2nd Regional Stakeholder Forum on Basin Development Plan
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Basin Development Plan Programme Phase 2

Environmental Assessment Methodology

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Presentation outline

A. Purpose of environmental assessment;

B. Environmental objectives and impacts;

C. General approach to environmental assessment;

D. Data requirements;

E. Timeframe & Work programme

A. Purpose of Environmental Assessment

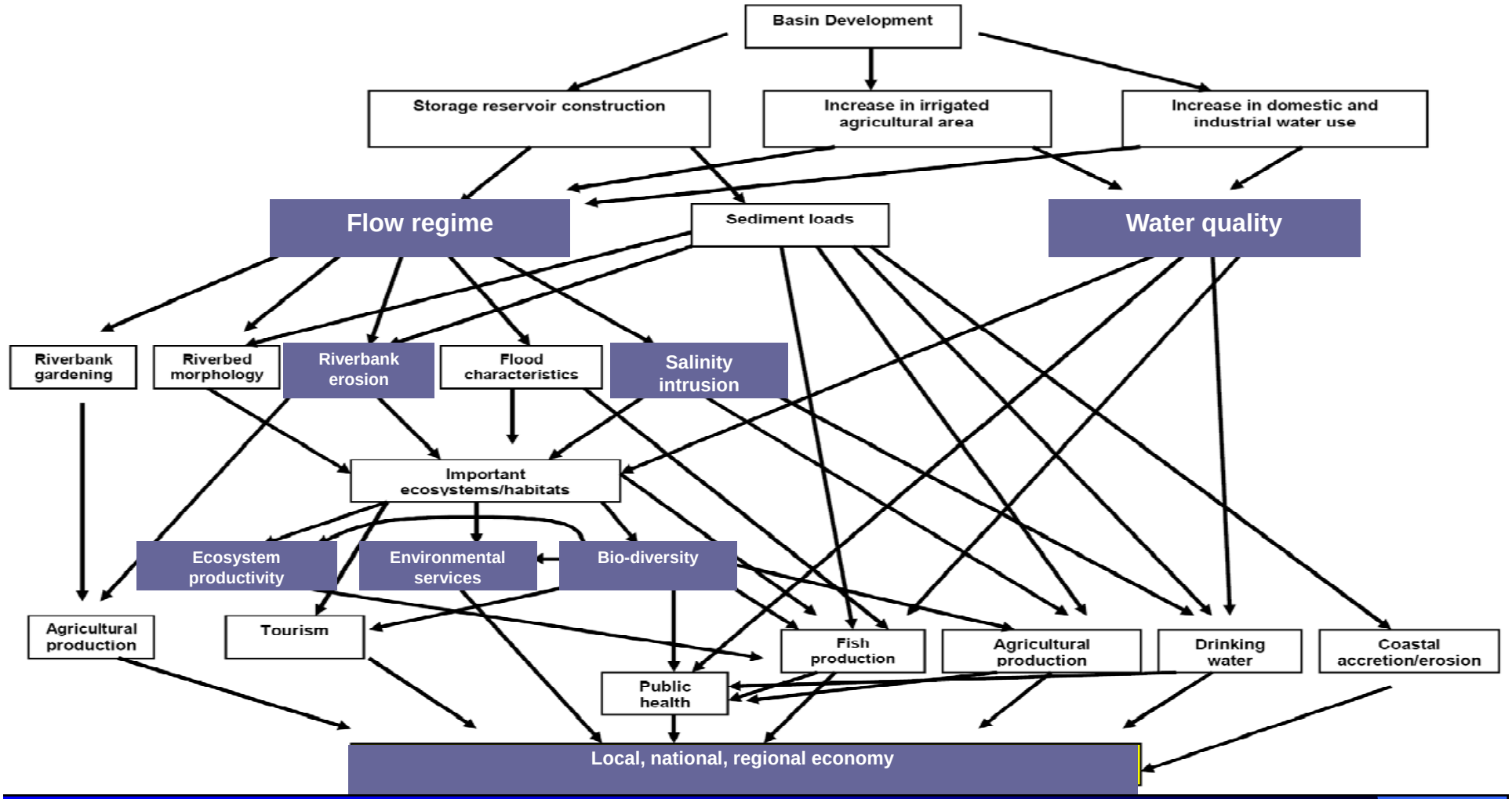
"*To evaluate the environmental impacts of the different scenarios in the context of the five environmental development objectives previously agreed between the countries as being most relevant to strategic decision making*"

