MEKONG RIVER COMMISSION

THE COUNCIL STUDY

"STUDY ON THE SUSTAINABLE MANAGEMENT AND DEVELOPMENT OF THE MEKONG RIVER, INCLUDING IMPACTS OF MAINSTREAM HYDROPOWER PROJECTS"

The Phase II Implementation Plan

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Document History

Version	Revision	Description	Issue date	Issued by
1	0	Draft Implementation plan for phase 2	Jan 2016	Henry
2	1	Draft Implementation plan for phase 2 prepared for consideration of regional consultation workshop on phase 2 based on internal comments and suggestions	Feb 2016	Henry
3	0	Revised the implementation plan on the scope of work, implementation plan, expected outputs delivery, a new implementation work and budget plan based on the agreed scope of work and deadline of completion. Working version to be finalized after review by the CS Team and the Member Countries	Sept 2016	Suthy Heng and core team
4	0	Further revisions based on CEO and CS Team comments.	Sept 2016	Suthy Heng and core team
5		Final revision based on the 7th RTWG meeting Comments including the budget prioritization	Oct 2016	Suthy Heng

1 EXECUTIVE SUMMARY

This document is prepared to describe the scope of work, implementation schedule, arrangement, and required a budget for the Council Study Phase 2. This is in response to Member Countries' instruction during the 22nd Council Meeting in January 2016 to the Secretariat to prepare this document for Member Countries review before the Council Study can officially proceed with its Phase 2. It is also recognized that this document will enable the Member Countries to make an informed decision on corrective actions on scope, schedule, and budget to assure the successful completion of the Council Study.

This document describes the detailed technical scope of work as agreed during the Regional Consultation Workshop on Phase 2 Implementation. Also, it does propose a prioritization and sequencing of Council Study technical activities. The sequencing is based on the following:

- Assessing impacts on flow, sediment, and water quality
- Assessing impacts on bio-resources
- Assessing impacts on coastal resources
- Assessing impacts on social and economic conditions.

With respect to the implementation schedule, the Council Study is divided into the following phases:

- Phase 1 (completed in March 2016)
- Transition Phase (April – early of Nov 2016)
- Phase 2-Preparation and assessment period (Nov 2016- Sept 2017)
- Phase 2- Reporting and Closeout of the project (Oct 2017 – Dec 2017)

Council Study Phase 1 has been completed successfully by March 2016. For it, the reader is referred to the Council Study Draft 2015 Annual Report.

During the Phase 1, the Council Study was arranged around separate Thematic and Discipline Teams. The new arrangement has been implemented for Phase 2 which maintains functions of the Thematic and Discipline Teams while integrating them inside a single integrated Central Team. The Central Team is coordinated by the Core Technical Coordinating Group. The Central Team is smaller and more cohesive than the previous implementation arrangement which involved several separate teams led by MRC Programmes. On top of cost saving and promotion of integrated approach, the transition to this new implementation arrangement is justified because of the new MRC organizational structure built on Core Functions.

In preparing this document, the required budget for the remaining scope of work for Phase 2 was re-evaluated based on i) the agreed scope of work for Phase 2 implementation, ii) the new implementation arrangement, and iii) recognition for the need to cost savings due to budget constraint. The resulting revised budget estimate of USD 2.4 M for Phase 2 is lower than the original estimate of USD 3.6 M. This estimate doesn't include a significant in-kind contribution by the MRC permanent staff.

With respect to the budget required, it has been long recognized that the Council Study is not fully funded despite the strong commitments that the Study consistently receive from the highest government level of all the Member Countries. Originally there was a significant funding gap of USD 2.38 M equalling the full Council Study budget. With the support and strong commitment of the member countries, they agreed to i) provide USD 500 K from the MRC Basket Fund 2016 and ii) borrow up to USD 500 K from the ARF to secure the funding for council study in 2016. With the results of the 7th RTWG meeting on CS, the budget plan of the council study implementation during 2016-2017 has been modified by key priority activities 1st and 2nd priority activities for 2017. For option 1 which focusing only the first priority activities, it is a total budget of USD 1.5 M with the anticipated secure funding from the EMF and BKF in 2017 with amount of USD 1.4 M and leaving the gaps of USD 100K while the option 2 which is focusing on the 1st and 2nd Priority activities for 2017 required the total amount of USD 1.64 M has been anticipated to get a secure funding from EMF and BKF in 2017 with amount of USD 1.36 M and leaving the budget gaps of USD 280 K. In addition, the scope of some components, especially the Coastal Assessment, have been radically reduced compared to the original plan and would need to be strengthened.

Along with the proposed implementation plan for the project to be completed by the end of 2017, several risks and measures to mitigate these risks have been identified. Because of the extensive preparatory work methodology testing during Phase 1 none of the risks are expected to be critical for successful finalization of the Council Study.

It should be noted that this implementation plan was prepared based on the challenges and lessons learned from Phase 1 and the recently agreed scope of Phase 2 in March 2016 and the scope of work as agreed work plan by the MCs during the 7th RTWG meeting held on 10 Oct 2016. These challenges and lessons learned are discussed in this document.

2 Introduction

2.1 Context

The **overall objective** of the Council Study is to *further enhance the ability of the MRC to advise Member Countries on the positive and negative impacts of water resources development on people, economies and the environment of the Mekong River Basin*. The study will reduce the uncertainty in estimating these impacts, providing the Members Countries with higher confidence information towards informed decision-making. The **specific objectives** of the Council Study are:

I. *Further develop/establish reliable scientific evidence base on the environment, social and economic consequences (positive and negative) of development in the Mekong Basin*
II. *Results of the study are integrated into the Mekong River Commission (MRC) knowledge base and enhance the Basin Development Planning (BDP) process*
III. *Promote capacity building and ensure technology transfer to Member Countries in the conduct of the study*.

The implementation phase of the Council Study is divided into two phases, Phase 1 and Phase 2, as illustrated in Figure 1. The phased approach has been introduced primarily because of budget constraints. The Council Study was originally intended to take a three-years but was compressed to about 1.5 years to compensate for the delays during the inception and planning phase and in the completion of the inception report. However, early in the process, it was recognized that this compressed schedule was unrealistic and was putting undue pressure to the Council Study Team. That's why the Council Study is implemented in two years' time. The extension of the Council Study was proposed as early as the 4th RTWG Meeting (March 2015) and the 41st JC Meeting (April 2015). The Phase 1 and Phase 2 implementation (with Phase 2 as basically representing the proposed extension of the implementation phase of the Council Study) was presented during the 5th and 6th RTWG Meetings, and proposed during the 42nd JC Meeting. The MCs have been in principle in agreement with the proposed extension but expressed that additional information should be provided by the Council Study Team before any approval can be officially made. During the 22nd MRC Council Meeting, the Member Countries instructed the Council Study Team to prepare a detailed implementation plan for Phase 2 (this document).

The Council Study original total budget is USD 7.1 M of which external funding (other than MRC in-kind) covers USD 6.2 M. Of this USD 3.7 M has been secured from the Development Partners and used for the Phase 1 during 2014 – 2016 for inception, planning, Discipline Team baseline work and Thematic Team data collection. The remaining Phase 2 budget of USD 2.5 M has been revised to USD 2.4 M due to cost saving measures. The Phase 2 budget is covered by i) USD 500 K from the MRC Basket Fund 2016 and ii) borrowing up to USD 500 K from the ARF. USD 1.39 M has been anticipated to the 2017 Council Study implementation from the MRC Basket Fund 2017. In addition scope of some components, especially the Coastal Assessment, have been radically reduced compared to the original plan and would need to be strengthened.

During the Phase 1 the Council Study was arranged around separate Thematic and Discipline Teams. The new arrangement has been implemented for Phase 2 which maintains functions of the Thematic and

Discipline Teams while integrating the teams within a single Central Team. The Central Team is smaller and more cohesive than the previous implementation arrangement which involved several teams led by MRC Programmes. The Central Team is coordinated by the Core Technical Coordinating Group. On top of cost saving and promotion of integrated approach, the transition to this new implementation arrangement is justified because of the new MRC organizational structure built on Core Functions.

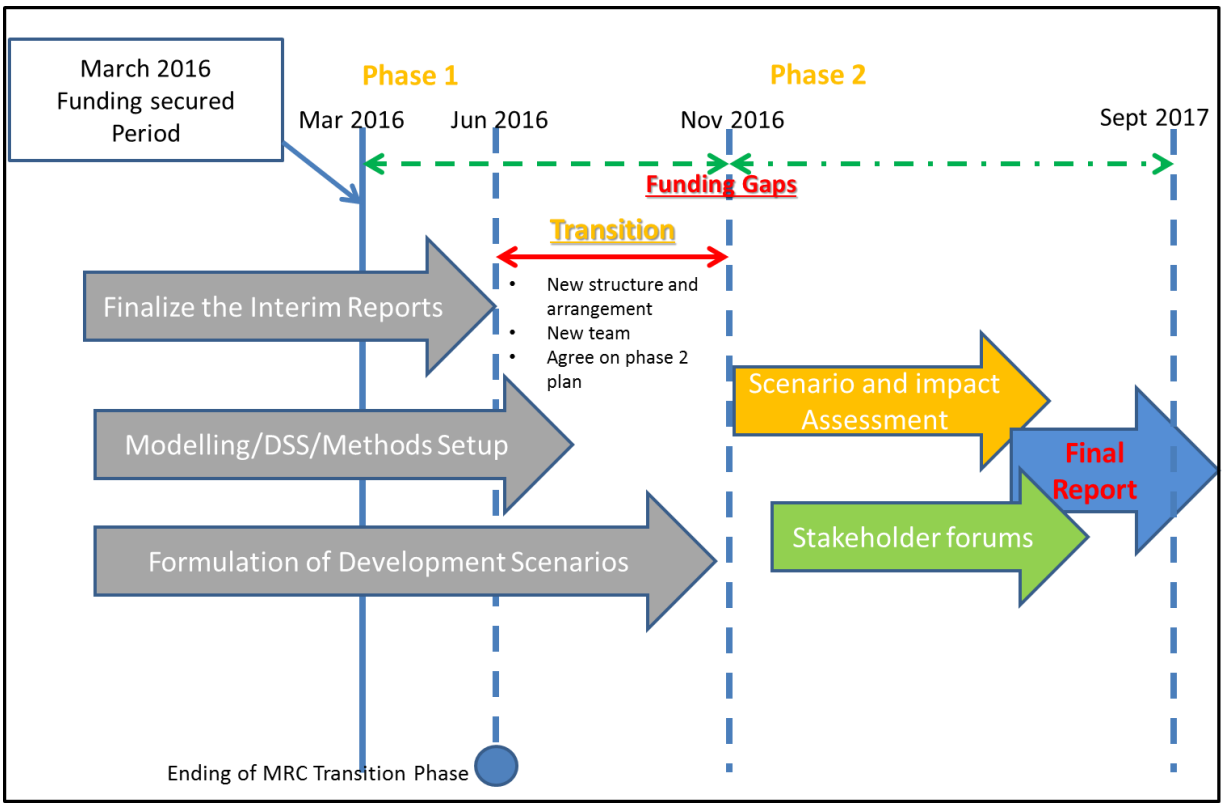

Figure 1. Proposed implementation phase

The Council Study objective of capacity building is primarily achieved with MCs learning by doing principle. As per the Inception Report, no training is explicitly funded unless it can be justified as part of performing the technical work.

2.2 Content of this Document

This document was prepared to describe the detailed implementation arrangement and schedule of tasks and deliverables for Phase 2. This document largely maintains the scope of work of the Council Study as per the approved Inception Report dated 27 October 2014. Some modifications to the scope have been made reflecting reduced CS budget compared to the original one.

This document, therefore, supersedes Chapter 4 (Study Implementation) and 5 (Study Management) of the Inception Report. However, Chapters 1-3 which are about the Council Study objectives, approach, and assessment methodology largely remain valid. When necessary, portions of the scope of work as described in the Inception Report are further elaborated in this document including any scope adjustments that have been agreed by the Member Countries during Phase 1.

2.3 Sequence of Events for Approval of This Document

This document will follow the following sequence for its review and approval.

- Initial Draft (end of January 2016)
- Member Countries Review (due on 15 February 2016)
- Second draft version (February 2016)
- Regional consultation meeting on Phase 2 implementation (end of March 2016)
- Work with the Core Team to improve the plan and updating the detailed work and budget plan (April to September 2016)
- Third draft version (September 2016)
- Member Country discussion and approval in the 7th RTWG meeting (October 2016)
- Final Draft (31 October 2016)
- Implementation begins (November 2016).

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3 Phase 2 Implementation Arrangement

3.1 Rationale

The MRC new organizational structure presents opportunities to improve the implementation arrangement of the Council Study. With the Programmes not existing anymore in the new MRC structure, a new implementation arrangement for the Council Study Secretariat Team is inevitable and necessary. The restructuring is further justified with the need to improve integration between the different disciplines and themes as well save costs. The following sections described the key features of the Phase 2 implementation arrangement and Figure 2 illustrates the proposed implementation arrangement.

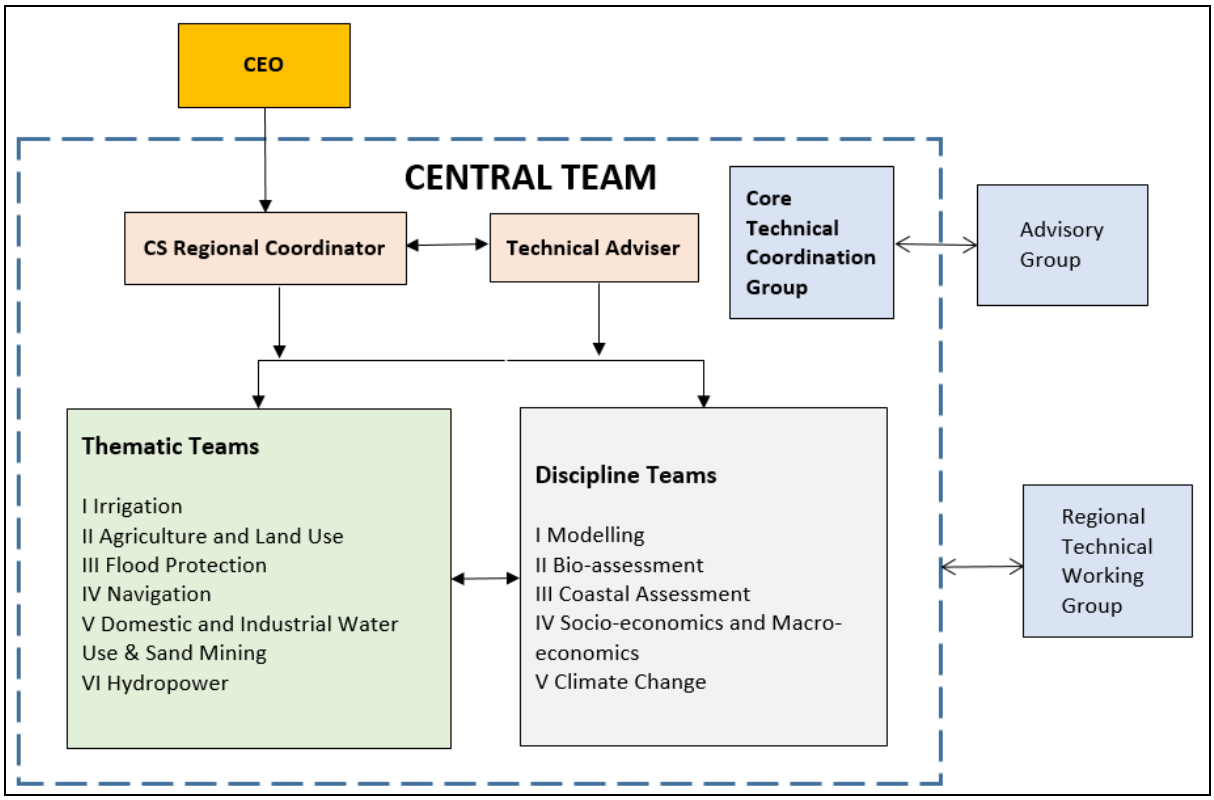


Figure 2. Implementation arrangement for Phase 2

3.2 Council Study Coordination

The current implementation of the Council Study is being managed and coordinated by the Council Study Coordinator and Technical Advisor:

- **Council Study Coordinator** to manage the scope, budget, schedule, and overall coordination of all processes and leading all sectors groups under this study

- **Technical Advisor** to support on technical coordination and consolidation of all the technical inputs of the various technical teams, provide additional technical direction, guidance, and quality control, and lead the preparation of the main reports.

For Phase 2, it is proposed to recruit two personnel, one for each distinct role as originally planned in the Inception Report.

3.2.1 Full-Time Council Study Coordinator

A full-time Council Study Coordinator will focus on day-to-day coordination and management aspects that include the following:

- Scope management
- Tracking schedules
- Controlling and tracking expenditure
- Overall management of consultants (including review/approval of timesheets and outputs)
- Coordination and communication with MCs
- Reporting to CEO and assigned Division Director
- Planning and implementation (including facilitation, post-meeting follow-up) of regional and national meetings and consultations (including stakeholder consultations)
- Communication and reporting to DPs
- Assistance to fundraising activities including proposal preparation and presentation

The Council Study Coordinator as per AWP 2016 will report directly to the MRC CEO. All consultants will be administratively supervised directly by and report directly to the Council Study Coordinator.

3.2.2 Part Time (SSA-Consultant) Technical Adviser for Technical Coordination

The part-time Technical Adviser for technical coordination will work closely with the Council Study Coordinator in the technical aspects that include the following:

- Coordinate, review, and consolidate technical inputs of the Team Members
- Provide technical direction and guidance according to technical scope and approach as per the Inception Report and agreed and documented adjustments during the implementation
- Participate during regional and national technical meetings and on as needed basis and directed by the Council Study Coordinator, participate in thematic- and discipline-specific technical meetings
- Synthesize Council Study results especially for the Cumulative Report
- Lead and serve as the primary author of the main report deliverables

The technical adviser will be supervised by and will report directly to the Council Study Coordinator.

3.2.3 Core Technical Coordination Group

A Core Team will be formed to lead the technical work on the various thematic areas and disciplines. This Core Team which is smaller and focuses more on the technical aspects essentially replaces the MRCS Coordinating Group of the Council Study. The Core Team role and responsibilities as the following:

- Serve as a technical platform to support the council study implementation
- Develop a consolidated work plan for council study implementation
- Development of the joint CS impact assessment framework
- Finalization of the development scenarios for CS including main and sub-scenarios
- Report overall and individual team progress
- Discuss and resolve specific management and technical issues. This includes creating ad-hoc technical working groups to plan and execute measures to resolve issues
- Elevate requests for review, guidance, and decisions to RTWG and NMCs and Line Agencies through the CEO
- Self-monitor and evaluate performance
- Review overall work plan/schedule and make/recommend necessary adjustments

The Core Team members include the following:

1 Regional coordinator for council study
2 International Technical advisor
3 Team leaders of thematic and discipline teams
4 International modelers on DSF and WUP-Fin
5 International consultant on Biora
6 International experts on Socioeconomic

Each technical member of the Core Team will be primarily responsible for conducting the required technical work and preparing the report deliverables for their respective thematic areas and disciplines. The Administrative Assistant will report directly to the Council Study Coordinator to provide as-needed administrative and logistic support to the Council Study activities.

