



A Background Study: Economic Benefits of the Muda Water Catchment



June 2009



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Report prepared by K.F. Lee for WWF-Malaysia
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Economic Benefits of the Muda Water Catchment**

by

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Executive Summary

Muda River and Catchment

Muda River is located in the northwestern part of Peninsular Malaysia. The upper and middle reaches of the basin belong to the State of Kedah, and the river downstream forms a boundary between the States of Kedah and Penang. The Muda River has been developed as one of the most important water resources for agriculture and water supply for Kedah and Penang. Both Kedah and Penang have the rights to use water from the Muda River.

There are four major dams within the Muda River basin, consisting of the Muda Dam, Pedu Dam, Ahning Dam and Beris Dam. The Muda Dam is on the mainstream of the Muda River about 130km upstream from the river mouth. The dam catchment area is 98,400ha with volume of 160 million m³. The dam reservoir stores almost all of the basin runoff discharge and conveys it to the Pedu Dam via the 6.6km long Saiong tunnel. Pedu Dam with a catchment area is 17,100ha, has an active storage capacity of 1,073 million m³ in the upper reaches of the Kedah River. Water conveyed to the Pedu Dam is principally used for the Muda Irrigation scheme of about 97,000ha. Thus the Muda Dam is part of the Muda River basin in terms of topography, but hydrologically, it is also shared with the Kedah river basin. The water is used for irrigation of rice cultivation along the Kedah River under the Muda Agricultural Development Authority (MADA).

MADA owns, operates and maintains the Muda and Pedu dams. In addition, MADA also manages the Ahning Dam located along the same river channel as Pedu Dam. The catchment area of Ahning dam is 12,200ha and its capacity is 275 million m³.

The Department of Irrigation and Drainage (DID) operates and maintains the Beris Dam located at the valley of the Beris River, 1.6km upstream of the confluence of the Muda River and Beris River. The catchment area of this dam is 11,600ha area.

When water demand exceeds the natural river flow discharge, water is released from the storage of the four existing dams – Muda, Pedu, Ahning, Beris.

Most of the water catchment areas of Muda, Pedu, Ahning and Beris dams are gazetted as Permanent Reserved Forests (PRFs) for both production and protection purposes by the Kedah State Government using the State-adopted National Forestry Act 1984.

Within the overall Muda River catchment, five PRFs have been gazetted with a total area of 143,327ha. PRFs in the catchment areas are categorised into different functional classes. Overall 64.5% of the area of these five PRFs are gazetted for timber production, and 32.3 % are gazetted for water catchment. The remaining areas are gazetted for research, education and recreation. In addition to this, a further 19,676ha of forest has also been proposed to be gazetted as PRFs.

Benefits

The forests of Ulu Muda play an important role in providing a clean and reliable source of water to Kedah, Penang and Perlis water supply for domestic and industrial use, and for irrigation. In 2005, the Muda catchment contributed RM157 million to Kedah and RM139 million to Penang in terms of annual water supply for domestic and non-domestic use. Together, the contribution is approximately RM296 million. The water supply companies in Kedah and Penang made profits from these revenues. The benefits of clean and reliable supply of water extend beyond the value of this amount because water is used as input for business and industry.

The preliminary survey conducted in this study was not able to determine the economic value of water for business and industry. Based on the survey responses of this study, companies adopt different strategies to ensure that there is sufficient water supply to meet their needs. These include water conservation strategies such as reusing and recycling of water, and contingency strategies such as, ground water abstraction, installation of desalination plant and tanking water from Kedah. These initiatives demonstrate that companies surveyed are prepared to spend and invest in to address water shortages.

Water is used directly for irrigation. The ratio of water for irrigation to water for water supply range is approximately 5 to 1 in terms requirement from river for the year 1995. Although the volume of water used for irrigation is five times more than water supply, the value of water for irrigation is not easily quantified for agriculture because farmers do not pay for water. In terms of benefits, it is estimated that the income for farmers in the MADA irrigation scheme is approximately RM776 million in 2006. Farmers incur costs of production such as labour, fuel and use of machinery. Water from the Muda catchment for irrigation has the potential to affect this value of approximately RM776 million annually.

The forests of the Muda catchment also provide values, some of which have not been estimated. These include the values for ecotourism with a potential value of RM13 million annually; educational and scientific purpose; non-timber forest products; medicinal and pharmaceutical values; cultural and heritage values; and the existence values of the diverse flora and fauna existing in the forests.

Various expenditures were made to ensure that water is provided for water supply and irrigation. It is estimated that the average annual expenditure of MADA that is related to providing water for irrigation is approximately RM19 million per year. DID estimates that the operational costs in the Muda catchment area are approximately RM0.4 million annually. Based on average operational costs per area, it is estimated that the Kedah State Forestry Department spent approximately RM6.1 million for year 2004 for the conservation of the PRFs in the Muda, Pedu and Ahning dam catchment areas. These total to approximately RM25.5 million a year.

Water supply companies, such as *Perbadanan Bekalan Air Pulau Pinang Sdn Bhd* (PBAPP) also invest in infrastructure to ensure the quality and reliability of delivering water. For instance PBAPP on average spent RM88 million annually from 2004 to 2007 for infrastructure projects (this value however does not include investments to protect water catchment areas).

Apart from costs related to the Kedah State Forestry Department for maintenance of PRFs in the Muda, Pedu and Ahning dam catchment areas, there appears to be little or no additional investment or contribution made by the Federal or State governments, water supply authorities and the private sectors of Kedah or Penang to conserve the forests of the Muda catchment areas. There are no existing arrangements in which relevant stakeholders are able to contribute towards the protection and conservation of Muda catchment area.

Based on the recently gazetted Kedah Water Resources Enactment 2008, river basin plans will be prepared for the purpose of integrated water resources management and according to the priorities, geographical areas and timetable determined by the Water Resource Board. The legislation also provides for the establishment of a water resources fund, and water development fund. Therefore there are opportunities within the current institutional framework to promote mechanisms for relevant stakeholders to contribute towards the protection and conservation of Muda catchment area.

Recommendations

Without disregarding the values from other uses, the values related to water use for water supply and irrigation are considerable enough to draw attention towards the conservation of the forests of Muda catchment area. In order to be more systematic in terms of estimating the benefits of Muda catchment area, it would be necessary to conduct detailed studies of the following nature:

- Cost-benefit analysis of protection of the Muda catchment forest in order to provide a more comprehensive picture of the overall benefits of forest protection.
- Cost-benefit analysis of activities in the Muda Water catchment area, in order to conclude what would be monetary impacts if these activities are carried out.

In order to ensure the effective protection of the Ulu Muda forest, it is necessary for stakeholders who wish to continue enjoying the benefits from Ulu Muda forest to do the following:

- Organise themselves to discuss various approaches and mechanisms that can be adopted to effectively manage the Ulu Muda forest. The recently gazetted Kedah Water Resources Enactment 2008 provides the platform for ideas that were suggested previously made by in 1995 (JICA, 1995) to formalise institutions for the management of forest and water resources. This legislation provides for the establishment of Kedah Water Resources Board and river basin committees as well as preparation of river basin plans.
- Develop a framework for stakeholders that are benefiting from the Ulu Muda forest to contribute financial resources for the management and conservation of this area. Some of the concepts that could be applied are the User Pay Principle and Payment for Environmental Services (PES). The recently gazetted Kedah Water Resources Enactment 2008 provides for the creation of Water Resource Fund, and Water Development Fund which could be used to receive payments based on the concepts mentioned above.

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Abbreviations

CAPEX	Capital Expenditure
DID	Department of Irrigation and Drainage
FREPENCA	Free Industrial Zone, Penang, Companies' Association
JICA	Japan International Cooperation Agency
MADA	Muda Agriculture Development Authority
MLD	Million Litres per Day
PBAPP	<i>Perbadanan Bekalan Air Pulau Pinang Sdn Bhd</i> Penang Water Supply Corporation
PES	Payment for Environmental Services
PRF(s)	Permanent Reserved Forest(s)
Sg.	Sungai
UPEN	<i>Unit Perancang Ekonomi Negeri</i> State Economic Planning Unit
WWF-Malaysia	World Wide Fund for Nature Malaysia

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1. Introduction

1.1 Background

Since the 1990s, WWF-Malaysia has been advocating for the need for improved protection of the Ulu Muda forests in Kedah for biodiversity conservation and also for water resource management.

In 2002, WWF-Malaysia prepared a study on nature tourism for the Kedah State government which included a preliminary economic valuation of the Muda catchment¹. This study provided estimated values of the water resources of the Muda catchment particularly in terms of direct revenues to the Kedah and Penang State governments from the sale of treated water and also the values derived from rice production dependent on irrigation water sourced from the Muda catchment. However, not much is known about the importance of water from the Muda catchment to the industrial sector.

1.2 Objective

The objective of this study is to outline the benefits of the Muda water catchment, particularly in terms of the use of water, including the importance of water to the industrial sector. This current study is intended to add on to the findings from a preliminary economic valuation carried out in 2002 above, with a particular focus on the water resources use.

1.3 Scope

The scope of this study covers the following:

- In terms of geography, the upper water catchment areas of the Muda River which consist mainly of several Permanent Reserved Forests (PRFs)
- In terms of benefits from the Muda River, the use of water for irrigation and for the industrial sector and consumption of treated water originating from Ulu Muda for the states of Kedah and Penang.

1.4 Methodology

In preparing this study, the following activities were carried out:

- Literature review of relevant data, including maps, on the water supply system in Penang and southern Kedah and its economic value.
- Interviews with representatives from relevant government agencies related to the management of the Muda catchment area or are involved in ensuring adequate water supply derived from the Muda catchment area, and from the private industrial/commercial sector in Penang and southern Kedah.

¹ Catchment is defined as drainage area of any river from the headwater catchment (usually consisting of highland areas) to the estuary (which encompass areas where there is tidal influence/brackish water as well as habitats associated to rivers such as freshwaters swamps, mangroves, etc). The catchment includes both the rivers that convey the water as well as the land surfaces from which water drains into those rivers and is separated from adjacent catchment by a drainage divide.

The use of the terms catchments, basins and watersheds are in part interchangeable.

- A survey on the importance of water for the industrial/commercial sector in Penang (refer to Annex 1 for the survey questionnaire).

