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THE COUNCIL STUDY

Study on the sustainable management and development of the Mekong river, including impacts of mainstream hydropower projects

Approach and methodology for social impact assessment of development scenarios

Working draft

Prepared by:
Basin Development Plan Programme

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Document history

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1	0	Draft report prepared for internal discussion	14 October 2015	Socio-Economic Assessment Team
	1	Draft report prepared for consideration of RTWG based on internal comments and suggestions	30 October 2015	Socio-Economic Assessment Team
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Abbreviations and acronyms

AIP	:	Agriculture and Irrigation Programme (of the MRC)
BDP	:	Basin Development Plan
BDP2	:	BDP Programme, phase 2 (2006 –10)
BDS	:	(IWRM-based) Basin Development Strategy
BioRA	:	Biological resource assessment team (under Council Study)
CCAI	:	Climate Change and Adaptation Initiative (of the MRC)
CIA	:	Cumulative Impact Assessment
CNMC	:	Cambodia National Mekong Committee
CS	:	Council Study
DMP	:	Drought Management Programme (of the MRC)
EP	:	Environment Programme (of the MRC)
FAO	:	Food and Agriculture Organisation
FMMP	:	Flood Mitigation and Management Programme (of the MRC)
FP	:	Fisheries Programme (of the MRC)
HH	:	Household
IBFM	:	Integrated Basin Flow Management (MRC study)
IFAD	:	International Fund for Agricultural Development
IKMP	:	Information and Knowledge Management Programme (of the MRC)
ILO	:	International Labour Organisation
IWRM	:	Integrated Water Resources Management
ISH	:	Initiative for Sustainable Hydropower (of the MRC)
JC	:	Joint Committee (of the MRC)
LMB	:	Lower Mekong Basin
LNMC	:	Lao National Mekong Committee
M&E	:	Monitoring and evaluation
MRC	:	Mekong River Commission
MRCS	:	Mekong River Commission Secretariat
MRC-SP	:	MRC Strategic Plan
NMC	:	National Mekong Committee
NMCS	:	National Mekong Committee Secretariat
NAP	:	Navigation Programme (of the MRC)
PMFM	:	Procedures for Maintenance of Flow on the Mainstream
PWUM	:	Procedures for Water Use Monitoring
SEDB	:	Socio-economic database (of the MRC)
SIMVA	:	Social impact Monitoring and Vulnerability Assessment (conducted by MRCS)
SoB	:	State of Basin report (of the MRC)
SocEc	:	Social Assessment team (of the Council Study)
TCU	:	Technical Coordination Unit (of the MRCS)
TNMC	:	Thai National Mekong Committee
UMB	:	Upper Mekong Basin
UN	:	United Nations
UNDP	:	United Nations Development Programme
VNMC	:	Viet Nam National Mekong Committee

1 Introduction

1.1 Main purpose of this report

The main purpose of this report is to provide guidance to the **approach and methodology for the social component**[1] of the triple-bottom line cumulative impact assessment of basin-wide development scenarios under the MRC Council Study[2]. The approach and methodology can be used also for the social assessment of the considered thematic scenarios under the Study.

This report takes as its primary guidance the Inception Report of the Council Study[3].

This report was the outcomes of two weeks intensive discussion and formulation by the National Expert on Social Science from the four riparian countries under the supervision of the International Expert and the MRC BDP team. This report was further improved by discussions held individually with members of other Thematic and Discipline teams of the Council Study in a series of meetings hosted by BDP. In addition, a mini-workshop was held on 24th September 2015 to present preliminary ideas on the assessment approach. The workshop was attended by country delegates, Council Study Team management and BDP team members. Feedback from the workshop is reflected in this report.

1.2 Report contents

This report contains three chapters as described below.

Chapter 2, Background to assessment approach, sets out the background to the planned social assessments under the Council Study. The chapter also identifies the water resource and relevant exogenous development drivers within the Mekong Basin that need to be taken account of in making the assessments, and discusses the scope of those assessments. The chapter concludes with a discussion leading to selection of assessment indicators.

Chapter 3, Approach and methodology, commences with the objective of the social assessment and an overview of assessment approach. The chapter then describes the four main components of this approach, being data assembly and analysis, projecting the social situation in the LMB without water resources development, assessing the impacts with water resources development and, finally, the planned deliverables and reporting.

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1 The term “socio-economic” assessment (as referred to in the Council Study ToR) has been replaced in this report by “social assessment” to better distinguish between the assessment of impacts on people and their livelihoods and those on the basin economy. Furthermore this distinction reflects also the terminology used in the MRC Indicator Framework.

2 The full title of the MRC Council Study is: “Study on the sustainable management and development of the Mekong River, including impacts of mainstream hydropower projects”

3 Inception Report of the MRC Council Study, Draft Final, 27 October 2014

Chapter 4, Data requirements, provides an overview of data requirements including basic social data requirements, spatial data requirements and information required of other Council Study teams as an input to the social assessments. The chapter identifies a small number of gaps identified in the MRC socio-economic database which are required to be filled.

2 Background to assessment approach

This Chapter sets out the background to the planned social assessments under the Council Study. The chapter also identifies the water resource and relevant exogenous development drivers within the Mekong River Basin that need to be taken account of in making the assessments, and discusses the scope of those assessments. The chapter concludes with a discussion leading to selection of assessment indicators.

2.1 Social assessment in the context of the Council Study

2.1.1 Objectives

The main objectives of the Council Study (CS) are to: (i) further understand the environment, social and economic impacts (positive and negative) of water resources developments; (ii) enhance the BDP process to support the Member Countries in the sustainable development of the basin; and (iii) promote capacity building, raise awareness and build trust.

The Council Study will mainly concentrate on transboundary issues, including the regional distribution of benefits, costs, impacts and risks of basin developments. The results will support cooperation on water resources development and management towards optimal and sustainable development.

The main aim of the development scenario assessment is to provide the MRC member states with an analysis of alternative development strategies, particularly with respect to their economic, social and environmental impacts, in order to reach a consensus on the key decisions that will shape the future development and management of the water resources within the LMB.

The three development scenarios comprise: (i) early development scenario, (ii) definite future scenario, (iii) planned development scenario. The time horizon and primary interventions for each development scenario are summarised in Table 1**.**

2.1.2 Structure of the Council Study

In addition to a Cumulative Assessment Team, six Thematic Teams have been established covering the important thematic IWRM sectors and sub sectors that contribute to development in the basin:

(i) **Irrigation** - including water use, return flows, water quality, and proposed diversions;

Table 1 Basin-wide development scenarios

	Development scenario	Time horizon	Primary interventions
1	Early development scenario	Up to 2007	Water resources infrastructure developed in the Lower Mekong Basin up to 2007
2	Definite future scenario	Definite future up to 2020	Early scenario plus water resources infrastructure developed, under construction and planned in the Lower Mekong Basin between 2007 and 2020
4	Planned development scenario	Planned future up to 2040	Definite Future plus infrastructure planned for implementation in the Lower Mekong Basin between 2020 and 2040

(ii) **Agriculture and Land use** - including watershed management, deforestation, livestock and aquaculture, and fisheries;

(iii) **Domestic and Industrial water use** - including mining, sediment extraction, waste water disposal, urban development, and water quality;

(iv) **Flood protection** structures and floodplain infrastructure;

(v) **Hydropower** - including potential of alternative energy options;

(vi) **Transportation** - including navigation, infrastructure to aid navigation, and roads on major floodplains.

These Thematic Teams are complemented by three **Discipline Teams**, tasked as follows:

(i) **Climate change** – climate change predictions to be incorporated in the assessments and proposals for adaptation measures to be incorporated in the scenarios where relevant

(ii) **Hydrological, hydrodynamic and water quality modelling** – impacts of the scenarios on mainstream river flows, sediment flows and water quality

(iii) **Bio-resource assessment** – impacts of the scenarios and of the related changes in mainstream river flows, sediment flows and water quality brought about by the scenarios on bio-resources (including capture fisheries) and geomorphological stability of the mainstream system

This report identifies the interfaces between each of the ten teams above with the requirements for social assessment.

2.2 Identification of development drivers

Development impacts within the LMB arise from interventions taken up in the water sector together with those arising from exogenous developments in other sectors.

For the purposes of the cumulative impact assessment (CIA) under the CS, **water resource developments** are taken as those broadly within MRC's remit. They include irrigated agriculture, agriculture and land use change, flood protection and management, hydropower, mainstream navigation and domestic and industrial water use.

Exogenous developments arise from other development activities which have bearing on conditions within the basin that affect the magnitude of impacts caused by water resource developments. Exogenous developments are those developments which can be expected to happen even without water resource development occurring and which necessarily must be factored into the cumulative impact assessment of water resource developments as they affect the magnitude of those impacts[4].

Taking the developments referred to in Section 2.1.2 against each CS team as the guideline of what is to be considered under the CS, Table 2 sets out the manner in which developments may be categorised for assessment purposes in the light of the discussion above.

