Final Report

PART II: PILOT ZONING SCHEME

CHAPTER 1
PRELIMINARY WORKS

1.1 Formulating a Pilot Zoning Scheme in the Project

1.1.1 Objectives of Pilot Zoning Scheme Formulation

The Erbil 2030 MP has faced difficulties such as incomplete or inconsistent development against the plan due to poor management and lack of integrated control instruments until now. The master plan would be required to secure its implementation by a binding power to manage urban activities, including the construction by the private sector. The zoning system is expected to be introduced into Erbil City as one of the powerful instruments to implement the master plan through regulatory or incentive measures.

The Project addresses this issue through the establishment of a model plan for a Zoning Scheme (ZS) through the pilot program in the priority area. The following are the objectives of the pilot program.

- To elaborate an appropriate subordinate planning system under the Erbil 2030 MP through the pilot zoning scheme formulation;
- To examine an enabling environment for the implementation of effective urban management and control for the master plan through a pilot program;
- To reflect on the current legal instruments for urban planning and management through a recommendation based on lessons learned from the pilot zoning plan formulation.

1.1.2 Preliminary Framework for Pilot Program in the Priority Area

The pilot program for establishing and demonstrating the Zoning Scheme (ZS) would be expected to contribute to the continuation of the process of regulatory arrangement in Erbil as a part of the KRG legislation. The following are illustrated preliminarily as an approach and scope of the program, implementation organization, process, and outputs for the pilot program.

(1) Scope and process of the Pilot Program

As mentioned in Section 1.1.1 above, the pilot program for a zoning scheme formulation aims to examine its applicability to the pilot area through several activities not only for the formulation of a zoning scheme primarily but also its planning process management.

(a) Preparatory Activities
- ✓ Setting implementation organizations (planning team, the planning committee, supporting group, other stakeholders' group, etc);
- ✓ Formulating the scope of the program for the zoning scheme;
- ✓ Defining the contents of the zoning scheme;
- ✓ Selection of a pilot area for a zoning scheme formulation in Erbil.

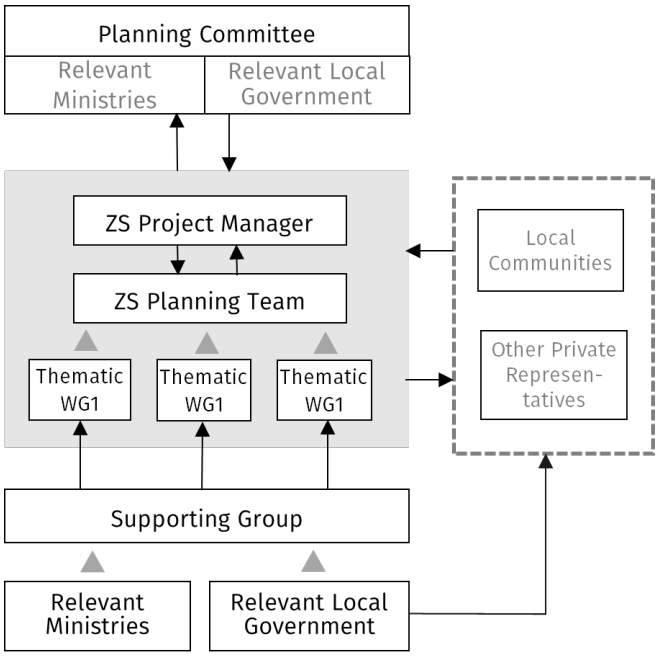
(b) Planning Activities
- ✓ Identifying planning issues for zoning;
- ✓ Drafting a zoning scheme through discussion with a technical supporting group.

(c) Validation and Consultation Activities
- ✓ Validation of the draft zoning scheme by the planning committee;
- ✓ Stakeholders' consultation on a proposed zoning scheme.

(d) Finalizing Activities
- ✓ Finalizing the draft zoning scheme;
- ✓ Lessons learned and conclusions.

(2) Implementation organization for scheme formulation

One of the initial tasks of the pilot program is to determine the organizational structure and the role internally and externally of relevant organizations in planning, discussion, and decision-making. Although this organization would play a temporal role only in the pilot program, this organization could be referable to further implementation of zoning schemes.



Note: ZS = Zoning Scheme, WG = Working Group
Source: JICA Project Team

Figure 1.1.1 Implementation Organization for Pilot Zoning Scheme Formulation in the Priority Area

Table 1.1.1 Key Role and Responsibility of Implementation Organizations

Organization	Key Role & Responsibility
Planning Committee	• Validate and approve the pilot program of Zoning Scheme (ZS) formulation, outputs • Monitor the implementation of the pilot program
Project Manager	• Preparation of a ZS project program in the priority area • Management of the ZS Planning Team (activities, schedule, internal and external communication, and coordination)
ZP Planning Team	• Implement planning activities based on the program (TOR, schedule, budget frame) • Prepare and submit ZS outputs • Monitor the implementation and review of ZS
Supporting Group	• Provide all necessary sector data and information to ZS Planning Team. • Coordinate sector programs and projects at the local level of planning
Thematic Working Group	• Validate and approve the program of the ZS project and ZS outputs • Monitor the implementation of ZS
Local Stakeholders	• Provide local information concerning urban management issues • Validate outputs during the ZS planning formulation

Source: JICA Project Team

(3) Outputs for Zoning Scheme

The Zoning Scheme is expected to have three outputs or deliverables 1) a report as an explanatory document including zoning contents and plan, 2) a regulation document describing the contents of regulations, and 3) a map delineating spatial information of zoning in an integrated manner.

On the other hand, the development control measures to be dealt with zoning scheme are expected to involve five (5) items 1) basic zoning elements such as boundaries, 2) use control (land and building), 3) form control (urban and building), 4) overlay zoning on the use and form control zoning, and 5) administration/enforcement describing variances for the deviation of regulation and enforcement.

Table 1.1.2 Zoning Scheme Outputs and Deliverables

Item	Contents	Scheme Output/Deliverable		
		Reporting	Regulations	Zoning
1. Basic Zoning Elements	Terms and Definitions	●	--	--
	Zoning Boundary	○	--	●
	Zoning District	○	--	●
2. Use Control	Use Control by Classification	○	●	●
	Color Code	○	○	●
3. Form Control	Urban Form Control Code	●	●	○
	Building Form Control Code	●	●	○
4. Overlay Zoning	Thematic Environment Control	○	●	●
	Thematic Development Incentive	○	●	●
5. Administration /Enforcement	Variances for Deviation	●	○	--
	Enforcement	●	○	--

Legend: ●= main output, ○ = supplement, --= not dealt
Source: JICA Project Team

(4) Expected timeline for Zoning Scheme formulation

The activities for Zoning Scheme formulation for the priority area are programmed during the course of the Project term in parallel with the formulation of Erbil 2050 MP. The timeline can be designed preliminarily in consideration of the following.

- **Preparatory activities in advance and in parallel with the formulation of Erbil 2050 MP:** Although the Zoning Scheme should be formulated in line with the spatial framework of the Erbil 2050 MP, preparatory activities such as implementation organizations, and the scope of the program can be introduced;
- **The planning activities would require a certain duration** including situation analyses, issues identification, zoning framework setting, drafting zoning, validation, and lessons learned, while necessary discussions would be held at appropriate timing;
- It should be noted that a pilot zoning scheme would not be able to be legitimated because of its pilot status without a **legislative framework** for a zoning scheme. It is necessary to examine its desirable scheme in a further stage of the Project.

Table 1.1.3 Activities Timeline for Zoning Scheme Formulation

Framework		2023				2024	
		Q-1	Q-2	Q-3	Q-4	Q-1	Q-2
Master Planning		▬	▬	▬			
Zoning Scheme Formulation	Preparatory Activities	▬					
	Planning Activities		▬	▬	▬	▬	
	Validation and Consultation		▲		▲	▲	
	Finalization Activities					▪ ▪ ▪ ▪	

Legend: ▲= Meeting/Discussion
Source: JICA Project Team

1.2 Selection of Priority Area for the Pilot Zoning Scheme in Erbil

1.2.1 Priority Area Selection Process and Result

(1) Priority Area selection process methodology & context

The selection of the Priority Area for Pilot Zoning Scheme has been carried out at early stages of the Project, after the clarification of the objectives and conceptual framework of a regulatory urban planning document in Kurdistan (see Part IV, Chapter 2). The early selection of Priority Area allowed for ample time to examine and debate the specific details of this innovative planning tool, as well as to establish the roles and responsibilities for planning and implementation.

The decision on the selection of the Priority Area was made through discussions between GDUP and the JICA Project Team, as outlined in the following process: setting-up the selection criteria, giving a score to all criteria based on a collective vote, confirming the pre-selection with high-level representatives of stakeholder organizations. Additionally, it was agreed during 2nd JCC Meeting on May 12th, 2022, that the final decision regarding the selection of Priority Area would be based on the consensus between MoMT including GDUP and UPDOE, Erbil Municipality Presidency in priority, and on the consultation of Erbil Governorate and related stakeholders.

(2) Selection criteria

Priority Area selection criteria were discussed and agreed between GDUP/UPDOE and the JICA Project Team on May 9th, 2022, as shown in Table below.

Table 1.2.1 Selection Criteria of Zoning Scheme Priority Area

Criteria Category	Criteria
1. Urban Development	a) Presence of available land for urban expansion; b) Necessity & urgency for having a zoning plan to foster urban expansion (strong real-estate attractiveness); c) Presence of older urban fabric zones having potential for urban renewal.
2. Urban Control and Regulation	a) Absence or obsolescence of urban plans; b) Presence of crucial agricultural lands to protect; c) Presence of key natural ecosystems to protect; d) Necessity & urgency for having a zoning plan to control urban expansion; e) Improvement of disaster prevention and urban resilience (including urban flooding mitigation); f) Presence of open and green spaces inside the urban fabric.
3. Complexity, Scale & Innovation	a) Complexity of development issues at the scale of Erbil; b) Urban functions playing a strategic / leading role at the scale of Erbil; c) Presence of a specific identity & "sense of place"; d) Presence of planned large-scale infrastructures (logistic hubs etc.); e) Presence of planned large-scale public facilities (universities, stadium, etc.); f) Presence of planned new and innovative economic activities (ICT etc.).
4. Implementation & Governance	a) Unicity of administrative entity (one municipality is better than multiple ones); b) Urban planning capacities & skills of local administration; c) Degree of involvement & cooperation of local administration; d) Degree of diligence & cooperation of local communities.
5. Replicability of the Pilot	a) Similarity of physical, natural, spatial, urban features to other cities in KRG.

Source: JICA Project Team

(3) Collective scoring of criteria for preselection

Individual scoring of selection criteria on a scale from 1 (weak) to 3 (strong) were performed for all candidate Municipalities of Erbil city during a working session between 11 staff of GDUP/UPDOE, Erbil Municipality and the General Directorate of Erbil Municipalities on May 11th, 2022. The result of the cumulation of individual scoring, giving the collective scoring, is shown in Table 1.2.2 below.

Table 1.2.2 Results of Selection Criteria Scoring for Pre-Selection of Priority Area

	Candidate Priority Areas (Municipalities)					
	M1	M2	M3	M4	M5	M6
1. Urban Development						
a. Presence of available land for urban expansion	1	19	21	14	19	28
b. Necessity & urgency for having a zoning plan to foster urban expansion (strong real-estate attractiveness)	5	22	20	13	12	21
c. Presence of older urban fabric zones having potential for urban renewal	32	12	7	10	5	10
2. Urban Control and Regulation						
a. Absence or obsolescence of urban plans	12	12	11	12	10	14
b. Presence of crucial agricultural lands to protect	5	22	24	24	16	20
c. Presence of key natural ecosystems to protect	7	16	25	20	17	18
d. Necessity & urgency for having a zoning to control urban expansion	5	23	24	22	19	28
e. Improvement of disaster prevention and urban resilience	23	26	19	24	31	18
f. Presence of open and green spaces inside the urban fabric	13	17	23	22	18	26
3. Complexity, Scale & Innovation						
a. Complexity of development issues at the scale of the Erbil	32	13	12	13	11	22
b. Urban functions playing a strategic / leading role at the scale of Erbil	28	28	16	10	9	16
c. Presence of a specific identity & "sense of place"	33	27	13	10	10	24
d. Presence of planned large-scale infrastructures (logistic hubs etc.)	12	28	14	9	11	27
e. Presence of planned large-scale public facilities	17	14	14	11	25	18
f. Presence of planned new and innovative economic activities (ICT)	10	21	14	13	18	27
4. Implementation & Governance						
a. Unicity of administrative entity	11	9	9	6	9	11
b. Urban planning capacities & skills of local administration	14	10	17	9	10	18
c. Degree of involvement & cooperation of local administration	14	10	11	10	13	11
d. Degree of diligence & cooperation of local communities	6	9	13	6	5	8
5. Replicability of the Pilot						
a. Similarity of physical, natural, spatial features to other KRG cities	10	22	15	12	18	19
TOTAL	**290**	**360**	**322**	**270**	**286**	**384**
Difference with the maximum	*76%*	*94%*	*84%*	*70%*	*74%*	*100%*

Source: JICA Project Team

Based on the results of the vote, Municipality 6 emerged as the pre-eminent candidate, amassing the highest point total (384) among all the options considered. As a result, it was pre-selected for further consideration.

(4) Summary of justification for preselection of Municipality 6

As a result of the discussions during the scoring session mentioned above, the justification of the scores can be summarized as follows.

i) There is a social mix (different social classes live together) in Municipality 6 which is less in other municipalities;
ii) Current Erbil Master Plan is planning numerous different projects in Municipality 6;
iii) Municipality 6 is an area which has the most marked topography (downstream to rivers) so that organizing urban development well there can help prevent more flooding and sewage problems as well as foster rainwater infiltration;
iv) Until now, most of the investments have occurred in the North and East of Erbil, thus to restore a general balance of development in Erbil, it can be a good idea to develop South - West (Municipality 6) from now on.

(5) Confirmation to high-level representatives and final selection

As a result of the pre-selection of Municipality 6 through the collective voting process previously detailed, high-level representatives were engaged in a series of meetings during the latter half of May 2022, in order to conduct a more thorough analysis and discussion and to achieve a consensus among key stakeholders. The Deputy Director of the Erbil Municipality Presidency agreed on the preselection

of the Municipality 6, the Deputy Governor of Erbil and the Minister explained that all municipalities in Erbil have challenges, and the Minister of MoMT approved the selection of Municipality 6.

As a result, the selection of Municipality 6 as the Priority Area for Pilot Zoning Scheme formulation has been officially adopted.

1.2.2 Appropriate Range of the Selected Priority Area for a Model Zoning Scheme

Although the existing situation of the Priority Area will be studied in detail and results will be published in the next report (Interim Report) to be submitted around August 2023, this section examines the current development status in the Sub-Municipality 6 as the selected Priority Area to clarify the adequacy for the formulation of a suitable model zoning scheme.

(1) Sub-Municipality 6 (Selected Priority Area) and its current development status

Based on quick examination of current conditions of Sub-Municipality 6 after the selection of Priority Area, some development issues have been raised and identified as follows toward appropriate zoning scheme formulation.

- **Registered residential plots in agriculture land as an overwhelming majority:** Agricultural lands as a predominant area (64%) out of the Priority Area has been planned and registered by residential area (around 60~80% out of the agricultural lands), where almost of all planned settlements will give a few opportunities to rearrange land use by zoning scheme.
- **Greenbelt threatened by new urban developments:** Several urbanizations in the adjacent areas of the Sub-Municipality 6 are observed even in the Green Belt area, considering this urban development trends, zoning scheme may be required to cover those threatened areas by further urban sprawls due to strong demand of horizontal expansion of residential and industrial developments in future.
- **Inappropriate settlement areas without consideration of river flow system:** The Priority Area involves several rivers and streams as one of the existing conditions, where floods become one of the critical issues due to recent intensive rainfall in Erbil. This water flow system in the planned and registered residential areas has not been considered carefully to avoid from potential disaster.

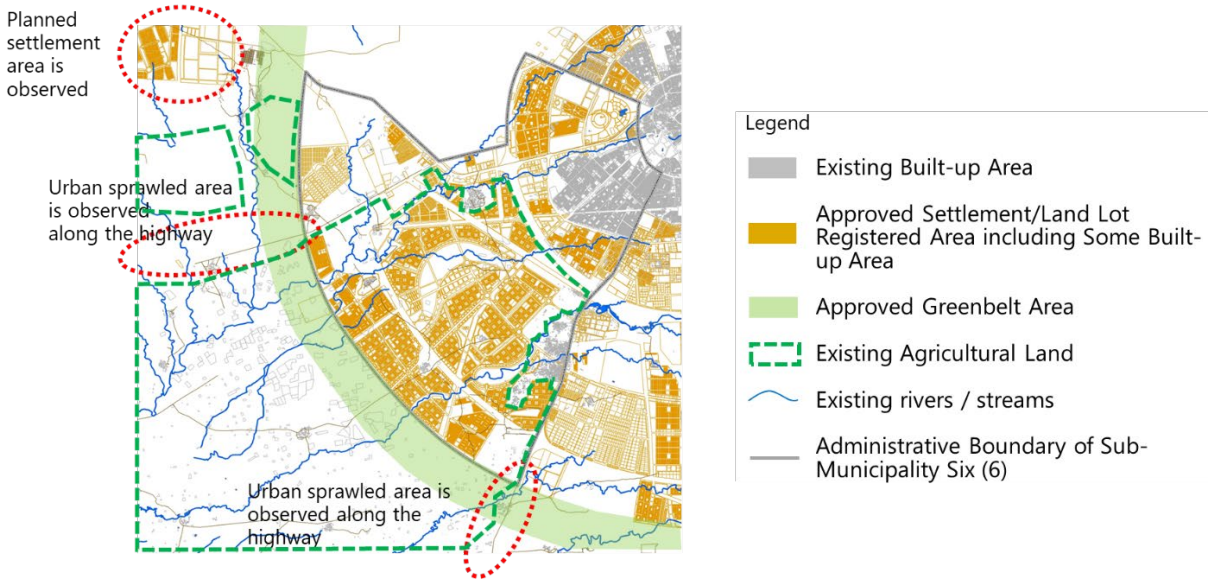


Figure 1.2.1 Current Development Status of Sub-Municipality 6

Source: JICA Project Team

(2) Discussion of possible options and assessment of the boundary for the Priority Area

In consideration with issues aforementioned of the Sub-Municipality 6, the range of the Priority Area could become a planning issue for appropriate zoning scheme formulation as a model plan. After research with UPDOE, it is presumed that these issues would be common to other Sub-Municipalities of Erbil, such as a divided piece of a pie in a concentric sequence from the center to a fringe.

1) Options for the appropriate range for zoning scheme formulation of the Priority Area

Under these conditions, the eastern side of boundary of the selected Priority Area needs to be examined for appropriate zoning scheme formulation whether it could involve a variety of land use types for a model zoning scheme or not, whether it could consider the expected Erbil 2050 MP formulation of the study area including the adjacent area of Sub-Municipality 6 or not, while Sub-Municipality 6 is expected to be fully urbanized by fixed future conditions composed of nearly mono-tone land use conditions up to the boundary. From this perspective, three options for the eastern side boundary of the Priority Area can be set and examined as follows.

(a) **Option A:** Adopting Sub-Municipality 6 for a model zoning scheme

- ✓ A model zoning scheme examines the area of Sub-Municipality jurisdiction
- ✓ A zoning scheme will follow just approved detailed plans' urban form and density (lot size, urban block, road network, etc.) where almost of all residential lots have been registered.
- ✓ The conflict by unsuitable land allocation on rivers or stream should be solved by some modification.

(b) **Option B:** Expanding the boundary to cover the Greenbelt area (1.5-km width)

- ✓ A zoning scheme enables us to show effective conservation measures for the Greenbelt to prevent agricultural lands and natural environmental areas from urbanization pressure as one of the urgent solutions within 10 years.

(c) **Option C:** Expanding the boundary up to the study area of Erbil 2050 MP (10-km width)

- ✓ A zoning scheme enables us to show a typical zoning application <u>conceptually</u> to the study area of Erbil 2050 MP to guide desirable development control and some incentive measures for agriculture land developments, archaeological site protection and some necessary urban developments toward long-term horizon.
- ✓ 10 km as the buffer area adopted to this option is based on the law no. 6 (Administration of Municipality) in the case of Erbil Municipality.
- ✓ If the actual zoning scheme has to be delineated by each zoning district, it should be based on scientific spatial baseline data, such as agricultural productivity assessment, archaeological site assessment, flood risk assessment.

2) Criteria for assessment of the options for the appropriate range of the Priority Area

The key criteria for assessment of the options can be set as follows, considering the formulation of a model zoning scheme applicable to a statutory zoning plan with adaptability to every type of land use including urban center, industrial area, neighborhood area, agriculture lands and natural environmental areas.

- <u>Functionality for a model zoning scheme:</u> variety of land use, effectiveness of control or guiding measure to existing/planned built-up and non-planned development areas.
- <u>Adoptability to cope with typical urban issues in Erbil:</u> agricultural land protection, disaster risk control, appropriate density guide, etc.
- <u>Representativeness of zoning instruments</u> as one of the implementation tools of Erbil 2050 MP: coverage of the planning area and typical land use category of Erbil 2050 MP

- Availability of baseline assessment for rational zoning scheme formulation: through land suitability analyses by flood risk assessment, agriculture productivity assessment, archaeological site assessment, etc.

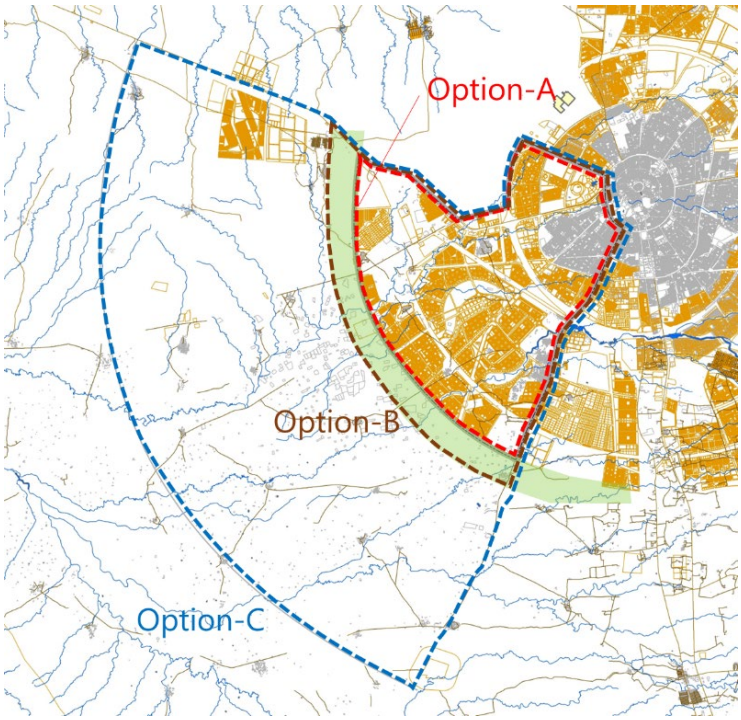
3) Assessment of three options for the appropriate range of the Priority Area

Three options are assessed for the appropriate range of the Priority Area, considering the formulation of model zoning. As a result, three options are almost close score and Option C with the highest score, but also with the highest negative score by the availability of baseline assessment for appropriate zoning scheme formulation.

Table 1.2.3 Assessment of Options for Appropriate Range of the Pilot Area

Assessment Criteria			Range for Priority Area		
			Option-A	Option-B	Option-C
1.Functionality for model zoning	1.1 Variety of land use		1	2	3
	1.2 Development control effectiveness	For existing/planned built-up area	2	2	2
		For non-planned area	--	2	3
2.Adoptability	2.1 Coping with typical urban issues	Agriculture land protection	--	1	3
		Flood risk management	2	2	2
		Appropriate density guide	2	2	2
		Efficient road network	1	1	2
3. Representativeness of zoning instruments for the Erbil 2050 MP			1	2	2
4, Availability of baseline assessment	4.1 Flood risk assessment*1		2	2	-2
	4.2 Agriculture productivity assessment*2		-1	-2	-2
	4.3 Archeological site assessment*3		-1	-2	-2
	4.4 Underground water resource assessment*4		-1	-2	-2
Total Score			8	10	11

Note: *1 could be based on the preliminary assessment by the JICA Project Team, *2 necessary to obtain it from the Ministry of Agriculture and Water Resource, *3 This assessment may take several years by the Directorate of Antiquity Erbil, *4 necessary to obtain it from the Ministry of Agriculture and Water Resource.
Source: JICA Project Team



Source: JICA Project Team

Figure 1.2.2 Options for Appropriate Range of the Pilot Area

4) Implication of the assessment results and necessary consensus for the rage of Priority Area

Whichever option is selected, the assessment result implies that every option would have merits and demerits in formulating a model zoning scheme. Especially Option C requires sufficient spatial data to assess careful land suitability due to large land areas for precise zoning district designation.

On the other hand, Option A will not provide flexible application or changeable rooms for zoning district planning, where almost urban forms have been fixed as low-rise residential areas with neighborhood public and commercial areas, because of predominant registered land plots already. This case as a model zoning scheme may not provide much useful or referrable instruments by zoning scheme as a model implementation instrument of Erbil 2050 MP.

In case of Option B, this involves the concerns of Option A and C. However, Option B would have some advantages of solving urgent issues to strengthening "Greenbelt" conservation, although the land suitability assessment is required by sufficient data, especially agricultural land productivity to be promoted or conserved, which strong evidence could retain agriculture lands rather than urbanization. Additionally, obtaining information on agricultural land assessment is critical for appropriate zoning planning.

To develop a model zoning scheme, these conditions should be discussed with relevant authorities (MOAWR, MOMT-GDUP and others) and clarified as critical premises of the study.

CHAPTER 2
PILOT ZONING SCHEME

2.1 Objectives of Pilot Zoning Scheme

Zoning is a planning control instrument for regulating the built environment and creating functional land markets as a common tool internationally. And zoning divides lands into sections that comprise the jurisdiction of a local authority, permitting land uses on specific sites to shape the layout of buildings, urban blocks, and cities and enable various types of development.

This zoning system is expected to be introduced into Erbil City as one of the powerful instruments to implement the Erbil 2050 MP through regulatory or incentive measures. The following are objectives to introduce the zoning system into urban planning and management in Erbil.

- To help balance a city to ensure proper land use and provide value to citizens who own property and public services provision
- To secure the public domain for public facilities and infrastructure including roads
- To protect the local environment and keep property values stable
- To provide the opportunity to stimulate or control socio-economic activities or development in specific areas

2.2 Zoning Scheme under Institutional Framework for Erbil

2.2.1 Urban Planning and Management in Erbil and Zoning Roles

(1) Challenges on urban planning and management in KRI

Urban planning, and management in KRI have been stipulated in Article 25 in Law no.6[1]. It defines two statutory plans (master plan and detailed plan) with tasks of municipalities such as announcement, acceptance or rejection, request of modification, granting a license of building or property. This unclear status of the planning system has brought negative impacts on urban planning and management in KRI and Erbil. The following describe the identified issues on urban planning and management in Erbil in comparison with other countries as referrable legislative frameworks and instruments.

1) Current urban planning and management system of KRG in comparison with other countries

In general, urban planning and management to guide and control urban activities are materialized by a "non-binding instrument" to mandate public administration and a "binding instrument" to control and manage urban activities (use and building form) by the private sector. The following are the current status of urban planning and management legislation of the Kurdistan Regional Government (KRG) in comparison with other countries' frameworks in Japan, France, the United Kingdom, and the United States.

- Kurdistan Region and Erbil with unsuitable subordinate planning practice: For the implementation of the master plan, a detailed plan without scopes and definitions has played an implementing role in the provision of settlement areas by an urban block or blocks by short-term phase addressing housing demand mainly rather than development control roles as the mid-long-term phase.
- Local Urban Plan (PLU) with zoning for a local authority's jurisdiction in France: PLU has an essential role in planning and managing urbanization in association with zoning regulations for an administrative unit of commune governed by SCoT as an upper planning framework.

[1] Law No.6 Administration of Municipalities of the Kurdistan Region of Iraq, 1993

- Zoning and District Plan as a part of city plan in Japan: There are three level control and management instruments in Japan by Prefectural Planning Area Master Plan (PPAMP) stipulating Urbanization Control Area (UCA) and Urbanization Promotion Area (UPA) and City Master Plan by use zoning, and District Plan as tailored overlay instrument on zoning by more detailed control instrument as a participatory urban control system with local community initiatives.
- Local Development Plan without zoning system in the UK: For urban management with all types of development and construction, the planning permission system plays an essential role in the UK. Developments and construction are assessed and granted discretionally by local authorities based on their Planning Obligations in the LDPs, Building Regulations, and local development orders for specific developments.
- Zoning Ordinance in association with Comprehensive Plan formulation in the USA: A comprehensive plan is the adopted statutory official plan of a local government in the USA, while each state prepares a regional plan as an upper spatial framework. For the implementation of a comprehensive plan, two instruments of zoning ordinance and subdivision have played key roles in local governments. Based on the Standard State Zoning Enabling Act (1924), zoning regulation has been undertaken as a Zoning Ordinance covering the entire jurisdiction of local government in every state.

Table 2.2.1 Comparative Spatial Planning System with KRI and Other Countries

Country		Statutory Urban Plans by Public Authority						Sector Plan (Public)	Planning Permission (Private) PP
		National	Regional	Sub-Regional	LA	Sub-LA	Specific Area		
Kurdistan Region, Iraq		--	--	--	MP	--	DP*	Infrastructure/ Others	Subdivision Plan
	zoning	--	--	--		--	--	--	--
Hierarchical and Definitive	France	SSC	SRADDT	SCoT/ PLUi	PLU	--	ZAC	PDU/PLH/ SDC	Guidelines / PP
	zoning	--	--	In PLUi	zoning	--	dzo	--	--
	Japan	NPS	RDP	PPPA	CMP	--	DPj	Various Thematic Plan	Guidelines for Subdivision
	zoning	--	--	--	zoning	--	dzo	--	--
	USA	--	RCP	THP*	CP	THP *	THP*	Various Thematic Plan	Subdivision Plan
	zoning	--	UGA	--	Zoning Ordinance	--	dzo	--	Subdivision Regulations
Discretional Management	United Kingdom	NPPF	RSS	--	LDF/LDP		--	Sectoral Local Plan	PP
	zoning	--	--	--	PO/LDO		--	--	--

Note: LA= Local Authority, MP = Master Plan, DP* = actual application of Detailed Plan, SSC = Schemes for Collective Service, SRADDT = Regional Spatial Development Perspective, SCoT = Integrate Territorial Plan, PLUi = Inter-municipal Local Urban Plan, PLU = Local Urban Plan, ZAC = Joint Development Zone, dzo=detailed zoning, PDU=Urban Transportation Plan, PLH=Urban Housing Plan, SDC=Commercial Development Scheme, NPS=National Spatial Strategy, PPPA=Prefectural Planning Area Master Plan, CMP=City Master Plan, DPj=District Plan, RCP=Regional Comprehensive Plan, UGA=Urban Growth Area, THP* =Thematic Sector Plan as non-statutory plans (transportation, neighborhood plan, redevelopment plan, etc) CP=Comprehensive Plan, NPPF = National Planning Policy Framework, RSS=Regional Spatial Strategy, LDF=Local Development Frame work as Core Strategy, LDP=Local Development Plan, PO= Planning Obligations, LDO=Local Development Orders
Source: JICA Project Team

2) Issues on a detailed plan and its implementation in urban planning and management in Erbil

The detailed plans (DPs) prepared mainly by UPDOE[2] have played a vital role in providing lands for the settlement coping with housing demand due to the current population increase in Erbil City rather than in controlling and managing private sector developments under Erbil 2030 MP, while PEM[3] has a role in allocating their lands and developing the necessary infrastructure and public facilities in ad hoc base within the limited budget framework. The following are identified as issues on current detailed

[2] Directorate of Urban Planning of Erbil (under GDUP-MOMT)
[3] Presidency of Erbil Municipality (MOMT)

plans and their implementation in Erbil.

- Remedying weak functions for urban management and control without binding instrument (zoning) to secure the master plan spatial framework and its management
- Necessary integrated plan addressing narrow planning area coverage contributory cause of disconnected service links (road, drainage system, etc) and non-coverage of environmentally vulnerable areas or agricultural lands to be protected
- Betterment of inappropriate planning ignoring physical conditions without rational and scientific methods and techniques
- Improving planning management mechanisms to cope with lack of monitoring and necessary modification of a plan in a sustainable manner
- Enhancing implementability to address inadequate infrastructure and public services generating poor living environments and to generate necessary financial sources

(2) Necessary legislative enhancement in a subordinate system by zoning scheme

As the zoning system composes of various regulations for urban development and management in expected classified zone districts, it could play an important role in re-organizing and integrating regulatory instruments of Erbil, where old and Iraqi legislations have been applied in ad hoc bases till now. The following are identified as issues on current legislative instruments in Erbil to be integrated into the zoning system.

- Integrating piecemeal regulations including old dated or Iraqi legislations for urban management and control that have not addressed current contemporary urban issues in Erbil
- Improving inefficient development and construction permit systems by complicated or overlapping procedures, paper-based works, and absence of coordination among various relevant authorities
- Improving legislation to enable the administration to monitor, evaluate and enforce illegal activities without monitoring systems and enforcement

2.2.2 Zoning Scheme Requirements and Applicability to Erbil

Although the zoning scheme could be certainly one of the effective solutions to enhance urban planning and management in Erbil, it is necessary to be incorporated into the current urban legislation framework efficiently and effectively. From this point of view, desirable roles and functions for zoning schemes are required to identify and clarify their applicability to the current legislative framework.

(1) Desirable roles and functions for zoning scheme

For the implementation of a master plan, its subordinate plans play a key role in urban planning at a local level in association with functions for control, management, and project implementation for urban activities under the spatial framework of the master plan.

Every plan including a master plan could have some sort of adequate instruments in “development control management”, “development promotion” and “norms/standards and guidelines” based on the desirable roles at each level of the plans. The following describe the desirable roles and functions for each plan including zoning scheme and applicability to each plan.

Table 2.2.2 Urban Control and Management Instruments for Statutory Subordinate Plan and Other Relevant Plans

Legislative Framework		Category		Key Type of Control and Management to be Introduced or Enhanced	Statutory Plan			Guide
					Master Plan	Subordinate Plan		Subdivi-sion Plan
						Zoning Scheme	Sector Scheme	
Development Control and Management	Urban Growth Manage-ment	Non-urbanization		• Disaster risk Control Area	●	○	○	--
				• Agriculture Product Promotion Area	●	○	○	--
				• Green Belt	●	○	○	--
				• Archeological Site Conservation Area	●	○	○	--
		Urbanization		• Urban Growth Boundary	●	○	--	--
				• Buffer Control Area (reserved land?)	●	○	--	--
	Urban Form Control	Land Form		• Plot Size	○*	○	--	●
				• Parking lot requirement	--	○	--	●
				• Access road regulation	--	○	--	●
		Building Form		• Floor Area Ratio (FAR)	○*	●	--	--
				• Building Coverage Ratio (BCR)	○*	●	--	--
				• Building Height	○*	●	--	--
				• Sky Exposure Plane Control (SEP)	--	●	--	--
				• Setback Control (front, sides, back)	--	●	--	--
		Urban Form Ensemble		• Landscape/Townscape Code	○*	○	●	--
				• Specific Urban Design Code	--	○	●	--
	Land Use Control	Land / Building Use Control by Use Classification			○*	●	○	○
		Public Domain		• Key Public Facilities (health, education, etc)	○*	●	○	○
				• Key Transportation Terminals	○*	●	○	--
				• Key Utilities Plant (water, sewerage, disposal)	○*	●	○	--
				• Park and Open Space / Cemetery Area	○*	●	○	○
			Network /Corridor	• Key Utilities Corridor (HVL, WTL, etc)	○*	●	○	○
				• Primary Road Designation with R.O.W	○*	●	○	○
				• Secondary Road Designation with R.O.W	○*	●	○	○
				• Tertiary / Access Road	--	--	--	●
Development Promotion	Land Distribution			• Land Allocation	○	○	○	●
	Urban Upgrade / Transform	Living Condition Improvement		• Revitalization/Redevelopment Scheme	○*	○	●	●
				• Land Readjustment Scheme	○*	○	●	●
		Urban Function Enhancement		• Transportation Hub Development Scheme	○*	○	●	○
				• Thematic Urban Hub Development Scheme	○*	○	●	○
	Attracting Private Sector	Economic incentive		• Deregulation in Designated Area	--	○	●	○
				• Financial/Tax Incentives for Investment	--	○	●	○
				• Development Subsidy	--	○	●	○
Guide/Norm	Physical Planning and Design Standard			• Urban Settlement / Housing	○	○	○	●
				• Public Service and Facilities Development	○	○	○	●
				• Infrastructure Network (road, utilities)	○	○	○	●
	Development Management Guidelines			• Thematic Planning Guidelines	--	--	●	○
				• Thematic Implementation Guidelines	--	--	●	○
				• Thematic Operation and Maintenance Guide	--	--	●	○

Legend: ● = to be stipulated/designated, ○ = to be incorporated/supported, ○*= to be referred (e.g. land use, density, urban reform implementation, etc), = existing instruments in Erbil, RoW=Right of Way, HVL=High Voltage Line, WTL= Water Transmission Line
Source: JICA Project Team

(a) Urban growth management to be stipulated mainly in a master plan
- ✓ Urbanization area by a growth boundary, budder control area (Erbil)
- ✓ Non-urbanization areas for disaster risk areas, agriculture

(b) Urban/building form control to be stipulated in a zoning scheme
- ✓ Landform (plot size, access road, etc)
- ✓ Building form (FAR, BCR, SEP, height, setback, etc referring to Table 2.2.2)
- ✓ Urban form ensemble (landscape/townscape control, other urban design code, etc)

(c) Land use control to be stipulated in a zoning scheme
- ✓ Land/building use control by zoning classification
- ✓ Public domain (key transportation facilities, key public facilities, key utilities' plants, etc)
- ✓ Public domain (key network or corridor: primary, secondary road, trunk utilities, etc)

(d) Urban development promotive instruments to be designated desirably in a master plan and zoning scheme based on studies by other detailed schemes
- ✓ Urban upgrade and transformation for living condition improvement of land readjustment
- ✓ Urban function enhancement for a transportation hub, commercial-business hub development schemes, administrative/institutional hub, etc.

(e) Promotive instrument to attract private sector investment with the above instruments
- ✓ Economic incentives (deregulation, financial incentives, development subsidies)

The following are supplement instruments to guide development and construction discretionally by the administration's guidelines with norms and standards.

(a) Physical planning, design standards for settlements, housing, public facilities, and infrastructure

(b) Development management guidelines in various thematic planning, implementation and operation, and management

Table 2.2.2 above indicates the desirable roles and functions of statutory plans (master plan and its subordinate plan including zoning scheme) and subdivision for urban control and implementation management.

2.3 Priority Area for Pilot Zoning Scheme

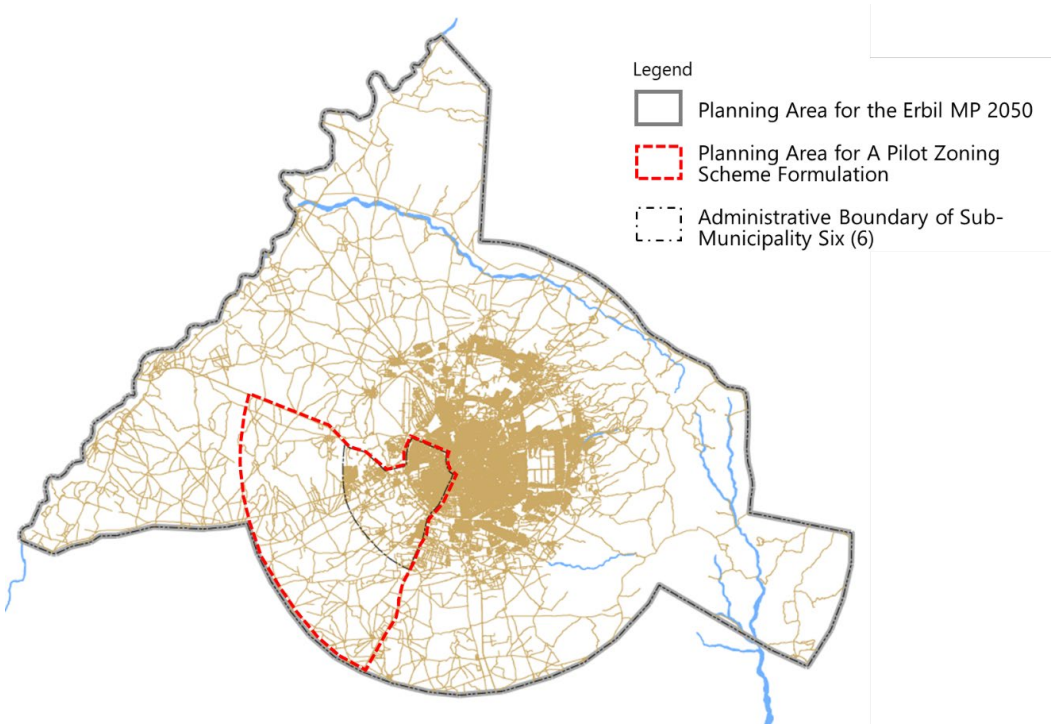
2.3.1 Priority Area in Erbil for a Model Zoning Scheme Formulation

1) The area range of a model zoning scheme of the Priority Area

After the selection of the Priority Area by sub-municipality level for a Pilot Zoning Scheme in the master plan area, its appropriate range of a zoning scheme area was validated by the members of Planning Technical Working Group (TWG) as discussed in Progress Report 1 (Part II Chapter1: Preliminary Works), taking into account conformity to the planning area of Erbil MP 2050.

2) Location of the area and administrative jurisdiction

The pilot zoning scheme area covers typical land use patterns by urban-rural transect in Erbil, where the area covers around 368 km^2 (13.5% out of the master plan area) located in the west-southern part of the MP planning area. This area involves Sub-Municipality 6 and 30 villages under three Sub-Districts of Shamamik, Gwer, and Rizgari, outside of Sub-Municipality 6. Figure 2.1.1 shows the location of the model zoning scheme area in Erbil MP 2050.



Source: JICA Project Team

Figure 2.3.1 Location Map for the Area for A Pilot Zoning Scheme Formulation

2.3.2 Urban Functionality of the Priority Area

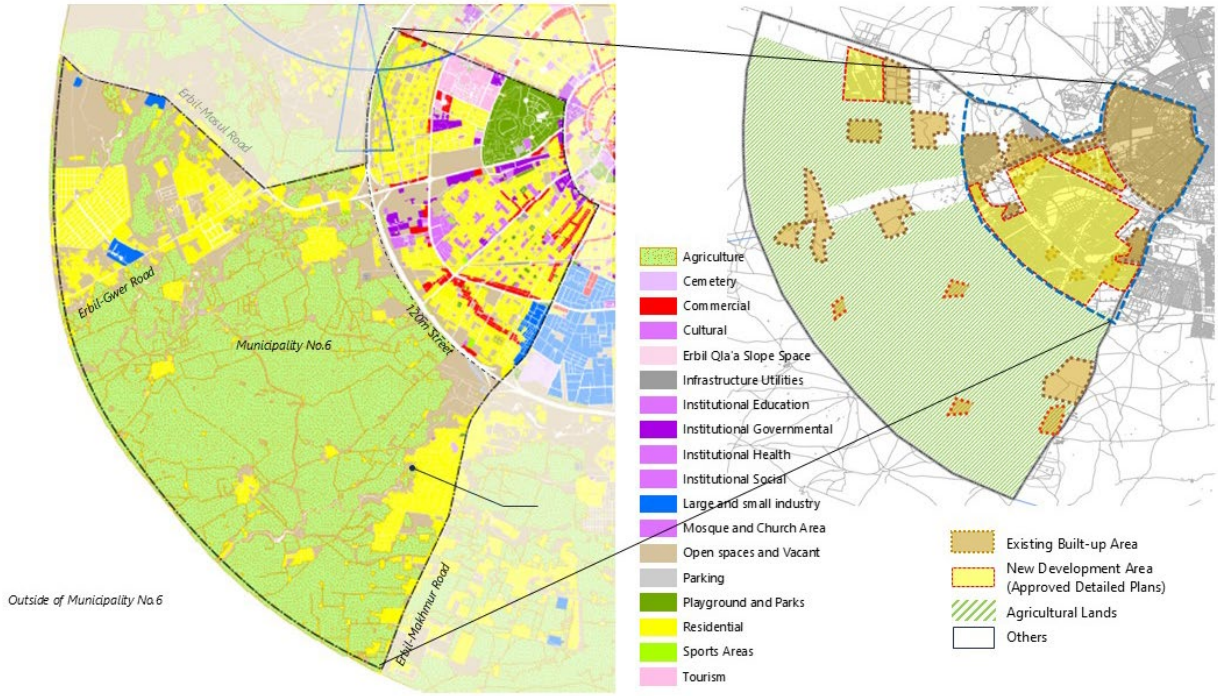
1) Historical transition

The urbanization in the area has evolved and expanded from the central area excluding the Erbil Citadel as the World Heritage site from the 1920s~1960s mainly toward the west-southern direction up to Peshawa-Kazi road to 2010s urbanization up to the 120 m ring road, of which direction is connecting to other cities of Iraq such as Mosul (Mosul-Erbil road) and Makhmur (Erbil-Makhmur road). The urban developments have continued currently beyond the 120 m road toward its peri-urban areas and agricultural lands including ongoing subdivisions and planned settlement areas, where the majority of residential lots have been registered,

2) The land use and urban function of the pilot area

The pilot composes of two jurisdictions of administrative area for Municipality no.6 and the outer fringe area where dominant agriculture lands, villages and some urbanised areas along major roads are spread.

In this urbanized area residential functions in Municipality no.6 are predominant even in the area's proximity to the city centre where higher education and hotel are the distinct distribution of urban functions in comparison with other urban areas in Erbil, and the biggest park of Sami Abdulrahman Park in Erbil locates in the area. Another urban function is characterized in the area by corridor industrial developments on both Mosul-Erbil Road with Erbil-Gwer Road and Erbil-Makhmur Road after crossing Sub-Municipality No.6.



Source: JICA Project Team

Figure 2.3.2 Location Map for the Area for A Pilot Zoning Scheme Formulation

2.3.3 Challenges on Urban Development and Management in the Priority Area

(1) Strengthening control measures to manage urban sprawls in peri-urban and corridors

- **Advancing trunk road-side developments against Erbil MP 2030:** Regional trunk roads linking with other cities in Iraq toward the west-southern direction have generated road-side developments along them in the area, where industrial factories, logistic, and commercial business facilities have been developed. As the majority of these developments do not conform to the land use plan by the "greenbelt" of Erbil MP 2030, certain measures to control and guide the corridor developments need to be introduced.
- **Required urban control and management enhancement outside of municipalities:** Law no.6 (Administration of Municipality) gives powers for urban control and management only to the municipality jurisdiction (in the case of the area: Sub-Municipality 6 under the Presidency of Erbil Municipality: PEM). On the other hand, villages, industrial estates, and other developments outside of municipalities have been managed by relevant authorities respectively without a whole spatial integration, which legislative measures need to be improved or newly established.

(2) Detailed Plans (subdivisions) planned with some inappropriate conditions

- **Some planned urban blocks without considering environmental vulnerabilities:** Based on Erbil MP 2030, new urban settlements in agricultural lands outside of the 120m Ring Road, have been planned where the majority of land plots have been registered already. Despite this actual status, some river or stream flows in the detailed plan areas seem not to be considered their drainage system or open spaces in the plans, although the plans are not a stage of detailed design. Another environmental vulnerability is observed in archaeological site distribution in the whole area of the detailed plans. Mitigation measures including certain research and appropriate designs against both environmental vulnerabilities should be taken to avoid worse consequences.
- **Settlements behind infrastructure provision:** Some residential settlements have been observed in agricultural lands on the detailed plan area without utility services (water, sewer, and electricity). According to a Sub-Municipality officer, the investment in infrastructure services has been given to existing built-up areas, where infrastructure in even existing settlements within the 120m Ring Road has not been provided fully yet. Appropriate measures for subdivision development with sufficient infrastructure should be considered and taken.
- **Predominant low-rise settlement allocation in the detailed plans:** A majority of the land use type in the detailed plans in the Priority Area is the residential use by typical single house lot subdivision except green area, where low-rise houses could be built presumedly. This condition would not be flexible to adjust their settlement density if higher density settlement is required in the future such as the realization of a compact city formulation.

(3) Future urbanization jeopardizes agricultural lands and sustainable food production

- **Agricultural lands in the peri-urban area considering food security and climate resilience effect:** The agricultural land in the west-southern part of Erbil is known as one of the potential areas for agricultural production in proximity to Erbil town as a large consumers market place, where there are also a lot of unexcavated archaeological sites under agricultural lands. In this context, exploitation of urban lands from these agricultural lands should be minimized and they need to be protected and promoted to their production.
- **A weak promotive and protective mechanism for agricultural lands:** The agriculture lands in the Priority Area have been decreased rapidly to change based on the strong incentives for investment into urban development in recent decades, and further productive agriculture lands toward the west-southern part of Erbil could be jeopardized possibly. The agriculture development in the west-southern parts as one of the fertile lands is required not only to retain them but also to be supported strongly by institutional supports and agricultural infrastructure development.

(4) Attractive urban function formulation against flat urban function distribution

- **Hierarchical and attractive urban service distribution:** Urban functions for Erbil are desirable not only to organize hierarchical urban services responding to various levels of citizen needs with their equitable distribution but also to respond to business demands as a competitive service provider. For the Priority Area, there would be two potential sub-centers in the area (especially the expanded future urban area beyond the 120m ring road) 1) a planned commercial-business center along a large green area and 2) the future railway station development area taking advantage of the node of urban activities.

- **Desirable TOD for sustainable urban mobility network formulation:** Expected population increase would generate more urban activities in association with traffic increase and congestion in Erbil and the Priority Area if the current mobility system is maintained by individual vehicle mobility. Transit Oriented Development (TOD) would be one of the countermeasures in combination with public transportation, its urban corridor development promotion, and effective mobility network sub-system (paratransit and walkway system) linking with expected urban centers and sub-centers in Erbil.

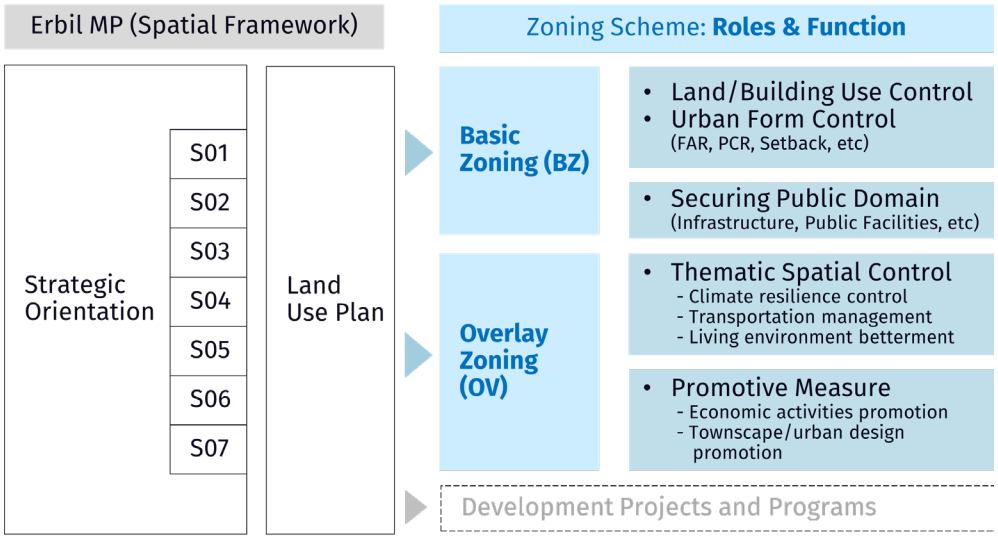
(5) Necessary urban control and management measures against economic-led development

- **Unsustainable land development by predominant low-rise settlement:** The Priority Area has been occupied predominantly by low-rise (low density) existing built-up areas and planned settlements too by the detailed plans. If this type of settlement development continues, its land demand would require large areas in association with enormous infrastructure investments as unsustainable development. These existing built-up areas and planned settlements should be guided by appropriate control measures to promote medium-density development (e.g. collective housing or multi-storied building), taking into account some incentive measures.
- **Unexpected high-rise building developments generating unharmonized development:** High-rise building developments (e.g. Empire real estate development, Rami Towers, Lalav Skyview) led by investors' expediency have occurred in the central part of changed from the original use in the detailed plans, due to weak legal control measures against strong investment incentive measures in Erbil. Although real estate developments have contributed to one of the key economic development in Erbil, those vertical large-scale housing development may generate unbalanced environmental conditions in terms of the surrounding townscape, infrastructure capacity, and traffic concentration. Appropriate urban control measures such as a zoning system are necessary to apply to this priority area to guide harmonized urban form.

2.4 Pilot Zoning Framework to be Applied to the Pilot Area

2.4.1 Tools and Measures of Zoning Scheme

A zoning plays one of the key roles in implementing a master plan with binding function to guide and control development activities in the entire master plan area to be conformed with directions of a master plan. There are two instruments of the zoning system by 1) basic zoning system to control land use and building form and to secure public domain for public facilities, and 2) overlay zoning system to control based on specific thematic spatial requirements (e.g. flood risk management) and to promote specific area development to materialize the master plan strategies with desirable incentive measures.

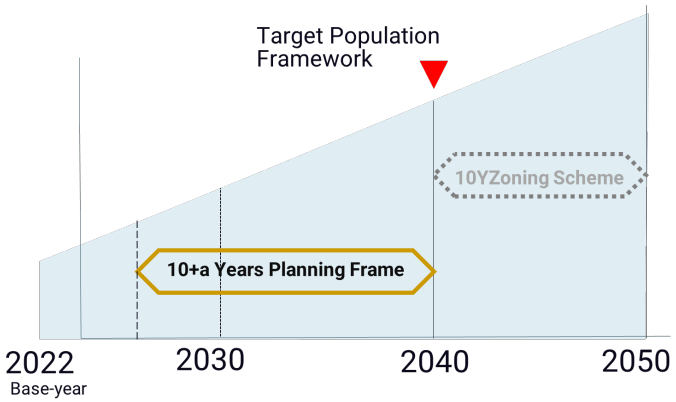


Source: JICA Project Team

Figure 2.4.1 Component Zoning to Materialise the Strategic Orientation of Erbil 2050 MP

2.4.2 Time Framework for Zoning Scheme

A time-framework for master plan is considered as a long-term plan by 10 years and more than 10 years, in which a review of the plan takes place after five years. On the other hand, a zoning scheme in general, has a shorter time-frame like less than 10 years to enable to fit with urban change because of zoning regulations to avoid malfunction of the regulations against unignorable urban changes. In case of this Erbil 2050 MP as a extra long-term plan, the year 2040 is defined as the medium target during the planning term. For this pilot zoning scheme, the specific timeframe is given.



Source: JICA Project Team

Figure 2.4.2 Time Framework for Zoning Scheme in Case of the Pilot Plan

2.4.3 Basic Zoning: Zoning Classification for Use Control and Guide

(1) Use classification system as a standard

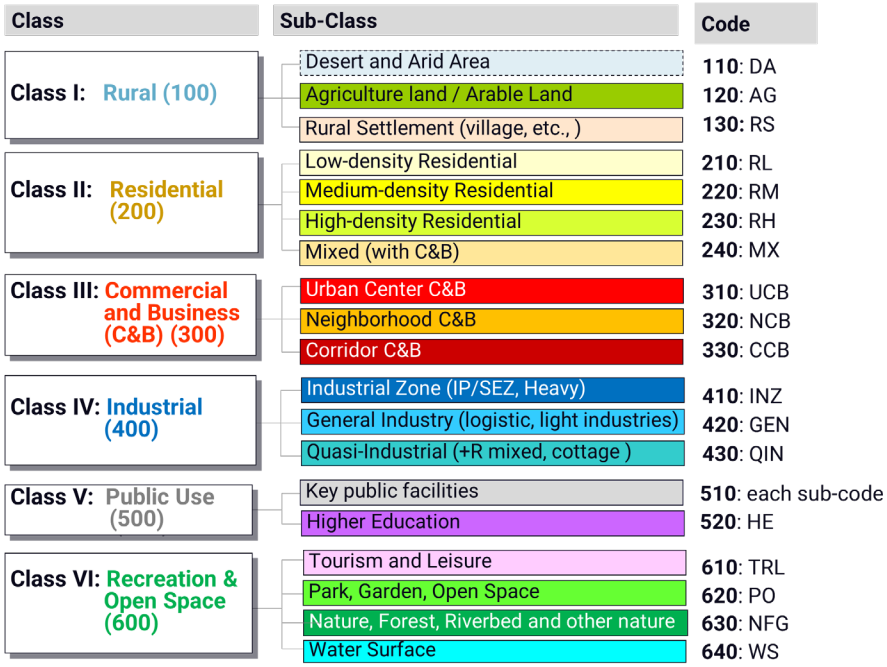
The proposed system of the basic zoning is expected to apply not only to the pilot area and the master plan area, but alto to other cities in the entire Kurdish region. The standard classification considers two aspects of 1) obligatory zoning classification where ever they are applied in various physical environment to avoid gaps from various quality of zoning outputs, and 2) some flexible range to fit with local context. These two aspects are represented by the classification system of 1) Class by large group and standard category and 2) Sub-class by small group as breakdown classification under the Class, of which some new sub-class can be developed to fit with local context.

(2) Coding system

As a part of the zoning standards system, a coding for the applied zoning classification becomes important, taking into account visible indication clearly to avoid misreading, especially the case of colour code printed by black & white. Their codes can be replaced or indicated in parallel by the numbers or abbreviation.

(3) Consideration with "public use"

Regarding lands for public facilities such as education, health, etc., a zoning system can secure a land for public facilities through designation of public use class zone. A land for public facility may face difficulty sometimes to acquire its land or to provide it by the relevant authority. Although such designation is required to be in existing public lands, they may also be difficult to have in dense development urban area. In consideration with this context, the public use class is considered by more flexible operation of land utilisation without specific purpose unless lands for public facilities are secured to cope with demands of public land acquisition. If the land for public facility is guaranteed, the sub-class code by specific purpose (e.g. school, hospital, etc.,) can be set in the zoning scheme.



Sub-code for Public Use

Code	Description
GO	Key Government / Institutions / Administration / Security by large site
BE	Basic education (primary school, secondary school, high school)
SP	Key sports and recreation facilities (Olympic stadium, other national level athletic facilities)
HS	Key health facilities with large site (national and referral hospital, specific hospital)
KU	Key utilities (large site for plant facilities for water supply, sewerage treatment, disposal)
TF	Key transportation facilities with large site (terminal, large depot, other transport facilities)
AP	Airport facilities
RF	Key religious facilities (Fridays' mosque, other religious facilities)
CE	Key cemetery with large site

Source: JICA Project Team

Figure 2.4.3 Proposed Zoning Classification for the Erbil 2050 MP

(4) Land or building use regulations by zoning classification

In order to create or maintain safe, comfortable and attractive urban environment, uses of land or building should be harmonized without generating conflicts or problems among living communities or economic activities. Therefore, each parcel by zoning classification has certain rules to protect or maintain certain land or building uses. There are three important aspects of this use regulation as follows.

1) Use control by type of socio-economic activities for land or building

- Various type of land or building use are identified as control target
- Necessary considerations with certain use generating negative physical impacts (e.g. noise, smell, vibration, or pollutive emissions, etc.) or ethical conflicts (e.g. unsuitable facilities or services for school/children, etc.)

2) Use control by scale (magnitude) of land or building

- Negative impacts by economic activities depend on volume of their activities (e.g. customers of a small shop are limited, but a big supermarket or shopping mall generating large customers with vehicle access in association with large traffic volume) should be controlled in a zoning parcel

3) Descriptive control of use

- Regarding citizen's right of living or economic activities, offense by restriction of these rights should be minimised zoning control. Therefore, descriptive judgement of land or building use whether they are in consistent with zoning regulation or not become very important for zoning administration.
- This descriptive judgement composes of three degrees by 1) permitted, 2) conditionally permit, and 3) not permitted.
- Figure 2.4.4 illustrates typical control criteria matrix by type of zoning classification and by type of land or building activities.

	Model Zoning Classification											
Land / Building Use	**DA**	**AG**	**RS**	**R**	**MX**	**CCB**	**NCB**	**CCB**	**INZ**	**GIN**	**QIN**	**TRL**
House, apartments including villages	△	△	●	●	●	●	△	●	X	X	△	△
School (pre-school, BS, SS)	X	X	△	●	●	△	△	△	X	X	X	△
Religious building	X	X	△	●	●	●	●	●	X	X	△	△
Public facilities (library, police, post, etc)	X	X	●	●	●	●	●	●	X	X	△	△
Hospital excluding clinic, university	X	X	△	●	●	●	●	●	X	X	X	△
Shop (150㎡ floor area max.)	X	X	△	●	●	●	●	●	X	△	●	●
Shop (500㎡ floor area max.)	X	X	X	△	●	●	△	●	X	X	△	●
Office	X	X	X	△	●	●	●	●	●	●	●	●
Hotel	X	X	X	△	●	●	●	●	X	X	X	●
Entertainment, bar/night club,	X	X	X	X	●	●	●	●	X	X	X	●
Theater, Leisure Facilities	X	X	X	X	●	●	●	●	X	X	X	●
Garage, Workshop, Transport Facilities	△	△	△	X	△	●	△	●	●	●	●	X
Warehouse, Storage	△	△	△	X	△	●	△	●	●	●	●	X
Factory with SOME possibility of Danger or Environmental Degradation	X	X	X	X	X	X	X	X	△	●	△	X
Factory with STRONG possibility of Danger or Environmental Degradation	X	X	X	X	X	X	X	X	X	△	X	X

●= permitted, △= conditionally permit, X= not permit

Source: JICA Project Team

Figure 2.4.4 Typical Use Regulation Matrix by Each Zoning Classification

2.4.4 Basic Zoning: Urban/building form regulations by zoning classification

(1) Types of urban/building form regulations

In order to create or maintain safe, comfortable and attractive urban environment, another important control measure is set to define urban or building form regulations without generating conflicts or problems (e.g. unsafe condition with physical obstacle, over capacity of volume of building in terms of road access or infrastructure capacity, or disagree building form destroying urban from ensemble, etc.) among living communities or economic activities. Therefore, each parcel by zoning classification has certain rules and regulations to create or maintain certain building form. There are four important aspects of this urban/building form regulation as following Table 2.4.1.

It should be noted that the Kurdish Region Government has these measures (height control, FAR, LCR and setback) but limited uses of building for single family house and commercial business buildings. Therefore, these control measures of KRG can be applicable to this zoning classification but requiring more rules and regulations to cover other type of building uses.

Table 2.4.1 Control Measures for Urban /Building in Zoning System

Urban/Building Volume/Form Control		Key Zoning Classification by Class Category		
		Residential (200)	Commercial & Business (300)	Industrial (400)
Form Control Measure	Height Control	● Required Absolute Control	○ Specific Commercial Area Control, if required	-- Generally one-story building (e.g. factory or storage building)
	Floor Area Ratio (FAR)	○ FAR functioning supplementally	● Considering land value maximization	○ Decent volume setting
	Lot Coverage Ratio (LCR)	● Securing safety and living environment	● Securing access (parking space) and gathering area	● Securing safety and access area
	Setback/building lines	● Securing safety and living environment	●	● Securing safety and access area

Legend: ● = most relevant, ○ = considerable, -- = not relevant,
Source: JICA Project Team

Table 2.4.2 Referrable Effect to Better Urban Management in relation to Urban/Building Form Control

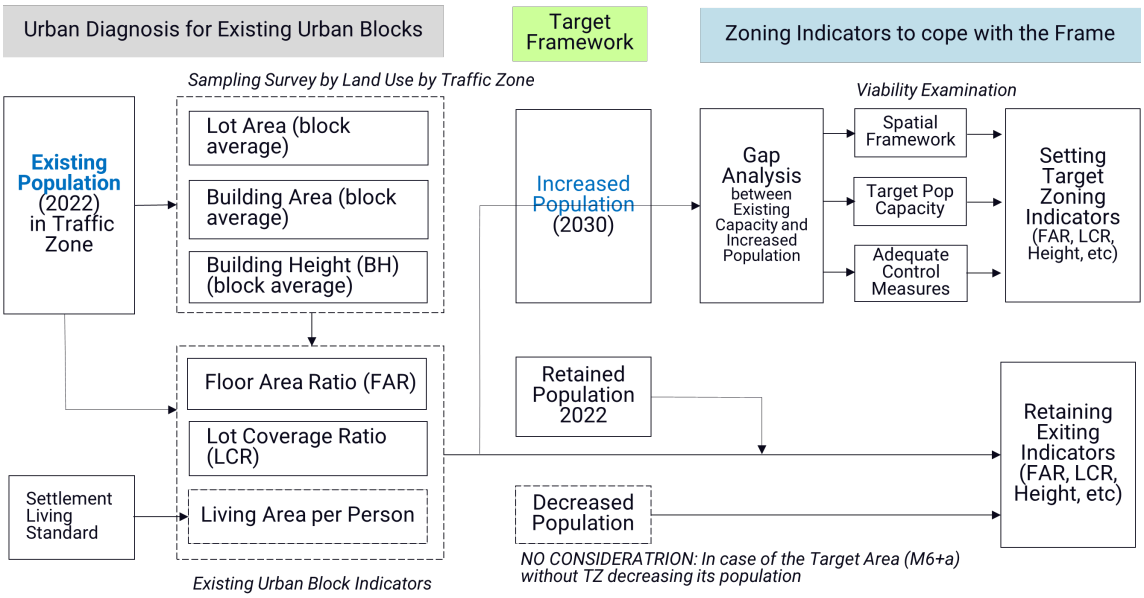
Urban/Building Volume/Form Control	Contribution Factors to Control Effectiveness							
	Urban Activity Volume			Safety		Urban Environment		Townscape/ Aesthetic
	Traffic Volume	Utility Capacity	Public Facilities	Structural Safety	Fire Fighting	Micro Climate	Sun Light*	
Height Control	○	○	○	●	●	○	●	●
Floor Area Ratio (FAR)	●	●	●	○	○	○	○	○
Lot Coverage Ratio (LCR)	○ parking	--	--	--	●	●	●	●
Setback/building lines	○ parking	--	--	--	●	●	●	●

Legend: ● = most relevant, ○ = considerable, -- = not relevant, Note: Sun Light in case of hot climate area may not be applicable rather shading structure consideration.
Source: JICA Project Team

(2) Consideration for examination of urban/building volume (FAR)

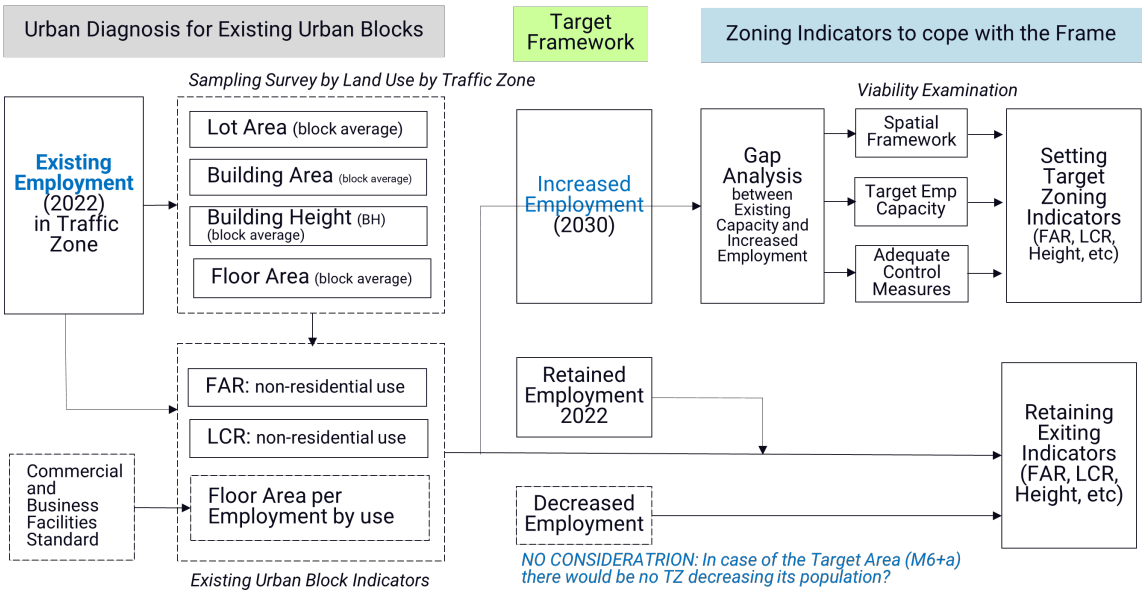
The control tool of floor area ratio (FAR) to be indicated in each zoning parcel, plays a key role not only in materialising the development framework (future population/employment) of a master plan, but also in guiding appropriate urban volume in association with required urban services and infrastructure provision. When FAR by zoning time-frame (within 10 years) is examined based on the development framework, the following process in general can be taken as desirable process in association with certain level of existing urban information (e.g. building use, building height, LCR, etc.).

- FAR setting process for settlement (residential and mixed-use zoning sub-class) based on population framework (night-time population) is illustrated in Figure 2.4.5
- FAR setting for economic activities (commercial & business, industry, public use) based on employment framework (day-time employment) is illustrated in Figure 2.4.6



Source: JICA Project Team

Figure 2.4.5 Typical Use Regulation Matrix by Each Zoning Classification



Source: JICA Project Team

Figure 2.4.6 Typical Use Regulation Matrix by Each Zoning Classification

2.4.5 Overlay Zoning

Overlay zones aim to formulate specific regulations for specified areas taking into account local context enhancement, by adding exclusive or additional regulations on the designated basic zoning system. Whenever a requirement of an overlay zone conflicts with a requirement of the underlying base zone, the overlay zone requirement will be superior to base zone controls. These controls sometimes are based on the other sector regulations such as environment protection, security and infrastructure. The following are key measures of overlay zoning, and Table 2.4.3 illustrates examples of key overlay zonings.

1) Urban growth management:

As an essential function of a zoning scheme to bind urbanization in the pilot area, urban growth management is critical to be defined and designated in the zoning plan to materialise the spatial structure or land use plan of Erbil 2050 MP. The following measures should be incorporated into the zoning plan of the target area.

- Urban growth boundary (2050): This boundary is designated by the area for future urbanisation area by the long-term target year of 2050 based on Erbil 2050 MP.
- Urbanization promotion boundary (2040): In order to promote infrastructure development to accommodate expected future population of the mid-term target year, this boundary is set on the zoning scheme.

2) Specific regulations and promotive measures

- Protective measures for environmental resources or risks (natural resource, hazard risks, cultural and historical assets, etc.)
- Safety measures of transportation and infrastructure operation and management
- Promotive measures for economic activities through development incentives

Table 2.4.3 Examples of Overlay Zoning for Typical Thematic Agenda

Policy Agenda	Policy Measures	Examples of Applicable Overlay Zoning
Climate Resilience	Disaster risk management	Flood risk control zone
		Control zone for land slide
	Water source management	Underground water protection zone
	Green and open space management	Green belt protection zone
		Special green coverage control zone
		Natural environment conservation/protection
		Agriculture protection zone
Mobility Management	Transport safety	Air drome control zone (height control)
	Traffic Demand Management	Parking management control zone
		Traffic control (one-way, entrance, etc)
		Transit Oriented Development (TOD) zone
Living Environment	Historical and Culture	Townscape control zone (height, color, etc
		Historical heritages conservation zone
	Living safety promotion	School zone
Economic Development Promotion	Urban development promotion	Urban rehabilitation / redevelopment zone
		Development bonus zone (density, height)

Source: JICA Project Team

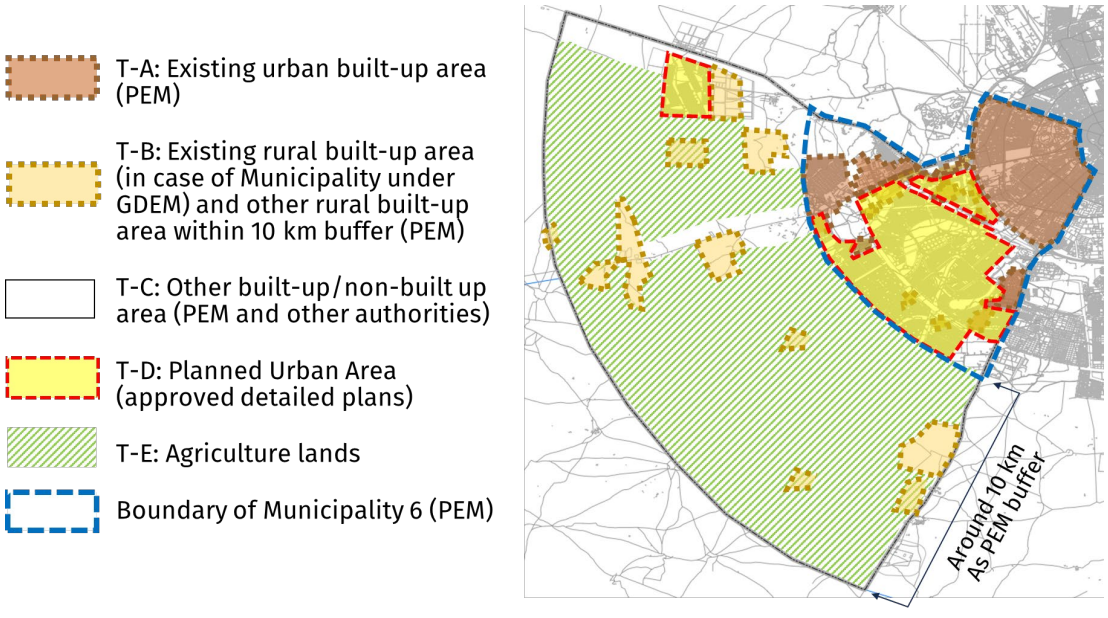
2.5 Draft Pilot Zoning Plan

2.5.1 Principles of zoning scheme adapting to the pilot area

(1) Decent adaptation of zoning scheme considering the local context

The pilot area is characterised by five distinct urbanization typologies regarding the current development status including the lands approved by detailed plan. Adaptation of a zoning scheme mentioned as the zoning framework afore-mentioned has some considerations in accordance with the typology of the land area and development status. Table 2.5.1 shows considerations when a zoning scheme is adapted to each typological area of the pilot area shown in below and Figure 2.5.1.

- Typo-A: Existing urban built-up area within 120 m Ring Road under the PEM (Presidency of Erbil Municipality) jurisdiction area
- Typo-B: Existing rural built-up area (municipalities under GDEM: General Directorate of Erbil Municipality) and other rural built-up areas under PEM outside of 120 Ring Road under within the buffer area (10 km from the boundary of PEM
- Typo-C: Existing built-up with industrial facilities and non-built-up areas
- Typo-D: Lands planned by the approved detailed plan where the majority of land lots for residence in the planned area has been registered
- Typo-E: Existing agricultural land under management by Ministry of Finance and Ministry of Agriculture and Water Resources



Source: JICA Project Team

Figure 2.5.1 Urban Development Typology in the Pilot Area

Table 2.5.1 Zoning Scheme Adaptation Principles considering Local Context of the Pilot Area

Urban Development Typology	Management Body	Zoning Scheme Adaptation Policy to Each Urban Development Typology
TA: Urban built-up area	under PEM and Municipality No.6	• As urban development activities in the existing settlements (single story) are stable developments in terms of future population, ZS also could follow this stable trend by decent zoning classification. • Large scale real estate developments with high-rise cadmiums are challenges to adapt appropriate zoning classification and volume indicators to be limited or not. • Development trend in residential areas increasing use changes needs to

Urban Development Typology		Management Body	Zoning Scheme Adaptation Policy to Each Urban Development Typology
			consider to adapt mixed use classification in future, • The road side development along planned public transportation system needs to promote TOD by supportive zoning
TB: Rural built-up area	Municipality within 10km buffer	under GDEM	• Each existing village area can be designated as "Rural Settlement (130)" where exiting urban structure and network are desirable to maintain as possible as it can, except urban services improvement inevitably. • When surroundings of existing village will be urbanized, buffer area for villages by open space is desirable to be introduced.
	Others within 10 km buffer	under PEM	
TC: Other built-up area or non-built-up area		under MOF	• As typical disordered urbanisation area without detailed plans, zoning scheme plays a key role in controlling and guiding appropriate urban development, especially along major corridors (Erbil-Mosul Road, Erbil-Gwer Road, and Erbil-Makhmur Road)
TD: Detailed Plan area approved		under PEM	• As almost of all land lots for detached house of the detailed plans' area have been registered, their urban form with roads would not be changeable. Therefore, zoning scheme would just follow their urban form inpronciple.
TE: Agriculture land		under MOAWR/MOF	• The agriculture lands are identified as one of the potential suitable lands in Erbil Governorate. Therefore, these agricultural lands would play a key role in providing agricultural products to Erbil consumers in terms of "food security" of Erbil. • Other considerable roles are 1) to support to maintain ground water recharge function and 2) a lot of archeological sites are spread in this agriculture land area. • In this local context, zoning scheme will play an important role in protecting this multi-layer resource land including agricultural production area.

Legend: ● = most relevant, ○ = considerable, -- = not relevant,
Source: JICA Project Team

(2) Materializing the spatial orientation of Erbil 2050 MP by zoning scheme

The Erbil 2050 MP sets out the strategic development directions and land use plans as the spatial development framework for this pilot zoning scheme. The application of Zoning is required as a means of realizing the MP as an upper-level planning to be followed. In particular, the function of overlay zoning is considered to be an important function in the realization of the urban development management policies of the MP. Overlay zoning can be placed on top of the basic zoning (land use and building form control function) and can specify regulative measures or promoting elements for the development.

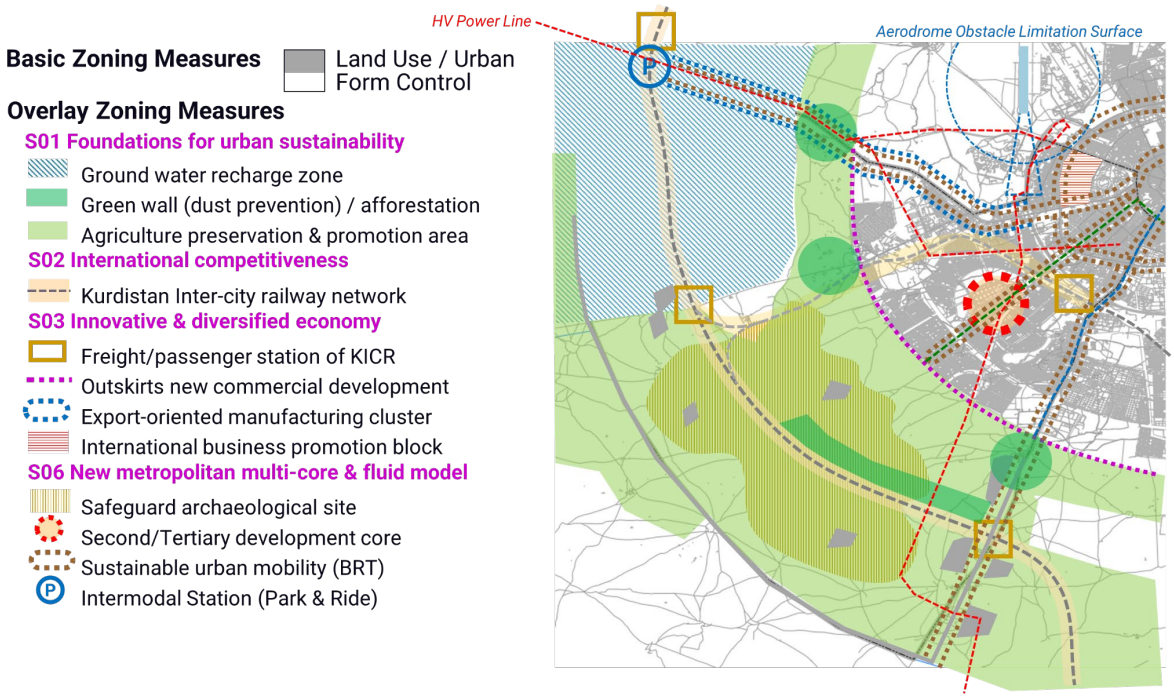
The MP has seven strategic development policies, each with specific spatial development methods. In Table 2.5.2, the adaptability of zoning measures for each spatial strategy of the MP is evaluated. Figure 2.5.2 illustrated the strategic orientation of the Erbil 2050 MP in the pilot area.

Table 2.5.2 Urban Control and Management Instruments for Statutory Subordinate Plan and Other Relevant Plans

no	Strategic Orientation	Spatial Framework in Target Area	Application ZS Tool		
			Binfing (B)		Non-B
			BZ	OVC	OVP
S01	Foundations for urban sustainability	Flood risk zone (riverside)	--	●	--
		Agriculture preservation & promotion area	○	●	○
		Green wall to prevent dust storm	●	--	○
		Agriculture irrigation project	--	--	○
		Agriculture products package & storage	--	--	○
		Afforestation by forest canopy	●	--	○
S02	International competitiveness	Kurdistan Inter-city railway network (S03)	--	●	--
S03	Innovative & diversified economy	Freight/passenger stations of KICR	●	--	○
		Export-oriented manufacturing cluster	●	--	○
		International business promotion block	--	--	○
		Outskirts new commercial development	●	--	--

no	Strategic Orientation	Spatial Framework in Target Area	Application ZS Tool		
			Binfing (B)		Non-B
			BZ	OVC	OVP
S04	New metropolitan multi-core & fluid model	Safeguard archaeological site	--	-●	--
		Second/Tertiary development core	●	--	--
		Sustainable urban mobility (BRT)	○	--	○
		Intermodal Station (Park & Ride)	●	--	--
S05	Robust efficient & resilient Infra	Access to urban mobility (BRT)	--	--	○
S06	Livable & human-scale connected neighborhoods	Development core with public services	○	--	--
		Pedestrian/bicycle priority/promotion	○	--	--
S07	Strong Kurdish identity & sustainable tourism	Archaeological site exploration	--	●	--
		Archaeological visitor management	--	--	○
		Agroforestry tourism product	--	--	○

Legend: ● = most required, ○ = considerable, -- = not relevant, BZ=Basic Zoning (use, form, etc), OVC = Overlay Zoning - Control, OVP = Overlay Zoning - Promotion
Source: JICA Project Team



Source: JICA Project Team

Figure 2.5.2 Spatial Development Framework by Strategic Orientation of Erbil 2050 MP

2.5.2 Land Use Zoning and Control Measures

(1) Urban Growth Management

1) Urban growth boundaries of the Pilot Area

Within the planning area of Erbil 2050 MP, the urban growth boundary is set, taking into account the development framework (population distribution by phases) of the master plan, where the urbanised area is proposed by the land use plan. And the urbanization promotion area is defined to give the priority to the infrastructure development up to 2040 in the pilot area.

2) Erbil Inner Green Belt

The Erbil Inner Green Belt was established and its development control and regulations have been promulgated too. It is expected that the green belt area may play a key role in controlling urbanization as one of the urban growth managements.

(2) Zoning classifications

Advantage of using the zoning system is quick and easy operation of judging the application documents of buildings construction largely due to the check list style assessment enabled by zoning regulations associated with each zone class. The classifications proposed for the pilot zoning scheme (six broad classes covering 19 sub-classes shown in the previous Figure 2.4.1) are adapted to the pilot area. A brief description follows.

1) CLASS I: Rural (+3 sub-classes)

The pilot area covers a wide range of land uses not only for the existing urbanised area, future planned are by detailed plan, but also other land uses including some arid land and large agriculture land. The Class-I of "Rural (100)" consists of "Desert and arid area (DA), "Agriculture (AG)", and "Rural Settlement (SRS)" to be retained and developed.

