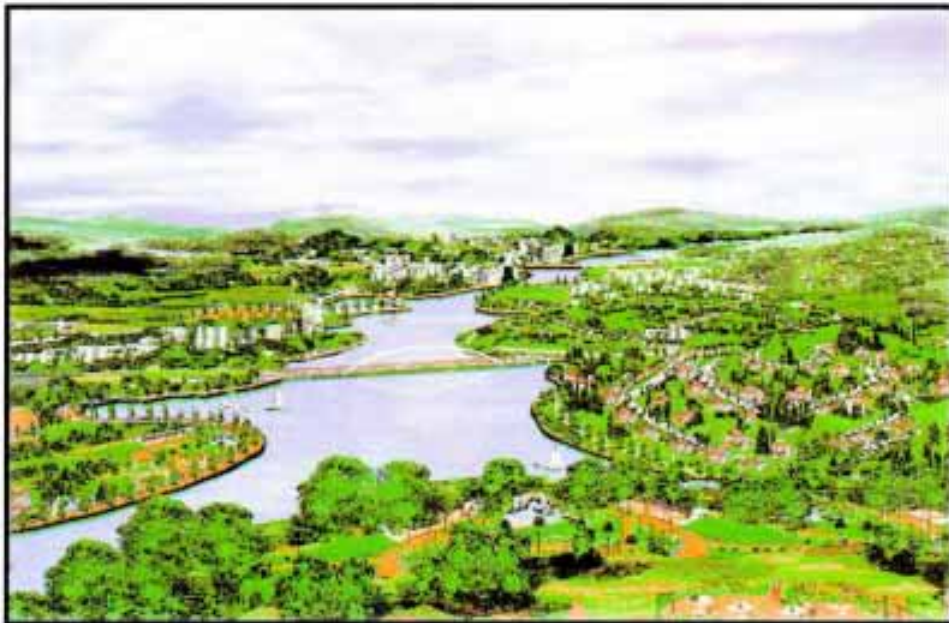


PERBADANAN PUTRAJAYA

**CATCHMENT DEVELOPMENT AND MANAGEMENT
PLAN FOR PUTRAJAYA LAKE**

VOLUME 2 : SECTORAL REPORT



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VOLUME 2 : SECTORAL REPORTS

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LIST OF ABBREVIATIONS

AAR	Average Annual Rainfall
AE	Actual Evaporation
AEP	Annual Exceedance Probability
AD	Advection – Dispersion
ARI	Average Recurrence Interval
BMP	Best Management Practices
BOD	Biological Oxygen Demand
CALSITE	Calibrated Simulation of Transported Erosion
COD	Chemical Oxygen Demand
Cr	Chromium
CW	Central Weir
DCIA	Directly Connected Impervious Areas
DID	Department of Irrigation and Drainage
DO	Dissolved Oxygen
DOE	Department of Environment
ED	Extended Detention
EMP	Environmental Management Plan
EPF	Employee Provident Fund
EQA	Environmental Quality Act
ERL	Express Rail Link
ESCP	Erosion and Sediment Control Plan
ESS	Electronic Submission Standards
GIO	Geographical Information Officer
GIS	Geographical Information System
GPT	Gross Pollutant Trap
GSM	Geological Survey of Malaysia
GUI	Graphical User Interface
HAZOP	Hazards and Operability
HD	Hydrodynamics
Hg	Mercury
ICMS	Integrated Catchment Management System
IDF	Intensity – Duration – Frequency
IMP	Information Management Plan
INRWQSM	Interim National Water Quality Standards for Malaysia
IOI	Integrated Oxygen Industries Sdn Bhd