Table 2 Categorisation of developments to be considered under the Council Study

Water resource developments *As defined by the CS thematic development scenarios*	**Exogenous developments** *As can be expected to happen with or without water resource developments*
▫ Irrigated agriculture [1] ▫ Agriculture and land use change [2] ▫ Domestic and Industrialwater use [3] ▫ Flood protection and management [4] ▫ Hydropower generation [5] ▫ Mainstream navigation [6]	▫ Rainfed agriculture including livestock [2] ▫ Aquaculture [2] ▫ Mining, sand mining and industrial water use discharge [3] ▫ Changes in flood plain land use and asset values including urban sprawl, roads etc [4] ▫ Capture fisheries and OAAs [BioRA] ▫ Climate change [CCAI] *Exogenous impacts on social conditions [CIA]:* ▫ Electricity distribution ▫ Poverty reduction support ▫ Externalities, such as remittances etc ▫ Migration and demographic change ▫ Commodity prices

References given in the table are to Thematic and Discipline teams whose scope of work under the CS is related to these developments

[4] To illustrate this point, increasing urbanisation by 2040 may mean there are less people in rural areas who would be affected by changing capture fish availability. Similarly, continued poverty reduction programmes may also mean that by 2040 the proportion of households dependent upon capture fisheries for their livelihoods is less. If both are true, then the impact of any reduction in capture fisheries would be lower in 2040 than if the same reduction were to occur today.

2.3 Scope of social assessment

2.3.1 Sectoral scope

The sectoral scope of the social assessment is to determine the impacts on social conditions within the LMB, driven by all MRC-related basin-wide water resource developments as shown in Table 2 above.

The nature and magnitude of these water resource development impacts will take into account the impacts of exogenous developments and their estimated impact on social conditions since the early 1900's in 2007, 2020 and 2040 throughout the basin.

2.3.2 Spatial scope

The assessments are to be conducted basin-wide on all areas within the LMB impacted by water resources development, with a particular focus on those areas directly impacted by changes in mainstream hydrology and bio-resource conditions (see main report), referred to throughout this report as being **within the corridor**).

In addition, other areas within the basin will be impacted by water resources developments and need to be factored into a fully basin-wide assessment. These areas, referred to as **outside the corridor**, are those areas principally where:

- Irrigation development occurs;
- Reservoirs are developed behind tributary dams; and
- Urban and rural water supply and sanitation is developed.

The approach and methodology for social assessment addresses the impacts both within and outside the corridor.

2.3.3 Temporal scope

The assessments are required to address the cumulative impacts of water resources development at three time steps as defined by the CS, being 2007, 2020 and 2040. For the purposes of the CS, cumulative water resources development is taken as that which has taken place in the modern era dating from the early 1900's. Selection of social assessment indicators

The social impact of the development scenarios will be assessed against the social assessment indicators in the MRC Indicator Framework. Within this, under the social dimension, two strategic indicators have been agreed with Member Countries:

- Living conditions and well-being; and
- Employment in MRC sectors.

In the current draft of the MRC Indicator Framework[5], social assessment indicators have been proposed, but not yet finalised. Under *Living conditions and well-being*, three assessment indicators are proposed: *demographic features*; *level of resilience at household level*; and, *level of resilience at community level*. Under *Employment in MRC sectors*, two assessment indicators are proposed: *proportion of population engaged in MRC sector activities*; and *proportion of people engaged in MRC sectors vulnerable to change*.

Whilst recognising the usefulness of the indicators above in monitoring overall conditions of people living within the basin, the requirements of the Council Study are to attribute changes in social conditions arising from water resources development. As framed above, the assessment indicators are such that it is not easy with these indicators to readily distinguish between the impacts arising from water resources developments and those related to exogenous development.

Since 2008-10 when the last basin-wide assessment was conducted by BDP2, major efforts have been made by MRC to improve knowledge of social conditions within the basin. Two surveys have been completed in the mainstream corridor and flood plains (SIMVA 2011, SIMVA 2014) and a MRC/BDP basin-wide socio-economic database has been initiated and substantially populated.

In the light of the increased data holdings, it is now possible to build on the earlier work of BDP, IBFM and SIMVA to develop a more comprehensive assessment approach than has been hitherto possible. Accordingly, a review has been conducted of whether more appropriate assessment indicators can be formulated for the purposes of the CS. This review has taken into consideration:

- The need to align with the scope of the Council Study, namely to provide MRC with a comprehensive overview of the consequences of water resources at specific time steps
- The need to select indicators that are clearly and understandably responsive to the changes brought about by water resources development
- The desire to reflect international best practice, but to tailor this to the specific needs of the MRC; and
- The desire to maximise use of assembled data and minimise further data collection needs.

As re-stated in the Basin Development Strategy 2016-20, a fundamental objective of the 1995 Mekong Agreement is cooperation to achieve "*the full potential of sustainable benefits to all riparian countries and the prevention of wasteful use of Mekong River Basin waters*". This aim is complemented with the Shared Vision for "*an economically prosperous, socially just and environmentally sound Mekong Basin*". Within the social dimension, water resources development can contribute to this objective by addressing the core issues of living conditions and employment within the LMB.

[5] MRC indicator framework for managing the Mekong Basin, BDP, draft 19 June 2015

Following a review of international practice in this area[6] and in the light of the considerations above, the review has concluded that the following assessment indicators should be adopted in the Council Study, measured **at community level**, which better distinguish the impacts of water resources development than simply estimating the levels of resilience at household and community levels.

Under the strategic indicator of **Living conditions and well-being**:

- **Water security** – *relating to access to safe water supplies, water availability for domestic and agricultural use and flood exposure;*
- **Food security**[7] – *relating to ability to meet food grain and protein requirements through home production and/or having sufficient income to pay for food;*
- **Income security** – *relating to being above the poverty rate and having sufficient monthly income; and*
- **Health security** – *relating to access to safe water, safe sanitation and health facilities.*

Under the strategic indicator of **Employment in MRC sectors**:

- **Employment** – *relating to employment in MRC-related sectors; and*
- **Gender equity** - *relating to the favourable equity conditions brought about by achieving water, food, income and health security*[8] *(as determined above).*

Security under Living conditions and well-being above will be measured by the number of people who are in communities in a secure situation. Employment will be measured in terms of the numbers of full-time equivalent (fte) jobs available. Gender equity will be measured by the numbers (or percentage) of females and males living in secure conditions.

Care has been taken in formulating the assessment indicators above that there should be sufficient social data to reasonably evaluate the consequences of water resource development for each indicator. This is demonstrated in the next Chapter where details are given of how each assessment indicator is to be measured at community level, the most disaggregated level that the data allow. However, as may also be seen in the next Chapter, each indicator is also influenced by exogenous developments, which have to be taken into account in the assessments.

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[6] Sources consulted include: UN-Water, 2013 for water security, FAO for food security, ILO for income security, UNDP (1994) for health security and IFAD for gender equity.

[7] Food security at national level is incorporated in the economic dimension of the MRC Indicator Framework and is addressed under the economic approach to assessments under the CS.

[8] Gender issues are believed to be relevant to water resource developments since women are more vulnerable than men during flood and drought due to their higher dependence on natural resources and social barriers that limit their adaptive capacity. Given the greater vulnerability of women to extreme floods, disaster risk reduction contributes to promoting gender responsive planning. Furthermore, gender inclusive development contributes significantly to economic growth and poverty reduction as well as to equity objectives by ensuring that all groups share development benefits, acknowledging that women and men are impacted differently by water resources development. In the context of the assessments made under Council Study, it is suggested that achieving water, food, income and health security will contribute to favourable conditions for women, rendering more equitable conditions with men.

It should be also noted that the emphasis throughout the social assessment is primarily on the **rural communities** within the basin. Urban communities can be impacted by floods and are clearly dependent upon water supply and sanitation services, but in general their condition is much more influenced by exogenous developments, such as economic growth, industrialisation and the like, than water resource developments. That said, the impacts of flooding on urban centres are addressed nevertheless under the economic assessments undertaken for the CS in terms of flood risk and related damages.

3 Approach and methodology

This Chapter commences with an overview of assessment approach. The chapter then describes the four main components of this approach, being data assembly and analysis, projecting the social situation in the LMB without water resources development, assessing the impacts with water resources development and, finally, the planned deliverables and reporting.

3.1 Objective of the social assessment

In response to CS objectives, the social assessments are designed to evaluate cumulative impacts at each time step (2007, 2020 and 2040). In this regard, the approach has been designed to provide:

- A projection of the overall social impacts at each time step, enabling consideration of equity;
- Alignment with the concept of the SoB monitoring actual development impacts in order to measure whether these consequences are being achieved; and
- The basis by which to assess incremental impacts between time steps, paving the way for later exploration of optimal and sustainable development pathways.

