Payment for Environmental Hydrological Services for Pangani River Basin, Tanzania.

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1. Introduction

1.1 Preamble

This study on Payment for Environmental Services (PES) is part of the IUCN's Water and Nature initiative (WANI) programme which aims to demonstrate sustainable ecosystem management in river and lake basins, empower people to manage their environment, promote wise governance of environmental resources, and develop and apply economic tools and incentives for environmental conservation, among others.

This study is part of the ongoing implementation efforts of the WANI worldwide. Because the flow of rivers is inextricably connected to the health of the catchment environment, the integrity of the environment in the basin catchment areas has to be assured. This study considers the use of economic instruments and incentives for this purpose in Pangani Basin, Tanzania.

Rationale for the study

Natural ecosystems provide important hydrological services which can secure the quantity and quality of water flow of rivers. Incentives for maintaining these vital functions are considered to be a potential option for conserving these environmental services. The protection of catchment areas is economically justified, if one considers the lack of alternative water sources. This makes the opportunity cost for water availability prohibitively high. The Payment for Environmental Services (PES) proposition is that the conservation of forests would be given a boost if land/ forest owners were to be compensated for their conservation efforts.

At the moment, forest owners and custodians are not rewarded for the value of the services that their forests provide to others. Since those external benefits do not enter the land/forest owner's cost-benefit calculations, much forest is converted to agricultural land or to wasteland. Landowners can usually generate far higher financial gains and economic returns from destructive or unsustainable land uses, which cause the degradation of ecosystems and negatively influencing river flows and water quality.

The PES recognises the failure to reflect these values and to financially reward the efforts by upstream custodians of the catchment and water sources. At present, downstream beneficiaries of ecosystem-hydrological services do not pay for the benefits they enjoy, while upstream land managers do not get the full benefit of their contribution

to conservation of the environment and management of water resources. They also receive no financial incentives to protect catchment areas or riverbanks.

1.2 Experiences of PES from the rest of the World

PES is a relatively new approach aimed at facilitating the conservation of the environment and there are a number of initiatives worldwide to support this. In Asia, for example, one protected nature area in Lao PDR currently receives 1% of the gross revenues of power exports from a downstream hydropower dam. In the USA, the city of New York pays upstream farmers to use environmental friendly practices in order to protect the City's drinking water supply. And a village in Ecuador changed a local law to create a fund for catchment forest management, paying local people to undertake conservation work in the forest.

1.3 Problem Statement and Aim of the Mechanism in the Pangani River Basin

The PES scheme for Pangani aims to address the following issues:

1- Water scarcity and quality in downstream areas due to deforestation and improper land management practices in the upper watershed.

2- Forest Department resource constraints for managing forests properly.

3- Landholders have insufficient income, and can earn more money from degrading the land than from conserving it for hydrological services.

4- Downstream water users have little awareness of the importance of upstream ecosystems for water conservation.

5- Although the 2002 Water Policy recognizes the importance of ecosystems and provides for a catchment conservation fee, it does not elaborate the details or mechanism for implementation.

The objectives of developing a PES scheme are to:

1- Improve water quantity and quality through conservation and improved management of forests, upper catchment and buffer zones near streams and rivers.

2- Improve funding for Forest Department management of catchment forests.

3- Generate financial and economic resources for landholders to benefit from managing land for hydrological services.

4- Improve downstream awareness that ecosystems matter for water.

5- Support the Ministry of Water & Livestock Development in developing a catchment conservation PES mechanism.

2.0 Situation Analysis of Water Use in Pangani Basin

Evidence shows that apart from declining river flows also the quality of water is deteriorating. The degradation of the catchment forests, untreated industrial and domestic effluents and agricultural run-off contribute to the pollution of the rivers in the basin. Significant forest cover loss has taken place in the Eastern Arc Mountains; especially the Pare and Usambara Mountains. Loss of forest cover does eventually

result in reduced dry season flows, soil erosion, sedimentation of rivers and reduction in water quality. Siltation, which is the result of erosion upstream, reduces the capacity of hydropower reservoirs and can cause damage to hydropower turbines.