In the process of preparing this study, information was obtained from the following agencies:

- Kedah State Forestry Department
- Penang Water Supply Corporation (*Perbadanan Bekalan Air Pulau Pinang Sdn Bhd - PBAPP*)
- Kedah Water Supply Department
- Department of Irrigation and Drainage (DID), Kedah
- Department of Irrigation and Drainage, Penang

The respondents to the survey consisted of the following:

- Four companies from the Free Industrial Zone, Penang, Companies' Association (FREPENCA)
- Two city hotels in Penang

1.5 Limitations

This study does not provide details such as the boundaries of the Muda River basin or the river and dam catchment areas, land use, or details of expenditures and investments.

The survey carried was only able to provide an indication of the importance of water to the industrial sector in Penang. As the sample size is too small to provide any conclusive results, the survey can only be considered as exploratory and indicative in nature. The survey was not able to estimate the contributions of water as an input to the revenues or profits of business and manufacturing sectors. Nonetheless the total payment for using treated water in households and industry were captured.

2. Muda River and its Catchment Area

2.1 Muda River

Muda River is located in the northwestern part of Peninsular Malaysia. The upper and middle reaches of the basin belong to the State of Kedah, and the river downstream forms a boundary between the States of Kedah and Penang (refer to Annex 2 for the map on rivers and river basins for Kedah and Penang). Muda River has been developed as one of the most important water resources for agriculture and water supply for Kedah and Penang. Riverbed sand is also extensively mined for use as construction materials. The river is used as a navigation channel for local fishing boats, particularly around the river mouth (DID & JICA, 1995).

There are three major tributaries of the Muda River System, namely the Ketil River with a catchment of 868km², Sedim River with 626 km² and Chepir River with 335km².

Both Kedah and Penang have the rights to use water from the Muda River. The breakdown of the lengths and area of river basin are presented in the table below.

Table 1. Muda River: Length, River Basin & Catchment Area

States	Length of Muda River Passing Through (km)	River basin (ha)
Kedah	180	4,302,000
Penang	23	10

Source: DID - unpublished data

There are four major dams within the Muda River basin, consisting of the Muda Dam, Pedu Dam, Ahning Dam and Beris Dam. Please refer to Annex 3 for the map of the dams within the Muda River system.

The Muda Dam was constructed in 1969 on the mainstream of the Muda River about 130km upstream from the river mouth. The dam catchment area is 98,400ha with volume of 160 million m³. The dam reservoir stores almost all of the basin runoff discharge and conveys it to the Pedu Dam via the 6.6km long Saiong tunnel, both of which were also constructed in 1969.

Pedu Dam has an active storage capacity of 1,073 million m³ in the upper reaches of the Kedah River. Its catchment area is 17,100ha. The water conveyed to the Pedu Dam is principally used for the Muda Irrigation scheme of about 97,000ha. Thus the Muda Dam is part of the Muda River basin in terms of topography, but hydrologically, it is also shared with the Kedah river basin. Hence the water is used for irrigation of rice cultivation along the Kedah River under the Muda Agricultural Development Authority (MADA).

MADA owns, operates and maintains the Muda and Pedu dams. In addition, MADA also manages the Ahning Dam located along the same river channel as Pedu Dam. The catchment area of Ahning dam is 12,200ha and its capacity is 275 million m³.

The Department of Irrigation and Drainage (DID) operates and maintains the Beris Dam located at the valley of the Beris River, 1.6km upstream of the confluence of the Muda River and Beris River. The dam has an area of 11,600ha for its catchment area (DID, 1993).

When water demand exceeds the natural river flow discharge, water is released from the storage of the four existing dams – Muda, Pedu, Ahning, Beris.

The total dam catchment area for the four dams is 139,300 ha.

2.2 Permanent Reserved Forests

Most of the river water catchment areas of Muda, Pedu, Ahning and Beris dams are gazetted as Permanent Reserved Forests (PRFs) for both production and protection purposes by the Kedah State Government using the State-adopted National Forestry Act 1984.

Within the river catchment area, five PRFs have been gazetted with a total area of 143,327ha (see Table 2). In addition to this, a further 19,676ha of forest has also been proposed to be gazetted as PRFs.

As the Muda Dam is also shared with the Kedah river basin in terms of hydrology, the Kedah River also originates from the PRFs that are part of the Muda River catchment area.

PRFs in the catchment areas are categorised into different functional classes. Table 2 presents the breakdown by functional class of the five PRFs that are gazetted by the Kedah State Government within the Muda catchment area and three proposed PRFs. Overall 64.5% of the area of these five PRFs are gazetted for timber production, and 32.3 % are gazetted for water catchment. The remainder is gazetted for research, education and recreation.

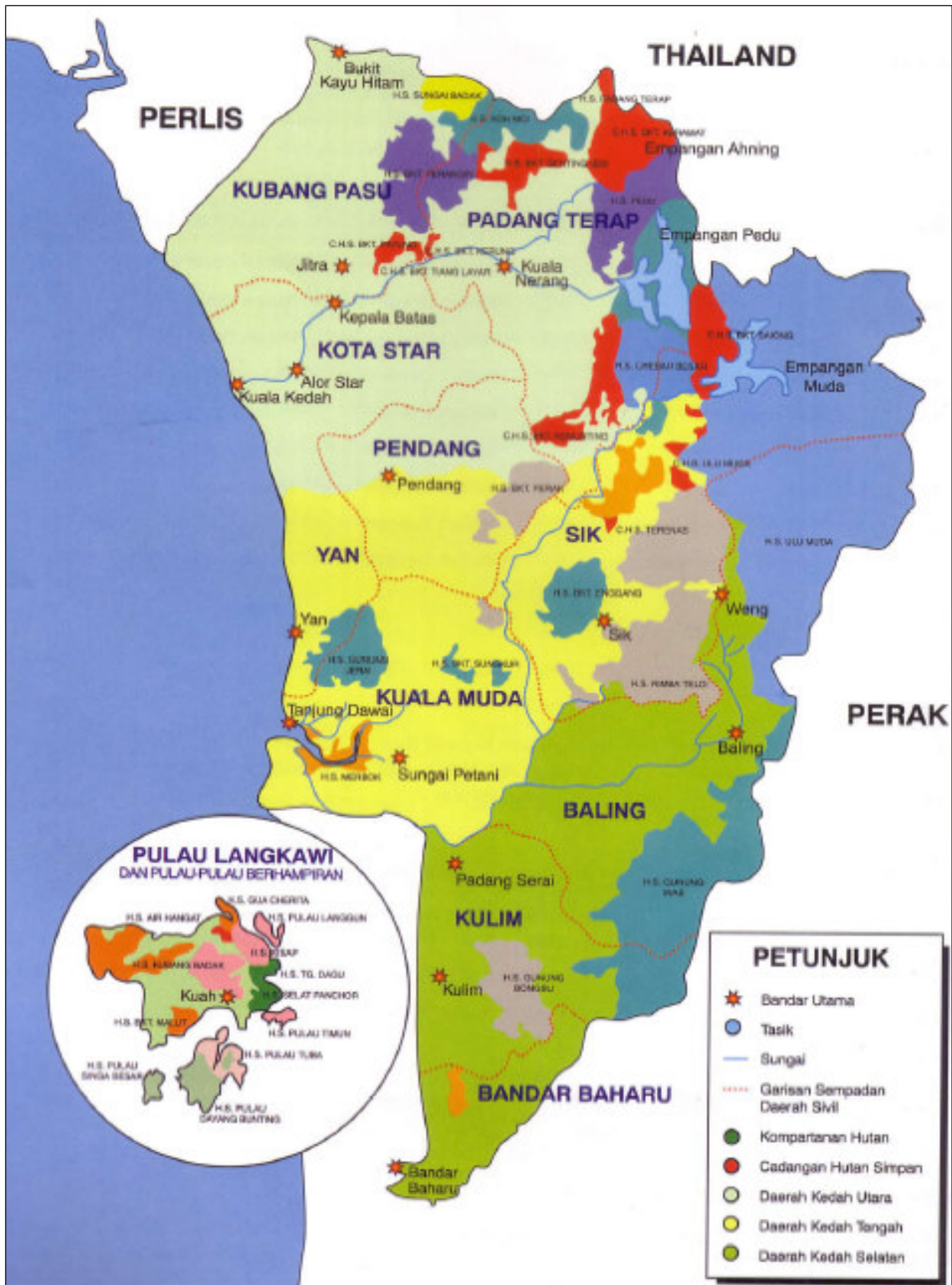
Figure 1 below shows the location of the PRFs.

Table 2. Gazetted and Proposed Permanent Reserved Forests (PRFs) in the Muda Catchment Area and their Functional Classes

Forestry Districts	Name of PRF	Functional Class (area in ha)					Total (area in ha)
		Timber Production	Water Catchment	Recreation	Educational	Research	
Kedah Utara	Chebar Besar	7,385	1,442				8,827
Kedah Utara	Padang Terap	5,602	7,356				12,958
Kedah Utara	Pedu	442	14,712	145			15,299
Kedah Tengah	Chebar Kecil	959	225				1,184
Kedah Tengah & Selatan	Ulu Muda	78,052	22,611		2,447	1,949	105,059
Total Gazetted (ha)		92,440	46,346	145	2,447	1,949	143,327
Percentage (%)		64.5	32.3	0.1	1.7	1.4	100.0
Proposed Area to be gazetted as Permanent Reserved Forests							
Kedah Tengah	Bukit Keramat*						10,226
Kedah Tengah	Bukit Saiong						8,191
Kedah Tengah	Ulu Muda (Addition)*						1,359
Total Proposed							19,676
TOTAL GAZETTED AND PROPOSED							163,003

Source: Kedah State Forestry Department (2008),
except for those marked with * obtained from Kedah State Forestry Department (undated)

Figure 1. Locations of Permanent Reserved Forests



Source: Kedah State Forestry Department Report 2004

In the year 2004, Penang gazetted water catchment areas on Penang Island using Section 4 of Water Supply Enactment 1998 (Government of Penang Gazette, 2004). The total area of gazetted water catchment in Penang is 6,290 ha (PBAPP, 2007). While this area is not related to the water catchment area of Muda River, it is interesting to compare this figure with the total area which is gazetted as forest reserve for water catchment in the forested areas of the Muda catchment in Kedah, of 46,346 ha. (Although the area that is gazetted for water catchment in Penang is approximately 14% of the total areas of the 5 PRFs that is gazetted as water catchment, Penang has gazetted 6.1% of its total state area for water catchment compared to 4.9% for Kedah)

2.3 Institutional Set-up

The Comprehensive Management Plan of Muda River Basin – Final Report prepared by JICA in 1995 had identified the stakeholders of the Muda River Basin. It suggested two institutional arrangements consisting of existing stakeholders for river management (see Table 3 below).

