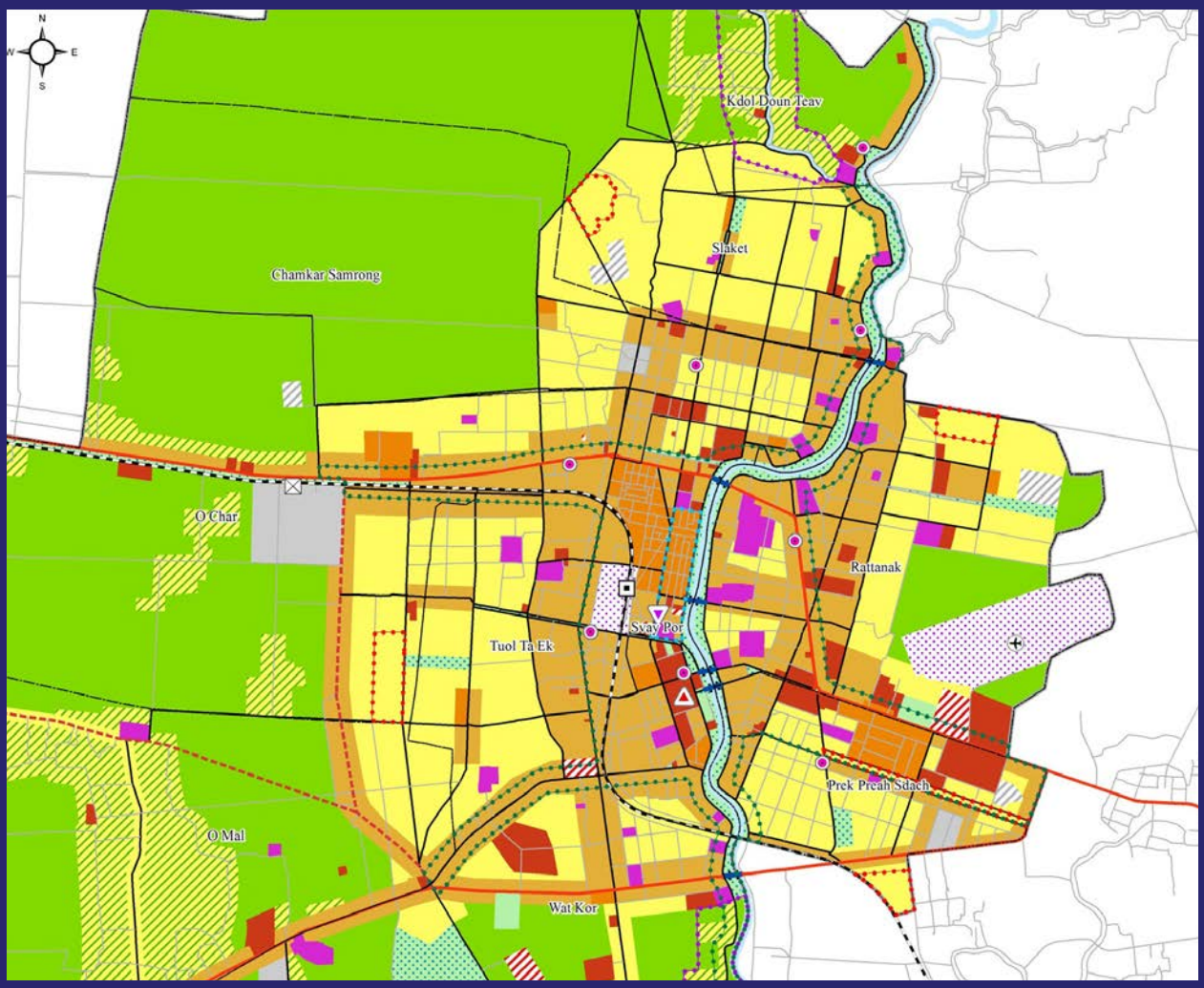
District & Municipal Land Use Master Plan and Land Use Plan Handbook

Spatial Planning Series No. 3



Ministry of Land Management, Urban Planning and Construction
General Department of Land Management

June 2016

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This Handbook is dedicated to the late

Dr. Franz-Volker Müller
born August 3, 1950
deceased March 22, 2015

for his outstanding support to land management and land rights recognition in Cambodia.

កិច្ចសហប្រតិបត្តិការ
អាល្លឺម៉ង់
DEUTSCHE ZUSAMMENARBEIT

Supported by GIZ Land Rights Programme II

Foreword

The Kingdom of Cambodia is home to an increasing population of more than 15 million people. Whereas a majority of the population live mainly from agriculture, the relation of our society to our land has changed considerably in the recent past. The urban population increases relatively faster than the population in rural areas, which strengthens the challenges of job creation, provision of public services and the construction of a Cambodian urban identity.

Transport infrastructures have quickly improved, accessing and connecting not only the capital but many areas throughout the country, fueling economic growth. Dynamic domestic and cross-border migration flows challenge local and national governance and transform the relations of people and land-based resources. While we recognize that past development has affected our forest and other natural resources, we strive to preserve the environment that we all depend upon.

It is the policy of the Royal Government of Cambodia to develop and adopt Municipal Land Use Masterplans for all towns and cities in the Kingdom until 2030. In areas of rapid development and emergence of competing interest, land use plans and building regulations that are binding to the citizens shall be established for specific districts and urban areas.

The many uses and functions of land are governed by different ministries and addressed in sector policies and plans. To strike a balance between the often competing uses and functions and to provide for a sustainable territorial development is the purpose of spatial planning. Therefore the Royal Government of Cambodia through the Council of Ministers approved the National Policy on Spatial Planning (April 08, 2011) and mandated the National Committee for Land Management and Urban Planning (NCLMUP) - with the MLMUPC as its secretariat - as the lead agency to implement spatial planning in Cambodia.

Whereas NCLMUP and the respective sub-national committees are established, it is clear that existing experiences on spatial planning are still limited in the country. It is this very reason why the MLMUPC embarked on the formulation of sub-national spatial planning handbooks that provide an overall direction, specific procedures as well as practical knowledge and advice based on spatial planning processes that have been piloted across the country in cooperation with GIZ.

These handbooks form a common basis for planners to follow, draw and exchange upon. They are a considerable contribution to an enabling framework for participatory spatial planning and thus for the sustainable territorial development of Cambodia's future.

Senior Minister

Minister of Land Management, Urban Planning and Construction, and
Chairman of the National Committee for Land Management and Urban Planning

Preface

Spatial Planning is at its infancy in Cambodia but is now embedded in a comprehensive legal and policy framework that envisions that the country's entire territory shall be used, organized, developed and protected by integrative, strategic territorial planning and the harmonization of regionally significant instruments and measures.

Competent authorities that take initiative, arrange, coordinate, and approve Spatial Planning are at work at four administrative levels: National/Regional, Capital/Provincial, Municipal/District/Khan and the Commune/Sangkat Levels. At sub-national level, Spatial Planning agencies are articulated to the unified administration as envisaged by the D&D Policy and based on the Laws on Administrative Management of Capital, Provinces, Municipalities, Districts, Khans, and the Law on Administrative Management of Communes/Sangkats.

Based on a number of relevant Sub-decrees, the National Committee for Land Management and Urban Planning has developed planning procedures that include the overall scope and the desired content of each sub-national spatial plan. This series of spatial planning handbook shall inform and complement the official procedures approved at Ministry level. It is conceived as a reference document easy to consult and to provide quick orientation concerning the spatial planning processes. It is a further step towards guiding and enabling sub-national actors to formulate spatial plans.

H.E. Dr. Pen Sophal

Secretary of State, Ministry of Land Management Urban Planning and Construction, and
Secretary-General of the National Committee for Land Management and Urban Planning

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List of Acronyms

CDP	Commune Development Plan
CDC	Council for Development of Cambodia
CEMAT	European Conference of Ministers responsible for Spatial/Regional Planning
CMDP	Community Managed Development Partners (NGO)
CLUP	Commune Land Use Plan
CWG	Core Working Group (under Municipal Working Group for Land Management and Urban Planning Working Group)
D&D	Democratic Development (previously Decentralization and De- concentration)
DCLMUP	District Committee for Land Management and Urban Planning
DED	Deutscher Entwicklungsdienst (German Development Service)
DLUMP	District Land Use Master Plan
DP	Detailed Plan
DSDP	District Strategic Development Plan
GDP	Gross Development Product
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit mbH
ISIC	International Standard Industrial Classification of All Economic Activities
LMUP	Land Management and Urban Planning
LMUP-C	Land Management and Urban Planning Committee
LMUP-WG	Land Management and Urban Planning Working Group
LUMP	Land Use Master Plan
LUMP-LUP	Land Use Master Plan and Land Use Plan
LRP II	Land Rights Program II (by GIZ)
LUP	Land Use Plan
M&E	Monitoring and Evaluation
MCLMUP	Municipal Committee for Land Management and Urban Planning
MIP	Municipal Investment Program
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MLUMP	Municipal Land Use Master Plan
MoI	Ministry of Interior
MoP	Ministry of Planning
MPLUP	Master Plan and Land Use Plan
MRC	Mekong River Commission
MSDP	Municipal Strategic Development Plan
MSLWG	Municipal State Land Working Group
NCDD	National Committee for Sub-National Democratic Development
NCLMUP	National Committee for Land Management and Urban Planning
NGO	Non-Governmental Organization
NIS	National Institute of Statistics
NSDP	National Strategic Development Plan
OD	Operational District
PCLMUP	Provincial Committee for Land Management and Urban Planning
PDLMUPC	Provincial Department of Land Management, Urban Planning and Construction
PES	Payment for Environmental Service
PIP	Public Investment Program
PPPS	Policies, programs, plans and strategies
PSLMC	Provincial State Land Management Committee

PSP	Provincial Spatial Plan
PWG	Provincial [Land Management and Urban Planning] Working Group
RGC	Royal Government of Cambodia
RUPP	Royal University of Phnom Penh
SEIA	Social and Environmental Impact Assessment
SNEC	Supreme National Economic Council
SWOT	Strengths, Weaknesses, Opportunities and Threats
VGGT	Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security
WWF	World Wide Fund for Nature

Overview: District/Municipal Land Use Master Plan and Land Use Plan

Type of plan

The District/Municipal Land Use Master Plan (LUMP) is a strategic spatial plan. Well-articulated and aligned to the Provincial Spatial Plan, it provides more detailed directions for spatial development. Additionally, the District/Municipal Land Use Master Plan provides a preparatory basis for the Municipal Land Use Plan (LUP) and comprehensive Commune Land Use Plan (CLUP).

Planning process

Similarly to the provincial spatial planning, the District/Municipal Land Use Master Plan process follows a "Situation-Target-Proposal "approach:

- Situation: Evaluation of the current situation and how it came about;
- Target: Set-up vision, goals and objectives;
- Proposal: Specify a possible route and strategy to the goals and objectives.

The Land Use Plan consists of a comprehensive and regulatory land use zoning that covers the entire area of the district/municipality.

Scope of Plan

At district/municipal level, the Land Use Master Plan endeavors to determine the specific spatial structure and main functions of the district/municipality by taking into account its integration into the province and build on the main potentials of the district/municipality. It aims to determine a vision and spatial development strategies to guide the physical and functional development of the district/municipality. It defines general land use types differentiated between buildable and control categories. It also specifically addresses future transport and communication networks, physical infrastructures, future pubic administrations and services, public spaces as well as agriculture-forest-water management in the entire territory.

The Land Use Master Plan serves as a reference for the Land Use Plan. The latter determines a use-based zoning based on the Land Use Master Plan with the corresponding detailed regulations for all types of land use zones. The Land Use Plan also includes building regulations (form-based zoning) such as building coverage ratio, road setbacks and building heights. The plan and its regulatory ordinance is legally binding to the administration and to the citizens.

Time horizon

15 years

Scale

1:50,000 to 1:25,000 for districts

1:25,000 to 1:10,000 for municipalities

Authority and institutions

The District/Municipal Land Management and Urban Planning Committee (LMUP-C) initiates the planning process under the supervision of the District/Municipal Council. Very likely, the committee will not be involved technically in the planning process, so a District/Municipal Land Management and Urban Planning Working Group (LMUP-WG) is assigned to work it out. The District/Municipal Council coordinates the whole process, and agrees on a draft Land Use Master Plan and/or Land Use Plan. It then forwards it to the Provincial Council through the Provincial Committee for Land Management and Urban Planning (PCLMUP) for consent. After this twofold agreement process, the plan is submitted to the National Committee for Land Manage-ment and Urban Planning Committee (NCLMUP) for final approval (see Figure 1).

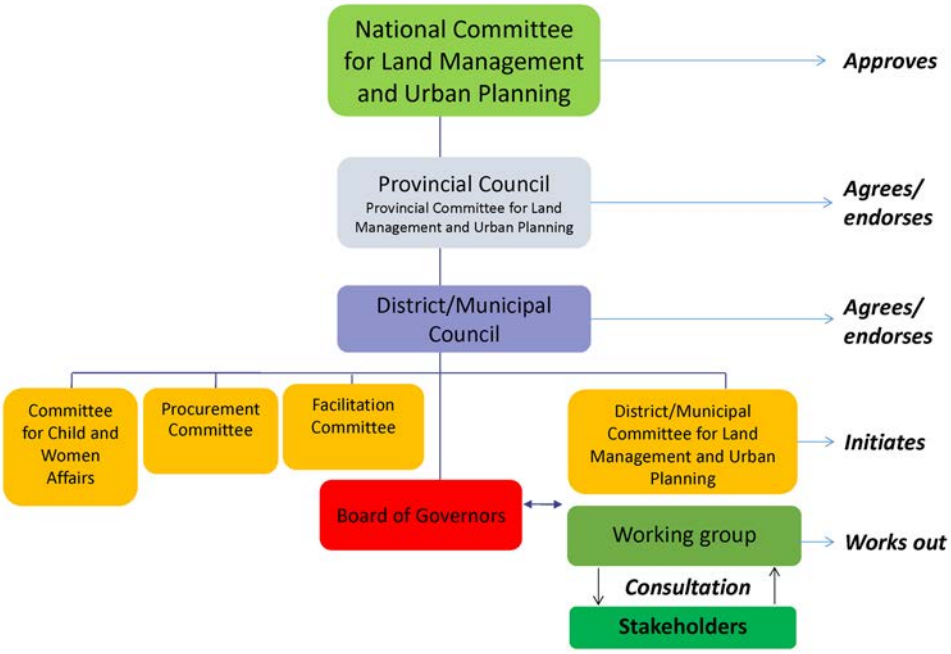


Figure 1 Involvement of Stakeholders in District/Municipal Land Use Master Planning and Land Use Planning

Planning Process

The planning procedure to design a **Land Use Master Plan** comprises a sequence of nine steps that take action over the course of approximately 26 months (see Figure 2). This is an indicative timing, assuming a smooth and un-interrupted planning process, which is in practice rarely the case. The division of the process into nine steps and this indicative timing is based on the Decision on the Detailed Procedure for Development of the Municipal, District and Khan Master Plan and Land Use Plan released by the National Committee for Land Management and Urban Planning (NCLMUP 2013).

Steps	Tasks	Time	Costs
Part A – Elaboration and Approval of District/Municipal Land Use Master Plan (LUMP)			
Step 1 - Preparations and launch of the district/municipal spatial planning process	Task 1.1 Scoping and Inception	30 days	4,500 USD
	Task 1.2 Establish the Land Management and Urban Planning Committee and Working Group		
	Task 1.3 Identification and gathering of stakeholders in 1st Spatial Planning Stakeholder Forum		
	Task 1.4 Capacity development needs assessment, team building and work planning		
Step 2 – Data collection and data management	Task 2.1 Data and information collection	150 days	4,000 USD
	Task 2.2 Geo-database management		
Step 3 – Situation analysis and envisioning the future	Task 3.1 Data analysis and maps production	90 days	8,000 USD
	Task 3.2 Environmental analysis		
	Task 3.3 Analysis of land use management at commune/Sangkat level		
	Task 3.4 Analysis of land use management and governance by District/ Municipal Land Management and Urban Planning Committee		
	Task 3.5 Presentation and discussion of situation analysis in 2nd Spatial Planning Stakeholder Forum		
	Task 3.6 Scenario analysis		
	Task 3.7 Discuss scenarios, identify long-term development goals and development vision with District/Municipal LMUP Committee		
	Task 3.8 Validate long-term development goals, development objectives and vision in the 3rd Spatial Planning Stakeholder Forum		
	Task 3.9 Finalization and documentation of results from planning step 3		
Step 4 - Draft the Land Use Master Plan	Task 4.1 Elaborate the strategy matrix	120 days	3,500 USD
	Task 4.2 Elaborate the spatial development model with District/Municipal LMUP Committee		
	Task 4.3 Draft thematic plans and strategies at district/municipal level		
	Task 4.4 Draft the integrated Land Use Master Plan		
Step 5 – Review of Draft Land Use Master Plan by district/municipal stakeholders	Task 5.1 Consultation on integrated spatial development strategies and draft Land Use Master Plan with Commune/Sangkat authorities	90 days	500 USD
	Task 5.2 Validate integrated spatial development strategies and draft Land Use Master Plan in a 4th Spatial Planning Stakeholder Forum		

Steps	Tasks	Time	Costs
Step 6 – Public display	Task 6.1 Prepare final technical report	60 days	1,000 USD
	Task 6.2 Public display (Draft Land Use Master Plan)		
Step 7 – Review of technical report	Task 7.1 Final presentation to provincial authorities and revision	60 days	500 USD
	Task 7.2 Final presentation to national authorities and revision		
Step 8 – Identification of priority projects	Task 8.1 Identification of priority projects	60 days	500 USD
Step 9 – Approval of the Land Use Master Plan	Task 9.1 Submit the LUMP to district/municipal and provincial authorities for final endorsement	125 days	1,000 USD
	Task 9.2 Submit the LUMP to national authorities for final approval		
	Total	785 days	23,500 USD

Note: The timing is indicative and based on the detailed procedure (NCLMUP 2013). The costs comprise only the activity costs including meetings, workshops, trainings, public forums and field work. They do not include the consultant fees, trainer fees, costs of office equipment and machinery, office running costs etc. The cost structure is indicative only and might vary based on district/municipality size and planning activities conducted on the ground.

Figure 2 Overall planning process of District/Municipal Land Use Master Plan

The planning procedure to design a **Land Use Plan** also comprises a sequence of nine steps that take action over the course of approximately 22 months (see Figure 3). This division of the process into nine steps is based on the Decision on the Detailed Procedure for Development of the Municipal, District and Khan Master Plan and Land Use Plan released by the National Committee for Land Management and Urban Planning (NCLMUP 2013). However, given the fact that the Land Use Planning Process is based upon and elaborated in continuity with the Land Use Master Planning Process, many activities conducted during this initial process do not need to be reiterated, so that the LUP process is shorter than the LUMP one.

Steps	Tasks	Time	Costs
Part B – Elaboration and Approval of the Land Use Plan (LUP)			
Step 1 - Preparations and launch	Task 1.1 Scoping and inception of the Land Use Plan	10 days	1,500 USD
	Task 1.2 Dissemination and gathering of stakeholders in 5th Spatial Planning Stakeholder Forum		
Step 2 – Data collection and data management	Task 2.1 Data and information collection	50 days	1,000 USD
Step 3 – Data analysis	Task 3.1 Improve geographic attributes of land use units	90 days	1,000 USD
	Task 3.2 Analyze existing townscape and building structure		
	Task 3.3 Analyze local tertiary road system (optional)		
Step 4 – Draft the Land Use Plan	Task 4.1 Define future land use type regulations (functional/use-based zoning ordinance) with District/Municipal LMUP Committee	120 days	1,500 USD
	Task 4.2 Define future building regulations (form-based zoning ordinance) with District/Municipal LMUP Committee		
Step 5 – Review of Draft Land Use Plan	Task 5.1 Consultation on draft Land Use Plan with Commune/Sangkat authorities	90 days	500 USD
	Task 5.2 Validate draft Land Use Plan in 6th Spatial Planning Stakeholder Forum		
Step 6 – Public display	Task 6.1 Prepare Final Technical Report	60 days	1,000 USD
	Task 6.2 Public display (Draft Land Use Plan)		
Step 7 – Review of technical report	Task 7.1 Final presentation to provincial authorities and revision	60 days	500 USD
	Task 7.2 Final presentation to national authorities and revision		
Step 8 – Identification of priority projects	Task 8.1 Identification of priority projects	60 days	500 USD
Step 9 – Approval of the Land Use Plan	Task 9.1 Submit the LUP to district/municipal and provincial authorities for final endorsement	125 days	1,000 USD
	Task 9.2 Submit the LUP to national authorities for final approval		
	Total	665 days	8,500 USD

Figure 3 Overall planning process of District/Municipal Land Use Plan

Part A

Elaboration and Approval of District/Municipal Land Use Master Plan (LUMP)

Step 1 Preparations and Launch of the District/Municipal Spatial Planning Process

Overall objectives

Before entering into the actual planning process, preconditions have to be set up in order to allow for a smooth and inclusive planning process. The involved authorities need to understand and own the planning process to foster cooperation and provide leadership. Operational planning agencies need to be in place to conduct the technical work. All relevant stakeholders are to be identified and involved from the start to aid data collection and verification as well as the planning and plan im-plementation later on.

Task 1.1 Scoping and Inception

Overview

During a first discussion at district/municipal level, the main authorities discuss the objectives and scope of the spatial planning process.

Who is involved?

- Initiation
  - District/Municipal Council
  - District/Municipal Committee for Land Management and Urban Planning
  - Provincial Department of Land Management, Urban Planning, Construction and Cadaster (for backstopping)
  - Ministry of Land Management, Urban Planning and Construction (for backstopping)
- Participants
  - District/Municipal Council and Board of Governors
  - District/Municipal technical line offices
  - Representative(s) from other district/municipality where spatial planning was successfully con-ducted

Activities/methodology

- **Introduce spatial planning approach to district/municipal authorities.** This presentation should clearly explain the overall objectives and approach of spatial planning and the added value spatial planning brings to the existing planning processes. A resource person (MLMUPC or external) should present a case study of spatial planning conducted in other districts/municipalities.
- **Discuss the purpose and benefit of conducting spatial planning.** Facilitate a discussion on the benefit of conducting spatial planning in the district/municipality and the overall scope of such a plan. Encourage active participation of all participants and allow sufficient time for debate.

Necessary outputs

- District/municipal authorities understand the objectives and overall procedure of spatial planning and give a green light to pursue the process.
- There is an agreement on the planning area covered by the Land Use Master Plan.
- The roles and responsibilities of authorities/agencies in the planning process (commune/Sangkat, district/municipal, provincial and national levels) are clear and understood.

Task 1.2 Establish the Land Management and Urban Planning Committee and Working Group

Overview

Following provisions of Sub-Decree No 77 (Royal Government of Cambodia 2013), a Land Management and Urban Planning Committee chaired by the district/municipal governor is established to initiate and coordinate the overall planning process. Each line office will be represented in this committee.

At the working level, an operational Land Management and Urban Planning Working Group (LMUP-WG) is assigned with the mandate to design and carry out the planning process: collection and analysis of all necessary data, maintenance of a spatial planning database, design of maps, elaboration of future spatial planning options and drafting of the spatial planning technical report. It is important that the District/Municipal Land Management and Urban Planning Working Group is an interdisciplinary (cross-sector) team. Ideally, the members of the working group are technical staff from the different technical line offices represented in the committee. Optionally, the working group can include members from non-state organizations (private sector, NGOs, etc.).

As there is a wide range of mapping and other detailed technical work, which accrues during the planning process, the District/Municipal LMUP-WG might not technically involve in every detail of the planning process. It has been a practical solution to assign a Core Working Group (CWG), which may comprise also lower level technical staff, in order to provide sufficient time for those tasks. The LMUP-WG in this set-up takes rather an advisory role.

Who is involved?

- Initiation
  - District/Municipal Council
  - District/Municipal Committee for Land Management and Urban Planning
  - Provincial Department of Land Management, Urban Planning, Construction and Cadaster (for backstopping)
- Participants
  - District/Municipal Board of Governors
  - District/Municipal technical line offices

Necessary outputs

- The district/municipal spatial planning agencies are established in clear connection with the sub-national government authorities.
- The District/Municipal Council assigns a District/Municipal Committee for Land Management and Urban Planning based on the provisions of Article 02 of Sub-Decree No 77. The District/Municipal Governor chairs the committee and its members are representatives from key technical line offices.
- A cross-sectoral Land Management and Urban Planning Working Group (LMUP-WG) is as-

signed with membership from state and, optionally, from non-state agencies.

- The working group meets on an agreed regular basis in a sufficiently equipped office.
- Optionally, a cross-sector operational Core Working Group could be established to carry out the actual technical work.

Task 1.3 Identification and gathering of stakeholders in 1st Spatial Planning Stakeholder Forum

Overview

Once the land management and urban planning committee and working group are in place, the different actors with a stake in the planning process are identified and brought together. The objectives and scope of the district/municipal land use master plan will be presented to them and their roles and necessary contributions will be discussed. An initial gathering is organized to discuss the expectations of stakeholders regarding the spatial planning process and the key spatial development issues to be ad-dressed.

Who is involved?

- Initiation
  - District/Municipal Council
  - District/Municipal Committee for Land Management and Urban Planning
- Participants
  - All stakeholders (Table 1)

Activities / methodology

- Identify all relevant district/municipal spatial planning stakeholders: Facilitate a process (stakeholder mapping or analysis) to identify the actors with a stake in land use management (Table 1 presents a non-exhaustive list of institutions).

Table 1 List of potential stakeholders in district/municipal spatial planning

Sector		Potential Stakeholders in Municipal MPLUP Process
State institutions	Provincial	Provincial Committee for Land Management and Urban Planning Provincial line-departments Provincial authorities (Council and Board of Governors)
	Municipal	Municipal Committee for Land Management and Urban Planning Municipal line-offices Municipal authorities (Council and Board of Governors)
	Commune/Sangkat	Commune/Sangkat Council members
	Village	Village heads
Semi-state actors	Public utilities	Water supply authority Electricity supply authority
	Private contractors	Waste management company

Non-State Actors	Private sector	Chamber of commerce Representation of large enterprises/investors (or federa-tion if any) Representation of small and medium enterprises (or fed-eration if any)
	NGOs	Provincial coordination body of local NGOs International NGOs NGOs concerned with land issues and/or climate change
	Bi- and multilateral coop-eration projects/programs	Programs/projects with relevant activities in the munici-pality or the district
	Education	Representatives of universities, students association
	Civil society	Youth/women associations and other associations Representatives of religious bodies Representatives of informal settlements/urban poor communities Representatives of ethnic minority groups/communities
	Press/Media	Association and individual journalists (Radio, TV, news-papers, online media)

- Organize a 1st Spatial Planning Stakeholder Forum: With participation from all spatial plan-ning stakeholders identified earlier, facilitate a workshop to introduce the overall objectives, approach of Land Use Master Plan and the expected contributions from different stakeholders. An external resource person can present a case study of land use master planning conducted in other districts/municipalities. Facilitate group work discussions (brainstorming) to discuss expectations of stakeholder towards the process, their readiness to contribute and the main spatial development issues to be addressed.
- Media announcement: announce the spatial planning process, scope and objectives through dif-ferent media (radio and TV broadcasts, newspapers, online media).

Necessary outputs

- Relevant stakeholders for the land use master planning process are identified (stakeholder map-ping).
- Stakeholders are aware of and understand the general spatial planning process.
- Clear commitments from different stakeholders to engage in the process are identified.
- Key priority issues to be addressed in the District/Municipal Land Use Master Plan are mapped out.

Figure 4 1st Spatial Planning Stakeholder Forum in Ta Khmau Municipality, 2013

Task 1.4 Capacity development needs assessment, team building and work planning

Overview

A team-building workshop is conducted with all members of the District/Municipal Land Management and Urban Planning Working Group with the objective to explain in detail the scope and procedure of the district/municipal land use master planning process. This includes a discussion about roles and tasks of each member and a capacity development need assessment discussed amongst all members.

Who is involved?

- District/Municipal Land Management and Urban Planning Committee and Working Group
- Provincial Department of Land Management, Urban Planning, Construction and Cadaster (for backstopping)

Activities/methodology

- **Present detailed Land Use Master Plan procedures:** Give a detailed presentation on the land use master planning procedure to all members of both committee and working group and facilitate a discussion on roles and responsibilities as well as modes of work (team building).
- **Work plan and roles/rsponsibilities:** Facilitate discussion and drafting of an overall work plan with a first time schedule and clear roles and responsibilities.
- **Training needs assessment:** Conduct an assessment of existing skills and needs among the mem-bers of the LMUP Working Group for further capacity development.
- **Introductory training:** Identify trainers and deliver introductory training on spatial planning to the members of the LMUP Working Group.

Necessary outputs

- Scope and procedures of the District/Municipal Land Use Master Plan are agreed upon.
- The LMUP Working Group works according to work plans elaborated and agreed by all team mem-bers.
- Roles and responsibilities amongst members of the LMUP Working Group are identified and assigned according to existing skills.
- Based on the identified needs, a capacity development curriculum is developed for the different members of the LMUP Working Group.
- Based on this training curriculum, the LUMP Working Group identifies training resources (resource persons, support budget, etc.).

Step 2 Data Collection and Data Management

Overall objectives

In a first step along the planning process, a relevant summary of spatial information, facts and figures needs to be compiled. This information, which forms the main basis for analysis, is derived from either existing documents (secondary data, such as statistics from ministries, international organizations, national or local NGOs) or is directly generated by the working group (primary data). The different datasets are then integrated in a geo-database that will support further analyses and mapping endeavors.

Task 2.1 Data and information collection

Overview

The process starts with a compilation of all existing data relevant to spatial planning of the concerned territory. Data are collected from different sectors, compiled, verified and consolidated. It is particularly important to mobilize all district/municipal line offices at this stage.

Who is involved?

- Initiation and implementation
  - District/Municipal Land Management and Urban Planning Working Group
  - Database/GIS expert
- People consulted
  - Stakeholders (Table 1)

Activities / methodology

- Collect secondary data: The data collection is organized according to a data requirement list that provides an overview of the data needed for the Land Use Master Plan (see Annex 1). A preliminary compilation of secondary data can be done by using open access data repository (identified in Annex 1). In order to capture data that might not be retrieved in the open access repositories, a complementary process of data collection should be initiated with each provincial and district/municipal technical line office and relevant non-state actors. Each member of the working group should be responsible for data collection within his/her own institution. It is highly recommended to collect time-series data in order to allow for later trend/evolution analysis. Also, it is important to compile all reports that provide data and information about land use and land management for the district/municipality. These documents are essential to allow for a proper interpretation of the data. All together the datasets shall be organized along the following themes:
  - Administration
  - Physical Environment
  - Demography
  - Settlements and Building Structure
  - Housing and Sanitation
  - Technical Infrastructures
  - Social Infrastructures
  - Land Use and Land Tenure
  - Environmental Profile

    - Economy
- Data collection workshop and/or meetings with line offices: The data collected until then may be incomplete, inaccurate or outdated. Against the list of required data, identify gaps in the data base and organize a data collection workshop with all stakeholders who potentially could provide missing data. Alternatively, the LMUP Working Group can organize a series of one-on-one meetings with line offices or non-state actors to organize this complementary data collection. Based on the workshop, the database is consolidated, upgraded and updated.
- Additional [primary] data collection surveys: In certain instances and for specific sectors/themes, the LMUP Working Group might conduct tailor-made surveys to find out specific information about e.g. land use/cover, road system, technical and social infrastructure, building structure, traffic information etc.. Primary data collection by the Working Group will require additional time and extra costs.

Necessary outputs

- A preliminary dataset is established with a clear structure and including all data relevant for the spatial planning process.

Task 2.2 Geo-Database management

Overview

Multi-sector datasets collected during Task 2.1 are geo-referenced and integrated in a multi-sector spatial planning database

Who is involved?

- Initiation and implementation
    - District/Municipal Land Management and Urban Planning Working Group
    - Database/GIS expert

Activities / methodology

Geo-database management: Identify a clear spatial database structure; the overall scope of it has to be established with clear themes and sections (see Annex 1). It is important to take this task seriously, as it is a foundation for the entire planning process.

Integrate all data in a structured spatial planning database system, so all data can be represented on a map. This integration requires specific data manipulations depending on the format of data to be entered into the database (see Figure 5). Geo-data are data with specific geo-referenced attributes so that they can be represented and combined (layered) with others on a map. In addition to these geo-data, there are a number of data relevant to spatial planning which do not necessarily have spatial attributes but which can be represented on maps:

- Geo-data existing as vector data with features represented as point, line or polygon;
- Geo-data existing as raster data in which the features are represented in a grid of pixels;
- Maps that are available only in hard copy documents can be scanned and integrated by geo-referencing in a Geographic Information System;
- Statistics available for specific administrative units (commune/Sangkat, village) can be linked/joined to existing administrative geo-data and then be represented;
- Secondary GPS survey data with coordinates of X-Y data can be entered in the system and used to generate geo-data.

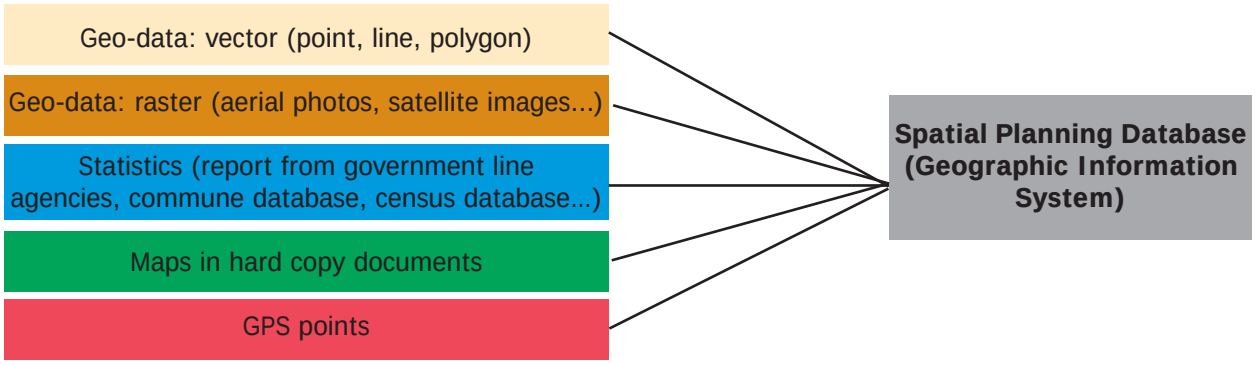


Figure 5 Integration of relevant spatial planning data into a spatial planning database

Checking quality, consistency and completeness of all data is important, and there is a need to ensure that the coordinate system is the same for all data of the spatial database in terms of projection and datum. In this regard, it is recommended to use the following coordinate system for all spatial data: Ellipsoid: Everest 1831, Projection: UTM, Horizontal Datum: wgs84. For each data in the database, a clear meta-database file should be created with complete description of data (sector, detail, type, update, source, etc.) (see Figure 6).

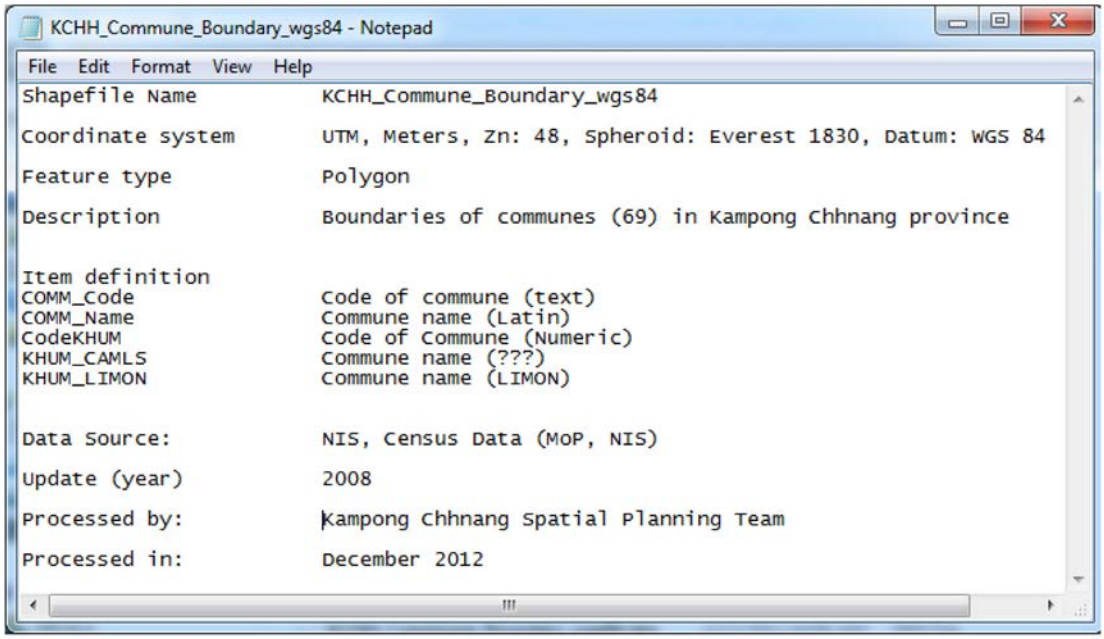


Figure 6 Example of meta-database file

Necessary outputs

- A preliminary computerized spatial database with a clear structure and meta-database, including all data relevant for the spatial planning process is established.

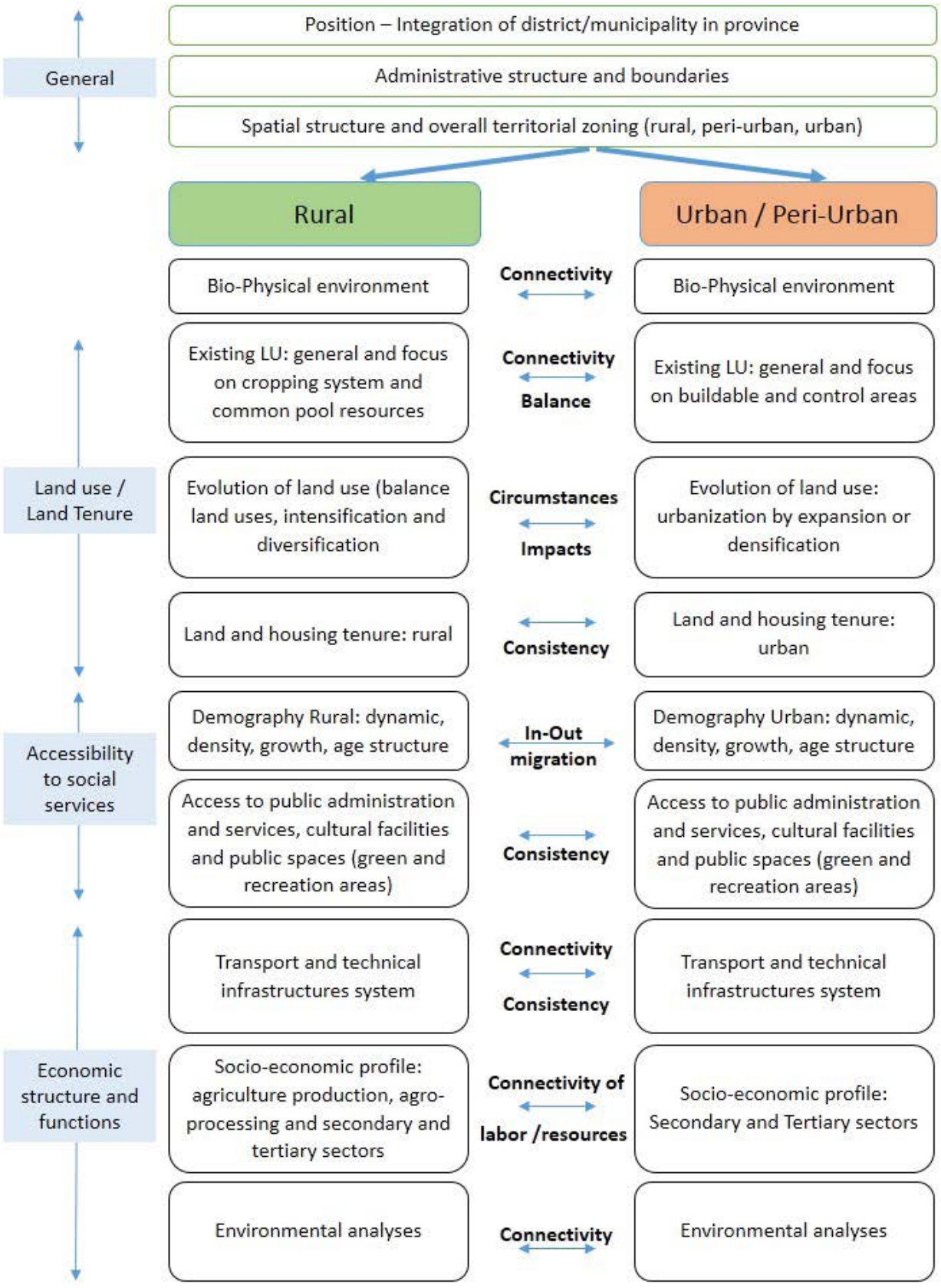
Step 3 Situation Analysis and Envisioning the Future

Overall objectives

The actual situation of the territory and the current land use are to be considered as a basis for spatial planning. The situation analysis includes a systematic review of strengths and weaknesses of a large diversity of sectors and thematic fields. It also offers an opportunity to discuss needs, potentials, opportunities and threats for further improvement.

Primary and secondary datasets are mapped and analyzed with both sector and cross-sector perspectives. A 'dynamic analysis' is undertaken to determine how spatial patterns and land use have been changing over time and are likely to change in the future. It is combined with a 'static analysis' aiming to examine in detail what the current land management challenges and potentials are.

After the diagnosis of the past and current land management situation, the spatial planning process now enters a prognosis phase that will engage the stakeholders in a discussion about the development of the district/municipality in future. In a view to anticipate needs and requirements of the population, the prognosis starts with a discussion on the possible future development scenarios related to demography, environment management, settlement and economic development. Combined with the results of the situation analysis, this sets the stage for formulating comprehensive long-term development goals and a vision, which captures and synthesizes these goals. The articulation of the different tasks in Step 3 is presented in Figure 7.


Position – Integration of district/municipality in province
General
Administrative structure and boundaries
Spatial structure and overall territorial zoning (rural, peri-urban, urban)
Rural
Urban / Peri-Urban
Bio-Physical environment
Connectivity
Bio-Physical environment
Existing LU: general and focus on cropping system and common pool resources
Connectivity
Balance
Existing LU: general and focus on buildable and control areas
Land use / Land Tenure
Evolution of land use (balance land uses, intensification and diversification
Circumstances
Impacts
Evolution of land use: urbanization by expansion or densification
Land and housing tenure: rural
Consistency
Land and housing tenure: urban
Accessibility to social services
Demography Rural: dynamic, density, growth, age structure
In-Out migration
Demography Urban: dynamic, density, growth, age structure
Access to public administration and services, cultural facilities and public spaces (green and recreation areas)
Consistency
Access to public administration and services, cultural facilities and public spaces (green and recreation areas)
Transport and technical infrastructures system
Connectivity
Consistency
Transport and technical infrastructures system
Economic structure and functions
Socio-economic profile: agriculture production, agro-processing and secondary and tertiary sectors
Connectivity of
labor /resources
Socio-economic profile: Secondary and Tertiary sectors
Environmental analyses
Connectivity
Environmental analyses

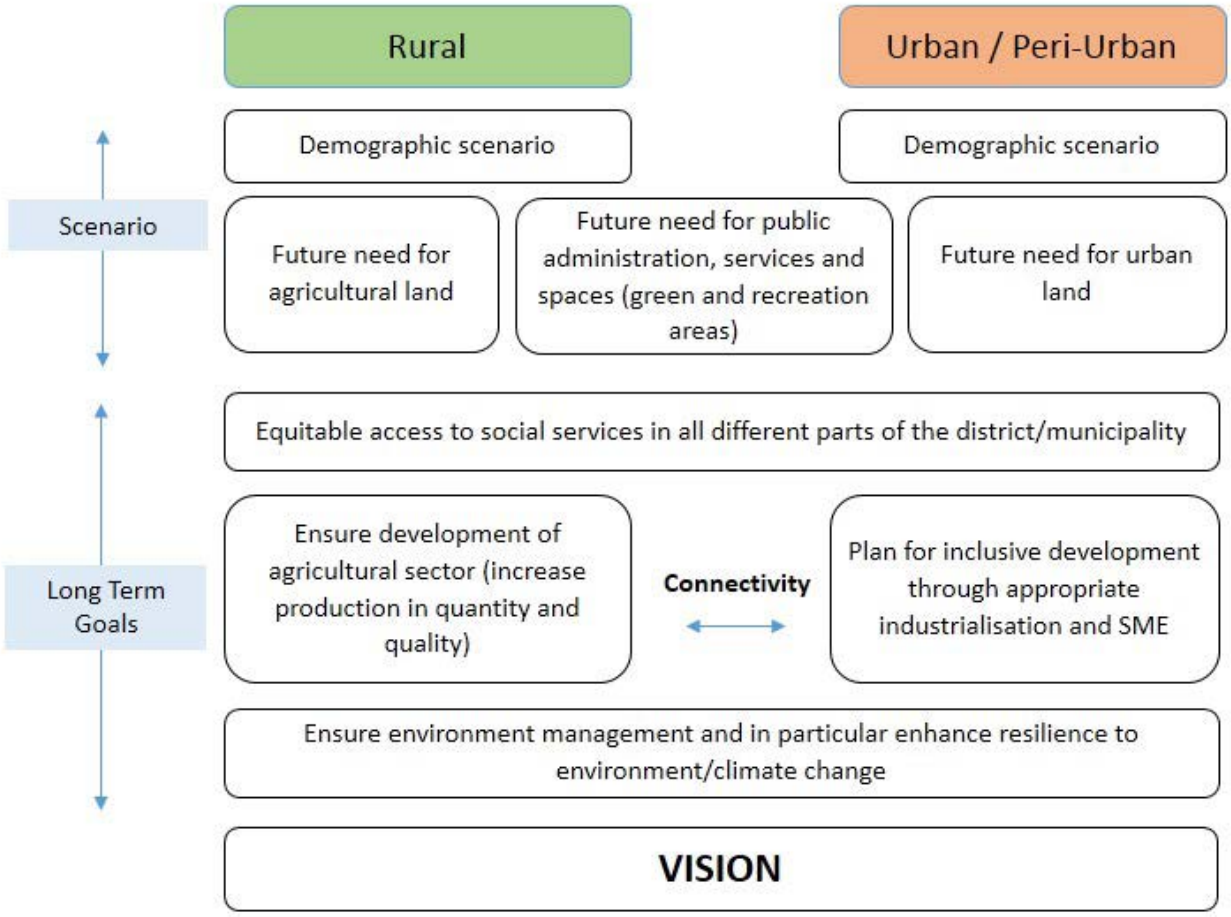


Figure 7 Articulation of tasks in Planning Step 3 Situation analysis and envisioning the future

Task 3.1 Data analysis and maps production

Overview

At this stage, data will be analyzed to understand the current patterns (static analysis) and trends (dynamic analysis) of parameters/indicators that are relevant to the spatial development of the district/municipality. Sector and thematic maps will be prepared to support these analyses and represent the results with geographic attributes. These maps will be key resource documents for further planning tasks. The analysis covers the entire territory of the district or the municipality but takes into account the specificities of rural and urban areas as well as the peri-urban interface. The process of data analysis, sketched in Figure 7, systematically addresses and emphasizes the linkages between rural and urban areas (flows of people and resources along communication ways).

Who is involved?

- District/Municipal Land Management and Urban Planning Working Group
- Advisor(s) (if available and relevant)
- Database/GIS expert

Activities / methodology

- Organize data analysis and mapping sessions. In order to conduct the data analysis working sessions need to be organized on a regular basis with specific assignments given to different members of the working group according to their expertise and skills. It is recommended to combine 'static' (at a given time) and 'dynamic' (over time) analyses. In a parallel process, mapping sessions (assisted with computerized GIS) are organized to spatially represent the results of data analysis or to conduct spatial analysis. Data analyses and mapping sessions should be corresponding, as results will be closely interrelated.
- To enable the LMUP working group in this rather complex task, the handbook suggests a guideline for data analysis and map production below, including key points and questions that need to be addressed during the analytical work. Specific examples are given from spatial planning processes in Battambang Municipality and Bavel District (Battambang Province), Kampong Chhnang Munici-pality and Rolea B'ier District (Kampong Chhnang Province) and Ta Khmau Municipality (Kandal Province).

Necessary outputs

- A complete set of sector and thematic maps (if necessary supplemented by graphs, tables etc.) is produced along the guideline, detailing all analyses and studies that are necessary in the master planning exercise.
- Each map and graph/table etc. is accompanied by a short text that describes and explains the main information presented on the maps and their relevance to the spatial development of the district/municipality.

A guideline for data analysis and maps production

The following is meant as a guideline to help the working group is carrying out the different types of analyses and producing the corresponding maps needed. As an additional support, a list of guiding questions is proposed in Annex 2. The specificity of the approach is to distinguish rural from urban and peri-urban areas so to look carefully at the ecological, social and infrastructural connectivity between both areas.

The guideline details the outputs under 16 different sectors/thematic fields that are either mandatory based on the Detailed Procedure for Development of the Municipal, District and Khan Master

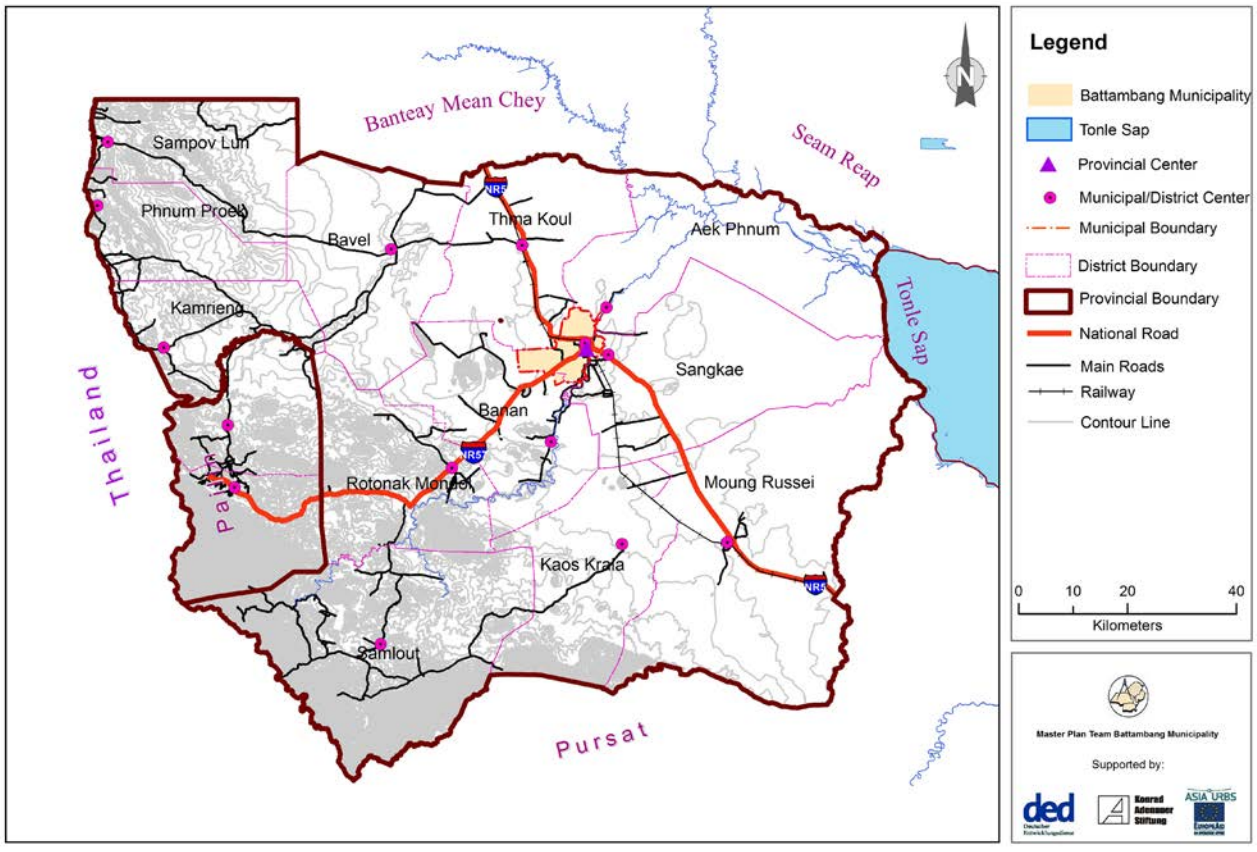
Plan and Land Use Plan (NCLMUP 2013) or optional but recommended during the process.

3.1.1 Position and integration of district / municipality in province / region (mandatory)

Analysis of the position and integration of the district/municipality in the wider provincial or regional territory:

- Scrutinize the connectivity of the district/municipal centre with other surrounding growth centres in terms of transport, flow of goods and people (see Map 1);
- Determine the contributions and roles of the district/municipality in the province/region in terms of urban centres hierarchy, population growth, regional connectivity of technical infrastructure, key economic assets and potentials, investment competitiveness, etc.;
- If existing, scrutinize higher-level plans (in particular the Provincial Spatial Plan) and examine their specifications and recommendations for the district or municipal development.

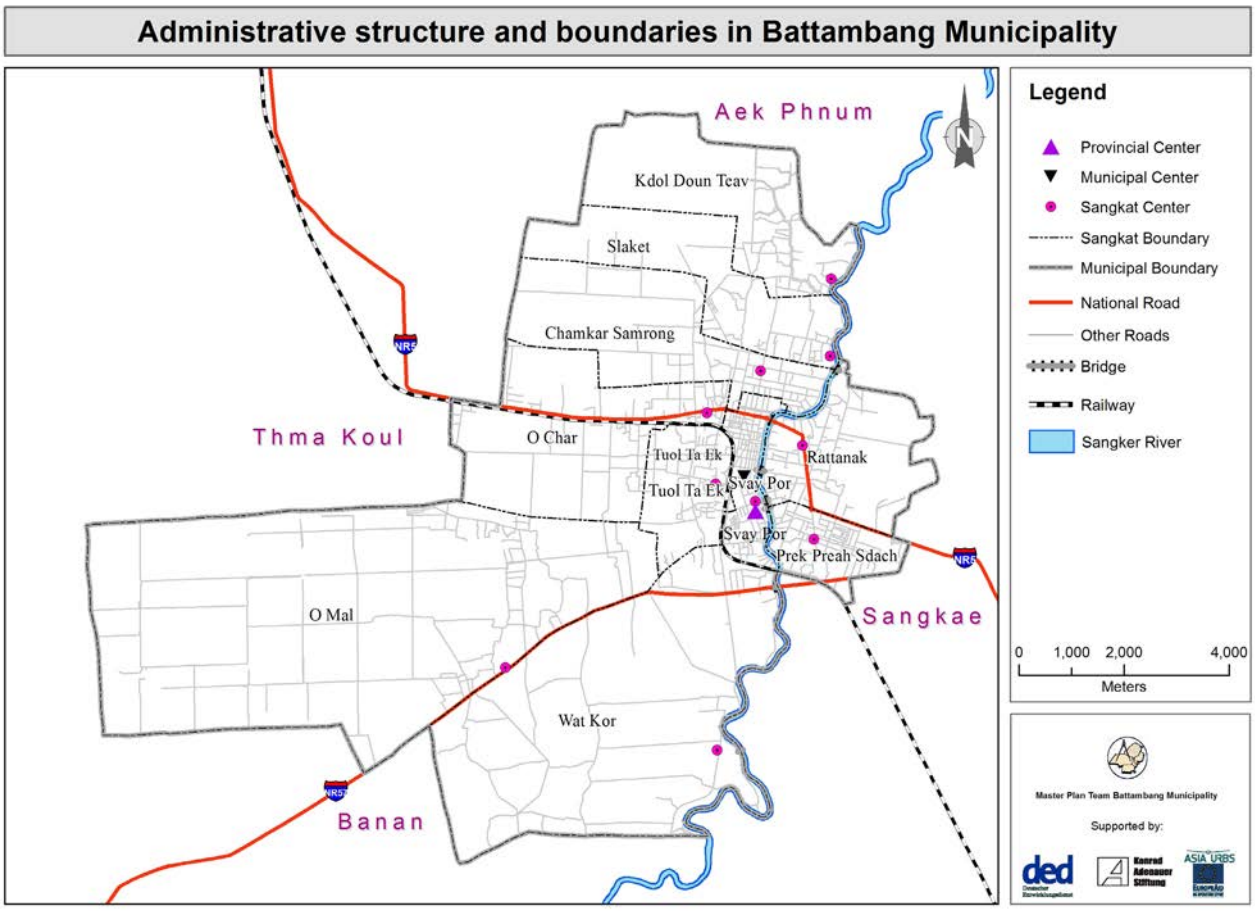
Position of Battambang Municipality in Battambang Province



Map 1 Position of Battambang Municipality in Battambang Province

3.1.2 Administrative structure and boundaries (mandatory)

- Establish the administrative divisions of the district or municipality. The analysis should focus on existing inconsistencies and need for clarification regarding commune/Sangkat (and village if relevant) boundaries and respective population affiliations (see Map 2);
- If necessary, organize a consultative workshop and field visit with commune/Sangkat/village authorities and rectify boundaries accordingly;
- Clarify toponymy (place names) and agree on a consistent transliteration from the original



Map 2 Administrative structure and boundaries in Battambang Municipality

3.1.3 Spatial structure and overall territorial urban/peri-urban/rural zoning (recommended)

- Establish an overall zoning of the district/municipal territory into three main ensembles: urban, peri-urban and rural. Operating a distinction between these three zones is important to focus sub-sequent analysis and planning measures into specific directions, while considering the interactions and balance between the three zones.
- The National Institute of Statistics (2012) reclassified the urban areas in Cambodia based on the following criteria:
  - All Sangkat belonging to Krong/Municipalities as established in the Sub-Decree No 18 (Royal Government of Cambodia 2008).
  - Any additional commune that fill all following criteria:

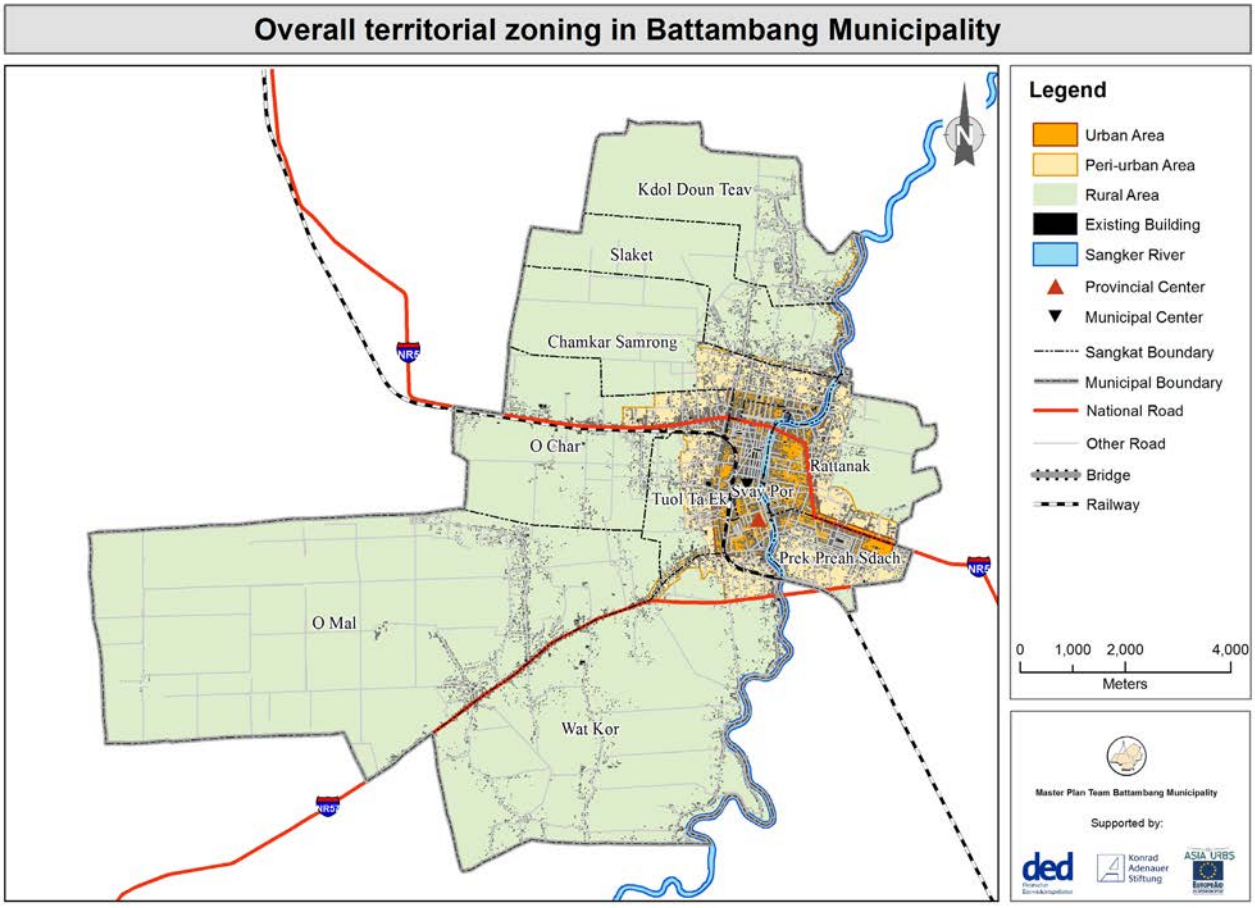
    Total population more than 2,000 people;

    Population density higher than 200 people/km²;

    Percentage of employment in agriculture (male and female) less than 50%.
  - Any other commune recommended by the director of the provincial department of planning. Based on this classification, there are currently 289 communes classified as urban in Cambodia.
- This classification set by the National Institute of Statistics is not entirely satisfactory for land use master planning purposes because the information is aggregated at commune/Sangkat level and does not allow for a more fine-grained spatial differentiation. There are two ways to address this constraint:
  - One is to apply the same criteria (as above) at village level, provided that village bounda-

ries are available. The establishment of village boundaries is required in the land titling efforts so cooperation with the cadastral team can help to address this constraint.