- DA would be a target of greening works.
- GA will be designated to the areas where agricultural production is possible by existence of easier access to water for agricultural use.
- RS as traditional settlement as villages or other settlements for economic activities

2) CLASS II: Residential (+4 sub-classes)

Class-II consists of "Low-rise Residential (RL)", "Medium-rise Residential (RM)", "High-rise residential (RH)", and "Mixed-use (MX)". The Class-II also allows grocery shops, etc. and cottage style industries.

- RL is to retain low density settlement to secure favorable living environment areas.
- RM will be applied in principle to settlements to be densified with multi-story residential buildings.
- RH is also aiming at densification of the area located especially in the urban centers which have larger potential for development of multi-storeys' buildings. Current real estate development areas can be fit with this category.
- MX is also categorized at CLASS II as it is a residential area in combination with commercial and business floors vertically or part of a land parcel horizontally in medium density settlements.

3) CLASS III: Commercial and Business (+3 sub-classes)

Class-III consists of "Urban Centre C&B" (UCB) and "Neighborhood Commercial & Business (NCB)", and "Corridor C&B (CCB).

- UCB is to be developed and improved as a dominant area for high-medium density commercial and business activities typically called as CBD (Central Business District) in the city centre.
- NCB is for areas such as the sub-centres of Erbil with medium density commercial and business activities to accommodate local markets or small-scale cottage industries.
- CCB (Corridor Commercial & Business) is for areas along primary urban roads allows medium dense development within a certain width in both sides from the road centre. This zoning classification could be incorporated into Transit Oriented Development with public transportation system.

4) CLASS IV: Industrial (+3 sub-classes)

- The Class-V consists of "Industrial Zone (INZ)", "General Industrial (GEN)" and "Quasi-Industrial (QIN)".

- INZ is to be designated for development or improvement of areas for industrial purposes, allowing heavy or special industrial zones only. The area needs to be equipped with adequate infrastructure at a suitable location with certain distance from other purposes.
- GEN is to accommodate the most typical industrial area including urban service industries (e.g. beverage, furniture, building material manufacture, printing, plastic manufacturing, etc.)
- QIN is another type of industrial land use class, allowing mixed use with others such as commercial and business. Typical facilities include logistics, light industries without pollutive production, and research and development (R&D) facilities of industries. it also aims to promote local small-medium scale enterprises (SMEs).

5) CLASS V: Public Use

Class-IV consists of "Key Public Facilities" with a code abbreviation for public use and "Higher Education (HE)".

- Coding for Key Public Facilities in the existing and future areas represented by annotation of major facilities which identifies types of the facility. These include basically large- scale public facilities such as government offices, institutions, transportation terminals, airports, utilities stations, and cemeteries based on the necessity to designate them.
- HE is also included in this class as it requires large-scale land block and provides large impact on the activities of surrounding areas as well as traffic conditions.

6) CLASS VI: Recreation and Open Spaces (+4 sub-classes)

Class VI consists of "Tourism and Leisure (TRL)", "Park, Sports and Open Space (PO)", "Nature, Forest and Green (NFG)", and "Water Surface (WS).

- TRL aims to encourage and promote attractive tourism area where facilities and infrastructure should be carefully developed to avoid deterioration of natural environment which is a source of attraction for sustainable tourism and leisure activities.
- PO will be designated for parks and sports recreation uses. At the same time, PSO will be utilized to raise the level of urban amenity typically brought by landscape and environmental control. (e.g. river-side green, seafront green, etc.). PO will be designated at the areas where green buffer should be introduced typically at the areas where living environment needs to be secured.
- NFG aims at protection of green environment which is expected to bring favorable effects to moderate climate of the city.
- WS is to protect natural water surface areas including wetlands where inundation takes place frequently or water is ponded permanently.
- It should be noted that these classifications are applicable to other planning areas in Erbil 2050 MP area, as the pilot area of the model zoning scheme contains almost all the zoning classification from the city centre to rural and natural area except desert area.

2.5.3 Urban form regulations

Urban form control is to regulate urban or building form through regulating the shape of buildings, such as height, volume, materials and colours, in order to materialise the future population or employment by building volume (bulk control) and the density of the area, and to formulate favorable streetscape in terms of safety, aesthetic, and micro-climate aspects. This is achieved by dimensional requirements for building design in the designated zoning class.

The building volume regulations have two elements: 1) lot coverage ratio (LCR), and 2) floor area ratio

(FAR). Supplementally, setback lines are a part of the regulation including parking space requirements. This pilot zoning scheme adapts typical regulations in association with standards of the regulations to the pilot area.

(1) Urban form control system

Urban form control in combination with building form and site form is achieved effectively by two tier control measures of 1) control and regulation for each building unit and 2) overlay form control or development control for area-wide building ensemble in certain harmonious urban or rural areas. These two control measures are applied to the target area taking account of urban characters to be promoted or conserved by them. In the pilot zoning scheme, some overlay zoning boundaries (river flood risk control zone, archaeological sites protection zone) are not specified due to insufficient basic information.

Table 2.5.3 Proposed Urban Form Control System and its Measures

Urban Form Control Target	Control Measure	Applied Measure	Strategic Orientation (Erbil 2050 MP: ●)	Reference
1. Single Building Unit	By Zoning Classification	1.1 Lot Coverage Ratio (LCR)	--	Standard control and regulation measures by each zoning classification
		1.2 Floor Area Ratio (FAR)	--	
		1.3 Building Height Control (BHC)	--	
2. Building Ensemble	Supplement Safety	1.4 Building Lines Control (BLC)	--	
		1.5 Lot Size	--	
4, Economic Development Promotion	By Overlay Zoning	2.1 Agriculture Inner Green Belt	○ (approved)	Specific or exclusive control and regulations adding regulations on relevant zoning classification
		2-2 Agro-Node Area	●	
		2-3 Agriculture irrigation zone	○ (planned)	
5. Environmental Safety		2-4 Airport safety overlay control and regulation	○ (planned)	
		2-5 Buffer zone for hazardous industrial facilities	●	
		2-6 River flood risk control zone and regulation	●	
6. Environment resource Protection		2-7 Ground water recharge zone	● not specified	
		2-8 Archaeological sites protection zone	● not specified	

Legend: ● = proposed by Eribil 2050 MP, ○ = planned/approval based on other sector plans, -- = not relevant
Source: JICA Project Team

(2) Lot coverage ratio (LCR)

LCR aims to regulate buildable area on the ground within a lot by allowable range of ground floor area of the building. Taking account of a role of LCR as one of the tools for densification of settlement, it is proposed to increase the ratio of LCR in necessary locations (zoning) where the Erbil2050MP density frame requires more densification. Table 2.5.4 indicates typical LCR by each zoning classification. It should be noted that the following are taken account of specific conditions when LCR is applied to each zoning classification with desirable urban form formation.

- Sufficient open space (low rate LCR) in case of high-rise building on “Residential High-density” zone.
- High rate LCR in case of “Commercial and Business” zone should be allowed by the conditions of “corner lot”, “fire-resistance building structure and treatment” and provision of “parking space” such as underground carpark

Table 2.5.4 Typical Standard Lot Coverage Ratio (LCR)

Zoning Classification	Control Range of Lot Coverage Ratio (LCR) by Zones							
	30%	40%	50%	60%	70%	80%	90%	100%
I Residential	Low-density (RL)		--	--	--	--	--	--
	--	Medium-density (RM)			--	--	--	--
	High-rise RHD (w/Cond1)			Other High-density (RH)			--	--
	--	Mixed Use (MX)				--	--	--
II Commercial and Business (C&B)	--	--	--	Urban Center C&B (UCB)			--	--
	--	--	--	Neighborhood C&B (NCB)			--	--
	--	--	--	Corridor C&B (CCB)			w/Cond2	
IV Industrial	Industrial Zone (INZ)			--	--	--	--	--
	General Industrial Zone (GEN)				--	--	--	--
	Quasi Industrial (QIN)				--	--	--	--

Note 1: w/Cond1 = In cases of LCR (30/40%) are applied to the case of medium-high rise residential building. Note 2: w/Cond2= The indicated rate of LCR is allowed by the conditions in case of "Corner Lot" and provision of "Parking pace" (e.g. underground carpark) or "fire-resistance building structure and treatment" Note 3: LCR = Land Coverage Ratio
Source: JICA Project Team

(3) Floor area ratio (FAR)

FAR as one of the essential tools for density control aims to regulate volume of building space (floor) by allowable range of total floor area of the building. FAR as essential densification tool of settlement is proposed to increase the ratio of FAR in necessary locations (zoning) based on the Erbil2050MP density framework. Table 2.5.5 illustrates typical FAR by each zoning classification.

Table 2.5.5 Typical Standard Floor Area Ratio (FAR)

Zoning Classification	Control Range of Floor Area Ratio (CUF) by Zones							
	60%	80%	100%	200%	300%	400%	500%	800%
I Residential	Low-density Residential		--	--	--	--	--	--
	--	--	Medium-density Residential			--	--	--
	--	--	--	--	RH		--	--
	--	--	Mixed Use (MX)				--	--
II Commercial and Business (C&B)	--	--	--	Urban Center C&B (UCB)				
	--	--	--	Neighborhood C&B (NCB)				--
	--	--	--	Corridor C&B (CCB)				--
IV Industrial	Industrial Zone (INZ)			--	--	--	--	--
	General Industrial Zone (GEN)			--	--	--	--	--
	Quasi Industrial (QIN)				--	--	--	--

RH: High-density Residential
Source: JICA Project Team

(4) Building height control

Building height control as one of the most visible controls in urban form controls aims to regulate absolute building height by allowable range of number of floors of the building. The lower buildings are majority in the target area by two floors and only ground floor.

Although building height is relating to FAR control measure, this measure would play a more considerable role in securing strict building height within desirable urban areas where specific town scape is required to be formulated or maintained. And also building height control is proposed generally to increase the height in necessary locations (zoning) based on the Erbil2050MP density framework. Table 2.5.6 illustrates typical numbers of floors in association with presumed height of building based on the key zoning classifications.

It should be noted that the following are taken account of specific conditions when the building height is applied to each zoning classification with desirable urban form formation.

- Higher building more than R+ 4 floor should consider conditions of lifts provision in the building, while lower building without the lift is defined by the R+4 floor buildings (ground floor included) as walk-up building
- Higher building than R+4 floor should consider conditions of fire-fighting, especially availability of reachable fire-fighting ladder truck to the upper floors of the building.
- Higher building in the specific area where the environment is required to conserve its town scape or scenery or to regulate buildings in terms of safety of specific infrastructure such as airport surface areas.

Table 2.5.6 Typical Standard Building Height Control

	Range of Building Height (by Floor, absolute height is as reference)													
No. of Floor	**R+1F**	**+2F**	**+3F**	**+4F**	**+5F**	**+6F**	**+7F**	**+8F**	**+9F**	**+10F**	**+11F**	**+12F**	**+13F**	**+14F**
(Building height m)	6.0	9.0	12.0	15.0	18.0	21.0	23.0	25.0	29.0	32.0	35.0	38.0	41.0	43.0
I Residential	RL	--	--	--	--	--	--	--	--	--	--	--	--	--
	--	RM			--	--	--	--	--	--	--	--	--	--
	--	--	--	RH						--	--	--	--	--
	--	MX			--	--	--	--	--	--	--	--	--	--
II Commercial and Business (C&B)	--	UCB								**w/C1**	**w/C2**			
	--	NCB				--	--	--	--	--	--	--	--	--
	--	CCB				--	--	--	--	--	--	--	--	--
IV Industrial	INZ		--	--	--	--	--	--	--	--	--	--	--	--
	GEN			--	--	--	--	--	--	--	--	--	--	--
	QIN			--	--	--	--	--	--	--	--	--	--	--
Reference	--	--	--	A*	B*	C*	--	--	--	--	--	D*	--	--

Note: RL = Row-density residential, RM = Medium-density residential, RH = High-density, MX = Mixed use, UCB = Urban center commercial and business, NCB = Neighborhood commercial and business, CCB = Corridor commercial and business
Note1: A*= A walk-up building applies to under 4th floor. *B=A building over 4th floor is required by the lift. C*= A building more than a 20 m height is treated by the high-rise building in combination with necessary equipment for fire-fighting. *D = standard fire ladder truck (35m~40m).
Note 2: w/Cond2 = The range of building height considers difficulties to cope with fire in high-rise buildings by ordinal fire-ighting ladder truck (D*)

Source: JICA Project Team

(5) Lot size and building lines control

Land lot size plays also one of the important roles in formulating settlement density. Standard range of plot size for each zone classification is proposed to be widen by introduction of smaller lot size taking account of the Erbil2050MP density framework. Table 2.5.7 proposes to set standard lot size to apply to each zoning classification.

Building lines as building setback measures within a property lot aims to be reasonably constructed, occupied and used for building purposes without danger to the health, safety of the occupants, security, and considering fire-resistance and micro-climate ventilation. Table 2.5.7 shows typical standard lot size and its building lines by each zoning classification.

Table 2.5.7 Typical Standard Lot Size and its Building Lines

Typical Lot Size		Building Lines by Standard Range of Land Lot Size							
		200 m^2	350 m^2	500 m^2	700 m^2	1000 m^2	1500 m^2	3000 m^2	5000 m^2 over
Road frontage (m)		3.0	3.0	4.0	4.0	5.0	6.0	7.0	9.0
Setback:	Rear (m)	1.0	1.5	1.5	2.0	2.0	3.0	3.0	5.0
	Side (m)	1.0 (0.0)*	1.5	1.5	2.0	2.0	3.0	3.0	5.0
I Residential		--	--	Low-density Residential (RL)				--	--
		Medium-density Residential (RM)							
		RH (low-rise bld.)		--	--	High-density Residential (RH: high-rise bld.)			
		Mixed Use					--	--	--
II Commercial and Business (C&B)		Urban Center Commercial and Business (UCB)							
		Neighborhood Commercial and Business (NCB)							--
		Corridor Commercial and Business (CCB)						--	--
IV Industrial		--	--	--	--	--	Industrial Zone (INZ)		
		--	--	--	--	--	General Industrial (GEN)		
		Quasi-Industrial (QIN)						--	--
Reference		A*	B*			C*			

Note: In case of common wall building, side building line is no interval or buffer between two different properties.
Source: JICA Project Team

(6) Overlay zoning application to specific areas in the pilot area

Overlay zones aim to formulate specific standards and regulations for specified areas, by adding exclusive or additional regulations on the designated basic zones. Whenever a requirement of an overlay zone conflicts with a requirement of the underlying basic zone, the overlay zone requirement will be superior to base zone controls. These controls sometimes are based on the other sector regulations such as environment protection, security and infrastructure. The following key overlay zonings in the pilot area are proposed to apply to the specific areas as itemised from 1) to 8).

1) Inner Green Belt Zone (approved plan with regulations)

- **Purpose:** to have a multi-purpose green belt area based on the Erbil Master Plan 2030 to 1) prevent urban sprawl, 2) preserve peripheral agriculture lands, 3) provide open recreational spaces, and 4) contribute to climate resilience and natural biodiversity and green landscape
- **Applicable measure:** Specific development and building control, and promote to create parks, utility facilities (sewerage plant), forestation, (the part of Inner Green Belt in the pilot area was designated by "zone A7 for Integrated Horticultural Family Farming"

2) Agro-Node Area

- **Purpose:** to be aware of "Inner Green Belt (IGB)" by formulation of a green gate on the cross point between the IGB and key regional roads, where a rest place with a fuel station, restaurant, coffee and local product shops are developed, and to promote and sell local agricultural products produced in IGB.
- **Applicable measure:** Specific development incentive provision to attract private sectors through a certain physical development plan including a business.

3) Agriculture irrigation zone

- **Purpose:** to protect and promote a planned agriculture lands development through improvement of irrigation system by the Ministry of Agriculture and Water Resources (MOAWR)
- **Applicable measure:** Direct government investment for the irrigation system and desirable legislative arrangement to maintain the agricultural land, regulation of building construction, etc.

4) Airport safety overlay control and regulation

- **Purpose:** to secure safe aircraft operation (taking off, landing) within the aerodrome area of the Erbil International Airport designated by Obstacle Limitation Surface Zone (OLSZ-IATA)
- **Applicable measure:** Specific building height control regulations (maximum building heights) within OLSZ.

5) Buffer zone for hazardous industrial facilities (Gwer Road Industrial Zone)

- **Purpose:** to avoid or mitigate severe damages of residents due to industrial area incidents (explosion, leakage of hazardous materials, polluted particle matters, etc.)
- **Applicable measure:** Specific building control zone with certain buffer zone can be introduced into certain influenced or risk areas of industrial area incidents. Development or construction permit system within the zone can be set.

6) River flood risk control zone and regulation

- **Purpose:** to avoid or mitigate severe damages of settlement from flood disaster of rivers
- **Applicable measure:** Specific building control zone with certain buffer along rivers can be introduced into certain influenced or risk areas of flood or inundation area based on the risk probability assessment. Several level of regulations can be set by mandatory resettlement, building structural conditions, other mitigation measures

7) Ground water recharge zone

- **Purpose:** to protect the land area without other use surface occupation to foster water infiltration to underground and promote green surface (preferably forest)
- **Applicable measure:** Specific development control zone for agricultural land zone classification can be introduced into identified lands by the master plan.

8) Archaeological sites protection zone

- **Purpose:** to protect archaeological heritage sites and promote them where researchers are investigating large potential areas in the southern part of Erbil 2050 MP planning area.
- **Applicable measure:** Specific regulation zone to prevent land development or building construction can be introduced into the potential archaeological excavation, where some excavation area can be open to the public as tourist destination.

2.5.4 Road network in the Pilot Area

The road networks consisting the future urban structure for Erbil 2050 MP, the pilot zoning scheme would follow also the road network 2050 in the pilot area. This is because of importance of securing right of ways of the road network in association with land reserve or expropriation.

The road network in the target is defined by their road classifications according to the road classification by the Iraq Highway Manual. The pilot area involves all road classifications from arterial road to tertiary road as shown in Table 2.5.8.

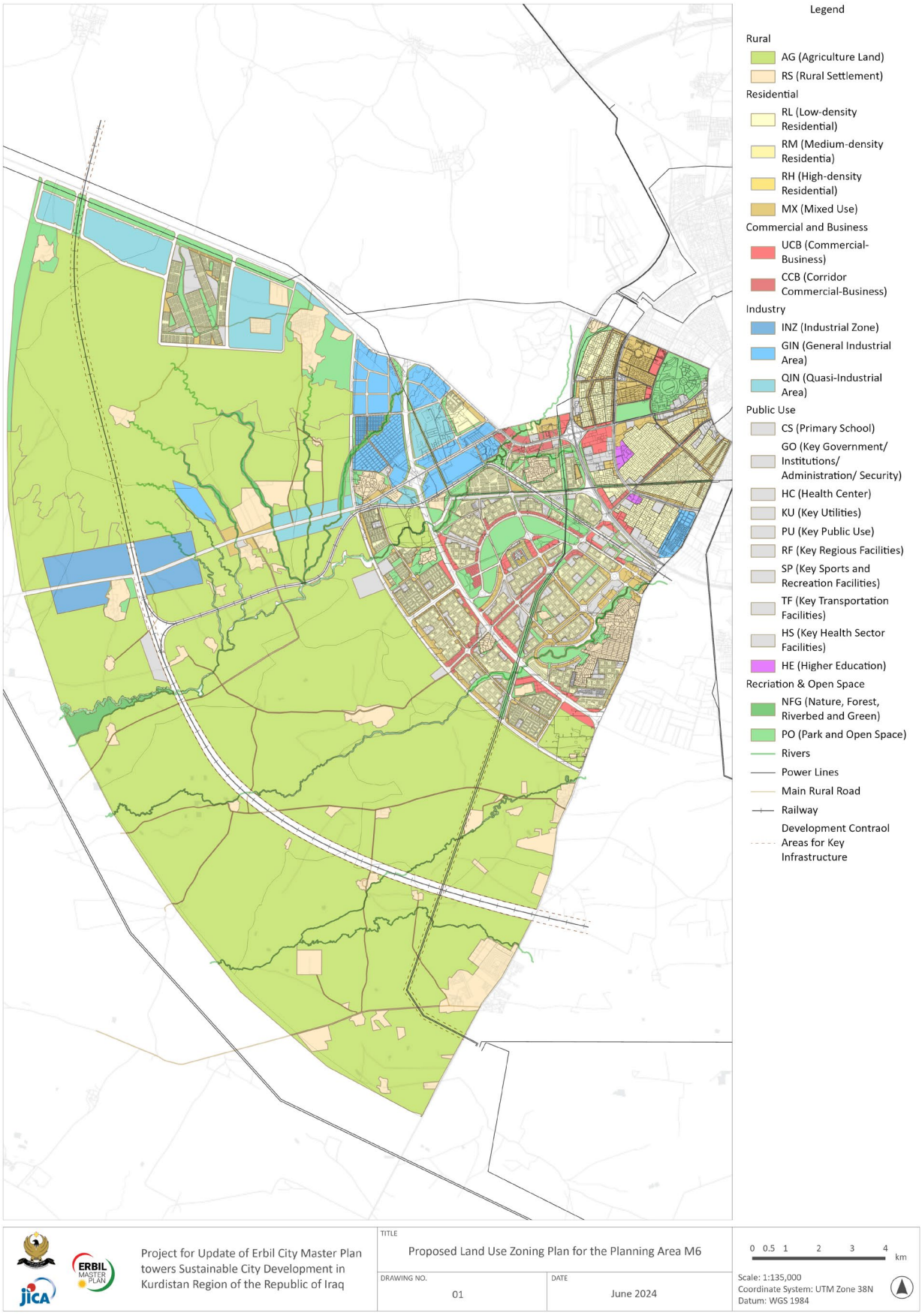
Table 2.5.8 Right of Way (R.O.W) to be Secured of the Road Network

Control Measure	Right of Way (R.O.W)	Reference
Arterial Road (Primary)	150 m	8th ring road
	120 m	7th ring road
	100 m	6th ring road
	80 m	
	60 m	4th ring road
	50 m	
	40 m	
	33 m	
Collector Road (Secondary)		
	25.5 m	
Local Road (Tertiary)	13.5 m	
	12 m	

Source: JICA Project Team based on the IRAQ Highway Deign Manual

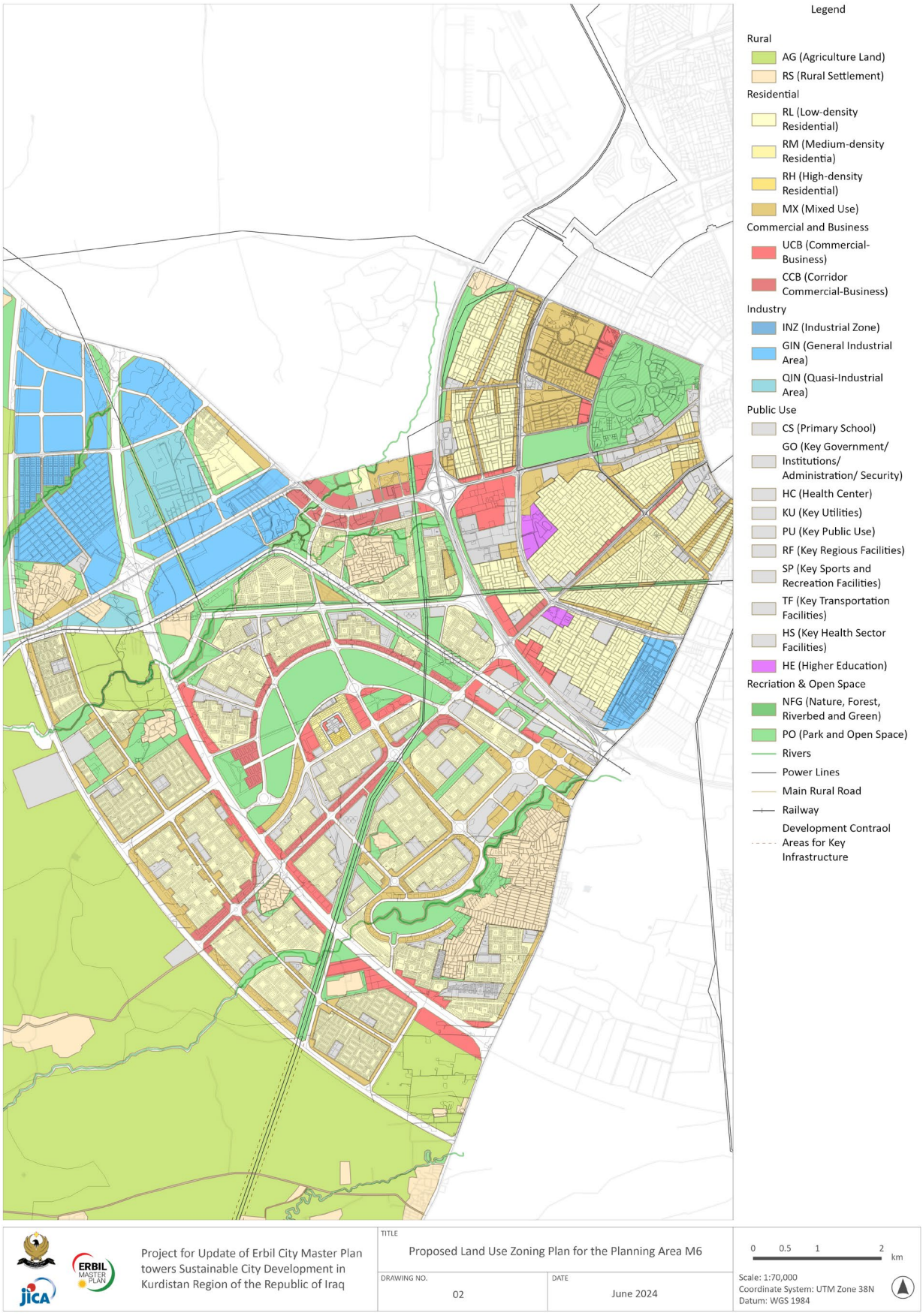
2.5.5 Proposed Pilot Zoning Scheme (Map) to Pilot Area (Municipality no.6 + other)

Based on all elements mentioned in the previous sections for zoning measures, the zoning map can be illustrated in Figure 2.5.3 to 5.as the report version, while the original size of map will be drawn at 1/5000 scale.



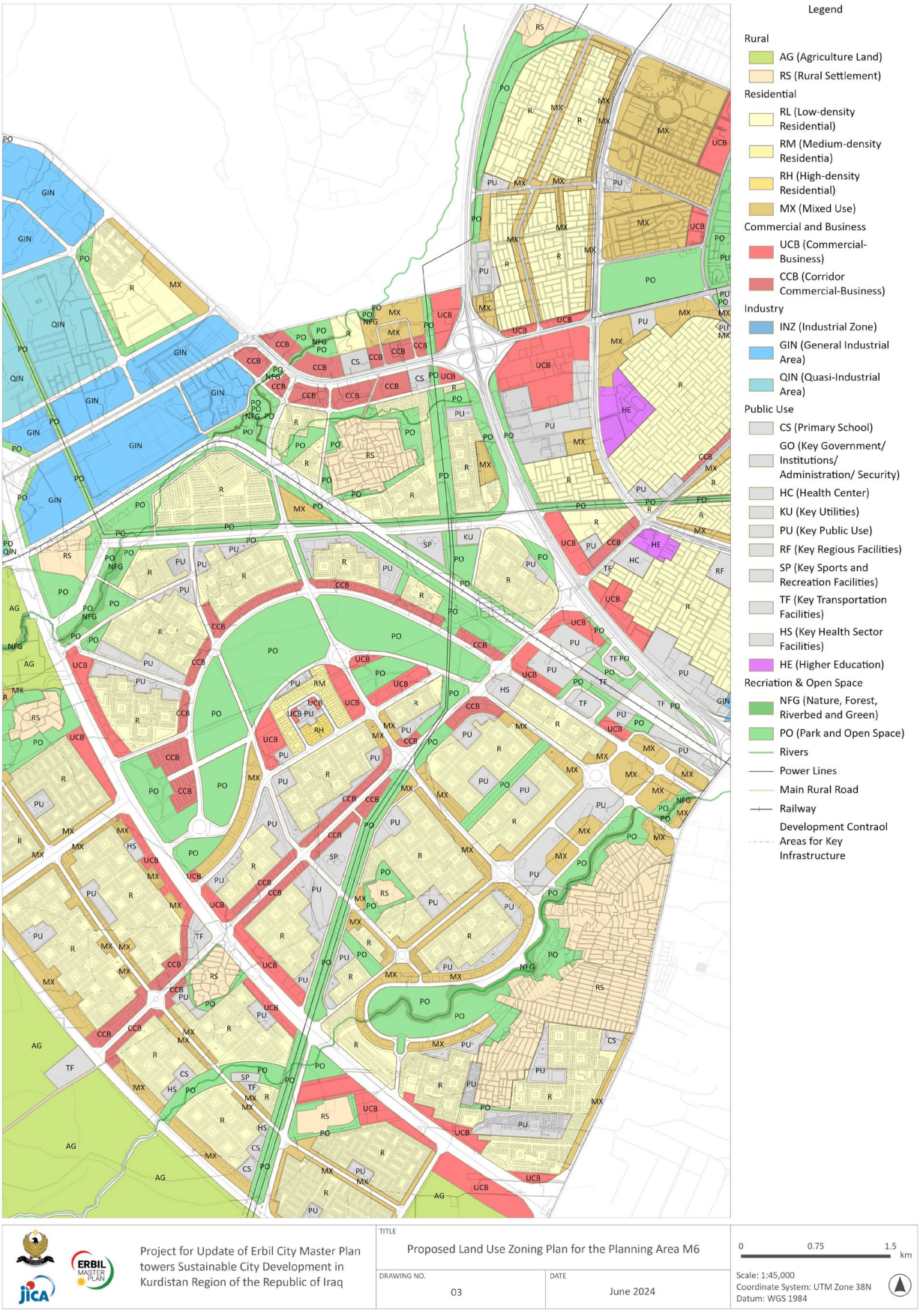
Source: JICA Project Team

Figure 2.5.3 Proposed Zoning Plan for Municipality 6 + a (Overview)



Source: JICA Project Team

Figure 2.5.4 Proposed Zoning Plan for Municipality 6 + a (Intermediate View)



Source: JICA Project Team

Figure 2.5.5 Proposed Zoning Plan for Municipality 6 + a (Detailed View)

2.6 Lessons Learned from the Pilot Zoning Scheme at Municipality 6 and its Extension Area

(1) Discussions on zoning scheme

During the course of the Project, several thematic discussions on the zoning scheme were held with GDUP (core counterpart members) and Technical Working Group (relevant experts from Ministries-sector directorate generals, local authorities-PEM, GDEM and PEM planning officers).

1) Thematic discussions on general zoning scheme and the pilot zoning scheme with relevant counterpart members

- Pilot area (priority area) selection (November 2022)
- Introduction of zoning scheme to Erbil (KRI) and its necessity (May 2023)
- Contents of zoning scheme for effective urban control and management (January 2024)
- Pilot zoning scheme adapting to the Pilot Area and its issues (Municipality no.6 and other area) (June 2024)

2) Key discussion contents on general zoning scheme and the pilot zoning scheme

Understanding a zoning system

- Although we understand the weakness of current urban planning and management system in the KRI and the need to introduce a zoning control system rather than the detailed planning system under the Master Plan, we need more time to understand it deeply and fully grasp it.
- It will take some time to introduce a zoning system into our administration due to the lack of legislation on urban planning and management, which will require the establishment of a new urban planning and management law to involve it in a new law.
- The explanation of the clear functional difference between a zoning scheme and a detailed plan is deserved.
- It is important for us to learn and understand how to formulate a zoning scheme and how to examine and modify regulations in line with the Master Plan.
- We need to elaborate standards and norms which a zoning scheme handles with to fit with our local context of Erbil.

In case of the Pilot Zoning Scheme practice

- The specific workings of the pilot zoning scheme can be understood with regard to its application to the pilot areas. In particular, the content of use and overlay regulations, which are not included in the detailed plan, can be seen to visualise the specific zoning applications of urban management and highlight issues.
- It is important for Erbil to control density where we understand a FAR will play a key tool in guiding and controlling desirable density in Erbil.
- It is important to implement the proposed zoning scheme for the pilot area as a trial regulation and as a first step for controlling the use of land and regulating the different uses on these lands.
- The pilot zoning scheme (overlay zoning) revealed issues of some discrepancy with sectoral regulation such as the aerodrome regulation and urban development, the detailed plan and agricultural land investment program. These observations became one of the pieces of evidence with lack of cooperation and coordination among the relevant authorities involved.

(2) Adaptability of zoning scheme into the current legislative framework

Through the pilot zoning formulation activities and discussions with its counterparts, this section discusses the possibility to introduce the zoning system to Erbil, which is expected to be one of the effective instruments for the effective implementation of the Erbil 2050 MP.

1) Basic urban planning and management system for effective implementation of the master plan

The requirements can be listed as follows when a zoning scheme is introduced into a subordinate plan for effective implementation of the master plan.

- A subordinate planning and management system should be established by introduction of a zoning system to supplement the weakness of current detailed planning system for appropriate and full-covered urban control and management of the master plan area.
- Long-term approach for establishment is required rather than immediate introduction of a zoning system, while the secondary best improvement is examined.
- Capacity development become inevitable element to enlighten relevant stakeholders in urban management.

2) Adaptable options for subordinate planning and management system for short-term improvement

The consultations and discussions on this project revealed that the introduction of a zoning system in Erbil would require time, for example through the establishment of a comprehensive legal system. it is necessary to consider other effective measures to address urban management issues in the short term.

- Establishment of "general urban regulation" could be a possible option to guide current detailed planning system, although holistic or integrated regulation would be difficult among several details plan.

(3) Capacity development on urban management

Technical skills in urban management are required to deal with complex urban issues in the absence of an adequate legal system. Even if the system is in place to a certain extent, capacity development on a regular basis is essential to understand and become proficient in urban management operation. The development of regular capacity development programmes by governments is important.

Final Report

PART III: STRATEGIC ENVIRONMENTAL ASSESSMENT

CHAPTER 1
APPLICATION OF STRATEGIC ENVIRONMENTAL ASSESSMENT

1.1 Concept of Strategic Environmental Assessment

1.1.1 Aims of Strategic Environmental Assessment

(1) SEAs as a New Approach to Development Interventions

A Strategic Environmental Assessment (SEA) is a new approach to development interventions, which has been adopted in an increasing number of countries. A SEA is applied at higher levels of any development intervention, such as policy and program levels, compared to project-specific environmental assessments, such as initial environmental examinations and Environmental Impact Assessments (EIAs). Naturally, a SEA is applied at an early stage in a development intervention typically for the purpose of policy formulation and master planning.

A SEA assesses a wider range of possible impacts, both temporal and spatial while project-specific environmental assessments mainly focus on marginal effects. That is, a SEA assesses the long-term, as well as the short- and medium-term, effects, along with effects on a larger geographic scale. A SEA is also applied to a wider scope of works, covering all different sectors and aspects that may be affected by any development intervention. In addition, an SEA assesses cumulative and complex effects.

In sum, a SEA represents the phase of effective planning for environmental development, where the environment is considered in its broadest sense. This is in sharp contrast to other economy-oriented developments, where environmental and social concerns are put on the sidelines at best. A SEA, on the other hand, puts environmental and social concerns in the foreground of development.

To satisfy all these conditions effectively, a SEA should be conducted by involving a wide range of stakeholders at an early stage in any development intervention. This is affected through (1) stakeholder meetings and (2) disclosure and sharing of relevant information.

1.2 Legal Framework of Strategic Environmental Assessment in Kurdistan

There are no rules and regulations on SEA that are implemented for higher level of development and policies in Kurdistan although there are Environmental protection laws, regulations and obligations on EIA that apply to projects at the project implementation stage.

1.2.1 Environmental Law

(1) The Law no. (8) for (2008) Environmental Protection and Improvement of the Kurdistan Region – Iraq

The Law no of Environmental Protection and Improvement of the Kurdistan Region – Iraq has been enacting as the primary legislative means empowering the government to establish regulations for the protection of the environment. The law includes general requirements related to air, water, soil, biodiversity, and climate protection and improvement, as well as the handling of wastes and dangerous substances and development of standards and emergency preparedness. Provisions for punishable rules and the development of future rules are also included.

(2) Law no. (3) for 2010 Environmental Protection and Improvement Board in Iraqi Kurdistan Region

To enact suggest the general policy for environmental protection the Environmental Protection and Improvement Board in Iraqi Kurdistan Region (EPIB KRG) was established in 2010. EPIB KRG has

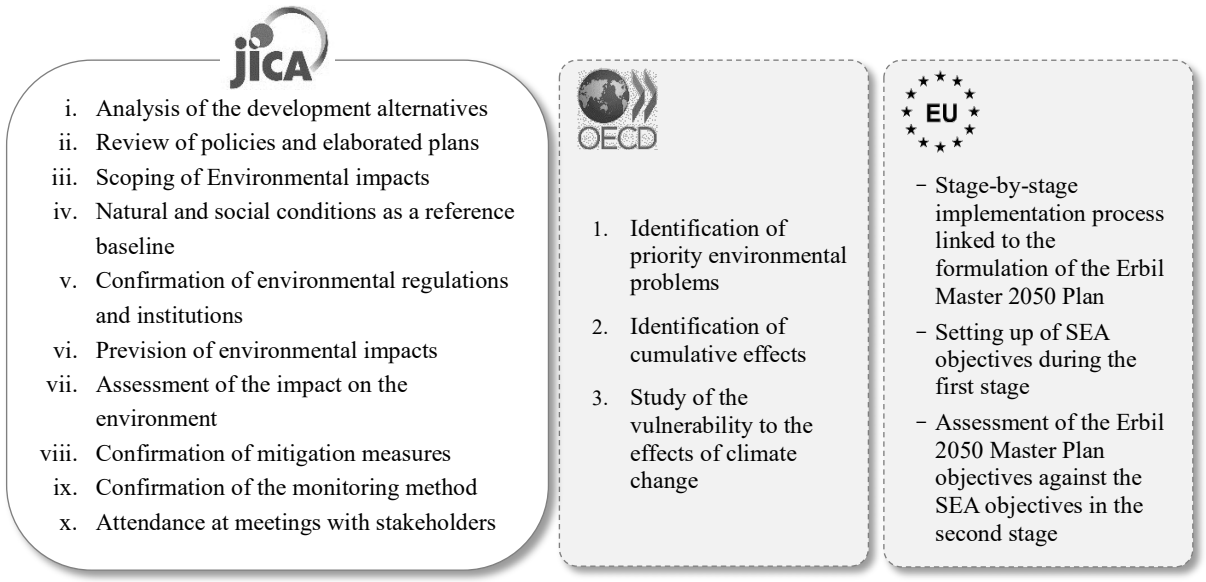
also several tasks: (1) formulating annual, medium, and long-term planning for environmental protection and improvement, (2) issuing special instruction for determinants, control, and required environmental information and auditing safety of environment project, (3) performing survey and tests related to environment affecting factors.

These tasks are carried out in collaboration with the Regional Directorate of Environment which is under supervision of EPIB KRG. In the case of Erbil, the Directorate of Environment of Erbil is the relevant department at the regional scale.

In accordance with those legislation, companies engaging in activities with the potential to impact the environment are required to submit an EIA to the government for review and approval prior to commencement of operations.

1.3 Selected Methodology for Strategic Environmental Assessment

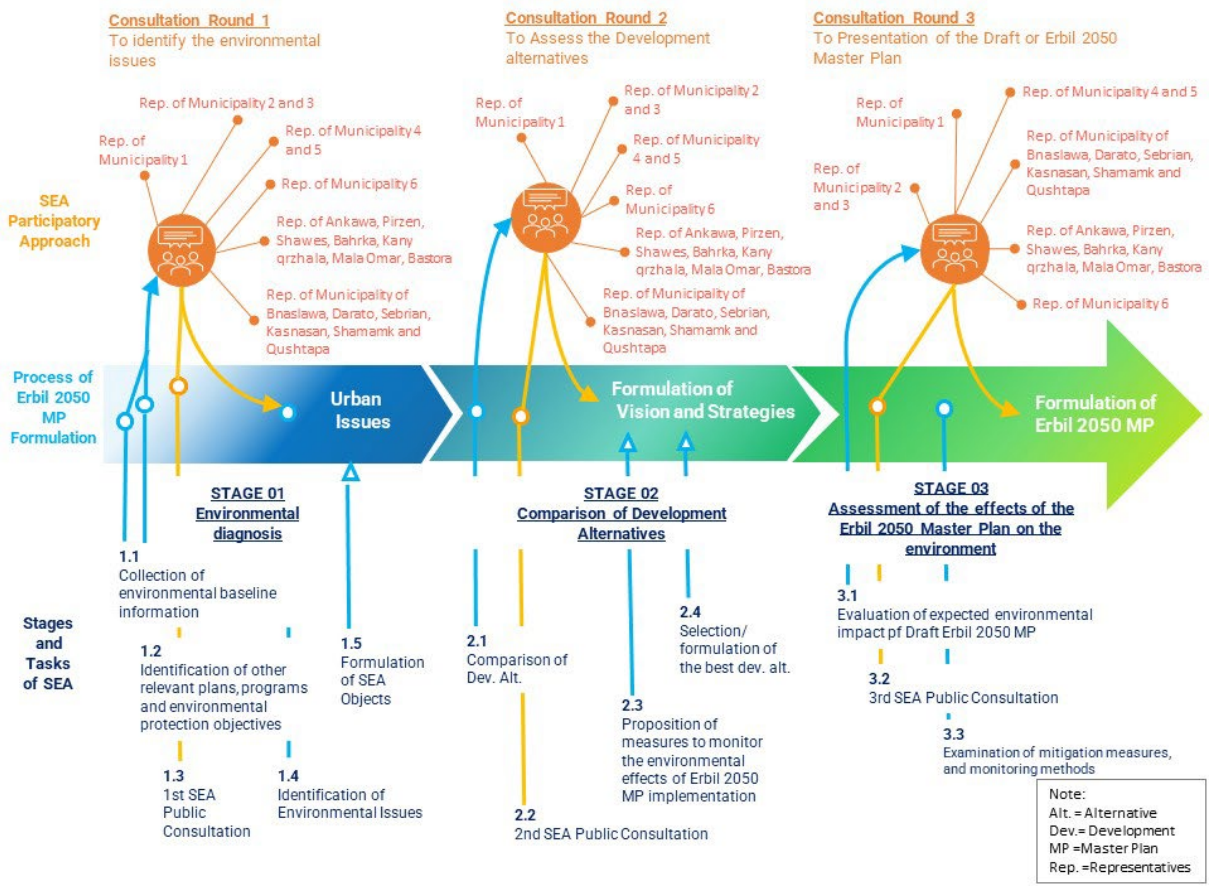
Due to the absence of legal and institutional framework of SEA in Kurdistan, a comprehensive and regulatory framework of SEA must be set up in the future. With this regard, the SEA methodology applying in this Project is established based on the JICA Guidelines for Environmental and Social Considerations (hereinafter referred to "the JICA guideline") updated 2022, the guideline published by OECD "Applying Strategic Environmental Assessment" (hereinafter referred to "the OECD guidelines") dated 2006, and the EU SEA Directives named "Environmental assessment of certain plans and programmes: Directive 2001/42/EC, Rulings of the Court of Justice of the European Union", which are both well-known guidelines for SEA.



Source: JICA Project Team

Figure 1.3.1 Methodological Framework of the SEA

Figure 1.3.2 shows that the SEA process set up for on the Project which consists of three steps: (1) Environmental diagnosis, (2) Comparison of Development Alternatives, and (3) Assessment of the effects of the Erbil 2050 MP on the environment. Each step involves public consultations in order to obtain a wide range of outputs on both natural and social environments. The theme, target participants and organizing method ("face to face" workshop, online survey, combined workshop, etc.) of each workshop would be decided through the discussion with C/Ps and relevant authorities. SEA objectives and indicators would set up based on the baseline survey, the result of SEA public consultation and discussion with C/Ps and relevant authorization in the first (1) step and would act as a guide to assess later stages.



Source: JICA Project Team

Figure 1.3.2 Outline of SEA Implementation Process

CHAPTER 2
ENVIRONMENTAL DIAGNOSIS

2.1 Collection of Environmental Baseline Information

Baseline information provides the basis for predicting and monitoring environmental effects and helps to identify environmental problems, tendency, and alternative ways of dealing with them. Both qualitative and quantitative data can be utilized for this purpose.

A Baseline Environmental Survey regarding natural conditions of the Project Area has been undertaken (see Appendix Section 1.1). Some of the information from the survey is reflected in the analysis of the existing environmental conditions (see Part I, Section 2.2).

2.2 Identification of other Relevant Plans, Programs and Environmental Protection Objectives

In Kurdistan, there were no specific and concrete environmental objectives in relevant plans, programs such as current Erbil 2030 MP (2007) and Vision 2030.

2.3 1st SEA Public Consultation

2.3.1 Objective of the 1st SEA Public Consultation

In the framework of SEA, a series of public consultations would be organized throughout the Project in the different municipalities of Erbil City by 3 steps as indicated in Figure 1.3.2. The objective of the 1st public consultation is mainly to collect opinions of the residents regarding the current environmental issues and future expectation on the neighborhoods, while promoting the Project to the public and establishing solid partnerships between Counterpart and municipal administrations in order to prepare other future collaborations. This consultation used the term of "Environment" in a human-centered and broad definition, with the purpose of fully understanding the living conditions of Erbil residents, including public health, safety, livability etc.

2.3.2 Consultation Process

To fulfil the objective of identifying environmental issues, 2 means are proposed as below:

(a) Individual Expression

Individual expression is an approach for the facilitators to get opinions of participants individually. The individual expression is written in a card (one opinion = one card). Each opinion is counted even if there are already same, similar, or close opinions mentioned, in order to be able to consider opinions of all people statistically. Participants are invited to express themselves in the language of their choice (Kurdish or Arabic).

(b) Participatory Mapping

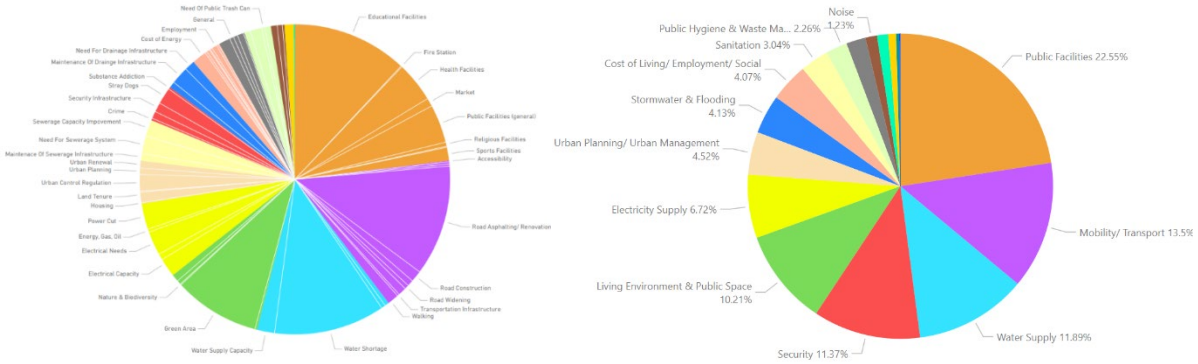
After participants expressed about the current (2022) problems, participants would indicate the problems on a map of the neighborhood. This allows to be able to spatialize the mentioned current issues in terms of environment and living conditions in each neighborhood of the municipality. The results of participatory mapping sessions have been digitized in GIS format in order to be analyzed and to be utilized in planning.

2.3.3 Result of 1st SEA Public Consultation

In the 1st SEA public consultation, there were 6 consultation workshops were held for Municipality 1~6, Ankawa, Bnaslawa, Darato, Kaznazan, between July 28 and August 11, 2022.

In series of the 6 consultations, a total of 304 Erbil residents had participated, consisted of 246 male and 58 female residents. The most represented age group is the fifty's (from 50 to 59 years old: 31%), followed by the thirty's and the forty's (23% each group), and over sixty's (over 60 years old; 15 %). The youngest age groups have a deficit of representativity with 7% for the 20's (7%) and 1% for the under twenty's. The oldest participant was 76 years old, and the youngest participant was 17 years old.

Through the 6 consultation workshops, 1,548 opinions had been collected. Participants focused in priority on the current problems (60%), followed by future Hopes (16%), current Assets (14%) and did not mention much about the future Fears of the community (10%). All opinions were analyzed and categorized into seventeen themes and eighty-four sub-themes. The most comment issue, including Current Problem, Assets, Future Fear and Hopes, is related to Public Facilities (23%), following by Mobility/ Transport (14%), Water Supply (12%), and Security (11%) etc.



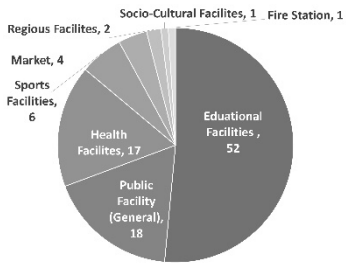
Source: JICA Project Team

Figure 2.3.1 Categories and Subcategories of 1st SEA Public Consultation

The main current environmental Problems pointed out by the citizens of Erbil City are Public Facilities (23%), followed by Mobility/ Transport issues (17%), Water Supply (14%), Living Environment & Public Area (10%), Electricity Supply (7%), Urban Planning/ Urban Management (5%), Sanitation matter, Security, Stormwater & Flooding issues, and Cost of Living/ Employment problems (all 4%), etc. (Table 2.3.1).

Table 2.3.1 Top Five Categories of Current Problem on 1st SEA Public Consultation

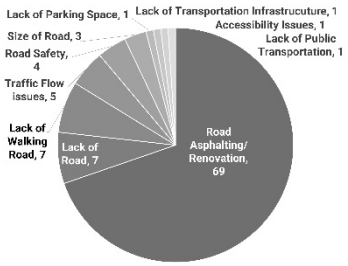
Public Facilities (ranked 1st Current Problem with 214 opinions)



Public Facilities problems concerns primarily the lack of Educational Facilities (52%), Health facilities (18%), Quality of Public Facilities in general (17%), lack of Sport Facilities (6%), of Market (4%), of Religious Facilities (2%) etc.

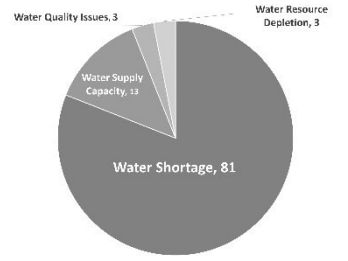
The educational facilities that have been identified as a problem range from kindergartens to higher education facilities. Moreover, there is a wide range of issues, from the tangible aspects such as insufficient facilities to the intangible aspect of educational quality.

Mobility/ Transport (ranked 2nd Current Problem with 154 opinion)



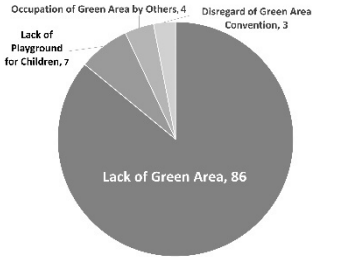
Mobility problems relate mostly to the bad state of roads which needs Asphalting & Renovation (69%) followed by lack of Road and Walking Road (both 7%), Traffic Flow issues (5%), Road Safety (4%), size of Road (3%) and lack of Parking Space, Public Transportation, Transportation Infrastructure and Accessibility issues (all 1% approx.).

Water Supply (ranked 3rd Current Problem with 132 opinion)



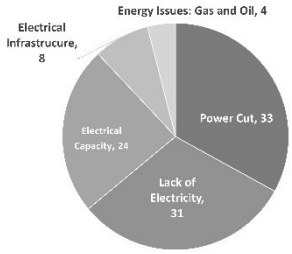
Water Supply problems relate mainly to Water Shortage (81%), but also to a smaller extent to the lack of Water Supply capacity (13%), Water Quality issues and Water Resource Depletion (both 3%).
It may be due to the low level of water wells, and deterioration of water networks. On the other hand, regarding the "water shortage" issue, it should be noted that the 1st SEA consultation was conducted during the dry season from late July to August.

Living Environment & Public Area (ranked 4th Current Problem with 97 opinions)



The lack of Green Area (86%) is the most common problem pointed out by the residents of Erbil City, followed by lack of Playground for children (7%), Occupation of Green Area by Others (4%), and Disregard of Green Area Convention (3%).
In addition to increasing the green parks with trees and plants as the wish of the residents in Erbil city, it has been expressed the hopes to have pond and playgrounds.

Electricity Supply (ranked 5th Current Problem with 75 opinions)



Current Problems in terms of Electricity Supply concern mostly Power Cut (33%) followed by lack of Electricity (31%), Electrical Capacity (24%) Electrical Infrastructure (8%), and Energy issues including Gas and Oil (4%).

Source: JICA Project Team

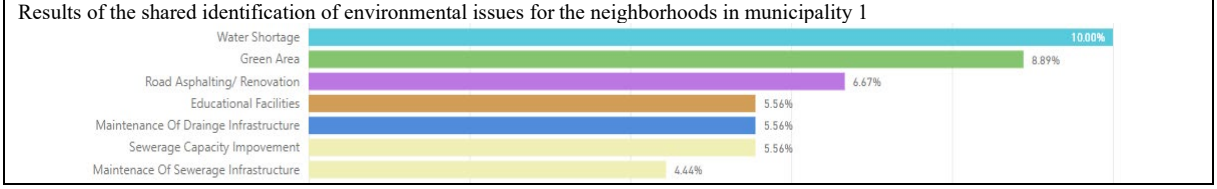
2.3.4 Result of the 1st SEA public consultation by municipality

As explained above, all collected opinion of the 1st SEA public consultation has been analyzed and complied into various familiar themes at the scale of Erbil City. The result of the 1st SEA public consultation is also analyzed by each municipality 1 to 6, Ankawa, Bnaslawa, neighborhoods of Inside and Outside of Inner Green Belt. Those results had been shared to each director of the municipality and collected their comments on the results as shown below. The opinion number in each table below includes all type (Current Problem, Current Asset, Future Fear, and Future Hope).

Table 2.3.2 Results of Identification of Environmental Issues in Municipality 1

Date: August 1st, 2022	Venue: Hall of Municipality 1	Participants: 39 citizens	Opinion #: 169

Results of the shared identification of environmental issues for the neighborhoods in municipality 1

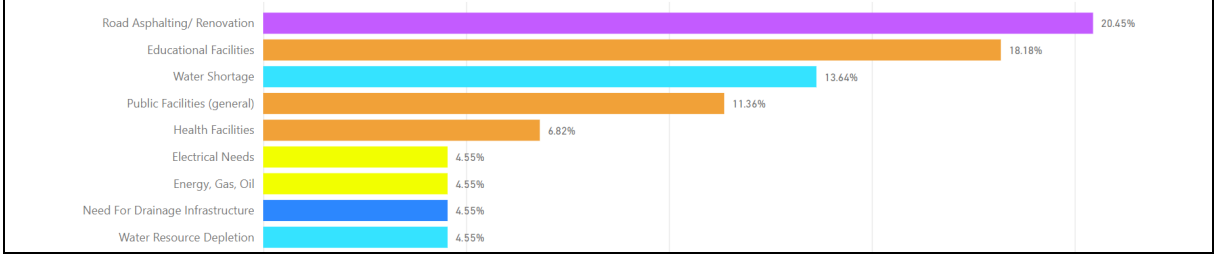


Source: JICA Project Team

Table 2.3.3 Results of Identification of Environmental Issues in Municipality 2

Date: August 11th,2022	Venue: Hall of Municipality 2	Participants: 14 citizens	Opinion #: 79

Results of the shared identification of environmental issues for the neighborhoods in municipality 2

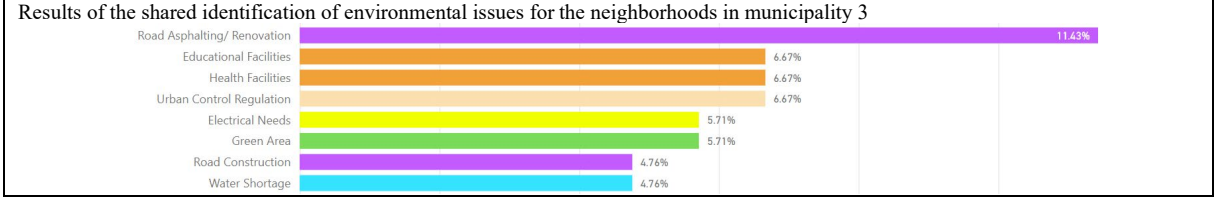


Source: JICA Project Team

Table 2.3.4 Results of Identification of Environmental Issues in Municipality 3

Date: August 11th, 2022	Venue: Hall of Municipality 3	Participants: 24 Citizens	Opinion #: 152

Results of the shared identification of environmental issues for the neighborhoods in municipality 3

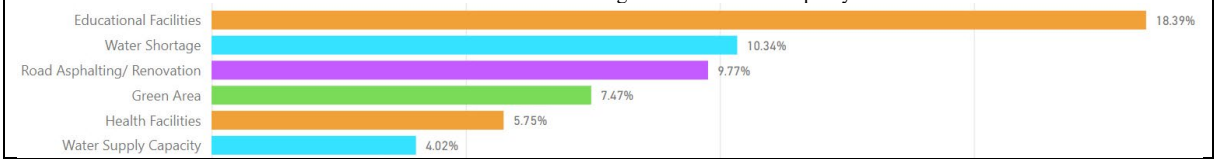


Source: JICA Project Team

Table 2.3.5 Results of Identification of Environmental Issues in Municipality 4

Date: July 28th, 2022	Venue: Hall of Municipality 5	Participants: 52 citizens	Opinion #: 293

Results of the shared identification of environmental issues for the neighborhoods in municipality 4

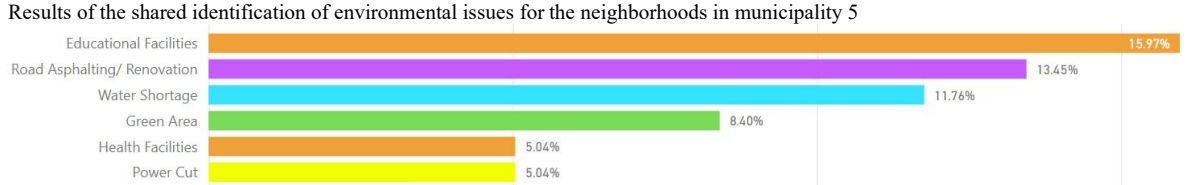


Source: JICA Project Team

Table 2.3.6 Results of Identification of Environmental Issues in Municipality 5

Date: July 28th, 2022	Venue: Hall of Municipality 5	Participants: 33 citizens	Opinion #: 169

Results of the shared identification of environmental issues for the neighborhoods in municipality 5

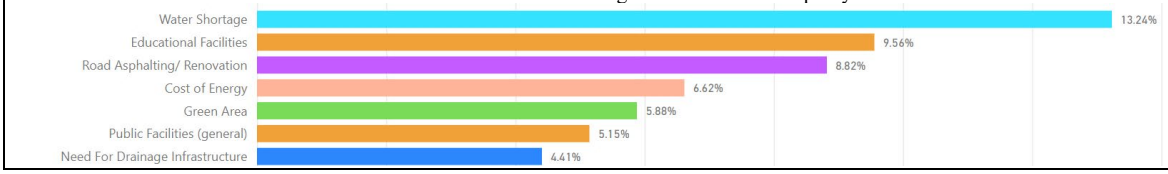


Source: JICA Project Team

Table 2.3.7 Results of Identification of Environmental Issues in Municipality 6

Date: August 3rd, 2022	Venue: Hall of Municipality 6	Participants: 49 citizens	Opinion #: 234

Results of the shared identification of environmental issues for the neighborhoods in municipality 6

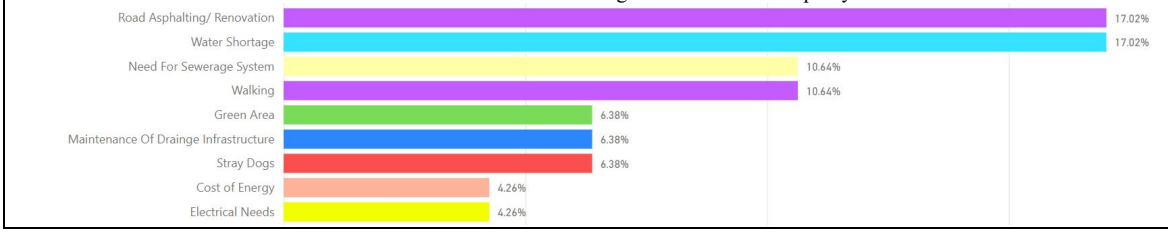


Source: JICA Project Team

Table 2.3.8 Results of Identification of Environmental Issues in Ankawa

Date: August 7th, 2022	Venue: Hall of Municipality Ankawa	Participants: 26 citizens	Opinion #: 65

Results of the shared identification of environmental issues for the neighborhoods in municipality of Ankawa

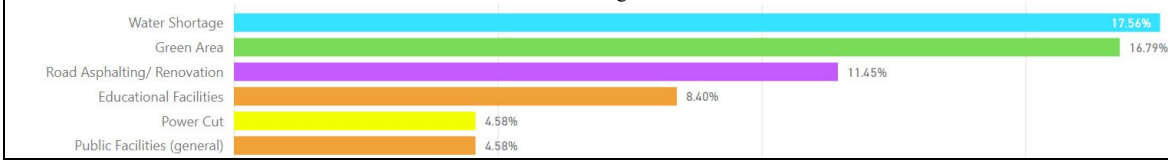


Source: JICA Project Team

Table 2.3.9 Results of Identification of Environmental Issues in Bnaslawa

Date: August 9th, 2022	Venue: Youth Center of Bnaslawa	Participants: 48 citizens	Opinion #: 247

Results of the shared identification of environmental issues for the neighborhoods in Bnaslawa

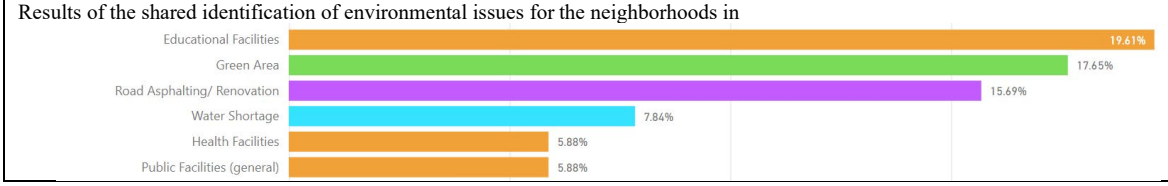


Source: JICA Project Team

Table 2.3.10 Results of Identification of Environmental Issues in Inside of Inner Greenbelt

Area: Pizen and Shawes	Date: Aug. 7th, 2022	Venue: Hall of Municipality Ankawa	Participants: *No participant	Opinion #: NA
Area: Darato, Kasnasan	Date: Aug. 9th, 2022	Venue: Youth Center of Bnaslawa	Participants: 10 citizens	Opinion #: 84

Results of the shared identification of environmental issues for the neighborhoods in

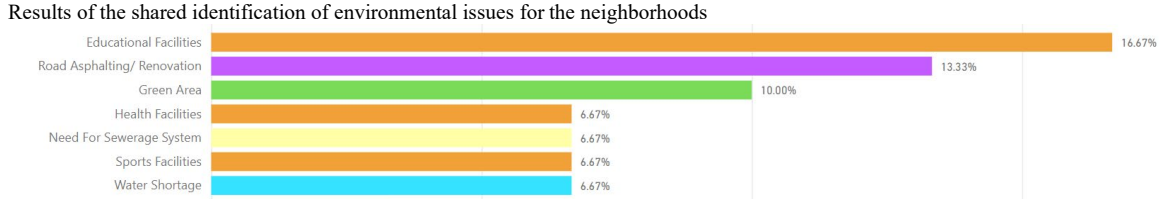


Source: JICA Project Team

Table 2.3.11 Results of Identification of Environmental Issues Outside of Inner Greenbelt

Area: Bahrka, Kany qrzhala, Mala Omar and Bastora	Date: Aug. 7th, 2022	Venue: Hall of Municipality Ankawa	Participants:4 citizens	Opinion #: 21
Area: Shamamk and Qushtapa	Date: Aug. 9th, 2022	Venue: Youth Center of Bnaslawa	Participants:3 citizens	Opinion #: 19

Results of the shared identification of environmental issues for the neighborhoods



Source: JICA Project Team

2.4 Identification of Key Environmental Issues

The identification of environmental problems is an essential and pivotal process in the formulation of the objectives of SEA. This process is based on an examination of the available baseline information, as well as on the results of interviews, surveys, and consultations with relevant agencies and stakeholders. Through this examination, a synthesis of the analyses of significant concerns that pose a formidable challenge to the future of the target area, and the preservation of important values is obtained. It is imperative to consider the importance of natural resources, public health, and overall quality of life in addressing these concerns. Consequently, it can be inferred that the major environmental issues in the region are a consequence of global phenomena such as climate change and issues that are specific to the locality. In determining the priority of the issues, the following criteria were considered: the spatial extent of the issue (local or global), the urgency of the issue, the potential irreversible impacts, the connection to other issues, and the potential positive outcomes that could be achieved through the implementation of Erbil 2050 MP.

2.4.1 Description of Key Environmental Issues

Three Key Environmental Issues have been identified in the Project Area as follows. Each Key Environmental Issue generally cumulates several Planning Issues, which are referenced under brackets (see Section 4.1.4 for details about the Planning Issue).

(1) Risk of Water Disaster

1) Floods (CLI-01)

Heavy rain poses a significant risk of flooding to the city of Erbil, particularly in areas where the natural riverbed has been filled in with man-made materials as a result of urbanization and its drainage basin. This can cause altered rivers or water reservoirs to become overwhelmed with stormwater, increasing the likelihood of flooding in these areas. The altered hydrological characteristics of these infilled riverbeds, such as reduced capacity to handle stormwater, exacerbates the risk of flooding in the surrounding areas. Moreover, the city of Erbil is located in a flat plain characterized by a moderate gradient that increases towards the north. This plain is bisected by numerous ephemeral wadis, which are temporary watercourses that only flow during and immediately after precipitation events especially intense rainfall. The presence of these wadis, along with the flat topography of the plain, contributes to the potential for flooding in the city, particularly during high precipitation events. It is important to note that this phenomenon not only poses a threat to the safety of the residents and infrastructure but also has a negative impact on the natural ecosystem and the hydrological balance of the city.

2) Water Scarcity (HYD-01)

Water scarcity is one of the most common problems to threaten human life as mentioned during the SEA 1st public consultation, the eco system and agricultural activities, especially during the summer dry season. This problem is inferred due to a variety of reasons. Climate change and population growth are some of the main factors that have led to an increase in water demand, while at the same time, the availability of water resources have decreased. Additionally, poor water management practices such as lack of conservation, inefficient irrigation methods, and over-extraction of groundwater resources could also play a role in water scarcity in Erbil. Pollution and contamination of water sources could also be a contributing factor.

(2) Deterioration of Air Quality and Climate Change

Factors that contribute to air pollution in the Study Area include the effect of human activities and natural causes. The air quality in Erbil City would depend on the level of these activities and the effectiveness of any measures taken to reduce pollution. It's important to note that, in general, air pollution can have serious health consequences and can aggravate respiratory conditions such as asthma and chronic obstructive pulmonary disease (COPD). There are predicted factors accumulating the air pollution blow:

1) Deterioration of Air quality due to human actives

(a) Increasing of vehicle emissions (POL-01)

Erbil city primarily relies on private cars as the main mode of transportation, with less frequent usage of public transport such as buses and bicycles. According to a study conducted within the boundaries of the ring road (120 meters) in Erbil city, private cars are the most prevalent mode of transportation. The study also revealed that the usage of public transportation such as buses and bicycles is less frequent. The analysis of the study showed that the levels of CO (Carbon monoxide) and HC (hydrocarbons) emissions from vehicles, were 81% and 85% respectively, which surpass the acceptable levels as per World Health Organization (WHO) guidelines[1]. The results of this study indicate that the transportation sector in Erbil city is a significant contributor to air pollution, and that measures should be taken to address this issue.

(b) Air pollution from the electric generator (POL-01)

Instability of the public electricity supply is noted in Erbil Municipality. As a result, the use of private generators as a source of electricity is common. However, there is not accurate data of the utilization rate of private generators as depended on a number of factors, including the availability, reliability and cost of the public electricity supply and the economic situation of the population. The widespread use of private generators may also have negative effects on the environment, such as air pollution and noise, and on the local economy.

(c) Air pollution from industrial estates (POL-02)

Industrial facilities which concentrated in southern part of the Erbil city are, aside of vehicle and electric generator, a major source of air pollution, and can release a variety of pollutants such as particulate matter, nitrogen oxides, sulfur dioxide, and volatile organic compounds into the air. These pollutants can have negative effects on human health, as well as on the environment.

2) Deterioration of Air quality due to natural causes

(a) Increasing of dust storm and its vicious circle (CLI-03)

It has been noted that the number of dust storms has increased over time in Erbil. This increase includes dust storms and floating and rising dust. This temporal distribution is thought to be related to other climatic parameters, namely temperature and precipitation, which is probably due to regional climatic variations in the region. The inhalation of fine particulate matter, such as dust and sand, that are present in dust storms can lead to respiratory problems, including asthma and bronchitis. Furthermore, these particulates can exacerbate pre-existing respiratory conditions, resulting in increased severity of symptoms. Dust storms can also have a significant impact on visibility, resulting in decreased safety conditions for transportation and other outdoor activities. Furthermore, dust storms can impede the normal functioning of activities such as agriculture, transportation, and power generation.

(b) Urban heat island effect (CLI-02)

The heat island effect in Erbil is caused by the concentration of heat-absorbing surfaces such as buildings and pavement, and the lack of green area which can provide shade and cool the air through evapotranspiration. The heat island effect has a significant impact on the quality of life for residents, leading to increased energy consumption and an increased risk of heat-related illnesses.

(3) Reduction of Green Area including Agricultural Activities (URB-10)

The urban encroachment including building residential structures, road, industrial constructions are threating integrity of greens spaces such as agricultural area and natural woods and groves. Reduction of these green spaces can lead to a variety of negative consequences on both natural environment and human activities including human health.

[1] Salah Farhan A Sharif, Hassan Abdulwahab Anjel. (2020), Air pollution estimation in Erbil city center using box mathematical model. Journal of Duhok University

1) Potential impact on the natural environment and natural disaster

The diminishment of green spaces as a result of urbanization can have detrimental impacts on the environment, including the loss of biodiversity including threatening decreasing species, exacerbation of flooding, and elevation of air and water pollution since green areas provide important ecological function such as carbon sequestration, water filtration and wildlife habitat. Green areas can also help to regulate the local climate by providing shade, reducing the urban heat island effect, and improving air quality. Furthermore, green areas can act natural sponge, that is to say it have been demonstrated to be more effective in mitigating the effects of flooding than areas covered in concrete, as they observe or possess the ability to temporarily retain rainwater, thereby facilitating its infiltration into the ground.

2) Potential impact on human activities

Urban encroachment can have detrimental effects on agricultural sustainability and profitability, as well as reductions in agricultural land. The displacement and fragmentation of agricultural lands due to urbanization can negatively impact the suitability of certain crops and livestock by preventing changes in local climatic and hydrologic conditions due to urbanization. Ultimately, it reduces the economic viability of agricultural activities. In addition, as previously mentioned, dust storms are a significant contributor to air pollution and human health hazards. It has been demonstrated that an enhancement in the density and robustness of vegetation can result in a decrease in the incidence and magnitude of dust storms. Furthermore, deficiency of green area such as natural groves or parks is liable to decrease the quality of people's lives because of the important function of green space as recreational opportunities for residents, such as picnicking, walking and biking, which can help to improve physical and mental health.

2.4.2 Analysis of Key Environmental Issues

In order for the identification of the environmental problems to fully benefit the formulation of SEA objectives, several key strategic questions, as shown in Table 2.4.1 below, need to be answered.

Table 2.4.1 Strategic Themes and Questions for the Identification of Key Environmental Issues

Strategic theme	Strategic question
Intensity	How good or bad is the current situation in comparison with other environmental issues in the Target Area?
Trend	Do trends show that it is getting better or worse?
Sensibility	Are particularly sensitive or important elements of the respective environment affected, e.g., vulnerable social groups, non-renewable resources, endangered species and rare habitats?
Reversibility	Are the problems reversible or irreversible, permanent or temporary? How far off is the situation regarding irreversible impact?
Remedy	How difficult would it be to offset or remedy any damage?
Cumulative/indirect effects	Have there been significant cumulative or synergistic effects over time? Are any such effects expected in the future?

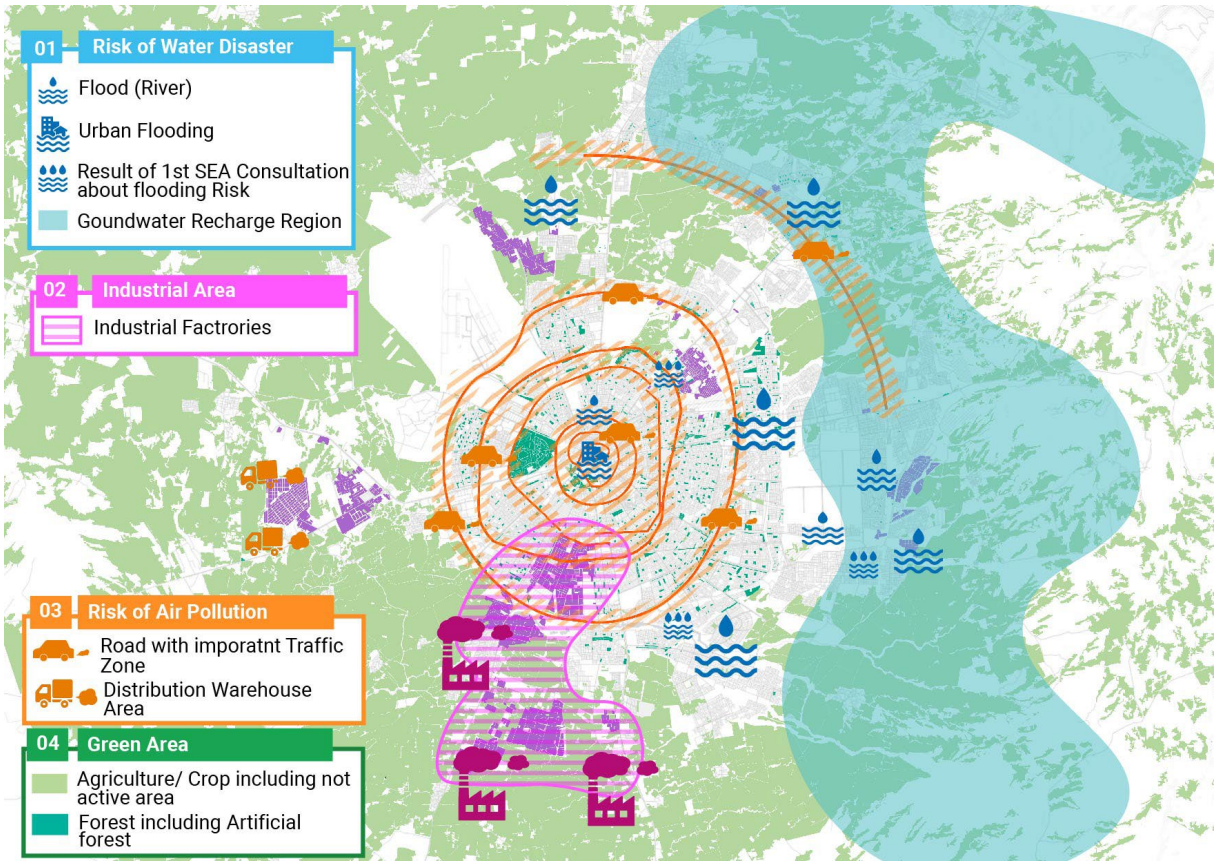
Source: JICA Project Team, based on the European SEA directive

Identified environmental problems are analyzed in Table 2.4.2 below and shown geographically on the map in Figure 2.4.1, on which only the problems that have a strong geographical presence are displayed.

Table 2.4.2 Analysis of Key Environmental Issues

Environmental Issues	Intensity	Trend	Sensibility	Reversibility	Remedy	Cumulative /indirect Effect
Risk of Water Disaster						
Floods	High	Growing	High (near riverside, and city center)	Reversible/ temporary	Hard to remedy	Soil contamination/erosion
Water scarcity	High	Growing moderately	High (especially during summer)	Reversible	Impossible	Decreasing in agriculture due to change soil properties
Deterioration of Air quality and Climate Change						
Increasing of vehicle emissions	High	Growing moderately	High (Rush hour, traffic conjunction area)	Reversible	Hard to remedy (Organizing the public transportation)	Accelerating urban heat island effect
Air pollution from the electric generator	Average	Growing slightly	Average (effect to whole Target Area)	Reversible	Hard to remedy (providing stable electricity)	
Air pollution from industrial components	Low (Not accurate data)	Growing slightly (Not accurate data)	Average (Near industrial concentration area in south of city)	Reversible	Hard to remedy (depollution)	
Increasing of dust storm	Average	Growing rapidly	Average (effect to whole Target Area)	Reversible	Hard to remedy	Declining in livelihood and economic activities due to inability to go out (Traffic condition etc.)
Urban heat island effect	Average	Growing (or Stable)	Average (effect to whole Target Area)	Reversible	Hard to remedy (Greening the city but taking time)	Demand of electricity for air-conditioning equipment
Reduction of Green Area including Agricultural activities						
Urban encroachment threatening the reduction of green area	High	Growing	Average (Not accurate data)	Irreversible	Impossible to remedy due to land use change	Threating the IUCL Accelerating urban heat island effect, Increasing stormwater runoff, which can cause flooding and erosion. Increasing the vulnerability to dust storm.

Source: JICA Project Team



Source: JICA Project Team

Figure 2.4.1 Summary Map of Identified Key Environmental Issues

2.5 Formulation of SEA Objectives

An SEA objective is a statement of what is intended with regard to a conceived development intervention, in which a desired direction of change is specified. SEA objectives represent a guiding path, which allows for an effective comparison to be made of the effects of alternatives (SEA Task 2-2) and an assessment of the environmental effects of the Erbil 2050 Master Plan (Task 3-1).

The achievement of SEA objectives is measured by using indicators and quantified targets. SEA objectives, indicators and targets might be revised at the point at which the collection of baseline information is finalized and consultation with relevant authorities, and as new environmental problems are identified.

The SEA objectives will be categorized into SEA topics in order to match the scope of the Erbil 2050 Master Plan as much as possible. SEA topics should cover all the environmental and social assessment components required by the JICA guidelines, but some arrangements and a simplification will be carried out in order to increase conformity with the current SEA, as shown in Table 2.5.1 below.

Table 2.5.1 Reorganization and Simplification of the Assessment Components into Strategic Environmental Assessment Topics

#	Assessment components from JICA guidelines		#	New SEA topic
01	Anti-pollution	Air quality	01	Pollution (air, water and soil) (POL)
02		Water quality		
03		Soil pollution		
04		Waste management	02	Waste production (WPR)
05		Noise and vibration	03	Population and human health (PHH)
06		Offensive odors		
07	Natural env.	Biodiversity and ecosystems	04	Biodiversity (ecosystems, fauna and flora) (BIO)
08		Geology, topography and soil erosion	05	Geological and hydrological erosion (ERO)
09		Hydrology and hydric erosion		
10		Protected areas	Not Applicable (outside of the Target Area)	
11		Water usage	06	Natural resource (incl. water) depletion (RES)
12		Climate Change	07	Climate factors (CLI)
12	Social environment	Involuntary resettlement	08	Population resettlement (PRS)
13		Local employment	09	Employment, poverty and working conditions (EMP)
14		Poverty		
15		Working conditions		
16		Children rights		
17		Local livelihood and resources	10	Local and sustainable livelihood (LOC)
18		Social infrastructure and service	11	Social and community cohesion (SOC)
19		Indigenous or ethnic minorities		
20		Poor distribution of benefits and damages	12	Equal distribution of benefits and damages (DIS)
21		Local conflicts of interest		
22		Gender	13	Gender (GEN)
23		Cultural heritage	14	CHL – Cultural heritage and landscape
24		Landscape		
25		Infectious disease and HIV	Not applicable	

Source: JICA Project Team

Table 2.5.2 Strategic Environmental Assessment Objectives and Indicators

SEA topics	SEA objectives	SEA indicators
POL	POL-Obj-01: limit air pollution to levels that do not damage natural systems, in particular, by reducing the need for travel, electric generator, and industry factories	− Mean urban air pollution of particulate matter (Sox, NOx, CO、CO2 and HC emissions and PM2.5) − Levels of key air pollutants/by sector and per capita − Distances travelled per person per year by mode of transport − Distribute solid and stable electricity
	POL-Obj-02: limit water pollution from industrial factories, wastewater and garbage including litters	− Quality (biology and chemistry) of rivers, groundwater, and ponds
WPR	WPR-Obj-01: minimize waste generation	− Waste production per capita
	WPR-Obj-02: promote waste re-use and recover through recycling, composting or energy recovery	− Amount of recycled waste, compost, and energy recovery
	WPR-Obj-03: promote sustainable production and consumption patterns	− Food losses along production and supply chains − Per capita global food waste at the retail and customer levels
PHH	PHH-Obj-01: protect and enhance human health and healthy living for all at all ages	− Infant mortality rate − Premature mortality by non-communicable disease − Premature mortality by traffic accident
	PHH-Obj-02: reduce the risk of industrial disaster (explosion etc.)	− Number of constructions containing human presence being exposed (inside minimum setback distance) to the risk of explosion of an industrial unit of an oil or gas pipeline
	PHH-Obj-03: create the conditions to improve health and reduce health inequalities	− Share of population with access to primary healthcare facilities (within 0.6-1.2km/8 to15 minutes by walking) − Density of primary health center (for every 9,600

SEA topics	SEA objectives	SEA indicators
		to 14,400 people in the population
	PHH-Obj-04: reduce offensive odors, noises and vibrations	− Number of people affected by ambient noise, offensive odors and vibrations − Proportion of tranquil areas
BIO	BIO-Obj-01: preserve endangered species	− Record of endangered species
	BIO-Obj-02: preserve the green area especially natural woods and grooves	− Area (ha) of annual land use change in native woodlands (etc.).
	BIO-Obj-03: preserve actual cultivatable green area	− Area (ha) of annual active agricultural land
	BIO-Obj-04: increase green area such as artificial green park, including shade tree and street tree	− Area (ha) of national land usage − Area (m) of controlled street tree
ERO	ERO-Obj-01: reduce geological erosion especially by controlling mining extraction	− Percentage of occurrence of runoff and floods in the vicinity of extraction site on rainy days
RES	RES-Obj-01: maintain equivalent use of water	− Daily water consumption per capita in urban and rural areas
	RES-Obj-02: promote recycling of wastewater	− Share of recycled water
	RES-Obj-03: increase water use efficiency and reduce losses and leaks	− Share of produced drinkable water − Share of lost water in the supply network
PRS	PRS-Obj-01: avoid any involuntary population resettlement	− Annual involuntary displaced population
CLI	CLI-Obj-01: reduce vulnerability to the effects of climate change, especially floods	− Pluviometry especially intensive rainstorm − Spatial data of flood-prone area − Spatial data of urbanized former riverbed
	CLI-Obj-02: avoid acceleration of heat island effect	− Surface temperature − Remote sensing
	CLI-Obj-03: reduce vulnerability to the effects of climate change, especially dust storm	− Dust Storm Index − Number of dusty days − Annual horizontal visibility
	CLI-Obj-04: reduce vulnerability to the effects of climate change (floods, heat island phenomenon, disruption of travel by extreme weather), especially through the integration of climate change measures in policies and planning	− Number of approved urban planning master plans integrating the study and proposition regarding adaptation to climate change
EMP	EMP-Obj-01: reduce poverty in all forms	− Proportion of men, women and children living under the poverty line
	EMP-Obj-02: achieve productive and sustainable employment for all	− Unemployment rate
	EMP-Obj-03: ensure decent working conditions for all	− Indicators of decent work, such as the percentage of children not in school
LOC	LOC-Obj-01: promote sustainable agriculture	− Crop and livestock yield gap (actual yield as % of attainable yield) − Working population and annual income in agricultural sector − Percentage of cultivated land area by utilizing water-saving irrigation systems (e.g., drip irrigation systems)
	LOC-Obj-02: achieve a high level of economic productivity through diversification, technological upgrading and innovation	− Growth of gross regional domestic product (GRDP) per capita in urban and rural areas
	LOC-Obj-03: promote inclusive and sustainable industrialization	− Manufacturing value added as a percentage of GRDP
	LOC-Obj-04: promote sustainable tourism, which creates jobs and promotes local culture and products	− Share of jobs in sustainable tourism sector
SOC	SOC-Obj-01: maintain and enhance social cohesion and equality (avoid social inequality)	− Gini index − Income growth of the most deprived part of the population
	SOC-Obj-02: maintain and enhance spatial	− Difference in the income of people living in the

SEA topics	SEA objectives	SEA indicators
	cohesion and equality (avoid spatial discrimination)	same part of a city
	SOC-Obj-03: maintain and enhance cultural cohesion and equality (avoid cultural segregation)	− Share of non-Muslim resident, and IDPs
	SOC-Obj-04: promote access to safe, inclusive and accessible green and public spaces	− Area (m2) of green and public spaces per capita
	SOC-Obj-05: maintain a peaceful and inclusive society and reduce all forms of violence	− Number of violent injuries and deaths per 100,000 of the population
DIS	DIS-Obj-01: ensure equal access to quality educational services for all	− Share of boys and girls completing primary and secondary education − Gap between the number of schools and the number of pupils enrolled and of school age, by area
	DIS-Obj-02: ensure equal access to safe and affordable drinking water for all	− Share of people having access to safe and affordable drinking water
	DIS-Obj-03: ensure equal access to adequate sanitation and hygiene for all	− Share of people having access to adequate sanitation and hygiene
	DIS-Obj-04: ensure equal access to modern and sustainable energy for all	− Share of people having access to affordable, reliable and modern energy services − Share of renewable energy in the global energy mix
	DIS-Obj-05: ensure equal access to a safe, affordable and sustainable transport system for all	− Percentage of the population within 0.5 km of public transit running at least every 20 min in urban areas and every 120 min in rural areas * Figure will be confirmed later
	DIS-Obj-06: ensure equal access to adequate, safe and affordable housing for all	− Percentage of the eligible population covered by national social protection programs
GEN	GEN-Obj-01: promote sustainable and decent job opportunities for women	− Female unemployment rate
	GEN-Obj-02: promote public security for women	− Number of public or green spaces certified open and secure for all female visitors
CHL	CHL-Obj-01: preserve remarkable historic buildings including Citadel and other culturally important human heritage	− Scale (numeric) of land use changes or destruction of registered heritage
	CHL-Obj-02: preserve and enhance the traditional urban fabric of old parts of villages	− Scale (numeric) of destruction or displacement of registered heritage

Source: JICA Project Team

CHAPTER 3
COMPARISON OF DEVELOPMENT ALTERNATIVES

3.1 2nd Round of SEA Consultation

In framework of the SEA, as explained in Section 1.8 and shown in Figure 1.8.2 in Part III, in order to explore inclusive and diverse directions with input from multiple perspectives, the public consultations with the concept of the SEA are planned to be implemented each phase. The objective of the 2nd Public Consultation was to conduct a comprehensive evaluation of the effects of various development alternatives on both the natural and social environment, encompassing the living conditions of individuals, while also soliciting the perspectives of the populace regarding the potential for enhancing these development alternatives (For each alternative, see Chapter XX).

