CGIAR Challenge Program on
WATER & FOOD

Annex 2 to the Award Letter
PROJECT PROPOSAL Mekong 1: IWMI

On optimizing reservoir management for livelihoods

Basin Development Challenges of the CPWF

To reduce poverty and foster development through management of water for multiple uses in large and small reservoirs

August 2009

1. Basin Development Challenge:

Mekong: To reduce poverty and foster development through management of water for multiple uses in large and small reservoirs[i]

2. Project:

Project 1: On optimizing reservoir management for livelihoods

3. Project Data

Duration: ___4 years (with most activities compressed into the first 2.5 years)
Target start date: January 2010
Finish date: Dec 2014 (most key activities will finish by June 2012)
Maximum budget requested from CPWF: US $ 1,599,775

4. Project Deliverable

Develop strategies for optimizing water management, including sequential management of reservoirs

5. BDC Goals to which the Project will contribute

New water storage infrastructure (WSI) are being built in various tributaries of the Mekong, including (but not restricted to) the common border area between Lao PDR, Cambodia and Vietnam. If this BDC is successfully addressed, these reservoirs will be managed in ways that are more fair and equitable for all water users. WSI management will take account of fisheries and agricultural potential as well as hydropower generation, and riparian communities will be able to utilize these water sources for multiple purposes. Catchments will be managed in ways that reduce erosion and the siltation of WSI, while benefiting riparian communities by opening up farming and other opportunities. Of importance will be the ability to manage WSI sequentially, along the length of rivers, so as to optimize benefits for all. In order to achieve this, water governance – the capacity to negotiate amongst water users (including dam operators) – must be improved, paving the way for policy and administrative changes that enable the sharing of benefits among riparian communities, among water users and between nations.

6. Links with other projects in the Basin Development Challenge[ii]:

The project will need to work with other projects in the BDC to contribute to a coherent research program that is lead by a Basin Leader. The project will need to work with Project 3 to develop methods for scaling up research outputs to the basin level.

7. Project Summary

This project is about livelihoods, and how they can be improved through reservoir management for multiple uses and users. It is about developing strategies for optimizing the benefits of WSI and increasing the ways in which water can be utilized for the benefit of the poor. Strategies can be developed for individual reservoirs or for cascades or systems of reservoirs.

This project will explore ways in which riparian communities can improve their livelihoods by taking advantage of agricultural, fisheries and other opportunities afforded by WSI development. Suitable strategies will broaden the uses of reservoir water to support livelihoods,

benefit riparian and downstream communities alike, increase the lifespan of reservoirs, and maintain hydropower generating capacity. Research will also seek to minimize negative down-stream impacts.

Research on water use and livelihoods will take account of different needs (agriculture, fisheries, hydropower, and the environment – for example, wetlands preservation) for different user groups (including gender differentiation). These needs can be direct or indirect (for example, health related issues), or for consumptive or non-consumptive use of water (for example, fisheries). In addition, water requirements may vary seasonally, annually or in the long-term (e.g. under the effects of global drivers such as climate change).

8. Links to previous and ongoing work

8.1 Previous and on-going work

The Mekong Basin has hosted many research and development initiatives that make available considerable information, knowledge and tools for our project. For example, a key focus of the CPWF's Mekong Basin Focal Project (BFP) was on changes in water regimes (especially dams and increasing irrigation diversions) that will impact water resources (in terms of quantity, quality and timing) and the related impacts on agricultural productivity, fisheries productivity, income, health and wellbeing. The Mekong BFP has produced various products linked to these topics (such as synthesis reports and maps on agriculture and fisheries related issues and poverty) which we will draw on for our project. The Mekong River Commission (MRC) holds accumulated knowledge particularly on environmental flow frameworks, hydrology, hydrological modeling, hydropower development, environment, fisheries, aquaculture, navigation and human development, and its Hydropower Programme offers extensive expertise and experience (MRC 2009). MRC's Lower Mekong Basin and Strategic Plan 2006-2010 will provide guidance through its framework for facilitating a more coordinated approach to integrated development through IWRM. Implementing this strategy is currently supported by projects under the Mekong Water Resources Assistance Strategy of the World Bank and Asian Development Bank (World Bank–ADB, 2006).

Also pertinent are the World Commission on Dams (WCD) recommendations, the Dams Development Project and the International Hydropower Association's (IHA) protocols for sustainable hydropower development. The WCD calls for including all stakeholders in planning and managing water resources in reservoirs and a more equitable distribution of benefits gained from dams. This can be facilitated through Decision Support Systems (DSS) which help structure decision processes and support analysis of the consequences of possible decision choices. Modern DSS can help understand system dynamics and facilitate the communication of information to people without technical abilities, so they can participate more fully in decision-making.

Several CPWF Phase One projects offer relevant DSS tools for optimizing various WSI management scenarios. PN36 utilized a number of tools to investigate inclusion of environmental and social issues in dam operation in the Nile Basin, including use of water resource models such as the Water Evaluation And Planning (WEAP) Model, the environmental flow model, and the Desktop Reserve Model (DRM) (McCartney, 2007; 2009). In PN10, decision support tools were developed by the WorldFish Center using Bayesian modeling to integrate sectoral priorities for sluice gate operation in the Mekong Delta, including rice production, shrimp farming, and freshwater fisheries. This included local stakeholder dialogues on optimizing sectoral outputs for management objectives including food security and income generation, and training key local stakeholders to use and update these tools (Baran and Jantunen 2004).

Hoanh et al. (1998) and Roetter et al. (2005) developed multi-scale models applying LUPAS approach developed under the CGIAR SysNet project for land and water use optimization. This approach was applied to develop a model for optimizing land and water use for hydropower, irrigation, crop and livestock, domestic supply and industry in Thailand's Mae Klong river basin (IWMI-SEA, 2003); and can be used as the basis for DSS to be developed in this project

Stakeholder participation in scenario building options is a critical aspect of our work and we will build on our previous experiences such as PN71, where various participatory tools were used to facilitate stakeholder engagement in the commune agro-ecosystem analysis (CAEA) approach in Cambodia, which studied water allocation in the Tonle Sap for fisheries and agriculture (CPWF, 2007).

8.2 Lessons learned

Current knowledge demonstrates that while dams are constructed to bring social and economic benefits, they also produce social costs. Decision-makers must either avoid or mitigate these costs if WSI are to become more sustainable and their net social and economic benefits maximized. This requires better dam planning and management and attribution of equal weight to engineering and economic aspects at the different stages in the planning cycle of WSI. This also implies more meaningful (i.e. beyond being just informed) stakeholder participation in decision-making processes which can be enhanced with DSS (McCartney, 2007; 2009;).

Several challenges to applying these lessons persist in the Lower Mekong. Water resources management capacity remains limited, with varying degrees of competence among countries and line agencies, and limited experience in applying IWRM. Sub-basin managers face the additional challenge of integrating processes both horizontally between sectors, and vertically between national, provincial and local government (World Bank-ADB, 2006).

Supporting agriculture and fisheries livelihoods in hydropower dam impact zones is also fraught with difficulty, both technical and social. Although WSI such as irrigation schemes can help diversify local livelihoods, such diversification may occur at the cost of livelihoods from fisheries, rather than from new economic opportunities created by irrigation. Unless local communities are actively involved in the planning and management of such structures, the costs and benefits can be unevenly distributed, with downstream fisheries livelihoods typically bearing the heaviest costs.

