9 LIVING CONDITION IMPROVEMENT

9.1 Issues, Visions and Strategies for Living Condition Improvement

1) Issues of Ger Area

The present policy for resettlement to the apartment area lacks feasibility and affordability for Ger area residents. In addition, various ongoing projects in Ger area mainly aim at a short-term improvement of their living conditions, and are lacking a long-term strategy and plan. To improve urban environment of Ger area in a comprehensive and sustainable manner, it is necessary to develop a clear vision and strategies as well as plan feasible implementation measures.

Main issues to be tackled for Ger area improvement are summarized as follows:

(a) **Mitigation of negative environmental impacts:** Uncontrolled expansion of Ger areas causes negative environmental impacts such as air pollution and smog from coal in winter, soil pollution from pit ratline without sewerage treatment, etc. These negative impacts affect not only Ger areas but also the whole UB City, and cause diseases and pollution.

(b) **Landuse:** Extensive and inefficient landuse where Ger area is expanding spoils and damages the natural environment. Settlement in dangerous areas such as riverbed and hilly terrain threatens lives and safety.

(c) **Infrastructure and public services:** There are few infrastructures and utility services in Ger area. Although water supply by kiosks has been improved by donors, these improvements just treat symptoms and are short term. A long-term fundamental solution for infrastructure development is lacking in Ger area.

(d) **Living conditions:** Because of lack of basic utilities, insufficient and inconvenient access to public facilities and utilities, degraded environment, etc., living conditions of Ger area are not sufficient to enjoy life in the city. In addition, of policies and effective supports to Ger area by the governments and donors are lacking. Although residents of Ger area are anxious about money, safety, children's future, etc., poor households cannot afford to consider improving living conditions by their own efforts.

(e) **Housing:** Of the 60% of UB citizens who live in Ger area, half of them (30% of total) live in Gers and the rest (30% of total) live in simple houses which are self-built wooden houses without connection of infrastructure. Both Ger and simple houses are inadequate as urban houses in terms of environment, sanitation, safety and townscape.

2) Vision and Objectives

"Civil minimum" is a minimum standard of living conditions in which all citizens can enjoy basic civic rights. In other words, governments must secure "civil minimum" for citizens. World Health Organization (WHO) has four (4) indicators for civic rights: (a) safety, (b) health, (c) convenience, and (d) amenity; in addition to them, 5) sustainability is newly added for environmentally and socio-economically sustainable development.

To secure healthy and safe life, living condition standards are set based upon these

indicators. In general, (a) safety and (b) health are stressed as a minimum standard. To encourage harmonization of neighboring environment, and diversification of urban facilities and activities, the indicators of (c) convenience and (d) amenity exist.

Since more than half of the UB citizens can not enjoy minimum public services, the most important issue is to secure a minimum for everyone. In Ulaanbaatar City, the target of living condition improvement will be “All urban residents live healthy houses with basic urban services in a safe and environment-friendly manner.”

At present, while the central Ger area is planned to be redeveloped to apartment areas, onsite improvement in the peripheral Ger area is ongoing to improve living conditions (for example: extending water supply network, pavement of roads). But it seems that the onsite improvement results in more settlements and expansion of Ger areas without fundamental solution to the desirable urban life. It is inefficient to invest immeasurable amounts to infrastructure development in the low-dense Ger areas. It is necessary not only to improve living conditions in the short-term, but also to plan a long-term vision and strategies in a comprehensive manner for a better future.

To achieve the vision, the following main objectives are proposed:

- Appropriate landuse and mitigation of environmental damage
- Effective development of infrastructure and urban utilities
- Comprehensive improvement of living conditions
- Legal and institutional mechanism for improvement of living conditions and housing development
- Raising people’s awareness of urban life, self-efforts and community participation

3) Strategies of Ger Area Improvement

To achieve the proposed targets, comprehensive strategies are need including planning mechanism, physical improvement, institutional arrangement, socio-economic improvement, etc. Six (6) strategies are proposed as follows:

(a) Define living condition standards

(b) Propose a proper zoning system and a clear resettlement mechanism

(c) Provide basic utilities by expanding the central infrastructure networks or developing a local cluster infrastructure system

(d) Supply various types of houses

(e) Establish various planning methodologies to provide proper urban facilities and services

(f) Self-help improvement and support by government

4) Zoning Mechanism for Controlling Ger Area Expansion

As proposed in Chapter 6, “Urbanization Promotion Boundary” is a borderline within which urban settlements are secured and public services are provided properly. To secure the “civil minimum” in the urbanized area and to restrict the uncontrolled expansion of Ger area, it is necessary to plan how to develop infrastructure and urban utilities as lifelines for citizens.

In principle, outside the urbanization promotion boundary should be designated as “Non-urbanization Area” where settlement is prohibited, resettlement is enforced, and public services are not provided to achieve the “Compact City” concept of Ulaanbaatar City. A proper legal and institutional system and feasible measures of resettlement need to be further studied. It is noted that more than half of the households in Ger area (living in Ger or detached houses without infrastructure) want to rebuild or improve their houses but not to move to other places (see Table 9.1.1). The existing policy is oriented to the resettlement of residents from Ger area to the central apartment area, which is not realistic and not welcomed by the residents. Another resettlement policy should be considered so that residents move to places nearby where they live now. In addition, issues on settlement in summerhouse areas expanding toward north and tourism areas needs to be properly handled.

Table 9.1.1 Willingness to Change Present House Condition

Willingness / Present Housing Type	Move	Rebuild	Improve	Do nothing	Total
Mid-rise	7.5%	3.1%	40.8%	47.8%	100.0%
High-rise	7.0%	3.0%	43.1%	45.7%	100.0%
Detached with infra	8.5%	5.4%	48.5%	36.9%	100.0%
Simple house	6.8%	11.8%	42.9%	37.8%	100.0%
Ger	12.5%	25.1%	35.7%	25.7%	100.0%
Total	8.4%	11.3%	41.0%	38.5%	100.0%

Source: Household Interview Survey, 2007, JICA Study Team

Inside the urbanization promotion boundary, Ger area will be transformed into two types of residential areas: one is “Low-rise Residential Area” (called middle and peri-urban Ger area), and the other is “High& Mid-rise Residential Area” (called central and middle Ger area). They will be clearly classified based on the conditions of infrastructure connection system and housing types.

The first condition is water supply. As proposed, the policy target related to water supply is “all the household access to tap water for the same price”. Although central infrastructure network expansion is difficult both technically and financially, the water supply network has covered most of the urbanized area by expanding the central network, constructing water reservoirs and water kiosks. For example, “The Second Ulaanbaatar Services Improvement Project” (USIP-2) by the World Bank has developed the water supply network, reservoirs and kiosks especially in the peri-urban area. Issues that need to be discussed are: (a) how to connect individual houses and facilities (local network system) to the water supply network, (b) how to integrate a short-term improvement by constructing kiosks with a long-term comprehensive development plan, and (c) how to narrow the gap of water price between Ger area and apartment area.

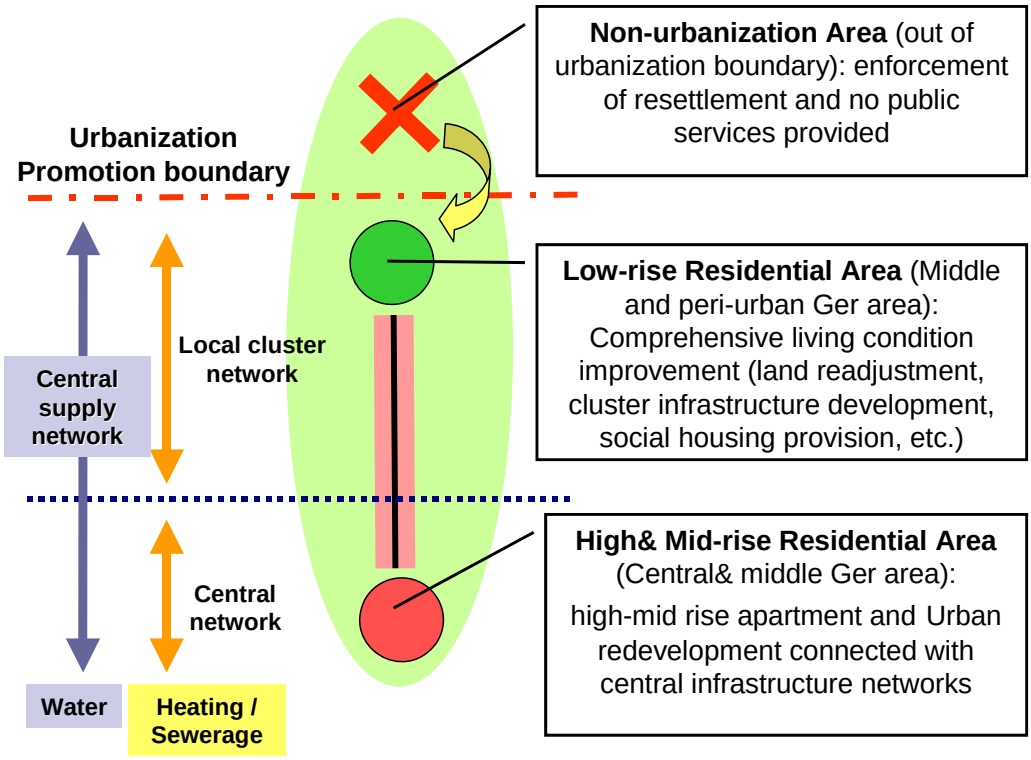
The second condition is heating and sewerage system. At present, future developments of heating and sewerage central networks are not planned to cover Ger areas. The proposed target is to provide clean heating and sewerage systems. It is necessary to clarify to what

extent these central networks will be extended in consideration of financial, technical and institutional aspects. Then the area outside the central network service area will be covered by “Local cluster network” or improvement of individual sanitation and wastewater treatment system.

The third condition is housing types. The housing types depend upon the infrastructure system and capacity, and measures of development (e.g. urban redevelopment, land readjustment, etc.) as well as financial capacity and willingness of residents.

In sum, the future development plan of present Ger areas is roughly categorized into three zones with conditions of infrastructure connection and housing types (see Figure 9.1.1). Based upon this strategy, the distribution of Ger area improvement projects needs to be further studied and proposed.

Figure 9.1.1 Basic Strategy of Ger Area Improvement



Source: JICA Study Team

5) Orientation for Ger Area Improvement by Area

The potential of future development of Ger area mostly depends on connectivity of infrastructure, especially central heating system. Depending on accessibility of infrastructure, Ger areas are categorized areas as follows:

a) Areas where the central infrastructure is rehabilitated and expanded
b) Areas where a local cluster infrastructure network is developed
c) Areas where the civil minimum is secured

Development of urban transport network (LRT/MRT Line 1 and 2) is an opportunity to

expand central infrastructure network. So in the short-term period, infrastructure development should focus on rehabilitation of existing central infrastructure network, in parallel with preparation for local cluster infrastructure development in remote areas. After improvement of central infrastructure capacity, expansion to other Ger areas can be developed. Local cluster infrastructure network can be developed in the Ger areas where remote Ger areas need to be urbanized as local commercial and community districts (ex: Dambadarjaa, Chingeltei, Khailaast, Bayankhoshuu, Nisekh, etc.). In these areas, local cluster infrastructure development should be integrated with other projects such as road development, land readjustment projects in a comprehensive manner.

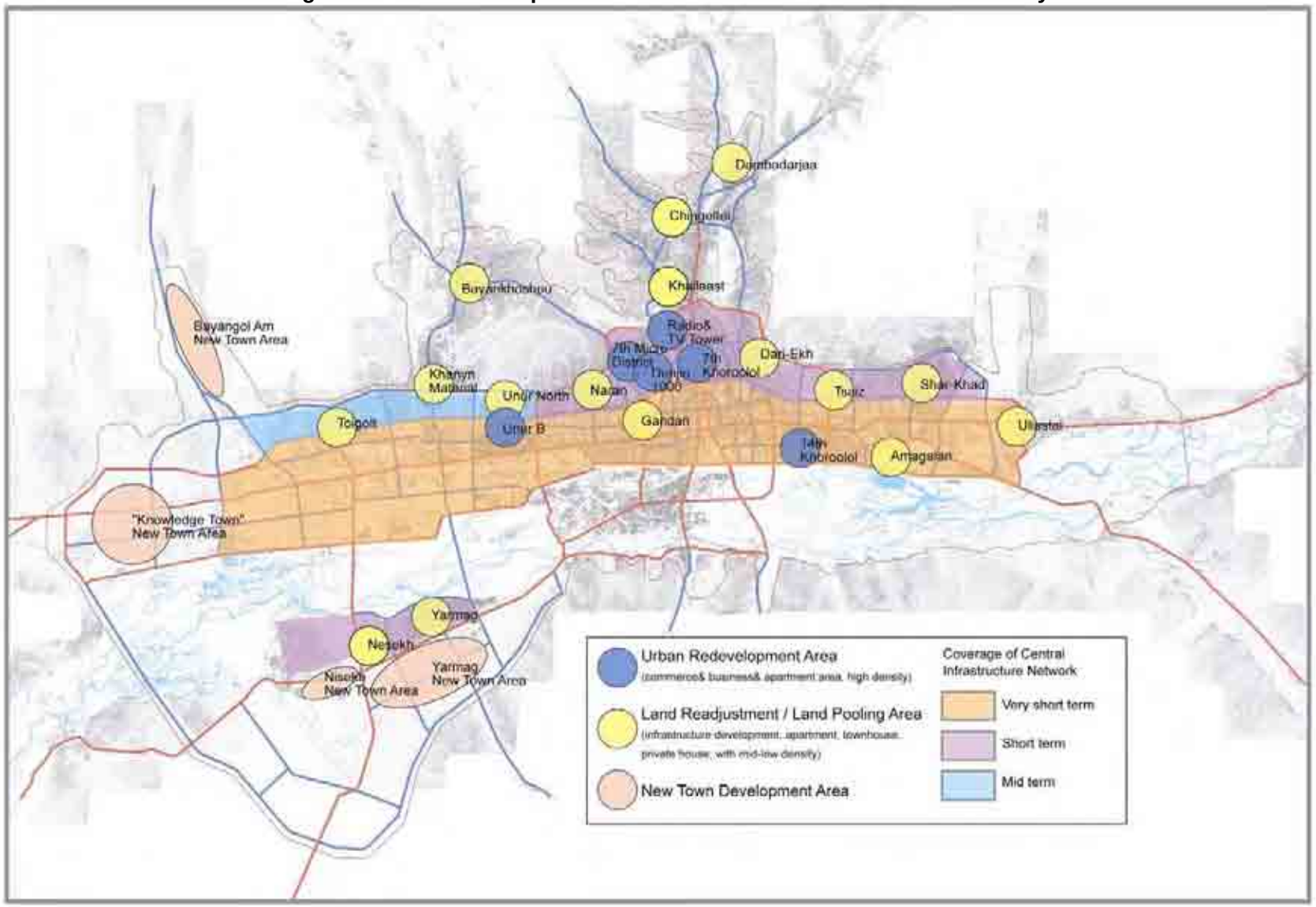
6) Infrastructure and Urban Utilities

The water supply network needs to cover the entire urbanization area, but as for the other infrastructure and urban utilities, measures of infrastructure development depend on financial and technical conditions. A local cluster infrastructure network is not connected to the central network, but it is systematically developed in certain areas. The area of this network is varied by local conditions, but it is proposed to develop a network for one community residential unit which enables the recovery of cost from the project implementation, sustainable operation and management by the community, etc.

Provision of minimum utility services is urgently needed to secure the civil minimum. For example: a) to install an individual sanitation systems like ECOSAN to reduce soil pollution, or b) to disseminate improved stoves to reduce air pollution. These minimum improvements should be covered by government subsidies as public service. In regard to water supply, the distribution of kiosks is planned by donors (mainly by USIP-1&2 of the World Bank). Without any future development plan, these investments might waste other investment made after them. These plans should be coordinated with the future landuse and infrastructure networks.

It is emphasized that this urgent service improvement is nothing but a treatment of symptoms on the road to the long-term vision of “Compact City”. It is necessary to consider appropriate measures on how to reduce the cost of the short-term treatment and how to develop long-term strategy and development plan at the same time.

Figure 9.1.2 Development Orientation of Residential Areas in UB City



Source: JICA Study Team

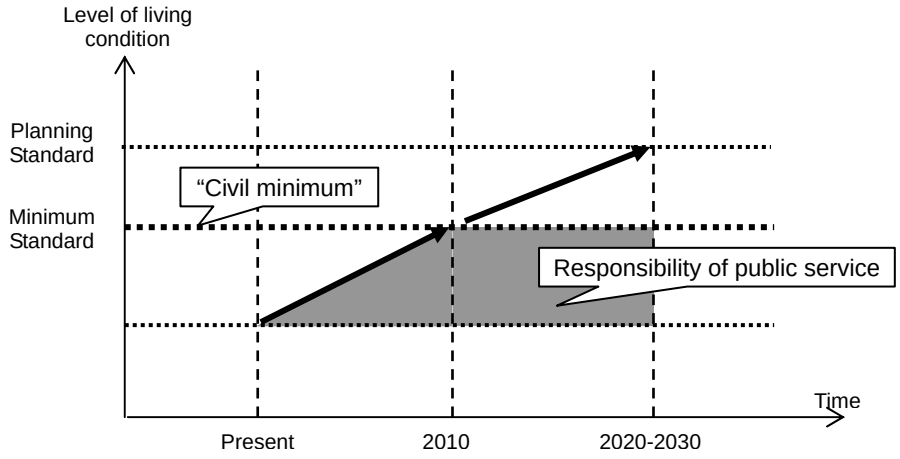
9.2 Planning Methodologies for Living Condition Improvement

1) Planning Standards for Living Condition Improvement

To achieve strategies for improvement of living conditions and policies to reach the target, it is necessary to establish clear living condition standards and define the responsibilities of the government and citizens. Two (2) standards will be examined: (a) “minimum standard” to secure the minimum living conditions as civil minimum, and (b) “planning standard” to achieve the desired civil life.

To satisfy the minimum and planning standards, the public sector plays an essential role, especially in Ger area where provision of public services is limited. The government has to be responsible to provide the necessary public services to secure “minimum standard” (see Figure 9.2.1). In addition to the public sector, the efforts of both individuals and communities are important since the capacity of the public sector is limited. Citizens also have the responsibility to understand their own roles and make efforts for living condition improvement.

Figure 9.2.1 Basic Concept of Living Condition Standard



Source: JICA Study Team

Although most of the people will live in apartments or houses connected to the central or local cluster infrastructure network, Ger and simple house residents who will not be able to enjoy public utility services will have to be provided with services to meet the minimum standard as “civil minimum”. During the transition from Gers without infrastructure and urban services to houses with infrastructure and urban services, a priority issue is to minimize negative environmental impacts such as air pollution and soil pollution which affects the individual health and sanitation conditions as well as the urban environment.