3.2.4 Advisory Group

An advisory group will be formed to advise the Core Team on a periodic basis or as per request by the Core Team. The advisory group will be composed of Division Directors, assigned senior technical staff including former Programme Coordinators who were involved in Phase 1 and have remained with the Secretariat.

3.3 Central Team

The Central Team is the Council Study implementing management and technical team. The thematic and discipline functions will be maintained under the Central Team although in more lean and integrated form. Corollary to this, following changes have been implemented:

- The Thematic Teams will consist relevant single MRC staff for each theme.
- The Thematic Teams will be supported by international consultants for final thematic report writing.
- The socio-economic and macro-economic disciplines will be combined.
- An MRC socio-economic specialist will lead the socio-economic/macro-economic assessment. He will be supported by social and economic consultants.

- There will be no Cumulative Assessment Team anymore. The analysis of the modeling results, integration of the Thematic Team outputs and the preparation of the Cumulative Report will be the responsibility of the Technical Advisor.
- Logical framework for the thematic areas will be developed starting from thematic deliverables (policy reports), indicators supporting the deliverables and modelling team inputs to achieve the deliverables.
- Modelling Team will be in charge of assessing, collecting, gap-filling and implementing Thematic Team data and scenarios together with the thematic leads.
- The Modelling, Bio-assessment, and Socio-economic teams will be closely coordinated in terms of schedules, indicators and outputs/inputs.

4 Scope of Work

4.1 General Principles

The main objective of Phase 2 is the assessment of the environmental, social, and economic impacts of water resource developments under the various development scenarios with and without climate change.

In general, the technical scope of work and the main report deliverables remain the same as documented in the approved Inception Report dated 27 October 2014. In order to produce the Study deliverables, the technical scope of work was subdivided under four major technical activities namely:

- Activity 1: Formulation of development scenarios; Thematic data collection; Development and setup of models, DSS, BioRA DRIFT and other tools (Phase 1)
- Activity 2: Phase 1 finalization focusing on the thematic data collection; Update of Phase 2 Implementation Plan; Council Study restructuring; Recruitment and other preparation for Phase 2; BioRa assessment tools development (Transition Period)
- Activity 3: Scenario Assessments (Phase 2)
- Activity 4: Preparation of Final Reports (Closure period)

This Phase 2 final Implementation Plan is prepared after successful completion of Phase 1 and partial execution of the Transition Period.

4.2 Thematic Scope

As defined by the Council Study Inception Report, taking into account the basin-wide MRC context as well as the needs for a comprehensive and holistic sustainability study for the Mekong River Basin, the Study covers the important thematic IWRM sectors and sub-sectors that contribute to development in the basin:

1. Irrigation; including water use, return flows, water quality, and proposed diversions;
2. Agriculture and Land use; including watershed management, deforestation, livestock and aquaculture, and fisheries;

3. Domestic and Industrial use; including mining, sediment extraction, waste water disposal, urban development, and water quality;
4. Flood protection structures and floodplain infrastructure;
5. Hydropower, including potential of alternative energy options;
6. Navigation; including infrastructure to aid navigation.

Phase 2 is structured around achieving the deliverables listed in the Council Study Inception Report dated October 2014. The deliverables will guide the Thematic Teamwork especially for their output indicators and define what type of information is required from the Discipline Teams (see ANNEX I for the details). The main (policy) deliverables are:

1. A Thematic Report on the Impacts and Benefits of Irrigation Development in the Lower Mekong River Basin Including Recommendations for Impact Avoidance and Mitigation Measures.
   The report will highlight the rate of irrigation expansion and the induced changes in flow parameters and the resulting changes in environmental, social and economic parameters including issues of food security, employment and transboundary benefits and costs. The report will also cover the impacts of irrigation on fisheries and the impacts of other developments on irrigation including dry season irrigation.

2. A Thematic Report on Impacts of Non-irrigated Agriculture Development and General Trends in Major Land-Use Categories in the Lower Mekong River Basin Including Recommendations for Impact Avoidance and Mitigation Measures.
   The report will indicate how land-use change including agricultural expansion can influence river to flow in term of quantity, quality, timing and content (i.e. sediment, nutrients, etc.) and the resulting transboundary positive and negative impacts on environmental, social and economic parameters. The changes in sediment transport linked to land-use change and erosion will be a key section in this report.

3. A Thematic Report on Impacts and Benefits of Domestic and Industrial Water Use in the Lower Mekong River Basin including Recommendations for Impact Avoidance and Mitigation Measures.
   This report will contain an updated map of large existing and planned and expanding urban and industrial centers within the basin, estimate water demand over the period covered by the Council Study, estimate general effluent and waste water discharge and highlight any possible risks of industrial spills or similar significant impacts. The report will further provide an estimate of the impact (positive or negative) of development in other sectors on domestic and industrial water use.

4. A Thematic Report on Impacts and Benefits of Flood Protection Structures and Floodplain Infrastructure and Impact of other Developments on Flood Risk Including Recommendations for Impact Avoidance and Mitigation Measures.
   The report will provide an assessment of the transboundary flood protection benefit and risks of existing and planned infrastructure. Furthermore, it will describe how these structures can influence river flow in term of quantity, quality, timing, and content and the resulting transboundary positive and negative impacts on environmental, social and economic parameters.

The changes in sediment transport and ecosystem fragmentation will be a key section in this report as they are highly relevant for agriculture and fisheries, thus for food security.

5. A Thematic Report on Impacts and Benefits of Hydropower Development in the Lower Mekong River Basin Including Recommendations for Impact Avoidance and Mitigation Measures.
   The report will present an assessment of the cumulative positive and negative impacts of hydropower development in selected Lower Mekong River tributaries and the mainstream. The focus will be on how the dams can influence fisheries, river flow, sediment and nutrient flux in term of quantity, quality, timing and the resulting transboundary positive and negative impacts on environmental, social and economic parameters in the mainstream corridor, floodplains and Delta as well as coastal processes. Two key sections of this report will be an estimation of the disaggregated economic benefits and updated assessment of sediment transport and the effect of change on geomorphology, bank erosion and coastal processes and fisheries.

6. A Thematic Report on the Impacts and Benefits of Navigation Infrastructure Development in the Lower Mekong River Basin Including Recommendations for Impact Avoidance and Mitigation Measures.
   The report will include two main sections: an assessment of how existing and planned navigation infrastructure can influence river flow in term of quantity, quality, timing and content and the resulting transboundary positive and negative impacts on environmental, social and economic parameters and an assessment of the positive and negative impacts of water resources development in other thematic areas on navigation.

7. A Report on the Cumulative Impacts and Benefits of the Selected Water Resources Developments (Cumulative Report) Including Recommendations for Impact Avoidance and Mitigation Measures.
   This report will highlight the cumulative impact of the developments in the six thematic areas of the river flow in term of quantity, quality, timing, and content and clearly indicate resulting transboundary positive and negative impacts on environmental, social and economic parameters. It will also show the economic benefits and costs of development including the direct costs and benefits, positive and negative economic externalities from the developments assessed in the six thematic areas including ecosystem services and social impacts and multiplier effects of development including impact on regional macro-economic development, trade flows, replacement costs of lost benefits, etc.

These reports will present the positive and negative impacts of the selected water resources developments assessed in the Council Study[1], highlight key concerns and present clear recommendations for the sustainable management and development of the Mekong River Basin including Impacts of Mainstream Hydropower Projects.

[1] Refers to the specific projects selected by the RTWG for analysis in the Council Study.

4.3 Geographical Scope

For the thematic topics identified as causing impact, listed in the previous section, the whole Mekong River Basin will be considered. A special focal area will be addressing the development on the Upper Mekong (Lancang) with respect to infrastructure and water use.

However, with respect to impacts (positive and negative) of a physical nature the focus would be on the following four areas:

1. A corridor on both sides of the mainstream from Chinese border to Kratie (Cambodia)
2. The Cambodia Floodplains including the Tonle Sap River and Great Lake
3. The Mekong Delta in Cambodia and Viet Nam
4. The coastal areas directly influenced by the Mekong River

The Mekong mainstream corridor is chosen based on the fact that along the mainstream, the cumulative impact of development and management in the basin is being directly felt, whereas in the tributaries the impact is mainly due to the activities in the specific tributary. The corridor area is based on the extent of direct impact on livelihoods dependent on the mainstream as defined by the MRC Social Impact Monitoring and Vulnerability Assessment, or SIM/VA, of the Environment Programme. The SIM/VA corridor is shown in Figure 3.

Tonle Sap River and Great Lake and other floodplains in Cambodia is an important area as it forms a unique hydro-ecological system with a unique fishery within the Mekong River Basin which is directly impacted by changes in the flow of the Mekong mainstream with respect to the flood pulse, sediment replenishment, flood extent, etc.

The Mekong Delta in Cambodia and Viet Nam are proposed because being at the end of the river's course it will be affected by the cumulative impact of infrastructure and water use. The central importance of the delta in agriculture and fisheries/aquaculture productivity makes it important to assess the potential impact, but also competing uses of water from the high population and many urban centers needs to be considered.

The coastal areas in this context are to be delimited to the areas directly affected by changes in the Mekong River's discharge into the sea together with the significance of coastal fisheries and coastal processes (affecting issues such as coastal erosion and impacts of sea-level rise) makes this an important area to study.

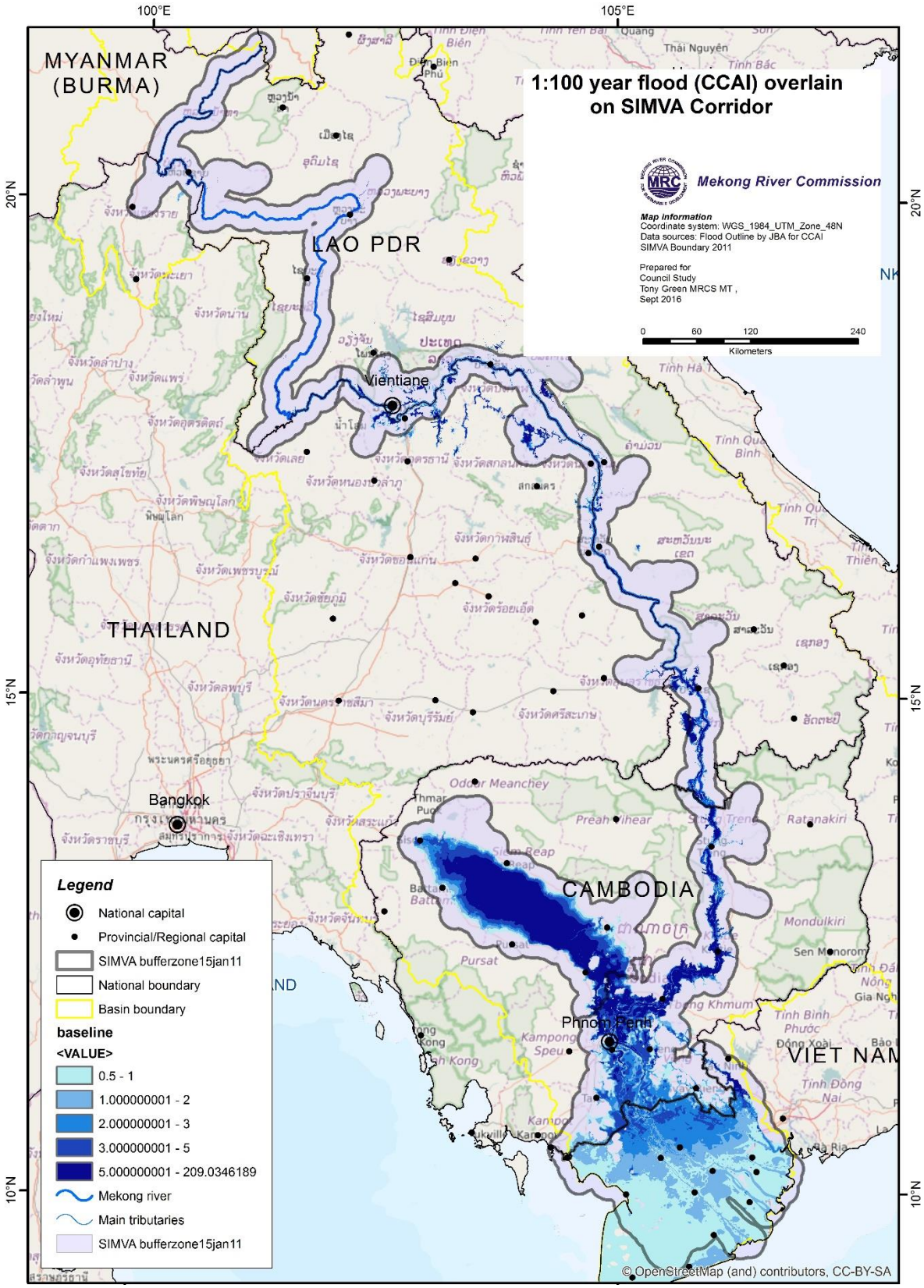


Figure 3. SIM/VA Mekong mainstream livelihoods impact corridor.

4.4 Stakeholder Engagement

MRC as a regional institution explicitly committed to public participation in its activities will seek broad stakeholder support for the Study. The objective of stakeholder engagement will be to manage expectations and develop a common understanding of the elements of the Council Study (objectives, values, scientific approach). This will be achieved through communication and discussion and will go beyond the simple dissemination and receipt of information.

The Council Study coordinator will work with the Regional Technical Group to identify key stakeholders and the issues of concern to them. As stakeholders are diverse, the engagement modalities may need to be catered to each group. This will require the mapping of key stakeholders and their stake in the Council Study and the development of targeted engagement modalities.

5 Development Scenarios

5.1 Proposed the Development Scenarios

Table 1 shows the complete list of main development scenarios and thematic sub-scenarios that were originally considered for assessment. During the 6th RTWG meeting, the following decisions were made in relation to these development scenarios.

- Flood Protection thematic sub-scenarios (scenario IDs 13, 14 and 15 in the table below) are removed from further consideration. As per RTWG concurrence, the level of flood protection infrastructure for 2020 and 2040 main development scenarios (scenario IDs 2 and 3) will be kept at the 2007 level, unlike other thematic sectors. The justification is that the assessment of the 2020 and 2040 main development scenarios 2020 and 2040 will allow the determination of the increase or decrease in flood risk in the absence of any additional flood protection. This information will be useful in determining flood protection measures for 2020 and 2040 that will effectively reduce the flood risk to acceptable levels.
- Only two navigation development scenarios have been proposed. i) The navigation scenario involving navigation infrastructure in conjunction with the full cascade of mainstream dams (Hua May to Kratie) is equivalent to the main development scenario 2040. ii) The navigation scenario involving navigation infrastructure in conjunction with the cascade upstream of Vientiane (Hua Xay to Vientiane) is assigned to be a Navigation thematic sub-scenario (scenario ID # 22).

The above decisions consequently reduce the number of development scenarios to be assessed from 24 to 19 scenarios. These 19 scenarios are further categorized using the following priorities:

- <u>High Priority:</u> This includes main development scenarios 2007, 2020 and 2040 with and without climate change (6 scenarios)
- <u>Medium Priority:</u> This includes the thematic sub-scenarios for the hydropower, irrigation, and navigation thematic area (7 scenarios)
- <u>Low Priority:</u> This includes the thematic sub-scenarios for the agriculture/land use change, and domestic/industrial thematic areas (6 scenarios). It should be noted that for the domestic/industrial thematic area, the focus will be on the level of sand mining and not on the domestic/industrial water consistent with

guidance from the Member Countries that this water use is known to have an insignificant impact.

Table 1. List of existing proposal for the development scenarios considered for assessment under the Council Study.

Scene #	Name	Level of Development*						Climate Change	Priority
		ALU	DIW	FPF	HPP	IRR	NAV		
1	Early Development Scenario 2007	2007	2007	2007	2007	2007	2007	No	High
2	Definite Future Scenario 2020	2020	2020	2007**	2020	2020	2020	No	High
3	Planned Development Scenario 2040	2040	2040	2007**	2040	2040	2040	No	High
4	Planned Development 2040 Under Low Climate Change	2040	2040	2040	2040	2040	2040	Yes – Low	High
5	Planned Development 2040 Under Medium Climate Change	2040	2040	2040	2040	2040	2040	Yes – Medium	High
6	Planned Development 2040 Under High Climate Change	2040	2040	2040	2040	2040	2040	Yes – High	High
7	ALU Thematic Sub-scenario 1: Low Level of implementation of 2040 Planned Development	Low	2040	2040	2040	2040	2040	No	Low
8	ALU Thematic Sub-scenario 2: Medium Level of implementation of 2040 Planned Development	Medium	2040	2040	2040	2040	2040	No	Low
9	ALU Thematic Sub-scenario 3: High Level of implementation of 2040 Planned Development	High	2040	2040	2040	2040	2040	No	Low
10	DIW Thematic Sub-scenario 1	2040	Low	2040	2040	2040	2040	No	Low
11	DIW Thematic Sub-scenario 2	2040	Medium	2040	2040	2040	2040	No	Low
12	DIW Thematic Sub-scenario 3	2040	High	2040	2040	2040	2040	No	Low
13	FPF Thematic Sub-Scenario 1								Cancelled
14	FPF Thematic Sub-Scenario 2								Cancelled
15	FPF Thematic Sub-Scenario 3								Cancelled
16	HPP Thematic Sub-scenario 1	2040	2040	2040	HPS1	2040	2040	No	Medium
17	HPP Thematic Sub-scenario 2	2040	2040	2040	HPS2	2040	2040	No	Medium
18	HPP Thematic Sub-scenario 3	2040	2040	2040	HPS3	2040	2040	No	Medium
19	IRR Thematic Sub-scenario 1	2040	2040	2040	2040	Low	2040	No	Medium
20	IRR Thematic Sub-scenario 2	2040	2040	2040	2040	Medium	2040	No	Medium
21	IRR Thematic Sub-scenario 3	2040	2040	2040	2040	High	2040	No	Medium
22	NAV Thematic Sub-scenario 1	2040	2040	2040	2040	2040	HPS1***	No	Medium
23	NAV Thematic Sub-scenario 1								Cancelled
24	NAV Thematic Sub-scenario 1								Cancelled

Note:
*Levels of developments for the various thematic areas: ALU = Agric/Landuse Change; DIW = Domestic and Industrial Water Use; FPF = flood protection/floodplain infrastructure; HPP = hydropower; IRR = irrigation; and NAV = Navigation
**Level of flood protection in development scenarios 2020 and 2040 are maintained at 2007 level
***Navigation level of infrastructure is in conjunction with HPP sub-scenario HSP1 (i.e., mainstream dams upstream of Vientiane)

5.2 A Final Proposed Development Scenarios

5.2.1 Proposed Main Development Scenarios

As a result of the Regional Consultation Meeting on CS Phase 2 Implementation, the member countries agreed to select option 4 ("hybrid option") for the Phase 2 implementation. This option focuses on the cumulative study and the hydropower thematic study and implements the selected priority thematic sub-scenarios 2040 for irrigation, flood protection, and sand mining. The final list of the development scenarios is presented in table 3 below.

The Council Study Phase 2 will be focusing on the 5 main development high priority scenarios with and without climate change and 2 additional main development scenarios for 1960 and 2000 as a second priority if fund and time available.

