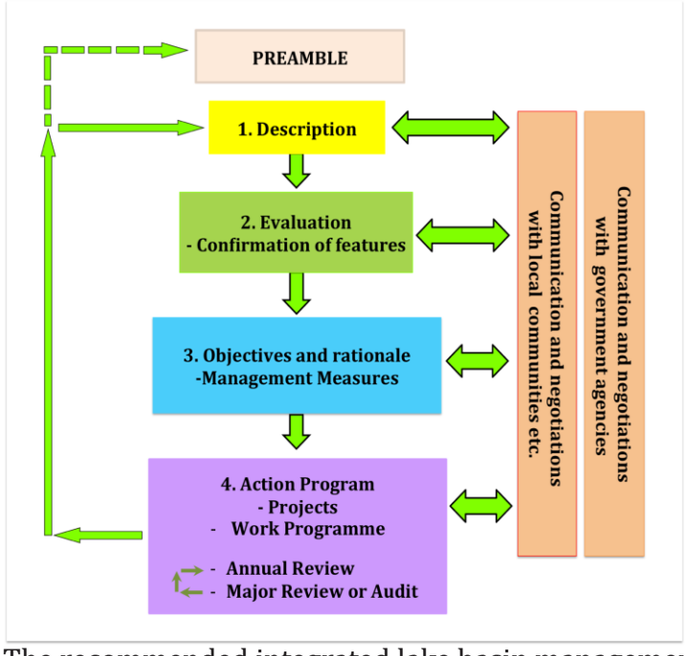


Figure X.1: The recommended integrated lake basin management plan scheme (ILBM plan scheme). Consisting of 4 blocks or 4 Chapters.

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It will cover the lake, and its watershed or catchment studies. It may involve determining and enhancing the lake's economic potential by performing economic, scientific and other actions related to all types of social and political stakeholders that are interrelated with the water body.

Briefly, the chapters in a 'lake management plan' are on Description, Evaluation, Objectives and Action Programs. The blocks show the need for consultation with the relevant government agencies and the communities as represented by the two blocks on the right-hand side. To keep the dynamic process of the management plan, it is recommended for the cyclic processes to be carried out to further improve the governance of the lake management.

Lake management plan processes on focus areas

This guideline is prepared for the development of a lake management plan that is based on local lake conditions and the present management situation of Malaysian lake scenarios. It is expected that lakes and its catchments are of different conditions.

To ease implementation, it is recommended that managers should focus on certain common areas (areas or subjects that commonly occur in lake management). There are many focus areas in lake management depending on the usage and location of the lake. Examples of the focus areas, with each one of them consisting of various specific matters, are as follows:

a. Geological and Physiographical Features
   i. Access to lakes
   ii. Hydrological

b. Water characteristics
   i. Water quality
   ii. Eutrophication

c. Ecological Attractiveness
   i. Nature conservation features
   ii. Economic value of ES

d. Stakeholders management (described in Socio-economic profile)
   i. Agencies involvement
   ii. Communities Participation

e. Governance
   i. Lake uses and its resource development facilities
   ii. Strengthening the pillars

Each of the focus area should go through the integrated lake basin management planning. Description, Evaluation, Objectives and finally the Action Program (referred to as in).

Thus, each of the focus areas has a range of important topics of interest that will be described in Chapter 1, and further evaluated in Chapter 2.

In the objectives and action program (Chapter 3 and Chapter 4), the numbering may not be in sequence, as the focus areas' subject matters will be formulated together in accordance to their level of relevance to the management (some subjects may be dropped after the evaluation process).

Focus areas may be different for different lakes and additional subjects may need to be added whenever necessary.

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The scope covered by this document

There are ten (10) sections of this guideline. A lake management plan should comprise of four chapters namely Description (Chapter 1), Evaluation (Chapter 2), Objectives (Chapter 3) and Action Programs (Chapter 4).

Section I is the introduction, which outlines the matrix process of developing the plan. This section focuses on how the management plan document is configured. It facilitates the understanding of and ease of use for developers of lake management plan.

In Section II through to Section V, the guide on writing Chapter 1, Chapter 2, Chapter 3 and Chapter 4 of the ILBM Plan is elaborated.

A template is included in Chapter 1 and Chapter 2, which can immediately be used by lake managers to fill in information needed and to prepare for the whole management plan.

Since Chapter 3 and Chapter 4 will deal with recommendations from the evaluation, the numbering system may not be continuous. Instead, the items will be mentioned in a more simplified format or table form.

Sections VI through Section X are pertinent subjects involved in developing the lake management plan. They are:

Section VI : Stakeholders Management
Section VII : Ecosystem Services Economic Value Assessment
Section VIII : Measures and Monitoring
Section IX : Management Implementation Programs
Section X : The Cyclic Process

Formation of the management plan

The overall picture of the guidelines is easily understood from the illustrative Figure X.1. However, the implementation program (of the management plan) usually requires more time and also additional expert inputs.

Nevertheless, the guidelines have simplified the process into a workable situation to produce a practical lake management plan.

Every action of the management planning process that has been decided will be easily translated into the daily routine of maintenance of the lake. Finally, the management program can be translated into the daily routine works contracts, easily managed by the lake managers, to benefit the lake owners and the stakeholders as a whole.

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Acronyms and Abbreviation

ASM	Academy of Sciences, Malaysia (Akademi Sains Malaysia)
BAKAJ	Badan Kawal Selia Air Johor
BKSA	Badan Kawal Selia Air
BMP	Best Management Practices
CBO	Community-Based Organization
CS	Cultural Services
CVM	Contingent Valuation Method
DBKL	Dewan Bandaraya Kuala Lumpur (Kuala Lumpur City
DID	Department of Irrigation and Drainage (see JPS)
DOE	Department of Environment (see JAS)
DVM	Direct Value Method
EA	Economic Assessment
ERCE	European Regional Center for Ecohydrology (Lodz, Poland –UNESCO)
ES	Ecosystem Services
ESFP	Ecosystem Service Factual Profile
ESPP	Ecosystem Service Perceptional Profile
ESSRA	Ecosystem Services Shared Risk Assessment
ESSVA	Ecosystem Services Shared Value Assessment
FGD	Focus Group Discussion
GOV	Government
GPT	Gross Pollutant Trap
ILBM	Integrated Lake Basin Management
ILBMP	Integrated Lake Basin Management Plan
ILEC	International Lake and Environment Committee (Japan)
IRBM	Integrated River Basin Management
IWRM	Integrated Water Resources Management
JAKOA	Jabatan Kemajuan Orang Asli *(Orang Asli Development Department)*
JAS	Jabatan Alam Sekitar (see DOE)

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JPBD	Jabatan Perancangan Bandar dan Desa *(Federal Department of Town and Country Planning)*
JPS	Jabatan Pengairan dan Saliran (see DID)
LMP	Lake Management Plan
m	meter
MEA	Millenium Ecosystem Assessment
mg/L	milligrams per liter
MLD	Million Litres per Day
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPCA	Minnesota Pollution Control Agency
MSAN	Majlis Sumber Air Negara (National Water Resource Council)
NAHRIM	National Hydraulic Research Institute of Malaysia
NALMS	North American Lakes Managers Society
NGO	Non-Government Organization
NLWQS	National Lake Water Quality Standards (NAHRIM, Malaysia)
NO_2	Nitrogen Dioxide
NO_3	Nitrate
OU	Operable Unit
PBT	Pihak Berkuasa Tempatan (Local Authorities)
PDCA	Plan, Do, Check, Action
PDRM	Polis Diraja Malaysia (Royal Malaysian Polics)
PERHILITAN	Jabatan Perlindungan Hidupan Liar dan Taman Negara (Department of Wildlife and National Parks)
PLKN	Program Latihan Khidmat Negara (National Service Training Programme)
PLW	Putrajaya Lake and Wetland
POA	Persatuan Orang Asli (Orang Asli Assosication)
PPj	Perbadanan Putrajaya
PPTC	Pusat Penyelidikan Tasik Chini (Tasik Chini Research Center)
PS	Provisional Services
PTG	Pejabat Tanah dan Galian (Land and Mines Office)
R&D	Research and Development
RS	Regulating Services

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SAJ	Syarikat Air Johor (Johor Water Company)
SEB	Sarawak Energy Berhad
SIP	Strategic Implementation Plan
SO2	Sulfur Dioxide
SOP	Standard Operating Procedure
SPAN	Suruhanjaya Perkhidmatan Air Negara (National Water Services Commission)
SS	Supporting Services
SWOT	Strength, Weakness, Opportunities, Threat (analysis)
TCM	Total Cost Method
TEEB	The Economics of Ecosystems and Biodiversity
TMDL	Total Maximum Daily Load
TNB	Tenaga Nasional Berhad
TN	Total nitrogen
TP	Total Phosphorus
TOURISM	Ministry of Tourism
Tribe	Coeur d'Alene Tribe
TSS	Total Suspended Sediment
TWAP	Trans boundaries Waters Assessment Programme (ILEC and UNEP)
UNDP	United Nation Development Program
UPEN	Unit Perancang Ekonomi Negeri (State Economic Planning Unit)
USDA	U.S. Department of Agriculture
USGS	United States Geological Survey
WQI	Water Quality Index
WQS	Water Quality Standards
WWTP	Wastewater Treatment Plant

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Glossary

Algae	Small aquatic plants lacking stems, roots, or leaves that occur as single cells, colonies, or filaments.
Basin	See watershed
Beneficial use	Any of the various uses that may be made of water, including, but not limited to, domestic water supplies, fish spawning, recreation in and on the water, wildlife habitat, ceremonial, spiritual, and aesthetics.
Benthic flux	The rate that dissolved chemicals flow out of or into the bottom of aquatic systems. More specifically, benthic flux (sometimes referred to as internal recycling) represents the transport of dissolved chemical species across the solid-liquid interface at the bottom of aquatic systems. The flux of solutes can be either positive (into the water column out of the sediment) or negative (out of the water column into the sediment) and can vary over multiple temporal and spatial scales.
Best Management Practices (BMPs)	Accepted methods for controlling nonpoint source pollution (see below). BMPs may include one or more physical, structural, and/or managerial conservation practices that reduce or prevent pollution from entering a water body.
Bioaccumulation	The process by which a compound from the environment is taken up by and accumulated in the tissues of an aquatic organism, both from water sediments and through food.
Bio- magnification	The increase in concentration of a substance that occurs in a food chain as a consequence of food chain energetics or low (or non-existent) rate of excretion/degradation of the substance.
Catchment	*See watershed*
Chlorophyll a	The dominant green, photosynthetic pigment in plants that is one measure of aquatic plant abundance and biomass.
Designated use	Water uses identified in water quality standards that must be achieved and maintained as required under the Clean Water Act.
Discharge	In the simplest form, discharge means an outflow. The use of this term is not restricted as to a watercourse or location and it can be used to describe the flow of water from a pipe, channel, or drainage basin. Other words related to discharge are runoff, flow, and yield.
Dissolved Oxygen (DO)	The oxygen dissolved in water.
Epilimnion	The uppermost layer in a thermally- stratified lake, occurring above the deeper hypolimnion (see also stratification). The epilimnion is warmer and typically has a higher pH level and higher dissolved oxygen content than the hypolimnion. Being exposed at the surface, it typically becomes turbulently mixed as a result of surface wind-mixing. It is also free to exchange dissolved gases (e.g., oxygen and carbon dioxide) with the atmosphere.

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Erosion	The wearing away of the landscape by water, wind, ice, or gravity.
Euphotic zone	Measured as the water depth where photosynthetically-active radiation is 1% of the light incident on the surface. The euphotic zone is the theoretical upper layer that has sufficient light to support viable photosynthetic activity (plant growth).
Eutrophic	This term generally refers to a fertile, biologically-productive body of water. It contrasts with oligotrophic and means literally, "nutrient rich".
Eutrophication	The natural process by which lakes and ponds become enriched with dissolved nutrients and sediments, resulting in increased growth of algae or macrophytes, and reduced water clarity. Cultural eutrophication is a term for the acceleration of the eutrophication process caused by human land use activities.
Flow	The amount of water flowing in a stream or river channel at the time of measurement. Flow is usually expressed as cubic feet per second (cfs).
Geochemical	This term refers to alterations in the earth's crust as a result of chemical changes; focused on the distribution of the earth elements.
Heavy metal-laden sediment	Sediment contaminated with heavy metals such as lead, cadmium, arsenic, zinc, antimony, copper, and mercury.
Hypolimnion	The lowermost, non-circulating layer of cold water in a thermally-stratified lake, often deficient in oxygen.
Limnology	The branch of science pertaining to the study of the physical, chemical, biological, and ecological aspects of fresh water; the structure and dynamics of ponds, lakes, streams, and wetlands.
Littoral zone	That portion of a lake or pond extending from the shoreline into the lake to the greatest depth occupied by rooted aquatic plants.
Load	The amount of substance, usually nutrients or sediment, discharged past a point. Load is expressed in amount of weight per unit of time.
Macrophyte	The larger, non-microscopic aquatic plants (often rooted) found in shallow areas of lakes and streams.
Mesotrophic	This term generally refers to a moderately fertile, biologically productive body of water, that means literally, "moderate nutrients".
Metalimnion	Also called the thermocline, the metalimnion is the middle layer of a stratified lake where water temperature changes rapidly with depth (more than 1 °C per meter).
Mixing zone	The portion of water body adjacent to a point source discharge where mixing results in the dilution of the effluent with the receiving water.
Model	A simulation by descriptive, statistical, or other means of a process otherwise difficult or impossible to observe directly. Often, the term refers to results of computerized modelling.
National Lake	Sets of water quality parameters and criteria for the purpose of

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Water Quality Standard (NLWQS)	protecting human health (recreation) and ecosystem health.
Nitrogen	An essential nutrient for plants and animals. Atmospheric molecular nitrogen comprises 80% of the earth's atmosphere.
Nonpoint source pollution	A dispersed source of pollutants generated from a geographic area when pollutants are dissolved or suspended in runoff and then delivered into receiving waters. Nonpoint sources are without a discernible point or origin. They include, but are not limited to: atmospheric deposition; surface water runoff from agricultural lands, urban areas, or forest lands; and subsurface or underground sources.
Nutrient loading	The addition of nutrients, usually nitrogen or phosphorus, to a water body (often expressed in amount of weight per unit of time). The majority of nutrient loading in a lake usually comes from its tributaries.
Nutrients	Elements or compounds essential to life, including but not limited to, oxygen, carbon, nitrogen, and phosphorus. The term commonly refers to those elements in short supply, such as nitrogen and phosphorus, which can limit growth.
Oligotrophic	Generally, refers to a water body with low biological productivity, and is the opposite of eutrophic: literally meaning, "nutrient poor".
Phosphorus	See TP, Total Phosphorus
Phytoplankton	Free-floating microscopic (usually) aquatic plants consisting of single cells or filaments, or colonies. Some phytoplanktons are flagellated. For example, free-floating diatoms are phytoplankton.
Point source pollution	Pollutants discharged from any discernible, confined, and discrete conveyance, including, but not limited to: any pipe, ditch, channel, sewer, tunnel, conduit, well, discrete fissure, container, concentrated feeding operation, marine vessel or other floating craft.
Pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.
Primary production	The synthesis of organic compounds by green plants in the presence of essential elements (e.g., nitrogen, phosphorus) and light energy.
Receiving waters	Those waters, which receive pollutants from point or nonpoint sources.
Riparian area	The area of land next to a stream, river, or lake. Maintenance of natural plants in the riparian area serves to protect water temperature and acts like a filter for runoff.
Riverine	Relating to, formed by, or resembling a river.
Secchi Disk	Plain white, circular disk 30 cm (12 in) in diameter used to measure water transparency or turbidity in bodies of water. The disc is mounted on a pole or line, and lowered slowly down in the water.

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Sediment	Fragmented organic and inorganic material derived from the weathering of soil, alluvial, and rock materials removed by erosion and transported by water, wind, ice, and gravity.
Sewage	The water-carried human and animal waste from residences, buildings, industrial establishments, or other places, together with such infiltrated ground water and surface water as may be present.
Sink	A depression where materials are held (e.g. sediment, nutrients, metals).
Stormwater runoff	Surface water runoff is usually associated with urban development, carrying both natural and human-caused pollutants. Storm water runoff can be conveyed to lakes, ponds, and streams either through point or nonpoint sources.
Stratification	The vertical separation of lake waters into three distinct layers, typically occurring from early summer into fall, due to differences in water density from warm water to cold water. The three layers are the epilimnion, the top of the lake, metalimnion (or thermocline), the middle layer that may change depth throughout the day, and the hypolimnion, the bottom layer.
Suspended sediment	Solids, either organic or inorganic, that are found suspended in a body of water and can be removed by filtration. The origin of suspended matter may be human-made wastes or natural sources such as silt.
Thermocline	A layer within a body of water or air where the temperature changes rapidly with depth.
Total Maximum Daily Load (TMDL)	A TMDL is a water body's maximum load capacity for pollutants in which beneficial uses are still fully supported. A TMDL can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. A TMDL can be expressed by the following equation: TMDL (load capacity) = [load allocation (nonpoint source) + waste load allocation (point source) + margin of safety]. In common usage, a TMDL also refers to the written document that contains the statements of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.
Total phosphorus (TP)	An essential nutrient for plants and animals derived from inorganic phosphate rocks. Phosphorus (a limiting nutrient) often controls phytoplankton growth in lakes. Phosphorus is incorporated into human-made products such as fertilizers and detergents.
Trophic status	This term refers to the nourishment status of a water body, i.e., oligotrophic, mesotrophic, eutrophic.
Turbidity	Cloudiness caused by the presence of suspended solids, such as clay, silt, and microscopic organisms in the water. Turbidity is an indicator of water quality. It can also refer to a scientific measurement of the extent to which light passing through water is scattered by fine suspended materials.

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Unstratified	A lake condition of mixed waters, from surface to bottom, with uniform water temperatures throughout (i.e., a lake that is not stratified and lacks definite layers).
Wastewater	Treated or untreated sewage, industrial waste, or agricultural waste, along with such water as is present. Sometimes referred to as effluent.
Water quality	A term used to describe the chemical, physical, and biological characteristics of water with respect to its suitability for a beneficial use.
Watershed	An area of land that is drained by a distinct stream or river system and is separated from other similar systems by ridgetop boundaries. The waters of those lands that would drain to a lake (also referred to as the lake "basin" and "catchment").
Wetlands	Lands where water saturation of the soil for at least part of the year is the dominant factor determining the nature of soil development and the types of plant and animal communities living within the area and the surrounding environment. Other common names for wetlands are sloughs, ponds, swamps, marshes, bogs, and riparian areas.

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Section I: Introduction

A. Organization of the ILBMP Guidelines 2017

1. Section 1 of this guidelines provides details on how to formulate an Integrated Lake Basin Management (ILBM) Plan document.
2. Simplified, easily understood illustrations, sketches and diagrams are used in these guidelines.
3. Practical tips on how to prepare each component of the plan are indicated within these guidelines.
4. The guidelines provide description and details on how to draw up a beneficial, practical lake management plan document, which is based on the four main processes indicated by the blocks (chapters), as illustrated in **Figure 1.1.**

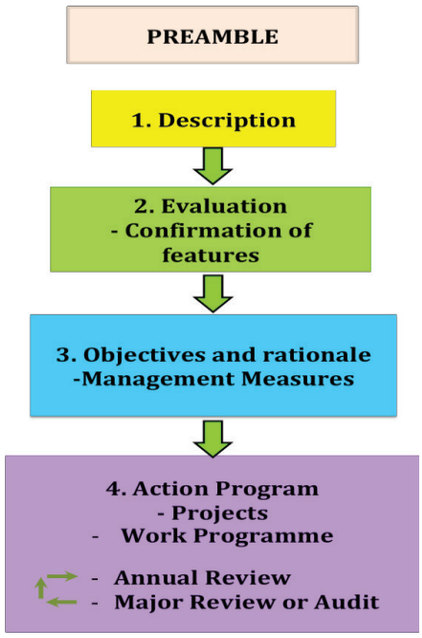


Figure 1.1: The main processes indicated by the blocks (Chapters) in the Integrated Lake Basin Management Plan Guidelines

5. The assembly of the ILBM Plan Guidelines is based on the four main processes of building up an ILBM plan i.e. Describing, Evaluating, Objectives and Action Program.
6. By following these processes in analysing and detailing the components of lake management issues, proper objectives and action plans can be easily identified. This will facilitate and simplify decisions regarding the work programs and review of the plan.

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B. The RAMSAR wetlands management plan

7. The configuration in this management plan approach is based on the New Guidelines for management planning for RAMSAR sites and other wetlands adopted by Resolution VIII.14 (2002) of the RAMSAR Convention.
8. In the RAMSAR guidelines, a simplified process of making a wetland management plan is structured as in Figure 1.2. The processes of the plan are divided into 4 main components or chapters 1.

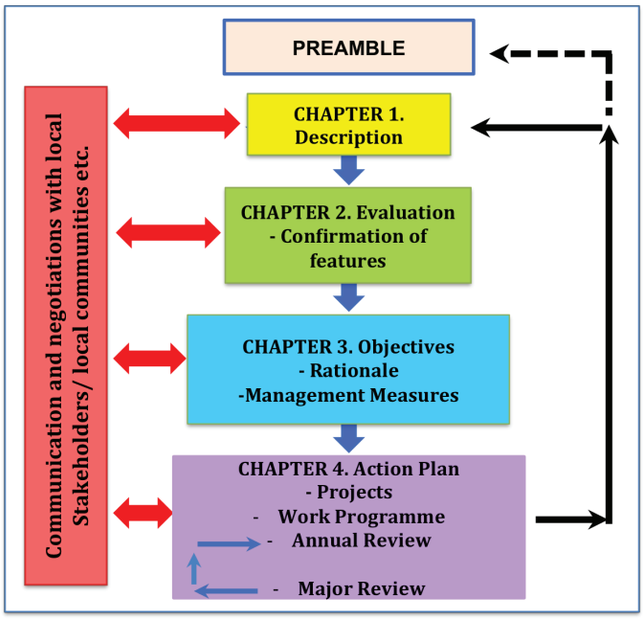


Figure 1.2: The structure and content of RAMSAR Wetlands Management Plan

9. The preamble is a simple statement on the management of the lake. It consists of forthright ideas of lake management relevant to stakeholders' precondition requirement.
10. The first chapter comprise of the description of the wetlands.
11. The second chapter elaborate on the evaluation of the ecosystem's matters (issues and problems) described in the description (Chapter 1).
12. The third chapter is about the process of identifying the operational objectives for the wetlands management. Chapter 3 progresses from Chapter 1's record of details and Chapter 2's evaluation of the ecosystem.
13. Management measures (and its corresponding monitoring exercise) is also identified and recommended in Chapter 3.

1 Ramsar handbooks for the wise use of wetlands

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14. Final chapter of a RAMSAR'S wetland management plan summarizes the actual implementation programs of the management measures and recommended actions schedules. The particulars are tabulated and summarized in Chapter 4, the Action Plans.

15. As comparison, in the ILECs' lake brief preparation, completing the lake brief is considered an almost completed lake management plan (LMP) with the exception of its 'action plan'.

16. Another important feature in the RAMSAR management plan guidelines is the looping or feedback system. The 'feedback' system is represented by the black arrow lines shown in Figure 1.2.

C. The configuration of the Malaysian ILBM Plan

17. Considering the systematic processes of preparing the wetlands management plan as promoted by RAMSAR, it is recommended that the same approach be applied for the preparation of ILBM Plan for the Malaysian lakes.

18. This can readily be appreciated by adapting the similar steps or blocks of processes as shown by the ILBM Plan Scheme in Figure 1.3. The figure shows similar blocks with additional blocks (for public participation) on the right hand side.

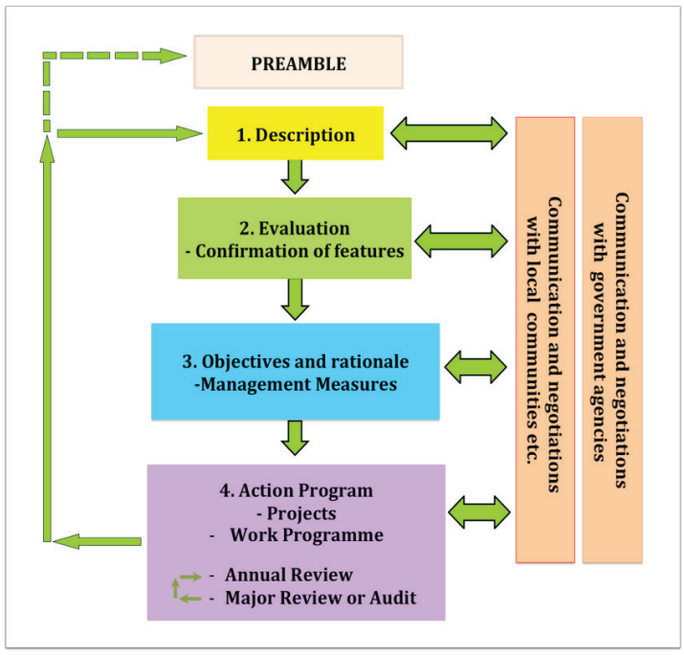


Figure 1.3: The recommended Integrated Lake Basin Management Plan Scheme (ILBM Plan Scheme)

19. Chapter 1 of the lake management plan comprise the description of the lake. With simplified list of sub topics related to the lake, details of the lake will be arranged in an orderly manner.

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20. Chapter 2, of the lake management plan is the evaluation process of the lake's issues and problems on matters as listed in the description (Chapter 1). All remarks or opinion on the lake matters will also be captured in this chapter. Comparison of the lake status with the expected lake condition is revealed in this chapter.
21. Annex A contains a list of various approaches of processing the assessment or evaluation of lake ecosystems.
22. Chapter 3 of the lake management plan is the process of identifying the operational objectives for the lake operation. This is possibly being determined from the evaluation process made in Chapter 2 with the details recorded in Chapter 1.
23. Recommendations for various 'management measures' required (in relation to the objectives) as well as the monitoring programs for its implementation are decided in Chapter 3.
24. 'Management measures' of the plan are actions required and articulated from the process of evaluation on management matters in Chapter 2. The owner or the lake manager of the lake should undertake its implementation. It is executed in the daily operation of the lake.
25. It is crucial to note that the process with the community's participation will be undertaken throughout the process of preparing the lake management plan (i.e. each process of description, evaluation, objective and action program which will include the communities' participation and government agencies' involvement).
26. The ILBM plan preparation emphasizing on the communication with the stakeholders (the communities' participation and government agencies' involvement) is shown as the orange blocks. The process is shown as the double- headed horizontal green arrows in Figure 1.3 (ILBM Plan Scheme).
27. Chapter 4 of the ILBM Plan is the Action Programs. This scope is appropriately changed from Action Plan (in the RAMSAR's management plan) to Action Programs. As we are preparing a plan, the action program will be one of the products within the plan.
28. Another important matter in Chapter 4 is the looping or feedback system, where all information taken (including the experience) during the management process will be re-used (re-accessed) for the next round of management process. This can be seen as the green arrow lines shown at the left hand side of Figure 1.3.
29. The reviewing on the monitoring data of the management measures duration and the level of authorities of the reviewing team is also being recommended within this part of the process. This is known as the cyclic process of the management plan.