To facilitate more efficient gathering of opinions, the 2nd Round of SEA Consultation was conducted on separate dates targeting experts from academia, NGOs, specialized administrative agencies, as well as representatives of the local community.

3.1.1 Outline of the 2nd Round of SEA Consultation

The 2nd Round of SEA Consultation was carried out on June 12th (Day 1) and 13th (Day 2), 2023. The consultation framework designed at the two different participants' background as below:

- Day 1: Representatives of environmental and social NGOs, Specialists, Academia (professors and post-doctoral students (hereafter "Specialists");
- Day 2: Representatives of local communities from each municipality 1~6, Bnaslawa, Ankawa, Kasnasan, Darato, Sebrian, Pirzen, Shawes, Bahrka, Kany Qrzhala, Mala Omar, Bastora, Shamamk, and Qushtapa (hereafter "Local communities").

Due to the capacity of the venue, Day 1 was conducted in the conference hall in GDUP and Day 2 was in the conference room in Erbil International Hotel relatively. On both days, participants were first given an overview of each development alternative by JPT and GDUP, and then divided into groups for discussion with facilitators. After group discussion, representatives from each group gave a five-minute oral presentation for sharing each discussion point. Each group had one or two facilitators to navigate the discussion and explain the details of characteristics on each Development Alternatives. In terms of language constraints, capacity building, technology transfer, and cooperation in project implementation, Technical Working Group members and GDUP contributed greatly to the explanation and understanding of the development alternatives as facilitators.

3.1.2 Methodology and Results of Day 1 Consultation with Environmental Specialists

(1) Methodology

On the Day 1, June 12th, 2023, 36 specialists from public and private universities in Erbil, the Environmental Protection and Improvement Board (EPIB), and local NGOs in Erbil. In order to allow the participants to make more use of their respective expertise, the five thematic groups shown in Table 3.1.1 below were set up for discussion. A Priority Theme was set up for each Group based on SEA objectives and indicators established earlier (see Section 2.5 above).

Table 3.1.1 Group Discussion Themes for Day 1 of 2nd Round of SEA Consultation

Group	Theme	Priority Theme
Group 1	Natural Environmental Impact	1. Pollution (POL), 2. Waste (WPR)
Group 2		1. Biodiversity (BIO), 2. Water/Soil Erosion (ERO)
Group 3	Social Environmental Impact	1. Socio-economic (EMP), 2. Accessibility (Transportation), 3. Education
Group 4		1. Cultural heritages (CHL), 2. Population resettlement (PRS)
Group 5	Climate Change	1. GHG emissions, Heat Island effect (CLI), 2. Water resource (inc. CLI-Fld, RES)

Source: JICA Project Team

During the group discussion, the participants evaluated each Development Alternative in accordance to the designated priority themes by the group. Particularly, they examined the potential impact associated with each Development Alternative and Business as Usual (BAU). Additionally, the participants provided descriptions and comments on the maps of each Development Alternatives, aiming to spatially indicate any identified issues or suggestions.

Source: JICA Project Team

Figure 3.1.1 Overview of Group Discussions of Day 1 of 2nd Round of SEA Consultations

In the end of group discussion, each group also gave a rating of the impact on a scale of -3 to +3 on a scale of 7, as shown in Table 3.1.2 below, which allowed easy comparison between Development Alternatives.

Table 3.1.2 Scale of Impact Assessment during Day 1 Group Discussion

Huge Negative Impact	Negative Impact	Little Negative Impact	No Impact (offset by several impacts)	Little Positive Impact	Positive Impact	Very good Impact
-3	-2	-1	0	1	2	3

Source: JICA Project Team

(2) Results

Group 1

Group 1 focused on the impact of each development alternative from the point of view of natural environmental issues especially air and water pollution and waste management.

(a) Air pollution

As for the air pollution, the location of the industrial area and its mitigation measure such as the green buffer is a key point of discussion. Consequently, Alternative C learned the highest positive arguments as the industrial zone will have buffer. Alternative A got a negative assessment because all residential areas will be concentrated inside of the Inner Green Belt and this may lead that air quality may be difficult to achieve due to the concentration of traffic congestion, car exhaust fumes and living conditions (gases from privately owned generators) even though it suggests removing all industrial area (as much as possible) and the airport from the target area. Using new technology for service and renewable technologies for industry is highly recommended by group.

(b) Water pollution

Unlike in the case of air pollution, Development alternatives A is rated positively with regard to water pollution as well as development alternative B and C. This is because Alternatives A and B would vertically develop the city and therefore reduce water pollution. In case of Alternative C, the group 1

envisaged that the industrial zone is subject to proper management and, as in the case of air pollution, notes that the presence of a green buffer zone in that zone is a positive indicator. Negative indicators for water pollution were marked by the impact of industrial areas. It was recommended that consideration be given to installing a new sewage system for the wastewater treatment plant in the south.

(c) Waste management

The key discussion on waste management in each development alternative is to control the collection of waste. As Development Alternative A is the compact city model, the residential areas are inside of the Inner Green Belt and easier to collect waste comparing with development alternatives which will establish several core cities. In addition to the difficulty of waste collection due to dispersed residential and industrial areas, the adverse effect picked up is the impact of residential and industrial waste on rivers; especially Development Alternative D-2 will contain the residential secondary core and some industrial areas.

Group 2

Group 2 focused on the impact of each development alternative from the point of view of natural environmental issues especially biodiversity and water/ soil Erosion.

(a) Biodiversity

As for biodiversity, the group 2 were required to discuss the impacts on three themes: Animal especially the endangered species of both fauna and flora, natural green area, artificial green area such as the park, and agricultural land.

The negative impacts on animals include the reduction of green areas and the generation of noise from residential and industrial activities. With regard to natural green area, none of the development alternatives will have a significant characteristic impact, as the urban area of Erbil is characterized by a lack of natural forest. On the other hand, the artificial green zones including parks and farmland will have both positive and negative assessments by each alternative. Development Alternative A has the most positive impact as most of the target area, which means outside of the Inner Green Belt, will designate either artificial green area or agricultural land. Concerning the negative impacts, comments were made regarding the type of industries that would be present in the industrial zone. The level of environmental impact may vary depending on whether heavy industries or light industries are established in the industrial zones. The crucial point to be noted is that there are no legal regulations in place from an environmental perspective to approve the construction of the proposed airport and industrial zones adjacent to each other, which are proposed in Development Alternative D-2.

(b) Water/ Soil erosion

The group highlighted the risk and potential of water and soil erosion, which could lead to flooding in the northern area outside of the Inner Green Belt, where Bahrka is located. Therefore, the significance of implementing an early warning system in that specific area where is targeted for tourism promotion under Development Alternative C was stressed.

Group 3

Group 3 focused on the impact of each development alternative from the point of view of social environmental issues especially socio-economic, and accessibility for public facilities such as Education, drinkable water, affordable Transportation system, and housing.

(a) Socio-economic

Group discussed the impact on employment opportunities/ job creation, considering the availability and size of industrial zones as an indicator. Consequently, Development Alternative A, which advocates for the relocation of industrial zones without constructing new ones, is viewed unfavourably.

(b) Accessibility for social service

The accessibility of educational opportunities was evaluated based on the understanding that the concentration of residential areas or the establishment of residential cores (Secondary Cores and residential cores) will likewise provide educational facilities. Therefore, Development Alternatives C, D-2 and A were rated positively in that order. It is important to note that the discussion did not consider the costs associated with establishing new schools and hiring additional teaching staff to support the proposed development plan.

In the context of water distribution, a noteworthy comment highlights that development in areas near the Great Zab River, whether for residential or industrial purposes, is able to potentially utilize the river as a new water source. However, it also underscores the essential need for the simultaneous development of water treatment facilities to address the increased demand and potential pollution arising from such development.

Regarding the accessibility of transportation, the connectivity between each residential area through ring roads is the main indicator for the discussion. Therefore, Development Alternative C learned negative assessment as each core is away from the other and it requires to take the 150m Ring road to travel each other.

The group rates Development Alternative C as the best proposal in terms of potential for residential facilities. On the other hand, it notes that Alternative A is difficult to promote the construction of Affordable Housing due to the limited area of possible residential land.

Group 4

Group 4 focused on the impact of each development alternative from the point of view of social environmental issues especially cultural heritages and population resettlement.

(a) Cultural Heritage

Cultural Heritage, in this context, contains three elements: Cultural heritage encompassing artificial structures such as cities and buildings, archaeological heritage, and green and urban landscapes. As the citadel of Erbil city is located in the center of the city and only Development Alternative A proposes the urban renewal operations in the oldest part of Erbil, the group indicated t a potential negative impact on this area for Development Alternative A.

Discussions regarding archaeological sites and heritage have been insufficiently discussed primarily due to ambiguity and a lack of sufficient information.

From the landscape perspective, the group expressed the most negative rating towards Development Alternative C and D. This negativity stemmed from several cores in areas that were originally agricultural land even of low productivity.

(b) Population resettlement

Development Alternative A, which includes the redevelopment of the historic old town where people have been residing for an extended period, was assessed as having the most significant impact. In addition, Development Alternative B and C has the potential to population resettlement due to establishment of the industrial zones and core.

Group 5

Group 5 focused on the impact of each development alternative from the point of view of climate change issues especially GHG (Greenhouse Gas) emission, flooding, heat island effect, and dust storm.

(a) GHG Emission

From the perspective of GHG emissions, generally relocation of the airport is considered as positive effect. In terms of the detail of development alternatives, Development Alternatives A and D were identified as having significant adverse effects. Regarding Development Alternative A, while all

lifestyle-related facilities, including residential areas, are located within the Inner Green Belt, which basically reduces travel time by car and other vehicles, there were concerns about the concentration of factors that may increase GHG emissions due to human activities and other factors. On the other hand, Development Alternative D was criticized for reasons related to adverse effects, such as the construction of large-scale industrial zones, emissions from industrial facilities within the same industrial area, and exhaust emissions from large vehicles in the area, despite having a lower population concentration within the city compared to Alternative A. For Development Alternative A, the group recommended to increase the green area inside of the city.

To mitigate the impact of GHG emission, it has been suggested to alleviate population concentration in residential areas (population dispersal) and increase the green space area within the urban area.

(b) Flooding

Creating a groundwater recharge zone with ponds while prohibiting urban development is considered effective at reducing flooding risk. However, there is susceptible to flooding from the north to the east and southeast, forming a semi-circle of the target area. Therefore, it is necessary to consider the mitigation measure if there is any development.

(c) Heat island effect

Development Alternative A was rated as the proposal that would have the most impact as the concentration of the building especially high buildings is one of the most powerful factors in exacerbating the heat island effect. To mitigate the heat island effect, the groups suggested to remove the airport and the industrial zones and create more greenery areas.

(d) Dust Storm

The group emphasized an important factor: the dust storms in the area typically blow from the southwest to the northeast, which differs from the general wind direction in Erbil city. As a result, the gateway cores or secondary cores located to the southeast outside of the Inner Green Belt will be directly affected and potentially damaged by these dust storms. As a mitigation measure, the group suggested establishing a second Green Belt outside the target area, extending from the east to the southeast in a semi-circular enclosure. This additional Green Belt aims to provide further protection and resilience against the impact of dust storms.

3.1.3 Methodology and Results of Day 2 Consultation with Representatives of Residents

1) Methodology

On Day 2, June 13th, 2023, 47 representatives of local communities, which from 18 neighborhoods: Municipality 1~6, Bnaslawa, Ankawa, Kasnasan, Darato, Sebrian, Pirzen, Shawes, Bahrka, Kany Qrzhala, Bastora, Shamamk, and Qushtapa. For the group discussion, the participants were divided by geographic location of their neighborhoods. Unfortunately, there were no participants from Mala Omer although 2 to 3 representatives were invited.

Table 3.1.3 Municipality and Neighborhood Assignments for Day 2 Group Discussions

Group Number	Municipality & Neighborhood involved
Group 1	Municipality 1 and 6
Group 2	Municipality 2 and 3
Group 3	Municipality 4 and 5
Group 4	Northern part 1
Group 5	Bastora, Bahrka
Group 6	Kani Qrzhala, Kauirgosk
Group 7	Bnaslawa, Kasnasan, Darato
Group 8	Qushtapa, Shamamk

Source: JICA Project Team


Source: JICA Project Team

Figure 3.1.2 Overview of Group Discussions of Day 2 of 2nd Round of SEA Consultations

Unlike Day 1, participants on Day 2 were asked to give opinions about each Development alternative, regarding (1) the expected future living conditions (environment, urban services, access to jobs, commercial areas, recreation, public facilities etc.) in their neighbourhoods and about (2) how they want Erbil to become in general.

2) Results

The opinions and suggestions are varieties based on the perspectives of their neighborhoods. The summaries of their comments are below.

Group 1 (Municipality 1 and 6)

- Relocating the airport would reduce noise pollution and the risk over citizens life
- High population density may lead to heavy negative effects on environmental pollution and traffic pollution
- Creating cultural cities outside of the city is a negative point
- Establishing many gateways cores (Development Alternative C) is good in terms of low noise pollution, environmental pollution, social perspectives, economy, and job opportunities
- Development Alternative D (Creating two north/ south cores) may lead social segregation

Group 2 (Municipality 2 and 3)

- Creating only one core center (Development Alternative B) may have negative impact of social equality.
- In terms of environmental aspect, (people are using the private generator. Therefore) it is better to replace the (private) generators to public electricity
- Consolidating industrial areas in one location is a good idea
- It is needed to connect with center of the city and each area with good transportation network such as Bus-Metro etc.
- Overall, public transport networks are lacking

Group 3 (Municipality 4 and 5)

- As living conditions, Development Alternative A is not good as the residential area is limited so other Development Alternatives are better
- However, from the environmental and agricultural perspective, Development Alternative A is good
- From social equality perspectives, creating north secondary core and south core is not good idea as it will create social inequality, and most people will move to the south part

- Establishing two huge industrial zone, which are located close to each other will affect negatively in the west of the city
- Development Alternative D-2 is the best as it will create job opportunities and new water distribution from the river side as new city area will be established near there

Group 4 (Northern part 1)

- Moving the airport to outside the city is good, instead of residential area we would like to expand the green area
- Enclosing Erbil city by a wide green belt to help reduce pollution
- Removing private generators in the city should be done
- Building cultural center and parks is good (It is necessary in Pirzen area and Serbian)
- Designing specific area for pedestrian within the street sidewalks is necessary

Group 5 (Bastora, Bahrka)

- Development Alternative A is good in terms of environment, but contrary in terms of services and entertainment it is not good as the area is limited.
- Development Alternative C is good in terms of accessibility, commercial and feasible
- It is better if the city expands towards the Great Zab River, because Bastora and Bahrka area are facing the lack of water in the most areas, and it would be better for tourism perspectives too.
- Building some dams on Great Zab River can be good idea

Group 6 (Kani Qrzhala, Kauirgosk)

- Tourism activities and area near the Great Zab River is good
- It would be good to have recreational area inside and outside of the city
- (Regarding the industrial areas proposed) If development is in accordance with environment laws, it will not have negative impact. However, it is better to install some filters (buffer) for all
- Increasing the agricultural land like Development Alternative A is good for many who would work on agriculture
- Using the Great Zab River for irrigation should be considered

Group 7 (Bnaslawa, Kasnasan, Darato)

- Industrial areas inside or near residential areas is bad for people' health
- Multi central city would provide job opportunities
- Reduce the risk of flooding is important
- Expanding the city to the river side would pollute the river water and its environment. It is better if a dam were built
- Development Alternative D may social segregation in community

Group 8 (Qushtapa, Shamamk)

- Development Alternative A preserves Green Belt and Agricultural Environment, in same time it is good for public facilities and agricultural activities
- Development Alternative B is good in terms of environment and public facilities, but the Erbil city (from the whole target area perspective) will have transportation problem
- Development Alternative C is the best in environment, public facilities, affordable housing, and job opportunities
- Development Alternative D is less good for Qushtapa in terms of environment, but good for public facilities, and job opportunities. Fr Shamamk there is no influence

- Development Alternative D-1 is not good for public facilities for Qushtapa and Shamamk, but may be good for Erbil as whole

3.2 Prediction & Comparison of Effects of the Different Alternatives

The process of forecasting and evaluating the impacts of development alternatives aims to identify the optimal, yet feasible, alternative that strikes a balance between the benefits associated with each strategic option. Rather than merely selecting the most desirable option based on economic, social, or environmental criteria, the analysis considers a comprehensive range of goals. Consequently, the SEA does not necessarily designate one specific alternative as the 'best' among the proposed development alternatives.

In line with the objectives of the SEA, the results of the evaluation and comparison of the five alternatives are summarized in Table 3.2.1 and further elaborated in Table 3.2.2 below. These tables include assessments of cumulative, secondary, synergistic, and short-, medium-, and long-term impacts, distinguishing between permanent and temporary effects, where applicable, as well as the results of the 2nd SEA Public Consultation and Comments from the TWG on the SEA assessments made by JPT.

It is important to emphasize that the assessment of Alternative E is limited as it was not addressed during the 2nd SEA Public Consultation and the TWG meeting which held in June 2023 because Alternative E was established based on the discussion and request from GDUP after the 2nd SEA Public Consultation and gathering comments from the TWG.

Table 3.2.1 Results Summary of the Comparison of the Different Strategic Alternatives

SEA topic		SEA objective	BAU	Alte. A	Alte. B	Alte. C	Alte.D-1	Alte. D-2	Alte. E
Anti-pollution measures	POL	POL- Air	A-	B+	C-	C-	C-	C-	C-
		POL-Wat	A-	B+	C-	B-	C-	B-	C-
	WPR	WPR- Rec/ WPR- Red	A-	C+	C-	A-	B-	B-	B-
	PHH	PHH- Hel	B-	B+	C+	C-	D	D	C+
		PHH- Ind	A-	C+	C-	B-	A-	A-	D
		PHH- Off	A-	B+	D	C-	B-	C-	D
Natural environment	BIO	BIO- Ani	A-	B+	D	C-	A-	A-	A-
		BIO- Gre	A-	A+	C+	B+	C+	C+	B+
		BIO- Agr	A-	B+	B+	A+	C-	B-	B+
		BIO- Art	A-	A+	B+	A+	C+	C-	B+
	ERO	ERO- Ero	A-	B+	C-	A+	B-	B-	B-
	RES	RES- Wat	A-	A+	D	B-	C-	D	A+
		RES- Was/ RES-Wll/ RES- Swa	Unfeasible to compare by Development Alternatives						
	CLI	CLI- Ghg	A-	B+	C+	C+	C-	C-	C+
		CLI- Fld	A-	A+	C+	A+	C+	C+	C+
		CLI- Hie	A-	B+	C+	D	C-	C+	D
		CLI- Dus	A-	C+	C+	B-	B-	C-	C+
Socioeconomic environment	PRS	PRS-Prs	A+	C-	A+	A+	A+	C-	B-
	EMP	EMP- Pov/ EMP- Emp	D	C+	A+	B+	C+	C+	A+
	LOC	LOC- Agr	C-	B+	A+	A+	C-	B-	A+
		LOC- Fod	C	B+	A+	B+	C-	B-	A+
		LOC- Tou	D	B+	A+	D	D	D	A+
	SOC	SOC- Equ/ SOC- Spa/ SOC- Saf	Unfeasible to compare by Development Alternatives						
	DIS	DIS- Edu/ DIS- Wat/ DIS- Enr	B-	A+	B+	C-	C+	C+	B+
		DIS- Tra	A-	A+	B+	B-	C-	B-	C-
		DIS- Hou	C-	B-	C+	B+	B+	B+	C+
	GEN	GEN- Job/ GEN- Sec	Unfeasible to compare by Development Alternatives						
	CHL	CHL- Her	D	C+	D	D	D	D	D
		CHL- Arc	C-	C-	C-	B-	C-	B-	C-
		CHL- Lan	B-	B+	A+	C+	C-	D	B-

Source: JICA Project Team

Note: BAU = Business as Usual
Effect = General Score of the Predicted Effect
ST = Score of the Predicted Effect on the Short Term
MT = Score of the Predicted Effect on the Middle Term
LT = Score of the Predicted Effect on the Long Term
A+/- = Remarkable Positive/Serious Negative Effect is Predicted
B+/- = Positive/Negative Effect is Expected to Some Extent
C+/- = Limited Positive/Negative/Neutral Effect is Predicted but a Further Survey is Required
D = The Effect is Very Small or Nil and a Further Survey is not Required

As previously indicated, the primary objective of the SEA is not to select a specific alternative among the proposed in this stage but to furnish information on the relative environmental performance of each development alternative, thereby enhancing the transparency of the decision-making process. Based on the outcomes of the impact comparison, it becomes evident that Alternative A stands out as the most environmentally advantageous and sustainable development alternative for Erbil.

CHAPTER 4
EVALUATION OF THE EFFECTS OF THE ERBIL 2050 MASTER PLAN

4.1 Result of Assessment

Based on the comparison of the potential impacts of the various strategic alternatives, an evaluation has been conducted on the direct, indirect, and cumulative effects of the Erbil 2050 Master Plan, specifically focusing on its proposed economic and infrastructure developments. It should be noted that the impact evaluations are not uniformly applied to all proposed developments; rather, they are assessed relative to the significance of their potential impacts. The evaluation will determine whether environmental issues have been integrated at the strategic level within the economic and infrastructure developments. Table 4.1 summarizes the results of the evaluation of the direct, indirect, and cumulative effects of the Erbil 2050 Master Plan.

Table 4.1.1 Result Summary of the Evaluation of the Effects of the Erbil 2050 Master Plan

SEA			Agriculture	Industry	Tourism development	Transport	Water Supply	Sewerage	Solid Waste Management	Housing and land use
Topic		objective								
Anti-pollution measures	POL	POL- Air	D	C-	D	D	D	D	C-/ D	D
		POL-Wat	D/ C-	C-	D	D	D	A+	D	D
	WPR	WPR- Rec	C+	C-	D	D	D	B+	B+	C-
		WPR- Red	B+	D	D	D	D	B+	C+	D
	PHH	PHH- Hel	D	D	D	C+	D	D	D	C+
		PHH- Ind	D	B-	D	D	D	D	D	D
		PHH- Off	C-	C-	D	D	D	C+	C-/ D	D
Natural environment	BIO	BIO- Ani	C+	D/A-	D	D	D	D	D	D
		BIO- Gre	B+	C-	D	C-	D	D	D	D
		BIO- Agr	A+	C-	D	C-	D	C+	D	C-
		BIO- Art	C+	D	C+	C+/ D	D	C+	D	C+
	ERO	ERO- Ero	C+	C-	D	D	D	D	D	C-
	RES	RES- Wat	C-	C-	D	D	D/ C+	C+	D	C-
		RES- Was	D	D	D	D	D	B+	D	D
		RES-Wll	D	D	D	D	B+	D	D	D
		RES- Swa	B+	D/C-	D	D	C+	B+	D	D
	CLI	CLI- Ghg	B+	C-	D	D/ C-	D	D	C-	D
		CLI- Fld	C+	D	D	D	D	D	D	C+
		CLI- Hie	B+	D	D	D/ C+	D	D	D	C-
		CLI- Dus	B+	D	D	D	D	D	D	C+
Socioeconomic environment	PRS	PRS-Prs	D	C-	C-	B-	D	D	D	B-
	EMP	EMP- Pov	C+	B+	B+	D	D	D	D	D
		EMP- Emp	C+	B+	B+	C+	D	D	D	D
	LOC	LOC- Agr	A+	D	C+	D	D	C+	D	D
		LOC- Fod	B+	C+	C+	D	D	C+	D	D
		LOC- Tou	D	D	A+	C+	D	D	D	D
	SOC	SOC- Equ	C+	C+	B+	D	D	D	D	D
		SOC- Spa	D	D	D	C+	D	D	D	D
		SOC- Saf	B+	D/ C-	C+	D	D	C+	C-	C+
	DIS	DIS- Edu	D	D	D	C+	D	D	D	C-
		DIS- Wat	D	D	D	D	C+	D	D	D
		DIS- Enr	D	D	D	D	D	D	D	D
		DIS- Tra	D	D	D	A+	D	D	D	D
		DIS- Hou	D	D	D	D	D	D	D	B+
	GEN	GEN- Job	D	D	D	D	D	D	D	D
		GEN- Sec	D	D	D	D	D	D	D	D
	CHL	CHL- Her	D	D	A+	D	D	D	D	D
		CHL- Arc	D	D	C+	D	D	D	D	D
		CHL- Lan	C+	D	B+	D	D	D	D	C+

Source: JICA Project Team

Note: A+/- = Remarkable positive/serious negative effect is predicted
B+/- = Positive/negative effect is predicted to some extent
C+/- = Limited positive/negative/neutral effect is predicted but a further survey is required
D = Effect is very small or nil and a further survey is not required

The major explanation and justification of the evaluation are summarized below.

(a) Agriculture:

- **Development of ago-neighbourhood**s may lead odour damage if insufficient consideration is given to compost and livestock due to the relatively close proximity of houses and farmland (PHH-Off: C-) and may cause water and soil pollution without proper livestock waste and pesticides water controlling measures (POL-Wat: C-).
- **Reuse of treated wastewater for irrigation** will help conserve water resources, and increase agricultural production and food and food security indirectly.
- **Climate smart farmland management** can reduce the impact from dust storms (CLI-Dus) and mitigate the heat island effect (CLI-Hie).

(b) Industry:

- **Expansion of the oil industry** inherently increases the risk of an industrial disaster (PHH-Ind: C-), such as explosions. There is a high risk of indirect disasters in the Lanaz oil refinery area due to the future passage of the railway. Shutdown of the Erbil oil refinery area (KAR), which established without proper administration and authorisation, will reduce possibilities the industrial disaster, and air, water and soil pollution. However, in case that appropriate and rigorous disposal procedures need to be followed when decommissioning factories or converting former factory sites to green spaces. (PRS-Prs: C-).
- If environmental considerations regulations are not strictly adhered to in the operation of the oil refining industry, under the supervision of the relevant ministries, the impact on the natural environment will be large and potential irreversible (Bio-Ani: D/ A-). In particular, the Erbil (KAR) oil refining area located within the Great Zab river basin is a risk of contamination by pollutants of soil and water, with an impact and potential threat to fauna, e.g., aquatic animals, migratory birds, and flora in the river basin. Therefore, ecosystems will be protected when its operations are suspended, and appropriate removal work is carried out.
- The removal of the Qatawi illegal industries, located outside the 120 m ring road and in close proximity to residential areas, and the urban renewal into a public park, has the potential to reduce health risks from hazardous substances from the industrial area. Therefore, if operations are stopped and appropriate removal works are carried out, the living conditions of the inhabitants will be improved.
- Ararat Industrial zone is located on a gently sloping hillside. As such, there is potential for soil erosion, loss of land infiltration functions and natural disasters such as a road flooding and landslides in heavy rains in case extreme weather events.
- **Transition to light industry** from heavy industry will lower the emission of GHGs and toxic substances. Nonetheless, the light industry, such as manufacturing and construction, which is a core sector, will still cause dust pollution, air pollution (POL- Air: C-) from diesel-fuelled construction equipment emissions, noise pollution from construction (PHH- off: C-) and water pollution from industrial waste (PHH-wat: C-).

(c) Tourism development:

- **Revitalization plans for the Citadel** and the surrounding area may result in temporary resettlement (including temporary cessation of economic activity due to redevelopment) in the early stages of planning (PRS-Prs: C-). In such cases, explanations and sufficient assistance for the residents will be necessary (detailed studies are required). On the other hand, in the long-term perspective, not only will cultural tourism in Erbil be revitalized and jobs created in related industries (LOC- Tou: A+), but cultural heritage will be protected through proper management (CHL- Her: A+).

- **Promotion of agricultural and culinary tourism** will support for local agriculture and local production for local consumption (LOC- Agr/ LOC- Fod: C+).

(d) Transport development:

- **Introduction of BRT** will improve the accessibility of mobilisation for all (DIS- Tra: B+), to services (DIS-edu: C+) and reduce health inequalities (PHH-hel: C+). It will also reduce personal car use and decreases emission toxics including GHG. However, if the transition to fully electric vehicles is not completed, full carbon neutrality cannot be expected. If the number of people using public transport does not increase, air pollution (POL- Air) and GHG emissions (CLI- Ghg) are likely to increase.
- **Improving the road network and implementing congestion management measures** will increase vehicle travel speeds and reduce emissions from stationary vehicles (NOx, PM and CO2), GHG emissions from logistics are expected to increase indirectly, due to the expected increase in travel between the various industrial areas, especially between the Gazna warehouse area and the various industrial zones (CLI- Ghg: D/ C-).
- The heat-island-effect will be slightly reduced if the number of vehicle users and congestion are eliminated by public transport. But the construction (including expansion) of roads will increase the heat island effect a negative impact (CLI-Hie: D), due to the increase in hard surfaces. This effect can be reduced by the introduction of electric vehicles, water-permeable pavement, and the promotion of roadside tree planting (C+).
- The construction of the 150 m plan could lead to large-scale involuntary resettlement, but as land acquisition has already been done, no specific additional involuntary resettlement will occur if the project proceeds as currently planned. In addition, the railway, which will run in a semi-circle from the north (to Duhok) to the west (to Koya) of the target area, will pass south of the Bastora Dam, which is proposed for construction, and from the north to the south (to Kirkuk), it will pass some areas have low density of residential area. The construction of railways or related highway and facilities may require the resettlement with resettlement action plan and financial compensation. It needs to consider related regulation including buffer to the residential areas (Prs-Prs: B-).

(e) Water Supply and Sewerage

- **The new construction of Ifraz4 WTP** only (Scenario 1) has a more positive effect than Scenario 2, i.e., new construction of Ifraz4 WTP plus additional Ifraz5, in terms of budget size and land acquisition. But scenario 2 has a better effect in terms of reducing groundwater dependency and increasing water supply (RES-Wat: C+).
- **Promoting wastewater recycling and improving water use efficiency** also has a positive effect (B+) on the sustainable management of water resources (RES-Wat and Wll) and indirectly on agricultural protection through the availability of water for agricultural use (BIO-Agr/ LOC-Agr).
- **Improving the sanitation and drainage system** will ensure a better health environment (PHH-Hel) and reduce offensive odours (PHH-Off: C+). Especially implementation of drainage improvements together with IQ-P23 will contribute to the reduction of flooding issues if realized (C +), but depending on implementation level and the extent of implementation, no specific improvements are expected.

- **Construction of a new Intermediary Treatment Facility (ITF)**. As the type of ITF has not been determined at this stage, a detailed assessment is not possible. On the other hand, the status quo of the existing anaerobic Digestion and Sanitary Landfill of ITFs generates methane gas, which causes GHG gas 60 times than CO2, as final products, in case two of them are selected as ITFs (CLI-Ghg: C-).
- The proposed landfill site is situated in agricultural land, albeit of low productivity, nonetheless soil and water pollution from leachate needs to be taken into account (SOC-saf/ DIS-wat: C-). Also its close proximity to the proposed railway line, depending on the distance, the view from railway users should be taken into consideration (LOC-Tou: D).

(f) Housing and land use:

- **Housing development projects** During the first and middle phase of implementation of the Erbil 2050 Master Plan, a large quantity of housing units will be constructed and development of mixed-use area in north of the city. This could have an impact (C-) in terms of geological erosion due to mining extraction for construction material (ERO-Ero) and in terms of increasing construction wastes (WPR-Was).
- **Development of the Green Belt and the Green Channel with the Agroforestry Park** in the southwest will green up the target area and act as a green wall to mitigate the effects of dust storms (CLI-Dus: C+).
- **Public building development projects** It is challenging to assess the number of educational institutions (primary and secondary education) to be established in a spatially equal manner. If the 15 min urban concept, which includes revising the plan for establishing educational facilities based on these new city development concepts, is implemented, it will be rated "D" (partially improved from the status quo or better than business as usual). However, the number of schools required depends on the decision on the teaching structure of the schools (one or two shifts). If a two-shift system is introduced and the number of schools is not expected to increase significantly over a one-shift system, the school would be assessed as 'C -'. It should be noted that this assessment is not taken into account the development and future expectation of private schools. When assessing education as a whole in future phases, it is necessary to take into account the entire educational capacity of the private schools included.

4.1.1 Mitigation and Amplification Measures

The following table shows some of the possible mitigation measures in terms of negative effects and some of the amplification measures in terms of positive effects.

Table 4.1.2 Mitigation and Amplification Measures of the Effects

Affected item	Potential direct, indirect or cumulative effect	Impact level	Mitigation or amplification measure	Predicted efficiency
POL-Air/Wat Limit Air and Water Pollution	Cumulative impact of gas emissions from all the different industries might lead to the degradation of air and water quality.	C-	Implementation of appropriate EIAs for new developments and environmental upgrading for existing plants and industry factories, leading to the monitoring of the compliance to environmental norms at each industrial plant allows the reduction of impacts on air and water environments.	Average (C- > D)
WPR-Rec Recycling	Industry uses large amounts of water in their production process.	C-	In order to decrease water consumption in industries, introduce water-saving technology and instruments.	Average (C- > C)
PHH-Off	Bad odor from agricultural	C-	Carefully plan a zoning plan of the Agri-	Average

Affected item	Potential direct, indirect or cumulative effect	Impact level	Mitigation or amplification measure	Predicted efficiency
	activities in the Agri-Neighborhood area		Neighborhood to ensure that agricultural activities that generate odors are located further away from residential dwellings.	(C- > D)
PHH-Ind/Off	Increase in risk of industrial disaster and adverse health effects	B-	- In order to prevent industrial disaster (by explosion)/ mitigate its risk, it shall be considered the zoning of Industrial Area with highly careful manner (Setting up facilities that are relatively less likely to cause industrial disasters in areas close to railways and its facilities, etc.) - Implementation of appropriate FS/DD/ EIAs (Instruction No. 1 of 2024: Project Classification and Environmental Consent in the Kurdistan Region of Iraq) and operating with environmental upgrading leading to the monitoring of the compliance to environmental norms allows the reduction of disaster risk - Obligation of fine and appropriate measure to pre For oil refineries Applicating	Average (B- > -C)
BIO- Ani	Water and soil pollution from the industry zone especially KAR is likely to affect existing aquatic ecosystems and bird resting areas	A-	- Environmental upgrading for existing plants and compliance with environmental considerations and other environmental standards as indicated by the EIA and appropriate and regular monitoring for emissions (gases and waste) during the refining and processing stages for new plant development.	Average (A- >C-)
BIO-Gre	Construction of new road (150m) in grass or shrublands	C-	- Consideration and introduction of roadside tree plantations and, where there are slopes, tree belts on the slopes.	Average (C- > D)
RES-Wat	Development of agriculture irrigation, industries and new hub towns create more water demand	C-	- Installation of wastewater reclamation system demonstration facilities in an industrial park/ zone and use of reclaimed water in the park effluent treatment facility - Installation of agricultural irrigation systems using reclaimed water	Average (C- > D)
CLI-Ghg	Emission from oil refinery, each industry, heavy trucks for logistic, and waste treatment	C-	- Introduce EV vehicle (including forklift), solar power generation (including subsidy), public awareness of energy saving, and appropriate implementation of green areas, including trees and turf in factories and development limited buffers. - Study/ Introduction of joint collection and delivery operations in logistics, especially city center. - In case anaerobic Digestion or Sanitary Landfill are chosen as ITFs, it is necessary to consider how to treat methane gas and control and monitor with proper manner.	Average (C- > D)
	GHG Emission from private vehicle	C-	- General vehicle restrictions on certain days and times in central areas (e.g. within 30 m roads), excluding residents in the same area.	Average (C- > D)
CLI-Hie	Construction of housing units, high buildings, road network	C-	- Promoting green roof and walls of buildings, grass tiles on parking slots, plating roadside trees, including public facilities including schools, health care center/ hospital, and administrative buildings	Average (C- > D)
PRS-Prs	Establishment of development limited zone in oil refineries, will generate expropriation and involuntary displacement.	C-	- The provisions for housing (village) in development control zones need to be checked. - In order to avoid expropriation and involuntary displacement, the right of way of planned railways and expressways shall be reflected in urban plans and villages plans and frozen as “reserved land for infrastructure”, so that no new development occurs.	Average (C- > C-)
	Revitalization of historical area	C-	Adequate public briefings should be held to explain and discuss the direction and details of the redevelopment.	Average (C- > C-)
SOC-Saf	Construction of landfill in low productivity agricultural area or near agriculture irrigation area	C-	The landfill project shall be covered by an EIA to evaluate their feasibility and to find appropriate design measures to minimize any soil and water pollution	Average (C- > D)

Affected item	Potential direct, indirect or cumulative effect	Impact level	Mitigation or amplification measure	Predicted efficiency
DIS-Edu	Spatially inadequate educational facilities	C-	Educational plan (especially for structure/ facility) shall be reexamined in order to provide an adequate number of classes for all school age students to be able to attend school.	Average (C- > D)
CHL-Lan	Construction on landfill near new trainway	D	- It is envisaged that the proposed landfill site will be constructed at an appropriate distance from the new railway line in accordance with regulations, but with the potential to enhance the surrounding landscape through greening-friendly landscaping.	D < C+

Source: JICA Project Team
Note: A+/- = remarkable positive/serious negative effect is predicted
B+/- = positive/negative effect is predicted to some extent
C+/- = limited positive/negative/neutral effect is predicted but a further survey is required
D = the effect is very small, or nil and a further survey is not required

4.1.2 Monitoring Plan

Establishing a monitoring plan is an important step in the environmental assessment process. This plan will enable continuous oversight of the development project throughout its implementation phase. Monitoring will focus on the most significant impacts, whether negative or positive, as well as mitigation and application measures.

In order to be effective and operational, monitoring plans should be simple to implement, realistic and achievable. This means that the number of indicators need to be reasonable and focused on both the potential impacts of the local development plan and the ability of local authorities to realistically undertake monitoring.

Monitoring indicators and targets can be aligned with or based on those established for the SEA objectives, as mentioned above (see section 3.2). However, due to insufficient information and inadequate follow-up by the relevant agencies, additional relevant indicators and targets need to be identified and established.

After the project completed and the MP is approved, in order to monitor the impact of the Erbil 2050MP, it is strongly recommended that the GDUP, the administrative body managing the MP, together with the EPIB and other administrative bodies managing and monitoring environmental and social considerations, review and update the indicators for SEA objectives and indicators. In particular, finalising the objectives and indicators and setting baseline values immediately after the start year of the MP and updating the data every 10 years will achieve a more accurate follow-up from an environmental and social considerations perspective.

Final Report

PART IV: URBAN MANAGEMENT & CAPACITY BUILDING

CHAPTER 1
URBAN MANAGEMENT FRAMEWORKS

1.1 Existing Legal Framework of Urban Planning and Management

1.1.1 Urban Planning, Management, and their Legislation

The urban planning system in the Kurdistan Region of Iraq (KRI) relies on limited legal frameworks with some legislative complexity in combination with old and new, regional and federal as the state of Iraq. The Law no.6[1] for the Kurdistan local administration is the latest legislation to define and stipulate slightly the planning system in the Kurdistan Region Government (KRG), of which Article 25 defines two types of statutory plans "Master Plan" and "Detailed Plan" without scopes and contents. However, there are various rules (e.g. order, circulation, instruction, etc.) through resolutions of the KRG or local administrations to cope with the lack of a full-fledged legislative framework. The following describes in brief.

(1) Administrative roles of relevant authorities in urban planning and management in Erbil

Urban planning and management in the KRI are highly centralized. The central government especially the Ministry of Municipalities and Tourism (MoMT) plays the leading role in urban planning and management. On the other hand, line ministries are responsible for the planning and implementation of sectoral (social and infrastructure) services. The Governorates and the Governors have a parallel role in overseeing and implementing urban plans and services, while the local authorities (municipalities) have played limited roles in management. Table 1.1.1 illustrates administrative roles by the relevant organizations mainly of MoMT in urban planning and management in Erbil.

Table 1.1.1 Administrative Roles of Relevant Organizations in Urban Planning and Management in Erbil

Category	Organi-zation	Statutory Urban Planning			Sector Plan*	Plan Management and Implementation				
		Master Plan	Detailed Plan	Appro-val		Land Allo-cation	Const-ruction Permit	Monit-oring	Infra-structure Dev*	Public Facility Dev*
Central Government	GDUP	●	△	●MP*	⊙	△	--	--	△	△
	UPDOE	⊙	●	●DP*	⊙	△	○	△	△	○
	GDWS	⊙	⊙	--	●	--	--	--	●/△	--
Local Authority	PEM	○	○	●DP*	○	●	●	●	⊙	--
	GDEM	○	○	●DP*	○	●	●	●	⊙	--

Legend: ●= main role, ⊙= supplemental role, ○= opinion/consultation, △= supervising/advisory role, --=not involved, * = Other authorities are involved other than MoMT, MP*=Master Plan is approved by the Minister of MoMT, DP=Detailed Plan is approved by UPDG and PEM or GDEM, SP=Sector Plan,: MoMT=Ministry of Municipalities and Tourism, GDUP= General Directorate of Urban Planning, UPDOE= Directorate of Urban Planning in Erbil, GDWS = General Directorate of Water and Sewerage, PEM=Presidency of Erbil Municipality, GDEM=General Directorate of Erbil Municipality
Source: JICA Project Team mainly based on Ministerial Order no.8068/1-MoMT, Ministerial Order no. 4032-MoMT, etc.

[1] Law No.6 Administration of Municipalities of the Kurdistan Region of Iraq, 1993

(2) Planning process and approval of development plans by relevant authorities

The master plan is formulated by the General Directorate of Urban Planning (GDUP-MoMT) through required consultation by relevant authorities and the local authorities (Councils of Municipalities) through several committees' validation including the Presidency of Erbil Municipality (PEM), the General Directorate of Erbil Municipality (GDEM) and public consultation by the municipalities. And it will be approved by the Minister of MoMT. The planning boundary of Erbil 2050 MP covers two jurisdictional areas by PEM and GDEM.

On the other hand, the formulation of a detailed plan involves several authorities at a local level in combination with the Directorate of Urban Planning in Erbil (UPDOE), the Urban Planning Directorate of Governorate (UPDG), and PEM in case within the Erbil Municipality or GDEM for outside municipalities beyond the Erbil Municipality. For approval, UPDG and Municipal Council are responsible authorities for normal Detailed Plan approval.

Table 1.1.2 Planning Process and Relevant Authorities in the Formulation and Approval of Master Plan and Detailed Plan in the Planning Area

Planning Process \ Relevant Authorities		Central Government (KRG)				Local Authority		Other
		PCMs	Minister-MoMT	GDUP	UPDOE at Local	Councils /PEM	Councils /GDEM*	Private/ Institution
1.Preparation				■		●	●*	
2.Formulation of Plan				■	●		●*	procurement
3.Technical Review of Plan				■	□ / ○	□ / ●	□ / ●*	
4.Public Consul-tation	Announce					□ / ●	□ / ●*	
	Examine opinions					□ / ●	□ / ●*	
	Submit of modification		Within 60 days		Within 30 days	□ / ●	□ / ●*	
5.Amend/modify a plan				■	●			
6.Approval		In case of large-scale plan ●	■			■ ●	■ ●*	
7.Variance for deviation				■	●			

Legend: ■ = master plan, ● = detailed plan, ■,● = main role, □,○ = opinion, * = in case of outside of Erbil Municipality,
Note: PCMs=Presidency of Council Ministers, GDUP= General Directorate of Urban Planning, UPDOE= Directorate of Urban Planning in Erbil, PEM=Presidency of Erbil Municipality (MoMT), GDEM=General Directorate of Erbil Municipality (MoMT)
Source: JICA Project Team based on Law no.6, Ministerial Order 8068/1 (MoMT)

(3) Norms and regulations for urban planning, and building construction with some rules and norms in KRG

The rules and norms for urban planning and management in KRI have been legislated and managed on an ad hoc basis by orders, circulation, and instructions referring sometimes to Iraqi regulations (mainly in the 1980s~1990s), which the MoMT has played a key role in legislating them. In this section, planning norms or standards are briefed in Table 1.1.2, taking into account important elements for urban planning management.

Table 1.1.3 Key Urban Planning Standards and Norms for Urban Planning and Management

Key Planning Considerations	Standard and Norm	Reference (relevant legislation or note)
1. Classification of Municipality	• Special class (capital of the region=Erbil) (SC) • Excellent class (capital of the governorate) (EC) • 1st Class: over 75,000 pop • 2nd Class: over 15,000 pop • 3rd Class: over 5,000 pop • 4th Class: less than 5,000 pop	• Law No.6, Article 10

Key Planning Considerations	Standard and Norm	Reference (relevant legislation or note)
2. Buffer Area Control from Administrative Boundary by Municipality Class	• A: within 10 km buffer from the boundary (SC) • B: within 7 km (EC) • C: within 5 km (1st Class) • D: within 3 km (2nd -3rd -4th Classes)	• No subdivision for settlement and industrial development • Law No.6, Article 55
3. Commercial/Industry Facilities Planning Standards	• 15 Facilities and 2 sites with locational conditions (distance, service population, conditional equipment, floor area, etc.) • Green area conditions (protective regulation, etc.)	• GDUP MO-7223 • Administrative Order 40 • PCMs 1460 • Guidelines/MOIE • MO-88
4. Neighborhood Facilities Planning Standards	• General planning standards (land use, parking, community facilities, climatic solution, etc.) • Housing/dwelling (plot area, population, floor area, etc.)	• Iraqi Urban Housing Standards 2010
5. Guidelines for Buildings in Erbil	• Building permit guidelines by types of buildings (setback, building height, fence, open space, etc.)	• Municipal Ordinance for Buildings in Erbil

Note: MO=Ministerial Order, GDUP= General Directorate of Urban Planning (MoMT), PCMs= Presidency of the Council of Ministers (KRG), MOIE = Ministry of Industry and Energy (KRG)
Source: JICA Project Team

(4) Detailed planning as a predominant implementation instrument for urban settlement

The detailed plan as a statutory plan defined by Law no.6 prepared by UPDOE or private sectors has a considerable role in providing housing areas to cope with the residential demand increase in Erbil. Therefore, it is required the design of land plots for land allocation in a detailed plan, after that PEM (or GDEM) is the responsible authority to prepare them, and the land registration office (Ministry of Justice) registers them officially.

There was no technical guidance or instruction for detailed planning till the year 2021, of which a majority of outputs consists of only a drawing of the plan and attached an official letter. In 2021, the MoMT has issued new guidelines for Detailed Plans to reduce inappropriate detailed plans and their implementation. The planning process including its approval is illustrated in Table 1.1.2.

Table 1.1.4 New Guidelines for Detailed Plan Formulation (2021)

Planning Category	Element	Detailed Element/Contents
Situation Analyses	Defining boundary	• Designation of planning area
	Physical Survey	• Topographic map, cadastral map, surrounding conditions
Site Plan and Layout (maps)	Road Network	• Road design according to mode of traffic (car, motorcycle, bicycle, walkway, disable users' consideration, crossing, etc.) • Pedestrian path and ramp, lighting, greenery spaces, furniture, etc.)
	Land Plot	• Number of plots to be delineated and allocated
	Public Facilities	• In accordance with Urban Housing Standards Manual 2010[2]
	Utilities	• Water supply, sewerage, electricity, transmission line
Building and Lot Form		• Open Space Ratio, Floor Area Ratio, Building Height, Setbacks

Source: JICA Project Team based on the Circular no.4032/GDUP-MoMT/05-05-2021

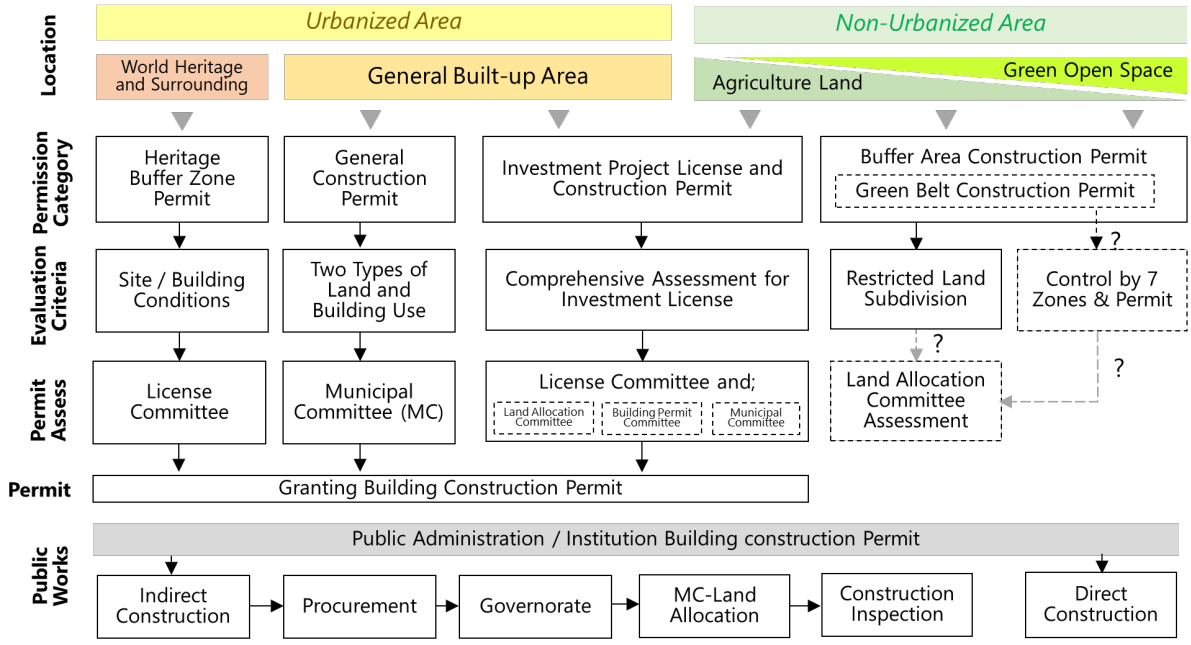
[2] Source: Republic of Iraq, Ministry of Construction and Housing / State Commission of Housing, 2010

1.1.2 Development and Building Permit

Development and construction in Erbil have been managed and controlled by several institutional and regulatory systems in terms of the land use conditions or type of construction (general construction or investment project) handled by different relevant authorities. Especially the investment projects in Erbil take a special procedure by an all-inclusive permission system from a feasibility study to a construction permit involving relevant authorities for land allocation, registration, and construction facilitated by the General Directorate of Investment Erbil (GDIE: branch office of the Board of Investment/BOI) and PEM.

However, the assessment and validation of applications for building permits are managed by common committees (land allocation, building permit committee, municipal committee) based on their necessary steps. There are two committees for the special projects to be validated the License Committee for Historical Buffer Zone permit and the Investment License Committee for investment projects. Every committee consists of core members from UPDOE, the municipality, and the mayor and other members as representative technical organizations (e.g. departments for infrastructure, transportation, environment, security, antiquity, and tax, etc.)

The steps for a building permit require three phase validations of 1) basic application documents (boundary, title deed registration, tax, cost estimates, etc., 2) site plan assessment whether its natural condition and utilities' links to surroundings are appropriate or not, and 3) building plan assessment. The duration will take 49 days as a maximum, in association with permission fees of 739, 650 IQD (506 USD) per application. Figure 1.1.1 illustrates each procedure of development and building permit briefly, although the step for "Green Belt Regulation" for building permit conditions needs to clarify whether it has been actually incorporated into the process or not.



Source: JICA Project Team based on the collected materials and the Establishment of A Building Control Regime for Kurdistan Region-Iraq, UNHABITAT 2016

Figure 1.1.1 General Process for Development and Construction Permit in Erbil

1.1.3 Land Management and Legislation

The current land management system in the Kurdistan Region has deep roots such as the Ottoman occupation and the British mandate during Iraqi regimes that reorganized several land-related legislation including agrarian lands reforms. In this historical succession, land tenure has been classified into mainly by six types of 1) "*Mulk*" (freehold in urban area), 2) "*Mulk Suruf*" (freehold agriculture area), 3) "*Amiri*"

(state-owned or controlled land by the state), 4) "*Waqf*" (endowment), 5) "*Hag Al Tasararuf*" (long-term leasehold), and 6) rent as shown in Table 1.1.5.

Table 1.1.5 Land Tenure Types in Kurdistan Region

Tenure Type / Category		Freehold				Leasehold	
		Muluk	Muluk Suruf	Amiri	Waqf	Hag Al Tasaruf	Rent
Ownership		Private	Private	State or controlled	Endow-ment	Private	Private
Location	Urbanized area	●	--	●	●	○	●
	Agriculture area	--	●	○	○	●with long-term	●

Legend: ●= corresponded mainly, ○= partially corresponded, -- = not corresponded
Source: Urban and Regional Planning and Land Management in Kurdistan /UNHABITAT 2016

(1) Current land management with relevant authorities in Erbil

There are four key authorities in relation to land management in Erbil, and the Land Allocation Committee coordinates, and validates lands transaction in Erbil as shown in Table 1.1.6.

Table 1.1.6 Land Management and Relevant Authorities in Erbil

Management Category	Authorities	Key Role and Activities
Main Land Management	Ministry of Finance and Economy (MOFE)	• Allocating lands for the expansion of municipal jurisdiction • Allocating lands to ministries for their projects • Collecting property tax
	Ministry of Municipalities and Tourism (MoMT)	• Land allocation to sectoral ministries and private sector and Land auction (leases, sells, etc.) by Directorate General of Real Estate Registration (DGRER)
	Ministry of Justice (MOJ)	• Managing properties through a registration system (transaction, subdivision, reclassification of land use, distraint, mortgage, etc.)
Sectoral Land Management	Bord of Investment (BOI) and General Directorate of Investment Erbil (GDIE)	• Giving an investment license as the precondition of land allocation • Managing investment projects in association with land allocation and transaction by rent or long-term lease, onerous transfer, and free of charge to the private sector with relevant authorities
	Ministry of Agriculture and Water Resources (MOAWR)	• Agricultural land management as a supervisory authority within municipalities • Agriculture land management for lands owned by MOFE
Land Allocation Committee (Erbil Governorate)		• Coordination with relevant authorities and validation of land allocation by members of GDUP, DGRER, MOAWR, Governorate, and Municipalities

Source: Urban and Regional Planning and Land Management in Kurdistan /UNHABITAT 2016

(2) Public domain management

In the case of urban planning and management, public domain in a narrow sense is defined as public spaces including roads, pedestrian, car parks, green and recreational parks, open space, and in a broad sense, all public areas or lands owned or managed by the governmental bodies (central, local and relevant institutions) for public services accessible to the public. Therefore, the public domain (lands and spaces) becomes an essential element to provide basic and attractive urban services and to be secured by appropriate urban development and management through legal instruments.

There are two types of legislative instruments to secure the public domain 1) design regulations or standards for infrastructure facilities and 2) zoning system for necessary public facilities. In Erbil, there is no zoning system as one of the strong control measures to secure public lands, while standards and

norms for infrastructure facilities such as roads, transportation facilities, utilities, and public facilities such as health and education are stipulated and guided in relevant legislative documents.

(3) Agriculture land for urbanization

Although agricultural lands in some parts of the peri-urban areas in Erbil have favorable conditions by fertile land, weather conditions, and certain water sources, they have faced difficult situations due to competitive environments with strong urbanization pressures generating water resources and land scramble, deterioration of water quality, etc. In terms of legislation for agricultural land disposal, Table 1.1.7 briefs its treatments that support and promote to release of farmers' lands to urban developments with conditions (land compensation) from agricultural lands in the master plan's urban areas.

Table 1.1.7 Legislations for Agricultural Land Disposition for Urbanization

Legislation	Year	Key Contents
Revolutionary Command Council Decision 850	1979	• To subdivide the agricultural lands to eliminate the scarcity of land due to the housing demand increase in the agricultural lands prohibiting the disposal • Not permissible to build or rebuild in a single residence beyond 800 sqm • Minimum housing lot 120 sqm (Governorate Center), 100 sqm (Sub-district center or district center)
Resolution (Compensation and Amortization) Agricultural Reform Lands, No. 90 of 1996.	1996	• Compensation for the alienation of agricultural land, with alternative land • To prohibit compensation in kind or cash for certain types of land
Decision 3 on Law no. 3[3]	1998	• To give the right to dispose of the state lands for agriculture and non-agriculture to the owner with compensation by the land share (8%, 12%)
Law no.5: Amendment of Law no. 3	2007	• Lands to be disposed, and registered in the name of Municipality • Compensation by the land share (12%, 20%)

Source: Relevant Laws, Decisions above mentioned.

1.1.4 Urban Development, Investment and Legislation

(1) Urban development demands stimulated by Investment Law no.4 in Erbil

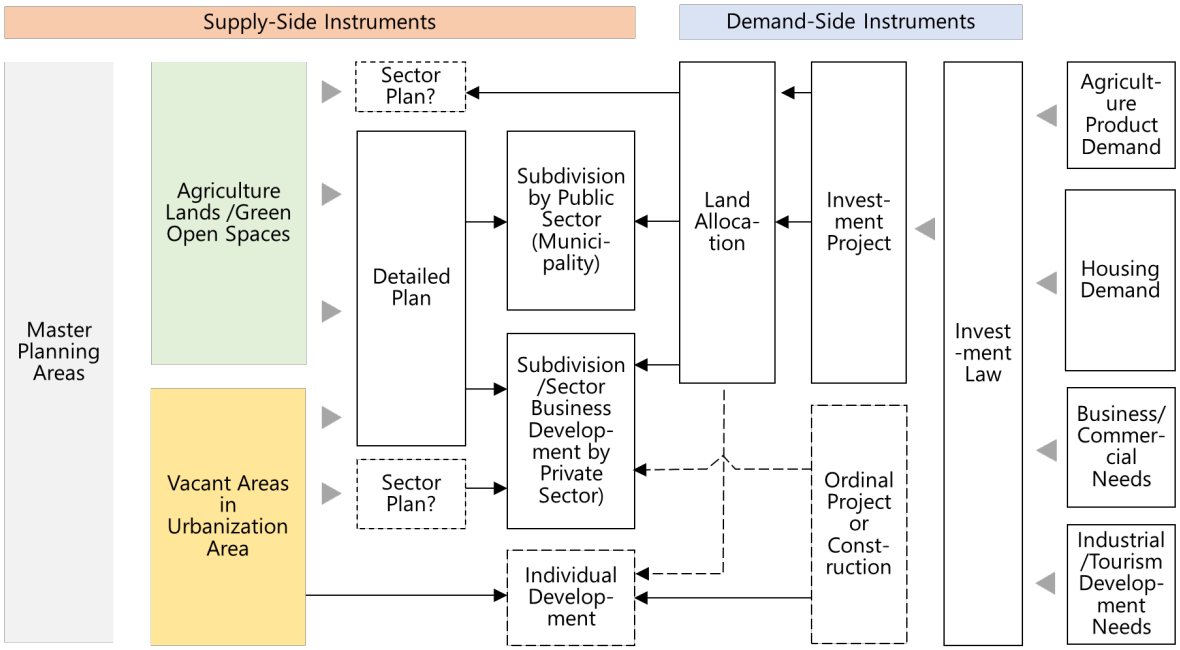
The current urban development has been accelerated after the promulgation of Law no 4 Investment (KRG/2006). Law no.4 provides attractive incentives by granting lands and tax incentives and exemptions for foreign direct investments (FDIs: 23% share out of the total investment amount) and domestic investments in the KRI. On the other hand, the commercial and business sector shares 39%, while the industrial sector shares 21% out of the total investment amount according to the investment data[4] in 2021.

The real estate business and its development (11 billion us$: housing sector 31%) has grown in association with large impacts spatially on urban development in the recent two decades in Erbil. And high-rise housing construction with commercial-business developments in the urban center and housing subdivision projects in peri-urban areas are observed at present.

(2) Strong support for urban development through Detailed Plans as supply-side drivers

To cope with urban development demands including the housing sector with large-scale of lands, the Detailed Plan as a statutory plan has played an essential role in legitimating the housing development and land allocation process in which PEM or GDEM and Land Registration office are responsible authorities to implement it. The majority of housing development has been planned by detailed plans and developed in the peri-urban areas in Erbil, where those developments have taken agricultural lands mainly as mentioned in the previous section.

[3] Law no.3 of Extinguishing and Partition of Lands within Municipal Borders
[4] List of Licensed Projects in KRG, 2021/BOI



Source: JICA Project Team

Figure 1.1.2 Current Urban Development and Investments with Key Instruments in Erbil

1.2 Existing Institutional Framework of Urban Management

1.2.1 Central government

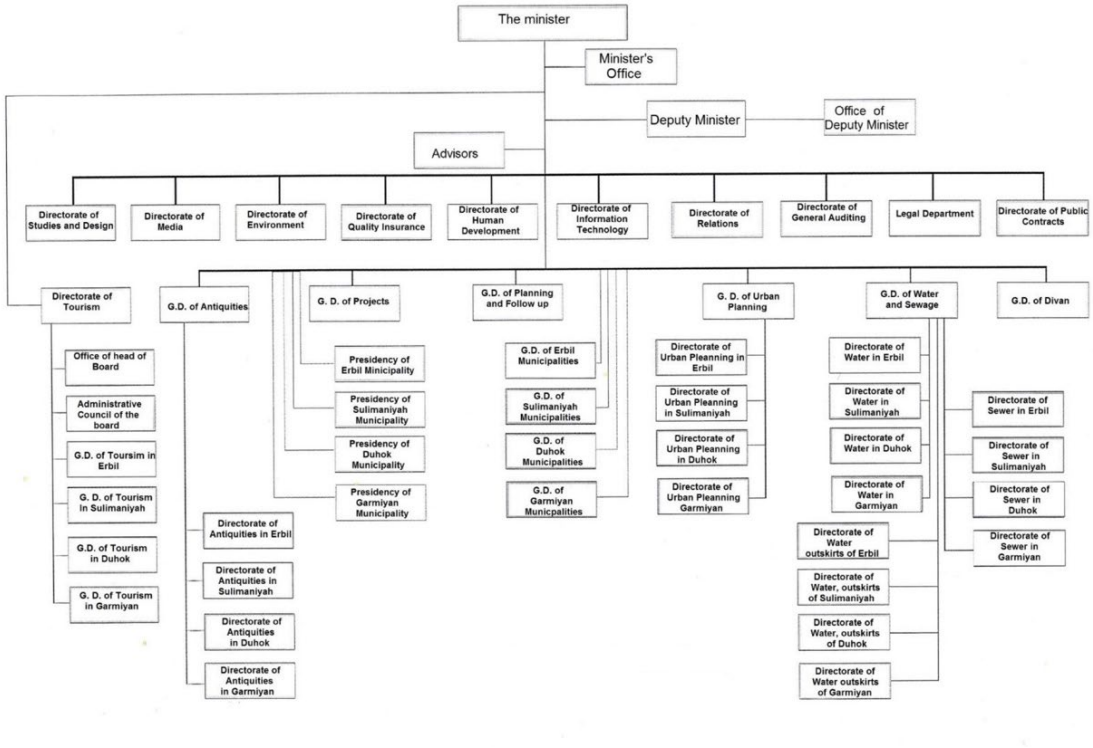
Kurdistan is a semi-autonomous region that is the governing body consisting of ministries for management and providing services, as well as a parliament for drafting and issuing laws and legislation. KRG is responsible for providing a wide range of services and governing the region in several sectors, including education, health, transportation, and security. Ministries work together under the Council of Ministers (COM) of Kurdistan Region.

The Ministry of Interior (MOI) oversees authority in the region through governorates, districts, and subdistricts. On the other hand, each ministry is responsible for providing services and drafting strategies for their sector for the whole region. Furthermore, ministries have departments and general directorates at each administrative level that provide services in line with the general strategy of the region and following regulations from their ministries respectively.

(1) Ministries involved in urban planning and development

All ministries are involved in spatial planning to some extent. However, the following ministries directly participate in urban planning and development:

- The main ministry undertaking urban planning and development control is the Ministry of Municipalities and Tourism (MoMT). According to law number 7, 2022 of MoMT, the duties of the ministry are drafting urban planning policies through preparing master plans and detail plans for cities and towns (through General Directorate of Urban Planning); providing services within municipality boundaries such as building roads and bridges (through local municipalities); and supervising and monitoring of master plan and detailed plan implementation as well as municipality plans. Board of Tourism (BOT) is under the ministry that is taking care of the tourism sector, and General Directorate of Archaeology oversees and protects the archaeological sites throughout the region.



Source: Ministry of Municipalities and Tourism, KRG

Figure 1.2.1 Organization Chart of the Ministry of Municipalities and Tourism, KRG

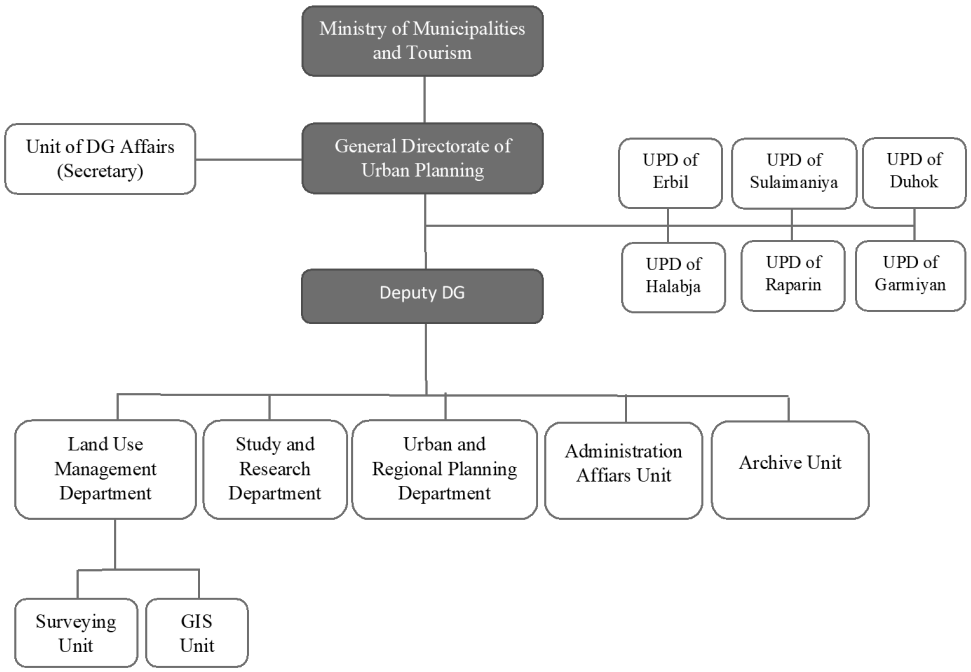
- The Ministry of Planning (MOP) is responsible for regional planning and strategic planning in accordance with all ministries. It is also in charge of capital investment budget that secures funding for ministries' infrastructural projects.
- The Ministry of Construction and Housing (MOCH) regulates housing policies and strategies, as well as government housing projects.
- Board of Investment (BOI) is independently under the Council of Ministers at a ministerial level. BOI is in charge of developing investment plan and strategy for the region. It guides and encourages investment opportunities based on the needs of the region. Its services include promotion, approval and licensing of various investment projects.
- Ministry of Justice (MOJ) handles the official land registration and works closely with MoMT.
- Ministry of Agriculture and Water Resources (MoAWR) manages the agricultural fertile lands in the region including lands adjacent to urban areas. It is also responsible of managing water resources and irrigation.

Other infrastructure ministries (such as Ministry of Health, Ministry of Education, Electricity) provide services in their respective sectors in line with MoMT.

All ministries that are involved in urban development should inform MoMT and MOP of their plans and strategies in their sectors respectively in order to be integrated into master plans and implementation plans.

(2) Mandates and authorities of General Directorate of Urban Planning (GDUP)

Referring to the ministerial order of MoMT number 8068/1 of 24/12/2020, urban planning duties and mandates within the MoMT are shared between General Directorate of Urban planning (GDUP), and urban planning directorates of governorates (UPDG). GDUP has the role of preparation, supervision as well as approval of master plans at the central level for all cities and towns. While UPDGs are having an advisory role working with municipalities and line directorates under ministries on master plan implementation within governorates on a local level.

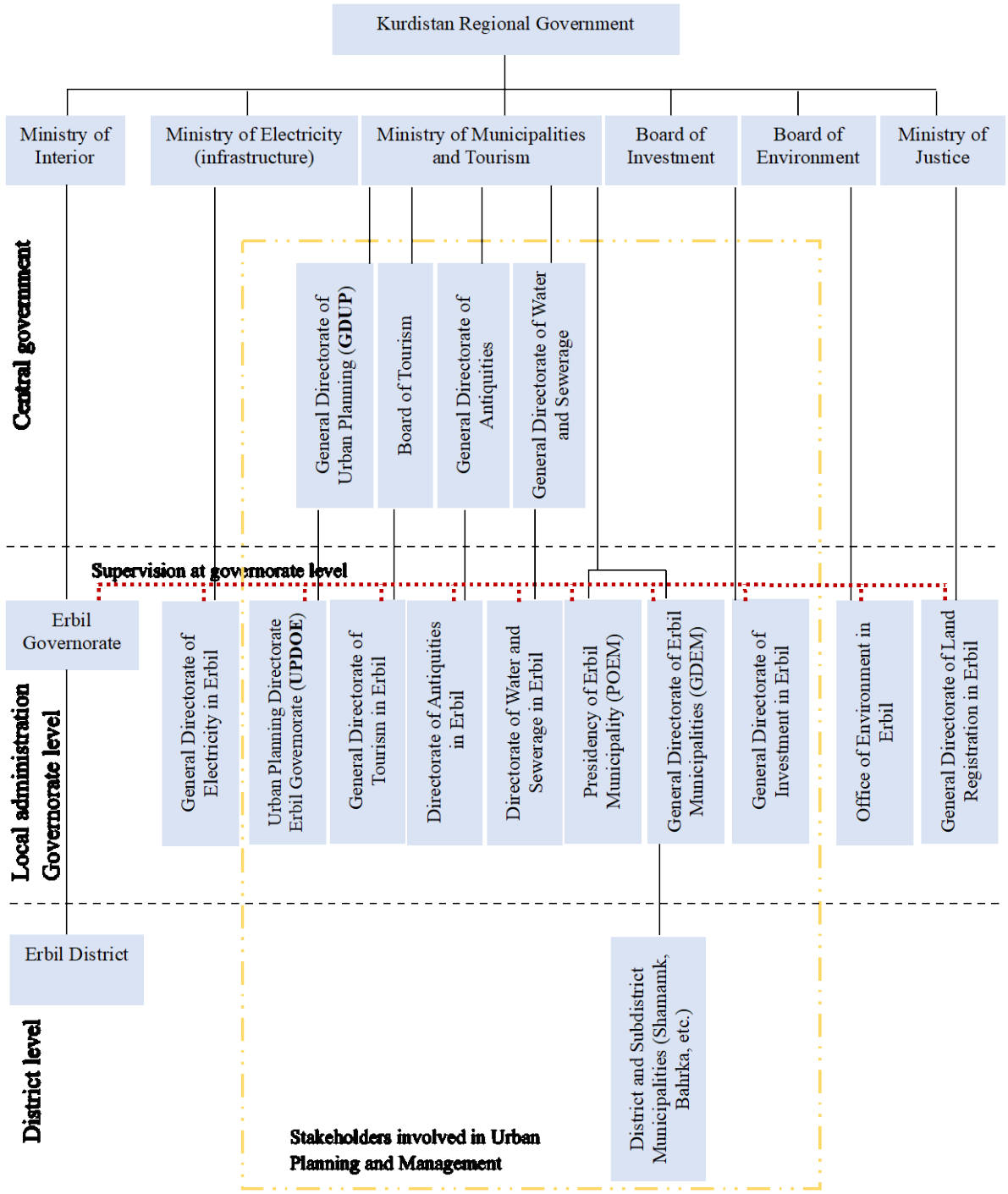


Source: General Directorate of Urban Planning

Figure 1.2.2 Organization Chart of the General Directorate of Urban Planning (GDUP)

The following are some of the main mandates of the General Directorate of Urban Planning:

- Drafting the urban planning policy at the regional level with the participation of the relevant authorities within the framework of the laws and applicable instructions and the general policy of Kurdistan Regional Government.
- Preparing a plan for organizing and developing villages within the municipal boundaries and issuing instructions related to this issue with the participation of the relevant authorities.
- Preparing the report on the issues of urban planning through the participation of specialized experts and holding workshops and conferences at the domestic and international levels.
- Preparing, supervising and approving base maps (Master Plan) for the cities and towns of Kurdistan Region, with the participation of the relevant authorities.
- Supervising and following up the technical works and plans of the urban planning directorates in the governorates and the independent administrations according to the authorities within the framework of the law and the applicable instructions.
- Supervising and following up the implementation of the sectoral design of the Master
- Plan sectors in accordance with the law and the applicable instructions.
- Preparation of regulations for designing and planning for sector maps and approving them by the Minister of Municipalities and Tourism.
- Preparing recommendations on topics that do not have clear instructions, provided that legal support is available and approved by the Minister of Municipalities and Tourism.
- The figure below shows the institutional system of organizations relating to urban planning, at both central and local levels.



Source: General Directorate of Urban Planning

Figure 1.2.3 Central Government and Local Administration Institutions

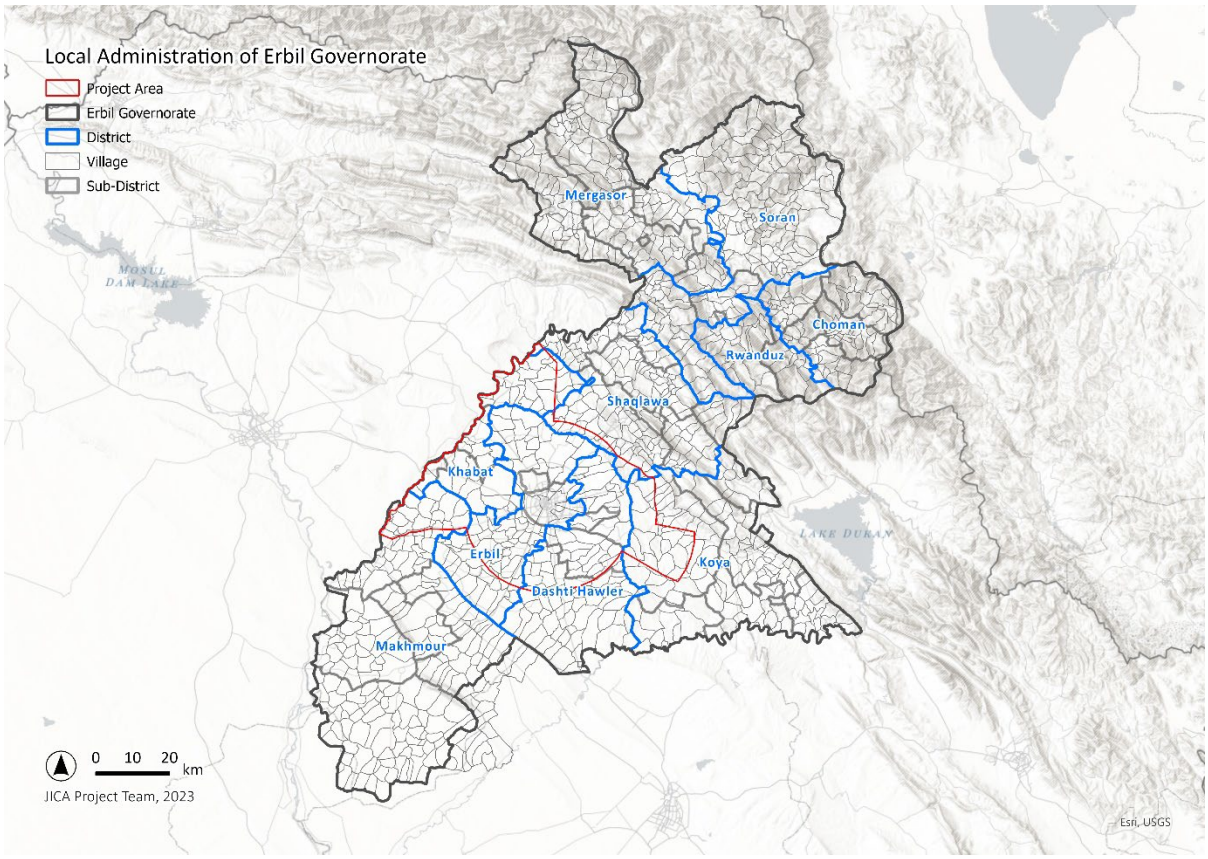
1.2.2 Local administration

The local administration of the Kurdistan Region refers to the system of governance at the sub-regional level within the region. This includes the administration of cities, towns, and rural areas and is responsible for providing services and implementing policies at the local level. The local administration works in line with the KRG to provide services to the local communities and is responsible for carrying out the policies and decisions of the central government from ministries.

(1) Administrative hierarchy under governorates and its relation to municipalities

1) Governorates, districts, and sub-districts

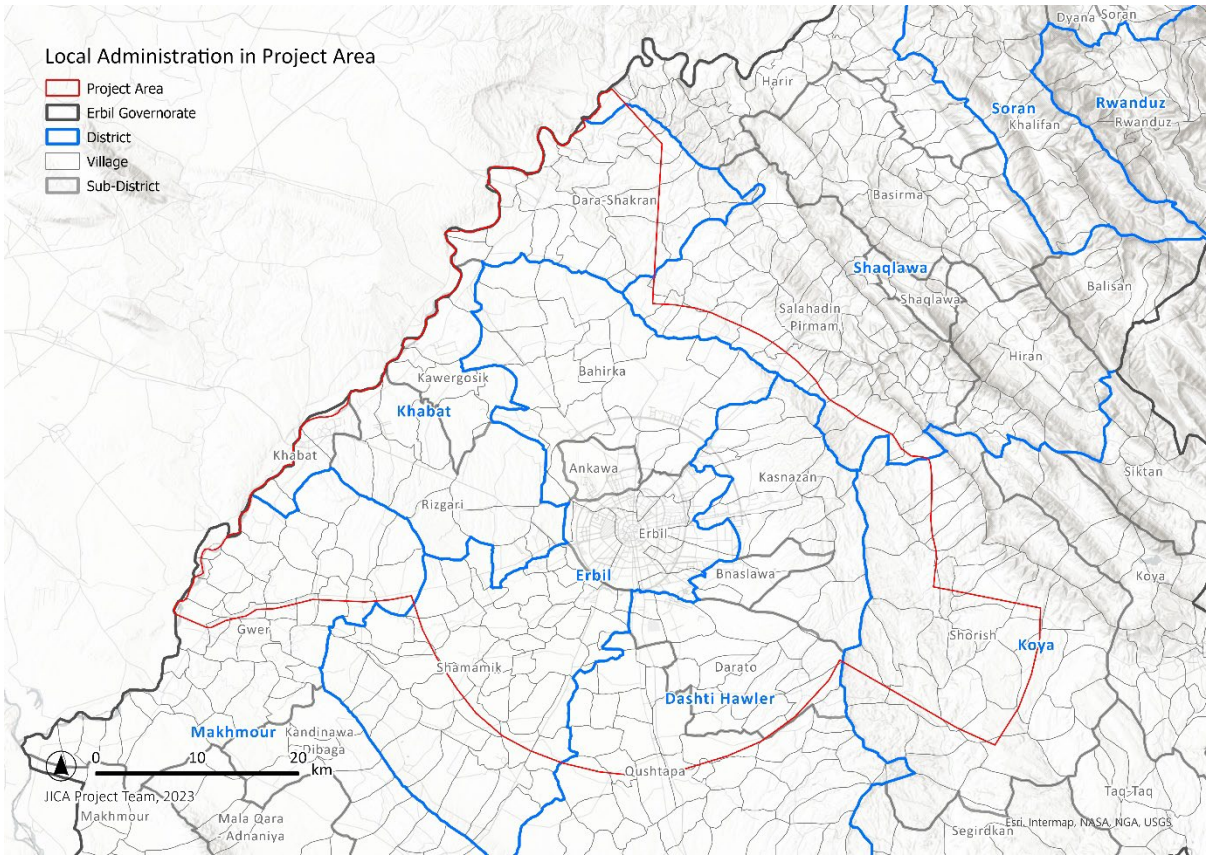
Governorate office is the 1st local administrative level and is the highest managing authority within a governorate. It supervises and oversees the work of all directorates under ministries at the governorate level including municipalities and urban planning directorate. The governorates are divided into districts (2nd administrative level), and the districts are divided into sub-districts (3rd administrative level). There is also a district office in each district city, and a subdistrict office in each subdistrict town. Each one of these administrative offices manage and supervise directorates within their boundaries at their respective levels. Villages are the smallest administrative unit within sub-districts. This hierarchy is managed by the MOI.



Source: JICA Project Team

Figure 1.2.4 Administrative Boundaries of Erbil Governorate

Each governorate has a Council of Governorate (COG) in which members are elected publicly. The council has an overseeing authority within its administrative boundaries as well as issuing decisions, measures and regulations to organize administrative and financial affairs. Council of Governorate also has the role of planning the overall policies for the governorate in coordination with ministries, as well as planning the development strategy in line with national and regional development strategies.