WorldFish and MRC recently completed a review of documented impacts of dams on fisheries-dependent livelihoods around the world including the Mekong region, and livelihood compensation or mitigation measures proposed or implemented through EIAs. The review results are consistent with the conclusion of an international expert group meeting convened by MRC (September 2008), that in the Lower Mekong Region, compensation for loss in yield from river fisheries is impossible to achieve through development of reservoir fisheries without relying heavily on the introduction of exotic species such as tilapia and carp, possibly with adverse ecological effects, and can be costly to sustain. The study also reviewed numerous hydropower EIAs in Laos and Vietnam, with important lessons on key stakeholders, livelihood impacts, mitigation measures for the three target areas. (Baran et al. in press).

9. Research questions

The following are the research questions that this project should address:

- How can the fisheries and agricultural benefits from WSI in the research target area be realized?
- How should WSI management strategies be altered in order to benefit downstream small-scale agriculturalists and fishing communities?
- If WSI management strategies were altered in certain ways, what benefits would arise as a consequence, and can these be measured in economic terms? Will hydroelectric power generation suffer from the adoption of such procedures?

How will your research address these research questions?

The prudent and sustainable use of WSI requires consideration of a large number of complex and inter-related issues and poses intricate technical and political challenges. Optimizing reservoir releases must take account water uses and users up- and down-stream of the dam wall. There are a diverse range of livelihood options that include irrigated agriculture, fisheries, and livestock raising; nomadic livelihoods through collection of non-timber forest products (NTFP's) and hunting that require the presence of and access to natural resources; economic imperatives that are in the National interest such as power generation; and water requirements for maintaining ecosystem services and biodiversity. Critical in the sustainable utilization of WSI is the maximization of benefits that would accrue to all parties and the environment.

Through our research, we will examine how to optimize the productivity and equitable use of water stored in reservoirs by analyzing trade-offs and promoting synergies between different use options, in a manner that optimizes income and food security (for farmers, fishers and riparian communities), water productivity (hydropower, irrigation) and environmental sustainability, while minimizing negative impacts.

To accomplish this, we will adopt an integrative framework linking two research components (Figure 1). Livelihoods component or Component 1: will characterise the natural and agro-ecological systems and resource base available and identify strategies to secure, enhance and improve existing livelihoods, through optimizing benefits of the WSI, in addition to exploring alternative livelihood options for farmers, fishers and riparian communities in the impact zone of large reservoirs. DSS component or Component 2: linked to (1), develop a DSS and facilitate stakeholder dialogues aimed at optimizing water management for competing uses, including agricultural and fisheries production, livelihoods, hydropower generation and environmental requirements. Emphasis will be placed on engaging local and national stakeholders in identifying desired outcomes at different scales, identify priorities for livelihood strategies, collecting and disseminating information, building their capacity to use the DSS developed, and ultimately to use this DSS for optimized design and operation of large reservoirs, with the use of various participatory techniques.

Through the livelihoods and DSS components we will address the three research questions posed above as follows:

How can the fisheries and agricultural benefits from WSI in the research target area be realized?

- Investigate and understand (a) the operational characteristics of the WSI – singly or in tandem; (b) the specific environmental and ecological impacts of WSI development on the land, water and fisheries resources; and (c) impacts on the livelihoods and welfare of affected communities within the impact zone, both upstream and downstream (under Output 1).
- Evaluate the opportunities and constraints for agriculture and fisheries/aquaculture based on the environmental and ecological attributes and socio-economic circumstances of target communities (under Output 1).
- Identify plausible livelihood options and determine the likelihood of uptake by affected communities in the context of their livelihood objectives and perceptions of opportunities and risks (under Output 2).

How should WSI management strategies be altered to benefit downstream small-scale agriculturalists and fishing communities?

- Determine the enabling conditions for livelihood-enhancement for the target communities through improved agriculture and fisheries/aquaculture development, including strategies for lifting constraints due to existing WSI management strategies (under Output 3).
- Assess the expected benefits from different strategy options and identify the most plausible scenarios (under Output 3).

If WSI management strategies were altered in certain ways, what benefits would arise as a consequence, and can these be measured in economic terms? Will hydroelectric power generation suffer from the adoption of such procedures?

- Examine the differential benefits of selected scenarios and associated trade-offs, and determine policy implications (under Output 3).
- Use the scenarios to develop strategic adaptation response plans for the study sites that could be offered for piloting at these sites (under Output 4).

10. Research Outputs, Methods and Uptake Pathways

10.1 Project research outputs (from MTP)

Main responsibility
Strategies for optimizing reservoir water management that increase the productivity of agriculture and fisheries, improve community livelihoods and contribute to environmental conservation, at an acceptable cost to hydropower generation and irrigation

With Project 3:
Methods for scaling up research outputs to the basin level

What additional research outputs should the project produce, if any? What does the output(s) add to the BDC?

1) Livelihoods Component
Output 1 - Characterization of the natural and agro-ecological systems and existing livelihood systems adopted by the communities living upstream, downstream and in the impact zone of the selected WSI.
Output 2 - Identification of enhanced, improved or alternative livelihoods options available for farmers, fishers and riparian communities, through optimizing benefits of the selected WSI.

2) DSS Component
Output 3 – Development of a DSS package for evaluating resource use options, goal achievements and trade-offs in optimizing production and livelihoods objectives under various development and management scenarios defined with stakeholder inputs.
Output 4 – Identification of resource use options and livelihoods adaptation strategies by using the DSS tools, under a set of development and management objectives prioritized by stakeholders for each impact zone of the selected WSI.

10.2 Project partners

Along with WorldFish and International Centre for Environmental Management (ICEM) as international partners, we have selected three key NARES partners to collaborate with us (one in each of the countries we propose to work in). Our intention is that the selected national partners would establish and manage key associations with other organizations and local institutions that are critical to the project. They will form crucial linkages for the project into line agencies (such as those linked to fisheries and water resources), ministries and other state and transboundary water resources actors along with the private sector. These actors will include but not restricted to: the Mekong River Commission; Water Resources and Environment Administration (Lao PDR); Nam Theun 2 Power Company (Lao PDR); Ministry of Natural Resources and Environment (Vietnam); Energy Vietnam; Ministry of Water Resources and Meteorology (Cambodia). In addition, we expect close collaboration with the CPWF and other Mekong project proponents and

expect that the combined networks of all parties will improve not only project delivery but importantly, the uptake and dissemination of results.
Our NARES partners are:
The Department of Agricultural Extension (DAE) within the Ministry of Agriculture, Forestry and Fisheries (MAFF) in Cambodia
The National Agriculture and Forestry Research Institute (NAFRI) within the Ministry of Agriculture and Forestry in Laos PDR
The Soils and Fertilizer Research Institute (SFRI) in Vietnam.
For additional information describing our international and NARES partners, please see the second Section 14. Project Team.