3.2 Overview of assessment approach

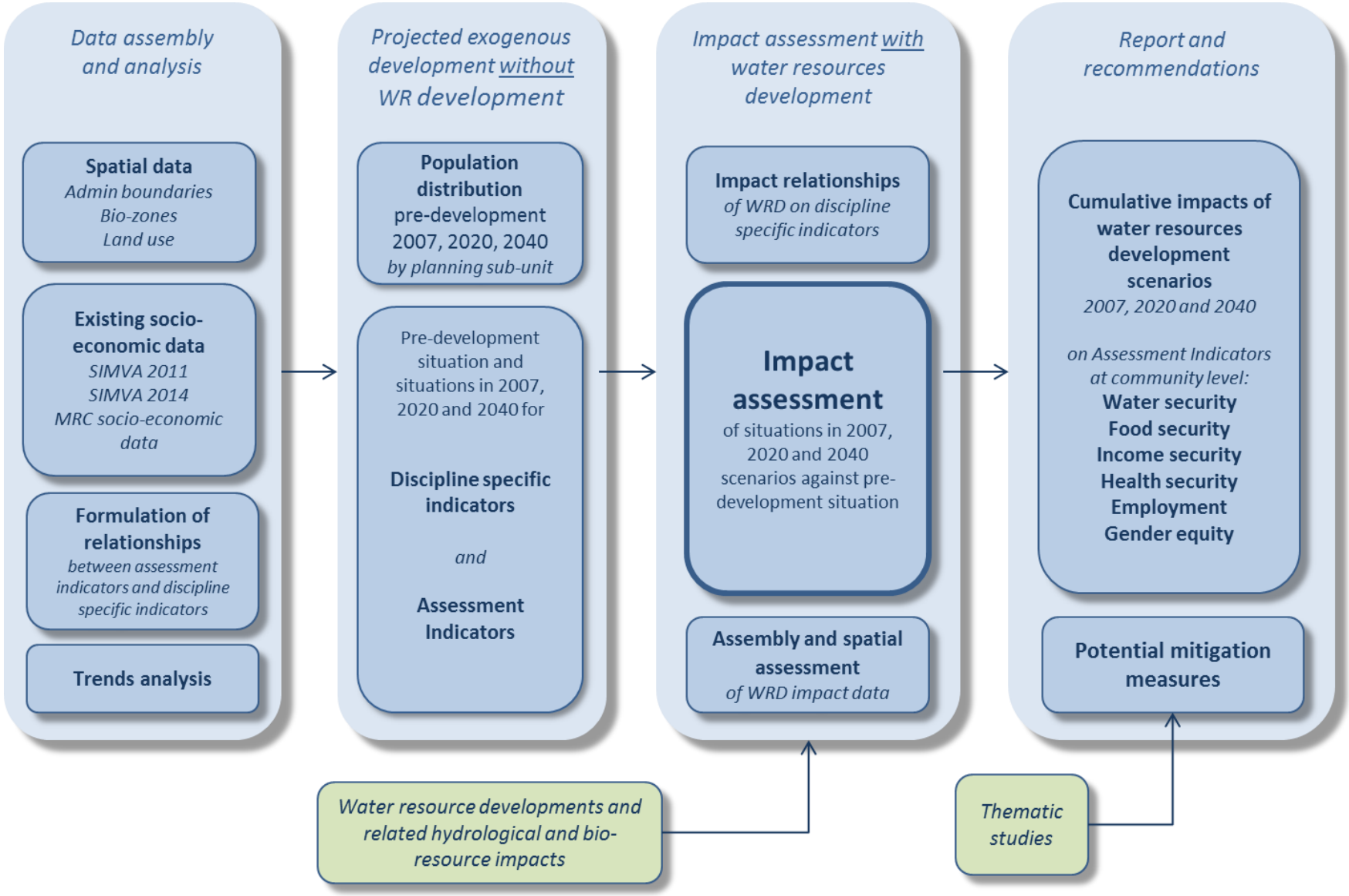
The approach and methodology to social assessment set out in this report conforms to Council Study requirements of being triple-bottomed line in a manner that integrates social, economic and environmental assessment.

The approach builds on that used in previous assessments by BDP and IBFM and those already initiated by other teams in the Council Study. It also seeks to capture the gains made by MRC in assembling a much more comprehensive social data base than was available for previous assessments.

The assessment approach has also been improved by factoring in the historic development trends and exogenous development, together with greater opportunities to employ spatial (GIS) analysis.

The key components of the assessment approach are illustrated in Figure 1. The four main steps are summarised below and are subsequently elaborated in the following sections.

Figure 1 Overview of approach to social assessment



(i) ***Data assembly and analysis***

The value of each social assessment indicator above is determined by reference to selected **discipline specific indicators** as described later in Table 4 later in this report. The basic values of each discipline specific indicator are first assembled from the available data sets and are mapped across the basin according to their sources (administrative boundaries, bio-physical zones, SIMVA point data, land uses, etc). **Assessment sub-units** (the basic spatial unit on which the social assessment is undertaken on) are defined by where these mapped layers overlap.

The assembled discipline specific indicator data are then examined and demographic trends are identified to form the basis for projecting values appropriate to the pre-development situation, 2007, 2020 and 2040

A review is also conducted to establish appropriate **thresholds** to be applied in evaluating the **assessment indicators** of water, food, income and health security of communities (in relation to the **assessment criteria** applied to **discipline specific indicators** as set out in Table 4 later in this report). This review takes into consideration the quality of data available and the presence of outlier values.

(ii) ***Projected situation without water resources development***

The first assessments are to estimate changes in discipline specific indicator values under exogenous development (without water resources development) from the pre-development situation (to the extent that information is available) to the 2007, 2020 and 2040 situation. The basis for the changes in indicator value will take into account the trends analyses undertaken in (i) above.

Based on the relationships described in Table 4 and the assigned threshold values as above, the value of each assessment indicator in each assessment sub-unit will be computed to portray the changes of the projected conditions from the pre-development situation to the situation in 2007, 2020 and 2040 throughout the basin under exogenous development without water resources development.

(iii) ***Impact assessment with water resources development***

Data from the Thematic Teams on the formulated water resource development scenarios is assembled first and mapped across the basin in a series of layers according to the nature of their impact. The primary layers will relate to irrigated areas, changes in land use, access to water supply and sanitation, flood protection arrangements, dam construction and related reservoir development and any new facilities relating to mainstream navigation. Detailed information requirements from Thematic and Discipline Teams are set out in Table 8 later in this report.

In parallel with the above, the impact relationships between the results of different aspects of water resource development will be quantified, based on the identified relationships shown later in Table 6 and using the techniques illustrated in Section 3.5.3 of this report. These impact relationships are similar in nature to the “response curves” being developed

by BioRA in so far as they will quantify the impact of changes in water resource development on the social discipline specific indicators in each assessment sub-unit. These social changes arise either from the direct impact of water resource development scenarios (eg irrigation developed) or indirectly via the bio-physical changes predicted by BioRA (eg change in capture fish abundance) as a result of changes in mainstream conditions brought about by, for example, flood protection or dam construction within the defined scenarios.

Based on the above, assessments will be made of the incremental impacts of water resource developments in 2007, 2020 and 2040 in each assessment sub-unit over and above those predicted to occur as a result of exogenous developments as determined in step (ii) above.

(iv) ***Report and recommendations***

The cumulative impacts of water resource developments as determined above are then brought together in a report which sets out for each scenario the incremental impacts of water resource developments over and above exogenous developments for the 2007, 2020 and 2040 scenarios (the latter with different assumptions of climate change).

The social impacts are measured according to the five assessment indicators within the two strategic dimensions of Living conditions and well-being and Employment in MRC sectors. Values will be aggregated by the LMB as a whole and by country to compare the relative impacts on each country.

Social impacts will also be mapped using the assessment sub-units to illustrate where favourable and unfavourable conditions arise in each assessment indicator. Insights gained from this will be combined with information gleaned from the Thematic and Discipline assessments to identify social impact "hot spots" and potential ways by which these may be mitigated. This will also contribute towards defining alternative water resource development scenarios that would result in improved social consequences and equity between Member Countries, which could inform the basis for exploratory scenario assessments that are planned for 2016-2017 in the MRC Strategic Plan.

3.3 Data assembly and analysis

As noted above, MRC has available substantial new information on social conditions within the basin, as well as a large library of digital maps relevant to social assessment[9]. Furthermore, BDP has recently published a report on development trends and future outlook[10] which has much useful information within it. In addition, under the CS, the BioRA team has recently prepared a draft report[11] which provides insight into environmental status and trends.

[9] Reference may be made to MRC's Planning Atlas of the Lower Mekong River Basin, prepared by BDP in 2011 following the scenario assessments made in 2008-10.

[10] Development trends and future outlook in the Lower Mekong Basin Countries, Draft report by BDP, August 2015

[11] BioRA Progress Report 2, Draft II, BioRA, August 2015

All of these data and information will underpin the data assembly and analysis required as an initial step in the social assessment of the CS scenarios.

3.3.1 Spatial data

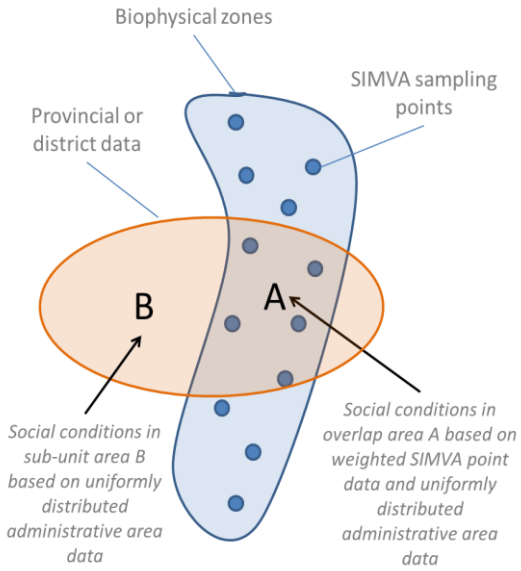
The social assessment will use GIS as a primary tool to overlay different data sets and to identify and measure the size of **assessment sub-units** that will form the basis for the assessment. The primary layers of information to be used in the spatial assessment are:

(i) The bio-physical zones as used by both BioRA and SIMVA to divide the focal areas of the assessment (see Section 2.3.2) into distinct parts relevant to the bio-physical impacts being assessed by BioRA **within the corridor**;

(ii) District and/or provincial administrative boundaries within which the social data held by MRC is generally presented; and

(iii) The impact areas of water resource developments **outside the corridor** where these do not relate to the bio-physical impacts that BioRA are assessing (eg irrigation, aquaculture, reservoir areas etc), and which are to be provided by the Thematic teams as part of the definition of scenarios.