B. Environmental objectives of the BDP

- **Maintain water quality and acceptable flow conditions**
- **Maintain wetland productivity and ecosystem services**
- **Manage salinity intrusion in the Mekong Delta**
- **Minimize channel effects on bank erosion**
- **Conservation of biodiversity**

Primary Objectives	Assessment Criteria: Specific development objective	Issue	Indicator Description
imal development (triple bottom line)			
1 Economic development	1.1 Increase irrigated agricultural production	Irrigable area, production tonnage and value	Incremental area
			Incremental crop production
			Net incremental economic value
	1.2 Increase hydropower production	Hydropower capacity, power generated and value	Incremental installed capacity
			Incremental power generated
			Net incremental economic value
	1.3 Improve navigation	River transport	Incremental navigable days by class
			Net incremental economic value
	1.4 Decrease damages by floods	Extent and duration of annual flooding by class	Average area flooded annually to max 0.5-0.9m depth
			Average area flooded annually > max 0.9m depth
			Incremental net economic value of flood damage
	1.5 Maintain productivity of fishery sector	Capture fisheries and aquaculture production	Incremental annual average capture fish availability
			Incremental annual average aquaculture production
			Net incremental economic value
		Impact of flow and sediment transport changes on deep pools	Sediment loads at specified locations on mainstream
			Water levels at specified locations on mainstream
			Net incremental economic values
2. Environmental protection	2.1 Maintain water quality and acceptable flow conditions	Water quality	Water quality incl. sediment in transport in mainstream
		Flow characteristics	Key flow charcateristics (to be defined)
		Protection of forests around Tonle Sap	Forest flooded for specified depth duration at Tonle Sap
			Net incremental economic values
	2.2 Maintain wetland productivity and ecosystem services	Productivity of wetland ecosystems	Incremental wetlands with required depth-duration
			Net incremental economic value
	2.3 Manage salinity intrusion in the Mekong delta	Impact of salinity intrusion on land use potential	Area within delta within thresholds of salinity levels
			Net incremental economic value
	2.4 Minimize channel effects on bank erosion	River bank erosion	Incremental area at risk to erosion
			Vulnerability to bank erosion
			Net incremental economic values
	2.5 Conservation of biodiversity	Impacts of flow management changes on endangered species	Incremental area of suitable habitats
			Estimated number of species affected
			Incremental net economic value of habitat areas
3. Social development	3.1 Maintain livelihoods of vulnerable resource-users	Health, food and income security	No. of people affected
			Severity of impact on health, food and income security
	3.4 Increased employment generation in water related sectors	Incremental sustainable employment from water resource interventions	Incremental number of people engaged in:
			Agriculture
			Fisheries
			Water-related service industries
			Tourism
4 Equitable development	4.1 Ensure that all four LMB countries benefit from the development of water and related resources	Aggregate benefits by country	Summation of incremental net economic benefits
			Summary of non-quantifiable impacts

Cause effect network of change



The cause-effect network is complex and the assessment will concentrate on those aspects of most relevance to the agreed key environmental indicators

Environmental impacts (1)

(Mainly) related to the changes in flow:

- Changes in riverbed morphology, sand bars, rapids, deep pools
- Changes in riverbank erosion
- Changes in area available for riverbank gardening



Environmental impacts (2)

(Mainly) related to changes in flooding:

Changes in area and distribution of valuable ecosystems/habitats:

- Changes in ecosystem productivity
  - Fish and other aquatic animals
  - Other products (Mekong riverweed)
- Changes in environmental services
  - Water supply in the dry season
  - Flow regulation
  - Water purification capacity
  - Cultural/religious values
  - Esthetic/tourism/recreational values
- Changes in biodiversity, flora and fauna