Source: JICA Project Team

Figure 1.2.5 Figure Administrative Boundaries in Project Area

2) Municipalities

According to the Law of Administration of Municipalities (Law Number 6 of 1993), a municipality is established in each of the cities/towns with a population of 3000 or more inhabitants. Generally, after establishing the municipality, a master plan should be prepared for it by GDUP, and the municipal boundaries are usually the outer boundaries of the master plan, but the municipality is also responsible to provide limited services within its district/subdistrict boundaries outside of the master plan. Also in some cases, there could be more than one sub-district within the master plan, thus, there will be a municipality for each subdistrict within the master plan boundaries. In such cases, municipal service regions might exchange or overlap. Regarding villages, there are no municipalities. Usually, the Ministry of Construction and Housing provides limited services for villages. It's also possible that the closest municipality can provide services if needed.

Municipalities also have municipality councils in which members are voted for in a public election. Their roles include making decisions on running affairs of the municipality including approval of master plans and detail plans. Municipality councils usually discuss and submit urban planning issues from citizens to urban planning directorates. They can review and decide on objections made by citizens on advertised master plans and detail plans.

3) Overlap of boundaries

Therefore, administrative boundaries are not the same as municipal boundaries. In the case of Erbil, for example, the current master plan engulfs the municipal boundaries of Erbil Municipality Presidency (which has 6 sub-municipalities across Erbil city), and several other district and subdistrict municipalities such as Ankawa municipality, Bahrka, Darato, Kasnazan, as shown in the table below.

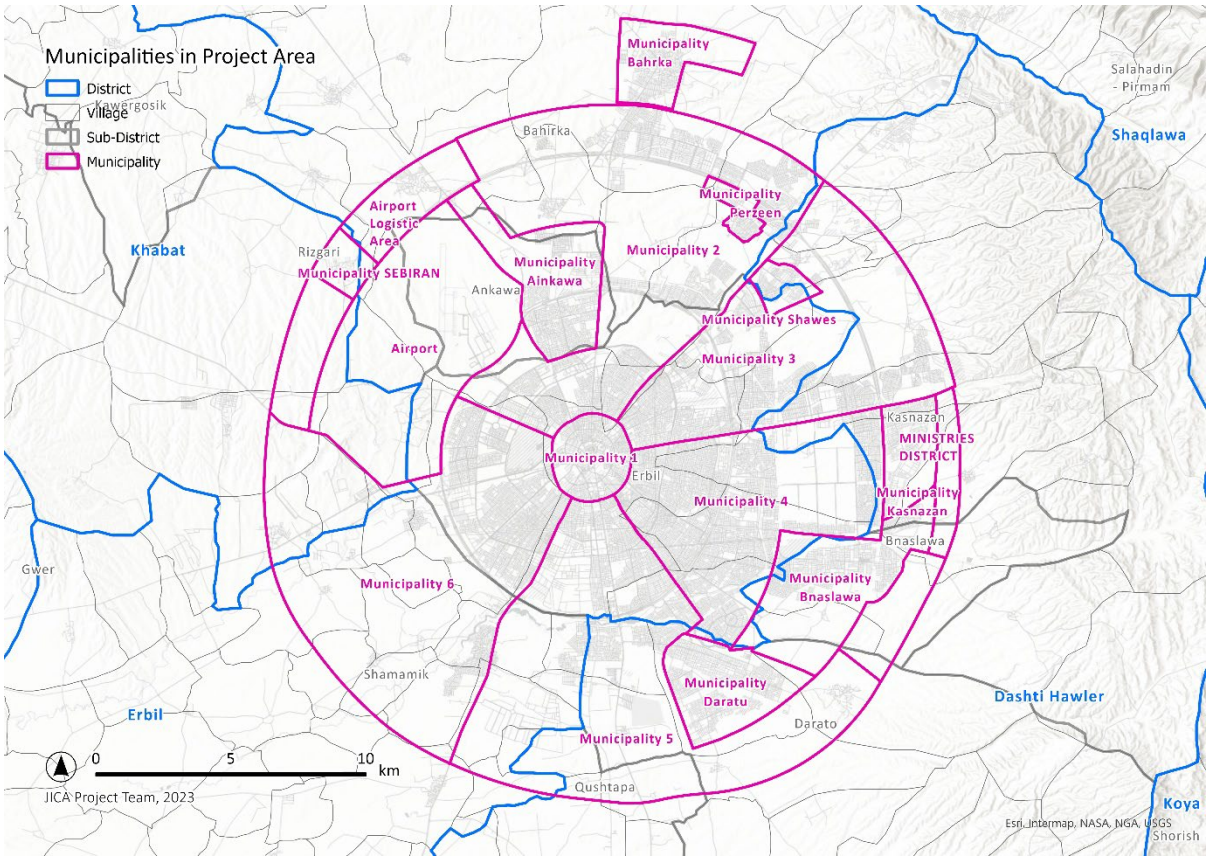
The main municipality in the governorate capital (Presidency of Erbil Municipality) is directly under the Ministry of Municipalities and Tourism. Whereas the other district and subdistrict municipalities (e.g. Ankawa, Bnaslawa, Shamamk, etc.) belong to the General Directorate of Erbil Municipalities

(GDEM) in the governorate, which in turn is under the Ministry.

Table 1.2.1 Municipalities of Districts and Subdistricts within the Project Target Area

Governorate	District	Subdistrict	Municipalities
Erbil	Erbil •	Ankawa •	Erbil (1, 2, 3, 4, 5, 6), Ankawa Bahrka, Pirzin, Shakholan, Sebiran, Shamamk
		Bahrka • • • •	
		Shamamk •	
	Bnaslawa •	Daratu •	Bnaslawa, Daratu, Kasnazan, Mala Omar, Shawes, Qushtapa
		Kasnazan • • •	
		Qushtapa •	
	Khabat •	Darashakran •	Khabat, Darashakran, Kawrgosk, Rizgari, Kani Qrzhala
		Kawrgosk •	
		Rizgari • •	
	Shaqlawa	Salahadin •	Bastora
	Makhmour	Kandinawa •	Sufaya

Note: (•) Number of municipalities in districts and subdistricts within the project target area.
Source: JICA Project Team



Source: JICA Project Team

Figure 1.2.6 Municipal Boundaries in Project Area

4) Process of Municipalization of rural areas

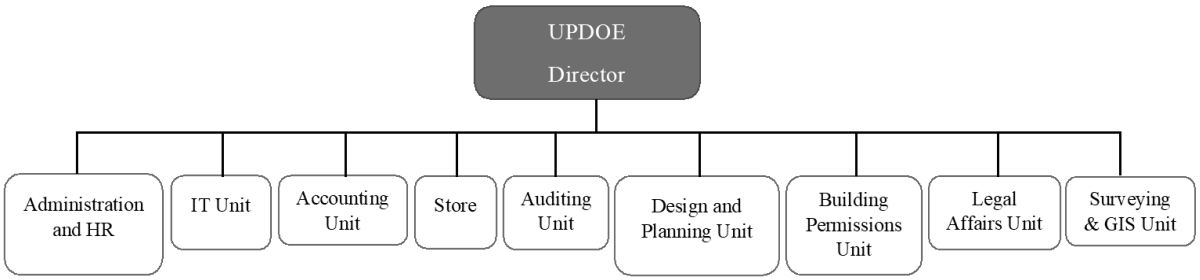
When municipality boundaries are expanded, villages become part of the municipality, thus, the municipality is obliged to provide municipal urban services in those villages. Therefore, to integrate a village into the urban area, the municipality requests from UPDOE to prepare a Detail Plan for the existing village. This action results in a process that converts the village into a quarter/neighborhood within the municipality (land ownership changes from Ministry of Finance/Ministry of Agriculture to MoMT). Houses are thus officially given residential plot registration papers, just like any other residential plot within the municipality. For example, there are 11 villages (big and small) within the

expansion of Municipality 6 boundaries. UPDOE and Presidency of Erbil Municipality (PEM) are currently working on preparing and approving detail plans for those villages.

(2) Urban planning directorate of governorate (UPDG) and its role

Urban planning directorates at the governorate level (UPDG or UPDOE in Erbil) are directly under the General Directorate of Urban Planning (GDUP). UPDGs should participate in preparing master plans by related authorities or competent consultants providing that GDUP is informed about the process from the beginning.

UPDG takes an advisory role within the governorate regarding the implementation of the master plans through related municipalities and sectoral departments. In addition to that, UPDG is responsible for preparing detail plans demanded by related municipalities in correspondence with land uses designated in the master plan. UPDGs also participate in various committees as members with municipalities and relevant directorate for resolving urban planning issues within the governorate.



Source: UPDOE

Figure 1.2.7 Organization Chart of Urban Planning Directorate of Erbil

(3) Presidency of Erbil Municipality at the core of master plan implementation

Master plans are considered as a development roadmap guide for municipalities. Therefore, municipalities are responsible for providing services in urban areas based on the land uses and regulations elaborated in the master plan. Such services include road and bridge construction, water provision, waste management, construction of parks and green areas, supporting tourism activities, and so on. The budget is allocated for municipalities by the Ministry of Finance. Municipalities can also use a certain percentage of their own budget generated from revenues.

Municipalities usually register land after the process of agricultural land amortization, thus having land ownership for preparing land plots for delivering services and facilitating development projects.

In consultation with UPDGs, municipalities have the responsibility of implementing and monitoring master plans, granting permission on the allocation of investment projects, as well as granting building permissions to developers.

Presidency of Erbil Municipality directly coordinates with Urban Planning Directorate of Erbil and GD of Investment in Erbil for facilitating development of investment projects. These municipality departments are involved in:

- Master plan unit.

  Manages master plan works and gives propositions of detail plan preparation. This unit is also responsible of land allocation for governmental projects and services, as well as making necessary preparations for lease projects.
- Unit for land allocation for investment projects and GIS.

  Does the necessary preparations for allocating land for investment projects, inputs data and information on the master plan and coordinates with agriculture department for land amortization and compensation.
- Land subdivision and mapping unit.

Works on land subdivision for locations where detail plans are prepared, in addition to land registration preparations.

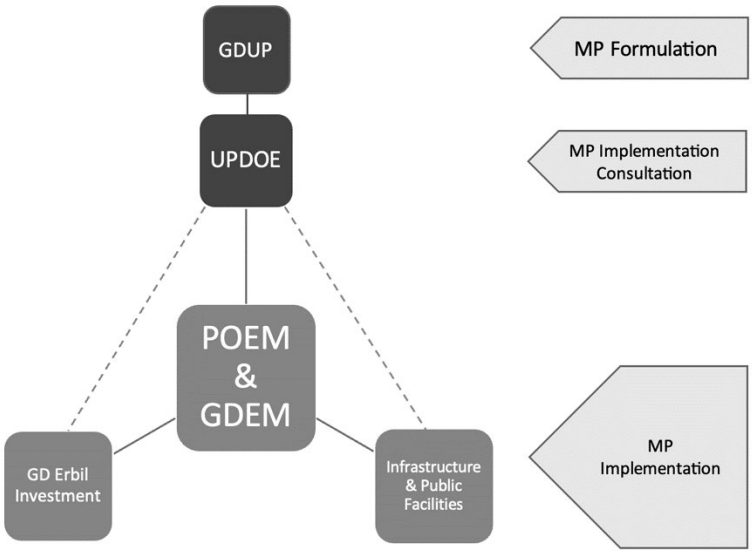
(4) Key players promoting and affecting urban development

Urban development is promoted and controlled by the local government authorities. After a master plan is prepared by GDUP and UPDOE, the municipality takes responsibility for the implementation. Therefore, municipalities play an important role in coordinating between relevant authorities for urban development. Municipalities, however, consult UPDOE for planning permission and building permit procedures.

One key player in development is the General Directorate of Erbil Investment promoting investors to build development projects. Thus, consultation and coordination with Municipalities and UPDOE are crucial. Nonetheless, due to a lack of coordination at certain times, projects have been built without full cooperation between authorities. The same goes for infrastructure and public facilities development authorities.

For this reason, committees are formed having members from relevant authorities to facilitate the implementation by strengthening coordination and reviewing documents of development submission. Yet, it sometimes leads to over-complication and unnecessity of procedures.

Some committees are established temporarily to tackle a certain issue such as the urbanization of a certain village or issuing recommendations for an infrastructure problem. But there are committees that are working rather permanently for licensing development projects.



For instance, land allocation for investment projects usually goes through the following steps (an example of a committee that is involved in the implementation of development projects):

(a) Request letter from directorate of investment is submitted to the municipality requiring land allocation for the project after a special committee (members from GD Investment, UPDOE, PEM, Education, Health, Tourism, Industry are included) decides a suitable plot size for the project.
(b) Land allocation proposed by unit for investment land allocation.
(c) Letter is sent to UPDOE for urban planning opinion of the location and project type.
(d) Letter is then sent back to GD Investment confirming land allocation.
(e) GD Investment sends the letter to PEM requesting identification of the actual project area on the field. Thus, PEM dispatches surveyors for project stakeout.
(f) Then PEM sends the letter back to GD Investment confirming actual project area identification.

(g) GD Investment thus requests from the investor to prepare project drawings as per the allocated area.

(h) Project drawings are submitted to a second special committee (members from GD Investment, UPDOE, PEM, Education, Health, Tourism, Industry are included) for reviewing and assessment for the purpose of approval.

(i) Finally, after the above steps are completed, the approved drawings are sent back to GD Investment for the necessary procedures of issuing investment license.

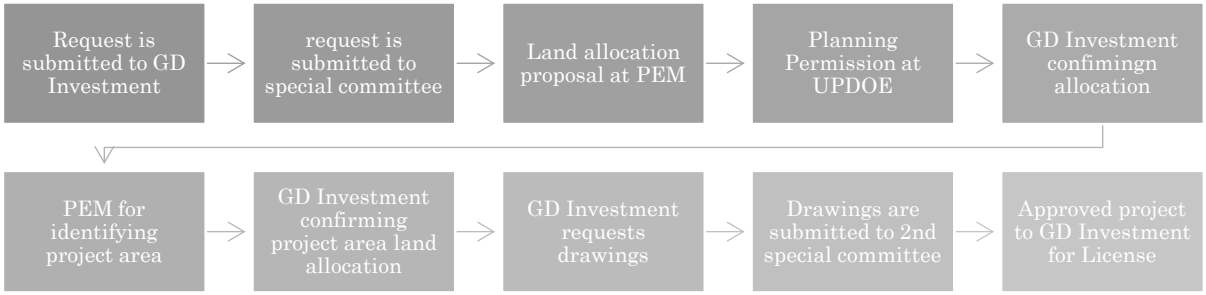


Figure 1.2.8 The Complex Procedure for Allocation and Approval of Private Investment Projects

1.2.3 Evolution of governance and status of decentralization

Urban planning is currently centralized in KRG. The Ministry of Municipalities and Tourism plays an important role in formulating overall strategies and regulations for urban development. However, urban management is decentralized to local administrations and municipalities to some extent. Recently, the KRG government has re-defined the authorities of governorates, districts, and subdistricts for the purpose of consolidating the principles of decentralization and improving the delivery of services at the local level, in addition to protecting local communities' interests (Governorates Law No. 3 of 2009).

In addition to this, the recent urban planning mandates issued by MoMT (No. 8086 of 2020) give more authority to urban planning directorates of governorates, albeit operational and technical authorities.

1.3 Challenges to Urban Planning and Management

1.3.1 Challenges to Legal Framework

(1) Urban planning and management system

- **Necessary improvement of subordinate planning for appropriate implementation**: The Erbil 2030 MP has faced difficulties in the implementation in association with discrepancies in detailed plans, and fragmented administration due to inadequate subordinate planning instruments under the master plan. The current planning system should be improved by subordinate planning instruments to implement the master plan appropriately, in which a detailed planning system can be reorganized, and a zoning system should be introduced.
- **Unsustainable local urban planning and management:** The Master plan covers multi-municipality jurisdiction that requires spatial integration by an upper level of planning authority (e.g. GDUP). On the other hand, local planning requires appropriate and effective implementation and management based on the local resources (communities, information, data, and sometimes problem understanding) where the local authorities have the advantage close to them. Toward expected future decentralization, planning functions and roles need to be devolved by the step-by-step implementation to local planning authorities.

- **Betterment of complexity in the urban management process:** Current building permit process in Erbil requires many inefficient steps (e-Regulation website shows that 148 steps and 10 relevant organizations are involved in reviews, verification, signed for approval of the building permit). This process has negatively affected efficient processes and urban development. In order to allocate the necessary time for substantive work for verification, the works by duplication, unnecessary processes, and paper-based documentation could be improved.

(2) Regulatory instruments

- **Piecemeal urban regulations generating inconsistent implementation and operation**: Although GDUP-MoMT has issued several new legislations (e.g. instructions or circulations) in recent years (2020-2022) to improve current problematic conditions of regulations including old-dated and the federal (Iraq) regulations not fit sometimes with Erbil environment, they are still partial and not comprehensive and integrated. And the proposed integrated building regulations for KRG by UNHABITAT (2016) have not been adopted yet by the MoMT.
- **E-regulation website is still just an information portal:** The KRG supported by international donors (e.g. USAID, UNCTAD), has launched a website for the "e-Regulations Erbil" as a guide platform of development control information. However, it seems that the website is not well-recognized among relevant offices. And it has not been developed yet toward the desirable establishment of the e-permission system including interactive submission by digital application document system for building permits.

(3) Land management system

- **Inevitable common framework and management mechanism among relevant authorities**: The limited land resource in the urban area brings naturally competitive conditions in economic use, environmental significance, living places, etc., in association with relevant authorities' interventions. For effective and harmonized land management, a common framework with the same goal and cooperative mechanism (e.g. land policy, administrative protocol or regulations for coordination) among relevant authorities would be required.
- **Necessary beneficial land allocation mechanism as valuable urban land assets:** One of the important roles of urban administration and management is to return urban development profits to citizens equitably for urban services quality, and living environment betterment or reduction of administrative costs, etc., as possible as they can. In consideration of this role, land allocation with free-charge release to the private sector needs to reconsider other systems to maximize land assets value through cross-subsidy mechanisms such as financial return for a land transaction, obligation of affordable housing provision, etc.
- **Necessary mindset of new urban lifestyle and its policy toward dense settlement:** Single-house with a land plot is the predominant lifestyle of Erbil citizens, where land demand for single-house requires more agricultural lands and natural environmental areas unless their lifestyle is changed. Multi-story housing or collective housing as medium-density housing in combination with land title deeds for owners is necessary to be promoted by policy formulation and legislation development.

(4) Other legislative instruments to support urban management

- **Insufficient financial source delivery in infrastructure provision for urban settlements:** After the allocation of lands to individual house owners in accordance with subdivision plans, some houses have been constructed without access roads, infrastructure, and urban services. According to the officer of the Sub-municipality, infrastructure provision will not be provided till 30% of occupation out of the total lots in the subdivision area due to insufficient budget. A minimum budget for the provision of infrastructure should be acquired and indispensable as minimum living conditions.

Ineffective data information management for urban development: Sufficient and appropriate urban information will be one of the essential tools to secure rational and scientific planning analysis and urban service to the citizen. There are several issues of urban information in Erbil where lack of data sharing, non-digital data and information, old-dated and scattered documents are observed.

1.3.2 Challenges to institutional framework

(1) Ineffective urban planning institutional arrangements

- Due to having no clear demarcation of roles and responsibilities, institutions often find themselves facing problems in resolving urban planning issues. As a result, various committees are formed on a regular basis to tackle issues and find reasonable solutions. However, this usually results in slow processes.
- Lack of cooperation between relevant stakeholders leads to misunderstanding of development intentions that in turn results in ineffective urban management and waste of resources. Thus, coordination between ministries at the central level must be improved.
- No regional planning or a regional master plan might also be a reason for the lack of cooperation between authorities at the central level. Thus, developing this idea could help improve overall cooperation and create a clearer vision for the government, and ministries specifically.
- Lack of urban development monitoring control regularly leads to encroachments and uncontrolled development.

(2) Overlapping of responsibilities among stakeholders

- Directorates are basically instructed by relevant ministries to deliver responsibilities, however, the governorate office authority within a governorate has the power to interfere and decide certain issues which often leads to conflict and confusion amongst relevant stakeholders, often resulting in contradiction of procedures and decisions.

(3) Challenges to decentralization

- The KRG has made progress in implementing decentralization in recent years. However, there are still challenges to overcome, including the need for increased capacity building and training for local governments, as well as improved coordination and cooperation between central and local authorities.

(4) Lack of information sharing between stakeholders

- There is no centralized system such as a GIS center among stakeholders for information sharing. This results in ineffective coordination on land management and smooth development procedures.
- All documents and procedures are paper-based, consequently leading to bureaucracy, routine, and inaccuracy.

(5) Lack of specialized staff to manage urban planning issues

- Most of the staff responsible for managing and processing urban planning tasks are engineers and architects. There is a clear lack of diversity and skill to work on understanding and resolving complex and comprehensive urban planning issues.

1.4 Roadmap for Urban Management Improvement

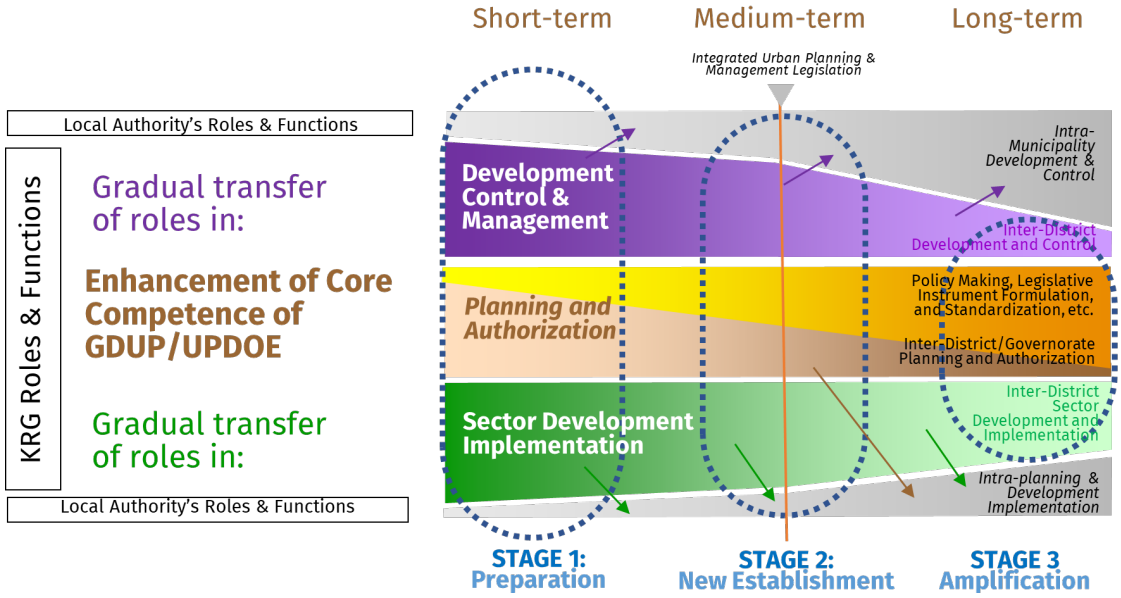
1.4.1 Improvement Policies & Measures towards MP Implementation

Improving the quality of urban management in Erbil requires a comprehensive institutional policy formulation aimed at implementing the new strategic orientations of the Erbil 2050 MP through an appropriate legislative environment, professional development of management and administrative governance. A holistic institutional arrangement is the key to improving urban management in terms of quality urban management and control measures, as well as improving the organisational system to address the weak urban management conditions at present. The following describes the improvement policy, the framework for implementation measures and the roadmap for improving urban management.

(1) Essential goal toward effective urban management improvement for MP implementation

1) Gradual improvement under the decentralization policy

Although Vision 2030 describes regional priority 7 (governance and rule of law) for the establishment of a decentralised system, decentralisation in the Kurdish region is still a long way off (this term is not in the constitutional text). However, there is no doubt that it is the local authorities, particularly in the field of urban planning and management, that can take into account the local context in planning and quickly address the various urban problems that arise on the ground. Therefore, for the effective implementation of the MP Erbil 2050, it is desirable to establish and expand their mandate gradually and steadily through the evolving urban management structure, while the urban management capacity of the local authorities is strengthened through the support and assistance of higher authorities.



Source: JICA Project Team

Figure 1.4.1 Gradual Improvement for Urban Management for Erbil 2050 MP Implementation

2) Desirable core competence of GDUP as central administration in urban planning and management for the Kurdish Region

The General Directorate of Urban Planning (GDUP) of the Kurdish Regional Government has various mandates, including the formulation of a master plan for all cities and municipalities in the region as local level urban management, where the current administrative status may imply insufficient local authority capacity to prepare an appropriate plan. In line with the aforementioned desirable directions of devolution of urban management to local authorities, the following core competencies of the GDUP as examples could be strengthened and prioritised for the gradual effective urban planning and management in the Kurdish Region.

- Policy and strategy making in urban planning and management in the region
- Preparing draft legislative instruments (law, decree, order, instruction, regulations) for urban planning and management
- Establishing planning standards, norms and guidelines in urban planning and management for the region
- Significant plan formulation at level of the regional importance (e.g. regional spatial development framework, thematic sector plans for contemporary urban agenda, etc.)
- Capacity development program for local authorities and establishment of registration system of urban planning and management professionals

(2) Improvement policies on urban planning and management and its implementation

In line with the direction of long-term decentralisation direction, three policies for improving the current urban planning and management system in Erbil for effective implementation of the MP can be set.

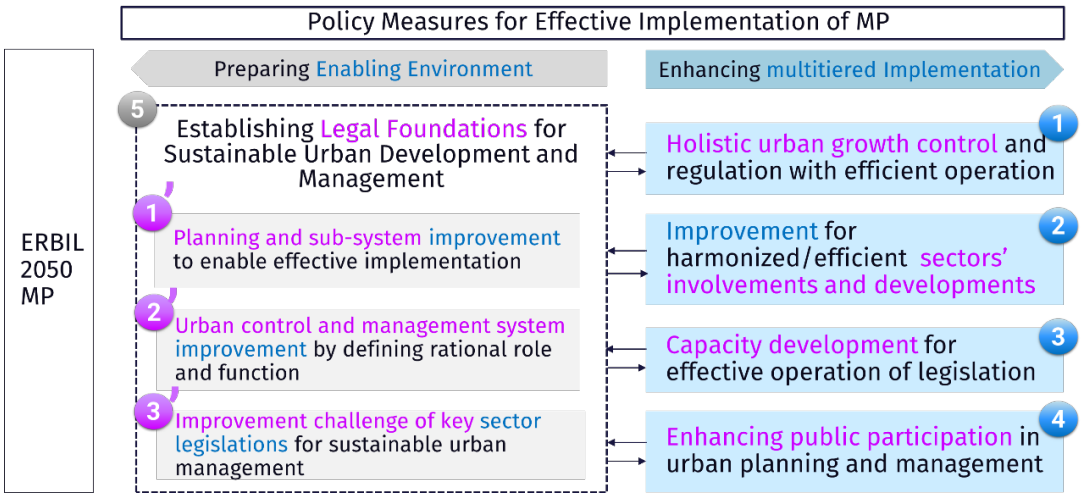
- Enhancing multi-tiered implementation measures and their improvement toward sustainable urban development and management
- Preparing an enabling environment for effective implementation of urban control and management through institutional improvement (legal foundations)
- Taking gradual improvement urban control and management system toward effective implementation mechanism Incremental institutional improvement toward effective implementation by local authorities in future

(3) Policy measures for effective urban planning and management

When the strategic orientations of Erbil2050MP are materialized on the ground, policy measures plan should address improvement policies of 1) enhancing multi-tiered implementation measures, 2) Preparing an enabling environment for effective implementation of urban control and management through institutional improvement (legal foundations). Five measures are presented as ways of materialising in the aforementioned improvement policies for urban planning and management as shown in below and Figure 1.4.2.

It should be noted that improvement of planning system could be one of the considerable measures for effective implementation, especially for detailed plan or other sector plan formulation, because a unsuitable plan without well considerations on existing socio-economic conditions and physical/environmental conditions could make inappropriate implementation.

- Holistic urban growth control and regulation with efficient operation
- Improvement for harmonized/efficient sectors' involvements and developments
- Capacity development for effective operation of legislation
- Enhancing public participation in urban planning and management
- Establishing legal foundations for sustainable urban development and management



Source: JICA Project Team

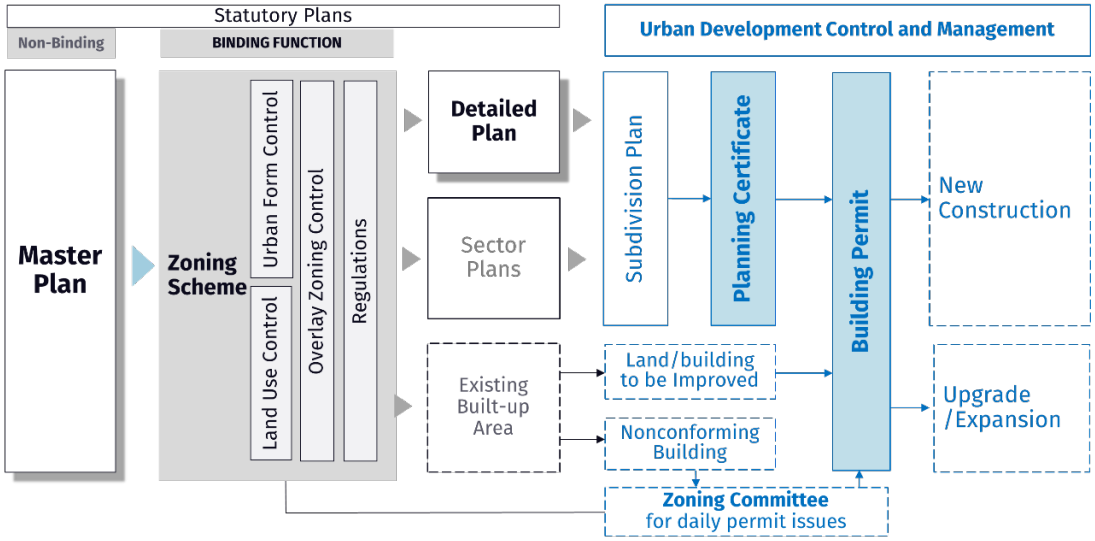
Figure 1.4.2 Policy Measures for Effective MP Implementation

2) Holistic urban growth control and regulation with efficient operation

The current status of urban development has been led by sectoral authorities such as infrastructure, economic development and investment without appropriate sectoral blueprints based on the previous master plan (Erbil 2030 MP) and sufficient coordination between sectoral implementation. On the other hand, the current increase in high-rise development may have a negative impact on local capacity to provide infrastructure and public services.

Although the detailed plans have played a key role in organising urban development as an aerial urban development measure of Erbil 2030 MP, without any binding power to guide building form specifically apart from general regulations of residential and non-residential building within Municipal boundary. To address these issues, certain urban development management measures need to be reorganised and improved through the introduction of integrated legislation.

As one of the most important measures for urban control, the development permit system in Erbil has not been effectively implemented, not only due to insufficient regulations (e.g. land/building use regulations) or complicated permit procedure (74 steps), but also due to the lack of an aerial control zoning system. The introduction of a zoning system as a platform for urban management would play an effective role in integrating sectoral development and permit systems.



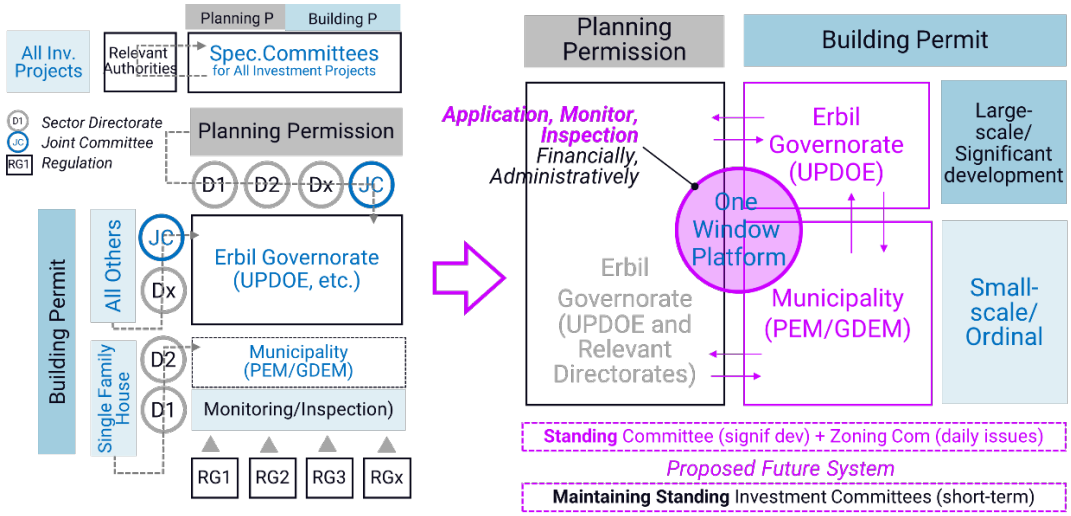
Source: JICA Project Team

Figure 1.4.3 Proposed Holistic Urban Growth Control and Regulation with Efficient Operation

Even if a zoning system is introduced, it would be difficult for it to be effective unless the inefficiency of the current development permitting system is improved. The current development permitting system is complicated and presents many obstacles to the efficient operation for development permits.

Typical issues include the existence of two development permit systems (1: licensing by UPDOE and local governments, and 2: licensing mainly by the Investment Board for investment projects), while the jurisdiction of local authorities in the UPDOE+PEM-GDEM licensing system is limited to only single-family house only. Taking into account the current permit system, the following improvement is proposed in line with the direction of decentralisation policy.

- The role in building permit can be shared among UPDOE (Governorate) and local authorities (PEM and GDEM) by the role for large-scale or significant construction works by UPDOE and all types of small-scale constructions to PEM and GDEM work.
- The planning permission work could be maintained by the current system through UPDOE, of which assessment of a planning application requires wider area planning consideration including possible necessity to coordinate adjacent areas development with high technical skill assessment.
- Coping with current insufficient monitoring system and cumbersome procedure of development or construction application and appraisal, a one window platform establishment can be proposed as common organisation shared by relevant authorities financially and human resources.
- Two standing committees are proposed by a planning committee utilizing the existing legislation but dealing with only regional significant development or development with possible negative impacts, and by a zoning committee to discuss and validate daily and large volume applications' assessment if there are some issues or conflicts. The existing investment committee may be maintained with a central political instrument.

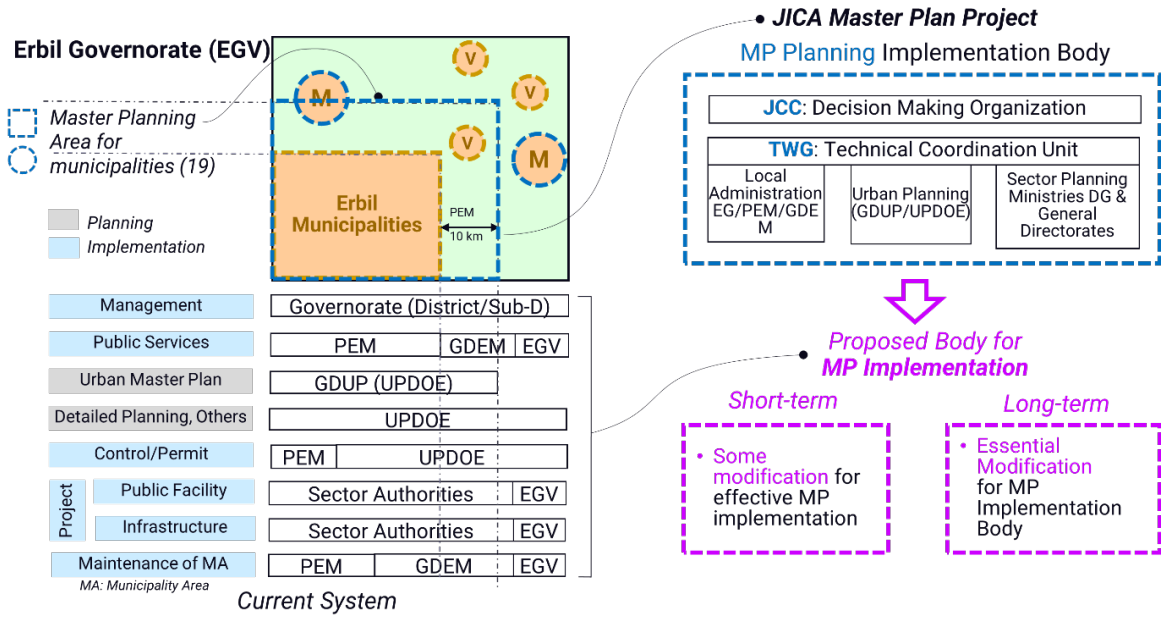


Source: JICA Project Team

Figure 1.4.4 Proposed Development Permit System Improvement for Effective Development Control

3) Improvement for harmonized/efficient sectors' involvements and developments

The Record of Discussion between the KRG and JICA provides for the continued operation of the JCC as the coordinating body for this master plan formulation project. However, this organisation does not meet the organisational requirements to be a temporary organisation for planning purposes and an implementation system according to the law (Law. No. 6). As some difficult institutional conditions are observed, an implementation system in accordance with the legal requirement can be achieved in the long term, while some modifications taking into account the current implementation system can be proposed for short-term improvement.



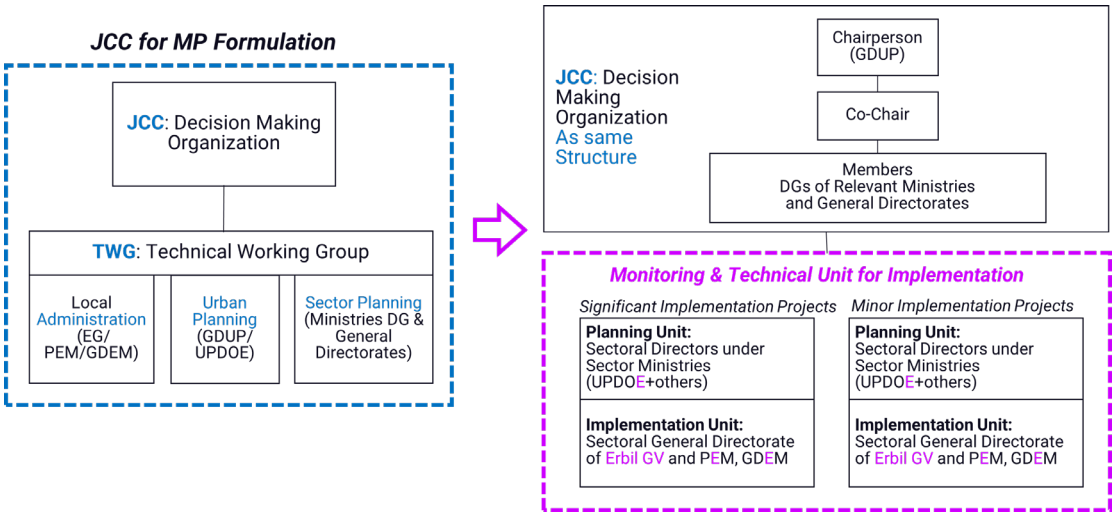
Source: JICA Project Team

Figure 1.4.5 Current Implementation System with Relevant Stakeholders and Proposed Two Stage Improvement for Succession of JCC

Shot-term Improvement

The improvement measures on the continued operation of the JCC for the short-term is proposed by minor modification based on the following considerations.

- The organization for decision-making body for MP implementation management is maintained by the same structure of the existing JCC for MP formulation as the Standing Committee.
- For the implementation, the function of monitoring and technical evaluation should be attached to the decision-making organization with certain tasks, staffing and budget to report the monitoring activities for MP implementation.
- The attached organisation for monitoring and technical validation of implementation, two groups for 1) significant implementation projects and 2) small or minor implementation projects are established consisting of two technical teams by planning unit (UPDOE and other sector directorates) and implementation unit (Erbil Governorate, PEM and GDEM).



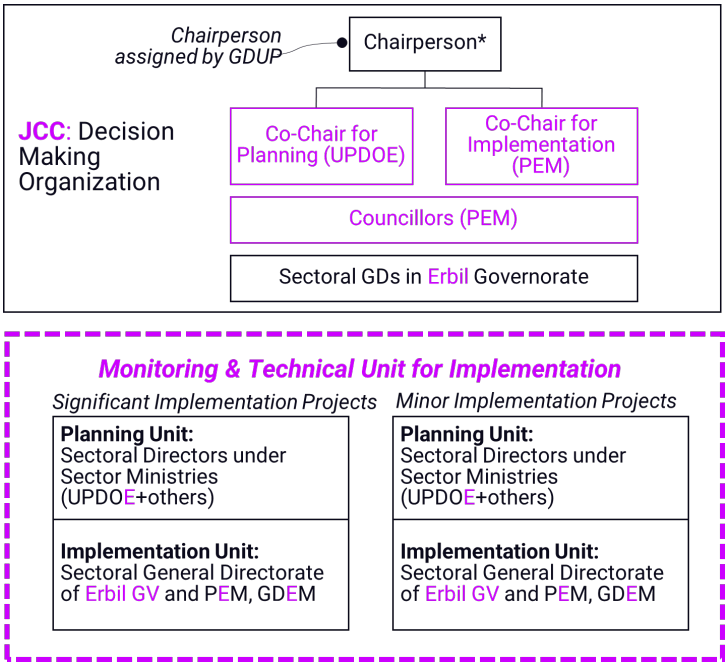
Source: JICA Project Team

Figure 1.4.6 Proposed Modification of JCC Organization as Short-term Improvement for Standing MP Implementation Coordination Body

Long-term Improvement

The improvement measures on the continued operation of the JCC for the long-term is proposed by an essential measure taking into account the required implementation management organization stipulated in law no.6 based on the following considerations.

- The decision-making organisation as the standing committee for MP implementation management composes of key members from the essential implementation organization added by Co-chair for implementation (PEM) and Co-Chair for planning (UPDOE) and PEM councillors.
- The monitoring and technical evaluation unit are attached also to the decision-making organization with certain tasks, staffing and budget to report the monitoring activities for MP implementation.
- The attached organisation for monitoring and technical validation of implementation is composed by the same function and structure with the short-term case.

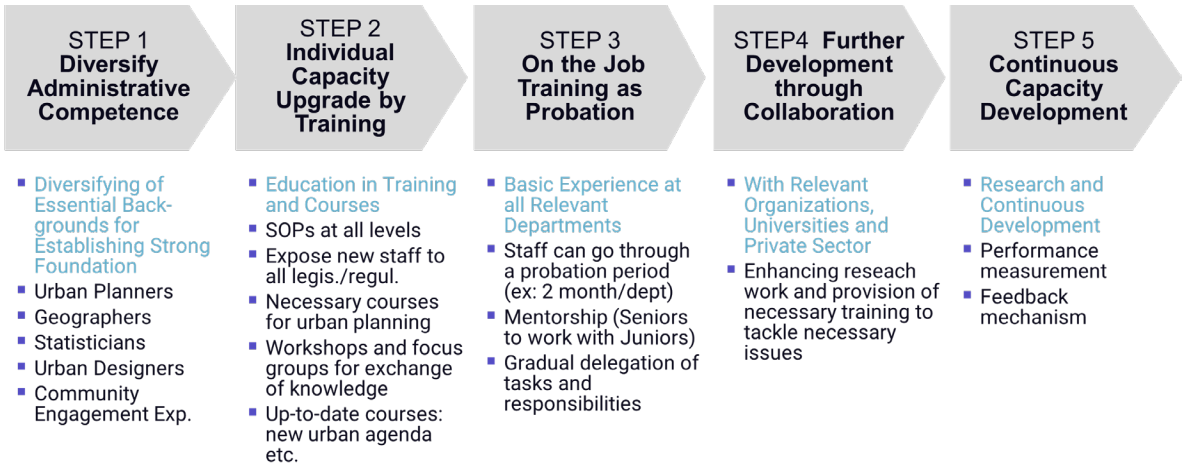


Source: JICA Project Team

Figure 1.4.7 Long-term: Proposed Body for MP Implementation as a Standing Erbil Urban Management Committee

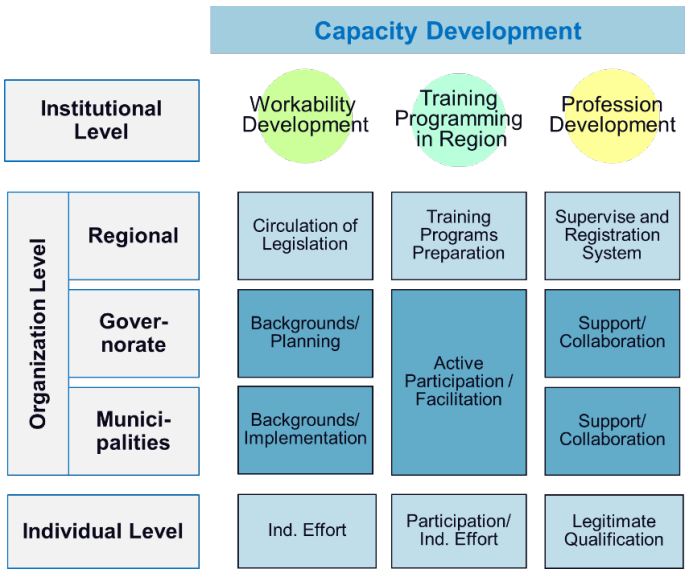
4) Capacity development for effective operation of legislation

The public officials responsible for the operation and management of urban development and control are key actors in the implementation of the Master Plan, who should have appropriate understanding, knowledge and sufficient skills to adapt the necessary measures, especially after the current institutional system are improved and strengthened. Therefore, specific development programmes would be required to strengthen their capacity and would also contribute to the improvement of institutional and organizational structures and systems that support policy implementation, such as governance, management and communication.



Source: JICA Project Team

Figure 1.4.8 Conceptual Diagram for Staged Capacity Development Program



Source: JICA Project Team

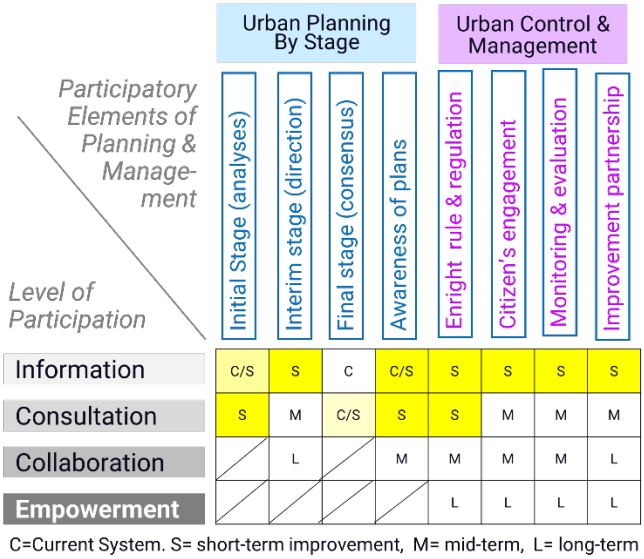
Figure 1.4.9 Conceptual Diagram for Staged Capacity Development Program

5) Enhancing public participation in urban planning and management

Effective urban management for MP implementation can be achieved also through well-organised administrative governance and people's understanding and cooperation in its implementation. Therefore, effective communication combined with sufficient outreach to the target stakeholders and the general public become inevitable elements for the implementation of urban management. Communication and outreach can also help to solicit feedback and input from stakeholders. Furthermore, communication and outreach can promote the visibility and recognition of the policy, as well as generate support and advocacy for the policy.

In Erbil today, it is expected that the Regional Government's readiness to provide citizens with urban planning information and participatory planning will still take time. Therefore, the degree of participation of citizens and the private sector in urban planning and urban management should be implemented in stages.

Figure 1.4.10 shows the proposed programme for citizen and private sector participation in urban planning and management according to two aspects (degree of participation and short, medium and long phased initiatives). And Table 1.4.1 shows referrable examples for participatory activities in accordance with the level of participation.



Source: JICA Project Team

Figure 1.4.10 Conceptual Diagram for Staged Capacity Development Program

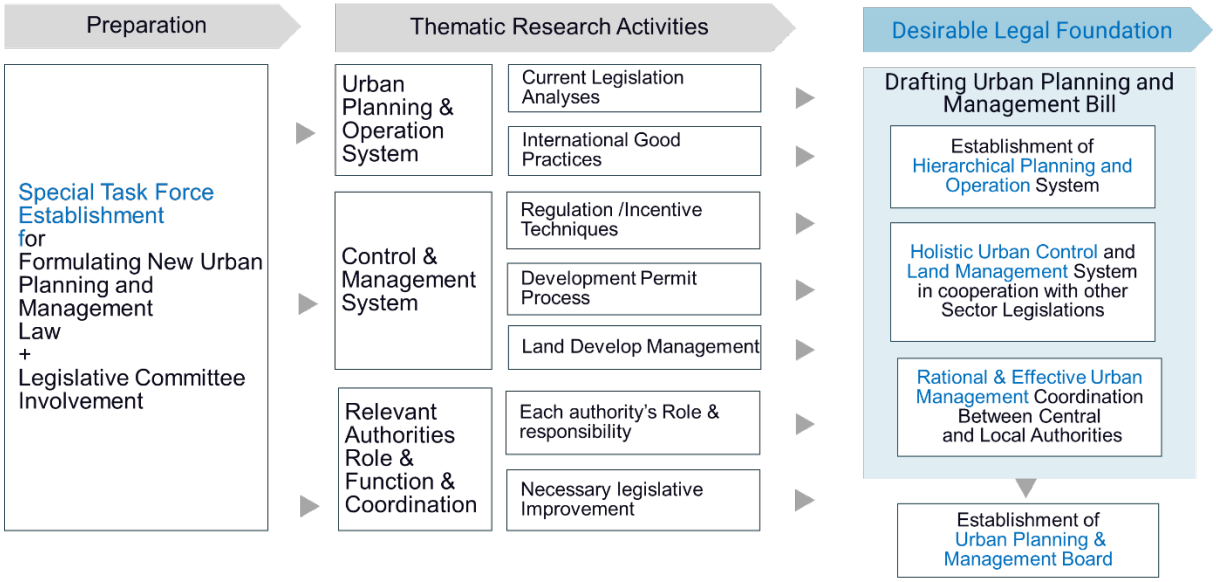
Table 1.4.1 Examples: Public Participation for Urban Planning and Management

Level of Participation	In Urban Planning	In Urban Control & Management
INFORMATION	• Public announcement by media (IT-s) • Urban issues survey (IT-s) • Website public relation (all-s)	• Flyers or website for urban control • Campaign program for awareness by media or events (URN)
CONSULTATION	• Community meeting for solution (IN-s) • Website public relation (all-s) • Electric pole / policy choice survey (IN-s) • Stakeholders' involvement in SEA (IN-s)	• Urban issue help call centre (ME) • Advocate expert dispatch to communities for local urban issues (ME)
COLLABORATION	• Citizen's Forum (all-s) • Specific local area improvement proposal by citizen to be incorporated into a plan(IN-s)	• Early warning post by local peoples for flood identification (ME) • Park maintenance services contracted by CBO / NGO (CE)
ENPOWERMENT	• Citizen's local plan establishment (all-s) • Involvement of a citizen's action plan into a implementation plan into a official plan	• Citizen's Trust Foundation for Cultural/Natural Assets Protection(IP) • Private-Sector Forum for investment opportunity (IP) • Local referendum for a project implementation (ME)

Note: IT-s=Initial stage, IN-s= Interim stage, F-s= Final stage, all-s = all stages from initial to final, URN=understand Rule & Norm, CE=Citizen's engagement, ME=Monitoring & evaluation, IP=improvement partnership
Source: JICA Project Team

6) Establishing legal foundations for sustainable urban development and management

The legal foundation underlying urban management must be consistent not only with those related to urban sector, but also with other important legislations related to urban and land management (e.g., property law, investment law, and agriculture-related laws, etc). Effective improvement of urban management cannot be achieved if only one side is improved. A new law for urban planning and management is proposed as one of the legal foundations handing and stipulating the proposed measures in afore-mentioned. In order to draft the new law, the considerations of 1) preparation by establishment of a special task force unit, 2) thematic research activities by the unit for desirable contents of the new, can be taken as shown as Figure 1.4.11.



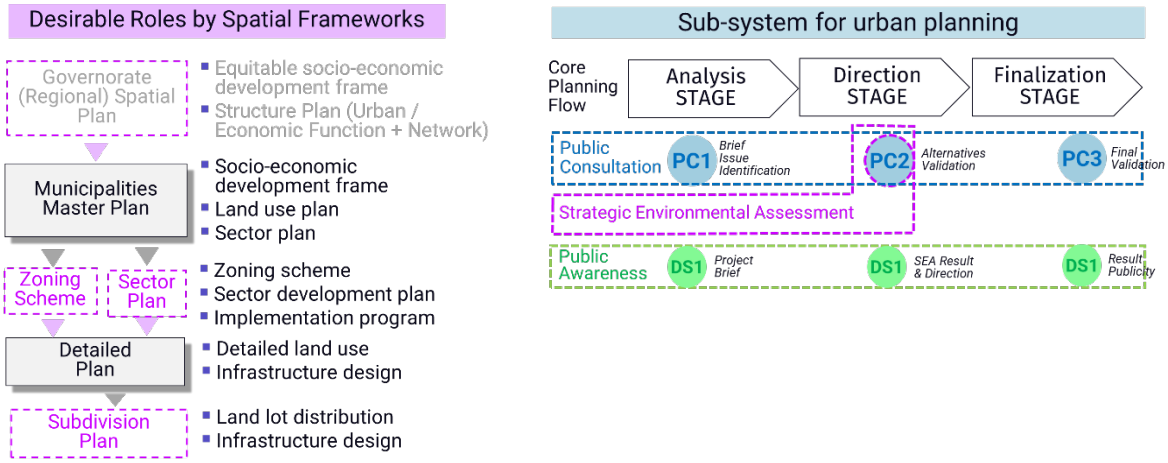
Source: JICA Project Team

Figure 1.4.11 Development Process for Giving Legitimacy for Desirable Urban Planning and Management

Effective planning and sub-system improvement

As discussed in the previous section (Holistic urban growth control and regulation), the current state of physical planning is inadequate in its planning function to guide better project implementation. Improvements are needed not only in zoning to strengthen the constraint function in urban management, but also in sector planning to accurately guide sector implementation, guide appropriate functions in the current detailed planning, etc. The effective planning and sub-system improvement are proposed shown in below items and Figure 1.4.12.

- Establishing "hierarchical statutory planning system" taking into account appropriate planning role and function supporting effective implementation supplemented by "upper spatial development plan" (e.g. Erbil Governorate Spatial Development Framework), "zoning scheme", sector plans by other authorities, and subdivision plan by private sector to be approved.
- Strengthening a planning formulation by statutory planning sub-system to be stipulated in legal documents, such as obligatory public consultation by planning phases, mandate assessment by SEA (strategic environment assessment), and public awareness activities.



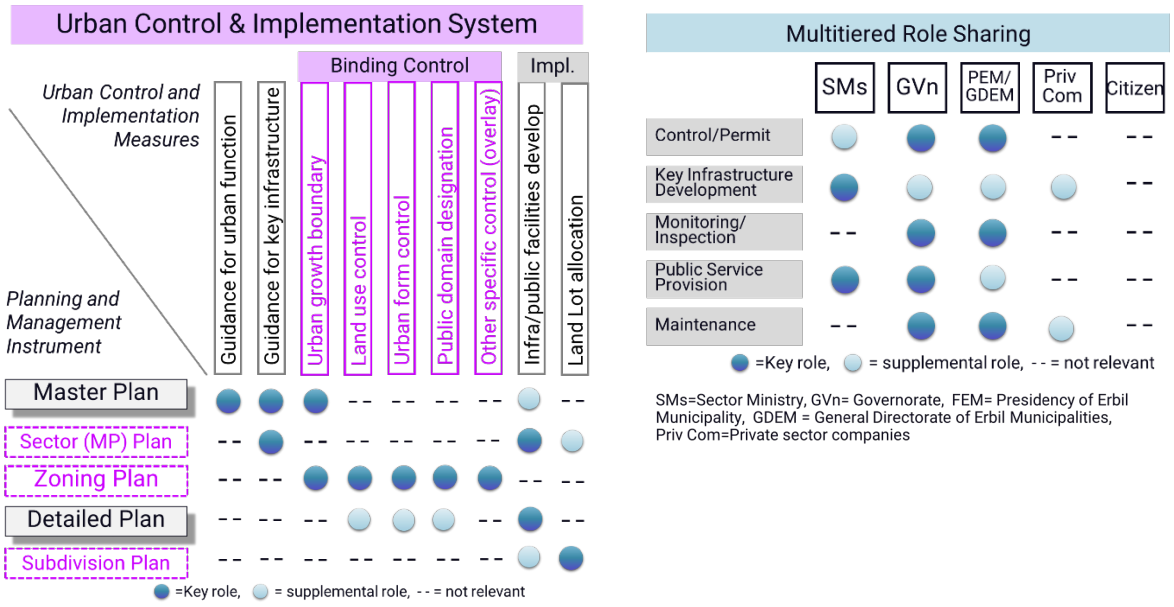
Source: JICA Project Team

Figure 1.4.12 Proposed Improvement in Effective Planning and Sub-system

Urban control and management system improvement by defining rational role and function

For the efficient implementation of urban management in Erbil, it is first necessary to clarify the content of the management (development regulations, etc.) to be stipulated in the planning process that defines it. The hierarchical planning described above should establish the development regulations and other items required at each level.

On the other hand, MP implementation requires not only development regulation, but also the division of roles between sector authorities and their coordination, the location of which needs to be institutionally clarified. Figure 1.4.13 shows the desirable roles in the relevant plans for development regulation and the desirable roles of the relevant authorities in management and maintenance.



Source: JICA Project Team

Figure 1.4.13 Desirable Improvement for Roles in Urban Management by Relevant Plans and Authorities

Improvement challenge of key sector legislations for sustainable urban management

The mainstay of urban development in Erbil today is real estate development through investment projects. Due to the situation in the Kurdish region, significant incentives are given to investment, which is carried out through a special development permit procedure. Some developments are sometimes inconsistent with detailed plans, which is a concern for sustainable urban development, including infrastructure supply capacities. In this context, relevant institutional framework including the Investment Laws to promote investment, need to be improved for coping with sustainable urban development. Although this issue is one of the difficult challenges, the following measures as examples can be introduced to guide sustainable investment for Erbi urban development.

- Introduction of the conditional development with requirements to contribute to sustainable development (e.g. obligatory 20 % floor provision out of total development floors for social/affordable housing provision in one large-scale housing development)
- Promotion of better investors' attraction into Erbil through utilizing ESG investment mechanism who concerns sustainable urban development.

The Erbil2050MP area also involves a lot of agricultural land in the peri-urban areas. In particular, agricultural land spreads outside the jurisdiction of the PEM (Presidency of Erbil Municipality as a municipal administrative agency of Erbil) and outside the PEM administrative area, which means that it is not managed in an integrated manner and is managed and developed by vertical sectoral authorities. And a detailed plan does not have any functional role to maintain agricultural lands to be protected. This institutional weakness should be improved to protect agricultural lands not only for food-security point

of view, but also sustaining green areas for climate resilience. The following measures as examples can be introduced to improve current legislation regarding to agriculture land or another legislation with incentive to give farmers' lands away.

- Strengthening relevant legislations for agricultural land protection with certain incentives for farmers to maintain their agricultural lands
- Reconsidering incentives for farmers' land release, where an agricultural land is identified as potential production area for agriculture.

1.4.2 Road Map for Urban Planning and Management Improvement

(1) Overall road map for proposed programs for urban planning and management in Erbil

The policies and measures for improving urban planning and urban management have been described, partly in line with the phased development, which means that a roadmap is provided. In this section, specific programmes are proposed for each of the aforementioned measures. Table 1.4.2 provides a detailed proposed programme for each of the five improvement policy measures and indicates whether the proposal can be implemented in the existing system or whether a new system is required.

Table 1.4.2 Programs and their Legislative Status for Improvement of Urban Governance Policy Measures

Policy Measure	Proposed Program	Status of Program	
		Under Current Legislation System	Necessary New Legislation
1. Holistic urban growth control and regulation	1.1 Special taskforce establishment for review and analyses toward holistic law and regulations establishment	●	--
	1.2 Legislative improvement toward holistic and effective development control instruments and procedure	◎	●
	1.3 One-window platform establishment of permit application, monitor, inspection of development, construction	◎	●
	1.4 Introducing zoning control system into Erbil	--	●
2. Improvement for harmonized sectors' involvements and developments	2.1 Retrofitting "JCC of MP formulation" to the sector coordination body for "MP Implementation"	●	--
	2.2 Establishing obligatory system for plan sharing of each sector plan (incl. actions) of relevant authorities	◎	◎
	2.3 E-urban information centre development as common data platform among relevant authorities (to public by long-term	--	●
3. Capacity development for effective operation of legislation	3.1 Special taskforce (1.1) as institutional capacity building programs in urban planning and management	●	--
	3.2 Establishing Standard Operating Procedure (SOP) in urban control and management operation	--	●
	3.3 Administrative training program (school) development in urban planning and management	--	●
	3.4 Legitimate Planners Association establishment in association with academic institutions	--	●
4. Enhancing public participation	4.1 Improving Public Disclosure Policy in urban planning and management	◎	◎
	4.2 Establishing online public communication system in administrative services and their grievances	--	●
	4.3 Improving participatory planning process in relevant urban planning	◎	◎
5. Establishing Legal Foundations for Sustainable Urban Development and Management	5.1 Special taskforce (1.1) establishment for a new legislation on urban planning and management	●	--
	5.2 Research and development on urban planning system and control management system	--	●
	5.3 Drafting a new urban planning and management bill and all administrative procedural works toward legislation	●	●
	5.4 Promulgation and dissemination of the law	◎	◎

	5.5 Establishment of Urban Planning and Management Board	--	●
	5.6 Establishment of Reginal/Governorate Spatial Framework	--	●

Legend: ● = viable under current legislation, ◎ = partially viable, -- = not relevant
Source: JICA Project Team

Table 1.4.3 shows the proposed timing of action for each short, medium and long phase of the programme for each of the five improvement policy measures.

Table 1.4.3 Implementation Program by Policy Measures for Urban Planning and Management

Policy Measure	Proposed Program	Key Authority	Status of Program		
			Short	Medium	Long
1. Holistic urban growth control and regulation	1.1 Special taskforce establishment for review and analyses toward holistic law and regulations establishment	Multi-authorities	▬		
	1.2 Legislative improvement toward holistic and effective development control instruments and procedure	MoMT	▬	▬	▬
	1.3 One-window platform establishment of permit application, monitor, inspection of development, construction	Multi-authorities	▬	▬	▬
	1.4 Introducing zoning control system into Erbil	MoMT	▬	▬	▬
2. Improvement for harmonized sectors' involvements and developments	2.1 Retrofitting "JCC of MP formulation" to the sector coordination body for "MP Implementation"	Multi-authorities	▬	▬	▬
	2.2 Establishing obligatory system for plan sharing of each sector plan (incl. actions) of relevant authorities	Multi-authorities	▬	▬	▬
	2.3 E-urban information centre development as common data platform among relevant authorities (to public by long-term	MoMT	▬	▬	▬
3. Capacity development for effective operation of legislation	3.1 Special taskforce (1.1) as institutional capacity building programs in urban planning and management	Multi-authorities	▬		
	3.2 Establishing Standard Operating Procedure (SOP) in urban control and management operation	MoMT	▬	▬	▬
	3.3 Administrative training program (school) development in urban planning and management	Multi-authorities	▬	▬	▬
	3.4 Legitimate Planners Association establishment in association with academic institutions		▬	▬	▬
4. Enhancing public participation	4.1 Improving Public Disclosure Policy in urban planning and management	Multi-authorities	▬	▬	
	4.2 Establishing online public communication system in administrative services and their grievances	Multi-authorities	▬	▬	▬
	4.3 Improving participatory planning process in relevant urban planning	MoMT	▬	▬	▬
5. Establishing Legal Foundations for Sustainable Urban Development and Management	5.1 Special taskforce (1.1) establishment for a new legislation on urban planning and management	Multi-authorities	▬	▬	▬
	5.2 Research and development on urban planning system and control management system	Multi-authorities	▬	▬	▬
	5.3 Drafting a new urban planning and management bill and all administrative procedural works toward legislation	MoMT	▬	▬	▬
	5.4 Promulgation and dissemination of the law	MoMT			▬
	5.5 Establishment of Urban Planning and Management Board	Multi-authorities	▬	▬	▬
	5.6 Establishment of Reginal/Governorate Spatial Framework	MoMT	▬	▬	▬

Legend: ▬ = main development phase, ▬ = partially implementation or continuous program operation
Source: JICA Project Team

(2) Specific road map toward establishment of comprehensive improvement for urban management

As explained in the previous section, there are limitations to improving urban planning and urban management within the current legal system, and it is important to take drastic measures to address these, i.e. to establish laws governing them. This section describes a roadmap for establishing such a system, in line with the ultimate goal of decentralisation.

1) Phased improvement with a long-term view toward decentralised urban management

- **Preparation stage through KRG`s initiative**: As a preparatory period in a short term, the central administrative body (KRG) in charge of drafting the legal system identifies existing systems problem and issues and examines advanced cases of other countries experiences in order to establish the basic legislations regarding to all relevant sector legislations to be harmonized and compatible in terms of well-organised urban management.
- **New establishment stage as administrative delegation stage:** Based on the issues identified during the preparatory stage, a comprehensive 'Urban Planning and Management Bill' will be developed, aiming to improve the efficiency of the current urban management system and establish an urban planning and management law through necessary discussions and procedures, which all relevant authorities from the central to local level, the role and function could be stipulated to delegate powers to local authorities.
- **Enhancement stage for establishment of balanced urban management system:** Through the trial operation of the urban management system among relevant authorities (central and local) based on the promulgated Urban Planning and Management Law, institutional improvements could be made to various issues and problems in actual administrative operations. On the other hand, the capacity building programmes would be strengthened to improve the knowledge and skills of those involved so that the new system can be effectively operated and managed, thereby establishing a certain level of desirable urban management system at this stage.

2) Comprehensive improvement of urban management legislations

The legal system underlying urban management must be consistent not only with those related to urban sector, but also with other important legislations related to urban and land management (e.g., property law, investment law, and agriculture-related laws, etc). Effective improvement of urban management cannot be achieved if only one side is improved. In this section, this section describes the proposed improvements that are required to improve the legal system with incremental improvements.

(a) Planning and management legislation review and drafting (Preparation- /Initial - Stage)

- ✓ The applicability of a model zoning scheme would be studied and elaborated, taking into account compatibility to current relevant legislations, to formulate a new integrated urban law (planning and management) establishment.
- ✓ Basic legislative studies for the formulation of a new urban planning and management law would be carried out by a special task force unit involving multi-sectoral legislative experts, taking into account the hierarchical planning system in the region and comprehensive urban management measures (zoning, regulation, licensing, competent authorities, etc.).

(b) Improving and urban regulations and permit system (New Establishment-/ Initial-Stage)

- ✓ The applicability of international standards and regulations for urban control and management would be studied and elaborated not only to localise them but also to cope with contemporary global issues into Kurdish Region and their urban centres including Erbil, taking into account harmonisation with key relevant development rules and regulations, as a part of a new integrated urban law (planning and management) establishment.

- ✓ This improvement in urban regulation should be part of an expected zoning system introduction that would incorporate land/building use, urban/building forms and urban volume into the regulations.
- ✓ The current complicated and paper-based permitting system would be improved to establish a rational and efficient permitting system towards delegation of relevant authorities taking into account the introduction of ICT technologies such as the e-permitting system.

(c) New integrated urban law establishment (New Establishment- / Transfer- Stage)

- ✓ In line with institutional arrangement for delegation of relevant authorities for urban planning and management, a new integrated urban planning and management bill would be formulated through necessary validations by relevant authorities, and deliberated in the Kurdistan Parliament toward the promulgation of it.
- ✓ The new urban planning and management law could involve the key contents of 1) urban and regional planning framework, system and administration, 2) required elements of hierarchical plans, and approved process, authorities and publicity with impact assessment, 3) planning rules and provisions, 4) land development and public domain management, 5) subdivision management, 7) urban management, modality and sanctions, 8) general rules, zoning and regulations, 9) permit system and authorities.

(d) Innovative urban control system development (Establishment- / Initiative- Stage)

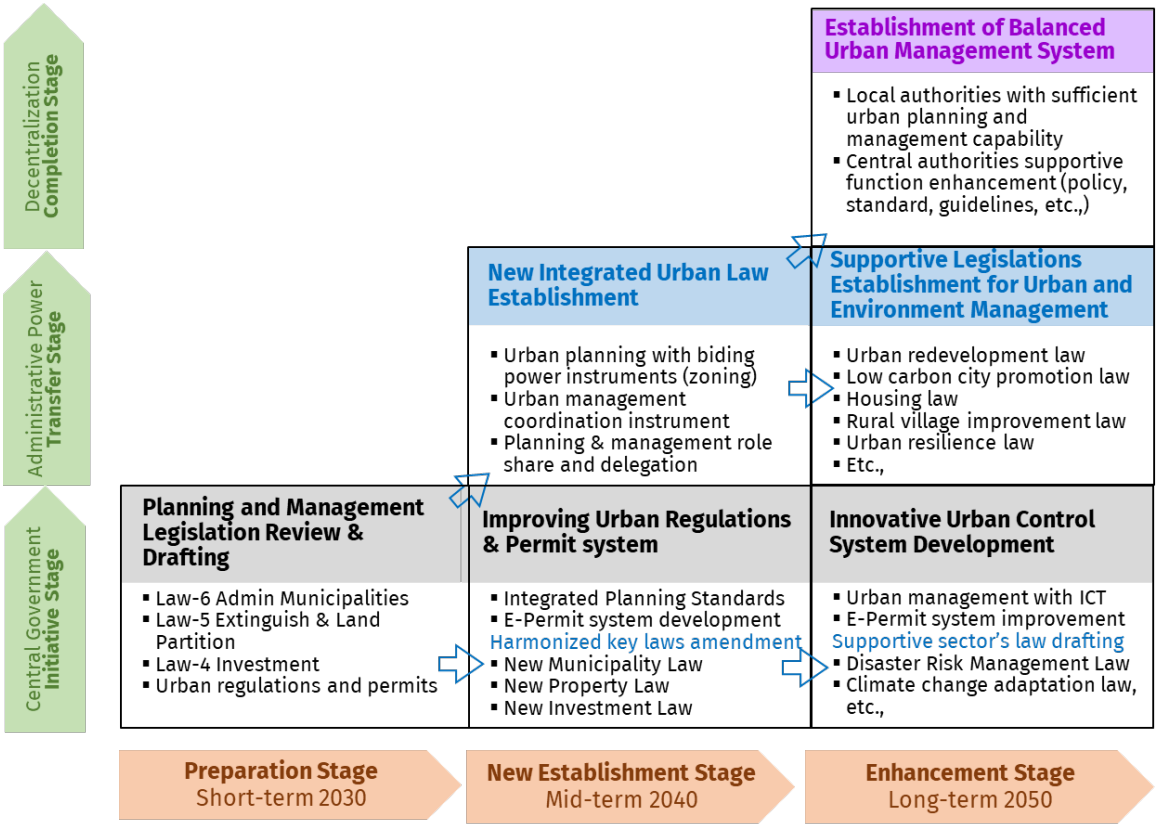
- ✓ At this stage, urban control and management could be developed effectively in innovative ways supported by IC technology, considering 1) extension of information services to personal devices for effective urban management to promote citizen cooperation, 2) user-friendly operation of permit system (full-scale e-permit), 3) efficient and smart operation and management of public utilities and facilities through ICT, and 4) early awareness information services through ICT to address urban resilience (disaster risks, climate change, etc.).
- ✓ After the expected enactment of the Urban Planning and Management Law, it is important to develop the legal systems of the other sectors involved in development management that could address contemporary urban issues. The laws for urban resilience to address natural disaster risks and climate change issues, and redevelopment laws to revitalise inappropriate settlements and economic activities (e.g. industrial area, CBD, TOD) could be developed and drafted by relevant authorities, while maintaining consistency with the Urban Planning and Management Law, and strengthening conventional laws such as land laws, agricultural laws, and laws and systems to ensure the preservation of the natural environment and historical heritage.

(e) Supportive legislations establishment for Urban and Environment Management (Establishment- / Transfer- Stage)

- ✓ The bills (draft laws) that could be drafted in the first stage would hopefully be adopted and promulgated through a legitimate process, while the capacity of the relevant administrative officials to deal with them would be strengthened, and the regular sensitisation programme for citizens on the new laws would also be carried out.
- ✓ Places with urban problems, where effective action has not been taken in the past, could be target areas for implementing measures under the new laws. After formulating appropriate plans, they would be monitored and evaluated to improve their implementation through the promulgation of orders or instructions.

(f) Establishment of balanced urban management system (Enhancement- / Completion- Stage)

- ✓ At this stage, local authorities, as the frontline players in urban planning and urban management, exercise their powers under the laws and its operation. There, sufficient personnel and systems are in place for operation and management, and as they build up a track record, they constantly improve the system (e.g. bylaws) in line with the situation on the ground. The planning and management local authority is positioned in the relevant law and becomes a legitimate administrative authority within the self-government.
- ✓ Meanwhile, the central government will create measures for more effective and efficient operation of urban planning and urban management by local authorities, strengthen and improve planning standards, etc. common to all municipalities, and disseminate these through guidelines and other means.



Source: JICA Project Team

Figure 1.4.14 A Road Map for Urban Management Improvement for Erbil

CHAPTER 2
CAPACITY BUILDING

2.1 Baseline Capacity Assessment of Target Organizations

Urban planning organizations play a critical role in shaping the development of cities and their communities. To be effective, they must have the capacity to carry out their mission and achieve their goals. This chapter assesses the capacity of the General Directorate of Urban Planning (GDUP) in the Ministry of Municipalities and Tourism (MoMT) of KRG. The capacity building approach aims at strengthening their skills in formulating, updating, and implementing urban master plans.

This assessment of Baseline Capacity mainly focuses on analysing existing individual and organizational capacities to better understand their strengths and particularly weaknesses to identify needs and areas for improvement. Structured interview survey SIS and questionnaire survey QS were conducted with officials from GDUP to have a better understanding of their urban planning skills and abilities.

2.1.1 Baseline Organizational Capacity

(1) General Directorate of Urban Planning (GDUP) as the main Counterpart Agency

The GDUP, under the umbrella of the by the MoMT, oversees the preparation, supervision as well as approval of Urban Development Master Plans in KRG (see Section 1.1). GDUP also plays a crucial role in drafting general urban planning policies at the regional level with the participation of relevant authorities. Additionally, GDUP is responsible to supervise and improve the technical works of urban planning by the governorate's directorates.

(2) GDUP departments and their tasks

Based on its organizational chart (see Section 1.2.1), GDUP consists of 3 departments: 1) the Urban and Regional Planning Department, 2) the Study and Research Department and 3) the Land Use Management Department. Under the last department are two 2 technical units: the Surveying and GIS Units. Finally, there are 2 units for internal management affairs: the Administration Affairs and the Archive Unit. Below follows a short description of the departments and units and their tasks:

1) Urban and regional planning department is the most essential department that takes on the core responsibilities of GDUP. Most of the Taskforce members of the Project belongs to this department. Their main responsibilities are:
   - To formulate new urban planning regulations and revise and improve existing regulations;
   - To review requests for the formulation of new master plans as well as studying and deciding on modifications of existing master plans;
   - To review requests on project allocation, master plan modifications, land use changes, and others;
   - To review land allocation for projects within the control buffer area of master plans.

2) Land use management department is responsible for storing information on master plans in general, and more specifically updates, modifications, allocation of projects, and land management related information. It consists of two main units:
   - GIS unit: takes care of storing all spatial information and GIS data on master plans.
   - Surveying unit: responsible for the archive of approved master plans and information on modifications and allocated projects. This unit also has a group of surveyors for field visits.

3) Study and research department reports on the current situation of master plans for cities and towns such as finding information on the number of master plans that need to be prepared or updated.

4) Administration and Archive units are responsible for internal affairs including human resources, official letter archiving and documentation, bookkeeping, accounting, and so on.

2.1.2 Baseline Individual Capacity

To understand the Baseline Individual Capacity of GDUP, i.e. the skills and abilities of their officers, questionnaires were distributed and interviews were carried out with 13 officers including Taskforce members of the Project.

The following are some of their main characteristics:

- The average age of Taskforce members is 42 years old.
- Taskforce members account for 37% of the total number of employees at GDUP.
- 84% have work experience of more than 10 years, and most of them had more than 15 years.
- Their main expertise is architecture (9). Other expertise includes urban planning (1), urban design (1), water resources and infrastructure (1), and mechanical engineering (1). Degrees are mostly bachelor's (6), master's (4), and PhD (1).
- More than 65% of participants have professional working proficiency in English. Others have a basic understanding of English.
- Most of the Taskforce members reported having intermediate to advanced skills in computer applications such as office programs, and CAD. However, the skills were mostly reported between basic and intermediate for GIS applications.
- Some Taskforce members mentioned that they work with all departments interchangeably in addition to their work.
- All participants reported having a desk and a computer for their work, but some are outdated. Additionally, 6 computers were provided by the project team for officers of the target organization.

Taskforce members' participation in external training programs with GDUP:

- More than half of the Taskforce members reported having participated in urban planning courses and training programs such as the UN-Habitat course on "Strengthening Urban and Regional Planning in KRI".
- The aim of these courses and trainings was to better understand the existing planning capacities of KRG and priority planning needs, to establish urban planning units in Erbil Governorate and within Ministry of Municipalities and Tourism and improve the capacity of staff so that they can perform planning duties. The project consisted of a training program and on-the-job learning, as well as carrying out studies.
- GDUP Taskforce members are currently participating in the Dutch VNG organization on a resilience program called LOGORep.
- This program aims to enhance the resilience of local government through small municipalities around Erbil in the field of 'Developing Sustainable and Resilient Cities and Communities'. The policy fields of the program tackle community development, institutional development, local economic development as well as post-conflict reconstruction.
- The broad objective of this program is to improve prospects for post-conflict refugees of neighbouring countries as well as vulnerable host communities by improving the resilience of local authorities. The specific objective is to improve the community's access to basic services and job opportunities.

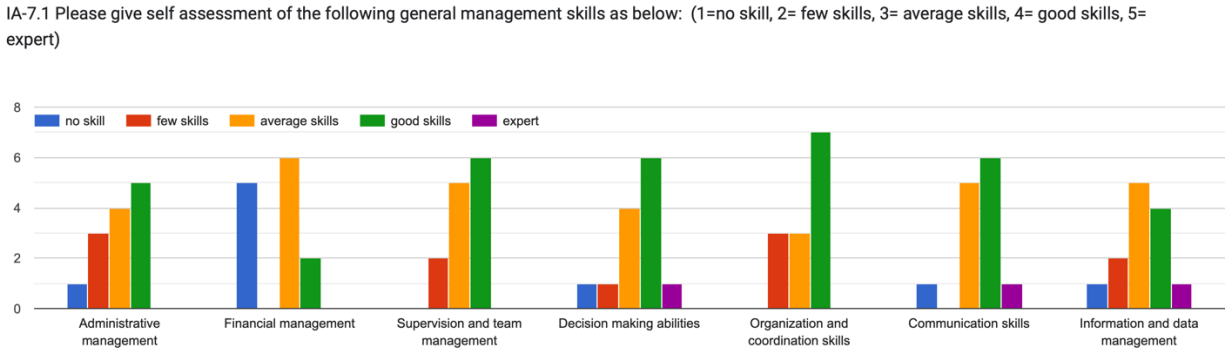
- Officers from GDUP recently joined a one-week VNG training course in the Netherlands regarding the above-mentioned program and visited certain municipalities in order to understand their work and learn about how municipalities tackle planning issues and involve local residents in the process.
- Others reported participating in courses such as comprehensive city planning, sustainable city planning in Latvia, and GIS and CAD courses.

2.1.3 Identification of Capacity Building Needs

To identify capacity gaps, the current individuals from the above-mentioned departments and units were assessed and compared to the expected skills to be acquired during the project. After the project is finalized, Taskforce members are expected to develop and strengthen skills of formulation, update and implementation of urban development master plans. The following are some of the strengths and weaknesses identified through the questionnaire and interviews:

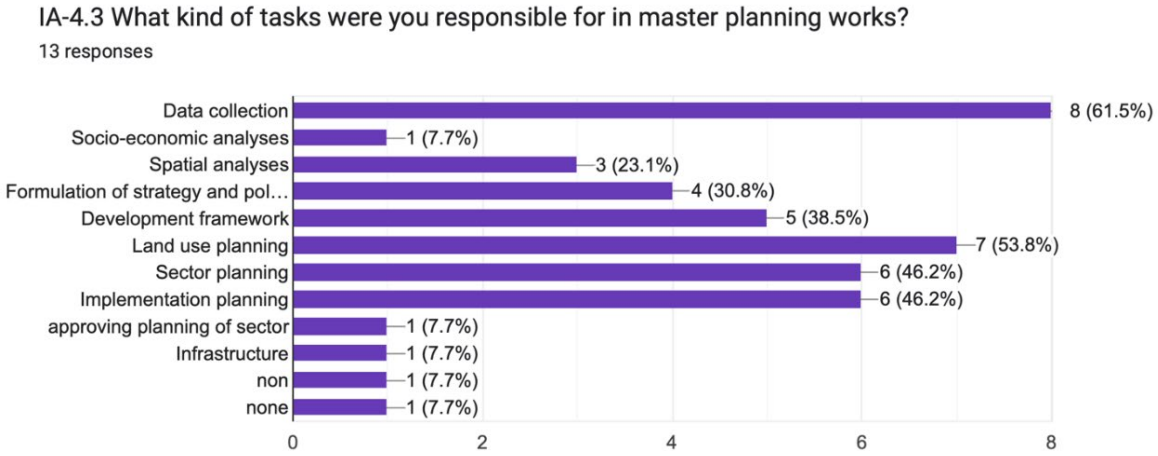
(1) Strengths reported through the questionnaire

- Good overall organization and management skills which are essential for inter-organization relations.



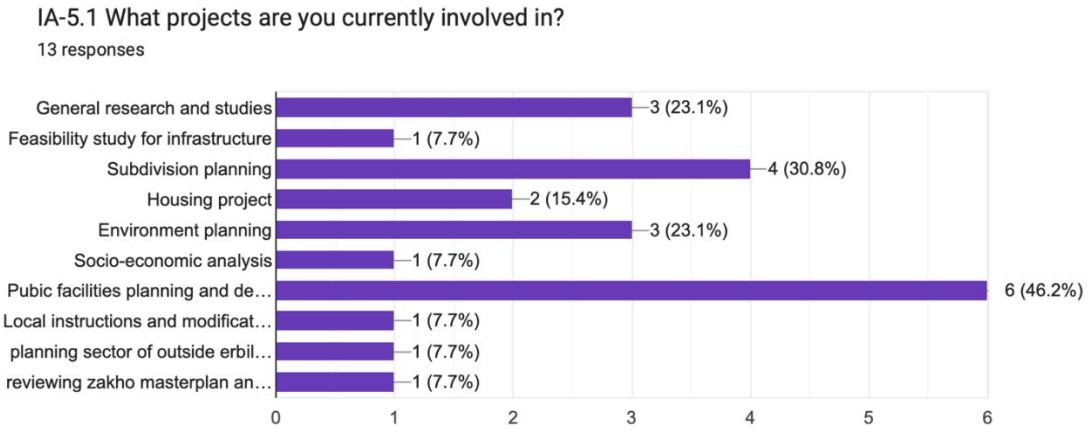
Source: JICA Project Team

- Currently supervising and formulating urban master plans is a good sign showing their active involvement in urban planning projects.