D. Lake management plan processes on focus areas[2]

30. This guideline aims to assist in the development of a lake management plan that is based on local site conditions. It is expected that all lakes and its catchments be in different conditions.

[2] Minnesota Interagency Lakes Coordinating Committee 1996

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31. To streamline the approach of processing many different aspects of the delicate lakes management matters, focus areas are introduced. The main intention is to avoid common occurring issues from being left out of the management plan. There are many focus areas in lake management depending on the usage and location of the lake.

32. Examples of the focus areas, with each consisting of various specific matters, are as follows:

    a. Geological and Physiographical Features
        i. Access to lakes
        ii. Hydrological

    b. Water characteristics
        i. Water quality
        ii. Eutrophication

    c. Ecological Attractiveness
        i. Nature conservation features
        ii. Economic value of ES

    d. Stakeholders management (describe in Socio-economic profile)
        i. Involvement of agencies
        ii. Participation of communities

    e. Governance
        i. Lake uses and its resource development facilities
        ii. Strengthening the pillars

33. In this guideline, each focus area has topics of interest described (in Chapter 1) and is further evaluated in the development of the lake management plan processes. This will be explained as follows and in later sections of the guidelines.

34. The detailing of each focus area is explained in Section II (The Description), where we will list out 'what we have and what we know'.

35. In the lake planning process, each of the focus area will undergo all the four processes i.e. Description, Evaluation, Objectives and Action Program.

36. In the objectives and action program processes (Chapter 3 and Chapter 4), the numbering of the focus areas may not be in sequence, as they will be formulated together in accordance to their level of relevance to the management. Some focus areas may be dropped after the evaluation (if the matter is not significance).

37. **Figure 1.4** details the simplified steps of the planning processes. The planning focus areas will be analysed in each of the steps.

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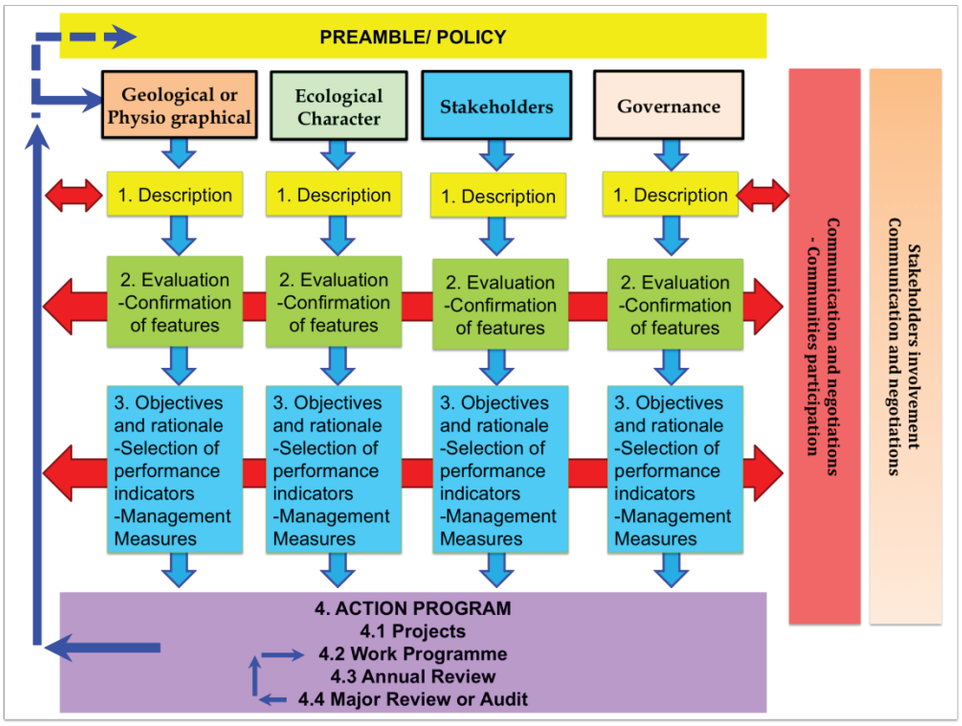


Figure 1.4: The simplified steps taken for each of the Focus Areas

38. As shown in the figure, the planning process is simplified into steps, which will experience all the four procedures. Each of the focus areas listed in 'D32' above will be processed in the same approach.
39. Therefore, in Chapter 1 and Chapter 2 a continuous numbering system is necessary in order to give attention to each focus areas that is described during every step of the process.
40. The application of tools such as the hydrological modelling or the statistical analysis of survey data will be addressed appropriately in the same part of the process.

E. Factors influencing the preparation of ILBM plan

41. The management plan should be:

    a. of a multi-scalar approach to its function;

    b. be linked to broad-scale landscape and its ecosystem;

    c. include the integrated river basin and coastal zone scales;

    d. incorporate and/or affect the local and regional sites planning in its policy and planning decisions.

42. A lake management plan is a process, not an event, i.e. it does not end with the production of a plan (a document), but continues throughout its implementation

    and beyond [3].It is the beginning of a bigger strategy of lake management.

[3] Thomas & Middletone 2003

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43. It is therefore recognized that the application of these guidelines will need to be flexible, depending on the particular characteristics and circumstances of each lake site or other wetlands.

44. The precautionary principle is important in the context of conservation management and planning. It should guide the planning process and influence the way in which we manage our sites, habitats and species.

45. The scope of any lake management plan should be as large as the site requires and no larger.4 (This is to prevent complicated overlapping and uncontrollable situations.) ILBM planners should recognize the need to integrate conservation site planning with wider sectorial and land use plans.

46. The integrated lake basin management (ILBM) plan can be integrated into the public development planning system at local, regional or national levels. The integration of site management plans into spatial and economic planning at the appropriate levels will ensure implementation, public participation and local ownership. Furthermore, integration will enhance the possibility of local as well as external funding.

47. Compromises are almost always made between study and action, protection and conservation, restoration and maintenance, and expense and expedience. With limited time, funding and information, such compromises may indeed be necessary.

48. Management specifically for lakes, at any scale, can ensure the best outcomes for sustaining the values and benefits of the lakes to landowners and the wider community.

49. Iterative gradual steps in the management of watersheds and lakes is often encouraged, i.e. small steps that move in the perceived correct direction, cost less and have less potential to damage non-target organisms or features.

50. Lakes are having unique features i.e. the flowing, slow moving water and the outflowing water into the river. For the understanding of its condition, lakes should be described in as minute detail as possible.

51. Individuals involved in managing a lake should, whenever possible, be involved in the planning process and, in all cases, ownership of the plan. Participating in lake management training programs will expedite the understanding of these guidelines and the ability to develop a plan.

F. Scope covered in these guidelines

52. Section I and Chapter 4: Action Program.

53. This section focuses on how the management plan document is configured. It facilitates the understanding and application of these guidelines by developers of lake management plans.

[4] Ramsar 2000

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54. Section II to Section V provides a guide on the writing of Chapters 1 to 4 of the ILBM Plan.

55. Templates that are included in Chapters 1 and 2 can be directly be used by lake managers to collect the necessary information for the preparation the whole management plan. Since Chapter 3 and 4 deals with recommendations from the evaluation, the numbering system will give way to a more simplified format or table form.

56. Sections VI to X are topics that explain the pertinent subjects in developing the lake management plan. They are:

Section VI:	Stakeholders Management
Section VII:	Ecosystem Services Economic Value Assessment
Section VIII:	Measures and monitoring
Section IX:	Management Implementation Programs
Section X:	The Cyclic Process

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Section II: Chapter 1 Description

A. Overview

1. The background of 'effective ILBM planning' starts with understanding fundamental details of our lakes.
2. For that purpose, understanding basic technical, social, economic and demographic factors influencing a lake is crucial. Knowing historical and current conditions, along with projected future conditions, helps to establish effective goals and objectives and to identify the appropriate actions to address our concerns.
3. The planning program starts with collecting available information. Note down all material and information including pertinent data (knowledge and local stories) before beginning to develop a lake management plan. This information forms the data needed to identify goals, objectives and actions appropriate for the lake.
4. This guideline arranges the topics of interest most related to the conditions and situations of Malaysian lakes. This original arrangement of topics enables a smooth progression into other chapters in the management plan.
5. This serves as Chapter 1 of the Integrated Lake Basin Management Plan (ILBMP).

B. General points regarding the description chapter

6. It is important to record the description of the lake in an orderly manner.
7. The description, which forms the chapter is the starting point of the management planning process. It provides the information used to fuel the rest of this process. It is fundamentally a collation and synthesis of existing data and information.
8. Start writing up this chapter by asking the question: 'what do I have?' and 'what do I know?'. Recording the information that is already available and known to us is the easier way of starting this chapter.
9. Plans, and in particular, plans for large, complex lake basins, should include a summary. These can be presented as text, but the addition of annotated maps and illustrations is helpful to explain issues.
10. In many cases, not all information needed for the basis of management planning will be available. To develop a realistic plan, all available data must be compiled and missing information should be recorded. The list of detailed information needed with its systematic numbering is shown in Annex A.
11. Additional information can also be added up in the list while maintaining its logical arrangement. A good write-up will enable the accuracy of the evaluation process (Chapter 2) of the lake.

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C. General Information of the lake

12. Lake management planning entails gathering all information and data related to the lake and its catchment, including the physical features, land use and social trends.
13. The details of important topics to be included in this chapter are listed in an orderly manner to ensure easy reference for the following chapters.
14. In general the description of the lake should be arranged according to our knowledge of the lake in the following manner:

    a. The general common information; and

    b. Details of our understanding in relation to the focus areas that are of concern (list of items in Volume 1, Section 1, D32).

15. In the introduction the following information is sufficient:

    a. The details of the management's desired outcome for the lake. The available vision, mission and possible existing policies.
    b. The development background of the lake i.e. is it a natural or a man-made lake?

16. General Information includes the lake's name, location and description of its river system and lake drainage basin or catchment.
17. The type of lakes identifies the source of the water:

    a. man-made lakes (reservoirs) are formed by a dam or weir. The year of construction and the information of its structure should be recorded.
    b. The origin of natural lakes (e.g. tectonic movement, volcanism, riverine formation) and estimated age of lake should be recorded.

18. Physical morphology (the basic information of the lake) e.g. the length, width, water surface areas, depth and volume) should be recorded.
19. Climate (normally tropical throughout Malaysia). The temperatures are stable and high throughout the year. There is some variation of rainfall amount according to the months in a year. The wind strength and direction can be recorded.

D. Land Use - State of lake catchment (Basin/Watershed)

20. The description of catchment area including size, topography of region and inflow-outflow river system.
21. The state of lake catchment from the regional patterns, forest cover, soil conditions, and land use pattern.
22. The landscape and waterscape, including visual features of lake and basin (various photos of landscape, physical facilities, water quality problems, land and water uses in riparian and upstream regions, biological and ecosystem conditions, unique fauna and flora, etc.).
23. A recognition of regional patterns and limitations that helps put the characteristics and conditions in a particular lake and watershed into perspective. Recording the catchments' boundaries, surface areas, drainage system and other information is useful.

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24. A description of the physical condition of the catchment i.e. its area, its topographical condition and the infrastructural development within the areas such as the villages and town areas.
25. The basin hydrology (a brief description of basin hydrology, including the rivers, major flow points and boundaries).
26. The sub-surface drainage (briefly describe groundwater flows, referring to hydrographical and hydrological maps, if available).
27. Notes: Maps are normally used to illustrate or delineate most of the information and various features of the catchment to minimise the time needed to understand the areas.

E. Common focus areas of lake management

28. The common focus topics of interest in lake management must be recorded in the description chapter before we progress to the evaluation chapter.
29. Figure 1.4 shows that the process for preparing the plan has to undergo the first two steps for each of the focus items in order to obtain realistic objectives and an effective management measure (the third step).
30. For that reason, the topics of common concern in lake management as listed in Section the focus areas is described here according to its topics.
31. Additional topics of interest can be added wherever necessary according to problems or issues faced by the particular lake.

F. Geological and Physiographical Features

Environmental

32. Geological information describes soil condition, such as sand, silt, clay or peat particles within the catchment. It is also beneficial to highlight the slope conditions.
33. Lake characteristics include the structure of the lake especially those involved in the formation of manmade lakes. e.g. the dam, weir and inlet/outlet drain.
34. Accessibility describes the type of road or path that connects to the lake. Access has important implications on the surrounding community's perceptions and future projects in the plan.
35. Lake characteristics can be described by its hydrological behaviour. With recent development of computer applications, the eco-hydrological responses of lake can be demonstrated further such as in the form of hydrological and hydraulic models.
36. As a tool to the ILBM Plan, these models need the description of the relevant lake information that should be elaborated in this part of the plan.
37. Hydrological information includes the water quantity and water balance data. The inflows and outflow rates are important hydrological information.
38. Calculation of water balance, hydraulics retention time and information required by the application to produce the lake hydraulics property. Other ecosystem-related information of the lake and water should be furnished wherever available.

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39. The hydraulics retention time (HRT) of a lake describes the character of the lake as well as the filling and flushing time of the lake. The application of hydrological computer programs can determine figures or important indices/coefficients, which support the evaluation of the lake's hydrological status.

G. Water Quality

40. Physical characteristics of water include the temperature (according to depth and time), the mixing situation of the water and the stratification pattern.

41. For the lake's water quality, a numbe r of parameters are needed for the planning of the lake management e.g. data related to the water quality index or the required lake water quality standards according to its relevant categories.

H. Chemical Data

42. General chemical water quality data can be summarized in tables for easy comparison (e.g., oxygen demand; nitrogen and phosphorus concentrations [organic, inorganic, particulate, and total suspended solids if available]; salinity; organic and inorganic chemical pollution.

43. Pollutant Loadings (tons/year) from rivers, groundwater and atmosphere in terms of the amount of the nutrients such as phosphorus, nitrogen, sediment and other organic waste.

I. Eutrophication

44. The overpopulation of blue-green algae in a lake will damage the aquatic ecosystem of the water body. Furthermore, the resultant algae bloom will also harm the lake user as toxic products are excreted in algal reproduction and decay.

45. Since eutrophication is considered a noticeable disaster to lake managers, its possible occurrence should be constantly monitored.

46. The status of a lake's trophic condition (the level of algal productivity in the lake water body) is measured by its trophic state index.

47. The algae species and the water quality parameters consisting of Chlorophyll-a, total phosphorus, total nitrogen and the Secchi depth transparency should always be measured and collected.

J. State of the Ecosystem

48. This comprises of a description related to the lake's state of ecological health, including conservation of fauna and flora and the description of the state of biodiversity conservation.

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49. Ecological characteristics are recorded by the collection of biotic data (e.g. main species, exotic species, and their productivity changes over time)

50. The overall state of lake ecosystem should be gauged by its biodiversity such as the presence of phytoplankton, zooplankton, fish or aquatic life, insects, and avifauna or birds. An orderly description of the types of flora and fauna species will demonstrate the ecological status of a site.

51. Ecological relationships and their implications for management (especially design of the water body systems) should be recorded. These relationships and implications for management are further clarified by listing out communities of species and their key (stone) processes, disturbance sources, key (stone) species and indicator species.

52. Examples of living communities that influence lake management are aquatic plants such as 'ekor kucing' *(Cabomba furcata)*, water hyacinth *(Eichhornia Crassipes)*, and 'rasau' (*Pandanus* sp.).

53. Key processes (which 'gear' the ecosystem as a whole or a large part thereof) influence the survival of these species, i.e. by changes in water levels at different times of the year, erosion process, or depletion of wetland or riparian vegetation.

54. The key (stone) species (e.g. ekor kucing of Chini Lake) can have a large impact on the ecosystem and/or those that react clearly and immediately on changes in the functioning of the lakes or wetlands. For example, it impacts the lake's fish population growth in the lake as well as the boat navigational potential subsequently the number of tourist visitors to the lake.

K. Stakeholder management

55. All matters pertaining to stakeholder management are described in detailed in Section VI.

56. Stakeholder management requires the collection of socio-economic information, especially cultural aspects such as the recording of existing cultural inclinations, community participation (for example by applying ESSVA to record the present local understanding of the lake) and the processes and agencies involved in lake management.

L. Social and demographic trends

57. The socio-economic profiling process includes documenting demographic trends, social status and the communities' economic status. It should also described the Population Dynamics (numbers, distribution, main cities, percentage of urban/rural, etc.) that include the educational level of the communities (extent and type of education, literacy rates, etc.)

58. Economic Sectors (major industries and production statistics; regional economic development issues including transportation, commerce sectors, livelihood issues in different parts of lake basins such as coastal upland and upper watershed regions; Gross National Income per capita within basin [noting also how it might differ from national average(s)] should also be profiled.

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59. This process also considers the economic activities taking place within the watershed and ways they can be sustained (or improved) with successful lake and catchment/ watershed management.

60. It can also shed light on the attitudes of people living in (or using the resources of) the lake's watershed. Does the majority perceive a resource problem? What is the present and projected population of the watershed, and where is it concentrated?

M. Cultural and heritage information

61. This section records the cultural and historical inclination of the communities e.g. matters related to their past or current practices; conservation and archaeological sites (e.g. information about the languages, ethnicities, indigenous peoples, religion, legends and beliefs about the lake) and other land uses.

62. Consultation of all stakeholders' process is needed to obtain local viewpoints and actual problems on the ground. The stakeholders' consultation (also known as 'Musyawarah') processes can be divided into two (2) programs. One relates to the involvement of the government agencies and the second one relates to the consultation sessions for the community participation programs.

N. Involvement of agencies

63. The involvement of agencies can be more clearly understood by identifying the agency, obtaining relevant information about the agency and establishing their level of involvement.

64. Organising a consultative forum can be part of the agency involvement process. Details of the consultation process with technical departments will be elaborated in Stakeholders Analysis, Section VI. The technical organization representatives are required to fill in questionnaire forms. They are allowed to consult their respective offices if needed.

O. Participation of communities

65. The common report on community profiling details its socio-economics status and is useful to determine matters related to communication (one key governance matter) needed for the community' participation.

66. There are many ways to determine the community' expectations and other social information i.e. site visits/observation, interviews, questionnaires/surveys and referring to local development documents i.e. district planning and structural planning.

67. The application of the Ecosystem Services Shared Value Assessment (ESSVA is very useful in regulating matters pertaining to community participation.

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P. Management and Governance

Uses of the lake and its resource development facilities

68. The type of lake use should be clearly written. This information should be matched with the expectations or anticipation of the communities located nearby or depending on the lakes for daily activities.

69. The existing lake facilities and its status should also be recognized. Further action programs will refer to this whenever necessary. The management indicators and the institutional management status should be observed.

Q. Management infrastructure

70. It is very beneficial to collect information of activities performed by various agencies.

71. Some government agencies or non-governmental organisations may have been conducting activities that need to be listed in the description chapter. Examples of activities are tree planting, control of wildlife such as elephants or tigers, water quality and fish monitoring.

72. Federal government agencies may conduct studies such as socio-economic profiling in the area. Such information should be recorded.

73. Non-structural matters such as informal rules (informal community rules; voluntary restrictions), formal regulations (industrial effluent regulations; protected areas [land use restrictions, ecological reserves]; etc.) and economic incentives (subsidies, taxes, etc.) should be recorded.

74. Activities aimed at raising awareness (including environmental education, environmental campaigns, activities of environmental NGOs and CBOs, etc.) should be compiled.

R. Governance

75. Information and background on management status should be described here. It can be written according to the six pillars of governance as described by the International Lake Environment Committee (ILEC 2005) i.e. policies, institutions, information, participation, technology and finance.

76. This section describe management indicators and its institutional management status. A brief description should be made of the challenges faced by communities, including access to information and justice as well as their right to participation.

77. A brief description of the six governance pillars is sufficient. The assessment of governance pillars is further explored in Chapter 2 (Section III) and the detailing of the process in Section VIII.

78. Information regarding the political status and major historical events within the basin and its boundaries can be useful to describe including any major historical events.

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S. Ensuring a Concise, Readable Description

Do not overload with information

79. Firstly, do not overload the reader with too much detail. The information gathered in the descriptive section should not be so overwhelming as to lead to a large and cumbersome plan.
80. The descriptive information should be relevant to the management of the lake and should not be excessively detailed.
81. Use simple terms to ensure all stakeholders can easily understand the description. Avoid using excessive scientific terms and jargon.
82. For information or data (especially pertaining to rare or endangered species) that is sensitive or may be misused, care should be taken to maintain its secrecy.

Facts should be quantified and qualified.

83. Keep all the written information concise and as correct as possible.
84. Do not include incorrect or unverified information. Any assumptions should be categorised rigorously.

Keep the main description brief by including maps, references and appendices.

85. Supporting information can be included in appendices, or simply referred to with references. Important information should be conveyed in maps.

Use of local knowledge

86. When collecting information on the lake/wetland and adjacent areas, local knowledge can be very valuable. The traditional knowledge held, and usually willingly offered, by indigenous people should be drawn on where available.
87. Consider involving, and remunerating, local people to gather data. This may be cost-effective and may enhance their interest and involvement in the plan (see section 4).

The unique lake sites

88. Some lakes possess special features or 'ecological character', which justify these sites, such as Man and Biosphere sites (e.g. Tasik Chini) or RAMSAR sites (e.g. Tasik Bera).
89. This 'ecological character' becomes the baseline against which the impacts of proposed developments, and success of site management, are evaluated by respective planners or authorities in some countries (Thomas & Middleton 2003).

Information should be regularly reviewed and updated

90. Information should be regularly reviewed and updated, so as to incorporate new sources of data and information, including updates from time-series monitoring.

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Annex A

Chapter 1 – Template of Lake Description

1.0	**CHAPTER 1: DESCRIPTION**		
1.0	**INTRODUCTION**		
1.0.1	The available vision and policy of the lake		
1.1	**General information of the lake**		
1.1.1	Name(s)		
	In English (or common name)		
	In local language(s)		
1.1.2	Location		
	Latitude (range from West to East) and Longitude (range from South to North)		
	The district/region and sub-district (state, province, etc.) jurisdictions		
	The lake is located within which catchment of the river		
	The upstream river basin		
	The downstream river basin		
1.1.3	Type of the lake:		
	man-made lakes (reservoirs): Physical features and years of construction; or natural lakes: Origin (e.g., which springs, hills or mountain) and estimated age		
1.1.4	Physical/ Morphology		
	Lake Length:	Meters	
	Maximum Width:	Meters	
	Lake Surface Elevation:	Meters	
	Lake Surface Area:	km^2 (hectares/acres)	
	Average Depth:	Meters	
	Maximum Depth:	Meters	
	Lake water volume:	$Meters^3$ (Litres/gallons)	
	Dam/Weir:	Yes/No	
	Water level control	Yes/No	
1.1.5	Climate		
	Monthly Average Temperatures:	(° C)	
	Minimum Temperatures:	(° C)	
	Maximum Temperatures :	(° C)	
	Precipitation	mm	
	Prevailing Wind Directions by Season;		
	Wind Strength:		
	Seasonal and Inter-annual Variability	(description)	
1.1.6	Land Use - State of lake Catchment (Basin/Watershed)		
	• Description of Catchment Area	- Landscape and Waterscape - Visual features - Size (km^2)	

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		• General geography of region:	(in relation to lake and neighbouring water bodies)
		• The state of lake catchment:	(from the regional patterns)
		• Other lakes connected:	...in cascade
		• Inflow catchment system	
		• Outflow catchment	river system
		• Get the regional patterns in lake water quality from the existing monitoring data	
1.1.7		Record the catchments' boundaries:	briefly description of
		• Catchments' surface areas:	Hectares
		• Delineate the catchments' boundary.	
		• The watercourses	referring to hydrographical and hydrological maps, if available
		• Drainage system	
		• Sub-surface Drainage /groundwater flows	
		• Calculate the catchments to lake surface area	Ratio
		• Topographical condition	e.g. Highest peak in watershed:
		• The structural development	
		• Numbers and areas of villages	Nos km^2
		• Numbers and areas of town:	Nos km^2
		• Primary Watershed Land Use:	Forested % Hectares
		• Water quality problems	
	Geological and Physiographical Features		
1.2.0	**Access to the lake**		
	Environmental Information		
1.2.1		**Geology**	
		Soil	
		Soil condition	
		Identify the soil types and slopes within the watershed	
		sand, silt, clay or peat particle	
1.2.2		**Lake Structure**	
		Dam/weir dimensions	
		Dam/weir safety information	
		Shorelines length	
1.2.3		**Access to the lake**	
		Any proper access	
		Condition	Good or Bad
		Type:	Asphalt/laterite/Crusher-run

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		Road condition:	Good/Bad/Worst
		Coverage of area:	%
		Use for:	Private/Business/Crops
		Need new/additional route	
1.3.0		**Hydrology**	
1.3.1		Hydrological modelling program as a tool	
		Bathymetric Map	
		Bottom contours,	
		Water Level Changes due to Flow Regulation;	
		Erosion and sedimentation	
		Slope and depth information	
		Intra- and inter-annual Water Levels	Changes:
		Intra- and inter-annual Water Volumes;	Changes:
		Water characteristics	
1.3.2		**Water Quantity/Water Balance**	
		Water Level Management	
		Inflows	(annual average in m^3/year),
		Precipitation,	
		Rivers	*(including indication if they are controlled),*
1.3.3		Groundwater location and level;	
		Water diversions	
		Outflows	(annual average in m^3/year),
		Evaporation,	
		Groundwater	
		Water Diversions	
1.3.4		Hydraulic Retention Times	in days/years
		Theoretical filling time	lake volume/annual inflow
		Theoretical flushing time	lake volume/annual outflow
	Water characteristics		
1.4		**Water quality status**	
1.4.1		**Water Physical Characteristics**	
		Water Temperature (versus time and depth)	
		Lake Mixing (vertical and horizontal, including main bays and sub-basins)	
		Lake Stratification (Period and Extent: epilimnion, metalimnion,hypolimnion)	
1.4.2		**Water Quality Status**	
		Water quality indices	
		Water Quality Index - WQI	
		Water Quality Standards -WQS	
		E. coli	
		Diurnal profile	
		Bioaccumulation	
		Sedimentation	
		Groundwater quality	

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1.4.3		**Chemical**	
		General chemical water quality	
		oxygen demand;	
		nitrogen concentrations	
		phosphorus concentrations	
		Organic particulate, and total	
		Inorganic particulate, and total	
		salinity;	
		organic	
		inorganic chemical pollution	
1.4.4		**Pollutant Loadings**	
		from rivers	(tons/year)
		groundwater	(tons/year)
		atmosphere	(tons/year)
1.5		**Eutrophication**	
1.5.1		**Aquatic life**	
		Macrobenthos	
		Phytoplankton	
		Zooplankton	
		Waterborne Pathogen	
1.5.2		**Pollutant Loadings**	
		from rivers	(tons/year)
		groundwater	(tons/year)
		atmosphere	(tons/year)
1.5.3		Related Water Quality Data	
		Chlorophyll-a	
		TN	
		TP	
		Secchi Depth	
1.5.4		Status of - Algae and trophic index	
		Eutrophication	
		Algae	
		Index	
		Other useful information	
		Ecological Attractiveness	
1.6		**Nature conservation features;**	
		State of the ecosystem	
		Biological characteristics - Biotic Data (Main species, Exotic species, Productivity changes over time)	
1.6.1		**Fish Management**	
		Fish species	
		Fish Population	
1.6.2		**Flora**	
		Vegetation - Aquatic Plants and Invasive Species	
		Uptake	
		Root	

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		Filtration
		ZII Plants
		Weeds
		Disease
1.6.3		**Fauna**
		Amphibians
		Cormorants, Turtles, and Other species
		Insects
		Pest
		Mosquito
		Reptiles
		Avifauna
		Exotic Birds
		Mammals
		Communities
		Brief description of general ecosystem/biodiversity issues in regard to littoral wetlands, rivers, atmosphere
1.6.4		**Biological and ecosystem conditions of the catchment/basin**
		Unique fauna and flora
		Physical facilities
		Land and water uses
		Other useful information
1.7		**Economic value of ES**
		Most of the information for Ecosystem Services are already provided in the description of the lake
		For preparation of a lake management plan, the economic valuation of the Ecosystem Services will need to be assessed and preparation for the survey works should be done during this process.
		Example of the survey questionnaire is as shown in **Appendix C** and the details in **Section VII**
		CVM surveys, TCM surveys
1.8.0	**Stakeholders management (Will be described in detail in the Socio-economic profile – Section VI)**	
	Methods of gathering communities and social information:	
		Reference to local development documents i.e. district planning and structural planning
		Site visits/observation
		Interviews
		Questionnaires/Surveys (ESSVA and Economic Value assessment such as CVM and TCM can be incorporated)
1.8.1	**Socio-economic information – used for profiling**	
		Socio economic profiling - Population Dynamics (numbers, distribution, main cities, percent urban/rural, etc.), Education (extent and types of education, literacy rates, etc.).
		Economic Sectors (major industries and production statistics; regional economic development issues, including transportation, commerce sectors, livelihood issues in different parts of lake basin such as coastal upland and upper watershed regions; Gross National Income per capita within basin [noting also how it might differ from national average(s)]).