Environmental impacts (3)

(Mainly) related to changes in water quality

- Impact of agricultural production in flooded areas (fertilizing effect of sediment)
- Impact on wetland productivity (fertilizing effect of sediment)
- Impact on fish production (nutrient status of flood water)
- Impact on biodiversity
- Changes in coastal accretion/erosion

Environmental impacts (4)

Related to changes in salinity in the Vietnamese delta:

- Impacts on agricultural production
- Impacts on the mangroves and ecosystem productivity
- Impacts on biodiversity
- Impact on fisheries

C. General approach and analysis framework

- Assessment will be focusing at the cumulative impacts of different development scenarios on key important natural ecosystems within different river zones at different time scales
- Assessment is limited to the following impact areas:
  - Areas directly affected by changed hydrological and water quality conditions in mainstream including areas affected by confined flooding near the confluences of tributaries
  - Tonle Sap and adjacent areas and floodplains in Cambodia and Vietnam
- Assessment will be based on available data and make use of studies/methods/techniques applied in previous studies e.g IBFM

C.1 Ecosystem-based approach

- There are important/valuable ecosystems within the Mekong River system which are likely to be cumulatively impacted by the hydrological changes caused by different development scenarios

- Each of these wetland ecosystems is unique in its characteristics and has its own ecological and socioeconomic role and importance . They are intimately linked with the ecological balance and socioeconomic well-being of MRB's people

- Their dynamic characters lead to the seasonal availability of abundantly diverse and varied resources, functions and services

- All of these natural ecosystems have 'water' as a key component regulating and determining their existence, health, productivity and services. Any change in hydrological conditions, either big or small, can lead to their degradation and loss

Valuable ecosystems/habitats

- River channels, Mekong and largest low gradient tributaries
  - Main river channels
  - Deep pools, rapids
  - Small islands and riverine sand bars
  - Seasonally inundated riverine forest
- Permanent and seasonally inundated floodplain wetlands
  - Seasonally inundated riparian forest
  - Mashes, small pools and seasonal wetlands in the lowland plains
  - Inundated grasslands
  - Rice fields
- Delta formations and the Plain of Reeds
  - Lowland forests
  - Inundated grasslands
  - Mangroves
  - Rice fields