In addition to the abovementioned development scenarios, the following two development scenarios listed in Table 2 be considered for assessment as per agreement by the Member Countries during the Small Technical Workgroup Meeting on Reference Scenario. For additional details, the reader is referred to the Draft Working Paper on Reference Scenario and Meeting Minutes which are available in the Council Study Team Site. It should be noted that the assessment of the 1960 and 2000 development scenarios will focus on impacts on flow and sediment. It should also be noted that data has not been identified and collected to support the formulation of these development scenarios although BDP2 Study can be used to provide initial data for the hydropower, irrigation, and domestic/industrial water use for the 2000 development scenario. As per agreement of the Member Countries, the availability of the data required to support the 1960 development scenario will be evaluated first before the formulation of the 1960 development scenario and its assessment can proceed. However, due to the limitation of budget and data availability, the 7th RTWG meeting recommended to classified this additional scenarios 1960 as the second priority.

Table 2. Additional development scenarios as per Technical Working Group Meeting on Reference Scenario, 12 November 2015, OSV

Scene #	Name	Level of Development*						Climate Change	Priority
		ALU	DIW	FPF	HPP	IRR	NAV		
25	Development Scenario 1960	1960	1960	1960	1960	1960	1960	No	Second Priority**
26	Development Scenario 2000	2000	2000	2000	2000	2000	2000	No	High

Table 3. Final proposed list of main and sub-development scenarios for Council study implementation

Scene #	Name	Level of Development*						Climate Change	Priority
		ALU	DIW	FPF	HPP	IRR	NAV		
	Cumulative Impact Asessment	+	+	+	+	+	+	+/- CC	High
	Main Development Scenario								
1	Early Development Scenario 2007	2007	2007	2007	2007	2007	2007	No	High
2	Definite Future Scenario 2020	2020	2020	2020**	2020	2020	2020	No	High
3	Planned Development Scenario 2040	2040	2040	2040**	2040	2040	2040	No & Yes	High
	Additional Main development scenarios								
4	Development Scenario 1960	1960	1960	1960	1960	1960	1960	No	High
5	Development Scenario 2000	2000	2000	2000	2000	2000	2000	No	High
	2040 Sub-Scenario								

	Development								
6	ALU Thematic Sub-scenario 1: Low Level of implementation of 2040 Planned Development								Cancelled
7	ALU Thematic Sub-scenario 2: Medium Level of implementation of 2040 Planned Development								Cancelled
8	ALU Thematic Sub-scenario 3: High Level of implementation of 2040 Planned Development	ALU3	2040	2040	2040	2040	2040	No	High**
9	DIW Thematic Sub-scenario 1- Substainable sand mining in the mainsteam	2040	DIW1	2040	2040	2040	2040	No	Second Priority**
10	DIW Thematic Sub-scenario 2- High sand mining rate in the mainstream	2040	DIW2	2040	2040	2040	2040	No	Second Priority**
11	DIW Thematic Sub-scenario 3								Cancelled
12	FPF Thematic Sub-Scenario 1								Cancelled
13	FPF Thematic Sub-Scenario 2	2040	2040	FPF 2	2040	2040	2040	No	High
14	FPF Thematic Sub-Scenario 3	2040	2040	FPF 3	2040	2040	2040	No	High
15	HPP Thematic Sub-scenario 1	2040	2040	2040	HPS1	2040	2040	No	High
16	HPP Thematic Sub-scenario 2	2040	2040	2040	HPS2	2040	2040	No	High
17	HPP Thematic Sub-scenario 3								Cancelled
18	IRR Thematic Sub-scenario 1								Cancelled
19	IRR Thematic Sub-scenario 2								Cancelled
20	IRR Thematic Sub-scenario 3	2040	2040	2040	2040	High	2040	No	High
21	NAV Thematic Sub-scenario 1								Cancelled
22	NAV Thematic Sub-scenario 1								Cancelled
23	NAV Thematic Sub-scenario 1								Cancelled
24	Planned Development 2040 Under Low Climate Change	2040	2040	2040	2040	2040	2040	Yes – Wet overall	High
25	Planned Development 2040 Under Medium Climate Change	2040	2040	2040	2040	2040	2040	Yes – Dry overall	High
26	Planned Development 2040 Under High Climate Change	2040	2040	2040	2040	2040	2040	Yes – Increased seasonal variability	High

Note:
*Levels of developments for the various thematic areas: ALU = Agric/Landuse Change; DIW = Domestic and Industrial Water Use; FPF = flood protection/floodplain infrastructure; HPP = hydropower; IRR = irrigation; and NAV = Navigation
**in the last 7th RTWG meeting, the member countries suggested that due to the budget, time, data and resource limitation, the Meeting suggested to i) keep the main development scenarios for 1960 as second priority, ii) the sub-scenarios for sand mining as second priority, iii) suggest to add sub-scenarios #3 for agriculture and land use as high priority, and iv) suggested to keep the subscenaiors for flood only #2&#3 as high priority.

5.2.2 Proposed Sub-Development scenarios

For the Hydropower impact assessment, the phase 2 implementation will be on 6 main development scenarios with and without climate change (as part of the Cumulative Study) with original agreed plan 3 thematic sub-scenarios (as documented in Working Paper "Development Scenarios for the Hydropower Thematic Area) and may also consider potential additional thematic sub-scenarios to validate/supplement/extend the Mekong Delta Study.

1) Previously proposed Sub-Scenarios:

The 2040 sub-scenarios (old proposal) planning for conducting the impact assessment includes:

HPS1: Mainstream dams upstream of Vientiane (Pak Beng, Luang Prabang, Xayaburi, Pak lay, and Sanakham, and All Trib Dams; No joint reservoir operation

The level of Development: Subset of Planned mainstream HPs implemented - The "subset" will be determined with MC on the basis of realistic constraints to full development. (see HP Scenario Report)

i) Only Se San 2 HPP built in Cambodia
ii) Some 6-8 Mainstream Dams which mainly are in the Lao PDR,
iii) About some 80% of Tributary hydropower dams built in Lao PDR and Cambodia;
iv) All the 6 UMB Chinese dams should be included in this scenario.
v) No Joint Operation (limited coordination) where each hydropower dam will be operated to maximize their individual energy production.

HPS2: Joint Operation among mainstream dams for navigation, fish passage, sediment flushing, and water quality considerations

- Level of Development as for HPS1
- Joint Operation and good coordination among all MS Dams and by taking account operation for navigation lock, fish passages, sediment flushing as well as measure to maintain acceptable water quality during and after sediment flushing.

HPS3: Joint Operation among mainstream dams and selected tributary dams for flood management and protection.

- As per HPST2 with some basin-wide Joint Operation and good coordination among all MS Dams and most tributary dams to strengthen flood management and flood protection measures throughout the Lower Mekong Basin as well as to maximize navigation potential.

2) Review of the Sub Scenarios:

- Certain changes have occurred to the basic assumptions for the scenarios since these Sub-scenarios were proposed in December 2015:
- New assumptions on the design and operations of the Base 2040 Scenario as per the above; therefore, some of the mitigation and operational changes are included in the base 2040 Scenario.
- The budget for the assessment is limited therefore reduce the number of scenarios to be analyzed by the MT and the BIORA and other discipline teams.

3) Proposed updated of HP Sub Scenarios:

- **HPST1:**
  - Level of Development: Subset of Planned mainstream HPs implemented - (as discussed with MC - see HP Scenario Report)
  - Mitigation and operations (limited coordination) as per the Base 2040 Scenario.

    - The HP Thematic report will assess the balance between economic, environment and social impacts due to the net change to the power production.
- **HPST2:**
    - Level of Development: Subset of Planned mainstream HPs implemented - (as discussed with MC - see HP Scenario Report)
    - Joint operation of key dams in the mainstream cascade and key tributary dams to improve production, multi-purpose opportunities and reduce impacts.
    - This will be based substantially on the ISH0306 outcomes and recommendations.
    - This contains combined elements of the previous HPST3 – therefore no need to repeat.

For flood protection: the phase 2 implementation will be on 6 main development scenarios with and without climate change (as part of the Cumulative Study) and it is proposed to focus on 2 thematic sub-scenarios as follows:

- FPF2: Urban protection at 1:100 ARP + floodplain management 1:20 ARP
- FPF 3: Joint Operation among mainstream dams and selected tributary dams for flood management and protection

For irrigation, the phase 2 implementation will be on 6 main development scenarios with and without climate change (as part of the Cumulative Study) and it is proposed to focus on 1 selected thematic sub-scenarios as follows:

- IRR 1: the Highest level of the irrigated area expansion in 2040

For Sand Mining, the phase 2 implementation will be on 6 main development scenarios with and without climate change (as part of the Cumulative Study) for domestic and industrial water use and it is proposed to focus on 2 selected thematic sub-scenarios as follows:

- DIW 1: Sustainable sand mining in the mainstream
- DIW2: High sand mining rate in the mainstream

For Agriculture and land use, the phase 2 implementation will be focusing only 1 sub-scenarios on land use.

- ALU 3: High Level of agriculture area expansions in the basin

5.3 Reference Period

The daily time-series flow, sediment, and water quality will be simulated for all development scenarios over the common 24-year reference period 1985 – 2008. As an additional analysis specifically requested by Lao PDR for their specific purpose, the 1960 development scenario will also be simulated over the period 1960 – 1984. The available of data to support the technical feasibility of conducting this additional simulation will be evaluated and presented to the Member Countries. More detailed information on the reference period is available in the Draft Working Paper on Reference Scenario and Meeting Minutes.

5.4 Reference Scenario and Indicator Statistics for Scenario Comparison

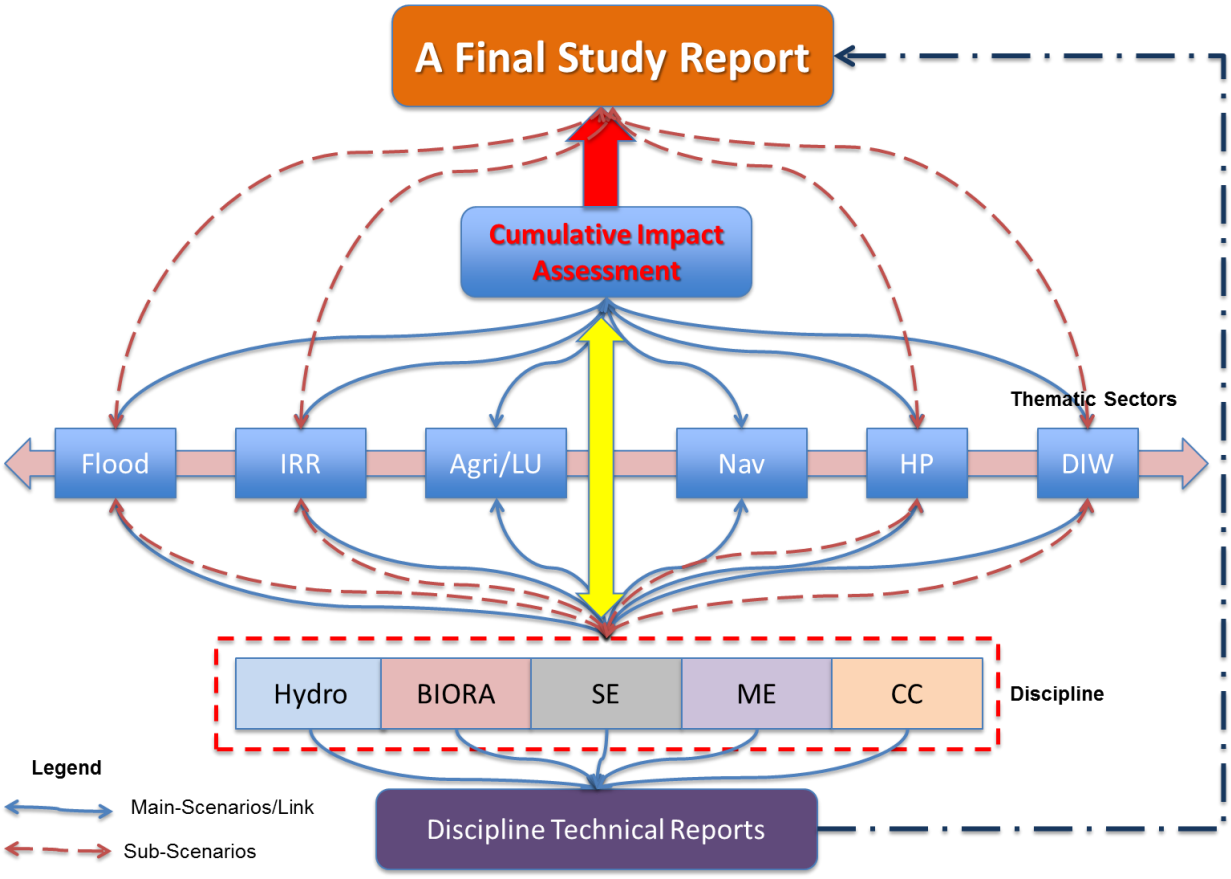
The development scenario 2007 will be used as the reference scenario which will be used as the common basis for comparing the assessment results of all other development scenarios. The comparison will be using a number of indicator statistics (average monthly flow, annual average

sediment load, etc.). These indicator statistics will be identified and selected in consultation with Member Countries. These indicator statistics may be selected from the modeled (hydrologic, hydraulic, sediment, and water quality) indicators that have been already identified for the BioRA DSS (i.e., modeled indicators that are linked to the various ecosystem indicators). More detailed information on the reference scenario is available in the Draft Working Paper on Reference Scenario and Meeting Minutes.

6 Assessment Framework

Although modeling plays a central role for the Phase 2 assessment, the modeling framework is not described in detail in this document. This is because it has been extensively documented, verified and communicated during Phase 1.

Modeling data status and requirements are presented in ANNEX II. Modeling linkages are presented in the diagram below.



6.1 Thematic Impact Areas

The six thematic areas will be assessed in terms of positive and negative impacts on a number of primary physical and biological (environmental) aspects, which include;

a. Fisheries and fish production including impacts of over-fishing and illegal fishing;
b. Environmental condition/health, the definition of which will be agreed upon for the study;
c. Biodiversity using internationally established indices;
d. Hydrology/water quantity which include ground water;
e. Water availability (drought);
f. Flood;
g. Food production;
h. Sediment transport including river bank stability, sand mining, delta sediment plume; and
i. Water quality including salinity intrusion.

There is also a need to assess how these changes result in positive and/or negative impacts on more complex social and economic aspects such as;

i. Food Security including impacts on food safety to the extent practicable;
ii. Quality of life-based on either existing indices of United Nations (UN) organizations, or new indices developed specifically for the MRB;
iii. Flood risk;
iv. Drought risk;
v. Human health, focusing on standard parameters used to assess health and Millennium Development Goals such as water-borne disease;
vi. Social development including changes in cultural and traditional aspects of life. Impacts of demographic change will also be considered.
vii. Economic development;
viii. Employment with a focus on income generation; and
ix. Distribution of economic benefits.

6.2 Impact of Climate Change

Climate change is an important factor in the Study and will be assessed in terms of how it may exacerbate (increase) or mitigate (reduce) some of the impacts caused by changes in water use, in essence, the Study will identify the risks and opportunities that climate change provides in the context of basin development.

There are already a number of climate change initiatives in the region, including the Climate Change and Adaptation Initiative (CCAI) of MRC. The Study will be able to draw from the information of these initiatives and use the modeling outputs to provide insights into the impacts relevant to the Study.

6.3 Overview of the Assessment Methodology and Framework

As indicated in the Council Study TOR, two impact pathways will be considered in the assessment;

1. Positive and negative impacts of water resource developments via changes in the hydrological regime. To illustrate, a dam or an irrigation project changes the timing, quantity, quality and/or content of the water which changes the biota which in turn has a socio-economic impact. This is similar to the process considered in the Integrated Basin Flow Management initiative.

2. Positive and negative impacts not transmitted via the hydrological regime. These include the primary and secondary economic costs and benefits of the selected water resources developments and infrastructure as well as other social benefits including access to services, employment opportunities, social displacement, migration, and gender impacts.

6.3.1 Assessment of Positive and Negative Impacts of Water Resource Development via Changes in the Hydrological Regime

Considering that many of the positive and negative impacts of water resources developments will be transmitted from the point of development to other countries and areas via changes in the hydrological regime, the Council Study will invest considerable time and effort in estimating those impacts.

These water resources developments to be analyzed may be located on the mainstream Mekong River or in any of the tributaries in the LMB. The analysis of impacts of the water resources developments on the river ecosystem and people will be limited to the Mekong River and Tonle Sap River and Great Lake and the Mekong Delta.

The Council Study will assess water resources developments in six Thematic Areas via its impact on five Discipline Areas (Figure 4). A team representing each Thematic Area will be tasked with developing and analyzing a series of water resources developments pertaining to their area. These developments may be located on the Mekong River or in any of the tributaries of the Lower Mekong River.

They will be assisted by the discipline teams who will be responsible for the analysis of the impacts in the mainstream Mekong River, Tonle Sap River and Great Lake and Mekong Delta of the water resources developments, including on the hydrological and sediment regimes, the riverine ecosystem and on the people with close links to the river and on the national economies.

The discipline teams will use information provided by the thematic teams to:

- Analyse and write up the impacts of the selected water resources developments on the:
    - hydrological regimes and flooding **(Modelling)**
    - sediments, nutrients and salinity (**Modelling**)
    - agricultural, fisheries and aquaculture productivity (**Modelling**)
    - aquatic habitats (**Bio-assessment**)
    - aquatic ecosystems (**Bio-assessment**)
    - river-linked livelihoods and ecosystem services (**Socio-economics**)
    - (macro) economics (**Socio-economics**)
- Provide assistance with knock-on effects of options in one Thematic Area on another **(Modelling)**
- Provide assistance with integrating the resource and macro-economic costs and benefits the selected water resources developments into each thematic description **(Socio-economics).**

Climate Change is part of each analysis. **Coastal Assessment** will provide through a consultancy package.