IPM	Integrated Pest Management
ITU	Information Technology Unit
IU	Information Unit
IWK	Indah Water Consortium
JAS	<i>Jabatan Alam Sekitar</i>
JKR	<i>Jabatan Kerja Raya</i>
JPBD	<i>Jabatan Perancangan Bandar dan Desa</i>
JPN	<i>Jawatankuasa Perancangan Negeri</i>
JPP	<i>Jabatan Perkhidmatan Pembentukan</i>
JPS	<i>Jabatan Pengairan dan Saliran</i>
KLIA	Kuala Lumpur International Airport
KPP	<i>Kawasan Perbadanan Putrajaya</i>
LE	Lower East Wetland
LGA	Local Government Act
MAM	Mean Annual Minimum
MAR	Mean Annual Rainfall
MARDI	Malaysian Agricultural Research and Development Institute
MDC	Multi-media Development Corporation
MDS	<i>Majlis Daerah Sepang</i>
MMKN	<i>Majlis Mesyuarat Kerajaan Negeri</i>
Mn	Manganese
MPN	<i>Majlis Pembangunan Negeri</i>
MPSJ	<i>Majlis Perbandaran Subang Jaya</i>
MS	Malaysian Standard
MSC	Multimedia Super Corridor
N	Nitrogen
NALIS	National Land Information System
NLC	National Land Council
NH ₃	Ammonia
NPS	Non-point Source
NWRS	National Water Resources Study
O & G	Oil and Grease
OP	Dissolved Phosphorus
OSHA	Occupational Safety and Health Act
P	Phosphorus
Pb	Lead

PE	Population Equivalent
PLCMC	Putrajaya lake Catchment Management Committee
Phosphorus Dis.	Dissolved Phosphorus
Phosphorus Par.	Particulate Phosphorus
PP	Particulate Phosphorus
PPA	Perbadanan Putrajaya Act
PTD	<i>Pejabat Tanah dan Daerah</i>
PTG	<i>Pejabat Tanah dan Galian</i>
R & D	Research and Development
SAMM	<i>Skim Akreditasi Makmal Malaysia</i>
SCC	Stakeholders' Consultative Committee
SDBA	Street, Drainage & Building Act
SOCISO	Social Security Organisation
SPS	Serdang Power Station
STP	Sewage Treatment Plant
SWMA	Selangor Waters Management Authority
SWMAE	Selangor Waters Management Authority Enactment
TCPA	Town and Country Planning Act
TD	Temporary Dam
TN	Total Nitrogen
TNB	Tenaga Nasional Berhad
TOR	Terms of Reference
TP	Total Phosphorus
UB	Upper Bisa Wetlands
UDDS	Urban Drainage Design Standard
UDG	Urban Design Guidelines
UE	Upper East Wetlands
UN	Upper North Wetlands
UW	Upper West Wetlands
UNITEN	Universiti Tenaga Malaysia
UPEN	<i>Unit Perancang Ekonomi Negeri</i>
UPM	Universiti Putra Malaysia
URS	User Request Study
USLE	Universal Soil Loss Equation
WPCP	Water Pollution Control Pond
WQ	Water Quality
WQCMS	Water Quality Catchment Management System
Zn	Zinc

CHAPTER 1
INTRODUCTION

1.0 INTRODUCTION

The Study Report for the Catchment Development and Management Plan for Putrajaya Lake (see Figure 1.1) is contained in **Volume 1- Main Report** and **Volume 2 - Sectoral Reports**. This Volume 2 contains the 8 sectoral reports for this study. The detailed study for each of the components are described in the following chapters under the following headings:

1. Environmental Studies
2. Water Resources Studies
3. Drainage Masterplan Study
4. Sewerage Masterplan Study
5. Land-use Masterplan Study
6. Development of the Basic ICMS
7. Legislation and Institutional Studies
8. Costing , Budget and Funding

The study approach is briefly described below.

1.1 STUDY APPROACH

The scope of the study is divided into 3 parts based on the sequence of work required to arrive at the Plan. However, during the study they are carried out in parallel and their outputs integrated continuously throughout. Figure 1.2 gives a schematic illustration of the work sequence and work components within the 3 parts as listed below:

- (a) Analysis of systems
- (b) Development and management plans
- (c) Implementation plans

1.1.1 Analysis Of Systems

1.1.1.1 The first part of the study involves analysis of the physical and human systems existing in the catchment. The components of the physical system that was analysed can be grouped under two headings. They are:

- (a) Environmental Studies
- (b) Water Resources Studies

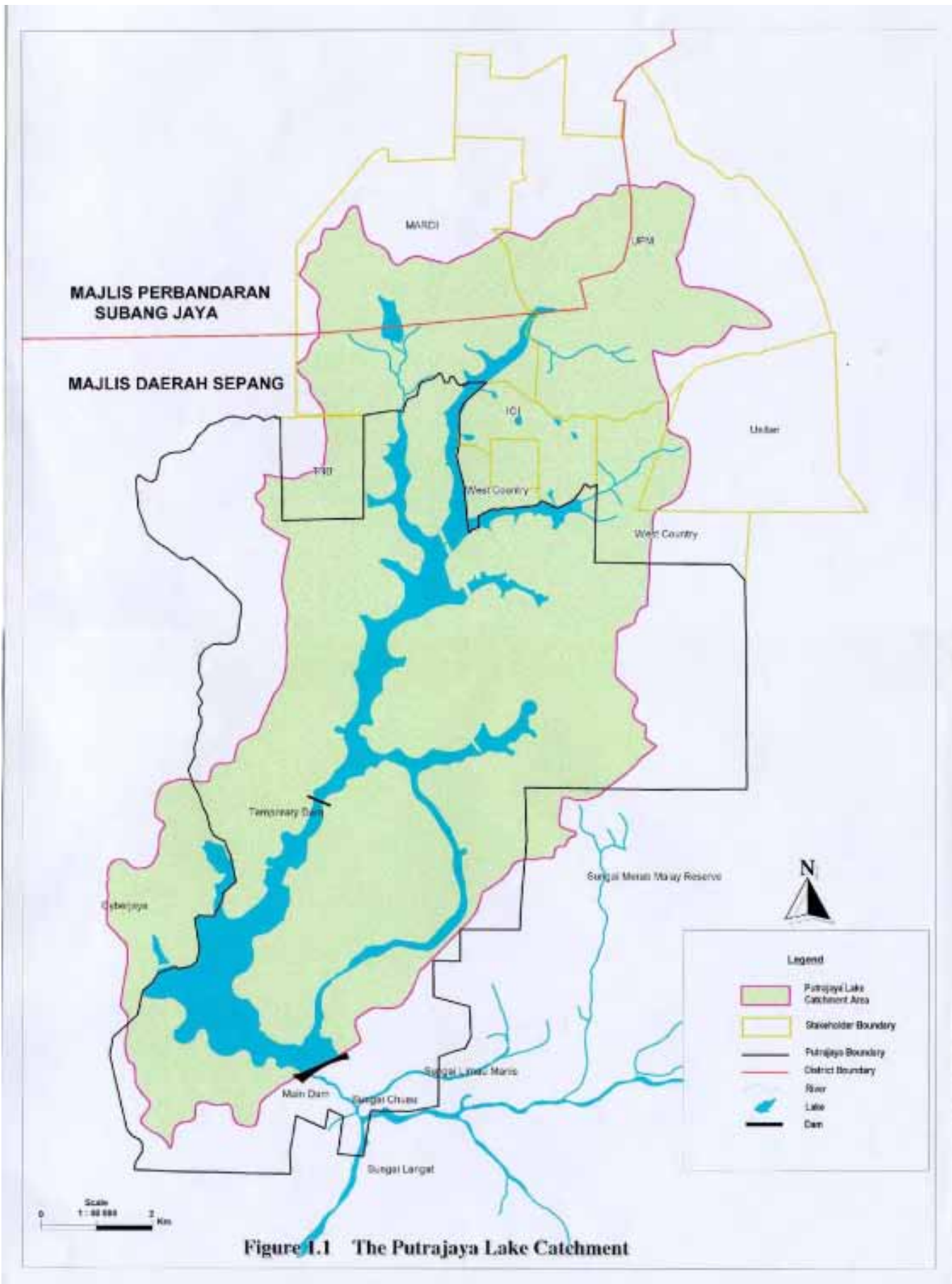


Figure 1.1 The Putrajaya Lake Catchment

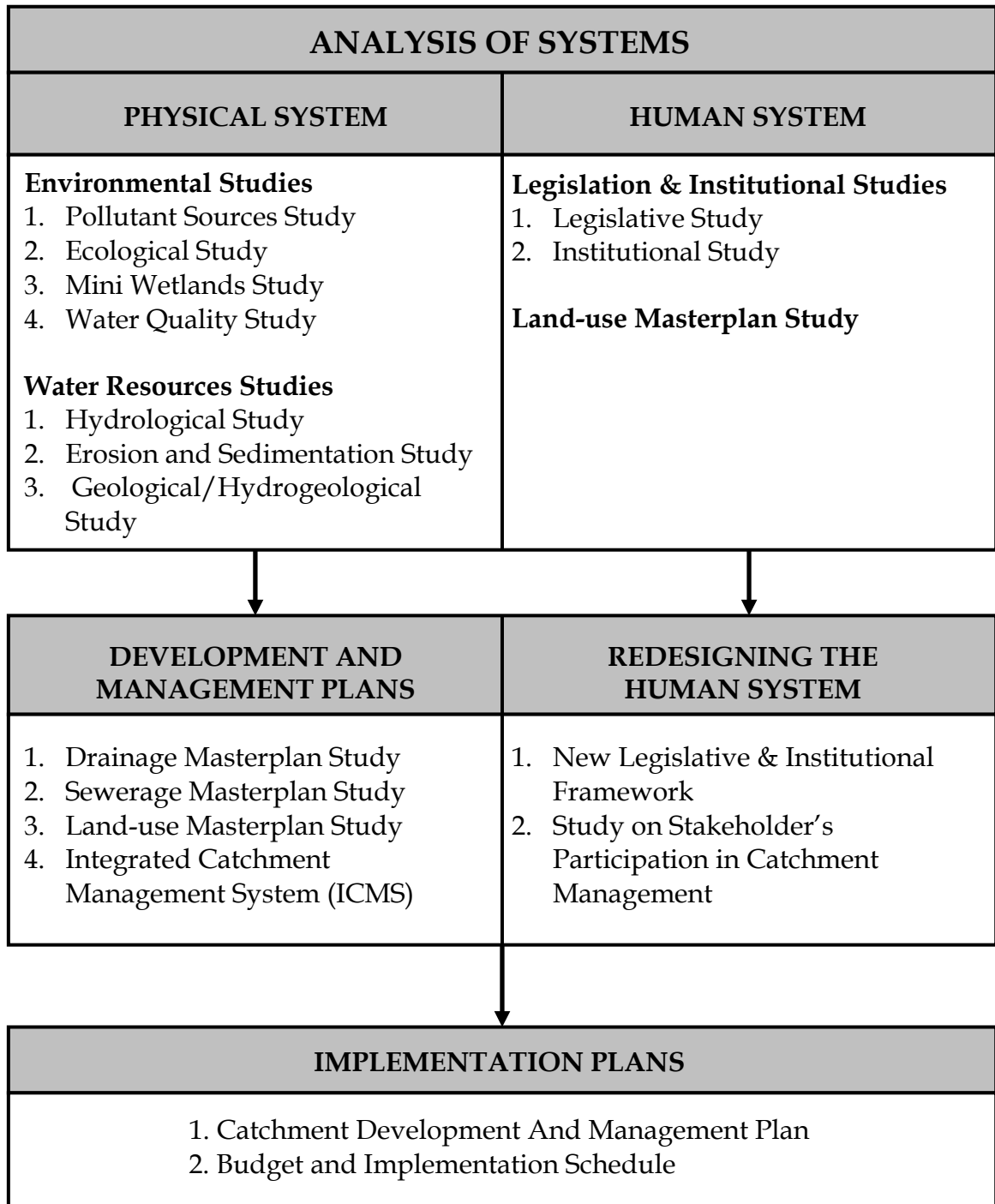


Figure 1.2 A schematic illustration of the work sequence and work components within the scope of study

1.1.1.2 The components of the human system that was analysed can be grouped under two headings. They are:

- (a) Legislation & Institutional Studies
- (b) Land-use Masterplan Study

1.1.2 Development And Management Plans

1.1.2.1 The second part of the study involves the preparation of the development and management plans to achieve the study objectives based on the outputs from the first part. To facilitate the implementation of the plans there is also a need to redesign the human system, i.e. the institutional and legislative aspects, based on the outputs from the analysis of the human system from the first part of the study.