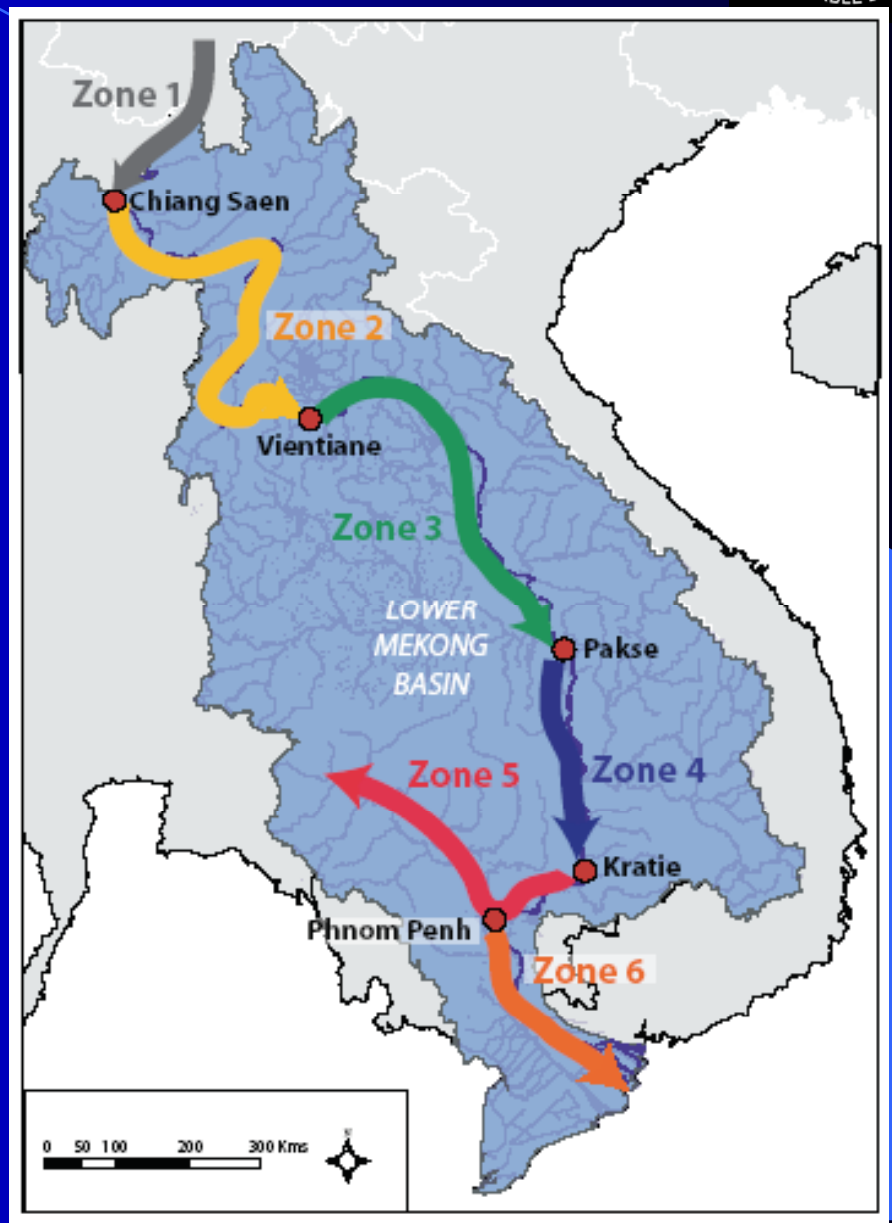
C.2 Area-based approach

Impact zones

1. **China to Chiang Saen-***headwaters & mountain rivers*
2. **Chiang Saen to Vientiane-***upland rivers in steep narrow valley*
3. **Vientiane to Mun River confluence-***the Thai/Lao midstream section & tributaries*
4. **Pakse to Kratie-***including wetlands of Sephandone, Khone Falls, Stung Treng & Kratie*
5. **Kratie to Phnom Penh including Tonle Sap Lake-***floodplains& Great Lake*
6. **Phnom Penh to the sea-** *Mekong Delta (Cambodia & Vietnam), tidal zone*

Impact seasons

- **Dry season, low flows (Dec-Apr)**
  - *Habitat for fish, OAA*
  - *Salinity control*
- **Transition period 1 (May)**
  - *Small floods trigger migration & movement along mainstream*
  - *Improvement of water quality*
- **Flood season (Jun-Oct)**
  - *Inundation of floodplains*
  - *Fish spawning areas*
  - *Flood storage & release in dry season*
- **Transition period 2 (Nov)**
  - *timing of downstream migration*
  - *Floodplains drying out*



C.3 ‘Hotspot’ approach

Special attention will be given to ‘hotspots, rare and endangered species & flagship species:

- **Ramsar sites (wetlands of International Important)**
- **World heritage sites & Biosphere reserves**
- **Protected areas**

- **Irrawaddy Dolphin, Mekong Giant Catfish, Eastern Sarus Crane, Siamese Crocodile**