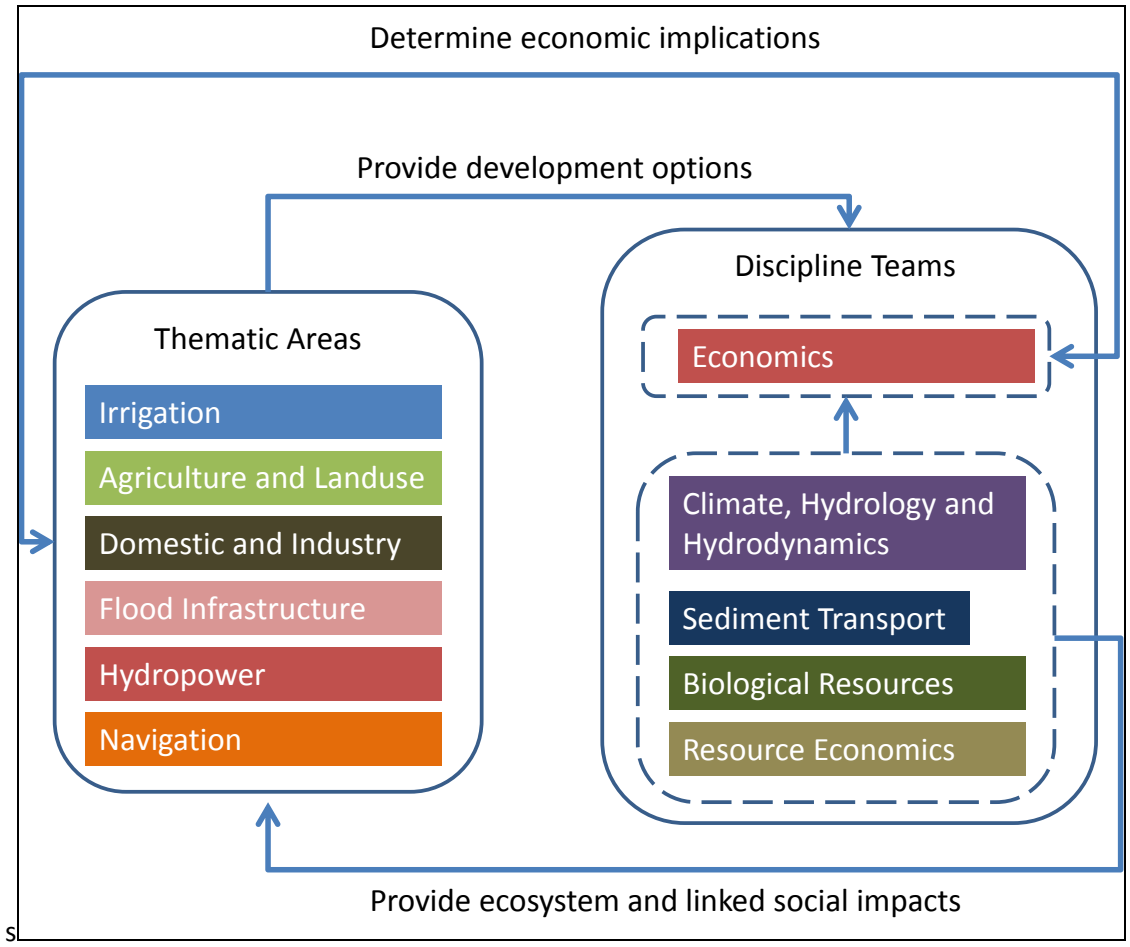


Figure 4. Organization and summary of information flow for the Council Study

6.3.2 Assessment of Positive and Negative Impacts of Water Resources Developments not Transmitted via the Hydrological Regime

A number of these impacts such as the primary and secondary economic costs and benefits of the selected water resources developments and infrastructure and social benefits including access to services, employment , social displacement, migration, and gender impacts will be captured in the social and economic assessments indicated above. However, there will be sector specific impacts that will need to be assessed separately by the relevant thematic teams.

Most of these sector-specific areas are described in the Council Study ToR T and in the specific Work Packages included as an annex to this report. These assessments will be the responsibility of the specific thematic teams with the support of consultants as needed and they range from evaluation of local impacts of water resource development projects to sector specific transboundary impacts.

Some of the direct impacts that need to be considered include:

Impacts of Sand Mining: There is considerable discussion on the various impacts of wide-scale sand mining. It was concluded in the Council Study planning meeting that the Environmental Programme would undertake this task with the support of consultants.

Navigation: It is likely that navigation infrastructure developments will not be of sufficient scale to cause significant transboundary environmental, social or economic impacts because of their limited impact on the flow regime. The only impacts in this context may be some potential impacts via localized water pollution and bank erosion from increased navigation.

However, the need for risk assessments, especially of major events such as oil or chemical spills have been indicated. Such a risk assessment would need to be carried out by the navigation thematic team with the support of specialized consultants as required and will include the following steps:

1. Data Gathering and Familiarisation
2. Hazard Identification
3. Risk Analysis
4. Risk Assessment
5. Recommendations for Risk Control

6.4 Bio-resources Assessment

The objective of the Biological Resources Assessment (BioRA) is to provide clear and comparable information on the impacts of proposed thematic developments on the aquatic resources of mainstream Mekong River downstream of the China border, inclusive of the Tonle Sap River, Great Lake, and the Mekong Delta.

Within BioRA, the DRIFT method (Brown *et al.* 2013) is being used to organize existing MRC data, information in the international scientific literature and expert opinion to provide a systemic and systematic picture for the Mekong River, Tonle Sap River, Tonle Sap Great Lake and the Mekong Delta ecosystems in terms of:

- their reference ecological integrity (health);
- possible future changes in integrity, as described in the evaluation of the water-resource development scenarios for each representative zone/site/area; and
- predictions of change in abundance/area/concentration (relative to Reference Scenario 2007) for a wide range of ecosystem indicators.

6.4.1 Sequence of Activities for the Biological Resources Assessment

The basic sequence of activities for the Biological Resources Assessment will be:

1. Collect/collate relevant data for the study river.
2. Augment with expert knowledge for similar river systems and a global understanding of river functioning.
3. Obtain simulated baseline daily (or sub-daily where appropriate) hydrological data for each representative zone (ANNEX III).
4. Obtain modeled baseline hydraulic, sediments and water quality data for each representative zone (ANNEX III).
5. Calculate annual indicator time-series for flow, hydraulics, sediment and water quality for each representative zone.
6. Construct relationships for the expected response of individual ecosystem indicators to changes in aspects of the flow, sediment or water quality regimes (these are called Response Curves).
7. Calibrate the DRIFT Data Management Tool.
8. Use Response Curves to predict time series of abundance changes for baseline condition.
9. Obtain modeled future changes in catchment hydrology for individual and cumulative water resources development configurations (see Section 3.1.5). Obtain modeled knock-on hydraulic, sediment and water quality effects.
10. Calculate annual indicator time-series for flow, hydraulics, sediment and water quality.
11. Use Response curves to calculate severity scores and develop time-series of change in abundance for ecosystem indicators for development configurations.
12. Calculate average severity score for a set of configurations for each indicator for entire hydrological time series.
13. Convert scores to provide a prediction of overall ecological condition.

The bulk of the work in the construction and calibration of the Response Curves will be done in a workshop setting at two workshops in Vientiane:

- Knowledge Capture Workshop
- Calibration Workshop.

The steps in the DRIFT process, as it is applied in the BioRA process are illustrated in Figure 5.

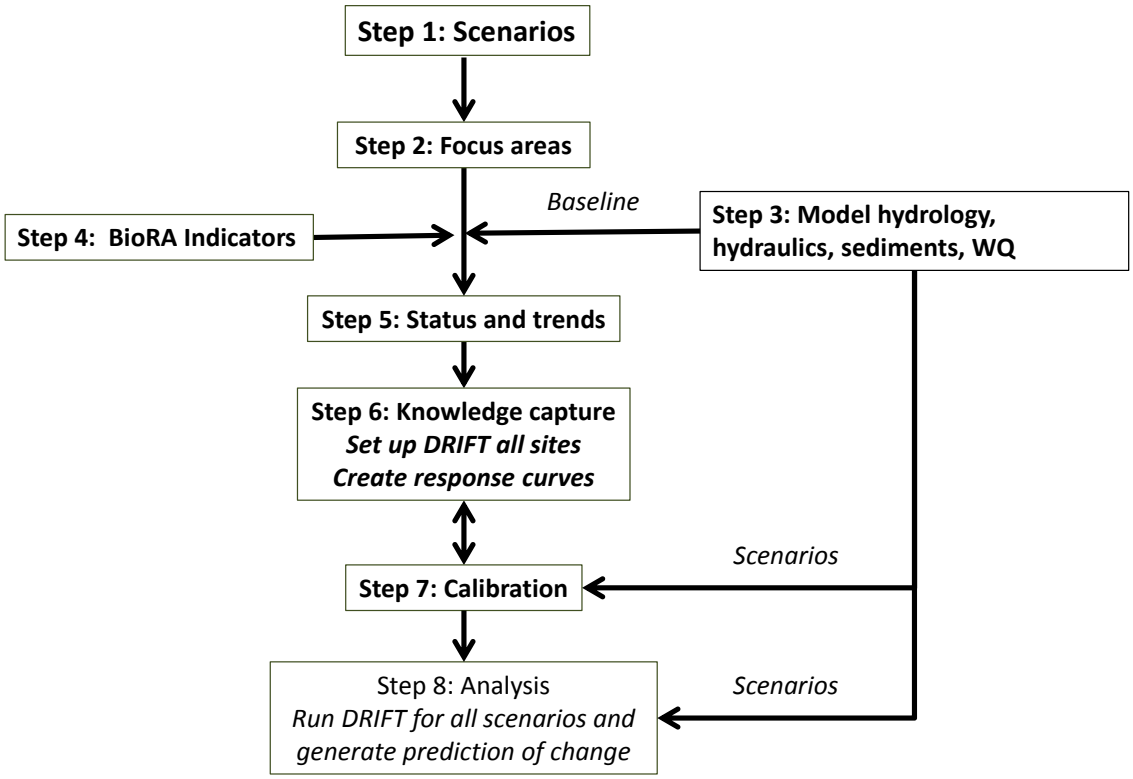


Figure 5. BioRA process diagram

BioRA assessment will be conducted for 8 Focal Areas (Figure 6).

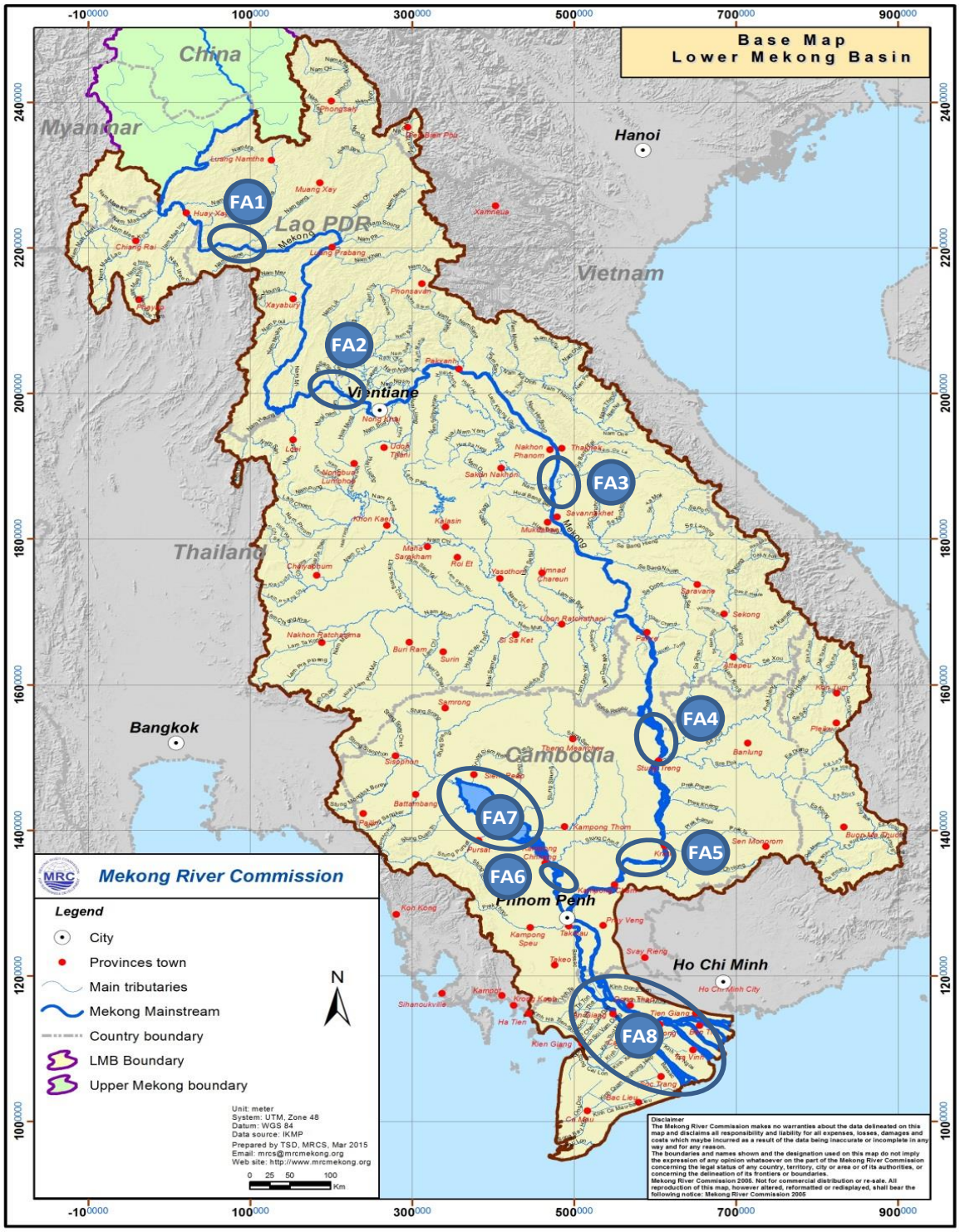


Figure 6. BioRA Focal Areas

The objectives of **the Status and Trends Assessments** are to:

- describe the present ecological status of the Lower Mekong River;
- describe the past ecological status of the Lower Mekong River – both as a reference point from which to make predictions and to establish trends that can be used later on in the analyses;
- describe the future ecological status of the Lower Mekong River in the absence of the water-resource developments included in scenarios (these are referred to as 'exogenous baselines'; see MRC 2015).

The results of the Status and Trends Assessment are provided in the Specialists' Report.

In **Knowledge Capture**, the specialist teams will construct a response curve for each of the links delineated for each indicator using the DRIFT software. To do this, the data collected and the understanding developed by MRC and other organizations over the last two decades will be augmented with life-history information for key species, expert opinion and will be underpinned by the hydrological, hydraulic, sediment and water quality modeling by the IKMP. The bulk of the response curve construction was done at the Knowledge Capture Workshop (KCW).

In **Calibration** the aim is to match DRIFT outputs with measured data and/or local and expert knowledge. To facilitate this process, as series of calibration data sets are prepared for use. Typically these include representatives of the period of extreme floods or drought. The bulk of the calibration was done in a workshop attended by the full team of BioRA specialists (BioRA Interim Report: Preliminary Calibration).

For each scenario, the **predicted changes** in the river represented are provided as:

1. estimated mean percentage change from baseline in the abundance or area key indicators;
2. time-series of abundance, area or concentration of key indicators under the flow regime resulting from each scenario; and
3. overall Ecosystem Integrity (condition).

The outputs for individual indicators will be combined to create composite indicators. The outputs will be used as inputs to the thematic and socio-economic assessments.

6.5 Socio-economic Assessment

6.5.1 Framework for the Socio-economic Assessment

One of the most important components in the Council Study will be a socio-economic assessment of the benefits and impacts of water resources developments and infrastructure. This assessment will be based on published reports and census data and/or targeted socio-economic assessments conducted in the context of the Council Study. Particular attention will be given to the communities and their specific engagement with the natural resources of the LMB. Levels of consumptive and non-consumptive water

use and levels of demand for the basin resources will be established and targeted social and economic assessments will be undertaken where no information exists.

The socio-economic assessment will cover all aspects relevant to the social dimensions of a triple-bottom-line assessment. This will include a measure of equity and access to social resources, health, and well-being, quality of life, social capital and livelihoods to indicate impacts via composite socio-economic indicators. The sub-indicators used to compile the composite indicator, should at a minimum, include indicators linked to the changing status of peoples' livelihoods, income, access to resources, and health and nutrition.

Using the knowledge generated by the other Discipline Teams on the impacts of water resource developments on hydrological, sediment transport, water quality, water productivity as well as the environmental parameters (**Step 1** in Figure 7), the socio-economic assessment will separately assess the impacts of water resources developments in each of the thematic areas as well as the cumulative impact of developments on the selected socio-economic parameters.

This information will be used by the thematic teams (**Step 2**) to compile the reports that are the principal deliverables of the project: six thematic reports pertaining to the six selected thematic areas describing the positive and negative impacts of water resources developments and infrastructure in the Lower Mekong River Basin including recommendations for impact avoidance and mitigation measures. The thematic socio economic assessments will be used by the socio-economic assessment as well as the ITA for cumulative assessment (**Step 3**) for a report on the cumulative positive and negative impacts of the selected water resources developments.

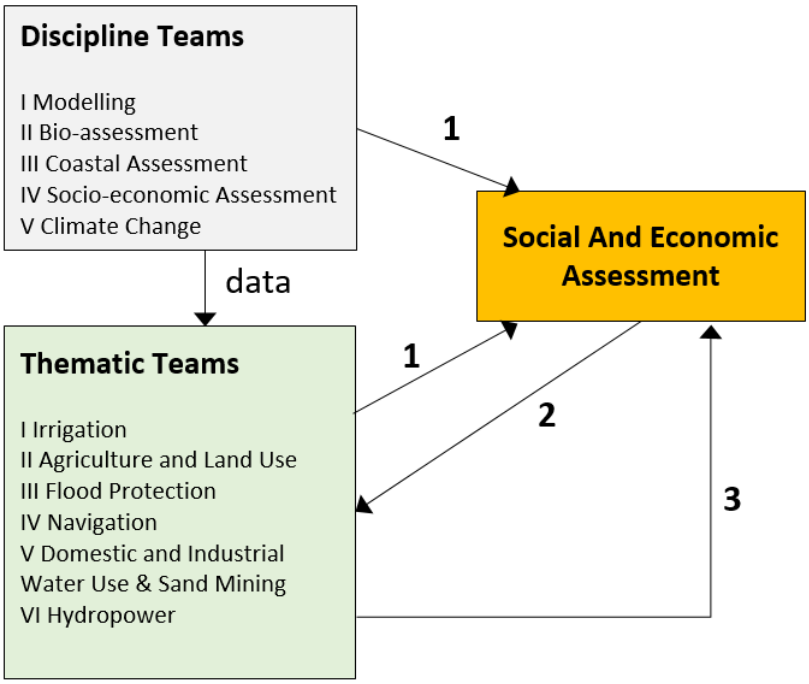


Figure 7. Socio-economic assessment work flow. 1 = data provision to socio-economics, 2 = socio-economic assessment for the Thematic Teams, 3 = thematic assessment for the Socio-economic Team & cumulative assessment.

6.5.2 Activities and Tasks for the Socio-economic Assessment

The team tasked with the socio-economic assessment will have the overall responsibility to further define the framework, coordinate, and carry out the socio-economic analyses required to produce the deliverables of the Council Study.

In general, the work will fall within the following areas:

1. Define the framework, approach, and methodology including indicators for the Socio-Economic Assessment;
2. Develop ToRs for and/or coordinate the work of international and national consultants;
3. Coordinate information exchange and activities between the Socio-economics Team and other teams including holding working sessions
4. Assemble data and carry out data analysis and assessment; and
5. Develop the Technical Report on the Socio-Economic Assessment of the Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin.

6.5.3 Defining the Framework and Indicators for the Socio-economic Assessment

As indicated above the socio-economic assessment will cover all aspects relevant to the social dimensions of a triple-bottom-line assessment. Therefore, the assessment will include a measure of equity and access to social resources, health, and wellbeing, quality of life, social capital and livelihoods to indicate impacts via a composite socio-economic indicator. The sub-indicators used to compile the composite indicator, should at a minimum, include indicators linked to the changing status of peoples' livelihoods, income, access to resources for food, and health. Gender aspect will be taken into account for the whole spectrum of the assessment.

In this context, the Council Study Socio-economic team lead will use existing best practice to define a set of socio-economic indicators by taking into consideration the products produced by of the former Basin Development Programme such as the BDP socio-economic database, and the Social Impact Monitoring and Vulnerability Assessment (SIMVA) undertaken by the former Environment Programme.