A wide range of industries, sisal estates and institutions are monitored by the PBWO for water extraction and pollution. The majority of them have been found lacking in effluent treatment and are required to either improve or install treatment facilities. Most of the water returned into streams and rivers from these places contain pollutants.

3.0 Cost of Catchment Conservation

Government funding for forestry and catchment conservation comes from two main sources. The main one is from the Central Government through the Division of Forestry and Beekeeping in the Ministry of Natural Resources and Tourism and the second level through the District Natural Resources Officer's budget to the President's Office Regional Administration and Local Government (PO-RALG).

PO-RALG mainly provides funds for Personnel Emoluments (PE) but not for operational expenditure. It is unfortunate that in the Appendices to the Volume III on Estimates of Public Expenditure Supply Votes (Regional) Details on Urban and District Councils Grants and Subventions, the Natural Resources' sector is not represented.

The gap between the amounts approved by the budgeting process and those disbursed is significant. In Arusha Region the shortfall is 32%, while Kilimanjaro and Tanga Regions have a shortfall of 33 and 23% respectively. Overall the money is inadequate given the geographical size of catchment areas and their important contributions to water supplies.

Other financial contributors to catchment protection are the Urban Water Supply and Sanitation Authorities (UWSSAs), which have a policy to conserve their water intake areas. Moshi Urban Water Supply and Sanitation Authority (MUWSA) for example, has a conservation programme whereby it provides a budget for conservation activities like tree planting, fencing etc. The budget for the year 2004/05 was Tshs 2.68 million for protection of water sources and wetlands.

4.0 Opportunity costs of water availability

The loss of surface flows from rivers and streams in the Pangani Basin has a wide range of negative economic implications. These include economic costs related to shortage of drinking water supplies with its concomitant time use implications in fetching water for domestic use and increased health risks. Low surface level also reduces opportunities for exploitation of agricultural land and access to (low cost) hydropower generation.

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Hydro-generation is the major contributor to Tanzania's electric power supply and its high reliance on this makes it mandatory to place due emphasis on maintaining the

integrity of the water catchment areas. This will ensure that the economy does not suffer due to disruption of hydropower production caused by declining water flows from the catchments.

Hydropower is the cheapest source of electric power generation in Tanzania compared to the other available sources of coal and diesel generation. Pangani's contribution to the country's hydropower equation is shown to be at around 12%, which is significant. The costs for producing electricity from hydropower in the Pangani Basin are low (ranging from 3-7 Tshs per Kw) compared to the use of thermal power generators (160-180 Tshs per Kw).

Urban Water Supplies

The cost of supplying water from boreholes is higher than that from gravity surface flows' sources. For example, in Mwanga water drawn from surface gravity flows is charged a flat rate of Tshs 1,000/- per month while that drawn from boreholes costs Tshs 3,000/- per month per household which is estimated to consume $8m^3$/month (equivalent to 8,000 litres per month). This difference is due to the cost of construction of a borehole and its high running cost.

Some streams become saline when water levels recede, hence making the utilisation of this water unsuitable for domestic and irrigation use. An alternative will be to make use of underground water through boreholes. This will, however, cause higher prices for domestic water users. For irrigators, the majority of small-scale irrigators will be left without a feasible option while large-scale irrigators will have to use high yielding boreholes (if feasible) to obtain water, which will increase production costs and reduce profit margins.

Water for Irrigation

Losing the surface flows of streams and rivers in the Pangani basin would increase the dependency on rain fed agriculture and the loss of irrigation dependent crops like paddy, flowers and sugarcane. There will be also reduction of certain crop yields, which need supplementary irrigation to mature. This will all have undesirable outcomes of food insecurity, increased unemployment and falling regional and National GDP. The option of transferring water from another basin is not feasible, while the switch to groundwater sources will be a short-term solution. Ground water sources depend on recharges from rainfall and the integrity of the catchment forest environment for efficient percolation (i.e. to reduce run-off and evaporation).