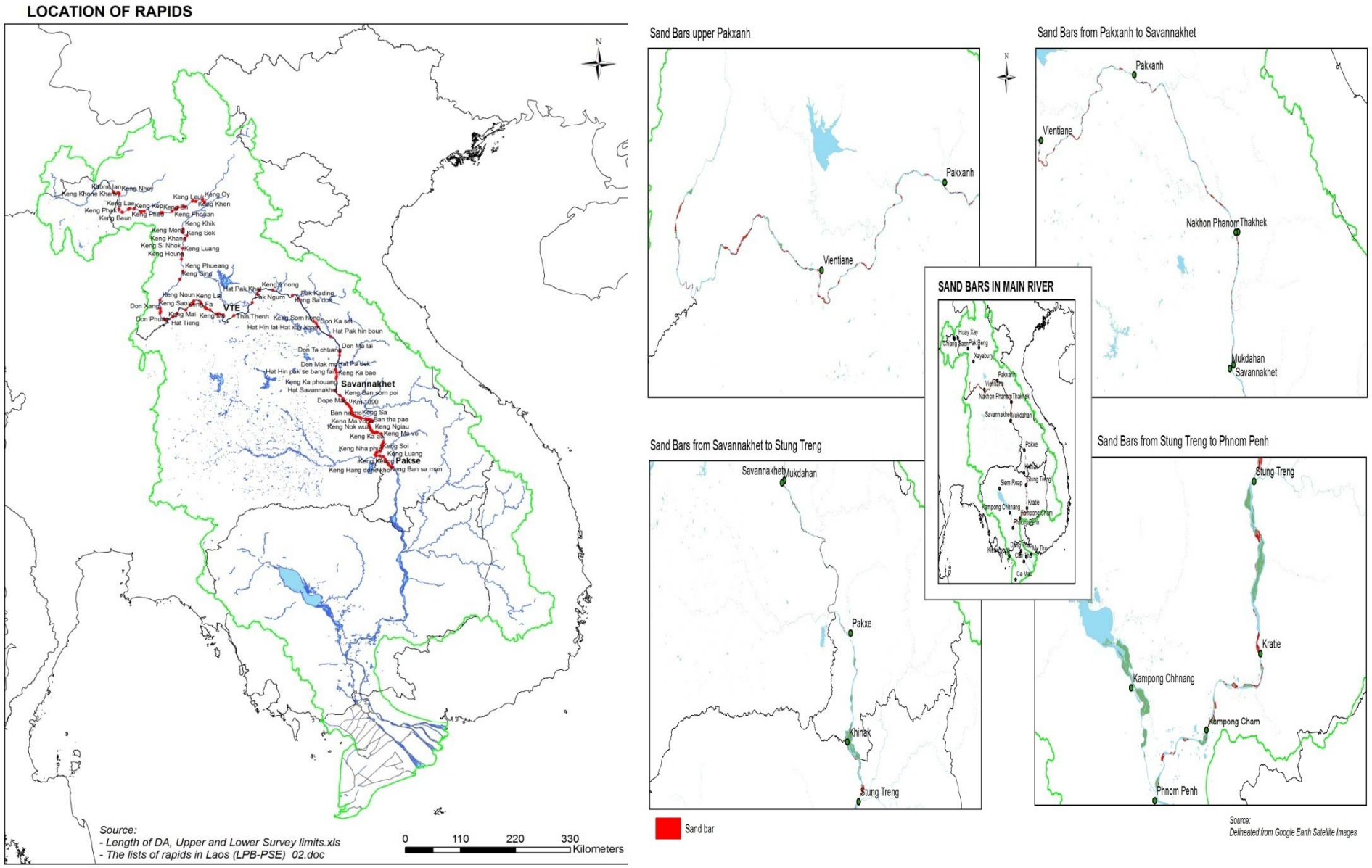


GIS map overlays

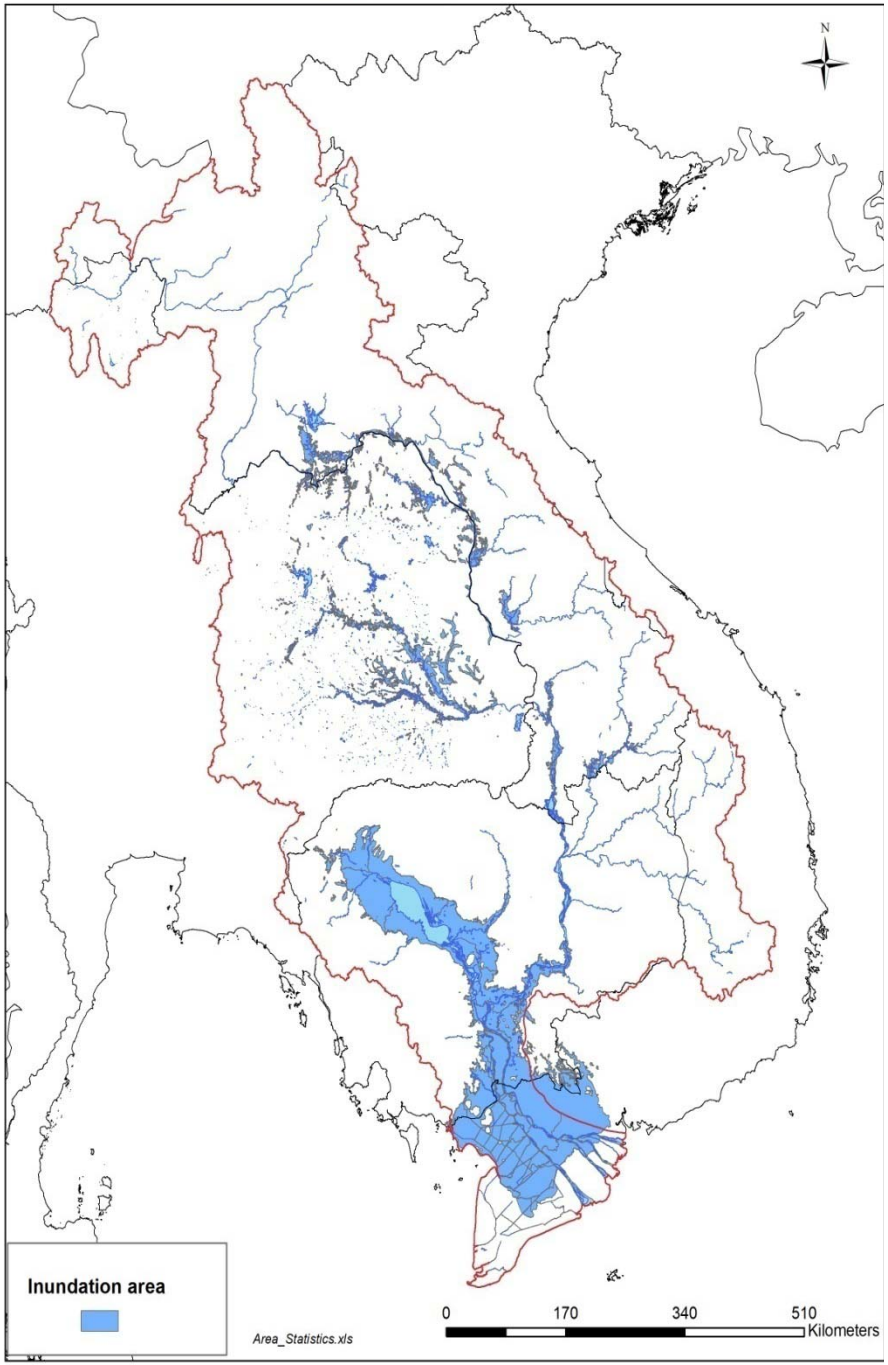
Many of the impacts will be spatially distributed, and assessment will be made by overlaying GIS maps