The central apartment areas have mostly been well planned and developed based upon the Russian urban planning standards. These standards are the original models of the present Mongolian Norms and Standards. But the norms and standards cannot be applied to Ger area which has been developing and expanding spontaneously and disorderly. To secure safe and healthy living conditions, living condition standards need to be clearly set to demarcate the responsibilities and roles of the public sector and citizens. Elements of living conditions are listed in Table 9.2.1.

To satisfy and evaluate the living conditions, these planning elements should be taken into consideration in any kind of urban planning. Standards are proposed for housing, basic utilities and public urban facilities (see Table 9.2.2). The existing standards of public facilities should be applied not only in the apartment area but also in the Ger area. For example, the minimum standard of 5 m^2/person for Park and Green Area is based on this standard; and the basic standard of 20 m^2/person is from the target of the UBMP-2020.

Table 9.2.1 Planning Elements of Living Condition Standard

Indicator	Planning Elements	
Safety	Safety from natural disaster	Landslide, earthquake, fire, flooding, evacuation, etc.
	Safety of daily life	Traffic safety, crime prevention
Health	Sanitation	Drainage, sewerage, solid waste, sunlight, ventilation, etc.
	Environmental pollution	Air pollution, soil pollution, water pollution, noise, negative impacts from industrial and transport sector, etc.
Convenience	Urban utilities	Water supply, sewerage, electricity, heating, solid waste, medical and health care service, etc.
	Transport	Access to public transport facilities, road network, etc.
	Urban facilities	Facilities of educational, cultural, health, administrative, commercial, security, telecommunication, sports, amusement etc.
Amenity	Green and openspace	Park, green, recreation space, landscape, etc.
	Preservation	Historical heritage, natural environment, etc.
	Community	Social network, community activities, common space, privacy, etc.

Source: JICA Study Team

Table 9.2.2 Proposed Policy Targets and Standards

Facilities		Policy Target	Minimum Standard (Civil Minimum)	Basic Standard (Planning Target)
Housing	Housing type	All households have shelters.	Living area: 10 m^2/person	Living area: 12 m^2/person
Utilities	Water supply	All households access to tap water with same price.	Houses without tap water: 25 m^2/person/day	Houses with central water pipeline: 200 m^2/person/day
	Sewerage	Domestic and industrial waste water is discharged after treatment with the environmental standards.	Use shield type pit latrine (ECOSAN)[1]	1) Connect to central sewerage network 2) Connect to local cluster sewerage network 3) Treated by septic tanks
	Electricity	All households are served with electricity	All households are connected with the electric power distribution network.	
	Heating	All households can use clean heating system	Use improved stoves or briquettes	1) Connect to central heating pipeline 2) Connect to local cluster heating network
	Solid waste	All households dispose solid waste with treatment measures.	Establish a garbage collection system by each community.	Treatment and recycle system
Facilities	Kindergarten	All households make access to these public facilities within the service catchment area designated for each service.	Size: 100 children per 1000 persons Service catchment area: r = 300-500 m Area: 30-40 m^2/child	
	Elementary & Secondary School		Size: 200 pupils per 1000 persons Service catchment area: r = 500-750 m Area: 18-50 m^2/pupil	
	Clinic and/or hospital for primary health care		Size: 9 beds per 1000 persons Service catchment area: r = 1-2 km Area: 60-300 m^2/bed	
	Parks & green areas		5 m^2/person	20 m^2/person

Source: JICA Study Team

[1] It is not realistic to treat solid waste onsite by each pit latrine in terms of cost and customs. It is proposed to establish solid waste collection system in which solid waste is utilized for fertilizer in gardens, or treated and disposed of at garbage dumps, etc.

2) "Neighborhood Residential Unit" Planning

As mentioned already, "40,000 Housing Unit Program" and related projects have faced difficulties in the implementation stage since they focus on only physical plans without a proper planning system and implementation mechanism. In this section, several planning methodologies are introduced which will be effective for Ger area improvement, especially for securing public facilities and utilities properly at the community level.

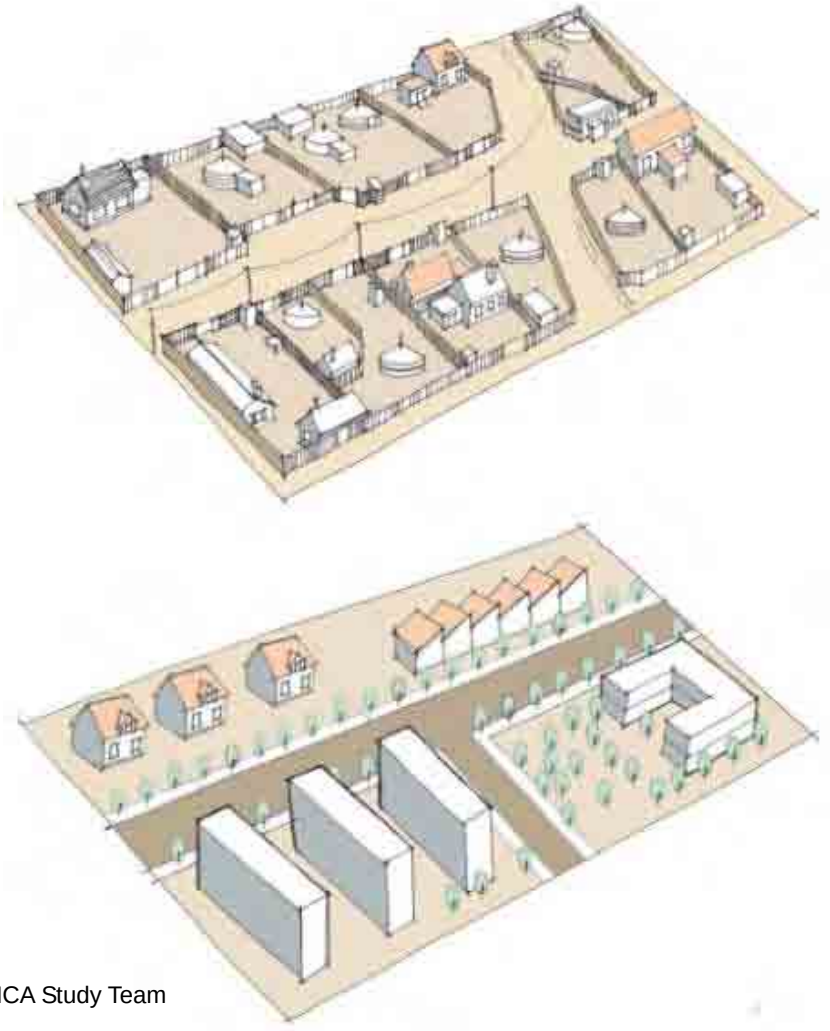
What residents of Ger areas are expecting as ideal living conditions are the following: (a) safe road (paved, with street lights and planting), (b) urban utilities (water, sewerage, heating, electricity, garbage, etc.), (c) public facilities and spaces (school, kindergarten, hospital, park, farm, etc.), (d) housing (mid-low rise apartments, detached houses with car parking, garden, etc), and (e) commercial and business facilities (offices, workshops, markets, amusement facilities, etc.) (see Figure 9.2.2). If these facilities are properly developed, most of Ger area residents prefer to stay in their present residential areas rather than move to central apartment areas.

Although various projects (ex. road, water pipeline, school development, etc.) have been conducted by government, donors and residents, ideal residential areas cannot be achieved without an appropriate planning system in a comprehensive manner.

"Neighborhood Residential Unit" is a basic urban planning unit to plot community facilities such as kindergarten, elementary school and parks in residential areas (see Figure 9.2.3). Basically, the service area of one (1) school is a basic unit, which consist of 7,000 - 10,000 population. In UB City, Khoroo-based "Neighborhood Residential Unit" can be applied for living condition improvement plans, especially in Ger area, whereby the residents can access public facilities and amenity spaces in the neighborhood and the school-centered community can be enhanced. In consideration of 2-shift system of classes and the capacity of complex schools (6 - 17 years old), covering 18,000 - 20,000 population, the average unit will be approx. 100 ha (1 km x 1 km) in one (1) Neighborhood Residential Unit (180 - 200 persons/ha). The central facility of this unit is a school, in which the service coverage is approx. 500 m so that pupils can go to school on foot.

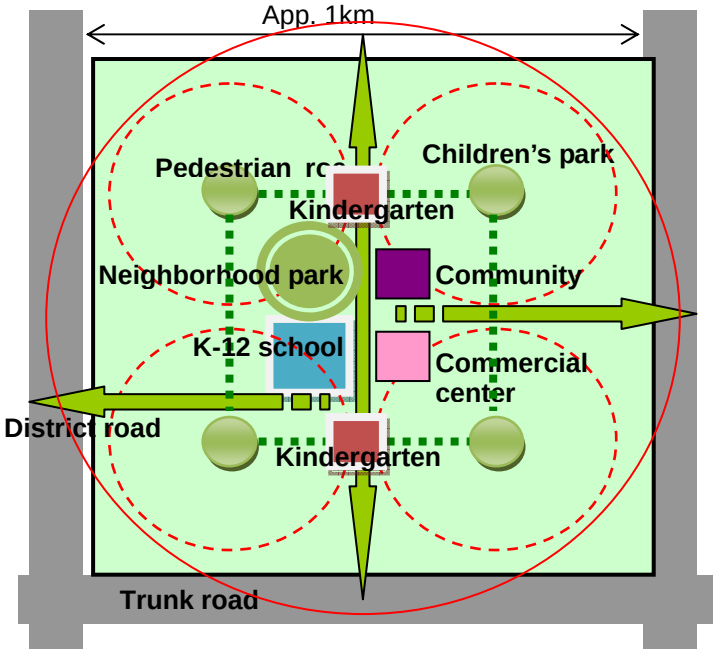
This planning approach should be shared with residents to design ideal living conditions and lifestyle in future. In this context, **"Neighborhood Area Development Plan" (NADEP)** is proposed as a participatory planning process to plan the necessary public and service facilities, infrastructure and utilities, public services, etc. with community participation.

Figure 9.2.2 Image of Present Ger Area and Future Residential Area



Source: JICA Study Team

Figure 9.2.3 Neighborhood Residential Unit



Source: JICA Study Team

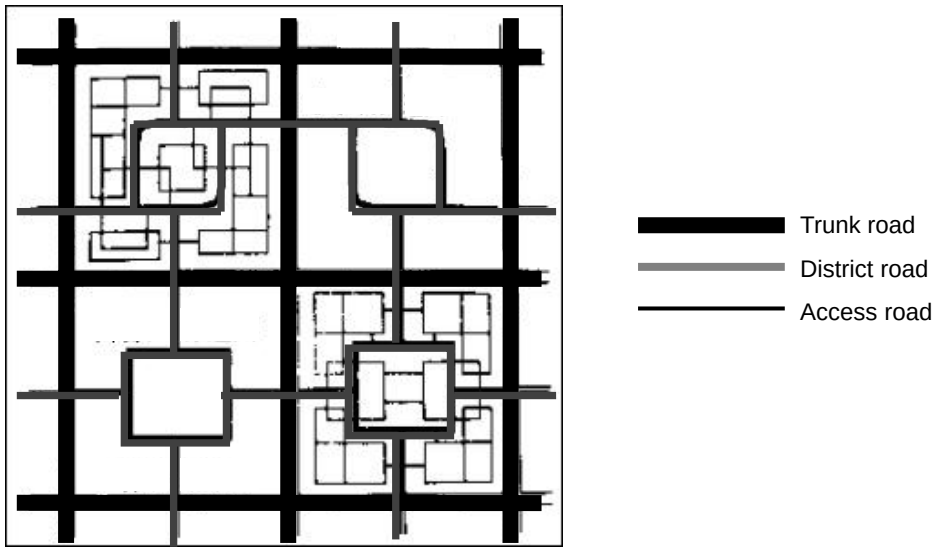
3) Road Network

Hierarchy of road network is necessary to separate cars and pedestrians, and remove through traffic from residential areas for safety. Arterial roads (w = approx. 22 m) enclose one Neighborhood Residential Unit, where cars including through traffic pass. Inside of residential areas, distributor roads (w = approx. 12 m) and access road (w = minimum 6 m) network are developed for pedestrian, mainly residents (see Figure 9.2.4). Necessary width of roads differ depending on landuse and size of development area (see Table 9.2.3).

Road network development should be integrated with other projects such as infrastructure development to unify road and infrastructure network. In combination with road network development, infrastructure and utilities such as pipelines of water, sewerage, heating are installed underground.

Central or City Governments need to invest and develop trunk roads with main utilities, while district roads, access roads and utility distribution network inside of residential areas are developed by a project implementation body (ex. the private sector, residential groups, etc.).

Figure 9.2.4 Hierarchy of Road Network



Source: JICA Study Team

Table 9.2.3 Proposed Planning Standard of Road Network in Residential Areas

			Residential area		Industrial area
			High density	Mid& low density	
Interval of roads		Trunk road	500 m	1,000 m	500 m
		District road	250 m	500 m	250 m
Width of district road	Size of development area	2.5 ha – 20 ha	16 m	10 m	12 m
		20 ha – 40 ha	25 m	12 m	16 m
		More than 40 ha	32 m	25 m	25 m

Source: JICA Study Team

4) Public Facilities

Urban Facilities: In case of Japan, public facilities are designated as “Urban facilities” under the Urban Planning Law. These facilities are planned in accordance with service coverage area (see Table 9.2.4). Once these urban facilities are designated, the

development area is legally secured for construction of these facilities. In case of Mongolia, public facilities such as schools, hospitals, parks of city level should be designated as urban facilities under the law, while government office, clinics, community facilities of local level are planned by local communities even without the legal system (see Table 9.2.5).

Table 9.2.4 Public Facilities with Planning System

	Block center	Community center	**Neighboring center**	District center	Central District Center (CBD)
Household (HH)		2300-2600	4,600-5,200	10,300-15400	38,500
Population (persons)	2,000-2,500	9,000-10,000	18,000-20,000	40,000-60,000	150,000
Public facility			Police box, post office	Police, fire station	HQ of Police, fire station, post office, telecom office
Infrastructure facility					Electricity and gas supply facility
Community facility			Community center	District center	Civic hall
Health facility			Clinic	Hospital	Hospital
Educational facility		Kindergarten	Complex school		University
Social welfare facility			Child nursery center		Elderly nursery center
Commercial facility		Market, shop, bathroom	Supermarket, shop	Supermarket, commercial street	Shopping center, department store
Business facility			Office	Bank, office	Hotel, business center
Amusement facility		Internet	Sports facility	Amusement facility	Amusement center
Park and open space	Community park	Block park	Neighborhood park	District park	City park, special park, sports park, etc.

Source: JICA Study Team

Table 9.2.5 Public Facilities with Legal System

Type of Public Facilities		Urban Planning Law (city-wide level)	NADEP (residential unit level)
Road	Trunk road	X	
	Distributor road		X
	Collector road		X
Park	City park	X	
	Special park	X	
	Sports park	X	
	District park	X	
	Neighborhood park	X	
	Community park	X	X
Infrastructure and urban utilities	Water	X (major facility and trunk network under trunk road)	X (local facility and local network inside residential area)
	Sewerage		
	Electricity		
	Heating		
	Solid waste		
Educational facilities	Public school	X	
Social welfare facilities	Hospital	X	
	Clinic		X
	Kindergarten		X
	Community facilities		X

Source: JICA Study Team

School: Pupils from 6 to 15 years old are under the compulsory education system. To provide 100% of children of these ages proper education at school, it is necessary to develop schools not only in central areas but also in present Ger areas. Under NADEP, two (2) kindergartens and one (1) complex school (6 - 17 years old) are planned in one (1) neighborhood unit with 18,000 to 20,000 population.

Park: Functions, sizes and locations should be various for urban amenities. Based upon the Urban Planning Law of Japan, hierarchical park planning system is proposed (see Table 9.2.6). In addition, since it is difficult to secure open space for parks in existing residential areas, it is proposed to develop “Community park”, which is a small neighboring open space with benches, play equipments, especially for elderly and children who have difficulty to access other parks. These community parks can be planned and developed by self-efforts of residents.

Table 9.2.6 Hierarchical Park Planning System

		Purpose/ main users	Size	Service coverage (radius)
City-level	City park	Recreation for citizen	-	-
	Special park	Park with special purposes (zoo, botanic garden, historical park, etc.)		
	Sports park	Sports activities for citizen		
District and community level	District park	Residents of same residential area	approx. 4 ha	1,000 m
	Neighborhood park	Neighboring community	approx. 2 ha	500 m
	Block park		approx. 1 ha	250 m
	Community park		-	-

Source: JICA Study Team

9.3 Affordable Housing Development in Ger Area

1) Expected Housing Types

According to the Household Interview Survey, more than half of the households desire to live in detached houses rather than apartments in the future (see Table 9.3.1). Furthermore, nearly two-thirds of the Ger households prefer detached houses. It can be said that the present policy to move Ger residents to high-rise apartments in the central apartment areas is not appropriate for them. In reality, recently constructed apartments are not affordable for poor Ger area residents and most of the apartments are purchased by rich people and private businesses. So far, the poor Ger area residents have no choice but to build “simple houses” by themselves to secure affordable private houses technically and financially.

Therefore, proper housing policies and institutional mechanism need to be formulated not only to supply affordable houses, but also to develop and supply various types of housing in terms of residential density, design, space, cost, environmental concerns, etc.

Table 9.3.1 Desired Housing Type

Desired Housing Type / Present Housing Type	Mid-rise	High-rise	Detached	Ger	Others	Total
Mid-rise	35.3%	22.6%	39.5%	1.6%	1.1%	100.0%
High-rise	24.4%	16.8%	52.9%	1.7%	4.2%	100.0%
Detached with infra	41.5%	12.2%	41.5%	2.4%	2.4%	100.0%
Simple house	31.2%	17.8%	47.9%	1.8%	1.3%	100.0%
Ger	20.6%	10.9%	63.2%	4.7%	0.6%	100.0%
Total	27.4%	15.5%	52.8%	3.0%	1.3%	100.0%

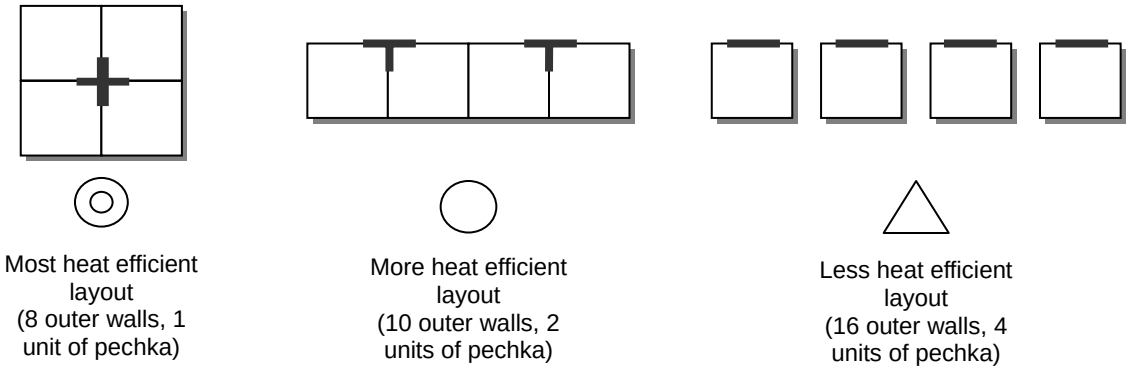
Source: Household Interview Survey, 2007, JICA Study Team

In regard to population density, 100 – 200 persons/ha is regarded as adequate to secure good living conditions. In case of Japan, this density is mostly for high-class residential areas or new towns in suburban areas. In case of Ulaanbaatar City, it is necessary to have dense residential areas to make landuse compact and concentrate investment effectively. Residential areas of 100 persons/ ha are various in terms of housing type, Floor Area Ratio and Building Coverage Ratio. To improve the present Ger area, low-rise and low-dense structures, mid-rise apartments (lower than five (5) stories without elevator) and low-rise detached houses or townhouses (row houses or terrace houses of two (2) stories) are suitable. These will be further studied and various types of residential areas for long term Ger area improvement plans proposed.