Table 3. Proposed Institutional Set-up for River Management

Institutional	Members	Roles
Muda River Basin Management Council	<ul style="list-style-type: none"> ▪ State UPEN (Kedah & Penang) ▪ DID (Kedah & Penang) ▪ MADA ▪ Forestry Department – Kedah ▪ Dept. of Land and Mines (Kedah & Penang) ▪ Water Supply Authorities (Kedah & Penang) 	<ol style="list-style-type: none"> 1. Approve long term and 5-year basin water resources development and management master plans for Muda River Basin 2. Approve basin policies and water use priority allocation, flood mitigation, river resources and river environmental management activities 3. Approve emergency actions during extreme drought. 4. Approve water pricing policies (abstraction and discharge).
Muda River Basin Technical Committee	<ul style="list-style-type: none"> ▪ DID (Kedah & Penang) ▪ MADA ▪ Forestry Department – Kedah ▪ Dept. of Land and Mines (Kedah & Penang) ▪ Water Supply Authorities (Kedah & Penang) ▪ Town and Country Planning 	<ol style="list-style-type: none"> 1. Promote and implement rational management of water resources of Muda River Basin through integrated and coordinate a policy planning of water resources development 2. Prepare long term and 5-year basin water resource development and management master plans for Muda River Basin. 3. Establish procedures to determine water use priorities during periods of inadequate water supply due to drought or other situations. 4. Establish guidelines and procedures for the prevention and control of flooding, soil erosion and damage to catchment areas and water courses. 5. Formulate policies and legal provisions for

Institutional	Members	Roles
	Departments (Kedah & Penang)	<p>management of the Muda River Basin for consideration and endorsement by the Muda River Basin Management Council.</p> <p>6. Coordinate and integrate different development and management plans and projects of various departments and agencies in the Basin.</p> <p>7. Coordinate land use planning and land use change with water resource planning, development and management of the Basin.</p>

Source: JICA (1995)

The Kedah Water Resources Enactment was gazetted in 2008. This legislation is not specific to the Muda River. It provides for the establishment and incorporation of the Water Resources Board. This board consists of the following members:

- (a) the Menteri Besar of Kedah who shall be the Chairman;
- (b) the State Secretary who shall be the Deputy Chairman;
- (c) the State Legal Advisor;
- (d) the State Finance Officer;
- (e) the Water Resources Director;
- (f) the State Director of the Department of Irrigation and Drainage;
- (g) the State Director of the Department of Environment;
- (h) the State Director of the Town and Country Planning Department;
- (i) the State Director of the Department of Forestry;
- (j) the State Director of the Department of Lands and Mines;
- (k) the State Director of the Department of Minerals and Geosciences;
- (l) the State Director of the Water Supply Department;
- (m) the General Manager of Muda Agriculture Development Authority (MADA); and
- (n) not more than two other members to be appointed by the State Authority who shall have substantial expertise in matters pertaining to the management and conservation of river basins and water resources.

The functions of this board are as follows:

- (a) to ensure, maintain and facilitate the **integrated and sustainable management of water resources and the water environment of the State** such as to ensure the safeguarding of the life supporting capacity of water and ecosystems, maximizing of their economic, social and environmental benefits for the present and future generations;
- (b) to regulate inter basin transfer of water within the State;
- (c) to promote and facilitate **cooperation and coordination between different agencies for multi functional uses of water resources**;
- (d) to coordinate the exploration and development of additional water resources;

- (e) to develop its capacity and expertise to act as the **central point of reference for integrated water resources management issues in the State**; and
- (f) to **advise the State Authority in respect of inter-State management and transfer of water**;

In addition the legislation ensures that there will be coordination in terms of preparation of river basin plan with other states. It is stated that *“The aim of ensuring integrated water resources management shall extend to any water body or river basin shared with another State in Malaysia and the Board shall endeavour to coordinate the preparation of the river basin plan with the other State in order to conclude a single river basin plan with specific measures for each State”*.

The Water Resources Board will also establish a River Basin Committee to be responsible for every river basin. The members of the River Basin Committees include the relevant District Officers and such other persons as may be determined by the Water Resources Director in consultation with the District Officers. The functions and powers of a River Basin Committee include the following:

1. investigating such matters affecting the management of the river basin as the Board may refer to it and preparing for the Board, a report of the investigation;
2. assisting the Water Resources Director in the preparation of a draft river basin plan and any other reports as he may require;
3. devising programmes and activities to implement the recommendations under the relevant river basin plan; and
4. exercising such other functions as the Board may direct.

In carrying out its functions and powers, the River Basin Committee shall include a process of consultation with relevant agencies and members of the public who have an interest in water resources.

Within the context of this legislation, the Water Resources Director shall, with the cooperation and participation of the relevant agencies, prepare river basin plans for the purpose of integrated water resources management and according to the priorities, geographical areas and timetable determined by the Board.

The river basin plan includes –

1. a statement of the objectives of the plan;
2. a reference to other policies and plans that has an impact on the river resources and the water environment;
3. identification of the water resources of the river basin;
4. the status of the quantity and quality of the water resources including current condition and development trends;
5. the activities that significantly influence the quantity and quality of the water resources and assess these impacts;
6. the water quality objectives for the water bodies;

7. **strategies and measures for the protection, conservation, development and use of the water resources and for maintaining or improving the quantity and quality of water and the water environment;**
8. indicators for the achievement of the objectives and the implementation of the measures;
9. identification of water conservation areas referred to in section 36; variation of river reserves referred to in subsection 34(2);and areas for extraction of sand and other rock materials referred to in section 39; and
10. any other matters which the Board may request to be included.

A river basin plan is prepared for each river basin and shall have effect for a period of ten years.

3. Valuing Ulu Muda Forests

3.1 Economic Valuation

Economic valuation refers to the assessment of monetary values to non-market goods² and services. These monetary values have a particular and precise meaning, depending on the methods of assessment. Economic valuation is defined by Barbier *et al.* (1997) as “the attempt to assign quantitative values to the goods and services provided by environmental resources, whether or not market prices are available to assist us”.

Goods or services such as clean air, clean water, and national parks contribute positively to human wellbeing. The market system puts monetary values on society's goods and services. Many environmental resources are complex and multifunctional, and it is not obvious how the myriad goods and services provided by these resources affect human welfare. In the case of wetlands and other ecosystems, there is no direct market for services such as maintenance of biodiversity, and flood control.

There is a growing recognition that natural functions provide real benefits and values, and that these values need to be included in decision-making processes. The loss of environmental resources becomes an economic problem when important values disappear, some are even irreversible. Each choice or options related to environmental resources have implications in terms of values gained and lost. This realisation increased environmental considerations in investment and planning decisions as well as integrating economic concern by the means of the economic valuation into nature conservation decisions. Please see Box 1 for an example.

Economic valuation provides a tool to assist with the difficult decisions involved. It provides a means for measuring and comparing the various benefits of natural resources and their ecosystems and can be a powerful tool to aid and improve their wise use and management. It is important to be reminded that economic valuation represents just one tool or input into decision making in addition other important considerations, such as political, cultural and technical environmental considerations (Barbier *et al.*, 1997).

Box 1. Including Economic Values in Decision Making

Optimal land use and management decisions for the forest (i.e., which maximizes our returns from wetland over the long term) depends on providing comprehensive and reliable information on the environmental, economic and social aspects of conservation as well as the development uses of the wetland. Without this information it is difficult to make truly rational comparisons between alternative land use options, and hence what would be the optimal land use for a particular area

Unless the full range of costs and benefits of projects, including their impact on the environment, are fully accounted for comparisons between options cannot be made fairly. Bad projects may be chosen, and good projects will not get fair consideration

Source: UNDP-GEF Project on Environmental Degradation in South China Sea and Gulf of Thailand (2003)

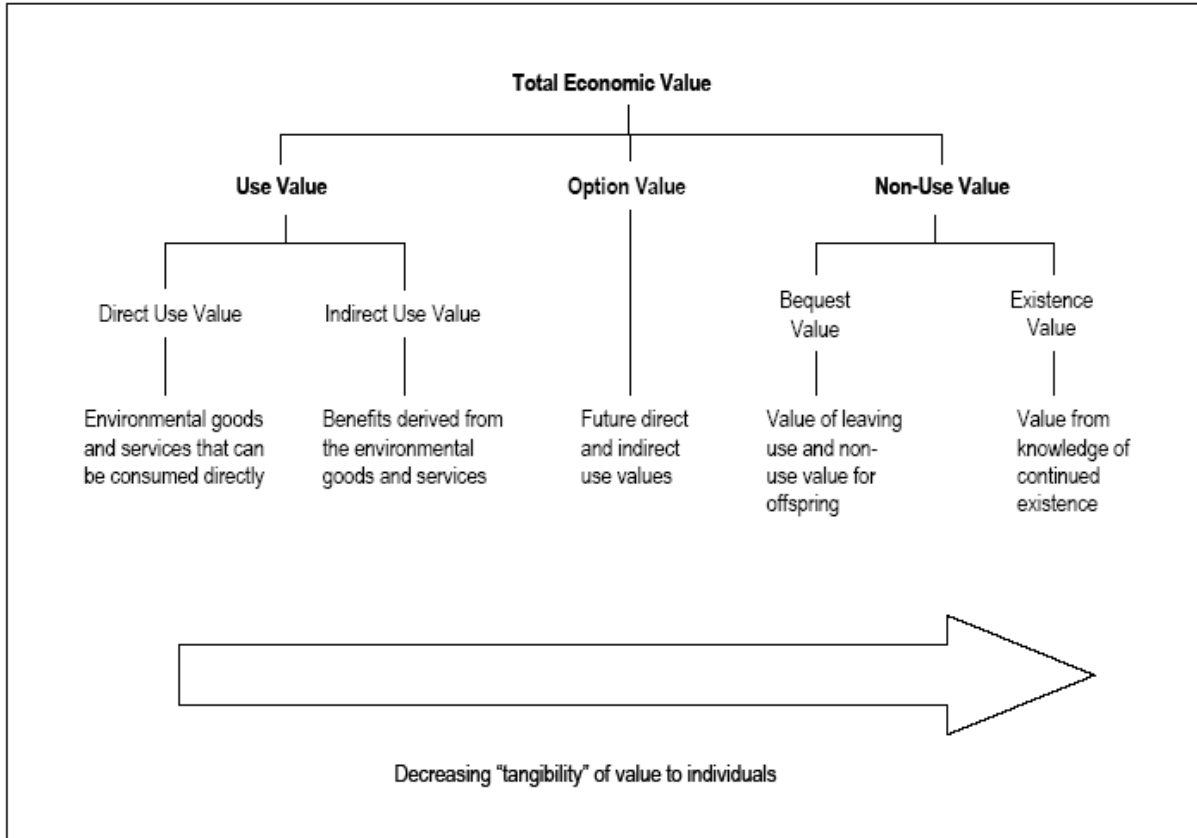
² Non-marketed goods has no markets, or may have a limited, or “incomplete” market