Figure 2 Spatial sub-units



Sub-units for assessment purposes will be defined by the overlap of (i) and (ii) above, as illustrated in Figure 2, which shows these as "A" within the corridor and "B" outside the corridor. The spatial assessment will determine the size (km^2) of each assessment sub-unit and compile the social characteristics for each. Those within the corridor (A) will be related to both SIMVA and the MRC/BDP socio-economic database according to the overlaps. Those outside the corridor (B) can only be related to data from the MRC/BDP socio-economic database.

SIMVA data are point data related to the SIMVA survey sites (see Figure 2), and the social characteristics will be drawn from the sampling points within each sub-unit as a weighted average, taking into consideration the sample size and spatial distribution of the sampling points within the sub-unit[12]. Data from the MRC/BDP socio-economic database are aggregated data within the administrative boundary. These data will be assumed to be uniformly distributed within the administrative boundary.

[12] There are standard GIS techniques for doing this similar to those used in hydrological analyses of rainfall stations within a catchment in which an "area of influence" of each sampling point is first computed and the weight of each sampling point is computed on the basis of the proportion of the sub-unit occupied by the "area of influence". If there is only one sample point, a weight of 100% is assigned.

GIS techniques will be used to compile a spatial database of all required social data drawn from the existing sources listed by sub-unit. These will be exported to a spreadsheet to simplify the further steps in the assessment. At the end of the assessment process, relevant information will be re-imported from the spreadsheet to provide maps to be used in the report.

3.3.2 Existing social data

As noted, there are three main sources of social data are SIMVA 2011, SIMVA 2014 and national statistics entered into the MRC/BDP socio-economic database. Not all these data are needed for the social assessment. From the preliminary work in preparing this report, the following datasets are needed as set out in Table 3 below. These are termed in this report as being the **discipline specific indicators** for assessment purposes.

Table 3 also highlights where gaps exist in the socio-economic database. Country delegates, whilst designing the socio-economic database, have indicated that these data should be available from relevant national agencies. **Attention is needed to fill these gaps as soon as possible.**

The data listed in Table 3 will have been collected in different years. Whilst preserving the base data for future reference, it will be necessary to adjust these data to a common year before assessments can commence. This will form part of the trend analyses described in Section 3.3.4 below.

3.3.3 Formulation of relationships between assessment indicators and discipline specific indicators

(i) ***Living conditions and well-being***

As set out in Section 0 above, each of the selected Assessment Indicators under the strategic indicator of Living conditions and well-being address whether different aspects of community security are being achieved and are related to different conditions being met.

These requirements are set out in Table 4 in a manner that provides transparent and robust **assessment criteria for assessing whether a state of "security" at community level** has been achieved for each of the four assessment indicators. As may be seen from Table 4, due to data limitations a slightly different approach is adopted inside and outside the corridor.

Inside the corridor use is made of the extensive data collected by SIMVA, allowing the complex relationships between social and bio-physical conditions to be evaluated. Outside the corridor, water resource developments (principally irrigation, aquaculture and reservoir development) are simpler and more straightforward to assess as they do not involve the complexity of the hydrological and bio-physical interactions. Furthermore, outside the corridor less detailed socio-economic data are available, suggesting a simpler but still reasonable assessment approach.

Table 3 Discipline specific indicators to be abstracted from SIMVA and socio-economic database for assessment purposes

SIMVA2011	SIMVA2014	MRC/BDP Socio-economic database				
			Cambodia	Lao PDR	Thailand	Viet Nam
▫ % of HHs with access to safe water ▫ % of HHs whose primary domestic water sources runs dry for more than x weeks in the dry season ▫ % of HHs reporting water shortages that resulted in crop damage in the last 12 months ▫ % of HHs reporting water excess that resulted in crop damage in the last 12 months ▫ Production of livestock (head count) ▫ Percentage of non-food expenditure ▫ Monthly income ▫ Number of income sources (fish/OAAs/river bank/non-aquatic resource) ▫ HHs expenditure ▫ Number of HHs access to safe water	▫ List of communities that have health facilities ▫ Village population by gender	▫ Population	District	District	Province	Province
		▫ Dependency ratio	District	District	Province	Province
		▫ Population density	District	Province	Province	District
		▫ Population growth rate	District	Province	Province	Province
		▫ Migration	Province	Province	Province	Province
		▫ Household size	District	District	Province	Province
		▫ Household expenditure	Awaited	Province	Province	Awaited
		▫ Poor people	Awaited	Province	Province	Awaited
		▫ Poverty rate	National *	Province	Awaited	Province
		▫ Households with access to safe drinking water	Awaited	Province	Province	Awaited
		▫ Households with access to sanitation	Awaited	Province	Province	Awaited
		▫ Households with health facilities	Awaited	Awaited	Awaited	Awaited

** If possible, the assessment would benefit from disaggregation of these national data to province or district level*

Table 4 Formulation of assessment indicators related to Living conditions and well-being

Assessment indicator	*Within the corridor*			*Outside the corridor*		
	Assessment criteria *to assess whether security has been achieved*	**Discipline specific indicators**	**Data source**	**Assessment criteria** *to assess whether security has been achieved*	**Discipline specific indicators**	**Data source**
Water security	***Communities are water secure if:***			***Communities are water secure if:***		
	▫ At least **A%** of HHs have access to safe water; *and*	% of HHs with access to safe water	SIMVA2011	▫ At least **A%** of HHs have access to safe drinking water; *and*	HHs with access to safe drinking water	MRC SEDB
	▫ Not less than **B%** of HHs have primary domestic water sources run dry for more than X weeks in the dry season; *and*	% of HHs whose primary domestic water sources runs dry for more than x weeks in the dry season	SIMVA2011	▫ At least **N%** of the assessment sub-unit has irrigation facilities ; *and*	Irrigation area	MRC Irrigation database
	▫ Not more than **C%** of HHs report of water shortages that result in crop damage in the last 12 months; *and*	% of HHs reporting water shortages that resulted in crop damage in the last 12 months	SIMVA2011	▫ Not more than **O%** of the assessment sub-unit is subject to annual flooding	Flooded area	IKMP flood maps
	▫ Not more than **D%** of HHs report of water excess that results in crop damage in the last 12 months	% of HHs reporting water excess that resulted in crop damage in the last 12 months	SIMVA2011			
Food security	***Communities are food secure if:***			***Communities are food secure if:***		
	▫ Within the assessment sub-unit rice production exceeds **E ton/capita;** *and*	Production of rice (t)	AIP	▫ Within the assessment sub-unit rice production exceeds **E ton/capita;** *and*	Irrigated and rainfed rice production	AIP
	▫ Within the assessment sub-unit protein production (fish/ aquaculture/ OAAs/ livestock/riverbank gardens) exceeds **F ton/capita;** *and/or*	Production of catch fish (t) Production of OAAs (t) Production of riverbank gardens (t) Production of aquaculture (t) Production of livestock	BioRA BioRA BioRA SIMVA2011, AIP	▫ Within the assessment sub-unit protein production (fish/ aquaculture/ OAAs/ livestock/riverbank gardens) exceeds **F ton/capita;** *and/or*	Aquaculture production Reservoir fisheries Paddy field fish, OAA production Livestock production	AIP FP AIP AIP
	▫ At least **G%** of HHs expenditure on food per capita above **H$/capita**	Percentage of non-food expenditure	SIMVA2011	▫ At least **P%** of HHs expenditure exceeds **Q$/capita**	Household expenditure	MRC SEDB

Table 4 (continued) Formulation of assessment indicators related to Living conditions and well-being

Assessment indicator	*Within the corridor*			*Outside the corridor*		
	Assessment criteria *to assess whether security has been achieved*	**Discipline specific indicators**	**Data source**	**Assessment criteria** *to assess whether security has been achieved*	**Discipline specific indicators**	**Data source**
Income security	***Communities are income secure if:***			***Communities are income secure if:***		
	▫ At least **I%** of HHs have income above the poverty line;	Monthly income Poverty rate	SIMVA 2011 MRC SEDB	▫ At least **Q%** of HHs expenditure exceeds **R$/capita**	Household expenditure	MRC SEDB
	And one or more of the following are met:					
	▫ At least **J%** of HHs have alternative income sources; *or*	Number of income sources (fish/OAAs/river bank/non-aquatic resource) Income source from agriculture	SIMVA 2011 AIP			
	▫ At least **K%** of HHs have income more than expenditure	HHs income HHs expenditure	SIMVA 2011			
Health security	***Communities are health secure if:***			***Communities are health secure if:***		
	▫ At least **L %** of HHs have access to safe water; *and*	Number of HHs access to safe water	SIMVA 2011	▫ At least **L %** of HHs have access to safe water; *and*	HHs with access to safe drinking water	MRC SEDB
	▫ At least **M %** of HHs have access to sanitation; *and*	Number of HHs access to sanitation	MRC SEDB	▫ At least **M %** of HHs have access to sanitation; *and*	HHs with access to sanitation	MRC SEDB
	▫ Has access to local health facilities	List of communities that have health facilities	SIMVA 2014 (Village data)	▫ Has access to local health facilities	Location of health facilities	MRC SEDB