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1.8.2		**Culture and historical information**	
		languages	Post Management – Nature
		ethnicities	Conservation
		including indigenous peoples	Present land use
		religion	Aesthetics/Arts interest
		legends	Public Interest
		beliefs about lake	
		Archaeology / Past land use	Communities' Lake Associations:
		Stakeholders (local communities/indigenous people)	
		Stakeholders Consultation Processes	
1.8.3		**Involvement of Agencies**	
		For the involvement of agencies, the following processes will be applied:	
		Identity of agency, its address and information will be listed.	
		Confirm which agencies are important stakeholders	
		A group program to identify the agency – which is suitable in which quadrant?	
		A survey questionnaire also can be conducted to confirm various matters	
1.9.0		**Communities participation**	
		Communities' participation by applying ESSVA to record the present understanding of the local related to the lake.	
		A survey can be conducted to determine the status	
1.10		**Management and Governance**	
1.10.1		**Lake Uses and Its Resource Development Facilities**	
		Non-structural Management Responses	
		Rules	
		Informal (informal community rules; voluntary restrictions)	
		Formal (industrial effluent regulations; protected areas [land use restrictions, ecological reserves]; etc.)	
		Economic Incentives (subsidies, taxes, etc.)	
		Raising Public Awareness (public awareness, including environmental education, environmental campaigns, activities of environmental NGOs and CBOs, etc.)	
		Uses of the Lake and Its Resource Development Facilities	
		Type of uses:	
		Water supply – drinking	
		Irrigation - agricultural	
		Flood/drought control facilities;	
		Fisheries and Facilities	
		Industrial water usage;	
		Recreational - Sports arena	
		Recreational - Tourism attraction	
		Other Uses	
		Details of Lake Use facilities	
		Jetties;	
		Safety/control buoys;	
		Bunkering;	

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		Sports locations;	
		Withdrawals facilities;	
		Boat maintenance;	

		Picnicking and sight-seeing locations	
		Wading/swimming areas	
		Fishing areas	
1.11.1	**Strengthening the pillars**		
		Brief description of the 6 governance pillars is sufficient. The assessment of governance pillars will be further explored in Chapter 2 (Section III) and the detailing of process will be in Section VIII.	
		Policy, Institutional, Communication, Technology, Participation – Community, Agencies involvement, Financial	
1.11.2		**Brief Description of Governance Challenges Facing People**	
		Access to information	
		Rights to participation	
		Access to justice	
		Political situation (partial duplication of Item 1.2 above)	
		Nations within lake basin and sub-national boundaries	
		Brief description of region's history	
1.12.1	**How to make the site description readable and meaningful**		
1.12.2	**Catchment's maps**		
		Major inflowing and outflowing rivers	
		Main cities and other relevant points of interest in basin	
		National/sub-national jurisdictional boundaries	
		Basin Demography - Population numbers, density and distribution	
		Other relevant information (maps etc. regarding geography, demographics, land use, etc.)	
		Geohydrological information for lake and its basin and/or watershed	
1.12.3	**Other maps, as appropriate**		
		Maps are normally used to illustrate or delineate the following:	
		Geological formation; Elevations, Vegetation types, Location of major wildlife habitats, Breeding and feeding grounds of migratory and non-migratory species	
		Factors relating to local communities such as:	
		● degrees of economic hardship	
		● local settlement patterns and others;	
		● land uses;	
		● Basin Demography - Population numbers, density and distribution	

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Section III: Chapter 2 - Evaluation

A. Overview

1. This section deal with the evaluation or assessment of the lake information that we have gathered in Chapter 1. This chapter seeks to confirm the status of features that have been previously listed.
2. An evaluation process is required for features where there have been no previous, or formal, recognition of their status.
3. Preparation of this chapter need to apply the scientific, engineering and the socio-economic information to understand the status of the lake. Knowledge of the various fields is essential in this chapter; thus it is recommended that the lake owner collaborate with other departments as members of a lake management plan working committee.
4. Members from other agencies that have expertise in various focus areas (such as NAHRIM, JPS, JAKOA, universities etc.), working together to prepare this plan, will find this evaluation process handy.
5. Tools used for analysis (such as hydrological modelling programs, socio-science analysis etc.) will be required to clarify or confirm their findings in this chapter.

B. Description on evaluation (What's the value, What's the condition)

6. Most efforts to improve the quality of a lake begin with an identified concern or problem. These concerns must be articulated as clearly as possible to motivate the management team to take the actions needed.
7. Evaluation is the process of identifying or confirming the important matters or issues (in relation to the relevant focus areas) for management planning.
8. For this guideline, the evaluating process is implemented by observing the focus areas determined earlier in Item D30, Section I. The focus areas of interest have been presented in Chapter 1 (Description) and the evaluation process must be applied to each in turn.
9. In the actual implementation of a lake management plan, additional or different focus areas can be taken as the main items. However we must bear in mind that these focus areas of interest are only the guiding topics, which can always be reduced or added up with any associated topics.
10. Evaluation should be undertaken for ecological character features, as well as for socio-economic features, cultural features, the stakeholders' expectations, the governance consideration and any other important features identified.
11. This process is needed so that the lake managers aware, at the earliest possible time, whether the characteristics of the lake in its catchment has changed, is "changing" or "is likely to change" including its ecological performance.
12. Evaluation enable us to identify problems. When a problem is identified, its impact, location and timing, as well as any known contributing factors, should be investigated.

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C. Evaluating the Focus Areas of Interest

13. As recorded in Item D30 in Section I and itemized as 1.2 to 1.11 of Annex A in Chapter I (Section II), the evaluation process will follow the sequence of topics.

14. For easy guidance and to facilitate continuity from Chapter 1, a template is provided in Annex B of this section. In order to simplify each topic, the sequence of numbering is detailed here.

D. Access to lakes and their infrastructural condition

15. Access to lakes can be very important in lake management because it determines the level of human control of the water body as an asset.

16. The Structural Management Responses assessment pertains to the structural issues of lakes. Other features of lake infrastructural information are Sewerage Systems, Industrial Wastewater Treatment Systems, Solid and Hazardous Waste Management Systems, and other relevant systems.

17. This assessment is related to the use of the lakes. Therefore, matters related to safety, security, control of access (i.e. the facilities such as jetties, shorelines, access to water areas) should be included to manage all water use conflicts.

E. Evaluating Hydrological Status

18. Evaluation of hydrological matters can be carried out with the application of the modelling programs or engineering applications. Tools such as Hydrological Modelling programs will be very helpful in this assessment. If the program is used, most of the evaluation will be carried out through the modelling process itself.

19. Examples of hydrological focus areas are:

i. Water Level Management: The level of water variation can be determined from the modelling results. Water levels can adversely affect the water lines along the shores which impact the livelihood of surrounding communities. If there is no hydrological model tool, the water level management can be determined from the manual exercise (e.g. water balance site monitoring and manual calculation for various hydrological information such as the flow rates, hydraulics retention time and water quantity).
ii. Control of inflow and outflow. Control of water flow rates into or out of the lakes can be determined by hydrological modelling. This can be the item of evaluation and discussion.
iii. Pollutant loading pattern. The pollutant pattern entering the lake can be simulated and this will give an opportunity for the manager to decide on the action program to control the lake's water sources.

20. We have listed a number of applications that can be used for hydrological analysis These programs are tools that can improve the lake management plan, but cannot directly improve the condition of the lake. All its recommendations significantly influence the way we manage the lakes and all its components including the stakeholders.

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21. Selection and Requirements of Software for Lake Modelling

Many software, either open-source or commercial, related to hydrology and hydraulics. However, before selecting any software for lake modelling, the objectives of the modelling must be addressed clearly.

Objectives

The main objectives of lake modelling are to study:

- The water volume changes in the lake due to the variation of inflow and outflow
- The movement and circulation of water due to the shape of the water body, bathymetry, point of water entry/exit, and changes in water volume
- The water quality behaviour and the assimilating capacity of the lake water toward the incoming pollutant from the contributing catchment.

22. Type of flow

Flow in the river and lake can be categorised by flow characteristics termed steady and unsteady flow.

- In steady flow, the flow rate does not change with time. This situation normally occurs in a channel at a specific point such as zero rainfall for duration of time. In this event, the flow in the river will stabilise before rainfall occurs.
- Unsteady flow on the other hand is caused by flow changes with time.
- The situation can be observed after rain where the water level in the channel increases and subsides after few hours or days.
- Waste water from housing areas varies significantly throughout the day due to human activities.
- Release of water from human-made structures such as dams or reservoirs.
- Effect of tides at estuaries

23. Type of model

The ability of the hydrological software to meet the required objectives should be determined. For the first case above, this normally involves a simple hydrologic modelling which includes:

- Rainfall runoff modelling
- Volume change in the lake

As for the second and third cases, more complex exercises are needed and normally handled by hydrodynamic modelling.

At present, the hydrodynamic modelling can be divided as follows:

- One-dimensional (1D)
- Two-dimensional (2D)
- Three-dimensional (3D)

1D modelling provides the changes of velocity and depth in one defined direction, x. 2D however computes the horizontal velocity component (Vx and Vy) or alternatively velocity vector magnitude and direction throughout the model domain. The 3D is an extension of the 2D where it provides the Vz in the vertical direction.

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24. Water Quality modelling

Pollutants in the lake are caused by many factors. The major factors are the flow variation either entering or leaving the lake, the amount of pollution load entering the lake, the movement or water circulation in lake and the retention time.

Meanwhile, the advection (the transport of heat, sediments or any matter by the horizontal flow of a fluid) and dispersion (the spreading of mass from areas of high to low concentration) process might affect the mixing process in the lake.

25. Sediment Transport modelling

Sediment from catchment due to erosion process are transported by water (fluvial processes). Coarse particles like sand tend to be deposited at the bottom of the lake, while smaller particles often settle out of slow-moving or standing water in lakes.

Normally, software is developed to carry out specific purposes. However, some software can handle multiple tasks. For example, software used in the modelling (e.g. eutrophication models estimating nutrient loading and trophic state from land use, pollutant concentrations and lake characteristics, model for lake/sediment interactions, heat transfer, etc.) may not be able to predict bed load or sand movement at the bed of the lake.

It is important to state that suitable sediment transport equation is required when doing modelling since each equation is only suitable for specific sediment sizes.

26. Data Requirement

Data for modelling very much depends on the need of the modelling. Simple models normally require less data as compared to complex models. However, as a rule of thumb, more data results in better analysis.

The data requirements for each category of the modelling are:

i. Rainfall Runoff model

- Rainfall
  - o Event-based
  - o Continuous
- Boundary of the contributing catchment
- Catchment land use
- Type of Soil
- Contour
- Lake properties (Storage vs. depth)
- Outlet structures

ii. 1D modelling

- cross section of the lake from upstream to downstream.
- Inflow from hydrologic model
- entry from upstream or midstream i.e. specific location along the river reach

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- Downstream condition

  o normally controlled by structure

  o receiving water body

iii. 2D / 3D modelling

- Bathymetry of the lake.
- Inflow from hydrologic model

  o Entry to or exit from the system at any location at the boundary of the lake. This will allow pollution to be estimated by the model more easily.

- Downstream condition

  o normally controlled by structure

  o receiving water body.

iv. Water Quality modelling

Depending on the objective of the analysis and the software capability, some of the common data required for water quality modelling is:

- Dissolved Oxygen
- pH
- Ammoniacal Nitrogen
- Biochemical Oxygen Demand, BOD
- Chemical Oxygen Demand, COD
- Total Suspended Solids
- Temperature (including heat)
- Salinity
- Nitrate
- Nitrite
- Phosphorus

v. Sediment transport modelling

Primary data required for sediment transport is:

- Particle size distribution
- Sediment concentration

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The table below provides some of the software with its capabilities. More detail on each software capabilities should be referred to the software developer.

Table 3.1 List of Software Application for lakes for various purposes

Name	**Categories**	**Dimension**	**Reference**
Hec - HMS	Hydrologic	1D	http://www.hec.usace.army.mil/software/hec-hms/
QUAL2E	Water Quality	1D	http://www.aquaterra.com/basins3/Watershed%20and%20Instream%20Models/QUAL2E.html
QUAL2K (extension of QUAL2E)	Water Quality	1D	http://www.qual2k.com/
MUSIC	Hydrologic Water Quality	1D	https://toolkit.ewater.org.au/music
SWAT	Hydrologic Hydrodynamic Water Quality	1D	http://swat.tamu.edu
HEC - RAS	Hydrodynamic	1D 2D	http://www.hec.usace.army.mil/software/hec-ras/
EUTROMOD	Water Quality		EUTROMOD: Technical Guidance and Spreadsheet Models for Nutrient Loading and Lake Eutrophication, Kenneth H. Reckhow, 1992
InfoWorks ICM	Hydrologic Hydrodynamic Water Quality Sediment transport	1D 2D 2D 2D	http://www.innovyze.com/products/infoworks_icm/

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Mike 11	Hydrologic Hydrodynamic Water Quality Sediment transport	1D 2D 2D	https://www.mikepoweredbydhi.com/products/mike-11
Delft 3D	Hydrologic Hydrodynamic Water Quality Sediment transport	 3D 3D	https://www.deltares.nl/en/software/
Mike 3FM	Hydrologic Hydrodynamic Water Quality Sediment transport	 3D 3D	https://www.mikepoweredbydhi.com/products/mike-3
EFDC	Hydrologic Hydrodynamic Water Quality Sediment transport	 3D 3D	https://www.eemodelingsystem.com/ee-modeling-system/efdc_explorer/overview
WASP	Hydrodynamic Water Quality	3D 3D	https://www.epa.gov/exposure-assessment-models/water-quality-analysis-simulation-program-wasp

F. Water Characteristics

27. Water quality is the number one concern of most lake users in Malaysia. The reason for this is that most potable water sources are from lakes. Most of the water intake is taken from rivers, with the water treated according to strict conditions required by the Ministry of Health. Evaluation of ambient lake water quality can be based on the National Lake Water Quality Criteria and Standards (NAHRIM 2016).
28. Water quality is related to the changes in the water regime and should be seen as a result of increased salinity (for lakes near the sea), upstream wetlands/riparian destruction, and declining fish stocks or other impairments, which include governance issues.
29. Water quality is influenced by the degree of pollution in the water, which involves a number of important parameters of water quality.
30. Impairments to lake resource uses, including ecosystem regulating services, may also result in upper-watershed degradation (including erosion and siltation), point and non- point source runoff from urban areas, shoreline degradation and alterations or other impairments.

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G. Eutrophication

31. Increased algal growth has become a topic of interest in relation to Malaysian lakes. The eutrophication status can be evaluated from the compiled nutrients inflow data.

32. When data is not available, a data sampling exercise should be organized to confirm this situation. The Trophic State Index is normally used to identify the eutrophication level of a lake. This index is measured by three important parameters i.e. Chlorophyll-a, Total Phosphorus and the clarity of the lake using the Secchi Disc.

33. Control mechanisms. For lakes that have been diagnosed with algae bloom, information on its control mechanisms detail should be compiled and reviewed. This can be marked as successful or requiring further action.

34. The Trophic State and its water quality characteristics can be described in the Table 3.2.

Table 3.2: The trophic state and the relevant water quality characteristics

Trophic State	Water Quality Characteristics
OLIGOTROPHIC	Clear waters with extreme clarity, low nutrient concentrations, little organic matter or sediment, and minimal biological activity.
MESOTROPHIC	Waters with moderate nutrient concentrations and, therefore, more biological productivity. Waters maybe lightly clouded by organic matter, sediment, suspended solids or algae.
EUTROPHIC	Waters extremely rich in nutrient concentrations, with high biological productivity. Waters clouded by organic matter, sediment, suspended solids, and algae. Some species may be eliminated.
HYPEREUTROPHIC	Very murky, highly productive waters due to excessive nutrient loading. Possible 'fish kill' condition. Many clearwater species cannot survive.

35. Trophic states may be labelled on lakes for ease of discussion. However, in actual scenarios, there is a smooth transition into each category. Data may show a lake as either eutrophic or mesotrophic at different times of the year. (If the general tendency for the lake is eutrophic, we refer to the lake as eutrophic.)

36. With the presence of aquatic plants, the Trophic State Index may adequately characterize the eutrophication situation. Domination of aquatic plants lakes may tend to have high amount of phosphorus in the bottom sediment and relatively low phosphorus in the water column.

37. Trophic Status Index only measures the portion of nutrients that are found in the water column, as evidenced by the amount of algae. Lakes with large amount of algae will have high phosphorus in the water. So, the true total nutrient status cannot be accurately measured using the Trophic Status Index if most of the nutrients are held in the sediment and the lake is loaded with aquatic plants.

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H. Evaluation of ecological character (habitats, species and natural processes)

38. The important aspects of ecological character (habitats, populations, and processes) of a site provides a focus for the planning process. For evaluation purposes, the changes within the ecological character are observed.

39. Areas to observe are the fisheries, wildlife, vegetation, littoral life (e.g. insects, amphibians, pests and avifauna).

40. In some areas, if the data and information are available, the ecological health is observed through a number of different indices such as, Water Quality Index, Sediment Quality Index, Benthic Index, Biodiversity Indices and Fish Tissue Index.

41. Types of changes in ecological character. The causes of adverse change in the ecological character of a lake can be grouped in broad categories of the changes in water regime, water pollution, physical modification, exploitation of biological products, and the introduction of exotic species.

42. The evaluation process should utilize the guidance for lake and wetland inventory and assessment (e.g. Ramsar Convention Secretariat 2010), which provide tools for evaluation of ecological character and the status of lakes.

43. The presence of the important ecological character features on a site should also be noted. For example, the site may contain legally protected species or habitats. It is essential that the legal status of such features be recognized.

44. The list of criteria as shown in Annex C1 is recommended for the evaluation of ecological character features. The list is not intended to be fully comprehensive, nor is it appropriate to all features on all sites. Only the relevant or useful criteria should be used, and additional criteria should be added, as circumstances require.

45. The relative importance of these causes varies regionally, nationally and even from site to site. In addition, the above causes of change are often interlinked, and it can be difficult to separate each of their effects. A simpler way to view change in ecological character is by the type of change as opposed to the cause of change. The type of change can be considered under three general headings: biological, chemical and physical.

46. In outlining an appropriate framework and method for the prediction of change in ecological character of lakes, site managers should be primarily concerned with types of change, specifically adverse change caused by human activity.

[1] RAMSAR Guidelines

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I. Economic Values evaluation of ecosystem services

47. In evaluating the economic values of a lake, it is appropriate to apply the techniques of economic valuation of lakes and draw on information provided by these techniques.2

48. There are several techniques of assessing ecosystem values. More details are shown in Section VII.

J. Communities Participation – application of ESSVA

49. For Communities Participation evaluation, the application of Ecosystem Shared Values Assessment (ESSVA) is recommended.

50. Perceptions of communities related to the river-lakes-estuary or wetlands and relevant comparisons can be assessed in a simple form. The relaxed-approach survey related to the daily life of community's members ensures this method's simplicity of use. Some results have shown a very positive ability to fill the gap between the management and the communities' perception of the ecosystem services.

51. Table 2.1 in Annex D shows the related questionnaires that can be used for the shared value assessment analysis.

52. The problem/issues of the communities, frustrations and expectations can be listed out in relation to the regional or district programs, the economics activities in the lake areas, the communities' level of dependency on the lake resources and the projected situation of the problems or issues.

53. It is recommended that an advisory group is available to assess and prioritize the concerns.

K. Evaluating the government agencies involvement

54. The 'influence' and 'importance' quadrant is a common and practical method. The method of application is by considering the position of a government agency on any one of the four quadrants.

55. The position within the four quadrants can determine how to deal with the various government agencies involved. This is elaborated further in Section VI.

L. Evaluating the governance status

56. The adequacies and inadequacies of lake basin management for individual lake catchments may be determined by reviewing and assessing the existing management activities and practices. Based on the comprehensive surveys of the state of worldwide lakes conducted over the past decades, relevant review questions have been categorized into six thematic domains.

2 Technical Report 3 Valuing wetlands: Guidance for valuing the benefits derived from wetlands ecosystem services]

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M. Policies

57. These include policies to govern people's use of lake resources, and its impacts on lakes: Is there a management plan with a realistic implementation scope? Does an adequate management plan already exist, or should the existing plan be updated? Are the relevant priorities and phasing clear?

58. Is there strong political will to support sustainable management? Is sustaining and building political will and commitment appropriately incorporated as part of the management program?

N. Institutions

59. Institutions to manage a lake and its basin for the benefit of all lake basin resource users can be addressed with the following questions: Is there a focal-point institution in charge? Are the relevant capacity-building and training programs effective? Does the institution focus on priority skills? Is it inclusive and open to cooperating agencies, community groups, etc.? Are any mid-course corrections needed?

60. Institutional factors include any limitations to the capacity and authority of organizations responsible for implementation of the plan. It also includes the inter-relationship (or lack thereof) between the organizations or agencies responsible for the lake conservation and wise use and those responsible for other sectors directly or indirectly affecting the lake at local, regional (sub-national) and national scales.

O. Participation - Involvement of people

61. This relates to the involvement of people to facilitate all aspects of lake basin management: Do effective mechanisms exist for participatory implementation? Does the existing management plan include all relevant stakeholders for its implementation? What changes have occurred with regard to awareness and understanding of the problems, and their linkages to stakeholder activities? What are the perceptions of program stakeholders?

62. Conflicts/communality of interest: includes the likely opposition or support of different stakeholders, depending on whether or not they see the management plan as contributing to their benefits, or providing an opportunity to develop their interests.

P. Technological possibilities and limitations

63. Technological possibilities and limitations that often dictate long-term decisions:

64. Are the existing technologies working well? If yes, could their performance be further improved? If no, what are the reasons for their performance not working properly? Have there been unexpected adverse impacts of technology applications? If yes, have the adverse effects been appropriately mediated? If no, should the applications be further replicated? Have either technology options or costs changed, and are such changes reflected in the management plan?

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Q. Knowledge and Information

65. Is knowledge of both traditional and modern scientific origin the basis for informed decisions; and is there a common, shared knowledge base about the priority management challenges? Does a monitoring system exist to measure changes in key governance and other relevant indicators? Is the database sufficient? What are the remaining key gaps? Are information management tools adequate to be effectively deployed?

R. Finances

66. Sustainable finances to support implementation of all of the abovementioned activities. Relevant questions regarding these domains include:

    Are the currently available financial resources adequate? How can access to financial resources other than those currently available be improved?

67. These six major topics comprise the essential governance ingredients that collectively form the management regime for the integrated approach for lake basin management encompassed within Integrated Lake Basin Management (ILBM) – They are referred to hereafter as the Six Pillars of Governance in ILBM.

S. Important notes on evaluation

68. The ability to identify problems in the lake not the final achievement for the evaluation process. There is a need to prioritize the problems. As problems cannot be tackled simultaneously, prioritizing the problems is imperative for an effective plan.