1.1.2.2 The studies to prepare the development and management plans are as follows:

- (a) Drainage Masterplan Study
- (b) Sewerage Masterplan Study
- (c) Land-use Masterplan Study
- (d) Integrated Catchment Management System (ICMS) Study

1.1.3 Implementation Plans

1.1.3.1 The scope of work for the third part of the study involves the integration of the results from the second part into a Catchment Development and Management Plan. It also involves the preparation of a budget and implementation schedule.

1.1.3.2 The detail study scope and outputs for each of the 8 sectors are tabulated in Appendix 1.1, for ease of reference.

APPENDIX 1.1 - The Proposed Study Scope and Study Outputs for each of the 8 Sectoral Studies

STUDY SCOPE	STUDY OUTPUTS
1.0 ENVIRONMENTAL STUDIES	
1.1 <u>Pollutant Sources Study</u>	
<ul style="list-style-type: none"> (a) Identification of all pollutant sources, with potential immediate and medium term impacts on the Putrajaya Lake water quality, associated with all current and proposed land-use within the Putrajaya Lake catchment. (b) Identification of trace pollutants which may have long term impact on the Lake water quality. (c) Preparation of a map indicating the existing and potential point and non-point sources of pollution in the catchment. (d) Identification and recommendation of appropriate technical and management measures for controlling or eliminating the identified pollutant sources. (e) Identification of the appropriate types of fertiliser and agricultural chemicals for use in the catchment. 	<ul style="list-style-type: none"> (a) A list of pollutant sources, with potential immediate and medium term impacts on the Lake water quality, associated with all current and proposed land-use within the catchment. (b) A list of trace pollutants, which may have long term impact on the Lake water quality. (c) A map indicating the existing and potential point and non-point sources of pollution in the catchment. (d) A list of recommended technical and management measures for controlling or eliminating the identified pollutant sources, including the appropriate types of fertiliser and agricultural chemicals for use in the catchment. (e) Recommendations on the most appropriate effluent treatment or other management measures, for the current and proposed development, that do not meet the desired pollutant loadings and effluent standards. (This will be prepared together with the Sewerage Specialist)
1.2 <u>Ecological Study</u>	
<ul style="list-style-type: none"> (a) An inventory of the fishes, flora and fauna existing in the current river and water courses environment, which will be presented in the form of an ecological inventory map of the river and water courses in the catchment. (b) Descriptions on the ecological environment sustaining the inventoried species and the possible consequences to the species arising from the 	<ul style="list-style-type: none"> (a) An ecological inventory map, mapping the locations in the catchment to the list of fishes, flora and fauna existing in the current river and water courses environment. The map shall be accompanied by pertinent descriptions on the ecological environment sustaining the inventoried species and the possible consequences to the species arising from the likely changes to the

STUDY SCOPE	STUDY OUTPUTS
<p>likely changes to the river and water courses environment due to the proposed and likely future developments in the catchment.</p> <p>(c) Assessment on the possible impacts on the desired ecological balance for the Putrajaya Lake and its associated wetlands.</p> <p>(d) Recommendation on the Best Management Practices (BMP) required to sustain the desired ecological balance for the Putrajaya Lake and its associated Wetlands.</p>	<p>river and water courses environment.</p> <p>(b) An assessment of the possible impacts on the desired ecological balance for the Lake and its associated wetlands, together with the best management practices to sustain the desired ecological balance.</p>
<p>1.3 <u>Mini Wetlands Study</u></p> <p>(a) A map showing the existing ponds in the catchment, its current usage and potential to be converted into a mini-wetlands, accompanied by a report describing the current state and use together with photos.</p> <p>(b) A set of implementation guidelines, including the identification of suitable plants, for any ponds considered feasible to be converted into a mini wetland. (This will be prepared together with the Water Quality Modeller and the Environmental Specialist)</p>	<p>(a) A map showing the existing ponds in the catchment, its current usage and potential to be converted into a mini-wetlands, accompanied by a report describing the current state and use together with photos.</p> <p>(b) A set of implementation guidelines, including the identification of suitable plants, for any ponds considered feasible to be converted into a mini wetland. (This will be prepared together with the Water Quality Modeller and the Environmental Specialist)</p>
<p>1.4 <u>Water Quality Study</u></p> <p>a) An inventory of the existing water quality at selected stations in the river and water courses in the catchment. It will be presented in a map showing the locations of the stations and the values of the pertinent water quality indexes.</p>	<p>a) Quantitative estimate of the pollutant treatment capacity of the Wetlands and the carrying capacity of the Lake.</p>