Some 18 threshold values are used in setting these assessment criteria, listed in Table 3 as "A" to "R". These threshold values will be developed following a review of the datasets once they are established, as described in Section 3.3.1 above. The setting of the threshold values will include:

- Consideration of introducing a "tolerance" to allow for outlier data captured in the SIMVA surveys in the cases of thresholds A, B, C, D, G, I, L, M, N, O and P - in other words would it be more appropriate to use a figure less than 100% to describe a state of "security" having been reached?
- Consideration of food grain (E) and protein requirements (F) per capita and how these may be correlated to production values in tons; and
- Consideration of minimum values (H and Q) to ensure HH capacity to purchase their food rather than produce it themselves.

The results of this review will be set out in the report and the value of each threshold held in tabular form in the assessment spreadsheet so that should different values be used, the assessments can be quickly recalculated.

(ii) ***Employment (inside and outside the corridor)***

As set out in Section 0 above, the selected assessment indicators under the strategic indicator of employment are the levels of employment in sectors related to water resource development at community level and the related gender equity consideration, as shown below in Table 5.

Table 5 Formulation of assessment indicators related to Employment

Assessment indicator	Assessment criteria	Discipline specific indicators	Data source
Employment	No. of people employed in MRC sectors	Full time equivalent (fte) paid or unpaid employment	Economic assessment data
	Proportion of total labour force employed in MRC sectors	Total people of employable age (male and female) from dependency ratio	MRC SEDB
Gender equity	% of female in water, food, income and health secure communities; % of male in water, food, income and health secure communities.	Village population by gender	MRC SEDB and where available SIMVA 2014 (Village data)

Employment (expressed as full-time equivalent jobs in MRC sectors) is not covered by either the SIMVA data or data available in the socio-economic database. To overcome this, estimates will be made by reference to the levels of production in each sector as determined in the economic assessment (see Appendix B), from which the labour requirements can be determined.

The gender equity assessment indicator is based on first determining which communities are secure in water, food, income and health (see (i) above) and then determining how many females and males are in these secure communities as a percentage of the population.

In both cases above, the same technique can be applied inside and outside the corridor.

3.3.4 Trend analyses

Trend analyses will be conducted on the assembled *discipline specific indicator* data sets (Table 3 above), taking into account BDP's Development Trends Report, the BioRA on environmental conditions and other national statistics as may be useful to determine demographic and social trends.

The objectives of the trend analyses will be to:

(i) Harmonise the discipline specific indicator data sets to a common year basis;

(ii) Establish, to the extent that information allows, a retrospective picture of social conditions in the pre-development situation (how far back this goes will depend on the data available); and

(iii) Project the values (forward and back) of the discipline specific indicators as may be expected in the pre-development situation and in 2007, 2020 and 2040 without water resources development occurring.

The analyses will form part of the final report and will create the foundation for the assessments conducted on the social situation with and without water resources development as described in the next sections.

3.4 Projected situation without water resources development

3.4.1 Overview

Once the data are assembled, the assessment indicator formulation calibrated and trends established, the next main step (see Figure 1) is to estimate social conditions without water resources development. In common with the approaches being adopted for environmental and economic assessment, an understanding of the cumulative impacts of water resources development can only be deduced if there is first an understanding of what conditions would have been like within the LMB had there been no water resources development.

It is widely appreciated that there are many different drivers of development and those exogenous to the MRC-related water resources sector (see Table 2 earlier) have, and are continuing to have, a powerful and generally positive effect on the basin's population.

It is very clear that, in recent years, rural poverty and malnutrition have been greatly reduced and that these trends can be expected to continue[13]. Economic growth, improved health, education, job creation and externalities such as growing remittances from abroad have all contributed to this decline.

Agricultural productivity has been increasing, contributing to increased food grain availability. At the same time BioRA is reporting increased pressure on fisheries and the wider environment, in part due to population growth and pressure on the eco-system since the 1960's.

In common with other countries, the LMB is also witnessing greater industrialisation and urbanisation, placing pressures on the cities and creating urban sprawl. Flood plains, which were formerly untouched wetlands and more recently have been exploited for agriculture and fisheries purposes, are increasingly being developed with factories, housing and roads and are of rising value.

Given the abundance of Mekong river flows, most, if not all, of these developments would have occurred whether or not water resources development had occurred. It is thus wholly appropriate that an understanding is reached first of the impact of these exogenous developments before considering the incremental impacts caused by water resources development.

3.4.2 Population distribution

The first step in projecting the situation without water resources development will be to estimate the demographic situation in the LMB in the scenario years of 2007, 2020 and 2040 and to compare these with those of the pre-development situation (taken by BioRA as 1900) to illustrate the changes expected to have occurred at these dates. This is required to determine the numbers of people (male and female) and households which are present in each in each sub-assessment unit at each of the time slices above.

These projections will be made at assessment sub-unit level using the spatial analysis described in Section 3.3.1 and will take into account population growth trends, migration and urbanisation rates. The projections will result in estimates of overall population by gender.

These projections will underpin both the assessment without and with water resources development. Whilst theoretically there is a feedback loop of demographic change brought about by future levels of water resources development, it is considered for now that this may be a minor effect given the growing significance of other parts of the economy exogenous to the water resources sector.

[13] Development trends and future outlook in the Lower Mekong Basin Countries, MRC Basin Development Programme (November 2015)

3.4.3 *Assessment of projected development without water resources development*

The assessment of projected development without water resources development will be conducted using the population projections above and applying the assessment criteria described earlier in Table 4 and Table 5.

The development impacts in this case will be driven by the predicted changes in values of the discipline specific indicators (see Table 3 above) under exogenous development conditions together with specific other data relating to agriculture and fisheries production.

The values of each discipline specific indicator in each sub-unit will be determined from the trends analysis (Section 3.3.4) and the value of assessment indicators in that sub-unit will be determined based on the applied assessment criteria in terms of changes in the population affected from the pre-development situation to 2007, 2020 and 2040.

Thereafter, the outcomes of the assessment in each sub-unit can be aggregated to provide an estimate of the outcomes by bio-physical zone, by administrative area (district or province) and by country. This aggregation will be done in a spreadsheet tool and can be both reported in tables or, by reimporting the data to the spatial database, in mapped form. An example of how the spreadsheet tool could be formulated is given in Figure 4.

3.5 Impact analysis with water resources development

3.5.1 *Overview*

The third main step shown in Figure 1 is to analyse the impacts of water resources development. This will be undertaken for each scenario against social conditions projected for the scenario year in question, taking into account demographic trends and exogenous developments as determined in the previous step (Section 3.4). This approach will provide a more realistic appraisal of water resource development impacts than has been hitherto possible. The assessments will be made of the incremental impacts of water resource developments in 2007, 2020 and 2040 in each assessment sub-unit over and above those predicted to occur as a result of exogenous developments as determined in Section 3.4.3above.

Analysis of water resources development impacts nevertheless requires an understanding of the influence that development in each thematic area will have on the communities where those developments occur and/or where those developments have impacts.

In developing the methodology for the assessments, it has been necessary to establish the linkages between water resource developments in each sector, together with relevant exogenous developments (see Table 2), on the discipline specific indicators (see Table 3) that underpin each assessment indicator (see Table 4 and Table 5). These linkages are set out in Table 6. The key steps in undertaking the impact assessment are:

- To take receipt of the required data from the Thematic and Discipline teams, prepare spatial overlays of the impact areas associated and abstract relevant data by assessment sub-unit and enter these in the overall assessment spreadsheet;

- Taking into consideration the nature of the data received, to build functional relationships between the discipline specific indicators and the development impact data; and

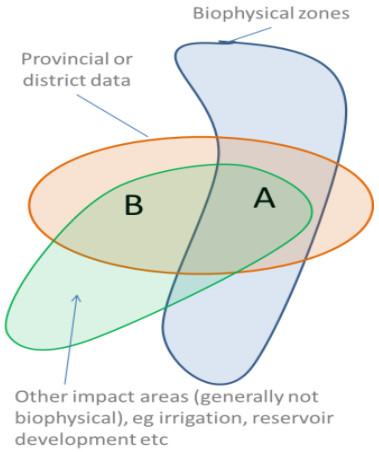
- To undertake the assessments making use of (i) and (ii) above, estimating the projected changes that development impacts would cause to the discipline specific indicators and applying the assessment criteria given in Table 4 and Table 5 to determine the effect on the assessment indicators.

These three steps are elaborated below in Section 3.5.2.