The effects of low water flows in the Pangani River are clearly visible downstream near the coast, where coconut palm groves alongside the river are dying due to infiltration of salt water. This is causing loss of capital, farmland and livelihoods of small farmers.

5.0 Willingness to Pay for Environmental Services

The study looked closely at the question, whether those exploiting water resources from a given watershed would agree to contribute to the sustainable management of the

catchment. Rural and urban households, irrigators and power generators were asked if they would be willing to pay for improvements in the quantity, quality and reliability of water supplies in the face of dwindling water flows in the streams.

A total of 6 water users associations for small-scale irrigation were surveyed, while 8 private large-scale irrigators were also covered. Seven (7) urban water supply and sanitation authorities were consulted and domestic consumers in 5 district centres were surveyed.

Domestic water consumers are by far the majority of water users although domestic consumption only accounts for less than 30% of total water supplies. The study focused on domestic users because they are more accessible through the urban water authorities. Because of the assured payments of the monthly water bills the authorities are potentially an interesting source for the Environmental Services Fund (ESF).

Comparison with national estimated consumption provision of 30 lcd (i.e. 150 litres per household of 5 persons per day), Mungushi in Hai and Same are the only ones consuming below the national benchmark, others surpass it. However, in some cases consumption maybe understated due to the fact that other water uses are normally not counted because they are performed at water sources such as rivers, lakes, wells etc. Such activities include washing of clothes, domestic utensils and even bathing.

During the survey, the main question asked was whether the respondent was willing to pay twice or more the amount they were paying at present so as to accommodate PES. Most of the respondents declined and went forth to suggest the amounts (post their votes), which they were willing to pay per month!

Comparing the upstream consumers of Usa River, Mungushi and Same to their downstream counterparts, the study found that upstream users are more willing to pay higher prices than downstream users. This can be explained by the fact that in upstream areas, the competition for water for irrigation, domestic and livestock is very high causing numerous water use conflicts, hence the desire to solve the problem.

Generally all the water users of Pangani basin were very enthusiastic about the prospect of their scarcity problems being addressed in a meaningful way with their participation. The majority however, expressed their desire for good and transparent management of funds.

The dependent variable Willingness To Pay (WTP) for the environment services fee, income and amount of water consumption emerged to be the most important factors, which influenced the surveyed domestic water users to be willing to pay for environmental services. These results are similar to those at Cotacachi, Ecuador, where they also found income and family size to be positively correlated and significant in explaining the willingness to pay of communities to obtain good quality water from conservation of the watershed.

Results from the WTP for environmental hydrological services by domestic water consumers indicate that the total amount of expected collections under the upper bound

values expected collections under the upper bound values scenario is Tshs. 709 million which is equivalent to US $ 720,000. The lower bound values scenario results into expected revenue collection of Tshs 445 million. Supposing that one desires a gradual increment in payment by consumers, therefore a Tshs 0.10/litre overall increment across the basin domestic water consumer will bring about Tshs 318 million per year. These amounts are estimated from paying urban water consumers in the basin. The total expected amount therefore would depend on the urban water supply authorities' collection efficiency. At the moment, collection efficiency of bills is satisfactorily high.

The grand total of expected collection from WTP will therefore be Tshs 780 million per year for upper bound values, 520 million per year for lower bound values, and Tshs 395 million per year for a gradual increment of Tshs 100/m^3.

It should be noted that, these amounts have been estimated from nine (9) urban centres of Arusha, Usa River, Mungushi/Hai, Moshi, Mwanga, Same, Korogwe, Pangani and Tanga. The Arusha, Moshi, Tanga and Mwanga estimates used the basin weighted averages computed from the 5 surveyed urban centres. Therefore, there is high prospect of collecting more funds if all the domestic water consumers in the basin are included.

So far the results from the WTP survey indicates that using both the lower (Tshs 445 million) and upper (Tshs 709 million) bound scenarios, a significant amount of money can be mobilised in excess of both the current allocations to the three regions for catchment conservation (insert value in Tshs) and collections by PBWO (approximately Tshs 403 million).