69. Non-structural Management Responses

    Rules, which include informal rules (informal community rules; voluntary restrictions) and formal regulations (industrial effluent regulations; protected areas [land use restrictions, ecological reserves, etc.])

    Economic Incentives (subsidies, taxes, etc.)

    Raising public awareness (including environmental education, environmental campaigns, activities of environmental NGOs and CBOs, etc.)

70. Evaluation of other features of importance in lake or wetland sites

    In addition to ecological character features, some sites will contain other features of equal importance, for example, cultural, socio-economic, geological and geomorphological, and landscape and environmental features. It is important that these features be given appropriate attention and that the full management planning process be followed for each.

    This is particularly important to ensure the involvement and input of all stakeholders (see Section V).

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71. The evaluation can also focus on the lake's support of human well-being in the form of values and functions, goods and services, and on cultural features, such as artefacts and structures with cultural, religious or faith significance, especially for local communities and indigenous peoples. Geological, geomorphological and landscape significance should also be evaluated in this section of the plan whenever details are available. Some lakes can have additional features that do not fall under either ecological character, socio-economic or cultural features, and these should also be identified and evaluated. An example would be the importance of a lake for scientific research or long- term monitoring.

72. Landscape and wilderness qualities are often overlooked in management plans when they apply for protected area status. For sites where habitat management and maintenance is important, and there are few human-made structures, the management of the habitat will usually also cover most landscape issues. For most natural protected areas, landscape management is concerned with minimizing, or removing human traces that are regarded as visually damaging.

73. Significant anthropogenic artefacts with historical, cultural or religious values should also be safeguarded through the management planning process. Such features could be included in a plan's section on landscape, but their protection and maintenance may be best achieved by regarding them as features of interest.

74. The scope of analysis should be elaborated in each chapter of the plan. That means that every item undergo the process of Description, Evaluation, identification of Objectives (which will include management measures and monitoring program) and the Action Program.

75. Evaluation criteria can be developed for each feature of interest if necessary. A list of criteria, with examples, is recommended for evaluating ecological character features, along with a list for socio-economic and cultural criteria, which should be further developed for each lake to take its specific socio-economic and cultural characteristics into account (see Annex D – sample of ESSVA questionnaires).

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Annex B

Chapter 2 – Evaluation

	Chapter 2 – Evaluation of lake	
2.0	**Introduction**	
2.1	General overview of lake evaluation	
	Geological and Physiographical Features	
2.2	**Access to lakes - From the information in Chapter 1**	
		Access is sufficient
		Access needs to be refurbished
		A new access is needed
		Structural Management Responses are also important in evaluating the structural matter of lakes.
		Sewerage Systems
		Industrial Wastewater Treatment Systems
		Solid and Hazardous Waste Management Systems
		Other Relevant Systems
		This subject of assessment is also related to the use of the lakes:
		Lake Use
		Safety and security
		Control of assets i.e. the facilities such as jetties, and shorelines
		Public water access
		Managing water surface use conflicts
2.3	**Hydrological**	
		Water level management
		Does the water level vary?
		By how much?

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		Flow in or out of the lake should be controlled in the following manner
	Water characteristics	
2.4	**Water quality – source of changes in the water regime**	
		Increased salinity
		Impairments to Lake Resource Uses: declining fish stocks?
		Impairments to Ecosystem Regulating Services: lake and wetland destruction?
		Upper-watershed degradation: erosion and siltation
		Shoreline degradation and alterations
		Impairments from governance issues
	Water quality – pollution	
		Observation on the changes in the water quality parameters
		Point and Non-point Source Runoff from town areas
		Point and Non-point Source Runoff from farms/estate
2.5	**Eutrophication**	
		From the Trophic State Index
		To check the different/changes in the Trophic State Index
		The trend of blue green algae dominance is diminishing or increasing
		Existing algae control mechanisms: success/progressing or not successful
2.6	**Ecological Attractiveness**	
2.6.1	Nature conservation features;	
	Areas of observation	
		Fisheries
		Wildlife
		Vegetation
		Insects/amphibians

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		Avifauna
	Types of changes that can change the ecological characters	
		Physical modification:
		Chemical exploitation: e.g. pesticides;
		Biological: e.g. introduction of exotic species
	The evaluation can be done on the following topics	
	Size:	
		Description of the size in comparison to the nature of its surrounding
		In relation to the population or communities
	Biological diversity	
		Status of natural sites:
		Status of constructed sites:
		Destruction of habitats:
		Extinction of species:
		Site deterioration: poor site condition
	Naturalness	
		Site without modifications
		Site which is influence by modifications
	Rarity	
		Endangered habitats
		Endangered species
	Fragility	
		Consider the changes or disturbances that have taken place within the lakes or catchments over a period of time
		Indicate positive or negative changes:

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	Typicalness	
		Common location or site
		Justification for maintaining a site condition
	Potential for improvement and/or restoration	
		Identify potential improvements
		Identify potential conditions for further deterioration
	Nature conservation features;	
		Living communities and biotic environment
		Key (stone) process
		Disturbance sources
		Key (stone) species
		Indicator species
		The process, species and management relationship
2.7	**Economic value of ES**	
		Evaluate data from the survey
		Arrange the output from the data analysis for the economics value assessment
		The evaluation is normally the product of statistically processed data obtained from the survey.
	Stakeholders management (describe in socioeconomic profile)	
2.8	**Agencies Involvement**	
		From the survey and from consultative forum
		Agencies most suitable to manage the lake: 1st /2nd/3rd
		Most influential agency
		Most interested agency
		Any legislation in the lake areas related to its management

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2.9	**Communities Participation – ESSVA**			
		List out the results of survey (ESSVA)		
		Communities participation (by applying ESSVA to record the change, or expectation of change in the understanding of the local)		
2.9.1	Determine if there are any conflicting issues			
			Well	Need to improve
		List out the communities' frustrations		
		List out the communities' expectations		
		Situations of the lake in relation to the district program		
		Situations of the lake in relation to the regional program		
		The economic activities taking place within the watershed and how they can be sustained		
		The attitudes of people living in (or using the resources of) the lake's watershed. Who are they? What do they do? How dependent are they on the resources?		
		Does the majority perceive a resource problem?		
		What is the present population of the watershed?		
		What is the projected population of the watershed?		
		Where is the population concentrated?		
	Governance			
2.10	**Lake Uses and Its Resource Development Facilities**			
		Non-structural management – control of sites		
		Safety condition		
		Rules or laws controlling lake use		
		Informal (informal community rules; voluntary restrictions)		

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		Formal (industrial effluent regulations; protected areas [land use restrictions, ecological reserves] etc.)
		Economic Incentives (subsidies, taxes, etc.)
		Raising public awareness (including environmental education, environmental campaigns, activities of NGOs and CBOs, etc.)
		Political situation (partial duplication of Item 1.2 above)
		Nations within lake basin
		Sub-national boundaries
2.11	**Strengthening the pillars**	
		Policy
		Institutional
		Communication
		Technology
		Participation - Community
		Participation – Agencies involvement
		Financial
		Brief description of governance challenges facing people
		Access to information
		Rights to participation
		Access to justice

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Annex C

Criterion for ecological character

Criterion 1 for evaluating ecological character features: Size
In most cases, the importance of a feature will increase with size. However, size as a criterion must always be linked to other qualities. Small areas of high-quality habitat can often be more highly valued than large areas of low-quality habitat.
Size is of particular importance where habitats are fragmented and populations isolated. The viability of small and isolated features and sites is usually questionable. Very small populations are often extremely vulnerable and can become extinct simply through chance despite appropriate management. Nevertheless, such places may, at times, represent the last remaining examples of a habitat or population and may therefore be significant in the maintenance of overall biological diversity.
Criterion 2 for evaluating ecological character features: Biological diversity
The maintenance of biological diversity is usually regarded as one of the most important aims of nature conservation and of the sustainable use of biological resources. This is largely because one of the most obvious, and serious, effects of human intervention on the environment has been the destruction of habitats and extinction of species. Consequently, management is frequently carried out in order to maintain, or even improve, site diversity. However, it must be recognized that there are occasions when high diversity is undesirable. For example, cut, over-drained, or otherwise modified peat bogs will contain a greater diversity of communities and species than an intact, natural bog.
High diversity is sometimes a feature of dynamic or disturbed habitats, giving rise to an opportunity for seral vegetation succession. Where this instability is natural, the resultant high diversity is highly valued. Conversely, where the disturbance is a consequence of human intervention, the value of the resultant diversity is doubtful.
Criterion 3 for evaluating ecological character features: Naturalness
Naturalness is one of the most important criteria applied to ecological character features. In general, the more natural a feature is, the greater the value of its ecological character. However, very few, if any, wetlands in the world can be regarded as wholly natural, and it is recognized that even highly modified habitats can be extremely important for wildlife.
Criterion 4 for evaluating ecological character features: Rarity
Rarity is the one aspect of biodiversity conservation that has generally received most attention, and, as a consequence, managers are usually aware of the most rare and endangered habitats and species on their sites. These will feature prominently in any management plan. Often it is the presence of rare habitats or species that leads to the selection of sites for protection management for management for Ramsar Sites, through the application of Ramsar Criterion 2 concerning threatened species and ecosystems.
Criterion 5 for evaluating ecological character features: Fragility
To a greater or lesser extent, all ecological character features demonstrate a degree of fragility. Fragility should always be considered within a time scale, and the degree to which the damage is permanent is a crucial consideration. Fragility is almost invariably linked to rarity; fragile features are, or soon become, rare.
Fragility should not always be dismissed as a negative factor. Many natural communities rely on disturbance for their survival. These usually ephemeral communities often occur during the early successional stages of dynamic habitats. Intentional disturbance is often a necessary and legitimate

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part of management aimed at setting back succession for the purpose of maintaining community vigour, as in the case of burning or grazing to enhance grasslands.
Species may also be fragile, most often as a result of habitat change or destruction. Some have such specialized and complex requirements that a seemingly obscure or minor change can have devastating effects.
Criterion 6 for evaluating ecological character features: Typicalness
Sites are usually selected and valued because they contain the best, or at least a good, example of a particular feature, for example through Criterion 1 for the identification and designation of Ramsar Sites. The qualities that render a feature exceptional are most often the unusual or rare. It is also important, however, that the typical and commonplace should not be undervalued. This criterion is particularly useful for providing the justification for safeguarding the typical features in an area.
Criterion 7 for evaluating ecological character features: Potential for improvement and/or restoration
Most features are, to a greater or lesser extent, imperfect. This criterion is used to assess the potential for improvement or restoration. Severely degraded features may have varying degrees of potential for improvement; some will have none at all, while others will have potential for total recovery given appropriate management. The need to identify this potential is crucial. There can be no justification for wasting resources in attempting to manage a degraded feature when the underlying reasons for the damage cannot be reversed.
The principles and guidelines for wetland restoration, adopted by COP8 Resolution VIII.16, provide further guidance on the selection of wetlands appropriate for restoration. (See restoration in Handbook 19].)

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ANNEX D

Recommended ecosystem service shared value assessment (ESSVA) questionnaires in Malaysia

NO	QUESTIONNAIRES					
1a	Using your knowledge and the map please indicate which one of the rating best reflects your opinion: Magnitude of Resource Use, related to the different development activities					
	PARAMETERS	1	2	3	4	5
	Agriculture					
	Livestock Production					
	Manufacturing Industries					
	Mining Activities (Sand, Minerals, Oil)					
	Domestic Water Use (Drinking, Laundry)					
	Commercial / Local Fishing					
	Timber					
	Tourism and Recreational					
	Hydropower (projects/dams)					
	Transport					
1b	Using your knowledge and the map please indicate which one of the rating best reflects your opinion: Degree of Stress, related to the different development activities					
	PARAMETERS	1	2	3	4	5
	Agriculture					
	Livestock Production					
	Manufacturing Industries					
	Mining Activities (Sand, Minerals, Oil)					
	Domestic Water Use (Drinking, Laundry)					
	Commercial / Local Fishing					

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	Timber					
	Tourism and Recreational					
	Hydropower (projects/dams)					
	Transport					
2	Impairments of Nature's Functions (in the past decades) To what extent, do you think, has each of the following functions of nature (many of them beneficial for humans) worsened in the past decades?					
	PARAMETERS	1	2	3	4	5
	Diverse animal and plant habitats - forming complex food chains (biodiversity)					
	Climate moderation (nature's function to moderate extreme climate patterns)					
	Pollution absorption capacity (wetlands, in particular, can absorb certain pollutants with its ecosystem functions)					
	Flood mitigation capacity (Nature's capacity to moderate flooding)					
	Drought mitigation capacity (Nature's capacity to moderate droughts)					
	Erosion mitigation capacity (Nature's capacity to prevent/reduce erosion)					
	Others if any					
3	Direct impact of upstream and downstream sub-basin activities on sub-basin waters. How much stress and negative impacts do you think your sub-basin waters have been receiving from the activities (agriculture, livestock production, manufacturing industries etc.) of your immediate **upstream** communities (A)? How much stress and negative impacts do you think your sub-basin waters have been receiving from the activities (agriculture, livestock production, manufacturing industries etc.) of your immediate **downstream** communities (B)?					
	PARAMETERS	1	2	3	4	5
	From your immediate upstream sub-basin activities?					

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	From your immediate downstream sub-basin activities?					
4	Direct impact of your sub-basin activities on your immediate downstream (A) and to the most downstream water bodies (B) How much stress and negative impact do you think your sub-basin activities are causing your immediate downstream communities (A)? How much stress and negative impact do you think your sub-basin activities are causing How much stress and negative impact do you think your sub-basin activities are causing the most downstream water bodies, such as lakes, river-mouth estuaries and embayments (B)?					
	PARAMETERS	1	2	3	4	5
	To your immediate downstream communities?					
	To the most downstream water bodies such as lakes and estuaries?					
5	Status of "Cultural Services" in and around Your Lake-River Basin How do you rate the following cultural service (intangible) values in terms of importance as well as degree of degradation through Q1-Q3 activities?					
	PARAMETERS	1	2	3	4	5
	Aesthetic, human wellbeing or scenic values					
	Traditions and traditional practices					
	Historical significance					
	Religious and spiritual values					
	Educational and research values					
	Natural heritage, i.e. home to endangered species					
6a	Solid Wastes - According to areas					
	PARAMETERS	1	2	3	4	5
	Magnitude of Management Problems					
	Magnitude of Impact on Ecosystem					
6b	Wastewaters - According to areas					

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	PARAMETERS	1	2	3	4	5
	Magnitude of Management Problems					
	Magnitude of Impact on Ecosystem					
6c	Sanitation, Excreta Disposal / Hygiene - According to areas					
	PARAMETERS	1	2	3	4	5
	Magnitude of Management Problems					
	Magnitude of Impact on Ecosystem					
7	Impact of Ecosystem Services Degradation on Human Health Human health is generally supported by ecosystem products and services (such as availability of fresh water, food and fuel sources) which are requisite for good human health. Over the past decade, how much do you think ecosystem service degradation has affected each of the following group of people in your basin?					
	PARAMETERS	1	2	3	4	5
	Your family					
	Your community					
	Your sub-basin					
	Your entire population basin population					
8	Impact of Ecosystem Services Degradation on Economy Economic activities in the river-lake basin use ecosystem products and services (such as fresh water, natural products, and fuels). Over the past decade, how much do you think ecosystem service degradation has affected each of the following group of economic activities in your river- lake basin?					
	PARAMETERS	1	2	3	4	5
	Your household economic activities					
	Your community's economic activities					
	Your sub-basin 's economic activities					
	Your entire basin's economic activities					
9	Responsibilities and Ownership To what extent do you think each of the following stakeholder groups should take a responsible and proactive role?					

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	PARAMETERS	1	2	3	4	5
	National					
	State government					
	Municipality/District/Local					
	You and your community					
	Your upstream and downstream community					
	Industries, businesses commercial operators, plantation owners					
	Religious groups					
	Others (specify)					
10	Improvement of Basin Governance Over the next decade or so, how much does each parameter needs to be improved to ensure significant restoration and improvement of river basin ecosystem integrity?					
	PARAMETERS	1	2	3	4	5
	Institutions – to make organizations and programs more effective for action					
	Policies and Programs – to identify policies and actions that may be most needed and most effective					
	Participation – to obtain public opinion and input					
	Knowledge and Information – to fill in the knowledge gap					
	Technology – to provide a mix of technological options					
	Financing – to explore different funding sources and financial mechanisms					

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Section IV: Chapter 3 - Objectives

A. Overview

1. This section describe the goals, objectives and the management measures (necessary actions).
2. To what extent or level do we need our lake to become? What do we need to maintain the important features of the lake? Both ideal but also realistic intentions or aims will become the operational objectives of our lake management plan.
3. ILBM Plan provides a mechanism for thinking about threats and opportunities and other difficult issues, solving problems, and promoting discussion between involved parties.
4. The management planning process should develop and articulate an ideal or desired condition, state or appearance for the future of the lake. To define this, reasonable and practical (achievable) objectives for the important lake features (ecological, socio-cultural or the ecosystem services) need to be identified through the product of the evaluation process (Chapter 2).
5. Objectives are an expression of a 'desired state' that should be achieved for a lake basin through management involvement or interference. They are thus statements of 'outcomes' rather than how to achieve them.
6. Preparing the management measures to achieve the operational objectives requires the key subjects to be processed and completed. They are the understanding of management goals and the confirmation of management objectives.

B. Goals and objectives

7. Goals are long-term targets to be accomplished that are worded as general statements. They are expected to be achievable. It is like a vision of what our lake would look like in future. Example: Protect and improve the water quality of the lake by reducing the nonpoint pollution entering the lake from the catchment.
8. Objectives are management targets or expression in terms of what the working team hopes to accomplish (or should be achieved) in incremental terms while progressing towards reaching goals. They are specific, short terms target and measurable.Examples: Reduce the phosphorus loading by 2% in 2 years time.
9. Objectives should, when appropriate, take account of natural and other processes.
10. An objective should have the following characteristics:

    a. Objectives must be quantifiable and measurable. If they are not measurable, it will be impossible to assess through monitoring whether they are being achieved.
    b. Objectives should be achievable. This is a very obvious, but often forgotten, characteristic – there can be little purpose in pursuing unattainable objectives.

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11. Objectives must not be prescriptive; they define the condition required of a feature and not the actions or processes necessary to obtain or maintain that condition.

C. Describe the conditions required for a feature

12. There are three key steps in the process of preparing measurable objectives:

- a. Describe the conditions that are required for a feature.
- Identify the factors that influence the feature, and consider how the feature may change as a consequence.
- Identify and quantify a number of performance indicators for monitoring progress in achieving the objectives for that feature.

13. For each identified key feature, prepare a simple statement about the conditions the plan is attempting to obtain or maintain .

14. Once the problems are identified and prioritized, objectives will be confirmed.

15. Staff and budget constraints may affect the number of objectives established for the lake basin management plan.

16. A differentiation should be made between the purpose of management and the management process, because the management undertaken to safeguard a feature or basinwill vary according to the condition of that feature or basin. For example, in the case of a derelict feature, recovery management may be applied until the feature reaches the desired condition, at which time maintenance management can be substituted. These two management approaches can be fundamentally different, or may simply vary in intensity.

D. Developing lake management objectives

17. In Chapter 1 we have ideally detailed out our lake, then in Chapter 2 we have performed the evaluation for each of the focus areas. From the evaluation exercise, we have some idea of what area to focus on and what action to be undertaken.

18. Sensible objectives should be developed before we could make implementable management measures or action programs.

19. The answers to these three questions will help confirmation of the objectives:

- Is the management able to change the lake situation?
- Is the management team group motivated enough to address the concerns?
- Will the costs of achieving it outweigh the benefits? Use the inventory information to determine the critical areas in need of management.

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20. Target management efforts to areas that will benefit the most from the management team input.

21. After the concerns have been identified and prioritized, develop a vision statement for the matters. Objectives will be collective in essence from the many focus areas. Figure 3.1 shows the schematically ILBM Plan that position of objective process which may combined the schemes of different focus areas.

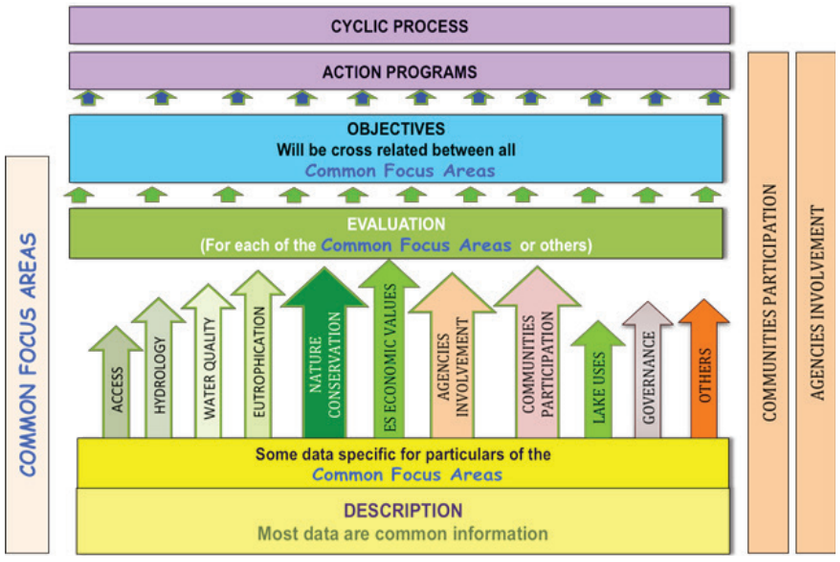


Figure 3.1: The schematically processes of ILBM Plan development steps

22. Objectives should lie at the heart of a management plan. They are the outcomes of management and the most important component of the plan.

23. An objective is the description of something that we want to achieve. For example wildlife outcomes are habitats, communities or populations (features) at Favourable Conservation Status.

24. Objectives which are 'SMART', generally applied to businesses, can, with modifications, be applied to lake ecosystem objectives:

S objectives for conservation features must Specifically address the feature.

M objectives for conservation features must be quantified and Measurable.

A objectives can be Achievable or Aspirational.

R Objectives must be Relevant to, and written in compliance with, the strategies, policies and legal obligations that govern the organisation responsible for managing the site or feature.

T Objectives for nature conservation management can be Time-based.

25. Objectives will always have a start date but it may not always be appropriate to specify a completion date.

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26. However, we may also recognise that our commitment to nature should be endless and not time-based. Conservation management is concerned with achiering the status that we aim and thereafter maintaining that status.

27. Objectives should, when appropriate, take account of natural and other processes.

28. Finally, identify management measures (or actions to) to achieve the objectives.

E. Appropriate steps

Step 1. Describe the condition that is required for a feature

29. Most current management plans avoid describing the conditions required of the features. Typically, the plan will discuss maintaining or improving a feature, but will not explain what is to be maintained or how to establish that it has improved. In order to judge whether the objectives are being achieved, there must be a clear description of the conditions that are required for the features.

30. The first step is to provide a description, using plain language, of the conditions that the plan is attempting to obtain or maintain. This is perhaps the long-term vision for the feature. There is no need to focus too strongly upon quantification at this stage – that should be done at a later point in the process.

31. A useful approach for habitats and species, which can be applied anywhere, can be found in references, for example the Natura 2000.1 this is a generic approach in defining an aspired condition for maintenance of a particular feature.

32. Habitats are considered having achieved favourable conservation status when they are stable or increasing in area, sustainable in the long term, possess favourable condition of typical species and control the factors that affect the habitat or its typical species.

33. Species are within favourable conservation status when their populations are viable in the long term, their range does not contract, sufficient habitat exists to support the species in the long term and the factors that affect the habitat, or its typical species, are under control.

34. These generic definitions of favourable conservation status for habitats and species are simply an expression of what would be wished of any habitat or species that requires management and could be applied to any feature on any site. Clearly, the generic statement must be developed into a more specific one for particular features of the site, but this in an excellent starting point.

35. Similar statements about “favourable status” should also be developed for features related to human activities and/or practices within the site and/ or the buffer zone, particularly in relation to their sustainability and the carrying capacity of the site.

Step 2. Identify the factors that influence the feature, and consider how the feature may change as a consequence

1 the European Union for Natura 2000 conservation sites

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36. The ability to achieve objectives will always be influenced by factors. Factors include policies, strategies, trends, constraints, practices, conflicts of interest and obligations, or anything that influences, or may influence, the features. These are essentially those activities that are causing, or are likely to cause, change in ecological character. It is important that both negative and positive factors be considered, since both will have implications for management.

37. The conservation management of habitats and species is mainly about controlling factors, and in particular the consequences of past, present and future human intervention, and the conflicts of interest among different stakeholders.

Notes

- When attempting to safeguard natural habitats, managers have to control, as far as possible, damaging human activities or influences, and to encourage those that contribute to long-term conservation.

- For example, hunting, timber extraction, and burning are often controlled.

- For habitats which have been created or modified by human influence, and have become valued as conservation sites, managers often maintain human influence, though they usually call this management (for example, the controlled burning or grazing of grassland to prevent it from reverting to scrub).

Step 3. Finally, identify management measures (actions) to achieve the objectives.

F. Management measures

38. Management measures or actions to be taken = HOW CAN IT BE DONE; AND HOW SHOULD IT BE DONE AND WHY.

39. In brief management measures are the translation of objectives into relevant intervention, action or work. It is the implementation of the action to realise the objectives decided earlier.

40. The decision to choose the type of actions or management measures to achieve a particular objective depends on the availability of a performance indicator.

41. The reason for this is that objectives must be quantified and measurable. This stage in the planning process identifies the performance indicators that will be used to provide evidence about the condition of a feature. Because it is not possible to measure the totality of a feature, there is a need to focus on a limited range of performance indicators.

42. Whenever performance indicators are established they must be monitored. That is their entire purpose. The measurement of the performance indicators provides the evidence that is used, in part, to determine the condition of the features.

43. More information are given in Section VIII on Management Measures related to the performance indicators and the monitoring exercise. There are also lists of common management measures with different performance indicators that a lake manager can apply.