3.5.2 Assembly and spatial assessment of water resource development impact data

There are essentially three types of impacts that have to be taken into account in the assessment process. Bio-physical related impacts, such as the impacts on wetlands and on capture fisheries, will be reported in relation to the bio-physical zones used by both BioRA and SIMVA. Unless guidance is given otherwise by those generating the data, these must be assumed to be uniformly distributed across the bio-physical zone (see Figure 3).

Figure 3 Overlaying impact data on sub-units



Thus the related impacts in sub-unit A will be based on the spatial proportion that sub-unit A is of the bio-physical zone.

Other water resource development impacts not associated with changes in bio-physical conditions (such as irrigation development, reservoir development, etc) will need also to be mapped and overlaid on the assessment sub-units (see Figure 3). Again, unless there is good reason otherwise, the impacts have to be assumed to be uniformly spread within the mapped impact areas and proportioned according to area to each overlaid sub-unit.

Thirdly, a number of exogenous developments under consideration will have direct impact on the discipline specific indicators. As above, these will be mapped according to the manner in which the impact data are assembled: in most cases this is likely to be based on administrative boundaries.

Each water resource and exogenous development impact will need to be mapped in the GIS as a separate layer. Once this is complete, the relevant attributes of development impact in each sub-unit will be exported from the GIS into the assessment spreadsheet for further analysis.

Table 6 Relationships between Thematic and Discipline team outputs and social discipline specific indicators and assessment indicators

Strategic indicator	Living conditions and well-being				Employment in MRC sectors	
	Relating to access to safe water supplies, water availability for domestic and agricultural use and flood exposure	*Relating to ability to meet food grain and protein requirements through home production and/or having sufficient income to pay for food*	*Relating to being above the poverty rate and having sufficient monthly income*	*Relating to access to safe water, safe sanitation and health facilities*	*Relating to employment in MRC-related sectors*	*Relating to equity conditions associated with water, food, income & health security*

	Assessment indicator	Water security				Food security			Income security			Health security			Employment	Gender	
	Discipline specific indicators	HHs with access to safe water supply system	HHs with secure supply for domestic use	HHs with secure supply for agricultural use	HHs exposed to flood damage risk	Total rice production	Total protein production (fish, livestock etc)	HH expenditure on food	HH income	Alternative HH income source	HH income and expenditure	HH with access to secure safe water supply	HH with access to improved sanitation	HH with access to improved health facilities	No. of fte jobs in MRC sectors	No. of females and males in water, food, income and health secure communities;	
CS team	*CS themes and information requirements*	*Relevance to socio-economic assessment indicators*															
	Water resource developments																
1	**Irrigation**																
	Irrigation area and location (mapped and size, ha)			☐		☐	☐	☐	☐	☐	☐				☐		*Note that gender assessment is based on water, food, income and health security assessment results and is not directly related to WR development drivers*
	Irrigated agricultural production (tons of rice/ha)					☐		☐	☐	☐	☐						
	Irrigated agricultural production (tons of in field fish/ha)						☐	☐	☐	☐	☐						
	Irrigated agricultural production (tons of in field OAA/ha)						☐	☐	☐	☐	☐						
	Irrigated agriculture employment (fte labour/year)							☐	☐	☐	☐				☐		
2	**Forestry and catchment area**																
	Forest area and location (mapped and size, ha)							☐	☐	☐	☐				☐		
	Forestry employment (fte labour/year)							☐									
	Income derived from social forestry (US$/ha)							☐	☐	☐	☐				☐		
3	**Urban and rural water supply and sanitation**																
	Urban water supply coverage (location, population served)	☐										☐					
	Rural water supply coverage (location, population served)	☐										☐					

Assessment indicator		Water security				Food security			Income security			Health security			Employment	Gender
Discipline specific indicators		HHs with access to safe water supply system	HHs with secure supply for domestic use	HHs with secure supply for agricultural use	HHs exposed to flood damage risk	Total rice production	Total protein production (fish, livestock etc)	HH expenditure on food	HH income	Alternative HH income source	HH income and expenditure	HH with access to secure safe water supply	HH with access to improved sanitation	HH with access to improved health facilities	No. of fte jobs in MRC sectors	No. of females and males in water, food, income and health secure communities;
CS team	*CS themes and information requirements*	*Relevance to socio-economic assessment indicators*														
	Rural improved sanitation coverage (location, population served)												☐			
4	**Flood management**															
	Full flood protection area and location (mapped and size, ha)				☐											
	Partial flood protection area and location (mapped and size, ha)				☐											
	Areas exposed to flash flooding (mapped and size, ha)				☐											
5	**Hydropower**				□											
	Reservoir area (mapped and size, ha)		☐				☐		☐	☐	☐				☐	
	Reservoir fisheries production (tons of in field fish/ha)						☐		☐	☐	☐				☐	
	Employment in reservoir fisheries (fte labour/year)								☐	☐	☐				☐	
	Employment in hydropower generation (fte labour/year)								☐	☐	☐				☐	
6	**Navigation (mainstream)**															
	Mainstream employment centres (mapped)								☐	☐	☐				☐	
	Urban employment in navigation (fte labour/year)								☐	☐	☐				☐	
	Rural employment in navigation (fte labour/year)								☐	☐	☐				☐	
IKMP	**Water resource availability and status**															
	Annual mean minimum water level at selected mainstream locations		☐									☐				
	Flooded area (at selected depth-duration) (mapped and size, ha)				☐											
	Extent of saline intrusion (mapped and size, ha)			☐		☐	☐								☐	
	Compliance with WHO water quality at selected mainstream locations	☐										☐				

Assessment indicator		Water security				Food security			Income security			Health security			Employment	Gender
Discipline specific indicators		HHs with access to safe water supply system	HHs with secure supply for domestic use	HHs with secure supply for agricultural use	HHs exposed to flood damage risk	Total rice production	Total protein production (fish, livestock etc)	HH expenditure on food	HH income	Alternative HH income source	HH income and expenditure	HH with access to secure safe water supply	HH with access to improved sanitation	HH with access to improved health facilities	No. of fte jobs in MRC sectors	No. of females and males in water, food, income and health secure communities;
CS team	*CS themes and information requirements*	*Relevance to socio-economic assessment indicators*														
	Exogenous developments															
2	**Non-irrigated agriculture including livestock**															
	Rainfed rice area and location (mapped and size,ha)			☐		☐	☐	☐	☐	☐	☐				☐	
	Rainfed rice production (tons of rice/ha)					☐			☐	☐	☐					
	Irrigated agricultural production (tons of in field fish/ha)						☐		☐	☐	☐					
	Rainfed rice area production (tons of in field OAA/ha)						☐		☐	☐	☐					
	Rainfed rice employment (fte labour/year)							☐	☐	☐	☐				☐	
	Livestock production by District (tonnes/year)							☐								
2	**Aquaculture**															
	Aquaculture area and location (mapped and size, ha)			☐			☐	☐	☐	☐	☐				☐	
	Aquaculture production (tons of fish/ha)						☐		☐	☐	☐					
	Aquaculture employment (fte labour/year)							☐	☐	☐	☐				☐	
3	**Mining, sand mining and other industrial water use and discharge**															
	Location and nature of industrial facilities (mapped by type)	☐							☐	☐	☐	☐				
	Location and size of sand mining facilities (mapped and tonnes/year)							☐							☐	
	Rural employment from sand mining (fte labour/year)							☐	☐	☐	☐				☐	
4	**Changes in flood plain land use including urban sprawl, roads etc**															
	Flood plain land use by type (mapped and size,ha)				☐			☐								
	Annual value of flood damages (mapped and amount US$/year)							☐	☐		☐					

Assessment indicator		Water security				Food security			Income security			Health security			Employment	Gender
Discipline specific indicators		HHs with access to safe water supply system	HHs with secure supply for domestic use	HHs with secure supply for agricultural use	HHs exposed to flood damage risk	Total rice production	Total protein production (fish, livestock etc)	HH expenditure on food	HH income	Alternative HH income source	HH income and expenditure	HH with access to secure safe water supply	HH with access to improved sanitation	HH with access to improved health facilities	No. of fte jobs in MRC sectors	No. of females and males in water, food, income and health secure communities;
CS team	*CS themes and information requirements*	*Relevance to socio-economic assessment indicators*														
BioRA	**Capture fisheries and OAAs**															
	Capture fisheries production per SIMVA sub-zone (tonnes/year)						☐		☐	☐	☐				☐	
	OAA production per SIMVA sub-zone (tonnes/year)						☐		☐	☐	☐				☐	
BioRA	**Other environmental assets**															
	River bank garden area and location (mapped and size, ha)					☐		☐	☐	☐	☐				☐	
	River bank garden productivity value (US$/ha/year)					☐		☐	☐	☐	☐					
	River bank garden employment (fte labour/ha/year)							☐	☐	☐	☐				☐	
	Inundated forest area and location (mapped and size, ha)							☐	☐	☐	☐				☐	
	Inundated forest areas productivity value (US$/ha/year)							☐	☐	☐	☐					
	Inundated forest areas employment (fte labour/ha/year)							☐							☐	
	Marshes and inundated grasslands area and location (mapped and size, ha)							☐	☐	☐	☐				☐	
	Marshes and inundated grasslands productivity value (US$/ha/year)							☐	☐	☐	☐					
	Marshes and inundated grasslands (fte labour/ha/year)							☐							☐	
	Mangrove areas area and location (mapped and size, ha)							☐	☐	☐	☐				☐	
	Mangrove areas productivity value (US$/ha/year)							☐	☐	☐	☐					
	Mangrove areas (fte labour/ha/year)							☐							☐	
	Coastal areas exposed to erosion/accretion (mapped and size, ha)					☐		☐	☐	☐	☐				☐	
	Areas exposed to bank erosion (mapped & size, ha)					☐		☐	☐	☐	☐				☐	