7.0 Payment Mechanisms and Management of Environmental Services

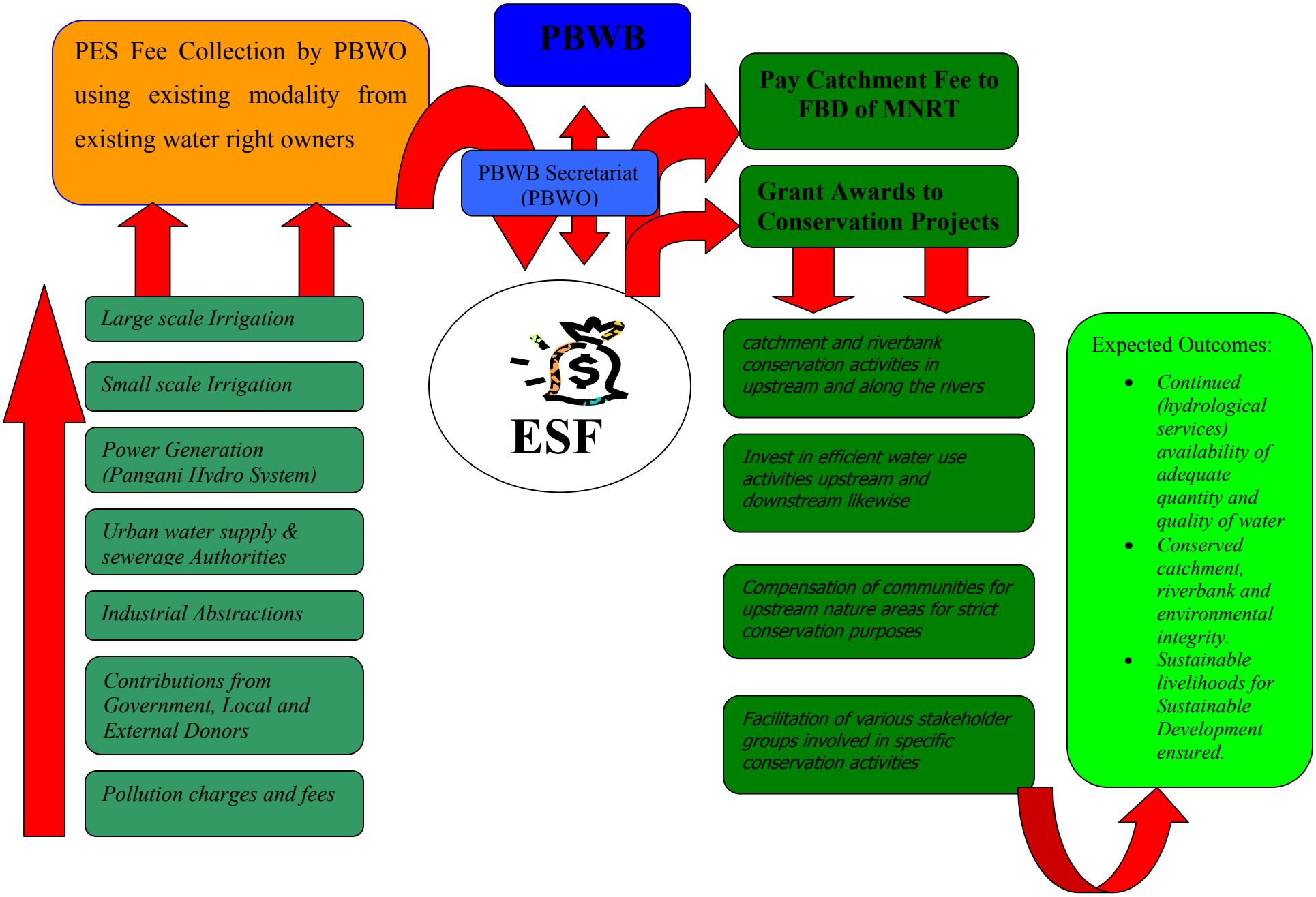
Funds

An Environmental Services Fund Mechanism (ESFM) is defined here as an institutional arrangement that results in the transfer of new or increased financial resources from those willing to pay for sustainably produced goods and/or forest ecological services, otherwise known as Payment for Environmental Services (PES), to those willing to ensure these goods and services are available in turn.