A critical issue in environmental concerns is how to improve quality of self-built houses in Ger area which are insufficient in structure, indoor air quality, sanitation, etc. The housing quality needs to be improved for environment preservation, cost efficiency as well as health and safety of the residents. The following four (4) measures are proposed preliminarily, which will be further studied and applied in a feasibility study.

- Introduction of ecological technology (ex. briquette, biogas, bio-toilet)
- Utilization of local materials to be supplied in volume and at low cost (ex: wool, soil, plaster coating)
- Improvement of local technology such as wood frame structure, brick structure, pechka (wall heating system of Russia), etc. (see Figure 9.3.1)
- Improvement of housing supply system such as “skeleton and infill” where structure is constructed by constructor and interior and equipment are installed by users.

Figure 9.3.1 Heat-efficient Layout of Housing Units



Source: JICA Study Team

2) Proposed Housing Types

Although many residents of Ger areas expect to own private detached houses with garden, car parking, etc. or move into apartments, it is necessary to consider its affordability. Housing development is basically invested in by residents, but if these residents have difficulties to construct and purchase houses because of poverty and joblessness, the public sector needs to provide technical and financial support under the appropriate housing policy (ex. social housing development, rental house development, community fund, etc.).

In terms of economic and environmental efficiency, “Town house” is recommended (see Figure 9.3.2). Town houses are a low-rise row houses, where several households (10-20 HH) live in one (1) community plan and develop it together. The land of housing areas is either shared with housing owners or owned by each household. Advantages of town house are: (a) land, infrastructure and utilities are integrated, (b) cost for construction and maintenance are cheaper than detached houses, and (c) heating is efficient since walls are common.

Currently, many households have constructed detached houses by themselves without appropriate technical standards. It is proposed to develop technical standards of self-built houses for safety. Town houses can be a good housing model so the community can take part in the whole process of planning, construction and management.

Figure 9.3.2 Image of Future Housing Types

Source: JICA Study Team

3) Self-help Improvement and Support by Governments

To implement these proposed mechanism and measures, self-help improvements and support by the government is indispensable. Self-sufficient financing and government subsidies need to be properly allocated to improve living conditions such as: i) support for sanitation and environment (e.g. affordable eco-toilets, improved stoves, etc.), ii) neighborhood public service improvement (e.g. solid waste collection, security, etc.), iii) development of technical support (e.g. construction guideline of self-build houses, assessment of housing condition, etc.), and iv) introduction of new technologies (e.g. eco house, low cost houses, etc.).

According to the result of the HIS, for improvement of living conditions, although it is difficult for the residents to contribute financially, they are willing to support by physical work like participating in paving work, cleaning work, etc. To overcome household financial difficulty, “Saving Groups” have been established to collect a small amount of money to save for community improvement. To activate these local activities, community participation in the planning and implementation process is significant (see Figure 9.3.3).

Figure 9.3.3 Conceptual Structure of Self-help Improvement

Source: JICA Study Team

9.4 Proposed Community-driven Implementation Mechanism

1) General

To develop residential area plans which Ger area residents themselves support and agree with, and to make these plans feasible technically and financially, it is necessary to develop "**Community-driven implementation mechanism**". This community-driven mechanism includes:

(a) Planning mechanism: "Neighborhood Area Development Plan" which includes community participation process with clear asset assessment and land readjustment system.

(b) Institutional mechanism: Public subsidy system for urban facility development.

(c) Financial mechanism: Institutional mechanism for sharing roles and responsibilities among governments, residents and private sector.

For appropriate implementation of residential area development projects for living condition improvement, the main issues are summarized in Table 9.4.1.

Table 9.4.1 Main Issues for Residential Area Development Projects

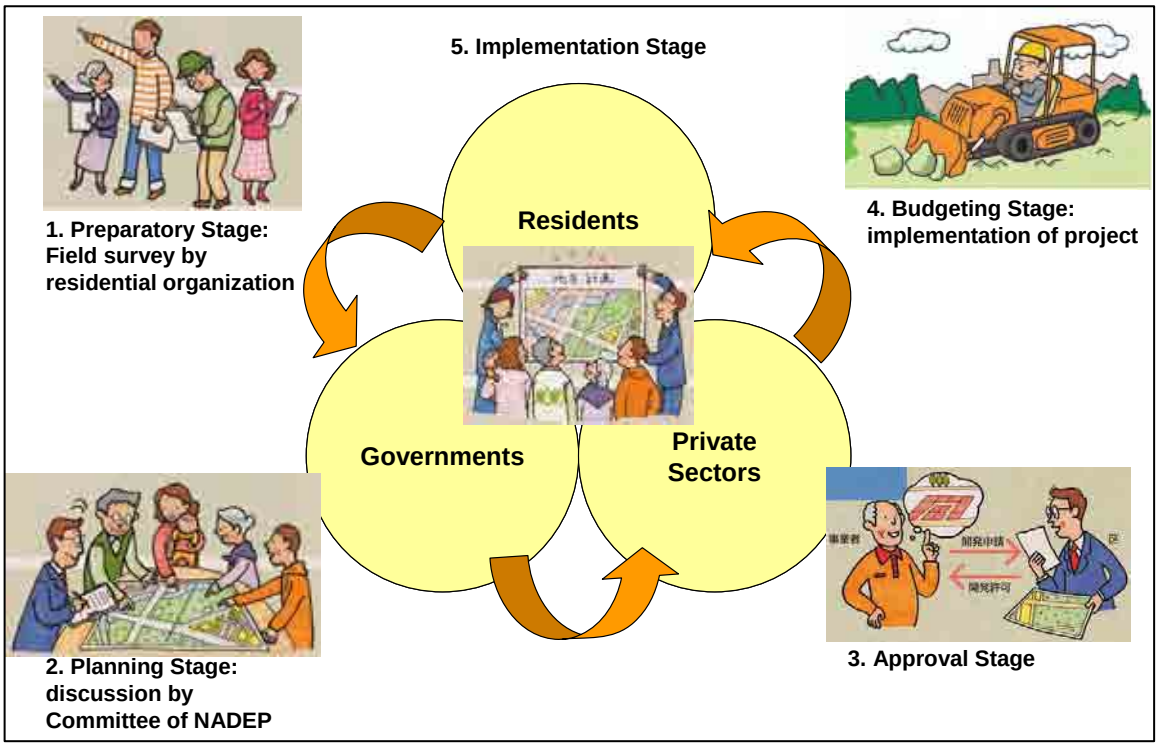
Issues	Contents
Formulation of "Neighborhood Area Development Plan" (NADEP)	• Contents of NADEP (landuse plan, road network plan, utility network plan, public facility plan, other guidelines) • Institutional system for approval and budget allocation • Institutional system for guidance and control of development by City Government • Monitoring system for implementation by local government and residents
Consensus building	• Formulation of residential group/ cooperative to facilitate and initiate projects • Land and asset assessment system with equivalent exchange • Social, economical and environmental consideration (support system for poor and elderly households, sanitary condition improvement, etc.) • Involvement of private sector
Financial feasibility	• Low interest financing for obtaining project implementation costs • Project bond • Community finance as bridge finance • Development financial cooperation by developers • Financial burden based on beneficiary-pay-principle by residents
Institutional mechanism	• Legalization of NADEP under hierarchical urban planning system • Establishment of land and asset assessment system • Institutional arrangement for LR project implementation • Designation of "off-limit zone"(prohibited settlement area) • Legal system for land expropriation and enforced relocation

Source: JICA Study Team

2) Planning and Implementation Mechanism for NADEP

It is necessary to involve three (3) main stakeholders, (a) residents, (b) governments, and (c) private sector (developers), in the whole planning and implementation process of NADEP (see Figure 9.4.1). This participation system aims to secure feasibility of consensus building among residents, smooth approval of plan by government, and financial sustainability.

Figure 9.4.1 Planning Process and Stakeholders of NADEP



Source: JICA Study Team

Among these three (3) stakeholders, residents are key stakeholders to promote NADEP. The main five activity stages are as follows:

i) Preparatory Stage of Identifying Issues and Vision: Residents raise problems and issues, as well as propose needs and plans for future improvement to local or City governments. At the same time, residents establish a residential group or a residential cooperative[2] to lead this planning process. UB City government dispatches "**Advisory Committee**" including experts such as consultants, city government officers, lawyers, and academics to provide technical support.

ii) Planning Stage of Basic Concept & Schematic Plan: The leader of residential organization and some members of Advisory Committee organize "**Committee for NADEP"**, to lead NADEP implementation process. This committee conducts field survey, consultations and meetings with residents to formulate NADEP.

iii) Approval Stage of Basic Plan of NADEP: Draft NADEP needs to be consolidated with UB City Master Plan. After that, UB City Government precedes to approval process under UB City Master Plan and related laws and institutional system. Development contribution (land or finance) and development permission under Urban Development Law needs to be

[2] Under the Mongolian Cooperative Law, minimum membership of cooperative is nine (9) persons.

applied for approval.

iv) Budgeting Stage of Phasing Projects: After approval of NADEP as a total future plan, Committee "Management Board of NADEP" is established to implement and coordinate development projects. This Management Board also manages project fund, and UB Government allocates the necessary budget especially for public facility and infrastructure development.

v) Implementation Stage of Detailed Project: As an implementation body, **"Special Purpose Vehicle (SPV)"** is established. This SPV receives bridge finance as part of community finance system under Mortgage Loan Law, and pays seed money or transfers land as a development contribution.

3) Survey and Analysis of Present Condition

Survey items for planning of NADEP and project implementation are summarized in Table 9.4.2.

Table 9.4.2 Survey Items for NADEP and Project Implementation Area

		NADEP Area	Project Implementation Area	
Scale		1/5,000-1/2,500	1/1,000	1/500
Social Condition	Population	Acreage, Population, Household	Acreage, Population, Household	
	Social Boundary	Neighborhood Group		
	Social Activity	Festivals, Events		
	Development Record	Development Record		
	Complaints	Record of Complaints		
	Rights	Outline of Land Price and Rights	Present Situation of Price, Landowners and Lease Holders in Round Numbers	Title Deeds, Building Registrations
Physical Condition	Natural Conditions	Topography, Soil, Water System, Record of Disease, Environment Factors, Pollution Level	Slopes, Soil	
	Land-use and Building	City Planning, Present Land-use, Use of Buildings, Scale of Buildings and Lots	Acreage of Land-use, Use and Structure of Buildings (Numbers)	
	Transportation	Roads (Width, Maintenance, Traffic Density), Railway Service, Bus Service, Record of Accidents		Present Situation of Roads
	Parks and Open Spaces	Parks and Open Spaces, Vegetation, Cultural Assets		Present Situation of Parks and Open Spaces
	Drainage and Sewerage	Rivers and Canals, Drainage and Sewerage, Swampy Area		Present Situation of Rivers and Canals
	Supply and Treatment Facilities	Water Supply, Garbage Collection, Other Facilities		Present Situation of Supply and Treatment Facilities
	Community Facilities	Educational Facilities, Administrative Facilities, Commercial Facilities, Fire Fighting Facilities, Other Facilities		Educational Facilities, Other Facilities

Source: JICA Study Team, based on "Hints and Ideas for Technical Standards and Guidelines of Implementing Land Readjustment", JICA

In addition, to preserve local resources such as heritage sites and landscape, and to lessen negative environment elements for safe and clean environment, present urban environment needs to be assessed (see Table 9.4.3). This is an important process so residents and planners can understand and share advantages and disadvantages of the area as the basis of planning.

Table 9.4.3 Contents of Assessment of Present Urban Environment

Category	Item		Examples
Elements of Preservation	History	Cultural Heritage	Including Relics under the Ground
		Monuments	Temples and Shrines, Old Buildings, Statues, Trees, etc.
	Landscape	Places Forming a Good Landscape	Waterside, Rivers, Seashore, Lakes, Woods, Forests, Roadside Trees, Woods in Temples and Shrines, Rows of Houses along the Street, Villages affluent in Greenery, etc.
		Viewpoints	Hills, Roads etc.
	Living	Residential Areas	High Quality Residential Areas
		Core Places of the Community	Places for Events and Festivals, Daily Meeting Places of the Inhabitants, Temples and Shrines, Markets, Parks, Playground, Schools, Community Roads, etc.
	Nature	Environmental Preservation	Forest Reserve, Woods for Slope Protection, Farm Land, Reservoirs, etc.
		Good Natural Environment	Precious Vegetation, Unusual Topography and Soil, etc.
Elements of Suffocation	Danger	Natural Disaster	Places of Floods, Land Subsidences, Landslides, etc.
		Fire	Dense Houses Areas, Narrow Roads, Provision of Hydrants, Other Obstacles of Fire Fighting, etc.
		Traffic Accidents	Accident Points and Routes, Volume of Traffic, Width of Roads, Daily Pedestrian Route and School Zone, Causes of Accidents, etc.
		Other Dangers	High Voltage Cables, Electric Substations, Gus Tanks, Factories, etc.
	Unhealthiness	Pollution (Noise, vibration, Smoke, Smell)	Factories, Railways, Station, High-Volume Roads, smelly Rivers, etc.
		Sanitation (Shade, Puddles, Germs)	Swampy Land, High-rise Building, Garbage Dumps, Slums, etc.
Elements of Shortage	Infrastructure	Houses	Quality and Density of Houses, Decrepit Old Houses
		Roads	Width, Curves and Network of Roads, Traffic Jams, etc.
		Drainage and Sewerage, Water and Electricity Supply, etc.	Undeveloped Area of Drainage and Sewerage, Water and Electricity Supply
	Access	Accessibility to Public Transport	Inconvenient Area to Access Bus Stops, Railway Stations, etc.
		Accessibility to the Community Facilities	Distance from houses to the Facilities (Especially for Infants and Elderly People), etc.

Source: “Hints and Ideas for Technical Standards and Guidelines of Implementing Land Readjustment”, JICA

4) Contents of "Neighborhood Area Development Plan (NADEP)"

"Neighborhood Area Development Plan (NADEP)" is a detailed area development plan under proposed four (4) tiered hierarchical planning system of UB Master Plan (see Chapter 17). Main objective of NADEP is to realize residents image of ideal future living condition and environment into a legalized urban planning system. In this context, NADEP can be called "bottom up plan" with community participation.

The contents of NADEP are similar with detailed development plan of 14th Khoroolol, 7th Khoroolol, TV Tower area, etc. which are necessary to get an approval by government for implementation. But this NADEP differs from these detailed development plans in that: (i) consensus building is acquired through participatory planning process, (ii) technical and financial feasibility is acquired by experts' evaluation, and (iii) approval plans of NADEP are stipulated by legal urban planning system.

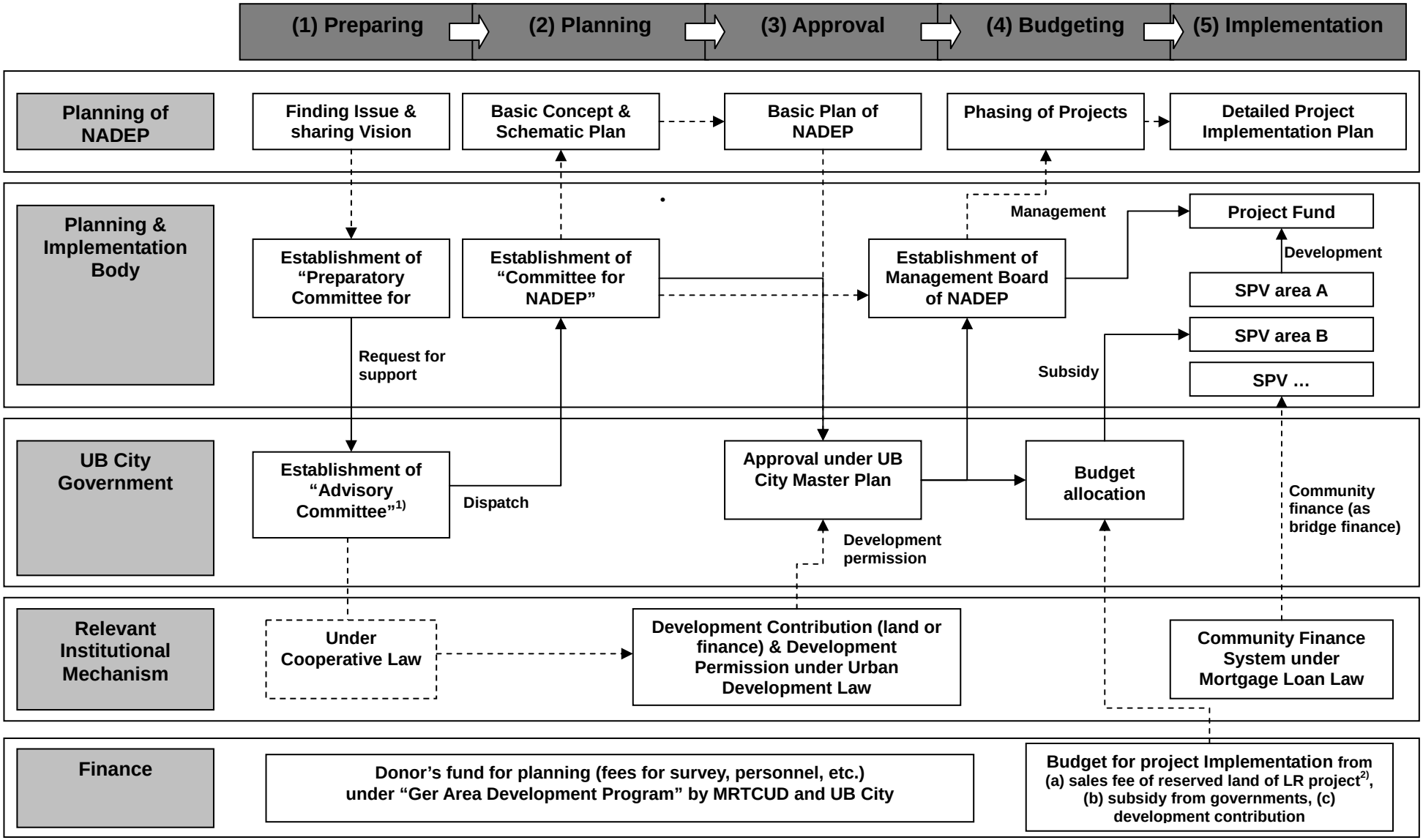
The planning elements under NADEP are detailed and specific compared to the City Master Plan, while contents are flexibly designed according to residents opinions and the details they want to regulate their future plan (see Table 9.4.4).