STUDY SCOPE	STUDY OUTPUTS
<p>(b) Evaluation on the possible impacts on the functional use of the Lake and operations of the wetlands based on an assessment of the water quality at selected stations for the proposed and likely future land-use scenarios in the catchment and the hydrological regimes arising from them.</p> <p>(c) A review of the proposed water quality monitoring strategy and plans for the Putrajaya Lake and Wetlands, with the objective of developing an integrated water quality monitoring strategy and plan for the Putrajaya Lake catchment.</p>	<p>(b) Quantitative estimate of the types and allowable pollutant loading, including effluent standards where applicable, from all current, proposed and future developments within the catchment. The results shall be presented on a map of the catchment, if possible.</p> <p>(c) A map showing the locations of the water quality stations in the catchment and the existing water quality expressed in terms of values of the pertinent water quality indexes.</p> <p>(d) An evaluation on the possible impacts on the functional use of the Lake and operations of the wetlands based on an assessment of the water quality at selected stations for the proposed and likely future land-use scenarios in the catchment.</p> <p>(e) An integrated water quality monitoring strategy and plan for the catchment</p>

2.0 WATER RESOURCES STUDIES

2.1 Hydrological Study

<p>(a) An assessment of the average monthly streamflows into the wetlands and Putrajaya Lake for the current, proposed and likely future water-use and land-use scenarios in the catchment.</p> <p>(b) A monthly water-balance study of the Putrajaya Lake and wetlands, based on the various monthly streamflow scenarios.</p> <p>(c) The study will also include all hydrological aspects required to support the evaluation of the impacts, due to the possible changes in the hydrological regimes in the catchment, on the river and water courses ecology in the catchment and on the water quality at selected stations along the river and water courses in the catchment.</p>	<p>Estimates of average monthly streamflows for the various water-use and land-use scenarios in the catchment will be simulated for use in the Water Quality Study</p>
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STUDY SCOPE	STUDY OUTPUTS
<p>2.2 <u>Erosion and Sedimentation Analysis Study</u></p> <p>(a) An analysis of the erosion and sedimentation potential in the Putrajaya Lake catchment, taking into account the results arising from the hydrological and geological/hydrogeological studies. Its result will be presented in the form of an erosion and sedimentation potential map of the catchment.</p> <p>(b) Preparation of recommendations and guidelines for the control of erosion and sedimentation in the catchment.</p>	<p>An erosion and sedimentation potential map of the catchment, together with pertinent recommendations and guidelines for the control of erosion and sedimentation in the catchment.</p>
<p>2.3 <u>Geological/Hydrogeological Study</u></p> <p>(a) A classification and zoning plan of the terrain in the catchment, according to geological/hydrogeological characteristics, together with an analysis of the groundwater flow regimes in the catchment.</p> <p>(b) Descriptions on the nature of each identified characteristics and the appropriate environmental and land-use management issues related to them.</p> <p>(c) Provision of the geological/hydrogeological information support for the erosion and sedimentation analysis of the catchment, development of the integrated drainage and sewerage masterplans for the catchment, hydrological analysis of the catchment and the land-use zoning of the catchment.</p>	<p>A classification and zoning plan of the terrain in the catchment according to geological/hydrogeological characteristics. The plan will be accompanied by a report describing the nature of each identified characteristics and the appropriate environmental and land-use management issues related to them.</p>
<p>4.0 DRAINAGE MASTERPLAN STUDY</p>	
<p>(a) Develop an integrated Putrajaya Lake Catchment Drainage Masterplan. The scope of the development shall involve a review of the Kawasan Putrajaya Drainage Masterplan and the current and proposed drainage plans (if any) for the areas outside of it (that are within the Putrajaya Lake catchment), with the objective of integrating the drainage plans to</p>	<p>(a) An integrated Drainage Masterplan for the catchment, showing the locations of all gross pollutant traps and green-belt zones.</p> <p>(b) Pertinent drainage planning and design guidelines.</p>