The concept of Total Economic Value Framework is most often used to assign economic values to environmental resources (Cavatassi, 2004). Total economic value (TEV) is a framework used to identify and estimate the monetary value of all economic benefits of society. TEV consists of three major components:

- *Use Values* which consist of the following:
 - *Direct Use Values* are those directly related to the use of the environmental good. For example, people visiting a national park derive recreation and education benefits from the experience.
 - *Indirect Use Values* refer to benefits that people derive indirectly from environmental goods and services. For example, forest preservation may have indirect impact on watershed protection and soil quality.
- *Non-Use Value*. These include benefits that are totally unrelated to any personal use of the environmental commodity. People may value environmental resources for a number of reasons without ever using or visiting them. There may be altruistic values associated with the knowledge that other people may enjoy the resource. These include:
 - *Bequest values* accruing from the desire to conserve environmental goods for future generations.
 - *Existence values* benefiting from the knowledge that our environment is being conserved.
- *Option Values*. This refers to the value of securing a possible future use of resource. In effect, by conserving the environment, one is retaining the possibility of using it in some point in the future.

Figure 2 below shows the components of total economic value of environmental resources. In general, use values are comparatively easy to estimate. As option values and non-use values are intangible in nature, estimating these become increasingly difficult compared to use values.

Figure 2. Total Economic Value Framework



Source: Cavatassi (2004)

Table 4 below presents an example of the types of value of the tropical forests.

Table 4. Types of Value of the Tropical Forests

Value category	Resources and Service Function	Examples
Use Value - Direct Value	Sustainable Timber Products Non – Timber Products Medicine Recreation Plant Genetics Education Human Habitat Fishery	Stumpage Value Ornamental Plants, Medicinal Plants, Herbs Recreation Forests Education Forests R&D / Gene Pool
Use Value - Indirect Value	Nutrient Recycling Water catchment Micro-climatic functions Air pollution reduction Carbon Store Biodiversity	Water catchment areas Flood mitigation Animals and insects for pollination Greenhouse gas regulation
Option Value	Possible future uses as per direct and indirect values above.	
Non – Use Value (Existence Value)	Existence value: value from knowledge of continued existence Bequest value: use and non – use value of environmental legacy accruing to a person from knowing that the good will be available in its current condition for future generations.	Habitats, species, genetic ecosystem, prevention of irreversible damage to habitat

Source: DANIDA-CEMD (2005)

3.2 Economic Values of Muda Catchment

WWF-Malaysia (2002) in its report entitled “A Study of Nature Tourism Development in Ulu Muda, Kedah Darul Aman” presented the benefits from the Muda catchment using the total economic value framework. This section presents the findings from this study. The use of the Muda catchment area is classified into three types of value categories:

1. Direct Use Values
2. Indirect Use Values
3. Non-Use Values

The direct use includes extractive use and non-extractive use. Extractive use includes water for irrigation, water supply for domestic and industrial use, sustainable timber harvesting as well as non-timber forest products such as ornamental plants and plants with medicinal properties etc. Non-extractive use includes the use in terms of the Ulu Muda forest as a destination for nature-based tourism, and also for scientific and educational purpose.

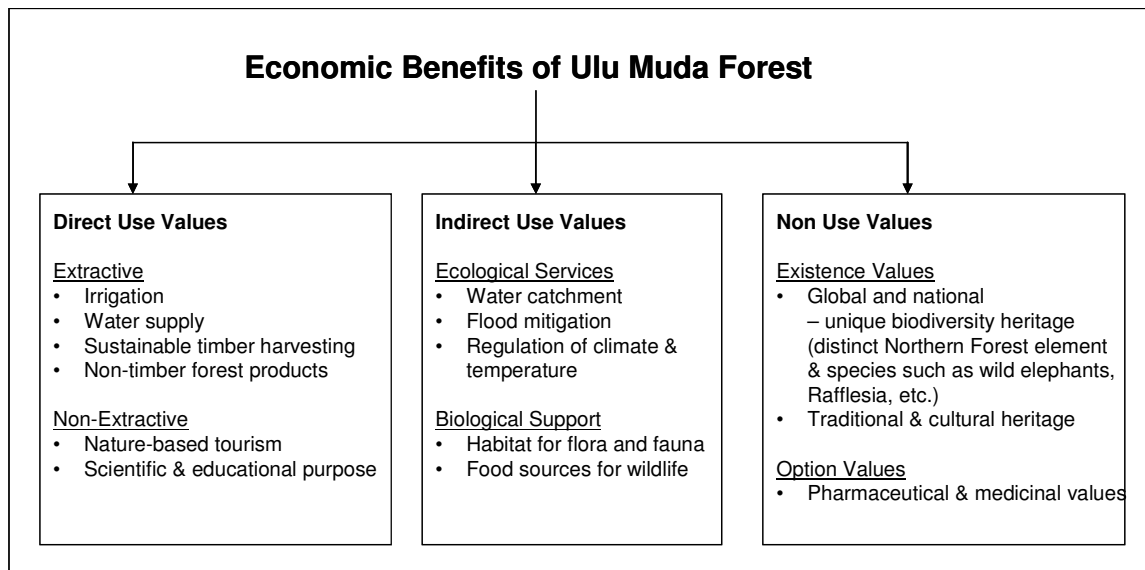
Indirect use of the area covers ecological services such as its function as a water catchment, its influence in terms of flood mitigation, as well as regulation of climate and temperature. In addition to ecological services, it is also habitat for flora and fauna.

Non-use values refer to values which are not currently being utilised. One of these is its existence value. The Ulu Muda forest is unique in many aspects; it is a source of traditional and cultural heritage for the local population. It also harbours many kinds of species, some of which have not been discovered and may have medicinal and commercial values for the pharmaceutical and also biotechnology companies.

An attempt was made by WWF-Malaysia (2002) to provide indicative figures for irrigation, water supply, timber, and tourism. Other values such as pharmaceutical potentials of the Ulu Muda forests, ecological services and existence values of its biodiversity were not estimated.

The economic values of Ulu Muda are represented in Figure 3. These values highlight the multifunctional uses of the Ulu Muda forest. Whilst these benefits illustrate the importance of the Ulu Muda Forest to the local communities, residents of Kedah, Malaysians and the global community, the challenge of this framework is to demonstrate a whole range of values in monetary terms. Direct values, particularly tourism, timber and hydrological values (agriculture and water supply) are highlighted in this study as partial values of the Ulu Muda forests. Annex 4 presents the indicative values of Ulu Muda forests.

Figure 3. Economic Values of Ulu Muda Forest



4. Water Use

This chapter describes the main uses of water from the Muda catchment area for irrigation and also water supply.

4.1 Irrigation

4.1.1 Agriculture

The main use of water from Muda River is for agriculture, particularly for the Muda irrigation scheme covering Kedah and Perlis. The Muda irrigation scheme occupies 126,155ha, of which 96,558ha, or 76.5% is used for rice cultivation. The breakdown according to the States of Kedah and Perlis is detailed in Table 5 below.

Table 5. Muda Irrigation Scheme

State	Land area within the Muda Irrigation scheme (ha)	Land area within the Muda irrigation scheme planted with rice (ha)
Kedah	105,851 (84%)	80,238 (83%)
Perlis	20,304 (16%)	16,320 (17%)
Total	126,155 (100%)	96,558 (100%)

Source: MADA Annual Report (2007b)

The total number of farmers involved in growing rice in the Muda irrigation scheme is 48,500 households (MADA, 2007a). In the year 2006, the average family income from agriculture is RM16,032 (MADA, 2007a). The total annual income of farmers in the Muda irrigation scheme is estimated at RM776 million per year. Based on the 84% of the Muda irrigation scheme located in Kedah, this contributes to RM652 million to the State of Kedah in the year 2006.

The Seberang Perai irrigation scheme covering an area of 8,000 ha in Penang is the second largest (JICA, 1995) in the Muda catchment area.

Table 6 below presents the water use for agriculture and also domestic and industrial water supply for the year 1995. The estimated volume of water for irrigation was estimated as 1,687 million m³, compared to 339 million m³ for water supply. The ratio of water for irrigation to water for water supply range is approximately 5 to 1 in terms of requirement from the river.

For irrigation the gross demand is the estimated total demand, of which some are supplied from rain water. Hence the requirement from Muda River is less than gross demand. For the demand for domestic and industry, the demand from Muda River is higher than gross demand because more water is required to produce the gross demand.

Table 6. Demand of Water from Muda River

Sector	1995	
	Gross Demand	Requirement from the Muda River
	(mil m ³)	(mil m ³)
Irrigation		
Muda	1,977	1,391
Balik / Seberang	156	80
Others	433	216
Subtotal	2,566	1,687
Domestic & Industry		
Kedah	129	136
Penang	166	194
Perlis	9	9
Subtotal	313	339
Total	1,991	2,896

Source: JICA (1995)

4.1.2 Water Shortage

There have been no water shortages (in Kedah or Penang) for the past 10 years. The most recent incidence of water shortage happened in 1998. During instances where demand for water exceeded the water availability in rivers, water is released to the granary areas from the Muda (released by MADA) and Beris (released by DID) dams. Table 7 below shows the year and volume in which water had been released from the the Muda and Beris dams. Note that the highest volume of water was released in 1998, corresponding to the shortage of water.

Table 7. Release of Water from Muda and Beris Dams (Various Years)

Year	Volume released (million m ³)
1998	85.0
2002	25.0
2005	40.0
2006	12.5
2007	8.8

Source: DID (unpublished data)

The dams in the Muda River catchment have important roles in providing a source of water during extreme drought. This illustrates the importance of the inter-relationships between the management of Ulu Muda forests upstream and implications on users downstream.