Table 9.4.4 Contents of NADEP

Category	Plan		Contents
Development orientation	Vision		Future image of area
	Future conceptual zoning plan		Conceptual map
Detailed development plan	Landuse plan		
	Road network plan	Trunk road, district road, access road	Location, width
	Urban utility plan	Water, sewerage, heating, electricity, solid waste	Location, capacity
	Public facility plan	School, kindergarten, hospital, clinic, community center, park, etc.	Type of facility, location, capacity
	Housing plan	Apartment, townhouse, detached house, etc.	Type of housing, number of stories
	Other guideline/ regulation		Regulation of building usage, environmental control, preservation of heritage, etc.

Source: JICA Study Team

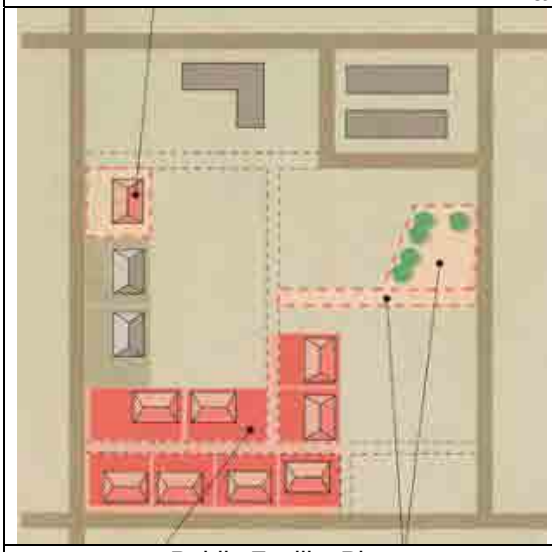
Figure 9.4.2 Whole Process of "Neighborhood Area Development Plan" (NADEP) and Project Implementation for Ger Area Development



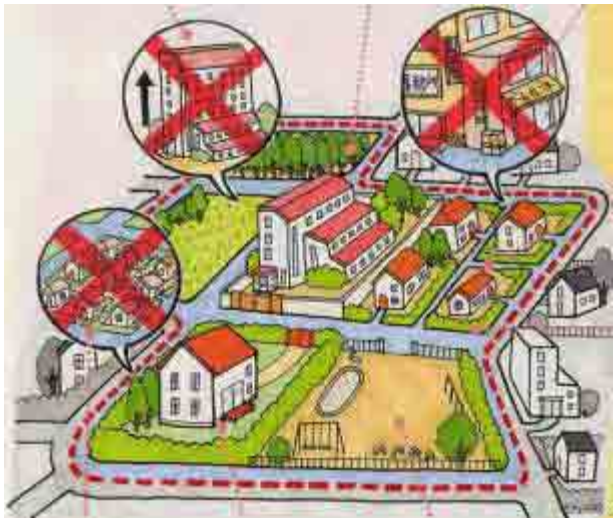
Note: 1) UB City government, MRTCUD, consultants, lawyers, etc. 2) UB City commits purchase reserved lands which are unsold for a certain period.
Source: JICA Study Team

Figure 9.4.3 Examples of Plans of NADEP

Landuse Plan



Public Facility Plan



Guideline/ regulation

Source: JICA Study Team

5) Introduction of Land Readjustment Project

(a) Introduction and Objectives of Land Readjustment

"Land Readjustment (LR)" is one of the popular urban development methods in Japan and Germany which have been introduced to many countries such as Taiwan, Korea, Australia, India, etc. Originally, this project aimed to develop roads or to register cadastral of agricultural lands, but its emphasis has shifted to develop agricultural land into urbanized area, and to readjust ill-defined lands into land lots with road network. In Germany and Australia, this is called **"Land Pooling"**, which puts all land lots together at the beginning and reallocates land lots after the project.

Basically, LR is aimed to develop urban Infrastructure and public facilities, excluding private housing development by readjusting land lots, developing road network, installing urban utilities such as water, sewerage, electricity, etc. An area developed with proper amenities is

valued higher than an area with poor infrastructure. Therefore, land readjustment not only enhances the value of lots within a project but also enables landowners to utilize their lots more effectively.

(b) Characteristics and Basic Concepts

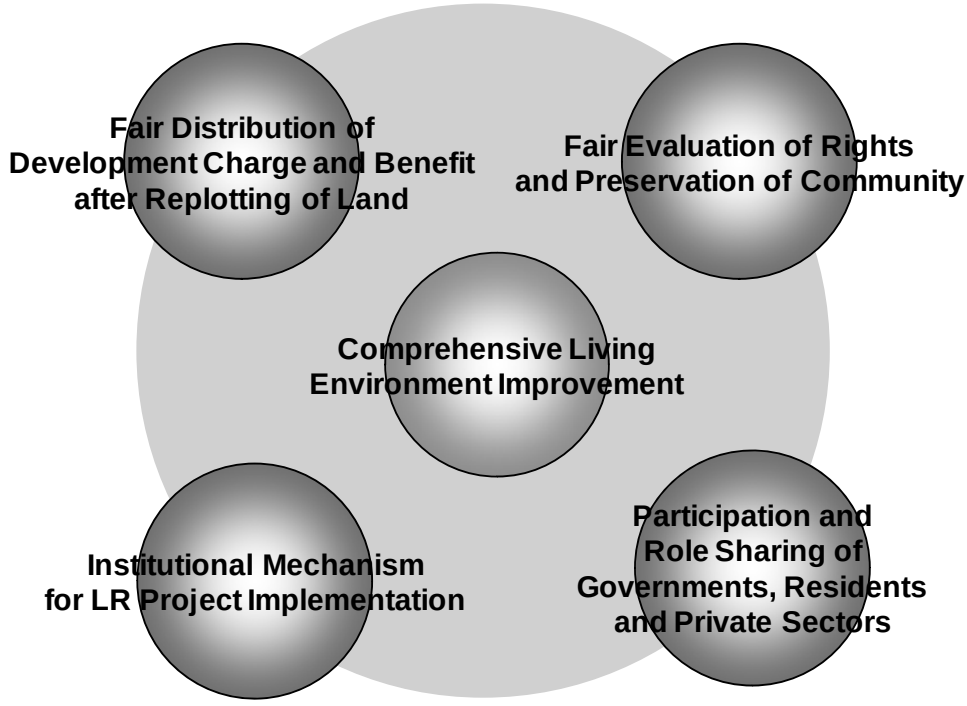
In the opposite direction of an individual urban development project where developers purchase whole lands, or housing development project of whole area, land readjustment has unique characteristics as follows (see Figure 9.4.4):

i) Comprehensive urban development method: land readjustment is a versatile and flexible method which can be applied to any project's scale and objectives such as small block for housing development, industrial park development, new town development, redevelopment of existing residential area, etc.

ii) Fair Distribution of Development Charge and Development Benefit: Although land readjustment requires landowners to contribute a part of their land, such contribution is considered as a type of development charge. However, in return they will enjoy a larger development benefit. A mathematical mechanism involving valuation in the design of replot ensures that development benefit and development charge are distributed fairly among the landowners.

iii) Preservation of community and lifestyle: Land readjustment can benefit such residents because the system does not require the landowners to surrender their land entirely. They can still continue to live with their community members in the project area if they agree to contribute a portion of their land for the land readjustment project.

Figure 9.4.4 Characteristics of Land Readjustment Project



Source: JICA Study Team

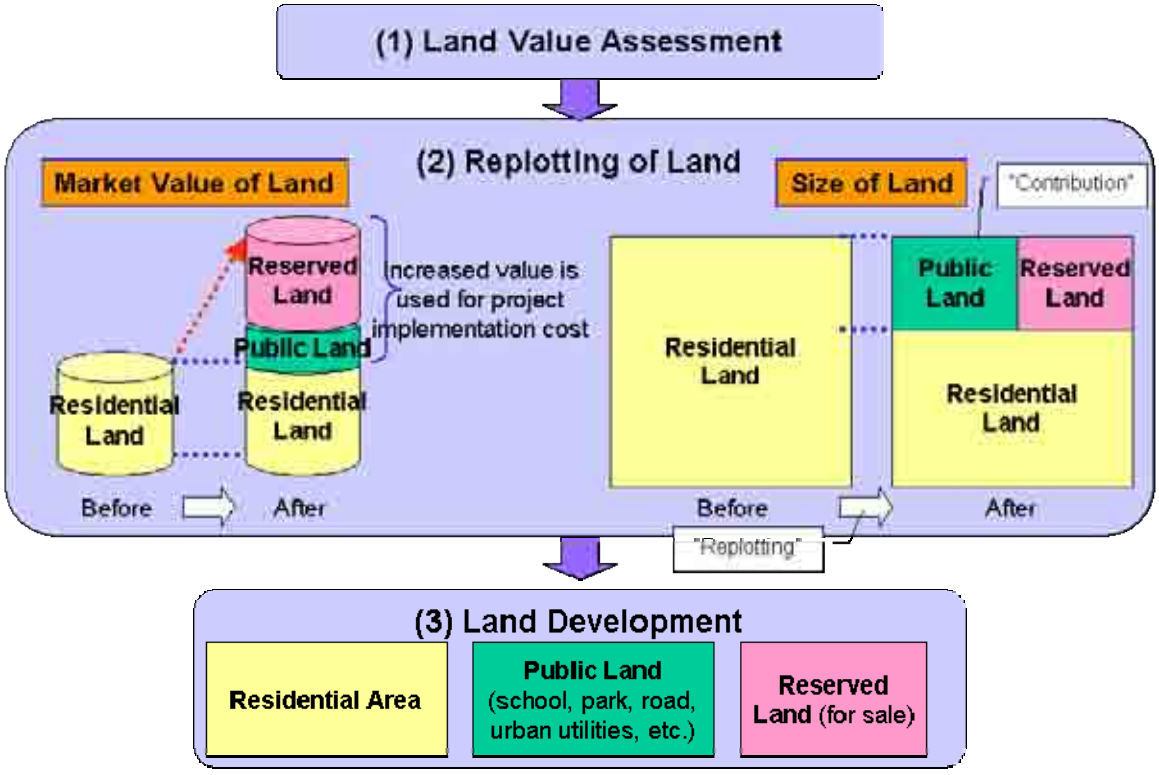
The basic approaches of LR are shown in Figure 9.4.5. In the LR process, major concepts of land readjustment are: (i) replotting ("*Kanchi*" in Japanese), (ii) contribution ("*Genbu*"), and (iii) reserved land ("*Horyuchi*").

(i) Replotting: Replotting design is an essential tool in land readjustment. It results in newly designed lots after a project has been developed. Every lot in a project area is designed as a replot. Even though the replot may have different shape, size and location compared to the original lot, all rights of the original lot are transferred to the replot, that is, each landowner is given a replot based on his original lot. In general, a replot fetches a higher value than the original lot, even though the size of the replot may be reduced.

(ii) Contribution: Original meaning of "*Genbu*" in Japan is "to reduce land". Every landowner in a project area has to contribute part of his land towards the provision of infrastructure, amenities and financial land. However, even though a landowner has to contribute part of his land, he benefits in terms of increased land value (see Figure 9.4.5).

(iii) Reserved Land: Before the introduction of financial land, every landowner has to pay his share of the project cost with cash. Some poor landowners could not pay. Therefore, a financing system was developed whereby instead of cash each landowner contributes a proportionate area of his land for the purpose of offsetting the implementation cost. The land which land owners contribute towards the project is called financial land. There are two (2) types of contribution: contribution for public land is called public contribution and contribution for financial resource is called financial contribution.

Figure 9.4.5 Basic Concepts and Approaches of Land Readjustment Project



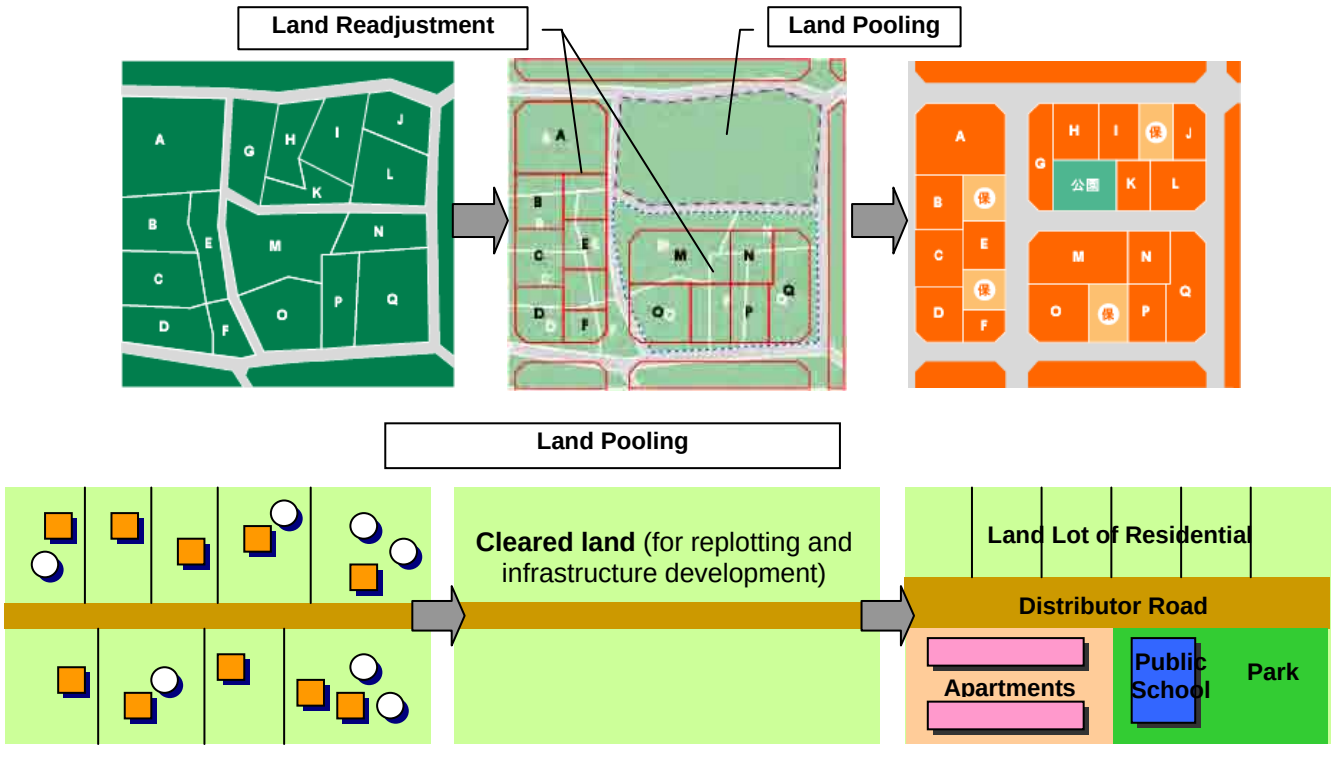
Source: JICA Study Team

As mentioned, “Land Readjustment” is a general project method to replot land lots and develop infrastructure and public facilities. In general, especially in Japan, original land shapes are mostly reserved while necessary partial land for road and public facilities are contributed. Land and asset assessment should be done in a detailed and accurate manner; accordingly it often needs to go through a complicated and time-consuming process.

Among the various implementation mechanisms of a land readjustment project, **“Land Pooling (LP)”** is a simple process which will be applicable in Ger area (see Figure 9.4.6). The process is as follows: 1) all stakeholders reach a consensus on land pooling for land readjustment, 2) the land plots are readjusted for securing public lands, providing infrastructure and utilities, and 3) the residents move back to the newly plotted land. Reserved land can be used for the public purpose, for sale, etc. Participation and consensus building of residents is indispensable to implement this land pooling system.

In this context, Land Pooling can be applied to remote Ger areas in Ulaanbaatar, because: (i) land lots are large and scattered despite of most of them are unused, (ii) land values are not high comparing to central apartment areas, and (iii) it is necessary to develop infrastructure and urban utilities in a comprehensive manner, rather than develop each facility separately. Comparison with merit and demerit between LR and LP are summarized in Table 9.4.5.

Figure 9.4.6 Process of Land Adjustment Project and Land Pooling Project



Source: JICA Study Team

Table 9.4.5 Comparison between LR and LP

		Land Readjustment	Land Pooling
Physical condition	Land	After land value assessment, reserve original land shape as much as possible, while necessary land lots are contributed.	After land value assessment, all residents move to other land temporarily and lands are cleared
	Building	Reserve existing buildings much as possible (including move to nearby temporarily)	After asset value assessment, demolish or move to other areas
Character-istics	Advantage	To reserve original land and assets as much as possible	To achieve comprehensive land and infrastructure development as planned
	Disadvantage	Difficult to acquire public lands and preserved lands on a large scale	Need to acquire temporary settlement areas

Source: JICA Study Team

6) Land and Housing Value Assessment System

To apply Land Readjustment (including Land Pooling) Project in Ger area, issues to be addressed are: i) how to assess land and asset value, ii) how to involve the public sector, and iii) who to implement the project. Not only for LR project, but also for any urban development projects in UB at present, the first and largest difficulty is land and housing value assessment which all stakeholders especially residents can agree with. To accelerate these urban development projects including LR, it is necessary to establish a legal asset value assessment system in UB City.

However in reality, market land value assessment is not stable, and public land value is not realistic. Present land value assessment by both market price and public price is not an objective rating system, so it takes long time for negotiation and consensus building. At this moment, UB City staff visit to individual households one by one to negotiate and ask proposed price from them, without any standards or measures for land value assessment. For example, because of this improper land value assessment system, developers negotiate directly with residents and acquire lands and housings at a price named in most of Ger area redevelopment projects such as 14th Khoroolol, 7th Khoroolol, etc. Common understanding and agreement among community is lacking, so social and economic inequality results.