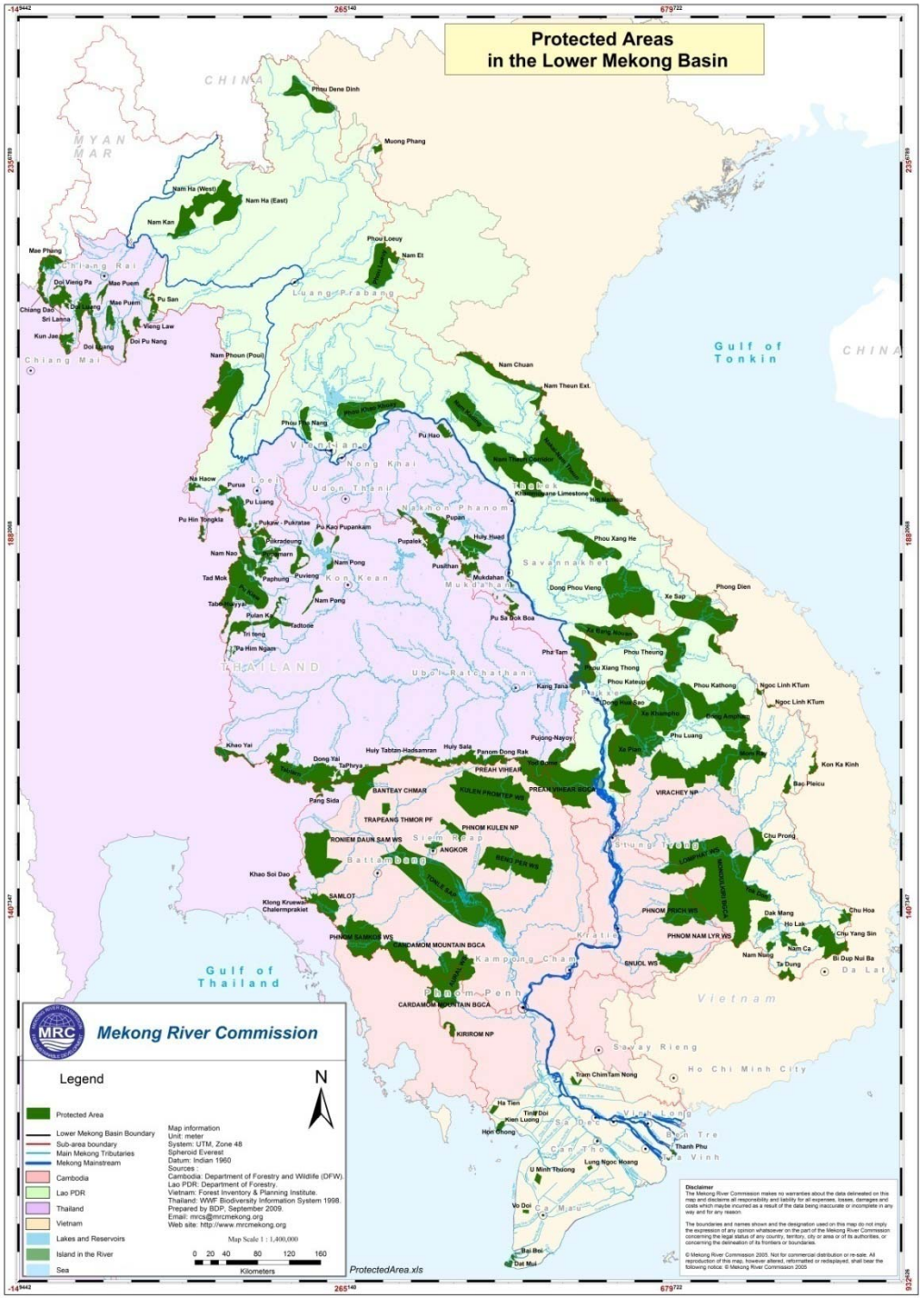
- Overlays of the important ecosystem/ habitat map with the flood maps (area, depth, duration), for each scenario and for an average, a dry and a wet years result in:
  - Changes in area of the ecosystems
  - Changes in ecosystem conditions