6.5.4 Information Exchange and Activities between the Socio-Economics Team and other Teams

The socio-economic assessment will draw from the other teams to assess positive and negative impacts of water resources developments and feed their information back to the thematic teams to enable them to develop their reports. These lines of communication will include:

a. Input from Thematic Teams on information related to the direct impacts of water resources developments and infrastructure on socio-economic indicators. These can include social displacement and resulting direct loss of livelihoods, employment benefits, loss of access to cultural practices, increased access to other economic activity, and increased mobility;
b. Information exchange with the Hydrologic Team and study coordinators on flow indicators that are directly relevant to socio-economic indicators;
c. Information exchange with the Biological Team and study coordinators on indicators that are relevant to socio-economic indicators;
d. Information exchange with the Macro-economic team on projected changes in household income, livelihood opportunities, and employment;
e. Provide information to the Thematic Teams and to the Cumulative Team to inform the compilation of the Thematic and Cumulative Final Reports; and
f. Collaborate with the Coordination team on the reporting and liaising with the four MRC Member Countries.

6.5.5 Economic Assessment

Benefits of water resources developments are usually clear and well established ranging from primary benefits accruing from the sale of power, increased crop production, and employment to the secondary and tertiary benefits of increased economic development, higher government revenue and expenditure and regional economic integration.

On the other hand, direct costs of water resources development are accounted in the investment decisions, the indirect social and environmental costs are harder to assess and therefore may not be fully considered. Since water resources development and infrastructure result in changes to the flow regime downstream, this can lead to a change in ecosystem services provided by the river and its derivative groundwater in the Lower Mekong River Basin. These foregone net ecosystem benefits would be the opportunity cost of taking action to develop the water resources of the basin. In a similar vein, any decision not to develop the water resource potential implies giving up the net economic benefits of hydropower, irrigation, land-use development and agriculture, urban and industrial water use, navigation and flood management including secondary and tertiary multiplier benefits in a national and regional context.

Furthermore, some of the indirect costs of water resources developments will be felt over time. A reduction in fisheries or ecosystem services for an example will be a gradual process and the full cost of that loss would likely be borne by people in 10, 20, 30 or more years in the future. Whereas in an economic analysis future benefits and costs are expressed in the context of Net Present Value (NPV) to facilitate informed decision-making at the current time, NPV does not fully capture the dynamism of an economy that results in changes in consumer preferences. In the context of the Lower Mekong River Basin, costs incurred due to the loss of fisheries based current consumption patterns may not fully reflect the social impact of that loss in a future where other alternatives to fish may be available and

cost effective. Therefore, the economic analysis will compensate for the dynamism of the regional and national economies and changes in relative consumption preferences.

The main components of any economic analysis of future states of the system are future changes in net ecosystem benefits and water withdrawal benefits, each with its component changes in costs and benefits. In the Council Study, alternative paths for developing the water resources will be examined and therefore the economic gains from water resources developments will be contrasted with the losses in ecosystem services.

Two streams of analyses will inform the Economic Assessment in the Council Study. They are the following:

1. Resource Economic Assessment, and
2. Macro-Economic Assessment.

6.5.6 The Resource Economic Assessment

The Resource Economic Assessment will capture the loss of downstream economic benefits from a baseline that exists today and will be presented in terms of changes in Net Present Value and via its impact on socio-economic indicators. The valuation of basin resources is required for the purpose of evaluating the impacts of gains and losses in economic welfare associated with decisions to develop or not develop the water resources of the Lower Mekong River Basin (and its tributaries). For this reason the analysis of basin resources is best circumscribed to include only those resources and sectors that will be affected by changes in the timing and amount of the flow regime – either in terms of impacts from changes in flow and timing downstream or in terms of the development benefits and impacts from the changes in development and land use patterns that accompany the water resource developments themselves.

In conducting the resource economics analysis, information will gathered from existing literature and field studies on the livelihood and economic values attributable to the river system in the basin. A number of studies conducted by the former Fisheries Programme and the former Environmental Programme SIMVA provide detailed data on the use of river resources by people and the corresponding values.

The river and wetland values at the field sites, (i.e. those values that could be affected by flow change) include values for household use of river-based natural resources such as fish, reeds, floodplain grass, floodplain gardens and floodplain grazing, as well as commercial river- and floodplain-based tourism. The values of all natural resource uses will then be upscaled for the basin as a whole, including those making up the selected water resource developments.

The economic analyses will measure the private wellbeing of the basin inhabitants, as well as the national wellbeing of the basin countries as a change from the baseline. Private wellbeing will be measured as the net change in household livelihoods. This is the net gain in welfare, due to the resources of the river basin and its functions, experienced by households. It is the net profits earned by

households in their income-earning activities. Private wellbeing as affected by intangible factors such as water quality will be assessed.

National wellbeing will be measured as the direct net change in national income. Measurement of the direct contribution to the national income will be extended to illustrate the total direct and indirect impact of resource use on national economies. This will be done using multipliers calculated from social accounting matrix (SAM) models. National wellbeing as affected by indirect use values, or ecosystem services, will also be measured in terms of national income[2].

The Council Study will clearly define the present-day and potential future uses of the water resource in the Lower Mekong River Basin. In the economic analysis, the losses in economic activity as a consequence of changes in the flow regime will be calculated in terms of the changes in ecosystem goods and services provided by the river system. In the subsequent analysis of configurations these annual values will be converted into streams of costs and benefits over defined time scenarios under defined discount rates. On a country-by-country basis these losses (and gains) will then be set off against the potential net benefits of the water resource developments that alter the flow regime.

This comparison will use the direct economic costs and benefits of the water supply, hydropower, and irrigation projects, as well as their impact on the ecosystem goods and services. For each water resources development, good and service, a reference case net present value will be calculated based on present day use of water in the basin; then net present values will be calculated for selected water resource development configurations. The change between each of the configurations and the reference case shows the net gains or losses to the economy for (a) the water resources developments and (b) ecosystem goods and services.

As successive configurations may incorporate the development projects of the former configurations, these configurations should not really be compared one with the other, but serve to illustrate the trend analysis. The results from the configurations can show how increasing levels of water use will affect the national economies of each country. The tradeoffs between the distributions of these values between sectors highlight the issues of transboundary water allocation and management in the basin.

6.5.7 The Macro-Economic Assessment

This component of the economic assessment would capture the benefits and costs of water resources development to the national and regional economies. The assessment would use two categories of data

a. Aggregations of the data provided by the resource economic assessment, and
b. Data provided by the thematic teams as to the current or anticipated benefits from the water resources development (i.e. power generated, agricultural production etc).

[2] The inclusion of non-use values (existence, bequest and option value) has not been considered in this design of the resources economic assessment for the Council Study as it may not be relevant to the main objectives of the Council Study, which are to inform the lower Mekong Riparian countries with regards to the relative impact of water resources developments.

These values will be used to assess the benefits and costs of development to the countries hosting the development as well as to other riparian countries.

The macro-economic assessment will seek to identify

- Contribution of domestic and international hydropower sales to GDP, government revenue (taxes and dividends) and foreign exchange,
- Contribution from export of agriculture products, manufacturing and/or navigational services to GDP, government revenue (taxes and dividends) and foreign exchange,
- Multiplier effects of hydropower infrastructure development and the power sales in the national and regional economies including sustainability,
- Multiplier effects of other developments including agriculture and manufacturing, and
- Distribution of costs and benefits - the incidence of benefits vs. costs amongst communities, livelihoods, countries and people of difference socio-economic strata.

In answering these and related questions, the following three-tiers of impacts will be assessed:

Direct Costs Benefits- Investment and other direct costs of development of infrastructure and direct revenue from the sale of power and other revenue sources.

Indirect Costs and Benefits - Positive and negative economic externalities from development including ecosystem services and social impacts valued and internalized.

Multiplier Impacts - Multiplier effects of developments including impact on regional macro-economic development, trade flows etc.

6.5.8 Development of socio-economic and macro-economic impact assessment indicators

The combined socio-economic and macro-economic impact assessment indicators will be developed by considering the impact and the response. The indicators will be developed by integrated approached including changing driver of the hydrology, sediment, nutrient, ecology and bio-resources and other thematic sectors as indicated in figure 8 as below:

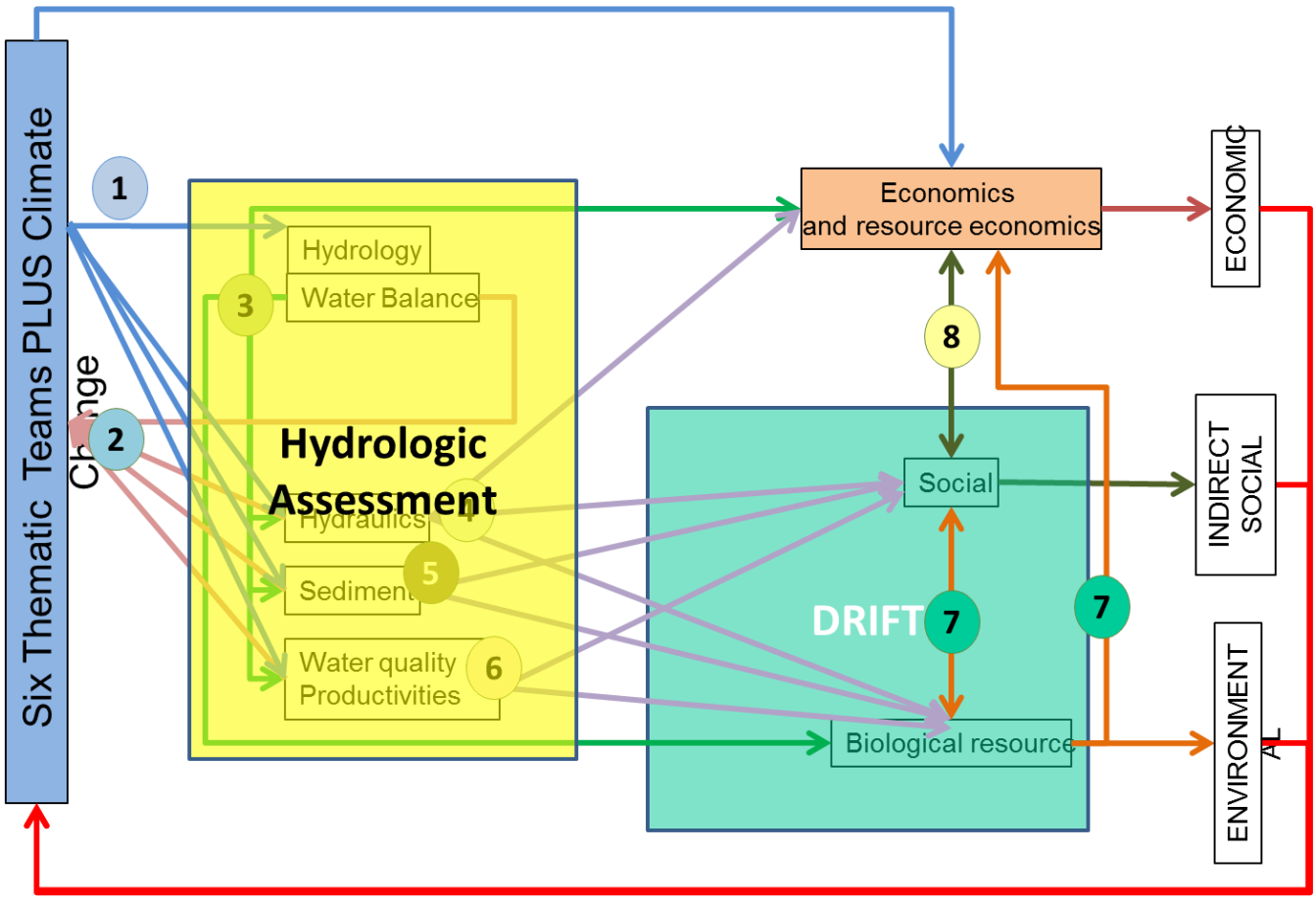


Figure 8: interlink between Hydrology assessment, Bioresources assessment, socioeconomic assessment and macro-economic assessment with other thematic sectors.

6.6 Report Deliverables

Annex IV of the Inception Report lists the various thematic and technical reports and supporting working papers deliverables for the Council Study. This section proposes the following consolidation of these reports when necessary.

6.6.1 Cumulative and Thematic Reports

The cumulative and 6 main thematic report deliverables remain the same and they are the following:

- Cumulative Positive and Negative Impacts of the Selected Water Resources Developments and infrastructure on the Social, Environmental and Economic Conditions of the Lower Mekong River Basin and Policy Recommendations.
- A Thematic Report on the Positive and Negative Impacts of Irrigation Development on the Social, Environmental and Economic Conditions of the Lower Mekong River Basin and Policy Recommendations.
- A Thematic Report on the Positive and Negative Impacts of Non-irrigated Agriculture Development and General Trends in Major Land-Use Categories on the Social, Environmental and Economic Conditions of the Lower Mekong River Basin and Policy Recommendations.

- A Thematic Report on the Positive and Negative Impacts of Domestic and Industrial Water Use on the Social, Environmental and Economic Conditions of the Lower Mekong River Basin and Policy Recommendations.
- A Thematic Report on the Positive and Negative Impacts of Flood Protection Structures and Floodplain Infrastructure on the Social, Environmental and Economic Conditions of the Lower Mekong River Basin and Policy Recommendations.
- A Thematic Report on the Positive and Negative Impacts of Hydropower Development on the Social, Environmental and Economic Conditions of the Lower Mekong River Basin and Policy Recommendations.
- A Thematic Report on the Positive and Negative Impacts of Navigation Infrastructure Development on the Social, Environmental and Economic Conditions of the Lower Mekong River Basin and Policy Recommendations.

It should be noted that the Cumulative Report will be equivalent to the Main Report. This report will incorporate and apply the knowledge gained from the thematic reports as well as the results of the assessment of the main development scenarios to understand better the interrelated and cross-cutting dynamics among the different sectors and produce policy recommendations that enhance positive benefits and reduce negative impacts.

In addition to the above reports, an Executive Summary will be prepared.

The Interim Thematic Assessment Reports submitted in Phase 1 represent an incremental version of the abovementioned thematic reports.

6.6.2 Technical Reports

Table 5 shows the various discipline-specific technical report deliverables, status and proposed consolidation when appropriate.

Table 5. List of Council Study technical report deliverables, their status, and proposed consolidation.

Technical Report as per Inception Report Annex IV	Proposed Consolidated Report	Status
Inception Report of the MRC Council Study	As Is	Completed
Scoping and Assessment Report of Existing Information, Data and Knowledge for the MRC Council Study.	As Is	Completed as Chapter 2 of the Inception Report
Hydrology Data, Modelling and Results Report for the Assessment of Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study.	Hydrology, Sediment, and Water Quality Data, and Results Report for the Assessment of Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study.	Several technical documents have been prepared and submitted to the Member Countries that will serve as input or attachments to this technical report including the following: ISIS Baseline Model for Mekong River in Upper Kratie Improvements of the ISIS LMB Baseline Scenario Model
Groundwater Hydrology Data, Modelling and Results Report for the Assessment of Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study.		

Sediment Data, Modelling and Results Report for the Assessment of Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study. Water Quality Data, Modelling and Results Report for the Assessment of Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study.		SWAT Model for Sediment and Nutrient Simulation in the Mekong River Basin The Sediment and Nutrient Data Available and Analysis for the DSF model Simulation in the Lower Mekong Basin eWater Source Model (Baseline 2007): Application in the Upper Mekong River Basin
Fisheries Assessment of the Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study. Environmental Assessment of the Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study.	Bioresources Assessment of the Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study.	Several technical documents have been having been prepared and submitted to the Member Countries that will serve as input or attachments to this technical report including the following: Volume 1: Specialists' Report Volume 2: Guide to Viewing and Updating the BioRA DSS Volume 3: Preliminary Calibration Report
Socio-Economic Assessment of the Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study. Macro-Economic Assessment of the Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study.	Socio-Economic (including Macro-Economic) Assessment of the Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study.	The following technical documents will serve as input to the methodology section or attachment to this technical report: Report on approach and methodology for Socio-economic Assessment Report on approach and methodology for Macro-Economic Assessment
A Climate Change Assessment of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study.	As Is	

6.6.3 Working Papers

Table 6 shows the working papers deliverables, status and proposed consolidation when appropriate.

Table 6. List of Council Study working papers, status and proposed consolidation.

Working Paper as per Inception Report Annex IV	Consolidated Report	Status
Specifications of Selected Irrigation Developments and Infrastructure for Use in Hydrological Modelling.	Development Scenarios for the Irrigation Thematic Area	Draft Completed
Specifications and map of Selected Non-irrigation Agriculture Development and General Trends in Major Land-Use Categories in the Lower Mekong River Basin for Use in Hydrological Modelling.	Development Scenarios for the Agriculture and Land Use Change Thematic Area	Draft Completed
Specifications and Map of Selected Domestic and Industrial Water Use in the Lower Mekong River Basin for Use in Hydrological Modelling.	Development Scenarios for the Domestic and Industrial Water Use Thematic Area	Draft in Preparation
Specifications and Map of Selected Flood Protection Structures and Floodplain Infrastructure for Use in Hydrological Modelling.	Development Scenarios for the Flood Protection and Floodplain Infrastructure Thematic Area	Draft Completed
Specifications and Map of Selected Hydropower Developments for Use in Hydrological Modelling.	Development Scenarios for the Hydropower Thematic Area	Draft Completed
Specifications and Map of Selected Navigation Infrastructure Development.	Development Scenarios for the Navigation Thematic Area	Draft Completed
Data Collection Guidelines for the Integrated Basin Flow Assessment of Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin – A Report for the Council Study.	Incorporated as a chapter or annex in the Various Technical Reports (Modelling, Bio-resource assessment, and socio-economic assessment)	In Preparation
Description and Map of Consolidated Eco-hydrological Zones and the Representatives Sites for the Integrated Basin Flow Assessment of Positive and Negative Impacts of Selected Water Resources Developments and Infrastructure in the Lower Mekong River Basin.	Incorporated in the Bio-resources Assessment Technical Report	Draft Completed and incorporated in the Bio-resources Assessment Report
Modelling Report on the Impact of Climate Change on Hydro-Climatology in the Lower Mekong River Basin	Incorporated in the Climate Change Assessment Report	In Preparation

7 Work Plan

7.1 Development of the Work Plan

The following guiding principles are adopted for the Phase 2 Work Plan development.

- Implementation planning will be highly evolving and will be evaluated periodically and any necessary adjustments reported during the RTWG Meetings.
- An agile development and implementation will be adopted by the Core Team to respond more quickly and effectively to uncertainties through an incremental and iterative process.

These principles take into account of the fact that not all information needed to prepare a definitive and specific plan are available and the successful application of the assessment framework (models, DSS, and the tools) is inherently complex and uncertain which may require some degree of iterations involving further enhancements of the assessment framework and the application. These guiding principles are also compatible with the highly participatory process that was followed in Phase 1 and will provide the necessary flexibility (i.e., explicit recognition by all parties that schedule and budget will be adjusted accordingly within reason) to even enhance the participatory process in Phase 2.