Assessment indicator		Water security				Food security			Income security			Health security			Employment	Gender
Discipline specific indicators		HHs with access to safe water supply system	HHs with secure supply for domestic use	HHs with secure supply for agricultural use	HHs exposed to flood damage risk	Total rice production	Total protein production (fish, livestock etc)	HH expenditure on food	HH income	Alternative HH income source	HH income and expenditure	HH with access to secure safe water supply	HH with access to improved sanitation	HH with access to improved health facilities	No. of fte jobs in MRC sectors	No. of females and males in water, food, income and health secure communities;
CS team	*CS themes and information requirements*	*Relevance to socio-economic assessment indicators*														
CCAI	**Climate change**															
	Impacts of CC on agricultural productivity (Percent change on yields)					☐	☐									
	Location and nature of CC adaption interventions (mapped by type)					☐	☐	☐								
CIA	**Social development**															
	Access to electricity supply coverage (mapped, population served)								☐							
	Access to health facilities (mapped, population served)													☐		
	Poverty reduction support (location, impact on poverty rate)							☐	☐		☐					
	Remittance income (location, impact on poverty rate)							☐	☐		☐					
	Migration and demographic change at District/Provincial level)	☐	☐	☐	☐			☐	☐	☐	☐				☐	
	Commodity prices							☐	☐	☐	☐				☐	

3.5.3 *Impact relationships of water resources development on discipline specific indicators*

The next step will be to build functional relationships between the discipline specific indicators and the development impact data as relate to both inside and outside the corridor (see Table 4 and Table 5). These relationships are conceptually similar to the "response curves" under development by BioRA and will serve a similar purpose by linking the impacts of changes in development conditions to changes in the discipline specific indicators.

The information provided in Table 6 will be the starting point to this substantive piece of work. Two examples of how these functions may be developed are given in the box overleaf. The examples given could be applied either within or outside the corridor using the different assessment criteria set out in Table 4 and Table 5.

The final report for the social assessment will include an appendix documenting how these impact relationships have been formulated.

3.5.4 *Impact assessment*

Impact assessment will be undertaken at sub-unit level in a spreadsheet tool built for the purpose. The advantages of using a spreadsheet for this purpose are: (i) transparency in the formulation of the assessment; (ii) increased usability allowing non-specialists access to the process; and (iii) rapid development of the tool and associated cost effectiveness.

The spreadsheet tool, which will be developed during the early part of implementing the social assessment will include:

(i) A listing of each assessment sub-unit with relevant attributes such as: country and administrative boundary it is within, which bio-physical zone it belongs to (if included within a zone), and existing and pre-development land use

(ii) Attribution to each sub-unit of the values associated with each discipline specific indicator (see Table 3) and the year the data relates to;

(iii) Trend functions (drawn from trend analysis) to convert the attribution data to a common year (see Section 3.3.4);

(iv) Attribution data as above adjusted to pre-development situation and to the 2007, 2020 and 2040 situations;

(v) A table of thresholds "A" to "R" to which define the assessment criteria as shown in Table 4;

(vi) Tables describing impact relationships with equations and logical statements developed (developed from Table 6);

(vii) A listing of development impact data (see Table 6 first column) attributed to each sub-unit for pre-development situation and for exogenous development scenarios

without and with water resources development for 2007, 2020 and 2040 (including climate change variants);

Examples of how impact relationships can be constructed

Example 1 – HH with secure supply for domestic use, contributing to water security

As shown in Table 6, relevant sectoral developments in this case are:

- **Reservoir area:** If a community is located adjacent to a reservoir then it is certain to have a secure supply of water for domestic use. The construction of a new dam and reservoir will create such a change, assuming that prior to construction a secure supply is not already available).
- **Annual mean minimum water level at selected mainstream locations**: Along the mainstream many communities are dependent upon surface water resources for domestic water use. Since the mainstream flow volume is far in excess of domestic use requirements, the critical issue is whether that resource can be accessed year round. In this regard, the minimum water level in the mainstream adjacent to the community may be taken as a guide to communities being able to access surface water within the mainstream corridor and flood plains. In some cases they may use pumps directly to draw water from the mainstream or minor tributaries; in others they may pump water from wells within this corridor whose water levels would be expected to be a function of mainstream water levels. In either circumstance, a fall in minimum mainstream water level would signal a threat to domestic water availability, whereas a rise would improve conditions. SIMVA data provide an assessment of current water availability at community level (ie in each sub-unit), and changes in mainstream water level can provide an indication of whether this status will improve or deteriorate in that community.

Example 2 – Total rice production, contributing to food security at community level

As shown in Table 6, relevant sectoral developments in this case are:

- **Food grain production in each sub-unit** - as provided by rainfed agriculture, irrigation agriculture and river bank gardens
- **Other factors affecting agricultural production and productivity** – such as extent of saline intrusion, coastal areas exposed to erosion/accretion, areas exposed to bank erosion and the impacts of CC and adaption measures on agricultural productivity

Data from the Thematic teams will generate information on the total food grain production in each sub-unit, expressed in tons of rice. Knowing how many people there are in the sub-unit, it is thus possible to estimate total food grain production within the area and whether this meets minimum requirements as expressed in the threshold value given in Table 4. The setting of that threshold will have to take into account estimates of the minimum HH food grain requirements per annum and the proportion of HH engaged in agriculture in order to adequately represent sufficiency of foo grain production, contributing to food security.

As noted above, other factors as listed may affect agricultural production and productivity within a sub-unit, either by impacting on the land area available for agriculture or on the yields that can be expected. These factors need to be incorporated into the response function as well.

(viii) A listing of development impact assessments for each scenario and for each social assessment indicator as above computed on the basis of the impact relationships and assessment criteria above;

(ix) Export tables to send selected data back to the GIS to be mapped; and

(x) Reporting tools to summarise assessment indicator values generated for each scenario and to compare between scenarios.

An illustration of how the spreadsheet tool will be constructed is given in Figure 4 (the data used are illustrative only to show how the tool would work). In the example given, water security is determined using the assessment criteria given in Table 4 applied to the projected discipline specific indicators for each scenario (ie. the estimated values of the discipline specific indicators after taking into account exogenous without or with water resource development impacts). The illustration shows how one scenario could be compared with another after water resources development impacts are taken into account.

3.6 Deliverables and reporting

The deliverables from the social assessment will contribute to the overall deliverable for of the CIA team, described in the CS Inception Report as and as noted in Section 1.1 of this report:

A Report on the Cumulative Impacts and Benefits of the Selected Water Resources Developments (Cumulative Report) Including Recommendations for Impact Avoidance and Mitigation Measures.

Towards this end, a **supporting report on the social assessments** undertaken will be provided which will:

- Summarise the approach and methodology used;
- Describe the pre-development situation;
- Provide a summary of the assessment indicator values by country and in greater disaggregation as required for 2007, 2020 and 2040;
- Provide details of the evolution of the distribution of both positive and negative social impacts between countries from the pre-development situation to 2007, 2020 and 2040;
- A comparison of the above impacts of water resources development on the assessment indicators with the impacts of exogenous development;
- Provide a commentary on these results, highlighting the positive and negative social impacts that can be observed from the results;

Figure 4 Illustration of a spreadsheet tool supporting assessment

Compliant (Score 1) if threshold exceeded and water secure if all four conditions are met

Thresholds applicable to all scenarios

Threshold values			
95%	95%	80%	5%

Base condition

Location descriptors						Population '000	Discipline specific indicators				Water security compliance				
Country	Province	District	Bio-zone	Sub-unit ref.	Size (km^2)		% access to WS	% with reliable WS	% with reliable irrig supply	% exposed to flood risk	Access to WS	Water for domestic use	Water for agriculture	Flood exposure	Overall
A	AA	AA-A	BZ-1	**100**	25	0.625	95%	85%	78%	0%	1	0	0	1	0
A	AA	AA-B	BZ-1	**101**	36	3.240	85%	90%	67%	0%	0	0	0	1	0
A	AA	AA-C	BZ-1	**102**	21	2.625	35%	45%	46%	0%	0	0	0	1	0
A	AB	AB-A	BZ-1	**103**	106	5.936	90%	60%	43%	25%	0	0	0	0	0
A	AB	AB-B	BZ-2	**104**	88	7.744	65%	90%	82%	35%	0	0	1	0	0
					75	7.500	99%	95%	92%	0%	1	1	1	1	**1**
				106	45	1.125	100%	85%	78%	0%	1	0	0	1	0
				107	25	1.650	85%	25%	15%	0%	0	0	0	1	0
				108	28	3.500	25%	90%	82%	0%	0	0	1	1	0
				109	66	3.696	77%	91%	68%	25%	0	0	0	0	0
A	AC	AC-E	BZ-4	**110**	72	6.336	100%	88%	85%	35%	1	0	1	0	0
A	AD	AD-A	BZ-4	**111**	43	3.225	100%	100%	82%	0%	1	1	1	1	**1**
				Total population		**47.202**				Total population compliant	18.811	10.725	28.305	23.490	**10.725**
										Percent of total	40%	23%	60%	50%	**23%**