10.3 Next users

It is envisaged that the immediate next users of the MK1 outputs will be the other MK projects. For example, MK1 needs to ensure that research outputs (such as alternative land and water use strategies, flow criteria for different uses and agro-ecological profiles) feed into the MK3 project, and are up-scaled to the catchment and basin scale. Similarly, various MK1 outputs will feed into MK2, MK4 and MK5, as discussed in the CPWF inception workshop in February 2010.
In addition, it is expected that the next users of the Livelihoods Component outputs will be relevant departments, ministries and policy makers in Cambodia, Lao PDR and Vietnam dealing with agriculture, fisheries, water resource management and energy development. Further, it is envisaged that the private sector who are intimately involved in the development and operation of WSI will benefit and utilize the outputs from this project. In addition, staff members of development agencies, donors, consultancy companies and research institutes working on watershed management are likely to find our outputs a useful source. In the case of the DSS Component outputs, it is envisaged that institutions that include the MRC; ministries charged with water resources planning and development; WSI builders, operators and concessionaries that come from the private sector; and international and regional financial institutions charged with providing loans for WSI development will all benefit from these outputs. From lessons learnt under the PN25 and PN50 projects both components will focus on capacity building with participation of NARES young researchers and university students for their degree (MSc, PhD) training because they will be the key future users of our research outputs in the development of Mekong countries.

10.4 Learning required by next users

Learning needs will be minimal. We will explain our methods and describe our results with sufficient clarity that our target audience will understand our motivation, techniques, and outcomes. It will be important for the next users to understand and actively contribute to development of the tools and methods that we adopt for future application. Beyond formal understanding, we believe that the approach and results can

be disseminated in an intuitive way so that the ideas and the implications for synergies and tradeoffs can inform decision making stakeholders more broadly.

10.5 Research methods

Output 1 - Characterization of the natural and agro-ecological systems and existing livelihood systems

We will first undertake a general characterization of the natural systems (such as wetlands) and agro-ecological systems and resources found upstream, downstream and in the impact zone of the selected WSI. Through these assessments we hope to gain a better understanding of what resources are present and can be used in terms of livelihoods and what the trends have been in resource use in the context of the WSI development (e.g., how natural resources such as fisheries are linked to flow regimes and how this has been altered by the WSI construction) and the environmental impacts of WSI development. We will also determine what key opportunities and constraints exist in the context of using the different natural and agro-ecological resources that are available. This assessment will be undertaken mainly through reviewing existing secondary data on natural and agro-ecological systems and resources in the study sites, (particularly those conducted for reservoir EIAs and their monitoring programs). We will also use GIS methodologies to produce a set of maps of the study sites that depict resource use characteristics and geographic and seasonal patterns. We will complement and calibrate the secondary data analysis with targeted field data collection, through interviews with key informants over two seasons and focus group discussions where we will conduct participatory exercises on traditional ecological knowledge and resource use patterns with selected local communities at the sites where the livelihoods analyses will be undertaken.

We will thereafter focus on the livelihoods of communities living upstream, downstream and around the selected WSI. First we will obtain an overview of the local people in the study sites through a review of secondary sources of data, including social impact assessments of WSI development (if any) at the selected sites. This will include communities resettled by the construction of WSI and those affected downstream whose livelihoods are dependent on the natural resource base that is impacted by changed flow regimes. Using a set of suitable criteria (e.g. poverty status, resource use patterns, livelihoods engaged in, ethnicity, gender aspects, etc) we will then select a representative sample of the population to undertake a more in-depth livelihoods analysis. Through our investigation we hope to address the following key questions: What livelihood activities are people currently engaged in? Where do they carry out these livelihood activities? What resources are they using? What are the gender differentials to consider in the context of resources and livelihoods? What are the other diversity factors (such as ethnicity, indigenous group, religion) that influence power dynamics in the local communities and are linked to differences in resource uses? What is their wealth status? How do existing formal and informal rules systems and organizational structures support or impede existing livelihoods systems in terms of value optimization, equitable distribution of benefits and sustainability? How has the

WSI impacted their livelihood activities and general well-being? And how have communities coped and adapted?
We will use a sustainable livelihoods approach for our investigation and explore the above questions around the different elements of the sustainable livelihoods framework (DFID 2001) that include:

- Social, human, physical, financial and natural capital or assets, and their ability to put these to productive use
- Livelihood strategies adopted based on the combination of assets available
- National, sub-national and local policies, rules and institutions and processes that shape access to assets and opportunities
- Vulnerability to both natural and anthropogenic shocks and stresses

For collection of primary data we will use a combination of participatory tools, household surveys and key informant interviews. In terms of the participatory tools, we will build on the revised CAEA methodology developed under PN71 (CPWF, 2007). We place emphasis on the tools that are more relevant in the context of the present set of research questions. For example, the tools that are associated with developing livelihood profiles and link to local livelihoods activities such as fisheries, agriculture, NTFP collection and water resource uses. The focus group discussions, key informant interviews and questionnaires will be customized to reflect the Mekong Basin issues and local knowledge. We envisage that our questions will be developed over several iterations to ensure that they are adapted to local issues and are relevant to the local context in the three sites. The field work will be conducted with the assistance of our local partners in the three countries. Two rounds of surveys will be conducted to ensure that seasonal variations in resource use patterns and livelihoods are captured. The first round will be considered the baseline survey for MK1. We propose to undertake both qualitative and quantitative analyses and our results will be at different scales – household level and commune level. These findings from Output 1, that include socio-economic profiles of target populations, current livelihoods activities, etc., will be linked to the decision support system (Output 3).

Output 2: Identification of enhanced, improved or alternative livelihoods options
In the analysis of livelihood options, we will review secondary material on lessons learned from livelihood compensation programs already established in our study sites or in similar WSI management initiatives. Baseline surveys already in existence for some of our study sites and available databases will be important sources of information, as well as Social Impact Assessment reports and impact mitigation programs. Thereafter through a set of participatory assessments held through focus group discussions, we will identify suitable and viable options available to the local communities associated with the WSI, such as opportunities linked to agriculture, fisheries, aquaculture, agro-forestry, NTFPs, animal husbandry, etc. As proposing entirely new livelihood activities to communities usually entails high risks, we will also explore how existing livelihoods can

be secured, enhanced or improved upon through a review of secondary information sources and data collection using participatory methods. The implications of existing formal and informal rules systems and organizational structures for the viability of livelihoods options will also constitute part of these assessments.

Our focus is also likely to differ between our study sites in the three countries based on their characteristics and the natural resource base available as well as the operational status of WSI in question. For example, we will place an emphasis on the potential use of the drawdown area in the newly completed Nam Theun II reservoir; downstream irrigation and reservoir aquaculture in the upper Sesan cascade dam in Vietnam, that have been operational for some time; and on mitigating negative impacts of WSI on wild capture fisheries and other locally-available livelihood options in lower Sesan river in Cambodia, where the site is a proposed new WSI in the downstream impact zone of upper Sesan cascade.

The participatory tools we propose will be partly adapted from those developed in the CAEA methodology under PN71 and include those that identify suitable alternatives and technological innovations in the context of livelihoods (CPWF, 2007). We will pay special attention to the opportunities available to the most vulnerable and poorest groups. We will also assess the impacts of these alternative livelihoods on poverty, gender and the environment. In addition, we will explore the institutional arrangements that would be required (both formal and informal), policy environment, marketing networks and infrastructure and importantly, the potential conflicts and trade-offs this could cause with other water users.