4.2 Domestic and Industrial Water Use

4.2.1 Treated Water Supply

In general, the demand for treated water supply increases annually due to increased per capita consumption of water for households, and also increased economic activities for business and industry.

Kedah

In terms of the total consumption of treated water supply in year 2005, the Water Supply Department of Kedah sold 203.6 million m³ of treated water. This represents a 2.3% increase from the previous year.

Penang

PBAPP sold 241 million m³ in 2005. The increase from the previous year is 3.4%.

Table 8 below gives a breakdown of treated water supply.

Table 8. Kedah and Penang: Metered Water Consumptions (2004 & 2005)

State	2004			2005		
	Domestic	Non-Domestic	Total	Domestic	Non-Domestic	Total
	(million m ³)			(million m ³)		
Kedah	150.2	48.9	199.1	153.5	50.1	203.6
Penang	141.7	91.3	233.0	145.9	95.1	241.0

Source: Malaysian Water Association in collaboration with the Ministry of Energy, Water and Communications (2006)

Overall, the total consumption of water in 2004 and 2005 was higher in Penang because Penang used more water for non-domestic purposes (95 million m³ for business, commercial and industrial activities in 2005) compared to Kedah (50 million m³ for year 2005). However, Kedah used more water for domestic purpose compared to Penang in both 2004 and 2005.

Per Capita Annual Use of Water

The population of Kedah is higher than Penang. Based on the volume of domestic use of water, Kedah and Penang for the year 2005, the per capita annual consumption of water was higher in Penang – 99.3 m³ compared to 83.1 m³ in Kedah (see Table 9 below).

The per capita consumption of domestic water supply in 2005 was higher in Penang by approximately 16 m³ per year.

Table 9. Kedah and Penang: Per Capita Domestic Use of Water (2005)

State	2005		
	Domestic Consumption* (million m ³)	Population**	Average annual consumption (m ³)
Kedah	153.5	1,848,100	83.1
Penang	145.9	1,468,800	99.3

Source:

*Malaysian Water Association in collaboration with the Ministry of Energy, Water and Communications (2006)

** Department of Statistics (2005)

Overall the per capita total water consumption in 2005 was also higher in Penang (164.1m³) compared to Kedah (110.2 m³) (see Table 10).

Table 10. Kedah and Penang: Per Capita Total Use of Water (2005)

State	2005		
	Total Consumption* (million m ³)	Population**	Average annual consumption (m ³)
Kedah	203.6	1,848,100	110.2
Penang	241.0	1,468,800	164.1

Source:

* Malaysian Water Association in collaboration with the Ministry of energy, Water and Communications (2006)

** Department of Statistics, 2005

The demand for water for industrial purpose will likely increase because the total proposed capital investment in Kedah for the manufacturing sector increased in 2006 and 2007, surpassing the investments in Penang. Please refer to Annex 5 and Annex 6.

4.2.2 Value of Water for Industry

It is difficult to estimate the contributions of water as an input to the revenues or profits of business and manufacturing sectors. Some of the manufacturing sectors surveyed only produced parts of the finished products components and hence the total value of the finished product was not readily available (please refer to Annex 7 for results of the survey).

Most of the organisations declined to reveal information about revenue and profits. The importance of water can only be implied in terms of the strategies that they adopt in order to ensure secure supply of water as indicated by the willingness of respondents to consider contingency strategies, increasing water tank capacity, water conservation and recycling. Because neither Penang nor Kedah has experienced serious water shortages in recent years efforts to consider and implement these strategies may not be widespread among the business and manufacturing sector.

Although the survey did not provide any conclusive data, it provided an indication of the importance of water to the industrial sector in Penang.

4.2.3 Raw Water Abstraction

The amount of water sold by water companies does not include non-revenue water such as water lost during distribution from leakages of pipes, and also use of water for fire-fighting and other non-revenue purposes. In the year 2005, the non-revenue water for Kedah is 43.8% and the non-revenue water for Penang is 19.4%. This means that the total water that is abstracted is at least 43.8% higher than the total water consumption for Kedah, and 19.4% higher than the total water consumption for Penang.

In terms of raw water abstraction, Kedah abstracts more water from Muda River compared to Penang. Table 11 below shows the number of total operational treatment plants, their designed capacity as well as average daily production for the year 2005.

Table 11. Statistics Related to Water Production (2005)

Item	Kedah	Penang
No of Operational Treatment Plants	32	9
Treatment Plant Designed Capacity (Million Litres per Day -MLD)	1,153	1,280
Average Daily Production (MLD)	976	819

Source: Malaysian Water Association in collaborating with the Ministry of Energy, Water and Communications (2006)

Kedah

In terms of water supply, Kedah has 32 water treatment plants with a combined capacity of 1,153 million litres per day (MLD). Only two plants with a combined capacity of 34 MLD do not draw water from Muda River. Based on the capacity of these plants, 96.5% (942 MLD out of 976 MLD) of the capacity of water supply is sourced from the Muda River indicating the importance of this river in terms of water security for treated water supply for the state of Kedah.

Penang

The Penang Water Supply Corporation or *Perbadanan Bekalan Air Pulau Pinang Sdn Bhd* (PBAPP) estimates that approximately 80% (655 MLD out of 819 MLD) (pers. comm.) of its total water supply is abstracted from the Muda River. This also indicates that the Muda River is critical for the security of treated water supply for the state of Penang. PBAPP does not pay for water abstraction.

5. Payments for Water

This chapter presents instances in which the use of water is paid for. Payments are made based on different basis. For instance a one-off payment in the case of payment for raw water by the state of Perlis; and payment for treated water supply for domestic use and non-domestic use which is based on quantity consumed.

It also presents indirect spending and expenditures that are related to supplying water, such as the expenditures incurred by MADA for the use of water for irrigation, investments in infrastructure to supply water, and also management and conservation of permanent reserved forests.

5.1 Payments for using water

5.1.1 Payment for raw water

Based on discussions with DID Kedah, there were agreements for transferring water from Kedah to Perlis between 1993 and 1998. From 1993 to 1997, Perlis agreed to pay RM55,000 per year to Kedah. This amount was increased to RM201,000 per year in 1998 but the agreement was not renewed in 1999. Under this agreement it was recognised that the water transferred is for domestic water supply, which is considered more important compared to agriculture.

5.1.2 Payment for treated water

The payment for treated water is reflected in the revenues of the water supply companies. For the year 2005, RM163 million was paid in Kedah for water for domestic use and non-domestic use. RM173 million was paid in Penang. Please refer to Table 12 below.

Considering that 96.5% of the water supply in Kedah and 80% of the water supply in Penang comes from the Muda catchment, the values that the Muda catchment contribute are RM157 million to Kedah and RM139 million to Penang annually.

Table 12. Kedah and Penang: Expenditures and Revenues (2004, 2005)

State	2004			2005		
	Expenditure (RM)	Revenue (RM)	Gross profit (RM)	Expenditure (RM)	Revenue (RM)	Gross profit (RM)
Kedah	122,730,533	166,067,831	43,337,298	128,992,142	163,057,712	34,065,570
Penang	120,049,609	170,399,232	50,349,623	129,761,377	173,437,874	43,676,497

Source: Malaysian Water Association in collaborating with the Ministry of Energy, Water and Communications (2006)

5.2 Expenditures Related to Providing Water

In the case of the use of water for irrigation, there are no direct payments incurred by the farmers. Farmers do not pay for the use of water by volume. Farmers pay RM15 per acre per

year towards the state tax system, which is not related to the quantity of water used. This section presents the expenditures that are related to providing water for irrigation.

5.2.1 DID Operational Costs

Based on discussion with DID Kedah, the annual operational costs incurred over the area of the Muda catchment forest is estimated at approximately RM375,000 annually. This figure is not specific to forest management because and is derived as follows:

1. It is estimated that half of DID Kedah's RM6 million annual budget is for maintenance of rivers (RM3 million per year for rivers)
2. The Ulu Muda forested area makes up one eighth of the area which DID manages (one-eighth of the RM3 million = RM375,000 per year).

DID's budget for maintenance of rivers are used for activities such as flood control (structural & non-structural), preparation of plans & guidelines, river rehabilitation etc and not specifically for catchment forest management.

5.2.2 MADA Operational Costs

MADA receives the majority of its funding from the Federal government. The allocated expenditure from the Federal government in 2006 is approximately RM102 million (see Table 13). In addition, the Kedah State government contributes RM1 million while Perlis contributes RM0.5 million annually to MADA (MADA, 2007a). The contribution from these two States is approximately 1% of the annual budget for year 2006 of MADA.

Table 13. Federal Government Allocated Expenditure for MADA (2006)

Allocation of Expenditure	RM
Development	41,760,000
Additional	5,500,000
Operational	55,510,800
Total	102,770,800

Source: MADA (2007a)

Based on the estimation of RM80 acre per year for operations and maintenance cost to provide water for irrigation from year 1992 to 2001, the average annual expenditure that is related to providing water for irrigation is estimated at approximately RM19 million per year (WWF-Malaysia, 2002).

5.3 Expenditures Related to Forestry Management and Conservation

The expenditures for forestry management by the Kedah State Forestry Department in terms of conservation and management of PRFs have not been quantified. The Kedah State Forestry Department (2005) reported that the expenditures of the Kedah State Forestry Department for the year 2004 amounted to RM13.09 million consisting of the following:

- Operational expenditures RM6.06 million
- Development expenditures RM7.03 million

The total gazetted PRF for Kedah in 2004 was 307,046ha, of which 143,327ha (approximately 47%) are in the Muda catchment area that are identified in this study. Assuming that on average, expenditures are proportional to the coverage of PRF, the estimated costs (operational and development) to conserve PRFs of the Muda River are approximately RM6.11 million.

5.4 Investments in Water Supply

Water supply companies have to continuously make investments to meet the growing demand for water. These investments do not include investments related to conservation of forests in dam catchment areas. The investments include the transfer of raw water to the delivery of water supply to their customers.

The following presents examples of the investment plans that are made by PBAPP.