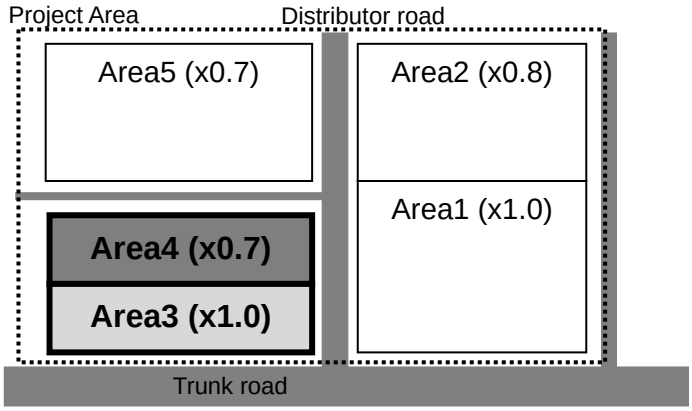
In this context, it is proposed to establish **"Weighting and Rating System for Land and Asset Value Assessment"** especially for Ger area improvement projects with community participation. This system has three steps: 1) weighting of land value by relative value assessment in the project area, 2) rating of each land value with score, 3) rating of each asset value with score (see Figure 9.4.7). In sum, characteristics of this system are:

- To establish land and asset value assessment committee including experts, lawyers, land management department of UB City, representative of residents.
- To define assessment indicators with clear common standards.
- To establish relative assessment system in each project area for consensus building among relevant stakeholders, especially land and asset owners in the area.

Figure 9.4.7 Weighting and Rating System for Land and Asset Valuation

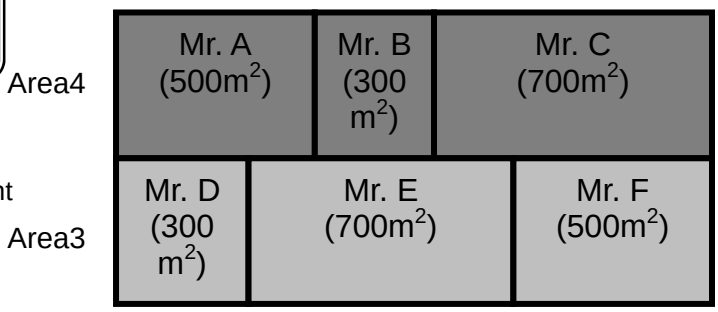
STEP 1: Weighting of land value relative to other land values in the project area

- Categorize homogeneous land lots for relative land value assessment
- Give advantage to land lots in front of trunk road or intersection
- Define weighting by each land lot (1.0 is the maximum)



STEP 2: Rating of each land value with scores

- Allocate score to each land of households by multiplying weighting and share of present land area



STEP 3: Assessment of Value

- Define indicators for housing and other asset assessment among stakeholders
- Define rank (weighting) of indicators, and score/ point for each indicator (Maximum points of rank: A=20, B=10, C=5)

Indicator		Rank	Scoring (example)			
			20	10	5	0
House	Structure	A	Detached with hard structure	Wooden house	Ger	
	Floor area	A	More than 200m2	100m2-200m2	Less than 100m2	
	Construction year	B		Less than 1 year	1-3 years	Older than 3 years
	Toilet	C			Flush / with septic tank	Pit latrine/ none
	Water supply	C			Running water/ well	Kiosk
	Electricity	C			Connected	None
	Heating	C			Electricity / improved stove	Coal stove
	Car parking lot	C			Owned	None
Others	Business right (annual turnover)	A	More than 10,000$	5,000$-10,000$	Less than 5,000$	
	Special consideration	C			(add points)	
Total (maximum score)		100				

Source: JICA Study Team

Table 9.4.6 shows a case study of this system. Although Mr. A and Mr. F have lands of the same size, the score of Mr. A is higher than of Mr. F, since the land value of Mr. A, who lives in front of the trunk road, is higher. In the asset value assessment, the score is very different because of housing structure, business rights, etc.

Table 9.4.6 Case Study on Weighting and Rating System

Indicator			Rank	Mr. A		Mr. F	
Land	Location	Score		Area 4	52	Area 3	74
	Area			500m2		500m2	
Asset	Structure*1		A	Detached (brick) 1	20	Ger 1, wooden 1	10
	Floor Area*2		A	150m2	10	25 + 50=75m2	5
	Construction year		B	2006	10	1995	0
	Toilet		C	with septic tank	5	Pit latrine	0
	Water supply		C	Kiosk	0	Kiosk	0
	Electricity		C	Connected	5	Connected	5
	Heating		C	Pechka (coal)	0	Coal stove	0
	Car parking		C	Owned	5	None	0
	Business right (annual turnover)		A / B	Grocery shop (7,000$/yr)	10	None	0
	Sub-total				65		20
Total (maximum 200) *3					117		94

*1 Use the score of 1 structure with higher score.
*2 Total of all housing structures.
*3 Total scores of land and asset.
Source: JICA Study Team

After the land and asset assessment, these scores need to be used for the land replotting process. Table 9.4.7 shows the process of land replotting after the project. The total scores of the project area are equal to 100% of developed residential land (684 points = 100% in this table). During the process of land readjustment, public lands and reserved lands need to be contributed for project implementation. After “contribution” of LR project, the rest of the land can be used for residential land (in this case, 2100 m^2 is for residential land, 300 m^2 is for public land and 600 m^2 is for reserved land). Then, after “replotting” process, total residential lands of 2100 m^2 are reallocated to all households.

It is found that although most of the households need to reduce the original size of land, some households who have a high score, because of good location and valuable assets, can secure their original or larger size of land (ex. Mr. D in this case study). After this replotting process, residents can resister the replotted land, or sell land to others.

Advantages of this proposed assessment are: (i) residents can participate in assessment process, (ii) stakeholders can define indicators and scores by themselves in a simple process, and (iii) values are defined as a score at the end so the assessment process is relative and flexible.

Table 9.4.7 Case Study on Land Replotting Process by Score

	Present Land Area (m2)	Score			%	Replotted Land Area (m2)
		Land	Asset*	Total		
Mr. A	500	52	65	117	17.1%	359
Mr. B	300	30	40	70	10.2%	214
Mr. C	700	70	55	125	18.3%	384
Mr. D	300	43	65	108	15.8%	332
Mr. E	700	100	70	170	24.5%	515
Mr. F	500	74	20	94	13.7%	289
Residential Land	3,000	-	-	684	100.0%	2,100
Public Land	0				10% of total land	300
Reserved Land	0				20% of total land	600

Source: JICA Study Team

7) Measures for Housing Development of LR project

In general, Land Readjustment project covers only development of public facilities, infrastructure, etc. Housing development needs to be implemented in a different project. Developers can get profits by constructing and selling apartments on reserved land. Although some of these apartments can be sold to original residents, most of the original residents need to develop new houses by themselves. The main measure to develop private houses for original residents is to sell some part of land lots to others and obtain cash for housing construction (see Table 9.4.8). In this context, it is necessary to consider appropriate measures for housing development which can be integrated with LR. For example, subsidy system and low-interest loan system for housing development under LR project is an incentive for residents to participate in LR project.

Table 9.4.8 Measures for Housing Development with/ after LR Project

	Detached house		Apartment / Town house	Move out
Land	Replot to land for detached house		Replot to land for apartment / town house	Compensation of land and asset
House	Original house	Relocation	New apartment/ town house	
	Compensation for Khassha/ wall	Compensation for housing relocation	Generate construction cost by selling replotted land*	
Issues	Replot the original land	Need to move out temporarily	Need self-finance if sales of land is not enough to cover construction cost Need to institutional system for technical and financial support for planning and design	Need to secure resettlement land (offered by UB City)

* see the box below
Source: JICA Study Team

Box: Construction of apartment by selling replotted land

Example: "you have land 490 m^2 after LR project (30% contribution from original land of 700 m^2)."

Condition of apartment: Construction cost is 400$/$m^2$, floor area is 75 m2/HH (including 15 m^2 of common space), management cost is 25% of construction cost. → (400+400x25%) x 75 = 37,500$/HH

Land price after LR project = construction cost of apartment / replotted land area = 37,500 / 490 = 77$/$m^2$

→ If land price after LR project is cheaper than 77$/$m^2$, you need self-finance or subsidy for construction.

9.5 Proposed Detailed Plans of Model Ger Areas in Unur and Dambadarjaa

1) Overview

Objectives: Projects for detailed plans of model Ger areas in Unur and Dambadarjaa aim to propose planning measures and institutional mechanism which are proposed in UB Master Plan Study, and verify feasibility and applicability, with community participatory approach.

- **Verify proposals in Master Plan:** Proposed project implementation mechanism (for example: urban redevelopment project, land readjustment project) as well as institutional mechanism shall be applied to the model areas.

- **Establish the feasible process from planning to implementation:** The whole process involving current situation analysis, development of plans with implementation measures, participation and coordination of stakeholders shall be demonstrated to replicate for other areas.

- **Raise awareness and motivate willingness for improvement:** Through dialogues with stakeholders, especially residents, they shall become aware of improvement of living conditions and create opportunities for community-based activities.

As already proposed in this Chapter, applicability of (a) “Neighborhood Area Development Plan” system and (b) “Land Readjustment” project need to be further elaborated. To develop detailed plans which are complied in line with proposed Master Plan as well as willingness and consensus of residents and stakeholders, the Study Team conducted a series of meetings and discussions, made plans and drawings, and held discussions with related stakeholders including district, Khoroo governments and residents.

Outcomes: In the planning and discussion process with stakeholders, major outcomes described below could be achieved.

(a) Sharing future development vision: To develop future vision which describe ideal living condition and lifestyle of residents, and share with relevant stakeholders such as local, City and Central governments need to be in line with UB City Master Plan. The proposed plan is designated as “Neighborhood Area Development Plan (NADEP)” under hierarchical urban planning system and legally approved, which residents monitor its implementation process.

(b) Proposal on appropriate infrastructure and housing development: Major urban facilities (for example trunk road, central infrastructure facility and pipeline, etc.) are developed by Central or City governments, while district facilities inside of residential areas need to be developed by the private sector or communities. These local facilities are developed by self-finance and also by subsidy or benefit costs of project. It is necessary to establish an appropriate institutional mechanism for project implementation. In case of remote Ger areas which are far from central network coverage area, “local cluster infrastructure network system” is proposed in Dambadarjaa. Land Readjustment and Land Pooling system were proposed and its feasibility evaluated. In general, most of residents who participated in meetings were afraid of and preferred not to reduce the size of land and

move out. Although the basic concept and approaches are understandable, implementation measures including land assessment and replotting need to be further discussed. In addition, since LR project doesn't cover housing development, the method to integrated with LR project and housing development project is concern of residents.

(c) Proposal on necessary institutional and financial mechanism: To achieve future vision and implement the proposed plan and project, necessary institutional systems such as urban facility, development contribution, community fund, etc. are proposed.

(d) Participatory process toward consensus building and feasibility: NADEP itself is a participatory planning process, and LR project needs consensus building among land owners. Establishment of residential cooperative and committee with relevant stakeholders is proposed to share clear roles and responsibilities. For participatory planning and implementation process, capacity development of these organizations and UB City governments are indispensable.

2) Selection Process of Model Areas

To tackle urban development issues with local characteristics and to verify the proposed project implementation mechanisms, locations of five candidate model areas were classified as belonging to one of the following areas for the purpose of setting out verification tasks:

Central Business District (CBD): to verify urban redevelopment project and its implementation mechanism (for example: rolling system)

Central Ger area: to verify urban redevelopment project and its institutional mechanism (for example: compensation of resettlement, charge for development by developers)

Middle Ger area: to verify land readjustment project and its institutional mechanism (for example: compensation of resettlement, land pooling system)

Peri-urban (remote) Ger area: to verify guided land development law and its implementation system (for example: establishment of authorized CBO/cooperatives for project implementation and management)

Based upon these proposed classifications of areas and applied legal and institutional system, JICA Study Team consulted with relevant stakeholders such as MCUD, Department of Construction and Urban Planning of Ulaanbaatar City, UPRDI, Urban Development Resource Center (UDRC, local NGO) and experts. After consultation and consideration of their intentions, five model areas were selected and planning orientations were developed (see Table 9.5.1 and Figure 9.5.1). Finally, participatory planning approach was applied to Unur and Dambadarjaa.

Table 9.5.1 Present Condition and Planning Orientations of Model Areas

Model Area (District and Khoroo)	Area (ha)	Density (persons/ha)	Present Condition and Related Plans/ Projects	Planning Orientation
CBD (Chingeltei 1)	13.8	337	Central built-up areas with mid-rise apartments and inner courtyard. Commercial and business functions are still low. Urban redevelopment plan has been proposed by Mongolian Urban Development Institute (MUDI).	Based upon proposed plan, implementation mechanism for urban redevelopment project (rebuilding of apartments and commercial buildings, cost recovery system, etc.) will be proposed.
7th Khoroolol (Sukhbaatar 9, 11)	125.2	188	Detailed plan was approved as phase 1 of "40,000 Housing Unit Program" (12,000 HH, 210 ha). UB City negotiates 3,000 HH individually without any conditions of resettlement or land value exchange.	Based upon approved Detailed Plan, implementation mechanism including land value assessment, condition of right conversion, development cost recovery will be proposed.
Unur Ger area (Songinokhairkhan 12, 13, 14, 15, 17)	353	-	Unur-B area is designated as Phase 2 of "40,000 Housing Unit Program", and planning of apartment and commercial area is ongoing. New trunk road development (east - west) is planned. This area is near to the station of proposed MRT. There are no public services and facilities in Ger area of Unur. The terrain is hilly with ravine.	A conceptual zoning plan of whole Unur area development will be formulated including apartment area development, road development and Ger area improvement. In the selected pilot project area (app. 10 ha), land readjustment project by land pooling system will be proposed.
Chingeltei (Chingeltei 17, 18)	38.4	70	Toward the Chingeltei Bus Terminal, Gers and simple houses are settled and expanded in hilly areas to northern direction. Water kiosks are developed by USIP of WB.	Resettlement issue from prohibited settlement area will be proposed (for example: current status of settlement, preferable condition for resettlement, proposal on affordable houses)..
Dambadarjaa (Sukhbaatar 17)	109.3	76	Dambadarjaa Temple is the most historical temple in UB City. Land are mostly privatized and settled in surrounding area. This area is the pilot project area of USIP-2 of WB to install water supply and sewerage pipelines and kiosks.	Conceptual zoning plan of whole 17th Khoroo will be formulated based on the concept of "Neighborhood Residential Unit" planning.

Source: JICA Study Team

Figure 9.5.1 Photos of Model Areas

CBD (1st Khoroo of Chingeltei)	 Inner courtyard as community space	 Greenery and pedestrian space	 Un-unified height of apartments
7th Khoroolol	 Ineffective landuse near central area	 Clustered Gers and simple houses on unleveled land	 Unclean and unused Water reservoir
Unur	 Long distance to central area	 Scattered Gers on hilly terrain	 Slippery access to Water kiosk
Chingeltei	 Ger areas expanding to hilly area	 Ger areas next to riverbed where settlement is prohibited	 Densification with simple houses
Dambadarjaa	 Densification with simple houses	 Gers expanding to north	 Openspace next to water kiosk as children's' playground

Source: JICA Study Team

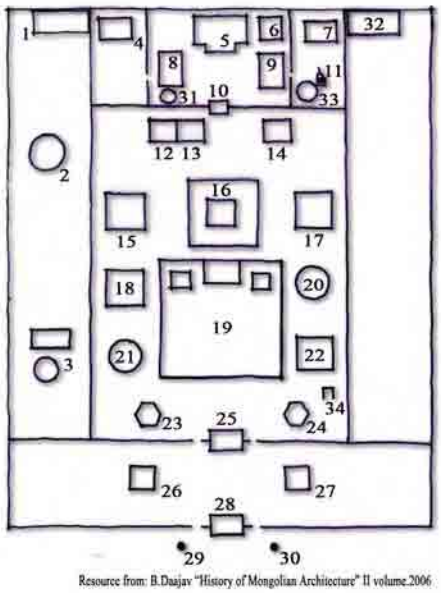
3) Present Conditions of Dambadarjaa Ger Area

(a) Historical Background

Ger area of Dambadarjaa selected by the research team is administratively a territory of 17 Khoroo, Sukhbaatar district occupying 93 ha of land in total. This Khoroo is located in the northern part of Ulaanbaatar city and has population of about 7000, 933 fenced areas, 1500 households, 55 streets, and 8 parts. Located 8 km from the city center, this Khoroo was created in 2007 by separating from 15th Khoroo located to the south from the road. 60% of the population is youth, 30% are children of school age. The reason why it is called Dambadarjaa is because of the temple located in this territory.

Dambadarjaa temple was a place of worship and enlightenment built for Bogd II and the construction work for this temple was finished in 1765 at this area called Altan tevsh (Golden manger). The temple refers to a place of worship and enlightenment in an isolated area and historically it was isolated for long time (see Figure 9.5.2). Since 1940s Ulaanbaatar urbanization progressed rapidly and the city started expanding to the north.

Figure 9.5.2 Dambadarjaa Temple



Resource from: B.Daajav "History of Mongolian Architecture" II volume.2006


Dambadarjaa Temple and Bogd Zonkhov Mountain

№	Name of the temples	Condition
1	Jas	destroyed
2	Jas	removed
3	Jas	removed
4	Sum	
5	Laviran	
6	Duinhor	removed
7	Sum	destroyed
8	West	
9	East	
10	Gate	
11	Suvraga	removed
12	III Bogd	-
13	II Bogd	-
14	IY Bogd	removed
15	Guremuud	removed
16	Zuu sum	removed
17	Jud	removed
18	Tsanid	removed
19	Tsogchin temple	
20	Jud datsan	removed
21	Tsanid datsan	removed
22	Mamba datsan	removed
23	Tuuhiin sum	
24	Tuuhiin sum	
25	Maharanzyn sum	removed
26	Hengeregiin sum	removed
27	Harangyn sum	removed
28	Haalgan sum	
29	Chiga	removed
30	Chiga	removed
31	Ger	removed
32	Storage	destroyed
33	Ger	removed
34	Bureen stair	removed

Source: JICA Study Team

(b) Issues

Since 1990s people started building fences and settling in areas near Dambadarjaa temple which was located outside the city and once pensioners and seniors started coming here in search of better air and clean environment local population grew. Dambadarjaa Ger area settlements were done without any planning or policy as with other Ger areas which is a common practice. First settlements were mostly clustered near the road but subsequently settlements grew and occupied the whole territory expanding to wetlands near the river which were divided into wooden fenced areas. There are many streets without outlet to the main road in this Ger area because of the disorganized land acquisition; this limits unimpeded access of ambulance and firefighting vehicles (see Figure 9.5.4).

Also it lacks public service buildings, and there are no schools, kindergartens and communal service facilities. Therefore, children of school age go to the secondary school located in 15th Khoroo which is far away and crowded in terms of enrolled students per class. In addition, migrants from rural areas move into nearby summerhouses and send their children to this school, increasing the school workload and negatively influencing the quality of training. Few small private shops operating here do not meet sanitary requirements. As there are no big service markets or supermarkets nearby so people tend to go to the city center or other big markets for more choice and lower prices; however, this consumes much of their time.

Last year, a clinic for people was newly built and opened. Khoroo's administration building is also being built but is not finished yet. It is too isolated and not in a central location. The present Khoroo administration is located at the center of the settlement and on a pedestrian road which is a location accessible by most people. But the new building is located to the northeast of the settlement which is not appropriate. Public transportation does not go through Khoroo and as the territory stretches from south to north and households at the northern part are 1.7 km from the bus station.