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Table 4.1: Template Recommended for Action Programs:

Focus Areas	Stakeholders related	Objectives	Recommendation	Type of reason (a to i)
Geological and Physiographical Features				
Hydrological		Objective		
Access to lakes		Objective 1		
		Objective 2		
Water characteristics				
Water quality				
Eutrophication				
Ecological Attractiveness				
Nature conservation features;				
Economic value of ES				
Stakeholders management (describe in Socio-economic profile)				
Communities Participation – ESSVA				
Agencies Involvement				
Governance				
Lake Uses and Its Resource Development Facilities				
Strengthening the pillars		Objective 1		
		Objective 2		

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G. Further guiding matters on objectives:

The relationship between factors and features

44. Once the factors have been identified, the effect that they will have on the feature must be considered. The influence of factors should be considered for each identified feature in turn.

45. Features will change as a consequence of the factors, and it is important that the direction of change and any potential indicators of change should be identified. This relationship between factors and the selection of appropriate performance indicators is very important. It is not possible to measure everything on a site; managers must focus, therefore, on monitoring those indicators that are most likely to change.

H. Operational limits

46. The purpose of operational limits is to define a range of values for each factor that will be considered acceptable and tolerable levels, with an example being. For example the shorelines stabilization works.

Recommended structure for presenting objectives

47. Once appropriate indicators and a monitoring program have been identified, the remaining task is to write a succinct and easily understood objective statement.

48. For each feature, begin with the description of the condition required for the feature, followed by the operational limits and the selected performance indicators, with defined limits.

49. Some examples of lake management objectives:

Objective 1 – Improve Scientific Understanding of Lake Conditions through Monitoring, Modelling, and Special Studies

Objective 2 – Establish and Strengthen Partnerships to Maximize Benefits of Actions under Existing Regulatory Frameworks

Objective 3 – Develop and Implement a Nutrient Reduction Action Plan

Objective 4 –Increase Public Awareness of Lake Conditions and Influences on Water Quality

Objective 5 – Establish Funding Mechanisms to Support the 2009 LMP Goals, Objectives, and Strategies

50. Examples of objectives on socio- economics:

Objective 6 - To adhere to the local agenda/plan;

Objective 7 - In relation to other participatory subject;

Objective 8 - Will be linked to the community's participations and agencies' involvement, and with other related lake management issues (in normal cases)

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51. Table 4.1 shows the simplified recommended objectives for focus areas of the lake management plan.

I. Rationale

52. The rationale of the objective of a plan is devoted to identifying and describing (in outline), the necessary matters of the lake or site features, to be maintained in (or restore them to) favourable status.
53. Decisions in this section are based on a second assessment of the factors. This time, the discussion focuses on seeking management solutions in order to bring the factors under control.
54. Control can refer to mean the removal, maintenance or application of factors. For example, fishing is an obvious factor for some lakes. Options to be considered here could include controlling, maintaining current levels of fishing, or introducing fishing in some other areas.
55. On all sites there will be a number of other responsibilities, obligations, and tasks that will need to be addressed, but which arise for reasons other than the management of features. It is important that these other obligations be included in the management plan, particularly since they can have substantial resource implications.

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Section V: Chapter 4 - Action Program

A. Overview

1. Chapter 4 is the last chapter of the lake management plan.
2. This section is a continuation of the rationale. In the rationale, the need for, and the nature of, possible management have been discussed and elaborated.
3. The outcome should be an outline of the management processes considered most appropriate to safeguard each feature. The function of the management project is then to describe in detail all the management measures (the work) that will be associated with each feature.
4. Once the obligations are known, managers can then move on to identify the management requirements in order to implement the works.
5. At this stage, negotiation with stakeholders becomes essential. While objectives are not negotiable, it is often possible to identify a range of alternative management approaches that would meet the objectives.

B. Chapter on Action Program

6. The decided management measures that are going to be implemented are called "actions".
7. Actions are the specific steps that will be taken to accomplish the objective. They are realistic and results-oriented and have been decided based on: proper information (Chapter 1), detail evaluation (Chapter 2) and with the specific objectives (Chapter 3) of this ILBM plan.
8. Strategic work program

    a. Incorporation of measures in a concise management plan. Plus indication of the expected impact of the measures and their costs, in order to determine the priority order per action.
    b. Description of measures which have to be carried out before the expiry date of the plan (the next revision date. In a lot of cases the currency of a plan is three to five, sometimes even ten years).
    c. Inventory of necessary and available support, finances etc.
    d. Final choice of management measures and setting up a global planning

C. Detail action program

9. Projects are descriptions of single actions to enable to control the realization process.
10. Work programmes - Those who have to carry out the management measures, should get adequate information about what, when, how etc.

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11. A planning system should also clarify and manage the execution in a specified time.
12. It is important that the following areas are given attention for each project:
    a. **When** when will the work be carried out and for how long?
    b. **Where** where on the site will activities take place?
    c. **Who** who will do the work and how much time will be required?
    d. **Priority** what priority is given to the project?
    e. **Expenditure** how much will the work cost?
13. Example of work Action Program is in Table 5.1

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TABLE 5.1: Example of Work Program

Focus Areas	The management measures	Monitoring exercise	Estimated cost/ Source of Funds	Where/ location	Who is working on	When to start	Method of implement ation	Priority
Geological and Physiographical Features								
Hydrological	Current pattern and velocity	Survey	HQ RM1 million	The lake	Lake management Unit		Tender	
Access to lakes	Access Road /guard house	Visitors count	Departmental	Lake fishing areas	Lake management Unit	Feb 2018	Internal quotation	high
Water characteristics								
Water quality	Rubbish control	GPT + trash trap	PBT: RM100,000	Inlet 33	Development Division			
Eutrophication	Control the nutrients flow - Install Smart Drat	T-P, T-N, Chl-a sampling	University: RM200,000					
Ecological Attractiveness								
Nature conservation features;	Key stone species	Purple heron	University: RM200,000	All along the peripherals	Wildlife Department	Feb 2018	Internal	high
Economic value of ES	CV Method of assessment	Survey	Consultant: RM200,000					
Stakeholders management (describe in Socio-economic profile)								
Communities Participation – ESSVA		Survey	Consultant: RM200,000					
Agencies Involvement	Musyawarah – government agencies	Survey and interview	Consultant: RM100,000					
Governance								
Lake Uses and Its Resource Development Facilities			Departmental					
Focus Areas	**The management measures**	**Monitoring exercise**	**Estimated cost/ Source of Funds**	**Where/ location**	**Who is working on**	**When to start**	**Method of implement ation**	**Priority**
Strengthening the pillars	Musyawarah with communities	Awareness of people	NAHRIM Consultant: RM100,000	At the town hall	NAHRIM/ consultant	May 2018	Lecture and survey	high

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D. Things to carry through the Lake Management Plan

E. The Cyclic Process

The review

14. Part of Cyclic Process - Yearly work plan - A detailed year programme, extracted from the global programme for the (three to five) coming years with detailed information about at least the following aspects:

    a. Which measures should be carried out, in which order, how, where, when, by whom.

    b. Where does the budget come from.

    c. How should regulations be implemented and enforced and by whom.

    d. Which research/monitoring programme should be carried out in what order, by whom.

15. Necessary to evaluate and adjust management measures, finances etc. Not to review the plan as a whole, but to keep on track.

16. The purpose of the short-term review is to confirm that a site is being managed in accordance with the requirements of the plan.

17. Results of management measures monitoring exercise can be used to reschedule the implementation of the measures decided. The initial results will also be useful to adjust the methodology of management measures implementation.

18. This exercise will enable the lake managers to determine the best or most appropriate management measures that need to be implemented and will able to produce the expected improvement or enhancement product for the benefit of the lake.

F. The Major Review

19. Major review of lake management plan is recommended to be implemented every 5 years (sometimes even 10 years).

20. Then, or even before the expire date it will be necessary to review the management plan by using the results of the monitoring programme, change in policy or increase or decrease of human use of resources in or outside the area.

21. A summary of all yearly programmes, with detailed information about at least the following aspects.

22. The level of management must be at the departmental or the ministerial level.

23. Management decision will be made to proceed with various recommendations in the major review exercise.

24. Major reviews should be considered an essential component of any planning process. The functions are to:

    - **Assess whether or not a site is being managed to at least the required standard**
    - **Confirm, as far as possible, that management is effective and efficient**
    - **Ensure that the status of the site features is being accurately assessed.**

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25. This process can be implemented by any external auditors or consultants. Like other environmental management processes, this process is a constructive process, which should identify any problems or concerns, and seek to provide recommendations for resolving issues.

26. Whenever possible, lake management plans should be regarded as public documents, and stakeholders should be given access to the plan.

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Section VI: Stakeholders Management

A. Overview

1. In addition to planning the management of nature conservation features, the lake management plan should also take into account the importance of the interests of the communities, as well as the cultural (including history, archaeology, religious and spiritual), visitor/tourism management, education and socio-economic aspects.
2. Lake managers must acknowledge the need to adopt an inclusive approach, which considers the interests of all stakeholders and, as far as possible, encourages their involvement in all aspects of appropriate site management planning.
3. Management of stakeholders deals with people whose lives are involved in or related to the lake. Even though it is a delicate task, applying good communications programs and systematic methodologies will make the management of stakeholders workable.
4. One of the key issues when building and maintaining a successful relationship among the stakeholders is to appreciate what can and cannot be negotiated.

B. Implementing the stakeholder's management

5. In the lake management plan process, this part is shown as the two orange blocks on the right of the ILBM plan scheme as in Figure 1.3.
6. There are three (3) important components to address stakeholder elements in lake management planning. They are:

   a. Community profiling:

   - This is the socio economics profiling of the local communities
   - The detailed description here would be used in the next two processes

   b. The communities' participation:

   This is the methodology in dealing with the communities to encourage their participation and to measure the improvement of such efforts.

   c. Agencies involvement

   This deals with the stakeholders from governmental agencies

7. Figure 6.1 shows the related components in the stakeholders' management process.
8. The stakeholders' participation process is implemented throughout the development of the plan i.e. from the start of the description process to the completion of the action programs.
9. The local communities are the people who live near the lake or within the lake's catchment or people whose lives are related directly or indirectly to the lake.

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10. People who are working in organizations such as government agencies and offices, non-governmental organizations (NGOs) or research institutions are included in the agencies involvements.
11. The management measures (or action programs) related to the stakeholders' management will normally be decided upon together with the communities participation and the agencies involvement to achieve other operational objectives of the plan.



Figure 6.1: The stakeholder management processes

C. Socio-economic profiling

12. The socio-economic profiling of data and details of the communities will be the general process in which the collected information and products will be usable/applicable in both the community's participation and agencies involvement processes.
13. The profiling process starts in the description's Chapter 1 throughout the evaluation, before establishing its objectives and conclude by building its action programs.
14. A socio-economic profiling process that is conducted using the normal methodology for areas related to the lake will be sufficient for the lake management program.
15. Methods that can be applied include site observations, interviews, standard surveys and consultation of the local communities or local planning reports.
16. A new approach to determine the gap between the communities' perception outlooks (ecosystem shared value assessment – ESSVA) and the actual stress of ecosystem services affecting them is now being introduced and seems to give a good conceptual understanding of the 'river-lake-estuary' management strategies.

D. Communities' participation

17. Experience has shown that management regimes that involve various local residents and indigenous communities tend to be more sustainable than those that are developed without their participation.
18. The community's participation in Malaysia is considered a new strategy for most communities and even government agencies. In the Malaysian situation, more public

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participation programs are now required in the implementation of planning and development projects.

19. Establishing meaningful/successful local participation in lake management will be difficult if basic development needs are not met such as in the case of Tasik Sembrong (NAHRIM 2016).

20. Figure 6.2 shows the scale of communities' participation in a management program.



Figure 6.2: Ladder of participation

21. In normal Malaysian situations, the communities' participation will be more of a partnership whose views are considered as the government agencies of a particular site or district conduct the decision-making and implementation of a management program.

22. However there is a gap in understanding between the target achievements of ecosystem condition with the actual sentiment of the communities. This situational gap will be more likely to be resolved by the Ecosystem Shared Values Assessment (ESSVA), which will be elaborated in item E in this Section.

23. Communities' participation is included in the lake management processes namely in:

    a. Description process: most information will be clearly observed in the socio-economic profiling process (Section 4 – item C) when applying the ESSVA concept (item E, the questionnaires are prepared at this stage);

    b. Evaluation process: identifying the problems (in ESSVA concept, the questionnaires results will be evaluated to determine the status of the ecosystem shared values);

    c. Confirming the objectives: deciding upon the solutions (partly from local knowledge and to some extent the agreeable management measures). The objectives for the communities' participation programs will be normally done together with other related management objectives;

    d. Deciding the Management measures: implementing management plans in a participatory approaches manner (whenever possible); and

    e. Monitoring program: monitoring the effectiveness of agreed measures (to address the problems and opportunities).

24. The most in-demand strategy that will allow for successful management of participation from the communities is a two-way communications channel and the

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information dissemination between the authorities and the communities.

25. Participation requires changes in roles and expectations for all parties – changes that are often seen as fraught with risk. In order for the process to be successful, it needs to be implemented in an atmosphere of trust.

26. If agencies are mandated by parliament or the judicial system to involve communities, this can provide a strong incentive for agencies to develop the necessary capacity to carry out participatory management. This, however, hardly happens in Malaysian scenarios.

27. For a better participatory program, it has to be:

    a. An open process, incorporating the project principles for lake management.
    b. Although the guidelines primarily focus on the benefits to local communities and indigenous people, it is equally true that research institutions, the private sector, and other parties should be included in management planning.
    c. A requirement that all parties must gain a benefit.

28. Over the long term, delegation of some management responsibilities to local communities can be less costly than traditional "protectionist" approaches. Local involvement also contributes to a reduction in enforcement expenditures because of voluntary compliance.

E. Applying ESSVA/ESSRA in ILBM's community's participation

29. The concept of Integrated Lake Basin Management (ILBM) relates to the Millennium Ecosystem Service (ES) Framework as applied to the river-lake-estuary basins. The overall Ecosystem Service (ES) associated with a river-lake- estuary complex provides for values/benefits to be shared by the basin communities, but the values could also be threatened or diminished by risks unless properly managed.

30. Ecosystem Services (ES) associated with a river-lake-estuary or ILLBM or IL2BM complex provides for values/benefits to be shared by basin communities, but the values could also be threatened or diminished by risks unless proper managed.

31. ES consists of Provisional Service (PS), Regulating Service (RS), Cultural Service (CS) and Supporting Service (SS). The "ILBM Platform Process", being a cyclic process of gradual, incremental, and long-term improvement of basin governance, make use of the ES framework as a major conceptual basis.

32. It is recognized now that for the sustainable management of a site, it is necessary to focus on the Regulating Service (RS) and the Cultural Service (CS) of the ecosystem services, instead of only focusing on the Provisional Service (PS).

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33. The strengthening of the Six Pillars of Governance, i.e., Institutions, Policies, Participation, Information and Knowledge, Technology and Funding, should not be pursued only for more PS at the expense of RS.
34. or the purpose of focusing the communities participation on RS and CS, the Ecosystem Shared Value Assessment / Share Risk Assessment (or ESSVA/ESSRA in short) will be very useful.
35. The first step in ESSVA/ESSRA is to find out the Ecosystem Service Perceptional Profile (ESPP) and the Ecosystem Service Factual Profile (ESFP). ESPPs are obtainable through questionnaire surveys. ESFPs are in the form of analytical assessment data and/or compiled statistical information and data. ESPPs can be depicted in relation to the spheres of influence/interaction of different scales for different ecosystem services.
36. ESSVA/ESSRA would be undertaken in the form of scoring of ESPPS projected, as in the case of geographical mapping, onto the available resources in relation to the ongoing compilation of scientific and managerial information/knowledge on natural, social and humanistic dimensions.
37. ESSVA/ESSRA will form a basis of the ILLBM platform process, with software, hardware and heartware, a conceptual framework which have led to very interesting and promising outcomes for sustainable use and management of basin resource of river-lake-estuary complexes.

F. Benefits of ILLBM or IL2BM – ESSVA

38. IL2BM-ESSVA provides a way to bridge (or to fill) the perception gaps between different stakeholders with different views and interests as well such gaps between people living in different locations in the basin (Upstream, Downstream of the lake, and around the lake).
39. As well as filling in the gap, this approach provides an opportunity for the basin population to evaluate their lake basin on current and future status and values, helping them to shape a shared vision and common understanding of the issues and challenges facing the lake basin.
40. IL2BM-ESSVA provides a methodology for the government to listen to the voice of community, enabling them to develop policies and programs that will be more outcome-focused, which in turn makes them widely supported and easily implemented.
41. This method of assessing the communities' participation also helps to develop a sense of "ownership" in the basin population, facilitating community participation in the lake basin management process.
42. On the other hand, ESSVA also enables different basin stakeholders to discuss their problems based on the same general framework that would help enhance the opportunity for mutual collaboration.

G. Operational objectives and management measures of Communities' Participation

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43. It is impossible to achieve enhanced sustainability of management activities, or "social sustainability" which is an inseparable component of the ecological sustainability of ecosystem resources, without taking into account the communities' needs and perspectives.
44. Establishing the objectives for the communities' participations will be much more straightforward when we consider the frustrations and expectations of the communities itself. Thus, the ESSVA methods of dealing with the community's participations will be workable.
45. Operational objectives of communities' participation will most likely to be combined with other related management components.
46. One example is regarding water safety for the community. The objectives will prevent accidents by establishing swimming zones or no trespassing areas etc. This will be more meaningful and effective if implemented together with the management measures of the communities' participation.
47. Another example is developing lake education or information centres (e.g. Lake/ Wetland/Nature Interpretation Centre in Putrajaya), which can be a good communities participation program since it can create awareness of the public and at the same time,

    a. catalyse active and informed participation of local and indigenous people;
    b. serve as demonstration sites for sustainable wetland management;
    c. support formal, informal and non-formal educational programmes that involve a wide range of stakeholders;
    d. help to bring local and indigenous people's concerns to the attention of decision-makers; and
    e. provide information and advice on wetlands and their management.

H. Monitoring (measuring/evaluation) of participatory programs

48. Communities should be continuously provided with assistance on measuring their progress in the participation process. They should be given the necessary advice on monitoring program designs that will improve the validity of the results.
49. Assistance should be provided, if necessary, on how to collect and interpret monitoring data through on-site training with members of the community;
50. Ensure the standard of a monitoring program by considering the following:

    a. intending to leave complete data sets with the community;
    b. be willing to sacrifice statistical rigour in favour of approaches more easily understood and mastered by the community;
    c. making sure that monitoring results are widely disseminated and understood in the community;
    d. it is necessary to include government agencies in the monitoring programme (to monitor their performance) and

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I. Monitoring Learning-by-doing (adaptive management)

51. Learning-by-doing (adaptive management) is new community participation method that has been recommended for better management of lakes and wetlands or other ecosystems.
52. It is a more open-ended approach which examines how a project succeeds or fails, or if there were any unintended (whether good or bad) outcomes.
53. The detail is summarized in Appendix 8.
54. The focus of a participatory evaluation will be on matters of concern to the community, with an emphasis on what the community can do, together with government, to improve upon the participatory arrangement.
55. To facilitate learning-by-doing, it is important to collect data to adopt an appropriate management attitude.
56. To ensure that the learning-by-doing method works, all commitments should be carried out, including arranging meetings and carrying out tasks agreed at meetings (this applies to all parties - local community members, government staff and project staff). Other important criteria are to:

    a. have the community elect or appoint individuals or committees to carry out agreed-upon tasks;
    b. ensure that these committees and individuals are held accountable to the community;
    c. see that agreements by government agencies to provide material or financial assistance are adhered to.

J. Other matters on Communities Participation

57. Ensure that key parties have a good understanding of each other's needs, responsibilities, limitations and culture with the following:

    a. Facilitate communication between the various stakeholders within (and outside) the community;
    b. Explain, to all stakeholders, regarding the framework and constraints within which government agencies work;
    c. Do not assume that communities understand the roles of government agencies, even if they have regular contact with them;
    d. Arrange workshops where local people and government staff can communicate and explore their separate objectives in relation to wetland resources;
    e. Establish mechanisms for regular communication between community representatives and staff of key government agencies.

K. Agencies Involvement

58. Since the institutional framework in the Malaysian lake management experience shows different kinds departmental involvement (with no single specialized department handling lake matters), it is advisable that the manager or the management team

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to include the details of government agencies' involvement in their stakeholders' management.

59. The process starts with the description procedure of stakeholders. The socio-economics profiling scopes will include some of this process.

60. The process of identifying the stakeholders (government agencies/departments) starts by listing all possible stakeholders that may have interest in the management of the lake.

61. The identified stakeholders, its address, and information will be listed. Each of the agencies will then be evaluated on their level of importance and relevance, with the question: is it fine to go ahead with managing the lake without involving the agency?

L. Evaluation of stakeholder forum (Agencies Consultation Forum)

62. A consultative forum will be the best technique to shorten the process of getting the agencies involvement in lake management. Furthermore, this process is necessary to get the view and comments from government departments' officers on the actual problems on the ground.

63. Details of the consultation process with the technical departments will normally involve the following:

    a. Questionnaires for the group discussion;
    b. The quadrant analysis of the departments involved;
    c. The SWOT analysis to be done by the group;
    d. Questionnaires for the individual participants of the consultation forum

64. The information from the questionnaires will be useful to identify certain situations that may be used for management purposes. The participants are allowed to consult their respective offices/departments if needed.

65. Evaluation of the agencies' status in the lake management can be carried out by using the quadrant as shown in Figure 6.3;

66. One of the activities of the consultative forum for the agencies is to identify the location of various agencies on the quadrant in Figure 6.3.

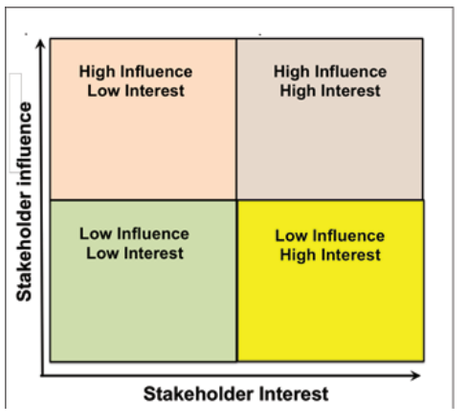


Figure 6.3: The Influence - Interest Quadrant

67. Having the position of agencies determined by a group of government officers will provide accuracy in the agencies' respective function and responsibilities.

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68. Their respective locations in the quadrant will also provide the recommended actions in dealing with the agencies.

69. The agencies consultation will provide the needed analysis of key government agencies and also for local authorities (where appropriate) to determine what inputs will be required to enhance their role in participatory management, and to provide necessary training and infrastructure.

M. The SWOT analysis

70. The extent of involvement of government agencies differs from different districts and different lakes. Dealing with different agencies is not straightforward in the practical sense of the word.

71. A simple tool for analysing the involvement of local government agencies is the use of the Strength, Weakness, Opportunity and Threat analysis (or better known as SWOT analysis).

Table 6.1: Table used for SWOT analysis

S (Strengths)	List of Strengths 1. 2. 3.
W (Weaknesses)	List of Weaknesses 1. 2. 3.
O (Opportunities)	List of Opportunities 1. 2. 3.
T (Threats)	List of Threats 1. 2. 3.

72. Table 6.1 is used to evaluate and analyse the extent of involvement of various agencies.

73. Upon completion of the analysis, lake managers should be able to identify appropriate strategies in dealing with different agencies.

N. Objectives and management measures for stakeholders

74. In deciding various management objectives related to stakeholders, the following should be considered:

    a. Ensure that tasks taken up by various stakeholders are within their capabilities and that they have sufficient time to perform them;
    b. Have regard to their level of understanding of the nature of the task;
    c. Look into the seasonal demands on local people's time, e.g., agricultural and ceremonial cycles;
    d. Be aware of prejudicial attitudes (e.g., lack of trust between local people and agency staff).

75. Ensure that funding agencies are kept up to date with the emergence of issues and the

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development of participatory management approaches. In this way they will be more prepared to accept necessary changes in direction or allocation of funds.

O. Measuring the level of involvement (performance monitoring/ evaluation)

76. Evaluation of the agencies involvement status is usually carried out by observing the coordination between different agencies involved in the lake management.
77. The smooth communication and coordination in implementing different departmental objectives will ensure better management of the lake.
78. Getting feedback from agencies regarding difficulties in project or management implementation (e.g. security or control of access) will be a good sign of improved management of the lake.

P. Action programs for stakeholders

79. Recommendations for stakeholders' action programs for both the communities' participation and the agencies' involvement will be identified from 'the quadrant' and 'SWOT' analysis output.
80. The questionnaire results will also determine the recommendations of management measures (or actions) in relation of the communities and the agencies.
81. The implementation of management measures for the stakeholders may be done as a combined effort. This means that the analysis of the three socio-economic components will be applied together among other management measures to achieve common objectives.

Q. Other matters that will support the stakeholders' management

82. Establish networks among communities involved in lake and wetland management and encourage regular contact and sharing of experiences:

    a. avoid a reliance on classroom approaches. For example, field visits led by local community members can be utilized;
    b. organize conferences and/or regular informal information exchange;
    c. extend networks to key local figures such as media representatives, business people, politicians etc., who may be able to support the community's participatory initiatives.

83. Prepare for replication and extension from the beginning of the initiative:

    a. Avoid the trap of facilitators feeling that they are the only ones who equipped to extend the approach to new communities;
    b. Train local people and build their confidence so that they can train people in other communities;
    c. Do not attempt replication too early in the project;
    d. Beware of "me too" requests for replication in other communities which are motivated only by a general impression that there are material benefits associated with participation in the initiative.

84. Do not overlook the need for new skills and major changes in attitudes relating to

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participatory processes. Use members of the local community to provide training inputs.

85. Pay attention to the level of understanding of local culture, traditional resource management regimes, lake ecology and extent of local ecological knowledge.