- Another way is to determine other classification criteria, according to [non-administrative] urban structure parameters such as building density, ground coverage ratio etc. An example of such classification is given in the Battambang municipal land use master plan where a distinction between the three zones was conducted based on average Building Coverage Ratio (BCR): urban > 25%, peri-urban 15-25% and rural < 15%) (see Map 3).
- In both cases, it is useful to identify and characterize a peri-urban zone conceived as an extension of the main urban area (result of an urban sprawl) becoming a transition area between the core urban and the rural hinterlands zone of the district/municipality.



Map 3 Overall territorial zoning in Battambang Municipality

3.1.4 Bio-physical environment (recommended)

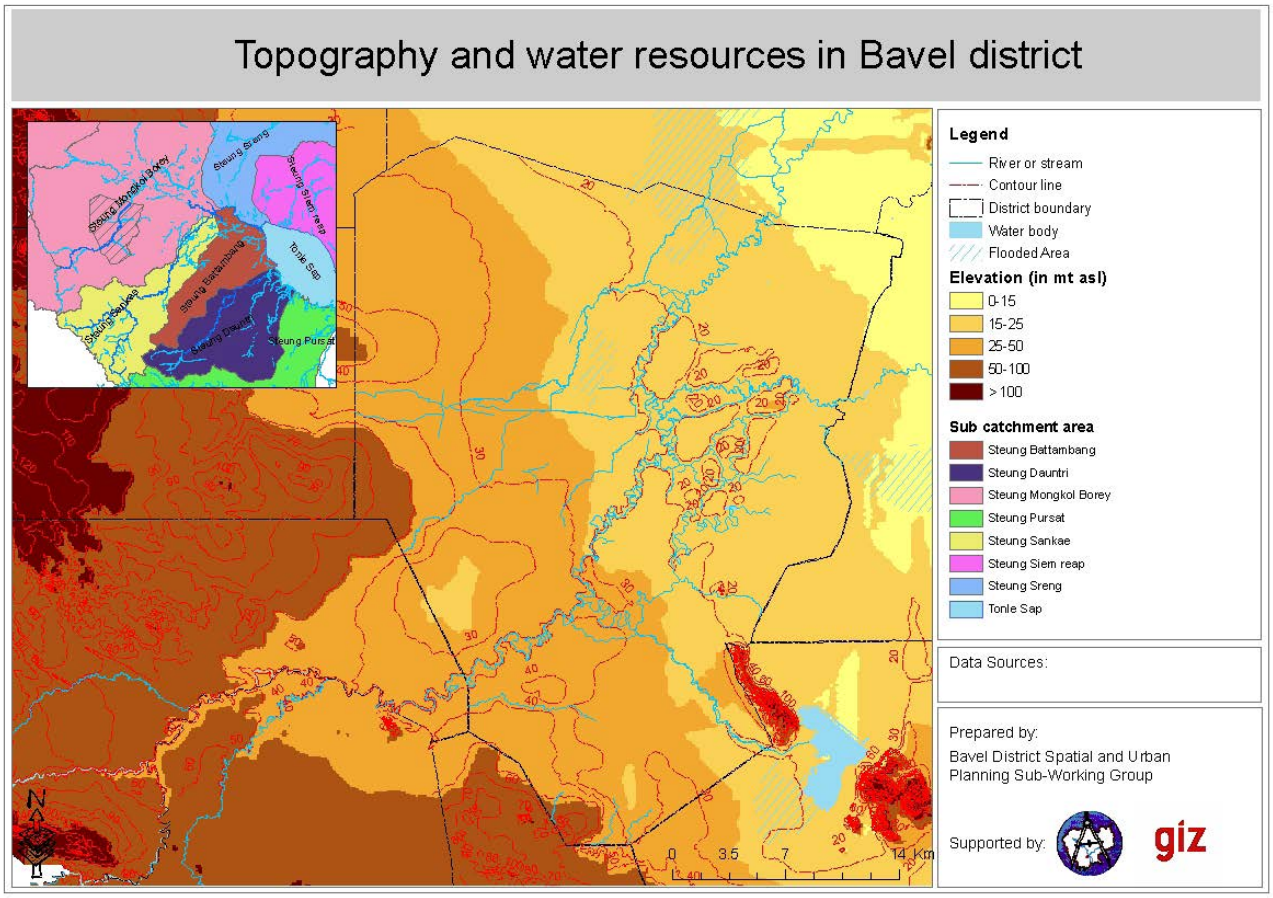
The socio-economic system of land use is embedded in the biophysical environment which structures the territory and constrains/enables land-based production activities as well as the shape and location of built-up structures. Hence, it is central to understand how these bio-physical structuring elements shape the territory being examined for land use planning purposes.

A watershed analysis that combines the analysis and mapping of topography and water resources is a useful entry into the biophysical environment. First focus is a description of the topography. Second focus is the access to and use of water, as it is essential to support life, the development of agriculture and ensures the transport of people and goods. The watershed analysis aims to examine the relation between topography and water while considering the following aspects:

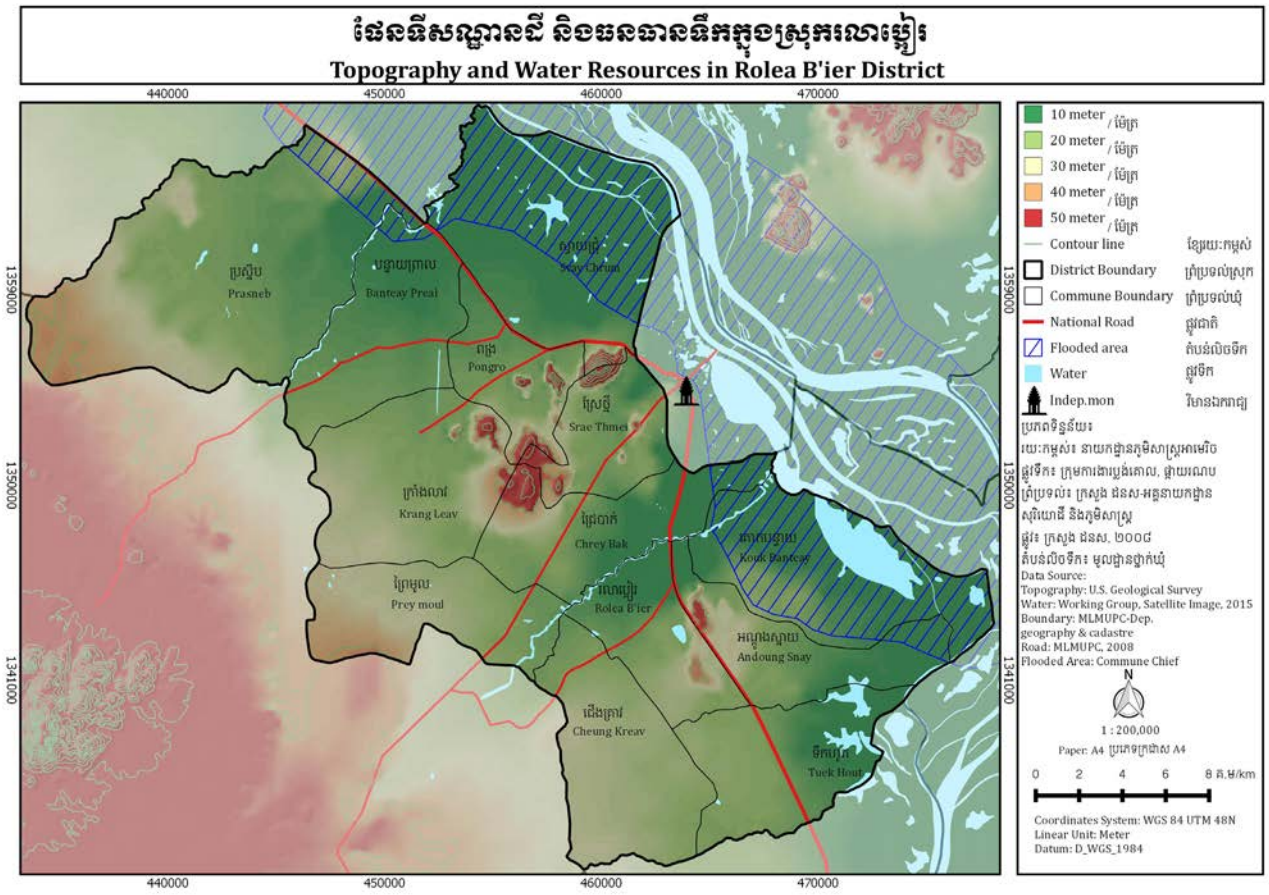
- Identify the main landforms where relief and slope present relatively uniform patterns (see Map 4);
- Identify the main water bodies (stream, rivers, ponds and lakes) and their catchment in the

district/municipality;

- Get a sense of the potential up-stream / down-stream water management issues with a particular attention to the connectivity between urban and rural areas through waterways.
- Identify the main sources of water for human consumption and for agriculture (springs, ponds/ lakes, rivers/streams);
- Identify eventual flood patterns (location and magnitude) and identify the settlements or agricultural areas that are flood prone (see Map 5).



Map 4 Topography and water resources in Bavel District (Battambang Province)



Map 5 Topography and water resources in Rolea B'ier District (Kampong Chhnang)

3.1.5 Existing land use (mandatory)

The identification, mapping and analysis of current land use is central to the land use master planning process. At this stage, the working group shall identify and map the different categories of land use based on a classification and symbology which will facilitate the sub-sequent definition of 'buildable areas' and 'control areas' specified in the Detailed Procedure for Development of Municipal, District and Khan Land Use Master Plan (NCLMUP 2013) and the land use zoning foreseen in the Sub-Decree No 42 on Urbanization of the Capital, Municipalities and Towns (Royal Government of Cambodia 2015). It is useful to distinguish two ensembles of land use categories: built-up ('buildable') areas and open spaces ('control areas'). For each ensemble, two levels of classification (general and specific) might be envisaged (see Table 2). For a comprehensive list and detailed definitions of land use categories, see Annex 6.

Table 2 Land use categories for existing land use mapping

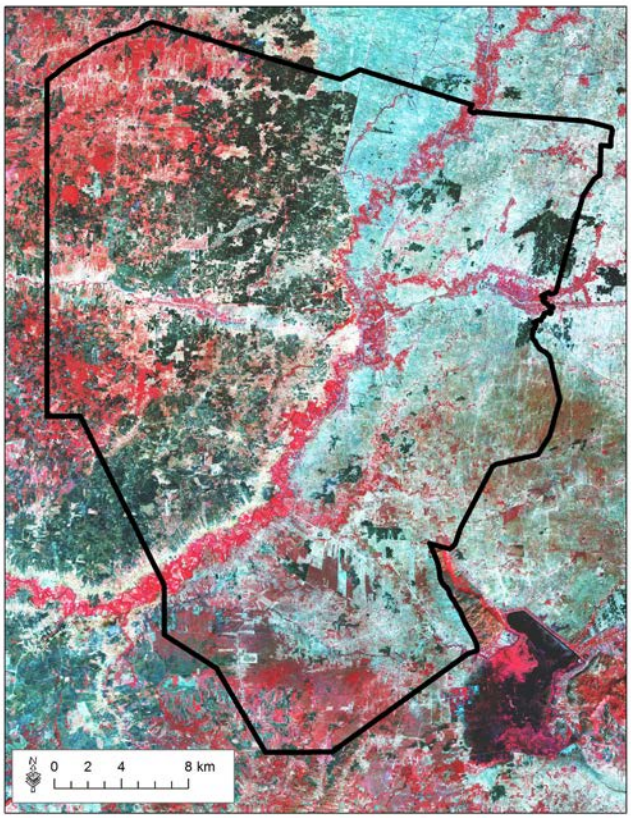
Built-Up ('Buildable') Areas	
General	**Specific**
Residential	Detached low-rise residential Attached low-rise residential Medium-rise residential High-rise residential Mixed residential
Commercial	
Industrial	Industrial Light industrial
Mixed use	
Public services	Health (referral hospital, health center, rehabilitation center, clinic etc.) Education (university, vocational training center, secondary school, primary school, kindergarten etc.) Public administration (provincial hall, district/municipal hall, commune/Sangkat center, provincial department, etc.) Other administrative facilities (post office, courthouse, police station, fire brigade etc.)
Transportation	Railway station, bus terminal, airport, dry port, harbor etc.
Tourism	
Public space and green areas	Public park, sports field, stadium, swimming pool, etc.
Culture and religion	Historical heritage, library, theatre, museum, pagoda, mosque, church, temple, cemetery etc.)
Residential with agriculture	
Technical infrastructure	Freshwater treatment plants, wastewater treatment plants, waste disposal sites, power stations etc.
Military	
Other Built-Up ('Buildable') Areas	

Open Space ('Control') Areas	
General	**Specific**
Agriculture	Rice (1 harvest) Rice (2 harvests) Chamcar (1 or several harvest) Rice and Chamcar Perennial crop Other cropping system
Forest	Evergreen Semi-evergreen Deciduous Bamboo Shrub land Other Agro-forestry
Water resources	Ponds - lakes Streams - rivers Canal - irrigation Wetlands
Stone and rocks	Mines and quarry

In line with these references, the identification and mapping of land use shall be carried out in two Steps:

- The interpretation of recent remote-sensing images (aerial photo or satellite image) (see Map 6) is instrumental to produce a first draft land use map. However, there are two constraints associated with this initiative. First, recent high-resolution images are not necessarily easy

to access at an affordable price. A way to go around this constraint is to work with Google Earth images that are available free of charge on the internet. Secondly, the classification and interpretation of remote-sensing images requires technical expertise, which is not necessarily available within the working group. If necessary, this work could be outsourced to third parties (university, private companies, etc.).



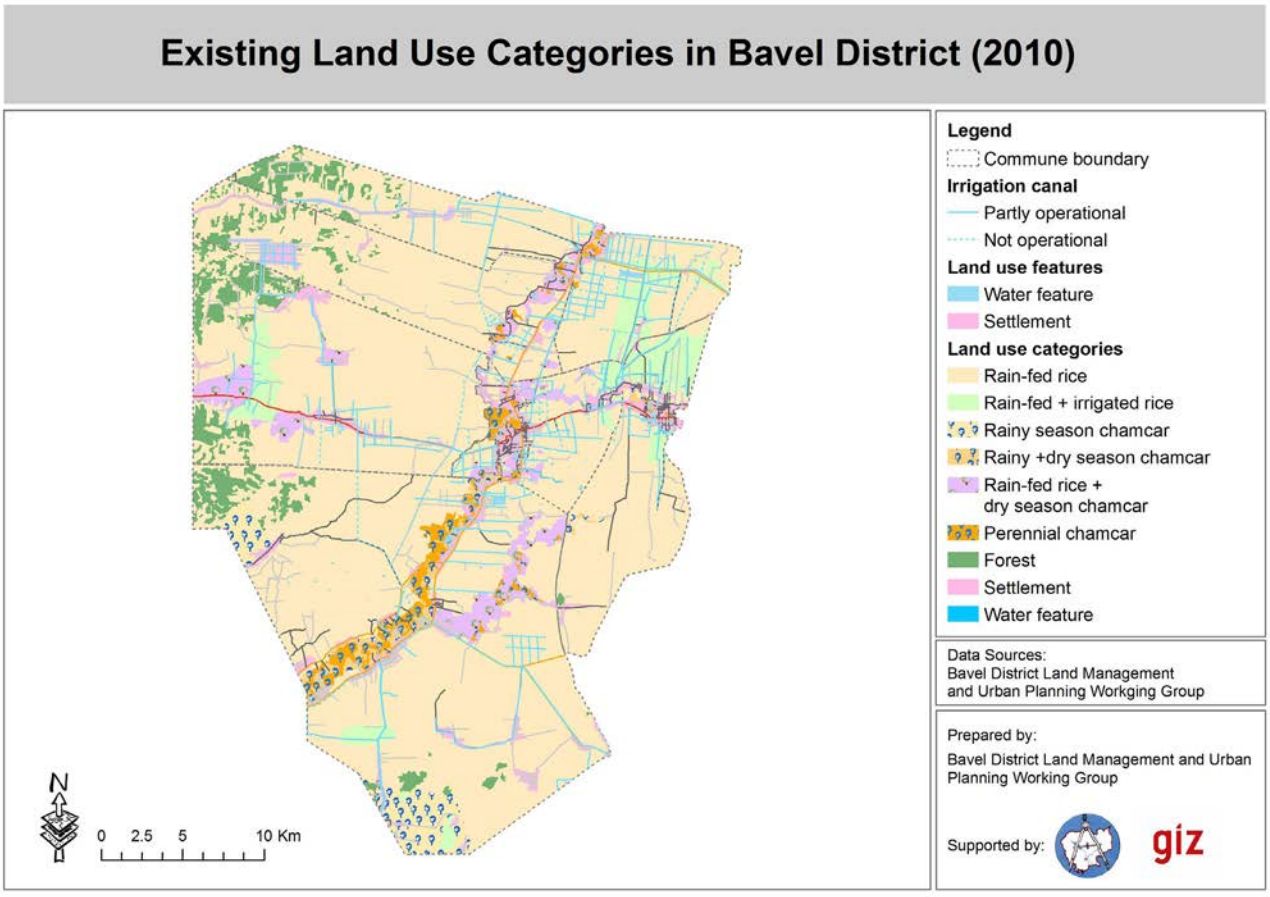
Map 6 Bavel District SPOT Image 2010

- A complete interpretation of the image will not be possible without conducting additional field surveys and consultation with land users. Field surveys assisted with GPS can help complement land use classification established previously but these additional surveys need to be organized in a consistent and systematic manner (see Figure 8). To this end, it is recommended to use a pre-defined list of land use features/milestones to be recorded with GPS (see Figure 9) (as given in Annex 3). Additionally, consultation with local authorities and land users is necessary to clarify the actual land use. In case of important missing information, land use mapping workshop(s) at local level might be needed.

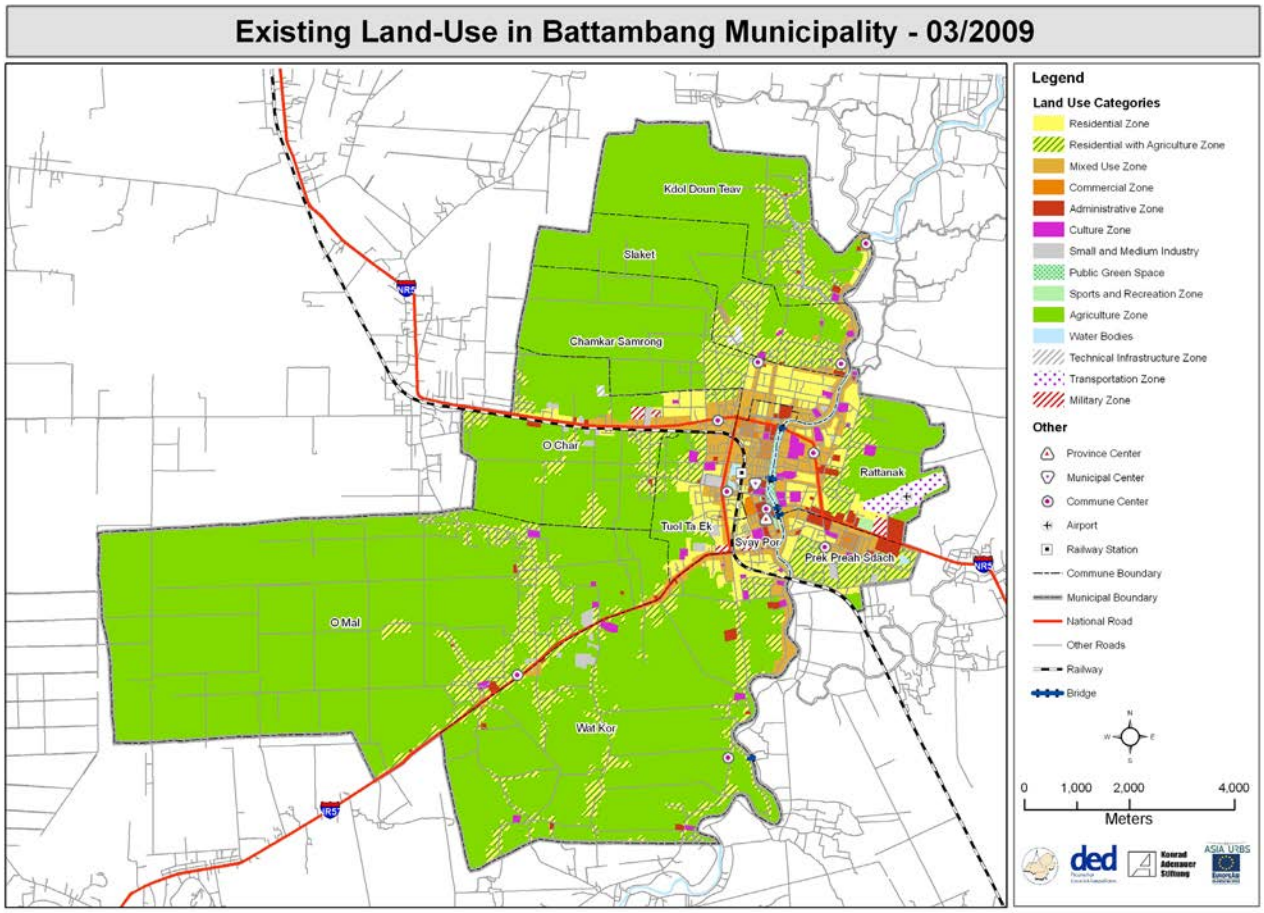
Figure 8 Land use mapping workshop in Bavel District, 2011

Figure 9 Field survey and land use reconnaissance associated with GPS

The results are displayed on a map (see Maps 7 and 8) and the area sizes of each land use category are computed in a table or diagram. This will constitute the baseline situation against which the future land use options will be compared.



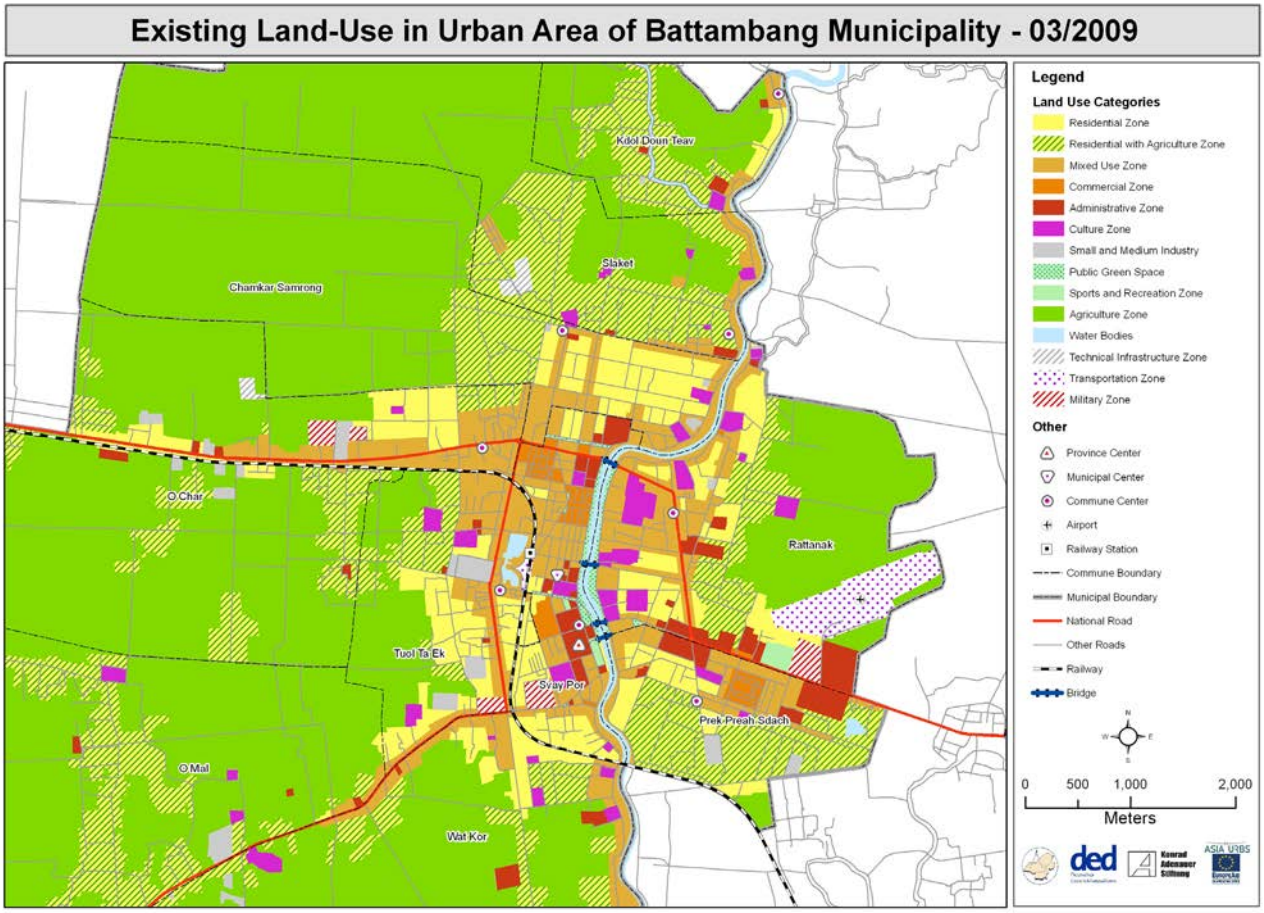
Map 7 Existing land use categories in Bavel District (Battambang Province)



Map 8 Existing land use categories in Battambang Municipality

For urban and peri-urban areas it is recommended to map the existing land use as detailed and geographically explicit as possible, as this information will be needed anyway as the base for the legally binding future land use zoning in the Land Use Plan (see Map 9). It may be advised to prepare an additional zoom-in map with a bigger scale (1:10,000 or 1:5,000) focusing on the urban area of the district/municipality, to allow better readability of the map (see Map 10).

Map 9 Existing land use categories in Battambang Municipality – Zoom-in/extract showing the level of detail and geographic explicitness

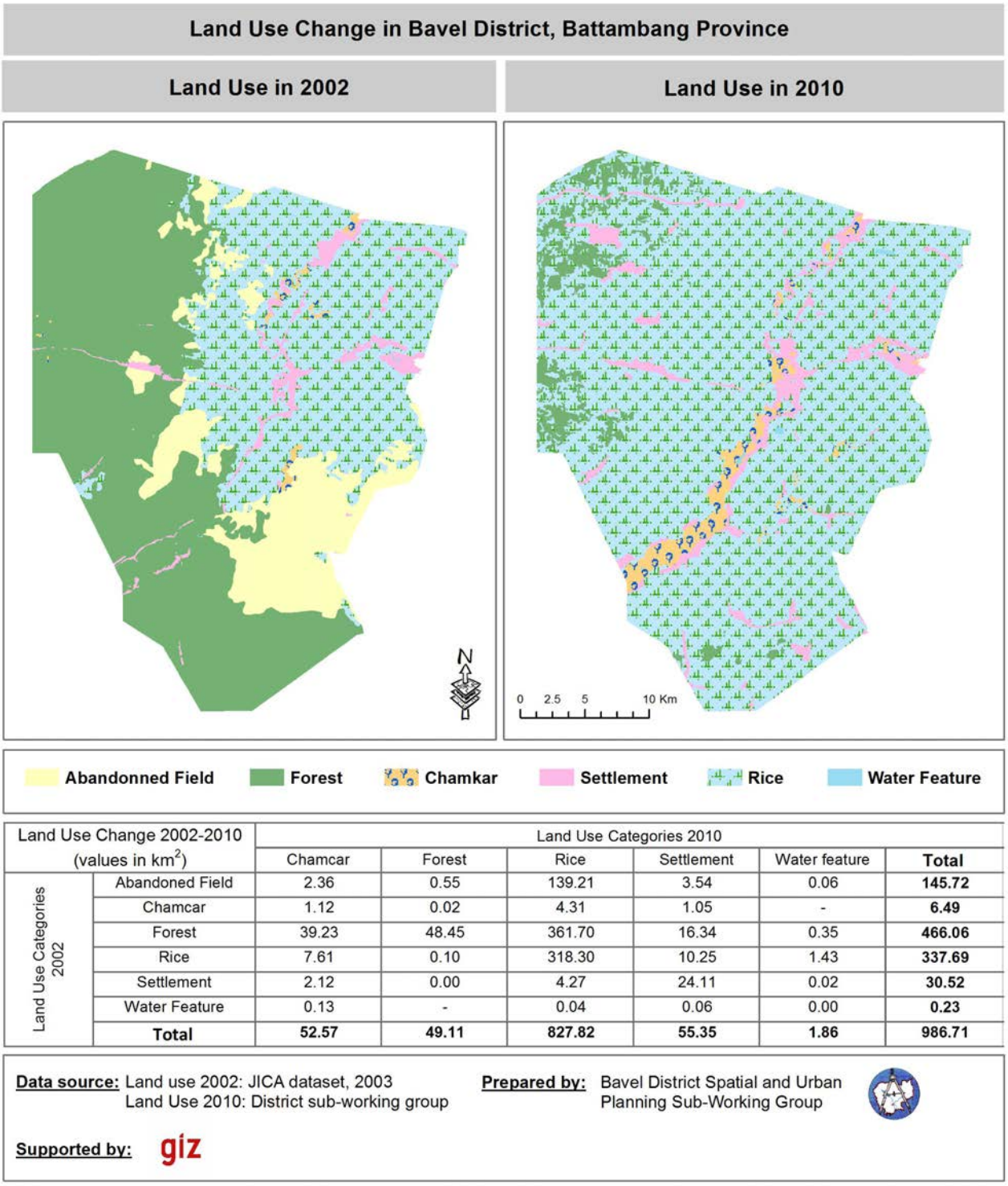


Map 10 Existing land use categories in urban area of Battambang Municipality

3.1.6 The evolution of land use from the past to the present (mandatory)

The scrutiny of the evolution of land use in the district/municipality conveys information about past dynamics and likely paths of changes in the future. It is thus an important part of the territorial diagnosis.

To conduct this analysis, the working group needs a collection of time-series maps, aerial photos or satellite images and historical accounts of the changes. If time-series geo-referenced data are available, it is possible to quantify land use changes for the district/municipality as pictured on Map 11 showing the land use change in Bavel District between 2002 and 2010. If a Provincial Spatial Plan exists, the results of the analysis of land use change conducted at district/municipal level are available and shall be used as an additional reference. In rural areas, land use change analysis considers transformations of land cover (e.g. typically deforestation associated with the expansion of agricultural areas) (see Map 11).



Land Use Change 2002-2010 (values in km²)		Land Use Categories 2010					
		Chamcar	Forest	Rice	Settlement	Water feature	**Total**
Land Use Categories 2002	Abandoned Field	2.36	0.55	139.21	3.54	0.06	**145.72**
	Chamcar	1.12	0.02	4.31	1.05	-	**6.49**
	Forest	39.23	48.45	361.70	16.34	0.35	**466.06**
	Rice	7.61	0.10	318.30	10.25	1.43	**337.69**
	Settlement	2.12	0.00	4.27	24.11	0.02	**30.52**
	Water Feature	0.13	-	0.04	0.06	0.00	**0.23**
	Total	**52.57**	**49.11**	**827.82**	**55.35**	**1.86**	**986.71**

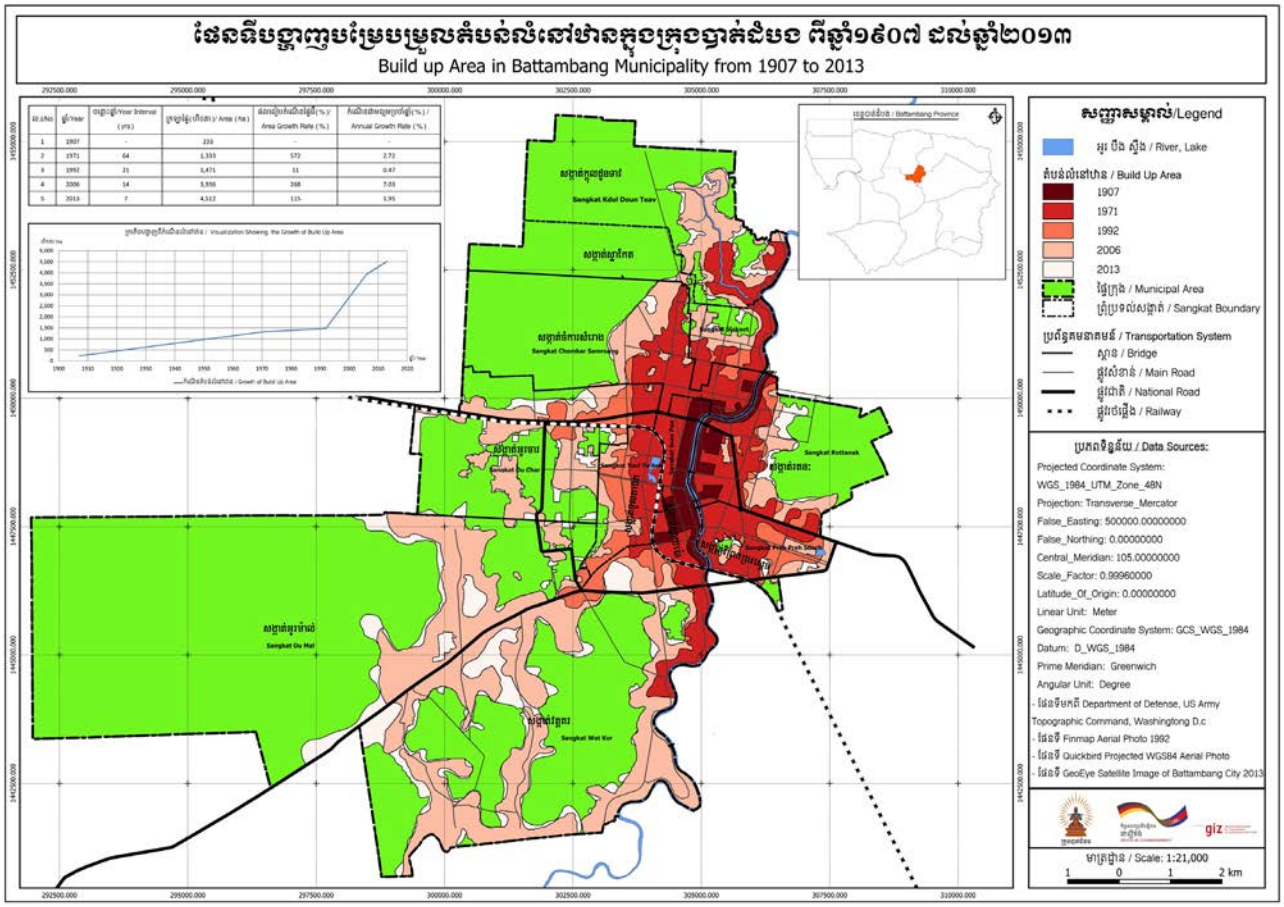
Data source: Land use 2002: JICA dataset, 2003
Land Use 2010: District sub-working group

Prepared by: Bavel District Spatial and Urban Planning Sub-Working Group

Supported by: giz

Map 11 Land use change in Bavel District (Battambang Province)

In urban areas, aerial photos/satellite images and archive documents from successive administrations (and in particular cadastre administration) allow an understanding of the evolution of built-up (settlement) areas, i.e. land conversion through urban growth against the background of the socio-economic transformations associated with urbanization (see Map 12). Typical examples would be the filling-in of lakes and ponds inside the urban area and conversion to newly buildable land, the conversion of agricultural land at the fringe of the urban area into new settlement expansion (residential, industrial and other uses), and conversion of farmland with road access in the peri-urban area into dispersed new settlement clusters (so-called 'leapfrog development').



Map 12 Evolution of built-up area in Battambang Municipality

If time-series of geo-referenced data are available, it is possible to quantify land use changes (i.e. agriculture area to settlement area) for the district/municipality as pictured in Figure 10 showing the dynamic of urban growth in Battambang Municipality between 1907 and 2003.

ល.រ/No	ឆ្នាំ/Year	ចន្លោះឆ្នាំ/Year Interval (yrs)	ក្រឡាផ្ទៃ(ហិចតា)/ Area (ha)	ផលធៀបកំណើនផ្ទៃដី(%)/ Area Growth Rate (%)	កំណើនជាមធ្យមប្រចាំឆ្នាំ(%) / Annual Growth Rate (%)
1	1907	-	233	-	-
2	1971	64	1,333	572	2.72
3	1992	21	1,471	11	0.47
4	2006	14	3,936	268	7.03
5	2013	7	4,512	115	1.95

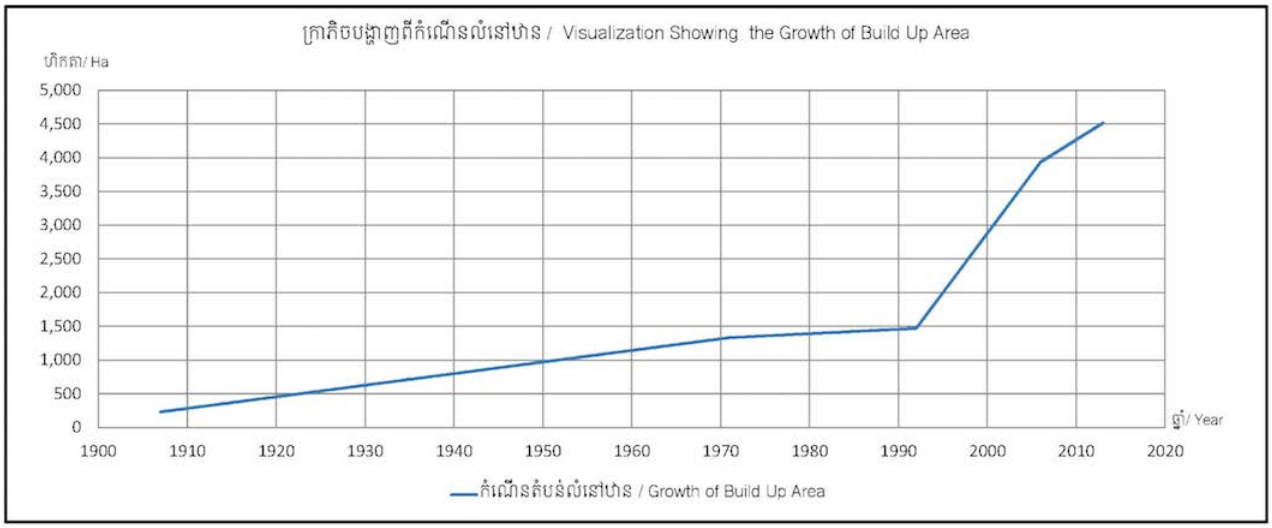


Figure 10 Evolution of built-up area in Battambang Municipality

In addition to the identification of land use change areas, the drivers and consequences (both positive and negative) of these changes need to be analysed. The fundamental causes of land use changes are diverse and shall be analyzed as well as documented by the working group. However, it is usually a combination of several causes, with synergetic interactions, that is likely to drive a region into a specific trajectory.

The land use change analysis initiated here by the LMUP Working Group with the information and knowledge available thus far will be complemented and finalized within Tasks 3.3 and 3.4, after consultations with commune/Sangkat and district/municipal authorities.

3.1.7 Existing land and housing tenure (recommended)

Land tenure arrangements concern the interactions between land use, the various land property rights (in a wide acceptation) and institutions that govern the access, use and control of land use and the actors who detained these rights and those in charge of their enforcement.

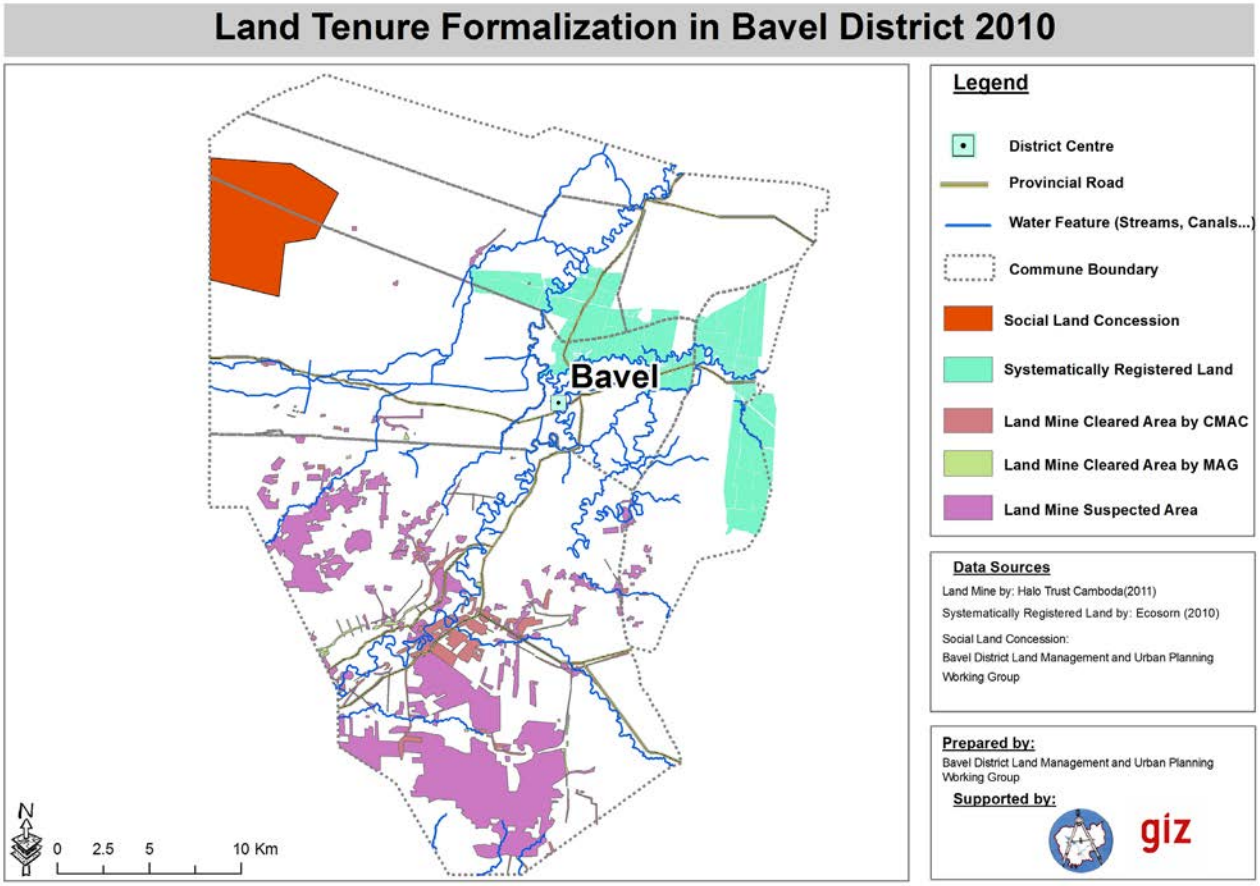
The inventory of formalized land tenure regimes shall be conducted in conjunction with land use analysis and include, for each specific arrangement, the identification of current location, analysis of management strengths and weaknesses as well as the need or potential for further development and the sector policy orientation with on-going and planned projects/programs (see Map 13).

Land tenure regimes or issues shall be examined taking into account legal provisions, actual implementation with possible conflict situations and resolution mechanisms addressed so far. In this exercise, State institutions (i.e. State Land Management Committee, agencies from line ministries. etc.) shall be consulted but it is critical to hear peoples` voices and understand with first-hand information how land users experience land tenure issues. Specific aspects for analysis would be:

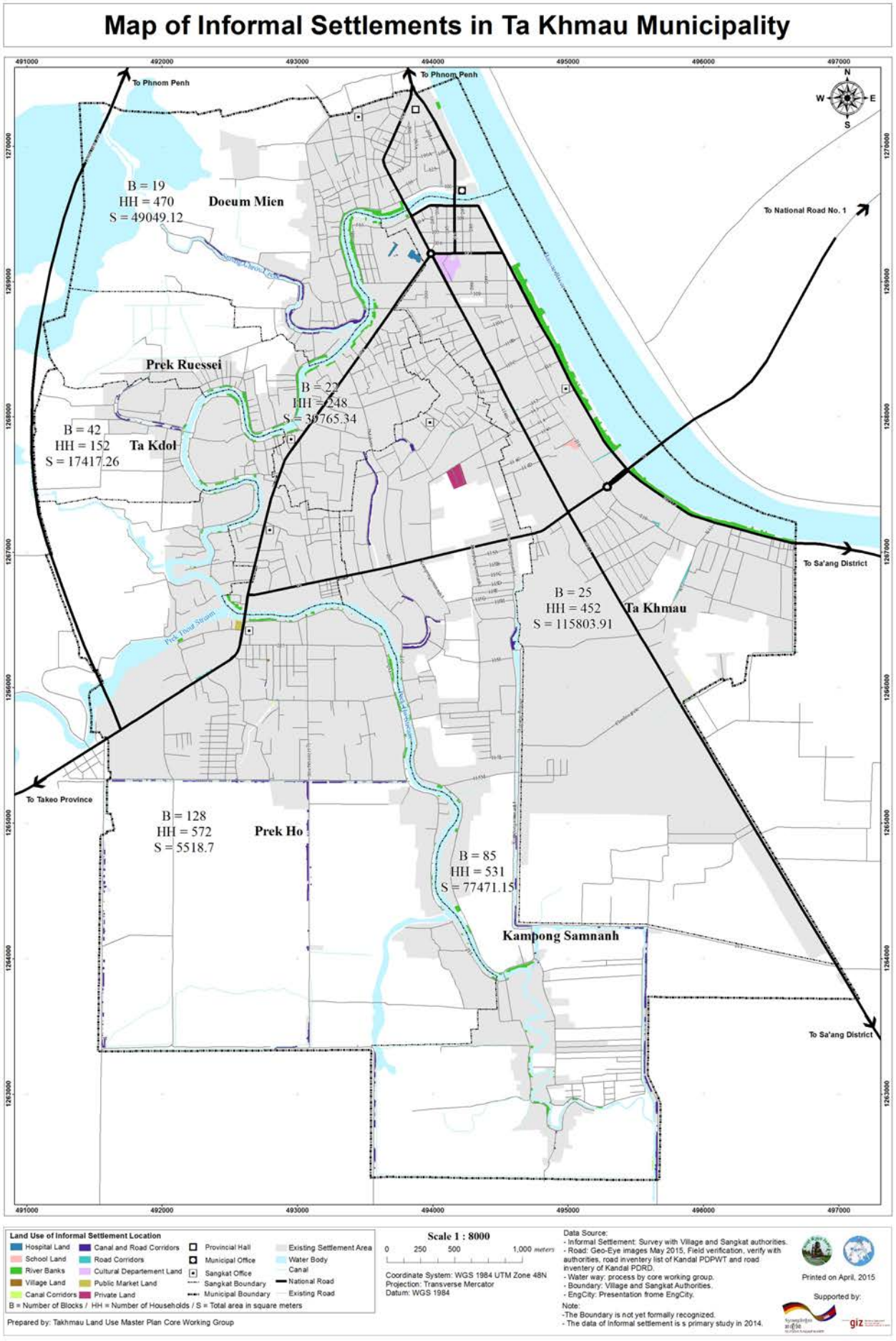
- Identify areas with private titles delivered as well as plans for the expansion of adjudication areas for systematic land registration; also identify areas with sporadic land registration;
- Identify informal settlement areas in rural and urban zones and existing or intended initiatives to formalize land rights under Circular 03 (see Map 14);
- In some statistical datasets, the housing situation (tenure status, number of illegal dwellings, num-ber of homeless etc.) is included under 'Social Aspects' (see commune database, census). For LUMP planning purposes, it is suggested to analyze these indicators under the sector of land, housing and tenure;
- Identify and analyze the areas and management of mining or economic land concessions (strengths and weaknesses). It is also important to review any existing environmental, economic and social impacts of these operations. This review also includes the examination of open and latent conflicts between households and companies as it relates to land claim overlaps/encroachment or other types of conflicts;
- Identify and analyze the areas and status of different types of social land concessions (strengths and weaknesses): households, ex-soldiers or police military;
- Identify and analyze the location and status of upland & wetland protected area under the management of Ministry of Environment. Identify and analyze the zoning of these protected areas: core zone, buffer zone, community zone and sustainable livelihood zone;
- In areas where ethnic minority groups live, identify and analyse the process of communal land titling as well as plans and projects for the expansion of the process;

As for common pool resources and management (forest, fisheries and wetlands):

- Identify and analyze the current location and management of community forestry/fisheries schemes (strengths and weaknesses) + need/potential for further development;
- Identify and analyze the current location and management of protected forest and fisheries conservation area left after removal of fishing lots;
- Identify and analyze the current location and management of forest concessions + need/ potential for further development;
- Identify and analyze other forms of forest management practices if any + need/ potential for further development.



Map 13 Land tenure formalization in Bavel District (Battambang Province)



Map 14 Existing informal settlements in Ta Khmau Municipality (Kandal Province)

3.1.8 Demographic profile

Demographic data such as population size, distribution and dynamic is essential to assess the needs of the population in relation to education and health facilities, physical infrastructures, employment and overall economic development. The Royal Government of Cambodia, together with development partners, put quite an effort to improve the capacity to collect and to analyze reliable demographic data to improve the various socio-economic and environmental development plans in the Kingdom.

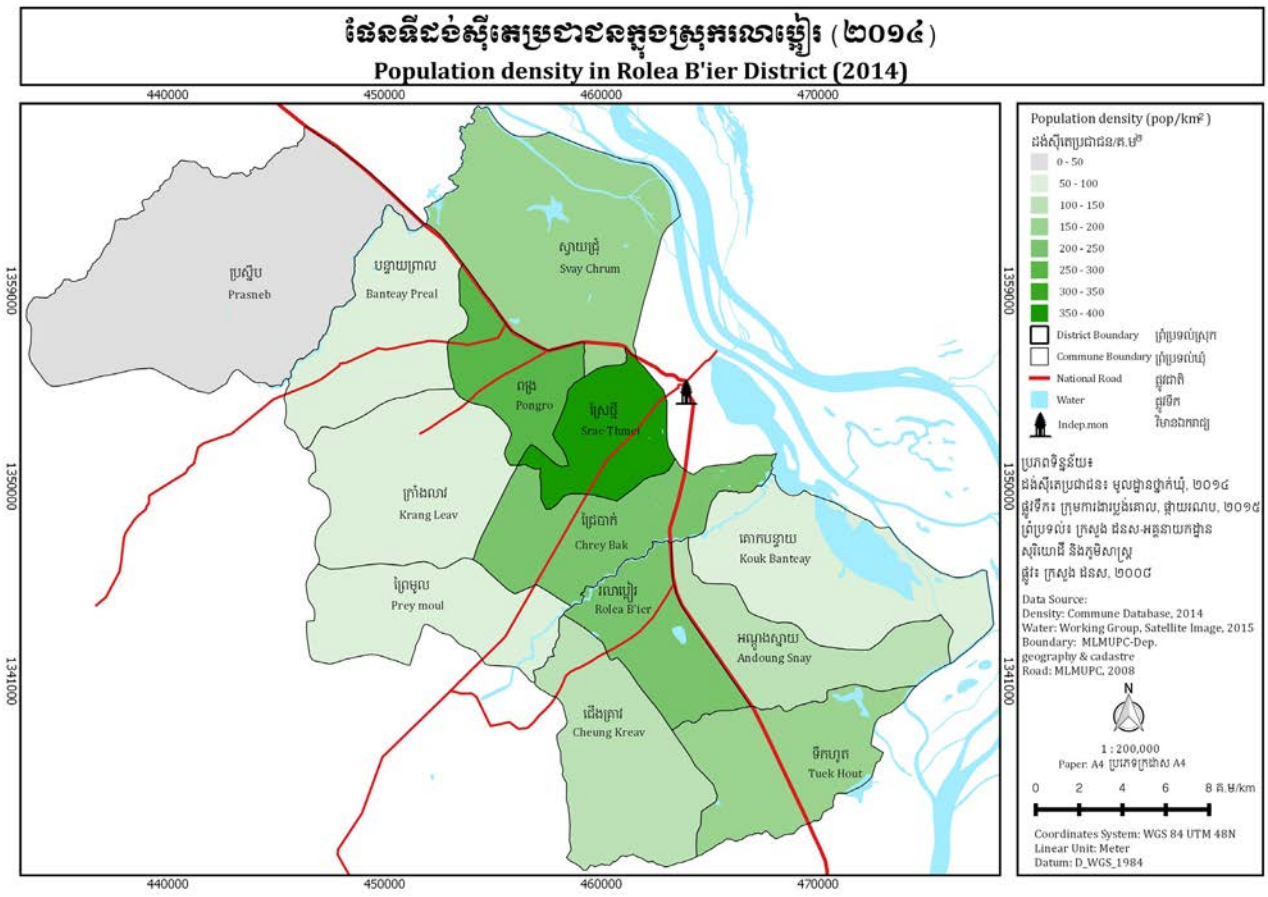
Population density (mandatory)

The population density given by the formula: $$Pop.Density = \frac{Nb\ People\ in\ area}{Area\ Size}$$

Information about population density allows us to identify areas in the district/municipality with relatively high/low demographic pressure on land and on physical/social infrastructures. It allows to interpret and to discuss the impacts created by a high demand for land for different/competing uses (residential, business, recreation, social etc.). It is also used to inform planning decisions on transport, green spaces/public parks, education and health facilities, and public services in general (supply standards).

Population density is calculated according to an area size and data is usually limited to commune/Sangkat level (see Map 15). However, if village boundaries are available, a population density map for the village level can provide a more fine-grained picture of the population distribution in the district/municipality. It can also be useful to compare population densities over time, to identify trends and demographic dynamic among communes/Sangkats (and villages).

In the above formula, if the number of people in an area is exchanged by the number of households (HH), we get another important indicator for urban analysis and planning - the “housing density”. A high housing density in an urban core area would for example be 100 HH per hectare, a low sub-urban density would be 35 HH per hectare. Housing densities should be calculated for settlement areas only, excluding open space areas such as water bodies, forest and agriculture land, as this would distort the results.



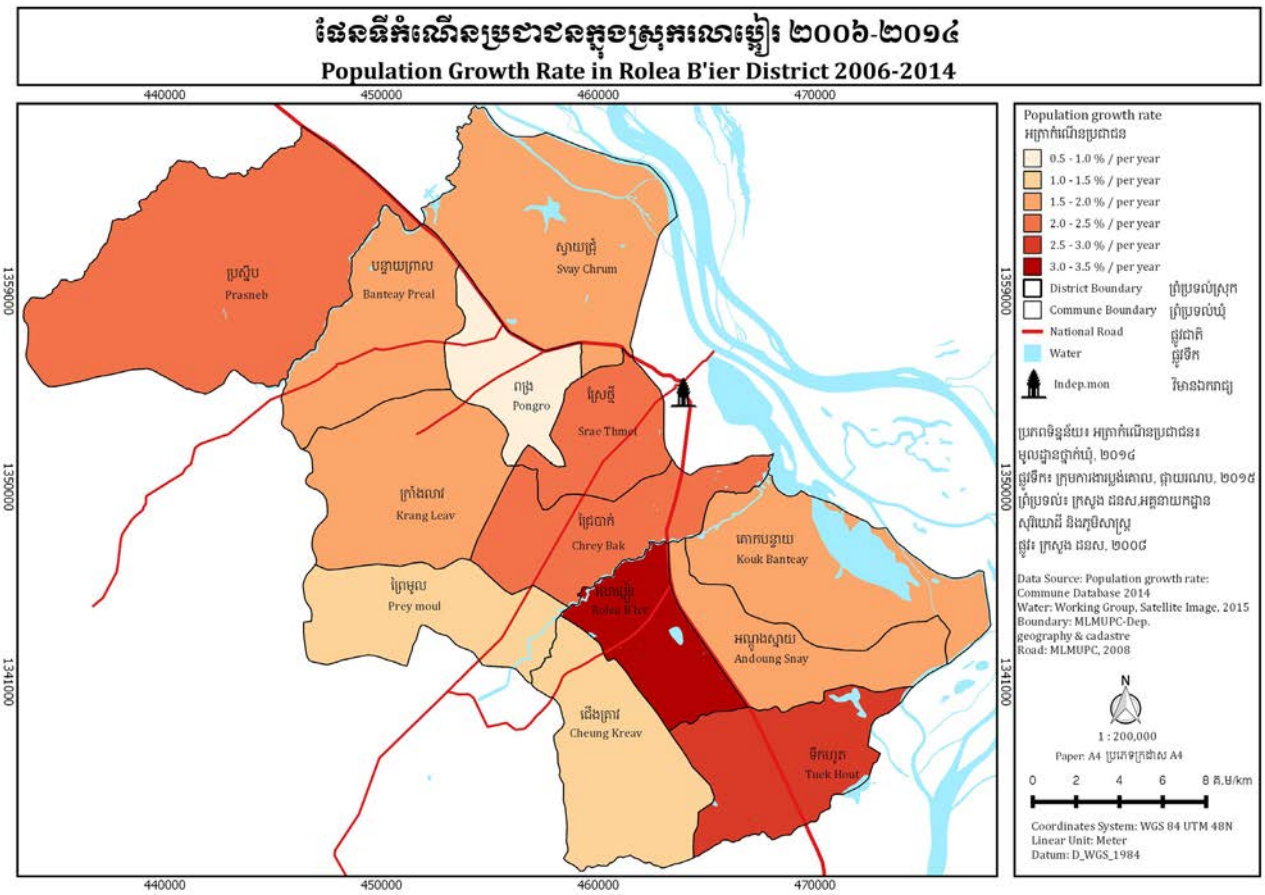
Map 15 Population density by commune in Rolea B'ier District (Kampong Chhnang Province) in 2014

Demographic growth rate (mandatory)

Demographic datasets available allow conducting longitudinal and disaggregated demographic analysis at commune/Sangkat levels, to get a sense of demographic dynamics in the district/ municipality.

The "demographic growth rate" given by: $$r = \frac{Ln\,(P_t) - Ln\,(Po)}{t}$$

Where, 'Po' is the population at the base year, 'Pt' is the population at the year 't' and 't' is the number of years between 'Po' and 'Pt'. The demographic growth rate gives the percentage of increase of the population over a certain period of time. It is useful to compare this demographic growth rate between communes/Sangkats (see Map 16), so as to identify different demographic dynamics within the district/municipality.