The assessment under Output 2 will be linked closely to the findings of our first set of activities under Output 1. Our results from Output 2 will be from both the household and commune level. Findings regarding potential livelihood options, the estimated production levels and benefits and the likely impacts on poverty and the environment are variables that could be fed into the DSS (Output 3) and also the identification of favoured livelihood adaptation strategies (Output 4). Other findings from Output 2– for instance on how the WSI operation might be modified to improve livelihoods, particularly of those living downstream, and the implications of different options on primary WSI purpose (e.g. hydropower) will also be linked to Outputs 3.

Output 3 – Development of a DSS package

Figure 1 shows the conceptual framework for implementing the DSS whereby multiple-goal linear programming (MGLP) is applied to evaluate combinations of various livelihood options under different objective functions (Hoanh et al., 1998; IWMI-SEA, 2003; McCartney, 2007; 2009). An objective function is mathematical translation of a particular development objective such as maximizing hydropower generation; maximizing food security; maximizing livelihoods enhancement (e.g. through increasing household income, increasing agriculture/aquaculture production); or minimizing environmental degradation (e.g. soil erosion).

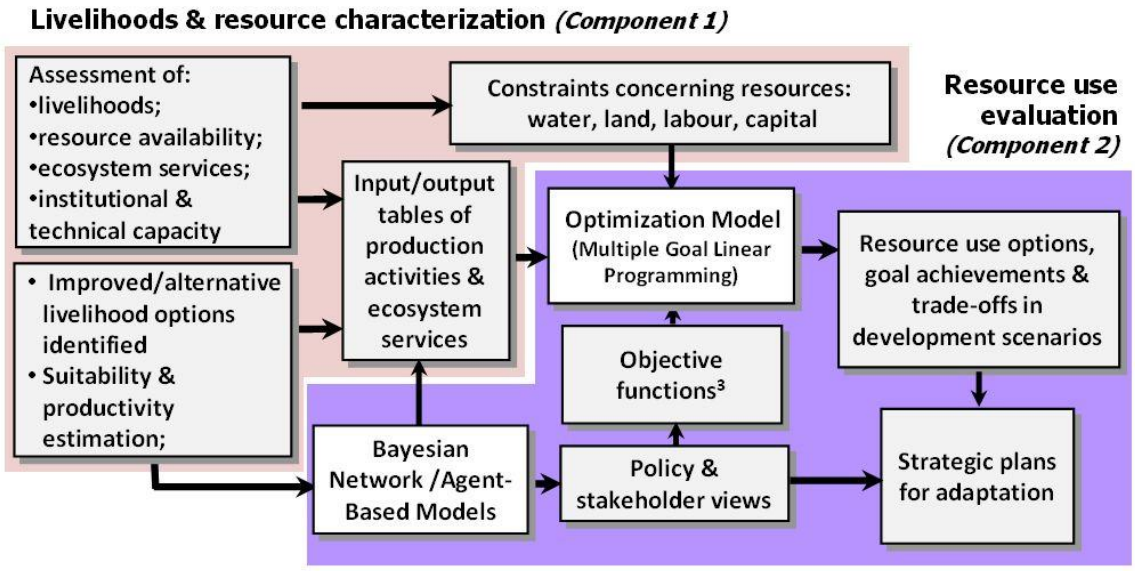

Figure 1. Framework for the Decision Support System, showing linkages between Outputs of Components 1 and 2 of the study.

The development objectives are identified through stakeholder consultations using participatory tools such as Bayesian networks or agent-based modeling (ABM) for eliciting their views and perceptions into structured decision rules. A preliminary set of invitees identifies the whole range of stakeholders, who are then engaged to identify objectives and management options. They also create a tree of options in which possible inputs and value of outputs are weighed. This process is repeated at three levels (local, provincial, and national). The Bayesian approach allows transparent quantification at all levels and computation of potential trade-offs (Baran and Jantunen, 2004).

Data to feed the MGLP model are estimates of inputs (land, water, capital, labour) and outputs (yield, by-products and impacts) of selected production activities (including agriculture and aquaculture) or ecosystem services; and the state and variation of the resources (such as climate change) in the target area, expressed as constraints. The knowledge base is provided by findings from Component 1 and from the stakeholder elicitation sessions using Bayesian/ABM tools.

The MGLP will be applied in several rounds of analysis. In the first round, every single objective function will be optimized without setting targets for other objective functions (Hoanh et al., 1998; Roetter et al., 2005; McCartney, 2007; 2009). Outputs of this round will be the optimal achievements, either maximum or minimum, of each objective function to reflect the limit of the WSI capacity. In the second round, each objective function will be optimized with targets set for another objective function. Outputs of this round are trade-offs between the two selected objective functions. In the subsequent rounds, each objective function will be optimized with targets of other conflicting objective functions. Outputs of these rounds are the resource use options

and achievements under different development and management scenarios (Hoanh et al., 1998; IWMI SEA, 2003; Castella et al., 2007). Figure 2 illustrates how the results from the MGLP can be presented as trade-offs between hydropower generation and livelihood enhancement. The trade-off curves suggest that the higher power generation the lower livelihood enhancement. Removing a constraint (such as providing more water from upstream of the reservoir) shifts the curve to the right side, hence improving the achievement of both objectives (Figure 2). Adopting an alternative water management scheme that targets livelihood enhancement may shift the existing trade-off curves such that power generation is reduced in favor of higher livelihood enhancement.

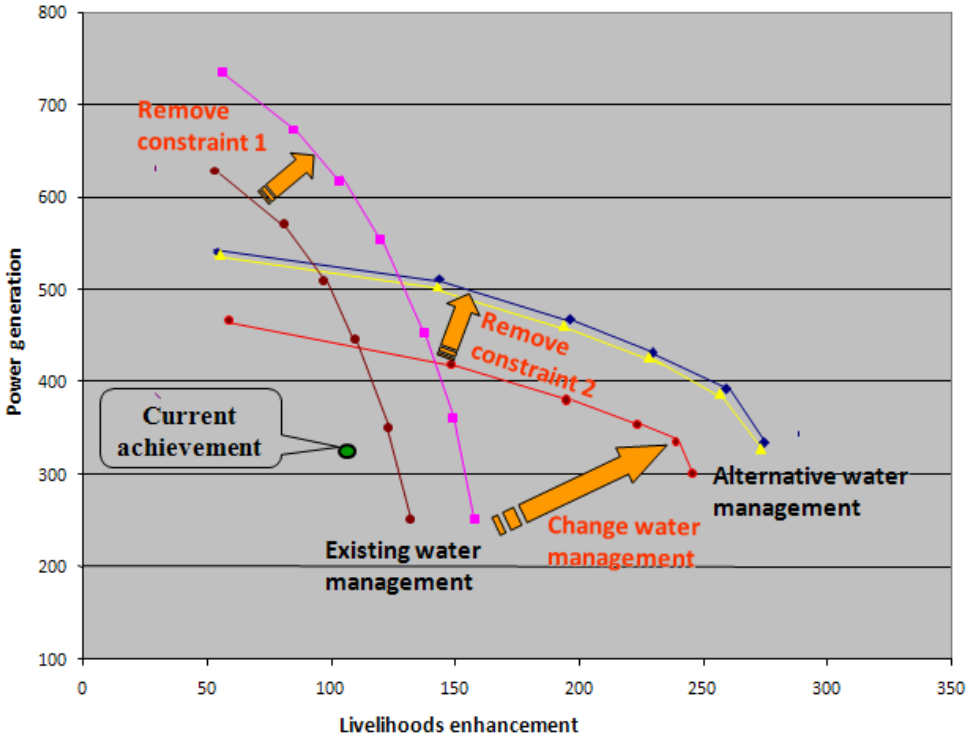

Figure 2, Example of graphical summary of results from trade-off analysis

Presented in this manner, the results of the trade-off analysis will help the stakeholders' gain better understanding on what they can achieve and what they will lose when considering different water management options. The output of the DSS could then provide the basis for developing strategic plans for adaptation to the changed conditions of WSI management and other changes as climate change and product price variations under Output 4.