Examples of GIS maps

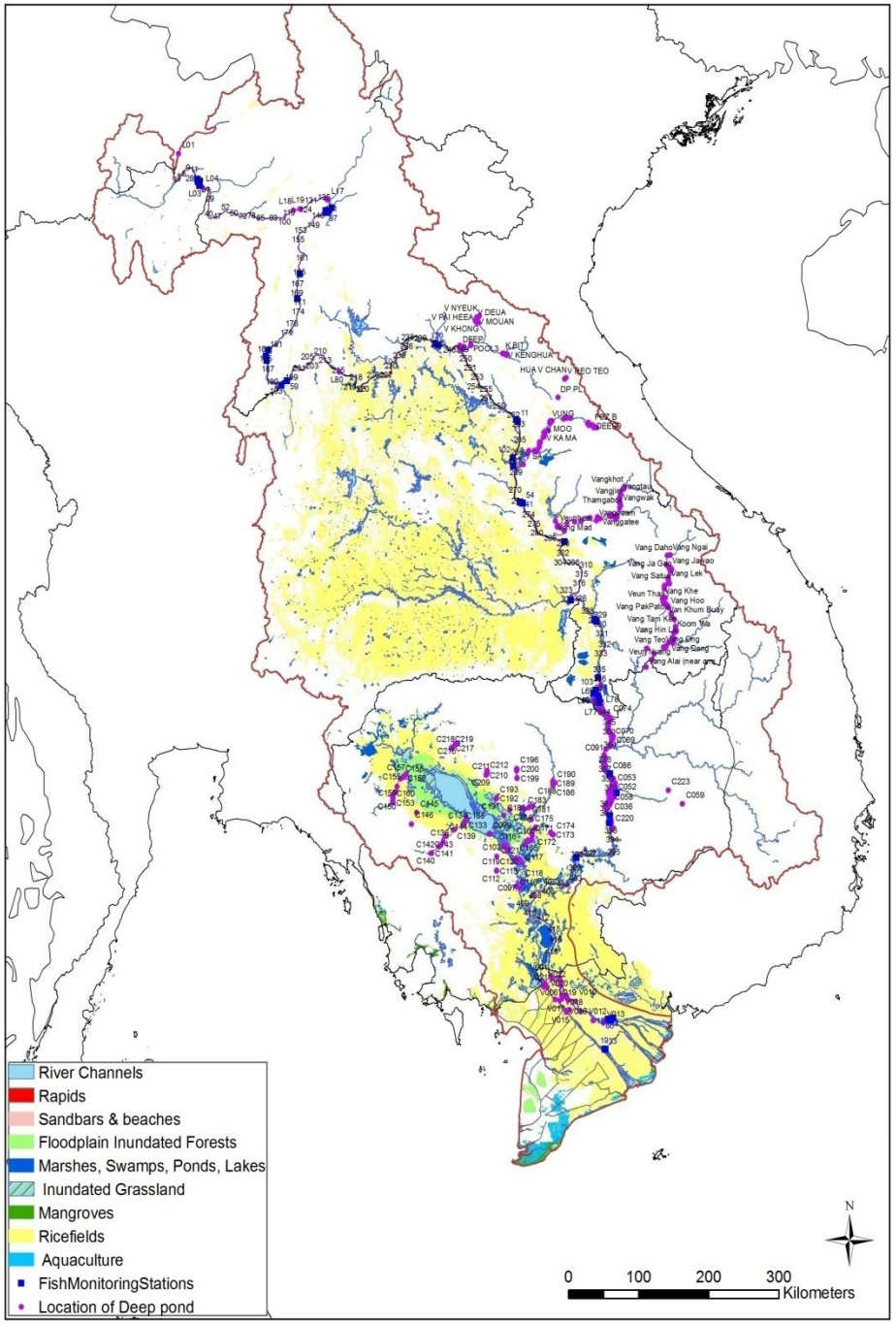


MAXIMUM INUNDATION EXTENT IN 2000





MAJOR WETLAND TYPES



Analysis of impact functions

- Impacts functions or relationship between causes (i.e. hydrological changes) and effects (i.e. environmental impacts) will be further analyzed and established

- Potential methods of analysis include checklist, matrices, network diagrams, secondary data reviews, trends analysis, expert opinion and judgement, and case studies

For example: using impact functions, changes in areas and ecosystem/habitat conditions can be translated to the differences in ecosystem productivity services & differences in biodiversity

D. Data requirements

- The main data requirements for the environmental assessments are related to:
  - River flows and water levels;
  - Flooding patterns;
  - Wetland Ecosystems and Habitats;
  - Irrigated Agriculture;
  - Population growth in relation to domestic and industrial water use;
  - Water quality (including suspended sediments);
  - Saline intrusion in Mekong Delta;
  - Riverbank erosion and sedimentation/erosion in the channel; and
  - Flood management in Mekong Delta and other areas of LMB

E. Timeframe

From now – November:

- All required maps / mapped data completed with support from BDP GIS specialists
- Major data required – collected & compiled

Nov-May: Analysis and consultation

- Major impact functions or cause-effect relationships analyzed

May-Jun: Finalization and reporting

- Summary of findings prepared

Thank you