Map 16 Population growth rate by commune in Rolea B'ier District (Kampong Chhnang Province) between 2006 and 2014

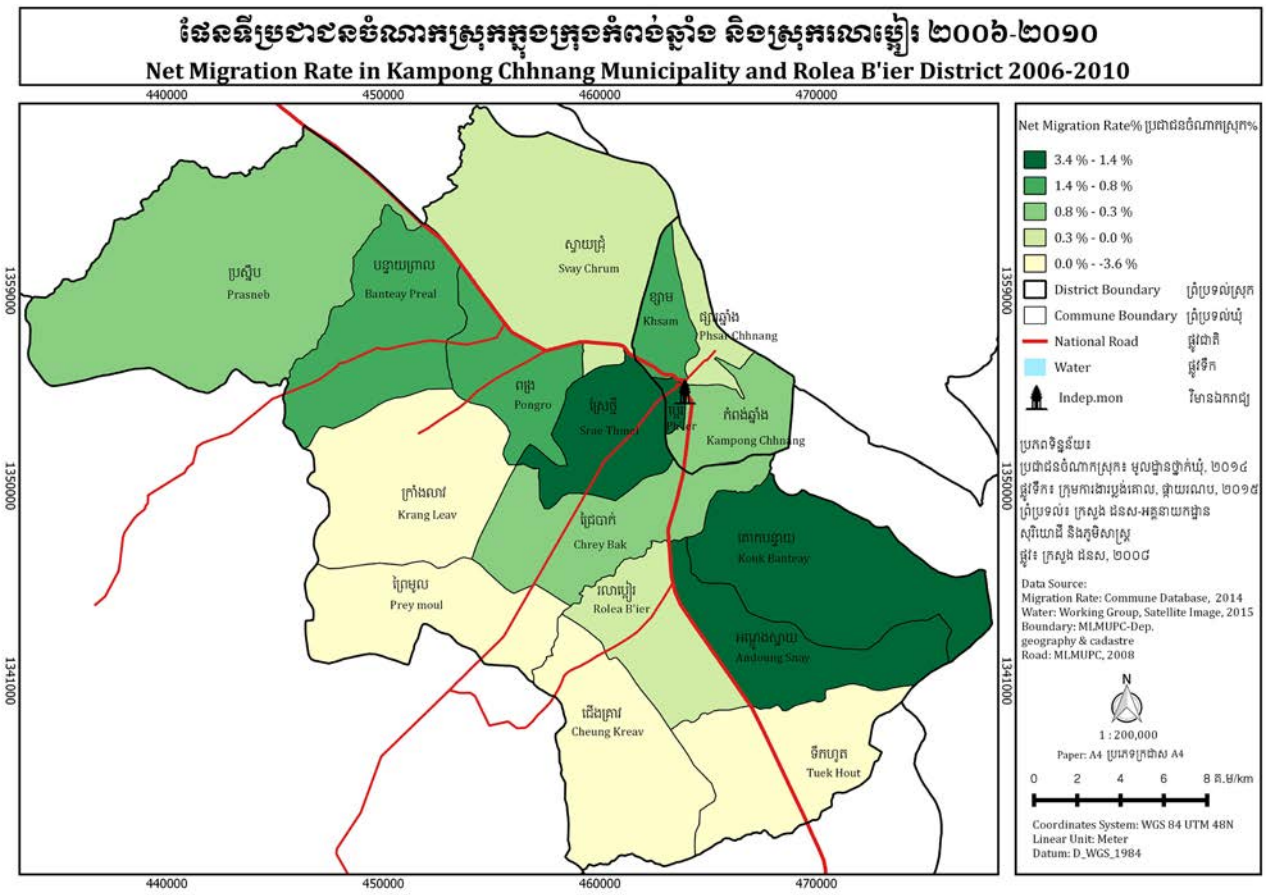
Net migration rate (recommended)

Migration is an important element in the growth of the population and the labour force of a district/municipality. In combination with fertility and mortality, migration determines the size and rate of population growth as well as its structure. In 2008, only 40% of the urban growth in Cambodia could be attributed to natural increase and 60% to net migration (Census 2008). Thus, for population growth analysis, it is useful to differentiate the natural growth (births vs. deaths) and migration balance (in-migration vs. out-migration).

The "commune/Sangkat net migration rate" is given by:

$$Net\ Migration\ Rate = \frac{Nb\ Immigrants - Nb\ Emigrants}{Total\ Population\ in\ district} \text{ x } 1000$$

A positive value of "net migration rate" indicates that more people have entered the com-mune/ Sangkat than people who have left during a specific time period, while a negative value means more people leaving than entering the commune/Sangkat during the same period of time. It provides useful information about the migratory dynamics of population into and from the commune/ Sangkat. It is also a significant indicator of the economic dynamism of the communes/Sangkats (see Map 17).



Map 17 Net migration rate by Sangkat in Kampong Chhnang Municipality and Roloe B'ier District (Kampong Chhnang Province) between 2006 and 2014

The main demographic indicators, such as population density, demographic growth rate and net migration rate should also be displayed in graphs and tables (see Figure 11 and Tables 3 and 4).

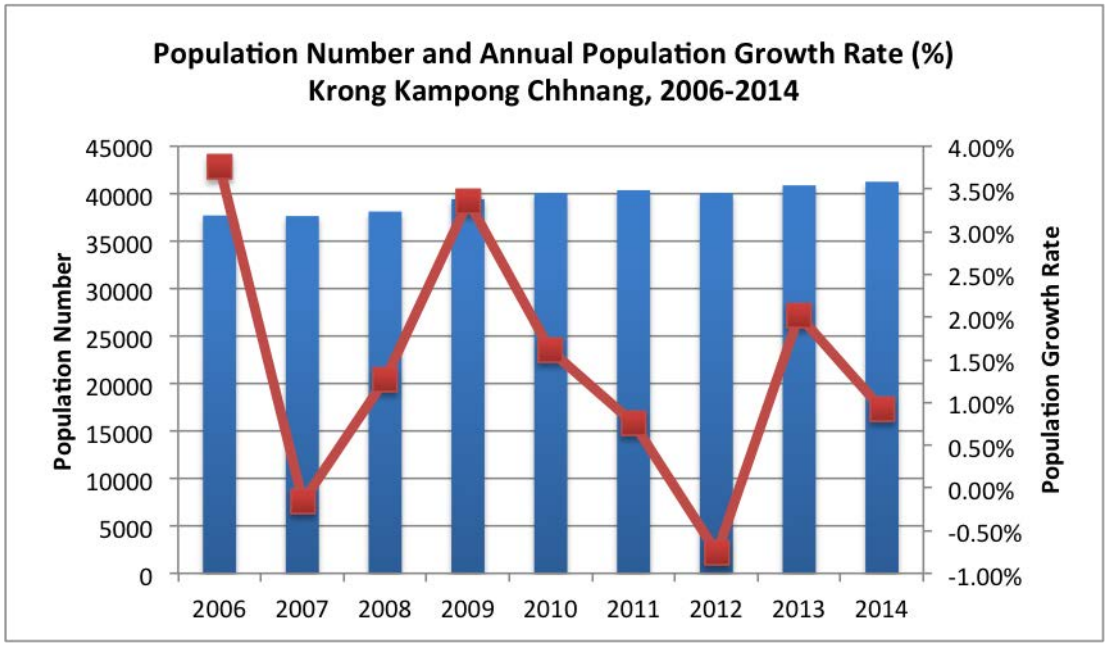


Figure 11 Population number and annual population growth rate in Kampong Chhnang Municipality, 2006-2014

Table 3 Population number, population density, annual population growth rate and net migration rate in Kampong Chhnang Municipality by Sangkat, 2006-2010

Name	Area Size (sqkm)	2006		2007		2008		2009		2010		Annual Population Growth Rate 2006-2010	Migration 2006-2010 by Sangkat		
		Population Number	Population Density	Population Number	Population Density	Population Number	Population Density	Population Number	Population Density	Population Number	Population Density		Number In-Migrants	Number Out-Migrants	Net Migration Rate
Whole Municipality	**46,82**	**37703**	**805**	**37643**	**804**	**38121**	**814**	**39420**	**842**	**40062**	**855,70**	**0,61%**	**1573**	**1384**	**0,47**
Kampong Chhnang	20,42	9885	484	8827	432	8836	433	9827	481	10330	505,91	0,44%	475	246	2,22
Khsam	12,63	5722	453	5943	471	6016	476	6125	485	6240	494,16	0,87%	316	304	0,19
Ph'er	2,39	5248	2200	5877	2464	5980	2507	6008	2519	6110	2561,42	1,52%	222	163	0,97
Psar Chhnang	11,39	16848	1480	16996	1493	17289	1518	17460	1533	17382	1526,57	0,31%	560	671	-0,64

Table 4 Population number, family number, and average household size in Kampong Chhnang Municipality by Sangkat, 2006-2010

Name	2006			2007			2008			2009			2010		
	Total Population Number	Total Family Number	Average Household Size	Total Population Number	Total Family Number	Average Household Size	Total Population Number	Total Family Number	Average Household Size	Total Population Number	Total Family Number	Average Household Size	Total Population Number	Total Family Number	Average Household Size
Whole Municipality	**37703**	**7385**	**5,1**	**37643**	**7326**	**5,1**	**38121**	**7415**	**5,1**	**39420**	**7653**	**5,2**	**40062**	**7847**	**5,1**
Kampong Chhnang	9885	2001	4,9	8827	1916	4,6	8836	1919	4,6	9827	2130	4,6	10330	2171	4,8
Khsam	5722	1274	4,5	5943	1282	4,6	6016	1295	4,6	6125	1293	4,7	6240	1354	4,6
Ph'er	5248	1111	4,7	5877	1135	5,2	5980	1161	5,2	6008	1161	5,2	6110	1213	5,0
Psar Chhnang	16848	2999	5,6	16996	2993	5,7	17289	3040	5,7	17460	3069	5,7	17382	3109	5,6

Age pyramid (recommended)

Compute and interpret the "age pyramid" of the district/municipal population (see Figure 12). The age-group pyramid gives information about the relative importance of age classes amongst the population. The age structure of the population affects the demographic, social, economic and political structures. The age structure of population is determined by three factors that affect the growth rate of the population, namely fertility, mortality and migration. The differences observed in the proportions of children, aged persons and the people of working age are accounted for jointly by the index called "age dependency". It is defined as the ratio of the combined child population (0-14) and aged population (65+) to the number of person in the intermediate age.

The comparison of the district/municipal population age pyramid for different dates is informative to capture demographic change and anticipate the changing needs of the population and the challenge of labor creation for the working population.

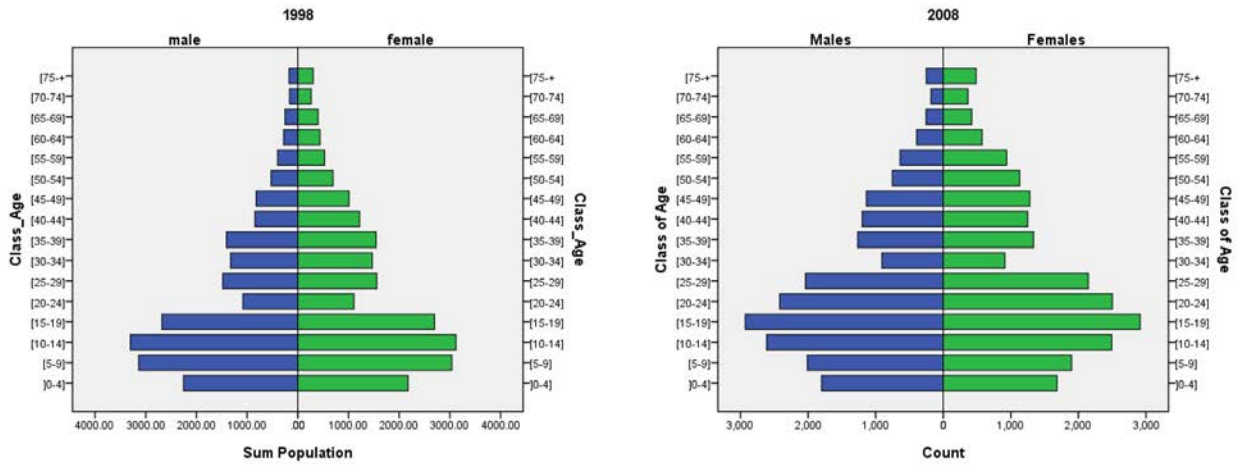


Figure 12 Age pyramid of Kampong Chhnang Municipality population in 1998 (left) and in 2008 (right)

3.1.9 Public administration and social services (mandatory)

Public services typically refer to infrastructures and services that have a function for the general public, whether for administrative, health, education, public order/security etc. (see Table 5).

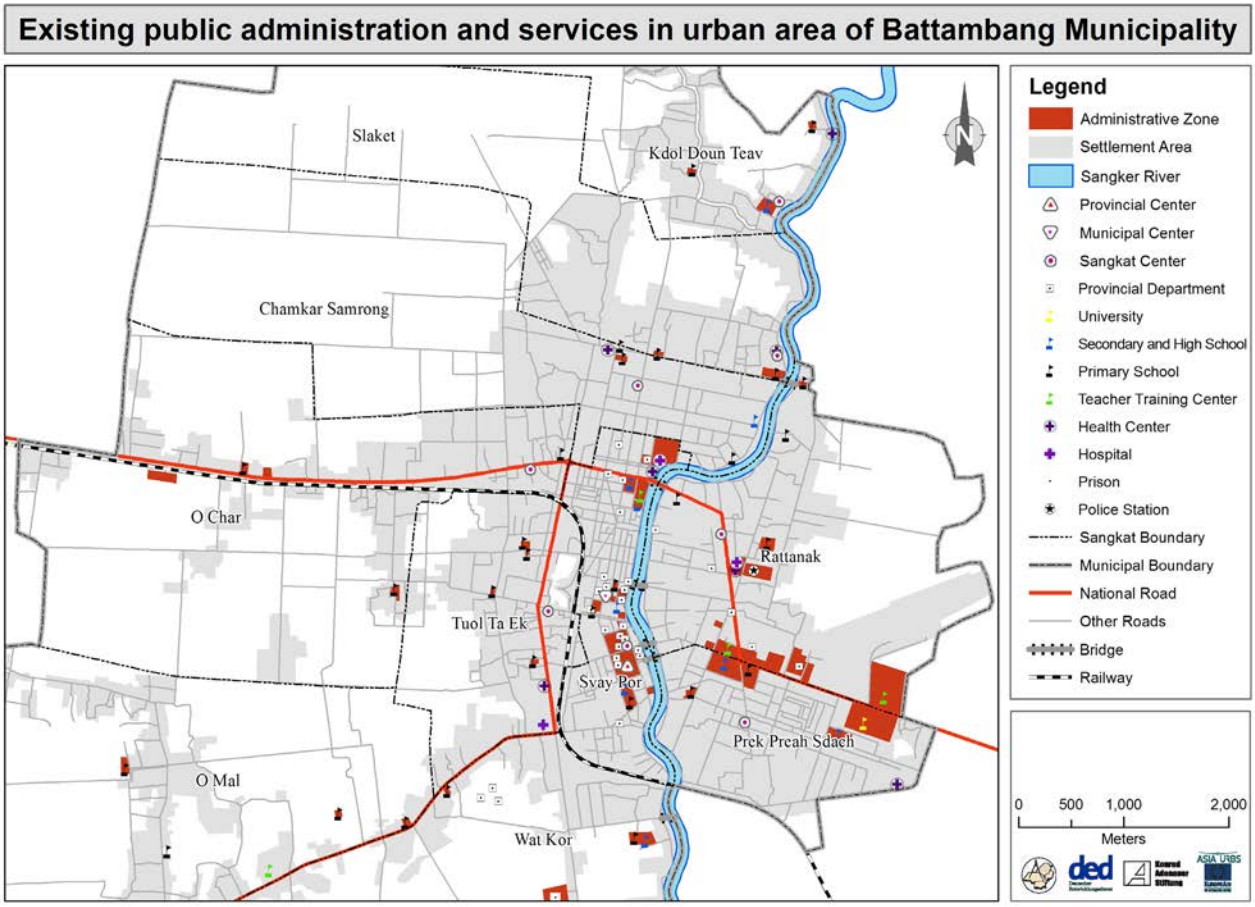
Table 5 List of public services

Sector	Type of service
Administration	Provincial hall District/municipal hall Commune/Sangkat hall Line department or line office Post office Other
Health	Referral hostpital Health center Clinic and private health institutions Other
Social	Senior home Orphanage Home for the disabled Rehabilitation center Other
Education	University Vocational training center High school Higher secondary school (Grades 10-12) Lower secondary school (Grades 7-9) Primary school (Grades 1-6) Kindergarten/Pre-school Other
Public order/ Security	Police office Fire brigade Courthouse Prison (Military facilities should be grouped separately under ‚Military') Other

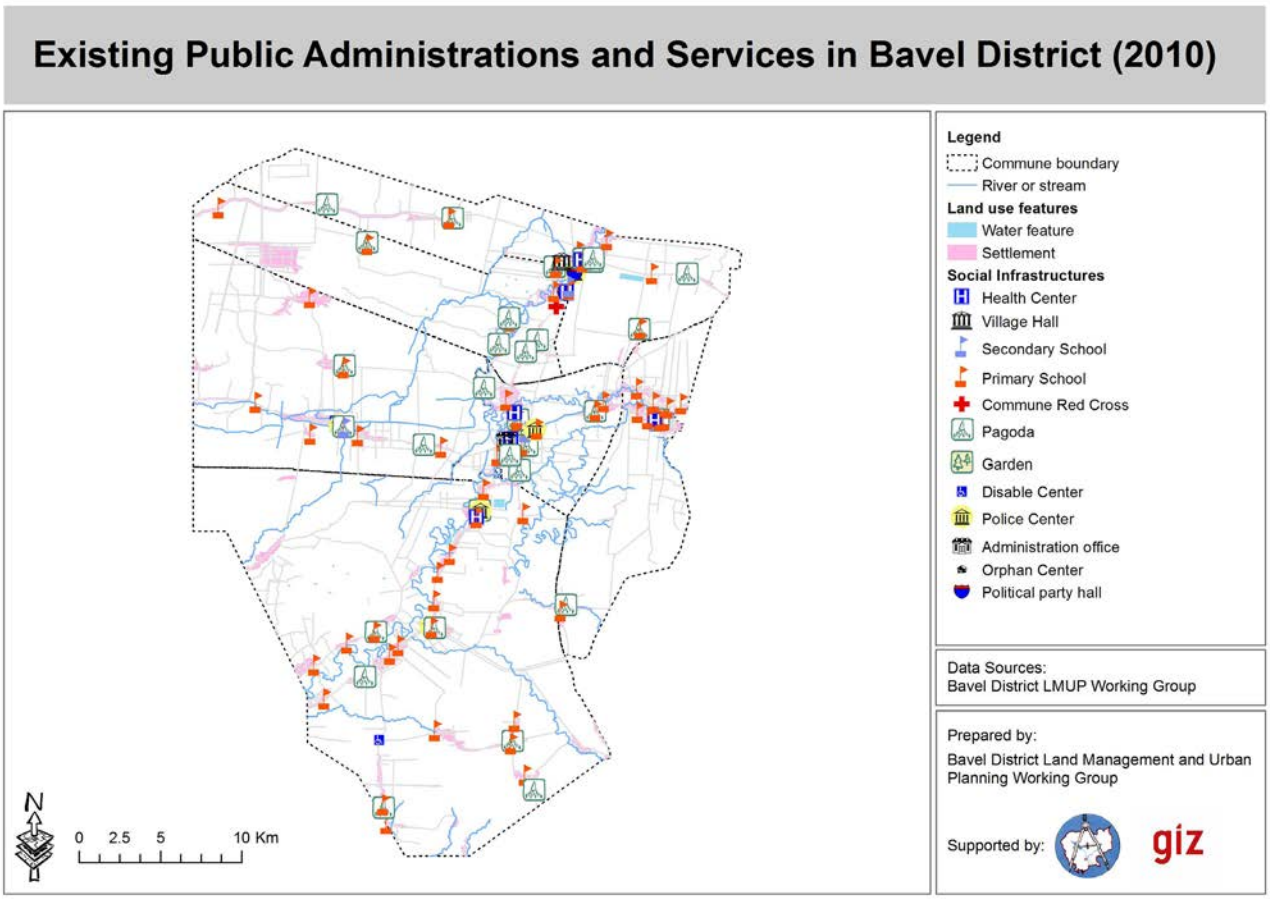
In the context of a district/municipal Land Use Master Plan, the following aspects should be addressed for each type of services:

- Determine accurate locations of the services and facilities compounds (see Maps 18 and 19);
- Provide general characteristics such as number, size, level and type of service/facility;
- For health and education facilities, identify capacity, frequentation and coverage area and identify areas in the district/municipality with low/insufficient accessibility to the particular service;
- Check balance in the provision of the services between rural and urban/peri-urban areas;
- Consider already planned/projected developments (connect with responsible line office/ department) and discuss the needs/potentials for further development of the services/facilities.

For relevant national regulations see Article 43 (standards for supply with schools and kindergartens) of Sub-Decree No 42 on Urbanization of the Capital, Municipalities and Urban Areas (Royal Government of Cambodia 2015).



Map 18 Existing public administration and services urban area of Battambang Municipality



Map 19 Existing public administration and services in Bavel District (Battambang Province)

3.1.10 Cultural and religious facilities (mandatory)

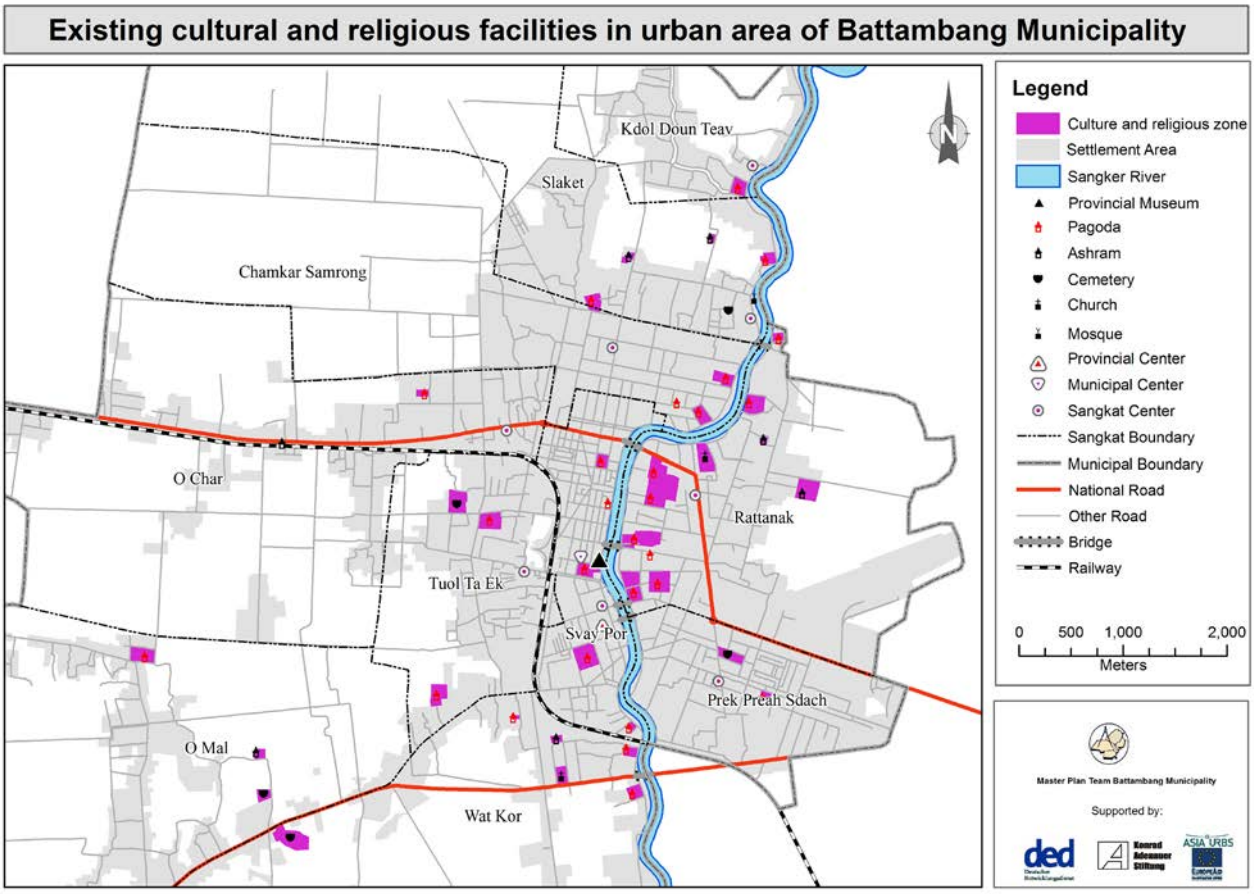
Facilities that serve cultural and/or religious purposes are analyzed separately from other public services. These facilities typically also serve a function for the general public or a particular group of the society (see Table 6).

Table 6 List of cultural and religious facilities

Sector	Type of service
Cultural	Cultural and/or historic sites such as temple grounds (prasat), archaeological excavation sites, cultural villages etc. Museums and cultural exhibition halls Libraries Theatres, concert halls and public stages Cinemas
Religious	Monasteries and ashrams Pagodas Churches Mosques Cemeteries, burial grounds

In the context of a district/municipal Land Use Master Plan, the following aspects should be addressed for these services/facilities:

- Determine and map the accurate locations of the services and facilities (see Map 20);
- Provide general characteristics such as number, size, type of service/facility;
- For historic sites such as temple grounds, archaeological excavation sites, cultural villages etc., identify the cultural heritage value and consider need for protection/conservation;
- Consider already planned/projected developments (connect with responsible line offices/ departments) and discuss the needs and potentials for further development of the services/ facilities.



Map 20 Existing cultural and religious facilities in urban area of Battambang Municipality

3.1.11 Transport infrastructure system (mandatory)

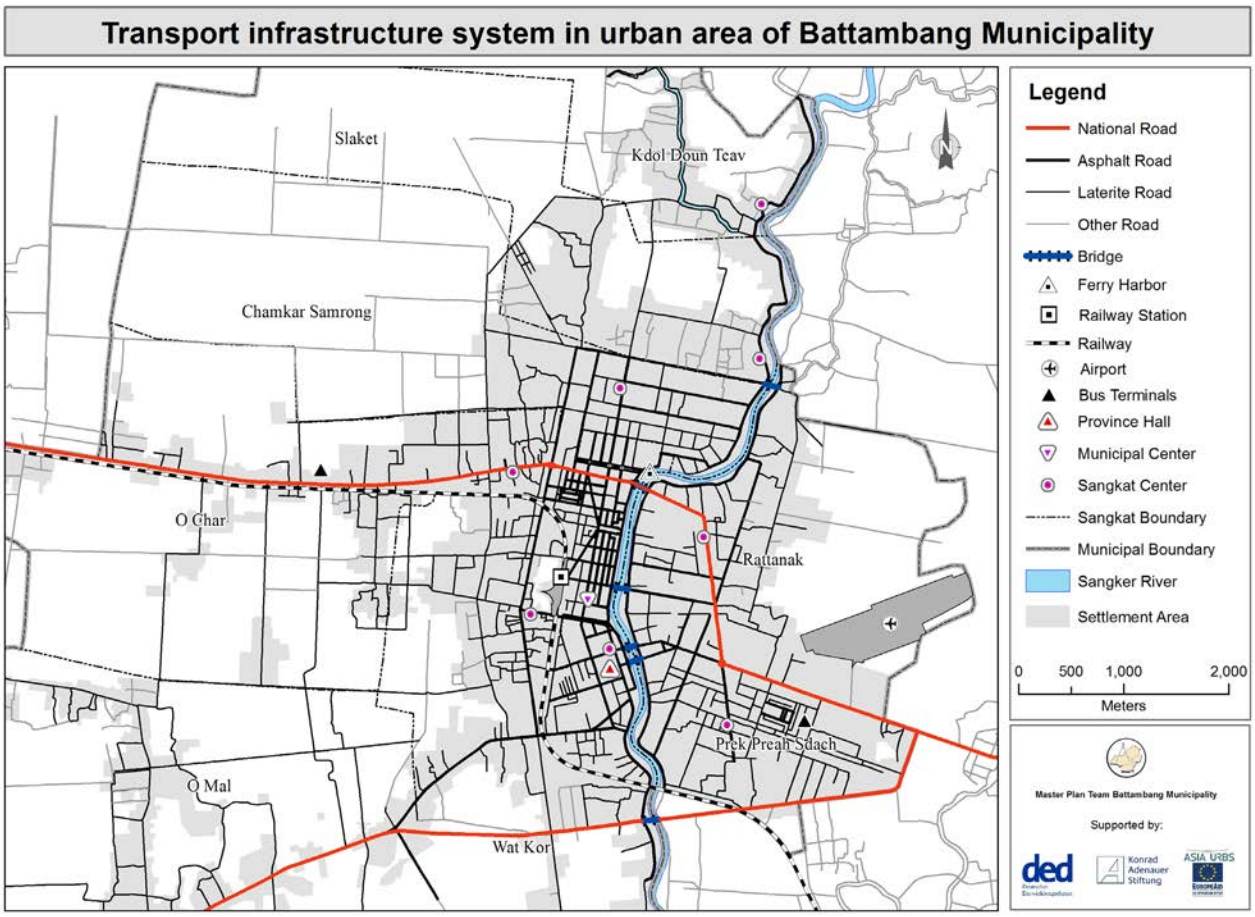
Transport infrastructures such as roads, railways and related facilities, navigable waterways and airports/airfields together constitute the transport system (network) of the district/municipality. Throughout Cambodia, the road network is obviously the most important form of transport, but waterways offer important alternatives in areas with low accessibility by road. Railways also offer important alternatives to road transport. Most of the existing railway lines in Cambodia are now being rehabilitated and new lines are planned. Airfields exist in many cities throughout the country but are usually not operational. Main aspects to be addressed during the analysis of the existing transport system are:

- Identify and map the accurate locations and routes of the transport infrastructure (see Maps 21 and 22);
- In the case of roads:
  - Identify and map the level of the road in the hierarchy (national, provincial, municipal or communal);
  - Check and map road numbers/names (if any);

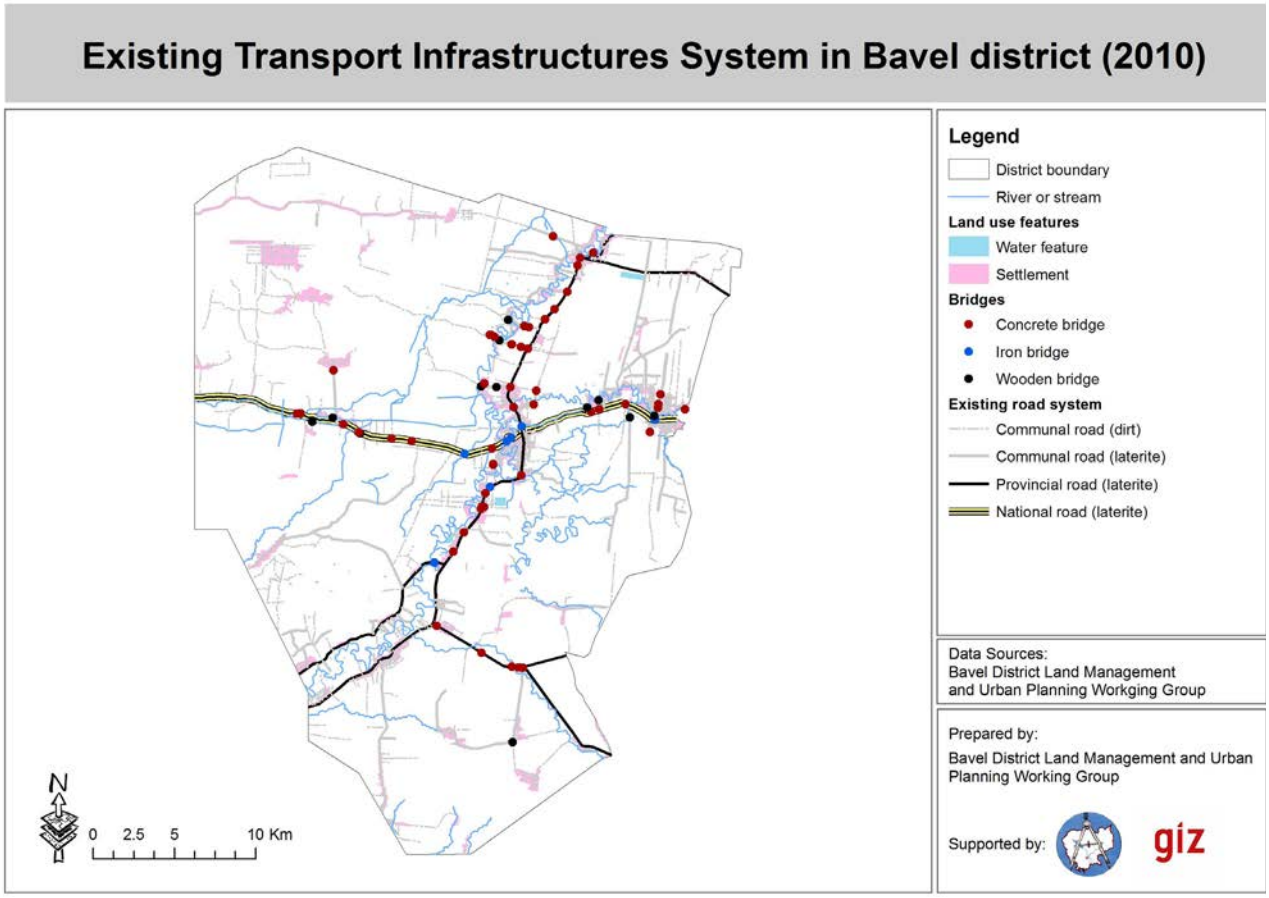
- Determine and map the road surface quality (asphalt, concrete, laterite, gravel, dirt);
- Acquire information about the road system functionality in the rainy season and identify areas in the district/municipality where the road infrastructure is subject to degradation due to flooding;
- Identify any road-based public transport lines such as regional or urban bus lines;
- Identify and discuss traffic problems such as road congestion, impairments caused by heavy vehicle traffic, road safety issues etc.);

- Collect and analyse all available information on transport demand characteristics and trends (number of vehicles, 'modal share' etc.)
- Review the status of current railway rehabilitation works in the district/municipality (if any);
- Identify key navigable waterways and landing areas for people and goods and characterize their functionality in dry and rainy season;
- Examine the connectivity of the urban transport network with the wider regional network as well as the connectivity of transport network between rural and urban/peri-urban areas;
- Identify the important transport 'stations' areas in the district/municipality (e.g. bus terminal, harbor/port, railway station etc.) and analyze the different challenges faced in the management of these transport hubs. Pay particular attention to multi-modal transport platforms, where different types of transport infrastructures intersect (e.g. harbor coupled with bus station etc.);
- Identify the areas in the district/municipality with low accessibility due to low endowment in transport infrastructures (cross-check with location of settlement areas, particularly new settlement areas);
- Discuss the needs/potentials for further development of transport infrastructures and consider the policy orientation on the sector (on-going and planned projects/programs).

There are four main legal documents governing the planning, design and management of road networks in Cambodia: The (i) Law on Roads (Royal Government of Cambodia 2014) determines standards for road classification (Article 7), (ii) Sub-Decree No 42 on Urbanization of the Capital, Municipalities and Urban Areas (Royal Government of Cambodia 2015) determines standards and regulations for (urban) road classification (Article 37), road intervals (Article 38), parking spaces for vehicles (Article 34) and land size standards for road networks (Article 41), (iii) Directive/ Instruction No 15 on the Use of the Roadway (MPWT 2004) determines road corridor widths per road type, and (iv) Sub-Decree No 197 on National Roads and Railroads Corridors Management in Cambodia (Royal Government of Cambodia 2009) sets standards on road corridor widths for National Roads.



Map 21 Existing transport infrastructure system in urban area of Battambang Municipality



Map 22 Existing transport infrastructure systems in Bavel District (Battambang Province)

3.1.12 Public spaces and green/blue system (mandatory)

The public and green spaces refer to areas mainly for relaxation, recreation and holding public ceremonies such as parks, gardens, playgrounds, children's play areas, and any other open spaces constructed and maintained to serve the public. These public green/open spaces form part of a wider ‚green/blue system' (see Table 7) that has a broad variety of important functions for the built-up environment and general living conditions of the citizens:

- They are important for health and recovery and serve especially under crowded/dense living conditions as a compensation space (use for leisure time, stress relief, recreation and rehabilitation);
- They serve as meeting point and communication space for the urban society and act as the 'stage' for various social and cultural activities;
- They enhance the beauty and appearance of the district/municipality and add to a unique cityscape and 'sense of place';
- They can have a cultural and religious dimension, as they are an important manifestation of the cultural heritage and historic development of the district/municipality;
- They have a strong beneficial impact on the urban ecology/ecosystem and its biodiversity (variety of cultivated and planted species and habitats);
- Urban vegetation improves the urban climate and air quality and reduces the 'urban heat island effect', by fixing dust and micro-particles, providing shade and cooling through evaporation;
- Peri-urban green/open spaces often serve food production (agricultural, vegetable/fruit, livestock, aquaculture within close proximity of the district/municipality;
- Rivers, canals and lakes form a natural rainwater drainage network, that often also serves as the sewage system;
- By providing necessary space for floodwater (storage or rainwater-runoff), river plains and sea-sonal wetlands protect against natural hazards (flooding).

Table 7 List of typical elements of green/blue system in urban, peri-urban and rural areas

	Type of green space or green/blue element
Urban areas	Public gardens and parks, including children's playgrounds and other activity areas Green/open sports areas and recreational areas Tree-lined streets, avenues, boulevards and public squares Rivers, lakes, canals and other water bodies and their embank-ments and quays Cultural/religious compounds with green character (pagodas, temples, cemeteries etc.) Other public areas with green character (e.g. pulic administration compounds etc.) Fallow land, idle urban spaces
Peri-urban and rural areas	Large-scale sports and recreation areas Tree-lined streets, avenues and dykes Rivers, lakes, canals and wetlands (regularly flooded areas) Private garden areas, orchards and plant nurseries (particularly traditional Khmer village character) Natural cultural landscape close to the city with rice fields, sugar palms, forest etc. Natural relief with mountains, hills, slopes etc.

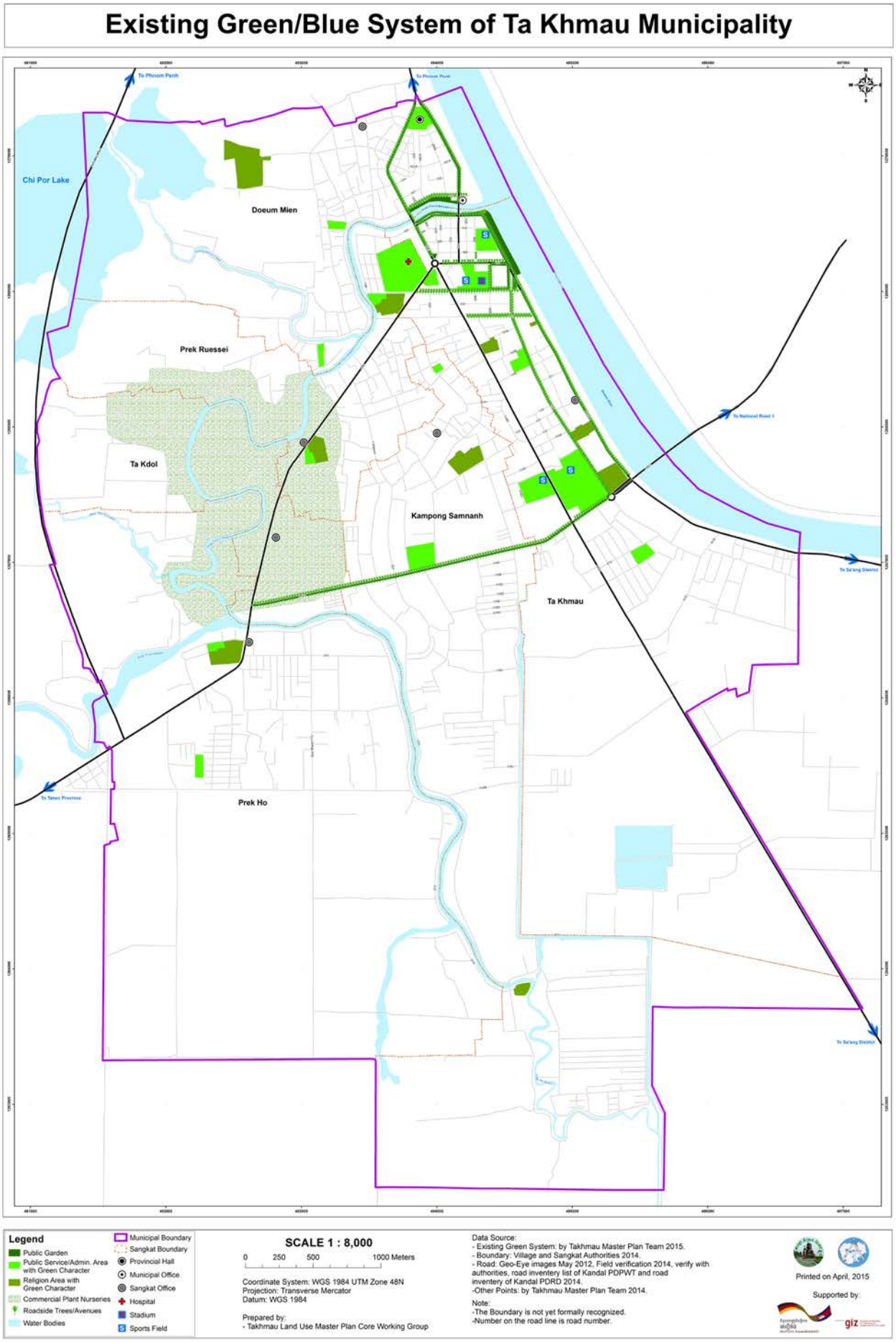
The main aspects to be addressed during the analysis of the existing public green spaces and green/blue system are:

- Identify and map the accurate location and size of main public green/open areas and ele-

ments as well as water bodies as part of the urban/peri-urban green/blue system and categorize their main types/functions (see Map 23);

- Evaluate the connectivity of these areas to form a green/blue network within the urban/peri-urban area and connecting to the surrounding rural area and landscape structure;
- Assess water retention capacities and flood patterns and determine ponds/marsh that have an ecological significance;
- Identify potentials and strengths such as green belts and connections, water bodies, important natural landscapes and elements with recreational, ecological or cultural value etc.;
- Determine the accessibility of public green spaces from residential areas;
- Identify problems or quantitative/qualitative deficits, such as missing green public gardens or green connections, lack of roadside trees, blocked access to green/blue elements/areas, improper maintenance and quality of public gardens, filling or pollution of water bodies etc.;
- Consider already planned/projected developments (connect with responsible line offices/ departments) and discuss the needs/potentials for further development of the green/blue system and its various elements/facilities.

For relevant national standards and regulations regarding public spaces and green areas see Articles 45 to 47 of Sub-Decree No 42 on Urbanization of the Capital, Municipalities and Urban Areas (Royal Government of Cambodia 2015).



Map 23 Existing green/blue system in Ta Khmau Municipality (Kandal Province)

3.1.13 Technical infrastructure systems (mandatory)

Technical infrastructure systems form an essential part of integrated spatial planning processes. They have a huge impact on the environment, on health, safety and the general living conditions of the district/ municipal citizens. Data regarding living conditions (i.e. access of sanitary facilities, safe water supply, sewage situation etc.) is listed in some datasets under 'Social Aspects' (see Commune Database, National Population Census). For LUMP planning purposes, it is suggested to analyze these indicators under the sector of technical Infrastructure systems. Technical infrastructure analysis for LUMP/LUP should focus on the following subsectors/themes and main issues (see Table 8):

Table 8 Subsectors/themes and main issues for analysis of technical infrastructure system

Subsectors/Themes	Main issues
Water supply	To balance water supply, ensure clean water supply for domestic use and other urban purposes
Rainwater drainage (and flood prevention)	To ensure urban rainwater drainage, and prevention of flooding
Sewerage	To ensure waste water collection and treatment by maintaining the urban environment
Solid waste management	To ensure proper collection and treatment/deposit of solid waste
Energy supply	To ensure urban power supply for domestic use and economic sectors/ businesses

To provide grounds for future unified (integrated) infrastructure facility planning by responsible sector agencies and utilities (in terms of supply source, distribution, collection and treatment network development), the analysis of technical infrastructure systems should address the following aspects:

- Location of existing network and facilities;
- Existing coverage and supply capacity;
- Existing consumption and demand patterns;
- Policy orientation on sector (on-going and planned projects/programs);
- Identification of current development issues with the technical infrastructure system (problems and deficits), such as existing gaps between supply capacity and service demands, technical issues, management issues, operation and maintenance, etc.

The LMUP Working Group shall source all necessary data from responsible line departments/ offices and utility companies. It is recommended to conduct supplementary surveys to collect required data, such as on facilities, management agencies related to sewerage and wastewater treatment and impacts of wastewater on the environment. Household interviews might be necessary to obtain assessments on facilities, management and demand for sewerage and wastewater treatment. Key stakeholder consultations will complement the analysis with relevant local knowledge and sector expertise (see Tasks 3.3 and 3.4).

A comprehensive set of maps should display the existing physical infrastructure for water supply, sewage/drainage, solid waste management such as sewer lines, drainage canals, reservoirs, dykes, water treatment and wastewater treatment plants, pumping stations, waste disposal sites, etc. as well as their coverage areas (see Maps 24-27).

Water supply system (mandatory)

The water supply system comprises sources, key facilities (collecting works, main pumping stations, water treatment plants etc.), pipe network and facilities attached to the distribution network

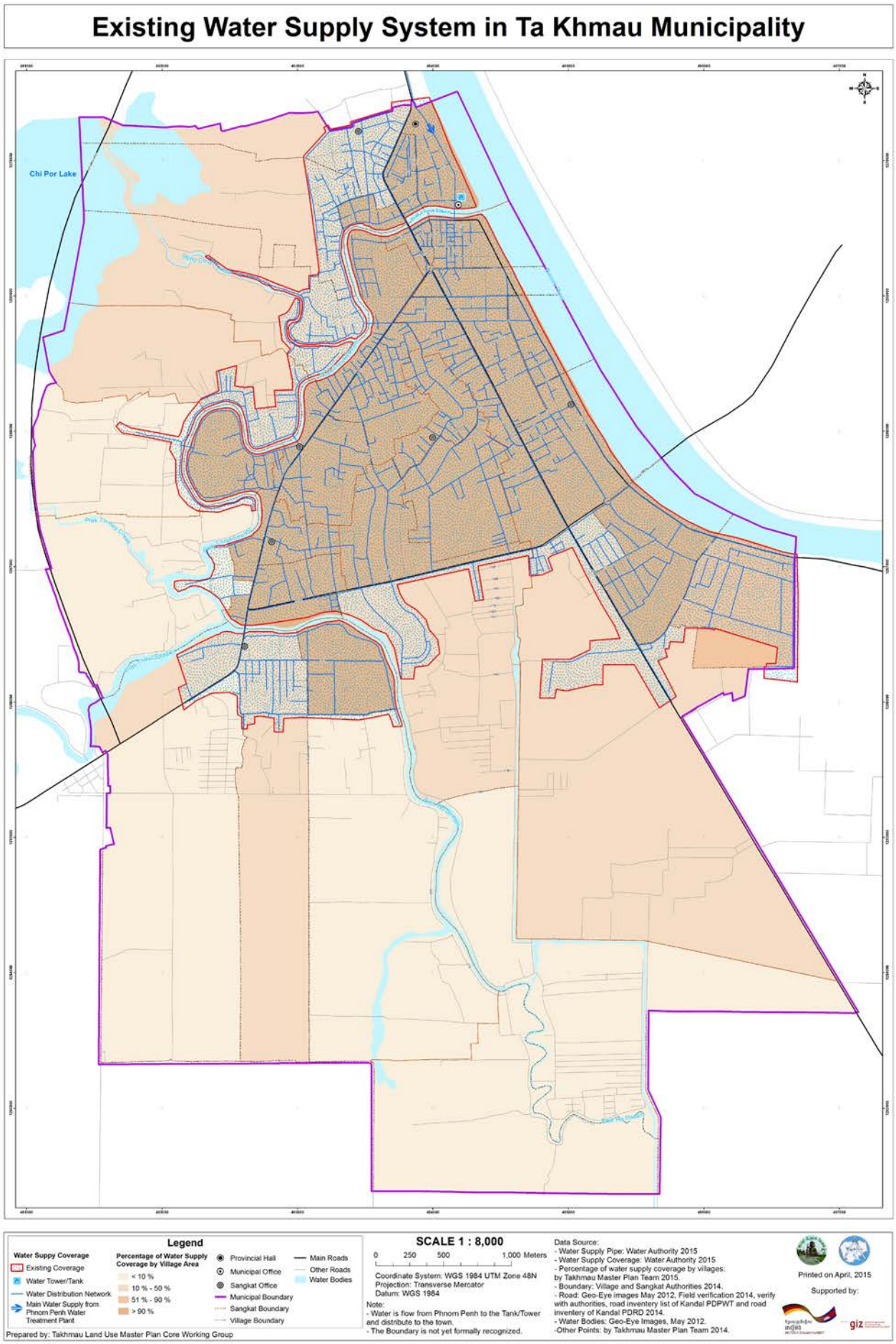
(pumping stations, water towers, reservoirs etc.) necessary to provide clean water for domestic/living purposes and other purposes in the district/municipality.

Main aspects to be addressed during the analysis of the existing water supply system are:

- Identify the accurate location and type/specification of infrastructures for water supply (intake facility, water storage, treatment plant, distribution network) (see Map 24);
- Evaluate the capacity and service coverage of these infrastructures (see Tale 9);
- Assess existing conditions and identify issues, such as insecure water sources and requirements for protection, water quality, water loss, underserviced areas etc.;
- Assess current management systems for infrastructure operation and maintenance (responsible institutions/agencies, service providers, tariffs and fees etc.);
- Examine the connectivity and balance of water supply networks between rural and urban/peri-urban areas;
- Discuss the needs/potentials for further development of the water supply infrastructure system and the policy orientation on (sub-)sector including ongoing and planned projects/programs.

Table 9 Main indicators for analysis of current water supply system

Indicator	Unit	Description
Service coverage	%	Rate of households/users with access to piped domestic water
	ha	Area serviced by water supply network
Average consumption	Lit/day/capita	Average consumption volume of domestic water
Capacity	m3/day	Total volume of supplied clean water
Water loss rate	%	Loss rate of unaccounted for water in total supplied water



Map 24 Existing water supply system in Ta Khmau Municipality (Kandal Province)

Wastewater and drainage systems (mandatory)

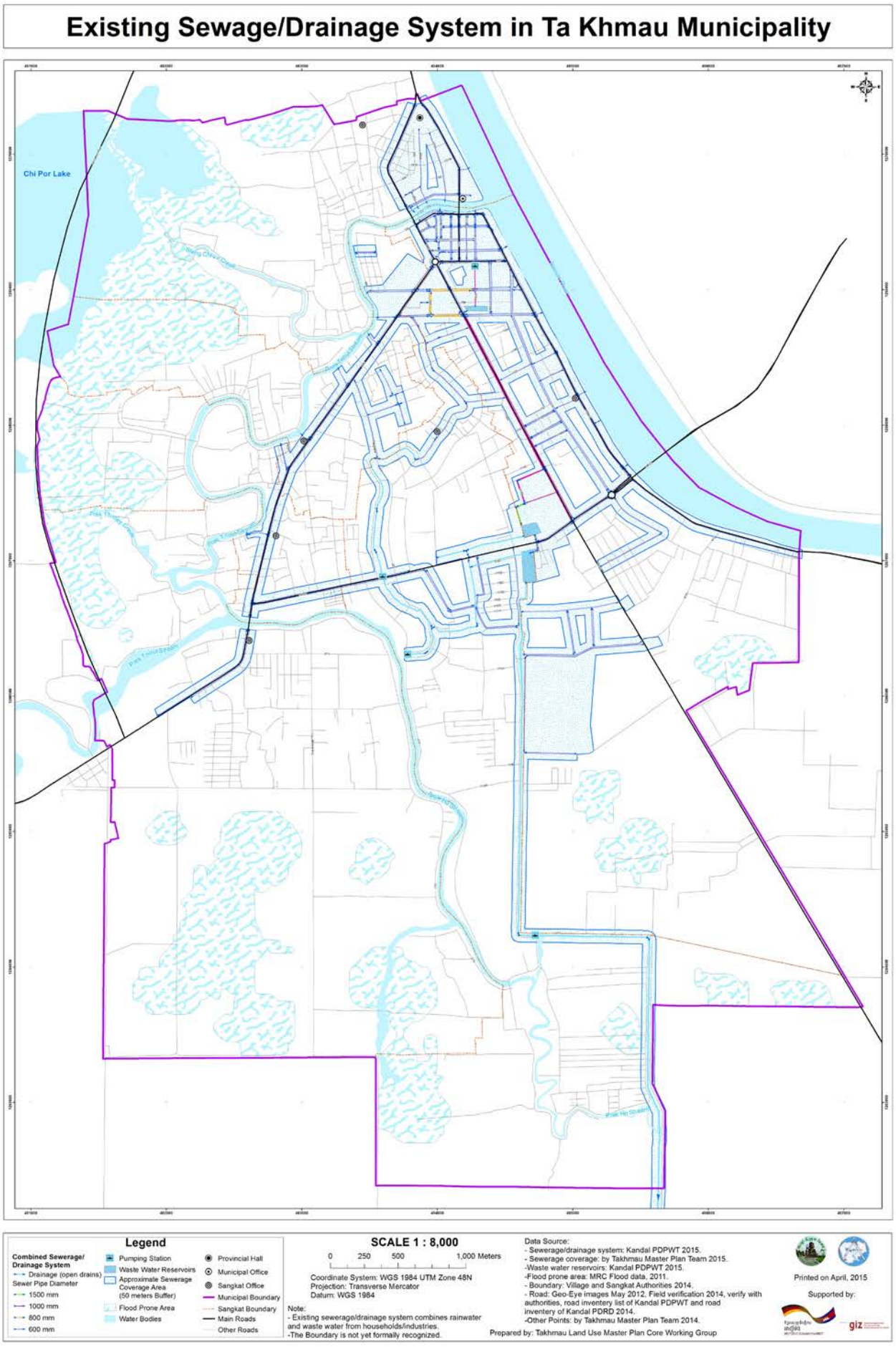
Wastewater consists of all domestic sewage (from sinks, baths and toilets), sewage water from businesses, and industrial sewage. The collection of sewage and rainwater runoff depends on the sewerage design (separate systems for rainwater drainage/sanitary sewers or combined system used for both drainage and sewerage). All sewage finally ends up back in the environment (receiving sewage fields and water bodies, groundwater) after undergoing (or most often not) treatment in a wastewater treatment plant to mitigate its effect on the environment. Rainwater drainage and flood prevention infrastructure comprises the urban drainage facilities (open sewers, piped drainage, rainwater reservoirs and basins, pumping stations etc.) and technical measures (retention/storage, dykes, sluices etc.) to prevent, protect and minimize risks coming from storms, floods, landslides etc.

Main aspects to be addressed during the analysis of the existing wastewater and drainage system are:

- Identify accurate location and type/specifications of sewage and drainage infrastructure and facilities (see Map 25);
- Evaluate the capacity and service coverage of these infrastructures (see Table 10);
- Assess existing conditions and identify issues, such as blockages (by solid waste, landfill, construction sites etc.), missing connections between segments or dead-ends without reservoirs, and impacts of (untreated) wastewater on the environment/vulnerable areas etc.;
- Assess current management systems for infrastructure operation and maintenance (responsible institutions/agencies, service providers, tariffs and fees etc.);
- Review and evaluate data on flood incidence (location, coverage, frequency, strength and damage) and current prevention measures, and map flood-prone (vulnerable) areas and existing flood control/prevention infrastructures (dams and dykes, reservoirs/retention spaces, rainwater storage basins etc.);
- Examine the connectivity and balance of wastewater and drainage systems between rural and urban/peri-urban areas;
- Discuss the needs/potentials for further development of sewerage and drainage infrastructures and the policy orientation on (sub-)sector including on-going and planned projects/programs.

Table 10 Main indicators for analysis of current wastewater and drainage system

	Indicator	Unit	Description
Drainage and flood prevention	Coverage	ha	Area covered by rainwater drainage
	Density	m/ha	Rate of drainage canals/ditches per area unit
	Scope	m/m of road	Rate of canals/ditches along the road system
	Affected area	ha	Area size affected by flooding
	Flooding incidence	Time	Frequency of flooding by duration and magnitude
Sewerage and wastewater treatment	Volume	Lit/day/capita	Average per-capita wastewater volume per day
	Service coverage	%	Rate and number of HH/users con-nected to sewage system
		ha	Area covered by sewerage and wastewater treatment services
	Capacity	m3/day	Capacity of wastewater treatment
	Average treatment rate	Lit/day/capita	Average volume of sewerage treated



Map 25 Existing sewerage and drainage system in Ta Khmau Municipality (Kandal Province)

Waste management (mandatory)

Waste management comprises all those infrastructure facilities and activities required to manage waste from its inception to its final disposal. This includes among other things, collection, transport, treatment and disposal of waste together with monitoring and regulations. It also encompasses the legal and regulatory framework that relates to waste management such as guidance on recycling etc. The term usually relates to all kinds of waste, whether generated through production (industrial waste), consumption (domestic/household and commercial waste), agricultural, and special (health care, hazardous waste, sewage sludge etc.) activities. Waste management is intended to reduce ad-verse effects of waste on health and the environment.

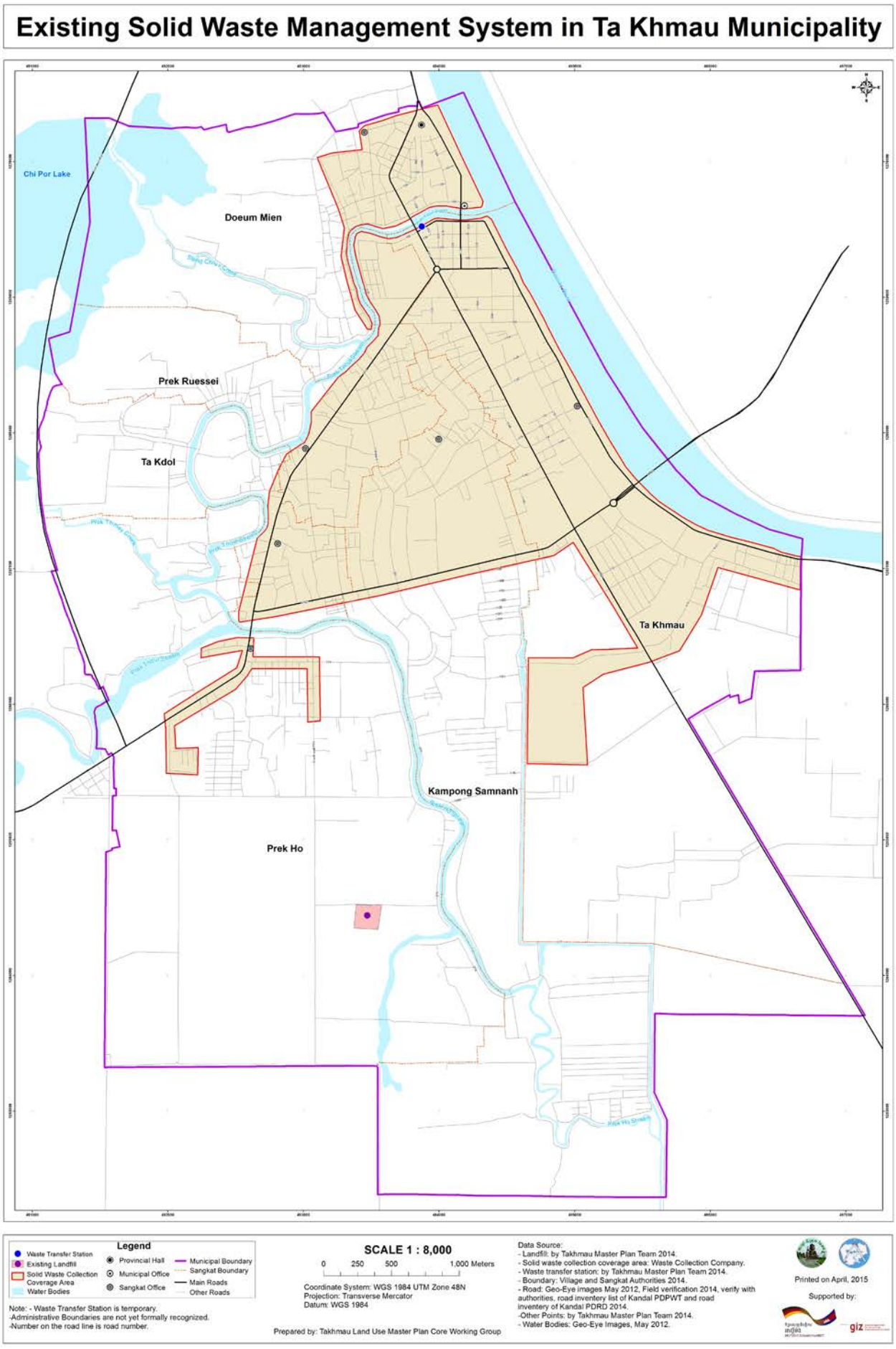
Main aspects to be addressed during the analysis of the existing waste management system are:

- Identify accurate location and type/specifications of waste management infrastructure and facilities (see Map 26);
- Evaluate the capacity of the coverage of the collection services (area, collection volume, frequency), the solid waste treatment (composting, recycling, combustion etc.) and disposal facilities (sanitary landfills, waste disposal sites etc.) (see Table 11);
- Assess existing conditions and identify problems, such as safety issues and environmental pollution through wild dumpsites and waste burning (awareness, behavior), insufficient technical standards/capacity of landfill sites, underserviced areas, etc.
- Assess current management systems for infrastructure operation and maintenance (responsible institutions/agencies, service providers, tariffs and fees etc.);
- Discuss the needs/potentials for further development of waste management infrastructures and the policy orientation on (sub-)sector including on-going and planned projects/ programs.