To ensure continued use of the DSS as WSI development in the region progresses, qualified partners from the national institutions involved will receive on-the-job training in using the DSS.

Output 4 – Identification of resource use options and livelihoods adaptation strategies using the DSS tools

We will base this output on two key pillars: i) the set of development objectives and management strategies prioritized by stakeholders for each impact zone of the selected WSI (e.g. river bed gardening and aquaculture development in reservoirs A and B), and ii) the quantification and optimization, by using the DSS, of these options, given local water management constraints and targets (e.g. 5 ha of gardening and 30 household aquaculture units in reservoir A, 1 ha of gardening and 60 aquaculture units in reservoir B) (Hoanh et al., 1998; McCartney, 2007; 2009) .

We will identify resource use and livelihood options by a literature review and participatory assessments in Output 2, in which we will review the classical options for diversified livelihoods having proven feasible in the region. We will present these options to stakeholders, and seek their input, to identify options acceptable in each site or at each level. We will thereafter integrate these objectives and options into the MGLP optimization model as "objective functions" as described in Output 3.

Once an optimized combination of adaptation options that meet the development objectives is identified by the DSS, we will discuss results with stakeholders at the community, province and national levels, to identify implementation pathways and possible constraints. We will also link with the multi-stakeholder platforms created under MK5 during this exercise, obtaining views from both pro-dam and anti-dam stakeholders.

We propose to prepare a strategic plan for adaptation for each of the three study sites, taking into account alternative WSI management and priority livelihoods identified through this consultative process. Exposure to available livelihood options and involvement of stakeholders, in particular at the local level, in the selection of relevant packages will ensure that the awareness and capacity of local stakeholders to participate in livelihoods/resource use prioritization process is substantially improved. We propose, with the assistance of our national partners, to consider piloting some relatively simple and inexpensive livelihood adaptation strategies that emerge as the "favoured" options through the stakeholder consultation process with communities plus the DSS scenarios that are presented. Community members who indicate willingness to pilot test livelihood options through a rapid survey will participate in this exercise and dam planners/operators will be involved in the process to ensure that there is "buy-in" for alternate ways of managing the WSI. We propose to monitor the success/failure of these livelihood strategies and prepare a report on the key findings and lessons learned. This will form part of the MK1 "exit strategy". MK5 will assist in linking with the relevant institutional networks to facilitate future uptake of the livelihoods that were considered a success. As part of our review, based on the livelihood options that are selected to be pilot tested, we will also undertake an impact assessment to predict the environmental

and social impacts and institutional constraints facing the selected livelihoods and suggest ways of managing these impacts.

10.6 Participatory research approaches

As our outputs would have been derived through a participatory stakeholder consultation process, we will use similar participatory approaches to discuss our findings with the various stakeholders (including next users of our outputs) and discuss the most suitable ways in which they can adopt and use the outputs and how they can overcome possible constraints that they may face in the process.

10.7 Change in user practice

Users will have the information required to optimize the productivity and equitable use of water stored in WSI such as large reservoirs, enabling them to promote synergies between different use options, in a manner that optimizes income and food security (for farmers, fishers and riparian communities), water productivity (hydropower, irrigation) and environmental sustainability, while minimizing negative impacts. They will also have the necessary information to promote appropriate policy interventions to optimize resource use options, possible achievement and trade-offs based on the outcomes of the optimization model produced under the DSS.

10.8 Suggested sites

We propose to work in the following sites that, together, reflect several aspects of hydropower developments and impacts:

- Vietnam: Se San cascade (Yali,)
- Cambodia: Lower Se San 2
- Lao PDR: Nam Theun II (reservoir and downstream areas) plus an additional site in Theun Hinboun to assess livelihoods and fisheries issues if the need arises.

Nam Thuen II (NT2), the largest hydropower development in Lao PDR, will begin operating in December 2009. The sale of electricity will generate substantial revenue for poverty alleviation. This trans-basin diversion project will impact two river basins, reducing fish catches and affecting water levels and quality downstream.

The Theun River dam will require resettlement of 6,200 persons. During peak power production, the reservoir will lose 80% of its volume causing a drawdown area of 37,000 ha. When operating, increased flows will cause erosion, flooding, sedimentation, and the loss of fisheries and aquatic resources, impacting 120,000 people downstream (Shoemaker et al., 2001). We will assess livelihoods in resettled communities that use the drawdown area to produce rice and raise livestock.

If an additional site is required to undertake some livelihoods and fisheries related assessment we propose to look at the Nam Theun Hinboun. This is a privately financed dam that officially commenced operation in 1998. According to Shoemaker (1998), approximately 6000 people close to the project site had to be settled as they were considered to be vulnerable to the effects of the project. In addition, many people living downstream have been reported to have been impacted by declines in fish catches, flooding or vegetable gardens and freshwater shortages.

We will emphasize downstream irrigation and reservoir aquaculture in the Se San cascade in Vietnam, where the demand for energy is increasing rapidly. The Central Highlands, which is an important agricultural region, will play an important role in meeting Vietnam's energy and development needs. On the Se San River several dams are already operating, under construction, or in planning. The Yali Falls dam for example was constructed between 1993 and 1996, with a 64.5 km2 reservoir filled by 1998. It aims to generate 720 MW of hydropower. Like many large dam projects, it has been highly criticized for causing various environmental impacts such as causing flooding and damaging fisheries. The irregular release of a large amount of water from its reservoir has affected the hydrological regime and the water quality of the Se San River downstream. The Se San cascade potentially offers an opportunity to optimize reservoir management to meet expected growth in irrigated agriculture and aquaculture.

The area downstream of hydropower installations on the Se San River in Cambodia offers the opportunity to address impacts of WSI on ecosystem services, including wild capture fisheries and NTFPs. Focusing on both the Se San River in Cambodia and the cascade of dams in Vietnam, we will examine opportunities for managing water releases to sustain aquatic ecosystems and the environment in an integrated, international river basin. It must be noted that according to Baird (2009), the Sesan 2 dam if built can be expected for cause the following impacts: about 78,000 people living above the proposed dam site are expected to lose access to migratory fish while tens of thousands of people living downstream from the dam site would be negatively impacted due to changes in hydrology and water quality, causing fisheries losses and impacts on domestic water supplies.

These proposed sites are based on CPWF recommendation and through consensus at the inception workshop in February. However, we realize that government commitment to the site selection will be crucial and therefore in the project inception phase will undertake consultations with the relevant governments and dam operators/developers with the assistance of MK5 to finalize the site selection. In addition, during the inception phase we hope to undertake some reconnaissance visits to the proposed sites to determine, from a practical point of view, the feasibility of working in these sites – for example, what is the degree of access we have to existing information and data; are we targeting communities/households that are suffering from development research "fatigue" – with several groups already working in the same areas in the past; are there multiple uses associated with the site and diverse livelihood activities, etc.