Discipline specific indicators and population data from social data sets

Post development situation

Location descriptors						Population '000	Discipline specific indicators				Water security compliance				
Country	Province	District	Bio-zone	Sub-unit ref.	Size (km^2)		% access to WS	% with reliable WS	% with reliable irrig supply	% exposed to flood risk	Access to WS	Water for domestic use	Water for agriculture	Flood exposure	Overall
			BZ-1	**100**	25	0.656	95%	95%	95%	0%	1	1	1	1	**1**
			BZ-1	**101**	36	3.402	85%	95%	95%	0%	0	1	1	1	0
			BZ-1	**102**	21	2.756	95%	95%	95%	0%	1	1	1	1	**1**
A	AB	AB-A	BZ-1	**103**	106	6.233	90%	95%	95%	25%	0	1	1	0	0
			BZ-2	**104**	88	7.131	65%	90%	82%	35%	0	0	1	0	0
					75	7.875	99%	95%	92%	0%	1	1	1	1	**1**
				106	45	1.181	100%	95%	95%	0%	1	1	1	1	**1**
				107	25	1.733	85%	25%	15%	0%	0	0	0	1	0
				108	28	3.675	25%	90%	82%	0%	0	0	1	1	0
				109	66	3.881	77%	91%	68%	25%	0	0	0	0	0
A	AC	AC-E	BZ-4	**110**	72	6.653	100%	95%	95%	0%	1	1	1	1	**1**
A	AD	AD-A	BZ-4	**111**	43	3.386	100%	100%	82%	0%	1	1	1	1	**1**
				Total population		**49.562**				Total population compliant	21.436	30.612	41.856	29.826	**21.436**
										Percent of total	43%	62%	84%	60%	**43%**

Population adjusted for future date

Discipline specific indicators factored by impacts of development using impact

Assessment compares total and percentage population compliant between scenarios, by country, zone, province, etc or mapped by sub-unit

- Taking into account the findings from other Thematic teams, identify where mitigation of negative impacts may be required, outlining the potential measures that may be taken up; and

- A summary of lessons learnt from undertaking the assessment and options to consider that would improve future similar assessments.

Appendices to the report would additionally include:

- A description of the trends analysis undertaken and findings;
- A description of the thresholds adopted and the rationale behind them;
- A description of the impact relationships adopted and the rationale behind them; and
- A summary of the spatial and spreadsheet databases compiled during the assessment.

In addition to the above, **the databases** themselves will be lodged in the MRC information system for future use.

4 Data requirements

This Chapter provides an overview of data requirements including basic social data requirements, spatial data requirements, and information required of other Council Study teams as an input to the social assessments. The chapter identifies a small number of gaps identified in the MRC socio-economic database which are required to be filled.

4.1 Social data

The socio economic data required for the assessments are listed in Table 3 of this report. As noted, the majority of these data are already available with MRC. Missing data or where improvements in data are desired are summarised below.

Table 7 Further social data requirements

Socio-economic database				
	Cambodia	**Lao PDR**	**Thailand**	**Viet Nam**
▫ Household expenditure	Awaited	*Available*	*Available*	Awaited
▫ Poor people	Awaited	*Available*	*Available*	Awaited
▫ Poverty rate	National *	*Available*	Awaited	*Available*
▫ Households with access to safe drinking water	Awaited	*Available*	*Available*	Awaited
▫ Households with access to sanitation	Awaited	*Available*	*Available*	Awaited
▫ Households with health facilities	Awaited	Awaited	Awaited	Awaited

** If possible, the assessment would benefit from disaggregation of these national data to province or district level*

4.2 Spatial data

Basic spatial data to underpin the social assessment are already available within MRC. Layers that will be required include:

- ❑ LMB base map;
- ❑ Administrative boundaries: National, provincial and districts;
- ❑ Definition of bio-physical zones;
- ❑ Location of SIMVA sampling points; and
- ❑ Pre-development and current land use.

In addition, any data on pre-development land use, particularly relating to land cover, will help with the assessments. Other spatial data related to development impacts are listed in the next Section.

4.3 Data from Thematic and Discipline teams

The data requirements from the Thematic and Discipline teams have been set out in Table 6, and are summarised below for convenience of those teams.

Table 8 Data requirements of Thematic and Discipline teams for the pre-development situation and for each scenario

Team	Data requirement
1	**Irrigation**
	▫ Irrigation area and location (mapped and size, ha) ▫ Irrigated agricultural production (tons of rice/ha) ▫ Irrigated agricultural production (tons of in field fish/ha) ▫ Irrigated agricultural production (tons of in field OAA/ha) ▫ Irrigated agriculture employment (fte labour/year) ▫ Irrigation dam (small, not hydropower) storage and reservoir area (mapped and size, ha)
2	**Agriculture and Land Use**
	Water resources development ▫ Forest area and location (mapped and size, ha) ▫ Forestry employment (fte labour/year) ▫ Income derived from social forestry (US$/ha) ***Exogenous developments*** ▫ Rainfed rice area and location (mapped and size, ha) ▫ Rainfed rice production (tons of rice/ha) ▫ Irrigated agricultural production (tons of in field fish/ha) ▫ Rainfed rice area production (tons of in field OAA/ha) ▫ Rainfed rice employment (fte labour/year) ▫ Livestock production by District (tonnes/year) ▫ Aquaculture area and location (mapped and size, ha) ▫ Aquaculture production (tons of fish/ha) ▫ Aquaculture employment (fte labour/year)
3	**Domestic and Industrial Use**
	Water resources development ▫ Urban water supply coverage (location, population served) ▫ Rural water supply coverage (location, population served) ▫ Rural improved sanitation coverage (location, population served)

Team	Data requirement
	Exogenous developments
	▫ Location and nature of industrial facilities (mapped by type)
	▫ Location and size of sand mining facilities (mapped and tonnes/year)
	▫ Rural employment from sand mining (fte labour/year)
4	**Flood protection**
	Water resources development
	▫ Full flood protection area and location (mapped and size, ha)
	▫ Partial flood protection area and location (mapped and size, ha)
	▫ Areas exposed to flash flooding (mapped and size, ha)
	Exogenous developments
	▫ Flood plain land use by type (mapped and size, ha)
	▫ Annual value of flood damages (mapped and amount US$/year)
5	**Hydropower**
	▫ Reservoir area (mapped and size, ha)
	▫ Reservoir fisheries production (tons of fish/ha)
	▫ Employment in reservoir fisheries (fte labour/year)
	▫ Employment in hydropower generation (fte labour/year)
6	**Navigation**
	▫ Mainstream employment centres (mapped)
	▫ Urban employment in navigation (fte labour/year)
	▫ Rural employment in navigation (fte labour/year)
IKMP	**Hydrological, hydrodynamic and water quality modelling**
	▫ Annual mean minimum water level at selected mainstream locations
	▫ Flooded area (at selected depth-duration) (mapped and size, ha)
	▫ Extent of saline intrusion (mapped and size, ha)
	▫ Compliance with WHO water quality at selected mainstream locations
BioRA	**Biological Resource Assessment**
	Capture fisheries and OAAs
	▫ Capture fisheries production per SIMVA sub-zone (tonnes/year)
	▫ OAA production per SIMVA sub-zone (tonnes/year)
	Other environmental assets
	▫ River bank garden area and location (mapped and size, ha)
	▫ River bank garden productivity value (US$/ha/year)
	▫ River bank garden employment (fte labour/ha/year)
	▫ Inundated forest area and location (mapped and size, ha)
	▫ Inundated forest areas productivity value (US$/ha/year)

Team	Data requirement
	▫ Inundated forest areas employment (fte labour/ha/year)
	▫ Marshes and inundated grasslands area and location (mapped and size, ha)
	▫ Marshes and inundated grasslands productivity value (US$/ha/year)
	▫ Marshes and inundated grasslands (fte labour/ha/year)
	▫ Mangrove areas area and location (mapped and size, ha)
	▫ Mangrove areas productivity value (US$/ha/year)
	▫ Mangrove areas (fte labour/ha/year)
	▫ Coastal areas exposed to erosion/accretion (mapped and size, ha)
	▫ Areas exposed to bank erosion (mapped and size, ha)
CCAI	**Climate change**
	▫ Impacts of CC on agricultural productivity (Percent change on yields)
	▫ Location and nature of CC adaption interventions (mapped by type)
CIA	**Cumulative Impact Assessment Team**
	▫ Access to electricity supply coverage (mapped, population served)
	▫ Access to health facilities (mapped, population served)
	▫ Poverty reduction support (location, impact on poverty rate)
	▫ Remittance income (location, impact on poverty rate)
	▫ Migration and demographic change at District/Provincial level)
	▫ Commodity prices

END