(c) Roads and open space

In terms of infrastructure there is no other road besides the paved road which goes along the southern part of the Khoroo; all other roads are not paved. UB City Government plans to expand and extend the road in the east, which accesses the Japanese Cemetery, into four (4) lanes and provide connection to the summer house area in north.

Of 97.2ha of total land area, 66.4ha of the settlement area is composed of individual land lots fenced by private fences (called "khassha")[3], 4.5ha is Dambadarjaa Temple, and remaining land is for auto and pedestrian traffic. Some streets are too narrow which restrict pedestrians to move with vehicles and put them in potential danger. There are few households that grow berry trees and bushes on their properties.

Population density of this Khoroo is 72person/ha and buildings (mostly Ger and simple houses) occupy 12.0ha land[4]. There are no specially designated open spaces, parks or gardens and non fenced areas are well trampled, becoming incapable of growing plants. Dambadarjaa temple is surrounded by cement fence with much unused space. Since

[3] KCR (Khassha Coverage Ratio) = Land plot area surrounded by khassha / Total land area = 66.4ha / 97.2ha = 68.3%. This does not include the khassha lot of Dambadarjaa Temple.
[4] BCR = Total building area / Total land area = 12.0ha / 97.2ha = 12.3%

residents do not have gardens or parks, so some trees within the fence were cut to secure areas for children to play. The capital city urban planning department is studying the feasibility of building a paved road to the east of 17th Khoroo.

Although most residents privatized their lands, only about 10% of them are listed in Property list. This is because people think that listing in the property list means paying land fees they are reluctant about this issue.

(d) Infrastructure and Urban Utilities

The whole territory of the Khoroo is connected to electricity network but as it is located far from the central infrastructure so there are no connections to heating system, clean water or sewage distribution network. Khoroo administration, clinic and firefighter buildings are heated by their own small low-pressure furnaces. The main building of Dambadarjaa temple had its own furnace when it was used for hospital before 1990s, but it is not operating now. Few households use low-pressure furnaces and most use ordinary furnaces that burn coal.

This Ger area has only four (4) water kiosks to supply transported water for residents on 90 ha land which is not sufficient. People go for quite a distance to obtain water for their daily needs and water supply of these water kiosks is irregular. World Bank project II on improving UB public utility service launched a project on water provision to the Dambadarjaa Ger area and it is planned to provide water to water kiosks and link a few households to water distribution network. Currently the project design work is being completed and implementation had just started. (see Figure 9.5.4). Launching a project on clean water distribution within the project to improve public utility services will help to regularize the provision of water to water kiosks.

Service organizations collect and dispose of solid waste each week. In some cases delay in this service leads residents to dispose waste in open areas.

There are four (4) water kiosks with transported water within the Khoroo, and most of them are located in the south. Some households living in the northern part have to go 700-850 m to get their water.

(e) Architecture and urbanization

The most significant building on the territory of the area under the research is Dambadarjaa temple. This temple used to consist of several buildings surrounded by walls where 1200 lamas from four (4) aimags would come and study in the beginning of 19th century. (D.Maidar. Mongolian architecture and urban development. p66, UB1972).

Dambadarjaa temple was taken under state protection several times: in 1971 by Resolution No.420 of the Ministers' Council of Republic of Mongolia and in 1998 by Resolution No.235 of December 23, 1998 of the Government of Mongolia. Although it is under state protection, the condition of the temple buildings is poor. The main temple building was used for other purposes and its design was changed to European, which remains until today and completely changes the appearance of the temple. Unused wooden structures now have deteriorated and are ready to collapse. There are few temple buildings used within the temple fence and there are some which have collapsed. Although the temple has enough space within its fence its utilization is low, limited to pedestrian traffic through eastern and western gates. In the evening, the fence gates are locked so the temple is not used for public purposes. Household fences in front and left of the temple fence limit temple visual

space and access to its gates.

Households living on the researched area have been there for almost 20 years and most of them have built better dwellings with wood and cement covering. Also there are people who got loans in the beginning of 1990s who built themselves 2-storey brick houses. Households, newly settled in the northern part, live in Gers. Self-built houses are more comfortable and warmer than Mongolian Gers but because people built them on their own without professional advice, much heat is lost during winter times through walls, ceilings and windows. Because electricity savings and building envelope are not made well during construction work, a large fire is needed to keep the home warm. This, of course, produces significant amounts of smoke and contributes to air pollution.

Most houses, about 70-80% are one-story buildings with wooden structure and cement covering from inside and outside. Streets mostly stretch from right to left and most of houses face the south. Households living along the central road have relatively small (300-400 m2) Khasshas whereas households living in the northern part of the Khoroo have 700 m2 or even larger Khasshas.

As for building utilization, 95% are for accommodation, the rest are for combined accommodation and services.

(f) Social and economic situation

There are no buildings to be used for social events, for example, large trade and service centers, arts and cultural places. Partnerships and savings groups are not in operation and though groups of tents were formed they are not functional and exist in the name only. As households obtained private property ownership, they started opening small shops and there are about forty (40) small grocery shops. This Khoroo has many pensioners living there whose household income is low, purchasing power weak and livelihood level generally low. Few households grow berries, potatoes and other vegetables to increase their income.

(g) Environment

The territory researched stretches from south to north for about 1.8 km. The Selbe River is on one side and Bogd Zonkhov Mountain on the other, reaching 0.8 km at its widest. Prolonged living in the area led to destruction and trampling of soil surface and the ground is not capable of growing any vegetation. Also because of lack of integrated sewage system, outhouses were used for many years leading to increased contamination of ground water. The Selbe River runs at the right side of this Khoroo and there is a dam protecting it from flooding; this reduces flood risks. Doing washing in river water during the warm season is one of the reasons for surface water pollution. Also because of lack of paved roads, vehicles drive wherever they want on the banks of the rivers destroying the bank vegetation. There are no public greenhouses, parks or gardens in this area and few households grow trees on their fences. During cold season, households mostly use coal for fuel. Because the Khoroo is located in the northern part of the city from where the wind mostly blows, there is relatively little smoke and air is comparatively pure.

(h) State administration and public participation

Khoroo has eight (8) parts and a council of seniors. Public servants working there just act on decisions from above and lack creative activities for public benefit. Citizens of Khoroo are divided by their party affiliations which impedes organization of public measures.

There is no designated building for public events. Democratic party and Mongolian People's Revolutionary Party have their small buildings which are used for public events during elections. Also a Christian church has activities there and rent their meeting room. Because of the high rent fees, people cannot use the church building except during the church meeting times. Although there are people who want to join their efforts to improve their living environment, they lack unified management and differences of household economic capacity leads to weak public participation and involvement. Rooms of the Lions' Club building located on the 15th Khoroo territory are used for public events like training, meetings and conferences, but because the rooms are small, they cannot accommodate many people.

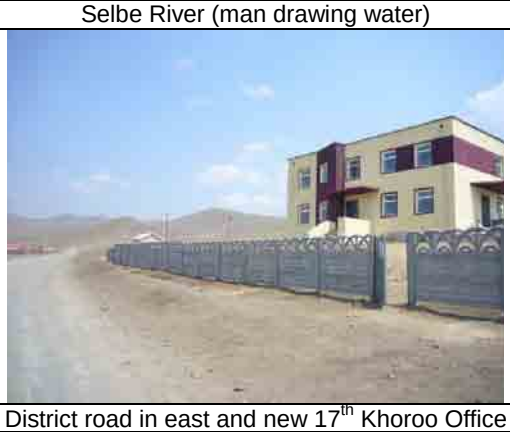
Figure 9.5.3 Photos of Dambadarjaa Ger Area

Dambadarjaa Ger Area expanding toward north

Water kiosk

Selbe River (man drawing water)

Unpaved road and khassha

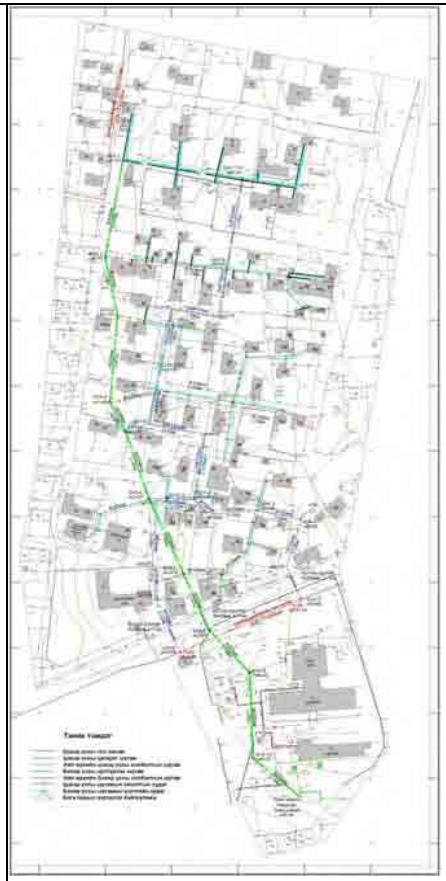


District road in east and new 17th Khoroo Office

Figure 9.5.4 Maps of Dambadarjaa Area

Problem Map described at residential meeting of Model Project

Water distribution network by WB-USIP2



Water distribution network by WB-USIP-2

Source: JICA Study Team

4) Opinions and Concerns of Dambadarjaa Area Residents

A series of residential meetings have been held at 17th Khoroo Office and CBO Office. Before starting to set a vision and do planning, residents discussed present living conditions, difficulties and issues, expected lifestyle and proposals to governments, etc. (see Table 9.5.2).

Table 9.5.2 Opinions of Residents in Dambadarjaa

Item	Opinion
Land	• Khoroo boundary is not clear and structure of administration unit is unsatisfactory. • Most of families have 0.03 ha land. In some case many families live in one Khashaa
Infrastructure	• Improvement of Roads and pedestrian ways (pavement and lightening) are urgent for travel and secure.
Public facility	• There are no social service buildings such as secondary school, kindergarten, etc.
Social condition	• Many low income people and single mothers live here.
General Proposals	• Project has to follow urban planning requirements and policy. • Some residents are interested to exchange a residence for land without additional payment. Some residents wouldn't move or live on land with vegetation. • Remove the Khashaas from the Dambadarjaa monastery outer wall through a regulation on cultural heritage to create public space on the south part of monastery and open it to the public. • To prohibit uncontrolled development and settlement, planning with community participation is significant to raise public awareness.

Source: JICA Study Team

5) Proposed Vision and Concept Plan

Proposed vision and concept plan were basically agreed on with participants of meetings, since this proposal reflected on their ideas and proposals, such as:

i) To preserve and rehabilitate Dambadarjaa area to revitalize a popular historical, cultural and tourism site for UB citizens.

ii) To preserve Selbe river and Bogd Zonkhov Mountain.

iii) To prohibit settlement in the riverbed for safety and environmental protection.

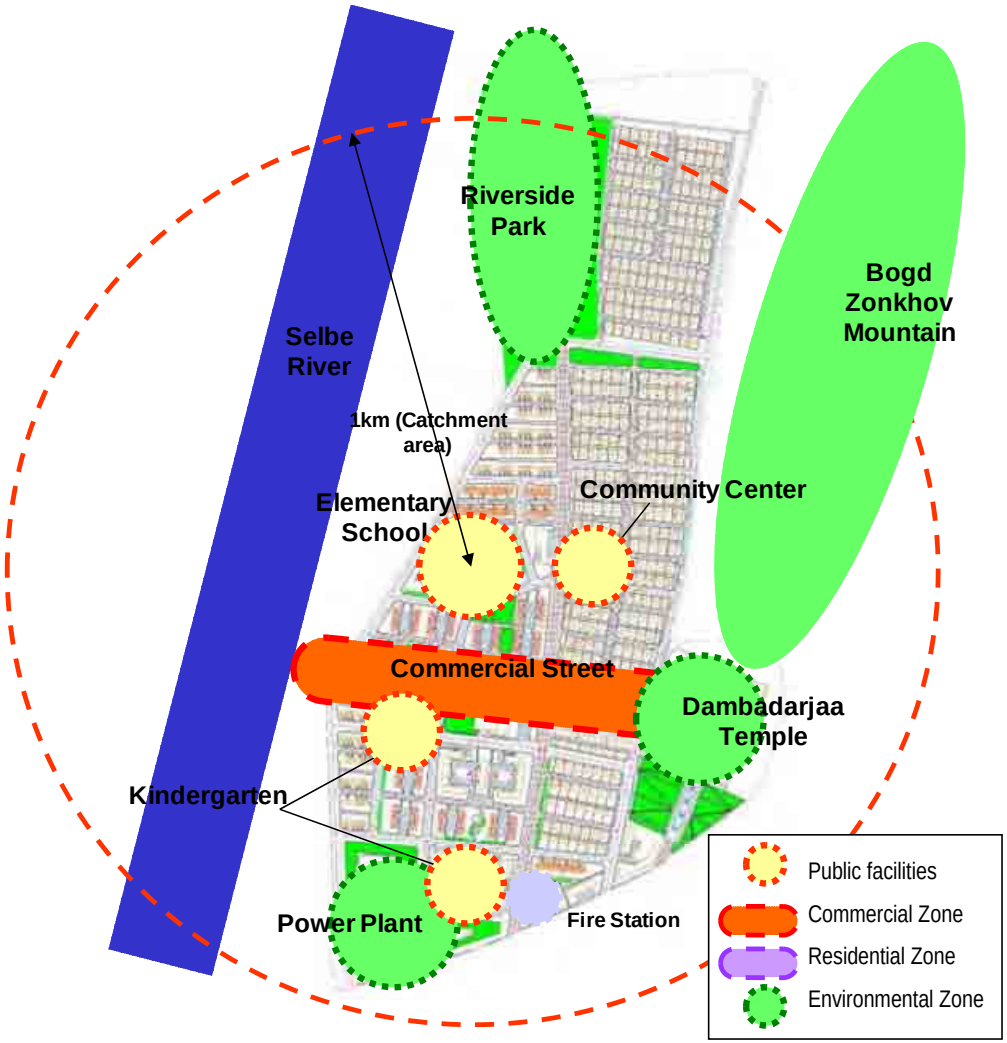
iv) To pay attention to the present lifestyle of residents including poor, elderly and jobless who enjoy growing vegetables, raising livestock, etc.

Since there are many old residents settled for many years, they are proud of this Dambadarjaa area. At the same time, they are very concerned about deterioration of natural and cultural environment. They don't expect drastic and dynamic change of living condition but they want to access necessary urban utilities such as water, sewerage, etc.

Taking into consideration these opinions and present conditions, the vision and concept plan of future Dambadarjaa was proposed as follows:

Vision: "Dambadarjaa area in future will be an ecological, historical and cultural friendly residential area where residents will manage community planning and living condition improvement by themselves."

Figure 9.5.5 Concept Plan of Dambadarjaa Area



Source: JICA Study Team

Table 9.5.3 Planning Elements of Dambadarjaa Area

Item			Present	Plan	Unit
Area	NADEP Planning Area		102		ha
	Project Area		102	109	ha
Population	Population of NADEP area		7,228		persons
	Population of project area		7,228	10,472	persons
Pop density			71	96	persons/ha
Housing	High-rise apartment (>6F)	No. of building	0	10	units
		No. of households	0	520	HH
	Mid-rise apartment (<5F)	No. of building	0	22	units
		No. of households	0	1,320	HH
	Townhouse	No. of building	0	20	units
		No. of households	0	240	HH
	Detached house	No. of building	-	81	units
		No. of households	19	81	HH
	Simple house (without infrastructure)	No. of building	-	0	units
		No. of households	1,139	0	HH
	Ger	No. of building	-	0	units
		No. of households	542	0	HH
Road	Major road	Total length	0	3,027	m
	District road	Total length	0	6,890	m
	Access road	Total length	0		m
Public facility	School	No. of school	0	1	units
		Capacity	0	1,660	students
	Kindergarten	No. of kindergarten	0	2	units
		Capacity	0	780	children
	Park	No. of park	0	5	units
		Area of park	0	15	ha

Source: JICA Study Team

6) Present Conditions of Unur Ger Area

(a) Historical Background

Unur Khoroolol is one of the largest sub-districts that are located in the western part of Ulaanbaatar city. The complexes including tall apartment buildings, trade and service, kindergartens, schools, and necessary constructions were planned & built in three block groupings and have been used since 1980s. Ger district, set in the northern part of Unur Khoroolol (1st sub-district) has been grown intensively for the past ten (10) years and informally it is called “Open Unur Khoroolol”.
”Open Unur Khoroolol” is divided into Khoroos 12th, 13th, 14th, 15th, 16th and 17th of Songinokhairkhan district. The survey covered the Ger district settlements of the 12th, 13th and the 14th Khoroos. Although the location is different (Ger districts are separated from the apartment buildings by roads), their administration is same.

(b) Urban planning

The Ger district is set on a plateau (higher than the area with apartment buildings) with undulating surface stretching over hills and coulee. Its soil, especially in the northern part, is rockier and usually it is top of the hill. Thus it is impossible to live on it. As a consequence of its location, most households who live in Ger districts can not directly access the main road. There is also a dike (between the areas with apartment buildings and Ger district) which is one of the barriers separating their locations.

There are many families settled with or without the certification of land in the survey area. This is one of the causes for not having a policy on land adjustment and urban planning as well.

The area does not have any industrial, service, cultural or public buildings. Social service are absent. However, Ger district has been expanding and settlement occupy the entire place that can be used.

(c) Roads and open areas

High-quality pavements of Unur Khoroolol are separated from the survey area by flood dike. Thus it is almost impossible to use these pavements directly but they can access them through some auxiliary roads.

Three (3) to four (4) years ago, a paved road started being built into the Ger district but little space to have roads and roughness of the surface made it impossible to continue the work. The streets are so narrow that the citizens cannot use public transport inside the Ger district. Therefore people have to walk for two (2) to three (3) km to utilize public transport. There are plenty of dead-end streets, and space inside the Ger district is insufficient to use transport. Except for the steep hills & coulee, there is no open area.

(d) Infrastructure

There is no centralized heating or waste & clean water systems linked to a central system. Some remote families don't have electricity. Service companies remove the solid waste but there is no place for the collected waste. Dike used to prevent the city from flooding continues for 1,510 m in the survey area.

There are 5 water kiosks but they are not sufficient for 800 families of three (3) Khoroos in the area. It is also a problem for some of the families, who live 800 m from the kiosks.

(e) Public service

In the Ger district, the only public services are small private shops and stalls. Facilities such as schools, kindergartens, governor house of the Khoroos and police are located across from the area. Consequently, people cannot access their elementary social service. In addition, ambulances don't come to this area because of inadequate & disorganized numbers/names of the streets/doors and numerous dead-end streets.