For relevant standards and regulations at national level see Sub-Decree No 36 on Solid Waste Management (Royal Government of Cambodia 1999) and Sub-Decree on Solid Waste Management in Urban Areas (Royal Government of Cambodia 2015).

Table 11 Main indicators for analysis of current waste management system

Indicator	Unit	Description
Service coverage	ha	Area covered by waste collection
	%	Rate of collection volume towards disposal
Capacity	tons/day	Location and capacity of solid waste deposit/treatment
Average consumption	kg/day/capita	Average generated volume of solid waste for collection and treatment



Map 26 Existing solid waste management system in Ta Khmau Municipality (Kandal Province)

Energy supply system (recommended)

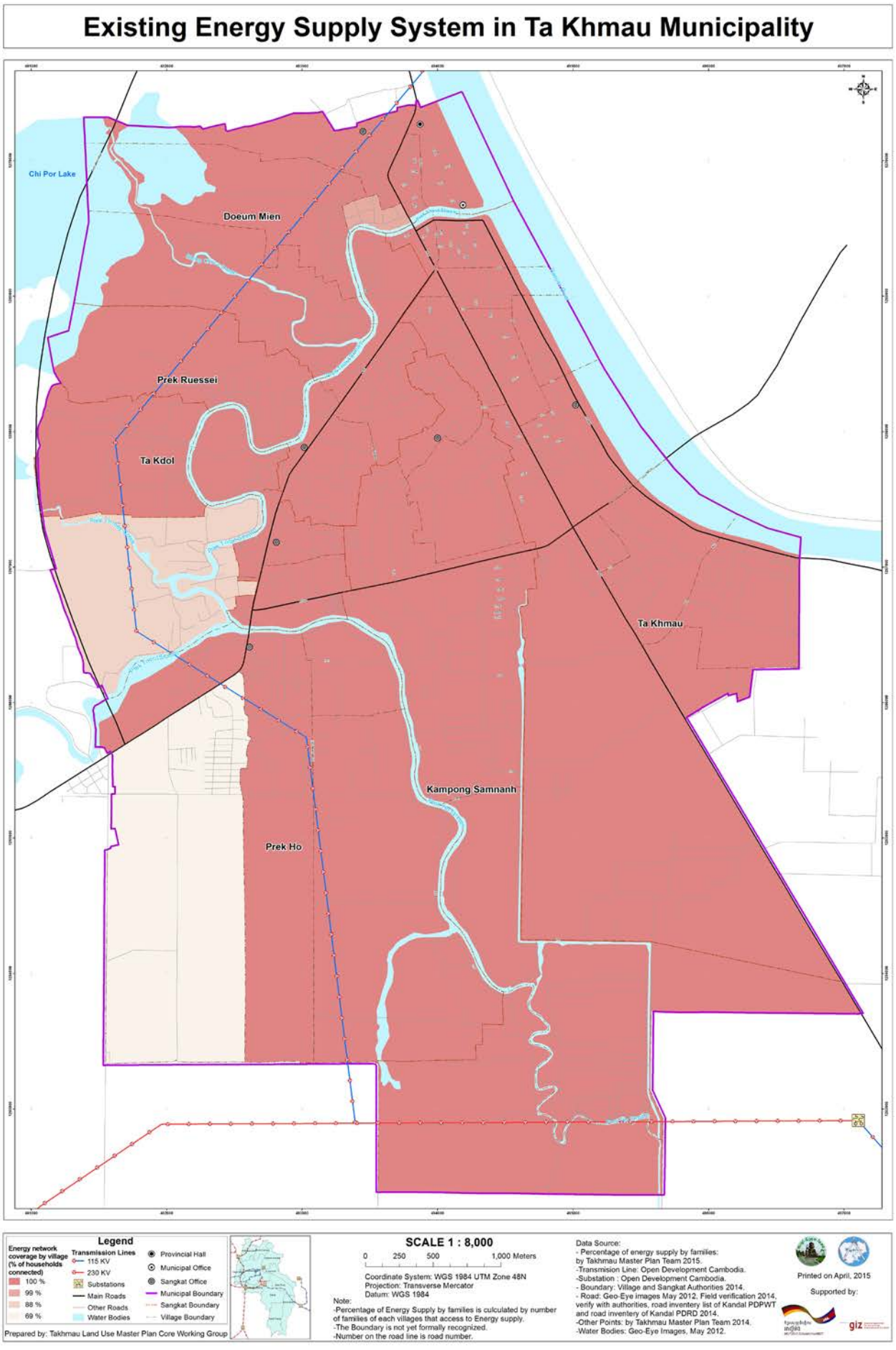
The provision of energy is a key factor in the development of Cambodia, especially for the improvement of living standards, for agricultural and for the development of small/medium and heavy industries. Cambodia's overall electricity demand has been growing by about 20 per cent a year due to economic growth and a widening national grid that is making electricity accessible to a larger population. The energy supply system covers power sources and the distribution network consisting of elevated cable grids, underground cable grids and regional transformation stations, which distribute power to the planning area. Electric power sources are power plants and primary transformer substations that are located inside or outside the district/municipal territory but cater to the planning area.

Main aspects to be addressed during the analysis of the existing energy supply system are:

- Identify the regional power system and sources relevant to the supply of the district/ municipality;
- Identify the accurate location and type/specification of the different sources of energy supply and distribution networks within the district/municipality (see Map 27):
  - Power plants (coal- and diesel-fired thermal plants, hydro-power (hydroelectric dams), solar power, biomass etc.) (see Table 12);
  - Transformation (sub-)stations;
  - Transmission lines (220, 110, 22 kV grid etc.).
- Evaluate the capacity/load and service coverage of these infrastructure facilities;
- Assess existing conditions and identify issues, such as power supply reliability and safety, underserviced settlement areas etc.;
- Assess current management systems for infrastructure operation and maintenance (responsible institutions/agencies, service providers, tariffs and fees etc.);
- Examine the connectivity and balance of energy supply networks between rural and ur-ban/ peri-urban areas;
- Identify the areas without access to electricity and discuss the challenges of energy supply in these areas (type, origin, problem if any);
- Analyze the environmental and social impacts of energy infrastructures (in particular hydropower dams);
- Discuss the needs/potentials for further development of energy supply infrastructures and the policy orientation on the sector including on-going and planned projects/programs.
- Another relevant aspect can be the location of above-ground power transmission cables and poles as well as telecom transmission towers, as they can negatively affect road safety and the appearance of the townscape.

Table 12 Main indicators for analysis of current energy supply system

Indicator	Unit	Description
Service coverage	%	Rate of domestic user connected to energy distribution network
Average consumption	kWh/day/capita	Average consumption volume of domestic use
Supply capacity	MW	Total supply of energy
Public lighting rate	%	Rate of public roads with lighting

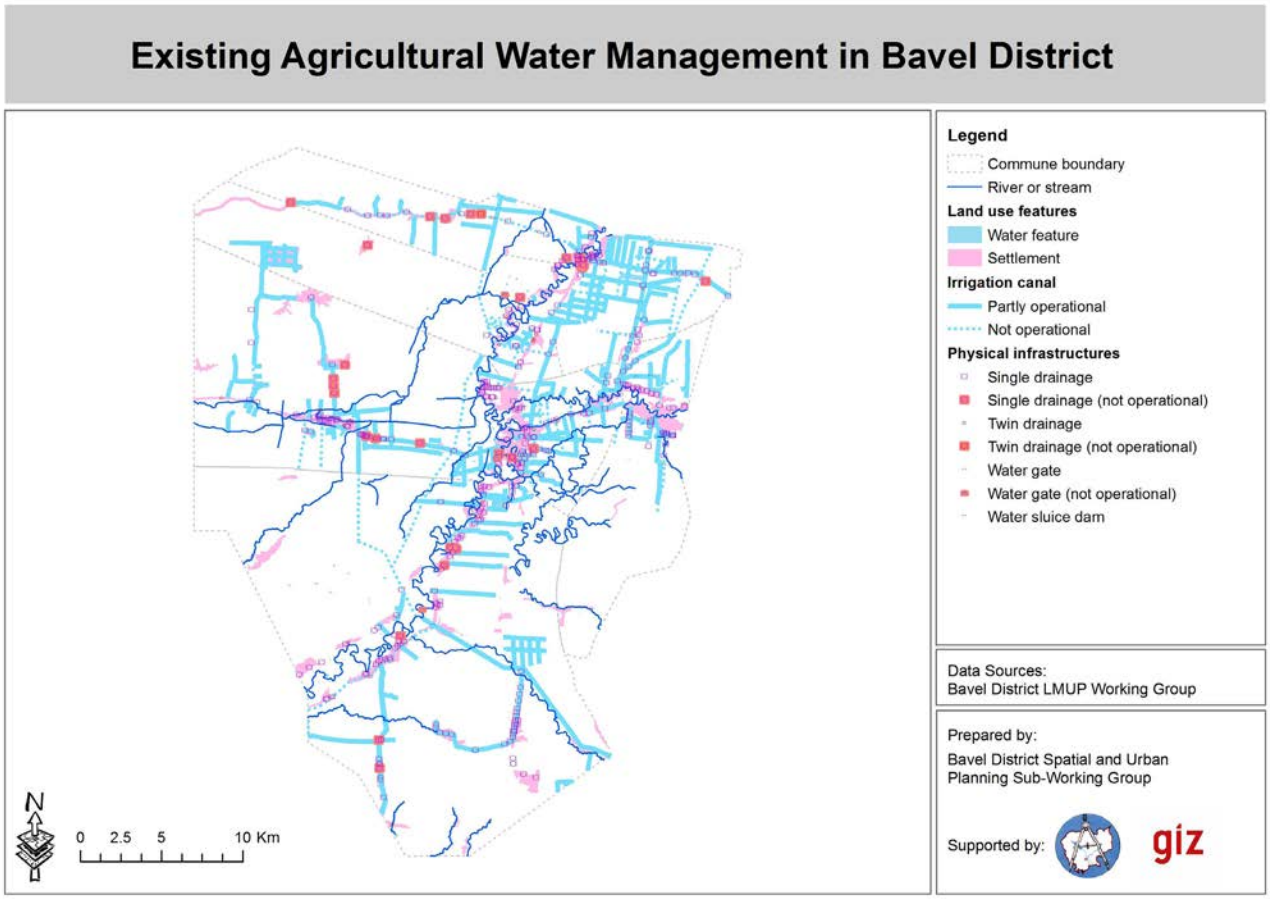


Map 27 Existing energy supply system in Ta Khmau Municipality (Kandal Province)

3.1.14 Agriculture and agro-processing economic profile (recommended)

Based on land use and land tenure mapping, a more functional analysis of the agricultural sectors needs to be conducted in rural and concerned peri-urban areas. This analysis includes a review of the agricultural production and post-production processes:

- Crop or livestock production: compute the cultivated areas and analyze the distribution of crops across the district/municipality (in relation with variables of bio-physical environment); identify pockets of agricultural production in urban areas.
- Identify areas with relatively low/high levels of agricultural intensification or diversification.
- For main crops and livestock, characterize and analyze the different rice and non-rice cropping systems:
  - Seasonal calendar (dry & rainy seasons);
  - Average yield for rice and non-rice productions;
  - Production constraints (land, water, labor, technology, access to inputs etc.);
  - Commercialization constraints (access to market, cost-price, sale price etc.).
- In regions where indigenous people are living, it is important to identify swidden agriculture land use system, which may co-exist in a mosaic with permanent agriculture land use patterns. It is also important to include customary land tenure arrangements of indigenous people, formalized or not under communal land titling.
- Identify and analyze soil degradation areas with unfavorable conditions for agriculture due to ero-sion, salinization, compaction, inadequate use of chemicals, forest conversion into permanent grassland/barren land, pollution, etc. Examine the current attempts to deal with this problem.
- A clear and detailed inventory of all important irrigation infrastructures should be conducted by the working group:
  - Identify the accurate location of each irrigation scheme including water reservoirs, headwork and command perimeter (agricultural area size that benefit from the water);
  - Characterize each irrigation scheme by water source (from river, reservoirs etc.);
  - Discuss the different types of problems in the technical design of the irrigation schemes;
  - Identify the degree to which the scheme is operational;
  - Identify the institutional bodies responsible for water distribution and management:
    - Farmer Water User Committee (FWUC);
    - Provincial Department of Water Resources and Meteorology;
    - Private entrepreneurs, companies etc.
  - Discuss the social/institutional problems encountered in the management of water;
  - Identify the current location and size of agricultural land and the number of families who benefit from the scheme;
  - Identify the location and size of agricultural land and the number of families who would benefit from the scheme if it was operational to its full extent;
  - Identify the type of work needed to rehabilitate the irrigation scheme and discuss if the rehabilitation work is worth its costs;
- Discuss the needs/potentials for further development of agricultural water management infrastructures and the policy orientation in the sector including on-going and planned projects/ programs (see Map 28).



Map 28 Existing agricultural water management in Bavel District (Battambang Province)

- Identify, locate and characterize agro-industries by sector, employment, capacity, competitiveness, articulation to agricultural production areas as well as problems and potentials (including in terms of water and soil pollution).

3.1.15 Secondary and tertiary economic sectors profile (recommended)

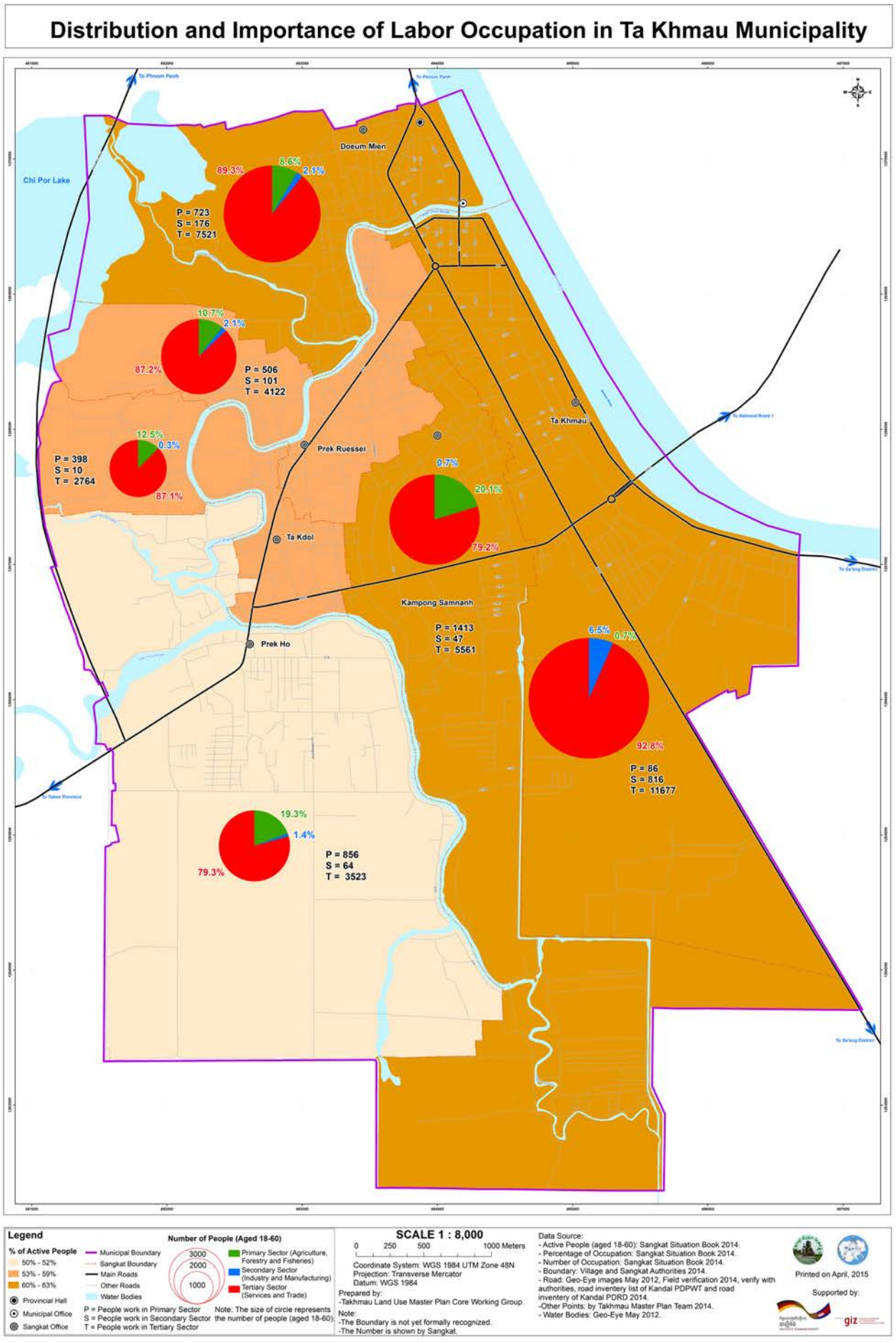
Spatial planning aims eventually at improving peoples' livelihoods so an analysis of the dis-trict/municipal economy is an essential task. It is important to examine the local economy through different angles so as to understand the factors that both promote and impede development. Economic profile analysis for district/municipal LUMP planning includes all relevant aspects regarding the spatial distribution and dynamic of (i) the economic structure, focusing on the establishments across main economic sectors, and (ii) the employment pattern of the population.

Employment

The employment pattern of the population is a very important dimension of the economy to be under-stood by the planners. The information on employment in the National Population Census database is classified according to the widely recognized International Standard Industrial Classification of All Economic Activities (ISIC) classification by the UN Statistics division (http://unstats.un.org/). The analysis should address the following main aspects:

- Identify the distribution of economically active population (labor force) according to main labor occupation and employment status as well as the unemployment rate;
- Identify and describe the spatial distribution of these main occupation categories across the district/municipality (see Map 29);
- Discuss the dynamics of job creation within the district/municipality: the sector which gener-

ates self-employment, those which recruit labor or which are in decline;
- Discuss the mobility of people associated to their jobs;
- Discuss the drivers of job migration within/outside the district/municipality (or country).



Map 29 Distribution and importance of labor occupation (by key sector and by Sangkat) in Ta

Khmau Municipality (Kandal Province)

Industries and manufacturing

The development of industries and manufacturing is a process that slowly reaches the Cambodian provinces and usually develops in parallel with urbanization. It creates new labor opportunities, promotes the diversification of the economy into services situated upstream and downstream of the industrial processes, but also is generating new claims and demands for land. The analysis of industries and manufacturing in the district/municipality should address the following main aspects:

- Identify, map and characterize the main industries as well as main clusters of small and medium enterprises (SME) by location, sector (ISIC categories) and analyze their access to infrastructure supporting facilities (water, power, sewage treatment and solid waste management, transport, parking, etc.). Location and land size will be documented in the existing land use map (refer to results of current land use survey);
- Analyse the number and size of enterprises and productive capacity (if data available);
- Assess their labour-hiring capacity, and discuss the dynamics of job creation in industries within the district/municipality;
- Analyse the environmental and social impacts of these operations (type and severity of pollution and mitigation measures, land conflicts with adjacent households etc.);
- Discuss the mobility of people associated with industrialization, creating new demands for physical, social and economic infrastructures;
- Review and discuss the current problems/needs and future prospects/potentials for further development, the policy and investment environment (current regulations and incentives, on-going and planned programs and projects etc.) for the industry and manufacturing sector.

Services and trade

Commerce and services are urban functions 'per se', with cities being the market places and service providers for their citizens as well as for their rural hinterland. This sector is growing rapidly, and is already home to 2/3 of the urban labour force in Cambodia. The analysis of services and trade in the district/municipality should address the following main aspects:

- Identify and describe the locations of main markets and commercial areas (shopping streets or other clusters) as well as local neighborhood markets/commercial sub-centers in the district/municipality and analyze their access to infrastructure supporting facilities (water, power, sewage treatment and solid waste management, transport, parking, etc.). Location and land size will be documented in the existing land use map (refer to results of current land use survey);
- Identify the number and size of enterprises (by ISIC category) and describe the productive capacity of the service sector and main trade flows (types of goods and importance) into/from the district/municipality (if data available);
- Review and discuss the current problems/needs and future prospects/potentials for further development, the policy and investment environment (current regulations and incentives, on-going and planned programs and projects etc.) for the services and commerce/trade sector.

Tourism

Tourism development is a part of the service sector, and gaining momentum across provinces and cities as an economic asset with significant development potential. Many districts/municipalities and regions in Cambodia show at least some local tourism potential, some even at international level. Urban areas might not always have the attractions within their administrative territory, but they often serve as the hub for access to transport and facilities/services (hotels, restaurants etc.)

near to the sites of interest. To know about the potentials of this economic subsector, the analysis of tourism services in the district/municipality should address the following main aspects:

- Identify and describe the main tourist attractions within the district/municipality and its adjacent surroundings (within day-trip distance). Location and land size will be also documented in the existing land use map (refer to results of current land use survey);
- Analyse the past evolution and future potential for tourist visitors (tourist numbers in general and at each attraction);
- Analyse the condition/status, the capacity and management of existing facilities and services in the tourism sector (hotel and gastronomy businesses, agencies and tours, other tourism-related infrastructures etc.);
- Review and discuss the current problems/needs and future prospects/potentials for further development, the policy and investment environment (current regulations and incentives, ongoing and planned programs and projects etc.) for the tourism service sector.

Poverty incidence

It is meaningful to analyse the spatial distribution of poverty in the district/municipality, to identify vulnerable communities and assist (sector) planners and decision makers in targeting services and assistance to poor households, to improve the effectiveness of poverty reduction. The poverty analysis should address the following main aspects:

- Analyze the relevance and distribution of poverty in the district/municipality, by identifying and mapping areas with high incidence of poverty. Household poverty level information can be aggregated by administrative area (village, commune/Sangkat, district/municipal levels) to compare and identify priority regions for assistance;
- Source data is available down to village level from the 'ID Poor Program' (Ministry of Planning 2013). Data includes the poverty category of all poor households ('Poor Level 1' (very poor) or 'Poor Level 2' (poor)), details of all members of poor households (name, sex, age, year of birth, relationship to head of household), photos of poor households, poverty rate comparisons between villages and communes, and other summary statistics;
- Discuss the reasons and drivers of poverty as well as the efforts being made for poverty reduction.

Task 3.2 Environmental analysis

Overview

In addition to the analyses conducted so far, a series of specific analyses should be undertaken to cover a range of environmental issues related to the development of the district or municipal territories. These are essentially cross-sector analyses that are based on the sector described in Task 3.1, e.g. forest, wetland, fisheries, etc.

Who is involved?

- District/Municipal Land Management and Urban Planning Working Group
- Database/GIS expert

Activities / methodology

- Organize data analysis and mapping sessions. In order to conduct the environmental analysis working sessions need to be organized on a regular basis with specific assignments given to different members of the working group according to their expertise and skills.
- Key points for data analysis. To enable the LMUP Working Group in this rather complex task, we propose hereunder a guideline including key points and questions that need to be addressed during the analysis phase.

Necessary outputs

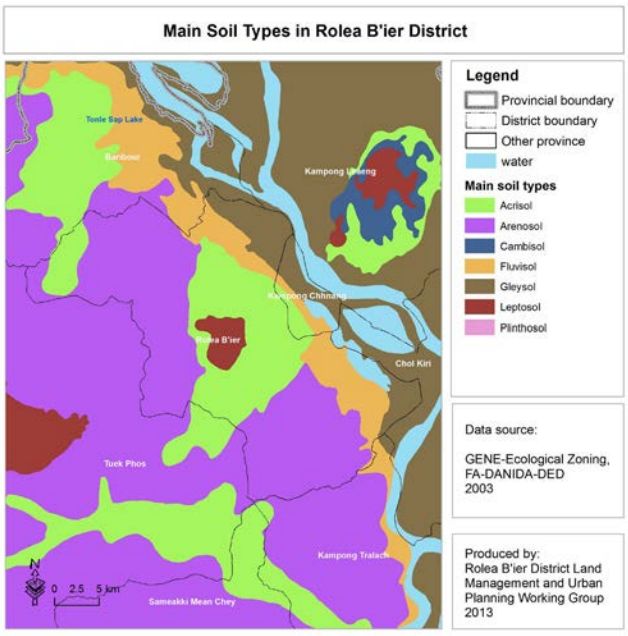
- A series of environmental analysis is produced along the guideline.
- Each analysis consists of a map that is accompanied by a short text that describes and explains the main information presented on the maps and their relevance to the spatial development of the district/municipality.

A guideline for environmental analysis

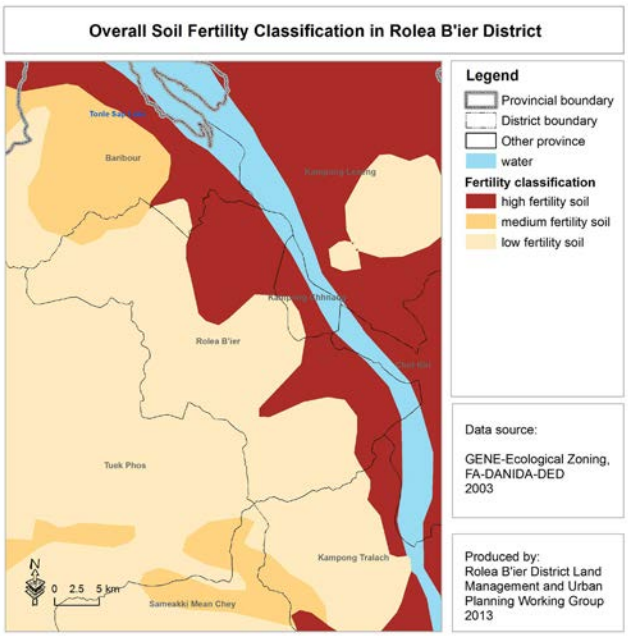
The following is meant as a guideline to help the working group conduct the different types of analyses. As an additional support, a list of guiding questions is proposed in Annex 2.

3.2.1 Land suitability analysis for agriculture and for urban settlement area

- Analysis of soil suitability for agriculture, in order to identify the land in the vicinity of urban and peri-urban areas that has high value for agricultural production and should therefore be protected from urban expansion (no conversion into 'buildable' settlement area);
- To achieve this, an overall evaluation of soil throughout the district/municipality is needed to determine the type of agriculture development measures that can be envisaged and to identify the higher value agricultural land that needs to be spared from urban development. Soil type identification and analysis can be a very complex exercise but simplified soil information is available. The analysis shall (i) identify and describe the main soil types, (ii) understand their main hydrological, physical and chemical characteristics and (iii) include overall fertility assessment (see Maps 30 and 31);
- Analysis of suitability for urban expansion (conversion of 'control' areas into 'buildable' settlement areas): To identify the areas suitable for urban expansion, all flood-prone areas, environmental conservation areas (water resources, forests etc.) and areas with high value for agricultural production in the vicinity of the district/municipality need to be mapped and potential conflicts with future urban expansion need to be identified.



Map 30. Distribution of main soil (according to FAO classification) in Rolea B'ier District (Kampong Chhnang Province)



Map 31. Soil fertility in Rolea B'ier District (Kampong Chhnang Province)

3.2.2 Pollution control

- Identify the different sources of pollution affecting air, water and soil by source of nuisance and severity;
- Evaluate the current measures for air, water, soil, noise, solid waste pollution control;
- Identify the potential to strengthen these measures.

3.2.3 Natural disaster management and Resilience to Climate Change

- Analyse the characteristics (location, severity, frequency, duration) of different types of natural disasters (flood, drought, landslides, river bank or coastal erosion, etc.) that affect the district/ municipality;
- Understand how floods or droughts have evolved over time, e.g. in the context of climate change. Some collaborative efforts with the Provincial Natural Disaster Management Committee are required here;
- Evaluate the impacts of those on physical infrastructures, settlement areas and agricultural land.
- Analyse existing capacity to adapt to the risks and general disaster preparedness;
- Discuss the needs/potentials for further development of physical infrastructures to mitigate future disasters and/or reduce vulnerability.
- Conduct one overall or a series of vulnerability analysis of specific sectors or land use types. Vulnerability depends on their exposure to the risks, their sensitivity (the degree to which they are impacted) and their adaptive capacity (see info box).
    - For each land use type, identify the major assets and resources at risk
    - Quantify their exposure to anticipated extreme weather events, e.g. on a scale from 1 to 10.
    - Quantify their sensitivity, e.g. on a scale from 1 to 10.
    - Quantify their adaptive capacity, e.g. on a scale from 1 to 10.
    - Calculate vulnerability of each land use system to the different events, document reasons of vulnerability.

- Discuss potential adaptation measures to enhance resilience of assets for each specific land use units.

Info-Box		
Vulnerability is defined as the "degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes" (McCarthy et al. 2001). In this definition key parameters of vulnerability are the stress to which a system is exposed, its sensitivity and its adaptive capacity.		
Exposure	**Sensitivity**	**Adaptive Capacity**
The exposure relates to the nature and degree to which a system undergoes environmental or socio-political stress. The characteristics of these stresses include their magnitude, frequency, duration and the area size of the hazard	Sensitivity is the degree to which a region or community can be affected, negatively or positively, by changes (in climate).	Adaptive capacity is a system's ability to adjust to climate change and variability, to moderate potential damage, to take advantage of opportunities or to cope with consequences.

3.2.4 Environmental conservation areas

- Identify areas where ecosystems are to be protected (type, location, size, coverage, current protection measures). Understanding ecosystems and managing them sustainably is at the core of successful land management. In Cambodia various projects have generated information on ecosystems and ecological diversity, but comprehensive information is limited and varies from province to province. An opportunistic approach is recommended, based on the available information in the respective district or municipality. One notable example is the In-Vest tool which enables decision makers to assess quantified trade-offs associated with alternative management choices and to identify areas where investment in natural capital can enhance human development and conservation." (http://www.naturalcapitalproject.org/invest/).
- Identify areas where natural elements/landscapes with cultural/heritage value are to be protected (type, location, size, coverage, current protection measures).
- An environmental analysis goes beyond the identification of the area to be conserved. In order to identify the most adequate and feasible conservation measures, the analysis should identify the main threats for nature conservation, understand the intricacy of their drivers and comprehend the interrelations with other forms of land use, e.g. how the expansion of agriculture might impact the protection of neighbouring forest or wetlands.

Task 3.3 Analysis of land use management at commune/Sangkat level

Overview

After a first round of data collection and map production, it is now time to submit the analyses to the scrutiny of Commune and Sangkat Council members, to village chiefs and to relevant non-state actors. In addition to reviewing and validating existing maps and analyses, the local stakeholders analyze the dynamic of land use change in both rural and urban areas in the district or municipality by discussing their drivers and positive and negative consequences. This serves as a basis to determine a comprehen-sive list of key development issues affecting people in their relation to land access and land use. First-hand information from local authorities and land users is crucial at this stage, also to cross-check once again the gathered information.

Who is involved?

- Initiation and implementation
  - District/Municipal Land Management and Urban Planning Working Group
  - Database/GIS expert
- People consulted in commune/Sangkat workshops
  - Commune/Sangkat council representatives
  - Village chiefs (selected representatives per commune/Sangkat)
  - Relevant non-state actors involved at commune/Sangkat level

Activities/methodology

- Prepare a set of maps and analyses established under Tasks 3.1 and 3.2.
- Conduct a series of thematic workshop at commune/ Sangkat level to present these maps and analyses to commune/Sangkat stakeholders for further update and validation. It is recommended to conduct a series of district/municipal workshops with all communes/Sangkats to cover one specific sector/topic or a series of different workshops per commune/Sangkat each covering all sectors/topics. Also a clustering of communes/Sangkats is a feasible approach. During the workshops the land use change analysis conducted earlier including their drivers and consequences is discussed with commune/Sangkat authorities. Additionally, a comprehensive list of land use-related development issues is identified by sectors or themes (inventoried in Task 2.2). A root cause analy-sis of these key issues and how they are addressed at commune/Sangkat level is conducted. Additionally and along the same sectors and themes, the key potentials for development in the com-mune/Sangkat are discussed.

Necessary outputs

- The maps and analyses established earlier are updated and validated by commune/Sangkat stake-holders;
- Main current land use types and land use changes are identified and analyzed for each commune/Sangkat along a root-cause type of analysis;
- A comprehensive list of key land use-related problems is established and analyzed including the institutional analysis of commune/Sangkat stakeholders on how to respond to those land use–related key development issues;
- A comprehensive list of development potentials in the commune/Sangkat is established. As an additional support a list of guiding questions is proposed in Annex 2.

Task 3.4 Analysis of land use management and governance by District / Municipal Land Management and Urban Planning Committee

Overview

After the series of workshops conducted at commune/Sangkat level, the analyses, maps and key land-use related development issues/potentials are consolidated and submitted to the scrutiny of the District/Municipal Land Management and Urban Planning Committee.

Who is involved?

- Initiation and implementation
  - District/Municipal Land Management and Urban Planning Working Group
  - Database/GIS expert
- People involved in workshop
  - District/Municipal Land Management and Urban Planning Committee

Activities / methodology

- Organize a workshop with representative of the District/Municipal Land Management and Urban Planning Committee to scrutinize the consolidated maps and analyses under Tasks 2.2 and 2.3, and revised after Task 2.4. During this workshop, the consolidated maps, analyses and key development issues ('land use'-related problems faced by population) are presented and further discussed with the LMUP Committee. During the workshop, the responsibilities and existing strategies and capacities of the public authorities (territorial administration and line offices) to address those land use problems (successes, shortcomings, obstacles) are further discussed.
- SWOT tools can be used to conduct this analysis but the exercise needs to be well prepared and structured: Prepare a complete overview of the relevant issues and which district/municipal actors will have a stake in them. Further, take a close look at the relevant policy documents beforehand, particularly:
  - District/Municipal 5-year development plan and 3-year rolling investment plan
  - National Strategic Development Plan
  - Sector policies of line ministries relevant to the stakeholders and the identified spatial issues

The session could be structured following a "classic" SWOT analysis. An introduction to the SWOT tool might be necessary. It is useful to use maps as resource documents, while facilitating the discussion.

Info-Box
SWOT Tool
Strengths are attributes, which are helpful to achieve the objective. Strengths are assets, which can include such things like: know–how, motivation, skills, support, information, infrastructure... Strengths also help to exploit potentials and opportunities.
Weaknesses are attributes, which are harmful to achieve the objective. Weaknesses can include such things as: limited know–how, insufficient skills and techniques, poor information base about opportunities, differing management and planning, limited experience. Weakness hampers the effective exploitation of the existing or future opportunities.
Opportunities are external conditions, which can be helpful to achieve objectives in the future. Opportunities can be described as areas where one may enjoy a competitive advantage over others. Opportunities and to some extend potentials need to be exploited, we need to make use of it.
Threats/Challenges are external conditions, which can hamper a performance in the future. Threats should not necessarily be seen only from the negative side. A threat can also be a challenge.

Necessary outputs

- The maps and analyses carried out earlier are consolidated at district/municipal level and validated by District/Municipal LMUP Committee.
- Main land use types and land use changes are identified and their root-causes and associated con-sequences are analyzed.

Task 3.5 Presentation and discussion of situation analysis in 2nd Spatial Planning Stakeholder Forum

Overview

At this stage in the process, the methods and results of the situation analysis are presented to all spatial planning stakeholders in a dedicated forum. This second forum is an opportunity to include all stakeholders and have discussed and agreed upon a wide range of problems and potentials for the development of the district/municipality. At this stage, reaching a broad consensus on the territorial diagnosis is key to consolidate the foundation for the prognosis in the subsequent planning tasks.

Who is involved?

- Initiation
  - District/Municipal Land Management and Urban Planning Working Group
  - District/Municipal Council
  - District/Municipal Land Management and Urban Planning Committee
- Participants in Spatial Planning Stakeholder Forum
  - All stakeholders (Table 1)

Activities/methodology

- Organize the 2nd Spatial Planning Stakeholder Forum. At this stage, it is important to bring the stakeholders (identified earlier in Task 1.3) and present them the key conclusions and maps of the situation analysis. The discussion is an opportunity to reach an agreement between stakeholders on the 'key development issues', i.e. the main land use-related problems and potentials in the dis-trict/municipality and their causes and consequences. Furthermore, stakeholders will jointly evaluate the efforts that are made to address those problems and harness those potentials. It is key to ensure and encourage active participation of all partici-

pants (allow sufficient time for debate and opt for an open discussion). As the range of topics under the situation analysis is very broad, it will require a very structured, targeted and flexible presentation and moderation, if the Forum shall be able to reflect on all issues in one go.

Necessary outputs

- The results of the situation analysis are presented to and discussed by all spatial planning stakeholders gathered in a forum. Any amendments requested by stakeholders are discussed and addressed.

Task 3.6 Scenario analysis

Overview

Spatial plans are a look into the future. The plans are elaborated in the present, based on identified development trends in the past, as well as on current development issues (problems and potentials). Spatial planning does however need to project future developments and demands for the planning horizon of the district/municipality. Besides knowledge on the current situation and the future development projections, choices for the future, which are made in a spatial plan are based on knowledge available or generated throughout the planning process as well as informed decisions.

In the context of the Land Use Master Plan, there are two main aspects in scenario thinking. On the one hand, demographic projections scenarios are key to anticipate the future population development and future needs for specific types of land use such as: housing, public facilities, agriculture etc. On the other hand, economic development scenarios will address the future need for land for economic development.

Who is involved?

- Initiation
  - District/Municipal Land Management and Urban Planning Working Group

Activities / methodology

- Working sessions of 1 or 2 days each are organized with participation from all the members of the LMUP Working Group to identify and discuss future trends and 'scenarios'. The guideline hereunder provides some methodological hints on how to conduct these exercises.
- Environmental change analysis is an important yet new topic for most of people who will engage on spatial planning in Cambodia. While the topic will undoubtedly gain traction in the future it is recommended to prepare and conduct a training session on environmental change and adaptation or resilience to be conducted in parallel. It seems timely to conduct it at this stage as the topic of environmental change will come up regularly in the planning process from this point onwards.

Necessary outputs

- Demographic growth scenario is conducted;
- Future population increase is converted and quantified into estimated future needs for housing and agricultural land;

A guideline for the development of scenarios

3.6.1 Project future demographic growth

Spatial planning needs quantitative models to discuss future development; however, the use of scenarios should be the standard today, as well as regular adaptation of the projection models (every 5-10 years). Even though general demographic development is rather stable and useful to project, population development in districts and municipalities is a more difficult issue, as it is are prone to high uncertainty regarding future net migration rates (in-migration vs. out-migration). Sector planning needs to be informed by demographic projection scenarios to roughly estimate the future requirements for water supply, energy, social facilities etc.

The elaboration of demographic projections aims to estimate what the total population of the district/municipality will be at the planning time horizon. This exercise is based on the past demographic growth and actual population number of the different communes/Sangkats composing the district/municipality. It should ideally take into account the expected natural growth and migratory balance of the population of each commune/Sangkat.

Based on the past demographic growth rate calculated earlier, the working group envisages several future growth scenarios (slightly lower, similar or slightly higher) (see Figure 13 and Table 13). The variant projections are not intended to indicate maximum or minimum amounts of population growth or decline. Given the relatively high uncertainty of population projections on district/municipal level, they rather provide alternative, plausible assumptions of what might happen in terms of future demographic condition. In order to identify the most realistic scenario as the future population trend (baseline) scenario, the demographic projection needs to be conducted for each commune/Sangkat, according to (i) its specific demographic growth rate, (ii) the actual district/municipal population density, and (iii) the discussion of its potential for economic development.

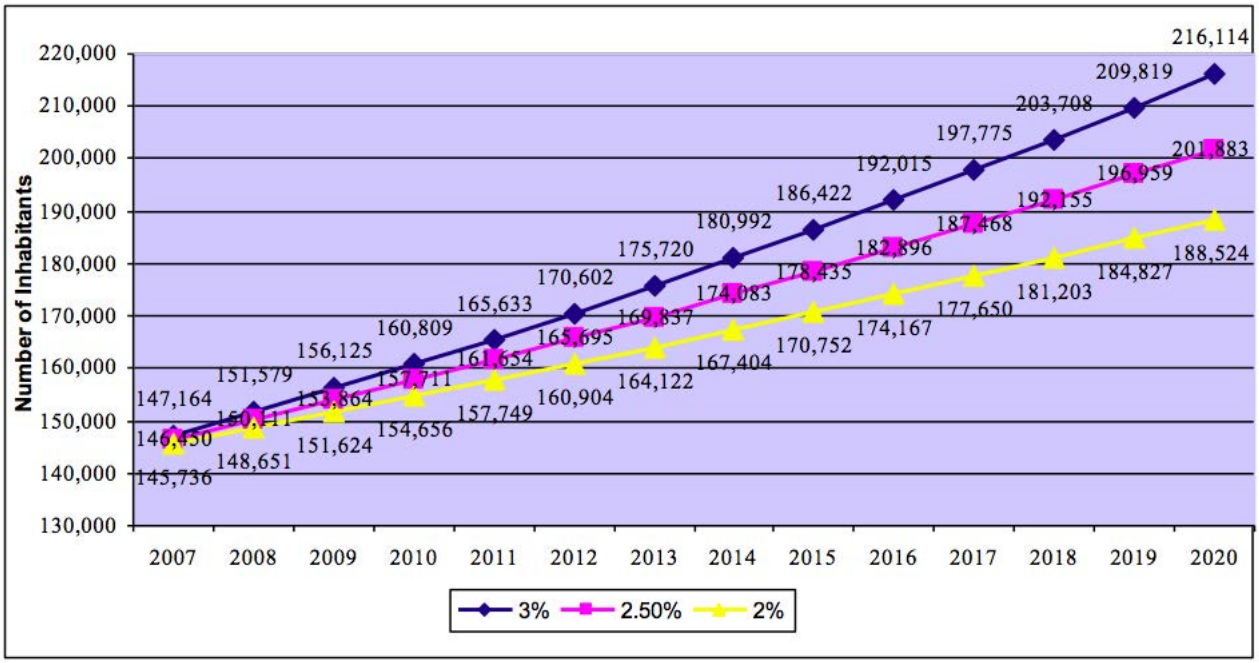
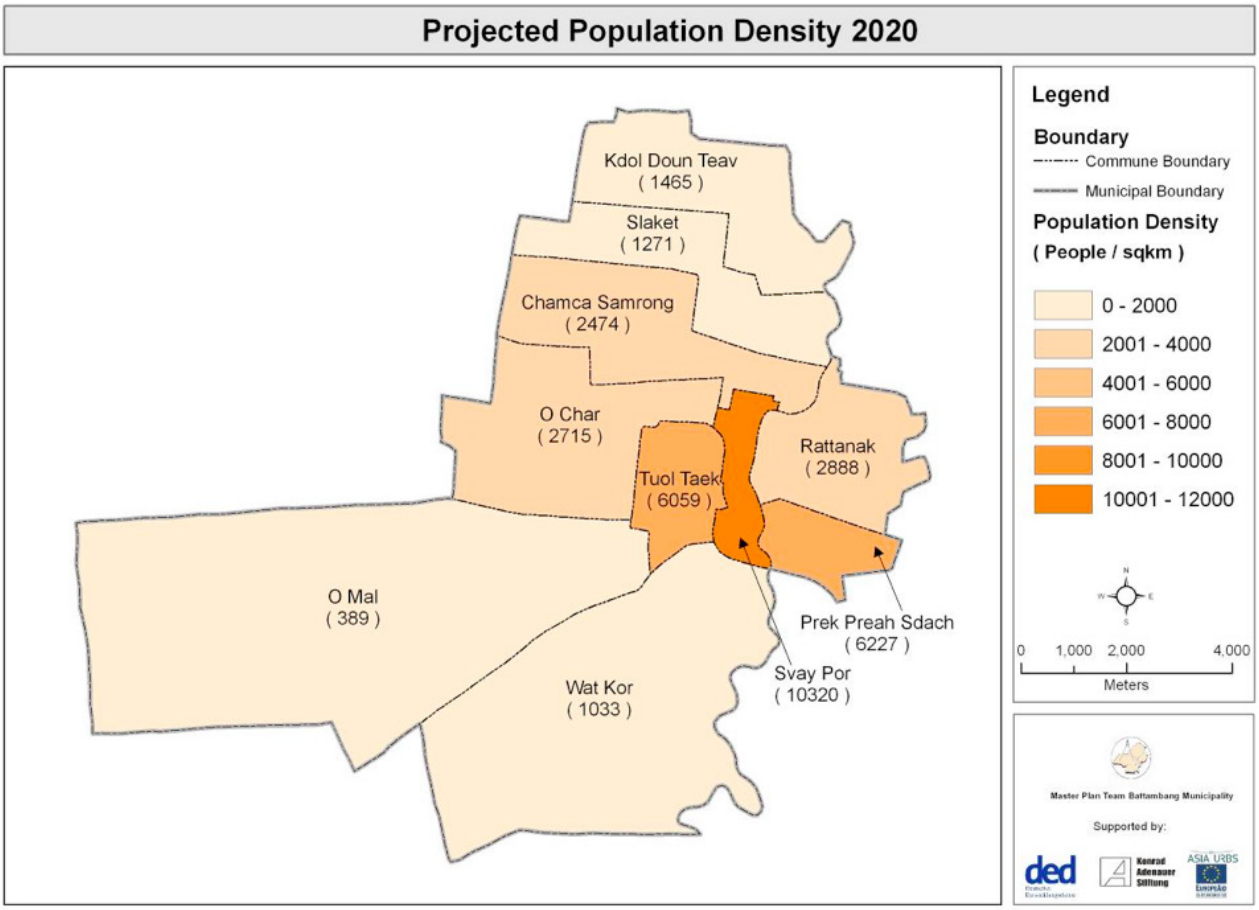


Figure 13 Projection of population development in Battambang Municipality 2007 to 2020 (based on three growth scenarios)

Table 13 Population in 2002-2006 and estimated population in 2020 in Battambang Municipality

Municipal Population in 2002-2006			Estimated Municipal Population in 2020		
Population in 2002	Population in 2006	Average annual population growth	Scenario 1 (2%/year)	Scenario 2 (2,5%/year)	Scenario 3 (3%/year)
133.656	142.878	1,72%	188.524	201.883	216.114

Finally, the projected population trend scenario can be illustrated per commune/Sangkat (or even per village) in a map displaying the future population density for the planning time horizon (see Map 32).



Map 32 Projected future population density by Sangkat in Battambang Municipality, in 2020

3.6.2 Project future land use demand (housing areas)

Land use master planning needs to be informed by demographic projection scenarios to roughly estimate the future requirements for land use demands by different functions. The demographic projection can help to estimate additional settlement (i.e. housing) areas that will be required in the future. In the simple/pragmatic method described below, the increase of population is converted into an estimated future number of new households and eventually into an estimation of new/additional housing area. The resulting figure is a rough estimation of the land that will be needed in the future for housing-related land use categories (residential zones, residential with agriculture zones, mixed use zones, commercial zones) (see Table 14):

- Part 1 of the table shows the estimated population (three scenarios) for Battambang Municipality in the year 2020;
- Part 2 of the table shows the estimated additional number of households in Battambang Municipality for the year 2020:
  - The future household number is calculated based on the projected population number and the estimated average household size (5.4 persons/household);
  - The existing household number is subtracted from this number;
  - The resulting additional household number is divided into families living in detached houses and in apartments/flats (with higher density and smaller plot sizes per unit). Due to the high share of detached housing in the municipality, it is estimated that ma-jor share (90%) of the new demanded units will be in detached (single-family) houses;
- Part 3 of the table shows the total demand for new housing areas in Battambang Municipality for the year 2020:
  - For the calculation of the land area needed for detached housing, an average of 600m2 of land is taken into account (plot size including proportional area needed for roads and infrastructure). For apartment housing the average land size is estimated at 300m2. These figures were based on a survey of existing average plot sizes and land shares for infrastructure in the municipality, and may be different in other cities;
  - Of the total resulting land demand, a share of 150 ha is deducted for building poten-tials on vacant/underutilised plots in existing housing areas (building potentials in existing settlement areas were surveyed in five representative case study areas with different density and building structure, and results were then projected on the total size of the existing settlement area);
  - Finally, a ‘development buffer’ of 20% is added, considering the estimated percentage of land that will not be available when needed for development (e.g. unclear land ownership can hinder land transactions and investment);
  - The final sum represents a rough estimation of the total demand for additional hous-ing areas for the future planning horizon time, and for three different demographic growth scenarios.

Table 14 Conversion of population increase into housing land requirements (Land Use Master Plan Battambang Municipality)

ESTIMATED POPULATION OF BATTAMBANG MUNICIPALITY UNTIL 2020			
	Scenario 1 annual growth 2%	**Scenario 2** annual growth 2,5%	**Scenario 3** annual growth 3%
Population in 2006	142.878	142.878	142.878
Estimated population until 2020	188.524	201.883	216.114
ESTIMATED HOUSEHOLDS OF BATTAMBANG MUNICIPALITY UNTIL 2020			
Households in 2006	25.196	25.196	25.196
Estimated households until 2020	34.912	37.386	40.021
Additional households until 2020	9.716	12.189	14.825
of which approximately: - in detached houses (90%) - in apartment units (10%)	 8.744 972	 10.970 1.219	 13.343 1.482
ESTIMATED DEMAND FOR NEW HOUSING AREAS UNTIL 2020			
Additional households in detached houses	8.744	10.970	13.343
Resulting demand for housing area (600m²/ household, including proportional roads and infrastructure)	524,6 ha	658,2 ha	800,6 ha
of which approximately: - building potentials in existing housing areas - additional new housing areas	 - 150 ha 374,6 ha	 - 150 ha 508,2 ha	 - 150 ha 650,6 ha
Additional households in apartment units	972	1.219	1.482
Resulting demand for housing areas (300 m²/unit, including proportional roads and infrastructure)	29,2 ha	36,6 ha	44,5 ha
Total demand for additional housing areas (Total 3.2.2+3.4)	403,8 ha	544,8 ha	695,1 ha
Additional development buffer (20%)	80,8 ha	109,0 ha	139,0 ha
Total demand for additional housing areas including development buffer (Total 3.5+3.6)	**484,6 ha**	**653,8 ha**	**834,1 ha**

3.6.3 Project future land use demand (agricultural land)

In the same line of thought, the increased number of households can be converted into the future area needed for agricultural land holdings. The calculation is slightly more difficult as it requires taking into account the future population that will be economically active or more widely dependent on agriculture.

- On the basis of demographic projections, the total population that will be living in the rural areas is obtained by projecting the average urbanization rate observed in the past;
- The active population is then estimated by projecting the decrease in age dependency ratio (number of not-working-age population as percentage of working-age population) observed during the same time period;
- On that basis, the scenarios of labor transfer from agricultural sector to the secondary and tertiary sector are introduced;
- The balance between total projected active population in rural areas and total expected labor transfer from agriculture gives the total projected number of active people that will need land for livelihood from agricultural practices;
- We then introduce different scenarios based on the intended support to the smallholder farming sector: for instance 0.50 ha/active, 0.75 ha/active or 1 ha/active.

Task 3.7 Discuss scenarios, identify long-term development goals and development vision with District / Municipal LMUP Committee

Overview

The results of the situation analysis combined with the development scenarios now serve as a basis to identify long-term development goals by district/municipal authorities. The discussion should make use and capture the content of existing 5-year Development Plans that are designed and implemented by the District/Municipal Council and the Board of Governors. The long-term development goals are com-prehensive in that they address the different development sectors/ themes. They are detailed and spec-ified into development objectives. The long-term develop-ment goals are then synthesized into a devel-opment vision that provides a picture of the district/ municipal territories ideal future.

Who is involved?

- Initiation and implementation
  - District/Municipal Land Management and Urban Planning Working Group
  - Database/GIS expert
- People involved in workshop
  - District/Municipal Land Management and Urban Planning Committee

Activities / methodology

- The results of the situation analysis/key development issues and results of the scenario dis-cussion are presented for discussion with the LMUP committee. On that basis, long-term development goals are identified. These long-terms goals are broad and comprehensive, yet realistic to be achieved in the planning period and should touch on the following areas:
  - Ensure economical and considerate exploitation of land and prevent land use conflicts;
  - Ensure equitable access to basic infrastructure and social services in all areas of the dis-trict/municipality;
  - Ensure sustainable development of agricultural sector (increase production in quantity and quality);
  - Ensure environmental management, protect natural resources and enhance resilience to climate change;
  - Ensure inclusive economic development and job opportunities through appropriate in-dustrialization and local SME based on endogenous potentials;
  - Ensure adequate shelter and safe living conditions for all citizens.
- Each district and municipality is equipped with a 5-year Development Plan that entails a com-prehensive list of development goals and strategic objectives to guide the development of its territory. These development goals present the advantage to be wide ranging and touch on several sectors and themes. It is essential to take these development goals into account in the design of the Land Use Master Plan to make sure that the spatial plans and development plans are aligned. In conformity with the 5-year Development Plan, each long-term develop-ment goal is detailed and specified into development objectives.

Table 15 Long-term development goals and corresponding development objectives in the Draft Land Use Master Plan for Bavel District (Battambang Province)

Long-term Development Goals	Development Objectives
Ensure demand-based expansion of settlements and liveable settlements for growing population	A) The expansion of settlement area for growing population is regulated B) Adequate public infrastructure is provided in urban areas
Ensure provision & equitable access to social / cultural services	A) Access to potable water in quantity and quality is improved B) Access and quality of public health services are improved C) Access and quality of public education services are improved D) Cultural sites of heritage value are protected and promoted E) Access to pagodas is improved
Ensure development of agricultural sector / increase production in quantity and quality	A) Agricultural productivity is increased through sustainable intensification B) Diversification of agricultural production is increased C) Storage and processing capacity of local agro-industry is improved
Enhance effective and sound environmental and natural resource management (protection and production)	A) Water, soil and air pollution is decreased B) Green network is increased C) Resilience to climate change and natural disaster has improved D) Environmental conservation and production areas are strengthened
Ensure inclusive economic development	A) Transportation network is improved to enhance mobility of people and circulation of goods B) Polycentric economic development structure is promoted C) Power is provided to areas without access to electricity/ Use of regenerative energy sources is promoted

- The long-term development goals are synthesized into a development vision that provides a snapshot of the district/municipal territories' ideal future. A vision defines how all stakeholders perceive the future of their district/municipality. It represents something towards they are striving for. Visions are bold development statements and provide directions for the future development. Because visions are critical ingredients for change, a good vision statement should therefore possess the following characteristics:
  - Achievable: A vision is ambitious, but must certainly be achievable or well-grounded on reality;
  - Inspiring: It encourages commitment and inspires enthusiasm. A good vision statement captures the imagination, engages the spirit and inspires performance. It is a driving force even during challenging times;
  - Easily understood: It is well articulated using simple, catchy and compelling language so that people concerned can relate to it and work hard to attain it;
  - Unique and distinctive: It builds on the distinct character of the district/municipality vis-à-vis other districts, cities and regions.

Table 16 Elements and attributes of a development vision

Vision elements	Attributes
People and society	Well-informed, healthy, inclusive etc.
Local economy	Competitive, diversified, environment-friendly etc.
Natural environment	Clean, safe, protected, restored etc.
Built environment	Balanced, planned, attractive, efficient etc.
Local governance/leadership	Progressive, responsive, accountable etc.

- A development vision can be illustrated into a logo or diagram, in order to be clearly understood and visualized (see Figure 14). The development of a long-term development vision requires the involvement of large diversity of stakeholders, not only technical experts.

Figure 14 Visualization of 'Vision 2030' of Battambang Municipality with six pillars of future development

Necessary outputs

- Long-term development goals (and corresponding development objectives) based on the results of cross-sector situation analysis, development scenarios and the existing 5-year Development Plan are elaborated per sector/thematic field and approved by the LMUP Committee;
- These long-term development goals are explained and documented in a short text;
- A development vision that captures the long-term goals and the singularity of the district/municipality is identified. The vision should be documented in a short text approved by the LMUP Committee.

Task 3.8 Validate long-term development goals, development objectives and vision in the 3rd Spatial Planning Stakeholder Forum

Overview

Thus far, the long-term development goals and vision have been discussed and consulted within the LMUP Committee. It is important to now widen the discussion and include all spatial planning stakeholders and interest groups. To this end, a third Spatial Planning Stakeholder Forum is gathered to present and validate these important milestones of the planning process.

Who is involved?

- Initiation
  - District/Municipal Land Management and Urban Planning Working Group
  - District/Municipal Council
  - District/Municipal Land Management and Urban Planning Committee
- Participants in Spatial Planning Stakeholder Forum
  - All stakeholders (Table 1)

Activities / methodology

- Organize the 3rd Spatial Planning Stakeholders Forum. The different development scenarios, long-term development goals, development objectives and development vision are presented and discussed in the stakeholder forum. Facilitate an open discussion on the results produced so far and encourage active participation of all participants (allow sufficient time for debate).

Necessary outputs

- The results of Step 3 are presented and discussed by all spatial planning stakeholders gathered in a forum. Any amendments requested by stakeholders are discussed and addressed.

Task 3.9 Finalization and documentation of results from Planning Step 3

Overview

The discussions that took place during the third stakeholder forum with the different actors will enable the working group to finalize the documentation of the results from Planning Step 3.

Who is involved?

- Initiation and implementation
  - District/Municipal Land Management and Urban Planning Working Group
- Other actors involved
  - District/Municipal Land Management and Urban Planning Committee
  - District/Municipal Council (for consent)

Activities / methodology

- Report writing.
- Presentation of the technical report to the LMUP Committee to decide whether to present the results of Step 3 to the District/ Municipal Council for their consent.

Necessary outputs

A technical report is formulated presenting all the results of the situation analysis. The report shall include the maps described above, which are grouped in two categories based on the Decision on the Detailed Procedure for Development of Municipal and District/Khan Master Plan and Land Use Plan (NCLMUP, 2013).

Mandatory outputs

- A technical report presenting all the results of Planning Step 3. The report shall include a complete documentation of the situation analysis, scenarios exercises, a final version (approved after the stakeholder forum) of long-term development goals and development objectives as well as the de-velopment vision.
- Mandatory maps to be produced:
    - Map of position of the district/municipality in province/region: This map should contain all provincial, district/municipal boundaries and names, the location and hierarchy of district/ municipal centres as well as national/ provincial transport corridors as well as main geographical features (rivers, lakes, mountains etc.);
    - Map of administrative structure and boundaries in the district/municipality: This map should indicate municipal, commune/Sangkat and (if available) village boundaries, names and location of administrative centres along with main transportation routes;
    - Map of existing land use categories: This map displays the different categories of current land use based on a distinct classification and symbology, which will facilitate the subsequent definition of 'buildable areas' and 'control areas';
    - Map of land use change/evolution of built up areas: This map shows the evolution/trends of urban growth and other important land use changes in rural areas;
    - Map of existing population density: This map shows the population density (persons/ha) per commune/Sangkat or per village (if village boundaries are available);
    - Map of existing public administration and services: This map displays the location and types of public administration facilities (provincial centre and departments, munici-pal/ district centres, commune/Sangkat centres, post office etc. and social service facilities (hospitals and health centres, schools and kindergartens etc.);
    - Map of existing cultural and religious facilities: The map should display all facilities that serve cultural (theatre, museum etc.) and/or religious purposes (pagoda, church, mosque, cemetery etc.);
    - Map of public green spaces and green/blue system: This map should contain the existing 'green and blue system' with public gardens and squares, sports and recreation areas, main tree-lined avenues, green corridors, main water bodies etc.
    - Map of existing transport infrastructure system: This map includes existing roads classified by type, railway lines, waterways used for transport, railway stations, bus terminals, airports, ports, bridges etc.;
    - Maps of existing technical infrastructure systems: This set of maps displays current technical infrastructure networks and facilities for sewage/drainage, water supply and waste management with their service coverage areas;
    - Natural disaster map: this maps displays the areas that are affected by or prone to natural disaster such as flood, drought, landslide, erosion;
    - Pollution map: This map displays the areas affected by and vulnerable to different forms of environmental pollution;
    - Environmental conservation areas map: This map shows the significant areas where the eco-systems are under some form of protection or areas that need to be protected.