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Section VII: Ecosystem Value

A. Ecosystem Services

1. Since the development and reporting on indicators of the status and trends for inland waters through the work of Millennium Ecosystem Assessment (MA) and the Convention on Biological Diversity (CBD), the ecosystem services approach has gained recognition, and its strategies have been widely used. This calls for the reassessment and transformation of conceptual-theoretical natural resource management and governance approaches to conservation.
2. Natural resource management and governance approaches to conservation efforts have demanded for the reassessment of the values of ecosystem.However, this singular focus on management ignored the fact that ecosystems are complex, dynamic, adaptive systems with nonlinear feedback and thresholds[1] and are tightly interlinked with human systems[2].
3. The conventional focus on ecosystems without considering impact on long-term human well-being is being revised. There are now more efforts to breach the gap between the benefit of harvesting the products of nature and the deterioration of livelihoods among the affected communities.Managers and scientists have recently used their reports to establish a lake ecosystem status rating or condition. The value is very useful in establishing trade between lost ecosystem services and the economic values that the society will gain.
4. The present approach highly regards the fact that ecosystems are complex, dynamic, and adaptive systems with nonlinear feedback and thresholds1 and are very inter-related to the local communities' way of life.
5. Recently, the value of ecosystem services status has been reported to establish the status of a lake or any ecosystem condition. The value is very useful in establishing the trade-off between the ecosystem services that is being lost and the economic values that will be gained by the communities.
6. Managers and scientists have recently used their reports to establish a lake ecosystem status rating or condition. The value is very useful in establishing trade between lost ecosystem services and the economic values that the society will gain.
7. The basic method of how to evaluate ecosystem services economic assessments is described in this section.

B. The need for ecosystem services assessment

8. Gap analysis is a technique that businesses use to determine what steps need to be taken in order to move from its current state to its desired, future state. It is also known as need-gap analysis, needs analysis, and needs assessment.
9. An important issue that has been raised is that how to fill the gap between the level of basic services provided by the wetland and lake ecosystems and the rapidly increasing and modernizing requirements of local populations.
10. Omitting environmental concerns from any planning and development effort can result in untenable economic losses for some of the poorest sectors of the population. This will also reduce the social and economic welfare status of rural residents.
11. Since these groups are rarely in the position to bear such costs or expenditures, it will impose high economic costs on public sector agencies responsible for providing basic services and assuring an acceptable standard of living for them.

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12. To ensure favourable management of our lakes, decision-making must be derived from improved evidence based of ecosystem management. In practice, this will require specific data collection exercises for local decisions to reflect local conditions and the specific nature of the decision

13. Table 7.1 can be used, in general, to determine issues and information needed to improve decision-making on water issues, such as wetlands and lakes (depending on the context and the policy requirements).

14. There are also identified methodologies for assessing the values of nature for specific local decision-making3.

Table 7.1: List of information needed to improve decision-making on water issues

NO	ISSUES TO BE OBSERVED	YES/ NO	INFO/ HOW IT HAPPENED
1	The water-related problems in place at the appropriate scale, and the translation of these problems into ecosystem services-based terminology;		
2	The objectives for social and economic development (e.g. health protection) and how the ecosystem services contribute, or could contribute;		
3	The distributional aspects of ecosystem services: who benefits and who loses, and also how the ecosystem services are distributed across time and space.		
4	The extent of the current stock of wetland and lake resources and its role in water supply (flow of services) at the scale in question, and relevant biophysical data to ensure insights on ecosystem functions that might not be visible from stock and flow indicators alone;		
5	The extent of previous wetlands/lakes, or existing degraded wetlands/lakes, which might be restored in order to provide ecosystem services to manage the problem in question;		
6	The economic value of ecosystem services, when possible, to inform decision-making, economic instruments and policies;		
7	How the water and wetlands or lakes and the ecosystem services they provide are changing and how they can be managed to address both biodiversity objectives and development objectives given the range of ecosystem service flows.		
8	A first overview of the full range of relevant ecosystem services that water and wetlands provide, and a more detailed analysis of ecosystem services that are of highest relevance to stakeholders (and their economic values if and where this is appropriate). Such a tiered approach in information can help ensure that a sufficiently complete picture of ecosystem services is created, while directing sufficient resources and capacity to the ecosystem services of particular relevance for the decision at hand;		

3 E.E.B.W.W8. Reports, 2013

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15. It is equally important to be aware of the essential complexity of the processes, interactions, and uncertainties of environmental indicators and valuation exercises.
16. In some cases, limited information will be a sufficient evidence base to inform policy action, but in others this will not be enough, particularly in the long term.
17. In the future, a better body of information on ecosystem services with high relevance to the economic challenges being considered and the concerned stakeholder groups involved is crucial in order to build indicators needed for evidence-based policy-making.

C. National and international policy makers

18. At the global level, the implementation of the following planning has been established for reference: the Strategic Plan for Biodiversity 2011–2020, RAMSAR Strategic Plan 2009–2015, United Nation Climate Change (NFCCC), and Millennium Development Goals (MDG).
19. An improved science-policy interface and support for the scientific/research communities are required to develop an enhanced measurement, in addressing knowledge gaps, and in using biodiversity and ecosystem service indicators and environmental accounts.
20. Establishing inter-governmental agencies platform (wherever possible) on biodiversity and ecosystem services can contribute significantly in the lake basin area.
21. Practical recommendations can be formulated for stakeholders to respond to the value of water and wetlands in decision-making processes.
22. The role and value of water and wetlands/lakes should be integrated in each of the inter-governmental platforms to improve water security and other water-related benefits. Ecological evaluation
23. Ecological evaluation is a separate exercise from the ecosystem services economic assessment. This evaluation is the basis of understanding the available status of the lakes' ecosystem services.
24. The process of evaluation starts with the key features central to the ecological character of a lake. Table 7.2 lists the criteria recommended for the evaluation of features4. The list is not intended to be comprehensive. Only the relevant or useful criteria should be used, and additional criteria should be added, as circumstances require.

Table 7.2: Example of Ecological Character of Wetlands (Source DeGroot et al. 2006)

Criteria	Short description	Measurement unit
Naturalness/ Integrity (representative- ness)	Degree of human presence in terms of physical, chemical or biological disturbance	• Quality of air, water and soil • % key species present • % of min. critical ecosystem size
Diversity	Variety of life in all its forms, including ecosystems, species & genetic diversity	• number of ecosystems/ geographical unit • number of species/surface area

[4]Managing Wetlands. Ramsar Handbook No. 16, 3rd edition, 2007

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Criteria	Short description	Measurement unit
Uniqueness/ Rarity	Local, national or global rarity of ecosystem and species	• number of endemic species & subspecies
Fragility/ Vulnerability (resilience/ resistance)	Sensitivity of ecosystems to human disturbance	• energy budget (GPP/NPP[1]) • carrying capacity
Renewability/ Recreatibility	The possibility of (spontaneous) renewability or human-aided restoration of ecosystems	• Complexity and diversity • Succession stage/-time/NPP • (restoration costs)

D. Integrating lake site management

25. The policy and planning decisions at broad-scale landscape and ecosystem areas, including at the integrated river basin and/or coastal zone scales, will affect the conservation and wise use of the wetlands and lakes sites. Recognising this, the guidelines deliberating the multi-scalar approach to wise-use planning and management.
26. The concept of Ecosystem Management has broad similarities with IRBM, where the ecosystem boundary is synonymous with the river basin boundary, but in which the focus is on maintaining ecosystem function.
27. It is vital that river and lake basin planners and managers recognize that wetland and lake ecosystems are key elements within a basin.
28. The ecosystems are the resource from which the commodity of water is derived (rather than being a competing user of water). Thus, thoughtful management of wetlands, such as use of wetlands to improve water quality, can be a solution rather than a restriction to IRBM.
29. One of the worst mistakes that can be made in ecosystem management is to believe that a feature is being successfully protected when in reality it is not.
30. When a lake site does not include a buffer zone, it is generally appropriate for lake management planning purposes to identify and establish such buffer zone around the core lake area defined within a lake site or wetland.
31. The buffer zone should be the area surrounding the lake within which land use activities may directly affect the ecological character of the lake itself. The objective of the buffer zone should be one of sustainable use through ecosystem management, consistent with the maintenance of the ecological character of the lake.
32. Another approach is to zonation, and one that is not mutually exclusive to the core/buffer zonation approach is that of establishing zonation for a particular use of a lake.
33. An example could be the use and development of a lake for ecotourism. Zonation would be used to establish which parts of a site where ecotourism access can occur, where ecotourism infrastructure should be placed (e.g. the sensitive siting of a visitor centre),and which parts of a site should exclude ecotourism owing to the sensitivity of the ecosystem to disturbance.
34. Such zonation schemes will generally cut across the core and buffer zones.

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Table 7.3: Features of lakes and wetlands for management planning

NO	FUNCTION OF LAKES AND WETLANDS	YES/ NO	NO	FUNCTION OF LAKES AND WETLANDS	YES/ NO
A	**Production functions**		**C**	**Processing and regulation functions**	
1	Timber production		1	Decomposition of organic material (land-based)	
2	Firewood production		2	Natural desalinisation of soils	
3	Production of harvestable grasses (construction & artisanal use)		3	Development/prevention of acid sulphate soils	
4	Naturally produced fodder & manure		4	Biological control mechanisms	
5	Harvestable peat		5	Seasonal cleansing of soils	
6	Secondary (minor) products		6	Soil water storage capacity	
7	Harvestable bush meat (food)		7	Coastal protection against floods	
8	Fish & shellfish productivity		8	Coastal stabilisation (against accretion/erosion)	
9	Drinking water supply		9	Soil protection	
10	Supply of water for irrigation and industry		10	Water filtering	
11	Water supply for hydroelectricity		11	Dilution of pollutants	
12	Supply of surface water for other landscapes		12	Discharge of pollutants	
13	Supply of ground water for other landscapes		13	Bio-chemical/physical purification of water	
14	Crop productivity		14	Storage for pollutants	
15	Tree plantations productivity		15	Flow regulation for flood control	
16	Managed forest productivity		16	River base flow regulation	
17	Rangeland/livestock productivity		17	Water storage capacity	
18	Aquaculture productivity (freshwater)		18	Ground water recharge capacity	
19	Marin culture productivity (brackish/saltwater)		19	Regulation of water balance	
			20	Sedimentation/retention capacity	
B	**Carrying functions – suitability for:**		21	Protection against water erosion	
1	Construction		22	Protection against wave action	
2	Indigenous settlement		23	Prevention of saline groundwater intrusion	
3	Rural settlement		24	Prevention of saline surface-water intrusion	
4	Urban settlement		25	Transmission of diseases	
5	Industry		26	Carbon sequestration	
6	Infrastructure		27	Maintenance of pollinator services	
7	Transport infrastructure				

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NO	FUNCTION OF LAKES AND WETLANDS	YES/ NO	NO	FUNCTION OF LAKES AND WETLANDS	YES/ NO
8	Shipping/navigation				
9	Road transport				
10	Rail transport				
11	Air transport				
12	Power distribution				
13	Use of pipelines				
14	Leisure and tourism activities				

(Derived from Annex III of CBD's Guidelines for incorporating biodiversity-related issues into environmental impact assessment legislation and/or processes in strategic environmental assessment; see Resolution VIII.9.)

E. Economic assessment of lake ecosystem services

35. The description of a site, which should summarise available knowledge, is followed by the economic assessment processes, which are the process of identifying important gap of values or status of the ecosystem services provided by a lake.

36. The purpose of assessment is to understand or to establish the status/condition of the lake comparing to the expectation of the natural or good ecosystem level, including the expectation of the local people.

37. The process of assessment helps to describe the 'values' associated with the lake and identifies the reasons for need of its conservation.

38. Examples of ecosystem services of lakes can be observed from the list of services provided by wetlands from RAMSAR's sites for wetlands as in Table 7.4.

Table 7.4: Examples of Ecosystem Services provided by wetlands

Supporting Services	***Provisioning Services***
Services necessary for the production of all other ecosystem services • Soil formation • Nutrient cycling • Primary production	• Products obtained from ecosystems • Food • Fresh water • Fuel wood • Fuel • Biochemical • Genetic resources
Cultural Services	***Regulating Services***
• Non-material benefits obtained from ecosystems • Spiritual and religious • Recreation and ecotourism • Aesthetic • Inspirational • Educational • Sense of place • Cultural heritage	• Benefits obtained from regulation of ecosystem processes • Climate regulation • Disease regulation • Water regulation • Water purification • Pollination

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39. While the lakes' normal functions are natural processes that continue regardless of their perceived value to humans, the value people place on those functions in many cases is the primary factor determining whether a lake remains intact or is converted to some other use.
40. It is imperative therefore that local people and other stakeholders, through the process of evaluation, identify and describe the values they hold for the lake.
41. To make assessment of the ecosystem services of lakes, features that determine its 'ecological character' should be evaluated. Focusing on the ecosystem services that the lake can provide will enable assessment of the lakes' values.
42. Where appropriate, assessment should also consider significant cultural and religious features of the lake. Geological, geomorphological and landscape significance of the lake should also be considered.

Identification of ecosystem services

43. The characterization ecosystem services in terms of its structure, function and benefits will follow the four main categories of ecosystem services as defined in "The Economics of Ecosystems and Biodiversity" (TEEB) taxonomy (see Table 7.5).
44. From this table, the magnitude of ecosystem services will be examined to reflect the degree of importance of an ecosystem service to our lakes. The structure, function and benefits will be examined and identified accordingly.

Table 7.5: Characterization of Lake Ecosystem Services

Ecosystem Services			
Provisioning	**Regulating**	**Supporting**	**Cultural**
Food	Climate regulation	Biodiversity	Spiritual and inspirational
Fresh water	Hydrological regimes	Soil formation	Recreational
Fiber and fuel	Pollution control and detoxification	Nutrient cycling	Aesthetic
Biochemical products	Erosion protection	Pollination	Education
Genetic materials	Natural hazards		

45. Information from the existing compiled data, especially from the Lake Brief, are used in the write-up for the questionnaires included in the ecosystem services economic assessment exercise.
46. To identify the various ecosystem information from a lake, a list of possible ecosystem services of a lake will be tabulated as in Table 7.7 using an example from Sembrong Lake (NAHRIM 2016).
47. The possible ecosystem services provided by our lake will be tick according to its availability.
48. Information from the local is very essential in filling up the information in the table.

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Table 7.6 Example of ecosystem services provided by lake

Ecosystem Services	***Status (O where appropriate)**	**NOTES**
Type of Ecosystem Services: Provisioning		
Food	/	Fish is harvested The value of fish will be documented using the data/research by Fisheries Department
Fresh water	/	For potable water The direct estimate of drinking water value will be assessed
Fibre and fuel	O	Minimal
Biochemical products	O	Gaharu – not significant
Type of Ecosystem Services: Regulating		
Climate regulation	O	Bigger scale
Hydrological regimes	/	Flood mitigation The economic impact of flood will be estimated
Pollution control and detoxification	O	Happening
Erosion protection	O	Very minimal
Natural hazards	O	Flood prevention
Type of Ecosystem Services: Supporting		
Biodiversity	O	Data available for the lake but not included in assessment
Soil formation	O	Reduced depth
Nutrient cycling	O	Data available for the lake but not included in assessment
Pollination	O	In a disturbed state
Type of Ecosystem Services: Cultural		
Spiritual and inspirational	O	Data available for the lake but not included in assessment
Recreational	/	Sought after angler's location Will be recommended in eco-tourism
Aesthetic	O	It is a scenic location Recommended in eco-tourism

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Ecosystem Services	*Status (O where appropriate)	NOTES
Education	O	Not yet enhanced

Note: O - Available information but not assessed;/- Assessed in detail

49. From the information in the description (of chapter 1) and analysis of the possible ecosystem services available in a lake basin, it is possible to make its economic value assessment.

50. The value assessment of the lake is to develop the understanding of opportunity losses due to lake degradation and this will focus on available information of key areas (e.g. flood mitigation, water supply, fisheries and aquaculture and recreational and eco-tourism).

51. Assessment process can be the direct economic value assessment as well as a survey to establish the values and potential losses associated with changes in water quality and quantity of the lake.

F. Values of wetlands and lakes

52. Values are by definition instrumental, anthropocentric, individual-based, subjective, context-dependent, marginal, and state-dependent (TEEB, 2010). Nevertheless, information on the economic importance of ecosystems is essential to support well-informed decisions regarding the trade-offs in land-use options and resource use.

53. There are many different possible derivations of the values of our lakes and reservoirs as shown in Figure 7.1.

Values of our lakes and reservoirs	
Direct Values • Domestic and industrial • Water supply • Transportation • Fishing • Recreation • Breeding Ground • Pewer supply	**Indirect Values** • Flood mitigation • Local climate • Moderation • Waste sink
Option Values • Biodiversity • Endemic species	**Non Use Values** • Legend and Myths • Religious and Sacred

Figure 7.1: Diagram depicting type of 'values' of our lakes and reservoirs[5]

[5] Blueprint for Lake and Reservoir Research and Development (R&D) in Malaysia

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54. There are a number of methodologies for making economic assessment (EA) of the ecosystem services (ES). These are the recommended methods that can be applied in Malaysian lake condition:

    a. Direct Value Methods (Using available data)
        - Fish Rent
            - Yearly harvested fish value from the lake
        - Water Rent
            - The water value for domestic supply (using the water volume take out for consumption);
        - Flood mitigation
            - The possible flood damage salvaged by the dam (of the lake);

    b. Indirect valuation (using survey data)
        - Contingent Value Method (CVM)
        - Travel Cost Method (TCM)
        - Benefit transfer (applying data from other lakes)

55. The indirect valuation methodologies, that are using survey data, will have the socio-economics profile in the questionnaires. It is recommended that for the purpose of ILBM Plan, the socio economics sector of the questionnaires be set up in sharing basis with the survey for CVM, TCM and also the ESSVA (Section VI) surveys.

56. Table 7.7 present a summary of the values available in literature across five identified types of wetlands, as summarised in Appendix 3 of TEEB (2010)[6].

Table 7.7: 'Values' of different services of wetland ecosystem

Category of wetlands	Service category	No. of estimates	Min. value (Int.$/ha/y)	Max. value (Int.$/ha/y)
Inland wetlands other than rivers and lakes (floodplains, swamps/ marshes and peatlands)	**Provisioning services**	34	2	9,709
	Regulating services	30	321	23,018
	Habitat services	9	10	3,471
	Cultural services	13	648	8,399
	Total	**86**	**981**	**44,597**

57. Substantial knowledge gaps on the value of wetlands exist; available data should therefore be seen as an indicator. The limitations of the valuation system for ecosystem services must also be acknowledged.

[6] A quick guide to the Economics of Ecosystem and Biodiversity

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G. Direct Value Method (DVM)

Fish Rent - Yearly harvested fish value

58. Value of fish harvested from this lake will be included in this report as part of the whole economic assessment of any lake. The data that can collected from various sampling exercise done by the Fisheries Department.

59. Further assumptions of fish value can be applied as follows:

- With the assumption that the total amount of fish mass caught in a year is 5% of the total amount of fish in the lake;
- Total fish Direct Market Value is taken from the price rate that is issued by the Department of Fisheries. The price is the average listed by the department at the time.

Water Rent - Water Supply Value

60. The water value for domestic supply (using the water volume take out for consumption in the nearby population);

61. Considering the lake water content is high in organic material, the cost of treating the water is assumed to be 70% of the minimum tariff for domestic consumption.

62. Data collection for water rent: Information regarding the water volume was taken from the amount of water extracted from the lake for domestic water use by the water companies. The volume of 58 (fifty-eight) Million Litres per Day (MLD) was given as the amount of daily water extracted and treated for that purpose.

The flood mitigation value of the lake (the Dam)

63. Some of lake function is to have the dam that makes up the lake to prevent flood events on its downstream areas. The flood-prone areas and its vicinity is mitigated by this dam. The dam seems to be functioning well in this flood mitigation role and thus, managed to prevent property damages in the area.

64. In order to understand the extent of its flood mitigation function, attempts were made to estimate the amount of possible flood damages in this area. The value of the possible damages is also part of the total value of the dam and the lake as it prevents these damages.

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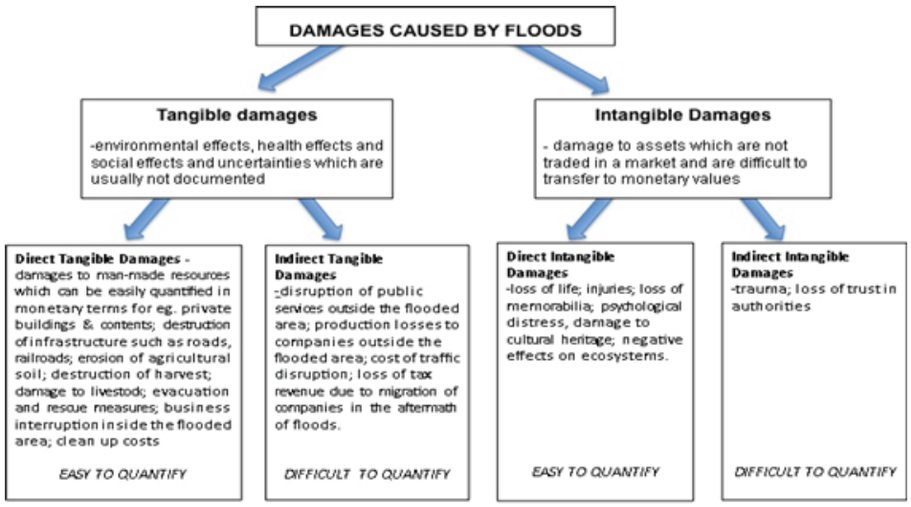


Figure 7.2: Estimating flood damage

65. The salvaged value estimate will be calculated from the total of tangible damages and the intangible damages caused by the flood as in Figure 7.2. The land use pattern of the possible flood areas, if the dam is not in place, will then be analysed in detail. The estimated flood damage to each different use of the land can be formulated.

H. Applying the Contingent Valuation Method (CVM)

66. For the purpose of Contingent Valuation Method (CVM) economic assessment for the lake value, data will be collected from the survey process.
67. Enumerators who will be appointed for this purpose will carry out the field survey. The enumerators will be trained before the field survey begins.
68. Information of the present status of the lake and the supposedly to be managed lake will be explained in detail to the participants of the survey exercise.
69. There are a number of different analysis methods for CVM and it is recommended that for best guide, reference be made to TEEB7.

I. Applying Travel Cost Method (TCM)

70. For estimating the tourism benefits, the travel cost method (TCM) can be used. The following activities are carried out:

    a. Preparation of questionnaire, pilot testing and revision of questionnaire
    b. Survey on visitors to the lake or adjacent areas
    c. Data analysis and derivation of recreation demand function for the ecotourism services of the lake
    d. Estimation of the consumer surplus associated with the demand curve using regression model

[7] G.Root, TEEB

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71. The questionnaire contains questions to deduce information regarding basic information of visitors and travel characteristics (mode of transport, distance travelled, travelling time, travelling expenses, frequency of visits, length of time spent at the site), perception and satisfaction level of the recreation and ecotourism activities, and socio-economic background of visitors.

Possible Environmental Friendly Tourism Assessment

72. Rapid appraisal on the compliance of the existing tourism activities in meeting the environmental friendliness was planned. These include interviews with the operators and communities on the tourism impacts, and direct observation on the site (site inspections) according to the outcomes of the interviews.

73. The areas to be included in the appraisal follow the guideline prepared by UNEP and WTO (2005).

74. The following activities should have been carried out:

    a. Preparation of questions to cover the research areas to be investigated,
    b. Identification of the operators and key informers among the local communities to be surveyed
    c. Analysis of the survey outputs
    d. Justification of the other outputs, i.e. socio-economy survey, travel cost survey

75. However, the proposed survey with operators was not carried out. The main reason was that the agro-tourism centre by the lake was closed down during the first field visit. Its prime attractions that included shaded spots for angling and several chalets fell into reserve area for water bodies following the recent delineation exercise by JPS. Only a rapid assessment on the tourism potential was conducted along with questionnaire surveys to visitors.

Recreational components

76. While it is used primarily as flood mitigation measures and sources of raw water for treatment, lakes are also known as havens for anglers. Anglers from surrounding and distant areas come to the lake for angling activities.

77. The agro-tourism kind of recreation also can be found in the surrounding area. Some centres provide such services for tourists such as nearby farms and other small operators.

78. Other recreational attractions do not really work well in the basin areas as explained above; the delineation of the lake boundaries has limited potential attractions on the lake shorelines.

79. Educational, research and environmental studies have been carried out in the lake on a small scale.

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Section VIII: Management Measures and Monitoring

A. Lake Management Measures

1. Lake management measures are the recommended actions to be implemented to achieve the chosen objectives.
2. Operational objectives are determined based on the evaluation (or assessment) done in Chapter 2. The evaluation of the lake's information and data generates ideas of what needs to be rectified, improved, or enhanced to accomplish the desired management objectives (target).
3. The recommendations for the management measures come from the findings of the operational objectives decided earlier in Chapter 3 of the plan.

B. Performance indicators

4. The performance indicators are used to provide evidence of a feature's condition.The indicators will eventually indicate the possibility of achieving the objectives need to be decided upon.
5. All recommended management measures for particular objectives must refer to the performance indicators as evidence of progress of the action programs. For example, a management objective of maintaining water quality will not be able to monitor each of its many components (which include salinity, pH, conductivity, dissolved oxygen concentration, nutrient concentration, heavy metal concentration, et cetera), as it is not feasible or cost-effective to do so.
6. However, a more appropriate performance indicator for water quality is nutrient concentration because it meets the four criteria detailed below.
7. In general, performance indicators:

    i. are characteristics, qualities or properties of a feature that are inherent and inseparable from that feature;

    ii. should be indicators of the general condition of a feature, and should be informative about something other than themselves;

    iii. must be quantifiable and measurable; and

    iv. should be measurable by an economical method.

8. Some general examples of performance indicators for the habitat and species components of ecological character features are listed in Table 8.1**:**

    i. Economic Viability
    ii. Local Prosperity
    iii. Employment Quality
    iv. Social Equity
    v. Visitor Fulfilment
    vi. Local Control
    vii. Community Wellbeing
    viii. Cultural Richness
    ix. Physical Integrity
    x. Biological Diversity
    xi. Resource Efficiency
    xii. Environmental Purity

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Table 8.1 : Different indicators for habitat and species

Type of indicators	Quantity The size of a population	Quality
Performance indicators for habitats	a. size of area occupied by the habitat b. distribution of the habitat	a. physical structure b. individual or groups of species indicative of condition c. individual or groups of species indicative of change
Type of indicators	**Quantity The size of a population**	**Quality**
Performance indicators for species:	a. the total number of individuals present b. the total number of breeding adults c. the population at a specified point in an annual cycle d. the extent or distribution of a population	a. survival rates b. productivity c. age structure

C. Recommended structure for presenting objectives

9. Once appropriate indicators and a monitoring program have been identified, the remaining task is to list down easily understandable objective statements.
10. For each feature, begin with the description of the conditions required for the feature, followed by the operational limits and the selected performance indicators, with defined limits.
11. Some examples of recommended management measures for typically decided operational objectives taken from the Chini, and Jor and Mahang Lake Management Plan (NAHRIM 2014, TNBR 2015) are listed in Table 8.2. More management measures can be added up depending on the need of its objectives and practicality of its application.
12. These recommendations comprise the operational management plan and enable it to be implemented by the management authorities or the lake managers.