11. Activities and Implementation Plan

*In the form of a **Gantt chart**, constructed as an Excel spreadsheet, which is part of the project workbook.*

12. Communications and alignment with CPWF Culture

12.1 Communications

Briefly describe your communications plan

The communication products will include:

- At least two journal articles and one policy brief (in English, Khmer, Vietnamese, and Lao) characterizing agro-ecological systems and livelihoods in the three study sub-basins, along with livelihood options available through optimizing benefits of WSI and adaptation strategies.
- Three, more detailed reports covering these same aspects, one for each of the sub-basins, including results of stakeholder consultations
- Short, journalistic articles summarizing project findings, for national media and regional publications such as MRC updates
- A DSS software package that can be used in future consultations with local stakeholders and easily modified to accommodate future developments or different characteristics in other sub-basins, along with a simple user's guide; available by CD-ROM and web download
- A suite of popular communication products in multiple media (posters, short video clips, cartoon books) in local languages, relating key messages on local ecology and livelihoods, WSI development choices, and specific livelihood development options (e.g., pond aquaculture, techniques for preventing soil erosion and improving crop production on sloping lands, etc.) that can be used in extension programs of government, NGOs, and community-based networks, and also reproduced or broadcast through mass media.
  - An open access website to make available preliminary project results and draft communication products for peer review and stakeholder feedback, and to disseminate final products

We will elaborate and adapt the communications plan and impact pathway at the start of the project in consultation with the teams implementing Mekong Projects 2 and 3 (regarding technical content) and Projects 4 and 5 (relating to stakeholder engagement and deliberation over WSI decisions).

12.2 Evaluative culture

Briefly describe how you will support an evaluative culture in the project

The project's implementation context is very dynamic in terms of changes in the status of WSI development in each sub-basin and changes in stakeholder needs and priorities. We therefore recognize the need to adopt the principles of ongoing, adaptive evaluation. Important aspects to be evaluated periodically during implementation include the extent to which:

- The focal questions for analysis are responding to the most important needs and priorities of local stakeholders, particularly poorer households, and with special attention to women's voices.
- The selected methodologies for analysis are being implemented to deliver results that will be easily understood by local stakeholders, including poorer households (e.g. livelihood strategies) and decision makers (regarding WSI development choices and management options).
- Local partners are gaining skills to apply and adapt the assessment tools used.
- Communication products are reaching key audiences effectively, and how well the communication plan is integrated within the communication and stakeholder engagement activities of allied CPWF projects, particularly basin projects 4 and 5.

12.3 Alignment with CPWF core values

This project aligns with CPWF core values as follows:

Capacity building and partnership: Project implementation will be undertaken jointly with national partners, with regards to technical content, stakeholder engagement and communications. Skills development of local partners is an explicit objective and a component of ongoing evaluation during project implementation. Capacity development through on-the-job training and short seminars, and degree training will be available and supported to both project team members and partner institutions more generally.

Interdisciplinary research: Each of the two components and the overall project is designed as an interdisciplinary package. Specialists in areas such as geo-spatial modeling, decision support systems, soil science, water management, fisheries, aquaculture, agriculture, and livelihoods assessment will design research plans jointly and integrate their findings in ways that communicate most effectively to key stakeholders.

Gender and diversity: Each of the sub-basins are home to significant ethnic minority populations, so a special focus of attention will be to ensure that these diverse voices are represented accurately in the analysis undertaken. Livelihood assessment and stakeholder engagement methodologies will give special attention as well to ensuring that women's voices are given equal weight, and that livelihood development strategies

are appropriate to women's needs. In addition, the project team itself represents exceptional gender and national diversity, and this will be carried through in capacity building activities.

13. Assumptions and Risks

Key assumptions and risks, and related precautions include:

Stakeholder support and participation: The nature of this project will require access to and the full participation of households, communities and other stakeholder groups to improve our understanding of their livelihoods. Given the limited time made available to consult with these stakeholders, we have assumed they will actively support the proposed project activities. We will ensure that all our activities in the field are undertaken in a coordinated manner, being respectful of the rights and social values of these communities. This will require us to closely work with our local partners.

Access to selected sites: While we have selected particular sites in the three countries in view of their relevance in the context of the research questions to be address, if for whatever reason we are unable to obtain access to undertake our research in these particular sites, we would consider other sites in consultation with the CPWF and relevant governments.

Access to information: Critical to the success of this initiative will be gaining access to information and secondary data of both a social and biophysical nature from stakeholders and actors intimately involved in hydropower development in the target sites. We appreciate the risk that this information may be too dispersed or too difficult to obtain to make use of effectively. We intend to manage this through partnerships with agencies well positioned to access such information at regional, national and sub-national levels, and through close collaboration with the MRC and National MRCs in facilitating access to data sources. We are confident of managing this risk in view of the prior track record of our project partners in accessing and interpreting such information effectively.

Links to decision making: There is a risk that decision making regarding water resource infrastructure in the sub-basins will outpace the timeline for analysis and communications proposed under this project (and the related CPWF basin projects). There is also a risk that decision makers will ignore research findings. We hope to mitigate these by early and ongoing engagement with both local stakeholders and key decision makers to ensure the relevance and timeliness of research results.

Timely implementation: There is a risk that project implementation will be delayed by difficulties in partner collaboration or technical challenges in undertaking the analysis

and producing results. We intend to manage this risk by selecting partners that each has a strong track record of collaborative work; by the local presence of international partners based in Vientiane, Phnom Penh, and Hanoi respectively to facilitate effective collaboration, and by the decision to front-load activities for completion during the first 2.5 years of the project.

14. Project Team[iii]

Names of team members	Professional discipline	Institutional affiliation and address	Area of expertise important to this project.	Brief description of research responsibilities with respect to the outputs and activities listed in the Gantt chart.	Commitments
Sonali Senaratna Sellamuttu (SS)	Natural resource management, Livelihoods Systems	International Water Management Institute, 127, Sunil Mawatha, Palawatta, Battaramulla, Sri Lanka. s.senaratnasellamuttu@cgiar.org	1/ Livelihoods research - using conventional socioeconomic surveys and participatory methods. 2/ Natural resource management (especially in wetland ecosystems – both inland and coastal). 3/Wetlands research that includes studying ecosystem services in the context of livelihoods and tools to assess integration of wetland biodiversity conservation and poverty reduction and integrated approaches – how socioeconomics can be integrated into multidisciplinary research. 4/Prior experience of project leadership and management.	Overall Project Leader; responsible for all reporting; contribute to the livelihood aspects of the project under **Outputs: 1, 2, 3 & 4.** Monitoring and evaluation in accordance with Section 12.2 above.	30% commitment to PN71 as project leader for 2010. Will commit 50% of time to this project and 20% to Project 2 if successful in 2010. From 2011 commitment will increase to 80 and 20% respectively if proposal 1 and 2 are successful.
Chu Thai Hoanh (CTH)	Hydrological measurement and analysis; water and crop modeling and remote sensing applications for water resources planning and management.	International Water Management c/o National Agriculture and Forestry Research Institute (NAFRI), Ban Nongvienkham, Xaythany District, Vientiane. Lao PDR. c.t.hoanh@cgiar.org	1/ Hydrological measurement and analysis. 2/ Water modeling and remote sensing applications for water resources planning and management. 3/ GIS and water modeling for managing agriculutre and aquaculture conflicts. 4/ Optimization in land use planning	Lead the development of DSS under Output 3 and contribute to **Outputs: 2 & 4**. This role will be mainly supervising staff deployed on Outputs 3 & 4.	For 2010 70% of time committed to activities associated with MRC climate change downscaling; modeling activities for the mainstream of the Mekong; and the completion of activities within the