Recommended outputs

- A short summary document is produced synthesising the key elements of the planning results so far and is circulated amongst the stakeholders, to increase awareness and ownership of the process and its contents.
- Recommended maps to be produced:
  - Map of spatial structure and overall territorial zoning: This map shows the existing urban, peri-urban and rural areas;
  - Map of topography and water resources: This map displays the biophysical environment of the district/municipality;
  - Map of existing land and housing tenure: This map shows the different land tenure arrangements on private and State land;
  - Map of population growth rate: This map shows the population growth rate over a distinct time period per commune/Sangkat or per village (if village boundaries are available);
  - Map of net migration rate: This map shows the net migration rate over a distinct time period per commune/Sangkat or per village (if village boundaries are available);
  - Map of existing energy supply system: This map displays current technical infrastructure networks and facilities for energy supply with their service coverage areas;
  - Map of agriculture and agro-processing economic profile and analysis: This map displays the major cropping and livestock systems and some overall information about local agro-processing/packaging;
  - Poverty map: This map shows the distribution of poverty across the district/municipality;
  - Map of soil type and soil fertility: This map shows the area with higher potential for agricultural production that should be preserved from industrialization or urbanization.

Step 4 Draft the Land Use Master Plan by Defining Integrated Spatial Development Strategies

Overall objectives

Spatial development strategies are based on the existing situation and aim for achieving the long-term goals, development objectives as well as the desired vision. They indicate how spatial development is to take place in the district/municipality to reach the long-term goals.

In order to ensure cohesion between territorial development strategies and existing development planning, the strategies are elaborated based on a so-called strategy matrix. The matrix articulates long-term development goals and development objectives (that are not necessarily spatially explicit) (Tasks 3.7 and 3.8) and spatially explicit development strategies including specific actions for implementation. A spatial development model is then elaborated which visualizes the essential conceptual elements of the future urban development. On that basis, the spatial development strategies and plans are further developed along key themes at commune/ Sangkat level. The actual Land Use Master Plan is developed by integration of these thematic strategies into plans at district/ municipal level (see Figure 15).

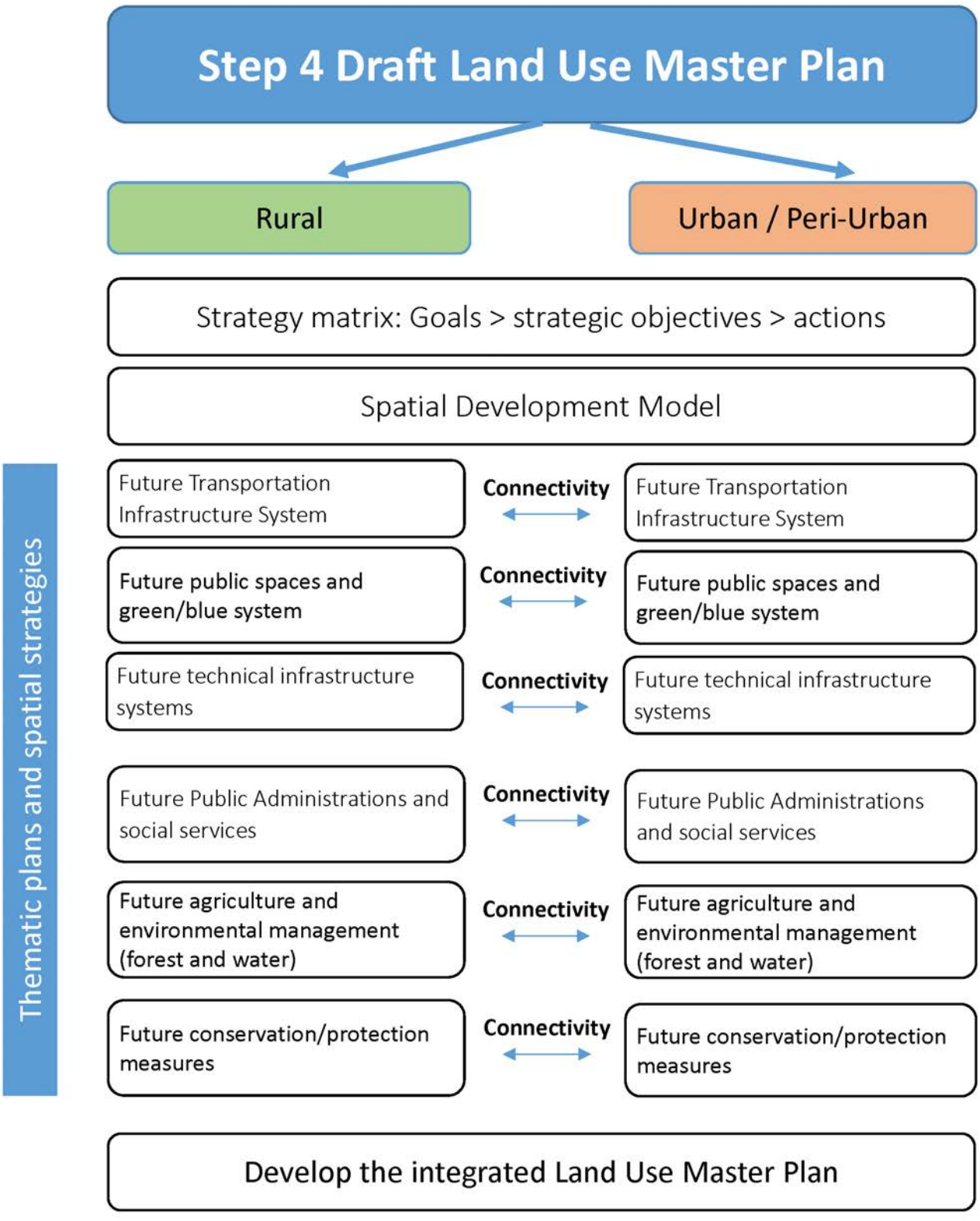


Figure 15 Articulations of tasks in Planning Step 4 - Develop the draft Land Use Master Plan

Task 4.1 Elaborate the Strategy Matrix

Overview

The strategy matrix summarizes long-term development goals and development objectives (that are not necessarily spatially explicit) (see Tasks 3.2 and 3.3) and corresponding spatial development strategies including specific action for implementation. The matrix is a key planning tool as it ensures cohesion between spatial development strategies and existing development planning within a unified planning framework at district/municipal level. At this stage, the matrix is initiated but will be updated and adjusted as the work proceeds throughout the subsequent tasks under Planning Step 4.

Who is involved?

- Initiation
  - District/Municipal Land Management and Urban Planning Working Group

Activities / methodology

The long-term development goals and objectives identified and validated in Tasks 3.2 and 3.3 are further detailed into spatially explicit spatial development strategies and necessary key actions for implementation. The exercise, conducted by the LMUP working group, will focus on identifying spatially explicit strategies for each development objective. The exercise can be demanding as possible contradictions/conflicts between sectors that may impede realization of the strategies need to be identified and addressed.

Necessary outputs

A draft strategy matrix is established that aligns (i) long-term development goals, (ii) development objectives, (iii) main activities and (iv) specific (spatially explicit) sub-activities required for implementation. An example of such a strategy matrix is given in the Annex (see Annex 4).

Task 4.2 Elaborate the Spatial Development Model with District / Municipal LMUP Committee

Overview

The spatial development model is elaborated based on the results of all planning tasks carried out thus far (situation analysis, scenario development, visioning and strategy matrix). The spatial development model is a simple and clear visualization of all essential conceptual elements that combine the spatial development strategies identified earlier. The design of the spatial development model is the key exercise that integrates the various aspects of the spatial development strategies. As such it can be seen as the overall guiding principle for the future spatial development of the district/municipality.

Who is involved?

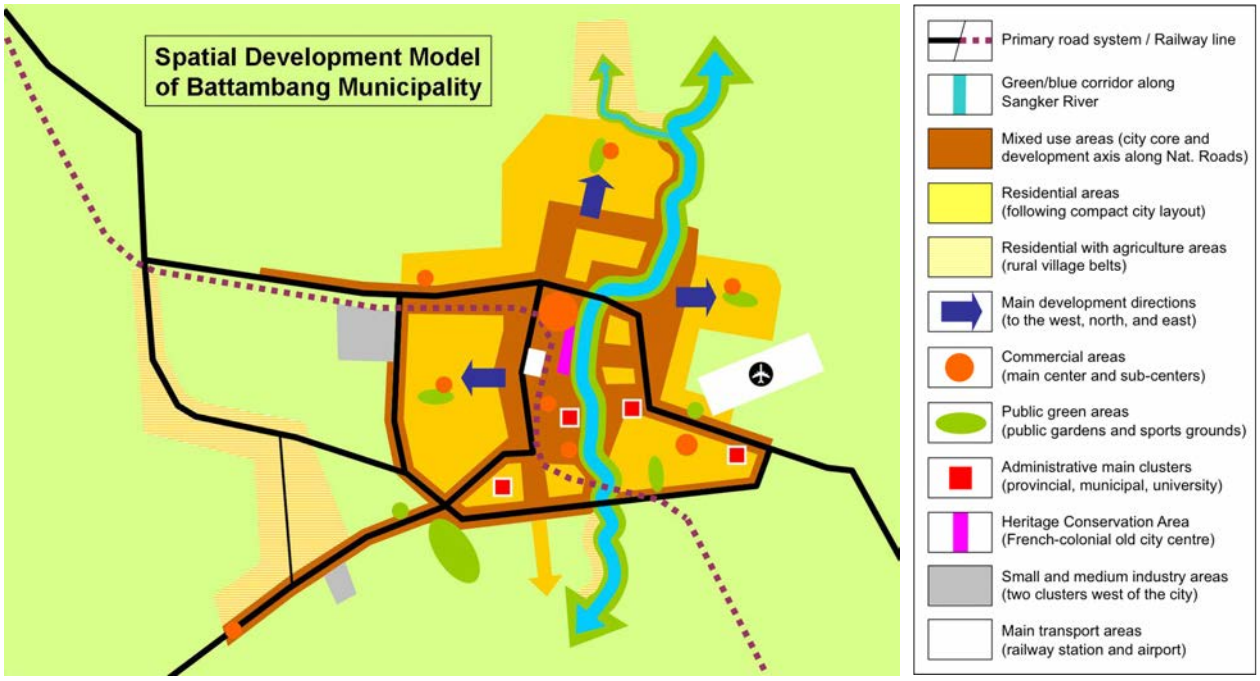
- Initiation and implementation
  - District/Municipal Land Management and Urban Planning Working Group
  - Database/GIS expert
- People involved in workshop
  - District/Municipal Land Management and Urban Planning Committee

Activities / methodology

- The design of the model is developed through a facilitated workshop attended by members of the LMUP Committee and Working Group. The results of previous tasks are supposed to be well known at this stage but the workshop should start with a brief presentation of the strategy matrix so to first reach an agreement on this. The spatial development model is meant to be spatially explicit but its main purpose is to give a general direction, a dynamic conceptual view on the future development of the district/municipality. The exercise consists of sketching out the important dimensions of the Land Use Master Plan (see Map 33):
  - The desired spatial structure of the district/municipality with the commercial and administrative/public service centers, industrial and other central development clusters;
  - The desired expansion of the settlement area with main growth directions and development corridors;
  - The main functional layout of residential areas, mixed use areas, industrial areas etc.;
  - The main structure of the future transport system (primary roads, railway, airport etc.);
  - The main structure of the future green/blue system (main public green spaces, water bodies etc.);
  - The planned conservation areas (both for buildable areas and control areas).

Necessary outputs

- The strategy matrix is agreed upon by the District/Municipal LMUP Committee.
- A unified simplified spatial development model on how the district/municipality might spatially evolve and look like in the future is drafted and agreed upon.



Map 33 Spatial Development Model for Battambang Municipality

Task 4.3 Draft thematic plans and strategies at district/municipal level

Overview

The different spatial plans and strategies are now developed and detailed on the basis of the overall spatial development model. The LMUP working group should proceed by plans or strategic sectors/themes; all detailed in a dedicated guideline (see hereunder).

Who is involved?

- Initiation and implementation
  - District/Municipal Land Management and Urban Planning Working Group
  - Database/GIS expert
- People involved in consultation and review
  - Relevant officials and/or other stakeholders for each thematic field

Activities/methodology

- The drafting of specific plans and thematic strategies proceeds through a series of thematic workshops bringing together the members of the LMUP working group and additional experts or stakeholders when needed or relevant. These could be representatives of district/municipal offices in charge of or relevant for each thematic field, non-governmental organisations/agencies and other experts.
- To enable the LMUP working group in this rather complex task, a guideline including key points and questions that need to be addressed is proposed hereunder.
- The strategies and actions identified in the strategy matrix and integrated in the maps and themes hereunder should be mentioned in the describing text that accompanies the respective maps to emphasize the link between the strategy matrix and the correspondingly developed maps.
- Present and discuss the results with District/Municipal Land Management and Urban Planning Committee.

Necessary outputs

- A series of draft strategies and thematic plans are consolidated at district/municipal level and produced along a guideline.

A guideline to develop thematic plans and spatial development strategies

4.3.1 Future transport infrastructure system

The main goal of this task is to prepare orientations for the development of rural and urban transport systems that are unified with spatial, land use, technical and social infrastructure plans to meet all future transport system demands. These important thematic strategies and plan should be conceptualized based on the situation analysis, the relevant development goals and objectives as well as the spatial development model. To achieve objectives such as (i) improved rural-urban transport linkages, (ii) improved connectivity among urban clusters and effective land use, (iii) convenient choice of and exchange between different (public and individual) transport modes, and (iv) improved road safety, etc., the plan should be based on corresponding strategies such as (i) rearranging the road network into a hierarchy of classified roads, (ii) adequate supply of missing road connections and necessary new main roads for access to new settlement areas, (iii) provision of safe and convenient inter-modal transport hubs, (iv) separation of intercity (regional) transport (transit traffic) from urban transport, and (v) support of public transport and pedestrian-friendly network etc.

The future transport infrastructure system plan should display the future internal network/system for rail, road, water and air transport infrastructure (including public transport services), integrated with the external network connecting to the province/region (Maps 34 and 35). It is recommended to pro-duce a plan covering the whole territory of the district/municipality as well as a plan in a larger scale showing the detailed concept for the future urban area(s). Existing and planned facilities should be differentiated. Be sure to consider the higher-tiers policy orientation on the sector as well as on-going and planned projects/programs. The future main transport infrastructure facilities and main road system will be subsequently integrated into the Land Use Master Plan (see Task 4.4). For relevant national standards and regulations regarding road transport infrastructure see section for transport system analysis under Task 2.2.

A functional road network hierarchy must assure the good accessibility of origins and destinations by networks with as direct as possible links and sufficiently wide driving lanes and sidewalks. The future road network consists of the primary, secondary and tertiary road system; it needs to be properly classified in hierarchic categories/road types according to their importance/function and size (see Table 17).

Table 17 Overview of road network hierarchy / road classification

	Road Type (Sub-Decree No 42)	**Classification (English name)**	**Function / Character**
Primary road system	(not included in Sub-Decree No 42)	Principal arterial roads (Connector roads)	Mostly national road level. Provide long-distance continuous routes within and between urban areas. Carry high volumes of (transit) traffic at higher vehicle speed. Traffic flows are controlled by road signs, divisional islands, traffic lights etc.
	Type 1 Roads	Arterial road	Mostly provincial road level. Continuous routes through rural/urban areas. Contain most of the urban commercial and institutional uses.
Secondary road system	Type 2 Roads	Collector roads (Distributor roads)	Mostly district/municipal road level. With continuity over short segments (0.4-0.8 km) collector roads gather traffic from numerous smaller streets and deliver it to and from arterial roads.
Tertiary road system	Type 3 Roads	Local roads	Mostly commune/village road level. Include all streets not on a higher system. They comprise 90 per cent of street lengths but carry less than 10 per cent of the total travel kilometres. The local roads may be short in length. Vehicle speeds are low.
	Type 4 Roads	Access roads	Give local access to plots inside a block, often as cul-de-sac with semi-private character.
	Type 5 Roads	Pedestrian lanes	Give priority to pedestrians, with limited or no motor vehicles. Often in commercial or tourism areas.

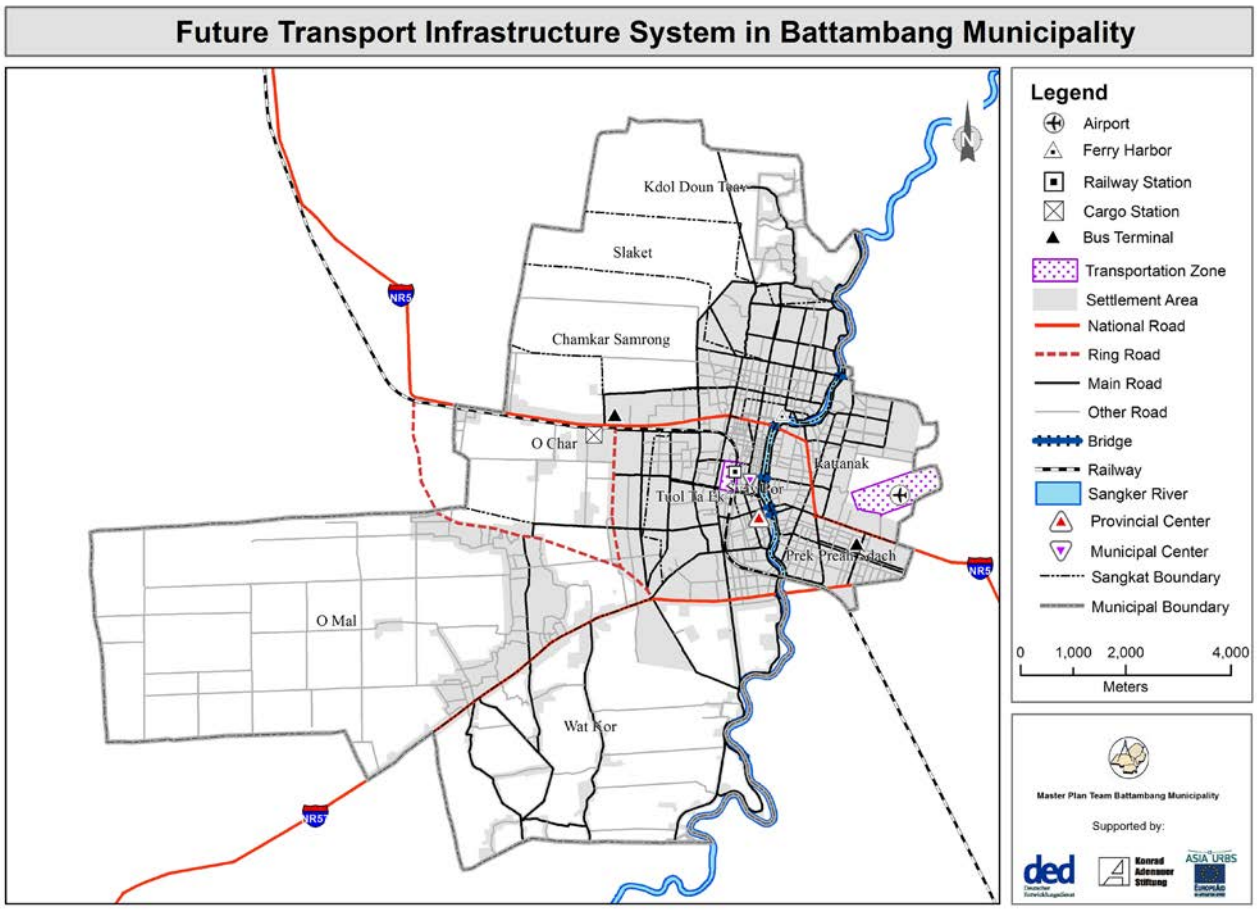
The road infrastructure is a very powerful planning instrument to guide future urbanization, as new road construction improves the accessibility of land, thus triggering new construction de-

velopment and land use change. As the future urban (buildable) area in the district/municipality will likely be expanded and population numbers/densities will increase, the transport strategies and plan have to be responsive, by securing adequate supply of (new) road infrastructure for the future settlement areas and the increased mobility demands of citizens and businesses. The future main road system consisting of primary and secondary roads needs to be decided upon and routes/road lines delineated in the plan, including new roads for urban extension areas, new road connections within or between existing settlements, planned ring roads or bypass roads etc. At the same time, it is important to consider the interrelation with and impacts on other thematic/sectoral aspects, such as environmental and disaster risk reduction strategies. For example, a new road construction crossing the river plains can block seasonal water flows and severely increase flood risks, and ring roads can actually trigger urban sprawl and un-controlled land use change, by giving access to former valuable agricultural land.

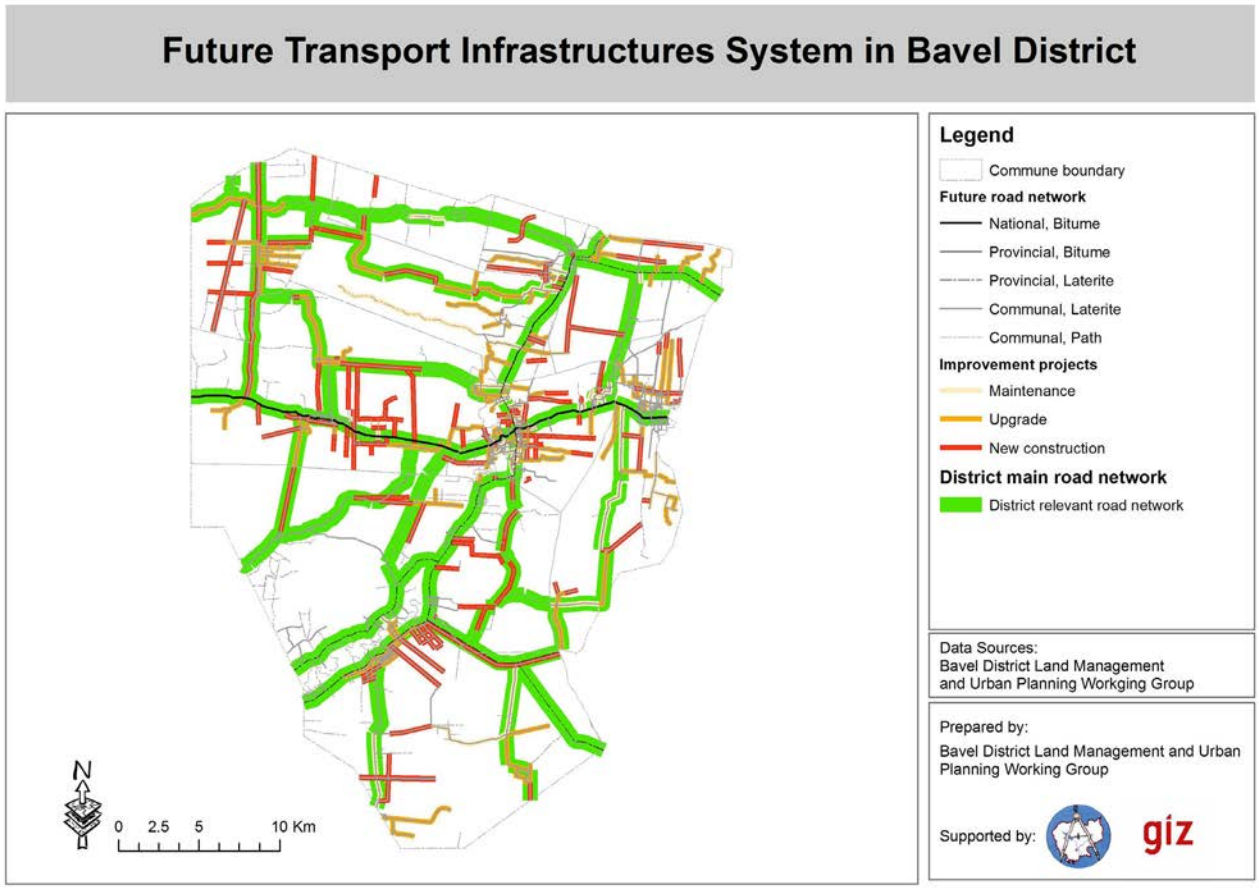
It is recommended to define the future road corridors (widths) for the main road system (primary and secondary roads) only, based on survey of the real situation and realistic assessment of technical/financial feasibility and expected social/environmental impacts. Within existing settlement areas, often there will not be the budget available to acquire private land for road widening or new connections by means of eminent domain (compulsory purchase for purposes of public utility) and proper compensation of private landowners.

For practicability and efficiency reasons, it is recommended not to determine the location of the tertiary road system (local roads, access roads etc.) in the Land Use Master Plan, as this can only be effectively done during detailed (project) planning for specific areas, and should be based on detailed case-by-case assessment of each specific situation and expected impacts. Optionally, this detailed planning work can be included in the Land Use Planning process (see Planning Step 6).

Finally, it will be essential to enforce national technical standards and regulations also for private residential developments (so-called 'Boreys') (see Sub-Decree No 42, Royal Government of Cambodia 2015), so as to secure the external connectivity of these areas to the existing road network as well as a sufficient share of land for public roads and parking space internally in those private compounds.



Map 34 Future transport infrastructure system in Battambang Municipality



Map 35 Future transport infrastructure system in Bavel District (Battambang Province)

4.3.2 Future public spaces and green/blue system

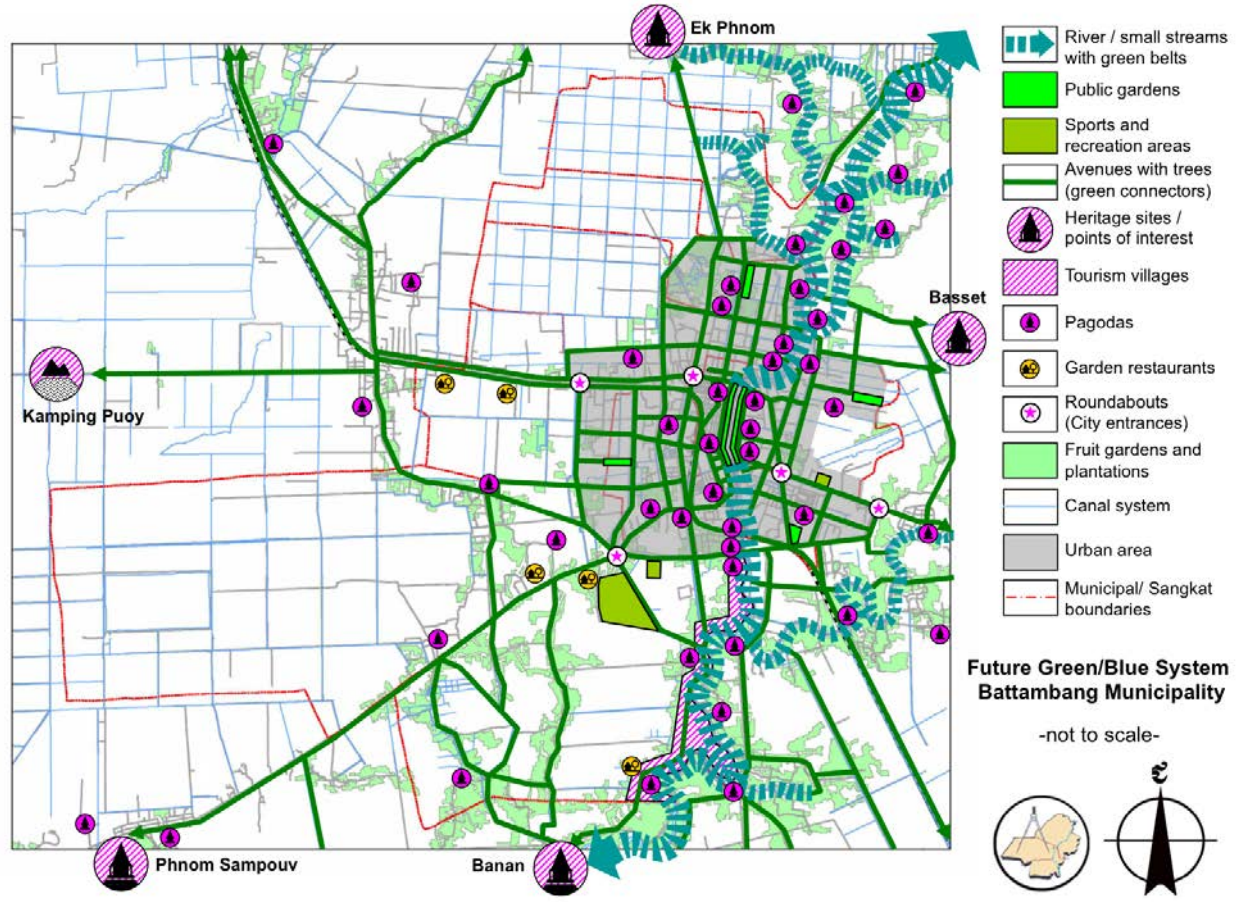
These important thematic strategies and the corresponding plan should be conceptualized based on the situation analysis (see Task 2.2), the relevant development goals and objectives as well as the spatial development model. To achieve objectives such as (i) improved environmental and health conditions, (ii) enhanced attractiveness of the townscape, (iii) good accessibility to and quality of green spaces and recreation areas for all citizens, (iv) improved resilience to climate change and natural disasters etc., the plan should be based on corresponding strategies such as (i) connectivity of green spaces and water bodies to from a green/blue network, (ii) provision of adequate new public parks and recreation areas for existing settlements as well as urban extension areas, (iii) planting of roadside trees along suitable main road system, (iv) enhanced provision and use of public green spaces and other suitable open spaces for flood prevention, storm water retention etc.

The plan should display the location and function of future internal 'blue and green' network with public gardens and squares, semi-public areas with green character, sports and recreation areas, cultural heritage sites and points of interest, main tree-lined avenues, green corridors, main water bodies etc., as well as the external connectivity to the surrounding landscape. It is recommended to produce a plan covering the whole territory of the district/municipality as well as a plan in a larger scale showing the detailed concept for the future urban area(s). Existing and planned facilities should be differentiated (see Maps 36 and 37). Major public green spaces and recreation areas will be subsequently integrated into the Land Use Master Plan (see Task 4.4). For relevant national standards and regulations regarding public spaces and green areas see Articles 45 to 47 of Sub-Decree No 42 on Urbanization of the Capital, Municipalities and Urban Areas (Royal Government of Cambodia 2015).

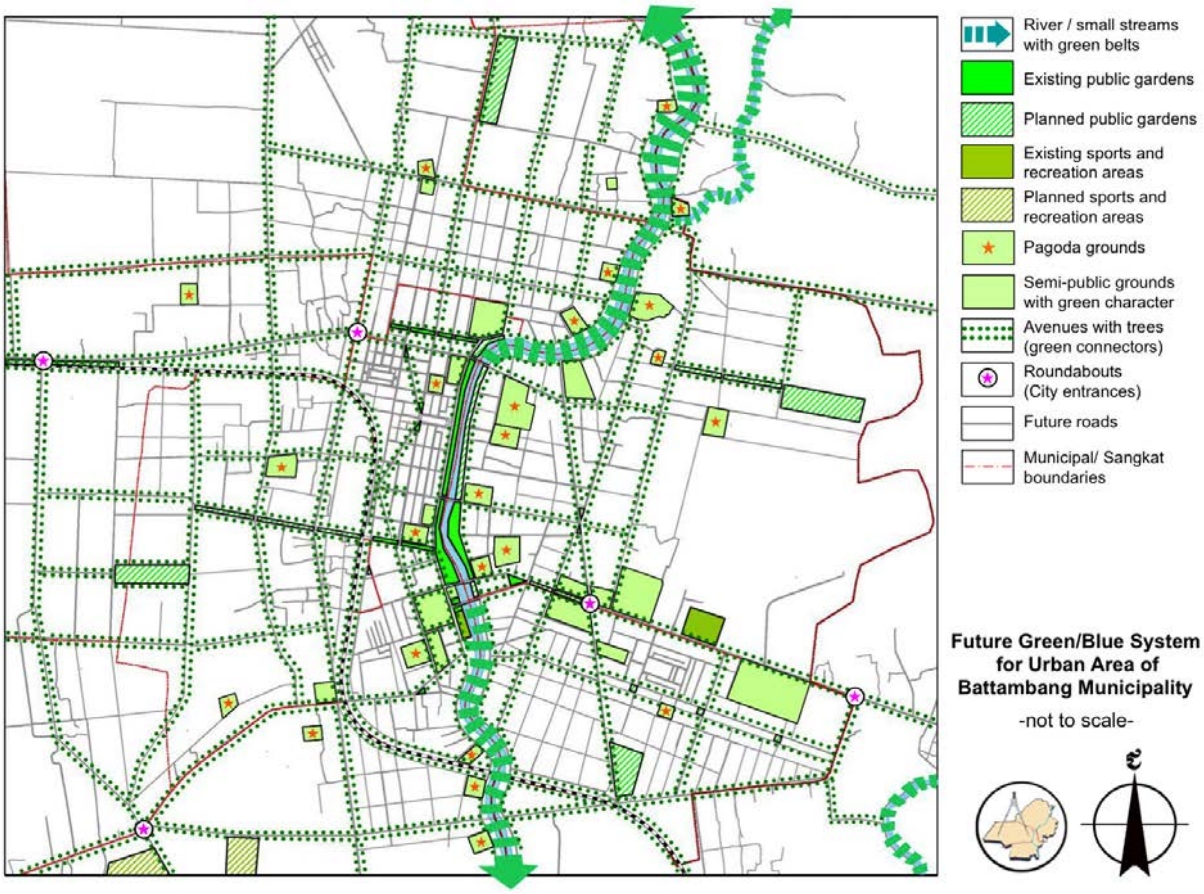
As the future urban (buildable) area will be expanded and population numbers will likely increase, the strategies and plan have to be responsive, by securing adequate supply of (new) public green spaces for the future urban areas and its citizens. Responsible line-offices and departments will need to be involved to discuss and identify future needs and adequate provision of facilities in suitable locations. It will be a challenge to find land in suitable locations for new/additional public facilities, as most often there will not be the budget available to acquire private land for this purpose by means of eminent domain (compulsory purchase for purposes of public utility) and proper compensation. It is therefore essential for the LMUP Working Group to have clear information on (public/private) state land in the district/municipality and to involve the responsible authorities in determining which areas are feasible for future use as public green spaces and recreation areas. Roadside public gardens (in-between the public road corridor/right-of-way), as well as public embankments (corridors) of water bodies should be considered for future use as public green spaces, while taking care to minimize negative impacts on existing land uses. Furthermore, improving the standards/quality and accessibility of existing public or semi-public green spaces will significantly contribute to a functioning green/blue network and im-proved living conditions in the district/municipality. Finally, it will be essential to also enforce national technical standards and regulations for private residential developments (so-called 'Boreys') (see Sub-Decree No 42, Royal Government of Cambodia 2015), so as to secure a sufficient share of land for public green spaces and recreational areas in those private compounds.

It is important to consider the various important functions of green/open spaces (see Task 3.1) especially for urban areas, that interrelate with other thematic/sectoral aspects, such as environmental and disaster risk reduction strategies. For example, with future impacts of climate change on rainfall patterns/severity and flooding, there will be increasing demand for 'room for water', while urbanization at the same time will increase building densities/surface sealing ratios and threatens to convert essential open water drainage and retention spaces. Here open green spaces have an important function for water retention and thus flood prevention. Also, with urban growth and conversion of agricultural land to settlement areas, there is a risk of losing valuable farmland for food production and water retention landscape in close proximity to the city/town. Here open green spaces, including selected waterbodies can limit disorderly and destructive 'urban sprawl' (uncontrolled and haphazard urban growth), e.g. by foreseeing a green belt consisting of 'control'

areas (forest, agriculture, water bodies etc.) around the future settlement area. Any measures to protect and management water bodies that have ecological significance need to be based on results from task 3.1 (13 - Public spaces and green/blue system) and task 3.2 (Environmental analysis).



Map 36 Future green/blue system in Battambang Municipality



Map 37 Future green/blue system in urban area of Battambang Municipality

4.3.3 Future technical infrastructure systems

The main goal of this task is to prepare orientations for the development of urban technical infrastructure systems that are unified (integrated) with spatial, land use, transport and social infrastructure plans to meet all future technical infrastructure system demands. The LMUP Working Group has the task to formulate the general technical infrastructure plans that give guidance to the detailed future facility plans to be elaborated by the sector agencies in such a way that it can effectively support the urban development process in line with the vision and development goals/ objectives as well as the spatial development model. The results of this task are:

- Sectorial strategies, target indicators, locations and technical specifications of key facilities;
- Orientations for water supply, rainwater drainage and flood prevention, sewerage and wastewater treatment, solid waste collection and treatment services, energy supply (and pub-lic lighting).

To achieve objectives such as: (i) improved sanitation and enhanced area coverage (based on target indicators/ratios), (ii) protection of urban/settlement areas from flood disasters, (iii) reduced waste pollution in residential areas, (iv) improved quality of electricity supply for households and businesses etc., the plan(s) should be based on strategies such as: (i) protect freshwater sources and improve/expand treatment facilities and distribution system, (ii) build wastewater collection and treatment system to cover the future urban areas, (iii) improve capacities of drainage system, combine with irrigation network and build dykes (iv) increase collection, develop solid waste treatment plant and technical landfill site, and promote 3R system (reduce, reuse and recycle), (v) improve and expand elec-tricity network, etc.

The plan(s) should display the exact location and function of future major technical infrastructure facili-ties and their coverage areas. Existing and planned facilities should be differentiated (see Maps 38-41). Major technical infrastructure facilities (see Table 18) will be subsequently inte-

grated into the Land Use Master Plan (see Task 4.4).

As the future urban (buildable) area will likely be expanded and population numbers will increase, the strategies and plan(s) have to be responsive, by securing adequate supply of (new) technical infrastructure services for the future urban areas and citizens. Responsible line-offices and departments as well as utility companies will need to be involved to discuss and identify future needs and adequate provision of facilities in suitable locations (see Table 19):

- Forecast future demands and analyse the gaps, including the identification of target indicators as a main activity of demand forecasting;
- Target indicators should be identified with reference to national standards but also with considerations to the future economic conditions and way of life in the city;
- Develop sector strategies for and overall regulations on technical infrastructure based on the future vision and development goals, the target indicators, demand forecasts and supply-demand gaps in the future.

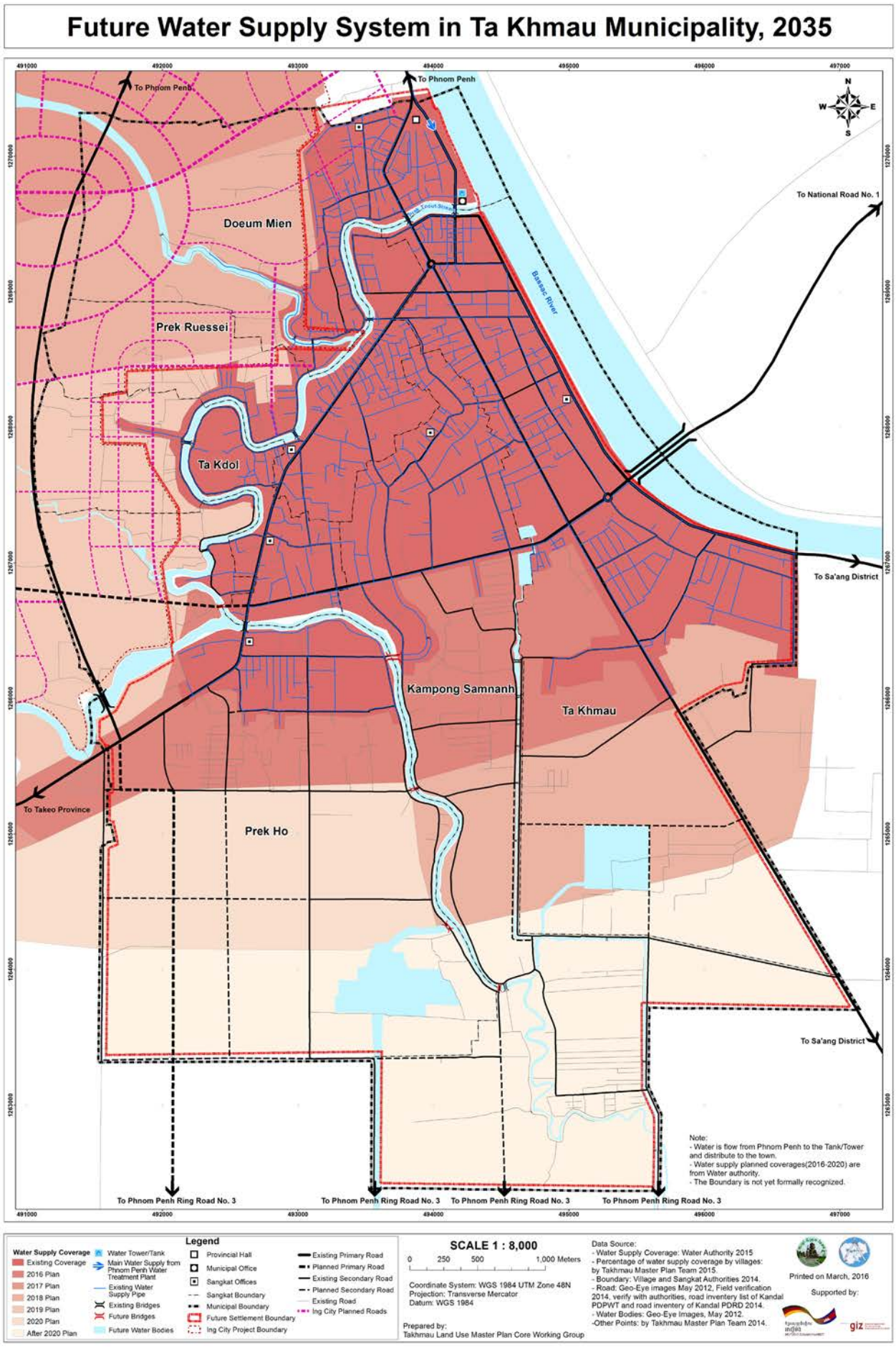
Table 18 Major technical infrastructure facilities

Sector	Infrastructure facility	Indicative item on integrated LUMP	Contents
Water supply	Coverage		
	Distribution network		
	Water supply facility	X	Location and size of intake and plant
Sewerage	Coverage		
	Main sewerage network		
	Sewerage facility	X	Location and size of treatment plant
Drainage	Drainage reservoir/ basin	X	Location and size of reservoirs/ basins
	Drainage network	X	Location and size of pumping stations
	Ground level by area/ main street		
Solid waste	Transfer station	X	Location and size of transfer stations, treatment plant and landfill
	Treatment plant	X	
	Waste disposal site	X	
Energy supply	Power source	X	Location and size of power plant
	Transfer and distribution network	X	Location of high voltage grid
	Transformer station	X	Location and size of transformer

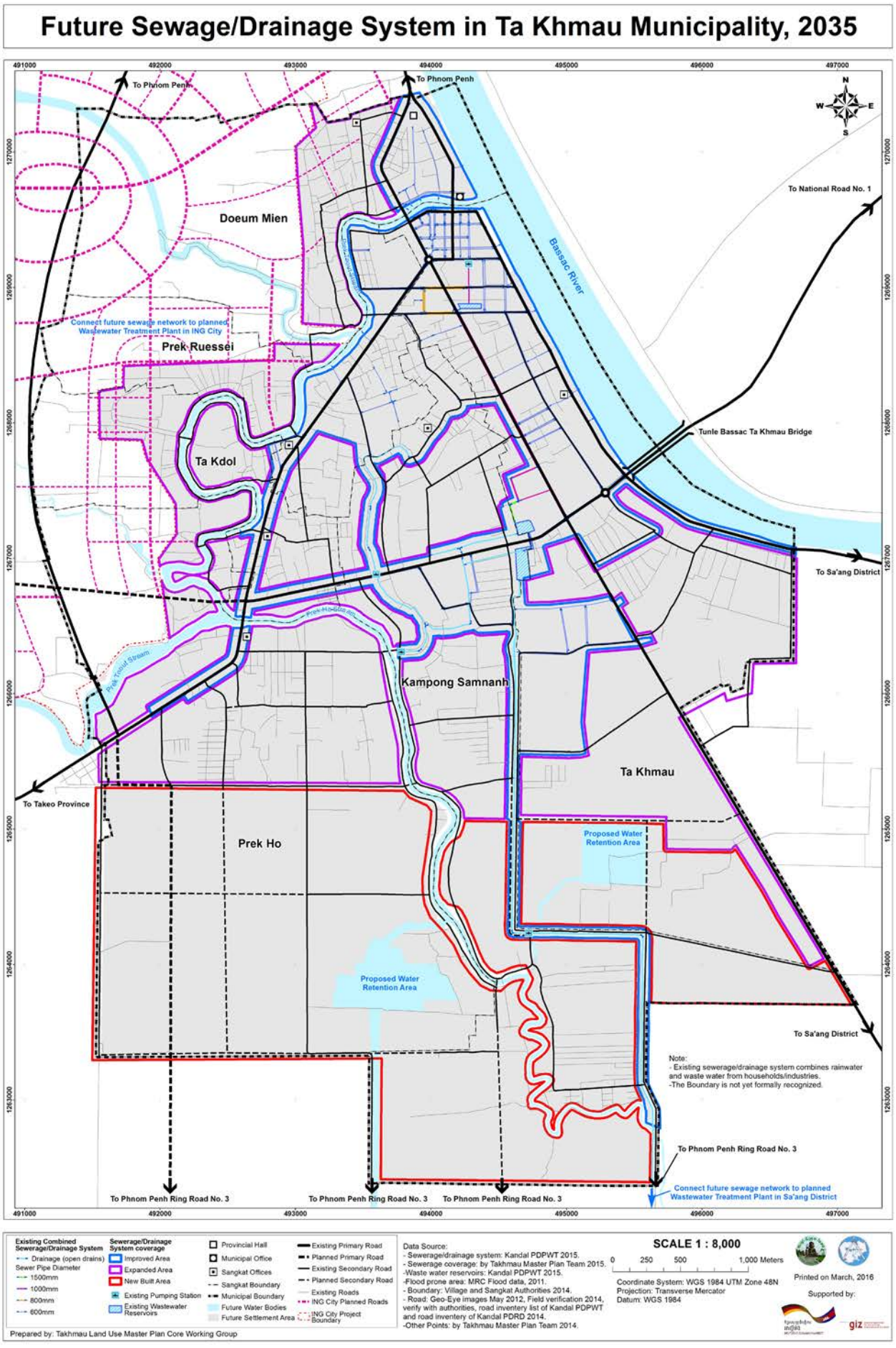
Table 19 Demand forecast and gap analysis overview

Sector	Future demand							Current capacity	Future gap
	Domestic/Households					Other (Industrial etc.)	Total		
	Consumption unit	Scope	Demand volume	Loss	Supply voume				
Water supply	(l/day/head)	(in %)	(m3/day)	(in %)	(m3/day)	(m3/day)	(m3/day)	(m3/day)	(m3/day)
Sewerage	(l/day/head)	(in %)	(m3/day)	-	(m3/day)	(m3/day)	(m3/day)	(m3/day)	(m3/day)
Solid waste	(kg/day/head)	(in %)	(ton/day)	-	(ton/day)	(ton/day)	(ton/day)	(ton/day)	(ton/day)
Energy supply	(kWh/day head)	(in %)	(kWh)	(in %)	(kW)	(kW)	(kW)	(MW)	(MW)

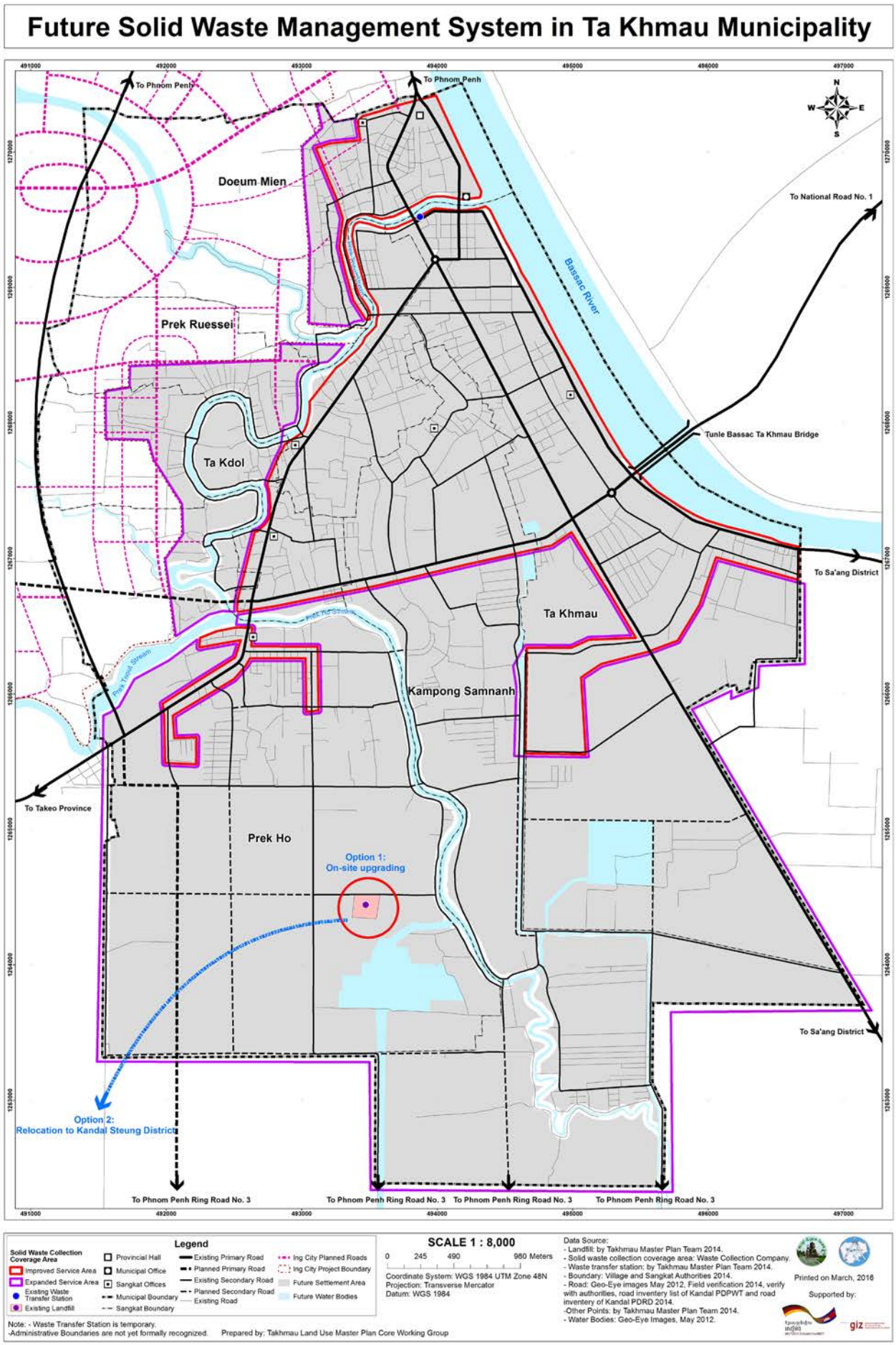
It will be a challenge to find land in suitable locations for new/additional technical infrastructure facilities (water and wastewater treatment plants, waste treatment and disposal sites etc.), as most often there will not be the budget available to acquire private land for this purpose by means of eminent domain (compulsory purchase for purposes of public utility) and proper compensation. It is therefore essential for the LMUP Working Group to have clear information on (public/private) state land in the district/municipality and to involve the responsible authorities in determining which areas are feasible for future use as technical infrastructure zones. Public road corridors (rights-of-way) need to be sufficiently dimensioned to allow the future integration or upgrading of technical infrastructure networks, while taking care to minimize negative impacts on existing land uses. Improving the standards/quality and coverage of the existing infrastructure networks will significantly contribute to a functioning system and improved living conditions in the district/municipality. Finally, it will be essential to enforce national technical standards and regulations also for private residential developments (so-called 'Boreys') (see Sub-Decree No 42, Royal Government of Cambodia 2015), so as to secure the external connectivity of these areas to the existing infrastructure networks as well as a sufficient supply of technical infrastructure services inside those private compounds.



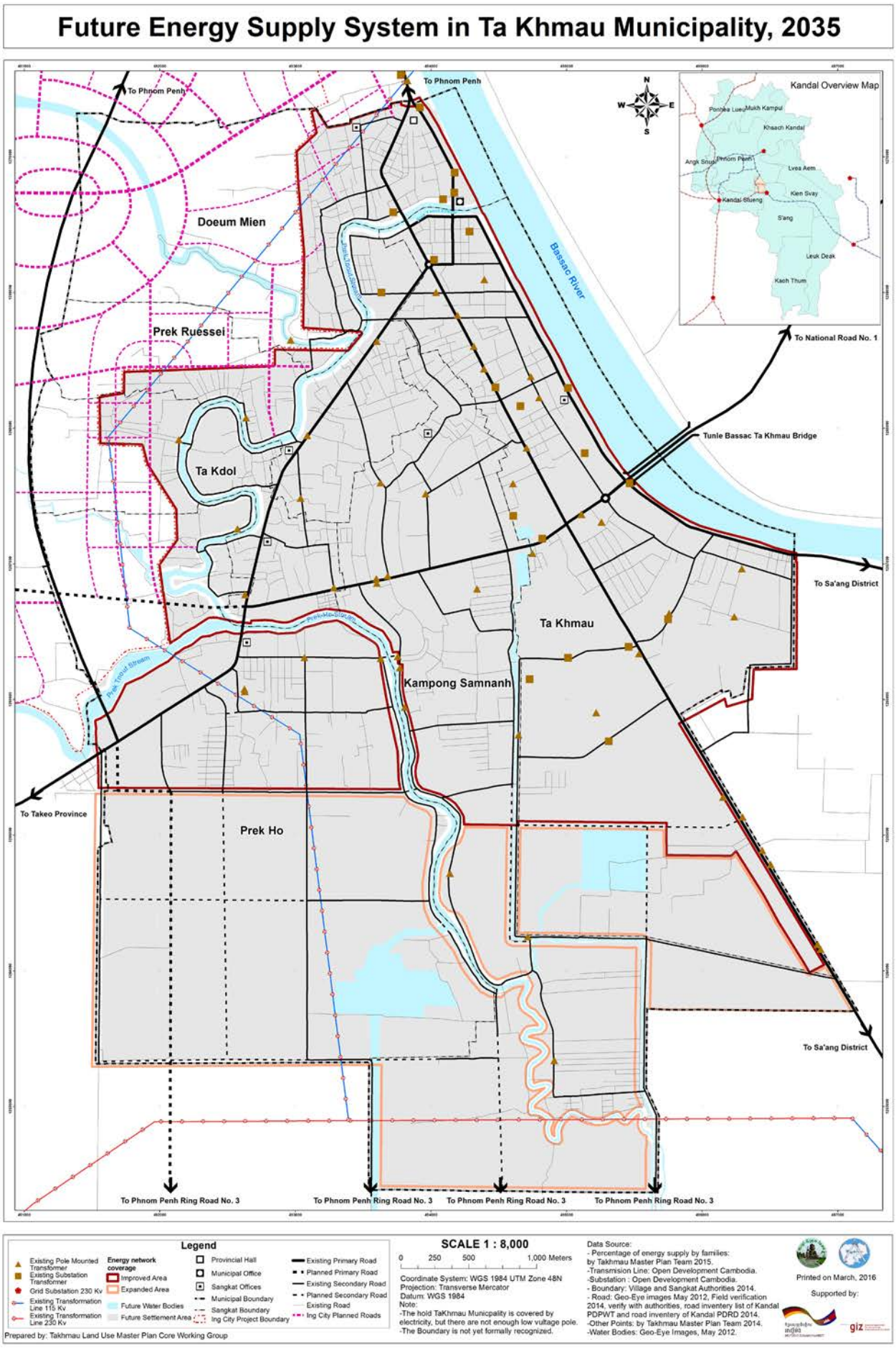
Map 38 Future water supply system in Ta Khmau Municipality (Kandal Province)



Map 39 Future sewage/drainage system in Ta Khmau Municipality (Kandal Province)



Map 40 Future solid waste management in Ta Khmau Municipality (Kandal Province)



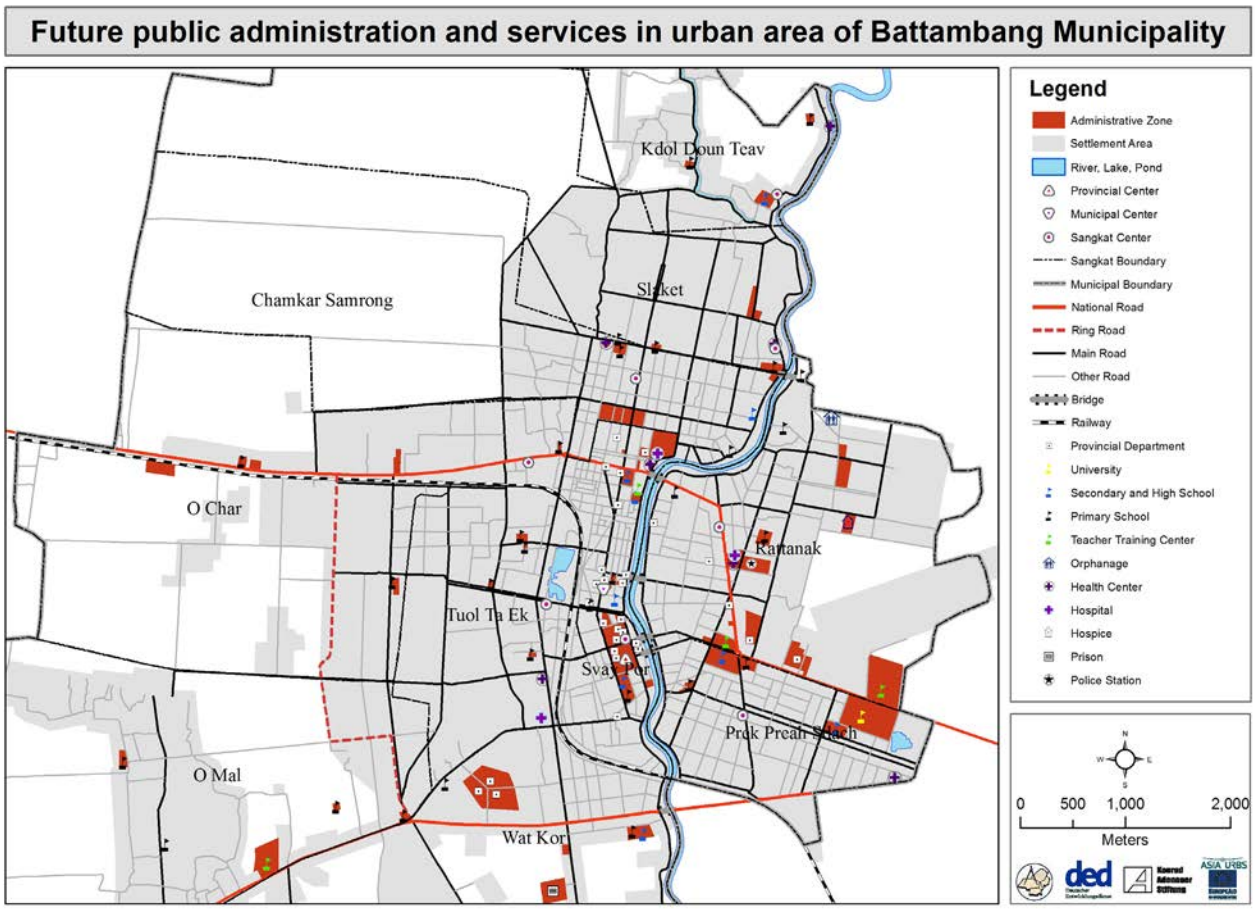
Map 41 Future energy supply system in Ta Khmau Municipality (Kandal Province)

4.3.4 Future public administration and social services

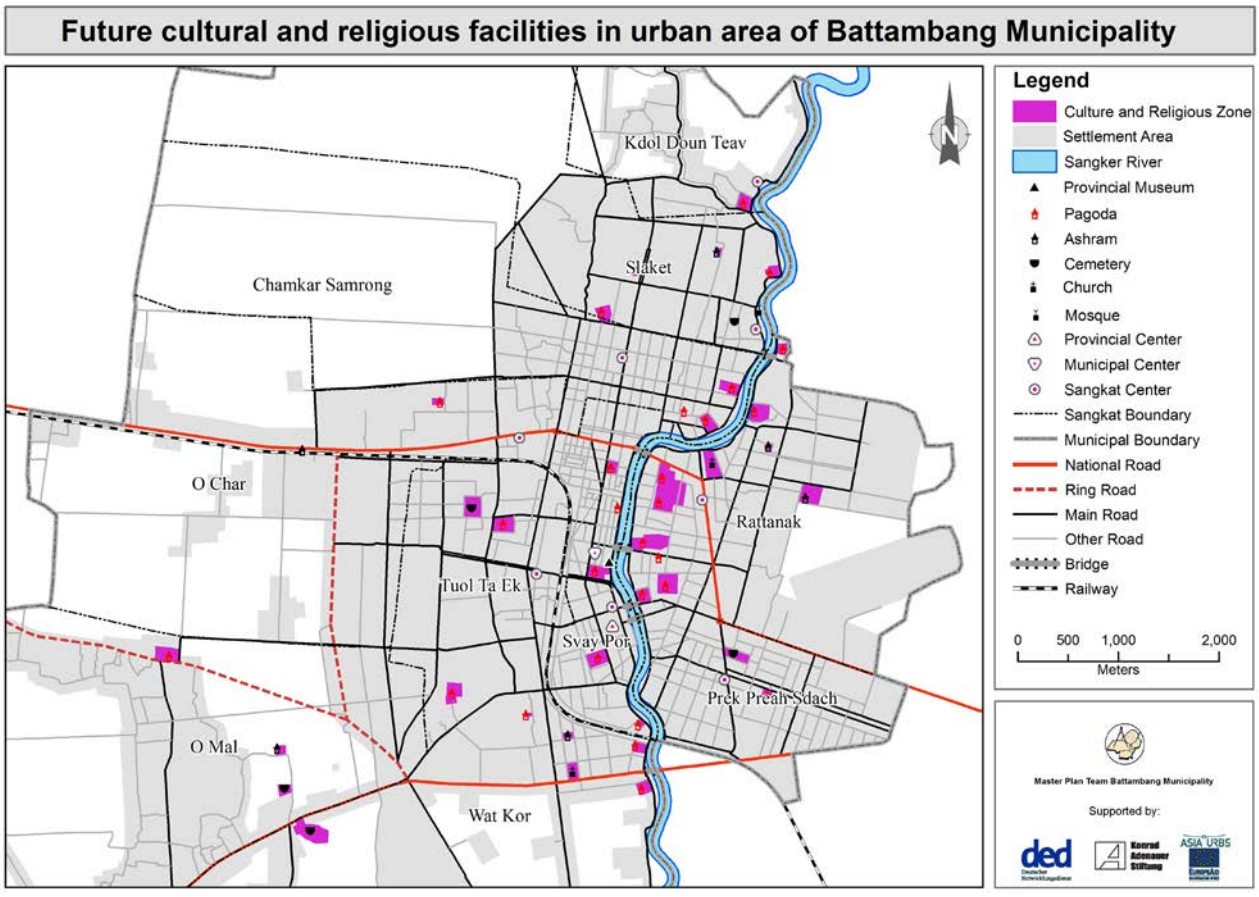
These important thematic strategies and the corresponding plan should be conceptualized based on the situation analysis, the relevant development goals and objectives as well as the spatial development model. To achieve objectives such as (i) inclusive access for all citizens to improved education and health facilities and services, (ii) inclusive access to improved administrative services on all levels (provincial, district/municipal, commune/Sangkat and villages) (iii) improved social stability and coherence between different social groups etc. the plans should be based on strategies such as: (i) securing the provision of adequate administrative and social facilities for the future population with sufficient coverage and easy access in existing settlements as well as for new settlement areas, (ii) provision of adequate locations (land use zones) for necessary extension or relocation of existing administrative and social facilities as well as necessary new facilities, (iii) provision of adequate facilities for groups with special needs (youth and elderly people, disabled, orphans etc.) (iv) enlarged capacities and quality of vocational training centres and higher education facilities, etc.