(f) Architecture and construction

Since the mid 1990s, a project on setting up a district with low-rise buildings was started in the 12th Khoroo, but issues on infrastructure were not reflected and solved during the project implementation. Only the lands were given out to the families and this could not become a real solution on buildings and land adjustment. For this reason, the new district gradually turned into a Ger district. Now the numbers of those low-rise buildings that have two stories and brick coatings occupy a few percent of the total buildings. The reason that the most households, settled in the survey area, live in Gers is relevant to the big movement from the countryside to the city during the past years. Due to lack of land and space in the northern part of the survey area, some families flattened the slopes of the mountains to build their Gers. The majority of the dwellings (60%) built in the area are wooden houses with clay coatings.

A project on building in the southern part of the Khoroos funded by the government will be implemented soon. The project will cover land, starting from the new 60-meter-wide magisterial, which will be built within the area of 12th, 13th, 14th, 15th, 16th and 17th Khoroos. To date, the general planning is progressing and Scheme of new Road is shown in the picture. The northern part of the magisterial, which is being built, will remain as a district with low-rise buildings in the future.

Social and economic development: The base of social communication is the population. However, there is no building designed for public activities such as culture house or building for arranging international fairs & trade. The only buildings used for the public service are small shops and stalls built by the citizens.

In the survey area, there are about twenty-three (23) small commercial stalls, but none of them meet the requirement of service standards. Some small industries (such as sewing, carpentry, auto service) are also run in the area as well.

(g) Environment

The Ger district is located in the north of Unur Khoroolol covering the entire terrace. The area of 12th, 13th and the 14th Khoroos, involved in the survey, is 1,540 m wide and 740 m long. There are large numbers of slopes, which are being used to dump litter. In cold seasons, coal is used to warm the houses. Thus the air is highly polluted, especially in the lower parts of the district (apartment building area) and this makes it difficult to breathe.

There's no roadway in the area. Therefore the soil is totally destroyed and it's impossible for the plants to grow. Also none of the households have grass or lawns in their yards.

To sum up, air pollution and soil contamination is high, the environment is retrogressing and living conditions in the settlement are inconvenient.

(h) State administration and public participation

In accordance with the administration division, building settlement and Ger district settlement are considered as the same Khoroo. All of the administration and social service offices are located in the building area. Therefore the Ger district can be taken as a whole as it is totally isolated from the society. Due to improper structure, indeterminate responsibility for the staff and lack of cadres, Khoroo is unable to work properly and provide services to reach each family. In order to improve livelihood of its households, Khoroo administration needs to work actively. It is still an important issue to reform the structure and divisions of the administration.

A non-governmental organization "New century" was established in the 13th Khoroo in order to improve the living conditions of the area. The organization incorporates over 2,000 households and organizes public activities. The main activities are occasions for receiving comments from the citizens & assigning them to the Khoroo, district, and city administration and accomplish actions to improve their living condition. However, they are not able to carry out large-scaled activities due to lack of office and financial problems. It would be effective to work with Khoroo citizens and these organizations, which know the terrain well, and help them to improve their skills.

Figure 9.5.6 Photos of Unur Ger Area

Unpaved road

Unpaved road in winter

Remote Ger area and ravine

Dumping site

Water kiosk halfway up a hill

Community park constructed by residents

Local NGO “New Century”

Problem Map

7) Opinions and Concerns of Unur Ger Area Residents

A series of residential meetings have been held at Local NGO "New Century" Office. Before starting to set a vision and do planning, residents discussed present living conditions, difficulties and issues, expected lifestyle and proposals, etc (see Table 9.5.4).

Table 9.5.4 Opinions of Residents in Unur Ger Area

Item	Opinion
Infrastructure	• New road has not been developed, so a planning proposal is not reliable. • Road improvement (pavement, street lighting) is very important for safety and accessibility • There are no public facilities in this Ger area • There are many ravines and floods threaten safety and life
Housing	• Most residents expect to move into apartments nearby. • If infrastructure is developed, they'd like to settle in this place.
Social condition	• Although there are many development plans by government, information is complicated and is not shared properly with Ger area residents • All public service and facilities are clustered in Unur A (apartment) area. • Educational and social environments need to be improved for children.
General Proposals	• Not only expecting and waiting for development by public agencies, but also the community can do something for themselves. • To prohibit uncontrolled development and settlement, planning with community participation is significant to raise public awareness

Source: JICA Study Team

8) Proposed Vision and Concept Plan

Proposed vision and concept plan were basically agreed on with participants of meetings, since this proposal reflected on their ideas and proposals, such as:

i) To take into consideration the future of children and provide proper education, safe and sanitary condition.

ii) To settle this area in a sustainable manner with appropriate infrastructure and urban services, public facilities and places for working, studying and playing.

iii) To gather individual and community power's to assist improving living conditions by themselves.

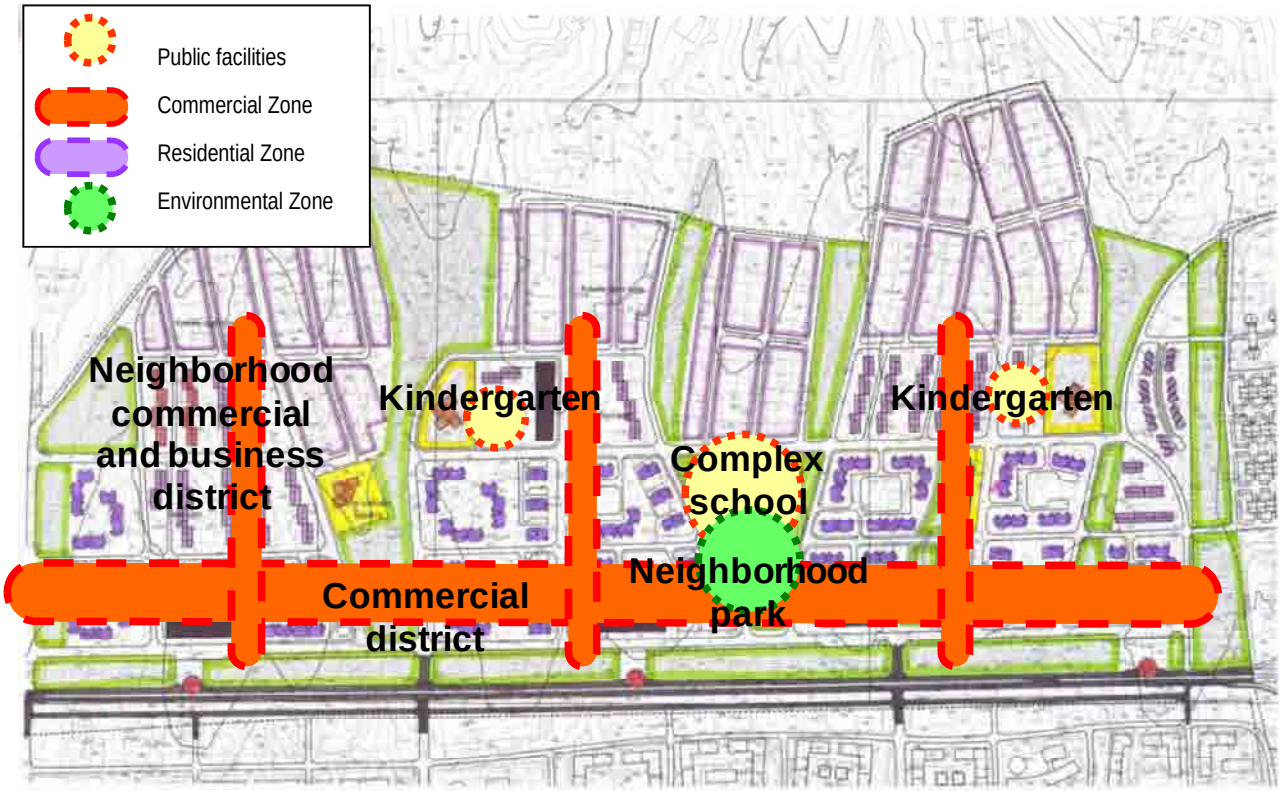
Unur Ger area is far from a trunk road, and there are no infrastructure and public facilities. In addition, and geographic feature make urban development difficult. There are six (6) ravines from north to south, which cause flooding accidents after heavy rain. Although the new trunk road has been planned in the Road Master Plan, implementation body has not been defined and many residents have settled in the planning area. In sum, both physical and institutional situations make this Unur area difficult for urban development.

On the other hand, since Unur Ger area is rather new compared to other Ger areas in UB City, many residents are young. Many residents are interested in living condition improvement and are willing to contribute ideas and labor. Social conditions are rather better than other Ger areas, and local NGO "New Century" has the capacity to facilitate activities with stakeholders.

Taking into consideration these opinions and present conditions, the vision and concept plan of future Unur area was proposed:

Vision: "Unur area in future will be comfortable and convenient residential area where residents will enjoy studying, working and playing in green areas and nature."

Figure 9.5.7 Concept Plan of Unur Area



Source: JICA Study Team

Table 9.5.5 Planning Elements of Unur Area

Item			Present	Plan	Unit
Area	NADEP Planning Area		226		ha
	Project Area			93	ha
Population	Population of NADEP area		12,366		persons
	Population of project area			13,600	persons
Pop density			55	145	persons/ha
Housing	High-rise apartment (>6F)	No. of building	0	0	units
		No. of households	0	0	HH
	Mid-rise apartment (<5F)	No. of building	0	123	units
		No. of households	0	2,148	HH
	Townhouse	No. of building	0	521	units
		No. of households	0	521	HH
	Detached house (with infrastructure)	No. of building	0	354	units
		No. of households	0	354	HH
	Simple house (without infrastructure)	No. of building	-	0	units
		No. of households	858	0	HH
	Ger	No. of building	-	0	units
		No. of households	1,633	0	HH
Road	Major road	Total length		6	km
	District road	Total length	3	6	km
	Access road	Total length	0	10	km
Public facility	School	No. of school	0	1	units
		Capacity	0	720	students
	Kindergarten	No. of kindergarten	0	2	units
		Capacity	0	660	children
	Park	No. of park	0	13	units
		Area of park	0	9	ha

Source: JICA Study Team

9) Discussion on Project Implementation Mechanism

As already explained in Section 9.4, the land and asset assessment and land readjustment project is a key mechanism of the proposed "Community-driven Implementation Mechanism". The Study Team explained and proposed these mechanisms, and discussed them with residents in meetings.

The major questions and opinions from residents, and answers from the Team are summarized below (see Table 9.5.6 for details).

- Most of residents insist on land ownership, size and settlement of present houses. They are afraid of resettlement or reduction of land, since land is a personal asset for them.
- Residents expect that the government will develop infrastructure and construct apartments, so they take a passive attitude.
- Residents understand the concepts of Land Readjustment and Land Pooling basically, but they couldn't understand or trust fully that land value would increase after the project. They expect to monitor LR pilot projects in other areas and apply solutions to their areas.
- Most of residents don't have the financial capacity to build new housing by themselves, so they would like housing development project to be integrated into LR project.
- Residents welcome participation in the planning process with governments, and expect to study urban planning system not only in theory but also in a practical manner.

Table 9.5.6 Questions and Answers on Project Implementation Mechanism

(1/3)

Category	Questions and Opinions	Unur	Damba -darjaa	Answers
Resettlement	Do we need to resettle to other places?	X		Keep to a minimum.
	If the area is designated to develop infrastructure must facilities, residents resettle?		X	Government will find a place for transfer.
Land	If we move to apartments, do we lose our land?	X		Apply for land-space exchange system.
	I own a building (150 m^2) including working space, and a land (700 m^2). Will these areas be reduced?	X		Yes, land area will be reduced. Building will remain whenever possible.
	How can we have land ownership together with common space?		X	By contribution or paying a settlement money.
	Why do residents who live far from project area need to contribute lands?		X	Land owners who will get a benefit from LR project need to share responsibility in an equal manner.
Land and asset assessment	How do we evaluate land and building of different sizes?		X	To set up a standard assessment point.
Responsibility and share of residents	How do we construct new houses? Are there any financial supports, or do we need to pay for it by ourselves?	X	X	Basically residents construct new houses in LR project. In some cases, exchange with land is possible.
	Do we owe any burdens/ debt after land pooling?	X		Basic responsibility is only land contribution.
	I understood the merit of LR is to generate public land, but the demerit is residents must owe cost for new housing construction. Are there any solutions not to owe any burdens?	X		Land-space exchange system is applicable with agreement among residents.

(2/3)

Category	Questions and Opinions	Unur	Damba -darjaa	Answers
Project implementation body and finance	Who will be a project implementation body?		X	Cooperative of land owners
	Who will pay/ invest for the initial project cost?	X	X	Debt loan
	I'm afraid that nobody may buy reserved land in Ger area.	X		Reserved land will be developed with infrastructure or building, and promote to private sector.
	I'm afraid sales of reserved land cannot cover whole project cost.	X		The project implementation plan is carefully planned for financial feasibility. If sales will not be enough, scale of project need to be reduced.
	Who will pay for construction cost of public infrastructure and facilities?		X	Urban facilities and infrastructure of trunk network is developed by government (MRTCUD or UB City).
Infrastructure and utility	Will infrastructure and utilities be developed in the LR project?	X		Yes. To develop infrastructure is one of main purposes of LR project.
	I think we can do other developments by ourselves if governments develop utilities.		X	Governments will develop trunk infrastructure, so residents should develop feeder network by themselves.
Housing	Can present houses be remain?		X	Yes, basically.
	What about residents who live new houses or large houses?		X	Basically, it is planned to remain.
	Young generations prefer to move to apartments, but elderly prefer to live in detached house.	X		The project plan will meet residents' needs and willingness.
	Many residents want to live in detached houses with gardens and car parking.		X	ditto
Employment	Can we continue home industry?	X		It is necessary to designate the area for home industry.
Planning process	Is it important to comply with city master plans?		X	Detailed plans should be complied with City Master Plan.
	The project with 10 households cannot contribute comprehensive living condition improvement for the whole area.	X		It is important to conduct a model project in a small scale to examine feasibility of other areas.
	We feel uneasy without specific visual image. Please show models and drawings.	X		We'll show video, CG, etc. for your understanding.
	Please understand our present situation (present house types and costs, family composition, income and job type, etc.) and propose the project in detail.	X		To achieve it, it is important to continue discussion and common understanding.
	Ger area in Unur has been expanding toward north. Can we live in apartments?	X		Land-apartment space exchange system is applicable.
	This project of JICA Study aims not only to implement the project but to develop a plan with residents. To achieve this objective, please show us the whole plans with visual tools for further understanding, and to explain responsibility of residents including finance.	X		Yes.

(3/3)

Category	Questions and Opinions	Unur	Damba -darjaa	Answers
Consensus building	If individual opinions are reflected to the project plan, the whole project plan will not be so integrated.	X		What it important is to understand the project implementation mechanism and make consensus building.
	We cannot rely on the project without guarantee/ approval of UB City.		X	The role sharing and consensus building between governments and residents are important.
	It is necessary to negotiate with each household.		X	To take a step-by-step approach is necessary.
	It is better to organize a residential meeting rather than to discuss with individual households.		X	At the beginning of LR project, organizing a residential meeting is necessary to share common information and understanding.
	I think residents will be able to understand and cooperate if the project is not planned only by UB City.		X	UB City is willing to discuss and share proposal of the project with residents.
	Since it will take time to explain and win the understanding from residents, so it is important that the proposed plan will be approved by the City Master Plan.		X	The NADEP plans of Unur and Dambadarjaa will be proposed in UBMPS, and it is hoped to be approved together with City Master Plan.
	To avoid arbitrary development by private developers which is not comply with the plan, It is better to discuss with not only UB City and residents, but also such developers.		X	The NADEP plans will be approved as an authorized city plan, which arbitrary development is legally prohibited.
Schedule	The proposed new trunk road in Unur proposed has not been developed for more than 20 years. I'm afraid this proposed plan will take long time to be implemented, too.	X		The proposed plans will be prioritized in UBMPS-2030.
	When will these proposed plans be implemented?		X	It depends on willingness and consensus building of residents, but the target is within 10 years.
Others	I misunderstood that JICA will implement this project, but now I understand that proposed plans should be implemented with our efforts in a sustainable manner.	X		With efforts and corporation of residents, JICA and UB City will be able to support technical aspects.
	Not only making a plan, but also measures and institutional mechanism to manage the plan is necessary.	X		A committee to manage urban planning of the area should be established.

Source: JICA Study Team

10) Conclusion and Next Steps

To establish "Community-driven planning mechanism", and to initiate sustainable efforts for implementation of plans and projects by stakeholders, it is necessary to accomplish the following tasks and issues (see Table 9.5.7). It is necessary to identify stakeholders and relevant agencies to facilitate and implement NADEP and urban development project (for example LR project) with financial and institutional feasibility, and these key stakeholders including community organizations, UB City and experts should cooperate to promote the proposed plans to other residents and to get approval of UB City as an authorized plan under the UBMPS-2030.

Residential meetings are a good opportunity for share opinions, build consensus and define role sharing (Figure 9.5.8). Without understanding and cooperation of residents, the

government cannot implement any projects, since the land property belongs to individual citizens. Responsibility of urban planning for living condition improvement should be shared among government, private sector and residents. Continuous efforts and discussions are expected for further understanding and verifying the financial feasibility of the proposed NADEP planning process.

Table 9.5.7 Outcomes and Next Steps

Issues	Outcomes of Model Area Project	Next Steps
Formulation of "Neighborhood Area Development Plan" (NADEP)	• Agreement of concept of NADEP and planning process • Institutional system for approval and budget allocation	• Institutional system for guidance and control of development by UB City • Monitoring system for implementation by local governments and residents
Consensus building	• Formulation of residential group/ cooperative to facilitate and initiate projects • Land and asset assessment system with equivalent exchange • Social, economic and environmental consideration • Involvement of private sectors	• Sustainable efforts for consensus building of NADEP and relevant projects to residents in the area (conducting workshops, meetings, etc.)
Financial feasibility	• Proposal on financial mechanism in UB Master Plan	• Establishment of proposed financial mechanism
Institutional mechanism	• Proposal on institutional mechanism in UB Master Plan	• Establishment of proposed institutional mechanism

Source: JICA Study Team

Figure 9.5.8 Photos of Residential Meetings

Source: JICA Study Team

10. DEVELOPMENT STRATEGY OF INFRASTRUCTURE AND UTILITY

10.1 General Considerations of Planning of Urban Utilities

1) Planning framework of population and households by housing type

In this section, based on the present situation discussed in Chapter 4 and the future population and household numbers projected by housing type, development strategies for infrastructure and utilities are discussed.

The population and households by housing types are shown below. The infrastructure shall be planned and developed for around 1,733,000 people or 444,000 households in 2030, an increase from 967,000 people or 220,000 households in 2007.