The overall goal of developing PES is to supplement efforts by forest managers through stakeholder participation of all those who use these ecological services. This should ensure a sustainable flow of hydrological services through adding financial value to their forests based on the benefits they generate. This mechanism will create the necessary incentives to users and managers to conserve and restore forests as well as water sources and riverbank areas. The main two features are; Firstly, PES can "capture" the non-market values of ecological services through economic transactions, thus creating new markets. Secondly, PES can charge on the non-marketed portion of people's willingness to pay for forest goods (hydrological services in this case), thereby increasing the market value of forest goods that are produced in a sustainable way.

Under PES the following diagram illustrates expected to be the sources and uses of funds:

FIG. 5: PES FEES COLLECTION AND ESF MANAGEMENT



The PES and ESF mechanisms above depict the kind of relationship and responsibility various stakeholders will have in the whole aspect of environmental conservation in the Pangani Basin.

As the diagram shows, water users will be required to pay their user fees (and PES fees to the collector PBWO or its representative (sub-catchment officers) who will then present the collections to the PBWO who will go on to deposit the PES portion into the ESF account.

The distribution of these funds will be done according to set procedures, some of which will be elaborated here. It is proposed that 40% of all collected PES funds be paid to FBD for catchment conservation in Pangani Basin. However, payment could also be made according to the base flows of adequate quantity and qualify from the catchment forests, but should not exceed 40% of the collections. It is proposed that 50% of collections should then be allocated to stakeholders based on priority issues of environmental degradation in efficient use of water, riverbank degradation and pollution in the whole basin and also on distributional equity (A significant fraction of this should be allocated proportionately to basin water users according to their contribution to PES fees payment. This is done deliberately to encourage stakeholders to influence the non-payers of fees to also pay. It is proposed that 10% of collections would be allocated to PBWO for monitoring and implementation of the mechanism.

Box 3: Proposed PES Distribution Mechanism

$PESF_a = 0.4CF_{fbd} + 0.3P + 0.2\,E_{sc} + 0.1Pbwo_m$

Where:

$PESF_a$ *=payment for environmental services fees allocation*

CF *=conservation fees paid to Forestry & Beekeeping department for Pangani basin forests.*

P_b *=Allocation to priority environmental and water conservation issues.*

E_{sc} *=Allocation to all sub-catchments on equity consideration aspects. (Proportional according to PES payment sub-catchment-wise).*

$Pbwo_m$ *= Allocation to PBWO for monitoring and implementation of mechanism*

Stakeholders from different parts of the basin (paying ones of course!) will identify a problem related to conservation of either the environment degradation or water conservation (aspects of efficient use) like canal lining, canal clean up, or restoration of river bank buffer zone environmental integrity (planting of appropriate vegetation cover) or construction of cattle troughs for watering livestock to avoid riverbank and irrigation canals and channels' destruction etc. These stakeholders may be comprised of a certain village community or water user group, working together with a forester,

hydrologist, irrigation expert, PBWO officer etc. It should be a collective effort utilizing all the relevant expertise available on the ground. They should put down a technical project proposal as much as possible and submit it to the PBWB secretariat (which is the PBWO). Depending on collection modalities, the PBWB may meet once or twice a year to consider proposals sent from all over the basin. Those proposals qualifying for basin priority allocation will be identified and considered thus. The reminder should be considered in the Equity allocations category.

Environmental Services Fund Management

Under the new mandate as an executive board, the current PBWO Board will be "*enhanced"* to manage the ESF as a trust fund for the stakeholders of the Pangani Basin conservation through PES. This arrangement is preferred due to its cost effectiveness and advantage through using existing institutional structures. The board's costs will be met partly by the PBWO as before because it will continue to carry on the tasks of the PBWO. The incremental costs due to enhancement would therefore be met by the fund from the PBWO allocation of 10% as detailed above (see Box).