The plan should display the exact location and function of future service facilities, including administrative facilities (offices and departments at provincial, district/municipal and commune/Sangkat levels, post, police, fire brigade etc.), healthcare facilities (provincial hospital, health centers, health points etc.), educational facilities (kindergartens, primary and secondary schools, high schools and universities, vocational training centers etc.), and other social services (homes for the elderly, youth centers, rehabilitation centers, orphanages etc.). It is recommended to produce a corresponding plan displaying the future location and functions of all cultural and religious facilities in the district/municipality (mu-seums, theatres, concert halls, temples, pagodas, churches, mosques etc.). Existing and planned facili-ties/locations should be differentiated in both plans (see Maps 42 and 43) Administrative and social service facilities will be subsequently integrated into the Land Use Master Plan (see Task 4.4).

As the future settlement (buildable) area in the district/municipality will likely be expanded and population numbers will increase, the strategies and plan have to be responsive, by securing adequate supply of (new) administrative and social services (particularly in education and health sectors) for the future settlement areas and its citizens. Responsible line-offices and departments will need to be involved to discuss and identify future needs and adequate provision of facilities in suitable locations. It will be a challenge to find land in adequate locations for new/additional public facilities, as most often there will not be the budget available to acquire private land for this purpose by means of eminent domain (compulsory purchase for purposes of public utility) and proper compensation. It is therefore essential for the LMUP Working Group to have clear information on (public/private) state land in the district/municipality and to involve the responsible authorities in determining which areas are feasible for future use as public administration and social service facilities. Furthermore, enhancing the capacity and accessibility of existing social infrastructure facilities can significantly contribute to improved ac-cess and service supply in the district/municipality. Finally, it will be essential to enforce national technical standards and regulations also for private residential developments (so-called 'Boreys') (see Sub-Decree No 42, Royal Government of Cambodia 2015), so as to secure a sufficient share of land for social services (kindergartens, primary schools etc.) in those private compounds.



Map 42 Future public administration and services in urban area of Battambang Municipality



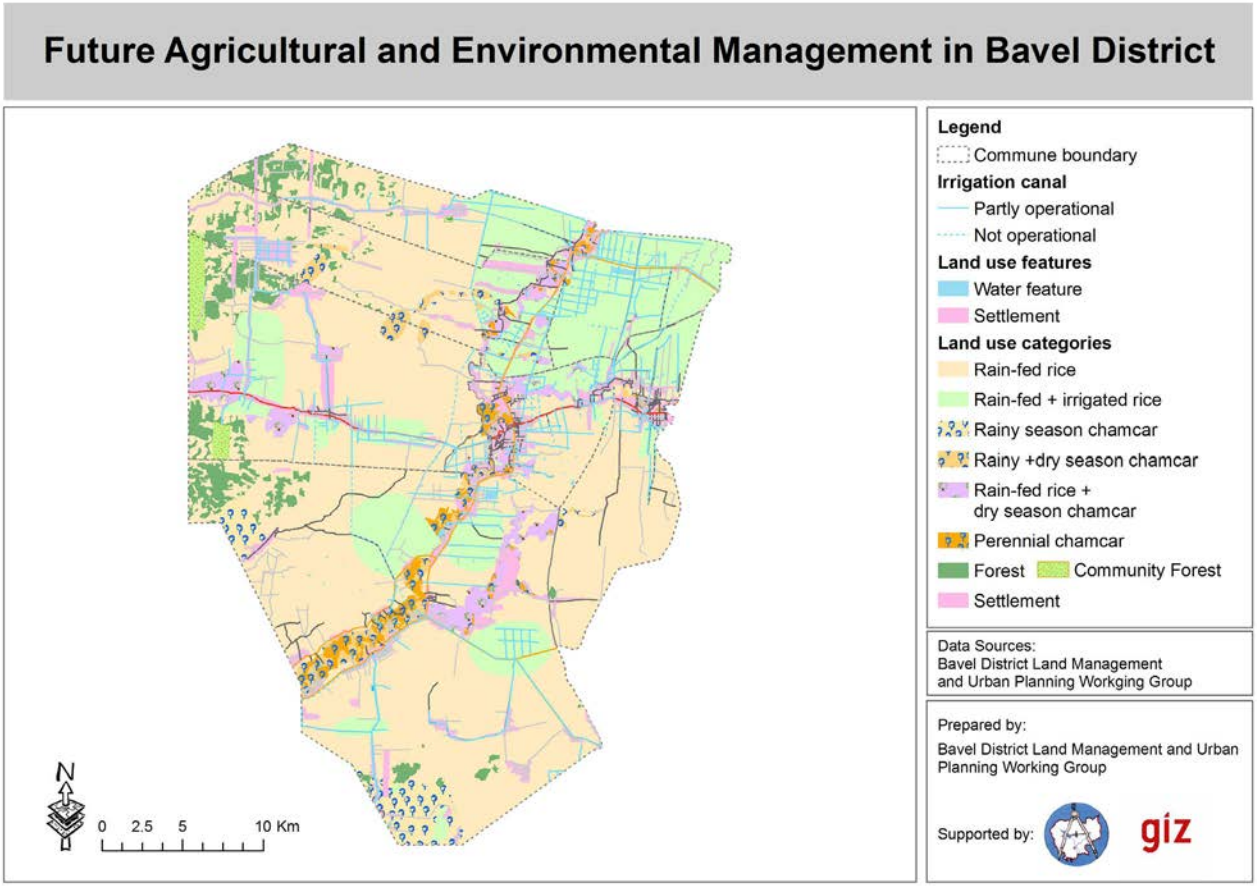
Map 43 Future cultural and religious facilities in urban area of Battambang Municipality

4.3.5 Future agriculture and environmental management (forest and water)

To achieve rural development objectives, an important set of themes to be addressed is the nexus between agriculture, forestry and water management that is central in land management and local livelihood strategies. As far as agriculture is concerned, strategies should be based on the possibility for intensification and/or diversification of the production, particularly through small-scale multi-purpose farming systems and along with it, the possibility to expand irrigation schemes. Forms of agriculture that are not family-based can be envisaged such as swidden agriculture (particularly in regions populated by indigenous people) or annual/perennial crop plantations. However, the possibility to establish medium to large scale annual or perennial cash crop plantations should be carefully studied in relation with potential impacts on the existing family-scale cropping system. Along with future agricultural management, key measures to manage and protect important water sources should be envisaged. Future forest management needs to be elaborated in line with future green systems. Areas where forest needs to be maintained should be clearly identified.

This plan should display (Map 44):

- Future irrigation scheme including infrastructure, water reservoirs and command perimeters;
- Intended location of the different types of cropping system (rice, non-rice annual and perennial crops);
- Water bodies that will have relevance for the development of agriculture (reservoirs, lakes, etc.);
- Wetlands and any terrestrial and aquatic transition areas;
- Pastures or meadow that are relevant in grazing;
- Forested areas.

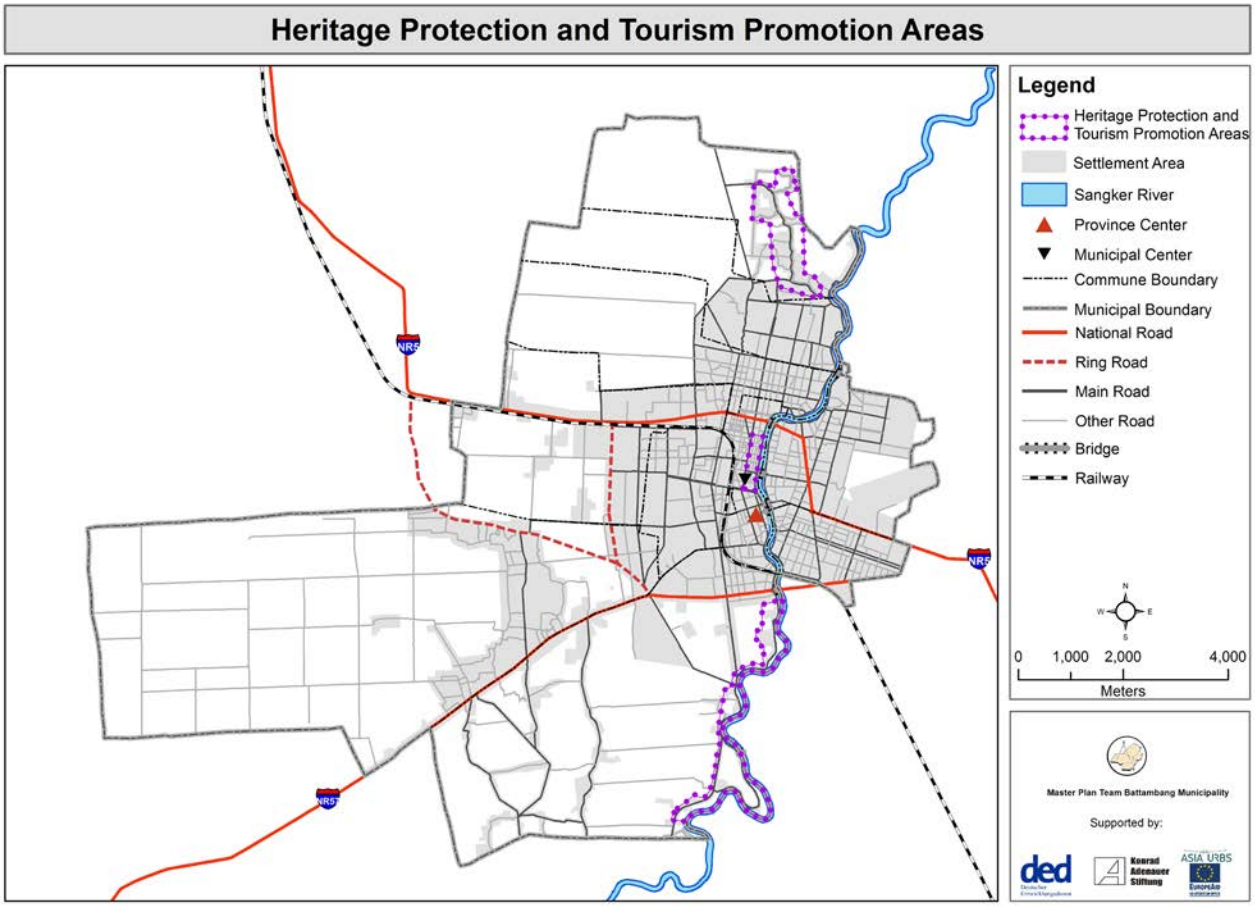


Map 44 Future agricultural and environmental management (forest and water) in Bavel District (Battambang Province)

4.3.6 Future conservation / protection measures

To realize the intended vision and development goals, conservation measures might be necessary to protect both built-up (e.g. cultural heritage) and natural areas, be it forest, wetlands, or particular landscape that has particular ecological or cultural relevance. Any of these areas should be given particular attention because of their unique features and/ or character. Their development shall be carefully observed and all changes be assessed and further regulated in the future. Purpose and focus for these areas can be varied (environmental protection, cultural heritage protection, tourism promotion, etc.), but corresponding conservation strategies have to be elaborated.

This plan should indicate any of the areas that need specific forms of conservation/protection and the type of protection envisaged (see Map 45 and Table 20). All areas for conservation/protection will be subsequently integrated into the Land Use Master Plan (see Task 4.4).



Map 45 Future areas for heritage protection and tourism promotion in Battambang Municipality

Table 20 Land use types and protection measures

Land use types	Forms of protection
Forest	Protected areas and protection forest previously managed by MAFF (Ministry of Environment) Community Forestry Community Protected Area Protection status and measures recognized by any other ministry/international organization Any other forms of place-based protection measure (DEIKA)

Wetland	Community fisheries Protection status and measures recognized by any other ministry/international organization Any other forms of place-based protection measure (DEIKA)
Water	Community fisheries Protection recognised by Ministry of Water Resources and Meteorology Protection status and measures recognized by any other ministry/international organization Any other forms of place-based protection measure (DEIKA)
Landscape/eco-system	Protection measures recognized by Ministry of Environment Protection status and measures recognized by any other ministry/international organization Any other forms of place-based protection measure (DEIKA)
Cultural/Built heritage	Protection status and measures recognized by Ministry of Culture and Fine Arts Protection status and measures by Ministry of Religions and Cults Protection status and measures recognized by any other ministry/international organization Any other forms of place-based protection measure (DEIKA)

Task 4.4 Draft the integrated Land Use Master Plan

Overview

The different thematic plans and strategies conducted earlier are now integrated into the actual Land Use Master Plan. The differentiation of specific land use types follows the same classification given above (see Table 2, Task 3.1). The detailed regulatory ordinance regarding functional land use (permit-ted and prohibited uses per land use type) and form-based (building regulations) will be developed from the Land Use Master Plan during subsequent elaboration of the legally binding Land Use Plan (see Part B - Elaboration and Approval of the Land Use Plan). The different types of land use are integrated into one plan based on the situation analysis, the spatial development model and the thematic plans and strategies. The exercise will raise many discussions and the identification of contradiction between sectors or claims on land that will have to be addressed and resolved. Down the line, specific calcula-tions are done to make sure that the future demand for housing areas is matched with the housing land supply proposed in the integrated Land Use Master Plan.

Who is involved?

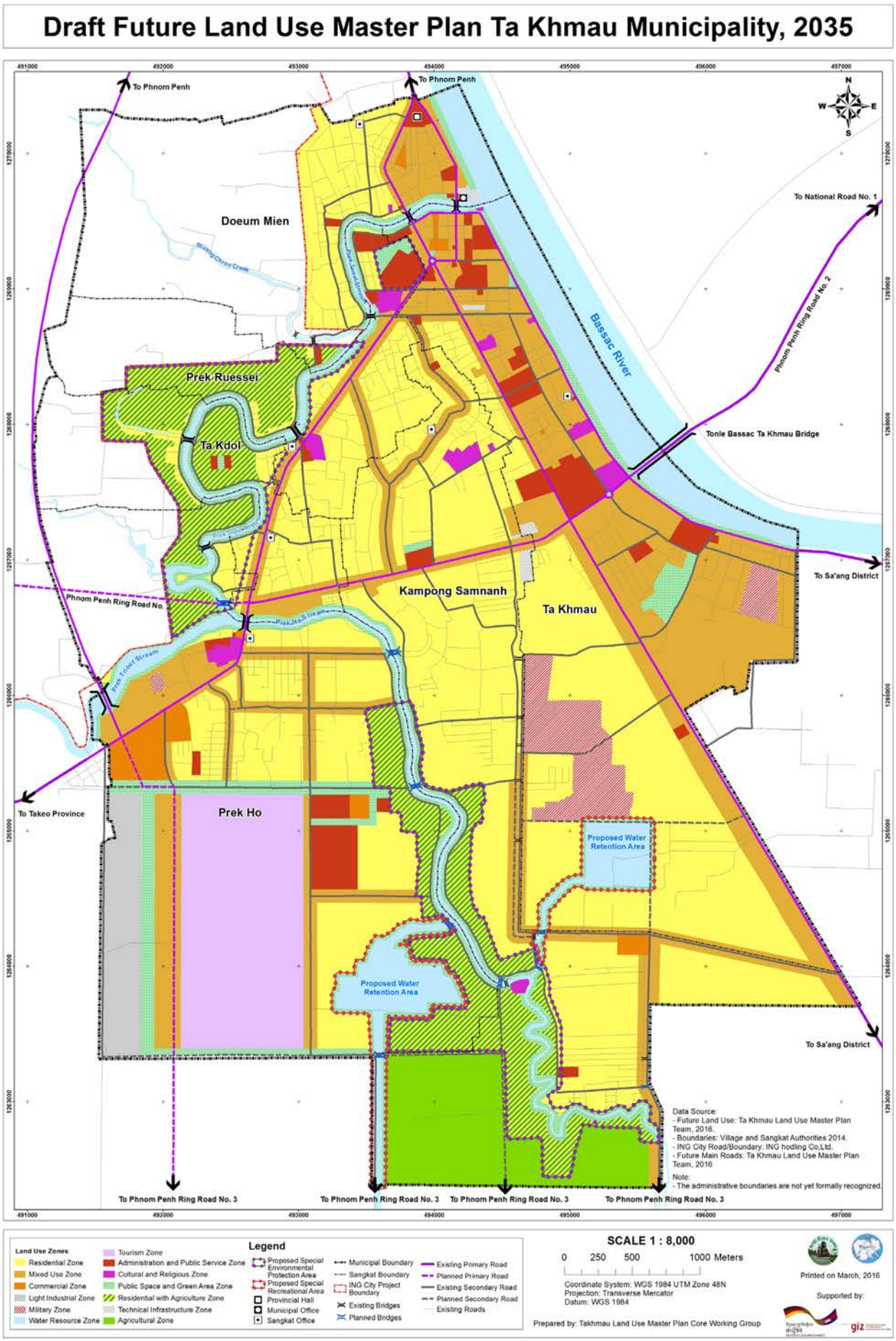
- Initiation and implementation
  - District/Municipal Land Management and Urban Planning Working Group
  - Database/GIS expert
- People involved in consultation and review
  - District/Municipal Land Management and Urban Planning Committee

Activities / methodology

- The integrated Land Use Master Plan is developed during a workshop which involves the LMUP Working Group and the GIS expert. The process is assisted with GIS tools. The work starts from the existing land use map and proceeds by gradual adjustment following the spatial development model and integrating the spatially explicit contents of the different thematic plans and strategies. The LMUP Working Group further delineates the future transport

infrastructure system and integrates and delineates the necessary land use zones for future residential, mixed use, commercial and industrial uses. The relevant facilities of other spatial development strategies (e.g. existing and future public parks, social facilities such as schools and health centres, technical infrastructure facilities such as wastewater treatment plants, waste disposal sites, etc.) are also integrated and delineated with corresponding land use zones into the integrated Land Use Master Plan (see Map 46).

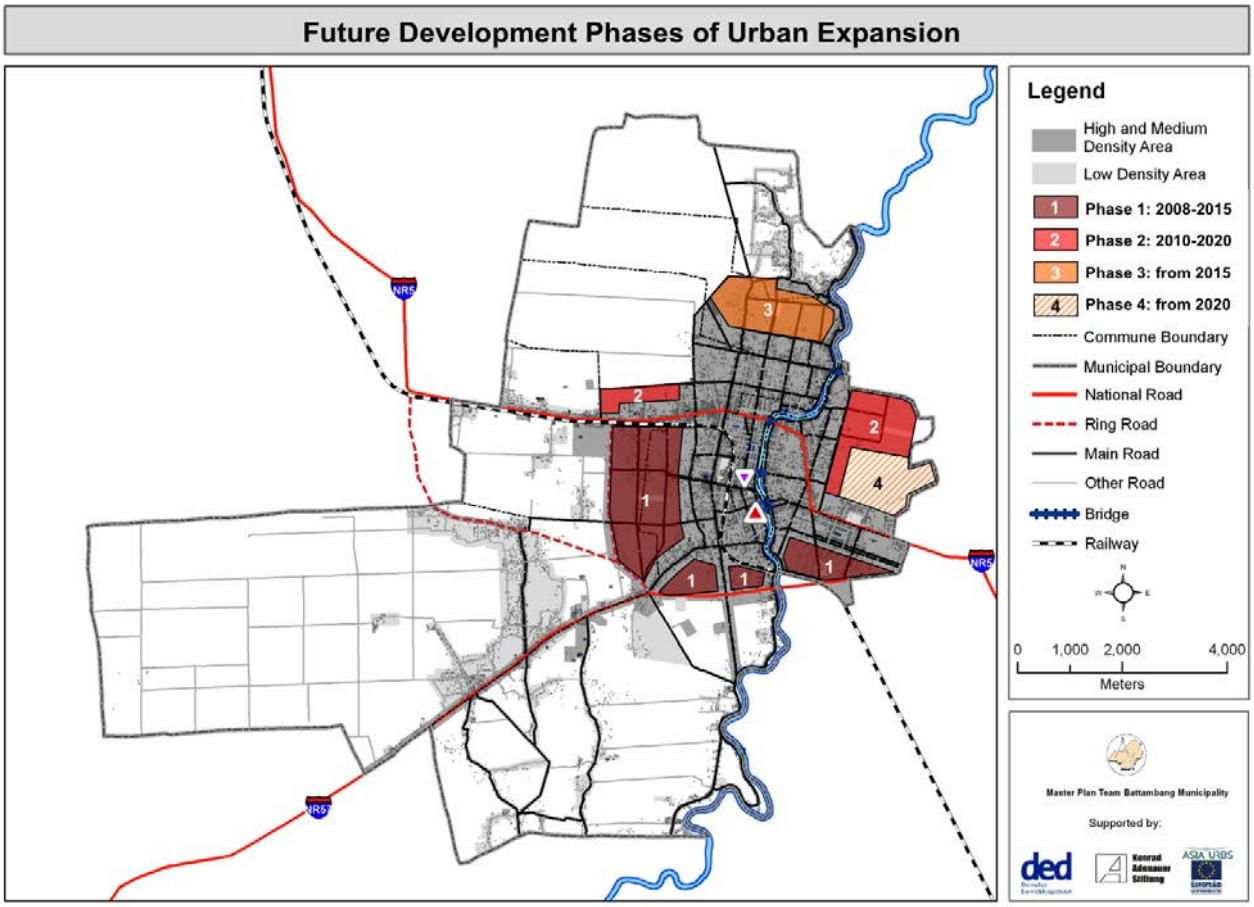
- Each and every area with obvious or expected tensions or contradictions between different uses/sectors/land claimants need to be addressed and decided. This is the reason why Task 4.4 is potentially a time-consuming one. Typical land use conflicts in urban areas would be for example the location of emitting industries (noise, smoke, odour etc.) or potentially hazardous uses (industries that handle hazardous materials, gas storage etc.) next to sensitive uses (residential areas, public use such as schools, sports areas, parks etc.). Typical land use conflicts in peri-urban areas would be for example settlement expansion versus agriculture use (and associated compensation). Typical land use conflicts in rural areas would be for example tensions between conservation of common pool resources and agrarian expansion.
- As the Land Use Master Plan should eventually differentiate between the 'buildable areas' and 'control areas' (see Table 2, Task 3.1), it is recommended to maintain this distinction clearly throughout the exercise. Buildable areas include existing urbanized/built-up areas and suitable future urbanizing areas and rural centres, where developments are encouraged and where infrastructure provisions will be facilitated. Control areas include water bodies and water storage areas, prime agriculture land, forests, and other zones less suitable for development, such as aquatic-terrestrial transition zones, flood-prone areas etc..
- While proceeding with the delineation of future land use types, it is important to keep in mind the necessary balance between the estimated future demand for housing land (see Table 14, Task 3.6) and the supply for housing areas in the integrated Land Use Master Plan. Specific calculations should be taken into account. A key challenge is the availability of exact data on the existing housing areas, so the exercise can only provide a rough estimation (see Table 14).
- It is recommended to develop a rough phasing concept for the future settlement expansion within the time horizon of the Land Use Master Plan. Here, the main urban expansion areas (for residential/mixed use or industrial use) should be assessed and ranked according to criteria such as their existing development pressure, potential and convenience for development, infrastructure access and ease of further provision, specific development constraints etc. The phasing concept should be cross-checked and harmonized with relevant spatial priorities within the thematic strategy matrixes. The approximate future development phases (between 5-15 years) and main urban expansion areas should be visualized in a map (see Map 47).
- Finally, the existing and future land use sizes (in ha) and shares (in percent) of all use categories should be summarized and compared in an overview table (see Annex 7).



Map 46 Draft Land Use Master Plan of Ta Khmau Municipality 2035

Table 21 Balance of new housing areas and demand for additional housing areas (Land Use Master Plan Battambang Municipality)

NEW HOUSING AREAS IN THE FUTURE LAND USE MASTER PLAN			
Increase of additional Residential Zones	+811,2 ha		
Decrease of Residential with Agriculture Zones	-402,5 ha		
Increase of additional Mixed Use Zones (455,5ha) (50% used for residential purposes)	227,7 ha		
Increase of additional Commercial Zones (87,1ha) (30% used for residential purposes)	43,5 ha		
Total additional housing areas in the Future Land Use Plan	**679,9 ha**		
Compared to total demand for additional new housing areas until 2020 (see Table 14, Task 3.6)	**Scenario 1: 484,6 ha**	**Scenario 2: 653,8 ha**	**Scenario 3: 834,1 ha**



Map 47 Future development phases of urban expansion in Battambang Municipality

Necessary outputs

- The thematic plans and strategies are integrated into a draft [future] Land Use Master Plan;
- A quantified calculation of the balance of supply and demand for new housing land;
- A plan showing the main development phases of urban expansion is produced;
- A detailed balance of existing and future land use by land use categories.

Step 5 Review of Draft Land Use Master Plan by District/ Municipal Stakeholders

Overall objectives

Once the Draft Land Use Master Plan has been developed by the working group and committee, it then goes into a review process, which is organized through consultation with commune/ Sangkat authorities and with stakeholders gathered in a fourth spatial planning forum.

Task 5.1 Consultation on integrated spatial development strategies and draft Land Use Master Plan with commune/Sangkat authorities

Overview

The draft integrated Land Use Master Plan produced at district/municipal level is now presented to and scrutinized by commune/Sangkat authorities. The local authorities should not only get a clear understanding of its zoning and the thematic plans and strategies, but also be actively engaged in discussing any conflicts that might arise from these.

Who is involved?

- Initiation and implementation
  - District/Municipal Land Management and Urban Planning Working Group
  - Database/GIS expert
- People involved in consultation and review
  - Commune/Sangkat Councilors and Village Chiefs/Development Committees members

Activities/methodology

- The integrated land use type map and the thematic plans and strategies are presented during a workshop to commune/Sangkat authorities. Alternatively, the working group could opt for a series of workshops to allow for sufficient discussion. The workshop is facilitated by the LMUP working group and the GIS expert. A map of the draft Land Use Master Plan relevant to the commune/Sangkat is discussed and the workshop proceeds with a systematic review of future land use types.
- Here again, current or expected tensions or contradictions between different land us-es/sectors/land actors and interests need to be addressed.

Figure 16 Consultative workshop on future transport infrastructure system with Sangkat/Commune Chiefs in Battambang Municipality, 2007

Figure 17 Consultative workshop on future green/blue system with Sangkat/Commune Chiefs in Battambang Municipality, 2007

Necessary outputs

- A second, amended draft of the Land Use Master Plan is produced after consultations with local authorities.
- If necessary, the balance of new housing areas in the future land use and demand for additional housing areas is re-calculated on the basis of the amendments.
- The draft Land Use Master Plan is presented to the LMUP Committee for discussion and amendments.

Task 5.2 Validate integrated spatial development strategies and draft Land Use Master Plan in a 4th Spatial Planning Stakeholder Forum

Overview

So far, the draft Land Use Master Plan has been discussed and elaborated within the LUMP committee and consulted with the Sangkat/commune authorities. It is now the time to widen the discussion and include all spatial planning stakeholders and interest groups. To this end, a fourth Spatial Planning Stakeholder Forum is organized to present and validate the final draft Land Use Master Plan. This forum is an opportunity to present in a more succinct but comprehensive way all the aspects of the draft Land Use Master Plan so that the stakeholders have an overview of how each planning step and the various tasks have been mastered.

Who is involved?

- Initiation and implementation
  - District/Municipal Council
  - District/Municipal Land Management and Urban Planning Committee
  - Commune councillors
- Participants in Spatial Planning Stakeholder Forum
  - All stakeholders (Table 1)

Activities / methodology

- Organize the 4th Spatial Planning Stakeholder Forum. The final draft of the entire Land Use Master Plan is presented and discussed in the stakeholder forum. Facilitate an open discussion

on the results produced so far and encourage active participation of all participants (allow sufficient time for debate).

Necessary outputs

- The results and products of the draft Land Use Master Plan are presented and discussed by all spatial planning stakeholders gathered in a forum.
- Any amendments requested by stakeholders are discussed and addressed in a final review process that follows the 4th Stakeholder Forum.

Step 6 Public Display and Endorsement by District/Municipal Council

Overall objectives

Based on previous consultations and reviews, a final technical report (including maps) of the LUMP is prepared and submitted to public display for a period of 30 days. The comments and recommendations made during that process by district/municipal, provincial and national committees for LMUP serve to revise the LUMP technical report. The technical report is then endorsed by the District/Municipal Council.

Task 6.1 Prepare Final Technical Report

Overview

Based on the draft documents produced so far and the comments made during the final consultation workshops and Forum, the District/Municipal LMUP working group will prepare a final technical report of the Land Use Master Plan.

Who is involved?

- Coordination
  - District/Municipal LMUP working group
- Participants
  - District/Municipal LMUP-WG
  - District/Municipal LMUP-C
  - District/Municipal Council and BoG

Activities/methodology

- The responsibility for finalization of individual chapters should be assigned to individual team members based on their respective sector background and in collaboration with the respective sector line offices.
- The compilation of the chapters and a final cross-check of all chapters should be done by the District/Municipal LMUP-WG and LMUP-C in a collaborative effort.

Necessary outputs

- A complete and final technical report (including maps) of the Municipal/District Land Use Master Plan is prepared (see proposed outline in Annex 6).

Task 6.2 Public Display (Draft Land Use Master Plan)

Overview

The draft District/Municipal Land Use Master Plan maps are put on public display during a period of 30 days at the district/municipal hall and optionally in each commune/sangkat hall in the dis-trict/municipality. The display allows citizens, associations, NGOs to peruse it and formulate final critiques or suggestions. A particularly important role of the District/Municipal LMUP working group and committee is to properly document on how different inputs from the public display were collected and reflected upon. This documentation needs to complement the technical report draft and be shared with District/Municipal Council and sent to PCLMUP and NCLMUPC for review and further recommendations. When this process is successfully finalized, the District/Municipal

Council officially endorses the technical report of the district/municipal Land Use Master Plan.

Who is involved?

- Coordination
  - District/Municipal LMUP-WG
- Participants
  - District/Municipal LMUP-WG
  - District/Municipal LMUP-C
  - PCLMUP
  - NCLMUP

Activities / methodology

- District/Municipal Council should give green light to start the public display.
- The District/Municipal LMUP-WG prepares and puts on public display A0 size maps of the Draft Land Use Master Plan including necessary future main spatial development strategies and plans as well as corresponding summarizing explanation in text form.
- The district/municipal and commune authorities should observe a period of 30 days for public display to give an opportunity to the public to take stock of the plan, suggest modifications or provide recommendations.
- All suggestions should be addressed properly in an inclusive process. The District/Municipal LMUP-WG should neutrally record all incoming suggestions, feedback and critiques. It is reasonable to categorize and group them, in order to address them systematically and efficiently. The list of (grouped) feedback from the public display needs to be complemented with documentation on how the feedback was addressed (e.g. taken up, partly taken up, not taken up) and the reasons behind.
- In case a complaint is filed during 30 days of public display, conciliation mechanisms need to be put in place as foreseen by the detailed procedure (NCLMUP 2013).
- District/Municipal Committee for Land Management and Urban Planning shall document the whole public display process and send the report to the Provincial Committee for Land Management and Urban Planning for review and comments and then proceed to the National Committee for Land Management and Urban Planning for further check and recommendations.
- Finally, a session with the District/Municipal Council is organized, in which the District/Municipal LUMP is endorsed. This should build upon previous presentations and involvements of the council in the process and particularly focus on core issues which arose from the public display and how these were addressed. Keep in mind that it is possible for the council to demand changes or request further clarification, so that actual approval might require another meeting.

Necessary outputs

- The public display is conducted over 30 days and all problems raised are addressed and properly documented;
- The LUMP technical report is amended, presented to and endorsed by District/Municipal Council.

Step 7 Review of Technical Report

Overall objectives

The final technical report is presented to provincial authorities (LMUP-C and Provincial Council) as well as to National Land Management and Urban Planning Committee. Comments and recommendations resulting from this process are integrated in the technical report.

Task 7.1 Final presentation to provincial authorities and revision

Overview

The District/Municipal LUMP is presented to provincial authorities (Provincial Council and PCLMUP). The District/Municipal LMUP working group and committee then conduct the final revision of the technical report based on the final review and comments made by the Provincial Council and Provincial Committee for Land Management and Urban Planning.

Who is involved?

- Coordination
  - District/Municipal LMUP-WG
- Participants
  - District/Municipal LMUP-WG
  - District/Municipal LMUP-C
  - PLMUP Committee

Activities/methodology

- A representative of the District/Municipality should deliver a presentation of the planning process and its key outputs (a revised version of the presentation developed for the final public consultation workshop) to the Provincial Council and Provincial Committee for LMUP.
- The responsibility for finalization of the technical report should be assigned to members based on their respective sector background and in collaboration with the respective sector line offices.

Necessary outputs

- A final technical report that incorporates the recommendations and addresses the comments of the Provincial Council and PCLMUP is produced and ready for the final approval process.

Task 7.2 Final presentation to national authorities and revision

Overview

The District/Municipal LUMP is presented to national authorities (NCLMUP). The District/Municipal LMUP working group and committee then conduct the final revision of the technical report based on the final review and comments made by the National Committee for Land Management and Urban Planning.

Who is involved?

- Coordination

    - District/Municipal LMUP-WG
- Participants
    - District/Municipal LMUP-WG
    - District/Municipal LMUP-C
    - PLMUP Committee
    - NLMUP Committee

Activities / methodology

- A representative of the District/Municipality should deliver a presentation of the planning process and its key outputs (a revised version of the presentation developed for the final public consultation workshop) to the National Committee for LMUP.
- The comments received during this presentation from the NCLMUP should be well documented and considered to amend the final technical report of the LUMP.
- The responsibility for finalization of the technical report should be assigned to members based on their respective sector background and in collaboration with the respective sector line offices.

Necessary outputs

- A final technical report that incorporates the recommendations and addresses the comments of the NCLMUP is produced and ready for the final approval process.

Step 8 Identification of Priority Projects

Task 8.1 Identify and prioritize projects based on the Strategy Matrix

Overview

In order to implement the Land Use Master Plan, it is important to identify projects, e.g. newly planned physical infrastructures. Equally important is to mainstream this process in the context of 5-year development and Investment plan developed at district/municipal level. In this process, the strategy matrix established in Step 4 is central as it ensures cohesion between spatial development strategies and existing development planning within a unified planning framework at district/municipal level.

Who is involved?

- Initiation
  - District/Municipal Land Management and Urban Planning Working Group
  - Database/GIS expert
- People involved in consultation and review
  - District/Municipal Land Management and Urban Planning Committee
  - District/Municipal Council
  - District/Municipal Board of Governors

Activities / methodology

- Review strategy matrix that specifies long-term development goals, development objective and spatially explicit strategies that are unified to the 5-year development plan
- Identify specific projects on the basis of activities and sub-activities detailed in the strategy matrix (see Task 4.1)
- Developed implementation and budget plans for each project
- Prioritize the implementation of these projects (short term, medium term and long term) based on the spatial development strategies of the LUMP

Necessary outputs

A list of prioritized projects to support the implementation of the LUMP is established in the context of the unified planning system at district/municipal level and aligned to the strategy matrix.

Step 9 Approval of the Land Use Master Plan

Overall objectives

The final technical report is submitted to responsible authorities for endorsement and approval. The process goes from District/Municipal council to the National Committee for Land Management and Urban Planning.

Task 9.1 Submit the LUMP to district / municipal and provincial authorities for final endorsement

Overview

The final technical report on the District/Municipal LUMP is submitted to district and provincial council for final endorsement.

Who is involved?

- Initiation
  - District/Municipal LMUP working group
- Participants
  - District/Municipal LMUP committee
  - Representative of the District/Municipal Council and BoG
  - Representative of the Provincial Council and BoG

Activities / methodology

- Submit to Municipal Council for endorsement
- Submit to Provincial Committee for Land Management and Urban Planning (PCLMUP) for agreement
- Submit to Provincial Council for endorsement

Necessary outputs

- The district/municipal council and provincial council endorse the District/Municipal LUMP

Task 9.2 Submit the LUMP to national authorities for final approval

Overview

The final technical report on the District/Municipal LUMP is submitted to national committee for land management and Urban Planning for final endorsement and approval.

Who is involved?

- Initiation
  - District/Municipal LMUP working group and committee
- Participants
  - Representative of the District/Municipal Council and BoG
  - Representative of the Provincial Council, BoG and Provincial LMUP Committee

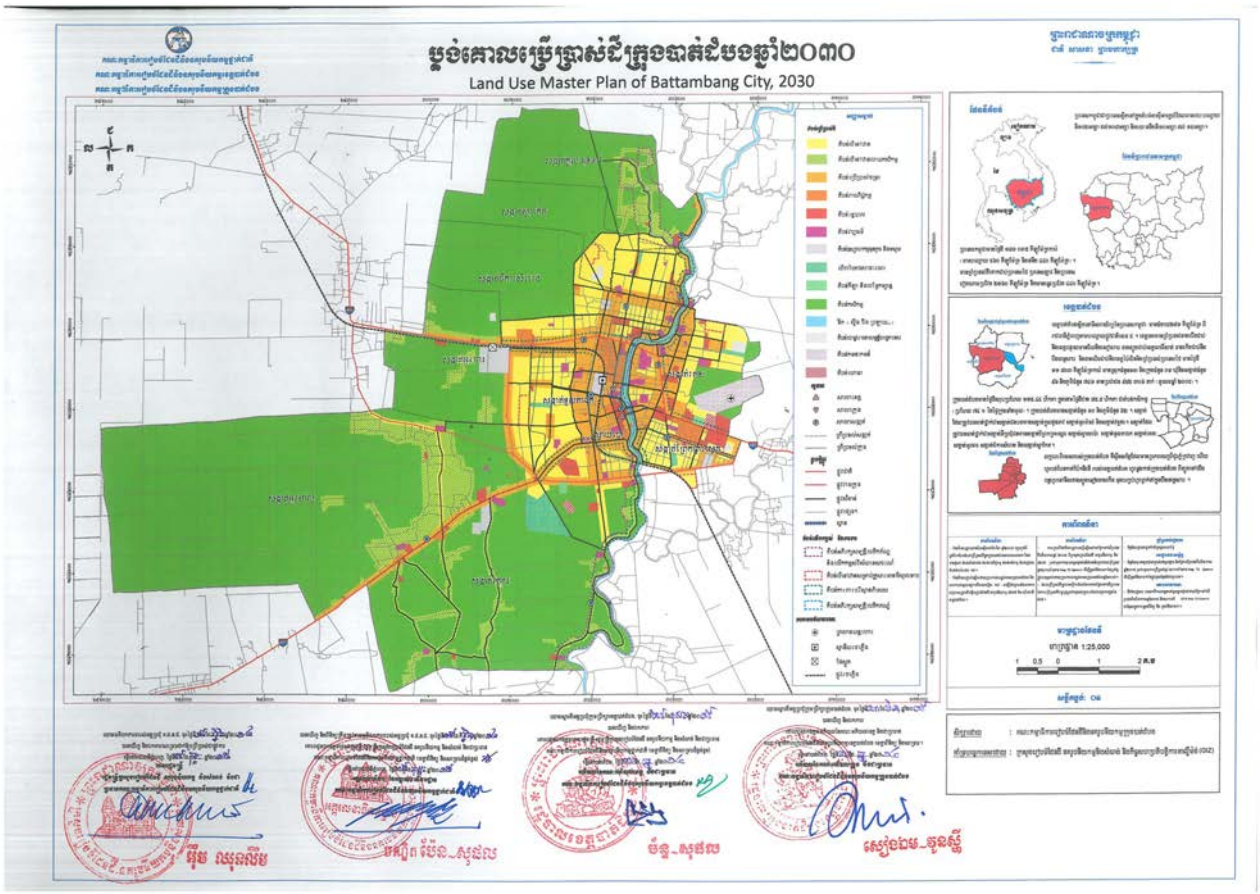
- NCLMUP

Activities / methodology

- Submit to National Committee for Land Management and Urban Planning (NCLMUP) for review, approval.

Necessary outputs

- The NCLMUP approves the LUMP and commences the process for having it promulgated/ enacted as a Sub-Decree.



Map 48 Land Use Master Plan Battambang Municipality – Official plan layout with stamps and signatures by higher Government authorities

Part B

Elaboration and Approval of the Land Use Plan (LUP)

Step 1 Preparations and Launch of the District/Municipal Land Use Planning Process

Task 1.1 Scoping and inception of the Land Use Plan

Overview

This start of the Land Use Planning process is straightforward as it routinely should proceed in direct continuity of and be closely based upon the Land Use Master Plan. All responsible planning agencies are operational, and the necessary cooperation mechanisms and other stakeholders are already in place since the Land Use Master Planning process (see Step 1, Part A for further detail).

District/municipal main authorities discuss the objectives and scope of the planning process and decide on the demarcation of the planning area for the Land Use Plan. District and municipal administrative territories in Cambodia significantly vary in size, with some Municipal administrations covering extensive rural areas, while some district administrations comprise one or more urban centers serving their largely rural territory. For districts it can be decided in consultation with the NCLMUP to focus the regulatory binding plan with its building regulations only on the existing and the future 'urban growth area', i.e. the area that is defined as 'buildable zone' in the strategic Land Use Master Plan (see Part A), and reduce the planning area of the Land Use Plan accordingly.

Who is involved?

- Initiation
  - Land Management and Urban Planning Working Group
  - Provincial Department of Land Management, Urban Planning, Construction and Cadastre (for backstopping)
  - Ministry of Land Management, Urban Planning and Construction (for backstopping)
- Participants
  - District/Municipal Council and Board of Governors
  - District/Municipal Land Management and Urban Planning Committee

Activities/methodology

- Introduce the land use planning approach to district/municipal authorities. This presentation should clearly explain the overall objectives and approach of regulatory land use planning and the contents and value that the legally binding Land Use Plan adds to the integrated MPLUP process. A resource person (MLMUPC or external) can present a case study of regulatory land use planning conducted in another district/ municipality.
- Discuss the interest and benefit of conducting regulatory land use planning. Facilitate a discussion on the benefit of conducting regulatory land use planning in the district/municipality and the overall scope of the plan, including geographically precise land use zoning and building regulations. Encourage active participation of all participants and allow sufficient time for debate.
- Discuss and decide on the planning area for the Land Use Plan. Based on the previous dicussion, facilitate a decision on the demarcation of the planning area for the regulatory Land Use Plan and consult with the NCLMUP in case the planning area should be reduced.

Necessary outputs

- District/municipal authorities understand the objectives and overall procedure of regulatory (detailed) land use planning and give a green light to pursue the process.
- The demarcation of the planning area covered by the Land Use Plan is agreed upon.

- A map displaying the planning area of the Land Use Plan is produced.
- The roles and responsibilities of authorities/agencies in the planning process (commune/Sangkat, district/municipal, provincial and national levels) are clear and understood.

Task 1.2 Dissemination and gathering of stakeholders in 5th Spatial Planning Stakeholder Forum

Overview

Once the scope and the planning area of the regulatory Land Use Plan have been decided, the different actors with a stake in the planning process are brought together to inform and disseminate about the LUP planning process. The objectives and scope of the district/municipal Land Use Plan will be presented to them and their roles and necessary contributions will be discussed. An initial gathering is organized to discuss the expectations of stakeholders regarding the spatial planning process and the key spatial development issues to be addressed.

Who is involved?

- Initiation
  - Land Management and Urban Planning Working Group
  - District/Municipal Council
  - District/Municipal Committee for Land Management and Urban Planning
- Participants
  - All stakeholders (Table 1)

Activities / methodology

- Organize a 5th Spatial Planning Stakeholder Forum: With participation from all spatial planning stakeholders identified during the LUMP process (Table 1), facilitate a workshop to introduce the overall objectives, approach of the regulatory Land Use Plan and the expected contributions from different stakeholders. An external resource person can present a case study of regulatory land use planning conducted in other districts/municipalities. Facilitate group work discussions (brainstorming) to discuss expectations of stakeholder towards the process, their readiness to contribute and the main spatial development issues to be addressed.
- Media announcement: announce the spatial planning process, scope and objectives through different media (radio and TV broadcasts, newspapers, online media).

Necessary outputs

- Stakeholders are aware of and understand the scope, the objectives and process of regulatory land use planning and the legally binding status of the Land Use Plan once it is promulgated.
- Clear commitments from different stakeholders to engage in the process are identified.
- Key priority issues to be addressed in the District/Municipal Land Use Plan are mapped out.

Step 2 Data Collection and Data Management

Task 2.1 Data and information collection

Overview

The LUP planning process is closely based upon and conducted in continuity of the planning steps and sequential results of the LUMP, therefore the working group can draw largely upon the data collected during the LUMP process (see Tasks 2.1 and 2.2, Part A).

However, as the Land Use Plan is the regulatory plan that determines the future functional (use-based) as well construction (form-based) development of the district/municipality as a legally binding ordinance, a range of supplementary data may need to be compiled for specific analysis.

Who is involved?

- District/Municipal Land Management and Urban Planning Working Group
- Advisor(s) (if available and relevant)
- Database/GIS expert

Activities / methodology

- For the townscape and building structure analysis the following basic physical information will be needed at the least: (i) Building height (in meter and/or number of floors); (ii) Building density (average Building Coverage Ratio (BCR) and Floor Area Ratio (FAR), (iii) Building coverage types (detached, semi-detached, attached), and (iv) Building alignment and road setback.
- For the analysis of built urban heritage various resources about the history of urban development should be compiled (historic maps and photos, studies, articles and magazines, interviews with resource persons etc.).
- For the analysis of existing land use as well as for the spatially explicit delineation of the future land use units based on the Land Use Master Plan, all land use units should be verified and precisely delineated using GIS tools and supplementary field surveys, where necessary.
- Further data on the existing tertiary road system will be needed, if the Land Use Plan aims to demarcate the future local tertiary road system (optional).
- As the necessary information will most likely not be readily available as reliable secondary data sets, the working group shall collect primary data by means of GIS-based interpretation of aerial photos/satellite images and supplementary field surveys. For practicality and efficiency reasons, it is recommended to focus the survey on area-wise, generalized data to identify areas with distinct common characteristics/features, as it will not be feasible to map every building/plot or every small access street but rather coherent clusters/blocks and areas (see Maps 49-53).
- For further technical information regarding data collection and management refer to the Land Use Master Plan process (Tasks 2.1 and 2.2, Part A).

Necessary outputs

- A preliminary dataset is established with a clear structure and including all data relevant for the Land Use Planning process; the dataset is integrated into the computerized spatial database (see Task 2.2, Part A).

Step 3 Data Analysis

Task 3.1 Improve geographic attributes of land use units

Overview

The strategic Land Use Master Plan (see Part A) is not required to be spatially explicit, so now it is time to improve and further define the geographic attributes of the existing and future land use units, by covering and reviewing all land use categories. As a legally binding regulatory plan, the Land Use Plan needs to provide geographically precise allocation and identification of all future land use units, which will be discussed and elaborated in the frame of subsequent drafting of the Land Use Plan (see Task 4.1, Part B).

Who is involved?

- District/Municipal Land Management and Urban Planning Working Group
- Advisor(s) (if available and relevant)
- Database/GIS expert

Activities / methodology

- The LMUP Working Group shall review the Existing Land Use Map (see Map 8, Part A) and identify those areas that need further detailed and geographically precise delineation (see Map 8, Part A). If necessary, land use type demarcations need to be adjusted, assisted by GIS tools and supplementary surveys for clarification.
- The LMUP Working Group shall review the Draft Land Use Master Plan (see Map 46, Part A) and identify those areas that need further detailed and geographically precise delineation of future land use zoning.

Necessary outputs

- The existing land use map from the LUMP process is reviewed and adjusted with geographically explicit land use units (for all land use categories).
- The future land use plan from the LUMP process is reviewed and all land use units are identified, that need further geographically precise delineation).

Task 3.2 Analyze existing townscape and building structure

Overview

The identification, mapping and analysis of the existing townscape and building structure is adding an important physical layer to the analysis that was undertaken during the survey for the Land Use Master Plan (see Planning Step 2, Part A), as the built-up urban environment forms the main 'hardware' of the city, and has significant impacts on the living conditions and sustainable urban development in general.

The analysis of townscape and building structure is not mandatory for the Land Use Master Plan, but crucial for the legally binding Land Use Plan with its form-based building ordinance. It is however recommended to execute this analysis already during Planning Step 2 of the LUMP process (Part A), as this allows integration and cross-reference with the analysis in other sectors/thematic fields and will avoid redundant work at a later point in time.

Who is involved?

- District/Municipal Land Management and Urban Planning Working Group
- Advisor(s) (if available and relevant)
- Database/GIS expert

Activities / methodology

The townscape and building structure analysis aims to examine the physical structure and appearance of the city while considering the following aspects:

- Analyze the typical character/appearance of the cityscape, which can be composed of distinctive elements such as (i) urban built-up and natural landmarks and monuments, (ii) the coherent building structure of ensembles, neighborhoods and quarters, (iii) the urban layout with its disposition of public spaces, block types and streetscapes, (iv) important axes, views and viewpoints, etc.;
- Identify important structural elements and buildings/constructions positively contributing to the townscape and 'sense of place';
- Identify problems and deficits, such as out-of-scale/disproportionate buildings and constructions, areas with chaotic/disorderly building structure or crowded/unhealthy living conditions, lack of adherence to and enforcement of existing building codes, etc.
- Identify the built urban heritage - those buildings, constructions and ensembles that have a specific value and/or outstanding importance because of architectural/artistic, cultural/religious, or historic reasons.

To enable the LMUP working group in this rather complex task, the handbook suggests a guideline for analysis and map production below, including key points and questions that need to be addressed during the analytical work. Specific examples are given from spatial planning processes in Battambang Municipality (Battambang Province).

Necessary outputs

- A complete set of sector and thematic maps (if necessary supplemented by graphs, tables and sketches etc.) is produced along the guideline, detailing all analyses and studies that are necessary in the land use planning exercise.
- Each map and graph/table etc. is accompanied by a short text that describes and explains the main information presented on the maps and their relevance to the spatial development of the district/municipality.

A guideline for data analysis and maps production

The following is meant as a guideline to help the working group conduct the analyses and produce the corresponding maps needed. The guideline details the outputs under five different thematic fields that are either mandatory based on the Detailed Procedure for Development of the Municipal, District and Khan Master Plan and Land Use Plan (NCLMUP 2013), or optional but recommended during the process.

The survey and mapping should concentrate on a set of few essential building parameters that will be relevant for the future determination of building regulations:

- Building density (Building Coverage Ratio and Floor Area Ratio);
- Building height (in meter and/or number of floors);
- Road setback and alignment;
- Building coverage type.

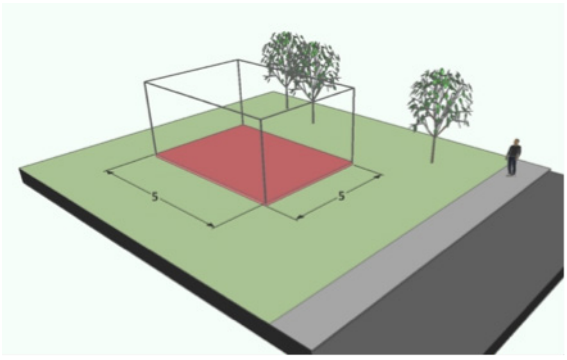
These four main building parameters shall be supplemented by a rapid survey and analysis of the built heritage (see Map 54) and a survey of the existing local tertiary road system.

3.2.1 Building density (mandatory)

The building density of built-up/settlement areas is defined by two main indicators: the Building Coverage Ratio (BCR) and the Floor Area Ratio (FAR). Both the BCR and FAR have important impact on the townscape and urban building structure; they are strongly interrelated with economic land use patterns and urban development in general. On the one hand, disproportionately high building densities can cause crowded and unhealthy living conditions, and lead to overload of public infrastructures. On the other hand, inadequately low building densities can cause unsustainable urban growth (conversion of valuable farmland into settlement) and lead to inefficient utilization of public infrastructures.

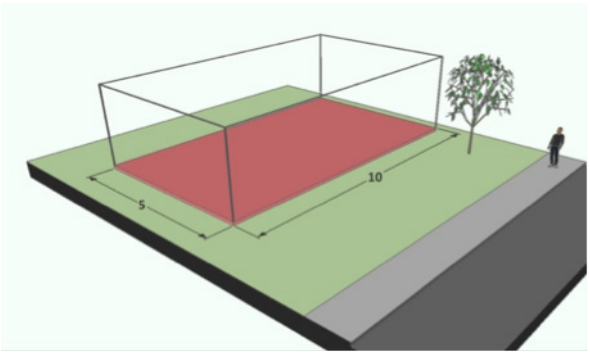
- The Building Coverage Ratio (BCR) defines the percentage of a plot that is covered by buildings and constructions (ratio of the build-up areas on a given plot to the total plot area). The BCR also further defines the permeable plot area that allows rainwater infiltration. For relevant national regulations see Article 21 of Sub-Decree No 42 on Urbanization of the Capital, Municipalities and Urban Areas (Royal Government of Cambodia 2015).

Example 1:



Plot area: 100m²
Building footprint/projection: 4x5= 20m²
BCR = 20÷100 = 0.2
20% of the plot is occupied by the building

Example 2:

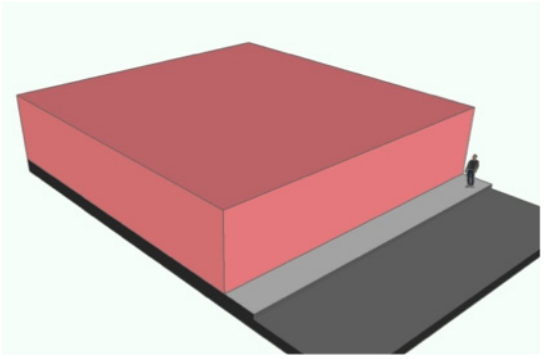


Plot area: 100m²
Building footprint/projection: 5x10=50m²
BCR = 50÷100 = 0.5
50% of the plot is occupied by the building

Figure 18 Building Coverage Ratio (BCR) parameter

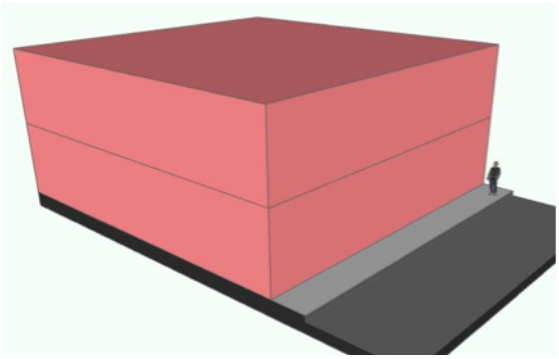
- The Floor Area Ratio (FAR) defines the ratio of the total floor area of all buildings on a given plot of land to the total plot area. For relevant national regulations see Articles 22 and 28 of Sub-Decree No 42 on Urbanization of the Capital, Municipalities and Urban Areas (Royal Government of Cambodia 2015).