Names of team members	Professional discipline	Institutional affiliation and address	Area of expertise important to this project.	Brief description of research responsibilities with respect to the outputs and activities listed in the Gantt chart.	Commitments
			at sub-national level 5/ Role-playing games and agent-based models for facilitating integrated water resources management.		CPWF Phase 1 programme. A commitment of at least 20% will be made to the project if successful.
Matthew McCartney (MM)	Hydrology and Water Resources	International Water Management Institute, IWMI m.mccartney@cgiar.org	1/ Hydrology and water resource modelling and management; 2/large dam operation and environmental flow estimation; 3/public health impacts of large dams; 4/ wetlands agriculture and livelihoods	Support activities in the development of DSS under **Outputs: 3 & 4.**	A commitment of 20% in the first 2 years of the project. This will be scaled back to a minimum of 10% in the final two years.
Suhardiman, Diana (DS)	Political ecology	International Water Management c/o National Agriculture and Forestry Research Institute (NAFRI), Ban Nongvienkham, Xaythany District, Vientiane, Lao PDR. d.suhardiman@cgiar.org	1/Policy process analysis in irrigation sector development. 2/ Inter-levels (from national to field levels) and cross-sectoral (inter-ministerial) institutional analysis in water resources management. 3/Policy document review and bureaucratic networks mapping. 4/ Farmers' water distribution strategy in irrigated agriculture. 5/ Organizational analysis of Water User Associations	Support activities under **Outputs: 1, 2 & 4**	20% commitment in years 1 and 2 declining to 15% in years 3 and 4.
Sanjiv de Silva (SDS)	Policy and institutional analysis	International Water Management Institute, 127, Sunil Mawatha, Palawatta, Battaramulla, Sri Lanka.	1/ Policy and legal analysis and institutional mapping for natural resource governance at national, sub-national and local scales, especially in wetlands and forestry	Assessment of policy, legal and institutional frameworks at national and local scales in the context of existing	A 10% commitment throughout the life of the project.

Names of team members	Professional discipline	Institutional affiliation and address	Area of expertise important to this project.	Brief description of research responsibilities with respect to the outputs and activities listed in the Gantt chart.	Commitments
		s.s.desilva@cgiar.org	systems. 2/ Water governance analysis at national, sub-national and local scales. 3/ Monitoring and evaluation of poverty reduction - sustainable ecosystem management tradeoffs within wetland systems.	livelihood systems and their implications for alternate sustainable livelihoods scenarios under **Outputs: 1, 2 & 4.** Monitoring and evaluation in accordance with Section 12.2 above.	
Terry Clayton (TC)	Communications	International Water Management Institute, 127, Sunil Mawatha, Palawatta, Battaramulla, Sri Lanka. t.clayton@cgiar.org	Teacher/trainer, editor, writer, facilitator and communications consultant	Development of a communication and outreach strategy. **Output: 4.**	0% commitment in years 3 and 4. He will make occasional commitments as required through years 1 and 2.
Eric Baran (EB)	Fisheries Ecology	WorldFish Center, P.O. Box 1135 Phnom Penh, Cambodia. e.baran@cgiar.org	Bayesian modeling decision-support tools, and training; Impact of dams on fisheries	Hydrology-fisheries inputs to the development of DSS; site specific fisheries livelihood/mitigation strategies; downstream impact on fisheries in Cambodia. **Output: 3 & 4.**	MRC Mainstream Hydropower SEA; Scenario-based assessment of alternative dam locations on Mekong fish migrations (to be completed by early 2010); CP/PN 71 (until 2010); CPWF Mekong Project 2, Project 3 (proposed). Proposed that 15% of time committed in

Names of team members	Professional discipline	Institutional affiliation and address	Area of expertise important to this project.	Brief description of research responsibilities with respect to the outputs and activities listed in the Gantt chart.	Commitments
					years 1 and 2 scaling back to 8% in the last 2 years.
Mark Dubois (MD)	Wetlands and fisheries-dependent livelihoods	WorldFish Center, P.O. Box 1135 Phnom Penh, Cambodia. m.dubios@cgiar.org	Participatory research methodologies; Participatory and Rapid Rural Appraisals; Village and institutional development planning	Site specific wetlands/fisheries livelihood strategies; national capacity building and stakeholder engagement. **Outputs: 1, 2 & 4.**	Wetlands Alliance Programme; CP/PN 71 (Until 2010); CPWF Mekong Project 2 (proposed). Proposed that 15% of time committed in years 1 and 2 scaling back to 8% in the last 2 years
Samonn Mith (SM)	Community development	WorldFish Center, P.O. Box 1135 Phnom Penh, Cambodia. s.mith@cgiar.org	Technical and organizational support to small businesses; Community development activities and local capacity building	Site specific livelihood strategy, national capacity building and stakeholder engagement in Cambodia. **Outputs: 1, 2 & 4.**	CP/PN 71 until 2010. 33% time commitment to the proposed project for years 1 and 2; 15% in the final year.
Jharendu Pant (JP)	Rural aquaculture	WorldFish Center, Jalan Batu Maung, Batu Maung, 11960 Bayan Lepas, Penang, Malaysia. j.pant@cgiar.org	Small-scale freshwater aquaculture; Integrated Agriculture-Aquaculture (IAA) Farming Systems; Participatory Planning and Development	Site specific aquaculture livelihoods strategies. **Output: 2 & 4.**	12% commitment to the proposed project in years 1 and 2 scaling back to 5% in years 3 and 4.
Suan Pheng Kam (SPK)	Agronomy, GIS and remote sensing applications to natural resources	WorldFish Center, Jalan Batu Maung, Batu Maung, 11960 Bayan Lepas, Penang, Malaysia. s.kam@cgiar.org	Geospatial analysis and modeling applications; agro-ecological analysis for aquaculture; gendered approach to livelihoods analysis; integrated biophysical and socio-economic assessment of natural resources and	Baseline analysis, characterization, and resource evaluation for optimization modeling. **Outputs: 1, 2, 3 & 4.**	12% commitment to the proposed project in years 1 and 2 scaling back to 5% in years 3 and 4.