It should be pointed out though that the above management set up is an open suggestion put forward for discussion by stakeholders. It may change according to the consensus of the major players. It is acknowledged that in order to be operational, the above suggested set up needs some changes to take place initiated by the minister, and that these changes will also affect all basins in their BWB structures. If this set up is agreeable and effected, it will be a good opportunity for harmonising management set-ups in the basins.

8.0 Monitoring Of ESFM Implementation

All stakeholders should do monitoring of PES collection and ESF Projects implementation collectively, each according to their capabilities and position. There should be monitoring for Economic, Social and Environmental aspects with respect to the monitoring of the quality and quantity of water in the basin. The proposed division of responsibilities is as follows below.

Table 10.1: Monitoring Of PES And ESF Projects Implementation

SN	Proposed Monitor/Stakeholder	Proposed activity to perform (which aspect, ecological, hydrological or social economic?	Reason/remarks
1.	PBWB	Overall overseer	It is composed of major stakeholders' representatives. Ultimate decision maker vested with the responsibility and powers to manage ESF
2.	PBWO	Supervision and management of catchment, provide hydrological expertise and monitoring	It is composed of major implementers with the mandate for the management of the basin waters.

3.	External Evaluation	Evaluation of performance, EIA monitoring, independent audits of ESF account,	Provide an objective assessment of ESF utilisation and activities' implementation.
4.	Forestry (Catchment and Regional and District Forest Officers)	Provide technical expertise and monitor vegetative cover rehabilitation and restoration activities.	It is composed of experts and experienced operational staff in forestry with further advantage of JFM approaches adopted
5.	Sub-Catchment officers	Catchment conservation fee collection and monitoring of water flow, use and users social and economic benefits. Co-ordinate and compile information from UWSSAs, WUGs, WUAs and Village communities.	Major responsibility at the sub-catchment level on behalf of the PBWO.
6.	UWSSAs, WUAs and WUGs	Catchment conservation, distribution of water, provision of education, fee collection and waste water treatment (ecological, hydrological and social economic aspect)	It's a major stakeholder, which consists of a full operating and management board.
7.	Large and Small-scale Irrigators (WUGs)	Catchment conservation fee collection and monitoring of water flow, use and users social and economic benefits	They leave near the catchment so it is easy to conserve and collect the fee. Provide rehabilitation and restoration information and statistical data.
8.	Village Communities	Village government through their Environmental Committees enforce by-laws	Protection, provide labour power for rehabilitation and restoration information and statistical data.

9.0 Operationalisation Of Payment For Environmental Services

There are several legal aspects, which need to be taken care of before the PES and ESF can become legally operational. In order to charge extra levies on the existing water bills, subsidiary legislation made under Water Utilisation (Control and Regulation) Act, 1974 already prescribe fees to be paid to the Basin Water Boards for various activities related to water. Applicable regulations should be amended to build in Fees to be collected for the purposes of PES.

In addition, PBWB may recommend to the Minister to make further Regulations on the various issues including penalty against water right holders failing to pay, return flows back to streams or rivers, treat effluents discharged into streams or rivers and underground strata and those abstracting water without water rights.

10.0 Further Work

Further work should be undertaken to investigate the actual relationships between catchment conservation and water yield. Economic returns from catchment conservation

are important in shading light on the justification of investment. In order to facilitate conservation, identification of people living in sensitive catchment areas for water sources should be done in order to estimate their land use benefits (opportunity costs) for future compensation in case of moving them. Monitoring indicators need to be developed in order to follow up performance and implementation of the PES and ESF activities. Tradable Water Permits have great potential in re-allocation of water in the basin if the necessary conditions for their operation become available. The necessary conditions, which are non-existent at the moment, include: lack of proper monitoring of the amount of water one gets, water rights are at the time being not enforced, transferable, and exclusive. Monitoring indicators need to be developed in order to follow up performance and implementation of the PES and ESF activities. Together with the above proposals, several other things need to be considered. These include technological improvement in irrigation for efficient use of water, institutional, legal, awareness creation of the PES to communities and decision makers alike, financial and compensation of tree farm owners.