Example 1:



Plot area: 100m^2
Total floor area: 100m2
FAR = 100÷100 = 1.0

Example 2:

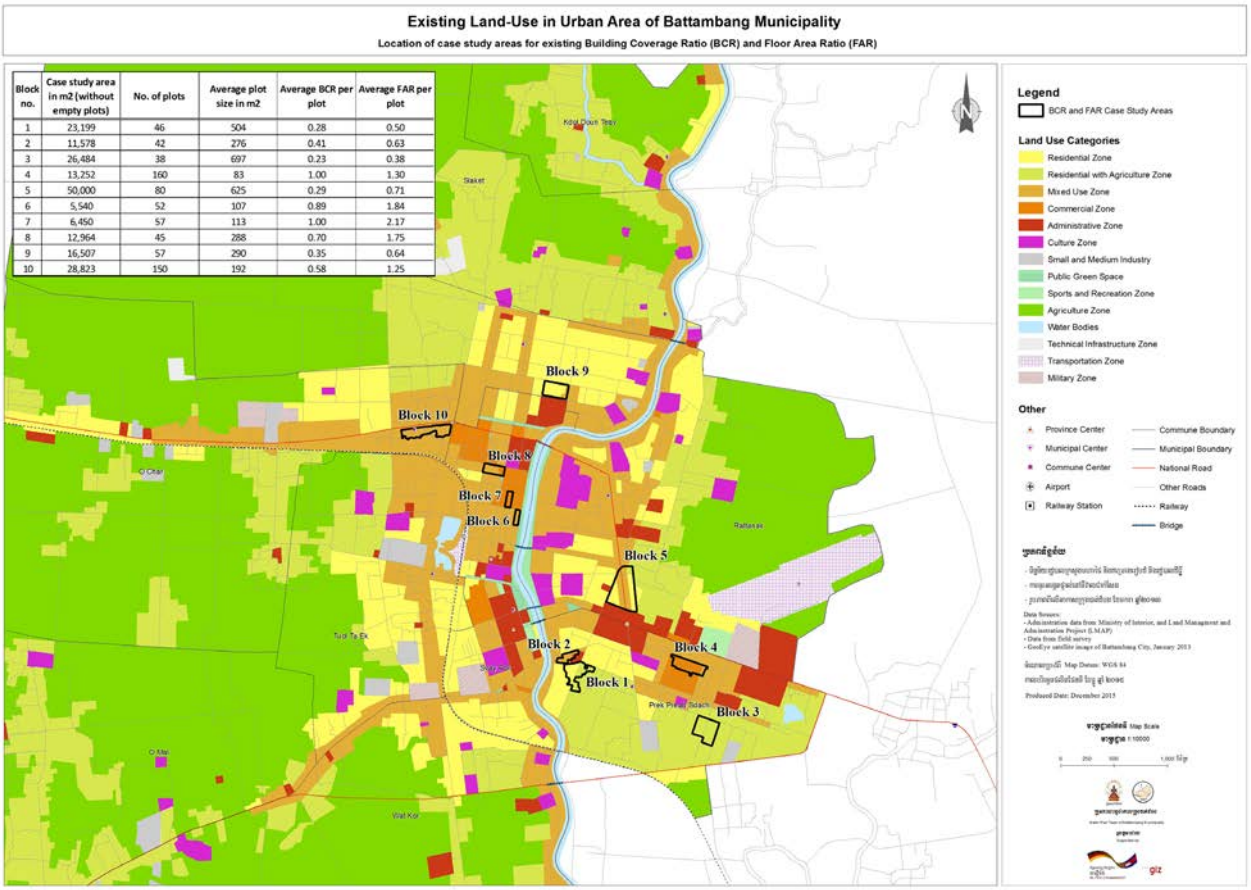


Plot area: 100m^2
Total floor area: 2x100 = 200m2
FAR = 200÷100 = 2.0

Figure 19 Floor Area Ratio (FAR) parameter

For practicality and efficiency reasons, it is recommended to conduct the building density survey not for the whole urban/peri-urban area but instead focus on a series of case study areas, representing typical built-up areas in the city. Representative case study areas shall be selected for all relevant 'buildable' land use types that are characterized by private land ownership and construction development (residential, residential with agriculture, commercial, mixed use, industrial). There is no need to survey public areas (administration and public services, cultural and religious, technical infrastructure, green spaces etc.) (see Map 49).

Furthermore, for each relevant land use type select different areas that are representative for typical low-, medium- and high-density settlement structures in the city. To determine a comprehensive set of typical case study areas, it can be useful to analyze a 'transect' of the city, meaning a continuous band of build-up areas from the urban center/core area until the rural area at the urban fringe.



Block no.	Case study area in m2 (without empty plots)	No. of plots	Average plot size in m2	Average BCR per plot	Average FAR per plot
1	23,199	46	504	0.28	0.50
2	11,578	42	276	0.41	0.63
3	26,484	38	697	0.23	0.38
4	13,252	160	83	1.00	1.30
5	50,000	80	625	0.29	0.71
6	5,540	52	107	0.89	1.84
7	6,450	57	113	1.00	2.17
8	12,964	45	288	0.70	1.75
9	16,507	57	290	0.35	0.64
10	28,823	150	192	0.58	1.25

Map 49 Existing building density (case study areas) in urban area of Battambang Municipality

Once the case study areas are determined, the actual survey process comprises four work Steps:

- First, GIS-based mapping of the areas including all plot boundaries and building footprints. For the existing plot boundaries/sizes digital cadaster data from the systematic land titling will be needed. The existing buildings should be digitized based on most recent available aerial photos/satellite images;
- Second, a detailed field survey is needed to update and verify the GIS-based work by checking the existing building stock in reality and add the number of floors for each building. This in-depth survey should also be used to get some detailed information on road setbacks/ alignment and building coverage types (see Map 50);
- Third, the average Building Coverage Ratio (BCR) and Floor Area Ratio (FAR) per each case study area are calculated based on the total size of all plots (note NOT to include vacant plots, as this would distort the results) and the total floor area (in all buildings with all floors);
- Finally, the results from all case study areas are synthesized in one overview table (see Table 22), by grouping into different land use categories and low-, medium-, and high-density areas. This table is the main result of the building density analysis. It should provide an evidence-based overview of the typical existing building densities in different parts of the city, and serves as a reasonable baseline for the definition of future building densities (BCR and FAR) in the Land Use Plan.

Map 50. Survey map of case study area in Battambang Municipality

Table 22 Overview of average building densities (BCR and FAR) in selected case study areas of Battambang Municipality

	Low density	Medium density	High density
Residential areas	(Block 3) BCR = 0.23 / FAR = 0.38	(Block 1) BCR = 0.28 / FAR = 0.5	(Block 9) BCR = 0.35 / FAR = 0.64
Mixed use areas	(Block 5) BCR = 0.29 / FAR = 0.71 (Block 2) BCR = 0.41 / FAR = 0.63	(Block 10) BCR = 0.58 / FAR = 1.25	(Block 8) BCR = 0.7 / FAR = 1.75 (Block 6) BCR = 0.89 / FAR = 1.84
Commercial areas		(Block 4) BCR = 1.0 / FAR = 1.3	(Block 7) BCR = 1.0 / FAR = 2.17

3.2.2 Building height (mandatory)

The height of buildings and constructions determine to a large extent the character of the streetscapes and the overall cityscape and skyline. Building heights depend on the overall urban design scheme and spatial planning of the city and have to be harmonized. Careful planning of building heights should avoid disproportionate buildings and any negative effects on the urban environment and living conditions (lighting, air ventilation, safety etc.), so to safeguard a specific coherent urban design and orderly and aesthetic character of particular areas.

Building heights can be determined either through the maximum overall building height (vertical distance measured from the average level of the ground around and contiguous to the building up to the highest point of the building in meter) or by measuring the maximum number of floors of a building (see Figure 20).

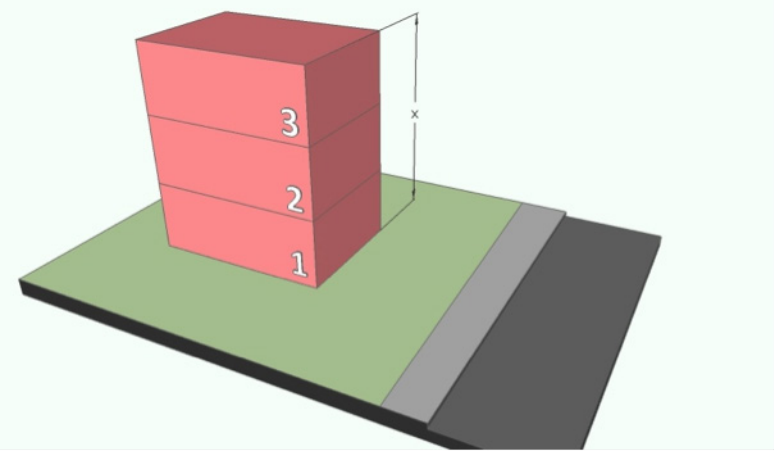
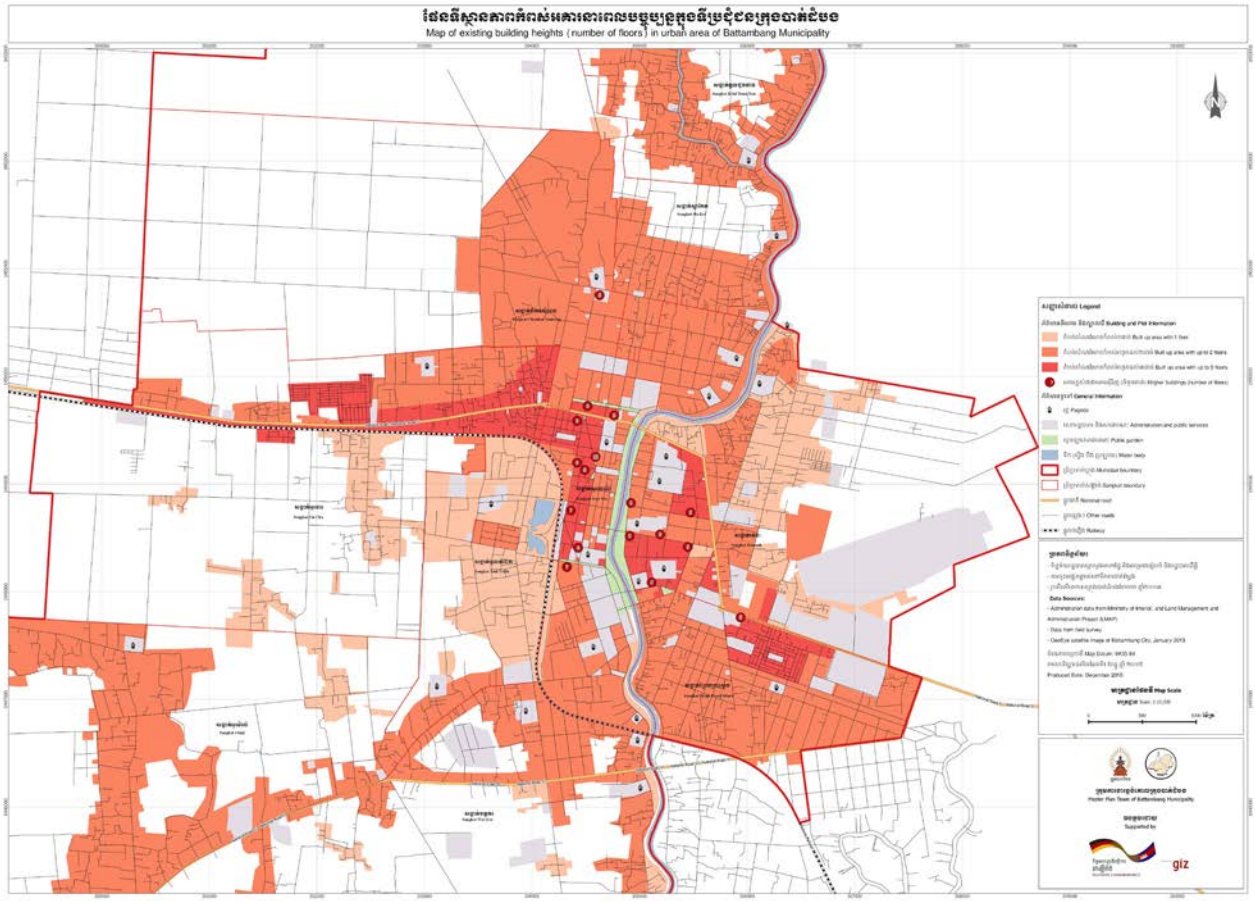


Figure 20 Building height parameters

For practicality and efficiency reasons, it is recommended to conduct the building height survey based on the number of floors. As this data will most likely not be readily available, the inventory is done through a field survey, to identify areas with coherent building height. Generally in municipalities and urban areas in Cambodia, most of the buildings still have one or two floors, while only few areas are characterised by three floors, and only singular buildings are higher than three floors (these are most often constructed after 2005 and either used as banks, hotels or private schools/ universities). It is therefore recommended to use corresponding height categories/ classes for the survey (see Map 51)



Map 51 Existing building height (number of floors) in urban area of Battambang Municipality

3.2.3 Road setback and alignment (mandatory)

The location and alignment of the buildings on a plot is determined by road setbacks and side and rear margins. Road setbacks ensure that the setback of buildings from the front property boundary to the right of way (distance between property boundaries that define the overall width of a road) is maintained. Building parameters are important: (i) to ensure that buildings and activities associated with them do not encroach onto the right of way, (ii) to safeguard sight lines for motorists, especially where the road bends or at junctions, (iii) to facilitate any future widening of the right of way. Side and rear margins for plots are important for safety and fire prevention purposes.

The road setback describes the line up to which the plinth/base of a building may lawfully extend within a plot on a street (the distance between roadside legal plot boundary and the building). No overhead projections are allowed beyond this line.

Side and rear setbacks (margins) describe the distance of the building structure to the legal side and rear plot boundaries (see Figure 21).

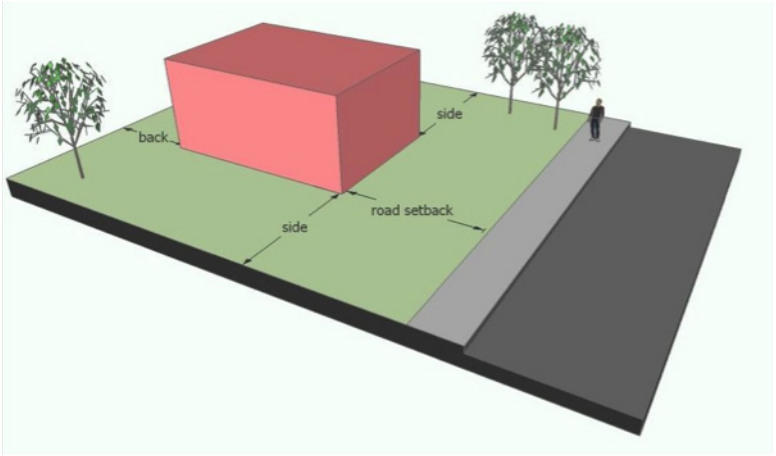
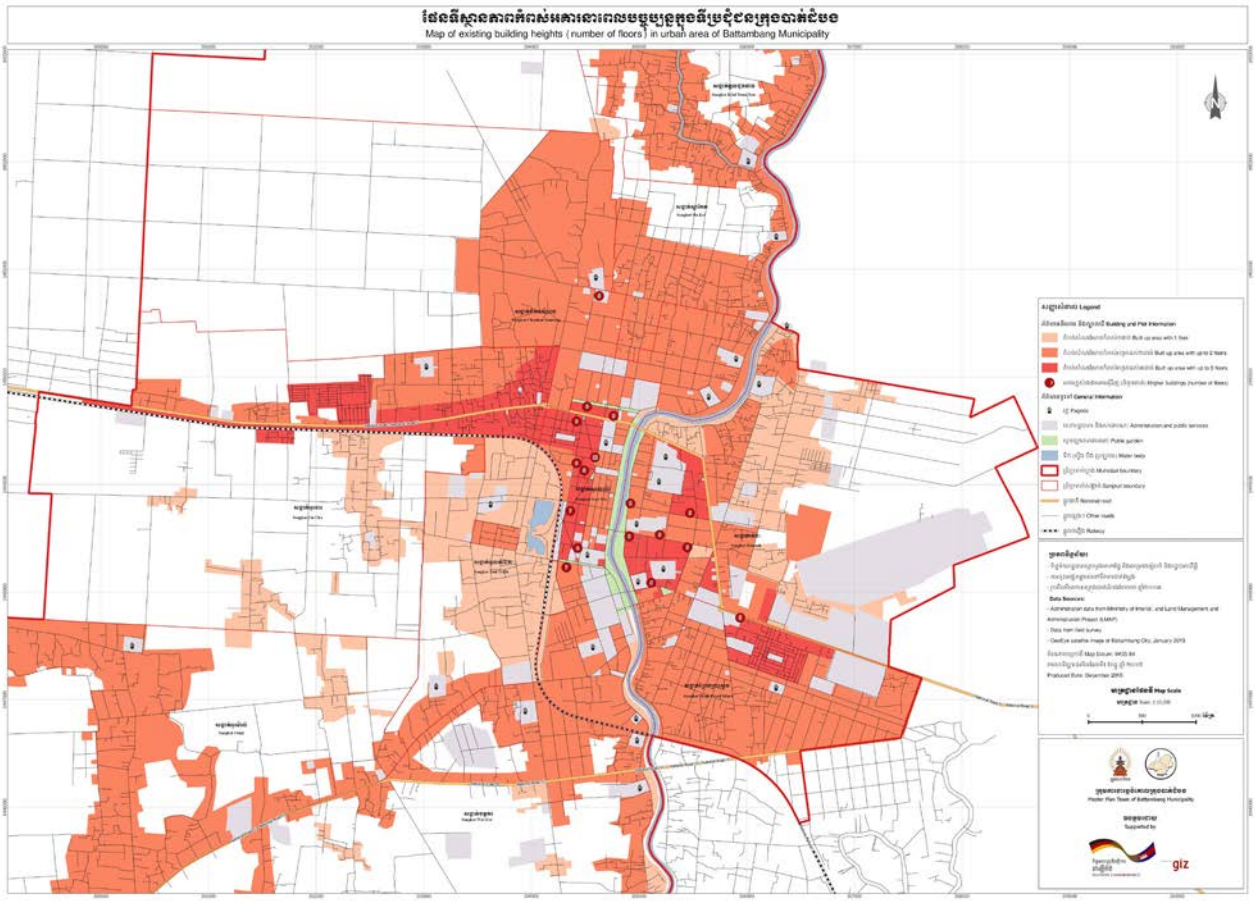


Figure 21 Road setback/alignment parameters

Road setbacks/alignments in urban areas in Cambodia often can be very heterogeneous, as they are following no particular regulations or planning deliberations. In urban core areas (commercial city centres) and around markets buildings often are erected without any road setback at all, i.e. directly on the roadside plot boundary. For practicality and efficiency reasons, it is recommended to conduct a survey of existing road setbacks generalized for whole road sequences, and to use corresponding categories/classes for the survey (see Map 52). For the survey, information on the width of existing road corridors (right of way) may be needed. This information should be available from the Office of Public Works and Transportation, or can be derived based on data from the systematic land titling (Cadastre Team in PDLMUPCC).

For relevant national regulations see Article 31 of Sub-Decree No 42 on Urbanization of the Capital, Municipalities and Urban Areas (Royal Government of Cambodia 2015).



Map 52 Existing road setbacks in urban area of Battambang Municipality

3.2.4 Building coverage types (recommended)

Building coverage types determine the relationship of a building to the side property boundaries. These building parameters have significant influence on the character of the streetscapes and the overall cityscape. Inadequate building coverage types (i.e. excessive use of attached buildings in conjunction with high building density) can have serious negative effects on the urban environment and living conditions (permeable surfaces, lighting, air ventilation, etc.) and distort the coherent urban design and orderly and aesthetic character of particular areas. Three different coverage types can be distinguished:

- Detached: Buildings are constructed with setbacks to both lateral/side plot boundaries.
- Semi-detached: Buildings are constructed with setback to one lateral/side plot boundary.
- Attached (linked): Buildings are constructed without any lateral/side setback.

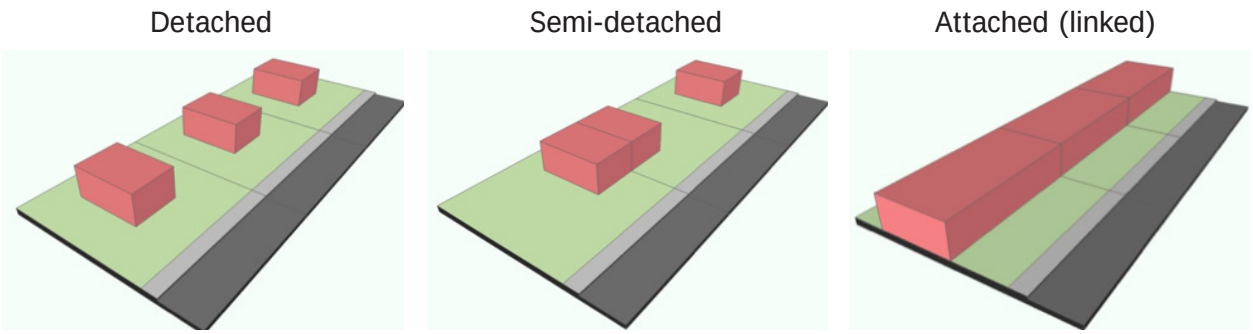
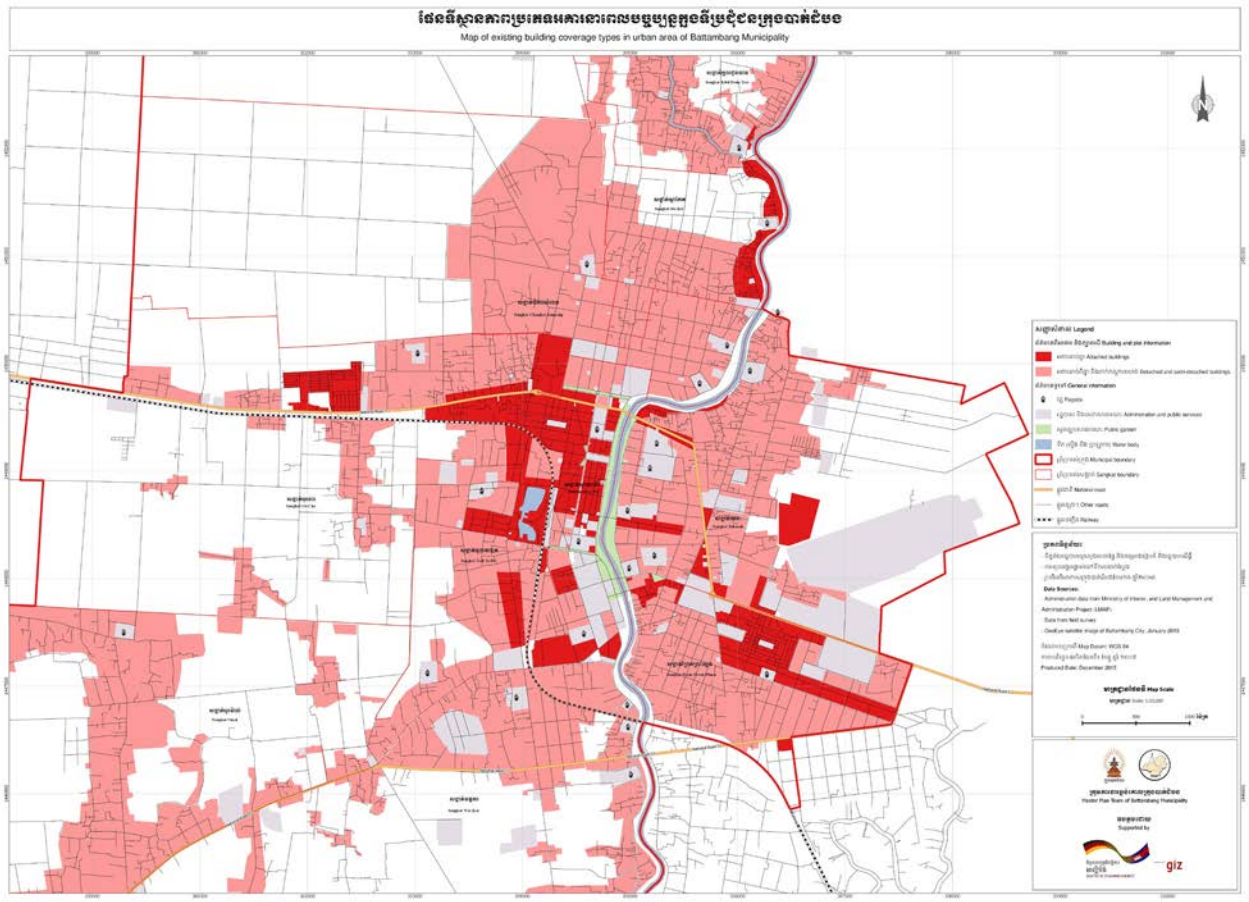


Figure 22 Building coverage type parameters

Building coverage types in urban areas in Cambodia often can be very heterogeneous, as they are following no particular regulations or planning deliberations. In urban core areas (commercial city centres) around market and along main arterial roads buildings often are erected with attached (linked) building coverage type, i.e. through the ever popular rows of shop houses (Pteah Luwen). For practicality and efficiency reasons, it is recommended to conduct the survey of existing building coverage types generalized for whole road sequences and coherent areas, and to use corresponding categories/classes for the survey (see Map 53).

For relevant national regulations see the Annex of Sub-Decree No 42 on Urbanization of the Capital, Municipalities and Urban Areas (Royal Government of Cambodia 2015), whereas: “Detached low-rise residential zone refers to zones for constructing detached low-rise housing, or buildings with one side attached such as villas, twin villas, houses with lots, houses surrounded by space on all sides, residential buildings, co-ownership buildings with Building Coverage Ratio and Floor Area Ratio determined by this Sub-Decree”, and “Linked low-rise residential zone refers to zones for constructing housing with walls attached to each other with low height such as flats, twin flats, residential buildings, and co-ownership buildings with Building Coverage Ratio and Floor Area Ratio determined by this Sub-Decree.”



Map 53 Existing building coverage types in urban area of Battambang Municipality

3.2.5 Built urban heritage (recommended)

Buildings/constructions and ensembles/areas can have a specific value and/or significance because of architectural/artistic, social and cultural/religious, or historical reasons. Furthermore, the existing built heritage can form a significant asset for the urban economic development, by promoting the (heritage-based) tourism service sector. Various elements and constructions can influence the townscape posi-tively and define the built form and (heritage) character of a city:

- The urban structure with its street layout, streetscapes, and system of squares and public gardens;
- Religious/cultural buildings like pagodas, temples and other monuments;
- Profane historic buildings and ensembles (e.g. traditional/vernacular Khmer architecture, French-influenced colonial architecture, new/modern Khmer architecture of the Sangkum Reastr Niyum etc.);
- Scenic landscape elements and beauty spots like rivers, lakes, avenues and urban forests, natural topography like mountains and hills;
- Historic technical constructions (e.g. bridges, water towers etc.)

During situation analysis, these elements should be identified through a rapid assessment (including field survey and research into urban development history resources (historic maps and photos, studies, articles and magazines, interviews etc.).

Identified heritage buildings and other elements that are potentially significant for historic, cultural, religious, aesthetic and/or architectural reasons shall be listed/inventoried with available background information and displayed on a map (see Map 54). Identified heritage ensembles, such as old city centers or shophouse ensembles from the French-Colonial period, public service/administrative building ensembles from the Independence Period (Sangkum Reastr Niyum),

or traditional Khmer villages with vernacular wooden houses and intact garden areas shall be mapped accordingly and supplemented by available data. The studies form a baseline for the elaboration of respective development objectives, strategies and actions for the conservation of existing built heritage during the following planning Steps.

The role and potential of those built heritage for the urban development, as well as imminent problems and threats caused by ongoing construction development etc. need to be discussed with key stakeholders to create awareness and understanding at an early point in time. Any construction development or intervention/change that could be potentially harmful to these heritage assets, needs to be carefully monitored already during the planning phase, and, if necessary, immediate action be taken by relevant authorities to prevent loss or damage.

Map 54 Existing heritage buildings in Ta Khmau Municipality (Kandal Province)

Task 3.3 Analyze local tertiary road system (optional)

Overview

The LUP planning process is closely based upon and in continuity of the planning steps and sequential results of the LUMP, therefore most of the analytical work described under Task 3.1.11 (Part A) does not need to be repeated. However, if the district/municipality decides to further define the future tertiary (local) road system during the Land Use Plan process (optional), in order to supplement the primary and secondary road system defined in the Land Use Master Plan (see Task 4.3.1, Part A), the existing local access roads (road types 3-5) now need to be further analyzed.

Who is involved?

- District/Municipal Land Management and Urban Planning Working Group
- Advisor(s) (if available and relevant)
- Database/GIS expert

Activities / methodology

Based on the analysis of the existing road network (see Task 3.1.11, Part A) and elaboration of the future road network (see Task 4.3.1, Part A) during the Land Use Master Plan (LUMP) process, the district/municipality can determine to have a closer look at the local tertiary road system during the Land Use Planning (LUP) process. Here, depending on local conditions and needs, the roads that were classified as tertiary roads before (road types 3-5; see Table 17) should be further assessed regarding their functionality and connectivity, as they give access to the neighborhoods and individual plots. Existing road corridor widths and related problems as well as impacts of and potential obstacles to future road widening should be analyzed in detail using aerial photos and further field surveys.

Necessary outputs

- An analytical map is produced, detailing the existing local tertiary road network.
- The map is accompanied by a short text that describes and explains the main information presented and their relevance to the spatial development of the district/municipality.

Step 4 Draft the Land Use Plan

Overall objectives

The Land Use Plan is the regulatory part of the Master Plan and Land Use Plan (MPLUP). The plan is developed from the strategic Land Use Master Plan and includes comprehensive and geographically defined land use zoning with respective detailed ordinance restricting the land use types, zoning and regulation on land use, construction, land development and conservation in each zone.

The designations of the Land Use Plan are legally binding to the administration and to the citizens. They form the legal base for subsequent development control and law enforcement and are thus safeguarding the intended future development of land use and construction in the District/Municipality.

Task 4.1 Define future land use type regulations (functional/use-based zoning ordinance) with District/Municipal LMUP Committee

Overview

Zoning regulations are mandatory rules as part of the legally binding Land Use Plan to achieve a specific spatial distribution of functions (land use) and desirable urban form. This task focuses on the use-based/functional zoning ordinance, by defining in detail the kinds of activities, which will be permitted and prohibited in particular land use categories (residential zones, commercial zones etc.) on the base of a revised future land use zoning plan that is based on the Land Use Master Plan.

As with all legally binding planning, a plan is only as good as it is implemented. Hence, it needs to be ensured that the building regulations are strictly enforced in the future. The implementing institutions on relevant government levels need to be aware of their specific responsibilities in the construction permission process and the mechanisms for effective and efficient development control need to be in place.

Who is involved?

- Initiation and implementation
  - Land Management and Urban Planning Working Group
  - Advisor(s) (if available and relevant)
  - GIS expert
- People involved in consultation and review
  - District/Municipal Land Management and Urban Planning Committee

Activities/methodology

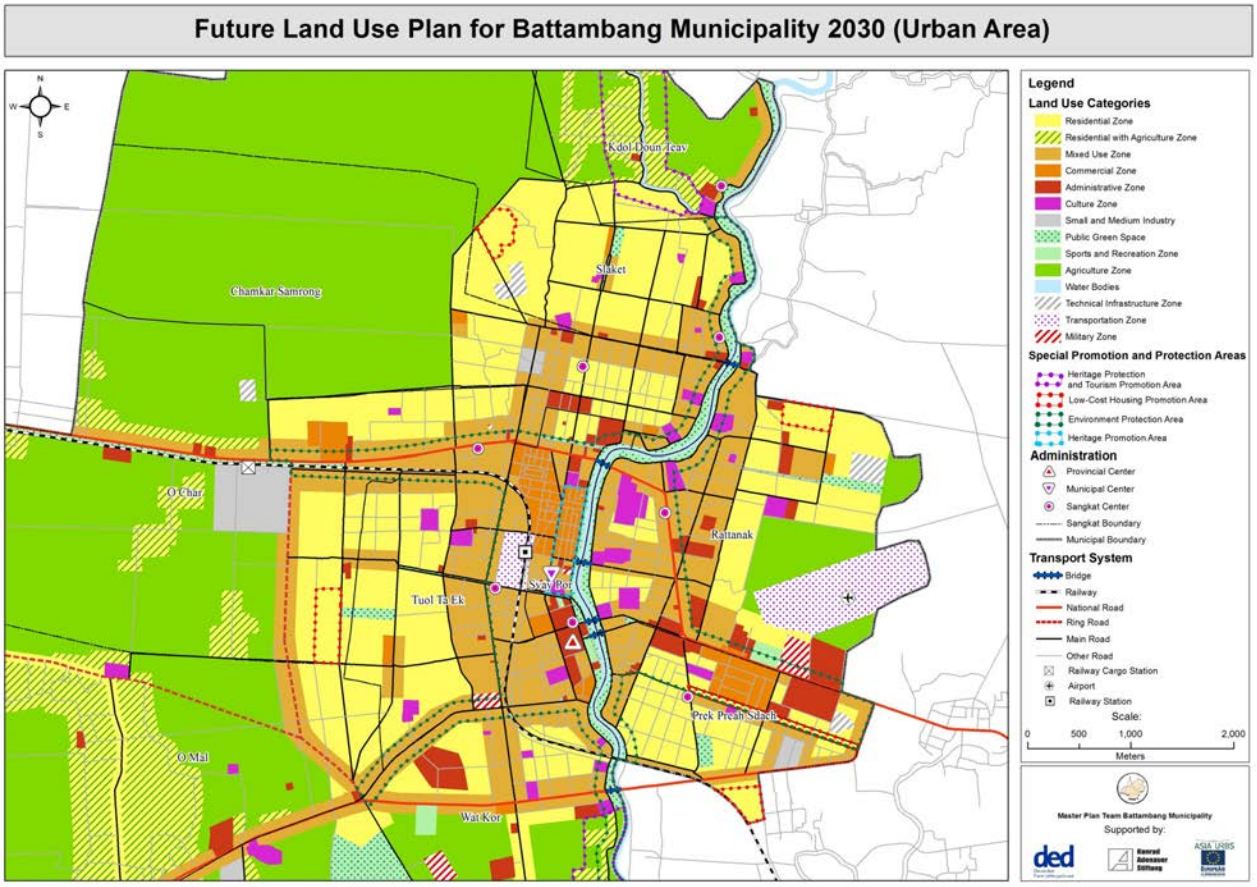
- The LMUP Working Group shall review the Draft Land Use Master Plan and identify those areas that need further detailed delineation of future land use zoning. As a legally binding plan, the Land Use Plan needs to provide geographically precise allocation and identification of all future land use units (see Map 55).
- If necessary, land use type demarcations need to be adjusted, assisted by GIS tools and supplementary surveys for clarification. The same applies for the balance of existing and future land use zones (see Annex 7), that needs to be adjusted accordingly.
- If the district/municipality decides to further define the future tertiary (local) road system during the Land Use Plan process (optional), the future local access roads (road types 3-5) now

need to be specified with their necessary road corridors, based on the primary and secondary road system defined in the Land Use Master Plan (see Task 4.3, Part A). Based on thorough case-by-case survey and analysis the tertiary road corridors are now defined and displayed in the draft Land Use Plan. For this challenging exercise it is recommended to (i) carefully consider all impacts (i.e. compensation costs etc.) of road widening particularly in existing settlement areas, (ii) to integrate road corridors already defined through the systematic land titling process, (iii) to integrate future local road concepts of known development projects particularly for urban extension, and (iii) to consult the draft tertiary road concept with relevant stakeholders (LMUP committee, line-departments, local communities, relevant land owners etc.) to find feasible solutions that can be implemented in the future.

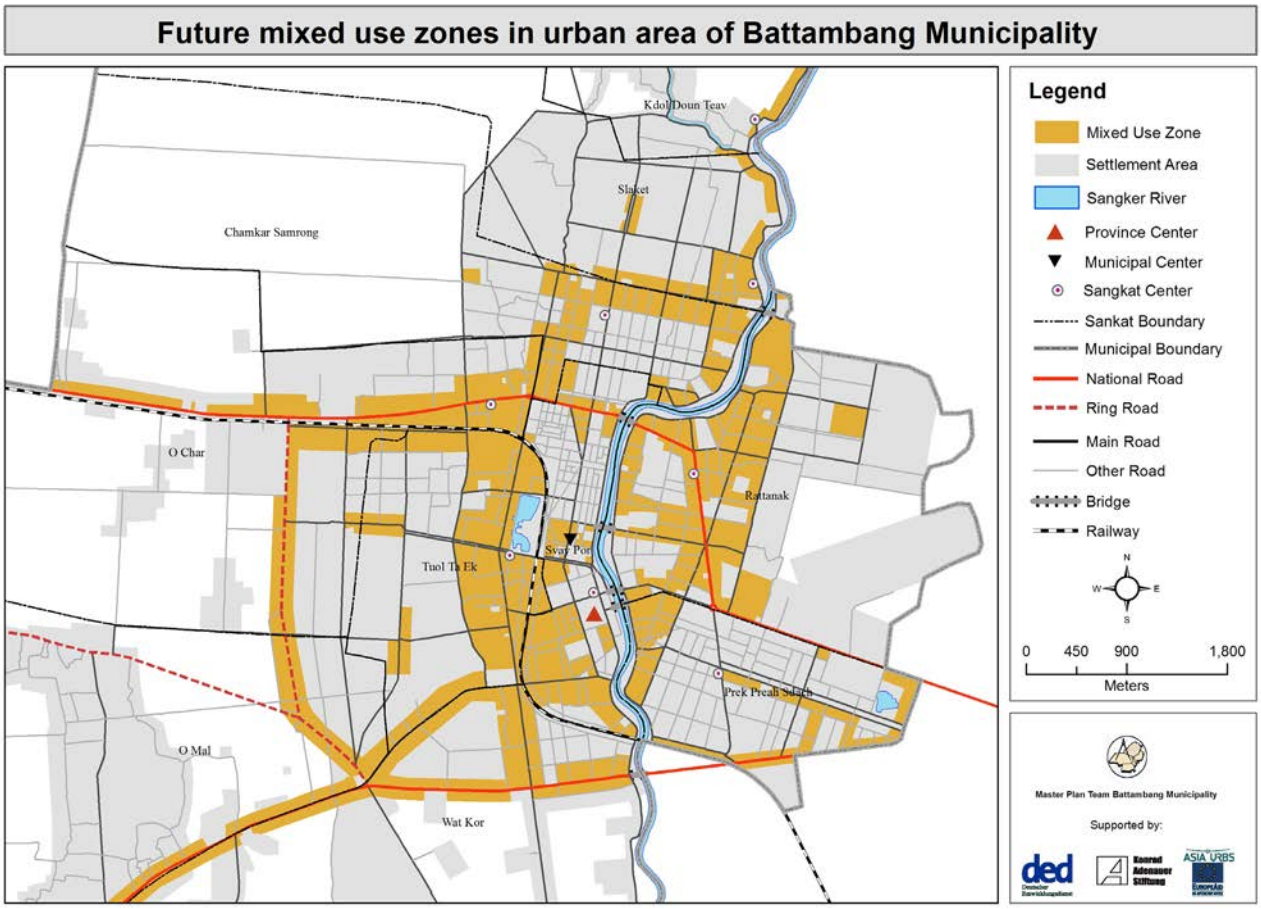
- The future regulatory land use ordinance (functional/use-based zoning) is developed by the LMUP Working Group and the GIS expert. The work starts from the revised future land use zoning map and proceeds by defining the detailed land uses/functions that will be permitted and prohibited in each future land use category. In the absence of specific land use regulations/standards pro-vided by the National level, this handbook suggests an exemplary land use ordinance for districts and municipalities that should be used for the exercise (see Annex 3). The listed general definitions and permitted/prohibited functions per land use category can be 'localized' and adjusted according to the specific local context and requirements (see Map 56 and Figure 23).
- The revised draft future land use zoning map and functional/use-based zoning ordinance is then presented for discussion and amendment to the District/Municipal LMUP Committee during a workshop.

Necessary outputs

- A revised and if necessary adjusted draft future land use zoning map with geographically precise delineation of land use types;
- A draft regulatory ordinance defining the general character and detailed list of permitted and prohibited functions for each future land use type;
- A draft future road concept including tertiary roads (local rods, road types 3-5) with detailed road corridor widths (optional);
- The draft future land use zoning map and the corresponding functional/use-based land use ordinance is presented to the LMUP Committee for discussion and amendments.



Map 55 Future Land Use Plan Battambang Municipality (Urban Area)



Map 56 Future mixed use zones in urban area of Battambang Municipality

Permitted and Prohibited Functions in Future Mixed Use Zones

(Battambang Municipality)

Mixed-Use Zones are intended to provide space for housing and to accommodate businesses that do not have disruptive effects on the residential function. Permitted are:

- Residential buildings (attached and detached residential houses, flats, apartment houses and blocks, farmhouses, shelters, huts etc.);
- All varieties of religious places (pagodas, temples, churches, mosques);
- Small-scale accommodation facilities (hotels, guesthouses);
- Small-scale entertainment facilities;
- Small-scale shopping facilities (shops, super markets);
- Service facilities (restaurants, offices, agencies and others);
- All kinds of education facilities (kindergartens, schools, vocational training centres, universities);
- All kinds of health facilities (health centres, hospitals, private clinics, doctors, pharmacies);
- All kinds of social facilities (orphan's homes, youth centres, centres for disabled people);
- Small-scale sports facilities (sports clubs, fitness clubs, and others);
- Workshops and handicrafts which are not seriously disturbing the residential function;
- Small-scale store places (storehouses, warehouses, store places for timber wood and construction materials) which are not seriously disturbing the residential function;
- Small-scale repairing workshops and washing places for light vehicles (cars, motorbikes);
- Gasoline stations.

In the rural area, additional small-scale utilisations related to agriculture are permitted (e.g. orchards, nurseries, vegetable gardens, raising pigs, cattle etc., poultry, and crocodile farming).

Prohibited are utilisations that seriously disrupt the residential function, in particular factories, workshops for metalwork and vehicle repairing, waste utilisation enterprises as well as market places. It is strictly prohibited to pollute the ground water in any way (if wastewater is produced, the owner of the respective facility or property is obliged to ensure proper wastewater treatment).

Figure 23 Land use regulations (functional/use-based zoning ordinance) for mixed use zones in Battambang Municipality

Task 4.2 Define future building regulations (form-based zoning ordinance) with District / Municipal LMUP Committee

Overview

Zoning regulations are mandatory rules (binding regulations) as part of the legally binding Land Use Plan to achieve a specific spatial distribution of functions (land use) and desirable urban form. This task focuses on the form-based zoning, by defining the building regulations that govern building form and the relation of buildings to the street. Building regulations are an essential part of the land use zoning, as the binding LUP will be the main ordinance to regulate and control the future construction development in the district/municipality.

Sub-decree No 42 on Urbanization of Capital, Municipalities and Urban Areas (Royal Government of Cambodia, 2015) comprises a set of meaningful standards and regulations for form-based zoning. However, the national regulations are too general to sufficiently govern construction development in all cities and urban areas across the entire country. Thus the district/municipal Land Use Plan needs to further define and localize those regulations according to their specific local context and situation (townscape and building structure, landscape and natural environment, history and cultural specificities etc.).

The main objectives and rationale for building regulations as part of the Land Use Plan are:

- To guide systematic and disciplined construction and prevent haphazard urban development;

- To secure the general requirements for living and working conditions which are conducive to good health (air ventilation, lighting), and the safety of the population (fire, hazard prevention), for example by limiting building densities and imposing setbacks;
- To provide proper utilization and maximum efficiency of space, for example by permitting higher building densities along transport corridors or near commercial centers;
- To minimize the negative impacts of new developments on the existing character of neighborhoods, streetscapes and adjacent properties through shading, overview and abrupt changes in building scale, for example by limiting building heights and imposing setbacks;
- To secure the requirements relating to the preservation of historic monuments and local centers, streets and public spaces of historical, artistic or architectural importance, and the characteristic town and landscape, for example by limiting building heights or imposing specific building types;
- To consider the requirements of sustainability, environmental protection and climate change, for example by limiting excessive sealing of open spaces or by allowing higher building densities.

Given the large sale an general scope of the Land Use Plan, it is highly recommended to focus on a few essential regulations that are (i) proportionate/adequate, (ii) simple and easy to understand, and (iii) applicable and controllable. Excessive over-regulation must be avoided, and all regulations need sound justification and be carefully substantiated in the Technical Report to the LUP. Emphasis should be given to general regulations for homogenous areas, i.e. not differentiated for each specific building block or even plot. Further detailed regulations should be limited to Urban Detailed Plans (UDP) for specific areas (e.g. particular valuable and sensitive areas, heritage conservation areas etc.). The form-based zoning (building ordinance) of Land Use Plans may include:

- the amount of space building structures may occupy on a plot (Building Coverage Ratio);
- the building densities at which plots can be used (Floor Area Ratio);
- the height of buildings (in meter and/or number of floors);
- the location of buildings on a plot (setbacks and alignment);
- the attached or detached construction of buildings to each other (building coverage type);
- the proportions of the types of spaces on a plot (e.g. how much landscaped space, impervious surface, parking space etc.);
- the minimum land lot size;
- further detailed regulations on building design (e.g. façade elements, roof shape, building materials etc.) should be limited to Urban Detailed Plans (UDP).

It is important to note that the building ordinance (as part of the LUP) will restrict the individual land use rights of land owners on their plot, and thus must be based on the fair consideration and balance of private property rights/interests against the common good/public interests. Existing land uses/functions have the 'right of continuancy', and regulations apply only for those land use changes mandatory for permission, after the Land Use Plan is ratified.

Who is involved?

- Initiation and implementation
  - District/Municipal Land Management and Urban Planning Working Group
  - Advisor(s) (if available and relevant)
  - Database/GIS expert
- People involved in workshop
  - District/Municipal Land Management and Urban Planning Committee
  - Provincial Department of Land Management, Urban Planning, Construction and Cadastre
  - Other relevant Line-Departments as needed (Public Works and Transportation, Culture

and Fine Arts, Environment etc.)

Activities / methodology

- It is recommended to develop the building regulations closely based on the detailed situation analysis and the relevant development goals, objectives and strategies elaborated during the integrated LUMP-LUP process.
- Building regulations should be linked to land use types as much as possible, while considering sub-categories (e.g. low-rise, medium-rise, high-rise residential zones).
- First draft regulations should be developed by looking at alternative options by the LMUP Working Group, while identifying corresponding advantages and disadvantages. The Working Group should invite other experts and stakeholders when needed or relevant.
- For better understandability, the draft regulations should be illustrated on separate plans (e.g. building height plan), and/or through supplementary illustrations/ diagrams.
- To support the conceptual work task, thorough field checks and the use of 3-D modelling of the building stock (if capacities available) are recommended.
- To enable the LMUP Working Group in this rather complex task, we propose hereunder a guideline including key points and questions that need to be addressed.
- Present and discuss the draft options and their consequences for the future development of the district/municipality with District/Municipal Land Management and Urban Planning Committee to get their feedback and necessary amendments.

Necessary Outputs

- A series of draft building regulations (where needed with options) are consolidated at district/ municipal level and produced along a guideline.
- The draft future land use zoning map and the corresponding functional/use-based land use ordinance is presented to the LMUP Committee for discussion and amendments.

A guideline to develop building regulations

4.2.1 Building Coverage Ratio / Floor Area Ratio

The Building Coverage Ratio (BCR) is an important regulation that defines the maximum percentage of a plot that can be covered by buildings and constructions (ratio of the built-up areas on a given plot to the total plot area). The purpose is to regulate the building density and limit the sealing of open space, for environmental reasons such as to allow rainwater seepage and to mitigate urban heat island effects etc. (for further reference see Task 3.2, Part B).

The Floor Area Ratio (FAR) defines the ratio of the total floor area of all the permitted buildings on a plot of land to the total area of the plot on which the buildings are located. It is an important regulation to limit and avoid excessive building densities (for further reference see Task 3.2, Part B).

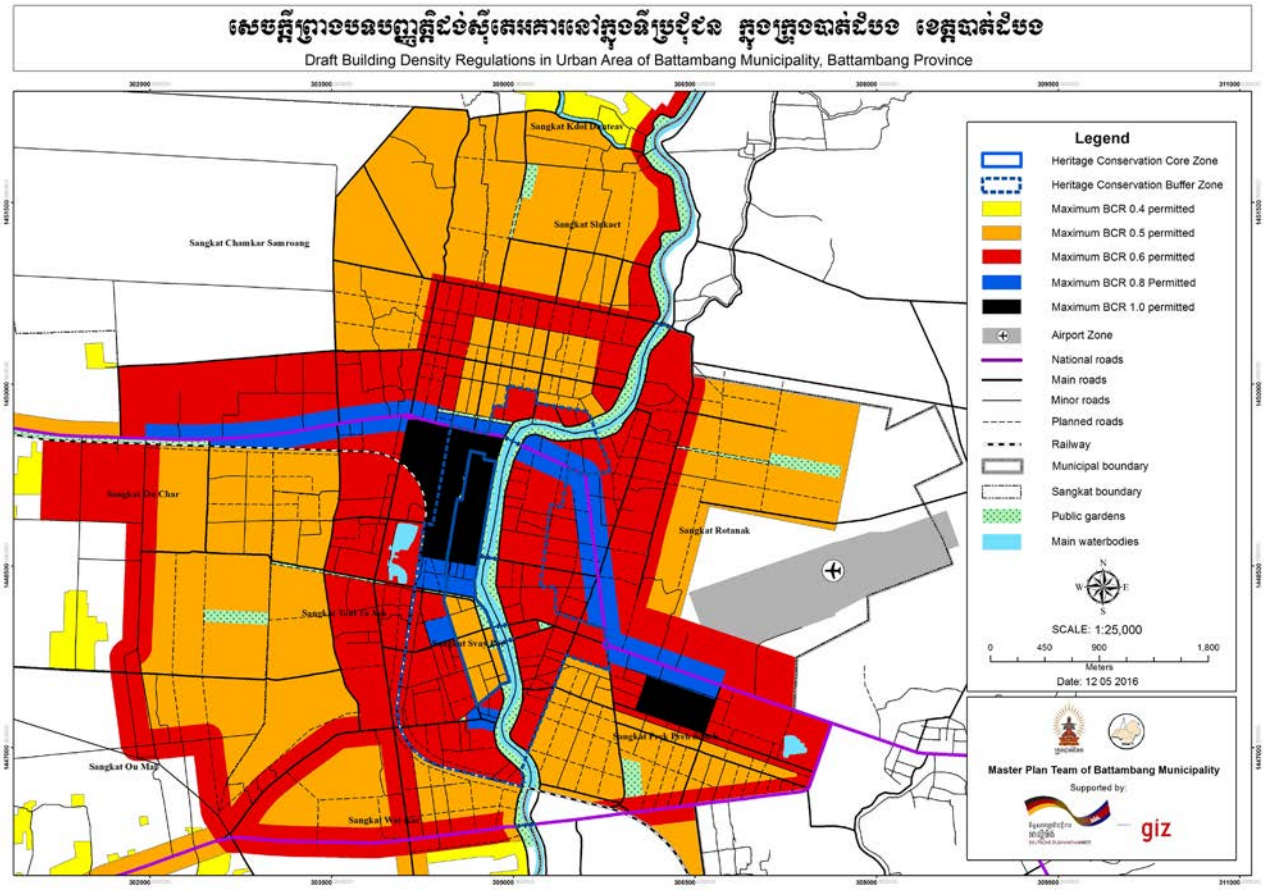
Sub-decree No 42 on Urbanization of the Capital, Municipalities and Urban Areas (Royal Government of Cambodia, 2015) determines maximum BCR and FAR values for the different land use categories (Articles 21 and 22 for Buildable Areas, Articles 25 and 26 for Control Areas). However, as these regulations are general and apply for the whole country, they need to be further detailed and localized according to the specific urban context of a particular municipality or urban area.

It is important to keep in mind that higher building densities allow for a more efficient use of land and are an important means to achieve a 'compact city' and avoid unsustainable urban growth and hap-hazard conversion of open/agricultural land into low-density settlement areas. On the other hand, excessively high building densities will negatively affect the environment, for example through sealing of open/permeable spaces and cause unhealthy living conditions. It is therefore

essential to find the right balance to regulate future building densities for the municipality, preferably closely based upon thorough situation analysis and the relevant development goals/objectives. For reference see Table 23 as well as Map 57 with the draft building density regulations for the Land Use Plan Battambang Municipality below.

Table 23 List comparing draft BCR and FAR regulations for the Land Use Plan Battambang Municipality with national standards from Sub-Decree 42

Land Use Zone	Draft Building Regulations LUP BTB		Sub-Decree 42	
	BCR	FAR	BCR	FAR
Low-Density Residential Zone	0.4	(x 2 fl.) = 0.8	0.5 (detached) 0.75 (linked)	1.5 (detached) 1.5 (linked)
Medium-Density Residential Zone	0.5	(x 3 fl.) = 1.5	0.6 (medium-rise)	3.0 (medium-rise)
High-Density Residential Zone	0.6	(x 5 fl.) = 3.0	0.6 (high-rise)	5.0 (high-rise)
Low-Density Mixed Use Zone	0.5	(x 3 fl.) = 1.5	0.7 (all mixed use)	10.0 (all mixed use)
Medium-Density Mixed Use Zone	0.6	(x 5 fl.) = 3.0 (x 7 fl.) = 4.2		
High-Density Mixed Use Zone	0.8	(x 5 fl.) = 4.0 (x 7 fl.) = 4.8		
Medium-Density Commercial Zone	0.8	(x 3 fl.) = 2.4 (x 5 fl.) = 4.0 (x 7 fl.) = 5.6	0.7 (mixed comm.)	10.0 (mixed comm.)
High-Density Commercial Zone	1.0	(x 3 fl.) = 3.0 (x 5 fl.) = 5.0 (x 7 fl.) = 7.0	0.75 commercial)	12.0 (commercial)
Industrial Zone	0.6	(x 3 fl.) = 1.8	0.6 (all industrial)	3.0 (all industrial)



Map 57 Draft building density regulations (Floor Area Ratio) in urban area of Battambang Municipality

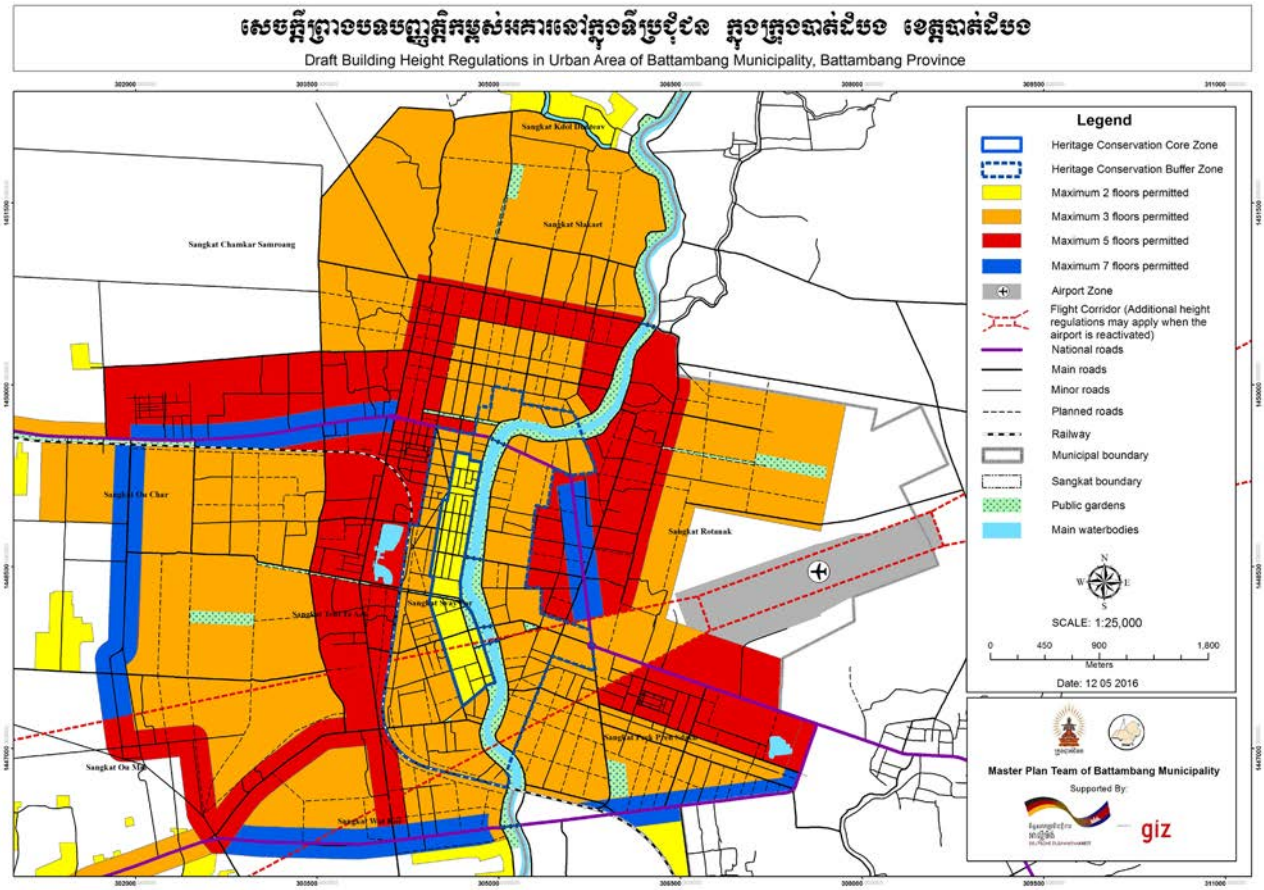
4.2.2 Building Heights

The purpose of building height regulations is to avoid unhealthy living conditions, protect a specific urban character and townscape (e.g. urban skyline, important view axes or landmarks/ monuments etc.), and avoid unsuitable/disproportionate buildings and constructions. The regulations are meant to guide and control the height development of the city, for example by zoning only suitable areas for medium- or high-rise buildings, while other areas (with a specific townscape and character) are restricted to low-rise buildings. Building heights can be regulated either through (i) the maximum overall building height in meter, (ii) by imposing the maximum number of floors that can be constructed in an area, or (iii) a combination of both (for further reference see Task 3.2, Part B).

For relevant national regulations see Article 30 of Sub-decree No 42 on Urbanization of the Capital, Municipalities and Urban Areas (Royal Government of Cambodia 2015), wherein: "The height of buildings in the cities shall be determined based on the region, building type, lot size, road width, and physical infrastructures where the construction is located, and the economic conditions, social conditions, the environment, geography, culture, comfort, health and beauty fitting the geographical location (...)". The Sub-decree further defines three classes of building heights, i.e. "Low-rise buildings are ranged from the ground floor, first floor and second floor, medium-rise buildings are ranged from the third floor to the eleventh floor, and high-rise buildings are ranged from twelve floors and above." However, these definitions seem not entirely practical/applicable compared to international standards, where the low-rise category is commonly defined as 1-3 floors, medium-rise as 3-7 floors, and high-rise as more than 7 floors (or 23 meters/75 feet).

It is important to keep in mind that higher buildings allow for a more efficient use of land and so are an important means to achieve a 'compact city' and avoid unsustainable urban growth and haphazard conversion of open/agricultural land into low-density settlement areas. On the other

hand, excessively high buildings will negatively affect the urban character and townscape, for example by disrupting the characteristic skyline of a city, by compromising the typical character of a low-rise residential neighbourhood, or by disturbing the integrity of a landmark building/monument (e.g. Buddhist pagoda, her-itage building etc.). It is therefore essential to find the right balance between preservation of the exist-ing townscape character (typical streetscapes, building ensembles and neighbourhoods etc.) and the future economic development and construction that will cause changes to the townscape. Therefore, future building height regulations should be preferably developed closely based upon thorough situation analysis and the relevant development goals/objectives, and should be discussed (if necessary in options) with key stakeholders. For reference see Map 58 with the draft building height regulations (max. number of floors) for the Land Use Plan Battambang Municipality below.