- Penang intends to increase the capacity of the Mengkuang Dam from 23.6 billion litres to 86.4 billion litres with an investment of RM700 million. The water stored at Mengkuang Dam is sourced from the Muda River.
- During 2006, PBAPP invested in 14 major infrastructure projects (PBAPP, 2007). Those that are related to raw water supply include:
 - Muda River Water Supply Scheme to increase the raw water abstraction and transfer capacity from Muda River to the Sg. Dua Water Treatment Plant; and to increase the pumping and treated water capacities of the Sg. Dua Water Treatment Plant
 - The construction of three 45 million litre reservoirs at Batu Kawan, Bukit Indera Muda and Pulau Jerejak.
- PBAPP invested RM351.2 million in terms of capital expenditures (CAPEX) from 2004 to 2007, or approximately RM88 million annually (see Table 14 below). The CAPEX covers investments to reduce non-revenue water, and also improve water use efficiency through engineering projects related to water intake points, canals etc.

Table 14. PBAPP: Capital Expenditures (2004-2007)

Year	Capex Investment (mil. RM)
2004	74.4
2005	85.3
2006	119.8
2007	71.7
Total	351.2

Source: PBAPP Annual Report (2006)

- PBAPP is also considering investing in the sourcing of water from Perak.

5.4.1 Costs factors in providing water

The expenditures to ensure clean water supply for agriculture and water supply will depend on:

- Quality of raw water. Significant changes in terms of the reduction in the quality of raw water will increase the costs of treating water to the required level. The quality of raw water could be affected by effluents from industrial or agricultural activities and siltation due to land clearing or logging.
- Reliability in the supply of water. Significant changes in terms of the reduction in the reliability of water supply to meet water demand may prompt investments in infrastructure. Dams and reservoirs are examples of investments that will be required to store water to meet demand during shortages.

6. Analysis

The values and benefits of the Ulu Muda catchment are intricately linked to water.

In 2005, the Muda catchment contributed RM157 million to Kedah and RM139 million to Penang in terms of annual water supply for domestic and non-domestic use. Together, the contribution is approximately RM296 million. The water supply companies in Kedah and Penang made profits from these revenues. The benefits of clean and reliable supply of water extend beyond the valued amount of RM296 million because water is used as input for business and industry.

Water is used directly for irrigation. The ratio of water for irrigation to water for water supply range is approximately 5 to 1 in terms of requirement from river for the year 1995. Although the volume of water used for irrigation is 5 times more than water supply, the value of water for irrigation is not easily quantified for agriculture because farmers do not pay for water.

In terms of benefits, the income for farmers in the MADA irrigation scheme is estimated at approximately RM776 million in 2006. Farmers incur costs of production such as labour, fuel and use of machinery. Water from the Muda catchment for irrigation has the potential to affect the value of farmers' income in the MADA scheme.

There are costs involved to ensure continued supply of values and benefits.

In addition to the values and benefits mentioned above, various expenditures were made to ensure that water is provided for irrigation and also water supply. Based on the average of operation and maintenance cost of irrigation per acre, the annual expenditure is approximately RM19 million a year. In addition, it is estimated that DID incurs approximately RM0.4 million annually for its operations in the Muda catchment area.

Apart from the indicative costs above, a preliminary estimation of the costs related to the conservation of the PRFs in the Muda, Pedu and Ahning dam catchment areas by the Kedah State Forestry Department is approximately RM6.1 million for year 2004.

Based on the findings above, Table 15 presents a summary of payments that were made for water.

Table 15. Summary Table: Payments for Water

Payments for Water	Year	RM (million)
Payment for Using Water		
Treated water supply: Kedah	2005	157.0
Treated water supply: Penang	2005	139.0
Total		296.0
Expenses related to providing water		
Operational and maintenance by MADA	Average of 1992-2001	19.0
Operational costs by DID Kedah (2007)	2007	0.4
Kedah State Forestry Department (2004)	2004	6.1
Total		25.5

Others costs: Investments by water supply industry, and industry / companies

In addition to the direct and indirect payments above, water supply companies, such as PBAPP also invests in infrastructure to ensure the quality and reliability of delivering water. For instance PBAPP on average spent RM88 million annually from 2004 to 2007 for infrastructure projects. This value however does not include investments to protect water catchment areas.

Based on the survey responses of this study, companies adopt different strategies to ensure that there is sufficient water supply to meet their needs. These include water conservation strategies such as reusing and recycling of water, and contingency strategies such as, ground water abstraction, installation of desalination plant and tanking water from Kedah.

Opportunity costs and arrangements for stakeholders to contribute towards water security of Muda River

In addition to some of the costs mentioned above, there are also opportunity costs for ensuring the quality and quantity of Muda River so that stakeholders continue to benefit from Muda River. The opportunity costs in this case are the values of the next best alternative that is foregone as the result of conservation of Ulu Muda Forests.

Apart from costs related to the Kedah State Forestry Department for maintenance of PRFs in the Muda, Pedu and Ahning dam catchment areas, there appears to be little or no additional investment or contribution made by the Federal or State governments, water supply authorities and the private sectors of Kedah or Penang to conserve the forests of the Muda catchment areas. There are no existing arrangements in which relevant stakeholders are able to contribute towards the protection and conservation of Muda catchment area.

Based on the recently gazetted Kedah Water Resources Enactment 2008, river basin plans will be prepared for the purpose of integrating water resources management and according to the priorities, geographical areas and timetable determined by the Water Resource Board. The legislation also provides for the establishment of a water resources fund, and water development fund. Therefore there are opportunities within the current institutional framework to promote mechanisms for relevant stakeholders to contribute towards the protection and conservation of Muda catchment area.

7. Recommendations

The forests of Ulu Muda play an important role in providing a clean and reliable source of water to Kedah, Penang and Perlis for irrigation and water supply for domestic and industrial use. In addition, the forests of the Muda catchment also provide values, some of which have not been estimated. These include the values for ecotourism with a potential value of RM13 million annually (WWF, 2002); educational and scientific purpose; non-timber forest products; medicinal and pharmaceutical values; cultural and heritage values; and the existence values of the diverse flora and fauna existing in the forests.

Without disregarding the values from other uses, the values related to water use for irrigation and water supply are considerable enough to draw attention towards the conservation of the forests of Muda catchment area. In order to be more systematic in terms of estimating the benefits of Muda catchment area, it would be necessary to conduct detailed studies of the following nature:

- Cost-benefit analysis of protection of the Muda catchment forest in order to provide a more comprehensive picture of the overall benefits of forest protection.
- Cost-benefit analysis of activities in the Muda Water catchment area, in order to conclude what would be monetary impacts if these activities are carried out.

In order to ensure the effective protection of the Ulu Muda forest, it is necessary for stakeholders who wish to continue enjoying the benefits from Ulu Muda forest to do the following:

- Organise themselves to discuss various approaches and mechanisms that can be adopted to effectively manage the Ulu Muda forest. The recently gazetted Kedah Water Resources Enactment 2008 provides the platform for ideas that were suggested previously made (ie. JICA, 1995) to formalise institutions for the management of forest and water resources. This legislation provides for the establishment of Kedah Water Resources Board and river basin committees as well as preparation of river basin plans.
- Develop a framework for stakeholders that are benefiting from the Ulu Muda forest to contribute financial resources for the management and conservation of this area. Some of the concepts that could be applied are the User Pay Principle and Payment for Ecosystem Services (PES). Annex 8 provides a brief description of PES. The recently gazetted Kedah Water Resources Enactment 2008 provides for the creation of Water Resource Fund, and Water Development Fund which could be used to receive payments based on the concepts mentioned above.

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Annex 1. SURVEY QUESTIONNAIRE

Survey of Importance of Water
for the industrial/commercial sector in Penang

	Organisation: _____	
1	2007 Annual water consumption (m ³) or (m ³ /day)	m ³
2	2007 Annual water consumption (RM)	RM
3	2007 Annual Profits	RM
4	2007 Water consumption (RM) / Annual Profits (RM)	%
5	Capacity of water tank (m ³)	
6	Total investments in water storage facility / equipment	RM
7	Strategies / actions to address water supply shortage / supply a) b) c) d) e)	
8	2007 Annual expenditures related to water conservation activities	RM
9	Damages caused by most recent water shortage / supply	RM (year:)
10	Highest damages caused by water shortage / supply	RM (year:)

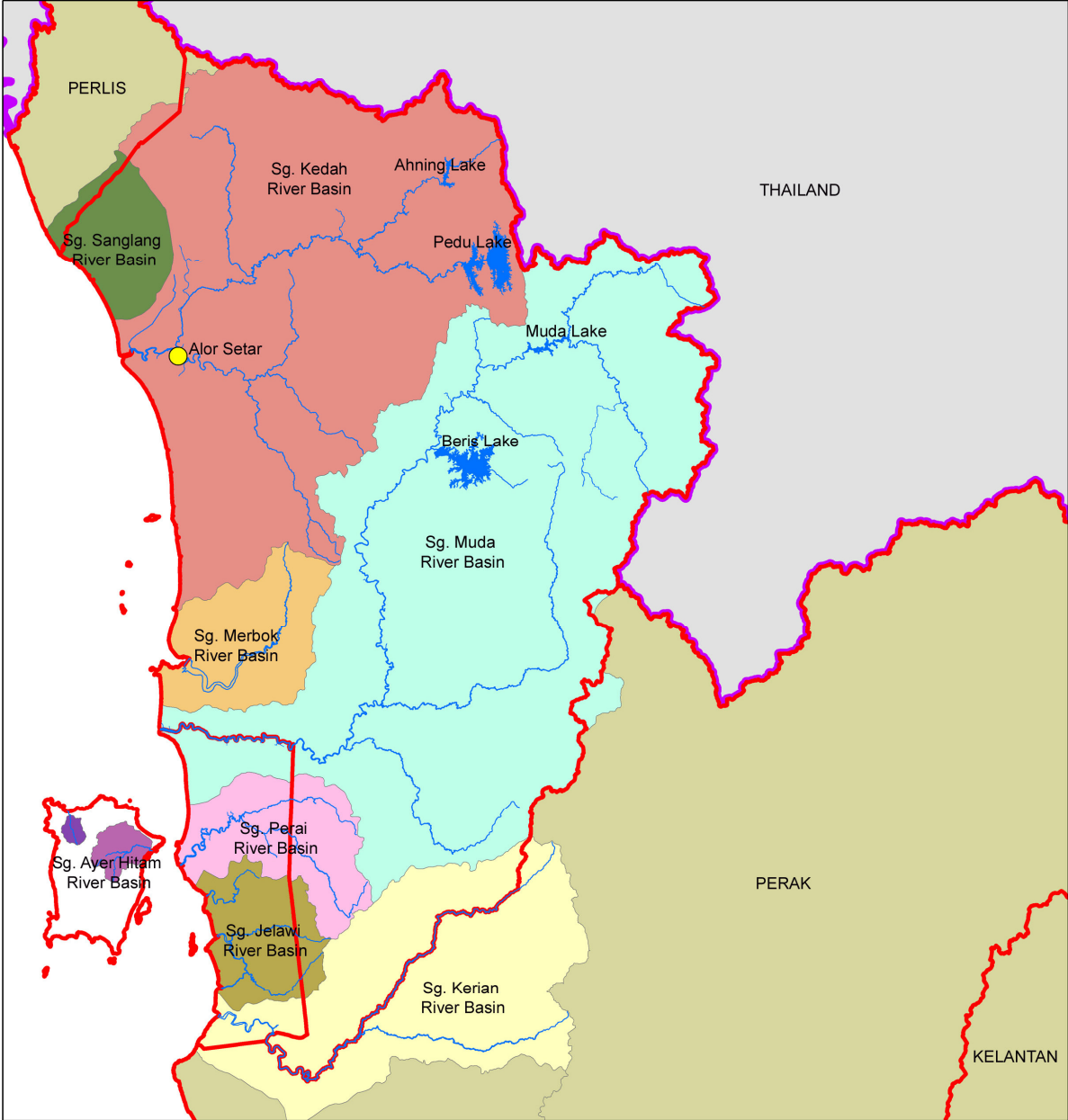
Thank You

Note:

- a) All information will remain confidential, and identity will be withheld.
- b) Information obtained in this survey will be presented either in aggregate form _____

Annex 2. MAP OF RIVERS AND RIVER BASINS IN KEDAH AND PENANG

Major Rivers and River Basins in Kedah and Penang



Legend

- Kedah State Capital
- State Boundary
- National Boundary
- Rivers
- Lake (these are reservoirs for the respective dams)

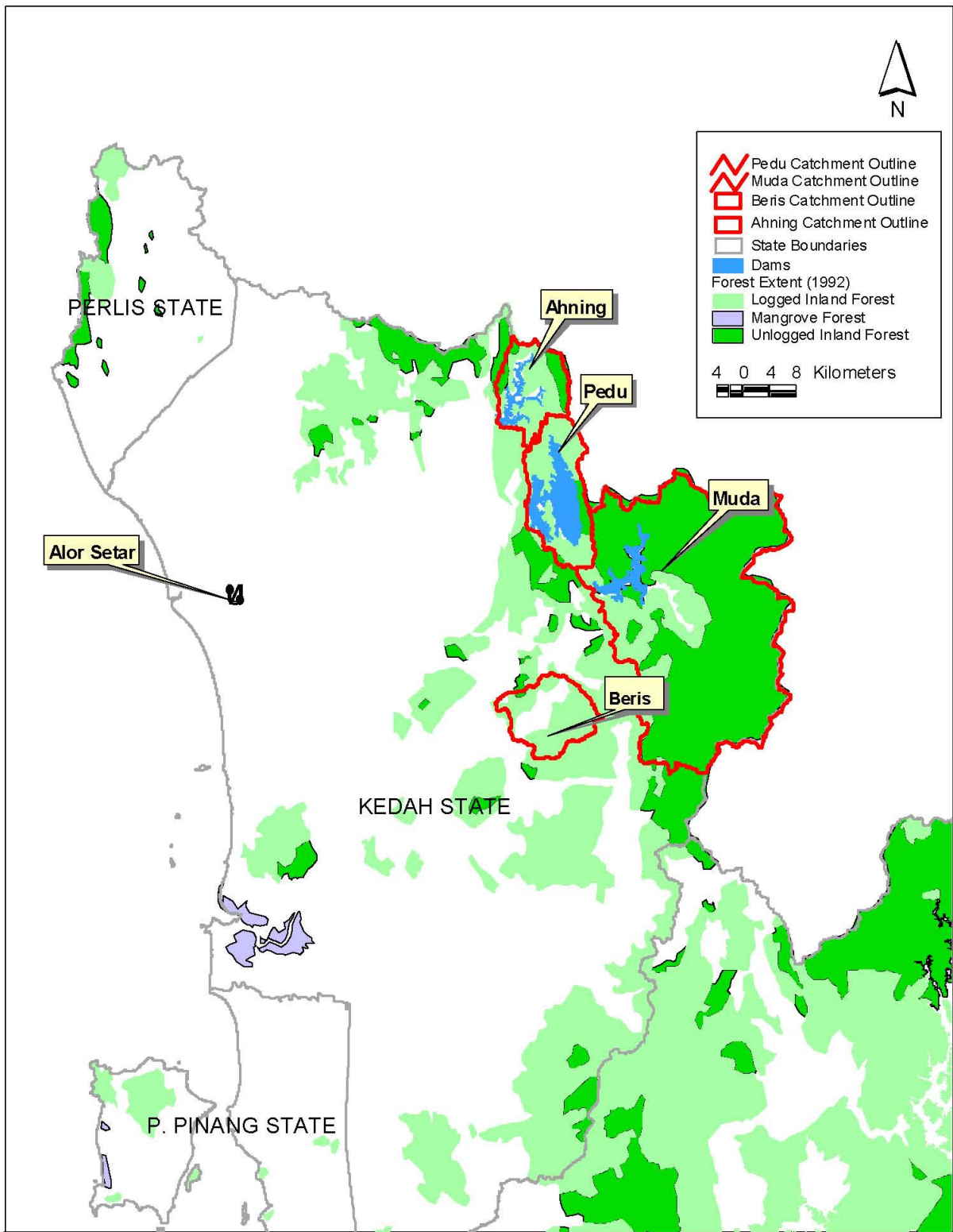
Map Source: Rivers and River Basins layer were extracted from National Physical Plan, Department of Town and Country Planning (2000)

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1: 440 000
 0 5 10 20 30 40 Kilometers



Annex 3. MAP OF DAMS AND WATER CATCHMENT AREAS



Spatial and Conceptual Guideline
for the Sustainable Development of the Forests of
Ulu Muda as a Nature Tourism Destination

MAP 1

Current Extent of Forests in Kedah



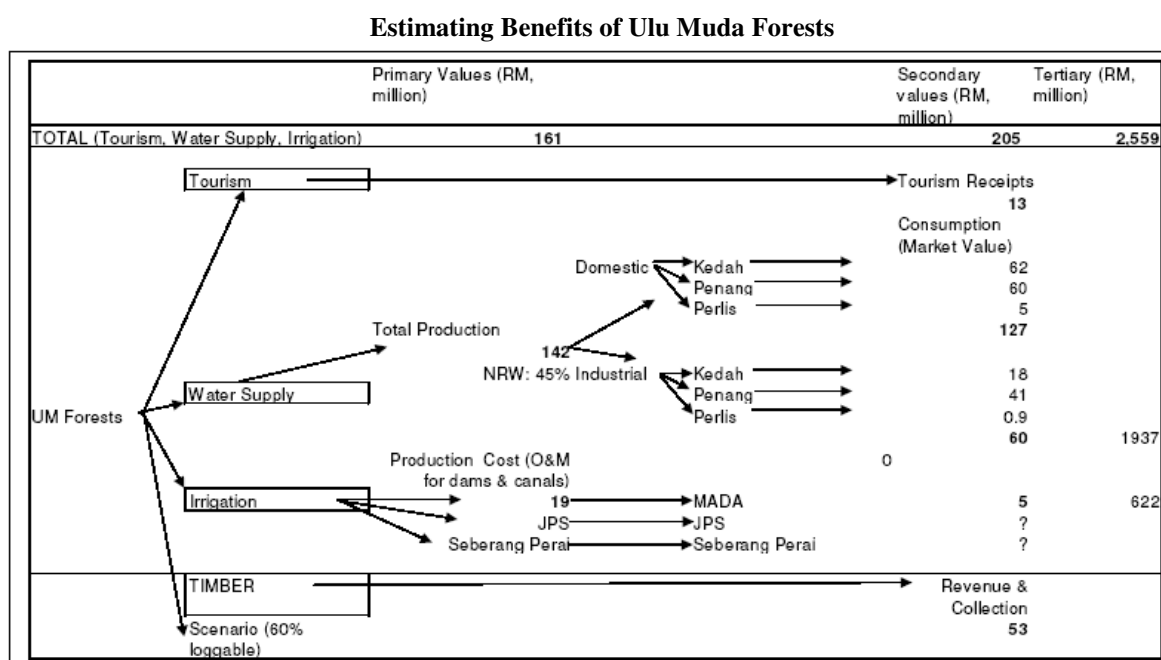
World Wide Fund for Nature (WWF) Malaysia

Annex 4. INDICATIVE VALUES OF ULU MUDA FORESTS

WWF(2002) estimated that the benefits of the Ulu Muda forests as follows:

- the primary annual value is RM161 million (*primary values are estimated based on direct and extractive costs to produce treated water supply and also water for irrigation*)
- the secondary annual value is RM205 million (*secondary values are estimated based on the receipts from environmental services of the forest, which are the total expenditure on tourism activities, treated water supply, and water for irrigation*)
- the tertiary annual value is RM2.5 billion (*tertiary values reflect the value of activities in which water is a primary input covering the output from industries and also income of farmers*).

The breakdown of the estimated benefits is illustrated in figure below.



Source: WWF (2002)

The estimated secondary value of RM205 million consists of activities the following:

- Tourism RM13 million.
- Benefit of water supply is RM187 million
- Irrigation RM5 million (tertiary values of irrigation is RM622 million)

The tertiary value from logging is estimated at RM53 million. It was estimated that the annual collection of premium and royalty to the Kedah is approximately RM1.8 million, while the collection including cess is about RM2.6 million. This estimation was based on the proposed heli-logging project that was estimated to cover a total area of 122,798ha which was to have been logged over a period of 10 years through a joint venture company between WTK Holdings Berhad and Yayasan Islam Negeri Kedah.

Considering that the methods of logging will have impacts on the other non-extractive benefits, the estimated secondary value RM205 million may also be affected. In total, the benefits from water supply, irrigation and tourism are approximately RM205 million compared to timber benefits of RM53 million.

Although indicative, these annual values are substantial and significantly relevant to guide policy decisions for conservation and management of the area.