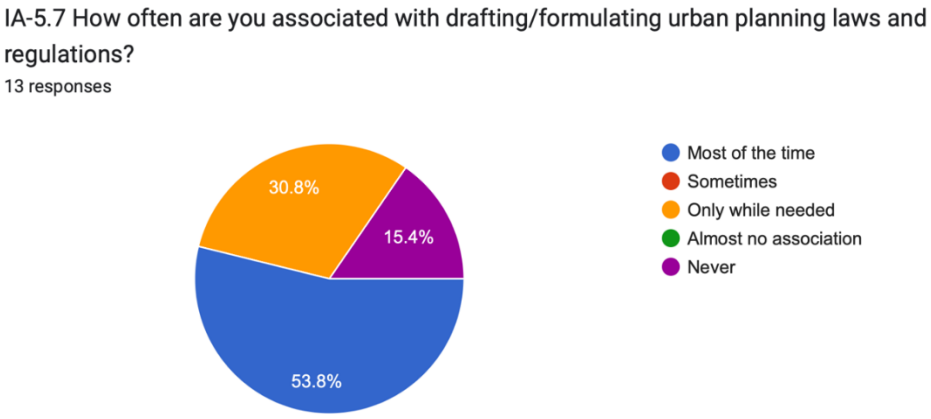
Source: JICA Project Team

- Active involvement in other various urban planning projects.



Source: JICA Project Team

- Involvement in reviewing and revising urban planning regulations.

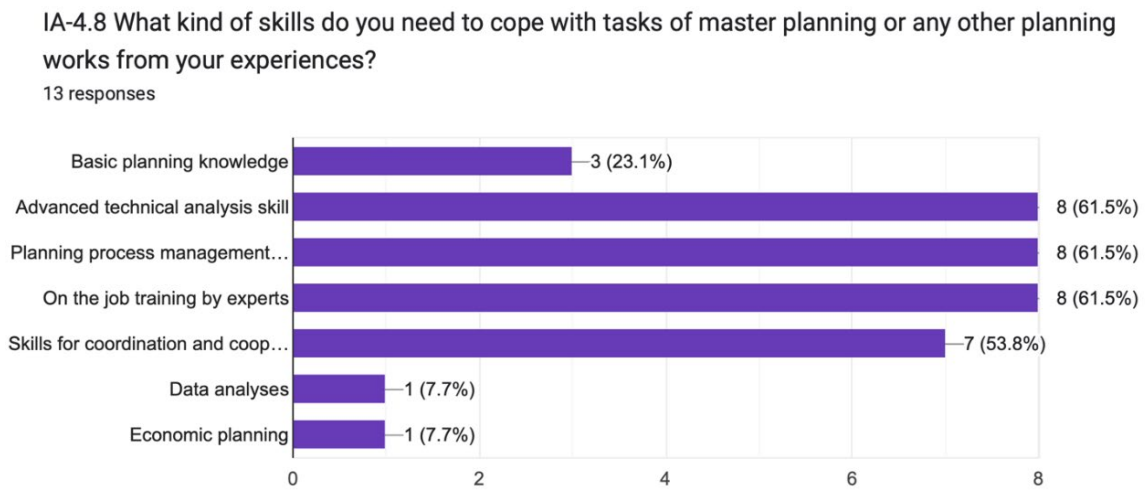


Source: JICA Project Team

(2) The following are some of the self-reported weaknesses

In general, Taskforce members reported having certain weaknesses such as general master planning skills, understating of the legal framework for urban planning management, comprehensive infrastructure planning and public facilities planning skills, as well as GIS skills. These charts show the need for capacity development and possible areas of improvement.

Some of the weaknesses reported are related to coordination and collaboration works with other organizations and lack of community engagement activities as well as involvement of developers into the planning process.



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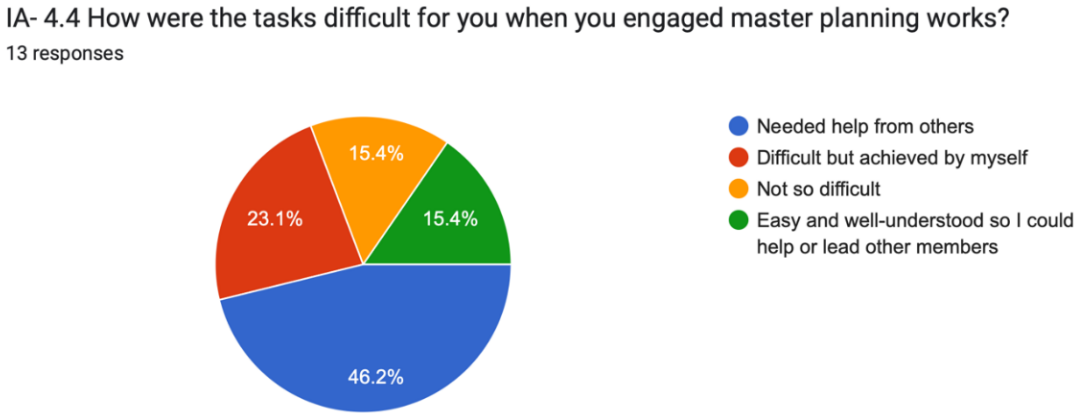
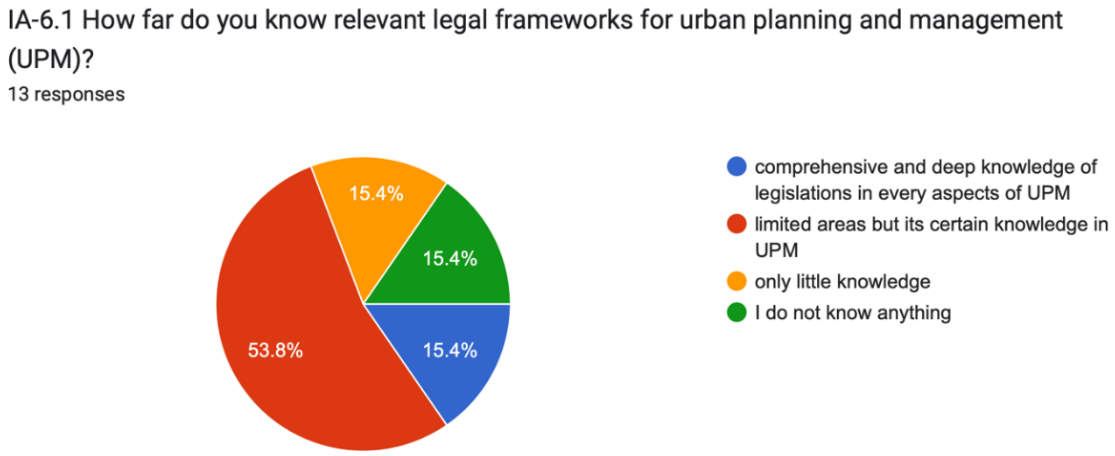


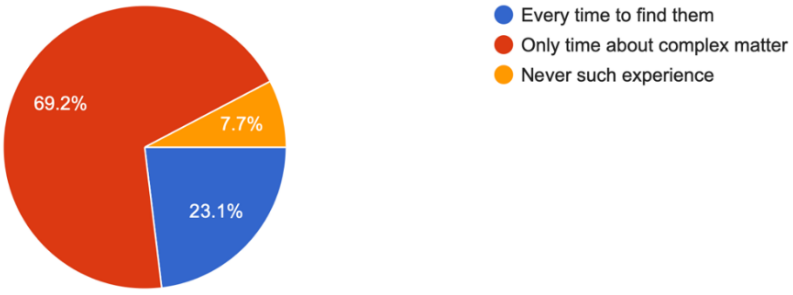
Source: JICA Project Team



Source: JICA Project Team

IA-6.4 How much do you face difficulties to refer to relevant legal documents for urban planning and management?

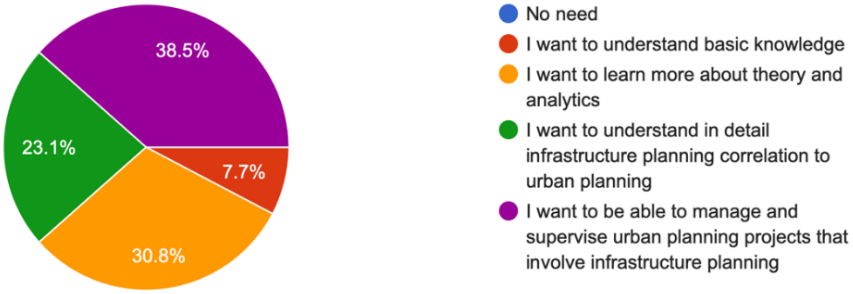
13 responses



Source: JICA Project Team

IA-7.3 Do you believe that you need to improve your knowledge on infrastructure planning (transportation, water, sewerage etc)

13 responses

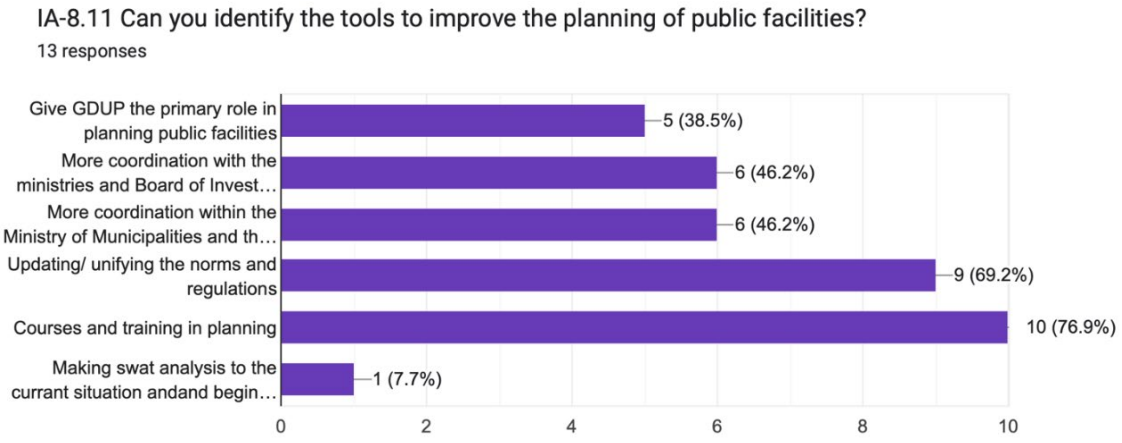


Source: JICA Project Team

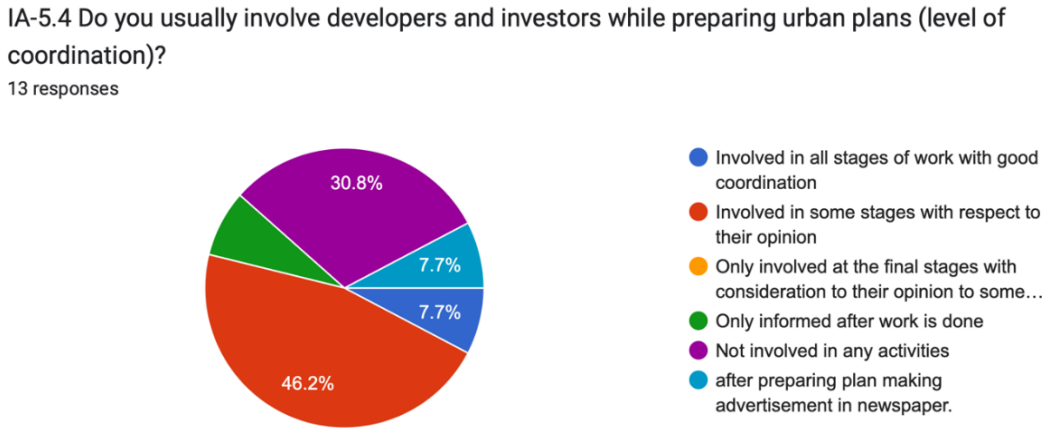
IA-6.6 How have you incorporated contemporary urban issues (climate change, disaster risks, digital transformation, TOD concept, etc) into your planning?

13 responses

Source: JICA Project Team



Source: JICA Project Team



Source: JICA Project Team

(3) Organizational issues reported

These are some of the organizational issues that are being discussed repeatedly by Taskforce members during interviews, working sessions, and meetings.

- No clear tasks and responsibilities as well as job descriptions at the organization thus making it difficult to understand and demarcate roles and tasks.
- GDUP is understaffed, and most departments need more officers and skills.
- Lack of diverse skills & backgrounds for an ideal urban planning organization such as urban planners, geographers, civil engineers, economists, urban designers, environmental specialists, data analysts, community engagement officers, and so on.
- A lot of routine and paperwork & administration tasks.
- The pressure of work and lack of time.
- No proper office space for an appropriate work environment and internal activities.
- Lack of coordination between ministries and directorates, however, can be considered an inter-organizational governance issue.
- Lack of available data and information to rely on.
- No budget is allocated for GDUP to carry on and follow up on projects

(4) Summary of the organizational and individual capacity building needs

To summarize the results, this table shows the key issues reported by officers and the needs for improving individual and organizational capacities.

Table 2.1.1 Summary of Organizational and Individual Capacity Building Needs

Type of capacity building	Key Issues/Needs	Recommendations/Actions for improvement	Sector
Individual	Lack of planning skills to cope with master planning works (basic planning skills, advanced analytical skills).	Taskforce members are actively participating in the project for updating the current master plan. Activities such as intensive data collection, analyzing of the current situation and methods used to integrate and address urban planning issues are being discussed with the target organization.	All sectors
	Difficulty in engagement in master planning works.	Taskforce members reported that they often need help to engage in master planning works, thus being at the core activities of this project will help improve their understanding and skills of the actual steps for preparing an urban master plan project. JPT experts work closely with Taskforce members on all sectors.	All sectors
	Limited knowledge on legal framework for UPM.	This can be improved by two measures by 1) individual efforts instructed by organization, and 2) organizational programs (e.g. lecture, test, group study, etc), However, organizational efforts will be more important and prioritized.	Governance - Legal
	Difficulty in referring to legal framework for UPM.	This issue should be addressed by two measures by 1) enhance legislative improvement to fill the gaps between UPM and existing legislations, and 2) continuous organizational efforts to administrative operation (e.g. internal instructions, protocol, organization rules, etc) through each officers' efforts (questionnaire, group discussions, etc)	Governance - Legal
	Need to improve knowledge on infrastructure planning (transportation, water, sewerage, etc.).	Presentation about planning concepts, applied methodology and outcomes will be made for each sector of infrastructure planning.	Infrastructure Group
	Need to improve knowledge on public facilities planning.	1) Legislative effort to organize data sharing and planning processes with the related ministries (MoP, MoH, MoE…) 2) Lectures, workshops, courses as tools to enhance individual and group skills for planning concepts, applied methodologies and outcomes- focusing on public facilities and their relation to other layers of the city (public spaces, streetscape, other facilities…)	MP Urban Planning and Local Urban Plan Group
	Incorporation of contemporary urban planning issues into planning (sustainable development, climate change, flooding measures, etc.)	The capacity of GDUP on climate mitigation and adaptation and the impact of climate change on cities will need to be build. Online resources are available such as this '*eLearning course on Passive Urban Cooling Solutions (Self-paced) | World Bank Group'*	All sectors
	GIS skills for urban planning use.	GIS group meetings across organizations under different ministries on methodology of GIS data creation, GIS data sharing, and GIS usage for planning.	Spatial Data Group
Organizational	No clear tasks and responsibilities as well as job descriptions.	Discussions and workshops will be made with the target organization to look more into the issue to analyze the main role and strategy and understand the nature of the administration system.	
	GDUP is understaffed.	1) A lack of diverse skills and backgrounds is clearly visible; thus, officers are engaged in all activities and steps of the project. This will help improve their understanding on different backgrounds. However, it might not be sufficient for the organization, so while hiring new staff, this has to be taken into consideration. 2) Within MOMT, there is a special directorate for human resource development (Directorate of Human Resource Development). They have their own plans for capacity development for the staff of	Governance - Legal
	Lack of diverse skills & backgrounds for an ideal urban planning organization.		

Type of capacity building	Key Issues/Needs	Recommendations/Actions for improvement	Sector
		the ministry, including GDUP. Therefore, discussions should be made with them to look into the issues reported by GDUP so that they can improve their plans according to the needs.	
	A lot of routine and paperwork.	GDUP and relevant organizations are being involved in all processes of the project. A local committee is formed (TWG) from members of those organizations so that more discussion and working sessions are held directly without a lot of routine and paperwork. In addition to this, ICT technologies will be applied involving stakeholders, thus, reducing routine and unnecessary paperwork.	Governance - Legal
	No proper office space for an appropriate work environment.	There is a plan for the ministry to move out of the current building to a new building or an existing more spacious building. However, discussions will be made with GDUP to understand actual needs and ambitions and of space and equipment, thus recommendations will be made accordingly.	Governance - Legal
	Lack of available data and information.	While the project had a difficult time collecting data from relevant organizations, it was clear that some data might be available by other ministries but no coordination for sharing mechanism was in place. Recommendations will be made to strengthen the inter-organizational coordination based on current involvement of stakeholders. JCC and TWG committees are going to play an important role regarding this matter.	All sectors.
	No budget is allocated for GDUP to carry on and follow up on urban planning projects.	While this depends on the strategies of the KRG government to strengthen the role of urban planning in the region, however, an allocation of a relevant budget might be necessary based on the capacity needs of GDUP to be able to formulate and implement urban master plans. This will also depend on long-term visions and strategies of MOMT in general, and GDUP specifically.	Governance - Legal

Source: JICA Project Team

2.2 Capacity Building Program

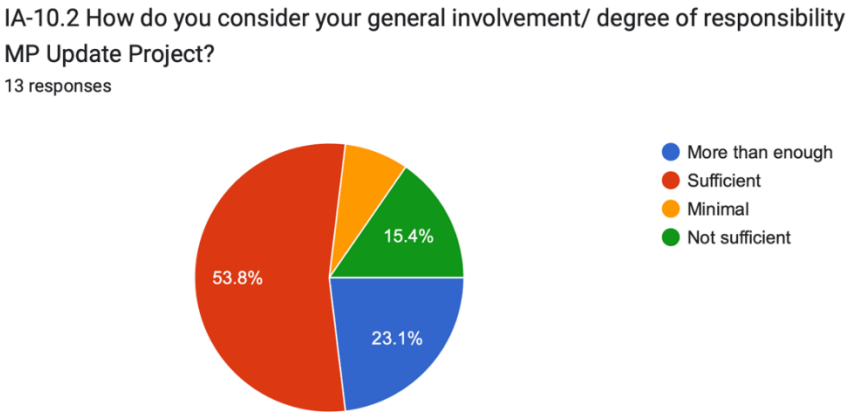
2.2.1 Capacity Building Program implemented during the project

(1) Involvement of Taskforce members in the project

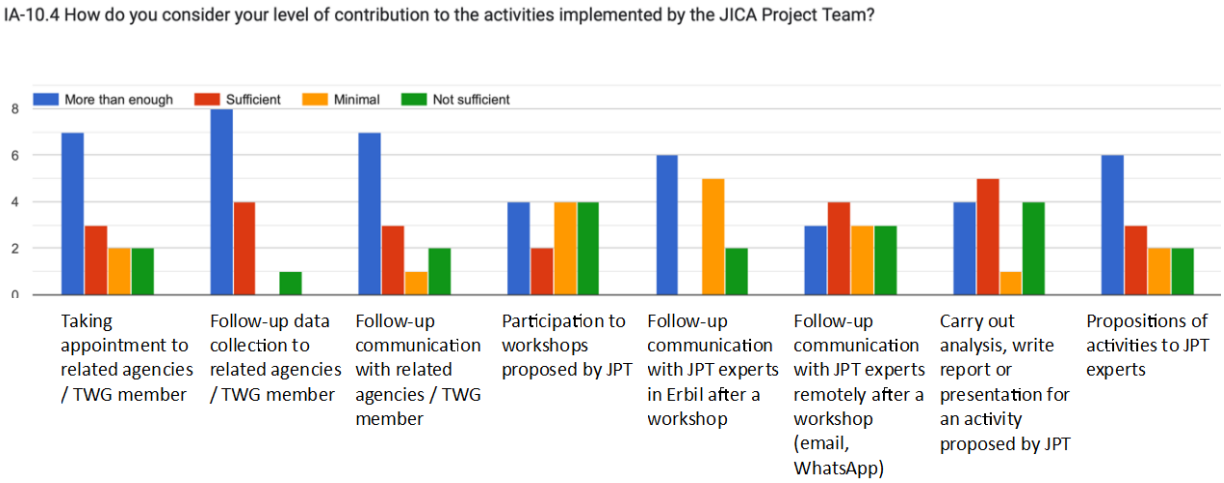
Throughout the project, Taskforce members of the target organization are expected to coordinate with most of the stakeholders in Erbil for the purposes of data collection and integration into the formulation of the master plan. This will help improve the coordination, collaboration, and cooperation skills of both individuals as well as relevant organizations. It will pave way for the future strengthening of relations that will work in favor of master plan implementation and follow-up.

Additionally, Taskforce members will learn about formulating urban planning policies and regulations, tackling urban issues, and better understanding and incorporating infrastructure planning into urban planning. Moreover, Taskforce members are expected to learn about contemporary urban planning issues such as (global warming, flooding, renewable energies, and sustainability).

It's worth mentioning that Taskforce members were asked about their involvement in the master plan project. They considered being sufficiently involved and expressed their readiness to keep or increase their degree of responsibility in the future.



Source: JICA Project Team



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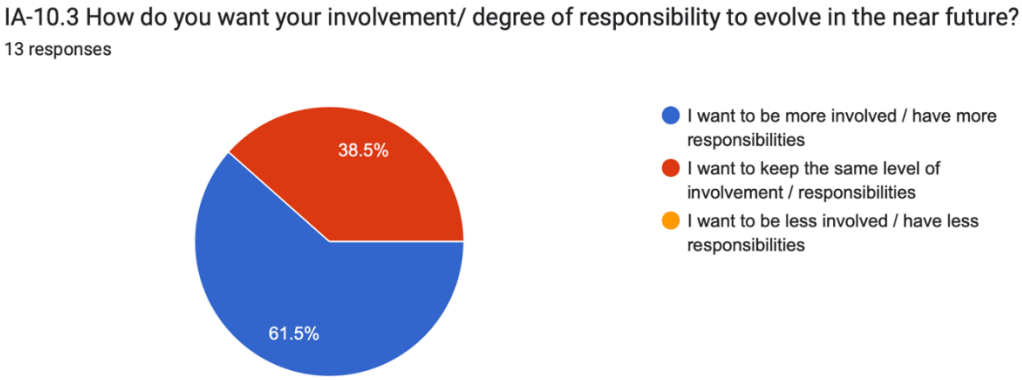


Source: JICA Project Team

(2) Activities implemented during the project

These are some of the main activities held during the project that ensured the involvement of Taskforce members from GDUP. Some activities were done in group sessions in collaboration with other organizations as well.

1) Inception consultations with GDUP Taskforce members were held at the start of the project to have a mutual understanding of the project contents as well as discuss suggestions for implementation.

- **Master plan / urban planning inception consultations** were presented by the project team leader to clarify the main outline of the master plan project and elaborate in detail on the necessary steps to be taken. This working session was done to clarify specifically STEP 2: Update of Erbil Master Plan on the general workflow of the project.
- **Local Urban Plan inception consultations** and selection of Municipality 6 for Local Urban Plan (LUP) : a working session was held with Taskforce members from GDUP and members of relevant authorities such as UPDOE, PEM and GDEM to explain the outline and the necessity of having a local urban plan under the level of the master plan. Then discussions were done to select a local municipality in Erbil to engage in implementing LUP as a pilot project based on specific scoring criteria that were examined before with the target organization.
- **Greenbelt and green areas planning:** a presentation by agriculture and green areas expert was held to examine the current situation of the greenbelt and urban green infrastructure in Erbil. Then the group discussed the reasons behind the difficulties of implementing the greenbelt and possible solutions.
- **Infrastructure inception consultations:** this meeting was also held with the target organization and other relevant stakeholders involved in infrastructure planning. The infrastructure group leader elaborated on the main structure of the group and the topics within the group such as (urban transport, water supply, sewerage, solid waste power, telecommunications as well as water resource development and irrigation). Then the main possible outcomes were discussed for each sub-sector.
- **Spatial data group inception consultations:** Spatial Data Group leader explained the overall workflow for GIS data collection, data analysis, and creation of Land Use Land Cover map. Discussions were made with Taskforce members and GIS officers in the following weeks to create LULC list for the master plan.

2) Long-Term Vision statements: Erbil 2030 MP had an ambitious vision for the future development of the city. However, because of the economic fluctuations of KRG during the past years, many of the visions were not realized. Thus, the project team experts had intensive discussions with the target organization to review all visions once again and discussed the possibility of integration into the updated master plan.

3) Urban Development Potential Analysis: This methodology was elaborated by the team leader for identifying future priority areas for urban development. Factors for urban development were discussed in a few working sessions with Taskforce members to identify the elements of urban development in Erbil. In addition to clarifying impulsiveness and repulsiveness that work as driving factors affecting future urban growth.

4) Strategic Environmental Assessment:

- A participatory and bottom-up approach to urban planning for understanding the living conditions of the inhabitants of Erbil. This exercise was dedicated to integrating a collective vision of environmental issues into the Master Plan. It is also an iterative approach to ask for the opinion of the population at each stage of the Master Plan's formulation (3 rounds of workshops)
- 1st round of public consultations was held with local inhabitants in the project target area with the help and arrangements of local municipalities.
- The process and analysis of results were explained in detail for the target organization and relevant municipalities.

5) Pilot on formulation of Local Urban Plan: A collaborative pilot project with Taskforce members involving all relevant stakeholders to formulate a local urban plan for within a selected municipality in the target area. Objectives of this exercise are:
   - To establish a framework for detailed planning system in line with the Erbil master plan through the development of LUP.
   - To create an enabling environment for implementation of effective urban management and control for the master plan.
   - To refer to improvement of the current legal instruments for urban planning and management through examination of applicable instruments.

6) Selection of traffic survey and company: discussions with infrastructure Taskforce members were done to identify the contents of the traffic survey and elaborate on the selection process for the companies involved in the survey.

7) The urban planning system in Japan: Legal framework expert of the team held a workshop with the target organization and relevant directorates to explain how the urban planning system works in Japan. Small discussions were made after the presentation to understand potential elements and the possibility of integration into the local urban planning system in KRG.

(3) Training in Japan

A two-week intensive training in Japan was organized for 10 Taskforce members of the target organization. This table shows the main themes for the training and visited organizations in Japan.

Table 2.2.1 Contents of Training in Japan

Theme	Theme in Detail	Organization	Note
Implementation of Urban Planning	Urban Planning System in Japan and Urban Regeneration	Ministry of Land, Infrastructure, Transport and Tourism	
	How to prepare urban master plan	Research Institute for Urban & Environmental Development	
	Method to prepare zoning map How to operate development permission	Research Institute for Urban & Environmental Development	
	Local plan to control urban form of middle-rise buildings in Makuhari	Chiba City	Including site visit
	Advanced urban development in collaboration between private sector and university	Kashiwanoha	Including site visit
	Flood management in urban area	Chiba City	
Promotion of attractiveness of existing urban area	Historical townscape promoted by the community participation	NPO Kawagoe Kurano Kai	Including site visit
	Conservation and utilization of historical area	Kanazawa City	Including site visit
Utilization of green area in and around urban area	Farmland preservation through the agricultural promotion area system	Ministry of Agriculture, Forestry, and Fisheries	
	Promotion of Green Area along with Urban Development	Futako Tamagawa Rise	Including site visit
Urban management using geographical information	Experience and issues to establish NSDI in Japan	Aoyama University (Professor Hiroshi MURAKAMI, Former president of Geospatial Information Authority of Japan)	- Data sharing between central and local government - How to establish GIS centre
	Utilization of geographical information in urban planning	Tokyo Metropolitan University (Emeritus Professor Hidenori TAMAGAWA)	

Theme	Theme in Detail	Organization	Note
	Integrated geographical information in local government	Asia Air Survey	
Low carbon city	Action Plan for Preventing Global Warming	Ministry of the Environment	
Town planning with enhanced public transport system	Promotion of public transport in the city using fuel battery	Tokyo BRT (Tokyo Metropolitan Government)	
	Transport system: Pedestrian and public transport in city centre as well as collaboration between public transport and private car in outer ring road area	Kanazawa City	Including site visit
	Urban transport planning toward low carbon society	Tokyo Institute of Technology (Professor Shinya HANAOKA)	
	Urban Redevelopment together with creation of transport hub	Saitama New Urban Centre (Saitama Prefecture)	Including site visit

Source: JICA Project Team

2.2.2 Implementation of Capacity Building Program

Below is the final list of events and activities conducted throughout the project with the main counterpart and related organizations. The list of activities includes interactive workshops, lectures, discussion groups, on-the-job training, and various other events. Members from GDUP counterpart actively involved in these activities as it's the main counterpart. In addition to that, members and officers from related organizations typically partake in activities relevant to their sectors, fostering coordination and strengthening cooperation between them, and resulting in fruitful and engaging discussions.

Table 2.2.2 Implemented Capacity Building Program

Theme / Group	Related Activity	Date	Duration	Venue	Activity Description	Respon-sible	Type of Activity	Participants
Local Urban Planning	3-1.a	2022/05/11	2 hours	UPDOE	Selection of Candidate Pilot Zoning Scheme Area: presentation of criteria, voting system etc.	Antoine Saurat	Interactive Workshop	All Taskforce members
Spatial Data	2-1.h	May and June 2022	3 hours each	UPDOE	Discussion about LULC nomenclature and Explanation about Urban Atlas Mapping Guide	Yuki Nagata	Lecture / Case Study / Benchmark	GIS Taskforce member and GIS officers of relevant organizations
Spatial Data		2022/06/08	3 hours	UPDOE	SDI scheme and WebGIS infrastructure	Hiroto Fujita	Lecture / Case Study / Benchmark	GIS Taskforce member and GIS officers of relevant organizations
Environment / SEA	5.c	2022/06/21	2 hours	Online	Briefing about the SEA and 1st SEA consultation	Marie Taketani	Lecture / Case Study / Benchmark	Dr. Chewas, Dr. Mohammed, Mr. Mustafa
MP Urban Planning & Land Use	2-1.a	2022/07/26	2 hours	UPDOE	Urbanization Potential Analysis: presentation of methodology, objectives, how to choose the factors, etc.	Antoine Saurat	Interactive Workshop	All Taskforce members

Theme / Group	Related Activity	Date	Duration	Venue	Activity Description	Respon-sible	Type of Activity	Participants
Environment / SEA	5.c	2022/07/28~8/11	3 hours each	Municipality's hall	Conducting the SEA public Consulation and Data input	Marie Taketani	OJT / Cooperative Work	Mr. Mustafa
Governance & Legal	2-1.c	2022/08/17	2 hours	GDUP	Explanation and discussions on institutional arrangements and Local Urban Plan.	Makine Kusano	Discussion Group	Legal and institutional framework and LUP Taskforce members.
Spatial Data	2-1.h	2022/8	2 hours each	GDUP	Discussion on specifications of LULC (a series of 3 meetings)	Shiori Taniguchi	OJT / Cooperative Work	GIS Taskforce member and GIS officers of relevant organizations
MP Urban Planning & Land Use	2-1.b	2022/10/31	2 hours	GDUP	KRG vision 2030 integration to master plan.	Antoine Saurat	Discussion Group	All Taskforce members
Governance & Legal	2-1.c	2022/11/06	1 hour	MoCH	Discussion on local housing policies.	Makine Kusano	Regular Meetings	MoCH housing department manager.
Environment / SEA	5.c	2022/11/7	1 hour	GDUP	Explain the result of the 1st SEA public Consultation and PowerBI system	Marie Taketani	Lecture / Case Study / Benchmark	All Taskforce members
Governance & Legal		2022/11/14	2 hours	GDUP	Urban Planning System in Japan.	Makine Kusano	Interactive Workshop	GDUP, UPDOE and GDEM management and staff including Taskforce members.
Local Urban Planning	3-2	2022/11/15	2 hours	GDUP	Discussion with Taskforce members about the upcoming tasks and contents of Local Urban Plan.	Makine Kusano	Discussion Group	LUP, Legal Framework and Masterplan taskforcde members.
Spatial Data	2-1.h	2022/11/20	2 hours	UPDOE	Explaination about methodology on LULC data creation	Shiori Taniguchi	OJT / Cooperative Work	GIS Taskforce member and GIS officers of relevant organizations
MP Urban Planning & Land Use	2-1.a	2023/01/8-9	3 hours	GDUP	Working session with Taskforce members on discussing factors for urbanization potential analysis.	Baravan Abduljabbar	Interactive Workshop	All Taskforce members.
MP Urban Planning & Land Use	2-1.b	2023/01/10-11	3 hours	GDUP	Working session with Taskforce members on reviewing long term vision statements to be integrated into the master plan update.	Baravan Abduljabbar	Interactive Workshop	All Taskforce members.
Economic Planning	2-1.e	2023/01/17	1 hour	BoT	Discussion on integration of Tourism Sector plans/visions/strategies into the masterplan update.	Haruo Yamane	Regular Meetings	Taskforce members and Board of Tourism officers

Theme / Group	Related Activity	Date	Duration	Venue	Activity Description	Respon-sible	Type of Activity	Participants
Spatial Data		2023/1/23	2 hours	UPDOE	Quarter Boundary names and boundary corrections.	Yuki Nagata	OJT / Cooperative Work	GIS Taskforce member and GIS officers of relevant organizations
Spatial Data	2-1.h	2023/1/23	2 hours	UPDOE	Explanation about methodology on GIS analysis using LULC data.	Yuki Nagata	Lecture / Case Study / Benchmark	GIS Taskforce member and GIS officers of relevant organizations
MP Urban Planning & Land Use	2-1.b	2023/02/07	1 hour	Online	Discussion on Erbil Masterplan Long Term Visions	Antoine Saurat	Regular Meetings	Dr. Chwas, Dr. Mohammed
Transport Sub-Group	2-1.a	2023/2/15	2 hours		Confirm the causes of traffic congestion and parking problems, and discuss the drafting of countermeasures in the road planning.	Michiya Nagura	Interactive Workshop	Relevant Taskforce members, Presidency of Erbil Municipality, UPDOE, MoTC, Traffic Police, MoI
Transport Sub-Group	2-1.i	2023/2/20	2.5 hours	GDUP	Explanation and discussion on the results of the traffic survey.	Toshiyuki Iwama	Interactive Workshop	Relevant Taskforce members, Presidency of Erbil Municipality, UPDOE, MoT, Traffic Police, MoI
MP Urban Planning & Land Use	2-3.a	2023/3/8	2 hours	GDUP	Development Alternatives Workshop 1: explanation of methodology	Antoine Saurat	Interactive Workshop	All Taskforce members
Environment / SEA	5.c	2023/3/8	1 hour	Online	Explain and Discussion for the 2nd SEA public Consultation	Marie Taketani	Lecture / Case Study / Benchmark	All Taskforce members
Local Urban Planning	3-2	2023/05/08-09	2 hours	GDUP	Pilot Program Framework for Zoning Scheme. Discussion Groups.	Makine Kusano	Discussion Group	GDUP and UPDOE TWG Members
Local Urban Planning	3-2	2023/05/10	2 hours	UPDOE	Pilot Program for Zoning Scheme TWG Discussion	Makine Kusano	Discussion Group	All TWG members
Local Urban Planning	3-2	2023/05/16	2 hours	PEM	Zoning Scheme applicability to KRG Legal Framework	Makine Kusano	Discussion Group	Erbil Municipality - Masterplan department staff
MP Urban Planning & Land Use	2-3.a	2023/6/5	2 hours	GDUP	Development Alternatives Workshop 2: presentation of alternatives	Antoine Saurat	Interactive Workshop	All TWG members
Environment / SEA	5.c	2023/6/11	2 hour	GDUP	Practice for working as facilitator	Marie Taketani	Interactive Workshop	TWG (Urban Planning members)
Environment / SEA	5.c	2023/6/12,6/13	3 hours each	Tbc	Conducting the SEA 2nd Public Consultation and deta input	Marie Taketani	OJT / Cooperative Work	TWG (Urban Planning members)
Environment / SEA	5.d	2023/06/14	2hours	GDUP	TWG Meeting on Environmental	Marie Taketani	Lecture / Case Study	All TWG members

Theme / Group	Related Activity	Date	Duration	Venue	Activity Description	Respon-sible	Type of Activity	Participants
					Impacts of Alternatives		/ Benchmark	
Spatial Data		2023/6/19	2 hours	GDUP	Explanation about GIS analysis and usage for spatial planning & interactive workshop regarding quarter boundary	Yuki Nagata	Lecture / Case Study / Benchmark	GIS TWG member and GIS officers of relevant organizations
Infrastructure	2.1-a	2023/08/02	2 hours	GDUP	Sector specific working group (water and sewerage): Analysis of the current situation, future population and demand projection.	Kiyoko Takamizawa	Interactive Workshop	Infrastructure TWG members
MP Urban Planning & Land Use	2.1-b	2023/08/10	4 hours	GDUP	MP2030 Land use review	Baravan Abduljabbar	OJT / Cooperative Work	TWG Members
MP Urban Planning & Land Use	2.1-b	2023/08/11	4 hours	GDUP	MP2030 Land use review	Baravan Abduljabbar	OJT / Cooperative Work	TWG Members
MP Urban Planning & Land Use	2.1-b	2023/08/14	4 hours	GDUP	MP2030 Land use review	Baravan Abduljabbar	OJT / Cooperative Work	TWG Members
Spatial Data		2023/08/19	2 hours	GDUP	How GIS is used in urban planning in Japan	Yuki Nagata	Lecture / Case Study / Benchmark	GIS TWG members, Urban Planning TWG members, head of Transportation and Infrastructure TWG theme
MP Urban Planning & Land Use	2.1-b	2023/09/12	2 hour	UPDOE	MP2030 Land use review	Baravan Abduljabbar	Discussion Group	UPDOE Manager and Staff
Infrastructure	2-2.a	2023/09/18	1 hour	GDUP	Inundation Analysis for flood prone areas.	Junichi Furukawa	Lecture / Case Study / Benchmark	Infrastructure TWG members from GDUP, GDWS and GDWR
Infrastructure	2-2.a	2023/09/21	1 hour	GDWR	Groundwater considerations	Yasuo Iijima	Lecture / Case Study / Benchmark	Infrastructure TWG members from GDUP, GDWS and GDWR
MP Urban Planning & Land Use		2023/10/8	1 hour	GDUP	Discussions on large scale public facilities planning.	Nada Borgi	Discussion Group	Dr. Chwas and Dr. Mohammed
MP Urban Planning & Land Use		2023/11/30	3 hours	GDUP	Explanation of urban spatial plan development and Strategic Orientations.	Antoine Saurat	Interactive Workshop	All TWG members
MP Urban Planning		2023/12/5	10 minutes	Hotel	During 4th JCC Meeting, TWG Ms. Azez (MoP) has	Antoine Saurat	Participation to	One member of TWG

Theme / Group	Related Activity	Date	Duration	Venue	Activity Description	Respon-sible	Type of Activity	Participants
& Land Use					presented the Strategic Orientation 3		Presentations	
MP Urban Planning & Land Use		2023/12/5	10 minutes	Hotel	During 4th JCC Meeting, TWG Mr. Dilshad (GDUP) has presented the Strategic Orientation 5	Antoine Saurat	Partici-pation to Presen-tations	One member of TWG
MP Urban Planning & Land Use		2023/12/5	10 minutes	Hotel	During 4th JCC Meeting, Dr. Mohammed (GDUP) has presented the Strategic Orientation 1	Antoine Saurat	Partici-pation to Presen-tations	One member of TWG
Spatial Data		2023/12/11	1 hours	GDUP	Explanation about prepared Data Catalog	Hiroto Fujita	OJT / Cooperative Work	Infrastrucure, GIS and urban planning TWG members
Spatial Data		2023/12/11	2.5 hours	GDUP	Explanation and exercise of Data Product Specification (DPS) Creation	Hiroto Fujita	OJT / Cooperative Work	Infrastrucure, GIS and urban planning TWG members
Spatial Data		2023/12/12	2 hours	GDUP	ArcGIS hands-on training (database design, domain and subtype setting).	Hiroto Fujita	OJT / Cooperative Work	Infrastrucure, GIS and urban planning TWG members
Spatial Data		2023/12/12	1 hours	GDUP	Introduction of base map use cases in urban planning and other areas of public administration	Hiroto Fujita	OJT / Cooperative Work	Infrastrucure, GIS and urban planning TWG members
Spatial Data		2023/12/13	1 hour	GDUP	Introduction of the SDI case studies.	Hiroto Fujita	Lecture / Case Study / Benchmark	Infrastrucure, GIS and urban planning TWG members
Spatial Data		2023/12/13	2 hours	GDUP	ArcGIS hands-on training (utilize feature class (road width from road polygon), topology)	Hiroto Fujita	OJT / Cooperative Work	Infrastrucure, GIS and urban planning Taskforce members
Spatial Data		2023/12/13	1 hour	GDUP	Satellite imagery interprepation and analysis to classify land use and land cover.	Shiori Taniguchi	OJT / Cooperative Work	Infrastrucure, GIS and urban planning TWG members
Spatial Data		2023/12/13	1 hour	GDUP	Geospatial Data Utilization Exercise: Sharing and publishing geospatial data / developing Web-based GIS	Shiori Taniguchi	OJT / Cooperative Work	Infrastrucure, GIS and urban planning TWG members
Local Urban Planning		2024/1/15	2 hours	UPDOE	Zoning Scheme preparation and feedback from TWG theme heads	Makine Kusano	Regular Meetings	TWG Theme heads
Local Urban Planning		2024/1/122	2 hours	PEM	Zoning Scheme preparation feedback and and railway options from	Makine Kusano	Group Discussion	Managers and planning officers from PEM, GDEM and UPDOE, and

Theme / Group	Related Activity	Date	Duration	Venue	Activity Description	Respon-sible	Type of Activity	Participants
					managers and planning officers from PEM, GDEM, GDUP and UPDOE			TWG Theme heads from GDUP
Local Urban Planning		2024/1/122	2 hours	GDUP	Zoning Scheme explanation for urban planning TWG theme members	Makine Kusano	Interactive Workshop	TWG urban planning theme members
Environment / SEA		2024/2/5	2 hours	GDUP	Practice for working as facilitator for the 3rd SEA consultation	Marie Taketani	Interactive Workshop	TWG (Urban Planning members)
Infrastructure		2024/2/14	2 hours	GDUP	Solid Waste Management Workshop, Selection of candidate lands for the SWM facilities Discussion on M/P (long-term plan)	Kiyoko Takamizawa	Interactive Workshop	GDUP, UPDOE EPIB, Environment of Erbil Environment MOMT Solid Waste Management and TWG urban planning.
Infrastructure		2024/2/15	2 hours	GDUP	Water Resource and Agricultural Water Supply Meeting Workshop.	Yasuo Iijima	Interactive Workshop	JCC, sector managers, TWG members, MoAWR GDWR, GDWS, Groundwater and Irrigation Directorates
MP Urban Planning & Land Use		2024/2/28	1 hour	GDUP	Explaining Estimation of Baseline Population.	Antoine Saurat	Interactive Workshop	Urban Planning TWG Theme and other theme heads
Infrastructure		2024/2/28	1 hour	GDUP	Groundwater Recharge Zone: Uses and Infiltration facilities. For a safe, rich, and comfortable lifestyle.	Yasuo Iijima	Interactive Workshop	Urban Planning TWG Theme and other theme heads
MP Urban Planning & Land Use		2024/2/28	1 hour	GDUP	Introduction to Transit Oriented Development of Mixed Use Cores. (1/2)	Antoine Saurat	Interactive Workshop	Urban Planning TWG Theme and other theme heads
Infrastructure		2024/0/13	2 hours	GDUP	Technical Workshop on Urban Transportation Planning	Toshiyuki Iwama	Interactive Workshop	Transportation and several Urban Planning TWG members
Infrastructure		2024/5/15	2 hours	GDUP	Technical Workshop on Transport Modelling	Toshiyuki Iwama	Interactive Workshop	Transportation Planning TWG members
Local Urban Planning		2024/5/29	2 hours	GDUP	Public facilities planning methods and analysis. Explaining the process of public facilities in the project.	Nada Borgi	Lecture / Case Study / Benchmark	Urban planning TWG members

Theme / Group	Related Activity	Date	Duration	Venue	Activity Description	Respon-sible	Type of Activity	Participants
Local Urban Planning		2024/6/4	2 hours	GDUP	Zoning Scheme for the Pilot Program and Discussion Groups: Applicability to the KRG urban planning system with examples and pending issues from Model Area.	Makine Kusano	Group Discussion	TWG Urban planning and theme heads
Governance & Legal		2024/6/11	2 hours	GDUP	Roadmap for GDUP towards effective urban planning and management.	Makine Kusano	Interactive Workshop	GDUP and TWG Theme Heads

Source: JICA Project Team

2.3 After-Project Capacity Building Plan

2.3.1 Target Organizations

In order to create a plan for capacity development, it is essential to address the challenges identified in the project's capacity assessment. Organizations aiming to strengthen their capabilities in addressing these issues will play a crucial role in shaping the desired future role. The main concerns highlighted are inefficient urban planning caused by a lack of defined roles and responsibilities among organizations, lack of information sharing, and a shortage of specialized staff with diverse backgrounds to address urban issues. Additionally, to further enhance the role of organizations in urban planning is the ability to formulate visions and strategies, foster inter-organizational collaboration and digital transformation. The capacity development plan in this section focuses mainly on the mentioned challenges to enhance the capacities of General Directorate of Urban Planning (GDUP), Urban Planning Directorate of Erbil (UPDOE) and relevant masterplan implementing bodies such as municipalities.

As mentioned in the previous sector, according to MOMT order 8068/1 dated 24/12/2020, urban planning responsibilities in MOMT are divided between the General Directorate of Urban Planning (GDUP) and urban planning directorates of governorates (UPDG). GDUP oversees central-level master plans for all cities and towns, handling preparation, supervision, and approval. UPDGs provide advisory support at the local level, collaborating with municipalities and line directorates under ministries for master plan implementation within governorates.

In addition to this, GDUP responsibilities encompass drafting regional urban planning policies in collaboration with relevant authorities, according to laws, instructions, and the general policy of the Kurdistan Regional Government. This involves preparing reports on urban planning issues with input from specialized experts, conducting workshops and conferences with relevant stakeholders. Additionally, the role includes overseeing and monitoring technical works and plans of urban planning directorates in governorates, ensuring compliance with legal frameworks. Supervision also covers tracking the implementation of detail designs within the Master Plan and formulating regulations for sector map designs (detail plans).

The roles of UPDGs and local municipalities are to work on master plan consulting and implementation monitoring respectively. UPDG serves in an advisory role within the governorate, guiding the implementation of master plans through collaboration with municipalities and sectoral departments. Furthermore, UPDG is tasked with designing detailed plans requested by municipalities, aligning with the land uses specified in the master plan. Additionally, UPDG actively engages in committees alongside municipalities and relevant directorates to address urban planning issues within the governorate.

Master plans serve as a guiding development roadmap for municipalities; thus, municipalities have the responsibility of delivering services in urban areas in accordance with the land uses and regulations outlined in the master plan. Working in collaboration with UPDGs, municipalities are also tasked with

the implementation and monitoring of master plans. They also hold the responsibility of approving the allocation of investment projects and granting building permissions to developers.

The absence of a clear vision and strategies, with undefined roles and responsibilities and poor collaboration, frequently results in issues and uncertainties regarding their respective roles. These problems often occur from inadequately preparing a master plan that aligns with actual development needs, population increase, and demand. As a result, tasks for implementation and monitoring might be unclear thus, overlap.

Under the current GDUP organizational structure and individual capacities reported in the capacity assessment, there is a clear lack of skills and backgrounds to tackle and achieve the mentioned challenges. Thus, the establishment of a diverse team of qualified personnel is essential for efficient planning, utilizing planning consultants and experts when necessary. This is also needed to facilitate collaboration between stakeholders and foster networks at local and regional levels for the exchange of expertise and knowledge to establish an enhanced urban planning system. Implementation of an incentive-based system can also be recommended to enhance staff commitment and productivity, and reinforce institutions by developing mandates, tools, guidelines, and information management systems for effective functionality.

However, one key issue worth mentioning is the lack of allocated budget for GDUP to carry on and follow-up urban planning procedures. Ultimately, the intention of enhancing the role of urban planning in the region relies on the KRG government's strategies. Allocating a budget aligned with GDUP's capacity needs is crucial for enhancing the role of GDUP to formulate and implement urban master plans as a base role. Additionally, this will help achieve the overall roles stipulated in the mandates. The success of this initiative also is related to the long-term visions and strategies of MOMT and the government.

On the other hand, facing current budgetary shortages may pose a challenge to budget allocation. However, improving the efficiency of existing capacities is achievable in the short run. Prioritizing the demarcation of roles and responsibilities and fostering collaboration can be emphasized without imposing additional strain on the budget.

2.3.2 Objectives and Target Years

The main objectives of GDUP, UPDOE and relevant municipalities for capacity development plan are:

1) Update roles, responsibilities and organizational structure for clarity.
2) Implement and diversify capacity development in governance, demography planning, and GIS.
3) Empower GDUP for policy alignment and sustainable planning.
4) Foster collaborative urban planning approaches to achieve good governance
5) Digitally transform GDUP and relevant directorates with GIS and ICT.

This capacity development plan has three parts. The short-term plan focuses on 2025, the medium-term plan has the target year of 2030, and the long-term plan looks ahead to 2035. Each part has its own goals and plans. This way, we can work step by step and achieve goals over time.

2.3.3 Capacity Building Strategies

To enhance the capacities of the target organizations and achieve the specified goals, a comprehensive strategy can be developed. This strategic initiative is designed to address key issues and goals for fostering collaborative planning. This plan encompasses three strategies to address specific objectives identified as essential for the enhancement of urban planning practices. From establishing organizational clarity to empowering institutions and collaboration. By implementing this approach with creative strategies, the capacity development plan aims to achieve its objectives progressively, ensuring sustainable and inclusive urban development.

Table 2.3.1 Strategies of Capacity Development Plan

Strategies	Objectives	Issues to Tackle
Strategy I: Foundation and Clarity	(1) Update roles, responsibilities and organizational structure for clarity. (2) Implement and diversify capacity development in governance, demography planning, and GIS.	• Organizational Structure Enhancement • Capacity Development Programs
Strategy II: Empowerment	(1) Empower GDUP for policy alignment and sustainable planning.	• Strategic Vision Alignment and Climate Change Adaptation. • Incorporate region-wide planning
Strategy III: Collaboration	(1) Foster collaborative urban planning approaches to achieve good governance. (2) Digitally transform GDUP and relevant directorates with GIS and ICT to enhance collaboration.	• Inter-organizational Collaboration • Digital Transformation through GIS and ICT Tools • Monitoring and Evaluation

Source: JICA Project Team

(1) Strategy I: Foundation and Clarity

The first step towards a strong organization with a clear role should be establishing a robust foundation. Thus, it's important to conduct a comprehensive review of existing roles and responsibilities within GDUP, UPDOE, and municipalities. Then, engage stakeholders through workshops and surveys to gather insights. As a result, utilize the feedback to redefine and clarify organizational structures. This is essential for enhancing the roles to avoid overlap and fill in the gaps.

1) Organizational Structure Enhancement:

   (a) Conduct a thorough review of the current organizational structure of GDUP, Urban Planning Directorate of Governorate, and relevant departments.
   (b) Collaborate with human resources and department heads to redefine roles and responsibilities, ensuring clarity and alignment with organizational objectives.
   (c) Implement a phased approach for structural adjustments, considering input from key stakeholders.

2) Capacity Development Programs:

   (a) Design and implement capacity development programs for relevant KRG agencies focusing on Urban Governance, Demography Planning, and the utilization of GIS for urban planning.
   (b) Customize training modules to address specific skill gaps identified in the capacity assessment.
   (c) Provide training and capacity-building programs for GDUP leadership and staff. Also, foster partnerships with academic institutions and international organizations for knowledge exchange and best practices.
   (d) Develop a sustainability framework that aligns policies with long-term urban planning goals.
   (e) Evaluate the impact of training programs through regular assessments and feedback mechanisms.

(2) Strategy II: Empowerment

To empower the role of GDUP within stakeholders as a leading organization, it is necessary to develop the ability to formulate visions and strategies that align with KRG policies. This will enhance their position to lead subordinate directorates with clear visions.

1) Strategic Vision Alignment and Climate Change Adaptation:

   (a) Establish a Taskforce within GDUP to specifically focus on formulating visions and strategies aligned with (and consult to formulate) KRG policies and addressing climate change challenges.
   (b) Conduct training programs and workshops for GDUP staff to enhance their understanding of climate change issues and strategic planning.
   (c) Foster partnerships with environmental and sectoral departments to integrate sustainable practices into urban planning strategies.

2) Formulate region-wide planning:

   (a) Gather relevant data on demographics, land use and land cover, environment, and economic indicators for the whole region to have a global understanding on the current situation.
   (b) Work on developing policies and strategies that utilizes regional resources and better defines the role of each city.
   (c) Ensure policies consider economic development, environmental sustainability, social equity, and infrastructure needs.

(3) Strategy III: Collaboration and Digital Transformation

To facilitate cross-agency collaborations and partnerships with municipalities, it is important to implement shared planning platforms to encourage information exchange and collaborative decision-making, and to integrate GIS and ICT technologies for data management and analysis, eventually achieving inclusive planning.

1) Inter-organizational Collaboration:

   (a) Facilitate regular forums, workshops, and collaborative sessions to encourage dialogue and information exchange among GDUP, Urban Planning Directorate of Governorates, and other relevant departments.
   (b) Develop a shared platform for communication and collaboration, such as a digital workspace for masterplan implementation and monitoring.
   (c) Establish joint working groups to address specific urban planning challenges and promote cooperative approaches.

2) Digital Transformation through GIS and ICT Tools:

   (a) Introduce and enhance Geographic Information System (GIS) and other Information and Communication Technology (ICT) tools to streamline urban planning processes.
   (b) Provide comprehensive training for GDUP and Urban Planning Directorate of Governorates staff on the utilization of GIS and other digital tools for urban planning use.
   (c) Collaborate with technology experts to ensure the effective integration and maintenance of the new systems.

3) Monitoring and Evaluation:

   (a) Establish a robust monitoring and evaluation framework to track progress in achieving the outlined goals.
   (b) Implement performance indicators to measure the effectiveness of the enhanced organizational structures, strategic vision alignment, collaborative efforts, digital transformation, and capacity development initiatives.

2.3.4 Human Resources Development

The lack of a diversified set of skills and backgrounds is a notable deficiency in GDUP. This deficiency encompasses a range of professionals including urban planners, geographers, civil engineers, economists, urban designers, environmental specialists, data analysts, community engagement officers, and others.

Achieving the outlined strategies for enhancing the capacities of GDUP in urban planning and governance requires a diverse set of human resources with various skills and expertise. Some of the key roles and skills needed are mentioned below. However, specialists with expertise in organizational development might be needed to lead the restructuring efforts, redefine roles, and ensure effective implementation of the new organizational structure.

- **Urban Planning and Climate Change Experts:** Urban planners with a focus on sustainability and climate change adaptation to formulate strategic visions aligned with KRG policies and address environmental challenges.
- **Regional Planners:** An expert in regional planning can think on a global level and incorporate transportation planning, water, and natural resource management to enhance economic and environmental aspects. They can identify opportunities for economic growth and development within the region.
- **Transportation Planning:** Transportation planners can work on the design and coordinate transportation systems to improve connectivity and accessibility. They also plan for the development of roads, highways, public transit, and other transportation infrastructure.
- **Technology and GIS Experts:** IT specialists and GIS professionals to lead the implementation of digital transformation initiatives, including the introduction of GIS systems and other ICT tools.
- **Collaboration and Communication Facilitators:** Facilitators with strong communication and collaboration skills to organize forums, workshops, and collaborative sessions, fostering inter-organizational cooperation.
- **Community Engagement Coordinators:** Professionals skilled in community engagement and public relations to involve local communities in the urban planning process and gather valuable input.
- **Data Analysts:** Analysts are proficient in data analysis to interpret GIS data and other relevant information, providing insights for informed decision-making.
- **Environmental Consultants:** Experts specializing in environmental sustainability to advise on integrating green practices into urban planning strategies and addressing climate change challenges, as well as working on preserving natural resources.

2.3.5 Road Map and Action Plan for Capacity Building

The following table shows the schedule for capacity building activities to be implemented throughout the three phases. Each strategy and objectives broken down into items and steps to follow.

Table 2.3.2 Schedule and Steps for Capacity Building Activities

Strategies	Objectives	Items	Short-term	Med-term	Long-term
Strategy I: Foundation and Clarity	Update roles, responsibilities and organizational structure for clarity.	Review existing structure of GDUP, UPDOE and relevant stakeholders.	X		
		Engage relevant stakeholders in identifying gaps and overlaps.	X		
		Define clear roles and responsibilities.	X		
		Circulate to relevant stakeholders and participate in training programs to clarify the new structures.	X		
		Monitor and adjust for improvement.		X	

Strategies	Objectives	Items	Short-term	Med-term	Long-term
	Implement and diversify capacity development in governance, demography planning, and GIS.	Current capacity assessment to identify needs in demographic planning	X		
		Identify GIS utilization needs in planning	X		
		Prepare and engage in training programs	X		
		Evaluate the effectiveness and adjust for improvement.		X	
Strategy II: Empowerment	Empower GDUP for policy alignment and sustainable planning	Establish a Taskforce within GDUP to focus on formulating visions and strategies aligned with KRG policies and addressing climate change challenges.	X		
		Conduct workshops for GDUP to enhance understanding of climate change issues.		X	
		Foster partnerships with environmental and sectoral departments to integrate sustainability.		X	
	Incorporate region-wide planning.	Gather data on demographics, LULC, environment, and economic indicators for the region to have a comprehensive understanding on the current situation.	X		
		Develop policies and strategies to utilizes regional resources and clarify the role of each city.		X	
		Policies to consider economic development, environmental sustainability, social equity, and infrastructure needs.			X
Strategy III: Collaboration	Foster collaborative urban planning approaches to achieve good governance.	Facilitate regular forums, workshops, and collaborative sessions to encourage dialogue and information exchange among GDUP, UPDG and relevant departments.		X	
		Develop a shared platform for communication and collaboration, such as a digital workspace for masterplan implementation and monitoring.	X		
		Establish joint working groups to address specific urban planning challenges and promote cooperative approaches.			X
	Digitally transform GDUP and relevant directorates with GIS and ICT to enhance collaboration.	Introduce and enhance Geographic Information System (GIS) and other Information and Communication Technology (ICT) tools to streamline urban planning processes.	X		
		Provide comprehensive training for GDUP and UPDGs on the utilization of GIS and digital tools for urban planning use.	X		
		Collaborate with technology experts to ensure the effective integration and maintenance of the new systems.		X	

Source: JICA Project Team

2.3.6 Capacity Building Packages

Based on the recommendations discussed in the previous section, the target organizations can focus on the following capacity building packages as next steps to improve their skills and capabilities towards achieving objectives shown in the roadmap and action plan for capacity building.

(1) Urban Governance Strengthening and Demography Planning

General Directorate of Urban Planning has a central role in urban planning in the region. It is essential for them to enhance their capacities in governance to lead the role and coordinate effectively within main stakeholders such as UPDGs and municipalities. One of the main issues discussed in this section is unclear roles and responsibilities between GDUP and UPDOE as well as relevant stakeholders that affects the planning and implementation of urban plans. Reviewing and strengthening their structure as well as demarcating roles and responsibilities will greatly affect and enhance planning and

implementation.

On the other hand, an essential and obvious element missing is demography planning which includes population distribution and housing supply and demand. Training is important regarding this matter to reshape the planning in the whole region and better identify roles and importance of each city in terms of economy and relation to population size.

Furthermore, lack of coordination between main stakeholders was noticeable during the project, which however, was improved by the initiatives of JPT. In addition to that, a systematic and inclusive coordination is needed to be able to promote good urban governance and achieve demography planning.

(2) Geographic Information Systems Use in Urban Planning

The GIS capacity-building package should be introduced to enhance urban planning efforts resulting from collaboration and digital transformation. This can be achieved with organizing discussion groups, workshops, and coordination sessions to facilitate understanding and information exchange among GDUP, Urban Planning Directorate of Governorates, and other relevant sector departments and municipalities.

GDUP, especially Taskforce and TWG members that participated in master plan preparation project, can lead this initiation because of the acquired relevant experience. As a result of this, a shared digital workspace can be developed for enhancing communication and cooperation. The efforts of developing this platform will be focusing on masterplan preparation, implementation and monitoring for various cities and towns. Joint working groups can be established to address specific urban planning challenges and promoting cooperative work.

This initiation should emphasize the introduction and enhancement of GIS and other tools to better usage in urban planning processes. Comprehensive training programs can be provided for GDUP and relevant sectors staff to ensure proficiency and knowledge in the technologies, with continuous learning opportunities and support from technology experts for effective integration and maintenance. This holistic technology approach is aiming at fostering inter organizational cooperation, make use of advanced technologies, to ensure efficient and effective urban planning.

(3) Regional Planning

The lack of regional planning is an obvious missing upper planning component. To establish and strengthen capacities that are able to formulate regional planning, a comprehensive capacity building package can be implemented for GDUP, with the participation of relevant ministries. This package will aim to enhance their ability to formulate visions and strategies aligned with KRG policies. This will ensure their role to effectively lead relevant and subordinate directorates. A key component should involve establishing a dedicated Taskforce within GDUP to focus on strategic vision alignment and climate change adaptation, to ensure that regional planning strategies address climate change challenges and comply with KRG policies. This course should also make clear guidance for urban planning at city level that can follow a region-wide plan. For this matter, training programs and workshops can be conducted to improve GDUP and UPDG staff's understanding of regional planning, climate change issues and comprehensive planning. The participation of environmental and sectoral departments is also important to foster collaboration and to integrate sustainable practices into the process of urban planning.

Additionally, activities should be done that include the work of GDUP to focus on gathering data such as demographics, land use, environment, and economics across the region. This should enhance their understanding to develop skills for comprehensive analysis of the current situation. With this data they can formulate policies and strategies for regional planning that enhance the use of regional resources and clearly define the roles of cities within the region. These efforts will emphasize economic development, environment enhancement, sustainability and infrastructure development. As a result, it will create a good approach to regional planning.

Final Report

PART V: CLIMATE CHANGE ADPTATION / LOW EMISSION CITY PLANNING

CHAPTER 1
READINESS ACTIVITIES

Erbil City, situated in the foothills of the Zagros Mountains, has a hot dry climate and summer temperatures are becoming gradually hotter with climate change. Also, rain storms are becoming increasingly larger, flooding parts of Erbil City. At the same time, the Erbil Governorate economy heavily relies on the exploitation of fossil fuels contributing to climate change.

It is in the interest of the Erbil City to adapt its citizens to climate change from gradual change (summer heat) and extreme weather events (rain storms). Additionally, Erbil is required to transform its economy in line with the Paris Agreement to become climate neutral by 2050. Revising the Master Plan for Erbil by incorporating solutions for the climatic issues Erbil is facing due to climate change is essential to keep the city habitable.

The intend to become a carbon neutral city was already expressed in the Erbil 2030 MP from 2007. Similarly, the desire to diversify the economy and greening the city by planting trees in and around the city. The latter will not only help compensate for Erbil's carbon footprint through sequestration of carbon dioxide (CO2), it will also adapt the city against climate change by reducing the heat island effect in the summer.

Transitioning Erbil towards becoming a carbon neutral and green city will require policy reform, climate finance and diverting financial streams away from carbon intensive activities. Progress can only be monitored by setting targets based on a baseline. A first baseline of Erbil's carbon footprint was calculated in its Sustainable Energy Action Plan (SEAP), which also included suggestions for emission reductions. The SEAP is reviewed in Section 1.2.

The carbon footprint for Erbil was calculated following the project methodology developed by the EU Joint Research Center for the EU Covenant of Mayors. This project methodology was developed for cities in Europe. Therefore, the methodology is less suited for cities in developing jurisdictions. In Section 1.1 Methodological framework, other methodologies are presented, and the Global Covenant of Mayors for Climate and Energy is discussed and selected as the project methodology to be used in updating the Erbil 2030 MP. Finally, Section 1.3 gives an update on the carbon footprint of Erbil anno 2021, using the methodologies selected from the discussion in Methodological framework.

1.1 Methodological Framework

With the ambition to become a carbon neutral city, Erbil City needs to reduce its current carbon footprint. An action plan with activities to reduce or mitigate Greenhouse Gas (GHG) emissions are referred to as carbon project. Unlike a "simple" afforestation project or most carbon projects, city carbon projects have multiple sectors, e.g., transport, energy consumption, land use change. And for each sector, there are different methodologies, methods or tools (tool methodology) available to calculate baseline GHG emissions and GHG reductions through policy reform and project activities. The overall methodology describing the entire project is the project methodology with a Project Design Document (PDD) or an Action Plan as the end result.

1.1.1 Internationally Accepted Methodologies

A project methodology is a standard procedure to describe a carbon project with a list of detailed project information and specifications, such as the project area (i.e., Erbil Proposed City boundary) the project period, some general information on in this case Erbil City. There are specifications on the carbon or GHG accounting, such as the greenhouse gasses accounting for per sector, reference year, targets.

With the emergence of the voluntary carbon market and later the compliance market, methodologies were developed to provide the buyer of carbon credits transparency on the calculation of the carbon credits. Over time, a multitude of methodologies to calculate carbon footprints have been developed within the context of climate mitigation, i.e., GHG reductions and sequestrations.

There has not been a similar development within the context of climate adaptation. Climate adaptation is much more difficult to standardize in methodologies because adaptation options are strongly determined by local circumstances in topography, hydrology and soils. Also, climate adaptation cannot be measured with one metric, unlike climate mitigation which is measured in tCO2 or Mg,

The methods to calculate GHG emissions are based on fundamental research investigating biogeochemical cycles, i.e., flow and quantification of chemical substances through the biotic (alive) and the abiotic compartments of the earth, i.e., atmosphere, hydrosphere and lithosphere.

The International Panel on Climate Change (IPCC) under the United Nations Framework Convention on Climate Change (UNFCCC) is highest authority on methods (methodology tools or module). It provides guidance on how to calculate GHG emission based on activity data (e.g., 500 liters per year) and emission factors (2.6kCO2/liter). The IPCC does not prescribe project development of GHG emission reductions and sequestrations.

A methodology in the context of carbon accounting is a PDD, which not only includes the methods used to calculate GHG emissions reductions and sequestrations, but also describes the activities and techniques involved to accomplish these reductions and sequestrations. Often a PDD focusses on one particular sector, e.g., private transport or a particular technology. e.g., solar farm.

Over the last two decades, there has been a proliferation of methodologies. As the Paris Agreement obligations are approaching (2030), a push for the harmonization of methodologies is pursued, specially by international financial institutions to decarbonize their portfolios.

The highest authority harmonizing methodologies is the International Financial Institutions Technical Working Group under the UNFCCC. This group is merging and upgrading existing methodologies previously developed under the Clean Development Mechanism (CDM) as part of the Kyoto Protocol. The carbon credits calculated through these methodologies are called Certified Emission Reductions (CERs).

The other large initiative under UNFCCC has been REDD+, Reduced Emissions from Deforestation and forest Degradation. The plus sign covers other activities, such as improved forest management, reforestation. REDD+ projects were mainly carried out in forested developing countries with high deforestation rates. Carbon credits generated under this initiative have biodiversity and social co-benefits. These carbon credits were not allowed to be traded at the compliance schemes in the EU. Most credits were sold on the voluntary market.

More appropriate for an urban setting is the Global Covenant of Mayors for Climate and Energy. This initiative is the merger of the EU Covenant of Mayors (2008) and the NYC Compact of Mayors (2014). Erbil City commissioned the Sustainable Energy Action Plan (SEAP) under the EU Covenant of Mayors in 2017. The Global Covenant of Mayors pursues both climate mitigation (reducing carbon footprint) and climate adaptation (gradual change and extreme weather events). In the near future, it will add a third pillar, currently under review on affordable energy access for the vulnerable.

1.1.2 Selected Methodologies

The Global Covenant of Mayors for Climate & Energy has developed the most appropriate project methodology for Erbil City. The project methodology or reporting framework is specific for cities including cities in developing countries. The methodology consists of three pillars: climate mitigation, climate adaptation and affordable energy for the vulnerable (inclusiveness). Concerning climate mitigation, the project methodology heavily relies on the existing framework of national GHG inventories developed by the IPCC.

The methodology covers all the relevant sectors, conventional sectors for cities such as energy consumption, transport, but also other sectors such as land use change. The methodology does not include urban expansion which is covered under the sector of construction of roads and buildings. But the project methodology allows adding new sectors.

The tool methodologies to calculate GHG emissions are detailed, but flexible acknowledging the reality on the ground for cities in developing countries, as is the case for Erbil City where data availability and

quality might not be ideal. In that context, the project methodology recognizes three reporting levels: 1) mandatory requirements, 2) recommendations and 3) additional options under three pillars of climate mitigation and adaptation and affordable energy for the vulnerable.

It is proposed that Erbil City does not yet formally join the initiative but starts to prepare itself to be able to join the Alliance of Global Covenant of Mayors, if this is their ambition. Currently, Erbil City is not set up to lead and steer this process lacking both expert capacity, human resources and finance as well as a single depository for all the data.

1.1.3 Description of Selected Methodology

Table 1.1.1 provides an overview how the Erbil 2030 MP update project aligned with the Global Covenant of Mayor for Climate and Energy. The Global Covenant of Mayors has been selected as the project methodology used to update the Erbil 2030 MP from 2007. This is the outcome of Activity 7-1.a Select methodology, fields and KPIs. The fields correspond to the sub-sectors and categories with each their own KPI.

The second phase in the Global Covenant of Mayors, assess impact (of GHGs) and (climate) risks, corresponds with establishing a baseline carbon footprint for Erbil City. This was already accomplished with the Sustainable Energy Action Plan (SEAP), developed under the EU Covenant of Mayors. This SEAP with data from 2015 is reviewed under Section 1.2 and this corresponds to Activity 7-1.b. Activity 7-1.b Calculation of baseline (2021) GHG emissions the framework of the Global Covenant of Mayors is followed and subsequently the calculation methods. This is further detailed in Section 1.3 below.

The three project activities under Activity 7.2 Concepts and calculation of future emissions corresponds to phase 4 Develop climate actions and adaptation strategy. Activity 7.3 Promotion to private sectors corresponds to the early stages of phase 5 Implement. Phase 6 Report and Monitor, 7 Validate and 8 Update climate actions and adaptation strategy are not covered by the Erbil 2030 MP project.

Here below follows a short description of the Global Covenant of Mayors project methodology. Cities are much larger emitters of GHGs than rural areas and most of the population already lives in cities and even more so in the future. Therefore, to address climate change effectively, cities need to lower their GHG emissions and protect their inhabitants from climate risk (adaptation). The alliance is also in the process of developing a safeguard (pillar) to ensure that energy is accessible and remains affordable for the most economically vulnerable urban residents.

This pathway is flexible in the sense that cities can decide based on their context with which of the first four phases they want to start first and whether they prioritize more on mitigation or adaptation.

Formally joining the Global Covenant of Mayors comes with the obligation to create real and significant impact. Within two years from the commitment letter, GHG emissions must have been calculated, climate risk from extreme weather events and gradual change must have been accessed and real and realistic targets must have been set. Within three years policy reform and measures to mitigate and adapt to climate change must have developed. In the fourth years implementation starts, followed by monitoring and evaluation after two years every two years. Progress is reported to the alliance through their Common Reporting Framework and uploaded on their website.

Table 1.1.1 Update Erbil City 2030 MP from 2007 Project Activities and Paris Agreement Aligned with the Pathway of the Global Covenant of Mayors on Climate and Energy

Activity	Update Erbil City 2030 MP from 2007	Phase	**Global Covenant of Mayors on Climate and Energy**
7.1 Preparation and baseline emissions			
7-1.a	Select methodology, fields and KPIs		
	The government of Iraq ratified the Paris Agreement (1/December/2021)	1	Make a commitment
7-1.b	Review SEAP (section 1.2)	2	Assess impact and risks
7-1.c	Calculation of baseline (2021) GHG emissions (section 1.3)		
	Targets and goals aligned with the Paris Agreement: 2030	3	Set targets and goals

Activity	Update Erbil City 2030 MP from 2007	Phase	**Global Covenant of Mayors on Climate and Energy**
	half baseline carbon footprint, net carbon neutral in 2050		
7.2 Concepts and calculation future emissions			
7-2.a	Climate change counter measure concepts and strategies and GHG emission reduction targets for each KPI	4	Develop climate actions and adaptation strategy
7-2.b	Calculation of future GHG emissions per alternative, Refining of GHG emissions calculation on selected MP		
7-2.c	Mitigation measures of inevitable GHG emissions		
7.3 Promotion to private sector			
7-3.a	Propose priority projects for GHG reductions and low carbon technologies and measures to be introduced by private sector	5	Implement
		6	Report and monitor
		7	Validate
		8	Update climate actions and adaptation strategy.

Source: JICA Project Team

In the Common Reporting Framework, there are mandatory requirements under each pillar (mitigation, adaptation and affordable energy access). Under mitigation, the city has to calculate CO2, methane (CH4) and nitrous oxide (N2O) emissions from stationary energy, transportation, waste and energy generation. These GHG emissions should be separated in direct (scope 1) and indirect (scope 2 and 3) emissions. Direct emissions are e.g., fossil fuels used in the public transport and indirect emissions are emissions e.g., from power plants outside Erbil City boundary. Finally, the action plan (policy reform and measures) should prioritize targeting the largest emitting sectors to make a significant impact.

Similarly, minimum requirements apply under the adaptation pillar. The city should carry out a Climate Risk and Vulnerability Assessment. Through this assessment climate hazards are identified and quantified. They should be ranked according on their negative impact based on frequency and damage. The highest ranked climate risks should be prioritized in the adaptation plan. The assessment should also identify those inhabitants that are most at risk. These are often marginalized people who due to their low economic position live in areas prone to climate hazards, e.g., flooding or do not have the means to protect themselves.

The climate mitigation and adaptation plan should include activities in the prioritized sectors, areas and stakeholders. Each action should be described together with roles and responsibilities of the local city government, ideally a financial strategy (sources and instruments), time frame with base year, target or goal in specific, measurable, achievable, realistic and time-bound terms (SMART) to be able to track progress. Ideally, the mitigation target is aligned with the Paris Agreement, reducing the city's carbon footprint by half in 2030 and become net carbon neutral by 2050. Climate adaptation does not have a similar target.

The project methodology allows for cities to buy and generate their own carbon credits to reduce their carbon footprint or become net carbon neutral. The methodology also strongly recommends cities not to only rely on public financing and climate finance from development partners or global climate funds. Finance from the private sector should also be pursued and leveraged.

The project methodology of the Global Covenant of Mayors is not completely different from the pathway Erbil City has taken before and while reviewing its Master plan. The ambition to become carbon neutral has been expressed in the first version of the Master plan. Also did Erbil City assess its carbon footprint with policy and measures for climate action. The climate adaptation part has not yet been addressed, but climate hazards and risks have already been identified (extreme heat and flooding). Erbil City is already on the pathway of the Global Covenant of Mayors and it makes sense to (eventually) formally join and complete the transition.

1.2 Review of SEAP

In Erbil 2030 MP, the suggestion was made to calculate the carbon footprint of Erbil City. In 2018, 10 years later, the carbon print of the entire Erbil Governorate was calculated and published in the Sustainable Energy Action Plan (SEAP) financed by the EU and coordinated by UNDP. The carbon footprint was calculated for eight sectors based on data from 2015.

The carbon footprint for the Erbil Governorate was calculated using the CES-MED tool kit and following the EU Joint Research Centre methodology according to the guidelines of the Covenant of Mayors for Climate and Energy. As mentioned earlier the EU Covenant of Mayors is now part of the Global Covenant of Mayors.

The review focuses on the carbon footprint calculations. The actions to reduce CO2 emissions listed in the SEAP will be covered under activity 7-2.a Climate change counter measures concepts, strategies and GHG reduction target for each KPI.

1.2.1 Methodology and Data Sets

(1) Carbon accounting framework, logic and calculations

The carbon footprint or Baseline Emission Inventory (BEI) for CO2 emissions were calculated for the following eight sectors: 1) Governorate buildings/equipment/facilities, 2) Tertiary buildings/equipment/facilities, 3) Residential buildings, 4) Public lighting, 5) Governate fleet, 6) Public transport 7) Private and commercial transport and 8) Agriculture. The sector of Agriculture has to be interpreted as electricity consumption in rural areas. Table 1.2.1 presents the carbon footprint calculated.

The tool methodology used to calculate the CO2 emissions was not the same for all sectors. The CO2 emissions from power supplied through the grid was calculated differently from the CO2 emissions where activity data in volume of fossil fuels were available.

Transportation sector - For the transport sectors the volume of fossil fuels consumed per year were available. The power plants generating power using fossil fuels this data was not available. In this case, the CO2 emissions were calculated indirectly.

CO2 emissions from sectors with actual fossil fuel data (units/time period) were calculated by multiplying this activity data with the emission factor (CO2/unit) for that particular fuel. For instance, a private vehicle using 500 liter per year has a carbon footprint of 1,350 kCO2 per year (500 liters x 2.7kCO2 per liter) or 1.3 tCO2 per year. Emission factors for fossil fuels (e.g., diesel) were used published by the IPCC in the Guidelines for national GHG inventories (2006).

Energy consumption from the grid - In case of power supplied through the grid, energy consumption measured in MWh for the relevant sectors was used. Instead of establishing the emission factor of the energy mix supplied to the grid for 2015, the only available emission factor for Iraq was used, i.e., 0.82 tCO2 per MWh. No reference was provided to the source of this calculation nor the year when this emission factor was calculated.

Furthermore, power cuts are common and electricity supplied through the grid averages to 19 hours per day. To calculate the assumed energy consumption for a full day of 24 hours, the energy use during the 19 hours per day was extrapolated by multiplying by 1.26 (24h/19h). Energy efficiency losses before consumption by end users were not taken into consideration in the overall calculation. These losses ranged around the 35 and 38%.

Energy consumption from diesel generators - Power provided through diesel generators was also calculated indirectly through the number of generators operating in the Erbil Governorate. It was assumed that diesel generators were used as back up during times of power outage. The average power outage was 4.4 hours per day. Based on information available online a standard 250 kW generator at its most efficient capacity of 75% uses 0.275 liters of diesel per 1kwh.

Non-electricity energy consumption - Energy consumption by residents for heating and cooking using kerosene and LPG were also calculated. The use of kerosene was available in liters and in kgs for LPG.

The two metrics were converted first to kWh and then to tCO2. Energy consumption and CO2 emissions from these two sources were added to the extrapolated figure for energy consumption by residents from the grid.

(2) Business As Usual (BAU) emissions calculation for 2030

For each sector a Baseline Emission Inventory (BEI) was calculated and based on these figures a Business As Usual (BAU) emissions for 2030. The CO2 emissions in 2015 were multiplied by 1.62% to obtain the future emissions for 2030 under the BAU scenario. The 1.62% was referenced originating from the EU Joint Research Centre but no explanation was provided how this figure was calculated.

The per capita CO2 emissions were calculated by summing up the CO2 emissions from all the eight sectors and divided by the 2,000,000 inhabitants living in the Erbil Governorate in 2015.

Table 1.2.1 CO2 Emission in the Erbil Governorate by Sector for 2015

Sector	Base year 2015		BAU 2030	
	MWh	tCO_2	MWh	tCO_2
1. Governorate buildings, equipment/ facilities	11,467	9,403	18,576	15,232
2. Tertiary buildings, equipment/facilities	2,391,690	1,961,186	3,874,537	3,177,121
3. Residential buildings	7,855,170	4,422,846	12,725,375	7,165,010
4. Public lighting	81,228	66,607	131,589	107,903
5. Governorate fleet	39,793	10,625	64,464	17,212
6. Public transport	-	-	-	-
7. Private and commercial transport	8,834,687	2,237,375	14,312,192	3,624,547
8. Agriculture	203,537	166,900	329,729	270,378
Total	19,417,572	8,874,942	31,456,462	14,377,403

Source: Kurdistan Region of Iraq Erbil Governorate, SEAP

1.2.2 Results and Observations

The CO2 emissions for the eight sectors are presented in Table 1.2.1. The total CO2 emissions in 2015 from all eight sectors in the Erbil Governorate is close to 9M tCO2. The two sectors with the largest carbon footprint are private and commercial transport (45%) and residential buildings (40%) causing 85% of all CO2 emissions. Tertiary building/equipment facilities is the third largest CO2 emitter. In total, these three sectors cover 98% of all CO2 emissions in the governorate of Erbil. No information is available for the public transport sector and no information for Erbil City has been calculated. The per capita CO2 emissions in 2015 were 4.4 tCO2.

1.2.3 Assessment of SEAP

(1) Dissimilar levels of precision carbon footprint calculation for each sector

The carbon footprint for each of the sectors is not equally precise. The sectors with the most precisely calculated carbon footprint are those with activity data measured in either liters or kgs, i.e., Governorate fleet (5) and Private and Commercial transport (7), including the consumption of kerosene and LPG under the Residential buildings (3).

The carbon footprint of sectors consuming energy through the grids is least precise. First of all, the emission fact of 0.82 tCO2 per MWh calculated for the entire country of Iraq and before 2015 may not have been representative for the Erbil governorate in 2015.

(2) Inconsistencies in carbon accounting logic

Secondly, there may be issues with some the carbon accounting logic. The 19 hours energy consumption was extrapolated to 24 hours to get a full 24 hours figure to capture emissions without power outages.

Yet, diesel powered generators were assumed to bridge this gap in energy consumption for 4 to 5 hours per day. Furthermore, their CO2 emissions were calculated based on some very general assumptions. Beside the potential issues using very general assumptions, more importantly adding the emissions from generators to the extrapolated figure for grid energy consumption seems double accounting and increase the carbon footprint of the residents unnecessary.

(3) Discrepancies in Baseline Energy Inventory

Thirdly, losses in the transformation and distribution of electricity along the grid ranged tween 35 and 38% before consumption by the end user. These are significant inefficiencies and these were not included in the calculation of the sectors depending on the grid. Unless, these losses were incorporated and included in the emission factor for the Iraq (0.82 tCO2/MWh) than the CO2 emissions are significantly underestimated.

Fortunately, the three sectors with the largest carbon footprint (2. Tertiary buildings, equipment/facilities, 3. Residential buildings and 7. Private and commercial transport) are significantly larger than the rest of the sectors. Therefore, there is no dispute which the largest sectors are and the aim of the SEAP to be able to identify the largest emitting sectors has not been complicated.

The future CO2 emission for 2030 under the Business-As-Usual scenario were calculated by multiplying the sector carbon footprint by a factor of 1.62. No logic was provided to explain this factor except it was derived from the EU Joint Research Centre supporting the Covenant of Mayors. Therefore, CO2 emissions for the sectors are not sufficiently substantiated and may not be usable as a reference scenario.

Using the per capita CO2 emissions for the Erbil Governorate to calculate the future carbon footprint under the BAU scenario provides a lower future emission for 2030. In the SEAP, the population in the Erbil governorate was slightly more than 2 million inhabitants (2,009,637). Based on population growth rates available from UN Projections the population of the Erbil governorate is estimated at 2.7 million in 2030. Multiplying the close to 3 million future inhabitants with the 4.4 tCO2 per capita from 2015 results in a future carbon footprint of slightly more than 12M tCO2. This is 2M tCO2 lower than the 14M tCO2 calculated in the SEAP.

(4) Carbon footprint of Erbil City

The data provided in the SEAP was not specific of Erbil City, which is the focus of reviewing Erbil 2030 MP. The population of Erbil City was estimated around 788,000 in 2015 according to UN. Multiplying the number of inhabitants by the per capita emissions results in a rough estimate of 3.5M tCO2 as the overall footprint of the city in 2015. This will increase to close 5M tCO2 for 2030 (4.8MtCO2) for 1,077,000 inhabitants predicted by the UN.

(5) Limited focus and scope of the SEAP

The above historical and future carbon footprints are underestimated. The SEAP only deals with the CO2 emissions. Other GHGs besides CO2 are not considered, such as, N2O, ozone (O3), chlorofluorocarbons (CFCs and HCFCs), hydrofluorocarbons (HFCs), perfluorocarbons (CF4, C2F6). The last three kinds of GHGs are used for air-conditioning and can be a significant source of GHG emissions in hot regions like Erbil. The minimum requirement under the Global Covenant of Mayers is that besides emissions of CO2 also emission of CH4 and N2O are calculated.