Names of team members	Professional discipline	Institutional affiliation and address	Area of expertise important to this project.	Brief description of research responsibilities with respect to the outputs and activities listed in the Gantt chart.	Commitments
			their		
Alan Brooks	Aquaculture development, program management	WorldFish Center, P.O. Box 1135 Phnom Penh, Cambodia a.brooks@cgiar.org	Commercial aquaculture production and value chain development, community-based natural resource management, fish trade and market	Provide quality control and management oversight for technical outputs produced by the WorldFish research team	
Yumiko Kura	Ecosystem and water resource assessment and monitoring, project management and coordination	WorldFish Center, P.O. Box 1135 Phnom Penh, Cambodia y.kura@cgiar.org	Water resources and wetlands assessment, aquatic biodiversity conservation, GIS analysis, fisheries policies	Facilitate timely inputs from the WorldFish research team and coordinate activities with the lead agency and other partners	
Jeremy Carew-Reid (JCR)	Environmental Assessment and Management	ICEM, 32 Xuan Dieu St, Tay Ho, Hanoi, Vietnam. Jeremy Carew-jecr@icem.com.au	Strategic environmental assessment, integrated river basin management, terrestrial and aquatic biodiversity rehabilitation and conservation	Review reports and summarize findings on impacts of WSI development at study sites; Compile secondary data on bio-physical and socio-economic conditions of the WSI impact zones; Review of literature on livelihood mitigation and compensation programs **Outputs: 1, 2 & 4.**	MRC Mainstream Hydropower SEA; Climate Change Impact, Mitigation and Adaptation in the Mekong Delta; CPWF Mekong Project 2, Project 3 (proposed). Occasional input over the life of the project as requested.
Peter-John Meynell (P-JM)	Water Resources and Wetlands	ICEM, PO Box 4340, Vientiane, Lao PDR. peterjohn.meynell@gmail.com	Environmental and social impacts assessment of hydropower; integrated river basin management; water resources and wetlands management	Review reports and summarize findings on impacts of WSI development at study sites; Review of literature on livelihood mitigation	MRC Mainstream Hydropower SEA; Cumulative Impact Assessment for hydropower development on 3S

Names of team members	Professional discipline	Institutional affiliation and address	Area of expertise important to this project.	Brief description of research responsibilities with respect to the outputs and activities listed in the Gantt chart.	Commitments
				and compensation programs; Determine with representative communities feasible livelihood options; Evaluate areas of conflicts, trade offs using DSS; Prioritize livelihood adaptation options through consultations **Outputs: 1,2 & 4.**	River basin; Cumulative Impacts Assessment of dams on the Nam Ngum river system; Transboundary Diagnostic Analysis for the Okavango River Basin; CPWF Mekong Project 2, Project 3 (proposed). Occasional input over the life of the project as requested.

Provide a brief text statement on why the lead institution is well-placed to lead the group.

IWMI and before that, the International Board for Soil Research and Management (IBSRAM), has more than 20 years experience in working in the countries of the lower Mekong Basin. Its research portfolio and experience over this period has covered the entire continuum from issues associated with land and water resources management at the individual household level through to contributing to the development of hydrological models for the Mekong mainstream and tributaries. Our experience in watershed management and understanding the process contributing to sediment generation and its mitigation will be invaluable in addressing livelihood options within the impact zone of these large WSI. Our role in irrigation in the region is extensive – ranging from implementation of participatory irrigation management in Cambodia to investigating the optimization of water allocation in diversified river basins in Thailand (Mae Klong basin). IWMI Southeast Asia has significant expertise in Agent Based Modeling (ABM) that has been successfully deployed on previous CPWF projects. The current skills that are based in the region and would be at the disposal of the project cover modeling of hydrology and land resources, and social disciplines. IWMI has developed strong and

meaningful relations with line agencies in the water and agricultural sectors in each of the four lower Mekong countries which will be invaluable in implementing this project.

Provide brief text statements on why the proposed institutions are qualified to carry out the proposed research.

Institution 1: **The WorldFish Center** is one of the 15 centers of the Consultative Group on International Agricultural Research (CGIAR), with a mission to reduce poverty and hunger by improving fisheries and aquaculture. The Center also has a high-level Country Agreement with the Royal Government of Cambodia represented by the Ministry of Foreign Affairs, with extended privileges that also cover IWMI. WorldFish has been leading a number of research projects in the Mekong region in the past years and also collaborated with key regional intergovernmental bodies such as FAO and MRC, on various joint projects. It has led and contributed to a number of CPWF Phase I projects, including CP/PN71 - Water allocation in Tonle Sap, CP/PN 35 - Community-Based Fish Culture, and CP/PN 10 - Coastal resource management for improving livelihoods and contributed to expert meetings and stakeholder consultation processes organized by the MRC Fisheries Programme, the Basin Development Plan, and the Hydropower Programme.

Institution 2: **ICEM - The International Centre for Environmental Management** is an independent public interest centre that helps governments, private sector and communities define and implement policies for ecologically sustainable development. It has been building on the work undertaken by various MRC programs, including the fisheries, navigation and agricultural programs as well the Basin Development Planning process. The result will be an advisory study to guide and inform MRC member countries. In addition, ICEM has also contributed to a number of SEAs (Strategic Environmental Assessment) for hydropower sector plans and conducted climate change impact and adaptation studies in Vietnam. ICEM has recently been commissioned by the Mekong River Commission to undertake a (SEA) of 11 planned hydropower dams along the mainstream Mekong River, in Cambodia, Laos, Thailand and Viet Nam. The SEA process has involved wide consultation with government, NGOs, civil society and the private sector, to facilitate information exchange and stakeholder participation. The country-level consultation has been facilitated by the National Mekong Committees.

Etc: NARES partners: In Cambodia we will work with the **Department of Agricultural Extension (DAE) within the Ministry of Agriculture, Forestry and Fisheries (MAFF)**, and its staff based at the Provincial Departments of Agriculture. MAFF has developed and officially adopted a participatory commune agro-ecosystem analysis (CAEA) system. These assessments cover the characteristics

of the land, land use, topography, water management issues including water sources and user groups as well as community characteristics and the priority commune agricultural concerns. DAE is mandated to implement CAEA around the country and to provide technical and extension support to a network of commune and district level development planning bodies.

In Lao PDR we will work with the **National Agriculture and Forestry Research Institute (NAFRI)** within the Ministry of Agriculture and Forestry. Its mandate is to consolidate agriculture and forestry research initiatives within Lao PDR under a single Institute and to develop a coordinated Agriculture and Forestry Research System. Within the Institute there are key four key commodity based livelihood centers that include the rice and commercial crops research center; forestry research centre; livestock research center; and living aquatic resources research center all of which will be important in the assessment of community livelihoods. Further the agriculture land research centre and the agriculture and forestry policy research center will play important roles in assessing livelihood options and possible policy options.

In Vietnam we will work with the **Soils and Fertilizer Research Institute (SFRI)**, which is the preeminent land resources research institute under the Vietnamese Academy of Agricultural Sciences (VAAS) of the Ministry of Agriculture and Rural Development (MARD). For more than 30 years, SFRI (formerly NISF) has worked in the field of sustainable land and natural resources management and demonstrated its ability to provide high quality research expertise in the areas of land use planning, soil science, natural resource management and environmental management. It is the leading organization in Vietnam in understanding the processes of soil erosion within highly incised catchments and the quantification of sediment generation from changed land use that is critical for water storage structures.

15. Indicative break down of budget

This is part of the project workbook

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[i] This project is one of several that together constitute a research program to tackle the basin development challenge (BDC). Please read the description of the BDC that can be found in the Medium Term plan. If you are successful you will be expected to work as part of a coherent research program, led by the Basin Leader responsible for program coordination and coherence.

[ii] Project linkages and project contribution are shown in the BDC impact logic model in the Medium Term Plan

[iii] The quality and experience of your project team will help ensure the delivery of quality outputs.