Annex 5. APPROVALS GRANTED FOR ESTABLISHMENT OF MANUFACTURING PROJECTS BY STATE (2003 – 2007)

Year	Number					Potential Employment					Total Proposed Capital Investment (RM Million)				
	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
State															
Federal Territory															
- Kuala Lumpur	20	26	20	18	12	1,208	1,764	1,002	1,853	537	386.4	163.8	149.5	503.9	92.4
Federal Territory- Labuan	-	-	2	3	-	-	-	111	581	-	-	-	20.3	2,222.80	-
Selangor D.E.	305	335	338	312	318	19,042	24,140	22,567	24,831	25,443	5,056.60	6,050.30	8,501.90	5,328.60	11,181.50
Pulau Pinang	137	144	148	156	134	9,890	9,235	21,642	13,539	8,833	1,923.00	2,030.30	4,624.80	5,350.70	4,768.70
Perak D.R.	65	54	51	62	59	5,464	3,855	5,044	4,112	8,353	2,825.70	1,316.00	1,377.40	1,181.30	2,034.60
Johor D.T.	219	256	234	222	188	19,849	24,013	40,920	21,286	25,772	1,956.80	3,987.10	8,107.90	7,736.30	9,242.80
Negeri Sembilan D.K.	46	45	25	37	40	4,108	2,686	1,404	3,222	7,982	1,844.10	1,086.30	337.5	1,799.90	2,675.60
Melaka	37	56	52	55	38	3,164	4,946	4,902	3,424	5,292	4,057.70	1,194.10	1,039.00	1,401.10	3,837.70
Kedah D.A.	49	66	44	59	46	5,368	6,434	7,933	5,180	5,288	879.4	5,250.40	1,763.40	9,880.20	13,990.20
Pahang D.M.	18	18	18	33	28	2,476	1,571	1,870	1,680	1,467	925.4	994.7	2,203.20	1,792.60	1,563.80
Kelantan D.N.	7	9	8	6	9	501	363	743	481	1,429	52.2	106.6	124.9	47.1	82.7
Terengganu D.I.	7	5	8	7	11	565	141	798	997	1,933	484.8	138.4	327.7	2,933.80	6,163.20
Perlis I.K.	3	1	2	3	2	157	5	382	340	178	30.6	0.5	31.4	61.2	7.1
Sabah	20	40	41	74	41	1,099	3,237	2,233	4,650	2,820	153.5	338.5	1,204.50	4,993.80	3,257.50
Sarawak	32	45	35	30	23	4,291	6,037	3,378	2,776	2,346	8,568.40	5,901.20	1,226.30	759.8	1,034.50
Undecided	-	1	1	-	-	-	207	27	-	-	-	215.4	16.9	-	-
TOTAL	965	1,101	1,027	1,077	949	77,182	88,634	114,956	88,952	97,673	29,144.70	28,773.50	31,056.60	45,993.00	59,932.10

Source: http://www.mida.gov.my/stats_man/2007/TableIX.html accessed in Aug 2008

Annex 6. APPROVED MANUFACTURING PROJECTS BY STATE, 2007 AND 2006

State	2007		2006	
	Number	Total Capital Investment (RM)	Number	Total Capital Investment (RM)
Kedah D.A.	46	13,990,217,173	59	9,880,240,184
Selangor D.E.	318	11,181,450,369	312	5,328,584,318
Johor D.T.	188	9,242,838,564	222	7,736,322,861
Terengganu D.I.	11	6,163,229,293	7	2,933,755,498
Penang	134	4,768,661,247	156	5,350,654,347
Melaka	38	3,837,712,605	55	1,401,122,548
Sabah	41	3,257,544,788	74	4,993,798,707
Negeri Sembilan D.K.	40	2,675,563,220	37	1,799,863,316
Perak D.R.	59	2,034,607,035	62	1,181,310,231
Pahang D.M.	28	1,563,764,188	33	1,792,564,217
Sarawak	23	1,034,465,848	30	759,819,817
F.T. - Kuala Lumpur	12	92,355,909	18	503,867,957
Kelantan D.N.	9	82,666,800	6	47,073,840
Perlis I.K.	2	7,110,000	3	61,180,115
F.T.- Labuan	-	-	3	2,222,849,271
TOTAL	949	59,932,187,039	1,077	45,993,007,227

Source: adapted from <http://www.mida.gov.my/press2007/table-RM/table13.htm> accessed in Aug 2008.

Annex 7. SURVEY RESULTS

Background

A survey was conducted using a standard questionnaire survey (please refer to Annex 2) to obtain relevant information as follows:

- Annual water consumption
- Cost of water as a percentage of annual profit
- Capacity of water tank
- Water conservation and recycling activities
- Damages due to water shortage

The respondents of the survey are from:

- Four companies in FREPENCA
- Two city hotels in Penang

As the sample size is too small to provide any conclusive results, the survey can only be considered as exploratory and indicative in nature.

Survey Findings

Water Consumption

Water is used by the respondents for many purposes such as for cooling towers, processes in manufacturing and production, cooking, drinking and use in toilets. Based on the responses, the annual consumption of water is between 0.1 million m³ and 1.4 million m³. The average is about 0.4 million m³.

	Highest	Lowest	Average
Annual Water Consumption (m ³)	1,363,827	102,955	369,260
Daily Water Consumption (m ³)	3,737	282	1,012

Cost of Water as Percentage of Annual Profit

There was no response to this section of the questionnaire.

Capacity of Water Tank

On average, the water tank capacity ranges from 0.3% to 5.4% of daily consumption.

	Highest	Lowest	Average
Percentage of water tank capacity as % of daily water consumption (%)	5.4	0.3	1.7

The percentage of water tank capacity over daily water consumption indicates the importance of water for a business organisation. It shows that some businesses are willing to make the investments in water storage facilities in order to increase availability of water during episodes of water supply disruption.

Water Recycling

Only two respondents mentioned that they recycle water. Water is recycled as follows:

- Water used during fire drill for water pump testing is recycled
- Recycling of used industrial water for non-consumption purpose such as toilet use and landscaping.

The percentage of water use which is recycled/reused by two of the respondents is 0.02% and 38% respectively.

Water Shortage

All of the respondents have not experienced any water shortage in the past 10 year. They also mentioned that they will not be compensated for losses from water shortage.

Contingency Strategies

In addition to strategies such as increasing water tank capacity, and reusing and recycling water, one of the respondents shared the following contingency strategies to mitigate the risk of water shortage:

- tanking water from Kedah using 5,000-gallons trucks
- ground water abstraction – which was later found to be not advisable in some areas because it will affect the stability in the land area.
- installation of desalination plant.

Survey Conclusion

It is difficult to estimate the contributions of water as an input to the revenues or profits of business and manufacturing sectors. Some of the manufacturing sectors surveyed only produced parts of the finished products components and hence the total value of the finished product was not readily available.

Most of the organisations declined to reveal information about revenue and profits. The importance of water can only be implied in terms of the strategies that they adopt in order to ensure secure supply of water as indicated by the willingness of respondents to consider contingency strategies, increasing water tank capacity, water conservation and recycling. Because neither Penang nor Kedah has experienced serious water shortages in recent years efforts to consider and implement these strategies may not be widespread among the business and manufacturing sector.

Although the survey did not provide any conclusive data, it provided an indication of the importance of water to the industrial sector in Penang.

Annex 8. PAYMENT FOR ECOSYSTEM SERVICES (PES)

Introduction

One of the greatest challenges facing national conservation is the lack of financial resources for funding long-term, comprehensive natural resource management, and conservation related initiatives at the national level.

Traditional methods and sources of financing natural resource management and conservation may not be sustainable in the long term. More and more, economic and market based instruments have been used for natural resource management and ecosystem conservation over the last few decades. New approaches are constantly being tried and tested with a view to produce and support positive environmental efforts through the transfer of financial resources from beneficiaries of certain environmental services to those who provide these services or manage these environmental resources.

“Payments for ecosystem services” (PES) is one such approach. Over the last decade, global use of PES schemes for forests, biodiversity and watersheds have gained popularity.

Ecosystem Services

Ecosystem services can be classified into four broad categories, namely:

- watershed protection: most common of services which include for water flow regulation, water quality maintenance, erosion and sedimentation control as well as flood control.
- carbon sequestration: important in relation to carbon sequestration
- biodiversity conservation: for the maintenance of ecosystem functions
- landscape and seascape beauty: important to nature /eco tourism

Forms of PES

PES schemes can take numerous forms. Payment schemes may be a market arrangement between willing buyers and willing sellers. Payment by tourists companies to African communities for the protection of their wildlife is one such example. It can also be a scheme intermediated by a large private or public entity, for example, a portion of household water bills in New York is used by the water company to buy watershed protection services from farmers in the vicinity of the water company intake. Schemes can even be government-driven, where public revenues are used to ‘pay’ the providers of ecosystem services.

A fundamental rule that would ensure a functioning PES scheme is the awareness of those paying for such schemes that they are in fact paying to secure a valuable ecosystem service, and those who receive such payments should engage in measurable activities to provide the ecosystem services in question

Some Examples of PES in Practice

United States

The United States currently has the largest PES program which takes numerous forms such as the Conservation Reserve Programme, the Nature Conservancy Programme, and the Local And Trusts Programmes. These programmes include the purchase of lands that are critical for habitat protection, biodiversity conservation and ecological functions. Tax relief is provided to landowners that are willing to protect the land for a particular purpose.

Costa Rica

In Costa Rica, a National Programme on PES was launched in 1996, which targeted private landowners. An amendment to the Forestry Law of the country legitimized the implementation of a PES system there. The Forestry Law has identified a number of environmental services derived from natural forests, tree plantations, and agroforestry systems, such as carbon fixation, hydrological services, biodiversity protection, and provision of landscape beauty. Private landowners are paid (fees) to undertake conservation activities (such as tree planting) and are paid according to land area that is reforested by them.

Columbia

The Columbian practice has been for user groups to pay for watershed services by purchasing the entire upper watershed. Here, power companies are to pay a percentage of revenues obtained from hydropower plants to regional corporations that are responsible for watershed management.

Conclusion

Payment for environmental services is a growing field. Though the concept and approaches have been defined somewhat, the main challenge lies to operationalize the concept in the national context. Various vehicles are needed to achieve the objectives of a particular PES scheme. Defining and understanding the services that ecosystem provides is a first and fundamental step to the PES process. Policy and legislative changes as well as institutional development become necessary to facilitate particular PES schemes. Efforts to identify, promote and develop PES schemes must be spearheaded by the government and a first step towards this effort would be to initiate a PES pilot scheme in Malaysia.

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WWF-Macroeconomics Programme Office

http://www.panda.org/about_wwf/what_we_do/policy/macro_economics/our_solutions/pes/index.cfm

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