There are two periods for phase 2 implementation including the i) preparation and assessment and ii) the reporting and closeout of the project

7.2 Preparation and Assessment period

Objective and scope of work:

- Prepare data, information, modeling and other tools for impact assessment in various sectors based on the defined scope of work .
- Simulate the results for the development scenarios as agreed scope of work (2007, 2020, 2040 with and without climate change) with some sub-scenarios of 2040 for cumulative impacts, Hydropower, irrigation, flood, sediment mining etc including the development scenarios 1960 and 2000.
- Undertake the Socio-Economic Assessment
- Simulate the result and respond curve for Bioresources assessment
- Undertake the Coastal Assessment
- Two Regional Stakeholder Meetings (Dec 2016 and Nov 2017)

7.3 Technical Scope of Phase 2 2016

Given the funding available, the technical scope of Phase 2 in 2016 will focus on the setup of the assessment of the development scenarios with respect to hydrological, hydraulic (including flood), sediment, water quality (nutrients), and bio-resources impacts. This will involve the following activities:

1 Modelling Impacts on Hydrology, Hydraulics, Sediment, and Water Quality
- Develop list of indicator statistics for comparison of modelling results
- Modelling of Development Scenarios 2007, 2020, and 2040 (with and without climate change) and Thematic Sub-scenarios

- Prepare input files for each development scenario
- Finalize the final report for flow, sediment, and nutrient

2 Bio-resource Assessment

- Development of the BioRA DSS for FA6, FA7, and FA8 (Delta)
  - Conduct Knowledge Capture Workshop to Develop Response Curves
  - Calibrate and Test Response Curves

3 Socio-economic and macro-economics

- Finalization of the assessment methodology
- Development of a list of the combined impact assessment indicators focusing on the impact and response for socioeconomic and macro economic

4 Thematic sectors

- Finalization of the main development scenarios including data collection from the member countries
- Draft list of 2040 sub-development scenario for irrigations, hydropower, flood protection and sand mining
- Collection of data input for 2040 sub-development scenarios

It should be noted that the above activities will involve the support of the thematic sector leads and the sector experts. This support will include the following:

- Preparation of the input files associated with levels of development and operations for the development scenarios
- Analysis of the modeling and assessment results

7.4 Technical Scope of Phase 2 2017

Phase 2 in 2017 is intended to complete the Council Study and is anticipated to take 09 months from January – Sept 2017. In addition, a three-month period from Oct-Dec 2017 will be devoted to project closeout activities. The technical scope of 2017 will focus on the following:

- Simulation of Modelling work for main and sub-development scenarios:
  - Run model and analyze results
  - Prepare draft report on results and analysis
- Modeling of Development Scenarios 1960 and 2000
  - Conduct feasibility of formulating 1960 development scenario based on availability of data (including climate data from 1960 – 1984)
  - Collect data and formulate development scenario 2000
  - Collect data and formulate development scenario 1960 (if feasible)
  - Run model for each development scenario and analyze results
- Revise draft report to incorporate results and analysis
- Assessment of Development Scenarios 2007, 2020, and 2040 and thematic sub-scenarios on hydropower, flood protection, irrigation, sand mining (without climate change) and three climate scenarios for 2040
  - Using model outputs from the modeling activity, run BioRA DSS for each development scenario and analyze results

    - Prepare technical report on results and analysis
- Socio-Economic Assessment of Development Scenarios 2007, 2020, and 2040 and thematic sub-scenarios on hydropower, flood protection, irrigation, sand mining (with and without climate change).
- Procurement and implementation of coastal assessment
- Preparation of thematic and cumulative reports
- Regional Stakeholder Meeting (Nov 2017)

It should be noted that the assessment of the 1960 and 2000 development scenarios is focused primarily on the impacts on flow and sediment only.

The project closeout will include the following activities and will be led by the OCEO since the Core Team will be completed by that time. If needed the Council Study Coordinator may be contacted to further support these activities.

Implementation Arrangement:

- The implementation of this phase will be mainly the duty of the core team with the technical support from the supported team together with the national technical working group of member countries. However, additional technical support from the international experts on social-economic and coastal assessment will be required.
- Coordination approached need to be strengthened, the council study regional coordinator will play the coordination role to work with various teams to implement the work according to the plan

Key Task:

- Consult thematic leads about task management planning
- Consult with thematic leads and experts for their information needs such as required modelling outputs
- Collect and gap-fill modelling and other assessment data
- Develop a list of indicators for the thematic, environmental, modelling and socio-economic assessments
- Prepare input files for scenario 2007, 2020, 2040
- Run models for scenario 2007, 2020, 2040 (CIA, HP, Irrigation, Flood, mining) with and without climate change
- Prepare report for scenario 2007, 2020, 2040
- Conduct feasibility of scenario 1960 and 2000
- Collect data and formulate scenario 1960 and 2000
- Run models for scenario 1960, 2000
- Revise results report to include scenario 1960, 2000
- Develop BioRA DSS for FA3, FA6, and F8-Delta
- Update Specialists Report

- BioRa assessment for scenario 2007, 2020, 2040
- Prepare report for results from the scenario 2007, 2020, 2040
- Prepare combined report on the results of scenario development 2007, 2020, 2040 including 1960 and 2000
- Conduct Socio-Economic and Macro-Economic Assessment
- Prepare Contract Procurement for Coastal Assessment
- Conduct Coastal Assessment

Deliverable:

- Incremental cumulative scenario modelling report October 2016, December 2016, February 2017
- Draft scenario modelling report, July 2017
- BioRA technical report, December 2016, May 2017; contributions to the technical reports, July 2017; contributions to the Cumulative report, September 2017
- Climate change impact assessment report, June 2017
- Draft socio-economic assessment report, July 2017
- Hydropower assessment report, November 2016, September 2017
- Coastal assessment report, September 2017
- Draft thematic impact assessment reports (flood protection, navigation, domestic and industrial water use, agriculture/irrigation and land use), July 2017
- Draft Report on Cumulative Assessment, September 2017
- Databases for the CS knowledge Base

7.5 Reporting Period, Including Closeout of the Project

Objective and scope of work:

- Prepare all reports required under the study such as the main report, including thematic, disciplines technical reports including cumulative impact assessment
- Get agreement from all member countries on the reports and all products made by this study.
- Organize the regional stakeholder workshop on the results of the study
- Submit the result to the Council meeting for information and guidance
- Prepare to close out the project

Implementation Arrangement:

- The implementation of this phase will be mainly the duty of the core team with the technical support from the supported team together with the national technical working group of member countries with the support from the international experts from various sectors including social-economic, macro economic and coastal assessment will be required.
- Engagement of external stakeholders in the exchange workshop will be required.

- Coordination approached need to be strengthened, the council study regional coordinator will play the coordination role to work with various teams to implement the work according to the plan
- The Joint Committee decision on publication of the final report is required.
- Guidance from Council meeting on the study will be necessary to close out the project.

Key Task:

- Finalization of Discipline Technical Reports
- Finalization of Thematic Reports
- Finalization of Cumulative/Main Report, December 2017
- Preparation of Executive Summary

Deliverable:

- The main report and executive summary of the council study will be produced and officially published.
- The interim report and other reports such as the results of the simulation of the development scenarios as well as other thematic and discipline reports will be a part of the annexes of the main report.
- The report on the feedback from the stakeholder meetings will be documented and included in the attachment of council study documentation.

7.6 Detailed Work Plan

Table 7 shows the proposed Work Plan with the following phases:

- Phase 1 (completed in March 2016)
- Transition Phase (April – early of Nov 2016)
- Phase 2-Preparation and assessment period (Nov 2016- Sept 2017)
- Phase 2- Reporting and Closeout of the project (Oct 2017 – Dec 2017)

Table 7 Proposed Overall, Specific and Interlink CS Work Plan for 2016-2017

Overall Work Plan for the Implementation of the MRC Council Study																				
		2016						2017												
	Activities and Tasks	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
A	**Completion of CS in Phase 1**																			
B	**Transition Phase of CS implementation**																			
	Setup a new CS core team at MRCS																			
	Get agreement on the Improvement of the biora-DSS model results and output																			
	Get agreement from MCs on downscaling of CS including Scope of work, planning and budgeting																			
	Finalization of the scenario formulation for priorities thematic and other disapline teams																			
	Collected all necessary dataset and information for model input																			
	Completion of model setup and calibration to be ready for scenario formulation and assessment																			
	Get agreement from MCs on work and budget plan for CS phase 2																			
C	**Implementation of CS in Phase 2 - Preparation and Assessment period**																			
C1	**Modeling and Hydrology assessment**																			
	… Develop list of indicators for model comparison																			
	Modeling-Main development Scenarios																			
	… Prepare input files for scen 2007, 2020, 2040																			
	… Setting up the main scenarios in the DSF																			
	… Run models for main scen 2007, 2020, 2040																			
	… Processing DSF results for WUP-FIN impact modelling									x										

	...Tonle Sap and Delta WUP-FIN impact model runs									x										
	...Post-processing, communicating results to the thematic teams and revision of simulations as required										x									
	… Documenting the simulation data, procedures and outputs										x									
	… Prepare results report for main scen 2007, 2020, 2040 including CIA, all sectors																			
	Modeling-Sub Development Scenarios																			
	… Finalize the sub-development scenairos for HP, irrigation, flood and sand mining																			
	… Prepare input files for 2040 sub scen for HP, Irrigation, Flood, sand mining																			
	… Run models for sub-scenario 2040																			
	… Processing DSF results for WUP-FIN impact modelling														x					
	… Tonle Sap and Delta WUP-FIN impact model runs																			
	… Post-processing, communicating results to the thematic teams and revision of simulations as required															x				
	… Prepare results report for Sub-scenarios 2040 for selected sector																			
	Modeling-Main development Scenarios 1960-2000																			
	… Conduct feasibility of scen 1960 and 2000																			
	… Collect data and formulate scen 1960 and 2000																			
	… Run models for scen 1960, 2000																			
	… Revise results report to include scen 1960, 2000																			
	Modelling--Coastal Assessment																			
	Development of work plan and approach																			
	Assessment result and technical reporting																			
C2	**Biora DSS assessment**																			
	Finalize input data for Biora simulation including FA, 5, 6,7 and 8																			
	Generate the response curve																			
	… Update Specialists Report																			

	… BioRa assess for scen 2007, 2020, 2040																			
	… Prepare results report for scen 2007, 2020, 2040																			
C3	**Prepare cumulative assesment report**																			
	… Prepare a combine results report on scenarios development 2007, 2020, 2040 including 1960 and 2000																			
C4	**Socio-Economic Assessment**																			
	development of the combine indicator and assessment framework																			
	Data assambly for analyis and assessment																			
	Prelimiary finding and working session with MCs on review the results																			
	Final report																			
C5	**Intergration and Link between Sectors and discipline teams**																			
1	**Integrating with the bio-assessment**																			
1.1	Developing approach, procssing software and outputs for the Tonle Sap																			
1.2	Developing approach, processing software and outputs for the Cambodian floodplains and Delta																			
1.3	Developing work plan for modelling data provision for the BioRA																			
1.4	DSF baseline model runs for BioRA																			
1.5	WUP-FIN BioRA baseline model runs																			
1.6	WUP-FIN BioRA test scenario model runs																			
1.7	Main scenario model runs for BioRA									x										
1.8	Sub-scenario model runs for BioRA												x							
1.9	Comparison and harmonization of results e.g. for fisheries												x							
2	**Integrating with the socio-economic assessment**																			
2.1	Define socio-economic data requirements for modelling			x																
2.2	Define and develop modelling outputs for the socio-economic assessment				x															
2.3	Clarify and harmonize BioRA and modelling inputs for s-e assessment																			

2.4	Develop socio-economic assessment technology (software, analysis tools, GIS assessment etc.) together with the s-e team									x											
3	**Data collection, gap-filling and output definitions for sectors**																				
3.1	Assessing status of the data collection			x																	
3.2	Acquisition of additional data																				
3.3	Data gap filling																				
3.4	Utilizing mainstream dam modelling by the ISH306																				
3.5	Communicating with the Delta Study for data integration						x														
3.6	Extract Climate Data from SimCLim Software for 2040 Climate and prepare for model input																				
3.7	Assessing availability of 1960 land use and infrastructure data as well as hydro-meteorological data for 1960 - 1984							x													
3.8	Develop modelling outputs for the thematic teams					x															
D	**Implementation of CS in Phase 2 -Reporting Period**																				
	Preparation of Discipline Technical Reports																				
	Preparation of Thematic Reports																				
	Preparation of Cumulative/Main Report																				
	Preparation of Executive Summary																				
E	**Other regular and ad-hoc Plan for support the council study**																				
	RTWG Meetings																				
	Small Group technical Meeting																				
	National Consultations																				
	Closeout Activities																				
	Regional Stakeholder Meeting																				

Attachment to the detailed discipline and sector work plan

AA	**Detailed Discipline Work Plan**																				

AA1	Socioeconomic assessment																		
Task 1	Term of Reference for international consultants to carry out socio-economic assessment and macro-economic assessment																		
Task 2	Discussion with thematic and discipline teams on assessment indicators																		
Task 3	Contract of international consultants (110 days for both assessments running from Oct 2016 to October 2017)																		
Task 4	Working session with thematic and discipline teams on combined indicators for socio-economic and macro-economic assessments																		
Task 5	Working session with the MCs to refined approach and methodology including composite indicators (2 days)					x													
Task 6	Final draft of assessment approach and methodology for both assessments					x													
Task 7	Data assembly (including purchasing of data and software) and analysis						x												
Task 8	Working session with thematic and discipline teams on assessments and preliminary findings										x								
Task 9	Working session with the MCs on Preliminary findings of the assessments (2 days)																		
Task 10	First draft assessment reports												x						
Task 11	Regional consultation workshop on the first draft (2 days)																		
Task 12	Final draft assessment report														X				
AA2	Modeling and Hydrologic Assessment																		
Task 1	Review and Check Inputs Collected from the Six Thematic Teams																		
Task 2	Additional Collected Expected Data, Gap Filling and Outputs Definitions																		
Task 3	Provision DSF for Scenarios simulation																		

Task 4	*Regional technical meeting with MCs to check those inputs*																				
Task 5	Main Scenario Models 2020/2040 for six thematic teams																				
Task 6	Initial Model Results for Internal Discussion						*														
Task 7	Extract Climate Data from SimCLim Software for 2040 Climate and prepare for model input																				
Task 8	Assess and Prepare 1960 Epoch Model including assessment of available hydrology, land use, sediment, flood and coastal/salinity																				
Task 9	Write technical Reports to support those scenarios formulation related to modelling input data , set-up and results																				
Task 10	Integrate with the BioRa Assessment																				
Task 11	Integrate with the Socio Economic Assessment																				
Task 12	Work with eWater and WUP Fin, ISH 306 teams on improvements for tool functionality necessary for scenario simulation and assessment																				
Task 13	*Regional technical meeting to check preliminary results for each thematic team*																				
Task 14	Support to Socio economic assessment																				
Task 15	Review and Check Inputs collected from the Six thematic on Formulate Sub-Scenarios																				
Task 16	*Regional technical meeting to check final model for each thematic team*																				
Task 17	Sub-Scenarios Models for Selected Thematic Teams																				
Task 18	Write technical Reports to support sub- scenarios formulation related to modelling input data , set-up and results																				
Task	*Regional technical meeting to check results for selected thematic*																				

19	*teams*																					
N0	**MT Outputs**																					
1	Model Output data to all Discipline + thematic Teams		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*					
2	Model Transfer to MC (2 intensive trainings on Sediment and WQ using 3 model packages)						*			*						*						
3	Revise Interim Reporting			*																		
4	1st Cumulative Scenario Report: Components, data and gaps and requested outputs. Model requirements				*																	
5	2nd Cumulative Scenario Report: Initial Simulations for Baseline 2020 and 2040. Outputs for Discipline teams						*															
6	3rd Cumulative Scenario Report: Simulations for Baseline 1960, 2020 and 2040 w/wo climate change. Output for Discipline teams								*													
7	Draft Scenario Modelling Report													*								
8	Final Scenario Modelling Report																					*
AA3	**Climate Change Assessment**																					
Task 1	Work with modeling team to provide climate change scenarios																					
Task 2	Interpreted result of modeling and data analysis									x												
Task 3	Write up the impact assessment report												x									
Task 5	Conduct national consultation workshops to present the findings																					
Task 6	Conduct a regional consultation workshop to finalise the report															x						
Task 7	Finalise the report																			x		
Task 8.	Transfer of climate change projection database and tool and training for application (in the framework of CCAI)						X															

AA4	Bioresource Assessment																			
Task 1	Finalise Reference Period (1985-2008) time-series datasets for each FA (1-8) from Modelling Team																			
	•Channel hydrology (discharge)																			
	•Channel hydraulics (Velocity, Channel Depth, Wetted perimeter and Shear Stress)																			
	•Sediment (loads and grain-size)																			
	•Water quality (Total nitrogen and total phosphorous)																			
	•Floodplain hydraulics (total silt, & sand, and area and depth of inundation)																			
	•Floodplain nutrients (nitrogen and phosphorous)																			
	•Tonle Sap Lake hydraulics (total silt, clay & sand, and area and depth of inundation)																			
	•Delta hydrology																			
	•Delta hydraulics																			
	•Testing scenarios																			
Task 2	Calibrate Response Curves for FAs 1-7					x														
Task 3	**Update interim technical report** (3 volumes): Specialist report; Guide to DSS and Calibration Report						x													
Task 4	Co**nstruct and calibrate Response Curves** for FA 8 (Delta)									x										
Task 5	**Revise DRIFT DSS** and conduct **2nd testing workshop** for the MCs to review the Response Curves											x								
Task 6	Finalize interim technical report (3 volumes): Specialist report; Guide to DSS and Calibration Report											x								
Task 7	Analyze water-resource development scenarios													x						
Task 8	**Technical Reports for inclusion in the Thematic Reports** (BioRA impact assessment report for all scenarios or thematic areas)													x						
Task 9	**Technical Report** for use in the Final Cumulative Impact Assessment Report																x			

Task 10	Meetings with Social and Economic lead consultants																				
Task 11	Develop cumulative impact assessment frame and contribute to its final report																			x	
BB	**Detailed Thematic Work plan**																				
BB1	**Hydropower Sector**																				
Task 1	Draft revised HP sub scenarios with justification for RTWG			x																	
Task 2	Confirm adequate budget for HP thematic report																				
Task 3	Confirm agreement on TOR and Contract variation with Multiconsult																				
Task 4	Arrange variation with FAS and amended contract sign by MRCS and Multiconsult																				
Task 5	Confirm modelling parameters and operations with modelling team				x																
Task 6	First Draft version of interim Assessment Report by Multiconsult					x															
Task 7	Coordination and discussion with MT on “main” scenario and sub scenarios																				
Task 8	Liaison between MT and Discipline experts with HP Trhematic lead /experts/IC																				
Task 9	Discipline report available for the “main scenario” for HP Thematic assessment team to commence writing.																				
Task 10	Outputs of HP Sub scenarios available -																				
Task 11	Draft HP assessment report – Multiconsult																				
Task 12	Review Draft HP Thematic report																				
Task 13	Update HP Thematic report based on Sub-scenarios by Multiconsult																				
Task 14	Final Review HP Thematic report																				

BB2	**Flood Protection**																			
Task 1	Discuss with MT on scenario formulation and data gap				x															
Task 2	Interprete result of modeling and data gap filling																			
Task 3	Conduct national consultation workshops to present the findings																			
Task 4	Participate in the RTWG Meetings																			
Task 5	Write up the impact assessment report													x						
Task 6	Conduct a regional consultation workshop to finalize the report													x						
Task 7	Finalize the report																	x		
BB3	**Irrigation**																			
Task 1	Work with modeling team to fill data gap for scenario formulation including sub-development scenario					x														
Task 2	Conduct national consultation meeting to discuss the formulated sub-scenario																			
Task 3	Interpret result of modeling and data analysis								x											
Task 4	Write up the impact assessment report													x						
Task 6	Conduct national consultation workshops to present the findings																			
Task 7	Conduct a regional consultation workshop to finalize the report														x					
Task 8	Finalize the report																	x		
BB4	**Agriculture and Land use change**																			
Task 1	Work with modeling team to fill data gap for scenarios formulation																			
Task 2	Interpret result of modeling and data analysis																			
Task 3	Write up the impact assessment report													x						
Task 5	Conduct national consultation workshops to present the findings																			
Task 6	Conduct a regional consultation workshop to finalize the report																			
Task 7	Finalize the report																	x		
BB5	**Navigation**																			
Task 1	Define missing data																			
Task 2	Provide missing data as agreed with disipline team																			

Task 3	Discuss results from MT																			
Task 4	Conduct regional workshop to discuss the results from MT for development scenario																			
Task 5	Write up the impact assessment report													x						
Task 7	Conduct national consultation workshops to present the findings													x						
Task 8	Conduct a regional consultation workshop to finalize the report														x					
Task 9	Finalize the report																	x		
BB6	**Domestic and Industrial water use**																			
Task 1	Collect data on industrial waste water				x															
Task 2	Collect data on sand mining extraction					x														
Task 3	Formulate development scenario for sand mining					x														
Task 4	Finalize the interim report				x															
Task 5	Conduct regional workshop to discuss the formulated development scenario																			
Task 6	Conduct national consultation workshop to discuss the formulated development scenario																			
Task 7	Analyze the collected data									x										
Task 8	Write up the impact assessment report													x						
Task 10	Conduct national consultation workshops to present the findings																			
Task 11	Conduct a regional consultation workshop to finalize the report																			
Task 12	Finalize the report																	x		

8 Budget

8.1 Budget Availability under CS as of July 2016

Table 8 shows the estimated to total cash/budget availability for the council study as of Jul 2016. This remaining available funding will be used to cover the implementation of the council study from Aug - Dec 2016. The fund availability from the earmark funding will be reserved for the using the expenditure for existing consultant contracts and the expenditure in the year 2017. The basket funding and fund from ARF will be used to cover the expenditure and operation including the payment of the consultant in 2016.