STUDY SCOPE	STUDY OUTPUTS
<p>the Kawasan Putrajaya Drainage Masterplan.</p> <p>(b) The Drainage Masterplan should provide a strategy for the drainage development within the Putrajaya Lake catchment.</p> <p>(c) It should include the identification of the locations of all gross pollutant traps and green-belt zones.</p> <p>(d) The plan shall be accompanied by all pertinent planning and design guidelines.</p>	
5.0 SEWERAGE MASTERPLAN STUDY	
<p>(a) Develop an integrated Putrajaya Lake Catchment Sewerage Masterplan. The scope of the development shall involve a review of the Kawasan Putrajaya Sewerage Masterplan and the current and proposed sewerage plans (if any) for the areas outside of it (that are within the Putrajaya Lake catchment), with the objective of integrating the sewerage plans to the Kawasan Putrajaya Sewerage Masterplan.</p> <p>(b) The Sewerage Masterplan should provide a strategy for the sewerage development within the Putrajaya Lake catchment.</p> <p>(c) The plan should be accompanied by all pertinent planning and design guidelines.</p> <p>(d) A design guide for the treatment facility to treat the sewage effluent to the required standard shall be provided.</p> <p>(e) An appropriate sewage effluent monitoring program together with a budget for its implementation shall be provided.</p>	<p>(a) An integrated Sewerage Masterplan for the catchment.</p> <p>(b) All pertinent planning and design guidelines.</p> <p>(c) A design guide for the treatment facility to treat the sewage effluent to the required standard.</p> <p>(d) A sewage effluent monitoring program.</p>
6.0 LAND-USE MASTERPLAN STUDY	
<p><u>Existing Land-use Study</u></p> <p>(a) Identification of land-use zonings and their associated restrictions. It will include any changes on the zonings according to certain time frames, if any.</p> <p>(b) Compilation and review of developments that are being planned,</p>	<p>(a) An integrated Land-use Masterplan for the catchment, comprising of a Zoning Plan and a Concept Plan.</p> <p>(b) A set of land-use control guidelines, comprising of a Planning Standard, Land-use Classification and Sketches & Illustrations, for all proposed and future developments in the catchment.</p>

STUDY SCOPE	STUDY OUTPUTS
<p>submitted for planning approval, approved and under development in the catchment.</p> <p>(c) Evaluation, together with the other pertinent specialists, the existing land use and their physical characteristics, in relation to the subsequent development of the land-use masterplan for the catchment.</p> <p><u>Land-use Masterplan Study</u></p> <p>(a) Develop an integrated Land-use Masterplan for the Putrajaya Lake catchment. It shall involve a review of the Kawasan Putrajaya Land-use Masterplan and the current and proposed land-use plans (if any) for the areas outside of it (that are within the Putrajaya Lake catchment), with the objective of integrating the land-use plans to the Kawasan Putrajaya Land-use Masterplan.</p> <p>(b) A systematic technical analysis of the advantages and disadvantages of the possible land-use options, taking into account the results, recommended management measures and requirements specified by the respective specialists will be carried out.</p> <p>(c) Preparation of pertinent guidelines and development conditions for all proposed and future developments in the Putrajaya Lake catchment.</p>	
7.0 INTEGRATED CATCHMENT MANAGEMENT SYSTEM	
<p>(a) Information Management Study - To review the information needs of the stakeholders and to list the information requirements for decision-making.</p> <p>(b) The Integrated Catchment Management System - To design a basic integrated catchment management system which includes relevant project data and database of critical information and for the proposed environmental monitoring plans.</p>	<ul style="list-style-type: none"> • A basic Integrated Catchment Management System, comprising of a GIS and pertinent information database.