Table 8.2: Examples of the Management Measures

Management Issues	Management Measures	Notes/Details how
Security and safety of users	Open up controlled access	Open up to public and tourists with proper zoning and control Ensure planted trees will have time to grow at the rehabilitated river and lake shorelines.
Zones of activities	Not done	Introduce 'access zones' for recreational purpose Measures to enforce the rules
Environmental Management System (ISO 14000)	As a tool to continuously improve the management approach	Measures that will ensure reducing damage to the ecosystem

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Pollution in water from surrounding settlements/villages	Selective placement of wetland plants along the shorelines of the river	Enhancement of river banks with endemic shrubs and cover crops
Inadequate understanding of use of the tunnels for sediment disposal system	Conduct research on possible use of the tunnels for sediment disposal system	Study on this matter Possible installation of separated piping system inside the tunnel Possible reduction of electricity production with improved water quality
Land Use Confirmation	Forested areas or attractive crops for tourism	Gazettement of Environmentally Sensitive Areas (ESM)

Management Issues	**Management Measures**	**Notes/Details how**
Financial	Development of the Facilities	▪ Chalets ▪ Fishing areas ▪ Swimming areas ▪ Golf ▪ Boating ▪ Cultural visits ▪ Educational visits ▪ Jungle trekking

D. An Overview of Lake Management Techniques

13. Items E, F, G, H, I ,J and K are lists of common solution or measures, but not limited to, that can be applied to lake management. Each will have its suitable time and place of application, and a combination of these may be used.

14. More detailed information on lake management measures and technical solutions can be found in publications available, such as through the NALMS publications , RAMSAR's guidelines and ILEC's resources.

E. Techniques of nutrient control

a. Non-Point Source Management: control of diffuse nutrient sources from the lake basin such as constructed wetlands, riparian vegetation and retention ponds

b. Point Source Management: control of point sources, usually channelled/piped discharges

c. Hydraulic Controls: diversion, dilution, flushing, and hypo limnetic withdrawal strategies

d. Phosphorus Inactivation: chemical binding of phosphorus to limit availability

e. Artificial Circulation and Aeration: mixing and oxygen addition

f. Dredging: removal of nutrient-laden sediments

g. Bacterial Additives: encouraging uptake of nutrients by non-algal microbes

h. Removal of Bottom Feeding Fish: elimination of major recyclers of nutrients

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F. Techniques of vegetation (plant) control

a. Drawdown: lowering of the water level to dry or expose susceptible vegetation to hot conditions

b. Harvesting: multiple methods of manual or mechanical plant cutting, with or without removal, and macrophyte collection

c. Bio-manipulation: the practice of altering biological communities to control macrophytes through biological control agent such as fish and insects

d. Herbicides and algicides: introduction of biocidal chemicals to directly kill vascular plants

e. Benthic Barriers: placement of materials on the bottom of a lake to cover and impede the growth of macrophytes

f. Dyes and Covers: addition of colouring agents or sheet material to inhibit light penetration and reduce vascular plant growth

g. Dredging: removal of sediment and associated plants to inhibit growth

G. Techniques of algal control

a. Artificial Circulation and Aeration: mixing and oxygen addition

b. Bio-manipulation: the practice of altering biological communities to control algae through increasing grazing pressure

c. Algaecides: introduction of biocidal chemicals such as copper sulfate and alum to directly kill algae

d. Skimming: removal of surface algal scum

e. Sonication: use of sound waves to disrupt and kill algal cells

H. Key elements for creating opportunity and reducing nutrient loading

15. Key elements for creating opportunity and reducing nutrient loading through sustainable development and bio-economy approaches include the following:

16. Environmental Aspects

a. Reduced nutrient loads
b. Secured cleaner energy sources
c. Re-stored wetlands
d. Improved sewage treatment
e. Conserved riparian zones
f. Leveraged water retention networks
g. Respected carrying capacities
h. Enhanced biodiversity

17. There are also different approaches, which are applying the best management practices (BMPs) to improve ecosystem services for multiple social, ecological and economic benefits.

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I. Social Aspects

a. Revitalized rural communities
b. Equity achieved through greater emphasis on recycling nutrients within the watershed and providing revenue streams back to farmers
c. Engaged youth
d. Conserved and enhanced cultural benefits related to water
e. Achieved food security

J. Economic Aspects

a. Excess nutrients and waste biomass harnessed for bio-economy opportunities –able to revitalize rural economies;
b. Bio-economy opportunities leveraged through use of local small-scale bio-refineries;
c. Electricity generated locally via bio-products and sold back to the central power grid;
d. Market for ecological goods and services thriving and active in rural settings.

K. Governance aspects

a. Adaptive management is the standard governance approach;
b. continually identifying, testing monitoring and improving BMPs, technologies and policies;
c. Use toolbox of approaches made available for use in different watershed settings;
d. Make monitoring of the sub-watershed-level to adaptively manage progress;
e. Integrate rural and urban approaches;
f. Improve habitat and shoreline management;

L. Designing a monitoring programme

18. Monitoring is defined by RAMSAR[2] as 'collection of specific information for management purposes in response to hypotheses derived from assessment activities, and the use of these monitoring results for implementing management.'
19. According to Resolution VI.1, the collection of time-series information that is not hypothesis-driven from wetland assessment is termed 'surveillance' rather than monitoring3
20. Generally, monitoring includes sufficiently detailed information sheet to provide a baseline for subsequent monitoring in order to detect any changes to these ecological and hydrological attributes (as explained in Section B).
21. Changes to ecological character outside natural variations may signal that site uses, or externally derived impacts on the sites, are unsustainable and may lead to the degradation of natural processes and thus the ultimate breakdown of the ecological, biological and hydrological functioning of the wetland.

[2] RAMSAR Framework for Wetland Inventory (annex to Resolution VIII.6)

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22. A framework for designing an effective lake-monitoring plan must take the following into consideration:

    a. Regular monitoring is required to detect actual or potential changes in ecological character.

    b. Monitoring does not necessarily require sophisticated technology or high investment and can be carried out at different levels of intensity.

    c. Select the most appropriate monitoring technique(s) available according to its priorities and available resources.

    d. A monitoring program should, ideally, be an integral part of a site-specific lake management plan.

    e. Where a management plan does not yet exist, it is still possible to implement monitoring programme (though without the framework of a management plan, it will be difficult to implement the results of monitoring effectively).

M. Monitoring performance indicators

23. Whenever performance indicators are established they must be monitored.

24. The measurement of the performance indicators provides the evidence that is used, in part, to determine the condition of the features.4

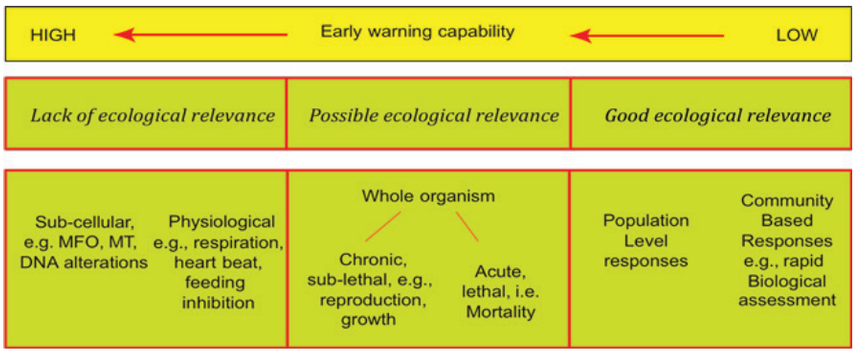


Figure 8.1. Relationship of Ecological Relevance and Early Warning Capability to measure biological responses (Source: Ramsar 1999)

N. Early warning indicators

25. The underlying concept of early warning indicators is that effects can be detected, as precursors to, or indications of the onset of, actual environmental impacts.

26. 'Early warnings' may not necessarily provide firm evidence of larger scale environmental degradation.

27. It provides an opportunity to determine whether intervention or further investigation is warranted.

28. Early warning indicators can also be defined as 'the measurable biological, physical or chemical responses to a particular stress, preceding the occurrence of potentially significant adverse effects on the system of interest'.

29. Most of early warning techniques are to assess the impacts of chemicals on aquatic ecosystems.

3 RAMSAR Framework for Wetland Inventory (annex to Resolution VI.13)
4 Handbook 18: Managing wetlands 53

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30. It is recommended that further assessments be carried out to identify appropriate indicators for other major types of change in ecological character.

O. Ideal attributes of early warning indicators

31. Effective early warning indicators should comprise the following attributes:

    a. anticipatory: it should occur at levels of organization, either biological or physical, that provide an indication of degradation, or some form of adverse effect, before serious environmental harm has occurred;

    b. sensitive: in detecting potential significant impacts prior to their occurrence, an early warning indicator should be sensitive to low levels, or early stages of the problem;

    c. diagnostic: it should be sufficiently specific to a problem to increase confidence in identifying the cause of an effect;

    d. broadly applicable: it should predict potential impacts from a broad range of problems;

    e. correlated to actual environmental effects/ecological relevance: an understanding that continued exposure to the problem, and hence continued manifestation of the response, would usually or often lead to significant environmental (ecosystem-level) adverse effects;

    f. timely and cost-effective: it should provide information quickly enough to initiate effective management action prior to significant environmental impacts, and be inexpensive to measure while providing the maximum amount of information per unit effort;

    g. regionally or nationally relevant: it should be relevant to the ecosystem being assessed;

    h. socially relevant: it should be of obvious value to, and observable by stakeholders, or predictive of a measure that is socially relevant;

    i. easy to measure: it should be easily measured using a standard procedure with known reliability and low measurement error;

    j. constant in space and time: it should be capable of detecting small change and of clearly distinguishing that a response is caused by some anthropogenic source, not by natural factors as part of the natural background (that is, high signal to noise ratio);

    k. non-destructive: the measurement of the indicator should be non- destructive to the ecosystem being assessed.

32. The importance of the above attributes cannot be over-emphasised, as any assessment of actual or potential change in ecological character will only be as effective as the indicators chosen to assess it. However, an early warning indicator possessing all the ideal attributes cannot exist, as certain attributes may be conflicting or unachievable.

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P. Examples of early warning indicators

33. Early warning indicators that are used for the evaluation of wetlands or lakes ecosystems can be categorized into three broad categories:

    a. rapid response toxicity tests;

    b. field early warning tests; and

    c. rapid assessments.

34. The role of these indicators, including their potential limitations (Ramsar 1999), is described in Table 8.3

Table 8.3: Role and possible limitations of types of Early Warning Indicators[5]

Type of Response and Role	**Potential Limitations**
a. Rapid response toxicity tests ▪ Laboratory toxicity assessment of sensitive whole organism responses (e.g. growth, reproduction) with rapid turnaround of results. They are predictive tests that potentially enable timely and flexible management actions (i.e. determining a safe dilution for discharge of effluents of changing composition) to be implemented.	▪ Ecological relevance of measured sub-lethal responses (e.g., growth, reproduction) has generally not been established.
b. Field early warning tests ▪ Field measurement of sensitive sub-lethal organism responses through monitoring or assessment. They can provide pre-emptive or preventative information so that substantial and ecologically important impacts are avoided.	▪ Ecological relevance of measured responses (especially biochemical biomarkers) has generally not been established.
c. Rapid assessments ▪ Standardized, rapid and cost-effective monitoring of various forms can provide 'first-pass' assessment of the ecological condition of sites over large areas. Broad coverage has potential to identify 'hot spots' and hence pre-empt and prevent similar occurrences elsewhere.	▪ Output is usually coarse and generally only detects relatively severe impacts.

35. Each of the techniques may meet different objectives in water quality assessment programs. Although the majority of early warning indicators are of a biological nature, physico-chemical indicators do exist and often form the initial phase of assessing water quality.

5 RAMSAR Resolution VII.10)

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Q. Objectives and its Recommended Management Measures

36. Table 8.3 listed examples of objectives and the corresponding management measures that are extracted from the development of Integrated Lake Basin Management Plan for Tasik Sembrong in 2016 (NAHRIM 2016).

37. There are other additional objectives and management measures that can be implemented in lake management plan.

Table 8.3: Summary Recommendation for Management Measures

No.	Objectives	Management Measures
	Socioeconomic Chapter	
1	To improve communication with the community	Organize communities' events
2	To apply best management practices for the farm	Produce and distribute the good practices and guidelines to the farmers
3	To reduce vascular plant growth (i.e. water hyacinth)	Coordinated effort from agencies
	Ecosystem Chapter	
4	To encourage more visitors	Improve connectivity and promotion for visitors
5	To reduce algae bloom	Use available technology to remove nutrients
6	Increase the source of fund	Contribution of funds from different sources
	Recreational and Tourism Chapter	
7	To open up designated shorelines for angling	Set up Relief House
8	To increase the number of anglers	Fishing competition as promotion
9	Create sustainable source of funding	Charge anglers permits of RM5.00/entry
10	To encourage other recreational activities i.e. kayaking and paddling	Dedicated area for non-motorized and motorized boats
11	To minimise conflict of use in the lake	Create zones for different uses
12	To increase the number of visitors for recreational purposes	Creating new recreational attraction
13	Increase the use of green technology	Application of available green technology for enhancement or development
14	Get more involvement from communities	Training for guide and control duty with communities' members
15	Plant 1000 trees every year	Encourage the communities to plant trees
16	To satisfy the need of the visitors and people surrounding the lake	Set up facilities to visitors
17	To ensure clean lake shorelines of litters	Set up a Management Centre to control visitors/users
18	To start motorized boat service	Set up facilities for operation

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No.	Objectives	Management Measures
	Management Chapter	
19	To coordinate various agencies' efforts	Have a management committee
20	To ensure safety control	Have registered lake users
21	To implement rules and regulations	Decide on the authority to implement rules and order
22	To have control of access to the lake	Create a designated road/access
23	To control allowable activities in the lake and also on shores	Establish an agency to enforce penalties and collect fees
	Financial Management	
24	To increase financial resources	Set up stations for fee collection (beef up tourism, fishing, recreational, purposes)
25	Improve control of water pollution in- flow	Expand the buffer zone of lake
26	To plant 1,000 trees every year in the buffer zone	Organise events and prepare trees for planting
27	To prevent direct drainage into lake	Improve drainage design
28	To reduce water pollutants in the lake	Improve inlet system design

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Section IX: Governance Status

A. Overview

1. The governance of lake management can be observed by studying the six subjects of concern, namely, Policy, Institutions, Participations, Information, Technology and Finance.
2. The status of the governance level of a lake should be deliberated on in order to gauge the improvement (or worsening) of management status. To a certain extent, we should be able to understand the level of good management applied to the lake.
3. In our ILBM Plan, it is recommended that the governance issues is analysed as one of the main focus areas. For that reason, the analysis of governance matters will be based on the description and evaluation processes and, together with other technical matters, will be formulated in the objectives.
4. Assessing the governance level of a lake management may be a delicate process. However, it will cover all the relevant issues on the various lake management measures that have been implemented in the ILBM; this will also allow in-depth comparison with management of other lakes.

B. ILBM Assessment Process

5. Assessment of the management status of a lake can be done as recommended by RCSE-SU & ILEC 2011) [1]. Figure 9.1 shows the matrix for the lake governance assessment purpose:

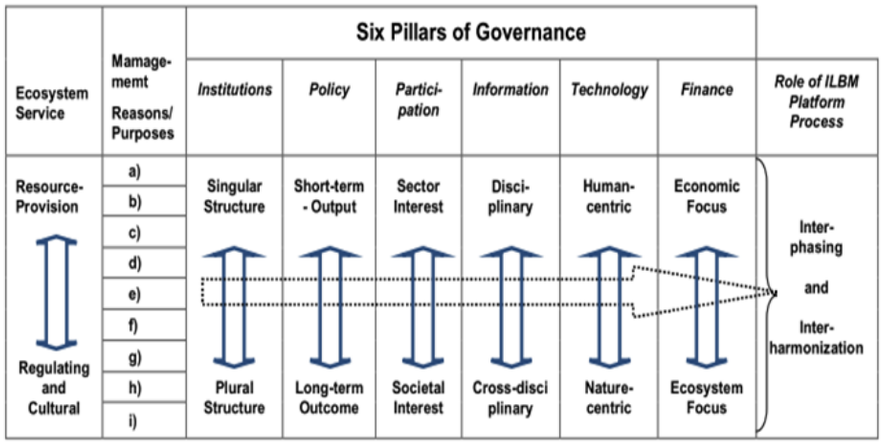


Figure 9.1: The matrix of lake assessment process (From RCSE-SU & ILEC 2011)

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6. For the purpose of this guideline, an initiative to conduct a sample lake governance status assessment will be shown. This assessment is based on a point system using the scale of 1 to 10 (with 10 as the maximum). The result shows most of the features in the lake management governance evaluation.

7. The arrangement for the matrix is simplified, with the arrangement for better governance placed at the top of the table. Figure 9.2 shows the matrix that is be used in this guideline.

Eco system Services	Multiple Management Reasons/ Purposes	SIX PILLARS OF GOVERNANCE						Role of ILBM Platform Process
		Policy	Institutions	Participation	Communi-cation	Technology	Financial	
	Good management indicators	Long-term Outcome	Plural Structure	Societal Interest	Cross Disciplinary	Nature-centric	Ecosystem Focus	Inter-harmonization
Cultural	a).							
	b).							
	c).							
	d).							
Regula-ting	e).							
	f).							
	g).							
Resource Provision	h).							
	i).							
	Common management indicators	Short-term - Output	Singular Structure	Sector Interest	Single Disciplinary	Human-centric	Economic Focus	Inter-phasing

Figure 9.2: Governance matrix – used to evaluate the overall management status of a lake

8. The details of indicators a) to i) shown in the column will be referred to in Table 9.6 in this section.

C. The lake management performance assessment methodology

9. The recommended matrix developed by ILEC (with little modification) as found in its guidelines, having the necessary components requiring observation and the particular lakes information.

10. The matrix has been adjusted to the Malaysian condition. The more relevant aspects (the best target) has been placed at the top of the table. The assessment is given for the six (6) pillars of governance (as shown in blue in the table). The level (of achievement) of these pillars is appraised (given points) in order to understand the level of good governance for a particular lake.

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11. ILEC's ILBM guidelines has described the nine (9) lists of normal responses or purposes of the management measures that can be applied to lakes. The list of reasons are included in the second column of Figure 9.2 as indicators (a) to (i).
12. The indicators are specified and explained as in Table 8.1 in Section VIII. Any management measures recommended as actions to be implemented in the management plan will fall under one of these indicators.
13. There are other responses from the lake management action; the list comprises of a number of selected normally detected responses. The explanation of the guidelines and its examples must be scrutinized for a better understanding of its applications.
14. The scale of points from 1 to 10 is applied. The scale is to indicate the level of achievement or success for each management measures or management actions already implemented. The better the achievements the more points it acquired.
15. A suggested guide for assigning points is shown in Table 9.1. As lake management in Malaysia is still a new field, this range may be revised with future expertise. At this point of time, the range from 1 is 10 is to simplify the point-based assessment. The maximum total for each governance column is 90 points.
16. Widespread use of this points-based assessment of lakes and wetlands management will pave the way for a more systematic review of these points from different parties throughout the nation.
17. A panel or committee will ideally review and compare these values from time to time, increasing the points' relevance with more comparison between different lakes and wetlands management. Finally the mapping of lakes management governance status will be more efficiently developed, with better management focus.

Table 9.1: Point System used in assessing Management Status

Point	Suggested Reason
0 - 2	▪ No clear information ▪ No detail
3 - 5	▪ Some information available ▪ No coordinated effort ▪ Some data
6 - 7	▪ Some coordinated effort ▪ Information can be observed ▪ Some outcome data
8 - 9	▪ Clear coordinated effort ▪ Clear information ▪ Clear outcome data
10	▪ Perfect 10

17. These ILBMP Guidelines rely on existing structures and authorities and do not propose creating a new level of government, laws or regulations. This section describes existing structures and highlights the coordination of existing legal authorities to support an effective lake management.

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18. The perfect 10 can hardly be achieved by any agency. It functions more as a benchmark to those who aim for the best outcome.

D. Management performance

19. This criterion is used to assess the potential for improvement or restoration. Severely degraded features, such as the slopes and the status of the incoming rivers, may have varying degrees of potential for improvement. Some will have none at all, while others will have some potential for total recovery given the appropriate management. The need to identify the gaps in the lake management potential is crucial.

20. The following description of governance performance is based on sample of lake in Johor (Tasik Sembrong Lake Brief, Table 9.2 . Many of the details (if it is not mentioned) may not refer to the respective lake as it is only meant to be a sample of creating the situation.

E. Major Lake Basin Governance Issues

Table 9.2: Major lake basin governance issues (using a sample lake in Johor)

Institution	The sample lake is managed by a government agency in Johor a) operation and maintenance of dam and associated works b) monitoring of reservoir water level, rainfall and other hydrological parameters c) management of release of water from reservoir
	Ownership of dam land is held by the State Authority of Johor
	Part of the catchment area is made up of permanent reserve forest, thus subjecting it to national legislation.
Policies	Presently, there is no specific government policy related to lake management. However, the lake forms part of the river basin and the Government is actively promoting the IRBM concept. Currently a National Water Resource Management Policy is being drafted whereby IRBM is a subset of IWRM; the policy is expected to contain aspects relating to IRBM.

Source: JPS & UTHM (2012)

F. Major Impact Stories

Table 9.3: Example of Major Impact Stories (Case Study of Tasik Sembrong)

No	Major Impact Stories	Details
1	Drought and Water Supply Rationing	In March 2010, the prolonged dry season caused the lake water level to drop to a dangerous level of 8.11m LSD which caused disruption to the Kluang District water supply
2	Sembrong Dam spillway overflow	During December 2006 and January 2007, the dam spillway overflowed due to high intensity rainfall. Prolonged flood was reported for more than 6 weeks in the downstream area, causing the evacuation of nearly
		30,000 people. Costs amounting to nearly RM 80 million were spent to rectify flood damage.

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3	Study to raise the spillway level of Sembrong Dam	In the event of 1 in 100 years chance of flood recurrence, the outflow from the dam would be doubled and flooding would occur at downstream area. Through feasibility studies, the reservoir conservation level has been raised from 8.5m LSD to 9.5m LSD. Spillway level has been raised to 9.5m.

Source: JPS & UTHM (2012)

20. Questionnaires for stakeholders of the lake (government agencies) may be used to determine a number of information related to the lake. The questionnaires were used to identify certain particulars especially matters related to sample questionnaires (items 22 to 31).

21. The detailed information and relevant remarks regarding the 'initial scoring' is listed in **Table 9.4**. The scores will be revised as more information is received.

Policies

This refers to policies to govern people's use of lake resources, and its impacts on lakes:

22. Is there a management plan with a realistic implementation scope? Does an adequate management plan already exist, or should the existing plan be updated? Are the relevant priorities and phasing clearly explained?

23. Does strong political will exist to support sustainable management? Is sustaining and building political will and commitment appropriately incorporated as part of the management program?

Institutions

Institutions to manage a lake and its basin for the benefit of all lake basin resource users can be assessed with the following questions:

24. Is there a focal-point institution in charge? Are the relevant capacity building and training programs effective? Does the institution focus on priority skills? Is it inclusive and open to cooperating agencies, community groups, etc.? Are any mid- course corrections needed?

25. Institutional factors include any limitations to the capacity and authority of organizations responsible for implementation of the plan. It also includes the inter-relationship (or lack of) between the organizations or agencies responsible for the lake conservation, wise use, and those responsible for other sectors directly or indirectly affecting the lake at local, regional (sub-national) and national scales. Participation/ Involvement of people Involvement of people is required to facilitate all aspects of lake basin management:

26. Do effective mechanisms exist for participatory implementation? Does the existing management plan include all relevant stakeholders for its implementation? What changes have occurred with regard to awareness and understanding of the problems, and their linkages to stakeholder activities? What are the perceptions of program stakeholders?

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27. Conflicts/communality of interest, which includes the likely opposition or support of different stakeholders, depending on whether they consider the management plan as contributing to maintain their benefits, or providing an opportunity to develop their interests.

Technological possibilities and limitations

Technological possibilities and limitations that often dictate long-term decisions:

28. Are the existing technologies working well? If yes, could their performance be further improved? If no, what are the reasons for their not working properly? Have there been unexpected adverse impacts of technology applications? If yes, have the adverse effects been appropriately mediated? If no, should the applications be further replicated? Have either technology options or costs changed, and are such changes reflected in the management plan?

Knowledge and Information

Knowledge of both traditional and modern scientific origin as the basis for informed decisions:

29. Is there a common shared knowledge base about the priority management challenges? Does a monitoring system exist to measure changes in key governance and other relevant indicators? Is the data base sufficient? What are the remaining key gaps? Are information management tools adequate to be effectively deployed?

Finances

Sustainable finances to support implementation of all of the above-noted activities. Relevant questions regarding these domains include:

30. Are the currently available financial resources adequate? How can access to financial resources other than those currently available be improved?

31. These six major topics comprise the essential governance ingredients that collectively form the management regime for the integrated approach for lake basin management encompassed within Integrated Lake Basin Management (ILBM). They are referred to hereafter as the Six Pillars of Governance in ILBM.