Table 8. Estimated total budget/cash available for the Council Study (updated in Sept 2016)

Funding Sources	Cash Availability (USD)	Validity date
Earmark Funding	300,000	Jun 2017 (Reserved for Phase 2)
Basket Funding	300,000	Dec 2016
Borrowing fund from ARF	250,000	Dec 2016
Total	**850,000**	

8.2 Estimated Total Budget Required for 2016 and 2017

Table 9 indicates the total budget requirement for the council study implementation from 2016-2017 in different priority of work. The option 1 indicates the scope of work for only the first priority activities which identified during the 7 RTWG meeting. While the option 2 covers the scope of council study work for 1st and 2nd priorities activities as agreed during the regional consultation meeting on council study phase 2 during Mar 2016. The detailed cost estimation for option 1 and 2 can be found in Table 10 and 11 below.

Table 9. The overall budget requirement for different years vs. priority on scope of work for CS

List of Options	Total Budget Requirement (USD)	Anticipated Budget Requirement (USD)			Remark
		BKF and EMF 2016	EMF 2017	BKF 2017	
1. CS implementation for 2016-2017 with 1st priority activities as recommended by 7th RTWG meeting	2,154,250	639,500	300,000	1,209,150	Reduced scope of work focusing only 1st Priority activities
2. CS implementation for 2016 -2017 to cover 1st & 2nd Priorities	2,347,500	704,500	260,000	1,383,000	Full scope as requested in the regional consultation meeting on phase 2 as agreed in Mar 2016

Table 10. Estimated total budget requirement for the first priority activities as requested by 7th RTWG meeting (Option 1)

	Items for expenditure	number of expert	expert number days or months	monthly rate	daily rate	Total	2016-BKF and EMF	2017-EMF	2017- BKF
A	**General**								
	Riparian Regional Coordinator, SC	1	15	8,000		120,000	32,000		88,000
	International Technical Advisor, SSA	1	100		750	75,000	26,250		48,750
	Administrative Assistant, SC	1	15	1,000		15,000	4,000		11,000
	Traveling and admin expenditure	1	1	60,000		60,000	20,000		40,000
B	**Sectors impact assessment**								
	Existing Contracts for international, regional and national	1	1	490,000		490,000	230,000	260000	0
	Riparian consultant to support domestic and industrial	1	6	4,000		24,000			24,000
	National expert for socioeconomic	4	20		300	24,000			24,000
	International Socio-Economic & Macroeconomic Consultants, SSA	1	105		750	78,750	22,500		56,250
	International Climate Change Consultants, SSA	1	20		750	15,000	7,500		7,500
	International sand mining consultant, SSA	1	15		700	10,500	4,900		
	International flood management consultant, SSA	1	25		700	17,500	4,900		12,600
	International land use consultant, SSA	1	25		700	17,500	4,900		12,600
	International irrigation consultant, SSA	1	15		700	10,500	4,900		5,600
	International Navigation consultation, SSA	1	20		700	14,000	4,900		9,100
C	**Modeling**								
	Riparian Modelling Lead Consultant, SC	1	10	6,250		62,500	25,000		37,500
	Riparian DSF Modeling Consultant, SC	1	10	6,000		60,000	24,000		36,000
	Assistant Modeller, SC	4	6	1,500		36,000			36,000
	International Integrated Modeling Consultant, SSA	1	100		750	75,000	37,500	20000	17,500
	International DSF Modeling Consultant, SSA	1	100		750	75,000	37,500	20000	17,500
D	**BioRA consultancy package**								
	Lead Consultant	1	25		850	21250	4250		17,000

	DRIFT DSS Management Consultant	1	25		850	21250	4250		17,000
	International Consultants	5	8		850	34000			34,000
	Riparian Consultants	2	5		600	6000			6,000
	DRIFT-DSS workshop	4	1	10000		40000	20000		20,000
E	**Coastal consultancy package**								
	International consultants	2	40		850	68,000	4,250		63,750
	Riparian consultants	4	10		300	12,000	6,000		6,000
F	**Consultation and communication meetings**								
	RTWG Meetings	2	2	10,000		40,000	20,000		20,000
	Small Group technical Meeting	4	6	10,000		240,000	30,000		210,000
	National Consultations	4	5	5,000		100,000	20,000		80,000
	Regional technical meeting on sub-scenarios formulation	1	4	10,000		40,000	20,000		20,000
	Regional Stakeholder Meeting	1	2	20,000		40,000	20,000		20,000
G	**Modelling knowledge transfer**								
	4 x 3 days training	4	3	5,000		60,000			60,000
H	**Biora Knowledge transfer**								
	4 x 3 days training	4	3	5,000		60,000			60,000
I	**Socioeconomic Knowledge transfer**								
	4 x 3 days training	4	3	5,000		60,000			60,000
J	**Closeout**								
	Report revisions, meetings arrangements, admin	1	1	35,000		35,000			35,000
					Sub-total CS	2,157,750	639,500	300,000	1,212,650

SC = Service Contract

SSA = Special Service Agreement

Table 11. Estimated total budget for the Council Study including (High and second priority) for option 2

	Items of Expenditure	# of Expert/ Time	# of Days/ months	Monthly rate	Daily Rate	Total	2016-BKF and EMF	2017-EMF	2017-BKF
A	**General**								
	Riparian Regional Coordinator, SC	1	15	8,000		120,000	32,000		88,000
	International Technical Advisor, SSA	1	100		750	75,000	26,250		48,750
	Administrative Assistant, SC	1	15	1,000		15,000	4,000		11,000
	Traveling and admin expenditure	1	1	60,000		60,000	20,000		40,000
B	**Sectors impact assessment**								
	Existing Contracts for international, regional and national	1	1	610,000		610,000	310,000	260000	40,000
	Riparian consultant to support domestic and industrial	1	8	4,000		32,000			32,000
	National expert for socioeconomic	4	20		300	24,000			24,000
	International Socio-Economic & Macroeconomic Consultants, SSA	1	105		750	78,750	22,500		56,250
	International Climate Change Consultants, SSA	1	25		750	18,750	7,500		11,250
	International sand mining consultant, SSA	1	15		700	10,500	4,900		5,600
	International flood management consultant, SSA	1	25		700	17,500	4,900		12,600
	International land use consultant, SSA	1	25		700	17,500	4,900		12,600
	International irrigation consultant, SSA	1	15		700	10,500	4,900		5,600
	International Navigation consultat, SSA	1	25		700	17,500	4,900		12,600
C	**Modeling**								
	Riparian Modelling Lead Consultant, SC	1	12	6,250		75,000	25,000		50,000
	Riparian DSF Modeling Consultant, SC	1	12	6,000		72,000	24,000		48,000
	Assistant Modeller, SC	4	6	1,500		36,000			36,000
	International Integrated Modeling Consultant, SSA	1	120		750	90,000	30,000		60,000
	International DSF Modeling Consultant, SSA	1	120		750	90,000	30,000		60,000
D	**BioRA consultancy package**								
	Lead Consultant	1	25		850	21250	4250		17,000

	DRIFT DSS Management Consultant	1	25		850	21250	4250		17,000
	International Consultants	5	8		850	34000			34,000
	Riparian Consultants	2	5		600	6000			6,000
	DRIFT-DSS workshop	4	1	10000		40000	20000		20,000
E	**Coastal consultancy package**								
	International consultants	2	40		850	68,000	4,250		63,750
	Riparian consultants	4	10		300	12,000	6,000		6,000
F	**Consultation and communication meetings**								
	RTWG Meetings	2	2	10,000		40,000	20,000		20,000
	Small Group technical Meeting	4	6	10,000		240,000	30,000		210,000
	National Consultations	4	5	5,000		100,000	20,000		80,000
	Regional technical meeting on sub-scenarios formulation	1	4	10,000		40,000	20,000		20,000
	Regional Stakeholder Meeting	1	2	20,000		40,000	20,000		20,000
G	**Modeling knowledge transfer**								
	4 x one week training	4	3	5,000		60,000			60,000
H	**Biora Knowledge transfer**								
	4 x one week training	4	3	5,000		60,000			60,000
I	**Socioeconomic Knowledge transfer**								
	4 x one week training	4	3	5,000		60,000			60,000
J	**Closeout**								
	Report revisions, meetings arrangements, admin	1	1	35,000		35,000			35,000
					Total :	2,347,500	704,500	260,000	1,383,000

SC = Service Contract

SSA = Special Service Agreement

Table 12 shows a summary of the budget situation of the Council Study. The secured funding in 2017 is about USD 300 K from EMF. It is also the anticipated funding station by option 1 and 2 as below.

Table 12. Budget outlook for 2017

Budget Item	Option 1. Estimated Amount USD	Option 2. Estimated Amount USD
Total Budget Required	1.5 M	1.64 M
Anticipated budget availability from the Secured Funding (Australia, Finland, Germany, Luxembourg, SDC, USA) for 2017	300 K	260 K
Funding from BKF in 2017	1.1 M	1.1 M
Funding gaps	100 K	280 K

9 Risk Management

The Council Study Draft 2015 Annual Report lists the overall risks, specific issues, and measures to mitigate the risks. To supplement this, Table 11 below shows risks specific to this Phase 2 implementation plan and proposed measures. It should be noted that the risks and proposed measures are based on the experience of the Council Study Team in Phase 1 including lessons learned.

Table 11. Risks and risk management associated with Phase 2 implementation

Risk	Specific Issues	Measures
Administrative Capacity	New ITA to support the Council Study Coordinator is not hired on schedule	Advertisement of the new ITA to support Council Study Coordinator has been posted (completed)
	Delay and loss of momentum due to required learning curve the new ITA for Council Study will have to overcome during transition	Get the ITA for CS on board as scheduled during the transition phase (Oct 2016-Nov 2016 time frame)
Technical Expertise	The combined indicator for socioeconomic is still pending	The socioeconomic team needs to take urgent actions on this issues together with an international expert on socioeconomic and macroeconomic. The combine indicators should be developed not later than Nov 2016.
	The domestic and industrial water use is still slow progress and the main and sub-scenario development are still pending	Accelerating to complete the interim report and finalize the main development scenarios and sub-scenarios on sand mining by Nov 2016.
	The interlink between Biora, socioeconomic, modelling and other thematic team is still missing	Establish interlink work and resource planning between all teams.

Budget	Budget required in 2017 to complete the study in 2017 is anticipated to be available only 1.39 M USD which is already reduced compared to the original plan. If 1.39 M USD is not secured there exists big risk for the project.	Initiate plan for 2017 as soon as possible to further evaluate this risk Engage DPs in discussions early for the purposes of securing additional funding for the Council Study or request for using ARF fund to fill the gap.
	Review of scope of work of the Council Study for the purposes of reducing scope due to budget limitation will take enormous time and cause significant delays similar to delays in the preparation of the Inception Report	Member Countries to agree on the proposed scope and work and budget plan to avoid further delays.

ANNEX I: Thematic Assessment Indicators

List of Main Deliverable	Description of the core requirement	Impact Assessment Indicators				Required Input from other Sectors/disciplines	Data requirement	Response. Team
		Key Requirement	Transboundary	Environment parameters	Socio & economic parameters			
1 Thematic Report on the Impacts and Benefits of Irrigation Development in the Lower Mekong River Basin Including Recommendations for Impact Avoidance and Mitigation Measures	The report will highlight the rate of irrigation expansion and the induced changes in flow parameters and the resulting changes in environmental, social and economic parameters including issues of food security, employment and transboundary benefits and costs. The report will also cover the	• Timeline of irrigated area for wet and dry season • Changes in production • Changes of irrigation demand and return flow including nutrient and fertilisers • Impact of irrigation on fishery within irrigated	Impact of changes to flow on tranboundary benefit and cost. (Who?) (what benefit and cost?)	Impact of changes to flow on environment and direct impacts within irrigated area. (environment parameters to be defined)	Impact of changes to flow on social, economic and employment. Expected Impact on Food production/food security Household/Farm Income	Impact of irrigation intensificationon fishery. Impact of other sectors on irrigations including dry season water requirement Climate Change scenario	• Rate of irrigation expansion past and future • Fishery data	Lead by irrigation Support by MT,SE, Biora and Fishery

List of Main Deliverable	Description of the core requirement	Impact Assessment Indicators				Required Input from other Sectors/disciplines	Data requirement	Response. Team
		Key Requirement	Transboundary	Environment parameters	Socio & economic parameters			
	impacts of irrigation on fisheries and the impacts of other developments on irrigation including dry season irrigation. The data collection and analysis should be sufficient spatial detail to assess the impact on mainstream for 1960, 2000 2007, 2020, 2040.	area. • Impact on other sectors development including flood plain flood protection						

List of Main Deliverable	Description of the core requirement	Impact Assessment Indicators				Required Input from other Sectors/disciplines	Data requirement	Response. Team
		Key Requirement	Transboundary	Environment parameters	Socio & economic parameters			
2 Thematic Report on Impacts of Non-irrigated Agriculture Development and General Trends in Major Land-Use Categories in the Lower Mekong River Basin Including Recommendations for Impact Avoidance and Mitigation Measures.	The report will indicate how land-use change including forested area, agricultural and urban expansion can influence river to flow in term of quantity, quality, timing and content (i.e. sediment, nutrients, etc.) and the resulting transboundary positive and negative impacts on environmental, social and economic parameters. The changes in sediment transport linked to land-use change and erosion will	• Land use change including agriculture expansion can influence river flow (quantity, quality, timing and content, sediment, nutrient) • Resulting the transboundary positive and negative impacts on environment, social and environment including socio and economic paramete	Assessment of the transboundary positive and negative impacts on environment, social and environment including socio and economic parameters	Define the Biodiversity and transboundary environmental impact parameters on land use changes	Food production, ecosystem services, resource valuation, transboundary social and economic impact parameters on land use changes	Assessment of the changes in sediment and nutrient transport linked to land use change and erosion. Climate Change impacts on species composition	• Define major land use categories • Historic Trend including 1960, 2000, 2007 and Future Trends of major land use • Floodplain areas to be protected against the flood. • Forest & wetland	Lead by agri. Land use team Support: MT, Biora, SE. CCAI

List of Main Deliverable	Description of the core requirement	Impact Assessment Indicators				Required Input from other Sectors/disciplines	Data requirement	Response. Team
		Key Requirement	Transboundary	Environment parameters	Socio & economic parameters			
3 Thematic Report on Impacts and Benefits of Domestic and Industrial Water Use in the Lower Mekong River Basin including Recommendations for Impact Avoidance and Mitigation Measures	This report will contain an updated map of large existing and planned and expanding urban and industrial centres within the basin, estimate water demand over the period covered by the Council Study, estimate general effluent and waste water discharge and highlight any possible risks of industrial spills or similar significant impacts. The report will further provide an estimate of	• Identify the impacts and benefits of the domestic and industrial water use • Updated map of large existing and planned expanding urban ad industrial centers • Estimate water demand over 1985-2008 • Estimate general effluent and water discharge • Highlight any possible	The impact of water use and waste discharge on water quality downstream. Effect of sand mining on morphology and bank erosion	Water quality changes in mainstream and impact corridor. Impact on biodiversity, wetlands etc Geomorphological change related to sand mining	• Identify the impacts and benefits of the domestic and industrial water use • Drinking Water • Economics of drinking water supply from surface water • Impact of effluent discharge • Requirements and amounts of sand mining necessary for development • Costs of bank protection required	Navigation regarding expected sediment generated from navigation channel maintenance Socioeconomics and flood sector regarding development	• Updated map of large existing and planned expanding urban ad industrial centers • Estimate water demand over 1985-2008 and project to 2040 • Estimate general effluent and water discharge • Historic and future sand mining	Lead: Domestic and industrial team Support by: MT, SE, and Biora?