The SEAP also only covers one source of GHG emissions. This is CO2 emissions from energy consumption generated with fossil fuels. It does not deal with other sectors such as municipal organic solid waste in landfill and sewage slush. These two urban public services are also sectors with a high carbon footprint. Both waste streams are a source of methane, a greenhouse gas 24 times stronger than CO2.

(6) Carbon footprint from urban expansion

In the 2030 Business As Usual scenario, the SEAP only extrapolates per capita consumption as per population increase. It does not capture GHG emissions from urban expansion as a consequence of

population increase. Urban expansion entails the construction of roads and buildings. The materials used such as, e.g., steel, cement and tarmac, are also a source of GHG emissions from material used. Then, there are the direct GHG emissions from the machines to build.

Even the Global Covenant of Mayors does not require to calculate the carbon footprint from urban expansion. This aspect in principle falls under the sector of Other AFOLU (Agriculture, Forestry and Other Land Use) and reference is made to IPPC guidance. IPCC guidance has a section dealing with land use change from other land uses to settlement, but it does not cover the extent of planned urbanization.

It may not seem relevant to have a rough estimate of the carbon footprint from physical urban expansion as it is not required under the Global Covenant of Mayors. On the other hand, there is a strong push from development banks as part of the Paris Agreement to green or decarbonize their infrastructure related projects. If Erbil City aims to submit financial requests to these institutions, it is required to offset the carbon footprint associated with the planned infrastructure.

In conclusion, the SEAP is a good first effort to calculate the carbon footprint of the Erbil governorate and the CO2 emissions calculated per capita provide an opportunity to gain some insight in the carbon footprint of Erbil City.

1.3 Calculation of the Baseline GHG Emissions & Sequestration

1.3.1 The Reporting Framework of The Global Covenant of Mayors

The Global Covenant of Mayors has been selected as the project methodology to calculate the carbon footprint of Erbil City. The newly proposed Erbil City boundary is used as the project boundary to delimit the project area. The project or target area covers 274 ha comprising the build-up area of Erbil City and the landscape around Erbil City with the presence of villages and dominated by farmland.

2021 is the reference year for the carbon accounting and the GHG emissions of all sectors mentioned under the Global Covenant of the Mayors will be calculated. This includes farmland converted to settlement as a result of urban expansion under the AFOLU sector. The other land use change considered is the farmland to forest as part of the CO2 sequestration effort.

The required sectors to report about are: stationary energy, transport and waste. The sectors are further subdivided in subsectors. Each subsector can be further subdivided in sub-category. For each sub-sector or category, it has to be reported if the emissions are direct from fuel combustion or indirect from the grid and whether the subsector is regulated through an Emission Trading Scheme (ETS) or not.

In addition, for each sub-sector, the type of energy is mentioned, followed by a short description of the activity or facility. Similarly, activity data, emission factors and emissions have to be mentioned, including the amount, unit and data source and the method for emissions.

The project methodology accommodates for data limitations, but these limitations need to be flagged through notation keys, clarified and used as a last resort option. There are four types of notation key, no occurring (NO), included elsewhere (IE), confidential (C) and not estimated (NE).

1.3.2 Stationary Energy

(1) Description of the Stationary Energy KPI

Table 1.3.1 Stationary Energy Sector KPI

Subsector	Description	Data Source	Additional Information
Residential	GHG emissions from residential buildings from energy use for lighting, appliances, cooking, heating, cooling, etc. When this electricity is supplied through the grid it is considered indirect and when supplied e.g., by diesel generators is considered direct. The use of kerosene and LPG will be sub-categories. (a stricter listing may be ideal)	Area of residential area and number of buildings from Existing Land Use Land Cover Data (JICA Project Team, 2022) Per capita energy use for lighting, appliances, cooking, heating, cooling, etc. from Household Survey (JICA Project Team, 2022) Ownership of generators in Erbil (23.4%) from Household Survey (JICA Project Team, 2022) Directorate of Erbil Electricity	Registry of electricity meters Commission on generators
Commercial	These are GHG emissions from commercial buildings e.g., commercial offices, banks, shops, hotels, private schools or clinics, other privately owned facilities, etc. Here as well the distinction between indirect and direct GHG emissions applies.	Chamber of Commerce Directorate of Erbil Electricity	Field data from commercial entities
Institutional	These are GHG emissions from public buildings, e.g., public schools, hospitals, government offices, publicly-owned facilities, etc. Public lighting is also included in this sub-sector.	Ministry of Interior Directorate of Erbil Electricity	
Industry	These are GHG emissions from energy use in manufacturing and industrial facilities, construction activities and energy industries.	Ministry of Industry Chamber of Commerce Directorate of Erbil Electricity	
Agriculture	These are GHG emissions from agricultural, forestry and fishing activities (e.g., fish farm), including energy used by the on-site farm vehicles and machinery, generators to power lighting, pumps and heaters.	Ministry of Agriculture Chamber of Commerce Directorate of Erbil Electricity	Field data collected from farms in the peri-urban zone
Fugitive	These are GHG emissions from the extraction, transformation and transportation of primary fossil fuels within the city boundary, including emissions occurring from oil and natural gas systems, e.g., equipment or pipeline leaks, evaporation and flashing losses, venting, flaring, incineration, accidental releases, etc.	Ministry of Natural Resources	Operation data from fossil fuel companies

Source: JICA Project Team

(2) Calculation of the Stationary Energy KPI Baseline Emissions

The overall GHG emissions from supplying power through to grid for the residential, commercial, institutional and industrial subsectors have been calculated under 1.3.7 Energy Generation KPI. The total GHG emissions from the Stationary Energy KPI are at least 6 MtCO2e per year based on the three power plants within the Erbil City target boundary.

The existing available activity data does not allow to calculate the GHG emissions per subsector. Data available is not structured according to the subsectors. Other activity data is not available e.g., fuel use by private generators. Protocols will have to be developed to capture this activity in the next two years.

1) Agriculture

GHG emissions from the Agriculture subsector has not been calculated as there is no data available on the energy use of farmers. There are 11,516 agricultural vehicles formally registered with Erbil City. Fuel to operate the vehicles is purchased at gas stations. Gas stations do not record fuel pursued per type of vehicle. Also, energy use either through the grid or through generations on the farms is unknown.

2) Fugitive

Erbil has well-developed supply chains from extraction, transformation and transportation of primary fossil fuels. Data on the volume of oil and gas extracted, transformed and transported must be available with the fuel fossil companies, but has not been shared. It is unknown whether emission from oil and gas systems, e.g., equipment and pipeline leaks are recorded.

1.3.3 Transport

(1) Description of the Transportation KPI

Table 1.3.2 Transport Sector KPI

Subsector	Description	Data Source	Additional Information
On-road	These GHG emissions are from energy use for on-road transportation of people or goods only within the target boundary. It is required to report GHG emissions for the following categories: municipal fleet, public transport, private and commercial transport.	Ministry of Transport and Communication Ministry of Natural Resources	Field data on government coupons for fuel purchases
Rail	There are GHG emissions from energy used for rail transportation of people or goods within the target boundary, e.g., as trams, urban railway subway systems, etc.	N/A	
Waterborne navigation	These GHG missions from energy use for water transportation of people or goods within the target boundary, e.g., ferries, sightseeing cruises, etc. Reporting of this sub-sector is only required if GHG emissions are significant.	N/A	
Aviation	These are GHG Emissions from energy use for air transportation of people or goods within the target boundary, e.g., sightseeing or emergency helicopters. Reporting of this sub-sector is only required if GHG emissions are significant.	N/A	
Off-road	There are GHG emissions from energy use by off-road vehicles and mobile machinery within the target boundary. Reporting of this sub-sector is only required if GHG emissions are significant.	N/A	

Source: JICA Project Team

(2) Calculation of the Transport KPI Baseline Emissions

Table 1.3.3 Annual Consumption of Fossil Fuels at Gas Stations in Erbil City

Product	2018	2019	2020	2021	2022 (Oct)
Gasoline/petrol (l)	915,480,000	968,040,000	968,760,000	1,021,680,000	1,080,000,000
Gas Oil/diesel (l)	357,570,000	387,958,680	379,547,280	392,831,280	468,000,000
LPG (t)	23,400	28,380	24,480	28,440	30,600

Source: Ministry of Transport

The GHG emissions were calculated for the *On-road* sector only and detailed at category level reported as total tCO2e emissions. No GHG emissions are reported for the *Rail*, *Waterborne navigation* and *Aviation* sectors. The absence of GHG emissions were reported in a Notation Key as no GHG emission occurring (NO), because Erbil City does not have a rail way system, navigable water courses or within target boundary aviation services. GHG emissions for the *Off-road* sector were considered insignificant.

Table 1.3.4 tCO2e Emissions from the Transportation Sector of Erbil City in 2021

Product	Activity data	Emission Factor		tCO2
Gasoline/petrol (l)	1,021,680,000	2.3	kCO2/l	2,349,864
Gas Oil/diesel (l)	392,831,280	2.6	kCO2/l	1,021,361
LPG (t)	28,440	3.0	kCO2/kg	85,889
Total tCO2e				3,457,114

Source: Ministry of Transport

2) On-road

Activity data quantified in liters per year and per product are provided in Table 1.3.3. The activity data for 2021 was used as it represents the latest and complete record. Emission factors published by the IPCC's guidelines were used. All vehicles including government vehicles are suppled through gas stations through a coupon or voucher system. The activity data not only covers the private and commercial category, but municipal fleet and busses of the public transport system. The total emissions for the Transport sector were 3.5M tCO2 for 2021 (see Table 1.3.4). GHG emissions per category is currently not possible to calculate. Obtaining data on the coupons used by the government vehicles would allow to separate fuel use at category level.

1.3.4 Waste

(1) Description of the Waste KPI

Subsector	Description	Data Source	Additional Information
Solid waste disposal	These are all emissions from solid waste that are disposed of at managed sites (e.g., sanitary landfill and managed dumps) and unmanaged sites, e.g., open dumps, including above- ground piles, holes in the ground and dumping into natural features such as ravines or wetlands.	Ministry of Municipalities Department of Municipal Solid Waste	Field data at land fill sites
Biological treatment	These are GHG emissions from biological treatment of organic waste, including composting and anaerobic digestion of organic waste.	N/A	
Incineration and open burning	These are GHG emissions from burning waste by controlled, industrial and uncontrolled processes. Waste incineration for the energy recovery is also included in this sub-sector.	N/A	
Wastewater treatment and discharge	These are GHG emissions from aerobically or anaerobically treatment processes of waste water and direct discharge of wastewater into lakes, ponds, rivers and streams.	N/A	

Source: JICA Project Team

(2) Calculation of the Waste KPI Baseline Emissions

1) Solid waste disposal

Only the GHG emissions from solid waste disposal subsector were calculated using the IPPC's First Order Decay (FOC) method to calculate methane (CH4) emissions. The method is a tier 1 approach and is considered only as an indication of GHG emissions.

EQUATION 1

$$\text{Methane emissions (Gg/yr)} = (MSW_T \bullet MSW_F \bullet MCF \bullet DOC \bullet DOC_F \bullet F \bullet 16/12\text{-}R) \bullet (1\text{-}OX)$$

MSW_T: total MSW generated (Gg/yr)
MSW_F: fraction of MSW disposed to solid waste disposal sites
MCF: methane correction factor (fraction)
DOC: degradable organic carbon (fraction) (kg C/ kg SW)
DOC_F: fraction DOC dissimilated
F: fraction of CH4 in landfill gas (IPCC default is 0.5)
16/12: conversion of C to CH4
R: recovered CH4 (Gg/yr)
OX: oxidation factor (fraction - IPCC default is 0)

Table 1.3.5 Daily Rates of the Categories of Municipal Solid Waste (t/day) for 2020

Non-degradable								Degradable							
Plastic				Other		Metal		Slow				Quick			
											313			805	
Plastic	Plastic PET	P film	HDPE	Industrial	Glass	Aluminum	Ferrous	Wood	Mixed paper	Compound	Yard	Sewage (feces)	Diapers	Food	**Total**
308	126	23	42	67	48	15	49	39	27	174	73	127	114	564	**1,796**
17%	7%	1%	2%	4%	3%	1%	3%	2%	2%	10%	4%	7%	6%	31%	

Source: Ministry of Municipality

The methane emissions from solid degradable waste were calculated from data presented in Table 1.3.5 Part of the FOD method is the assumption that degradable organic carbon (DOC) is converted to methane at the end of the year, in this case 2020. To increase the validity of the methane calculations and set a bottom line, only the categories with quick degradable organic carbon were considered (sewage, diapers, food). These three categories represent 72% of all the degradable waste and 45% of the entire waste. This means that quick degradable waste is the major source of methane emissions.

Table 1.3.6 Daily and Annual Methane and CO2 Emissions from Quick Degradable Organic Carbon in Municipal Solid Waste in Erbil City for 2020

OC (t)	DOCf	MCF	F	16/12	tCH4/day	tCH4	tCO2e/day	tCO2e
805	0.5	0.8	0.5	1.3	161	58,765	3,864	1,410,360

Source: JICA Project Team

The formula takes into account that not all of degradable organic carbon is broken down in the anaerobic bacterial process (IPPC default setting 0.5). In addition, methane gas is only a fraction of the landfill gas produced during the process of anaerobic breakdown (IPCC default 0.5).

In the case of Erbil City, the methane correction factor for unmanaged and land fill deeper than 5 m was selected (0.8); furthermore, methane is not recovered for energy purposes nor oxidized. The annual methane emission and equivalent CO2 are presented in Table 1.3.6 and shows that methane emissions in 2020 were close to 60,000 tCH4 and the equivalent of almost 1.5M tCO2e.

2) Biological treatment

GHG emissions for biologically treating organic waste (composting) are not reported, because organic

waste is currently not being composted. This will be indicated in the table with a Notation key (NO).

3) Incineration and open burning

Similarly, GHG emissions were not calculated for the Incineration and open burning sector. Undoubtedly, waste is partially burned uncontrolled at the municipal solid waste site and outside. The scale, volume and regularity of this uncontrolled burning is not recorded. Without activity data GHG emissions cannot be calculated. This also flagged with a Notation key (NO).

4) Wastewater treatment and discharge

Finally, sewage as part of the wastewater treatment was also not calculated as sewage (feces) are collected from septic tanks and used as fertilizer in the agricultural sector. The volume of waste water discharged by industry is unknown.

1.3.5 Industrial Processes and Product Use (IPPU)

(1) Description of the IPPU KPI

Subsector	Description	Data Source	Additional Information
Industrial processes	These are GHG emissions from processes that chemically or physically transform materials, e.g., production of cement, lime, glass, etc. (mineral industry), ammonia, nitric acid, adipic acid (chemical industry), e.g., iron steel and metallurgical coke, ferroalloy, aluminium, magnesium (metal industry)	Ministry of Industry	Processing information and data from factories and companies
The use of products	There are GHG emissions from the actual use of GHGs in products, e.g., refrigerators, foams or aerosol cans and products derived from fossil fuels, e.g., plastics, asphalt, kerosene, fertilizer, etc.	Ministry of Industry	Processing information and data from factories and companies

Source: JICA Project Team

The GHG emissions from IPPU sector are optional and not required to be reported.

(2) Calculation of the IPPU KPI Baseline Emissions

The GHG emissions from IPPU have not been included from the carbon footprint assessment.

1.3.6 Agriculture, Forestry and Other Land Use (AFOLU)

(1) Description of the AFOLU KPI

Subsector	Description	Data Source	Additional Information
Livestock	These are GHG emissions from livestock emitting CH4 (methane farts) from their enteric fermentation digestive system	Ministry of Agriculture	Market data on livestock Sale data on animal feed
Land use	These are GHG emissions from land use change. There are six categories of land use: forest land, cropland, grassland, wetlands, settlements and other. Changes from a high-density carbon land use, e.g., forest change to a low-density carbon land use, e.g., cropland. GHGs are removed when low carbon land use is converted to high carbon land use.	Ministry of Planning	Research by universities
Other AFOLU	These are GHG emissions from biomass burning without energy recovery, e.g., wild fire, liming to reduce soil acidity, urea and synthetic fertilizer application to improve harvests, etc.	Ministry of Planning Ministry of Agriculture	Remote sensing analyses Sale data on synthetic fertilizers

Source: JICA Project Team

Reporting GHG emissions from the AFOLU sector are optional. Currently, data on the livestock subsector is limited. In addition, livestock ownership by farmers is mostly relatively small. Consequently, the associated GHG emissions will be considered insignificant. Similarly, under Other AFOLU, GHG

emissions from bush burning to prepare land are relatively small and insignificant. Currently, sewage from Erbil City is used as fertilizer. The use of synthetic/ fossil fuel-based fertilizer is probably small and insignificant. GHG emission from Land use only occur when there is a change in land use from a high-carbon density to a lower-carbon density land use. An initial estimation of future land use changes is provided here below.

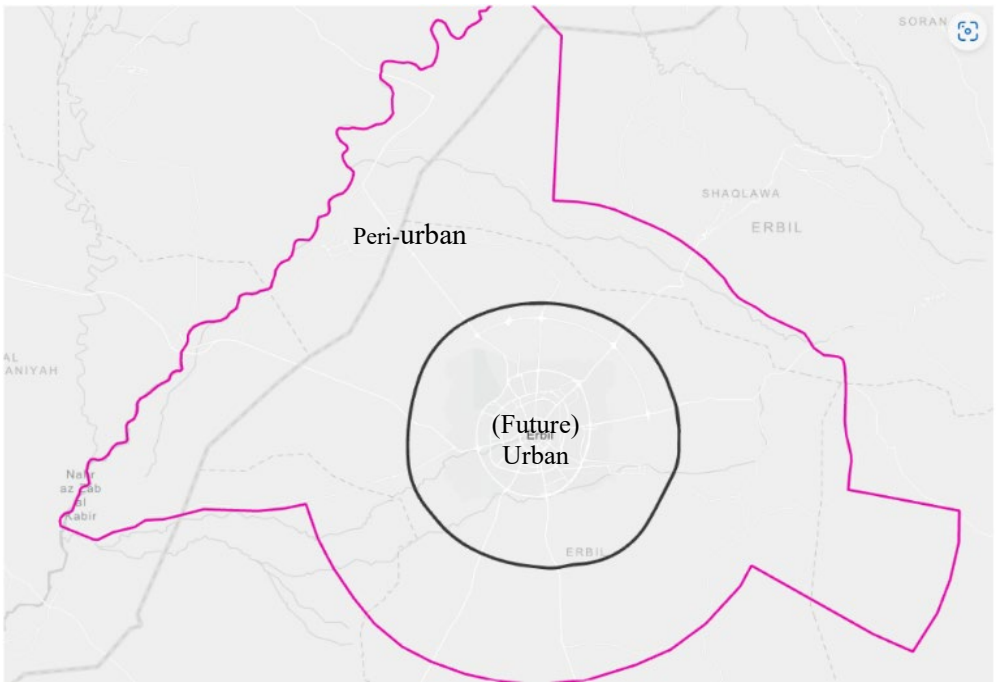
(2) Calculation of the AFOLU KPI Baseline Emissions

The first step of calculating GHG emissions from land use is to establish the changes in surface areas of the different categories of land use over time through a remote sensing analysis. Second step is to establish the carbon density of each of the category of land uses.

Table 1.3.7 Land Use in the Erbil City Target Area

LU Category	Peri-urban		(Future) Urban	
	ha	%	ha	%
Crop land	143,204	65%	17,803	33%
Settlement	9,780	4.4%	35,259	66%
Forest land	110	0.1%		
Other[1]	65,891	30%		
Water	1,214	0.6%	192	0.4%
Total	220,200		53,254	
%	81%		19%	
Grand total				273,454

Note: [1] Barren land with sparse with shrubs
Source: JICA Project Team



Note: The boundary of study area is colored in pink, municipality is colored in black.
Source: JICA Project Team

Figure 1.3.1 Map of the Erbil City Target Area and the (expanded) Erbil City, i.e., the (future) urban zone and the peri-urban zone around the (future) urban zone

Table 1.3.7 provides a land use assessment for the Erbil City target area from 2022. There is a (future) urban zone and the peri-urban zone. The urban zone comprises Erbil City and the future expansion

within the black outline area in the map above (Figure 1.3.1). 66% of this zone is urbanized and classified a settlement. A third of the area inside the urban zone is cropland. This cropland is the land available for urban expansion in the future, hence the label of (future) urban zone.

Cropland has very little above ground biomass in the form of trees. Most of its carbon is Soil Organic Carbon (SOC). The loss of Soil Organic Carbon with urbanization will to be insignificant compared to the carbon footprint of urbanizing the cropland. Buildings and roads have a high carbon footprint.

One potential option to compensate for the carbon footprint from urbanization is planting trees in the peri-urban zone, either as plantation forest and agroforestry, trees on farmland. If the 86,976ha of rainfed farmland out of the143,204ha of cropland and 65,981ha of barren land is planted with trees constituting a carbon density of on average 50tCO2e per ha, the total volume of sequestered CO2 would be close to 8M tCO2e in 30 years.

1.3.7 Energy generation KPI

(1) Description of the energy generation KPI

Subsector	Description	Data Source	Additional Information
Electricity-only generation	These are GHG emissions from energy (both renewable and non-renewable) consumption for the purpose of generating grid-supplied electricity in power plants.	Ministry of Electricity Ministry of Natural Resources	Power grid Authority Operation data from power plants
CHP	These are GHG emissions from energy consumption (both renewable and non-renewable) for the purpose of generating electricity and thermal energy in Combined Heat and Power (CHP) plants.	N/A	
District heating/cooling	These are GHG emissions from energy (both renewable and non-renewable) consumption for the purpose of generating thermal energy only in district heating/cooling plants.	N/A	
Distributed local renewable energy generation	These are GHG emissions from local energy generation (electricity, heat, etc.) facilities that are not grid-connected.	Ministry of Electricity Ministry of Natural Resources	Registered owners of solar panels and solar heaters

GHG emissions are reported for only the *Electricity-only generation*. There are three power plants in Erbil City reported by the Ministry of Electricity. Together they emit close to 6MtCO2e per year in GHG emissions. The fourth power plant has a capacity of 29MW, which is supplying the Governorate House and military. It is unknown which fuel is uses. If it is gas than the plant emits 110,218 tCO2e in GHG emissions.

It is currently unknow if the three power plants cover the energy demand for all the residents and industry. There may be other power plants outside Erbil City target boundary which are supplying to the grid. Protocols will need to be developed to capture this information.

Erbil City does not have *Combined Heat and Power Plants*, nor *District heating/cooling facilities*. The GHG emissions from *Distributed local renewable energy generation* are optional, but they were considered insignificant.

(2) Calculation of the energy generation KPI baseline emissions

Activity data quantified in million standard cubic foot (MMSCF) per year for the three power plans are provided in table 1.3.8. The activity data for 2021 was used as it represents the latest and complete record. Emission factors published by the IPCC's guidelines were used.

Table 1.3.8 Annual Consumption of Fossil Fuels (MMSCF1) at Power Plants in Erbil City

Power Plant	2018	2019	2020	2021	2022 (Oct)
ECCPP	60,737	64,944	59,426	62,964	44,899
KHURMALA GPP	53,759	52,626	61,495	43,658	63,013
KHABAT PP	542	33,215	11,344	16,352	13,572

Note: [1] million standard cubic foot
Source: Ministry of Electricity

Table 1.3.9 shows the CO2 emissions for the three power plants within the Erbil City target area. The Erbil City Combined Power Plant (ECC PP) and Khurmala Power Plant both uses natural gas and the Khabat Power Plant heavy oil. Together in total they emitted close to 6M tCO2e in 2021 to supply Erbil City with power through the grid.

Table 1.3.9 tCO2e Emissions from Energy Generation of Erbil City in 2021

Product	Activity data	Emission Factor		tCO2
ECC PP	62,964	54.9	tCO2/MMSF	3,454,758
KHURMALA GPP	43,658	54.9	tCO2/MMSF	2,439,153
KHABAT PP	16,352	3.1	tCO2/ton	50,855
Total tCO2e				5,944,765

Source: Ministry of Electricity

1.3.8 Disclosure on emissions credits

(1) Description

In countries with Emission Trade Scheme (ETS), certain industries with a high carbon footprint are allowed to emit GHGs, referred to as Emission allowances. This means that although they are allowed to emit GHGs they are not actually reducing their carbon footprint. Similarly, entities buying carbon credits to offset their carbon footprint are not actually reducing their GHG emissions. Therefore, reporting carbon credits used to offset CO2 emissions will help track the level of actual GHG emissions and reductions within the target area.

(2) Disclosure

Erbil City does not have an ETS. Therefore, there are no Emission credits to report. Currently, Erbil City is not asking entities, e.g., NGOs, hotels, companies, to disclosure their use of carbon credits.

1.4 Overall Baseline Carbon Footprint

The carbon footprint of the major sectors GHG emissions has been calculated. The Stationary Energy sector is the sector with the biggest carbon footprint (6M tCO2e), followed by the Transportation sector (3.5M tCO2e) and Waste sector (1.5M tCO2e). The grand total is 11.5M tCO2e. This is good general overview and the carbon footprint can be refined to subsector and category level with new data. Suggestions were provided in the description tables for each KPI.

The carbon footprint calculated for Erbil City here is much bigger than the carbon footprint in 2015. The 2015 baseline carbon footprint for the two sectors measured (energy and transport) is 3.5M tCO2 based on the per capita calculation. The carbon footprint for the same sector is 9.5M tCO2. The current carbon footprint is almost a factor 3 bigger (2.7).

This increase cannot be explained by growth the population and probably also unlike by growth of the economy. The per capita and only available approach is mostly likely not representative of the actual situation of Erbil City in 2015. In Erbil City there is high carbon intensity industry, such as steel mill and cement factory both consuming a high amount of electricity. The current carbon footprint for Erbil City is more representative of the actual situation.

CHAPTER 2
LOW-EMISSION CITY PLANNING CONCEPTS

2.1 Climate Change Adaptation Vision for Erbil

The vision for Erbil City and its peri-urban surroundings (the Target Area) is to be a low carbon and resilience economy and municipality by 2050. The updated Master Plan 2050 for Erbil (Erbil 2050 MP) details the mission towards this vision. Major threats to the well-being of Erbil City are: 1) extreme heat, 2) water shortages and 3) dust storms (Local Climate Adaptation Plan for Kurdistan region 2023 UNDP; Nationally Determined Contributions Iraq 2021, UNEP), as explained in Section 4.1 of Part I.

These threats are connected and reinforce each other. Longer periods of droughts dry out the land and increase desertification creating more dust storms. Less and more variable rainfall (larger rain storms) create water shortages and flooding as rainwater does not infiltrate the dried-out land but runs off over land to the lowest point. In extension, these threats impact agriculture through water shortages, which increases food insecurity; water shortages increase water insecurity in particular of large cities such as Erbil. Extreme hot days and dust storm impacts the health of specially the elderly and young.

Erbil City is not only a victim of climate change, it is also contributing to climate change through GHG emissions and land use change. The economy of Kurdistan including Erbil heavily relies on the oil export to Turkey for foreign domestic revenue and the use of fossil fuels for its local industry and power. Erbil City and its surrounding rural area (peri-urban) are sparse in tree and plant cover in general. Consequently, Erbil City consists of and is surrounded by hard and dry surfaces which easily heat up in the sun and in return heat up the atmosphere in and around Erbil City.

In the Erbil 2050 MP, there are 13 priority sectors with each its own sector development plan and priority projects to boost short-term change. Climate change is already impacting each sector and each sector is contributing to climate change. Therefore, each sector needs to adapt to climate change (resilience) and mitigate (reduce) its contribution to climate (low carbon). However, certain sectors are more relevant or important than others in this context. Some sectors need to be transformed to contribute to the resilience of Erbil City and other sectors need to reduce their GHG emissions.

The important adaptation sectors are: Water supply (5), Water resources & Irrigation (4), Flood Management (10) and Sewerage (6) to overcome water shortages and the Green Area Management (sub)sector (13b) is also important to overcome the extreme heat and dust storms. Similarly, the sectors of Urban Transport (3), Power and Energy (8) and Solid Waste Management (7) emit significant amounts of GHGs, which need to be reduced. The Climate Adaptation (sub-)sector (13a) is important to leverage the climate finance needed to pay for the transformations of the sectors mentioned above.

Objectives on how Erbil City can transform towards a low carbon economy are described in Section 2.4 GHG Emission Reduction Targets discussing the Economic & Industrial Development and Investment Promotion sector. The objectives for Erbil City to become a resilient municipality are described in next sector.

2.2 Climate Change Adaptation Objectives for Erbil

The objectives described for the context of Erbil City and its surroundings (peri-urban area) can be applied to the other large urban centers in Kurdistan and are relevant for the Urban and Regional Planning sector (1). Here an overview is provided to understand the interconnectedness of the adaptation sectors. More details are provided under Section 2.3 “Climate Change Adaptation Policies for Erbil”. There are three threats Erbil City needs to adapt to: 1) extreme heat, 2) water shortages and 3) dust storms.

- Extreme heat - To reduce the impact of extreme heat in Erbil City, green and blue spaces need to be created. Green spaces create shade and help infiltrate rainwater within the city. Blue spaces help to keep the air in the city humid. Both provide an opportunity for people to cool down (see Part I, Chapter 10). People can also cool off in public facilities when they have been converted to cooling centers and turned into a green space. For the planned expansion of Erbil City, the green and blue spaces can be incorporated into the design of the new city. For the existing city this is more challenging and most likely some build up space needs to be cleared if not enough open spaces are available. Ideally, green and particularly blue spaces are created where there is a risk of flooding (see Part I, Chapter 10).
- Water shortages – Mean annual rainfall has not (yet) significantly changed with climate change. But the distribution of rainfall over the year has become more variable and the occurrence of extreme rainstorms and droughts have increased due to climate change (UNDP, 2023). The larger rainstorms have increased the risk of flooding and the prolonged drought have increased harvest failure. Ideally, the excess of rainwater is harvested and used to overcome periods of drought (see Part I, Section 8.7).
- Dust storms – Dust storms are becoming increasing problematic and creating a public health hazard. Longer and more intense droughts due to climate change are causing the land dry out and storms to become more powerful. The best way for Erbil City to protect itself from dust storms is to create wind barriers by growing trees in peri-urban areas and to reduce the availability of dust by the topsoil moist and covered (see Part I, Chapter 10).

2.3 Climate Change Adaptation Policies for Erbil

It is important to consider best practices for each sector and how sectors can create synergy to solve the problem at hand. Once those considerations have been contemplated and interventions have been decided a policy framework can be developed to support the planned outcome. Setting up these policies are not a one-time off, but need to be reviewed and evaluated on their effectiveness and efficiency and whether they cause harm to vulnerable groups (see the case below).

(1) Water Supply (sector 5)

Water consumption by households in Erbil City is very high. The Erbil City could tackle the issue of water shortages by increasing the price for water usage. This is appropriate for middle- and high-income households, but poorer household might get in financial trouble. Therefore, poorer household may have to receive water saving devices, such as a water saving showerhead for free or a low price. The handout of water saving devices can be covered by the increased water fees charged to middle- and high-income households.

(2) Water Resources and Irrigation (sector 4)

The water related sectors all reference to the depletion of the aquifer and overconsumption of water. Large consumers are households and the irrigation agricultural sector. One of the main interventions is to consider the construction of the Mandawa Dam (2050B). The dam would be able to harvest a considerable volume of water. Nonetheless reducing water consumption will still be necessary. The water catchment of the Mandawa Dam will also need interventions to avoid erosion silting up the reservoir, even more important when the dam is going to generate hydro power; interventions such as planting trees and conservation farming to avoid soil erosion.

To replenish the ground water aquifer, it is important to promote infiltration in the city and in peri-urban area around the city. Increasing infiltration in the city can be accomplished by creating green and blue areas where stormwater can accumulate and infiltrate into the ground. In the peri-urban area increasing tree cover and covering bare soil with organic matter such as mulch and cover plants reduce and slow down run off water increasing infiltration. This can be accomplished through agroforestry and conservation farming (see Part I, Chapter 10).

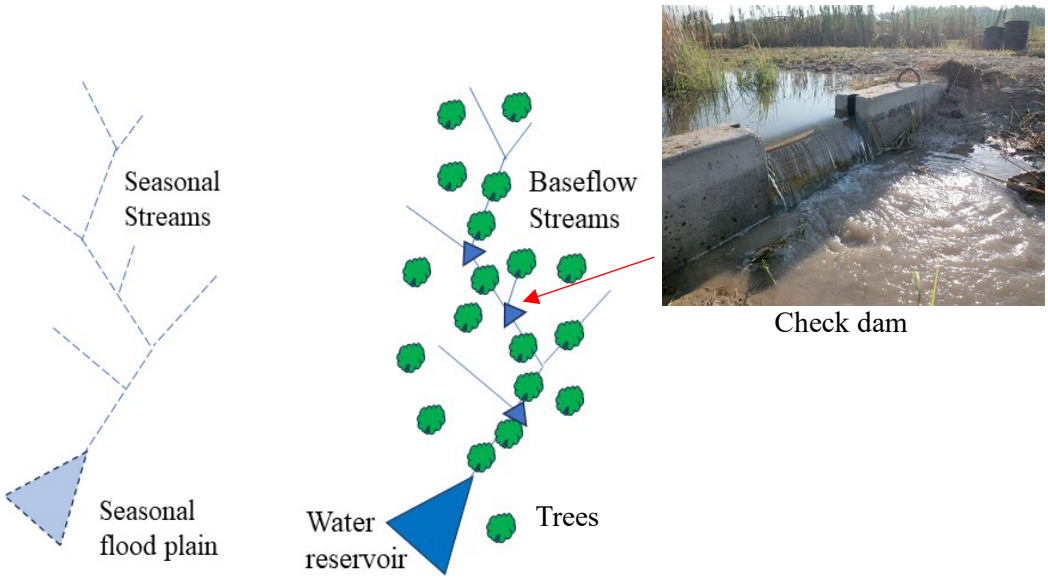


Figure 2.3.1 Current Situation of Dried Out Catchment (left) versus a Catchment with Water Reservoir, Check Dams and Agroforestry (right)

Water harvesting should also be increased in the peri-urban area by building water reservoirs with upstream smaller check dams. This avoids that storm water immediately run off and interfiles, recharges the aquifer (Figure 2.3.1). In addition, the harvested water in the reservoirs and water behind the check dams can be used for irrigation. The increased water availability around these sites also provides good areas to plant trees. Irrigation farms can use the harvested water instead of extracting water from the already depleted aquifer. An additional intervention to reduce water consumption by these large farms is to have them switch from sprinkler irrigation to drip irrigation (Figure 2.3.2). Banks can provide agricultural loans for farm to transition.

Source: JICA Project Team

Figure 2.3.2 Sprinkler Irrigation System (left) vs a Drip Irrigation System (right)

A water catchment approach can be adopted to create synergy between the different interventions. For instance, the sectors agriculture, biodiversity and water mentioned in the Local Climate Adaptation Plan for Kurdistan can be integrated at catchment level. By planting native trees native wildlife is attracted promoting the local biodiversity.

(3) Flood Management (sector 10)

Flood prevention can also be accomplished through the interventions mentioned above, the small check dams in combination with a larger reservoir dam and agroforestry and conservation farming. By putting

this system in place at water catchment level, the storm water runoff is slowed down and stopped at the dams. Consequently, large volumes of rainwater running down the hills are avoided and the smaller streams will not cause major flooding.

There is an alternative option in the context of flooding. Creating a recharge zone may be an option to recharge the aquifer. However, without any information how much and long it will take to recharge the aquifer, it might be a better option to channel the flooding water to a storm water reservoir where the water is collected, treated and used to supply Erbil City with water, instead of pumping ground water from a dwindling aquifer. This option would be even more important when the Madwana dam is not build (2050A).

The development plan for the flood management sector mentions that the current drainage system in city is not adequate to process large amounts of storm water. Certain areas within the city are temporarily inundated if not flooded. Areas where houses and commercial buildings are regularly should become blue spaces to temporarily contain storm water. To create the blue space the buildup area should be removed. Another option to relieve the drainage system is by encouraging households and building owners to install rain barrels, underground storage tanks and create green roofs. This will slow down storm water going into the drainage system. Ideally, the storm water will be collected in a storm water reservoir available to supply the city with water after it has been treated.

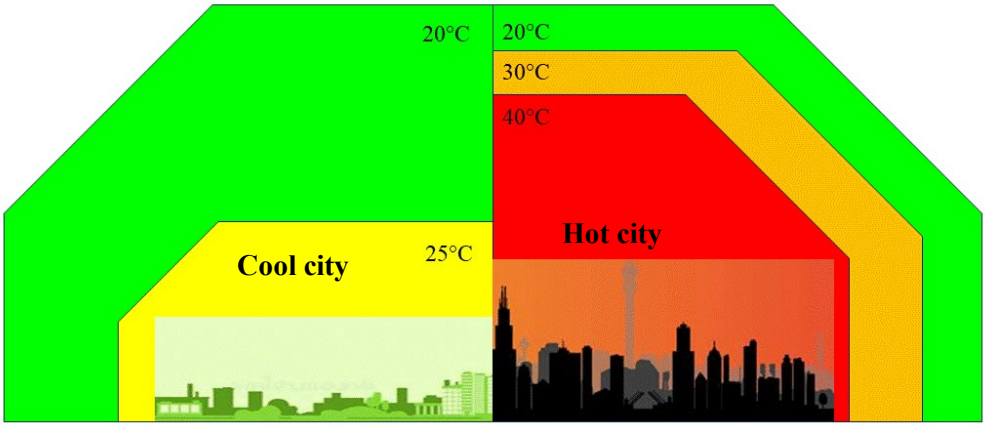
1) Sewage (sector 6)

Currently, black sewage water is flowing out of the city into the rural area, which is not only a waste of water, but also a source of pollution. The sewage sector development plan already mentions the construction of a water treatment plant. The water recaptured will alleviate some of the water shortages. The water treatment plant could also be a collection point for septic tank trucks to dispose of their sewage water.

2) Climate Change Adaptation (subsector 13a) and Green Area Management (subsector 13b)

The objectives of the sector of Green Area Management cover Erbil city (urban) and its rural surroundings (peri-urban area to counter the threats of extreme heat, water shortages and dust storms. As already mentioned above Erbil City should have enough green and blue spaces to be able to cool the city down (discussed in more detail under Green Areas Management 13b.

The objectives of the Climate Change Adaptation sector are focused to leveraging climate finance for Erbil City and its surroundings. There are millions of USD available for climate adaptation and mitigation when Erbil City is properly set up to receive this funding. For this to happen the authorities need to identify a delivery mechanism which they can use to channel the funding to the communities in need of adaptation. For instance, elsewhere the intergovernmental fiscal transfer system is used to channel the climate finance for locally led adaptation. The other component that needs to be put in place is a bottom-up planning process to inventory climate issues, choose climate adaptation and mitigation solutions and turn this into a climate adaptation plan together with a budget.



Source: JICA Project Team

Figure 2.3.3 The Heat Island Effect Compared between a City with Green and Blue Spaces (left) and without Green and Blue Spaces

(a) Green Area Management (13b)

Erbil City needs to create green and blue spaces. One of the leading principles on how many green and blue spaces are required can be the vision of Erbil City to become a walkable city, i.e. the public and commercial facilities are within reach of a 15 min walk. This means that the farthest distance to a facility is 1250m (5km/h). Consequently, each block of 1768 by 1768m or 3km2 should have a green/blue space. Erbil City current surface area is roughly 115km2. Consequently, Erbil City should have close to 40 green spaces in the future. Population density is metric that could be used to determine the size of green spaces. The higher the population density within the $3km^2$ block the larger the green space needs to be able to fit a portion of the population seeking refuge from the heat. The minimum green space per capita is $10m^2$ according to the WHO. Population density in Erbil City is roughly 8,000 capita per km2. So, 8ha per $3km^2$ of green spaces is needed.

Cooling of the city is not only pursued through creating green and blue spaces. Additional cooling can be obtained by creating tree cover along roads and trees on private property. Buildings should where possible have green roofs. Outdoor parking space should have grass tiles instead of an asphalt or concrete pavement. Grass tiles warm up less and promote infiltration. Other options are water features such as a fountain help to keep the air moist and play fountain allow children to play in the water and keep cool.

Green Area Management is also important outside Erbil City in the surrounding rural area. The rural area around Erbil City is also dry and contributes to the heat island effect. Currently, rain fed agriculture is the dominant form of agriculture. Most of the crops are grown over the winter when temperatures are lower and more rainfall is available. To reduce the heating potential of the existing farmland is to adopt conservation farming and agroforestry.

Conservation farming entails zero-tillage and covering the topsoil with organic matter, i.e. mulch. When soil is tilted by a plough soil moisture and nutrients escape the soil making it drier and poorer. Not tilting the soil and covering it with mulch conserves moisture in the soil and reduces the temperature of the soil, allowing plants to grown better. Agroforestry is planting trees on farmland. The trees cast a shadow on the soil helping it not to dry out. The trees do not compete with the crops and when for instance olive or pistachio trees are planted, farmers have an additional cash crop. Trees and mulch also help rainfall infiltrate into the soil and avoid it running off immediately, recharging the aquifer.

Agroforestry and conservation farming also help against dust storms. Since the topsoil is not dusty and covered by mulch the winds cannot pick up the soil particles and suspend them in the air creating dust pollution. Planting trees to the south of Erbil City in a trellis pattern also help block the winds and reduce the impact of dust storms affecting the city. The planting trees, however, is challenging due to water shortage in the summer. Planting trees in compostable pods filled with water increases their change of

survival.

(b) Climate Adaptation (13a)

Adaptation to climate change is needed in urban and peri-urban or rural area. For climate adaptation to be effective, it needs to be informed how people are experiencing the impact of climate change. Due to local circumstances, the impact of climate change can be very localized. Local needs require local solutions. One of the best practices is to inventory the needs of local people through a bottom-up planning process.

Not only adapting Erbil City is important. Adapting the peri-urban area is equally important. If the rural area around Erbil City is not properly adapted to climate change, there is the risk that rural communities will seek refuge in the city from climate change. This is a general trend observed elsewhere creating problematic informal settlements in the city, i.e. slumps.

The peri-urban rural area also provides food for the city. Farmers around cities often produce crops such as vegetables for sale in the city. It is important that the farmers around Erbil City are able to continue to supply the markets and shops of Erbil City with food. Therefore, these farmers need to be adapted to climate change. Agroforestry and conservation farming, i.e. the same interventions to reduce the heat island effect and the formation of dust storms, are used to adapt farmers to climate change.

The first part of adapting the rural communities is to have or put in place a bottom-up planning process to collects the issues local people are facing and offer them locally appropriate solutions. This is known as locally led climate adaptation. This can be done through a development planning process at village level. During a village meeting, community members are asked about their climate change issues which are matched with potential solutions. Community members decide their solutions and all the solutions/ interventions become a climate adaptation plan with a budget. A similar process can be put in place for urban communities (more under section 4.2 Concepts of Low-Emission City Planning for Local Urban Plans.

2.4 GHG Emission Reduction Targets

Erbil City needs to reduce its GHG emissions to become a low carbon economy and municipality. The reduction targets Erbil City needs to pursue are dictated by the Paris Agreement from 2015. This climate treaty has been signed and ratified to the Government of Iraq and in extension the Kurdistan region has to comply. The Nationally Determined Contributions of the Iraq Government mention as one of the main transformations is to switch to renewable energy generation and the need to diversify the economy to be less dependent on the export of fossil fuels. One of the sectors the Iraq government is promoting is the tourism sector.

Erbil City is not very different from the rest of Iraq. Its energy generation relies on the burning fossil fuels and Kurdistan relies for its foreign domestic revenue on the export of oil to Turkey. Similarly, as part of the economic and industrial development and investment promotion sector, Erbil City is trying to promote the tourism sector. At the same time, Erbil City is planning on expanding its industrial zones which under the current conditions is counter-productive to reducing its GHG emissions.

Table 2.4.1 The Business as Usual (BAU) GHG Emissions for Erbil City vs the GHG Reduction Required according to the Paris Agreement (MtCO2e)

Scenario	Base year				Annual rate	
	1997	2022	2030	2050	2022-2030	2030-2050
BAU		11.0	17.0	23.0	0.8	0.3
Paris 1997	3.0	11.0	1.5	0	-1.2	-0.1
Paris 2022		11.0	5.5	0.0	-0.8	-0.7

Source: JICA Project Team

The Paris Agreement states that signatories should reduce their GHG emissions by half by 2030 from a baseline year from the 90s before 1997 (related to the Kyoto Protocol) and be carbon neutral by 2050. Erbil City does not have data to calculate its GHG emissions before 1997.

The only baseline for Erbil City was calculated over 2022 and the Erbil City's carbon footprint was 11,000,000 tonnes of carbon dioxide (11MtCO2). A reasonable estimate of Erbil's GHG emissions of Erbil City could have been in the range of 3MtCO2 per year before 1997. Under the Paris Agreement this would mean that Erbil City would have to reduce its GHG emissions to 1.5tCO2 per year by 2030. Currently, Erbil City emits around 11MtCO2 per year. This would mean that Erbil City would have to reduce its current GHG emissions by 1.2MtCO2 per year over the 8 years (Table 2.4.1). This is unrealistic and also not based on actually data.

Table 2.4.2 The Business as Usual (BAU) GHG Emissions for Erbil City vs the GHG Reduction Required according to the Paris Agreement (MtCO2e)

Scenario	2022	2030	2050	Annual rate
BAU	11.0	17.0	23.0	0.8
Paris	11.0	5.5	0.0	-0.8

Source: JICA Project Team

Alternatively, the reduction targets can be calculated for Erbil City when it has to be carbon neutral by 2050. This mean that the 11MtCO2 GHG emissions have to reduce to zero over a period of 28 years (2050-2022). This results in an annual emission reduction of 0.8MtCO2 per year until 2050 (Table 2.4.2). This reduction target is much more realistic for Erbil City and this reduction target is also based on actual figures. However, these figures are not considering Erbil City expansion. Ideally, Erbil City's urban expansion from household electricity consumption would be covered by renewable energy such as from solar farms.

To construct a pathway for Erbil City to reduce its GHG emissions according to the calculated reduction target of 0.8MtCO2 per year, an economic and industrial development assessment on how to become a low carbon city was carried out. The analysis showed that the main three sectors with high GHG emissions are the power generation, transportation and solid organic waste. The energy generation through fossil fuel power plants is the sector with the largest GHG emissions, roughly 6MtCO2 per year, 3/5 of all GHG emissions.

(1) Power & Energy (sector 8)

Tackling the energy generation by replacing the existing fossil fuel power plants by renewable energy systems such as solar farms is the best available option. Another option is replacing the use of fossil fuel generators with grid storage batteries in combination rooftop systems. Hydropower is another option in case the Mandawa Dam is constructed (2050B), without the Mandawa Dam (2050A) this sustainable source of energy will not be available. An interim solution is to upgrade the existing single cycle power plants to a combined cycle power plant. Based on the Erbil City Combined Power Plant (ECCPP), an additional 37% KWh can be generated from the same amount of fuel, i.e., some 289MW on the existing capacity, reducing tCO2 per generated kWh. However, this would only a temporarily and expansive solution. It is better to pursue the construction of solar farmers. This urgency of switching to renewable energy is not yet reflected in the sector development plan of the Power and Energy sector. Once the power is generated from renewable sources, Erbil City can expand its industrial zones without increasing its GHG emissions.

(2) Urban Transportation (sector 3)

Transportation is the sector with the second largest GHG emissions. All transport, private, business and public, relies on vehicles powered by fossil fuels. There are two options to reduce GHG emissions in this sector. The first option is to promote the uptake of electric vehicles in combination with (rooftop) solar systems. Only promoting electric vehicles (without a solar system) would mean that vehicles are getting charged by electricity generated by fossil fuel power plants. The additional load and demand

may not balance out the reduced direct use of fossil fuels from gas stations. Furthermore, there is already a shortage of power in general and the shortages would only increase when vehicles are charging through the grid. On the other hand, electric vehicles can also service as grid batteries from which households and companies can draw power from and stablish the grid. Ideally, public transport should lead by example and have electric busses.

The second option is to improve and optimize the public transportation system. A convenient and affordable public transport system could convince people to not use their cars. This would reduce GHG emissions as less cars drive around. It would also help traffic congestion. The reduction in GHG emissions would be even further reduced when the busses are electric and charged with renewable energy. Ideally, Erbil City develops its own metro system powered by a solar farm. This is the case for the Dutch railway system which is powered by a wind park in the North Sea. Building a subway system is a huge investment for the city but can be implemented piecemeal over the next 25 years. The subway system could be extended by building underground shopping centers and provide shelter from extreme heat. In Canada, the reverse has happened where the subway system also functions as an underground city during the winter period.

(3) Solid Waste Management (sector 7)

Solid organic waste is not collected separately but dumbed in land fill where due to anaerobic conditions bacteria produce methane, a greenhouse gas 24 times stronger than CO2. The sector development plan for the Solid Waste Management already mentioned the importance of separating municipal solid waste into organic waste, recycle waste and waste for energy recovery.

By collecting and treating organic waste to compost and liquid fertilizer methane emissions are avoided. For 2022, the GHG emissions from methane formation from solid organic waste were calculated at 1.5MtCO2 per year. This is huge reduction potential, reducing Erbil City GHG emissions from 11MtCO2 per year to 10MtCO2 per year.

The compost and liquid fertilizer also have a value for the agricultural sector. Currently, in many cities in developing countries the produce grown by farmers in the peri-urban area are consumed in the city and the waste dumped in a land fill. By treating the organic waste and recycling back to the farmers a circular agricultural sector is created. Organic waste can even be treated by black soldier flies which protein can be used for fish farmers. Separating waste for energy recovery can also contribute to less GHG emissions when this energy is converted to electricity.

CHAPTER 3
FUTURE GHG EMISSIONS OF ERBIL MASTER PLAN

3.1 GHG Emissions Calculation for Erbil Master Plan

The future GHG emissions for the business-as-usual (BAU) scenario were calculated indirectly. Actual data on energy consumption by the residential and non-residential (commercial, including industry) sectors is not available, only the overall output from the power stations. The Sustainable Energy Action Plan (SEAP) with data from 2015 mentions the energy consumption of the residential and non-residential sectors in kWh to be 7.9M (23%) and 2.4M MWh (76%), respectively (see Table 1.2.1 above). These percentages of the two sectors were used to calculate the GHG emissions for 2022 by multiplying them by the total GHG emissions from the stationary sector, i.e., 6MtCO2.

To calculate the future GHG emissions for both sectors, different parameters have been used. For the residential sector, linear population increase (capita) has been used from 1.8 million in 2022 to 3.0 million in 2050. For the commercial sector, the expansion of the industrial zones in hectares (ha) has been used from 2,819 ha in 2022 to 7,119 ha in 2050 (Table 3.1.3). For each sector the emission factor was calculated by dividing the GHG emissions by the hectares for the commercial sector and by capita for the residential sector (Table 3.1.2).

The same logic was applied for the transportation sector, for which there was also no data available for the commercial and private vehicle use separately, i.e., commercial transport by hectares and private by capita. For the solid waste sector, the population increase was used to calculate future GHG emissions. The results are presented in Table 3.1.1.

Table 3.1.1 Erbil City's GHG Emissions in the Business as Usual Scenario (MtCO2e)

Sector	Subsector / KPI	2022	2030	2040	2050A	2050B
Stationary energy	Commercial (inc. industry)	1.4	2.2	3.1	3.5	3.5
	Residential	4.6	6.1	7.6	9.1	9.1
Transportation	Commercial	0.8	1.3	1.8	2.0	2.0
	Private	2.7	3.5	4.4	5.3	5.3
Solid waste	Residential	1.5	2.0	2.5	3.0	3.0
	Total	**11.0**	**15.2**	**19.4**	**23.0**	**23.0**

Source: JICA Project Team

Table 3.1.2 GHG Emissions Factors for each Sector/KPI for 2022

		2022	
Sector	Subsector	tCO2/ha	tCO2/capita
Stationary energy	Commercial	492	
	Residential		4.6
Transportation	Commercial	287	
	Private		2.7
Solid waste	Residential		1.5

Source: JICA Project Team

Table 3.1.3 Parameters Increase from 2022 to 2050

Parameters	2022	2030	2040	2050A	2050B
Industrial area (ha)	2819	4535	6305	7119	7119
Population size (capita)	2.0M	2.2M	2.6M	3.1M	3.1M

Source: JICA Project Team

Under the business-as-usual scenario with no renewable energy, Erbil City's GHG emissions increase from 11MtCO2e in 2022 to 23MtCO2e in 2050. Population increase is the main driver of GHG emissions (Residential energy consumption, transportation and solid waste). Although GHG emissions

from commercial activities are not as big, their relative increase is higher, 2.5 (commercial) versus 2 (residential), respectively. Limited growth of both sectors would seem a reasonable strategy to keep Erbil City's GHG emissions from growing too much, especially since energy and water resources are already stressed. It is also clear that in the business-as-usual scenario, Erbil City will not reduce its GHG emissions as committed under the Paris Agreement.

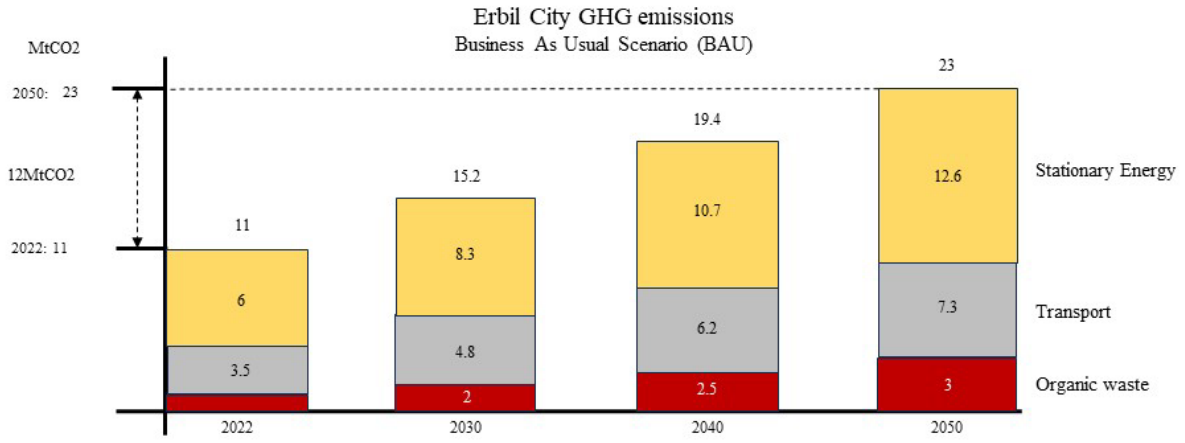
Erbil City needs to consider the above-mentioned suggestions under Section 2.4 "GHG emission reduction targets". In addition to those suggestions, Erbil City could consider instead of pursuing an economy build on (heavy) industry, pursuing a knowledge-based economy, which requires far less energy. Erbil City could focus on becoming a center of expertise on renewable energy and water related climate adaptation. These two domains are already in demand and will grow even more so in the short-term as the Middle East is slowly drying out due to climate change.

It would help if the new urban expansion and associated household consumption of electricity is generated through renewable means. This means that Erbil City only needs to reduce its current carbon footprint of 11MtCO2 per year. If this is not the case, Erbil City GHG emissions will roughly double with a predicted doubling of the population to 23MtCO2 per year (Table 3.1.1). Using per capita GHG emissions is not a very accurate approach to calculate future GHG emissions, but it nonetheless provides a rough idea of future GHG emissions. Ideally, figures are available for household and business energy consumption separately. Currently, Erbil City harbors some heavy industry such as a steel mill and a cement factory. It would be in Erbil City's interest not to expand those industries. If the steel mill is melting iron using an induction furnace it would be able to use renewable energy.

As already calculated above, Erbil City will have a GHG emission reduction of 1.5MtCO2 when solid organic waste is treated to compost. This is a relatively easy reduction to accomplished when the planned treatment plant is built within two years and operating full scale. This would reduce Erbil City GHG emissions by 10MtCO2 per year, representing a 13% reduction.

As already calculated earlier some of the GHG emissions can be reduced through sequestration by planting trees in the peri-urban area. If the 143,204ha of cropland and 65,981ha of barren land were planted with trees constituting a carbon density of 50tCO2e per ha, the total volume of sequestered CO2 would be close to 10M tCO2e in 26 years. This only compensates Erbil City's GHG emissions for one year in the business-of-usual scenario.

3.2 GHG Emissions Reduction Scenarios by Adopting Different Interventions



Source: JICA Project Team

Figure 3.2.1 Erbil City GHG Emissions in the Business As Usual Scenario (BAU)

The Green Management sector, i.e., agroforestry and afforestation, urban green spaces have a sequestration potential. The figure above shows the contribution of the emitting sectors in the Business

As Usual scenario. To comply with the Paris Agreement and to reach the Long-term Development Vision of the Erbil 2050 MP, all these sectors need to be zero emitting in 2050, or compensated by the amount of carbon sequestered by the Green Management Sector.

First the sequestration potential from the Green Area Management Sector is calculated. Cropland in the peri-urban area was assessed at 143,204ha. This means that besides the maximum 56,228ha of irrigated cropland, 86,891ha is managed as rainfed farmland. This is poorly managed farmland as is evident from remote sensing images on Google Earth and the fact that dust storms impact Erbil City. To avoid dust formation, increase moisture and soil fertility farmers should be trained in the principles of conservation/climate smart farming and adopt agroforestry. EUCF and retail banks could offer these farmers affordable agri-loans in combination with free or a minimal charge for training in climate smart agriculture. This alone is not sufficient. The banks should also through the not-for-profit branch promote tree planting on farmland.

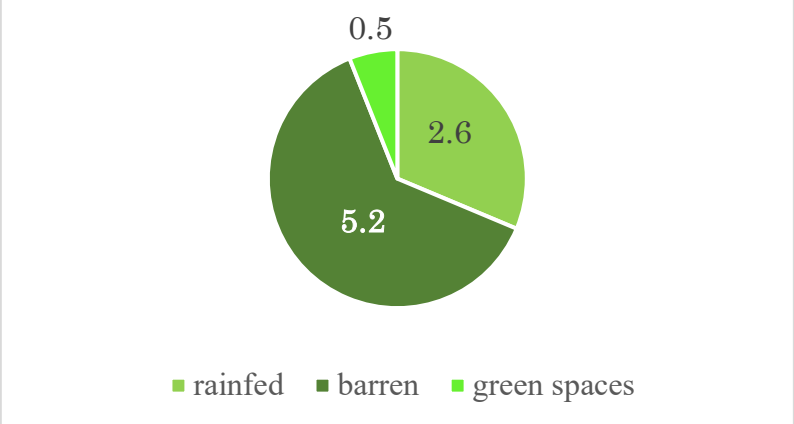
This practice could turn rainfed farmland into a carbon sink. Potentially, one hectare under agroforestry (20 trees/ha) could sequester 30tCO2 (including Soil Organic Carbon). Consequently, the 86,976ha of rainfed farmland could sequester 2,6M tCO2 in 25 years in 2050. The same practice of tree planting could be applied to the 65,891ha of land classified as barren land, i.e., shrubland. Currently, this land has not economic agriculture or forestry value. This barren land mostly covers the hills west and east of Erbil City. The economic value of this land can be increased in the medium by planting the lower slopes with olive and pistachio trees. Essential is to increase water retention in these hills by building check dams ideally by non-profits who also plant the trees. By planting the upper slopes with conservation trees, biodiversity increases. When planted at a high density a carbon density of 80tCO2/ha can be obtained and planting the 65,891ha would result in an additional 5.2M tCO2 sequestered in 25 years in 2050.

Table 3.2.1 Carbon Sequestered by Trees in Green Spaces until 2050

2050	Surface Area (ha)	Carbon Density (tCO2/ha)	Total carbon (tCO2)
Parkland	7,212	15	108,186
Forest	11,264	34	382,979
	18,476	**24.5**	**491,164**

Source: JICA Project Team

The table above shows the amount of carbon sequestered by the green spaces. The surface area allocated for green species is 24,940 ha of which 18,476ha in intended to be planted with trees. These spaces vary from open parks to forest bordering streams. Three types of vegetation were considered: grassland (no trees), parkland, i.e., free standing trees in grid of 15x15m, and forest, i.e., trees forming a closed canopy. Only the CO2 sequestered by trees was considered.



Source: JICA Project Team

Figure 3.2.2 Carbon Sequestration Potential for Erbil City until 2050

The figure above shows the potential sequestration on rainfed farmland through agroforestry, barren land through afforestation in the peri-urban area and the potential sequestration by planting trees in urban green spaces. The barren land has the largest potential 5.2MtCO2, followed by rainfed farmland 2.6MtCO2 and 0.5MtCO2 by trees in parks. The total of 8.3MtCO2 in 2050 is constitutes in an annual sequestration potential of 0,32MtCO2 per year. The total for the period 2025-2030 (5 years) is 1.6MtCO2 and for the 2031-2040 and 2041-2050 is 3.2MtCO2.

Table 3.2.2 Number of Vehicle Million Trips per Day

Mode	2022	2040	2040-BRT	2050	2050-BRT
Car	1.6	2.0	1.8	2.3	1.7
Taxi	0.3	0.4	0.4	0.5	0.5
Bus	0.0	0.0	0.0	0.0	0.1
Truck	0.1	0.2	0.2	0.2	0.2
Total	2.0	2.6	2.5	3.0	2.5

Source: JICA Project Team

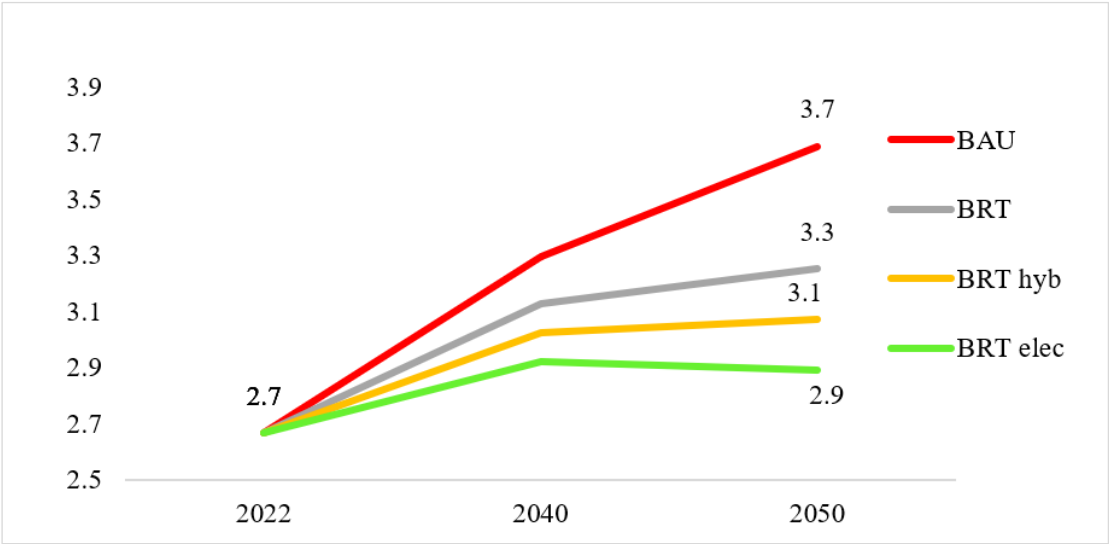
The transport sector is the second largest emitting sector with 3.5MtCO2 in 2022. In 2022, out of the 2M trips per day, 93% of the trips were done by cars and taxis and these are predicted to grow to almost 3M trip per day. The assumption was that improved public transport decreased the number of car and taxi trips, which in turn reduce GHG emissions.

Table 3.2.3 The Amount of GHG Emitted by Cars and Taxi in Response to Improved and Green Busses

Year	*BAU*	*BRT*	*BRT hyb*	*BRT elec*
2022	2.7	2.7	2.7	2.7
2040	3.3	3.1	3.0	2.9
2050	3.7	3.3	3.1	2.9

Source: JICA Project Team

The trips were converted to GHG emissions by dividing the 2 million trips in 2022 by 3.5MtCO2 to get an GHG emissions per trip and multiplied by the number of trips for scenario. Two scenarios were added for green busses: hybrid busses 50% of the trips were electric and electric busses all trips were electric.

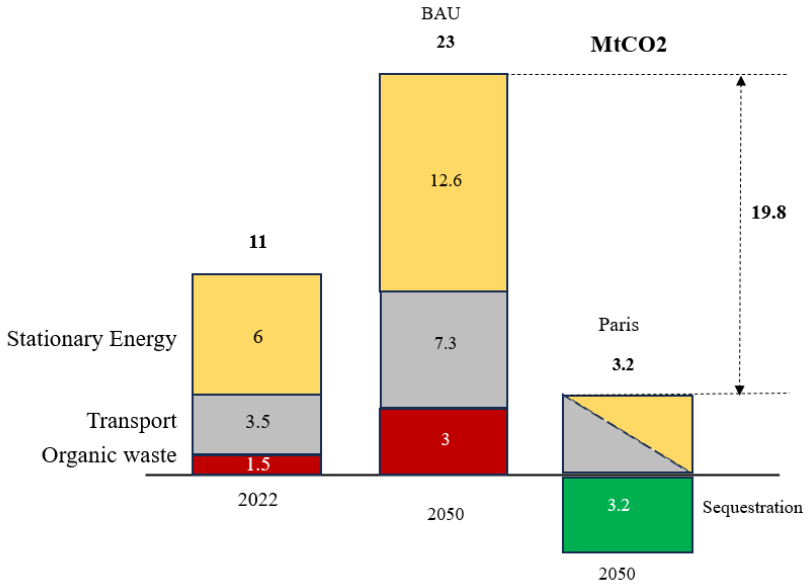


Source: JICA Project Team

Figure 3.2.3 GHG Emissions Reduction from Improving and Greening Public Transport

The graph above shows the by improving the public bus services car and taxi trip go down and subsequently GHG emissions from 3.7 to 3.3MtCO2 between 2022 and 2050. With hybrid busses GHG emissions reduce to 3.1MtCO2 and only electric busses to 2.9MtCO2 in 2050. The graph shows that

switching to green electric busses has the highest potential. The graph also shows that improving and green public transport is only a partial solution, since cars will still emit 2.9MtCO2 in 2050 if cars and taxis don't become electric.



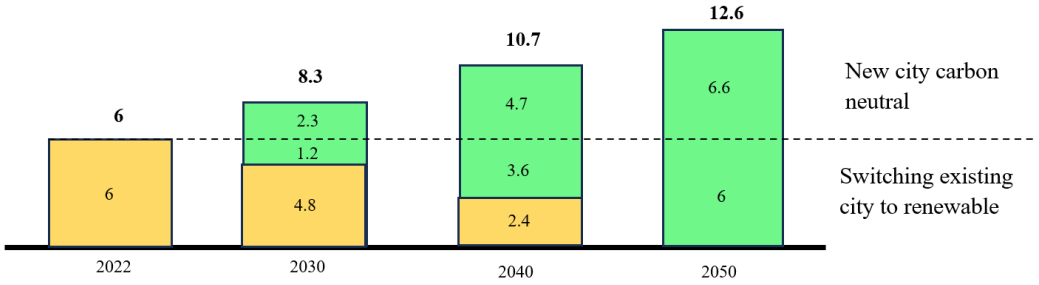
Source: JICA Project Team

Figure 3.2.4 Erbil City GHG Bassline Emissions, under BAU and Paris Regime by 2050

The figure above shows the baseline GHG emissions of Erbil City in 2022, the GHG emissions in 2050 if Erbil City does not reduce its GHG emissions (BAU) and the GHG emissions Erbil City is allowed to emit according to the Paris Agreement and depending on sequestration to be carbon neutral. Taking into account the 3.2 MtCO2 sequestered, Erbil City only has to reduce its GHG emissions by 19.8MtCO2 instead of 23MtCO2. This means that Erbil City needs to reduce its GHG emissions by 0.8MtCO2 annually over the coming 25 years. Any delay by Erbil City in reducing its GHG emissions will need to be compensated by a higher rate of decarbonization over the remaining years if it intends to respect the Paris Agreement.

Strategically, it is in Erbil City advantage to initiative its GHG emission reduction by tackling low hanging fruit, i.e., interventions relatively easy to implement. One of those is tackling methane emissions from organic waste. Building a basic composting facility is not capital or knowledge intensive, neither time consuming and not complex to operate. The collection of organic waste can be built upon the exiting trash collection. Finally, the facility can generate a revenue stream from its compost and leachate as fertilizers for farmers, contributing to a circular agricultural sector. The organic waste can also be treated with larvae of black soldier flies which can be used as protein for animal feed for e.g. fish and chicken farms. In five years, GHG emissions from organic waste could be avoided.

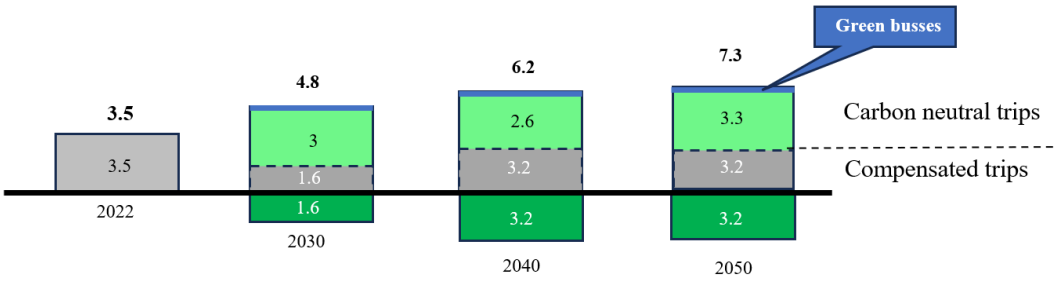
The energy sector is the largest GHG emitter relying on fossil fuels to generate electricity. In the Business-As-Usual scenario GHG emissions will increase to 12.6MtCO2 per year. This will be a very challenging sector to transform. Expansion of Erbil City is the driver of these GHG emissions adding 6.6MtCO2 to the GHG emissions of 6MtCO2 by the existing city. Here the intervention would be that the new city is powered only using renewable resources delivered by centralized, e.g. solar farmers, or decentralized systems, i.e., rooftop. Currently, there are renewable energy projects proposed and soon to be operating. When the new city is power by renewable power, only the GHG emissions of the existing city remain, i.e. 6MtCO2.



Source: JICA Project Team

Figure 3.2.5 Decarbonization Regime for GHG Emissions from Stationary Energy to Reach Paris Target in 2050

The graph above shows the demand for power as Erbil City expands over time until 2050. In the baseline year all power is generated using fossil fuels. Above the dotted line is the demand for power of the expanding city. Below the dotted line the existing city is decarbonized gradually to become full renewable in 2050. On average 8% of the demand each year needs to be supplied from renewable sources. Under the section under the Erbil Urban Climate Fund, it is shown how this is potentially possible through rooftop system and green mortgages.

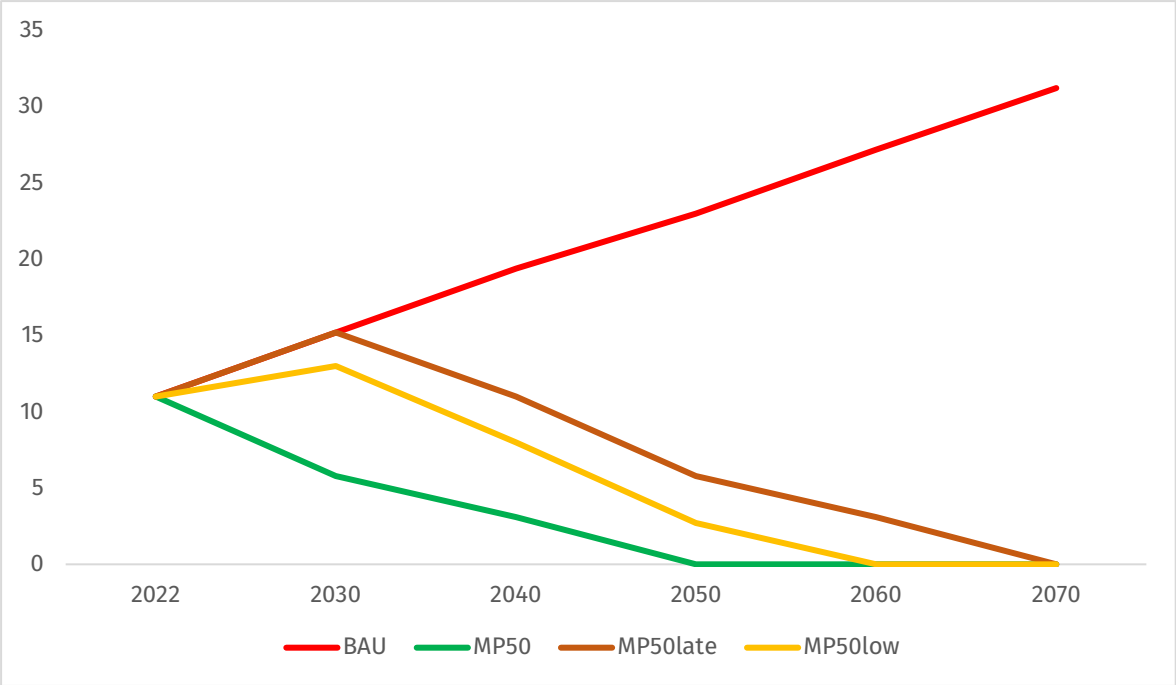


Source: JICA Project Team

Figure 3.2.6 Decarbonization Regime for GHG from Transportation to Reach Paris Target

The graph above shows the regime required to decarbonize the number of trips over time until 2050. The transport sector is the second largest sector with 3.5MtCO2 in the baseline year and growing to 7.3MtCO2 in 2050 under the business-as-usual scenario. This is most likely the most challenging sector to change. Erbil City is a very car-oriented city. Improving and greening public transport only shaved off a small sliver from trips by cars and taxis, 0.2, 0.4 and 0.8MtCO2 for 2030, 2040 and 2050, respectively.

Currently, it is unknow how many fossil fuel trips will be replaced by carbon neutral trips through walking or cycling as the city aims to become walkable. It is also challenging to predict the uptake of electric vehicles. Therefore, the carbon sequestered by agroforestry, afforestation and green spaces is used to compensate the GHG emissions from transport. This almost halves the GHG emissions from transportation. However, this is risky, because there is the risk of drought, wildfires which could turn this sink into a source. Promoting the update of electric vehicles will be essential for this sector.



Source: JICA Project Team

Figure 3.2.7 Erbil City GHG Emissions under BAU, Paris regime, delayed implementation and low performance

The above graph shows the accumulated GHG emissions for the three main GHG emitting sectors and the GHG sequestering sector under the Business-As-Usual (BAU), under the Paris Agreement regime (MP50), when mitigation measures are 5 years late (MP50late) and when mitigation measures are not implemented to the full (MP50low). The implementation of the mitigation measures under the Paris regime are ambitious. The best performance will be supported if the Erbil Urban City Fund is set up to ensure an efficient and effective flow climate finance to implement the mitigation measures. When the mitigation measures are implemented later or not to the fullest the zero emissions target of 2050 will not be met and occur 10 to 20 years later between 2060 and 2070.

CHAPTER 4
LOW-EMISSION CITY PLANNING IMPLEMENTATION PROMOTION

4.1 Low-Carbon Technologies & Measures targeting Private Sector

The authorities of Erbil City have two main options available to push the private sector to adopt low carbon technologies or take low carbon measures. On the one hand, authorities can put in place rules and regulations and on the other hand, they can put in place fiscal policies. If the authorities have the availability over climate finance they can also co-invest with private sector as part of a private public partnership (see section 4.3).

New rules and regulations are the stick option to change the behaviour of companies, but also a carrot option is required to make this process effective. For instance, the authorities can put in place the rule that office buildings which only need power during the day are not allowed to use a private generator but should switch to a solar system on their rooftop. If the owner of the building does not comply within a certain period the enforcing agency will give the owner a penalty. The authorities can also put in place an additional fee on private generators because they cause air pollution. These are some stick options.

The money coming in from the new fees can be used to provide a subsidy on the purchase of solar panels. This is a carrot option. An additional carrot option would be to provide additional fiscal advantages. For instance, authorities can grant the building owner a reduction of the local taxes or a cheaper business license.

If Erbil City had applied and received climate finance from a multi-lateral fund, it could make this funding available to financial institutions with favourable conditions (e.g., a lower interest rate) for investment to private sector to switch to solar panels. The advantage is that this funding is recycled in the sense that as private sector repays its favourable loan, the funding is available again for other companies.

When more substantial investments are needed Erbil City can set up a Public Private Partnership (PPP). PPPs are investment constructions where a public entity co-invests with a private entity. The public entity can contribute to kind, such as making land available or ensuring a minimum price for the commodity or a guarantee market. The public entity can also contribute financially. It is also possible to set up a PPP to apply for climate finance to a multi-lateral fund, such as the Green Climate Fund.

The above does not only apply specifically to solar energy. It can be applied to promoting the use any other low carbon technologies and measures. For instance, upgrading energy inefficient machinery, cooling systems, replacing electric boilers with solar heaters. This mechanism can even be used to push companies to switch to water efficient technologies. For instance, authorities can push large commercial farmers which use irrigation to switch from sprinkler irrigation to drip irrigation, or push them to build water harvesting systems.

4.2 Concepts of Low-Emission City Planning for Local Urban Plans

There is a new development occurring in the domain of climate change adaptation and mitigation. Currently, most climate change adaptation and mitigation projects are top-down developed with little or no impact from stakeholders and beneficiaries at the grass roots level. This has a signification risk of project failure and mal-adaptation. Involving the target stakeholders, either households or businesses, to participate in the project design helps to develop a project which is tailored to the needs of those people and likely to be more successful in identifying their actual issues and solving them with solutions which serve them best. This is also known as a decentralized delivery mechanism for project development and implementation.

Currently, this is a growing practice for rural development and which has also been adopted to climate

adaptation initiatives. The foundation of this new practice is to build upon the existing rural development planning process or creating one, as proposed under climate adaptation sector for the peri-urban rural area of Erbil City. As already explained under the climate adaptation sector, having such a planning process helps to identify the real on the ground issues and provide actual solutions. It also allows to leverage climate finance to implement these projects.

As similar practice is slowly getting applied for the urban context. In many developing countries, rural people migrate to the bigger cities in response to climate change. The people settle in marginal areas in the city which are often also impacted by climate change. For instance, in Kampala the capital of Uganda, rural people forced to leave their villages due to drought, settle in degraded wetland in Kampala. Unfortunately, these "free" wetlands are also prone to become flooded with extreme rain storms. These urban climate issues are slowly getting addressed in a similar way as in rural areas. If Erbil City decided to adopt this approach it would be at the forefront of urban climate adaptation and mitigation.

The planning process lends itself not only for climate adaptation or mitigation. Through regular annual or ad hoc neighborhood planning meetings, the residents can share their issues on traffic, air and water pollutions, drainage problems. City engineers and social workers can present potential solutions and convert these solutions into a local urban plan with a budget cost for city authorities. The costs of all local urban plans are compiled at city level. Having these budget costs available will facilitate allocating existing budget and raising (climate) finance from ODA partners.

For instance, the household survey in Erbil City has high-lighted the issues with private generators causing air and noise pollution and high costs. Other issues were the extreme heat. Applying the above-mentioned planning process to this case, the next step after the interviews would be to organize a meeting and discuss solutions which fit the respondents. Finding solutions by interacting with the responders would help come up with locally appropriate solutions. A local business owner may opt to install his own roof top solar system; households may opt install a solar heater to replace their electric boiler and reduce their electricity bill; other households who don't have a high electricity bill, may opt installing water saving shower heads to reduce their water consumption. Another option for instance at neighborhood level, for people to pool their demand for solar panels and get a reduction on the installation as group.

4.3 Erbil Urban Climate Fund

In this section the Erbil Urban Climate Fund is discussed. Firstly, the reasoning behind setting up the Erbil Urban Climate Fund. Secondly the operations of the fund are explained and finally the green taxonomy.

4.3.1 Climate Finance Delivery Mechanism

For Erbil City to become a low carbon and resilient city, the interventions mentioned in the new master plan need to be financed. Without prospect to finance, the new masterplan is unlikely to be (fully) implemented. This was the case for the previous version of the masterplan. The ambitions mentioned in the old masterplan were not implemented due to a large part the lack of finance. An obvious source of finance is climate finance.

Cities have been recognized as main drivers of climate change and climate finance is available to assist cities governments to curve their emissions and protect their inhabitants against the negative impact of climate change. For example, there is the Green Climate Fund's Green Cities Facility. However, this facility only covers a few countries in Eastern Europe, Africa and the Pacific-Asia region and does not include cities in desert countries such as in the Middle East.

IFC (International Finance Cooperation) part of the World Bank Group is another source of climate finance. IFC has a regional approach and the focus of its region "Middle East, Central Asia, Türkiye, Afghanistan, and Pakistan" is "Mitigating and Adapting to Climate Change". Climate finance from IFC is available for multinational or large national businesses and financial institutions.

Unfortunately, most cities in developing countries are not prepared to be able to receive climate finance.

The 2021 State of Cities Climate Finance Report (2021)[1] mentions that current streams of climate finance for cities are in general not adequate and more funding is needed to close the gap. This is particularly the case for cities in developing countries. One of the reasons is that developing countries and their cities lack the capacity. Increasing the capacity of the Erbil City government is important and should be part of the package, focusing on developing green fiscal policies, rules, regulations and rewards.

The masterplan also takes a private sector approach through its promotion investment. This means that finance is made available as an investment to businesses. Investments need to be repaid. Financial institutions are best in place to evaluate the business' ability to repay investments and they have the staff and (tracking) systems to monitor and enforce lending agreements. The Erbil City authorities are not equipped do this properly. The role of the Erbil City authorities is to prioritize which investments best serve Erbil City from public point of view and the masterplan's vision.

Unfortunately, there is a mismatch between the size of the finance provider and the size of the businesses in Erbil City. Most businesses in Erbil City range from small to medium and a few large companies. Most climate finance is allocated in large volumes, e.g. millions of USD. For example, entities such as IFC will not allocate finance to the relatively small businesses in Erbil City. Therefore, an intermediary is required. These can be retail banks, if the banks in Erbil City are large enough. But it is more efficient to have an intermediary body managing and monitoring all the climate finance in Erbil City which also allows the city authorities to be part of the decision making.

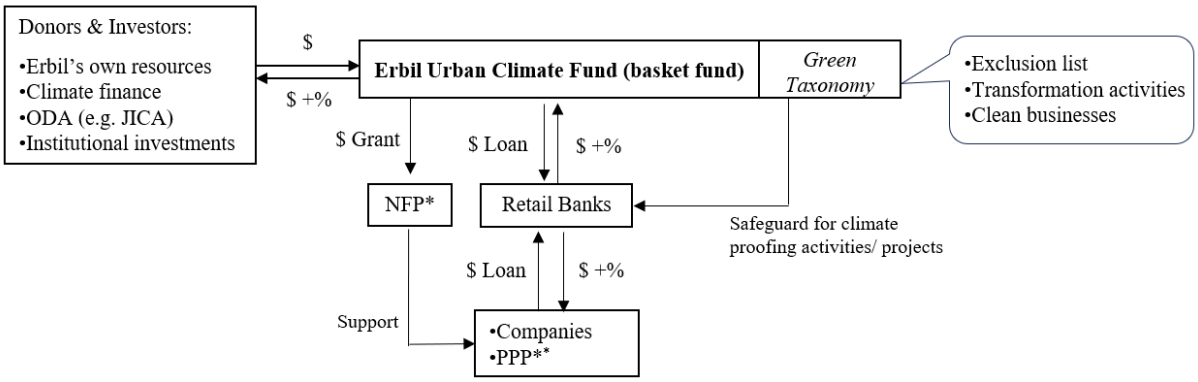
Climate finance for Erbil City can be fast-tracked, by setting up a fund, which receives finance from multi-lateral climate funds and makes the funding available to retail banks in Erbil City. The best option is to set up a fund within an existing development bank such as the Islamic Development Bank or Kurdistan Central Bank by opening a dedicated credit line. The funding deposited on the credit line has the only purpose to be used for climate mitigation and adaptation. This approach saves time and resources since opening a credit line is faster and less resource intensive then setting up a completely new fund. This has been done in East Africa setting up the Biodiversity Investment Fund within the East Africa Development Bank.