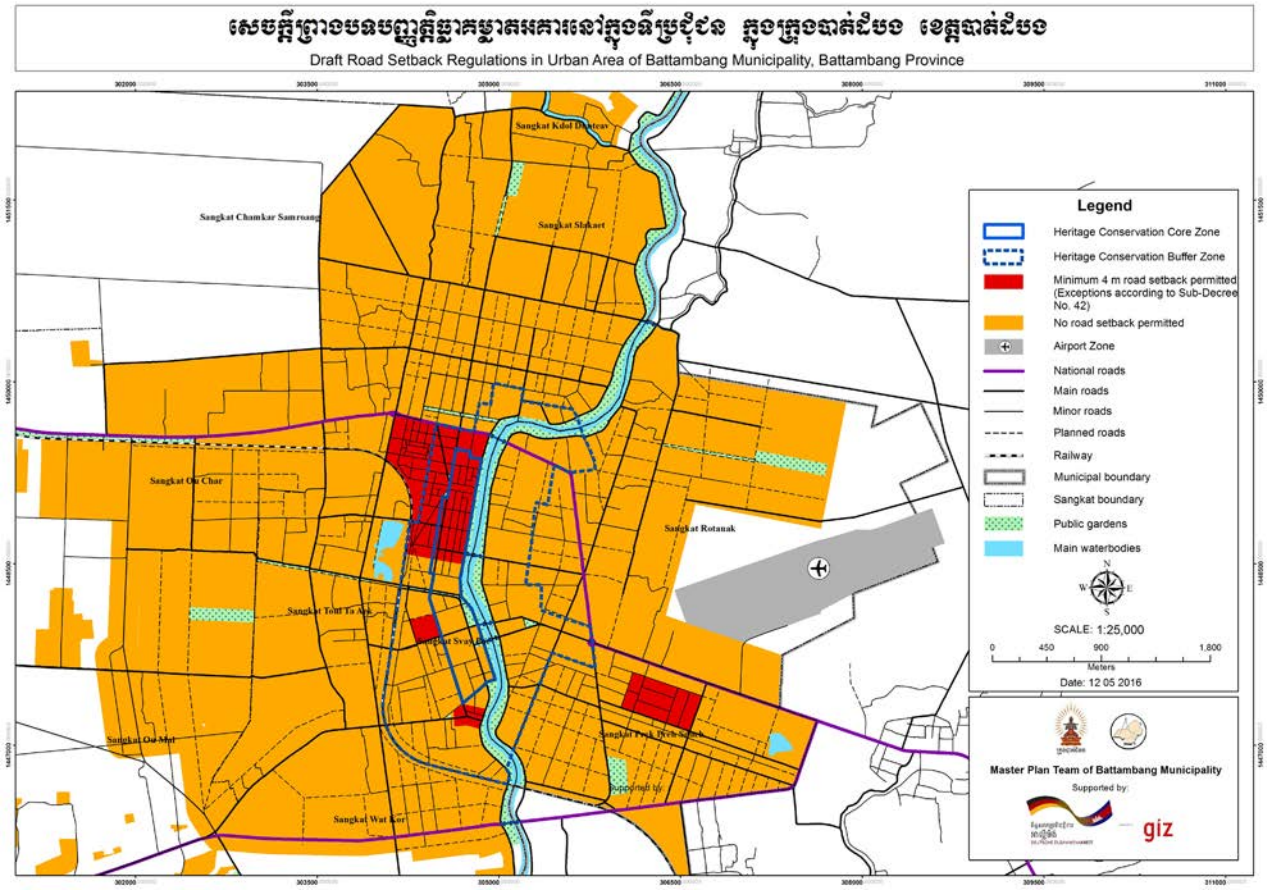
Map 58 Draft building height regulations in urban area of Battambang Municipality

4.2.3 Building Alignment / Road Setback and Margins

Building alignments can be imposed on either side of main roads to ensure that the road setback of buildings and constructions (from the front property boundary to the right of way) is maintained. The purpose of building alignment is: (i) to ensure that buildings and activities associated with them do not encroach onto the right of way, (ii) to safeguard sight lines for motorists, especially where the road bends or at junctions, (iii) to facilitate any future widening of the right of way (distance between property boundaries that define the overall width of a road). Side and rear margins for plots (i.e. minimum distance of building structures to the plot boundary) can be imposed to guarantee specific building patterns and for fire prevention purposes (for further reference see Task 3.2, Part B).

It is important to keep in mind that Article 31 of Sub-decree No 42 on Urbanization of the Capital, Municipalities and Urban Areas (Royal Government of Cambodia 2015) already regulates the road

set-back/alignment and side margins in detail. It is therefore recommended to identify the areas where those standard regulations cannot be applied, for example where no setback is needed because of their specific appearance/character and urban design (in old city centres with shop-houses from French colonial period etc.), and those areas where larger setbacks than the national standards are needed because of their specific character (low-density residential neighbourhoods with green character or along National Roads etc.). Therefore, future building alignment regulations should be preferably developed closely based upon thorough situation analysis and the relevant development goals/objectives, and should be discussed (if necessary in options) with key stakeholders. For reference see Map 59 with the draft road setback regulations for the Land Use Plan Battambang Municipality below.



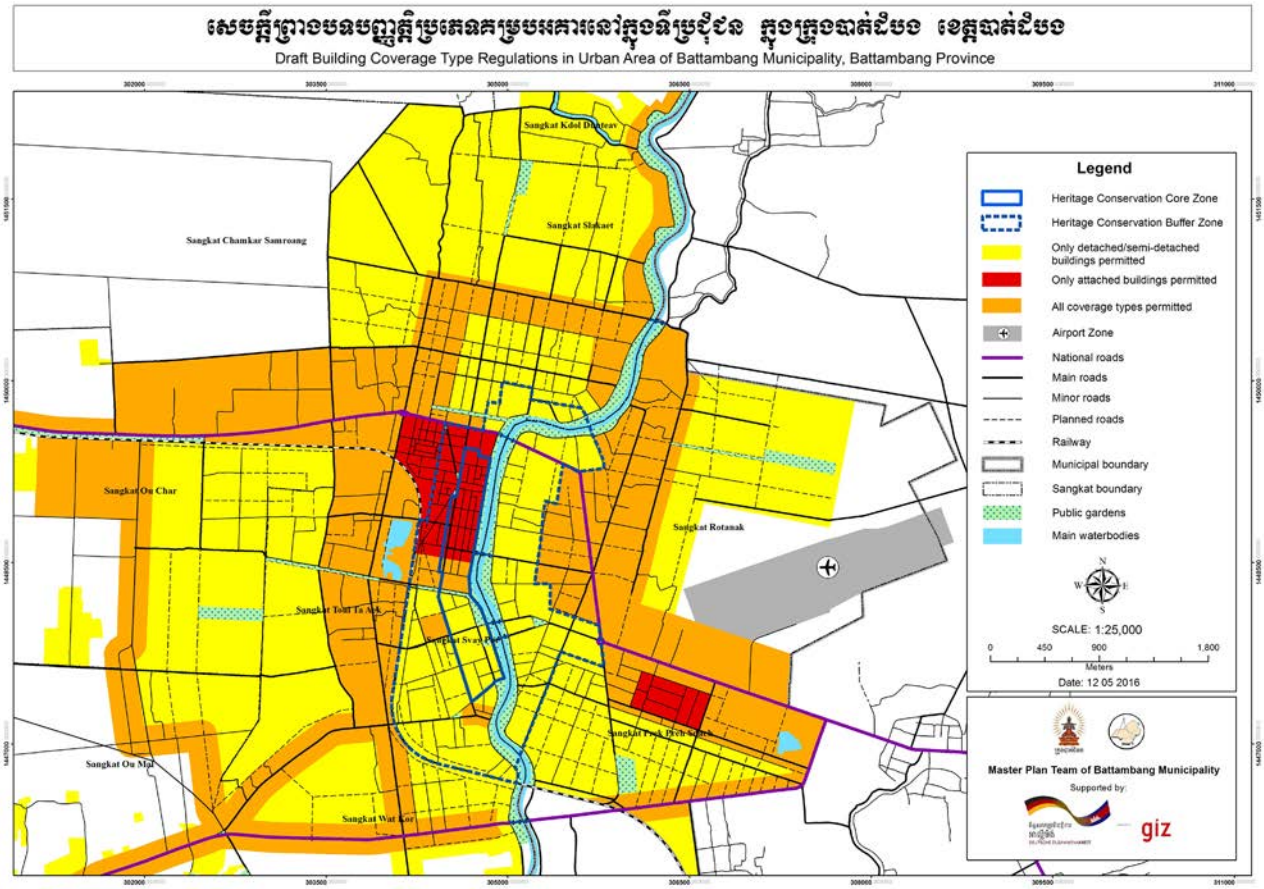
Map 59 Draft road setback regulations in urban area of Battambang Municipality

4.2.4 Building coverage types

Specific building types (villas, detached houses, semi-detached houses, apartment buildings etc.) or coverage types (attached, semi-detached, detached) can be imposed (promoted or prohibited), to maintain or guarantee the specific character of an area and avoid unsuitable/inadequate buildings and constructions (for further reference see Task 3.2, Part B).

For relevant national regulations see the Annex of Sub-decree No 42 on Urbanization of the Capital, Municipalities and Urban Areas (Royal Government of Cambodia 2015), wherein: “Detached low-rise residential zone refers to zones for constructing detached low-rise housing, or buildings with one side attached such as a villa, twin villas, houses within lots, houses surrounded by space on all sides, residential buildings, co-ownership buildings (…)” and “Linked low-rise residential zone refers to zones for constructing housing with walls attached to each other with low height such as flats, twin flats, resi-dential buildings, and co-ownership buildings (…).”

It is important to keep in mind that the attached building coverage type produces high building densities (BCR and FAR) and very urban (city centre) streetscapes. It is therefore recommended to identify those areas where attached buildings (shophouses = 'pteah luwen') will be permitted such as commercial centers and primary main roads, while permitting only detached and semi-detached houses in other areas, to keep their specific appearance/character and urban design. Therefore, future building height regulations should be preferably developed closely based upon thorough situation analysis and the relevant development goals/objectives, and should be discussed (if necessary in options) with key stakeholders. For reference see Map 60 with the draft building coverage type regulations for the Land Use Plan Battambang Municipality below.



Map 60 Draft building coverage type regulations in urban area of Battambang Municipality

Step 5 Review of Draft Land Use Plan by District/Municipal Stakeholders

Overall objectives

Once the Draft Land Use Plan has been developed by the working group and committee, it then goes into a review process, which is organized through consultation with commune/sangkat authorities and with stakeholders gathered in a sixth spatial planning forum.

Task 5.1 Consultation on draft Land Use Plan with Commune/Sangkat authorities

Overview

The draft Land Use Plan produced at district/municipal level is now presented to and scrutinized by Commune/Sangkat authorities. The local authorities should not only get a clear understanding of its zoning and the thematic plans and strategies, but also be actively engaged in discussing any conflicts that might arise from these.

Who is involved?

- Initiation and implementation
  - District/Municipal Land Management and Urban Planning Working Group
  - Database/GIS expert
- People involved in consultation and review
  - Commune/Sangkat Councilors and Village Chiefs/Development Committees members

Activities/methodology

- The integrated land use type map and the thematic plans and strategies are presented during a workshop to commune/Sangkat authorities. Alternatively, the working group could opt for a series of workshops to allow for sufficient discussion. The workshop is facilitated by the LMUP working group and the GIS expert. A map of the draft Land Use Master Plan relevant to the commune/Sangkat is discussed and the workshop proceeds with a systematic review of future land use types.
- Here again, current or expected tensions or contradictions between different land uses/sectors/land actors and interests need to be addressed.

Necessary outputs

- A second amended draft of the Land Use Plan is produced after consultations with local authorities.

Figure 24 Consultative workshop with Sangkat Chiefs on land use zoning and regulations, Bat-tambang Municipality 2008

Figure 25 Consultative workshop with Sangkat Chiefs on land use zoning and regulations, Battambang Municipality 2008

Task 5.2 Validate draft Land Use Plan in 6th Spatial Planning Stakeholder Forum

Overview

So far, the draft Land Use Plan has been discussed and elaborated within the LMUP committee and consulted with the Sangkat/commune authorities. It is now the time to widen the open discussion and include all spatial planning stakeholders and interest groups. To this end, a sixth Spatial Planning Stakeholder Forum is organized to present and validate the final draft Land Use Plan. This forum is an opportunity to present in a more succinct but comprehensive way all the aspects of the draft Land Use Plan so that the stakeholders have an overview of how each planning step and the various tasks have been mastered.

Who is involved?

- Initiation and implementation
  - District/Municipal Council
  - District/Municipal Land Management and Urban Planning Committee
  - Commune councillors
- Participants in Spatial Planning Stakeholder Forum
  - All stakeholders (Table 1)

Activities / methodology

- Organize the 6th Spatial Planning Stakeholders Forum. The draft detailed land use zoning and building regulations are presented and discussed in the stakeholder forum. Facilitate an open discussion on the results produced so far and encourage active participation of all participants (allow sufficient time for debate).

Necessary outputs

- The results and products of the Draft Land Use Plan are presented and discussed by all spatial planning stakeholders gathered in a forum.
- Any amendments requested by stakeholders are discussed and addressed in a final review process that follows the 6th Stakeholder Forum.

Step 6 Public Display and Endorsement by District/Municipal Council

Overall objectives

Based on previous consultations and reviews, a final technical report (including maps) of the LUP is prepared and submit to public display for a period of 30 days. The comments and recommendations made during that process by district/municipal, provincial and national committees for LMUP serve to revise the LUP technical report. The technical report is then endorsed by the District/Municipal Council.

Task 6.1 Prepare Final Technical Report

Overview

Based on the draft documents produced so far and the comments made during the final consultation workshops and Forum, the District/Municipal LMUP working group will prepare a final technical report of the Land Use Plan.

Who is involved?

- Coordination
  - District/Municipal LMUP working group
- Participants
  - District/Municipal LMUP-WG
  - District/Municipal LMUP-C
  - District/Municipal Council and BoG

Activities/methodology

- The responsibility for finalization of individual chapters should be assigned to individual team members based on their respective sector background and in collaboration with the respective sector line offices.
- The compilation of the chapters and a final cross-check of all chapters should be done by the District/Municipal LMUP-WG and LMUP-C in a collaborative effort.

Necessary outputs

- A complete and final technical report (including maps) of the Municipal/District Land Use Plan is prepared (see proposed outline in Annex 6).

Task 6.2 Public Display (Draft Land Use Plan)

Overview

The draft District/Municipal Land Use Plan maps are put on public display during a period of 30 days at the district/municipal hall and optionally in each commune/sangkat hall in the district/municipality. The display allows citizens, associations, NGOs to peruse it and formulate final critiques or suggestions. A particularly important role of the District/Municipal LMUP working group and committee is to properly document on how different inputs from the public display were collected and reflected upon. This documentation needs to complement the technical report draft and be shared with District/Municipal Council and sent to PCLMUP and NCLMUPC for review and further

recommendations. When this process is successfully finalized, the District/Municipal Council officially endorses the technical report of the district/municipal Land Use Plan.

Who is involved?

- Coordination
  - District/Municipal LMUP-WG
- Participants
  - District/Municipal LMUP-WG
  - District/Municipal LMUP-C
  - PCLMUP
  - NCLMUP

Activities / methodology

- District/Municipal Council should give green light to start the public display.
- The District/Municipal LMUP-WG prepares and puts on public display A0 size maps of the Draft Land Use Plan including necessary future main spatial development strategies and plans as well as corresponding summarizing explanations in text form.
- The district/municipal and commune authorities should observe a period of 30 days for public display to give an opportunity to the public to take stock of the plan, suggest modifications or provide recommendations.
- All suggestions should be addressed properly in an inclusive process. The District/Municipal LMUP-WG should neutrally record all incoming suggestions, feedback and critiques. It is reasonable to categorize and group them, in order to address them systematically and efficiently. The list of (grouped) feedback from the public display needs to be complemented with documentation on how the feedback was addressed (e.g. taken up, partly taken up, not taken up) and the reasons behind.
- In case a complaint is filed during 30 days of public display, conciliation mechanisms need to be put in place as foreseen by the detailed procedure (NCLMUP 2013).
- District/Municipal Committee for Land Management and Urban Planning shall document the whole public display process and sent the report to the Provincial Committee for Land Management and Urban Planning for review and comments and then proceed to the National Committee for Land Management and Urban Planning for further check and recommendations.
- Finally, a session with the District/Municipal Council is organized, in which the District/Municipal LUP is endorsed. This should build upon previous presentations and involvements of the council in the process and particularly focus on core issues which arose from the public display and how these were addressed. Keep in mind that it is possible for the council to demand changes or request further clarification, so that actual approval might require another meeting.

Necessary outputs

- The public display is conducted over 30 days and all problems raised are addressed and properly documented;
- The LUP technical report is amended, presented to and endorsed by District/Municipal Council.

Step 7 Review of Technical Report

Overall objectives

The final technical report is presented to provincial authorities (PCLMUP and Provincial Council) as well as to the National Land Management and Urban Planning Committee. Comments and recommendations resulting from this process are integrated in the technical report.

Task 7.1 Final presentation to provincial authorities and revision

Overview

The District/Municipal LUP is presented to provincial authorities (Provincial Council and PCLMUP). The District/Municipal LMUP working group and committee then conduct the final revision of the technical report based on the final review and comments made by the Provincial Council and Provincial Committee for Land Management and Urban Planning.

Who is involved?

- Coordination
  - District/Municipal LMUP-WG
- Participants
  - District/Municipal LMUP-WG
  - District/Municipal LMUP-C
  - PCLMUP

Activities / methodology

- A representative of the District/Municipality should deliver a presentation of the planning process and its key outputs (a revised version of the presentation developed for the final public consultation workshop) to the Provincial Council and Provincial Committee for LMUP.
- The responsibility for finalization of the technical report should be assigned to members based on their respective sector background and in collaboration with the respective sector line offices.

Necessary outputs

- A final technical report that incorporates the recommendations and addresses the comments given by the Provincial Council and PCLMUP is produced and ready for the final approval process.

Task 7.2 Final presentation to national authorities and revision

Overview

The District/Municipal LUP is presented to national authorities (NCLMUP). The District/Municipal LMUP working group and committee then conduct the final revision of the technical report based on the final review and comments made by the National Committee for Land Management and Urban Planning.

Who is involved?

- Coordination
  - District/Municipal LMUP-WG
- Participants
  - District/Municipal LMUP-WG
  - District/Municipal LMUP-C
  - PLMUP Committee
  - NLMUP Committee

Activities / methodology

- A representative of the District/Municipality should deliver a presentation of the planning process and its key outputs (a revised version of the presentation developed for the final public consultation workshop) to the National Committee for LMUP.
- The comments received during this presentation from the NCLMUP should be well documented and considered to amend the final technical report of the LUP.
- The responsibility for finalization of the technical report should be assigned to members based on their respective sector background and in collaboration with the respective sector line offices.

Necessary outputs

- A final technical report that incorporates the recommendations and addresses the comments given by the NCLMUP is produced and ready for the final approval process.

Step 8 Identification of Priority Projects

Task 8.1 Identify and prioritize projects based on the Strategy Matrix

Overview

In order to implement the Land Use Plan, it is important to identify projects, e.g. newly planned physical infrastructures. Equally important is to mainstream this process in the context of 5-year development and Investment plan developed at district/municipal level. In this process, the strategy matrix established in Step 4 (Part A) is central as it ensures cohesion between spatial development strategies and existing development planning within a unified planning framework at district/municipal level.

Who is involved?

- Initiation
  - District/Municipal Land Management and Urban Planning Working Group
  - Database/GIS expert
- People involved in consultation and review
  - District/Municipal Land Management and Urban Planning Committee
  - District/Municipal Council
  - District/Municipal Board of Governors

Activities / methodology

- Review strategy matrix that specifies long-term development goals, development objective and spatially explicit strategies that are unified to the 5-year development plan
- Identify specific projects on the basis of activities and sub-activities detailed in the strategy matrix (Task 4.1, Part A)
- Developed implementation and budget plans for each project
- Prioritize the implementation of these projects short term, medium term and long term based on the spatial development strategies of the LUP

Necessary outputs

- A list of prioritized projects to support the implementation of the LUP is established in the context of the unified planning system at district/municipal level and clearly aligned to the strategy matrix.

Step 9 Approval of the Land Use Plan

Overall objectives

The final technical report is submitted to responsible authorities for endorsement and approval. The process goes from District/Municipal council to the National Committee for Land Management and Urban Planning.

Task 9.1 Submit the LUP to district / municipal and provincial authorities for final endorsement

Overview

The final technical report on the District/Municipal LUP is submitted to district and provincial council for final endorsement.

Who is involved?

- Initiation
  - District/Municipal LMUP working group
- Participants
  - District/Municipal LMUP committee
  - Representative of the District/Municipal Council and BoG
  - Representative of the Provincial Council and BoG

Activities / methodology

- Submit to Municipal Council for endorsement
- Submit to Provincial Committee for Land Management and Urban Planning (PCLMUP) for agreement
- Submit to Provincial Council for endorsement

Necessary outputs

- The district/municipal council and provincial council endorse the District/Municipal LUP

Task 9.2 Submit the LUP to national authorities for final approval

Overview

The final technical report on the District/Municipal LUP is submitted to national committee for land management and Urban Planning for final endorsement and approval.

Who is involved?

- Initiation
  - District/Municipal LMUP working group and committee
- Participants
  - Representative of the District/Municipal Council and BoG
  - Representative of the Provincial Council, BoG and Provincial LUMP Committee
  - NCLMUP

Activities / methodology

- Submit to National Committee for Land Management and Urban Planning (NCLMUP) for review, approval.

Necessary outputs

- The NCLMUP approves the LUP and commences the process for having it promulgated/enacted as a Sub-Decree.

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Annexes

Annex 1 List of spatial and non-spatial data required for District/ Municipal Land Use Master Planning and Land Use Planning

Section	Topic	Data	Source	Update	Access online
Geography	Administration	Administrative boundaries (country, province, district and commune)	Department of Geography (Phnom Penh)	As available	
		Village boundaries	PDLMUPCC - Team involved in Systematic land registration	As available	
		Location of administrative center	Department of Geography (Phnom Penh)	As available	
Physical Environment	Topography	Contour lines	Ministry of Public Works and Transport (Jica Data Set)	2002	
		Digital Elevation Model/hill shade	Mekong River Commission Interactive Atlas	2003	
	Watershed	Watershed boundaries (catchment)	Mekong River Commission Interactive Atlas	2003	
	Climate	Weather data (precipitation and temperature)	Provincial Department of Water Resources and Meteorology	As available	
	Hydrology	Water bodies	Ministry of Public Works and Transport (Jica Data Set)	2003	
		Water streams	Ministry of Public Works and Transport (Jica Data Set)	2002	
		Flood incidence (central area)	Mekong River Commission Interactive Atlas	2003	
	Geology	Rocks	Mekong River Commission Interactive Atlas	2003	
			Ministry of Public Works and Transport (JICA Data Set)	2003	
	Soil	Soil (with FAO classification)	Mekong River Commission Interactive Atlas	2003	3
	Ecology	GENE-ecological Zoning	Forestry Administration/DANIDA/DED	2003	3
Demography	Population	Number of people, by sex and commune/district for several consecutive years	National Population Census of Cambodia	1998 & 2008	1
			Commune database	2006-2014	2
		Number of immigrant and emigrant over a certain period of time	National Population Census of Cambodia	2008	1-3
		Population by age group	National Population Census of Cambodia	1998 & 2008	1
			Commune database	2006-2014	2-3

Settlement and Building Structure	Settlement	Location and size of main settlement in rural areas	Ministry of Public Works and Transport (JICA Data Set)	2002	
		Location and size of main urban centers	Department of Land Management, urban Planning, Construction and cadastre	As available	
		Location and description of informal settlements in urban/rural areas	Provincial administration	As available	
	Building Structure	Plot structure	PDLMUPCC – Team involved in Systematic land registration	As available	
		Building structure (building coverage/footprint and building height/number of floors)	Satellite photos, Google Earth portal (...); own field survey	As available	5
		Building density (BCR and FAR)	Own calculations (based on building and plot structure)	As available	
Housing and Sanitation	Housing	Nature of construction (permanent, semi-permanent, temporary) by roof material	Commune Database (CDB)	2006-2014	2
			National Population Census of Cambodia	1998 & 2008	1
		Main source of light	Commune Database (CDB)	2006-2014	2
			National Population Census of Cambodia	1998 & 2008	1
	Sanitation	Access to and type of toilet facilities	Commune Database (CDB)	2006-2014	2
			National Population Census of Cambodia	1998 & 2008	1
		Type and location of main source of drinking water (households with access to improved water sources)	Commune Database (CDB)	2006-2014	2
			National Population Census of Cambodia	1998 & 2008	1
Physical Infrastructures	Transport infrastructure	Location and type/status of road (classification, surface type, connectivity)	Ministry of Public Works and Transport (JICA Data Set) - Provincial Department of Public Works and Transport and/or PDLMUPCC; Commune Database (for number of vehicles)	2002 for JICA dataset, as available for other sources	
		Location and type of bridges			
		Location and status of railways and stations			
		Location and status of navigable waterways and ports/ harbors			
		Location and status of bus stations and public transport lines/services			
		Demand characteristics and trends (number of vehicles, modal share, traffic congestion etc.)			

Physical Infrastructures	Rural water management infrastructure	Location and status of main irrigation schemes (canal, gates, command areas)	Commune Database (CDB)	2006-2014	2
			Ministry of Public Works and Transport (JICA Data Set)	2002	
			Provincial Department of Water Resources and Meteorology	As available	
		Location and status of flood protection infrastructures (dams and levees)	Ministry of Public Works and Transport (JICA Data Set)	2002	
			Provincial Department of Water Resources and Meteorology	As available	
	Urban water management	Location and coverage/capacity of freshwater supply system (network, freshwater treatment plant, pumping stations, inlets etc.); consumption/demand characteristics and trends	Provincial Department of Public Works and Transport	As available	
			Cambodia Water Authority	As available	
		Location and coverage/capacity of sewage/drainage system (network, wastewater treatment plants, pumping stations etc.); consumption/demand characteristics and trends	Provincial Department of Public Works and Transport	As available	
			Cambodia Water Authority	As available	
	Energy supply	Location and coverage/capacity of electric transmission network and distribution facilities with origin of electricity; consumption/demand characteristics and trends	Open Development Cambodia	As available	3
			Provincial Department of Industries, Mines and Energy	As available	
			Cambodia Electricity Authority	As available	
		Location and coverage/capacity of (hydro-) power stations and reservoirs	Open Development Cambodia	As available	3
			Provincial Department of Industries, Mines and Energy	As available	
			Cambodia Electricity Authority	As available	
	Solid waste management	Location and capacity of landfill sites	Provincial Department of Environment; Department of Public Works and Transport	As available	
		Location of area covered and status of waste collection services (quantities recycled, dumped etc., by waste type)	Contracted waste collector company (e.g. CINTRI)	As available	
	Energy infrastructures	Location and capacity of electric transmission line with origin of electricity	Open Development Cambodia	2011	3
			Provincial Department of Industries, Mines Energy	As available	
		Location and capacity of hydropower station and reservoirs	Open Development Cambodia	As available	3
			Provincial Department of Industries, Mines Energy	As available	
	Waste management infrastructure	Location and capacity of main dump fill site	Provincial Department of Environment	As available	

Social infrastructures	Education	Location of education facilities (kindergartens, primary/ secondary schools, universities and colleges, vocational training centers) with number of students/teachers, enrolment status, literacy rate; Access to primary/ secondary/ higher education and vocational training	Provincial Department of Education, Youth and Sport	As available	3
			Commune Database (CDB)	2006-2014	2
			Census Geo-database, NIS-MoP	2008	
			Department of Education	As available	
	Health	Location of health facilities (referral hospital, clinic, health centers) with number of beds/staff; Access to primary and secondary healthcare, infant mortality, life expectancy	Commune Database (CDB)	2006-2014	2
			Census Geo-database, NIS-MoP	2008	
			Provincial Department of Health	As available	
	Religion	Location and importance of main religious cult places (pagodas, churches, mosques etc.)	Provincial Department of Cults and Religion	As available	
	Culture	Location and importance of main cultural facilities (heritage/historical assets, library, museum etc.)	Provincial Department of Culture and Fine Arts	As available	
Land Use and Land Tenure	Land use cover	Location of different categories/types of land cover	Ministry of Public Works and Transport (JICA Data Set)	2002	
			Commune Land Use Map, produced by Ministry of Land Management, Urban Planning, based on JICA database	2002	
		Land cover raster	Google earth portal	As available	5
			Landsat images	As available	6
	Built-up area	Classification of all urban areas and built-in infrastructure	Provincial Department of Land Management, urban Planning, Construction and Cadastre		
	Agricultural production	Cultivated areas size for different crops n rainy and dry season	Provincial Department of Agriculture		
		Yields for different crop	Provincial Department of Agriculture	As available	
		Cultivated area size per HH	Commune database	2006-2011	2
		Location and importance of animal raising activities	Provincial Department of Agriculture		
	Private land titles	Area with delivered titles under the LMAP/LA-SSP program and under the Order 01	Provincial Department of Land Management, Urban Planning, Construction and Cadastre	As available	
	State land	Location and ownership of public/private state land	State land Management Committee, PDLMUPCC		

Land Use and Land Tenure	Concessions	Location and status of social land concession	Provincial Department of Land Management, Urban Planning, Construction and Cadastre	As available	
		Location and status of economic land concession (national and sub-national levels)	State land Management Committee, PDLMUPCC		
		Economic Land Concession	Open Development Cambodia	2011	3
			Ministry of Agriculture, Forestry and Fisheries	2011	4
			Provincial administration	2011	
	Forestry	Forest cover	Forestry Administration (Cantonment)	1993-1997-2002-2006-2010	
			Open Development Cambodia	1973-1989-2000-2004-2009-2014	3
		Community forestry	Forestry Administration (Cantonment)	As available	
			Open Development Cambodia	2011	3
		Location an capacity of tree planting (nursery)	Forestry Administration (Cantonment)	As available	
		Protected area (Conservation) area under management FA	Forestry Administration (Cantonment)	As available	
			Open Development Cambodia	2011	3
		Forest concessions	Forestry Administration (Cantonment)	As available	
		Forest rehabilitation area	Forestry Administration (Cantonment)	As available	
	Protected area	Protected area under management MoE	Provincial Department of Environment	As available	
			Open Development Cambodia	2011	3
		Community Protected Area	Provincial Department of Environment	As available	
		Location of conservation area managed by MoE (TSBR)	Provincial Department of Environment		
	Fisheries	Location and status of Community fisheries schemes	Fisheries Administration (Cantonment)	As available	
			Open Development Cambodia	2006	3
		Fishing lot and conservation area	Fisheries Administration (Cantonment)	As available	
			Open Development Cambodia	2006	3

Land Use and Land Tenure	Stone/Rocks	Location and type of stone/ gems extraction area	Provincial Department of Industries, Mines and Energy		
		Area attributed as mineral concession (Mining licenses)	Provincial Department of Industries, Mines and Energy	As available	
			Provincial Department of Land Management, Urban Planning and Construction	As available	
			Open Development Cambodia	2011	3
Environmental Profile	Pollution control	Locations, source, severity and current measures of air, water, soil, noise, and waste pollution Provincial Department of Environment	Provincial Department of Land Management, Urban Planning, Construction and Cadaster		
	Disaster prevention	Location, severity, frequency and current measures of floods, landslides, subsidence, river bank erosion etc.	Provincial Department of Environment; Provincial Department of Public Work and Transport		
	Climate change resilience	Current incidence and measures	Provincial Department of Environment		
	Vulnerability	Number of families/persons affected by natural disasters (heavy storms, floods, droughts, fires)	Commune Database (CDB)	2006-2014	2
Economy	Investment	General economic character and investment profile of province/municipality	Cambodia Municipality and Province Investment Information by Council for the Development of Cambodia (CDC)	2013	7
		Investment (FDI, domestic) by type	Provincial Hall		
	Agriculture	Type and number of agriculture enterprise/farms and processing	Census of Agriculture in Cambodia	2013	
	Industries	Types, location and employment level of large, medium and small industries/enterprises	Provincial Department of Industries, Mines Energy	As available	
			Economic Census of Cambodia	2011	8
		Location and status of Special Economic Zones (SEZ)	Open Development Cambodia	2011	3
	Socio-economy	Employment status, poverty/wealth profile, income structure	Commune Database (CDB)	2006-2014	2
			National Population Census of Cambodia	1998 & 2008	1
		ID-Poor classification	The Identification of Poor Households Programme, MoP	As available	9

Economy	Employ-ment	Individual labor occupation of active population (by economic sector/industrial composition, age, gender and education)	Commune Database (CDB)	2006-2014	2
			National Population Census of Cambodia	1998 & 2008	1
		Household main labor occupation (by economic sector/ industrial composition)	Commune Database (CDB)	2006-2014	2
			National Population Census of Cambodia	1998 & 2008	1
		Job migration	Commune Database (CDB)	2006-2014	2
			National Population Census of Cambodia	1998 & 2008	1
	Commerce and Services	Location and type of main commerce	Provincial Department of Industries, Mines and Energy	As available	
			Commune Database (CDB)	2006-2014	2
		Characteristics of commerce and service sector (type, size, location)	Provincial, Municipal or District Hall		
	Trade	Type and value of imported and exported products	Provincial Department of Taxes		
	Tourism	Location and type of main tourist attraction	Provincial Department of Tourism	As available	

1 http://celade.cepal.org/khmnis/census/khm1998/

2 http://db.ncdd.gov.kh/

3 http://www.opendevelopmentcambodia.net

4 http://www.maff.gov.kh

5 http://www.google.com/earth/index.html

6 http://landsat.usgs.gov/products_data_at_no_charge.php

7 http://www.cambodiainvestment.gov.kh/KM/

8 http://www.stat.go.jp/english/info/meetings/cambodia/e11f0vil.htm

9 http://www.mop.gov.kh/projects/idpoor/tabid/154/default.aspx

Annex 2 List of guiding questions for Planning Step 3 (Part A)

Sector / Thematic field	Guiding questions
Position of the city in the region/province	Has the city a strategic location in the region/province? Is the city well connected with growth centers and gateways? Is the city provided with favorable orientation at higher-level plans/policies?
Demography	Have the city/settlement areas in the district (center) been growing by attracting people from outside? Have the city/settlement areas in the district (center) been urbanizing in a sustainable manner? What are the current issues of urbanization?
Social	Are the people provided with basic social services (education, health etc.) adequately and equitably (service quality, coverage)? Are cultural values/heritage of the city/district properly preserved and enhanced? What is the nature of poverty and where are the poor distributed? Are the people provided with adequate employment? Are there enough, suitable jobs? What are the government plans and policies to improve social condition of the population?
Economic	Has the city`s/district's economy developed in sustainable manner with-out generating negative social and environmental impacts? Is the city/district provided with competitive industries compared with other cities/districts? Is investment environment conducive for foreign and domestic investors?
Environment	Is environmental sustainability maintained in the city/district? What are key environmental issues? How does urban growth affect the environment? Does the city/district provide adequate mitigation and adaptation measures against climate change and natural disasters? Are the people aware of the importance of environmental issues?
Spatial Structure and Land Use	Can the city/district (center) function as a growth and service center in the province/ region? How is the spatial organization of settlements within the city/district (compact, dispersed, polycentric etc.), and how does it affect the envi-ronment? Is the city's/district's settlement structure clustered in such a way that land is effectively used and environment is preserved? Are there desert-ed/unused areas? How do the urban areas connect and interact with the rural area? Are the settlements areas within the city/district expanding in sprawl-ing/chaotic manner, affecting rural areas negatively?
Agriculture	How have the agricultural sectors evolved in the past years? Do agriculture sectors provide decent income to smallholder farmers? What are the possibilities and conditions to sustainably intensify and diversify agricultural production? What are the government plans and policies to improve agricultural sectors? What are the possible conflicts revolving around questions of agricul-tural land access? How is the agriculture sector affected by the development of non-agricultural land use (e.g. urbanization, industrialization, etc.)?

Forest and Wetlands	How important are forest and fisheries resources for local livelihoods, district/municipal economic development and watershed stabiliza-tion? What are the possibilities and conditions to sustainably manage exist-ing natural resources? What are the government plans and policies to improve natural re-sources management? What are the possible conflicts revolving around questions of access, use and control of natural resources? How natural resources are affected by the development of others forms of land use (e.g. agriculture, urbanization, industrialization, etc.)?
Transportation	Is the city/district connected to major regional centers in an effective manner? Is the road network in the city/district sufficient in terms of quantity and quality? Is traffic controlled and managed well in the city/district? Can people travel safely in the city/district? Is a good public transport system in place to reduce traffic congestion and ensure environmental sustainability? Are the settlement areas convenient for pedestrians and non-motorized vehicle users?
Technical Infrastructure	Are the people provided with basic technical infrastructure services (en-ergy, water, sewage and drainage, waste collection, etc.) adequately and equitably (service quality, coverage)? What are the issues regarding physical infrastructure supply in the city (energy, freshwater, wastewater collection and treatment, drainage, solid waste management etc.)?
Housing and land tenure	Are people provided with secure and well-maintained houses with suffi-cient living spaces? Are there existing communities with insecure tenure and temporary (non-permanent) housing? Which people groups can afford houses, which can't? Do land market prices balance with its locational and socio-economic values?
Public Garden and Green Space	Does the city/district have sufficient parks and green space within an accessible distance to ensure the recreation and wellbeing of the people? How is the accessibility to green spaces of urban population? What are issues of the urban green system? (e.g. scattered, quality, greenery area, functions, etc.)
Townscape and Building Structure	Is the townscape in the city well managed to post a unique image of the city and ensure good living environment of the people? Does building construction follow the official standards and obey build-ing permissions? Are there developments that mismatch/ disturb their surroundings and have a negative effect on townscape and/or the living environment? Are there any monuments, ensembles or constructions of outstanding heritage value in the city, and are they properly protected and preserved?

Annex 3 List of land use regulations for Municipal/District Land Use Plan

Land Use Zone	Sub-Category	Definition	Permitted	Prohibited
BUILDABLE AREAS (BA)				
Residential Zone		Zones primarily for constructing housing/residential buildings	All kinds of residential buildings Small scale shops and services for daily life (that serve the residential neighbourhood) Small cafes and restaurants that serve the residential neighbourhood Small hotels and guest houses Home offices	All utilizations disrupting the residential function, in particular: Factories Metal workshops Vehicle repair workshops Construction companies Warehouses and depots Petrol and gas stations Large scale restaurants and shopping facilities Entertainment/amusement businesses Other disruptive functions (causing noise or air pollution, smell, health risks or any hazards)
(Sub-Categories)	Detached Low-rise Residential Zone	Zones for constructing detached low-rise housing, or buildings with one side attached such as a villa, twin villas, houses within lots, houses surrounded by space on all sides, residential buildings, co-ownership buildings		(see Residential Zone)
	Attached Low-rise Residential Zone	Zones for constructing housing with walls attached to each other with low height such as flats, twin flats, residential buildings, and co-ownership buildings		(see Residential Zone)
	Medium-rise Residential Zone	Zones for constructing housing of medium height such as a villa, twin villas, flats, twin flats, residential buildings, and co-ownership housing buildings		(see Residential Zone)
	High-rise Residential Zone	Zones for constructing housing of high height such as residential buildings, co-ownership housing buildings		(see Residential Zone)
	Mixed Residential Zone	Zones for constructing different types of housing such as attached housing, semi-attached housing, detached housing, residential buildings, and co-ownership housing buildings		(see Residential Zone)

Commercial Zone	Zones primarily for constructing buildings and facilities for commerce, central businesses and other services	Market places and other shopping facilities such as shops, shopping centres, super markets Office buildings, banks and other service businesses Residential buildings (residential use only in upper floors) Cultural facilities such as theatres, concert and exhibition halls, cinemas, dancing halls, libraries, museums Cafes, restaurants and bars/ entertainment businesses Hotels and guesthouses Education businesses such as private schools and universities Health facilities such as private hospitals and clinics Congress halls and trade fair areas Wholesalers and suppliers Sports facilities such as sports clubs, gyms etc. Small scale warehouses and depots Petrol and gas stations	All kinds of functions producing noise and/or air pollution Factories and industrial facilities Large warehouses and logistic functions causing high traffic demand for heavy vehicles Depots for dangerous/ hazardous goods such as chemical substances, petrol, gas, etc. (except for petrol and gas stations)
Industrial Zone	Zones for constructing buildings and facilities to serve large scale industrial sectors that are seriously disrupting in character	Factories and industrial facilities of all kinds Large scale warehouses and logistic facilities Depots for dangerous/ hazardous goods such as chemical substances, petrol, gas, etc. (disaster risk reduction and environmental regulations apply!)	All housing and residential functions General accommodation facilities Health, education and social facilities
Light Industrial Zone	Zones for constructing buildings and facilities to serve small scale industrial purposes, that are not seriously disrupting in character	Small scale factories Handicraft workshops such as metal work, carpentry, concrete work, pottery, dying etc. Food processing facilities such as ice factories, bakeries, slaughterhouse, breweries, rice mills etc. Petrol and gas stations Garages and washing places for vehicles Repair workshops of all kinds Construction companies, warehouses and depots/ storage sites Recycling places Residential functions for business owners and technical personnel (guards etc.)	Heavy industry and industry with seriously disrupting character Depots for dangerous/ hazardous goods such as chemical substances, petrol, gas, etc. (except for petrol and gas stations) Health, education and social facilities General residential buildings General accommodation facilities

Mixed Use Zone	Zones for constructing housing, and to accommodate businesses and services that do not have disruptive effects on the residential function	Residential buildings and functions Workshops and handicraft businesses that are not disturbing the residential function Hotels and guesthouses Small scale shops and service businesses Small scale repair workshops and washing places for light vehicles Cafes, restaurants and bars/ entertainment businesses Education businesses such as private schools and universities Health facilities such as private hospitals and clinics Administrative facilities Religious facilities Small scale warehouses and depots Small scale agriculture functions Petrol and gas stations	Factories and industrial facilities All kinds of functions producing noise and/or air pollution such as metal workshops, ice factories, recycling places etc. Market places, shopping centers Large warehouses and logistic functions causing high traffic demand (heavy vehicles) Depots for dangerous/ hazardous goods such as chemical substances, petrol, gas, etc. (except for petrol and gas stations)
Transportation Zone	Zones for constructing buildings, infrastructures, and services for transportation purposes	Railway stations and other railway buildings, railway lines and other necessary technical infrastructure related to railway services Railway cargo services and necessary technical infrastructure related to railway cargo services Airports Bus and taxi stations Harbours, ports and ferry stations Freight terminals and logistical distribution centers including warehouses and depots Other transportation facilities, in particular for public purposes	Heavy industry and industry with seriously disrupting character Accommodation facilities General residential buildings
Tourism Zone	Zones for constructing buildings and facilities to accommodate tourists and tourism-oriented services and businesses	Accommodation facilities such as hotels and guesthouses Tourism-related services such as information centers, travel agencies etc. Cafes and restaurants Entertainment/amusement facilities Cultural facilities Tourism-related shopping facilities Small scale tourism-related handicraft workshops Small scale sports and recreation facilities Residential buildings and functions	All utilizations disrupting the tourism function, in particular: Factories Metal workshops Vehicle repair workshops Construction companies Warehouses and depots Large scale shopping facilities and technical infrastructures, etc.

Administration and Public Service Zone	Zones for constructing buildings and facilities for administration and public services	Administrative facilities such as ministries, departments, units, capital halls, provincial halls, municipal halls, district halls, khan halls, commune and Sangkat halls, etc. Educational facilities such as universities, high schools, vocational training centers, schools, and kindergartens Social and health facilities such as senior homes, homes for the disabled, orphanages, hospitals, health centers, rehabilitation centers etc. Offices of NGOs and political parties Other administrative facilities such as post offices, courthouses, police stations, fire brigade etc.	(All other uses)
Public Space and Green Area Zone	Zones with predominantly green areas and facilities that primarily serve relaxation, recreation and/ or ceremonial functions and are open to the public	Public parks such as municipal parks, commune/Sangkat parks, neighborhood/village parks and children playgrounds Regional parks, forest parks, botanical and zoological gardens Roadside parks and boulevards Sports fields and stadiums of all kinds, including their service facilities Swimming pools and golf courses Monuments (statues) and their surrounding public area Picnic areas, rod-fishing areas, boating areas Small scale cafes and restaurants that are not disrupting the public green function Small scale facilities that serve the public green function such as parking space, public toilets, boat station etc.	In general, the Public Space and Green Area Zone shall be kept free of buildings. As an exception, small buildings may be permitted if they serve the major functions of the public green space and do not disturb its function and character
Cultural and Religious Zone	Zones for constructing buildings and facilities that serve historical, artistic, cultural, and religious purposes	Cultural and/or historic sites such as temple grounds, archaeological excavation sites, cultural villages etc. Religious buildings such as monasteries, pagodas, churches, mosques, temples etc. Cemeteries, burial grounds Religious schools and universities Small scale residential buildings related to the religious/cultural function such as housing for dignitaries monks/nuns, ashrams, religious retreats etc. Museums and exhibition halls Libraries Theatres, concert halls, cinemas	(All other uses)

Miscellaneous Zone	Unique to geographical features of particular area		
Residential with Agriculture Zone	Zones mainly serving rural housing purposes and utilizations related to agricultural uses	Detached residential houses Facilities related to agricultural function, such as barns and warehouses for agricultural products, rice mills, orchards, nurseries, animal farming etc. Small scale shops and services for daily life (that serve the neighborhood)	All utilizations seriously disrupting the residential function, in particular: Brick factories Metal workshops Heavy vehicle repair workshops Large scale shopping facilities and market places Construction companies, etc.
Technical Infrastructure Zone	Zones mainly serving the construction of technical infrastructure facilities	Drinking water treatment plants Wastewater treatment plants Waste disposal and waste separation sites Power stations Canals and ponds for drainage, sewage and irrigation Other technical infrastructure sites	(All other uses)
Military Zone	Zones mainly serving national defence and military purposes of the Royal Armed Forces of Cambodia and the Military Police	Buildings and facilities for military purposes, such as: Military administration facilities Military health facilities Military education facilities Military airports or ports Other military technical facilities such as garages, warehouses and depots etc. Accommodations for soldiers and military personnel	Large-scale storage facilities for ammunition and dangerous explosives Facilities with seriously disrupting character General residential buildings
CONTROL AREAS (CA)			
Agriculture Zone	Zones mainly serving agricultural as well as agro-industrial purposes	- Agriculture uses such as rice fields, plantations, vegetable gardens, tree nurseries etc. - Facilities for livestock rearing - Facilities for aquaculture, fish farming etc. - Small scale workshops serving agricultural purposes, tools and vehicles - Small scale facilities for processing agricultural products such as rice mills - Small scale warehouses and depots for agricultural products, timber wood, tools, fertilizer etc. - Private farmhouses for residential use by the farmers household only - Canals (irrigation, sewage, drainage) - Water reservoirs/ water tanks	- All kinds of buildings, except those listed under permitted functions - Workshops, facilities for agriculture processing and storage that are large scale and have a disrupting effect on the environment and character of the agriculture area (large scale construction, high demand for heavy traffic etc.)

(Sub-Categories) Note: Useful for land use analysis only, should not be used to regulate future land use!	Agriculture Zone (Rice)	Zones mainly serving agricultural purposes including the diversity of cropping systems existing in Cambodia with rain-fed, irrigated, receding or deep-water varieties	(See Agriculture Zone)	(See Agriculture Zone)
	Agriculture Zone (Annual crop, non-rice)	Zones mainly serving agricultural purposes including the diversity of cropping system existing in Cambodia with rain-fed, irrigated, receding or deep-water varieties	(See Agriculture Zone)	(See Agriculture Zone)
	Agriculture Zone (Perennial crop)	Zones mainly serving agricultural production including all tree crop plantations such as rubber, pepper, fruits trees, cashew etc.	(See Agriculture Zone)	(See Agriculture Zone)
	Agriculture Zone (Animal production)	Zones mainly serving agricultural purposes devoted to livestock production and involving animal rearing practices and the confinement of animals under specific shelters for animals	(See Agriculture Zone)	(See Agriculture Zone)
Forest Zone (Permanent Forest Estate)		Forest areas and forest needing to be protected, conserved, and reforested	Forests, grasslands, forest conservations, forest reservations and flooded forests etc, including related constructions for forest maintenance or forest administrative purposes only	(All other uses)
(Sub-Categories) Note: Need to be discussed and decided by NCLMUP, as it covers regulations governed by other ministries!	Protected Areas	Under jurisdiction of the Ministry of Environment. Management under Royal Decree on Protected Area and Law on Protected Area	(Based on Law of Forestry 2002)	
	Private Forest	Private property. Plantation forest or natural grow		
	Permanent Forest Reserve			

	Production Forest	Timber and NTFP production, forest concession, degrade forest, regeneration forest, state plantation forest, community forest		
	Protection Forest	Forest eco-system protection, watershed protection, biodiversity, cultural heritage, tourism, religious forest		
	Conversion Forest	Idle state forest land, not designated for use, temporary category (may become State Private Property)		
Water Resource Zone		Water surfaces and sources needing to be conserved and protected	Sea, rivers, streams, canals, lakes, reservoirs and other hydrological constructions, etc.	(All other uses)
(Sub-Categories) Note: Need to be discussed and decided by NCLMUP, as it covers regulations governed by other ministries!	Domestic use		Drinking, washing, bathing and other domestic purposes including watering for animal husbandry, fishing and the irrigation of domestic gardens and orchards, in a manner that will not affect other legal right of others. Not subject to licensing	Any polluting substances determined by the Government Sub-Decree
	More than domestic use		The diversion, abstraction and use of water resources for purposes other than those mentioned above and the construction of the waterworks relating thereto. This is subject to a license or permit	Any polluting substances determined by the Government Sub-Decree
	Conservation – no use			Any polluting substances determined by the Government Sub-Decree
Conservation Zone (Protected Area Zone)		Natural areas and scenery needing to be protected to serve environmental, economic, social, scientific, educational, and recreational purposes	Water bodies including river banks, beaches etc. National parks Mountain areas Wetlands, flooded forest etc. Wildlife sanctuaries Fishing areas (i.e. at Tonle Sap Lake) Buffer zones	Any development without special environmental assessment and permission
Miscellaneous Zone		Unique to geographical features of particular area		

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Annex 4 GPS field sheet

Sector	Type	Detail	Code
100- Social Infrastructures	Education	Kindergarten	111
		Orphanage	112
		Primary School	113
		Secondary school (college)	114
		Secondary school (lycee)	115
		University	116
		Chinese school	117
		Vocational training center	118
		Other	119
	Health	Health center	121
		Referral Hospital	122
		Private clinic	123
		Private doctor	124
		Red Cross	125
		Other	126
	Cult	Pagoda	131
		Chinese temple	132
		Vietnamese temple	133
		Church	134
		Mosque	135
		Other	136
200 - Public administration	Government	Provincial department	211
		Municipal/District office	212
		Other	213
	Territorial authority	Provincial Hall	221
		Municipal/District Hall	222
		Sangkat/Commune Hall	223
		Village house	224
		Other	225
	Police	Provincial Police Headquarter	231
		Municipal/District Police Post	232
		Sangkat/Commune Police Post	233
		Other	234
	Military Police	Provincial MP Headquarter	241
		Municipal/District MP Post	242
		Sangkat/Commune MP Post	243
		Other	244
	Military	Provincial Military Headquarter	251
		Municipal/District Military Post	252
		Other	253
	Justice	Court	261
		Prison	262
		Other	263

Sector	Type	Detail	Code
300 - Technical Infrastructures	Transport	Bridges	311
		Airfield	312
		Dry port	313
		Taxi station	314
		Bus Station	315
		Water port	316
		Other	317
	Energy	Electricity plant	321
		Petrol/Gas Station	322
		Solar Panel Station	323
		Antenna (telecommunication)	324
		Other	325
	Waste	Dump fill (managed)	331
		Dump fill (unmanaged)	332
		Incinerator	333
		Other	334
	Water	Water treatment station	341
		Irrigation gate	342
		Irrigation reservoir	343
		Other	344
400 - Commerce	Market	Market (roofed)	411
		Market (open-air)	412
		Other	413
	Commerce	Shop	421
		Restaurant	422
		Hotel	423
		Sport center	424
		Other	425
500 - Enterprises- Industries	Food	Ice fabric	511
		Rice Mill	512
		Food processing	513
		Other	514
	Non-Food	Garment factory	521
		Ironsmith	522
		Carpenter	523
		Other	524
600 - Open Space		Monument	611
		Garden	621
		Sport field	631
		Other	641

Annex 5 Excerpt from a draft Strategy matrix for Future Green System, Environmental Protection and Climate Change Adaptation (2016 - 2035)

LUMP Ta Khmau Municipality - Draft Strategy Matrix for Future Green System, Environmental Protection and Climate Change Adaptation (2016 - 2035)																
No	Sector (Code)	Overall Goal	Objectives	Main Activities	Sub-Activities	Spatial Relevance		Timeline			Main Actors		Measures			Indicators	Source of Verification
						Yes	No	Short-term	Mid-term	Long-term	Responsible	Executive	Legal	Technical	Budgetary		
9	Green System, Environmental Protection and Climate Change Adaptation	Develop Ta Khmau Municipality to become a comforable place for living and recreation with clean and green environment	Preserve, protect and extend public green spaces in the city for harmonious living of citizens and tourism promotion	Preserve and improve existing public green areas	Concept study to preserve and improve existing public green areas						Relevant line- department-s Municipal Office Provincial Office	Provincial Office				Before 2020, the concept to improve existing public gardens has been studied	Report by relevant line department and provincial office
					Improve existing public green areas (for example construct concrete river embankments for protection and extension of river bank gardens)						Relevant line-departments Provincial Office	Provincial Office				Before 2020, all existing public gardens are improved	Report by relevant line department and provincial office

				Construct new public gardens and recreational areas in the whole municipality	Study the concept on developing the green-belt along the blue system in the municipality to become part of the green system					Relevant line-departments Provincial Office	Provincial Office				Before 2025, the developing of green-belt along the blue system has been done	Report by relevant line departments Report by Provincial Office
					Identify potential areas for new public gardens, recreation areas, sports and gym places in each Sangkat					Ta Khmau CWG Municipal Office PDPWT PDL-MUP-CC PDE	Provin-cial Office				Before 2025, potential areas for public gardens, recre-ation areas, sport and gym places in each Sangkat have been identified	Report by Municipal Office Report by TK LUMP CWG

Study the design concept for public gardens, recreation areas, sports and gym places in each Sangkat				Ta Khmau CWG Municipal Office PDPWT PDL-MUP-CC					Before 2035, the design concept for public gardens, recreation areas, sport and gym places in each Sangkat has been developed	Report by Municipal Office Report by TK CWG
Construct green belt, public gardens, recreation areas, sports and gym places in each Sangkat (for example con-struct concrete embankments along Prek Thnoat Stream and construct as public garden, construct public garden inside PM military center, public gardens in new residential development areas, public gardens along the twin road to Sa-ang District)				Ta Khmau CWG Municipal Office PDPWT PDL-MUP-CC					Before 2035, all public gardens, recreation areas, sport and gym places planned in the LUMP have been construct-ed	Report by Municipal Office Report by TK CWG

					Study on possi-ble solutions to solve land use conflicts inside Chey Chom Neah Hos-pital to be organized as public garden and special environmental protection zone						PDH PDLMUPCC Munici-pal Office	Provin-cial Office				Before 2020, pos-sible solu-tions to solve land use con-flicts inside Chey Chom Neah hos-pital to be organized as public gar-den and special protec-tion zone have been studied	Report by Health Depart-ment Report by PDL-MUPCC Report by Mu-nicipal Office

Notice

Short-term (<5 years)

Medium-term (<10 years)

Long-term (>10 years)

CWG = Core Working Group
MLMUPC = Ministry of Land Management, Urban Planning and Construction

MoE = Ministry of Environment
MoIH = Ministry of Industry and Handicraft

MPWT = Ministry of Public Works and Transportation
NGO = Non-Governmental Organization
PDE = Provincial Department of Health
PDIH = Provincial Department of Industry and Handicraft
PDLMUPCC = Provincial Department of Land Management, Urban Planning, Construction and Cadastre
PDME = Provincial Department of Mine and Energy
PDPWT = Provincial Department of Public Works and Transportation
PDT = Provincial Department of Tourism
PDWR = Provincial Department of Water Resources
TK LUMP = Ta Khmau Land Use Master Plan

Annex 6 Outline Structure for a District / Municipal Land Use Master Plan and Land Use Plan Technical Report

Chapter 1 Introduction

1.1 Preface
1.2 Background and Rationale (Definition and relevance for sustainable development, time horizon, objectives etc.)
1.3 Policy and Legal Framework
1.4 Institutional Framework
1.5 Spatial planning methodology (planning procedure, spatial and non-spatial data collection, participation etc.)

Chapter 2 Situation Analysis

2.1 Position and integration of District/Municipality in province/region
2.2 Adminsitrative structure and boundaries
2.3 Spatial structure and overall territorial urban /peri-urban/rural zoning
2.4 Bio-physical environment (climate, topography, soil types, water resources etc.)
2.5 Existing land use
2.6 Evolution of land use from past to present
2.7 Townscape and building structure (building density, building height, road setback and alignment, building coverage type, built heritage etc.)
2.8 Land and housing tenure
2.9 Demographic profile (population density, demographic growth rate, net migration rate, age pyramid etc.)
2.10 Public administration and social services (administrative, education, health, culture and religious, other facilities)
2.11 Transport infrastructure system (roads, railway, waterways, air)
2.12 Public spaces and green/blue system
2.13 Technical infrastructure systems (water supply, sewerage and drainage, solid waste management, energy supply)
2.14 Agriculture and agro-processing economic profile (agriculture, forestry and fisheries)
2.15 Secondary and tertiary economic sectors profile (economic structure, employment, industries and manufacturing, services and trade, tourism, poverty incidence)
2.16 Environmental analysis (land suitability analysis, pollution control, natural disaster management, environmental conservation areas etc.)

Chapter 3 Future vision and long-term development goals

3.1 Scenario analysis (demographic growth scenarios, future land use demand)
3.2. Vision
3.3. Long-term development goals
3.4 Development objectives

Chapter 4 Land Use Master Plan and Integrated Spatial Development Strategies

4.1 Spatial Development Model
4.2 Strategic matrixes for key development sectors/themes (main development goals > development objectives > main activities > activities)
4.3 Future transport infrastructure system
4.4 Future public spaces and green/blue system

4.5 Future technical infrastructure systems (water supply, sewerage and drainage, solid waste management, energy supply)
4.6 Future public administration and social services
4.7 Future agriculture and environmental management (forest and water)
4.8 Future conservation/protection measures (climate change adaptation, disaster prevention, cultural heritage, tourism, informal settlements etc.)
4.9 Future integrated Land Use Master Plan of District/Municipality (land use zoning per each category, balance of future housing areas and future demand, comparison of existing and future land use zones)
4.10 Phases of development (optional)

Chapter 5 Land Use Plan

5.1 Scope and planning area of the Land Use Plan
5.2 Future land use type regulations (functional/use-based zoning ordinance)
5.3 Future building regulations (form-based zoning ordinance)

Chapter 6 Implementation Framework

6.1 Responsibilities (based on Strategy Matrixes)
6.2 Link between Spatial Planning and Development Planning
6.3 Plan updating and lower spatial planning levels
6.4 Monitoring of implementation

Annex

Participatory process (list of workshops/meetings and public forums with relevant stakeholders)
Results of final public display and stakeholder forum
(Other annexes on demand)

Annex 7 Balance of existing and future land use zones in Battambang Municipality (Planning Step 6)

	Land-Use Category	Area Size					
		Existing			Future		
		in ha	in % of Total Municipal Area	in % of Total Set-tlement Area	in ha	in % of Total Municipal Area	in % of Total Set-tlement Area
1	Residential Zone	456,7	3,96%	15,77%	1.267,9	10,98%	30,86%
2	Residential with Agriculture Zone	1.379,6	11,95%	47,63%	975,3	8,45%	24,04%
3	Mixed Use Zone	584,5	5,06%	20,18%	1.040,0	9,01%	25,31%
4	Commercial Zone	42,1	0,37%	1,46%	124,9	1,08%	3,08%
5	Administrative Zone	132,6	1,15%	4,58%	181,0	1,57%	4,46%
6	Culture Zone	104,4	0,90%	3,60%	99,2	0,86%	2,44%
7	Small and Medium Industry Zone	65,5	0,57%	2,26%	81,1	0,70%	2,00%
8	Public Green Space	17,6	0,15%	0,61%	178,1	1,54%	4,39%
9	Sports and Recreation Zone	9,1	0,08%	0,31%	15,0	0,13%	0,37%
10	Agriculture Zone	8.557,5	74,13%	---	7.353,4	63,70%	---
11	Water Bodies	89,9	0,78%	---	81,6	0,71%	---
12	Technical Infrastructure Zone	10,5	0,09%	0,36%	22,1	0,19%	0,55%
13	Transportation Zone	64,2	0,56%	2,22%	104,0	0,90%	2,56%
14	Military Zone	29,6	0,26%	1,02%	20,3	0,18%	0,50%
Total Settlement Area		**2.896**		**100%**	**4.109**		**100%**
Total Battambang Municipality		**11.544**	**100%**		**11.544**	**100%**	

This series of handbooks is the result of a collaborative effort between Provincial / District / Municipal-based Spatial Planning working groups, Experts and Decision Makers at the Ministry of Land Management, Urban Planning and Construction and GIZ advisors.

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