List of Main Deliverable	Description of the core requirement	Impact Assessment Indicators				Required Input from other Sectors/disciplines	Data requirement	Response. Team
		Key Requirement	Transboundary	Environment parameters	Socio & economic parameters			
4 Thematic Report on Impacts and Benefits of Flood Protection Structures and Floodplain Infrastructure and Impact of other Developments on Flood Risk Including Recommendations for Impact Avoidance and Mitigation Measures.	The report will provide an assessment of the transboundary flood protection benefit and risks of existing and planned infrastructure. Furthermore, it will describe how these structures can influence river to flow in term of quantity, quality, timing, and content and the resulting transboundary positive and negative	• Assessment of transboundary flood protection benefit and risk of existing and planned infrastructure • How the structure can influence river flow (quantity, quality, timing ad content) • Assesment of transboundary impact positive and	• Assessment of transboundary flood protection benefit and risk of existing and planned infrastructure • Assesment of transboundary impact positive and negative on environmental, social and economic parameters • Opportun	• Assessment of transboundary impact positive and negative on environmental parameters.	• Assessment of transboundary impact positive and negative on social and economic parameters including flood risk and damage •	Assessment of the impact of the changes in flooded areas in terms of environment, agriculture and socioeconomics Climate Change and sea level rise	• Flood protection structure • Floodplain infrastructure • Information on flood risk • Planned development in the floodplain (Historic 1960 2000, 2007) and projected 2020 and 2040. Distribution of population and	Lead: flood team Support by MT, Biora, SE and fishery and agriculture And Climate Change

List of Main Deliverable	Description of the core requirement	Impact Assessment Indicators				Required Input from other Sectors/disciplines	Data requirement	Response. Team
		Key Requirement	Transboundary	Environment parameters	Socio & economic parameters			
	impacts on environmental, social and economic parameters.	negative on environmental, social and economic parameters • Assessment of the impact of the changes in sediment transport and easy fragmentation for agriculture, fishery and food security	ities of dam storage and catchment management as well as flood plain management				assets at risk of flood in 2020, 2040	

List of Main Deliverable	Description of the core requirement	Impact Assessment Indicators				Required Input from other Sectors/disciplines	Data requirement	Response. Team
		Key Requirement	Transboundary	Environment parameters	Socio & economic parameters			
5 Thematic Report on Impacts and Benefits of Hydropower Development in the Lower Mekong River Basin Including Recommendations for Impact Avoidance and Mitigation Measures.	The report will present an assessment of the cumulative positive and negative impacts of hydropower development in selected Lower Mekong River tributaries and the mainstream. The focus will be on how the dams can influence fisheries, river flow, sediment and nutrient flux in term of quantity, quality, timing and the resulting transboundary positive and negative impacts on environment	• Assessment of the cumulative positive and negative impacts of hydropower development in Lower Mekong River tributaries and the mainstream • Assessment of transboundary positive and negative impacts on environmental, social and economic parameters in the mainstre	Assessment of transboundary positive and negative impacts on the flood, environmental, social and economic parameters in the mainstream corridor, floodplains and Delta as well as coastal processes due to the influence of the dams to fisheries, river flow, sediment and nutrient flux in term of quantity, quality and timing.	Assessment of transboundary positive and negative impacts on environmental parameters in the mainstream corridor, floodplains, and Delta as well as coastal processes due to the influence of the dams to fisheries, river flow, sediment and nutrient flux in term of quantity, quality and timing.	Assessment of transboundary positive and negative impacts on social and economic parameters in the mainstream corridor, floodplains, and Delta as well as coastal processes. People and food production directly and indirectly affected	Assessment of the influence of hydropower development on the fishery, river flow, sediment, nutrient flex on quality, quantity, and timing. Agricultural impacts	Hydrology, sediment, nutrient, fishery, dam locations on main and tributary, hydropower, spillway and flushing capacity and operating regimes. SE data including power benefits	Lead: HP Support:Biora, MT, SE and fishery

List of Main Deliverable	Description of the core requirement	Impact Assessment Indicators				Required Input from other Sectors/disciplines	Data requirement	Response. Team
		Key Requirement	Transboundary	Environment parameters	Socio & economic parameters			
6 Thematic Report on the Impacts and Benefits of Navigation Infrastructure Development in the Lower Mekong River Basin Including Recommendations for Impact Avoidance and Mitigation Measures.	The report will include two main sections: an assessment of how existing and planned navigation infrastructure can influence river flow in term of quantity, quality, timing and content and the resulting transboundary positive and negative impacts on environmental, social and economic parameters and an assessment of the	• Assessment of how existing and planned navigation infrastructure can influence river flow in term of quantity, quality, timing and content and the resulting transboundary positive and negative impacts on environmental, social and	Assessment of transboundary positive and negative impacts on environmental, social and economic parameters based on the existing and planned navigation infrastructure on river flow (quantity, quality, timing and content)	Assessment of transboundary positive and negative impacts on environmental parameters (river flow) based on on the existing and planned navigation infrastructure and the expected maintenance dredging regime.	Assessment of transboundary positive and negative impacts on social and economic parameters based on on the existing and planned navigation infrastructure on river flow and improved trade	Assessment of the positive and negative impacts of water resources development in other thematic areas on navigation including effect of mitigation measures such as sediment flushing.		Lead: Navigation Support by: MT, Biora, SE and all Sectors

List of Main Deliverable	Description of the core requirement	Impact Assessment Indicators				Required Input from other Sectors/disciplines	Data requirement	Response. Team
		Key Requirement	Transboundary	Environment parameters	Socio & economic parameters			
	positive and negative impacts of water resources development in other thematic areas on navigation.	economic parameters • Assessment of the positive and negative impacts of water resources development in other thematic areas **on navigation**.						

List of Main Deliverable	Description of the core requirement	Impact Assessment Indicators				Required Input from other Sectors/disciplines	Data requirement	Response. Team
		Key Requirement	Transboundary	Environment parameters	Socio & economic parameters			
7 Report on the Cumulative Impacts and Benefits of the Selected Water Resources Developments (Cumulative Report) Including Recommendations for Impact Avoidance and Mitigation Measures	This report will highlight the cumulative **impact** of the basin developments in the six thematic areas on the agreed CS river corridor and as such is key to the success of the Council Study. The assessment of transboundary positive and negative impacts will use the triple bottom line of environmental, social and economic parameters and must be comprehensive and authoritative for guiding	• highlight the cumulative impact of the developments in the six thematic areas on the river flow in term of quantity, quality, timing and content and clearly indicate resulting transboundary positive and negative impacts on environmental, social and economic parameters	transboundary positive and negative impacts on environmental, social and economic parameters of the six thematic teams	Overall assessement of the environemtal impact including bioresources, ecology, risk of envoronment due to the development and including ecosystem services and value	Overall and specific asessement of economic benefits and costs of development including the direct costs and benefits, positive and negative economic externalities from the developments assessed in the six thematic areas including ecosystem services and social impacts and multiplier effects of development including impact on regional macro-economic development, trade flows, replacement costs of lost	Specific assessment result from 6 thematic sectors	Result from main and sub-developoment scenario. Social and Economic data for 1960, 2000, 2007. 2020 and 2040 projections	Lead: CS coordinator and ITA Support by Core team

ANNEX II: Data Requirements, Expected Data and Status of Collected Data

Data Requirement, Expected Data and Status of Collected Data				
Data Requirement	**Expected Data**	**Status of Collected Data**	**Method to fill data gap**	**Remark**
I. Domestic and Industrial Water Use including Sand Mining				
Domestic Water Use				
A. Population in year 1960, 2007, 2020 and 2040 **B.** Water use rate per capita for year 1960, 2007, 2020 and 2040	Tables with spatial reference or maps	National level data only; No data for efluent; no data for 1960	Use existing spatial model data to scale up or down based on national level data. Use SIMVA population distribution. Socioeconomics to define Urban/Rural change to 2040	Large population difference in Vietnam compared to BDP2 baseline
Industrial Water Use				
C. Industrial demand in year 1960, 2007, 2020 and 2040 **D**. Net water use rate per industry for year 1960, 2007, 2020 and 2040 **E.** Nutrient loads per industry for year 1960, 2007, 2020 and 2040	Tables with spatial reference or maps	Only Vietnam data for extractions available. No effluent or pollutant data	Estimate missing countries; use global data on industrial effluent releases	
Sand Mining				

F. Location of Sand mining e.g. Vientiane -Nong Khai or Phnom Pen-Vietnam Border for (2007,) 2020 and 2040 G. Volume of sand extracted/ dredged/ excavated **H.** Time and Period	Tables with spatial reference or maps	Overall Current situation provided by the WWF, details requested but not yet received; This cannot be used without checking; scenario data missing; time and period missing.	Cross check on sand use, Sustainable mining can be estimated with modelling; other scenarios.	2007 baseline doesn't include sand mining; WWF/DSMP data for Cambodia is a snapshot in 2012 and may not be correct
II. Irrigation				
Irrigated Area at district level				
A. Irrigated area in sub-basins for 1960, 2000, 2007, 2020 and 2040; for wet and dry season; for rice and other crops	Tables with spatial reference or maps	Only national level data for total irrigation area (?); no data for 1960	Use dry/wet season rice and other crop areas; scale existing model areas up or down based on national data	Data may differ from that used in BDP
Nitrogen, Potassium and Phosphorus average loads in kg/ha				
B. Annual fertiser applications and runoff nutrient loads from irrigated and rainfed agriculture for sub-basins for 1960, 2000, 2007, 2020 and 2040	Tables with spatial reference or maps	Level of data varies depending on country; scenario information incomplete, maximum to near future; historical trend analysis available for all countries	Use existing information on the other countries to complete where not available for baseline; use trend analysis to complete future scenarios. Use BDP and MRC WQ data	
III. Agriculture and Land use Change				
Land use				
A. Landuse factors (or areas of the land use classes) in sub-basins for 1960, 2007, 2020 and 2040; (it should be 8 - 9 land use classes)	Tables with spatial reference or maps	Data for national level only for rainfed agriculture, forest and mining (?); no data for 1960	Scale existing spatial model land use areas up or down based on national level change; use old maps for 1960	2007 should correspond to the 2003 MRC Land Cover Map
Mineral mining				

B. Mining type, location, water use and nutrient and sediment release	Tables with spatial reference or maps	No data	?	Information of harmfull substance releases such as heavy metals would be useful in the future
IV. Flood Protection				
Expected FLood Protection				
A. Clear Maping of where different flood protection exista for Baseline and is expected for 2020 and 2040	Maps and statistics of flood banks and gates and areas protected with design flood return period	None available	MT has some information in existing models. Can compile from local knowledge and satelite imagery then check with local experts	FMMP plan to mobilise national experts when fund available
Bank Protection				
B. Mapping of Existing and Expected Bank Protection Works including Vietnam Delta	Lengths of river bank protected from erosion	None Available	Can compile from local knowledge and satelite imagery then check with local experts	Bank protection works associated with sediment
Flood Plain Development				
C. Expected Flood Plain Development including areas reserved for flood storage and conveyance and areas to be protected	Initial Studies contain some indications	Flood Plain and wetland to be protected	For Scenarios some assumptions must be made and then consulted on	Initial Studies will define this if they start in time
Flood Impact and Damages				
D. Expected Flood Damages and People Affected	Initial Studies contain some indications	Initial STudies define Damages for current day at selected pilot districts	Initial STudies will fill otherwise CCAI methodology could be considered	Necessary to link with Socioeconomics
V. Navigation				

Class of Navigation					
	A. Clear Maping of where different class of navigation is planned and minimum depths of water for Baseline, 2020 and 2040 Cases	Location and Depth of different class of navigation.	Master Plan and Interim report provide main requirements.	Continue work with NAV	It has been agreed no sub scenarios but ISH Subscenarios will impact
Navigation Dredging					
	B.Interpretation of expected navigation dredging capital and maintenance	Location and size the channel where are needed to expand and amount of sand dredging from each location during both dredging and maintenance	By reach dredging requirements to be supplied by NAV		Not sure if all data available as NAV working to compile
Benefits of and Costs of Navigation					
	C.Benefits of and costs of Navigation quantified for socioeconomic anlayses	Cost and benefit of proposed improvements	Master Plan has data	Continue work with NAV	Not necessary for modelling team
VI. Hydropower					
HP Dam Characteristic					
	A. Rated Gross Head (M) **B.** Install Capacity (MW) **C.** Overall Efficiency at Gross Head **D.** Full Supply Level (MAMSL) **E.** Low Supply Level (MAMSL) **F.** Spillway and Location G: Year of Commissioning	Basic Statistics of each project on mainstream and tributaries	Data Available. Question mark on Latsua and Sambor proposals. Data for Low level gates at Xayaburi not provided by MC	Use presentation and ISH306 assumptions. Continue working with ISH to confirm design to be used in simulation	Additional Chinese dams expected
HP Dam Sediment and Nutrient Trapping					

A. Expected Sediment Trapping **B.** Expected Nutrient Trapping	Basic Statistics of each project on mainstream and tributaries	ISH306 Data provided	Use presentation and ISH306 assumptions. Continue working with ISH to confirm design to be used in simulation. Review delta study and request @Special Additional STudies reports and data.	ISH 306 work planned for 2017 to cover all mainstream dams. For subscenarios need one with no LMB mainstream
Rule Curve of HP				
G. For mainstream LMB need to have indication of daily operating range, any specific seasonal change such as Xayaburi flood drawdown and Pak Beng dry season change in FSL. Sediment management regime and flushing. For Tributaries will use BDP2 where possible	ISH is conducting studies of Upper Cascade during 2016 and has supplied reporting and models (ISH0306)	The operating regime for sediment flushing is still not defined for the whole cascade. The operation studies for Xayaburi have not been made available.	MT and ISH Agreed that in principle the main cumulative scenario should assume designs compliant with MRC Preliminary Design Guidance and Xayaburi may be used as the main template for Lao dams. MT can interprete ISH306 sugested operating procedure for an upper cascade for a consistent operation of 11 dams. For Cambodia we can assume the NHI proposals if or when those are agreed. Review Delta Study for relevant assumptions.	EDS 2007,Dev 2020 and Dev2040. Need to revisit the Chinese Dam Operating Curves assumed given post 2010 experience. Request Delta Study dam simulation details

ANNEX III: Abiotic information required for the Biological Resources Assessment

Discipline	Zones	Input data	Time-step	Appropriate MRC model	Data outputs	Data required for DRIFT at the start of:
Hydrology	Representative river sites in Zones 1, 2, 3, 4a	Hydrological time series	Daily	SWAT	Historic daily discharge Baseline daily discharge	SET-UP
			Daily	IQQM	Daily discharge associated with Thematic configurations	ANALYSIS
Site Hydraulics	Representative river sites in Zones 1, 2, 3, 4a	Hydrological time series	Same as input hydrology	iSIS (where available and subject to clarity on the spatial resolution of iSIS set up)	Water level Water depth in channel Velocity Lateral connectivity Longitudinal connectivity Inundated area of floodplain Water depth on floodplain	KNOWLEDGE CAPTURE
Hydrodynamics	1, 2, 3, 4	Hydrological time series	Same as input hydrology	iSIS (where available)* (Note: iSIS is not capable to provide sub-daily changes in discharge as a result of dam operation)	Sub-daily changes in discharge as a result of dam operations (Floodplain inundation patterns Hydrological changes associated with channel change	KNOWLEDGE CAPTURE and ANALYSIS
	4b (Tonle Sap Great Lake)	Hydrological time series	Same as input hydrology	iSIS	Inundation area Depth of inundation Timing and duration of inundation	KNOWLEDGE CAPTURE and ANALYSIS
	5 (Mekong Delta)	Hydrological time series	Same as input hydrology	iSIS	Salinity distribution in the delta Extent and timing flooding and inundation in the delta	KNOWLEDGE CAPTURE and ANALYSIS

Discipline	Zones	Input data	Time-step	Appropriate MRC model	Data outputs	Data required for DRIFT at the start of:
Sediments/ Geomorphology	1 ,2, 3, 4, 5	Baseload and suspended sediment time series	Same as input hydrology	iSIS* (*Note: iSIS capability to produce these outputs range from none to limited)	Suspended sediment concentration Grain size of suspended sediment Bedload supply Grain size of bedload Exposed extent of rocky and sandy islands Bed elevation Bank erosion and slumping Effects of dredging and sand mining (particularly in Delta) Depth of large pools	KNOWLEDGE CAPTURE and ANALYSIS
Water Quality	1 ,2, 3, 4a	Water Quality time series	Same as input hydrology	iSIS* (*Note: iSIS capability to produce these outputs range from none to limited)	Conductivity Temperature pH Dissolved oxygen Total suspended solids (from sediment modelling) Organic content Nutrient concentrations	KNOWLEDGE CAPTURE and ANALYSIS
	4b Tonle Sap Great Lake	Water Quality distribution time series	As above	As above	As above	As above

Discipline	Zones	Input data	Time-step	Appropriate MRC model	Data outputs	Data required for DRIFT at the start of:
	5 (Delta)		Same as input hydrology	iSIS* (*other models with 2-D sediment transport modelling capability may be linked to iSIS if found necessary and appropriate)	Salinity Temperature pH Dissolved oxygen Water clarity DIN, DIP and silicate	KNOWLEDGE CAPTURE and ANALYSIS

Discipline	Zones	Input data	Time-step	Appropriate MRC model	Data outputs	Data required for DRIFT at the start of:
Hydrology	Representative river sites in Zones 1, 2, 3, 4a	Hydrological time series	Daily	SWAT	Historic daily discharge Baseline daily discharge	SET-UP
			Daily	IQQM	Daily discharge associated with Thematic configurations	ANALYSIS
Site Hydraulics	Representative river sites in Zones 1, 2, 3, 4a	Hydrological time series	Same as input hydrology	iSIS (where available and subject to clarity on the spatial resolution of iSIS set up)	Water level Water depth in channel Velocity Lateral connectivity Longitudinal connectivity Inundated area of floodplain Water depth on floodplain	KNOWLEDGE CAPTURE
Hydrodynamics	1, 2, 3, 4	Hydrological time series	Same as input hydrology	iSIS (where available)* (Note: iSIS is not capable to provide sub-daily changes in discharge as a result of dam operation)	Sub-daily changes in discharge as a result of dam operations (	KNOWLEDGE CAPTURE and ANALYSIS
					Floodplain inundation patterns	
					Hydrological changes associated with channel change	
	4b (Tonle Sap Great Lake)	Hydrological time series	Same as input hydrology	iSIS	Inundation area	KNOWLEDGE CAPTURE and ANALYSIS
					Depth of inundation	
					Timing and duration of inundation	
	5 (Mekong Delta)	Hydrological time series	Same as input hydrology	iSIS	Salinity distribution in the delta	KNOWLEDGE CAPTURE and ANALYSIS
					Extent and timing flooding and inundation in the delta	
Sediments/ Geomorpho	1 ,2, 3, 4, 5	Baseload and suspended sediment time series	Same as input	iSIS*	Suspended sediment concentration	KNOWLEDGE CAPTURE and ANALYSIS

Discipline	Zones	Input data	Time-step	Appropriate MRC model	Data outputs	Data required for DRIFT at the start of:
logy			hydrology	(*Note: iSIS capability to produce these outputs range from none to limited)	Grain size of suspended sediment	
					Bedload supply	
					Grain size of bedload	
					Exposed extent of rocky and sandy islands	
					Bed elevation	
					Bank erosion and slumping	
					Effects of dredging and sand mining (particularly in Delta)	
					Depth of large pools	
Water Quality	1 ,2, 3, 4a	Water Quality time series	Same as input hydrology	iSIS* (*Note: iSIS capability to produce these outputs range from none to limited)	Conductivity	KNOWLEDGE CAPTURE and ANALYSIS
					Temperature	
					pH	
					Dissolved oxygen	
					Total suspended solids (from sediment modelling)	
					Organic content	
					Nutrient concentrations	
	4b Tonle Sap Great Lake	Water Quality distribution time series	As above	As above	As above	As above
	5 (Delta)		Same as input hydrology	iSIS* (*other models with 2-D sediment transport modelling capability may be linked to iSIS if found necessary and appropriate)	Salinity	KNOWLEDGE CAPTURE and ANALYSIS
					Temperature	
					pH	
					Dissolved oxygen	
					Water clarity	
					DIN, DIP and silicate	