The Erbil Urban Climate Fund can be set up as a basket fund. This means it can receive finance on its credit line from different sources and not only from multilateral climate funds and members of the World Bank Group. As a basket fund, the Erbil Urban Climate Fund could also receive funding from its bilateral or multilateral partners for development, such as JICA and even from its own Kurdistan, Iraqi its own government. The additional advantage of a basket fund is that the fund is not depending only on one source for finance. This provides a secure and continuous stream of funding.

The scope of the Erbil Urban Climate Fund can be set up covering the whole of Kurdistan. Ideally, the fund is first piloted in Erbil City to gain experience, learn lessons, to improve the system, before it is expanded across Kurdistan.

The Erbil Urban Climate Fund could also have a non-private sector branch. This branch is managed by the city government/departments and targets households, member-based organizations and NGOs. For instance, the city can develop a program to reduce runoff into the street gutters by offering households rain barrels. These rain barrels would be supplied by a company which gets paid through the fund. So, the private sector would still be indirectly involved as the supplier of climate mitigation and adaptation products. Similarly, NGOs can help out farmers restoring catchments by constructing check dams and planting trees. These activities are too expensive for farmers to bear.

[1] 2021-State-of-Cities-Finance-Executive-Summary.pdf (citiesclimatefinance.org)



Source: JICA Project Team

Note: *Not-For-Profit

** Public Private Partnerships

Figure 4.3.1 Funding and Investment Structure of the Erbil Urban Climate Fund

Figure 4.3.1: The Erbil Urban Climate Fund (EUCF) is set up to receive finance ($) from different partners, i.e., (impact) investors and donors. In case of investors, the EUCF repays the investment with interest ($+%). EUCF will pass on the interest costs to the retail banks, which will pass it on to the borrowers. The climate finance from the EUCF will come with "strings attached" in the form of a Green Taxonomy. This taxonomy is a tool to ensure that the loans to companies and PPPs is used to adapt to and mitigate climate change. The EUCF can decide to use the donations from partners either investments to businesses or as grants to not-for-profit organizations. Not-for-profits will receive grants which support businesses in becoming low-carbon emitting and/or resilient, e.g., restoring water catchments for farmers.

4.3.2 Operations

There are four parts to an effectively and efficiently operating fund with significant impact. First, there is efficiently channelling the climate finance. Secondly, there is the need for a green investment taxonomy. Thirdly, ideally there are city policies to create a sense of urgency for businesses to transform. Finally, there is a climate expo event organized to inform businesses about technological and nature-based solutions.

Firstly, the climate finance that is channelled through the Erbil Urban Climate Fund should be transferred efficiently and effectively to retail banks, who in turn disburse it to businesses that contribute to lowering their GHG emissions or their clients' GHG emissions and/or help adapt themselves or their clients to prevailing and future negative impacts from climate change. This can be real estate companies retrofitting their buildings with renewable energy systems, heat protecting insulation and water saving devices. But it also includes agri-businesses switching from sprinkler to drip irrigation.

There are also priority projects listed in the new masterplan which contribute to climate change mitigation and adaptation. Some of these, often, larger projects are financed through bi-/multi-lateral agreements between the Erbil/Kurdistan/Iraq government and its development partners. For instance, the Mandawa hydropower/water reservoir is such as project. Such projects do not require a retail bank as a lender. But there are other add-on projects which could involve businesses and the need for an investment through a retail bank. For instance, a large floating solar farm could be installed on the future Mandawa lake.

Secondly, the investments financed through retail banks need to regulated to ensure that projects contribute to climate mitigation and adaptation and avoid financing fossil fuel projects. Often retail banks have an exclusion list mentioning activities which the bank will not finance, such as projects related to tabaco, or projects involving child labour. An extended version of an exclusion list is a green taxonomy. This taxonomy describes activities or is a decision-making tool which bank staff can use to assess whether the project proposed by the prospecting business contribute to climate change mitigation

and/or adaptation.

Thirdly, rules, regulations and rewards by policy makers are an essential part of "promoting" businesses to transform and become low- carbon emitting and climate resilient. For this to happen, as mentioned earlier, the capacity of the Erbil City staff needs to be built to understand, develop and adopt green policies. Ideally, Erbil City does not reinvent the wheel and adopts existing green policies from elsewhere and/or adapts them to local circumstances. One option is to change the building codes to force real estate owners to retrofit or construct new buildings according to low-carbon emission and climate resilient standards. Another option is to set up a carbon trading emissions system, where GHG emitting businesses have to buy carbon credits to compensate for their pollution. Erbil City can also reward businesses for their efforts to become low-carbon emitting and climate resilient. Erbil City can start to charge businesses a climate tax. The more emitting and least climate resilient the higher the tax. The tax income could be deposited into the Erbil Urban Climate Fund and made available for projects.

Fourthly, developing green policies is often a time consuming and political slow process. The Erbil Urban Climate Fund could function without it as long as it makes business sense for companies to borrow money from the fund. "Luckily" climate change already has a significant impact which may prompt companies to adopt techniques and change behavior in response to climate change. Businesses also often are not informed and aware about potential technological and nature-based solutions which may help them. Once the green taxonomy and fund have been set up a climate expo can be organized show casing the latest and locally appropriate climate solutions available to businesses. For instance, mobile drip irrigation is common practice in the drier parts of the USA. The same technologies can be adopted by agri-businesses in Erbil to lower their water consumption.

The timeline to technically operationalize the Erbil Urban Climate Fund could be as short as six months to maximum one year. This includes: finding the appropriate and/or willing financial institute and setting up a credit line. This is a well-established practice. Due to the political urge to tackle loss and damage from climate change, allocating seed capital of one million USD should not be difficult. Selecting retail banks in Erbil City to onlend the climate finance to should not take more than a month. More time consuming is developing the Green Taxonomy and training bank staff in applying the methodology of the Green Taxonomy. Adopting existing and developing new green policies could be a political process, unless a technical approach is taken such as upgrading the building codes. Organizing a climate expo should also not take more than a few months.

4.3.3 Green Taxonomy

First the basics of a green taxonomy are explained before the concept for a Green Taxonomy for the Erbil Urban Climate Fund is described. Taxonomy is the science of classifying objects, structures, activities and processes into separately distinct groups (taxon). The oldest branches of taxonomy are plant and animal taxonomy. These taxonomies are also accompanied with an identification key to be able to identify the organism in question.

A taxonomy in the context of the financial sector is a classification of economic activities, e.g., growing wheat, manufacturing solar panels or building residential homes. These economic activities have an environmental or ecological footprint. They are using natural resources, e.g., water, minerals, crude oil, and they produce waste, e.g., GHGs and non-reusable materials. Certain economic activities are more damaging to the environment and depleting non-renewable resources than other economic activities. The oil and gas sector causes more environmental damage than sustainable forestry.

A green taxonomy is a classification of economic activities with currently the smallest environmental footprint. Green taxonomies also take into account how much an economic activity is contributing to climate change either through the GHG emissions or permanently removing vegetation and water from an area. Important for the financial sector is also understanding how resilient a business is carrying out a certain economic activity. The investment needs to be repaid and when a business collapses due to climate change.

Table 4.3.1 Priority Sectors and Interventions for Addressing Climate Threats

Priority sectors aligned with the prominent climate threats interventions			
1. Extreme heat:	2. Water scarcity:	3. Dust storms:	4. Flooding:
Urban planning (1)	Water resources & Irrigation (4)		
Public facilities (11)	Water supply (5)		
	Sewage (6)		
	Flood Management (10)		Flood Management (10)
Green Area Management (sub)sector (13b)	Green Area Management (sub)sector (13b)	Green Area Management (sub)sector (13b)	Green Area Management (sub)sector (13b)
Priority interventions			
Low rise building & open spaces	Pricing to reduce consumption	**Agroforestry**	Water reservoirs
Public building with subterraneum spaces (geothermal cooling)	**Drip irrigation**	**Afforestation**	**Check dams**
Green and Blue spaces (Parks & ponds)	Treat sewage water for irrigation		Blue spaces
Green roofs & walls			

Source: JICA Project Team

New rules and regulations than the loan is lost (non-performing loan) or needs to be restructured. Financial institutions are risk adverse and a green taxonomy is a tool to derisk their loan portfolio. Ideally, each institution should have or follow a green taxonomy. Green taxonomies are also used as green fiscal policy. The EU and countries such as Japan are pushing their financial sector to become low-carbon emitting, climate resilient and circular.

There are two types of green taxonomies, i.e., descriptive and analytical. A descriptive green taxonomy is a classification with pre-approved economic activities with a minimal or no environmental footprint safe to invest. It is the opposite of an exclusion list often used by banks. Such a taxonomy requires less capacity building of investment officers assessing loan proposals. When a request for a loan from a business fits the description of the economic activity listed in the green taxonomy the loan is approved. Ideally, the description or rigor of the due diligence is sufficient to filter out economic activities which rely on underlying ungreen activities. For instance, solar panels manufactured with power generated by burning coal still have a large carbon footprint.

The analytical taxonomy is a climate risk assessment of the business or economic activity matched with potential climate solutions. This taxonomy can be initiated either by the business or the bank. For instance, the bank has noticed an increase in non-performing loans in its agricultural portfolio. In response, it decides to screen its clients and concludes they are being impacted by water shortages due to climate change. The bank decides to provide its farmers free training in climate smart agriculture, and affordable loans to switch to drip irrigation and drought resistant crop varieties.

The EUCF's green taxonomy will be more of a descriptive taxonomy. Ideally, it is grouped around to two objectives of the new masterplan: 1) low carbon emitting and 2) climate resilience. The other aspect to consider is that EUC fund will be covering two distinct but linked geographical areas, i.e., the (future) urban and the peri-urban areas. The (future) urban area is characterized by urban expansion and transforming the existing city with the peri-urban area supporting the city in terms of food, work and recreation.

In Table 4.3.1, the priority sectors are aligned with the climate threats and priority interventions to counter the threat. The priority interventions are a guideline towards developing economic activities supporting these priority interventions. The priority interventions in bold in the Table 4.3.1 are considered for EUCF and the Green Taxonomy. The EUCF should focus on only a few sectors at the start of its inception and expend and scale up later into other sectors.

One of these sectors is the construction or building sector. It has the potential to promote low-carbon and climate resilience urban expansion and transformation targeted to home owners and financed

through mortgages. This avenue tackles several other climate threats and contributes to the reduction of GHG emissions.

To tackle the threat of extreme heat urban planning should aim to maximize low rise building and open places. Low rise buildings are less exposed the solar radiation than tall buildings and they also require less steel and concrete which have a high carbon footprint. The typical most abundant type house is the terrace house with one or two floors in rectangular blocks of two rows of houses linked back-to-back. The block may have inlets for parking and local shops (see Figure 4.3.2). Characteristically there is little greenery or space for green. Most of these houses are also family owned.

The building assignment for the short-term is to build enough houses and apartments for the new 218,000 people until 2030 (2030: 2,200,000; 2025: 1,982,000). If dwelling preference remains the same as observed from the household survey, 2/3 of the people will (want) to live in houses and 1/3 want to or can only afford to live in apartments. This means that with 3.65 people per household 59,726 dwelling units need to be build: 1909 appartements and 39,817 terrace houses. The standard dimensions for the dwelling used here is 10 x20m, so 2000m^2.

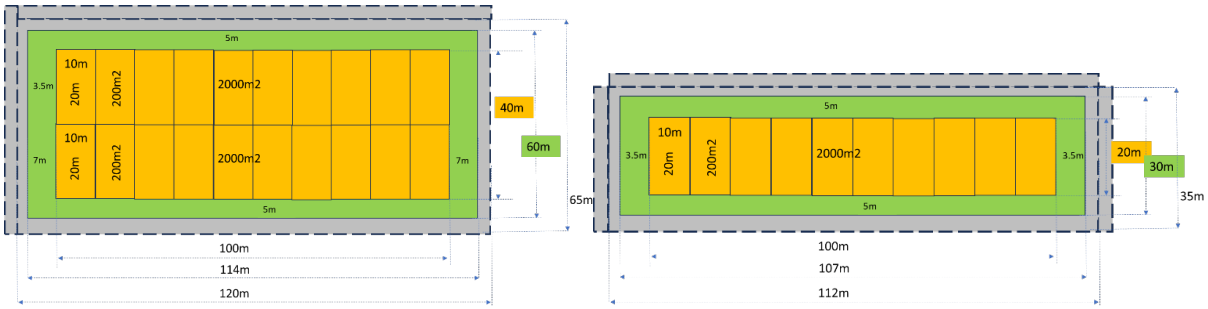
Low rising apartment blocks are set here at maximum 3 stories high with 10 apartments per story. Maximum blocks with terrace houses are set at 20 with the same dimensions of 20x10 m. Minimum green space, including sidewalks, around the blocks is set at 60%. This allows to plant trees. Half the street is included to calculate the minimum block surface area. Figure 4.3.3 shows the dimensions for the blocks. The total surface area for a terrace house block is 0.7ha and for an apartment block is 0.4ha. Total surface area to house the almost 60,000 households is almost 1700ha (1659ha). Figure 4.3.4 shows the almost equivalent surface area (1500ha) outlined in yellow on google earth image for Erbil City.

The new urban expansion areas can be offered to existing and prospecting home owners, instead to only (large) real estate developers. These large developers come with their own money and will try to maximize their profits by catering to the high-end market. Erbil City most likely will also have little leverage over these real estate developers to push for low-carbon and climate resilient housing. Prospecting and existing home owners depend a bank loan to build or retrofit their new or existing home. This dependence allows to leverage for low-carbon and climate resilient building options.

It is already common place at sustainable retail/mortgage banks to charge a lower mortgage rate when sustainable options are built in the house. So, the mortgage for a traditional house is more expensive than a climate proof house. Existing home owners may consider to move out of their existing poorly adapted house and have a new climate proof house built, or they retrofit their existing house with solar panels and solar heater, heat protecting insulation, etc.

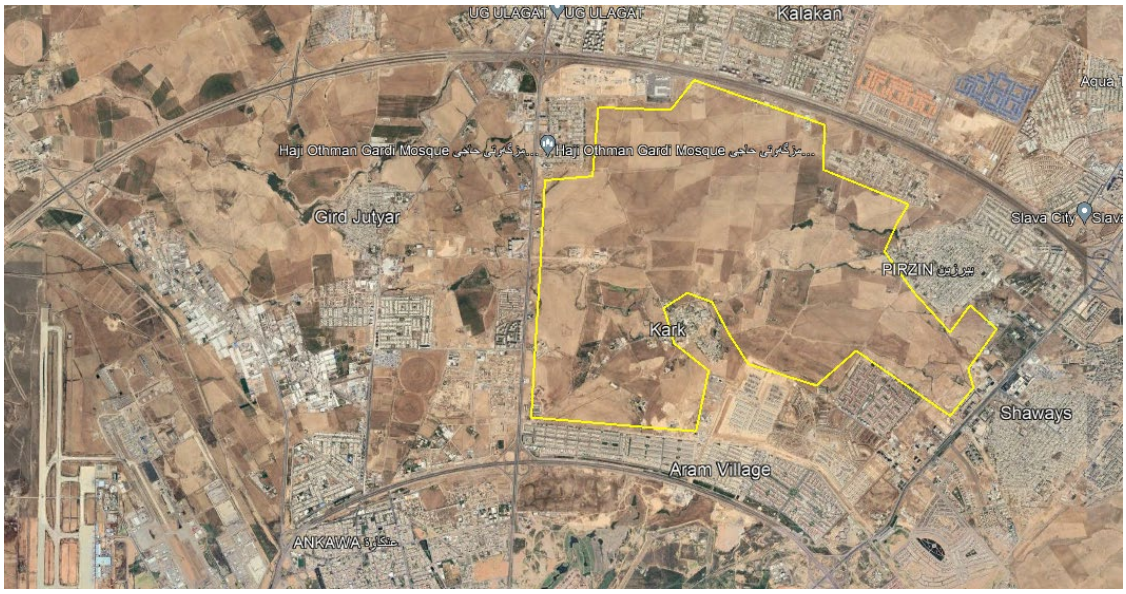
Source: Google Earth

Figure 4.3.2 Typical Urban Block with Terrace Houses



Source: JICA Project Team

Figure 4.3.3 Block of Terrace Houses (left) with Dimensions for the Building (orange), Green Space (green) and Street (gray), Block of Apartments 3 Stories High.



Source: JICA Project Team

Figure 4.3.4 Surface Area to House 90% of the New People until 2030 in Low Rise Building with 60% More Green Space Compared to Existing Traditional Neighbourhood in Erbil City

Prospecting and existing home owners will need to be convinced. Therefore, it will be important to develop a marketing strategy to promote climate proof housing. The climate expo can also have a section on climate proof homes. Ideally, there is also an aware raising campaign about the impact of climate change, future increases in costs in terms of taxes, fees and the price for water and power. The other advantage is that retail banks are familiar with mortgages.

Climate proofing new and existing houses also contribute to low-carbon energy and low water consumption. Households (HH) in Erbil City are the main drivers of energy and water consumption. They on average consume 1,230liters of water per day and 3,000kWh per month. The potential benefits of retrofitting these town houses with solar panels and rainwater harvesting system is high.

Most of the houses in Erbil City are two story terrace houses with a flat roof. An average roof has a surface area between 85 and 250 m^2. On a 200m^2 roof, 90 solar panels with dimensions of 99 x196cm (±2m^2) can be easily fitted. With only 300W per panel such as system has a capacity of 27KW. With only 4 hours of solar radiation per day the system capacity is 108KWh per day or 3240kWh per month (30days). On the remaining 10m^2 a solar heater can be installed removing the need for an electric boiler. Consequently, the house hold become self-sufficient in terms of power.

The same roof can be used for rainwater harvesting. The maximum harvesting volume for a 200m^2 roof with a mean annual precipitation rate of 400mm is 80,000 liter per year. Water consumption per household is 1230 liter per house per day or close 450,000 liter per year (448,950l). When the 80,000 liter is used by the household, it reduces close to 20% in pipped water. This is 10% more than the reduction pursued by the GDWS from 330lpcd in 2024 to 300lpcd over 25 years in 2050.

So, mortgages offered to homeowners through the EUCF will contribute to a reduction in GHG emissions and water consumption, more green space in the new urban fabric with more spaces for trees. It will also increase the demand for businesses installing solar panels, water harvesting and purification system, induction cook stoves, electric showers, solar heaters, heat protecting insulation, etc. These businesses may need bank loans to expand their operations with the increase in demand. Similar, to home owners, businesses may also decide to their businesses with solar panels. Propelling the energy transition. A next step for households and businesses would to buy electric vehicles for transportation and as a home battery. Over time, as the EUCF has observed a peak in mortgages, it can decide to reallocate part of its finance to bank loans for electric vehicles.

Source: JICA Project Team

Figure 4.3.5 Street in Cadiz, Spain

Add on interventions to this approach, is using the flood risk map to identify area where flood water accumulates naturally and transform those risk areas in blue spaces surrounded with green spaces. These blue spaces also function of recharge areas to replenish the ground water within the city. The Not-For-Profit branch could also be involved in greening the existing and new neighborhoods by planting trees and vines around and between urban blocks covering streets with shade.

Another important sector to directly target through the EUCF is the agricultural sector. The agricultural sector is a main consumer of groundwater, and it has contributed to dust storms due to poor land use management. On the other hand, agricultural land and general landscape also have the potential to become a carbon sink through planting trees and ecosystem, restoring biodiversity and providing the scenic back drops for recreation and (eco)tourism.

Currently, there are two forms is agriculture: rainfed and irrigated. Rainfed agriculture is dominated by winter grains grown over the winter months when rainfall is sufficient to yield crops. Irrigated farming tends to grow higher value crops due to the investment and costs for irrigation. Currently, watering crops is done through mobile sprinkler systems. Sprinkler systems are water intensive with a high ratio of

water loss through evaporation and runoff. Mobile drip irrigation is much more water efficient and much more precise in watering the crops. A reduction between 20% and 50% is possible. Existing sprinkler irrigation systems can be adopted, so farmers do not have to invest in completely new systems. It also allows to mix the water with liquid fertilizer such as leachate and reduce N_2O emissions, a GHG.

The Ministry of Agriculture and Water Resources is planning to develop 43,252 ha under irrigation across four agricultural area around Erbil City (see agricultural sector for more detail). By 2050 it aims to have added an additional 7,388ha to the 43,252ha under development. Converting from sprinkler to drip irrigation saves water and allows the saved water to be used for irrigation elsewhere. This water is saved and used immediately. The saved water loss is set here at 30%. This means that an additional 12,977ha could be irrigated. This is almost double the number of hectares compared to the sprinkler expansion plan, within a much shorter period than 25 years and without the water extraction and channelling infrastructure. The EUCF should target existing irrigated farms and provide them an affordable bank loan to switch to drip irrigation to increase water efficiency and increase productivity.

The impact of the EUCF if well implemented could have a significant impact and contribute importantly towards Erbil City becoming a low-carbon and climate resilient city. If all new houses were installed with solar panels as described above, this would be the equivalent of a solar farm with capacity of 1.2MkW, generating 150MkWh per month. Similarly, 3.7M m^3 of rainwater would be harvested. If agroforestry and forestry would be adopted close to 8M tCO2 would be sequestered by 2050.

Final Report

APPENDIX

CHAPTER 1
IMPLEMENTED BASELINE SURVEYS

1.1 Environmental Baseline Survey

1.1.1 Survey Description

(1) Goals of the Survey

The goal of the Environment Baseline Survey is to capture the environmental conditions in the Project area. The outcomes of the Environment Baseline Survey are intended to be used as basic knowledge in the Strategic Environmental Assessment (SEA) of the Erbil 2050 MP formulation (see Part III).

(2) Activities of the Survey

The four activities of the Survey are the following:

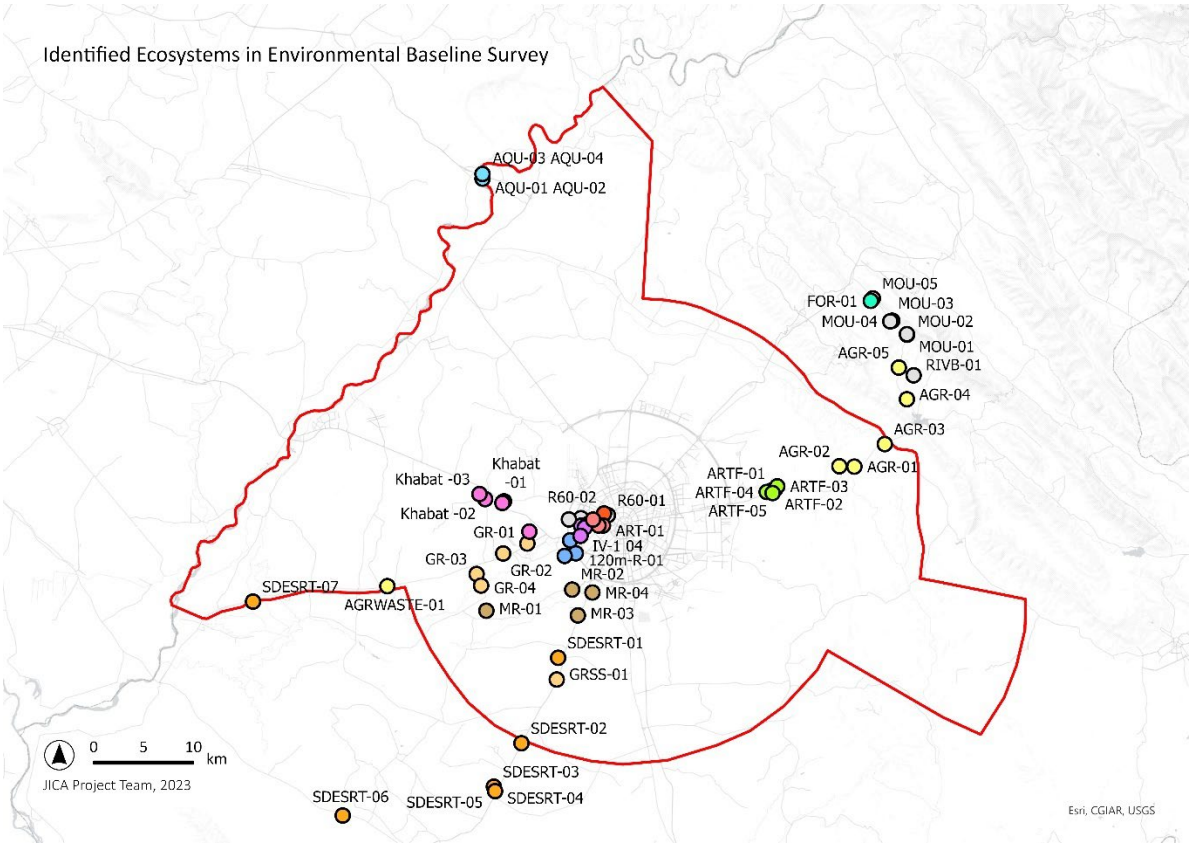
1) **Baseline Information Collection**: based on literature review and interview with relevant organizations, the consultant was requested to collect the relevant information and data mentioned in the checklist provided in the ToR, which is relating to the following.
    i) legal and institutional framework of environmental protection;
    ii) environmental policies, plans, targets, programs and projects;
    iii) physical environment (topography, geology, soil);
    iv) climate (meteorology, extreme weather events such as flooding or dust storms);
    v) natural environment & biodiversity (vegetation, wildlife, ecosystems);
    vi) living environment & disasters (air, water and soil quality, natural disasters);
    vii) natural resources & consumption (surface and groundwater resources).
2) **Field Survey on Natural Ecosystems & Agricultural Areas**: carrying out a field survey on a total of 50 sample points distributed within the different ecosystems existing in the Project Area, the consultant was requested to identify natural and agriculture land cover (vegetation species and agriculture crops), ecological richness, among others information.
3) **Field Survey on Priority Area (Municipality 6):** carrying out a field survey on all green spaces of Municipality 6, the consultant was requested to make an inventory of all green, agriculture and open areas of the area, including localization, photos and information in terms of land tenure (municipal, private), ecological functions and richness, ecosystem services for society (providing shadow etc.), presence of distinct cultural assets (archaeological sites etc.).
4) **Data Analysis and Deliverables Production**.

(3) Implementation of the Survey

- Selected subcontractor after the tender process: MapCom Company, represented by General Manager Hewa Arif Azeez, +964 750 452 1308, hiwa@mapcom.org;
- Implementation period: Expected from 2022.07.01 to 2002.09.30 but delayed until 2023.01.31.

1.1.2 Survey Results

Due to a certain number of factors, including data scarcity in KRI, inefficient communication and coordination between main actors, the Environment Baseline Survey was implemented with limited success, especially the collection of baseline information. Indeed, only a fraction of the requested data in the checklist could be collected and analyzed, resulting in a relatively poor Environment Baseline Survey report. The field surveys were carried out with more success, as shown in Figure on the next page, but the explanation of the survey and the expected analysis part could have been better in the report.




Great Zab Riverside Ecos. (AQU-02)


Artificial Forest (ARTF-05)

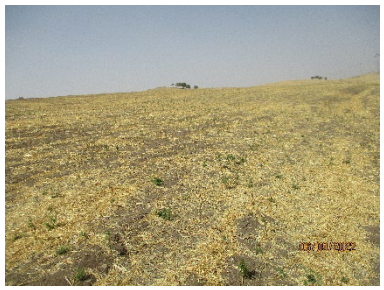

Khabat Ecosystem (Khabat-03)


Grassland Ecosystem (GR-03)


Mixed Shrub Ecosystem (IV-01-4)


Irrigated Agriculture (MR-02)


Urban Park Ecosystem (R60-01)


Inactive Agriculture (SDESRT-01)


Mountainous (outside Project Area)

Source: JICA Project Team

Identified Ecosystems in Environmental Baseline Survey

1.2 GIS Baseline Survey

1.2.1 Outline of GIS data product

(1) Data Contents

The GIS data product created in this project is listed as Table which consists of Base map and City Planning data. This data was created as Geodatabase (GDB) format with the survey standard shown in Table below. The detail of contents is shown in the sector report (GIS data catalogue).

List of prepared GIS data in the project

Category	Name of GDB	Contents
Base map	ECMPGD_01_BaseMap.gdb	- Administrative boundaries (existing data) - Topographic maps (existing data) - Block and road data - 3D Building data - Satellite imagery (SPOT: 1.5m GSD) - Digital Elevation Model (DEM)
City Planning data	ECMPGD_02_CityPlanning.gdb	- Land Use Land Cover (see Section 2.4.2) - Public facility data - Residential Typology (see Section 2.4.4) - SEA consultation (see Part III) - Transportation data (Road network)

Source: JICA Project Team

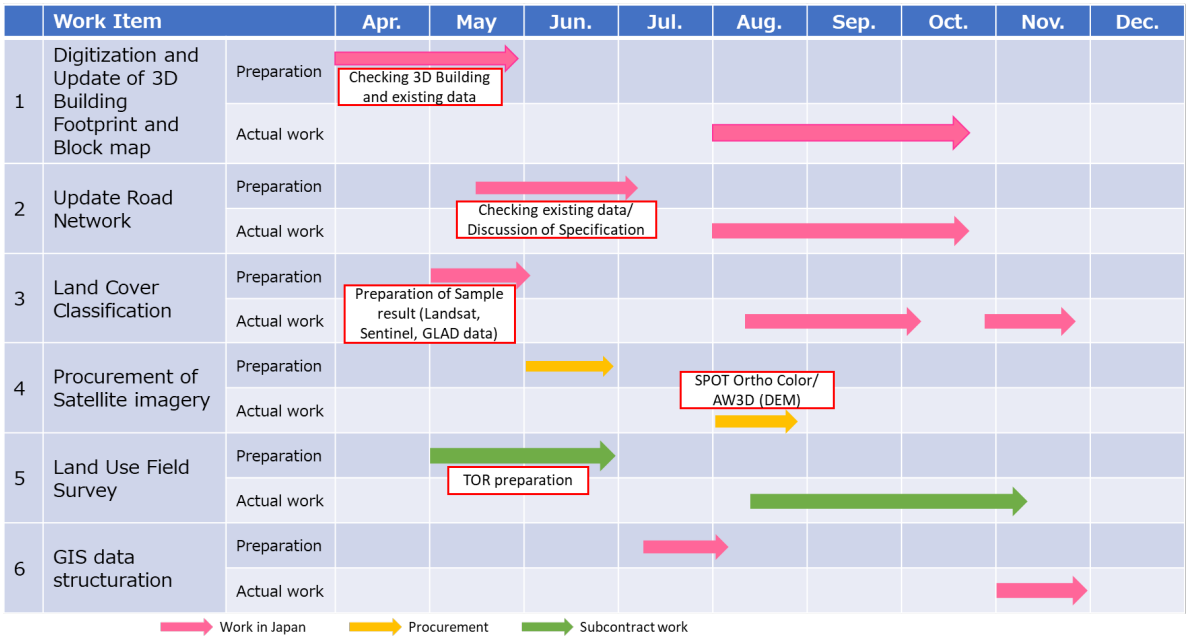
Survey Standard

Projection	Universal Transverse Mercator (UTM) Zone 38 North
Spheroid	WGS-84

Source: JICA Project Team

(2) Workflow

The workflow of GIS data creation is shown as Figure below. The data source to create GIS data was collected and procured by August 2022, and the data processing was completed by October 2022. The subcontract work was conducted the area between RW5 and RW8 which covers 428km2. The work consists of office work and field work, in which approximately 6,600 features have been collected in total. The additional field survey and quality assurance were conducted in November 2022. All the process including data structuration and quality assurance has completed by the middle of December.



Source: JICA Project Team

Workflow of GIS Baseline Survey

1.2.2 GIS Data Creation

(1) Base map

The data source and processing method of base map except for the existing data such as administrative boundary and 1:1,000 scaled topographic map data which is created in 2011 is shown as Table below.

List of Referenced GIS data

Data type	Data source	Processing method
Block and road data 3D Building data	- 1:1,000 scale topographic map - 3D building model data[1] (Procured in this project)	- Update the block and building footprint data based on the existing data by using SPOT imagery. - Refer the building height data from the existing data. - Apply the 3D building model data procured in this project only for the area which does not have building height information in the existing data.
Satellite data	- Downloaded and Procured in this project	- Procured SPOT 6/7 imagery for the whole project area. - Procured DEM (AW3D: 1.0m) for the area inside of RW8 - Downloaded DEM (AW3D: 30m) for the whole project area.

Source: JICA Project Team

The administrative boundary data was collected from GDUP. Municipality and Quarter boundary data is the latest data which has been updated by KRG in 2022 and waiting for the official approval.

The block, road and building footprint data was created based on the 1:1,000 scale topographic map which was created in 2011 for the water management project, covering the area inside of RW8. The building footprint data incudes the building height which is referred to the 1:1,000 scale topographic map and 3D building model data procured in this project.

Figure below shows the sample of final product of base map.

[1] 3D building model data created with AI technology by ONEGEO GmbH, Germany.

Source: JICA Project Team

Sample Image of Base Map (Left: Block map, Right: 3D building model)

(2) City planning data

The data source and processing method of city planning data except for the residential typology and SEA consultation map is described as follow.

1) Land Use Land Cover map (Inside of RW 8)

The Land Use Land Cover map inside of RW8 was created by updating the existing data listed in Table below with satellite imagery interpretation and field survey.

Data source of LULC map (Inside of RW9)

Data type		Data source	Area	Date of creation
Land Use Land Cover	- Land Use data (Erbil MP 2007)	- GDUP	- Inside RW5	- 2007
	- Land Parcel Data (private, public, vacant)	- Erbil Governorate	- Inside RW5	- 2008-2013
		- GDUP	- Inside Erbil Municipality	- 2008-2013
	- Public facility data	- Erbil Municipalities	- RW5 - Green Belt	- 2022

Source: JICA Project Team

For the area inside RW5, the LULC data was created with the cooperation with Erbil Governorate. As the first step, the LULC data was updated with the existing data (Land Use data of Erbil MP 2007) and satellite imagery interpretation. The land use of public facility was updated based on the existing data of Erbil Governorate after Erbil Governorate officials translated all public facility data from Kurdish to English. The area that needed to be checked on the ground was flagged during the interpretation, and field survey was conducted for about 800 points in total by the cloud-basis GIS application.

For the area outside of RW5, the LULC survey was conducted by Joint Venture of View Pioneer Company and Point Path Company; the subcontractor in Erbil. The field survey was conducted after the satellite imagery interpretation. The 5% of the created data was inspected as quality assurance.

2) Land Use Land Cover map (Outside of RW8)

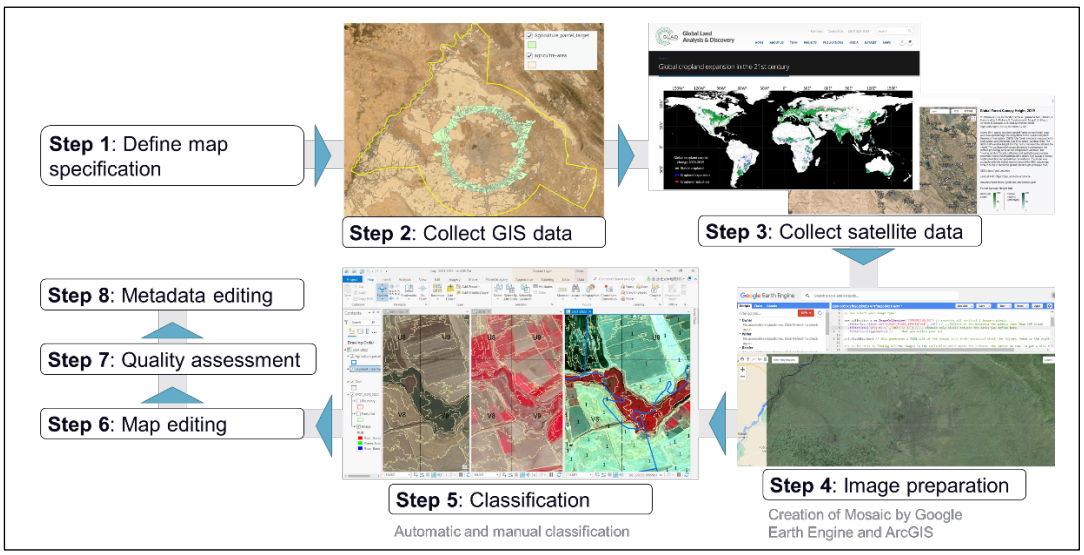
The Land Use Land Cover map outside of RW8 was created by satellite imagery analysis. The area is divided into two considering the necessary data at planning stage; agriculture parcels on Greenbelt 1 and outside of Greenbelt 1. Table below shows the data specification, source, and processing method.

LULC Creation by Satellite Imagery Analysis (Outside of RW8)

Data type	Agriculture parcels on Greenbelt 1	Outside of Greenbelt 1
Specification (LULC category)	- Agriculture (Active/ Inactive) - Bare Ground - Built-area - Forest - Barren (Grassland/ Shrub) - Water	- Agriculture (Active/ Inactive) - Bare Ground - Built-area - Forest - Barren - Water
Data source	- SPOT 6/7 (2018,2021,2022) - Global Forest Canopy Height2019[2] - Global Cropland 2019[3] - Cadastral Boundary Data (shared by GDUP)	- Sentinel-2 (2021)[4] - Global Forest Canopy Height2019 - Global Cropland 2019 - Village Area Data (shared by GDUP)
Processing method	- By using three seasons of SPOT 6/7, land cover is classified into 6 categories with 8 sub-categories. - For agriculture area, it is classified into active/inactive area for each parcel.	- By using Sentinel-2 image, land cover is classified into 6 categories with 7 sub-categories.

Source: JICA Project Team

The process of satellite imagery analysis is shown as Figure 1.2.3.



Source: JICA Project Team

Process of Satellite Imagery Analysis

The sample of final product of Land Use Land Cover map is included in the sector report.

3) Transportation data (Road network)

The road network data with road class and width was created based on the existing data of GDUP by updating with satellite imagery interpretation.

[2] https://glad.earthengine.app/view/global-forest-canopy-height-2019
[3] https://glad.umd.edu/dataset/croplands/
[4] Downloaded as mosaic image through Google Earth Engine.

1.3 Simple Traffic Survey

Based on QCBS selection method the Abacus company was awarded to conduct the traffic survey in the city of Erbil. The contract was concluded on October 7, 2022. An introductory workshop was done on July 21, 2022 to explain the objective and meaning of the survey in regards to the transportation planning, objectives and methods of the traffic counts and interview survey, taxi O-D survey, and bus passenger and operating survey. The survey schedule was discussed in order to obtain a close coordination of the Erbil Traffic Police and other relevant organizations.

1.3.1 Cordon and Screen Line Survey

Traffic volumes at Cordon and screen line locations are collected using video recording methodology in which the data is divided to 30-minute periods and classified into eight categories as follow:

i) Private Car (for private use (sedan, SUV, pick-up, etc.))
ii) Taxi (All kinds of taxis)
iii) Large Bus (Ordinary bus with seat capacity more than approximately 30)
iv) Coaster Bus (Seat Capacity approximately 30)
v) Minibus (seat capacity less than 30)
vi) Small truck (lightweight truck, pick-up truck with 2 axles)
vii) Large truck (more than 2 axles)
viii) Motorcycle
ix) Others (3-wheel vehicle, other)

The cordon line survey is conducted on October 10, 2022 for 24 hours and screen line survey on October 17, 2022 for S1 to S10 and on October 19, 2022 for S11 to S17. Locations of the cordon and screen line survey are shown in Table below.

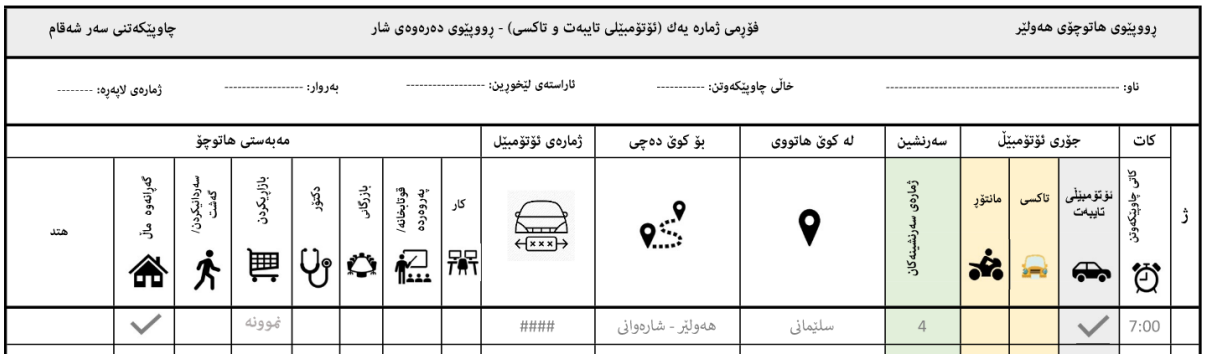
Location of Cordon Line (C1 – C11) and Screen Line (S1 – S17)

ID	Location	Duration
C1	Duhok Road – North of Gazna	24 hours
C2	Bahirka Road – North of Bahirka	24 hours
C3	Pirman Road (Masif Road) near Erbil Horse Club	24 hours
C4	Koya Road – East of Kasnazan, near Anfal Monument	24 hours
C5	Kirkuk Road – South of Darato, at Alen Spices Factory	24 hours
C6	Old Kirkuk Road near Baran Plastic Shop	24 hours
C7	Makhmur Road – Qoritan	24 hours
C8	Sarkarezan Road near Bridge	24 hours
C9	Off Mosul Road – Qaryataq	24 hours
C10	Mosul Road – Kani Qirzhala	24 hours
C11	Erbil International Airport	24 hours
S1	2 Sidi Lawan near Lawan City	16 hours
S2	Drkawa Mosque near Bnaslawa Old Road	16 hours
S3	Kornish Street near Bnaslawa Old Road	16 hours
S4	120m Service Road at Mnara City	24 hours
S5	Abdul Khaliq Maaruf at Mnara City	16 hours
S6	100m Road – Langa, Mamostiyan 2	24 hours
S7	40m Road – Langa, Mamostiyan 2	16 hours
S8	Ala Street at PAR Hospital	16 hours
S9	Mala Fandi Street at New City	16 hours
S10	Runaki Street at Runaki Park	16 hours
S11	Kirkuk Street at Tablo Mall	24 hours
S12	Quasmlo Street at Franso Hariri Stadium	16 hours
S13	Makhmur Road near Kuran, Azadi	24 hours
S14	Nawroz Street at Asiacell HQ	16 hours
S15	40m Road near Justice Tower	16 hours
S16	100m Road near Jihan University	24 hours
S17	120m Road at Lebanese and French University	24 hours

Source: JICA Project Team

1.3.2 Roadside Interview Survey

As part of the cordon and screen line survey, a roadside interview is conducted at 10 cordon line locations (except C11) and 15 screen line locations (except S4 and S17 on 120m Road). The target number of vehicles to be interviewed is set to about 5% - 10% of daily traffic, but depends on traffic condition. The main purpose of the roadside interview is to provide information about: Vehicle Type; Origin – Destination; Trip Purpose; Number of Seats; Estimated Travel Time; Bus Company Name and Bus Route Number (Bus Only); Name of Start/End Bus Terminal (Bus Only); Type of Commodity (Truck Only); Maximum Load (Truck Only); Loading Ratio (Truck Only). The surveyors receives training on the survey day on survey data collection procedure. 3 survey teams consisting of 4 surveyors per team are positioned at each location. The roadside interview is conducted manually on a hard copy of the survey form as shown in the Figure below.



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ناو: ..... خاڵی چاوپێکەوتن: ..... ناراستەی لێخوڕین: ..... بەروار: ..... ژمارەی لاپەڕە: .....

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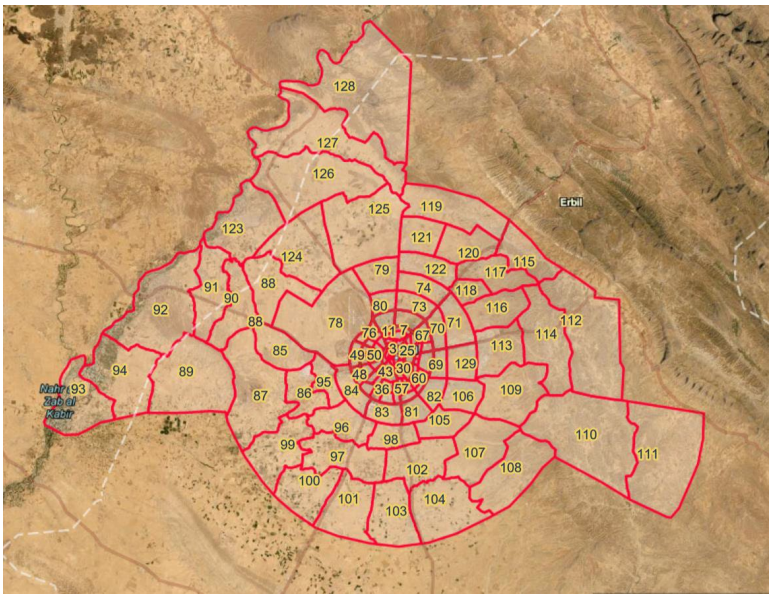
Source: JICA Project Team

Samples of Simple Traffic Survey Form

Origin and destination are coded as Traffic Assignment Zones as shown in the Figure below.



Source: JICA Project Team

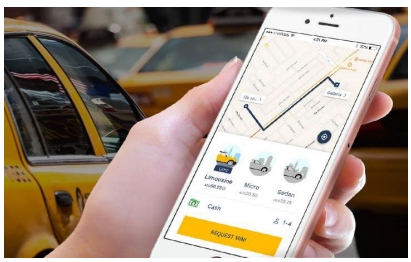
Figure 1.3.1 Traffic Assignment Zone Map

1.3.3 Bus Passenger and Operating Survey

The objective of bus survey is to collect detail passenger and operational conditions data for all currently operating bus lines. The key component of the survey is: Passenger counts at major bus stops; and time recording of arrival/departure at major bus stops. Information about the bus lines and major bus terminals are obtained from Transportation Syndicate and Erbil Transportation Directory. At each major bus terminals surveyors manually count the boarding/un-boarding passengers during assigned period. At least one surveyor per bus line rides the bus to track exact bus route, collect travel time information between bus stops, and boarding/un-boarding at other bus stops. Counts are done by the surveyors manually using hard copy forms to collect passenger counts at each major bus stops. Abacus Bus Tracking Application are also used by the surveyors who rides the bus line to record exact bus route and track and input passenger count information.

1.3.4 Taxi O-D Survey

The main objective of the Taxi O-D survey is to collect trip information of passengers using taxis which is a major transportation mode in the City of Erbil. The taxi drivers install an Abacus-developed tracking application in which drivers can input the number of passengers for each ride and track their daily trips using the application. The drivers upload their trips daily, and the Abacus supervisor daily verifies their journeys and assist to solve any technical issues. Abacus initially selected 32 taxis to participate in the survey. In fact, it became 35 taxis at the beginning of the survey, but 6 taxis withdrew while 5 new taxis joined. The final number of the participating taxis are therefore 34. The survey period is two weeks from September 28 to October 12, 2022.



Source: JICA Project Team

Taxi Tracking Application

1.4 Household Survey

1.4.1 Survey Description

(1) Goals of the Survey

The goal of the Household Survey (hereinafter, the Survey) is to grasp social and economic conditions of households living in the Project area. The Survey consists in visiting 1,100 different households distributed in the Target Area and ask relevant questions to the leader of the household or his/her representative. The outcomes of the Survey are intended to be used as input data to, among others, the establishment of the Socio-economic Framework of the Erbil City Master Plan.

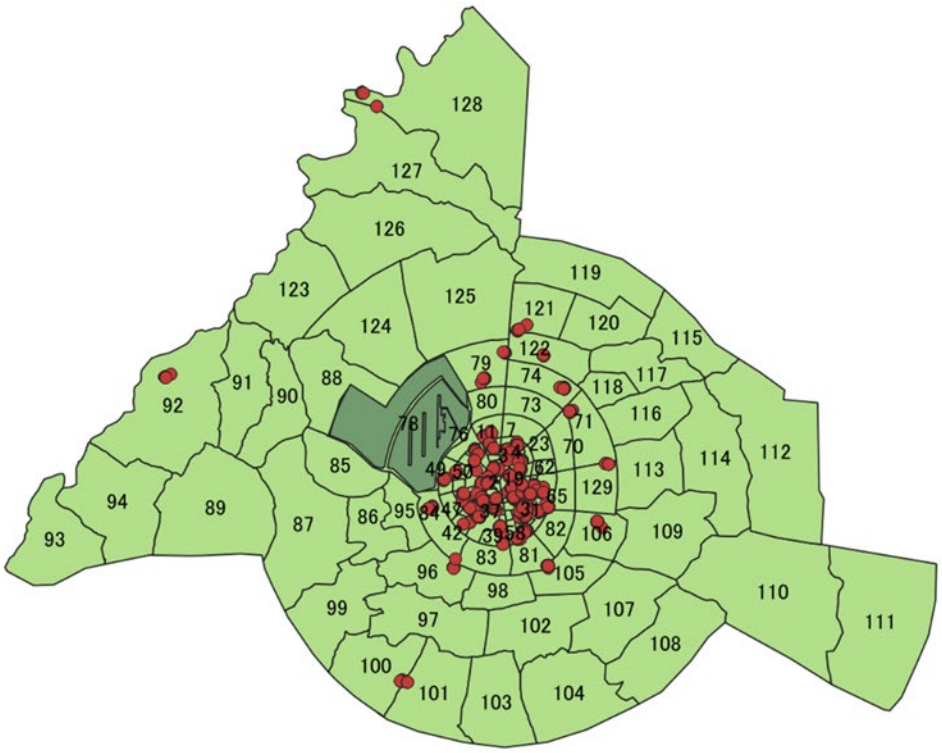
(2) Activities of the Survey

The four activities of the Survey are the following:

A) Creation of Questionnaires in Kurdish and English
B) Creation of Sampling and Survey Implementation Methodology
C) Implementation of Household Survey
D) Data Aggregation and Deliverables Production

(3) Survey Target Area

The Target Area of the Survey is divided into Traffic Zones (hereafter "Zones"), as shown in the Figure below. The Project's Target area is the City of Erbil and the surrounding area.



Source: JICA Project Team

Survey Target Area and Sampling Locations

(4) Creation of Questionnaires

Based on the Requested Information to be collected during the Household survey shown in the Table below, a relevant Questionnaire was created in both Kurdish and English to carry out interviews smoothly.

Questionnaire shall include both (1) the Question to ask to household leader, but also the (2) possible answers as "multiple choices" to be selected by surveyors based on the answer by household leader. In order to be able to set-up nested questions, it is expected that the Survey is implemented based on open-source mobile data collection tools.

Requested Information to be collected during the Household survey

ID	Theme	Information
Socio-Economic structure and living conditions		
1	Demographics	Number, sex and age of all household members (including leader)
2		Education level
3		Nationality
4	Economy	Household average monthly income
5		Employment Status and Economic sector of Occupation
6		Car ownership
7	Housing & Property	Land & house ownership (owner or rent)
8		Means of property acquisition (subdivision, built house yourself, real estate operation, succession, introduction by acquittance, etc.)
9		Previous living location (neighborhood, city, country) and housing type 5 years and 10 years ago
10		Type of settlement (housing type)
11		Living duration (years) in this home
12		Reason for moving from previous address to the current address
13	Personal Trip	Location of Work or Study and transportation mode of all household members (including leader)
14	Energy consumption	Household consumption of electricity (peak season and off-season) - annual or monthly
15		Household consumption of natural gas - annual or monthly
16		Household consumption of gasoline for cars - weekly
17		Energy conservation awareness
18	Water Supply	Sources of domestic water (public water supply, private well and electric pumps, water supply for housing complexes, etc.)
19		Uses of water (drinking. miscellaneous, gardening/agriculture)
20		Water supply hours (24/7? or how many days in a week and how many hours in a day?)
21		Monthly water use (m3) and number of people per household
22		Satisfaction with water quantity, quality, and water pressure
23	Sewerage/ Wastewater	Status of household wastewater treatment (cesspools, septic tanks, collective treatment in housing complexes, etc.)
24		Desludging status (frequency per week, fees)
25		Problems related to wastewater (insufficient capacity of pit/pipe, clogged drains, inadequate road drainage, odors, etc.)
26	Drainage	Availability of storm water drainage channels near the residence
27		Experience of flooding/inundation during heavy rain events
28		Experience with sewage back-ups
29	Solid Waste	Where do they dump their garbage? (Household yards, collection sites, storm drains, outlying dumping sites)
30		Frequency of solid waste collection per week and fees
31		Segregation practice of combustible/noncombustible/recyclable waste or no practice
32	Other infrastructure	Connection to internet (at home – fiber, on smartphone, etc.)

Satisfaction / Perception of living environment		
33	Living place	Degree of satisfaction with present housing and neighborhood conditions
34		Feeling of promiscuity with neighbors (sound, odors) and of oppression by built environment (height and density of buildings)
35		Any plan to move to another neighborhood and/or housing type?
36		If yes, ask reason why to move: space, environment, etc. and ask to which neighborhood
37		Would you accept to live in an apartment for a cheaper rent?
38	Public Facilities /Amenity	Are you satisfied with local **public facilities** & services (schools, health clinic, post, police post, fire station, administration, library, etc.), and if not, what are the problems?
39		Are you satisfied with **green areas, recreation areas and open-space** in your neighborhood? If no, what are the problems?
40		Are you satisfied with current **urban landscape** (looks of streets, buildings, advertisement, etc.)? If no, what are the problems?
41	Mobility & Transportation	Are you satisfied with **traffic conditions** in your neighborhood? If no, what are the problems?
42		Are you satisfied with **parking system** on streets? If no, what are the problems?
43		Do you use **bus**? If no, would you use bus if service was improved? If yes, are you satisfied with bus conditions? If no, what are the problems?
44		Do you use **bicycle**? If no, would you use bicycle if riding conditions were improved (if safe bicycle lanes were implemented)? If yes, are you satisfied with bicycle conditions? If no, what are the problems?
45		Are you satisfied with **walkability** of the streets? If no, what are the problems?
46	Vision of the city as a whole	Pride: what are you proud of in Erbil?
47		Things to improve in Erbil
48		What would be the elements of an ideal city?
49		Do you think urban heritage (citadel and surrounding) shall be protected or modernized?
50		Do you think agriculture around Erbil is important? If yes, would you like to buy local agricultural produce? If no, what is the reason?

(5) Successful bidder

1) Name of subcontractor
   - Company name: Thinkbank
   - Contact person: Ms. Caroline McGarr (Managing Director)
   - Address: Empire World T3-17, 5, Erbil 44001, Irak
   - Phone: +9647503431729
   - E-mail: caroline@thinkbankiraq.com
2) Period of performance of the subcontract
   - August 15, 2022 to September 30, 2022

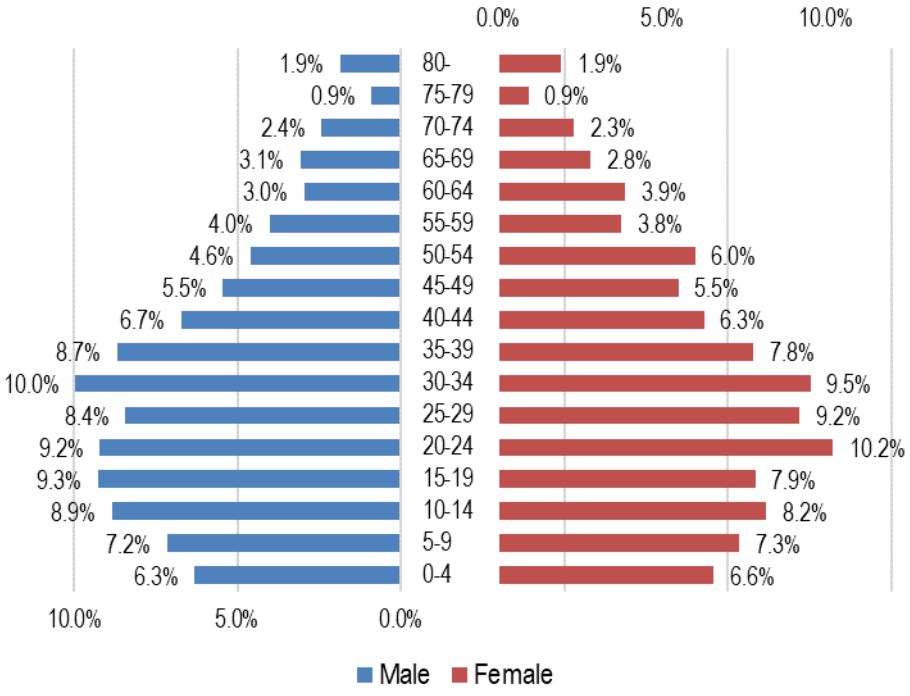
1.4.2 Survey Results

- **Housing Type**
  1. Regular-standing house: 877 (87%)
  2. High-standing house: 15 (1%)
  3. Apartment: 117 (12%)

- **Respondents Gender**
  1. Male: 440 (44%)
  2. Female: 569 (56%)

- **Sex**
  1. Male: 1,886 (51%)
  2. Female: 1,783 (49%)
  3. Total: 3,669

- **Age**
  1. 0-4: 236 (6%)
  2. 5-9: 266 (7%)
  3. 10-14: 313 (9%)
  4. 15-19: 315 (9%)
  5. 20-24: 356 (10%)
  6. 25-29: 323 (9%)
  7. 30-34: 358 (10%)
  8. 35-39: 303 (8%)
  9. 40-44: 239 (7%)
  10. 45-49: 201 (5%)
  11. 50-54: 194 (5%)
  12. 55-59: 143 (4%)
  13. 60-64: 125 (3%)
  14. 65-69: 108 (3%)
  15. 70-74: 87 (2%)
  16. 75-79: 33 (1%)
  17. 80-: 69 (2%)
  18. Total: 3,669



1.5 Flooding Analysis

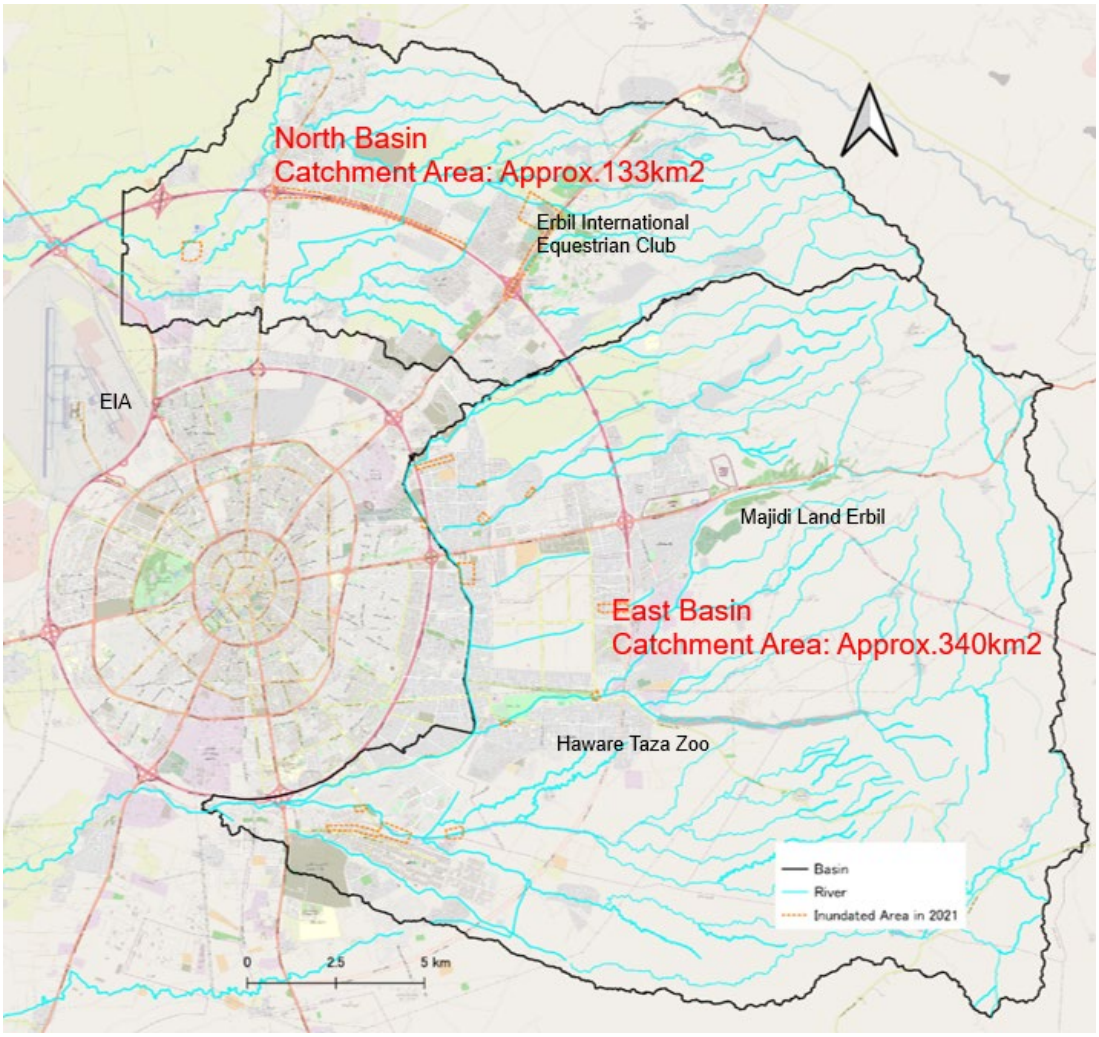
(1) Goals of the Analysis

The main goals of the analysis are:

- to grasp the flow direction of flood (alignment of existing river and stormwater network), major overflow points of flood and accumulation points of flood from a general stand point.
- to recognize current problems (e.g. developments and road embankments on rivers) visually.
- to consider the above issues into spatial planning of the Erbil 2050 MP.

(2) Basins for the Analysis

Basins for the analysis consisted of two basins which are shown below.

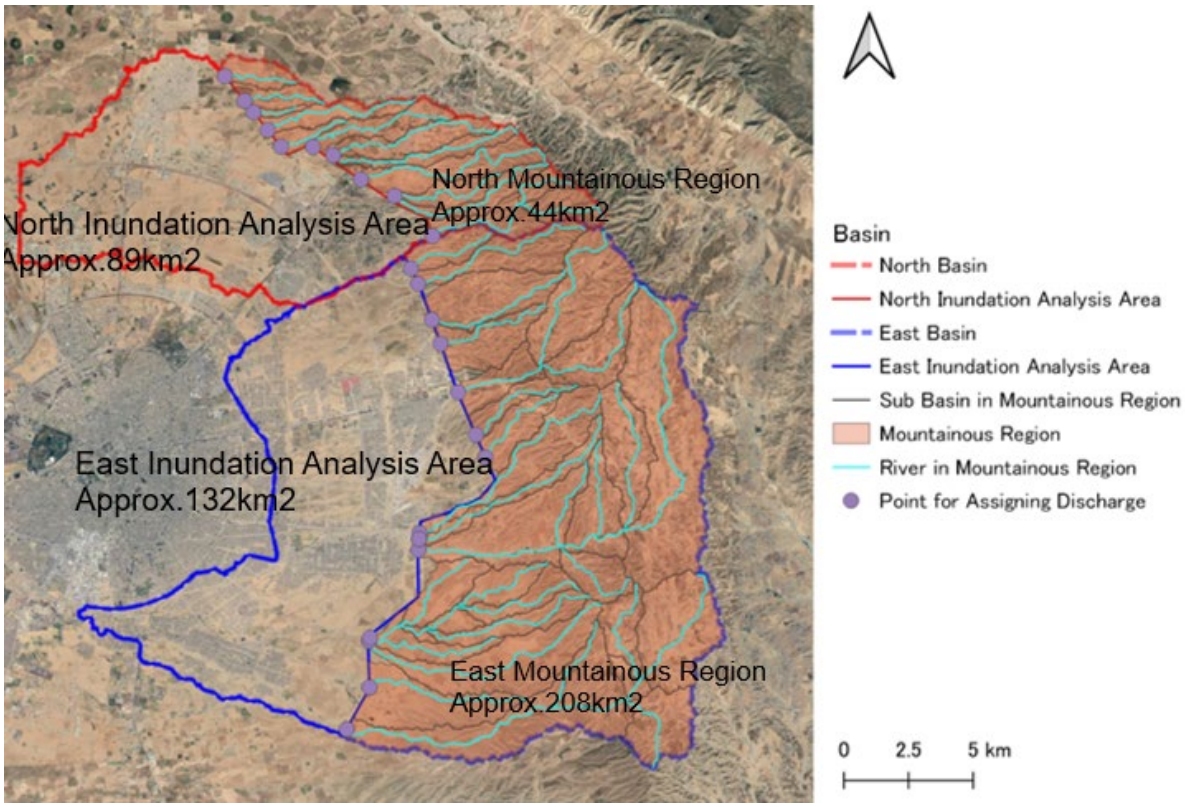


Source: JICA Project Team

Basins for the Analysis

(3) Flooding Analysis Area

In the mountainous region of the basin, rainfall flows into the topographic depressions and the flood does not spread widely. Therefore, the mountainous region was excluded from the Flooding Analysis area. Discharge from the mountainous region were calculated by a runoff analysis and assigned to the most upstream side of Flooding Analysis area.



Source: JICA Project Team

Flooding Analysis Area

(4) Flooding Analysis Model

For the Flooding Analysis model, 2 options were considered and the Option 1 was selected.

- Option1: Applying direct rainfall to basins
- Option2: Assigning discharge at particular points of river

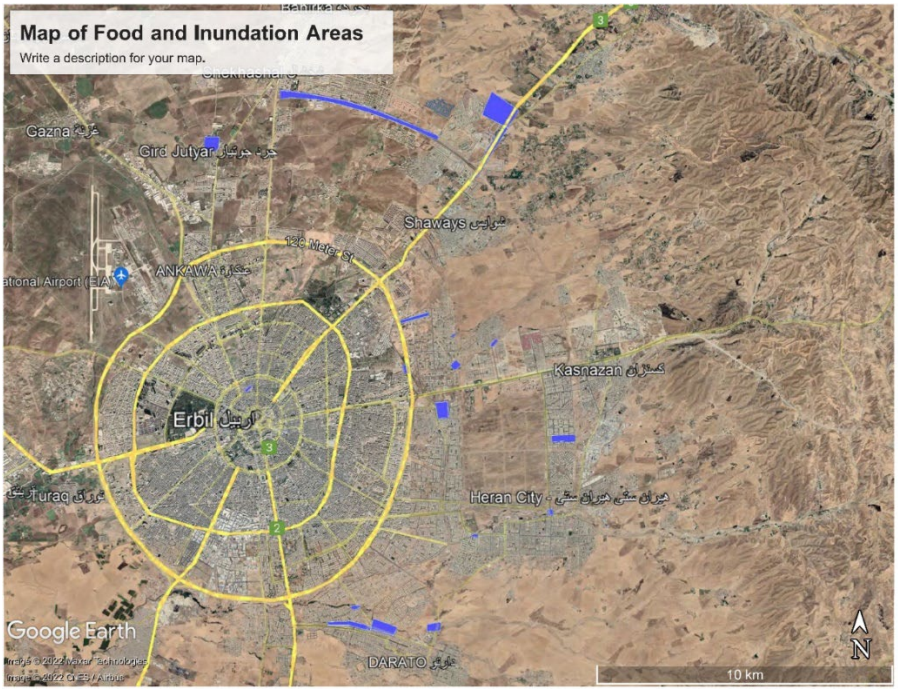
Option2 takes less computation time than Option1, however it is necessary that stormwater channels are sufficiently developed. On the other hand, actual situation seems that stormwater network is not well developed which causes the water to flow in part to the river and in land at some areas.

Other reasons for selecting Option1 include the non-clarity of both the river and the stormwater networks and the uncertainty caused by outdated DEM data for some sub basins due to rapid urban expansion.

(5) Inundation area

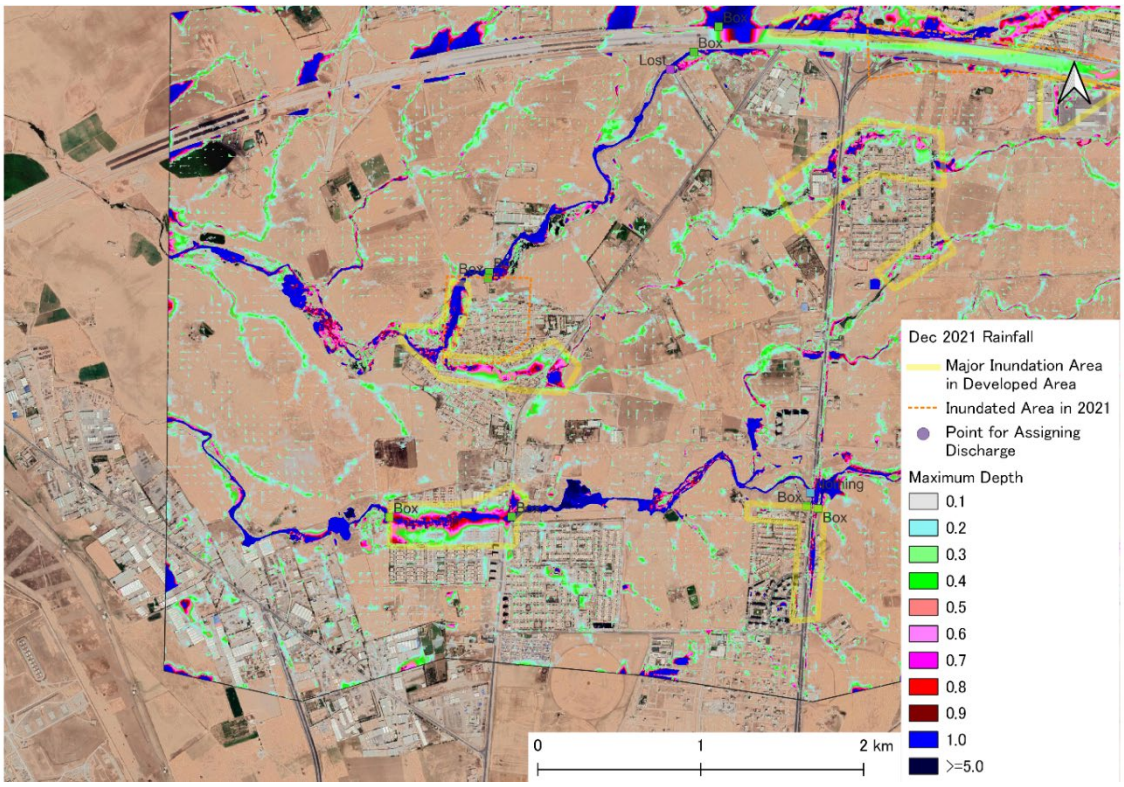
Actual inundated areas in 2021 flood, as shown below, were provided from GDWS. Calculated Inundation areas are shown in maps below and the actual inundation areas are shown in the results. Most of inundation areas were used to be river. Although the calculated inundation areas are larger than the actual inundation areas, the results are considered to be appropriate because of the following reasons.

- The actual inundation areas are generally covered.
- Culverts and channels were constructed or are under construction or are proposed at many of calculated inundation areas after December 2021 rainfall.

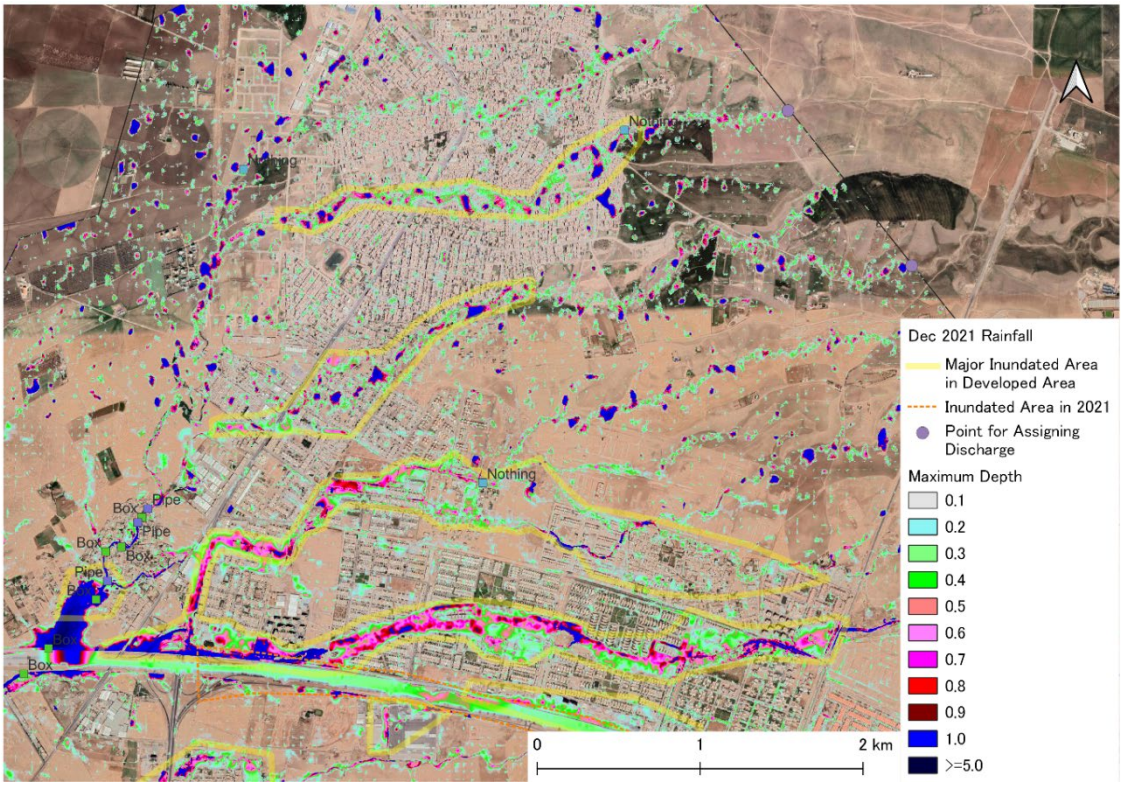


Source: GDWS

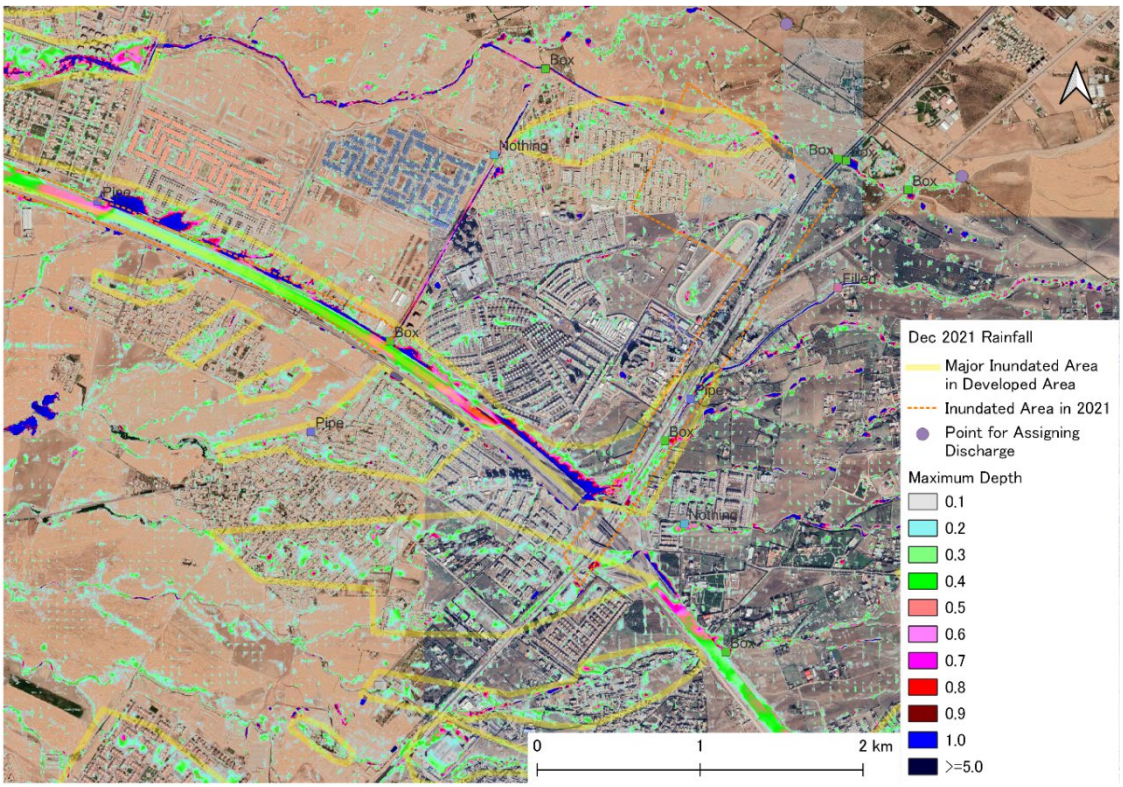
Actual Inundated Area in 2021 Flood



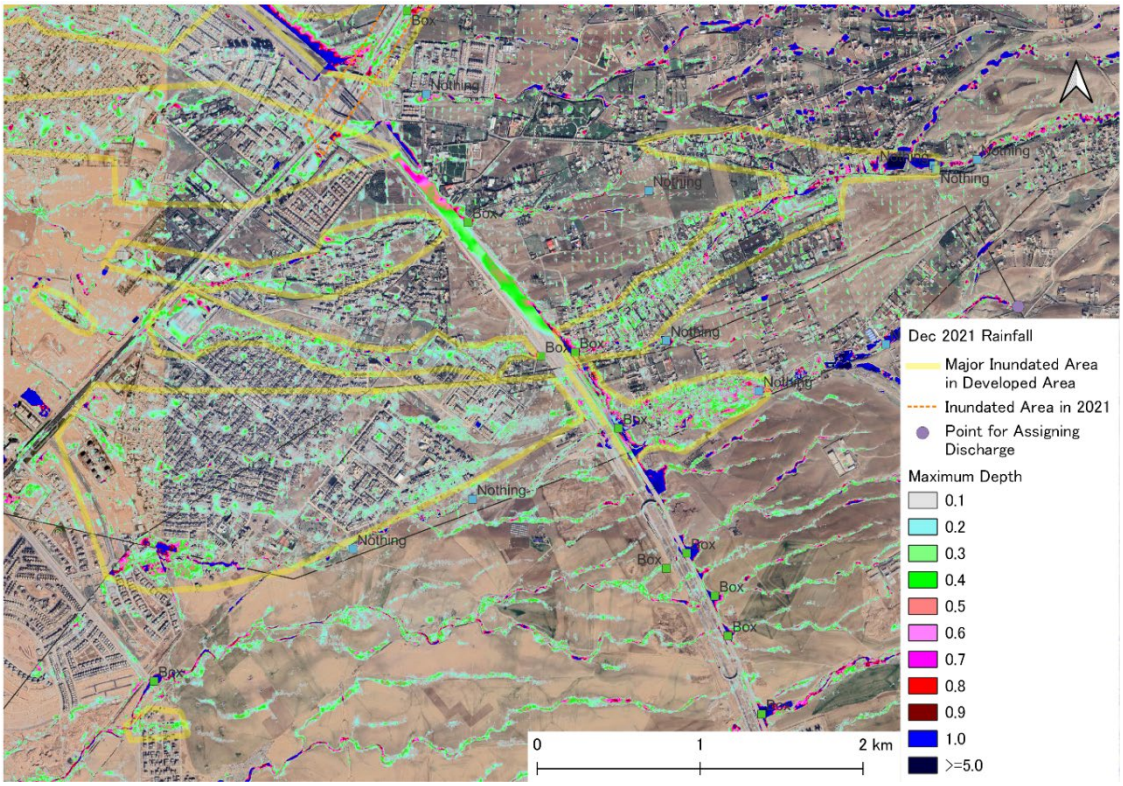
Flooding Analysis Results for Case A (December 2021 Rainfall) (1/10)



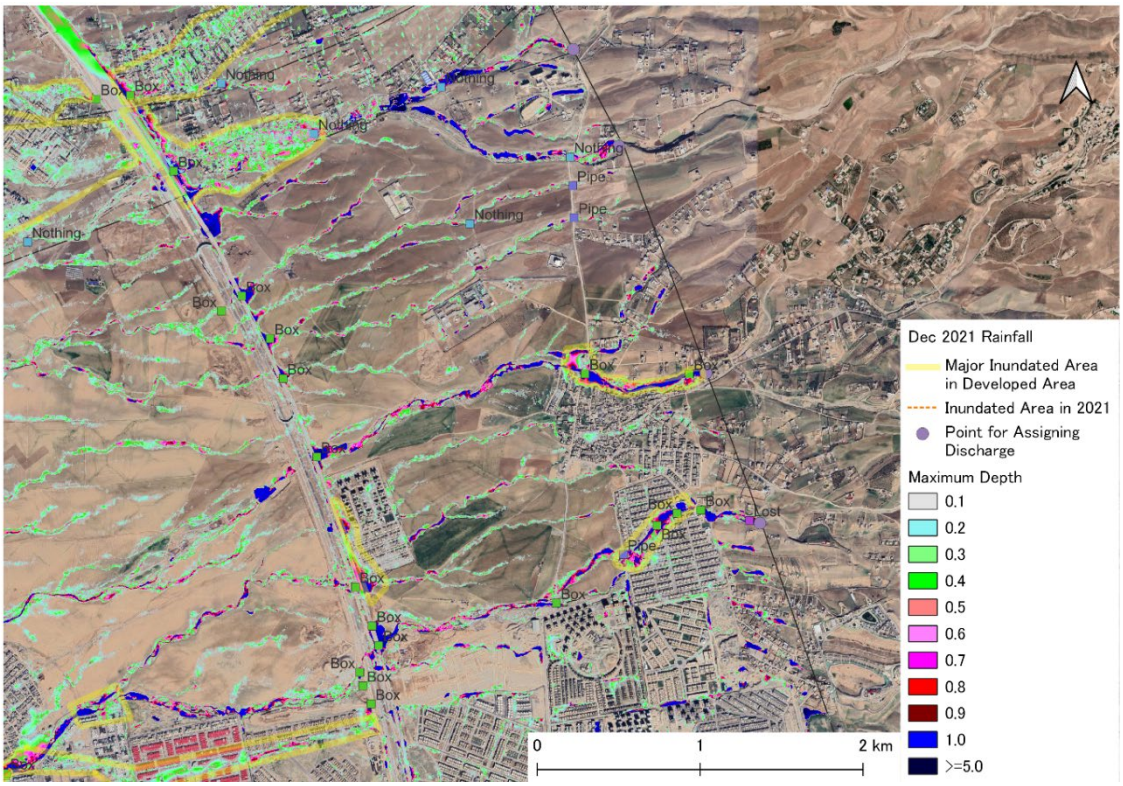
Flooding Analysis Results for Case A (December 2021 Rainfall) (2/10)



Flooding Analysis Results for Case A (December 2021 Rainfall) (3/10)



Flooding Analysis Results for Case A (December 2021 Rainfall) (4/10)