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G. Example of Management Indicators

Table 9.4: Points given to the various sample lake indicators

Bil	Point	Details recorded	Remarks
Institutions (plural structure, singular structure)			
a.	3	3 agencies have focused works on the lake, on a more technical basis Agencies have some fund allocations for the works At the site, coordination not done	More effort needed
b.	3	3 agencies have works and programs on the lake, on a more technical basis At the site there is no coordination and having conflicting situation	More prudent management approach needed
c.	2	There is no satisfying action by the enforcement department to reduce potential impact e.g. controlling the effluent level from the oil palm mill/pig farm There is not much coordination at the site, and some of the work programs conflict with each other	Nothing much done
d.	3	There are ongoing efforts to remove Keladi Bunting by JPS Equipment to remove algae by ray technology is currently tested by the SAJ	No clear positive product
e.	2	There is no sense of urgency among the officials related to the stresses on the lake No effective efforts are expended	Nothing much done
f.	1	No department works and/or programs regarding conflics in lake use No coordination on site	No effective management action
g.	3	Fisheries Department has enforced fish catch limit Fisheries Department controls activities by the fishermen	
h.	1	Tourism efforts are not implemented No clear plan for tourism	
i.	2	No effort for WS There are currently no programs for fish-derived products	No clear positive product
	20/ 90	There seems to be no significant institution responsible There are some singular structured institutional efforts There is no plural structured institutional efforts No coordinated effort No proper outcome detail	
Policy (long term outcome?, short output?)			
a.	2	No clear policy	
b.	2	No clear policy There is study for the Lake Brief by the University Tun Hussein On Malaysia (UTHM) There is NAHRIM support for this guideline	Some active involvement
c.	3	There is NAHRIM long term support for the ILBMP There is JPS effort to gazette the lake area	
d.	2	Different agencies with different direction and purpose	
e.	1	No clear policy No pollution control program e.g. sewerage	
f.	1	No coordination No lead agency	

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Bil	Point	Details recorded	Remarks
g.	3	There is input from Jabatan Pengairan dan Saliran (JPS) and Jabatan Perikanan Malaysia Input from Jabatan Pertanian, DOE and Jabatan Haiwan is needed Available support from NAHRIM	Active involvement
h.	1	Tourism development is needed There is no control of or charges for water for irrigation There is a need for all stakeholders to participate	Not coordinated
i.	2	Tourism development is needed There is a need for all stakeholders to participate There is a coordination of tourism development and activities. More information is needed	Not coordinated
	17/ 90	There seems to be no significant application related to society There are some sectorial short-term output policies There is some long-term outcome policy effort There is no coordinated effort There are no specific details regarding outcomes	
Participation (Societal interest, Sectoral need)			
a.	2	No coordination No information	Nothing much done
b.	2	No effort to communicate with the communities No effort to communicate among agencies	
c.	2	Communities have not initiated any effort to distribute information	
d.	2	Communities have not initiated any effort to protect the lake	
e.	3	Monitoring by JPS, SAJ Monitoring/research by NAHRIM	Active
f.	1	No coordination No information	
g.	2	FELDA is only minimally involved, with no effort on its part Other areas are own by private plantations companies e.g. Sime Darby Big tracts of land are owned by private individuals and there is a need to control these u	Active
h.	2	No coordination No information	
i.	2	No coordination No information	
	18/ 90	There seems to be no significant application related to society There is some sectoral societal interest by local villages with individual land ownership There is some societal interest and control No coordinated effort No proper details of outcome	
Information (Cross disciplinary, Single discipline)			
a.	1	No coordination, No information	Nothing much done
b.	2	No coordination, No information	Nothing much done
c.	1	No coordination, No information	Nothing much done
d.	2	No coordination, No information	Nothing much done

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Bil	Point	Details recorded	Remarks
e.	1	No coordination, No information	Nothing much done
f.	2	No coordination, No information	Nothing much done
g.	2	No coordination, No information	Nothing much done
h.	1	No coordination, No information	Nothing much done
i.	3	Some effort by Local District Fisheries Department Actions by Fisheries Department: Register fishermen, given via Government subsidies	
	15/ 90	There seems to be no communication effort There is single disciplinary effort There is cross disciplinary communication No coordinated effort No proper details of outcome	
Technology (Nature Centric, Human Centric)			
a.	2	No coordination, No information	Nothing much done
b.	2	No coordination, No information	Nothing much done
c.	3	Need to replant buffer trees Need more buffer areas	
d.	2	No coordination, No information	Nothing much done
e.	2	No coordination, No information	Nothing much done
f.	2	No coordination, No information	Nothing much done
g.	2	No coordination, No information	Nothing much done
h.	2	No coordination, No information	Nothing much done
i.	2	Ultrasonic for killing algae (however, not the best technology)	Nothing much done
	19/ 90	There seems to be no significant technological application There are few technological programs for human centric efforts (e.g. weir, replanting) There are efforts by JPS to gazette lake areas, which may conflict with BAKAJ's purview? No coordinated effort No proper details of outcome	
Finance (Ecosystem focus, Economic focus)			
a.	3	JPS removes Keladi Bunting and Hydrilla JPM monitors fishery license and gives subsidies	Nothing much done
b.	3	SAJ tests the use of rays to remove algae JPS suggests to fence up lake areas	
c.	2	SAJ tests the use of rays to remove algae	Not a good method
d.	2	No coordination, No information	

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Bil	Point	Details recorded	Remarks
e.	2	No coordination, No information	Nothing much done
f.	2	No coordination, No information	Nothing much done
g.	2	No coordination, No information	Nothing much done
h.	2	No coordination, No information	Nothing much done
i.	2	No Tourism efforts No information	Nothing much done
	20/ 90	There seems to be some fund allocation in a few government departments There is no financial support for economic efforts in tourism There are few financial options for ecosystem improvement/ maintenance efforts No coordinated effort No proper details of outcome	

32. To generate the common understanding of the terms used, examples are provided in Table 9.5. The management measures required to manage a lake will be categorized in one of the nine criteria listed here. The multiple management reasons or purpose of actions listed in Table 9.6 are used as the criteria to assess the potential for improvement or restoration of all governance matters.

Table 9.5: Example of using the Assessment Criterion - Multiple Management Reasons/ Purposes

The two 'output-oriented' indicators (Necessary as condition-oriented indicators are easier to obtain)	'enabling process' indicators	Examples of 'enabling process' indicators may include: ● comprehension of stakeholder involvement in the preparation and creation of a management plan; ● enactment of regulations on the mesh size of nets in order to reduce the quantity of inadvertently-harvested juvenile fish; and ● legal and institutional reforms for harmonization of various environmental management plans.
	'stress reduction' indicators	Examples of 'stress reduction' indicators may include: ● increased reed bed area resulting from de-siltation operations; ● reduced industrial pollution loading because of more stringent enforcement; ● reduced excess water withdrawals; ● reduced agrochemical application per cropland area; ● reduced silt and sediment carried into the lake.
Environmental status indicators (Values that are not easy to obtain, or are complicated but indispensable)	This is because of the 'lag period' that typically occurs after corrective or remediative actions on a lake due to the long residence time. This means some period of time will pass before actual improvements are noticeable and/or measurable.	The environmental status indicators may include: ● decreases in the nutrient concentrations; ● improvement in the state of ecosystem health, as reflected in an increased biodiversity index; and ● degree of benefit for communities and stakeholders from the measured changes in environmental conditions. This is determined from the use of questionnaires or surveys.

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Table 9.6: The Assessment Criterion - Multiple Management Reasons/ Purposes

Multiple Management Reasons/ Purposes	Details
a) Developing resource values	Develop plans for the sectorial agencies in charge of the lake. • e.g. its resources like water supplies is done by reducing the possible pollutant; • or fisheries by fish stocking to increase the fish population
b) Enhancing resource values	Working out a plan to improve existing efforts; • For example promoting tourism and recreational facilities.
c) Decongesting resource use	This efforts is implemented in such a way that undue pressures would be alleviated by, • for example, reducing the number of fish catches through both statutory and non-statutory means.
d) Resolving resource use conflicts	Introduced new plans may involve compensatory payments or the creation of a new resource base to ease the resource use competition
e) Reducing environmental stress	Setting up works particularly in relation to the quality of lake water. • The plans usually stipulate structural means (e.g., construction of sewerage systems), • as well as non-structural means (e.g., enhancement of regulatory activities such as compliance monitoring of the quality of discharged effluents; public education programs to change human behaviours). There is a whole range of stress reduction measures including: o removal of noxious sediments form the lake bottom, o promotion of agricultural Best Management Practices (BMPs), o introduction of local eco-labeling, etc.
f) Rehabilitating and restoring ecosystems	Repairing of degraded habitats such as: • Sanding the lake bottom after sediment removal for restoring the shellfish habitat is considered as rehabilitating and restoring riparian ecosystems • Vegetation replanting for shorelines protection
g) Protecting resource value damages from extreme events	Delineation efforts of reed-bed protection zones for maintaining and enhancing ecosystem integrity are examples of resource value protection from extreme events
h) Taking precautionary adaptation and mitigation measures	This is a rare type management measures, however, one example is the often-heated debates as to whether or not to allow siting of facilities that may have potentially irreversible adverse impacts on the ecosystem properties of the lake (e.g., dams; resort complexes)
i) Improving the overall ecosystem health maintenance	This is a long-term comprehensive plan which cover the health aspects of an area.

33. The assessment criterion topics will then be referred to in all management measures undertaken for any lake, in accordance with each of the six governance sectors. The extent of success or level of work done for each governance sector will be determined using a scale of 1 to 10 (with 10 as the best score).

34. The details of the assessment method are shown in Table 9.4 and can be used as an example here. For the purpose of this guideline, initiatives were taken to assess the governance status for some lakes. The points were awarded for actual activities or management measures carried out at the lake.

35. The lake assessment effort will enable future comparisons to understand the governance status of different lakes. An example on the main topic of discussion is described as follows:

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- **Policy:**
  Since the lakes are for the single purpose of hydro electric power generation, there is no clear management policy for lake ecosystem health. The extent to which Tenaga National Berhad (TNB) as the main lake user has policies in place to recognize and support lake basin management was determined based on the information in the briefs. However, it appeared that there was little explicit recognition of lakes in the GLC's water resources policies.

- **Institutional:**
  TNB is the single agency acting as custodian for the Jor and Mahang lakes. There is already a well-defined SOP of operation within the lakes. There is a lack of coordination with other agencies related to lake management as the lakes are for only used for hydroelectricity generation.

  Stakeholder discussions show indicated some need to collaborate with other agencies in order to better manage the lakes and/or to make use of the lakes for other functions. Collaboration comes with responsibilities of all agencies involved. In a way, collaborations may improve the management of the lakes, as well as lessen the responsibility of the single agency owner.

- **Public Participation:**
  Stakeholder's participation and its analysis is necessary for an open lake ecosystem as in the case of the Jor and Mahang Lakes. Working with public expectations in mind will increase the benefit of the program.

  The consultative workshop has produced a number of expectations. Satisfying simple expectations of stakeholders will resolve a lot of management problems. The expectations of both government agencies and communities must be taken into account.

- **Communication:**
  Stakeholder discussions show that ongoing efforts by TNB to make the public and the communities more aware of events concerning the lake and their hydropower stations. However, there is still no available work plan of implementing these activities.

- **Technology:**
  Technological application onto the lake is necessary as it is severely polluted with silt and sediment. The discussions during the stakeholder consultative forum showed high demand in using the necessary technology in order to improve conditions.

  At this stage there has not been any application of technology in relation to the sample lakes.

- **Financial support:**
  TNB is financing all the cost for the two lakes. However, financing for the sake of the ecosystem management of the lakes is still not clearly defined by the GLC.

  It is necessary that the financing mechanisms would be more focused on repairing, conserving and maintaining the ecosystem and well-being of the two lakes. Working on this will increase the sustainability of the lake.

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36. For both sample lakes, an average of 20.4 out of 90 points was collected with the highest point scored by the Public Participation subject. The weakest governance subject is Communication, which needs to be seriously enhanced.

37. The application of governance assessment points to Malaysian lakes is helpful as it will enable the implementation of improvement efforts in a well-programmed manner. Further monitoring of the result of the efforts (management measures) taken will continuously reveal its effectiveness.

38. This effort will ensure the carrying out of future assessments to understand and monitor the lake status.

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Table 9.7: The sample of a lake governance assessment (Source: TNBR 2015)

Ecosystem Services	Multiple Management Reasons/ Purposes	SIX PILLARS OF GOVERNANCE						Role of ILBM Platform Process
		Policy	Institutions	Participation	Communi-cation	Technology	Financial	
	Good management indicators	**Long-term Outcome**	**Plural Structure**	**Societal Interest**	**Cross Disciplinary**	**Nature-centric**	**Ecosystem Focus**	**Inter-harmonization**
Cultural	Improving the overall ecosystem health maintenance	2 (nothing much done)	2 (nothing much done)	2 (TNBR)	1 (nothing much done)	2 (nothing much done)	2 (nothing much done)	
	Taking precautionary adaptation and mitigation measures	1 (nothing much done – e.g. STP site?)	2 (nothing much done)	2 (nothing much done)	2 (nothing much done)	2 (nothing much done)	3 (TNBR)	
	Protecting resource value damages from extreme events	1 (nothing much done)	2 (nothing much done)	3 (by Orang Asli)	1 (nothing much done)	3 (TNBR)	2 (TNBR)	
	Rehabilitating and restoring riparian habitats	2 (nothing much done)	2 (nothing much done)	3 (TNBR)	2 (TNBR)	(dredging)	2 (TNBR, TNB)	
Regulating	Reducing environmental stress	1 (nothing done)	2 (nothing much done)	3 (monitoring by TNBR)	1 (nothing much done)	2 (nothing much done)	2 (Nothing done)	
	Resolving resource use conflicts	1 (nothing done)	3 (TNBR)	3 (TNBR)	2 (nothing much done)	2 (nothing much done)	2 (nothing much done)	
	Decongesting resource use	2 (Jab. Perikanan)	2 (fish stocking)	3 (TNBR)	2 (nothing much done)	2 (nothing much done)	2 (nothing much done)	
Resource Provision	Enhancing resource values	3 (TNBR)	1 (tourism effort not started)	3 (TNBR)	1 (nothing much done)	2 (nothing much done)	2 (nothing much done)	
	Developing resource values (e.g. water supply and fish products)	3 (fish stocking)	2 (no effort for WS, having fish Products program)	3 (TNBR)	3 (nothing much done TNBR)	2 (nothing much done)	2 (nothing much done)	
	Common management indicators	Short-term - Output	Singular Structure	Sectoral Interest	Single Disciplinary	Human-centric	Economic Focus	Inter-phasing
		16/90	18/90	25/90	15/90	17/90	19/90	122.22
		17.78	20.0	27.78	16.67	18.89	21.11	20.37

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H. Typical Forms of Plans and Their Implications in the ILBM Platform Process

39. Four general categories of plans for lake basin management, i.e. Vision Plans, Short-term Action Plans, Intervention Plans, and Comprehensive Plans, are described in Figure 9.3. It is meant to visualise the role of the ILBM Platform in the planning process. The normal presumption is that Vision and Action Plans can be statutory or non- statutory. In contrast, most intervention and comprehensive plans are statutory in nature. Use of the previously noted 'output-oriented' indicators would be relevant in evaluating the status of the various plans.

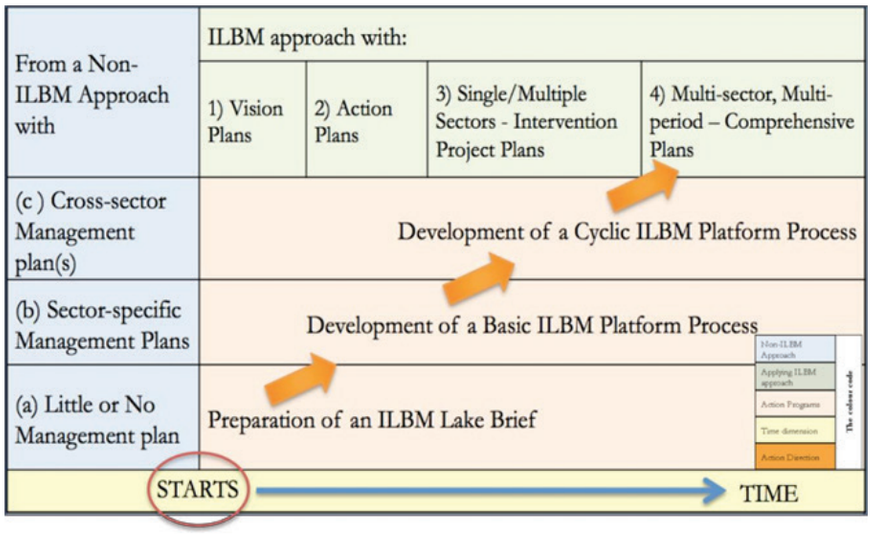


Figure 9.3: ILBM approach with Categories of Plans for Lake Basin Management (Source: RCSE-SU & ILEC 2011)

I. Transformation from a Non-ILBM approach to an ILBM approach in planning

40. The management plan of a lake may revolve around 'STARTS' (bottom left of Figure 9.3). This is the usual situation whereby there is only little or no management plan. Ideally, lake management plan must start at the beginning of the envisioning process of an ideal/long-term lake endpoint visualised by the lake owner or manager.

41. In the illustration, it may appear that most events happen during the transformation phase. In reality, the lake management plan will encompass all the sectors (cross-sectors) and comprehensive (multi-period) program from the very beginning.

42. The cyclic process is the process that will bring forward the initial plan to the level of comprehensiveness and multi-sectorial arrangements. This is one of the reasons why the handling of agencies must be focused upon. By doing so, collaborative works can be explored from the beginning of the management plan.

43. The collaborations of different agencies on lake management improvements may form multi sectorial comprehensive plans. In the beginning they may be non-statutory in nature.

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Section X: Cyclic Plan

A. The Cyclic Process

1. The concept of cyclic process is essentially to plan, implement, and check all actions of the programs. The whole process of developing the Integrated Lake Basin Management (ILBM) Plan can be clearly observed in this Section.
2. A lake management plan should incorporate a version of the cyclic process to ensure all management measures are properly implemented.
3. The cyclic process starts when the management measures are implemented. An appropriate monitoring program is concurrently executed while the chosen management measures are implemented.
4. A detailed monitoring program will monitor the status of each management measure as they are implemented. The data resulting from the monitoring will eventually be analysed and reviewed.
5. Thus, reprisals and refinement (whenever necessary) are recommended to improve earlier management measures during the next round of action programs as they are implemented.

B. Annual or short-term review

6. ILEC recommends the cyclic process to be applied within the management of lakes, and included in the relevant action program.[1]
7. This means that proposals and recommendations that have been implemented in the action program will be repeated (maybe for a number of times) and any improvement (or lack of) will be recorded and reported for further management decision. This can be more clearly demonstrated in Figure 10.1.

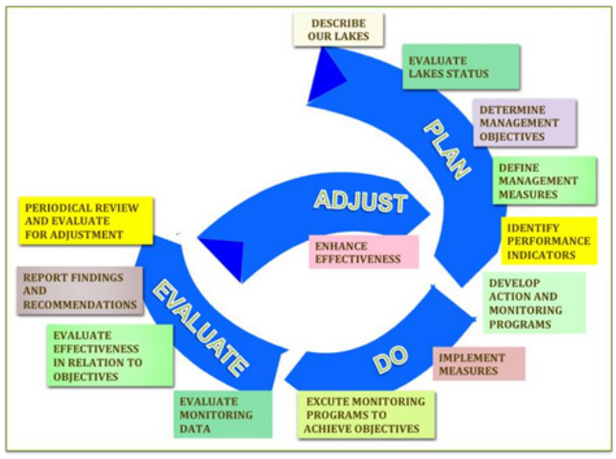


Figure 10.1: The position of management review in the schematic of ILBM Plan cyclic process

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[1] ILEC platform

8. The management decisions may be made during the management review. Its position is as shown in Figure 10.1. It is necessary to evaluate and adjust management measures according to its present status.
9. The implementation of certain management measures can be done repetitively. Enhancement of the actions will be implemented whenever necessary according to the desired result of the various management objectives.
10. This does not mean that the entire management plan will be renewed, but rather, to ensure the management measures are workable.
11. The main purpose of the short-term review is simply to confirm that a measure or action is being managed in accordance with the requirements of the plan.
12. The monitoring data will be able to show the effectiveness of the chosen management measures.

C. Major review or audit

13. Major reviews or audits should be considered an essential component of any planning process. The functions of audit are:

    a. To assess whether or not a site has been managed to the required level as decided during the process of determining its objectives or in accordance with a certain baseline;

    b. To confirm, as far as possible, that management is effective and efficient; and

    c. To ensure that the status of the site features is being accurately assessed.

14. The audit process is best, though not always necessarily, carried out by external auditors. It is a constructive process, which should identify any problems or concerns and seek to provide recommendations in order to resolve any issues.
15. Reviews and audits will usually be carried out in accordance with a predetermined timetable. The interval between reviews will be a reflection of the confidence that managers have in their ability to protect the site features. For sites with robust features which are easily managed, the interval may be five years or more. However, for fragile sites, where threats are not readily controlled, the interval between reviews should be much shorter.
16. On all sites, reviews should be undertaken at any time if new or unforeseen threats become apparent. It is essential that the timing of the planning process is adjusted to meet the requirements of the site.
17. For sites on the RAMSAR List which have been included in the Montreux Record owing to recognized threats to their ecological character, a RAMSAR Advisory Mission can be regarded as one form of review and/or audit.
18. In a lot of cases the frequency of a plan review is three to five years, and up to ten years.
19. At, or before, the expiry date, it will be necessary to review the management plan using the results of the monitoring programme, change in policy or increase or decrease of human use of resources in or outside the area.
20. Major reviews should be considered an essential component of any planning process. The functions are to:

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a. Assess whether or not a site is being managed to at least the required standard
b. Confirm, as far as possible, that management is effective and efficient c. Ensure that the status of the site features is being accurately assessed.

21. Finally, whenever possible, management plans should be regarded as public documents, and stakeholders should be given access to the plan.

D. Method: Adaptable Management Strategy[2]

21. The goal of the LMP is to protect and improve lake water quality by:

a. limiting basin-wide nutrient inputs that impair lake water quality conditions;
b. changing the solubility of mining-related metal contaminants in lake sediments, which will be influenced by the lake nutrient content.

23. Adaptive management approach that serves as the foundation for the ILBMP and identifies specific ways to evaluate progress and adapt to new information or circumstances.
24. In order to safeguard lakes and their features, managers must adopt a flexible approach that will allow them to:

a. Respond to the legitimate interests of different stakeholders;
b. Adapt to the changing demands (e.g. political demands);
c. Accommodate uncertain and variable resources; and d. Survive the whims of the natural world.

25. The overall strategy embodied in the LMP to accomplish this goal is adaptive management. At its core, this approach relies on:

a. Monitoring to establish lake conditions and track changes over time;
b. Modelling to predict possible future scenarios if key factors change;
c. Implementation of actions to reduce nutrients; and
d. More monitoring to determine lake response relative to the overall goal.

26. Monitoring will guide decisions regarding additional implementation actions on a repeated annual cycle. This process is consistent with the ILEC's recommended cyclic process.

[2] Coeur d'Alene Lake Management Plan 2009

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27. The adaptable management process as incorporated in the RAMSAR planning approach is as follows (see Figure 10.2):

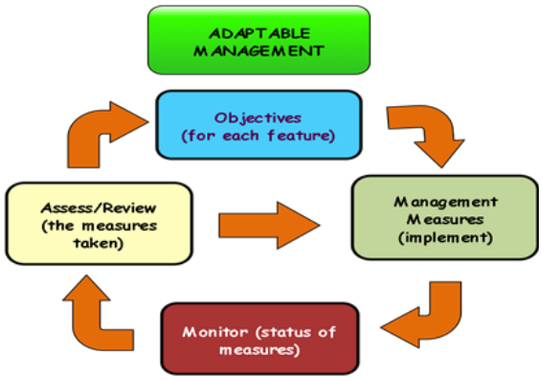


Figure 10.1: The adaptable management cycle

28. A decision is made about what should be achieved (i.e., quantified management objectives are prepared for the important features).
29. Appropriate management, based on the best available information, is implemented to achieve the objectives. The whole process cycle of the management plan is as shown in Figure 10.3

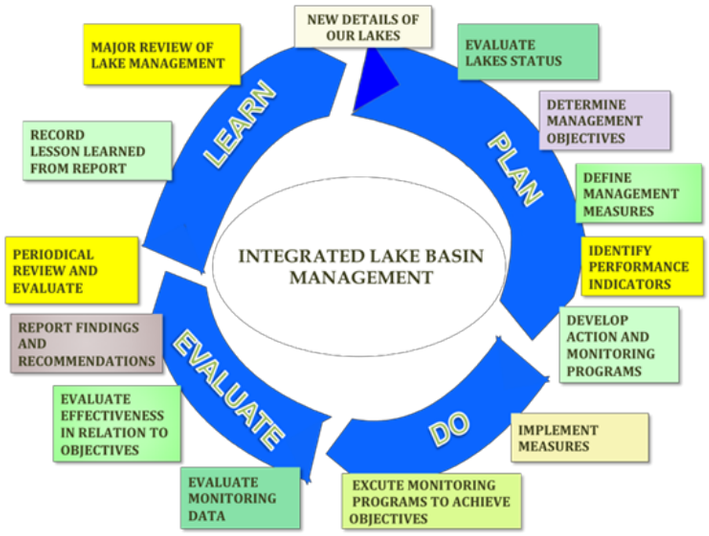


Figure 10.3: The whole cycle of ILBM Plan cycle

30. The features are monitored in order to determine the extent to which they meet the objectives.

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31. If objectives are not being met, management measures will need to be re-defined.
32. Monitoring is continued to determine if the modified management measures is meeting the objectives, and this step is repeated for any further adjustments, as necessary.
33. The following are examples of plan that require comprehensive 5-year reviews:

    a. Comprehensive community plan includes a 5-year review of Lake Management Plan implementation.
    b. Water quality trends, success of nutrient reduction projects - algae removal implementation actions.

34. There are several different scenarios that could result from the adaptive management process described above.
35. If current regulations are followed and enforced, and recommendations are implemented and demonstrated to be effective (as determined by improvements in lake water quality), then there would be no need to change regulations.
36. If water quality deteriorates and current regulations are not being followed or enforced adequately, and/or if BMPs are determined to be ineffective; then the control from local government and with the responsible authorities (i.e. Department of Environment) to ensure corrective steps are taken.
37. If the current regulations are followed and enforced, and recommendations are implemented, yet water quality deteriorates, other actions will need to be taken. New and/or strengthened regulations between partner authorities i.e. effluence water quality control, surface run-off quality control (use of additional devices) and premises effluent control (use of O&G device in all premises with polluted effluent i.e. restaurants, motor vehicles workshops) may need to be established.

E. Performance actions and milestones

38. Performance actions lead to milestones that gauge the success of each of the planning strategies implemented. Performance actions are what the ILBM Plan partners set out to accomplish, and the milestones are the outcome of these actions that determine success.
39. The actions and milestones should correspond with the Management Objectives and Strategies described in Section III.

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