STUDY SCOPE	STUDY OUTPUTS
<p>(c) Technology transfer – Transfer and integrate the basic ICMS into the existing Perbadanan Putrajaya GIS/MIS and training of client’s personnel.</p>	
<p>8.0 INSTITUTIONAL AND LEGISLATION STUDIES</p>	
<p>8.1 <u>Institutional Study</u></p>	
<p>(a) Existing Institutional Framework Study A systematic review of the existing institutional arrangement/set-up and administrative framework in the catchment will be carried out. It shall involve the mapping of the organisational structure, responsibilities and interfacing between them, for the control of development in the catchment.</p> <p>(b) New Institutional Framework Study A study to develop and recommend the most effective and appropriate new institutional/administrative arrangement/set-up to implement the developed Catchment Development and Management Plan for Putrajaya Lake will be carried out. It shall involve the identification of all legislative and administrative amendments, to put into effect the new institutional/administrative arrangement or set-up. It shall be based upon the implementation, monitoring and development control requirements recommended by the various specialists in the project team and shall be developed jointly by the project team.</p> <p>(c) Study on Stakeholder’s Participation in Catchment Management A study to define the strategies for engaging the current and future catchment stakeholder’s participation for sustainable management of the catchment.</p>	<p>(a) A Catchment Management Statement Policy of Putrajaya.</p> <p>(b) A report on the existing institutional arrangement/set-up in the catchment.</p> <p>(c) Recommendation on the most appropriate institutional arrangement/set-up for the implementation of the developed Plan.</p> <p>(d) A set of strategies for participatory management of the Putrajaya Lake Catchment.</p>

STUDY SCOPE	STUDY OUTPUTS
<p>8.2 Legislation Study</p> <p>(a) To identify and review present legislation involving catchment management issues. Specifically this will involve the review of specific legislation related to the management, regulation and control of water resources, land, municipalities and town and country planning. It will also require a review of legislation that regulates and impinges on various activities such as pollution, mining, siltation, forestry, management of water resources, sewerage, drainage, farming, and recreational activities;</p> <p>(b) Interface with the various consultants on the legal basis for the implementation of various methods proposed to be adopted to enable effective management of the catchment area. Given the scenario where there are quite a number of stakeholders involved the Legislation consultant will have to work very closely with the institutional expert;</p> <p>(c) Make recommendations on any appropriate changes to existing legislation and propose the formulation of new legislation, if any, for the effective management and control of activities in the catchment area including enabling the various recommendations of this Study to be implemented; and</p> <p>(d) Liaise with the Perbadanan and other authorities on all legal issues pertaining to the effective management of the catchment area.</p>	<p>(a) Review of existing legislation at the State and local level. This review will be made available at the Preliminary Report Stage;</p> <p>(b) Recommendations on changes, if any, to existing legislation will be made in the Interim Report;</p> <p>(c) An identification, in the Interim Report, will be made of the most appropriate legislation that may be used as a vehicle to formulate subsidiary rules to enable the implementation of the various recommendations made in this Study;</p> <p>(d) Draft amendments, if any, to existing legislation <i>provided such amendments are minor involving not more than one statute and, in the opinion of the legislation specialist, the work involved may be accommodated within the present time frame allocated to the legislation specialist.</i> Such drafts shall be submitted in the Draft Final Report;</p> <p>(e) Recommendations, in the Draft Final Report, pertaining to the formulation of new legislation; and</p> <p>(f) A TOR for the formulation of such new legislation including major changes to existing legislation.</p>

STUDY SCOPE	STUDY OUTPUTS
9.0 IMPLEMENTATION PLANS	
<p><u>Catchment Development and Management Plan</u></p> <p>(a) Integration of all the requirements of the masterplans developed in the study together with the guidelines and management measures, recommended by each of the specialists in the study team, which shall culminate in a number of development control checklists.</p> <p>(b) Identification of the organisations and their officers who shall be responsible for the development control in the catchment, analysing their existing development control procedures and recommending changes, where necessary, to integrate the use of the checklists into the procedures.</p> <p><u>Budget and Implementation Schedule</u></p> <p>(a) Provide indicative costing of the proposed management measures to support the project team’s decision on the most effective Catchment Development and Management Plan for Putrajaya Lake.</p> <p>(b) Prepare a master implementation schedule and an overall implementation budget.</p> <p>(c) Evaluation of possible funding options for the implementation of the recommendations arising from the study.</p>	<p>(a) A Catchment Development and Management Plan.</p> <p>(b) An indicative costing of the proposed management measures, an implementation budget for the Plan together with a list of the possible funding options.</p> <p>(c) An implementation schedule for the Plan.</p>