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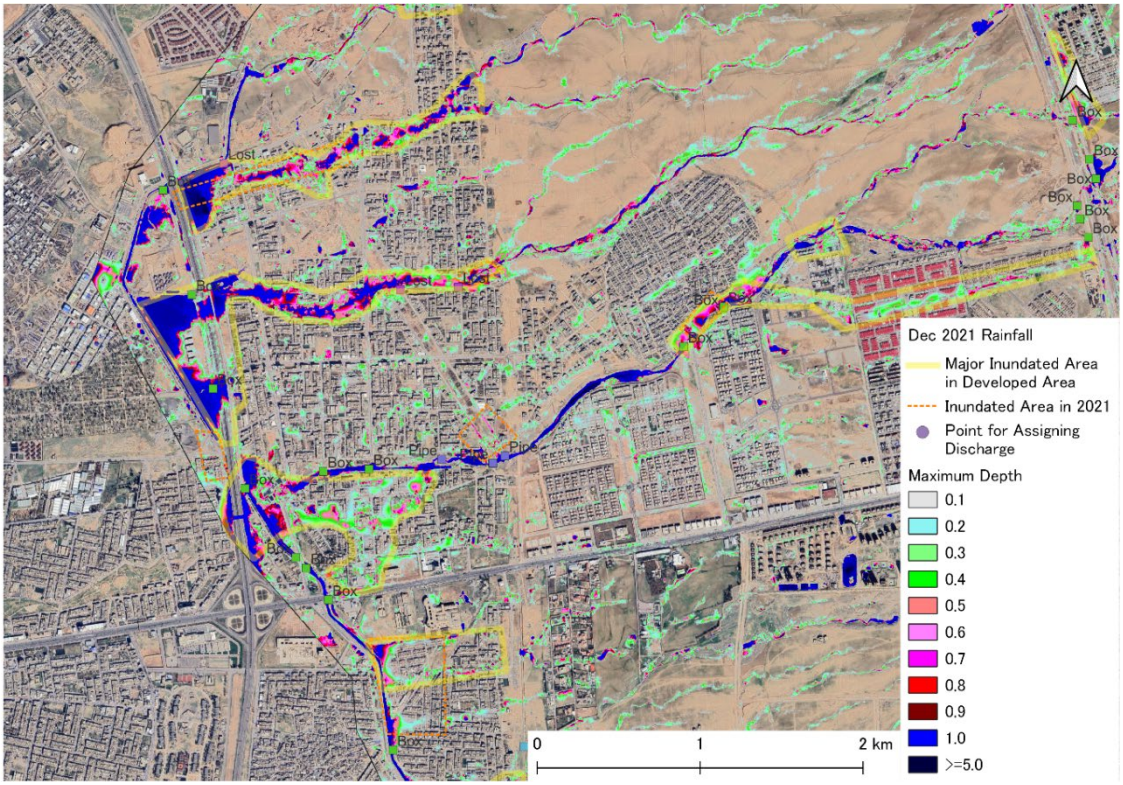
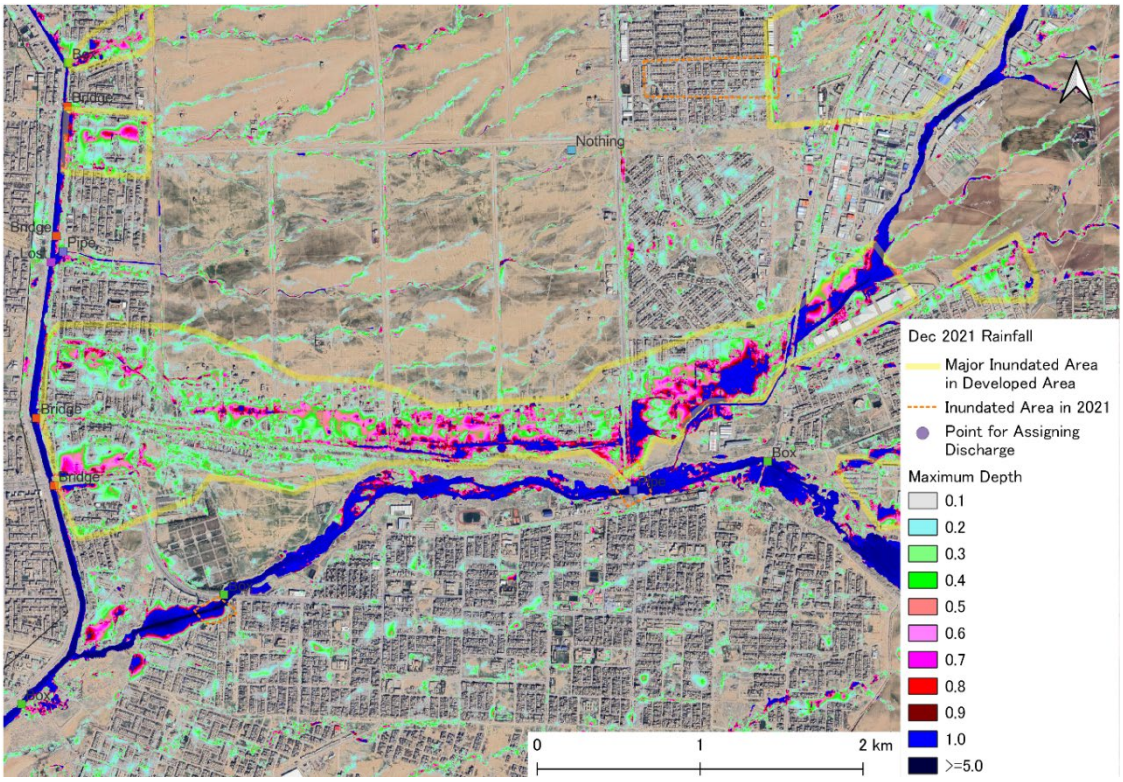
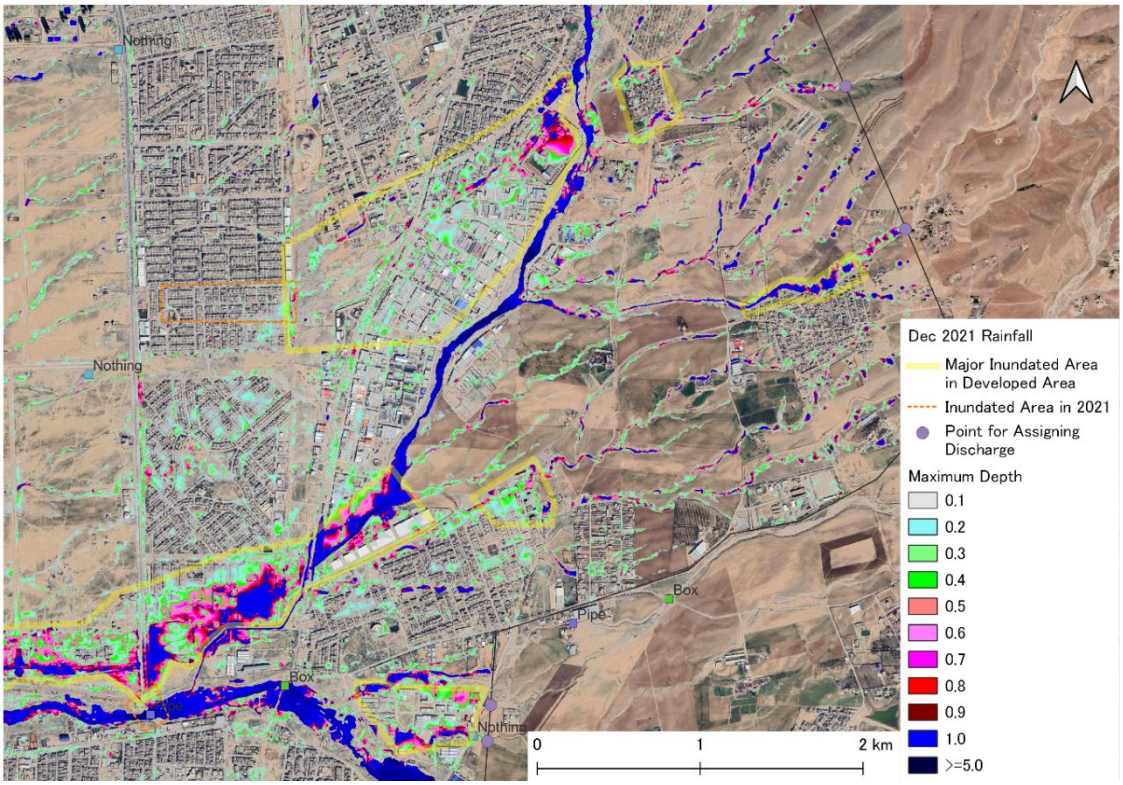


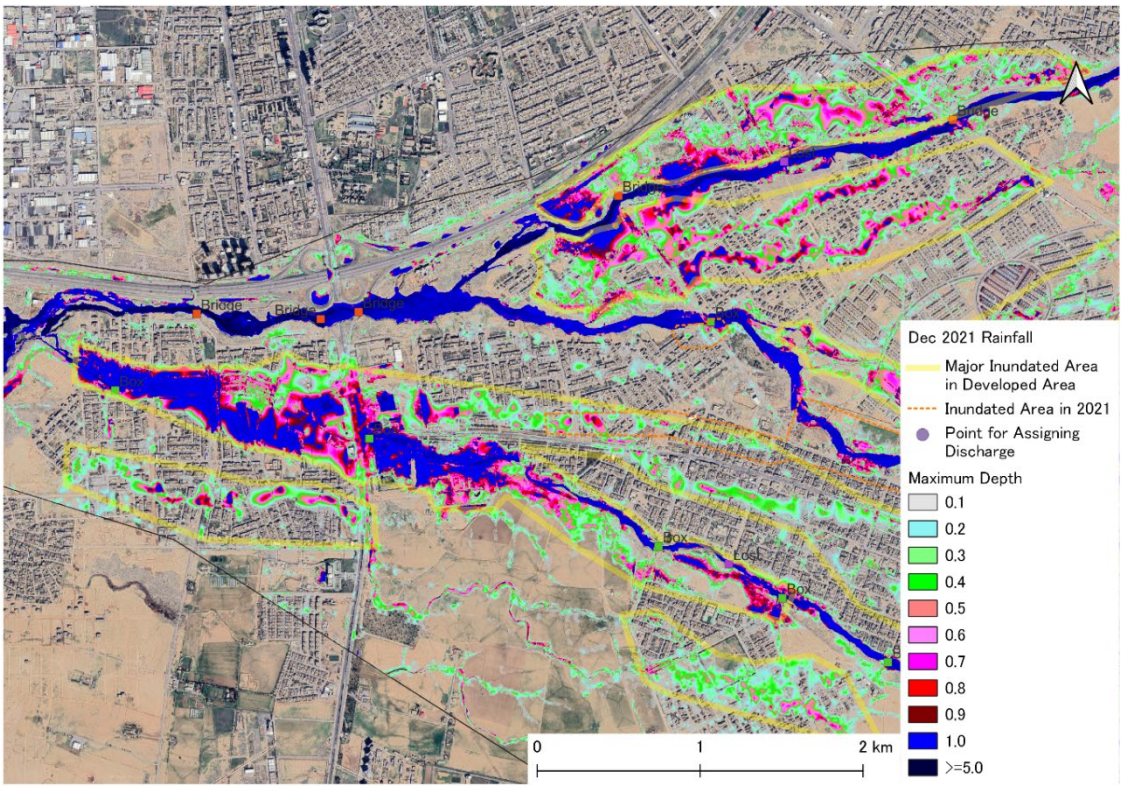
Flooding Analysis Results for Case A (December 2021 Rainfall) (6/10)



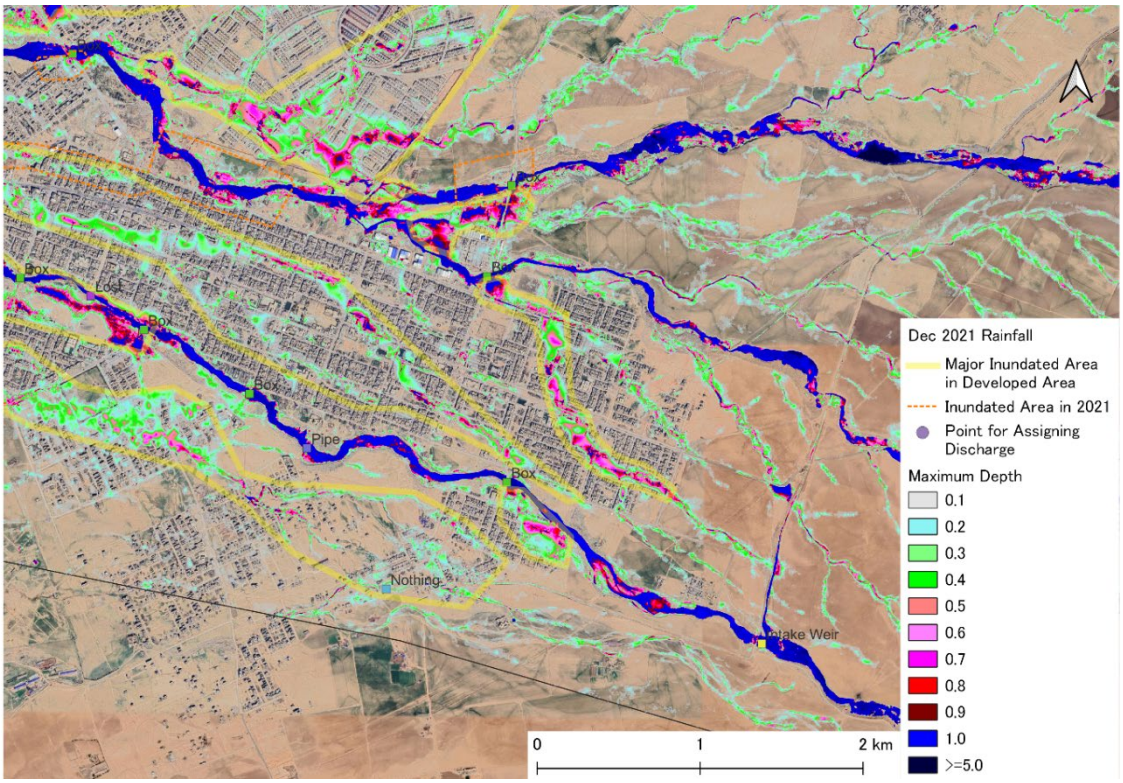
Flooding Analysis Results for Case A (December 2021 Rainfall) (7/10)



Flooding Analysis Results for Case A (December 2021 Rainfall) (8/10)



Flooding Analysis Results for Case A (December 2021 Rainfall) (9/10)



Flooding Analysis Results for Case A (December 2021 Rainfall) (10/10)

CHAPTER 2
PROJECT INFORMATION DISSEMINATION EVENTS

2.1 Investment Seminar

2.1.1 Goals of the Investment Seminar

The goals of the Investment Seminar are the following.

- To foster private businesses' understanding of the Erbil Master Plan 2050, encouraging collaboration with the KRG to successfully implement the plan;
- To provide information to private businesses on possible business and investment opportunities, especially those related to climate change adaptation and mitigation, and create momentum for a collaborative effort by the private sector and government to promote climate change adaptation and mitigation.

2.1.2 Format of the Investment Seminar

1) Time/date: 15:30-18:00, October 2, 2024
2) Venue: Erbil Chamber of Commerce meeting room
3) Agenda:

Introductory Speeches		**15 minutes**
15:00 – 15:15	Introductory Speeches by various parties	15'
Presentation of the Erbil 2050 MP & Investment Opportunities		**60 minutes**
15:15 – 15:25	Erbil 2050 MP Project Summary Presentation	10'
15:25 – 15:45	Presentation of the Main Contents of the Erbil 2050 MP	20'
15:45 – 16:15	Business/ Investment Opportunities for MP Implementation	30'
16:15 – 17:00	**Networking Coffee Break**	**45 minutes**
17:00 – 18:00	**Q&A / Discussion with the participants**	**60 minutes**

4) Participants: 70 participants, including His Excellency Minister of MoMT, the Deputy Governor of Erbil, members from the Ministry of Trade and Industry, Board of Investment, Erbil Chamber of Commerce & Industry, Investors Union, GDWS, GDEM, UPDOE, JICA Iraq Office, JICA Project Team and other participants from the private sector.

2.1.3 Summary of the Investment Seminar

Introductory speeches were made by the president of Erbil Chamber of Commerce and Industry, His Excellency Minister of MoMT, Deputy Governor of Erbil Governorate and a representative of JICA Iraq Office in Erbil.

The presentations followed, firstly by the Project Manager of GDUP on the outline of the Erbil Master Plan 2050. Then, the JICA Project Team made a presentation on the investment and business opportunities related to climate change adaptation and mitigation focusing on the areas of water resources, water supply, sewerage, solid waste management, urban transportation and power and energy. The team leader made a brief explanation of the outline of these sectors and the expert in charge of the private sector promotion followed by presenting new technologies promoted by Japanese companies in

these areas and business opportunities for Erbil investors.

The presentation was followed by a networking coffee break for about 30 minutes, in which the participants freely asked questions to GDUP officers and JICA team experts and exchanged views with them, especially regarding the Land Use Plan, which was exposed in the hall.

Then, a discussion session was held subsequently.

2.1.4 Results of the Investment Seminar

Overall, the investment seminar was considered successful as an initial step to widen the views of the businesspeople in Erbil, who have tended to pay attention to real estate and land development only, that there are plenty of new opportunities for business and investment related to climate change adaptation and mitigation. They understood better that the climate change issue is not only a global agenda, but also a new chance for them to develop their businesses. To create new businesses in Erbil related to climate change on the ground, however, continuous efforts by GDUP and the Board of Investment are required to disseminate information on future possibilities for new business related to climate change adaptation and mitigation.

Speech of MoMT Minister

Participants

Coffee Break

2.2 Citizen Public Consultation

2.2.1 Goals of the Citizen Public Consultation

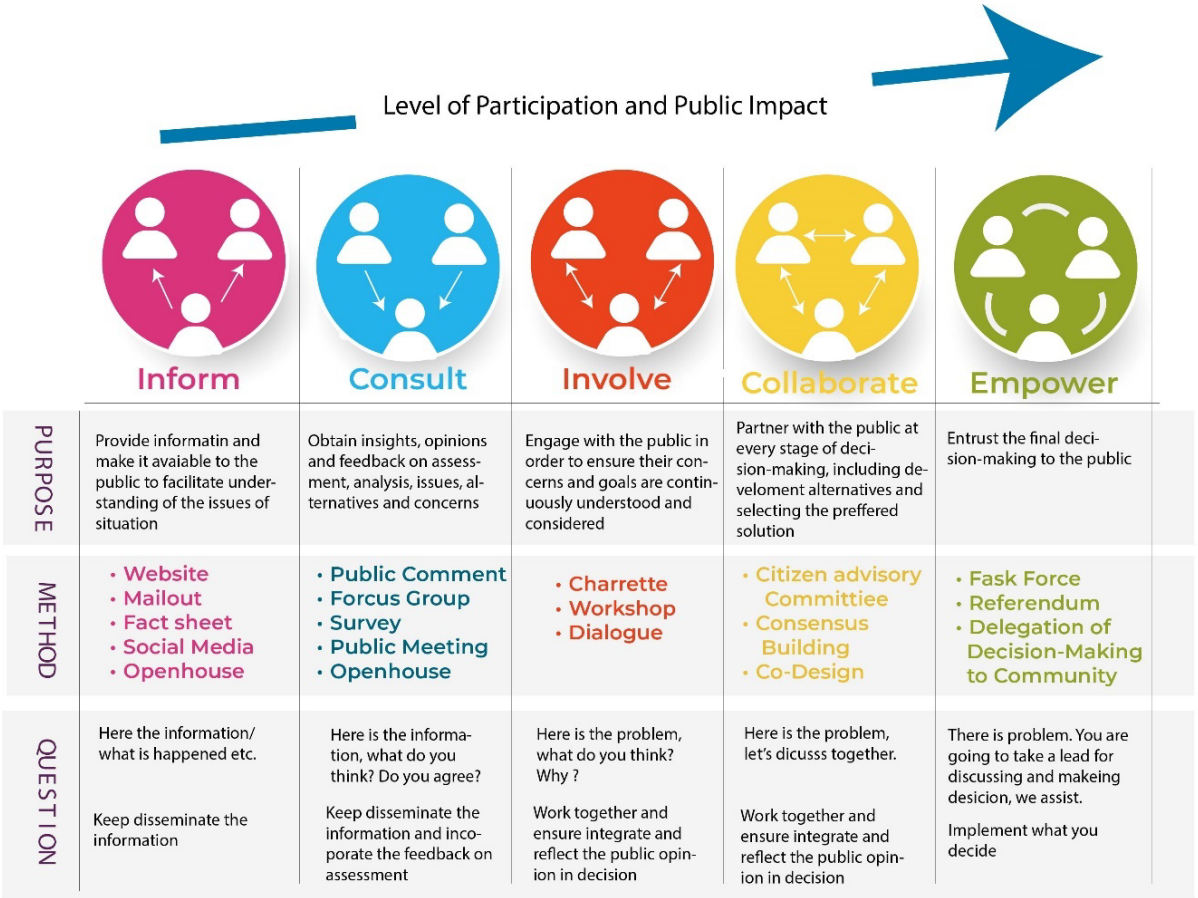
Public consultation in urban planning involves engaging the community in decision-making processes related to land use, infrastructure, development, and other aspects of urban design. The primary goals and benefits of public consultation include inclusive decision-making, improvement of legitimacy, identification of local needs, promoting transparency, enhancing community ownership and mitigating the conflict in the stage of implementation.

2.2.2 Objectives and Framework of the Citizen Public Consultation

To promote the transparency and active participation of public, the public consultations with citizens are organized alongside with overall objectives below:

1) Collective feedback of Proposed Erbil Master Plan 2050 (MP) regarding selected themes
2) Dissemination of information on the MP to the public

As shown in the Figure below, the method of the workshop is depended on the purpose of the event. In order to achieve the above objectives, an open house method was adopted for this workshop.



Source: JICA Project Team based on IAP2 Spectrum of Public Participation

Level of Participation and Public Impact of Public Participation

The Open house method is flexible, informal approach designed to encourage participation, collaboration, and engagement of a wide range of participants. It allows participants to explore different venues and activities at their own pace. Due to time limitations, the event was held over three (3) days at a total of six (6) locations. Participants can participate in the event anytime and any venue as their wishes during the event time. The event was publicized by e-mail to NGOs, through FB, and by

Municipality to the Moktar (heads of each neighbourhood) and anyone who are interested.

2.2.3 Contents of the Public Consultation

One GDUP official and three facilitators were present at each site to give an overview of the MP and explain each of its features. At the venue, the MP's land use map (A0 map) and characteristic points were displayed and explained by the facilitator and others, and feedback was received from the participants. Feedback was not restricted to those related to our explanations but covered a wide range of topics related to the land use and MP being presented.

The highlighted characteristic points are below:

1) Wetland Park
2) Erbil Lake
3) Cornish renovation
4) Agro-node
5) Water-harvesting Ponds
6) Sport Complexes
7) Erbil International Fair Central EIFC
8) Development of Rail connection
   Northern Development Area (NDA)

Source: JICA Project Team

Land Use Map at the venue

Participants could write their comments and feedback on the feedback sheet containing the land use map; therefore, they can add and draw the points and related comments directly. In addition, Opinions are also collected by the facilitators, who listen to the opinions of the participants.

Event Date and Venue

Date	Time	Venue
9/29 (Sun.)	10:00 – 12:00	Municipality 5 hall
		Bnaslawa youth centre
9/30 (Mon.)		Ankawa hall
		Municipality 3 hall
10/2 (Wed.)		Municipality 1 hall
		Municipality 6 hall

Source: JICA Project Team

2.2.4 Result of Citizen Public Consultation

(1) Participants Information

The total number of participants at the six venues was 153, of whom 80% were men. By age, 12% were in their teens and 20s, 29% were in their 30s, 30% were in their 40s, 14% were in their 50s, 14% were in their 60s or older, and 1% were unanswered, with 60% of the respondents in their 30s and 40s. Participants come from a variety of backgrounds, including Moktar, educators, lawyers, and the self-employed.

(2) Contents of Feedback

The feedback contains a variety of views, some of which fall under the level of detailed planning rather than MP level, but from the residents' perspective. Each comment is provided below by theme. Comments received from several participants, or several similar comments are underlined.

1) General

- Very good, hopefully the MP will be implemented successfully.
- Excellent work! Wishing you continued success. This is an outstanding project with great potential.
- Very good, hopefully it will be implemented successfully as soon as possible.
- This master plan is essential for the development of Erbil.
- I would greatly appreciate the implementation of this initiative and hope it will come to fruition. However, I regret to say that it appears unlikely to be executed.
- Hopefully it will be implemented successfully as soon as possible.
  Erbil has divided into two distinct zones: the northwest, known as the Golden Zone, and the southeast, mentioned as underdeveloped zone. In the Golden Zone, facilities and services—including transportation, infrastructure, electricity, water supply, and roads—are significantly better than those in the southeast. It is essential to create additional ponds, increase green spaces, and develop more main roads to enhance the overall quality of life in the area.
- I am satisfied with the points and changes
- I want to thank you for your hard work and your work is amazing and I hope for better work in the future for our city.
- We want to thank you for your projects, and I hope for better projects in the future and we would like to have a modern industrial zone
- Thank you it's very important and good work.
- The Bakhmnara sector map is very appropriate and we hope it will be implemented as soon as possible.
- Thank you. The issues faced by the residents in the neighbourhoods of Tajil, Arab, and Khanaqah need to be addressed. I sincerely appreciate your attention to this matter.
- This is an excellent idea.
- Expressing my gratitude to everyone involved in this remarkable plan, this is an excellent idea.
- Thank you it's very important and good work.
- It's important to start implementation process (and provide the required budget)
- I hope you will be successful in this project I'm really happy about this project from now on the migration will be from Europe to Erbil, but I have a few suggestions.
  (a) No more residential land distribution instead builds more buildings outside the city
  (b) Paying more attention to the sewage system in Erbil in general
  (c) More lakes
  (d) Building more subways because of the traffic
  (e) More hospitals and schools and all of its fields just like Europe.
- I would like to express my sincere gratitude for your outstanding work and wish you continued success in all your endeavours.
- This is an excellent idea, and I sincerely appreciate your efforts.

- Very good, well done!
- Me as a citizen in general I see this master plan is good and I hope it will be done successfully.
- I hope the work is carried out with dedication, and that the proposed plan is executed effectively and as intended.
- Appreciating your work.
- Erbil has divided into two distinct zones: the northwest, known as the Golden Zone, and the southeast, mentioned as underdeveloped zone. In the Golden Zone, facilities and services—including transportation, infrastructure, electricity, water supply, and roads—are significantly better than those in the southeast. It is essential to create additional ponds, increase green spaces, and develop more main roads to enhance the overall quality of life in the area.

While there are a number of evaluations of the project and the MP, there are also expectations for the implementation of the MP. The comments concerning the implementation and past experience of the MP, and its implementation were often raised. It necessary to consider well their voice and aspiration for prioritization of implementation.

2) Green Infrastructure

- Determining the green belt of the city
- Increase number of parks and green area
- Increase green areas/ greenery
- Adding a park in Ankawa 108 neighbourhood
- Adding parks and green areas for the citizens of Kurani Nwe neighbourhood
- Adding a park in Ankawa is very necessary and there are lots of vacant lands in the north of Ankawa
- Increase and provide green space in Gazna village
- Increase the green area in Ankawa
- Increasing parks and greenery for Ankawa
- Increasing the number of parks by increasing interest in denying the park, maintaining and sustaining the area, and continuing interest in water resources.
- We propose to create a large park for gatherings and celebrations near Ankawa (north of Ankawa from the airport to Gazna Road)
- Increase greenery and parks in the city, especially in New Erbil
- Citizens should be allowed to add greenery themselves and not be prevented
- Construction of greenery next to 120m street in Bahari Nui and Shadi neighbourhoods to become a place of rest for the citizens of the neighbourhood
- Inside the city needs more green area.
- Focusing on the development of additional green spaces and a greenbelt.
- The area within the 120-meter road has few green areas.
- The expansion of green areas around Erbil is needed.
- The green areas in the south of Erbil are very few.
- Due to changing and worsening weather conditions, expanding green areas it is essential to become a top priority and will be implemented as soon as possible.
- Lack of greenery

- More green areas inside and outside of the city because we lack green areas and it's not up to the international standards which could cause health problems because of the bad environment.
- Tree planting.
- It should be built like Sami Abdulrahman Park in Darato

Many of participants expressed their wishes of increasing of green area, greenery and parks in their neighbourhoods. In the design phrase of the implementation (projects), it would be necessary to incorporate designs that increase greenery, such as planting trees and installing street trees appropriate to the climate and soil.

3) Transportation

Railway

- Having a railway station in the northeast
- There should be railway lines to reduce congestion
- Expanding the railway line to link the inner areas of the city, i.e. linking Erbil and Shaqlawa as an example, or a road (Bastora in the Hanara area)
- We as the village of Baghlumnara have comments on the installation of the railway line and its passage through our village. We request that the route of the railway line be moved to another place. We request that the railway line be moved outside 150m Street
- Certain elements of the master plan may face challenges and can be declined, such as the proposed southeast railway, due to the presence of oil reserves in the area below the ground.
- provide the railway station near Qushtapa as it has an important role connecting Erbil city to the southern cities

Public transport

- First and foremost, I would like to express my gratitude to everyone involved in this remarkable plan. I encourage you to prioritize street improvements to address the traffic issues within the city, similar to the water reservoir project initiated by the Prime Minister, which is projected to resolve Erbil's water crisis for the next 300 years. Additionally, we need to develop a modern, high-speed railway along the 30-meter, 60-meter, and 100-meter streets in the near future to further alleviate traffic congestion.
- To reduce traffic congestion in the city, public transportation such as trams and subways should be increased. Install a tram on 30m Street to reduce the number of small cars going to the city center, a metro line on 100m Street to transport citizens, and a railway line on 120m Street to connect it with other cities.
- Having Public transportation line from Ankawa neighborhood to the city center
- Metro is important to be provided to the whole areas of Erbil and also connecting each to the other one.
- Having a bus line from Ankawa 108 to Ankawa
- Increase transportation lines to reduce congestion
- Establish a subway system (Metro) connecting to the city center.
- As a citizen of this city, I would like to suggest creating a trainway and metros especially on the main roads such as (60m,100m,120m,150m) trainway should be on these roads it will solve the traffic problem especially at working hours and school hours and it will make the people use less cars.
- Implementing a train and metro system to reduce congestion and crowd.

- Providing bus transportation lines
- Providing more buses for student transportation
- Provide buses with all government agencies to reduce congestion on the streets, cleaning and reducing environmental pollution due to the increased number of vehicles

Road

- Increase highways
- Paving the roads
- The Kurani Nwe neighbourhood lacks street crossings, leading to frequent traffic accidents and fatalities. Additionally, there is a need to add roundabouts to the roads for improved safety.
- Increasing the exit and entry gates in Erbil, for example, exit from Erbil to Koya via Kasnasan is very difficult due to the congestion of the road, so the road should be widened or added another road
- Providing government buses for public transportation
- Creating pedestrian line in Ankawa Bazar
- Adding a bicycle lane to Ankawa streets
- Defining a pedestrian path throughout the city, including districts and sub-districts, and traffic signals for pedestrians according to traffic engineering timings, and reducing traffic congestion during morning shifts and exits.
- Repair of roads and sewers
- Construction of a bicycle park
- The streets of Kurdistan neighborhood should be repaved
- The main road of the neighborhood (Arab Kand) is two and a half kilometers long and the streets need to be repaired
- Widening and widening of main streets
- In the village of Sueri Gowra near the road to Gower, there is an attempt to build a road that goes through this village, so we ask that this road not be built
- Regulation of roads and highways
- For the surrounding Sebardan road, until now they haven't done anything for it and it created so many problems for the citizens, until now they haven't created sewer system for Sebardan and the municipality doesn't have and plans for Sebardan.
- We request that attention be given to the 30-meter road in Sebardan village, and that it be completed to facilitate the separation of informal housing.
- Asphalting the 15-meter road located between Erbil and Sebardan.
- Ambulance street should be separate
- There should be a public transportation line, i.e. a bus line on 120th Street
- Public roads should have lights (bulbs)
- Focus on the appearance of Kirkuk streets and renovation to reduce congestion
- Placing a greater emphasis on maintaining and enhancing the conditions of Kirkuk Road and Makhmoor Road. Both roads currently lack proper cleanliness and would benefit significantly from increased green areas and landscaping improvements.
- As it is obvious, Kirkuk road connects more than 16 southern provinces to Erbil, as well as with these tourists in southern Iraqi cities, so it needs a civilized and modern appearance for Erbil
- Increasing the entrance gate into Erbil due to the traffic congestion, especially on the Pirmam-

Masif road

- Renovation of Erbil-Qushtapa road

Other

- Congestion is less in Ankawa, Bahrakah Road and Saydeen Ankawa during shifts in all.
- Parking on the streets should be arranged
- Treat manholes
- Completion of Sar Kanda Pis Bridge (Great Sueri Village)
- Under the 120 m bridge in Bahari Nui neighborhood, which is located between Baghlu Minara village
- I recommend that the General transportation roads has not paid attention to properly inside Erbil.
- Provide buses for governmental employees in order to reduce street congestion
- Add parking spaces in section nine (9). {the new residential area}

Regarding transportation, there are several different kinds of feedback are raised. Some of them stated the metro and tramway to be implemented. The same option has been a point of discussion in the project and is linked to why the MP is promoting BRT. On the other hand, the reasons for this have not been fully explained to the general public and need to be fully understood during the development and implementation of the transport plan. In addition, the condition of the roads and congestion in each district will be considered and assessed through detailed planning and future implementation of the MP.

4) Public Facilities

Education

- Increase the number of schools in Bahirka
- Moving colleges from inside the city to outside the city to eliminate traffic congestion
- Renovation of schools and mosques
- We as the residents of Beriat belonging to the sixth municipality demand more services for our neighborhood because no services have been provided to it, neither schools nor local streets that become flooded in winter and dusty in summer
- Construction of secondary school for (Great Sueri Village)
- Construction of kindergarten for (Great Sueri Village)
- Renovation Sebardan school.
- Increase schools that are not adequate in most neighborhoods
- Establishing schools in those areas and relocating all universities to the southren part of the city is essential.
- I believe that institutes and universities should be centralized in a single location, with dormitories nearby as well as connected by metro line services.

Health

- Adding hospitals to Kani Gulan and Qalay New
- Increase the emergency hospital to four hospitals (North) (South) (East) (West)
- More public hospitals should be built
- We (Sebradan village) urge the timely completion of the hospitals.
- Construction of an emergency hospital in northern Erbil because the emergency hospitals in the east and west are very far from us
- Increase the number of emergency centers outside the city

- Increase number of public hospitals
- Construction of hospitals for citizens at low-income liveable neighbourhoods

Park/ Studium

- Serving the poor neighbourhood by building a children's park
- In this master plan it has not been referred where the international football stadium will be, as a young citizen I hope that the government and stake holders will build an international stadium and a big sports complex and pay more attention to the sports sector for attracting foreign people and for the good of our people.
- The sports center has significant importance to Erbil, particularly for the youth population.
- We need a football stadium for our youth to benefit from
- Construction of play city in Baranti area
- Construction of mixed stadiums for all places because we do not have any mixed stadiums yet
- For the city of Ankawa, build a park (containing all requirements) similar to the Sami Abdul Rahman Park and its location on the borders of Ankawa. (the location is determined on Figure below with *)

Source: JICA Project Team

Recommendation from a Participant for a Park in Ankawa

General

- Directorates should be consolidated in one place
- Separation of military and civilian airports
- Add the following in the Kurani Nwe neighborhood: park + stadium + high school
- Provide services such as (hospitals, health centers, kindergartens, stadiums and parks, fire brigade)
- Relocation of the national card center of the residents of Shadi neighborhood to a place near us which is now in Ankawa.
- Turaq neighborhood needs green space, high school, secondary and primary schools and gardens.
- The neighborhood school and hospital need renovation. It has been built for 30 years
- Government departments should be relocated to a centralized location or positioned in close proximity to one another.
- From Pirash, Sebardan and Hawlery New till Erbil there is a noticeable absence of parks, sports facilities, and playgrounds for children. Additionally, the school in Sebardan is small.
- Relocating governmental institutions outside the city center and establishing new governmental institutions within the 150-meter perimeter to enhance convenience for residents.
- This is an excellent idea, and I sincerely hope it will be implemented soon. However, it is important to also consider the Hasarok area, as it currently lacks essential facilities such as quality schools, healthcare centers, parks, and overall basic services.

Unfortunately, educational and health facilities such as primary and secondary schools, clinics and hospitals and other public facilities are not shown on the land use map because of the level of the details. For this reason, participants might provide a number of comments on schools and hospitals. It is also unfortunate that opinions about stadiums have been expressed despite the fact that it was highlighted in the land use map of the venue and explained by the facilitator.

5) Water Resource/ Water parks

- Water shortage in summer and floods in winter
- Solving water shortage issues in Bahirka
- Use unfiltered water to irrigate agricultural land and parks instead of potable clean water
- Adding pipes from the rivers to irrigate the greenery in the city
- Acknowledging and increasing ponds between Koya plain and Kasnasan
- Eastern Erbil has water problems in summer. If the Cornish Canal, which extends from New Erbil to Qatawi, a water line from the Great River should be laid to solve the water shortage problem
- Shadi neighborhood (Bahari Nui) there is a large sewer that has not been closed For the health of citizens
- Treatment of urban pipes with sewers is not good
- Expand drainage channels to improve water flow.

- Problems with water accumulation, flooding and lack of roads. Rainwater collects in Raperin neighborhood (Seventh of April). In the 100-meter road we can build a waterway both for the beauty of the city and a fountain to reach the sea road into the pavilion as a solution to this problem. Because a lot of water accumulates that the water goes from the north industry to 100 meters road and then goes to Raperin neighborhood (Sabba Nisan) and then goes to 40 meters road and enters the houses on 20 road near Saba Nisan and then goes 40 meters near Shanga Beri office.
- For the lake I think the water outside of the city should be used for creating rivers and harvesting rainwater inside the city.
- Focusing on creating new dams in southwest of Erbil.
- Increasing number of parks and ponds in Makhmoor Kirkuk road.
- Increasing number of ponds.
- Due to the risk of flooding and the low water levels within the city's reservoirs, it is necessary to utilize the dams more effectively.
- Solving the water problem
- Having more projects to avoid wasting rainwater

The problem of water shortage during summer and flooding during winter is highlighted. To question concerning the ponds, facilitators explained the importance of the ponds established in the eastside of Erbil and wetland park etc.

6) Waste management/ public hygiene

- Garbage waste in Kani Qarzala landfills This garbage is thrown there This garbage should be treated This smell is very bad and unhealthy We ask with the growth of Erbil We ask you to develop specially with the growth because shopping centers are the best source of income
- Lack of sewage in Kurdistan neighborhood
- Treatment of urban pipes with sewers is not good
- In winters we get all the water from 150m road the sewage system can’t keep up with all that water in sebardan.
- Focusing on sewer system.
- I hope that the water issue will be resolved in the future, allowing us to get effective benefits and creating dams for rainwater collection.
- Separating water Stream “Cornish” of Bnaslawa and Kasnasan.
- Removal and renovation of Kani Qarjala landfill
- I ask the new master plan to take into account the environment and the landfill of Kani Qarzala is not healthy for Erbil. This landfill does not need to be renovated، It should be removed because Erbil is now very expansive, and the smell and smoke reaches new neighborhoods and new cities
- It is very important to solve the problem of garbage in Kani Qarzala area to take into account the health of the people of Erbil and its surroundings.
- We would like to thank the staff of (Narkh) Company for cleaning the wholesale market, but more attention should be paid to the cleaning of the wholesale market.

There were some questions regarding the landfill and waste treatment policy/ projects. As the landfill site and mechanism had been not yet finalized, facilitators explained the potential and possible areas.

7) Environmental Considerations

Industry

- Relocation of industrial zones outside the city
- Relocation of factories from the outskirts of the city
- Pay attention to the environmental sector, especially as environmental pollution has caused cancer incidence, which has increased significantly compared to previous years, causing harm to the next generation. Causes of environmental pollution in Erbil are:
  (a) Iron manufacturing plant
  (b) oil refinery
  (c) Wastewater in Erbil (which is used illegally in most places to irrigate fruit and vegetable crops) that causes disease.
- Treatment of gas odor that spreads at night
- Relocating industrial zones to the city mainly to 150-meter road.
- Factories inside Erbil should be moved outside the city
- Removal of factories inside Erbil.
- Decreasing the industrial areas on Kirkuk Road.
- Not building more contraction factories close to the city.
- It is better to reduce real estate investment near industrial areas for the sake of citizens' health.
- Relocating north and south industrial areas to outside the city.

General pollution

- Reducing generators and resorting to solar energy to reduce pollution in general because in 2024 it reached 80%, which increases respiratory diseases.
- Eliminating private generators in the city
- Factory treatment and car smoke
- Treatment of odor in Erbil
- Reduce these smoking vehicles, especially two-ton vehicles
- There is a ditch in the southern area of Turaq where dirty water flows and makes many people sick.
- Environmental pollution is caused by bad smells and excessive dust. Therefore, it should be treated with the following points
  (a) By planting more trees and closing factories near the city centre
  (b) Determination of vehicle number
- The air in Erbil is very polluted. Generators and factories should be reduced
- The smoke from the crocodile mine, which is harmful to the health of citizens, should be treated

Airport

- Transfer of the airport to the outskirts of the city
- Relocation of the airport to the outskirts of the city
- Moving the airport out of the city
- We propose moving the airport to a far place.

Afforestation/ Environment protection

- Increase afforestation within the city for the medians of streets and areas or vacant and unowned lands.
- Direct implementation of the garden and green areas construction project in all districts, which is because they are abandoned and empty plots of land.
- Planting trees on vacant lands that are suitable for Iraq climate
- Increasing forests outside the city in a way to support the country's economy. The goal is to use the trees for local factories in the furniture industry and for other required purposes. Use wood and its formation in limited areas adjacent to the borders of Erbil, such as Paulownia or Gerhard trees, with gratitude for exporting wood to other countries to revive the local economy.
- Pay attention to environmental cleanliness
- Paying attention and keeping the road and animal fields clean and protecting the environment
- Preventing the construction of farms that cause the destruction of agricultural land
- I would like to suggest building more green areas inside the city for the purpose of a cleaner environment because of pollution factories and generators.
- For the first step we should start with creating green areas to prevent the dust and fix the environment

Most comments related to environmental considerations are about the industrial pollutants and aspirations/ request to get better environment. Some residents complained of air pollution and strange odours as the current situation; it is proposed in the MP to eliminate or downsize some industrial zones and to convert them into green spaces, and these directions are in line with the wishes of the resident.

8) Agriculture/ Market/ Tourism

- Thank you very much. We have commercial center for the market of all Kurdistan and Iraq. The government should consider these markets, provide them with a specific place and develop them, especially in Erbil, which is still growing Open the market neatly and beautifully, especially the market of fodder, chemicals, agricultural supplies, customs and general markets with respect
- Moving bars and liquor vendors out of the city.
- Ankawa 108 should have its own Bazar.
- Redesign old Ankawa and make it a touristic place and use the lands and properties within the area.
- Renovate the Erbil Castle and expand surrounding green spaces. Restore the historic minaret to preserve its cultural significance.
- The geographical location of Erbil Fruit and Vegetables wholesale market is very convenient. We thank all government agencies.
- Agricultural land should be protected, especially outside the 120m street in the north and south of Erbil, because most of the land is surrounded by wire, we cannot use it for agriculture
- Building more tourist places to attract more foreign people such as modern museums, modern sports complexes, big parks, theaters, cinema, modern big bazaar.
- Paying more attention to agriculture and supporting farmers with farming equipment.
- The Northern Development Zone may not be suitable, as it would require the relocation of fertile soil, impacting agricultural activities.

- The construction of farms around Erbil has caused the destruction of agricultural land, waste of groundwater and excessive consumption of electricity.

9) Other

- The celebration area (park) contains all the requirements for health services, especially during the celebration of Nowruz holidays in a nearby area in Ankawa District.
- Providing permanent sources of drinking healthy water throughout Erbil because Erbil is a tourist area, and to increase tourist attraction, humanitarian and health services must be provided and increased.
- We propose redesigning the old part of the city in a modern way.
- We propose to create a place far from the city for public celebrations for young people.
- Establish the borders of each region and a certified copy for all districts and sub-districts to avoid and end the problems that are currently occurring for the administrative and municipal units in Erbil.
- Proper treatment for wild animals such as dogs.
- We as residents of Qariataghi Harki village located on 150m street cannot build houses and our fate is unknown.
- Pay attention to the city's appearance in terms of engineering.
- The power grid must be underground.
- Removal of internet towers from inside the neighborhood to outside the city.
- Ensure the provision of essential services prior to land distribution or the development of new neighborhoods. Halt large-scale housing projects, as they do not serve the interests of low-income communities.
- Relocation of all the government departments and non-governmental departments to one location which leads to less traffic inside the city and the usage of cars will be less.
- Enhancing focus on the southwestern region of Erbil by increasing the number of residential areas and expanding green spaces.
- Increasing the number of residential units in underdeveloped areas to provide greater opportunities for low-income individuals to purchase affordable land and housing.
- Moving all government offices to (120-150) street to reduce congestion.

Municipality1

Municipality 3

Municipality 5

Municipality 6

Ankawa Municipality hall

Land Use Map and Descriptions

Bnaslawa Youth Centre Hall

Event Poster

CHAPTER 3
STRATEGIC ENVIRONMENTAL ASSESSMENT DETAILED RESULTS

3.1 Detailed Results of the Comparison of the Different Development Alternatives

		BAU				Alternative A				Alternative B				Alternative C				Alternative D-1				Alternative D -2				Alternative E			
		Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT
POL		**A-**	C-	B-	A-	**B+**	C+	B+	B+	**C-**	C-	C-	C-	**C-**	B-	C-	C-	**C-**	B-	C-	C-	**C-**	B-	C-	C-	**C-**	B-	C-	C-
	Air	- The polluted air from the industrial area in the west without any green buffer will come into the center of the City because of the wind direction. - The expansion of the urbanization to east				- Heaviest and polluting industries will be relocated to outside of residential zone (out of the target area - Transit- Oriented Development (public transportation and walking) will lead decreasing the vehicle usages				- New industrial zone outside of greenbelt will not have the surrounded buffer and some residential areas (low density) are nearby - The development of forestation of Inner Green Belt will help to absorb pollutants in the air from the l Industrial areas to the city - The pollutants from airport and related vehicles toward the airport will flow into the city center directly as there is no green buffer or other mitigate on measures				- New industrial zone outside of Inner Green Belt will be surrounded by green buffer therefore the air pollution from industrial zone will be reduced - Industrial logistical support area will increase heavy vehicle - CO2 and other pollutants from Industrial logic support area will flow to New Gateway core (from North-West to South-East), if its support area will have a green buffer, the hazardous effect may be reduced - The development of forestation of Inner Green Belt will help to absorb pollutants in the air from the l Industrial areas to the city				- The development of forestation of Inner Green Belt and the green buffer measurement will help to absorb pollutants in the air from the Dural Industrial Cores - Emissions will increase due to the reliance on private vehicles to travel between each Secondary Core to the City center				- The development of forestation of Inner Green Belt and the green buffer measurement for the industrial area will help to absorb pollutants in the air to the city - The relocation of airport will reduce the potential air pollutants of inside of Inner Green Belt (the City Center)				- The development of forestation of Inner Green Belt and the green buffer measurement will help to absorb pollutants in the air from the East-West Industrial Zone and Punjina Bestana Industrial Zone - Emissions will increase due to the reliance on private vehicles to travel between Bahrka Core and Mandawa Development Core to the City center - The pollutants from airport and related vehicles toward the airport will flow into the city center directly as there is no green buffer or other mitigate on measures			
	Wat	**A-**	B-	A-	A-	**B+**	C+	B+	B+	**C-**	C-	C-	C-	**B-**	C-	B-	B-	**C-**	C-	C-	C-	**B-**	C-	B-	B-	**C-**	C-	C-	C-
		- The Punjina and Vestana industrial parks will have water pollution impacts because they will be located above the groundwater recharge zone - The expansion of the urbanization to east will pollute the groundwater recharge by domestic wastewater.				- The most pollutive factories will be out from the target are - Regulation (prohibition) of development in the eastern part of outside of Inner Green Belt will prevent water pollution by industrial and domestic wastewater.				- The development of Industrial Corridor and fish farms will create the potential of water pollution - Regulation (prohibition) of development in the eastern part of outside of Inner Green Belt will prevent water pollution by industrial and domestic wastewater.				- The development of Industrial Zone and scattered industrial area will create the potential of water pollution - 4 Gateway cores will need more the development of sewerage network for domestic wastewater - Regulation (prohibition) of development in the eastern part of outside of Inner Green Belt will prevent water pollution by industrial and domestic wastewater.				- The development of Industrial Zone will create the potential of water pollution - Gateway cores will need more development of sewerage network for domestic wastewater - Regulation (prohibition) of development in the eastern part of outside of Inner Green Belt will prevent water pollution by industrial and domestic wastewater.				- The development of Industrial Zone and some new industrial area will create the potential of water pollution - Great Zab Core will need the development of sewerage system for domestic wastewater for avoiding the water pollution to Great Zab - Regulation (prohibition) of development in the eastern part of outside of Inner Green Belt will prevent water pollution by industrial and domestic wastewater.				- The development of Industrial Zone and Fish farms will create the potential of water pollution - Both Mandawa Development Core and Bahrka core will need more development of sewerage network for domestic wastewater - Mandawa Development Core has potential to influence the water quality of the Great Zab River from domestic Sewage and household waste as it is located in the upper side - Regulation (prohibition) of development in the eastern part of outside of Inner Green Belt and will prevent water pollution by industrial and domestic wastewater.			

		BAU				Alternative A				Alternative B				Alternative C				Alternative D-1				Alternative D -2				Alternative E			
		Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT
WPR	Rec Red	**A-**	C-	B-	A-	**C+**	C-	D	C+	**C-**	C-	C-	C-	**A-**	C-	B-	A-	**B-**	C-	B-	B-	**B-**	C-	B-	B-	**B-**	C-	B-	B-
		- Expansion of the scattered organizational area (including business, residential and industrial area) will increase the waste collection area				- Most of residential area is inside of inner-green belt, therefore it is easy to collect the residential waste - Heaviest industries will be out therefore less industrial waste will be produced				- Expansion of the residential area (New urbanization core in North) and industrial area will increase the waste collection area				- Expansion of the urbanization area (including business, residential and industrial area) increase the waste collection area = High cost for waste collection				- Establishing two new secondary cores (residence and commercial) will expand the public waste collection area - Dual industrial cores will create more industrial waste				- Establishing two new secondary cores (residence and commercial) will expand the public waste collection area - Dual industrial cores will create more industrial waste				- Establishing two new secondary cores (residence and commercial) will expand the public waste collection area. - Two industrial cores will create more industrial waste			
PHH	Hel	**B-**	B-	B-	B-	**B+**	D	C+	**B+**	**C+**	D	C+	C+	**C-**	C-	C-	C-	**D**	D	D	D	**D**	D	D	D	**C+**	D	C+	C+
		- Lifestyle-related measures for good health such as walking will not implemented, as the mean of transportation will remain the private cars or taxi				- The walkable city strategies with public transportation in city will prevent the lifestyle diseases - The accessibility to the health facilities will be improved				- Single Integrated Urbanization core will have health facilities based on the smart city concept				- Difficulty in introducing public transportation will increases travel by private vehicles (depriving people of opportunities for exercise like walking) -Establishment of public hospitals will also be difficult due to budget constraints				- Difficulty in introducing public transportation will increases travel by private vehicles (depriving people of opportunities for exercise like walking) - Public hospital (health care center) can be established in New Secondary Core				- Difficulty in introducing public transportation will increases travel by private vehicles (depriving people of opportunities for exercise like walking) - Public hospital (health care center) can be established in New Secondary Core				- The walkable city strategies with public transportation in city will prevent the lifestyle diseases - Difficulty in introducing public transportation will increases travel by private vehicles (depriving people of opportunities for exercise like walking) - Public hospital (health care center) can be established in Mandawa Development Core and Bahrka Core			
		A-	C-	B-	A-	**C+**	D	D	C+	**C-**	C-	C-	C-	**B-**	C-	B-	B-	**A-**	C-	B-	A-	**A-**	C-	B-	A-	**D**	C-	D	D
	Ind	- Industrial areas adjacent to residential areas will be the risk from fire and factory explosions that could kill residents and destroy homes, and from the toxic gases generated by the explosions.				- As the heavy industries will be relocated in outside the target area, the industrial disaster risk will be decreased.				- New Industrial Corridor will have the potential of the industrial disaster - There are a buffe zone between industrial area to residential area therefore the possible damage to the nature will be occurred but less to residents				- New industrial areas in north-west will have the potential of the industrial disaster - The residential area will be closed to industrial area.				- The large-scale industrial cores area will be affected to near other industrial unit if there are fire explosion of oil refineries				- As the East Industrial Core zone is large, it would be affected to near other industrial unit if there are fire explosion of oil refineries - There will be huge damage to the airport if there is industrial disaster as the industrial zone is near to the airport				- There will be a buffe zone between industrial area to residential area therefore the possible damage to the nature will be occurred but less to residents - The Punjina Bestana Industry will be separated by the Inner Green Belt			
		A-	B-	A-	A-	**B+**	C-	B+	B+	**D**	C-	D	D	**C-**	C-	C-	C-	**B-**	A-	A-	B-	**C-**	A-	B-	C-	**D**	C-	D	D
	Off	- The lack of consideration and implementation of policies and regulation for industrial and residential areas (such as industrial and residential areas are adjacent to each other) will not mitigate offensive odors and sound damage to citizens at all - Ignorance of environmental regulation by Industrial and business will spur adverse effects				- Airport will be one of the noisiest causes. It would be less noisy as the airport will be remote to outside of the target area after deconstruction noise. - Relocation of heaviest industry will dramatically reduce the offensive odors and sound damage.				- The offensive vibration and noise from the vehicles will be reduced as the Integrated development city may have all social facilities (less movement to other areas for education/ health etc.) - Construction of new industrial zone + new integrated city will create the noise and vibration (at the first stage), especially as the new industrial zones do not have a green buffer or similar measure and are likely to have				- The mean of transportation will be private cars from outside of the Inner Green Belt to inside for job, education, and other social activities, therefore the noise and vibration from vehicle will be increased, thus the proportion of quiet areas will be decreased - East of outside of the Inner Green Belt will have more negative impact by vehicles and trucks because of				- Dual Industrial Cores will have more order, noise and vibration from construction and operation of the industrial factories, especially at the first stage as it requires a time to foster the green buffer until the level of mitigations. It will be mitigated some part the green buffer surrounding each zone will work effectively - The noise and vibration from vehicles towards each core will increase as the distance between each core and the city				- Eastern part (new industrial area) will have more noise and vibration from construction and industries - The noise from the airport will be reduced by relocation of the airport to outside of Inner Green Belt and the Inner Green Belt acting as a buffer				- East-West Industrial Zones, Fish farming promoting area and the Punjina Bestana Industrial Area will have more order, noise and vibration from construction and operation of the industries factories, especially at the first stage to surrounding area. As it requires a time to foster the green buffer until the level of mitigation. It will be mitigated some part the green buffer surrounding each zone			

		BAU				Alternative A				Alternative B				Alternative C				Alternative D-1				Alternative D -2				Alternative E			
		Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT
										a negative impact on tourism and settlements (especially around rivers) due to noise and order pollution.				industrial logistic hub - The Green buffer of New Industrial Zone will reduce the negative impact from its Industrial Zones				center								will work effectively. - New establishment such as development cores are outside of the Inner Green Belt - The noise and vibration from vehicles towards each core will increase as the distance between each core and the city center			
BIO	Ani	**A-**	B-	A-	A-	**B+**	D	C+	B+	**D**	C-	D	D	**C-**	B-	C-	C-	**A-**	B-	A-	A-	**A-**	B-	A-	A-	**A-**	B-	A-	A-
		- Limited green space and farmland will reduce the number of migratory birds (Near-extinct species) flying over the area				- Outside of the Inner Green Belt will be promoted for agriculture/ orchards/ green area. This helps to protect animals including birds etc. - The ponds will contribute to the ecosystems of plants and animals, including migratory birds such as the sociable lapwing.				- The ponds will contribute to the ecosystems of plants and animals, including migratory birds such as the sociable lapwing. - The industrial corridors and urbanization core in the North will create noise, order and air pollution which may affect any wild species - The fish farms will the potential that fish brought in from overseas and farmed escape from farms and become exotic species, interbreeding with wild species and contaminating their genes and spreading diseases and pests				- Noise from industrial area will cause negative impact on protection animal - Limited green space and farmland will reduce the number of migratory birds (Near-extinct species) flying over the area - The ponds will contribute to the ecosystems of plants and animals, including migratory birds such as the sociable lapwing. - Establishment of new Gateway Cores, especially three (3) South-West residential cores, will give negative impact, even though the residential type will be low density model, V10if no strict regulation will be applied for necessary protection of biodiversity.				- The ponds will contribute to the ecosystems of plants and animals, including migratory birds such as the sociable lapwing. - The West side of Erbil where the airport and Dual industrial area will have noisy environment. - the Northern and Southern Secondary Core will have noise and vibration especially during the construction of the housing				- The effect of human activities from residential area and industrial area - The ponds will contribute to the ecosystems of plants and animals, including migratory birds such as the sociable lapwing - The South industrial zone located outside of Inner Green Belt will negatively affect the biodiversity				- The ponds will contribute to the ecosystems of plants and animals, including migratory birds such as the sociable lapwing. - Development on the upper Great River has a tremendous potential to alter the environment not only in the area to be developed, but also in downstream areas. - The fish farms will the potential that fish brought in from overseas and farmed escape from farms and become exotic species, interbreeding with wild species and contaminating their genes and spreading diseases and pests - the Mandawa Development Core will have noise and vibration especially during the construction of the housing			
	Gre	**A-**	C-	B-	A-	**A+**	C+	B+	A+	**C+**	D	C+	C+	**B+**	D	C+	B+	**C+**	D	C+	C+	**C+**	D	C+	C+	**B+**	D	C+	B+
		- the urbanization will be accelerated along with Ring Road which supposed to have green belt				- Outside of the Inner Green Belt will be promoted for agriculture/ orchards/ green area. - Especially the South-West are where newly proposed area, and the West will be protected for the agricultural activities				- The natural forest will be decreased by establishment of Industrial Corridor although the forestation of Inner Green Belt will progress				- Development (area expansion) in the Inner Green Belt will be highly promoted - The diversified agriculture will enrich the green area				- The natural forest will be decreased by establishment of Dual Industrial Cores although the forestation of Inner Green Belt will progress				- The natural forest will be decreased by establishment of Dual Industrial Cores although the forestation of Inner Green Belt will progress				- Outside of the Inner Green Belt will be promoted for agriculture/ orchards/ green area. - Especially the South-West are where newly proposed area, and the West will be protected for the agricultural activities			

		BAU				Alternative A				Alternative B				Alternative C				Alternative D-1				Alternative D -2				Alternative E			
		Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT
BIO	Agr	**A-**	C-	B-	A-	**B+**	D	C+	B+	**B+**	D	C+	B+	**A+**	C+	B+	A+	**C-**	D	C-	C-	**B-**	C-	C-	B-	**B+**	D	C+	B+
		- the urbanization will be accelerated along with Ring Road which supposed to have green belt				- South-West of Erbil (outside of the Inner Green Belt will promote more agricultural activities				- South-West of Erbil (outside of the Inner Green Belt will promote more agriculture - Although integrated urbanization core will be promoted, it will have some forest area				The North and the West of Erbil will have the diversity of Agriculture				- Dual Industrial Cores in the West may take water resource. - Water Zone can be used for agricultural activities - The effect will be different by the types of industries: heavy or light industries				- Water recharge zone can be used for agricultural activities - The moving the airport and industrial area in the West, Northen Secondary Core and Great Zab Secondary Core will give impact on farmland area - The South industrial zone located in outside of Inner Green Belt will give negative impact in terms of soil, water and air pollution if proper prevent measures will not be applicated				- South-West of Erbil (outside of the Inner Green Belt) will be promoted more agriculture and South of Erbil will be promoted for wheat Agriculture. - Although integrated urbanization core will be promoted, it will have some forest area			
	Art	**A-**	C-	B-	A-	**A+**	C+	B+	A+	**B+**	D	C+	B+	**A+**	D	B+	A+	**C+**	C-	D	C+	**C-**	C-	C-	C-	**B+**	D	C+	B+
		- The accelerated urbanization alongside of Ring Road will decrease the forest/ agricultural land of the Green Belt				-- the Inner Green Belt will be forestation -Because that the Industrial area and airport will be relocated to outside of the target area, the artificial green area such as parks and recreation area will be increasing.				- The Inner Green Belt will be forestation -Integrated urbanization core will the artificial green area such as parks and recreation area will be increasing.				- The Inner Green Belt will be forestation - The artificial forest will be promoted as buffer for industrial zones in the North-West of Erbil and for Gateway cores in South of Erbil. - The forested green area in the East will be slightly larger than other alternatives - Gateway Cores will provide the opportunity to connect the parks with the agricultural land as a green network				- The Inner Green Belt will be forestation - Dual Industrial Cores and the Northern and Southern Secondary Core will be established - Dual Industrial Cores will have small forest as buffer zone however it will take time for the forest to grow enough to mitigate the impacts from industry. - The parks inside the Two cores (Northen and Southern) may be interweaved with the greenery into the Inner Green Belt				- The Inner Green Belt will be forestation - There is not any green buffer zone for the relocated airport - Former Airport Site will have parks and greenery under the residential projects				- The Inner Green Belt will be forestation -Integrated urbanization core will the artificial green area such as parks and recreation area will be increasing.			
ERO	Ero	**A-**	B-	A-	A-	**B+**	C+	B+	B+	**C-**	D	C-	C-	**A+**	C+	B+	A+	**B-**	C-	B-	B-	**B-**	C-	B-	B-	**B-**	C-	B-	B-
		- The East of Erbil where the water recharge zone is, and the North of Erbil will have huge risk of the water and soil erosion because of the urbanization				- Water recharge zone will be established and mitigate flash floodings				- Traditional/Cultural Tourism Center will have possibility to cause the geological (water) erosion if there is no mitigation matter such as setting ponds etc.				- Mixed agriculture promoted zone will prevent soil erosion				- The Northern Secondary Core will have possibility to cause the geological (water) erosion if there is no mitigation matter such as setting ponds etc.				- The Northern Secondary Core will have possibility to cause the geological (water) erosion if there is no mitigation matter such as setting ponds etc.				- The Bahrka Core will have possibility to cause the geological (water) erosion if there is no mitigation matter such as setting ponds etc. - Development of Mandawa Development Core may cause the water and soil erosion as the influence by changes of the natural landscape. It is necessary to consider and examine its effect and take mitigation measure.			

		BAU				Alternative A				Alternative B				Alternative C				Alternative D-1				Alternative D -2				Alternative E			
		Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT
		A-	B-	A-	A-	**A+**	C+	B+	A+	**D**	C-	D	D	**B-**	C-	B-	B-	**C-**	D	C-	C-	**D**	C-	D	D	**A+**	C+	B+	A+
RES	Wat	- Water recharge zone will not be established; therefore, it will be difficult to secure an adequate supply of water.				- Water recharge zone will be established, and the residential zone is concentrated inside of the greenbelt, therefore the distribution line will be compact.				- Water recharge zone will be established therefore it will increase the water potential. - however the North integrated urbanization core and cultural tourism core will need of the water - Connecting with Great Zab River will be introduced new industrial activities and water usage				- Water recharge zone will be established therefore it will increase the water potential - However, the water usage varies by region because new four (4) gateway cores will be established separately between the North to the West and the South. It will be required to improve/ develop the distributing line - The four (4) Gateway Cores will reduce the centralization of water consumption by residential area because of elimination of population concentration - New industrial zone in the Northwest will need water resource				- Water recharge zone will be established therefore it will increase the water potential. - However, the water usage varies by region because new (2) gateway cores will be established separately between the North and the South. It will be required to improve/ develop the distributing line - New industrial zone in the Northwest will need water resource				- Water recharge zone will be established therefore it will increase the water potential - If the development in western Erbil, including Core, will be a water network that uses the Great Zab River as its source of water, the impossibility of water use will be reduced.				- Development of the Mandawa Development Core will include the establishment of the new Dam. New Dam will be able to cover the necessity of water in near area. - Water recharge zone will be established therefore it will increase the water potential. - Connecting with Great Zab River will be introduced new industrial activities and water usage			
	Was Wll Swa	It is unfeasible to compare by Development Alternatives																											
		A-	B-	A-	A-	**B+**	D	C+	B+	**C+**	C-	D	C+	**C+**	C-	D	C+	**C-**	B-	C-	C-	**C-**	B-	C-	C-	**C+**	C-	D	C+
CLI	Ghg	- The dysfunction of greenbelt - scattered urbanization will increase the vehicle usage caused the GHG emission increase - The Industrial zones will not have buffer for offsetting the GHG emission				- GHG emission from the airplane and related vehicles in the airport will be reduced as the airport will be relocated - However, the relocation of the airport from the target area will increase GHG emissions due to the longer travel distance from the city center to the new airport, unless the introduction of eco-friendly transport and public transport should also be considered -Density of population will be high, however if the public transportation and walkable city project with Transit-Oriented Development (ToD) will be applicated, it will reduce the GHG emission form the transportation - The development of greenbelt will offset the GHG emission				- The density of the population will be decreased by the integrated urbanization core in North, however the vehicle usage between inside of the City and the Core city will increase. - The development of greenbelt will offset the GHG emission				- The density of the population inside of the City will be decreased by the 5 Gate Way cores in outside of the inner greenbelt, however the vehicle usage between inside of the City and each core cities will increase - The development of greenbelt will offset the GHG emission - Industrial zones in the Northwest will create GHG emission however forest buffer will offset its effect (it takes a time until the forest grows)				- The development of greenbelt will offset the GHG emission - The density of the population inside of the City will be decreased by the two secondary cores in outside of the inner greenbelt, however the vehicle usage between inside of the City and each core cities will increase - The two secondary cores will not be surrounded by forest which can offset CO2 from the residential area - Dual Industrial Cores will be relatively larger than other alternatives. The GHG emission will be mitigated by the forest buffer however it takes a time that the forest grows enough.				- GHG emission from the airplane and related vehicles will be reduced as the airport will be relocated. however, there is no buffer between the industrial area. - Density of population of the City will be decreased, however the vehicle usage between inside of the City and the two secondary cores in Northwest and North will be increased - The development of greenbelt will offset the GHG emission				- The development of greenbelt will offset the GHG emission - The density of the population inside of the City will be decreased by the two secondary cores in outside of the inner greenbelt despite of the expected population growth - The two secondary cores will not be surrounded by forest or mountains which can offset CO2 from the residential area - The introducing the public transportation and walkable city project with Transit-Oriented Development (ToD) will reduce the GHG emission form the transportation, however the vehicle usage between inside of the City and each core cities will increase			

		BAU				Alternative A				Alternative B				Alternative C				Alternative D-1				Alternative D -2				Alternative E			
		Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT
		A-	B-	A-	A-	**A+**	C+	B+	A+	**C+**	C-	D	C+	**A+**	C+	B+	A+	**C+**	C-	D	C+	**C+**	C-	D	C+	**C+**	C-	D	C+
	Fld	- No steps have been taken to prevent flooding. - The area is further urbanized beyond the flood-prone areas.				- The limitation of development of the Groundwater Recharge zone and installation of pond (reservoirs) will mitigate flash flooding				- The limitation of development of the Groundwater Recharge zone and installation of pond (reservoirs) will mitigate flash flooding - The Northeast area (where Traditional/ Cultural Tourism Center) has the potential of water/soil erosion. It should be considered which kind of activities and facilities will be created				- The limitation of development of the Groundwater Recharge zone and installation of pond (reservoirs) will mitigate flash flooding - The North Area where mixed agriculture promotion zone will have the potential of the potential to prevent landslides and flooding. However, it is assumed that the land is properly cultivated and well maintenance				- The limitation of development of the Groundwater Recharge zone and installation of pond (reservoirs) will mitigate flash flooding - The North Area where the Northen Secondary Core will have the potential of water/soil erosion. It may cause the flooding the northern part of the inner City				- The limitation of development of the Groundwater Recharge zone and installation of pond (reservoirs) will mitigate flash flooding - The North Area where the Northen Secondary Core will have the potential of water/soil erosion. It may cause the flooding the northern part of the inner City				- The limitation of development of the Groundwater Recharge zone and installation of pond (reservoirs) will mitigate flash flooding - The North Area where the Bahrka Core is has the potential of water/soil erosion. It may cause the flooding the northern part of the inner City			
		A-	B-	A-	A-	**B+**	D	C+	B+	**C+**	C-	D	C+	**D**	C-	C-	D	**C-**	B-	C-	C-	**C+**	C-	D	C+	**D**	C-	C-	D
CLC	Hie	- The dysfunction of greenbelt - Scattered urbanization will increase the vehicle usage caused the GHG emission increase (it will also accelerate the heat island effect) - The Industrial zones will not have buffer for offsetting the GHG emission				- The airport relocated development area will some high density residential however it will also have park & green recreation area and Villa's style residential will be introduced. it is efficient to prevent (mitigate) the heat island effect. - The public Transportation development with walkable city (ToD) will reduce the vehicle usage - The area of the industrial park is not much different from the existing (2023).				- The very high- and high-density residential units will be mostly outside of the Inner Green Belt, and it will have forest (or park) inside of middle of its area. Those forest can mitigate the heat island effect. If there is not, heat island effect will be caused				- The new high density residential units will be mostly outside of the Inner Green Belt which near to the forest of the greenbelt. Those forest can mitigate the heat island effect. If there is not, heat island effect will be caused - The vehicle usage will be increasing as each gateway cores will be separated geographically.				- The new very high- and high-density residential units will be mostly outside of the Inner Green Belt which near to the forest of the greenbelt. Those forest can mitigate the heat island effect. If there is not, heat island effect will be caused - The vehicle usage will be increasing as each gateway cores will be separated geographically.				- The airport will be relocated outside of inner greenbelt and most of residential units will be low density residential the parcs and green recreation - The new very high- and high-density residential units will be mostly outside - The vehicle usage will be increasing as each gateway cores will be separated geographically.				- The new high density residential units will be mostly outside of the Inner Green Belt or Mountainous area such as Mandawa, and each cores will have forest (or Park). Those forest can mitigate the heat island effect. If there is not, heat island effect will be caused - The public Transportation development with walkable city (ToD) introduced in each core will reduce the vehicle usage - The vehicle usage will be increasing as each development cores will be separated geographically.			
		A-	B-	A-	A-	**C+**	D	C+	C+	**C+**	D	C+	C+	**B-**	C-	B-	B-	**B-**	C-	B-	B-	**C-**	B-	C-	C-	**C+**	D	C+	C+
	Dus	- The dysfunction of greenbelt, especially from south to north where the dust wind comes - The urbanization (low to medium density residential units) will expand to the south to west. It will lose the forest or active agricultural land which can mitigate the dust storm damage to human				- The direction from which the dust comes (the Southwest and West) will have muti-purpose agriculture zone, and the development of the inner green zone will reduce the damage of dust to the City canter				- The direction from which the dust comes (the Southwest and West) will have muti-purpose agriculture zone - The new development of the Outer Green Belt zone will reduce the damage of dust to the cities and residential areas located in outside of the Inner Green Belt				- New gate way cores which located in south to west will be affected the dust storm directly - The new development of the Outer Green Belt zone, especially the West and Southwest side will reduce the damage of dust to the City center.				- The new industrial area and relocated airport will be in the West which the dust comes - The new development of the Outer Green Belt zone will reduce the damage of dust to the cities and residential areas located in outside of the Inner Green Belt				- The new industrial area and relocated airport will be in the West which the dust comes - The new development of the Outer Green Belt zone, especially the West and Southwest side will reduce the damage of dust to the City center.				- The direction from which the dust comes (the Southwest and West) will have muti-purpose agriculture zone. Damage to Erbil center (residential) will be reduced, but damage to agricultural products is likely to occur. - The new development of the Outer Green Belt zone will reduce the damage of dust to city center and agricultural area.			

		BAU				Alternative A				Alternative B				Alternative C				Alternative D-1				Alternative D -2				Alternative E			
		Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT
PRS	Prs	**A+**	A+	A+	A+	**C-**	D	D	C-	**A+**	A+	A+	A+	**A+**	A+	A+	A+	**A+**	A+	A+	A+	**C-**	D	D	C-	**B-**	B-	B-	B-
		- Resettlement will rarely occur				- In central of the City, the resettlement or temporary resettlement will occur because of urban renewal operation which may happen in mid term				- Resettlement will rarely occur				- Resettlement will rarely occur				- Resettlement will rarely occur				- Resettlement will be occurred by relocation of the airport				- The establishment of Dam in Mandawa area and development of Mandawa Development Core will cause resettlement of some village			
EMP	Pov Emp	**D**	D	D	D	**C+**	C+	C+	C+	**A+**	B+	A+	A+	**B+**	B+	B+	B+	**C+**	C+	C+	C+	**C+**	C+	C+	C+	**A+**	B+	A+	A+
		- The employment related industries will slightly increase				- The employment related Agricultural, Tourism activities, and public transportation will be increased - Industrial zone and the airport related employment will be out of the target area				- Various sectors and industries will be created: Industries, Fisheries (fish farms), agriculture, tourism, other service sector				- Various sectors and industries will be created: Industries, Agriculture, and public service sector				- The employment related industries, Tourism activities, and public service will be increased				- The employment related industries, Tourism activities, and public service will be increased - As short terms, the construction related employment will be increased because of the relocation of the airport				- Various sectors and industries will be created: Industries, Fisheries (fish farms), agriculture, tourism, other service sector			
LOC	Agr	**C-**	D	C-	C-	**B+**	C+	B+	B+	**A+**	B+	B+	A+	**A+**	C+	B+	A+	**C-**	D	C-	C-	**B-**	D	C-	B-	**A+**	C+	B+	A+
		- Dispersed urbanization will lead to a decrease in farmland and also to an increasing dispersion of small farms scattered throughout the area.				- The southwest side of outside of the green belt will be promoted more agriculture				- The southwest zone of outside of the Inner Green Belt will be promoted several kinds of agriculture				- New agriculture promotion will be introduced alongside of Great Zab and the north part of green belt. As most those area is low agricultural production zone in 2023, it takes time to cultivate fully				- Dual industrial Cores will be established where the agricultural area in 2023				- Dual industrial Cores will be established where the agricultural area in 2023 - The industrial area in south of greenbelt will be expanded				- The southwest zone of outside of the Inner Green Belt will be promoted several kinds of agriculture			
	Fod	**C-**	D	C-	C-	**B+**	C+	B+	B+	**A+**	B+	B+	A+	**B+**	C+	B+	B+	**C-**	D	C-	C-	**B-**	D	C-	B-	**A+**	B+	B+	A+
		- Dispersed urbanization will lead to a decrease in farmland and also to an increasing dispersion of small farms scattered throughout the area.				- The southwest side of outside of the green belt will be promoted more agriculture				- The southwest zone of outside of the greenbelt will be promoted several kinds of agriculture - Fish production will contribute the domestic fish consumption				- New agriculture promotion will be introduced alongside of Great Zab and the north part of green belt. As most those area is low agricultural production zone in 2023, it takes time to cultivate fully				- Dual industrial Cores will be established where the agricultural area in 2023				- Dual industrial Cores will be established where the agricultural area in 2023 - The industrial area in south of greenbelt will be expanded				- The southwest zone of outside of the greenbelt will be promoted several kinds of agriculture - Fish production will contribute the domestic fish consumption			
	Tou	**D**	D	D	D	**B+**	D	C+	B+	**A+**	C+	B+	A+	**D**	D	D	D	**D**	D	D	D	**D**	D	D	D	**A+**	C+	B+	A+
		- No particular change				- It will be easy to access to Citadel because of ToD approach - Riverside Recreation will attract tourists				- Traditional/ Cultural Tourism Canter will attract international tourists				- No particular change				- No particular change				- No particular change				- Mandawa Development Core will offer water-based tourism with natural landscape - The Concept of Bahrka Core, that urban city with traditional agriculture landscape may attract tourists			
SOC	Equ Spa Saf	It is unfeasible to compare by Development Alternatives																											

		BAU				Alternative A				Alternative B				Alternative C				Alternative D-1				Alternative D -2				Alternative E			
		Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT
DIS	Edu Wat Enr	**B-**	D	C-	B-	**A+**	C+	B+	A+	**B+**	C+	B+	B+	**C-**	C-	C-	C-	**C+**	C+	C+	C+	**C+**	C+	C+	C+	**B+**	C+	B+	B+
		- Dispersed, unorganized urbanization will require a large number of public facilities in each area. In addition, budgetary constraints limit the number of social service (education, health etc.) which may increase the distance people must travel to receive the service.				- From a spatial perspective, the provision of social services (education and health) is relatively easy since most of the residential neighborhoods are located in the city canter.				- Social service (education, health etc.) will be distributed among the cities inside of the Inner Green Belt, the Integrated Urbanization core in north and small villages. Therefore, the public budget will also be allocated to various areas. (The more area, the lower the budget per location. Comparing Alternatives, which will have many cores, relatively less distribution points)				- Social service (education, health etc.) institutions will be distributed among the cities inside the greenbelt, the four Gateway cores and small villages. Therefore, public budget will also be allocated to various areas. (The more area, the lower the budget per location.)				- Social service (education, health etc.) will be distributed among the cities inside the greenbelt and the two Secondary Cores in north and south, and small villages. Therefore, public budget for education will also be allocated to various areas. (The more area, the lower the budget per location.)				- Social service (education health etc.) will be distributed among the cities inside the greenbelt, the two Secondary Cores in north and Near Great Zab and small villages. Therefore, public budget will also be allocated to various areas. (The more area, the lower the budget per location.)				- Social service (education, health etc.) will be distributed among the cities inside of the Inner Green Belt, the Bahrka Core and Mandawa Development Core and small villages. Therefore, the public budget will also be allocated to various areas. (The more area, the lower the budget per location. Comparing Alternatives, which will have many cores, relatively less distribution points)			
	Tra	**A-**	C-	B-	A-	**A+**	C+	B+	A+	**B+**	D	C+	B+	**B-**	C-	B-	B-	**C-**	C-	C-	C-	**B-**	C-	B-	B-	**C-**	C-	C-	C-
		- Due to the lack of initiative for the consideration of traffic issues especially the development of public transport, it will lead the high dependency on the use of private vehicles. It would perpetuate the supremacy of private vehicles as the sole mode of transportation, resulting in limited access to employment opportunities and social services for individuals from lower socioeconomic backgrounds.				- The ToD approach which promotes the walkable city will develop the public transportation service: providing the means of transportation for all.				- Due to development of the integrated urbanization core in North under the Public - Private Partnerships, the transportation issues will be considered for long term				- Due to the creation of several gateway cores, the public budget will increase for social services, and it will become that an adequate public transportation network will be difficult to maintain. It would maintain the dominance of private cars as the only mean of transport and deprive the accessibility of job opportunity and social services for the lower class in society				- Due to the creation of the Northern and Southern Secondary Cores as mainly residential purposes, the public budget will increase for social services, and it will become that an adequate public transportation network will be difficult to maintain. It would maintain the dominance of private cars as the only mean of transport and deprive the accessibility of job opportunity and social services for the lower class in society				- Due to the creation of the Great Zab and Southern Secondary Cores as mainly residential purposes, the public budget will increase for social services, and it will become that an adequate public transportation network will be difficult to maintain, especially the distance between the city center and Great Zab Core. It would maintain the dominance of private cars as the only mean of transport and deprive the accessibility of job opportunity and social services for the lower class in society				- Due to the creation of the Mandawa Development Core and Bahrka Core as mainly residential purpose, the public budget will increase for social services, and it will become that an adequate public transportation network will be difficult to maintain. It would maintain the dominance of private cars as the only mean of transport and deprive the accessibility of job opportunity and social services for the lower class in society - Mandawa Development Core and Erbil center are some distance apart			
DIS	Hou	**C-**	C-	C-	C-	**B-**	C-	B-	B-	**C+**	C-	D	C+	**B+**	C-	C+	B+	**B+**	C+	B+	B+	**B+**	C+	B+	B+	**C+**	C-	D	C+
		- The trend of relative effort from KRG to develop affordable housing may continue but might not be sufficient to cover future needs				- Due to luck of urban expansion area (because of regulation of the development of outside of the Inner Green Belt), it will be difficult to provide affordable housing				- In the framework of urbanization under PPP scheme, public authorities can impose a certain percentage of affordable housing				- Affordable housing can be developed in the gateways in both extension of existing villages for hosting local lower-class residents and newcomers in newly developed gateway cores.				- The consideration for affordable residential area in south will provide the equal opportunity for all				- The consideration for affordable residential area in Great Zab Secondary core will provide the equal opportunity for all				- In the framework of urbanization under PPP scheme, public authorities can impose a certain percentage of affordable housing			
GEN	Job Sec	It is unfeasible to compare by Development Alternatives																											

		BAU				Alternative A				Alternative B				Alternative C				Alternative D-1				Alternative D -2				Alternative E			
		Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT	Effect	ST	MT	LT
CHL	Her	**D**	D	D	D	**C+**	C-	D	C+	**D**	D	D	D	**D**	D	D	D	**D**	D	D	D	**D**	D	D	D	**D**	D	D	D
		- No particular change				- The heritage-let urban renewal strategies with ToD approach will improve the accessibility for tourists and promote the heritage tourism. - However, it is essential that adequate landscape preservation measures are taken into consideration.				- No particular change				- No particular change				- No particular change				- No particular change				- No particular change			
	Arc	**C-**	D	C-	C-	**C-**	D	C-	C-	**C-**	D	C-	C-	**B-**	D	C-	B-	**C-**	D	C-	C-	**B-**	D	C-	B-	**C-**	D	C-	C-
		- A part of Ring Road 11 and industrial area in Quaritan (south) will be located in the archaeological potential site. Adherence to guidelines for proper preservation will be required.				- A part of southwest (From the 120m ring road to Multi-Purpose Agricultural Zone in southwest) will be located in the archaeological potential zone. Adherence to guidelines for proper preservation will be required.				- A part of southwest (From the 120m ring road to Multi-Purpose Agricultural Zone in southwest) will be located in the archaeological potential zone. Adherence to guidelines for proper preservation will be required.				- A part of southwest especially the Qoritan Gateway core area, a northern part of the Ganza Gateway Core area in northwest and new Industrial Zone near Kani Qrzhala will be located in the archaeological potential zone. Adherence to guidelines for proper preservation will be required.				- Northern part of the New Dual Industrial Cores will be located in the archaeological potential zone. Adherence to guidelines for proper preservation will be required.				- Airport relocation area and some industrial area in Quaritan (south) will be located in the archaeological potential site. Adherence to guidelines for proper preservation will be required.				- A part of southwest (From the 120m ring road to Multi-Purpose Agricultural Zone in southwest) will be located in the archaeological potential zone. Adherence to guidelines for proper preservation will be required.			
	Lan	**B-**	C-	B-	B-	**B+**	D	C+	B+	**A+**	C+	B+	A+	**C+**	D	C+	C+	**C-**	C-	C-	C-	**D**	B-	C-	D	**B-**	C-	B-	B-
		- No Green landscape in Green Belt. - Dispersed urbanization and construction of dispersed industrial areas will dramatically alter forest and farmland landscape.				- The forestation of Greenbelt will retain green landscape. - Outside of Greenbelt, the landscape of the green nature (including artificial forest) and farmland, and waterscape will be promoted and preserved. - Inside of Greenbelt, urban landscape will be considered when the urban renewal strategies with ToD approach will be implemented.				- The forestation of Greenbelt will retain green landscape. - Outside of Greenbelt, proposed Mixed Agricultural Zones in south and Traditional & Cultural Tourism Center will promote and preserve the rich landscape of the green nature (including artificial forest) and farmland.				- The forestation of Greenbelt will retain green landscape. - Outside of Greenbelt, proposed Mixed Agricultural Zones in south and Traditional & Cultural Tourism Center will promote and preserve the rich landscape of the green nature (including artificial forest) and farmland.				- The forestation of Greenbelt will retain green landscape. - Outside of Greenbelt, the landscape by some villages and some low production farmland will be maintained (preserved) due to Dual Industrial Cores and two Secondary Cores.				- The forestation of Greenbelt will retain green landscape. - Inside of Inner Greenbelt, the airport relocation area will be developed with urbanization plan with green areas (parks); the process from demolition of the airport to redevelopment of the city needs to be a long-term process.				- The forestation of Greenbelt will retain green landscape. - Natural Landscape in the Mandawa Development Core area will be altered.			

Source: JICA Project Team

Note: BAU = Business as Usual
Effect = General Score of the Predicted Effect
ST = Score of the Predicted Effect on the Short Term
MT = Score of the Predicted Effect on the Middle Term
LT = Score of the Predicted Effect on the Long Term
A+/- = Remarkable Positive/Serious Negative Effect is Predicted
B+/- = Positive/Negative Effect is Expected to Some Extent
C+/- = Limited Positive/Negative/Neutral Effect is Predicted but a Further Survey is Required
D = The Effect is Very Small or Nil and a Further Survey is not Required