Table 10.1.1 Future Population and Households

(Unit: 000)

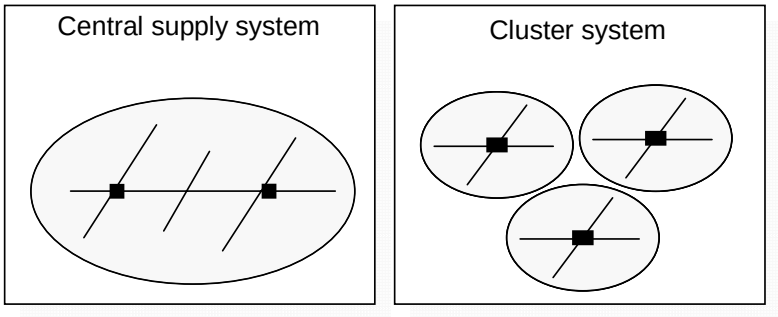
		2007	2010	2015	2020	2025	2030
Households	Apartment	86	109	147	184	225	265
	Detached with Infra	2	22	54	87	117	148
	Simple house w/o infrastructure	74	68	58	48	37	27
	Ger & others	58	51	40	30	17	5
	Total	220	250	299	349	396	444
Population	Apartment	379	471	618	758	899	1,032
	Detached with Infra	9	93	228	356	469	576
	Simple house w/o infrastructure	327	295	244	196	150	106
	Ger & others	253	221	170	122	69	18
	Total	967	1,081	1,262	1,432	1,587	1,733

Source: JICA Study Team

2) Provision System of Utility Services

Basically, utilities are to be provided by expanding the central network system. However, remote area from the center, including the existing Ger area and new town development areas might have cluster system of its own, not connected to the central system.

Figure 10.1.1 Basic Concept of Cluster System of Provision of Utility Services



Source: JICA Study Team

Area development in UB city are broadly categorized into urban redevelopment, land readjustment / land pooling development of Ger area, and new town developments as already explained in Figure 9.1.2 in section 9. 1.

For the central area redevelopment, the central network system should be enhanced and connected to the development. And also it is possible for a development has its own utility system like heating even in the central area.

In case of Ger area development, some areas can be covered by the expansion of the central network because of locational advantage of being near the central area.

However in case of remote Ger area developments and new town developments, the remoteness makes it costly to expand the network outward. For the expansion of network sometimes necessitates, in addition to the new pipe installation, the expansion of the existing network distribution capacity in order to increase the whole distributing capacity to serve the remote development. Accordingly the cluster system seems better for those area developments.

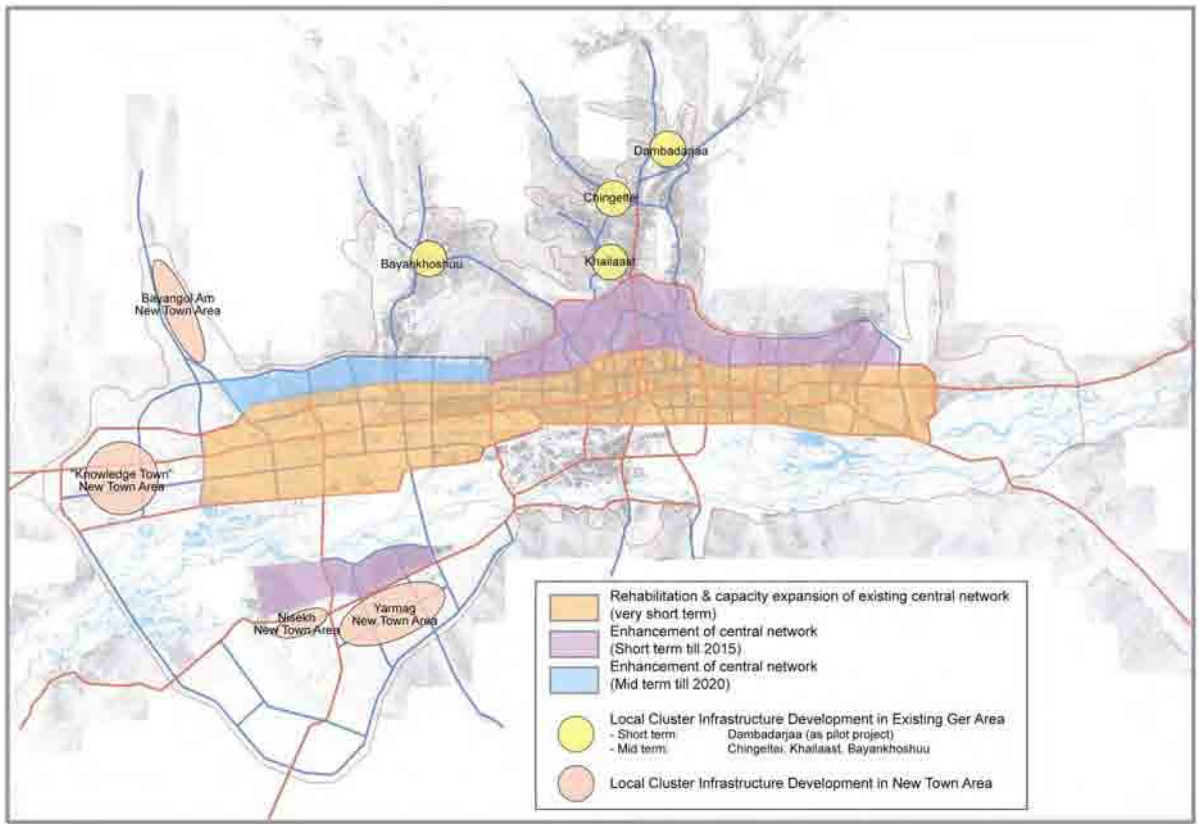
.As described in section 9.2, power and water shall be supplied by the central system, although in some area water might be supplied through pipe-connected kiosks. On the other hand, heating and sewage system will not be able to cover all the city area by the central network system. At present, to study possibility to introduce such a cluster system for a neighborhood residential area development in Ger area, the JICA Study Team is conducting the pilot project in Dambadarjaa.

As described in section 9.1, systems to provide infrastructure in Ger area are categorized into three (3) systems as follows: (a) the central infrastructure rehabilitated and expanded, (b) a local cluster infrastructure network, and (c) the civil minimum is secured by individual.

Based on this idea about Ger area development and new town development, it is proposed that basic development framework of utilities shown in Figure 10.4.2. In the central area where the central network system is in place will have capacity expansion of the existing network by rehabilitation in short term, and the adjacent area to the north of the central area and area near the airport will have enhancement / expansion of the central system. And remote Ger area and new towns will have local cluster system.

To determine which system to be introduced, the central system or a specific cluster system to a specific area development, a further study including technical and financial feasibility should be conducted.

Figure 10.1.2 Proposed Development Framework of Utility



Source: JICA Study Team

10.2 Water supply

3) Planning Strategy

Based on the problems and issues summarized in Chapter 4, the planning strategies are stated as follows:

(a) **Expansion of Supply Capacity:** Water supply capacity needs to be increased by establishment of ***new water sources***, and the improvement of dilapidated and outmoded facilities.

(b) **Reduction of Water Losses for Environmental Sustainability**: For environmentally sustainable use of water, it is important to reduce the losses of water by the improvement of the outmoded and dilapidated water distribution facilities.

(c) **Effective Demand Management:** Measures such as the appropriate installation of water meters and a more appropriate water tariff structure to improve cost recovery and financial management. Such tariff structure will include an equitable allocation of water tariffs between apartment-dwellers and Ger area users. A campaign to raise the public's awareness of water conservation will be mandatory.

(d) **Improvement of Financial Viability:** The water tariff should fully recover the cost of supplying water to the final users by setting appropriate prices. Therefore the water sales price shall be studied and revised.

(e) **Revision of Water Tariff Gap between Apartment and Ger Area:** From a social equality perspective, the gap between the water tariffs of apartments and water kiosks should be minimized.

(f) **Promotion of Water Recycling:** The future increase in water demand in line with the growth in the population of apartment-dwellers will lead to a water supply shortage unless measures are taken. To conserve the precious water resources, water recycling shall be introduced as much as possible.

(g) **Equitable Water Supply:** In order to provide more equitable service among citizens, the first priority is to improve the water supply in Ger area. This will be achieved by connecting the existing Ger area with the central water supply system and construction of more water kiosks.

(h) **Watershed Management:** Water resources to serve the rapidly growing UB City are limited. In this sense, comprehensive watershed management including water resource preservation and protection is critical for sustainable development of UB City.

4) Planning Target

The ultimate target is to ***supply all the citizens with piped water*.** However, as estimated, traditional Gers and simple houses without infrastructure will remain to some extent in the urbanization process even though housing shall become modernized. Such dwellings will be supplied with water from piped water kiosks.

Water consumption per capita has been decreasing but is still at a high level of around 285 Liter/person/day (L/pers./day hereafter). And the total water consumption, when divided by the total number of apartment dwellers, is around 226 L/pers./day (based on 2007 data).

USUG and the Water and Waste Water Master Plan 2020 (WWWMP2020) employ per capita water usage levels as follows:

- Apartment dweller: 230 L/pers./day through the planning period;
- Detached house with infrastructure: 80 L/pers./day; and
- Ger and simple houses not connected to the central system: 25 L/pers./day in 2010 and afterward.

However, if such high unit demands are adopted, the total water demand will exceed supply capacity. Accordingly, the unit water demand needs to be re-considered. As shown in Chapter 4, per capita consumption has been decreasing drastically. Based on this trend, water conservation could be attained by demand side management. The Water Authority, according to an interview with an official, aims at 150 L/pers./day, and also a USUG official stated that the water consumption per capita has been drastically reduced and will fall to almost 150 L/pers./day by 2030.

5) Demand

As mentioned above, water demand depends largely upon the per capita consumption of water for apartment and detached house dwellers as well as the total population living in

such housing units.

In this section, the water demand in 2030 was calculated for low and high water demand scenarios, namely, 230 L/pers./d and 150 L/pers./d. The following assumptions were used.

Assumptions

(i) Per capita water consumption

- Apartment dwellers
  (High demand scenario) 230 L/pers./d through the planning period
  (Low demand scenario) from 230 L/pers./d in 2008 decreasing to 150 L/pers./d in 2030
- Detached house with infrastructure: 80 L/day, increasing to the same level as apartment dwellers in 2030 (i.e, to 230 L/ pers./day for the high demand scenario and 150 L/pers./d for the low demand scenario)
- Ger and Simple houses not connected to the central system: 25 L/pers./d in 2010 and afterwards as stated in WWWMP 2020.

(ii) The water leakage rate was 23% in 2007 and is on a declining trend. It will be improved to 10% in 2030. Accordingly, the effective rate of water distribution in 2030 will be 90%.

(iii) Water for industry has been decreasing recently; however, it is assumed that demand for industrial water will increase as economic development progresses. Economic growth will mostly be led by the service sector and GRDP growth of less than 2% is used for the growth rate of the industrial water demand.

(iv) Water for other facilities is assumed to increase along with population growth.

(v) Detached houses with infrastructure consume less water than apartments; however, it is assumed that consumption will increase from 80 L/pers./d to the same amount as apartment dwellers'.

Table 10.2.1 Water Demand Forecast (Lower Demand scenario, 150 L/pers./day)

	unit	2007	2010	2015	2020	2025	2030
1. Unit consumption							
Apartment (Low, Mid, High rise)	(L/pers./d)	230	218	198	181	165	150
Detached with Infra	(L/pers./d)		85	98	113	130	150
Ger & Simple house w/o infra	(L/pers./d)	7.2	25.0	25.0	25.0	25.0	25.0
2. Water Demand							
Apartment (Low, Mid, High-rise)	(m^3/day)	87,374	102,468	122,595	136,912	147,989	154,853
Detached with Infra	(m^3/day)		7,893	22,308	40,172	61,043	86,465
Simple house w/o infra	(m^3/day)		7,378	6,111	4,904	3,749	2,651
Ger & Simple house not connected to the central system	(m^3/day)	3,220	5,533	4,258	3,044	1,715	453
Sub- total	(m^3/day)	90,594	123,272	155,272	185,032	214,496	244,421
Private enterprises	(m^3/day)	11,178	12,490	14,579	16,553	18,342	20,027
Public institutions (facilities)	(m^3/day)	7,388	8,255	9,636	10,940	12,123	13,237
Industrial factories	(m^3/day)	6,364	7,367	8,724	10,262	12,071	14,034
Sub-Total	(m^3/day)	24,930	28,112	32,940	37,755	42,535	47,298
Leak (Ineffective water)	(m^3/day)	38,937	37,579	36,667	34,319	31,557	28,717
Total	(m^3/day)	**154,500**	**217,100**	**257,800**	**294,900**	**331,100**	**367,700**
Leak rate to total		0.252	0.223	0.183	0.149	0.122	0.100
GRDP growth rate			1.05	1.03	1.03	1.03	1.03
Population growth			1.04	1.03	1.02	1.02	1.02

Source: JICA Study Team

Table 10.2.2 Water Demand Forecast (Higher Demand scenario, 230 L/pers./day)

		2007	2010	2015	2020	2025	2030
1. Unit consumption							
Apartment (Low, Mid, High rise)	(L/pers./d)	230	230	230	230	230	230
Detached with Infra	(L/pers./d)		88	112	142	181	230
Simple house w/o infra	(L/pers./d)	7.2	25.0	25.0	25.0	25.0	25.0
Ger & Simple house w/o infra	(L/pers./d)	7.2	25.0	25.0	25.0	25.0	25.0
2. Water Demand							
Apartment (Low, Mid, High-rise)	(m^3/day)	87,374	108,343	142,247	174,328	206,781	237,442
Detached with Infra	(m^3/day)		8,205	25,558	50,720	84,933	132,579
Simple house w/o infra	(m^3/day)		7,378	6,111	4,904	3,749	2,651
Ger & Simple house not connected to the central system	(m^3/day)	3,220	5,533	4,258	3,044	1,715	453
Sub- total	(m^3/day)	90,594	129,460	178,174	232,996	297,178	373,124
Private enterprises	(m^3/day)	11,178	12,490	14,579	16,553	18,342	20,027
Public institutions (facilities)	(m^3/day)	7,388	8,255	9,636	10,940	12,123	13,237
Industrial factories	(m^3/day)	6,364	7,367	8,724	10,262	12,071	14,034
Sub-Total	(m^3/day)	24,930	28,112	32,940	37,755	42,535	47,298
Leak (Ineffective water)	(m^3/day)	38,937	39,359	41,787	42,748	43,073	43,018
Total	(m^3/day)	154,500	225,000	285,800	351,300	425,300	510,700
Leak rate to total		0.252	0.223	0.183	0.149	0.122	0.100
GRDP growth rate			1.05	1.03	1.03	1.03	1.03
Population growth			1.04	1.03	1.02	1.02	1.02

Source: JICA Study Team

6) Supply Capacity

In Mongolia, 80% of water is supplied by ground water and 20% surface water; and according to the Water Authority, the aim is to shift this ratio to a 50%-50% ratio of groundwater and surface water in 2030. In UB City, groundwater is supplied from four water sources, with a total design capacity of 241,000 m^3/day. According to the Water Authority around 400,000 m^3/day of water is available from both ground water and surface water combined (further study is necessary to confirm the details of this).

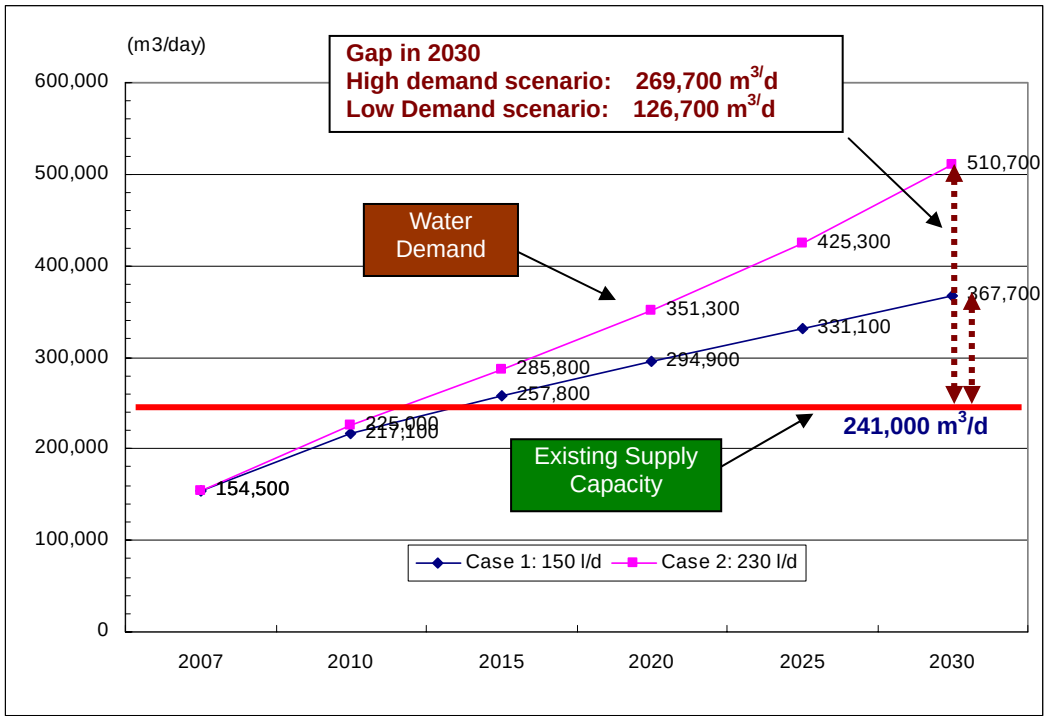
Both ground and surface water sources will need to be investigated to find more supply capacity to meet the future demand, which shall further be controlled by demand-side management measures.

7) Demand-Supply Gap

As shown in Figure 10.2.1, in 2030 the gap between demand and supply is predicted to be around 367,700 m^3/day in the low demand scenario of 150 L/pers./day and 510,700 m^3/d in 2030 for the high demand scenario of 230 L/pers./d. The demand-supply gap in 2030 is 126,700 m^3/d for the low demand scenario and 269,700 m^3/d for the high demand scenario.

For the high demand scenario, the water demand will reach 237,100 m^3/d in 2011 and 249,100 m^3/d in 2012 for the low demand scenario, 234,100 m^3/d in 2012 and 242,000 m^3/d in 2013. In either demand scenario, water supply shortages will be faced within only a few years.

Figure 10.2.1 Future Demand and Supply Capacity Gap



Source: JICA Study Team

8) Proposed Programs

The following programs are proposed to reduce the demand-supply gap and for the other planning issues.

(1) Enhancement of water supply capacity

(i) **Expansion of Existing Water Source:** Based on the WWWT MP2020, water intake from the existing water source of the Central will be increased by 19,800 m^3/d and intake from the Meat Factory and Industrial sources will be reduced.

(ii) **New Water Source Development:** There are a few options as shown below. These options shall be studied carefully to ensure sustainable use of limited water resources including both groundwater and surface water.

- ***Lower Nalaikh (Gachuurt)*** water source（41,000 m^3/d, 41 wells, 10.7 km of water collection pipelines, 21 km of transmission pipeline, 2 reservoirs (6,900 m^3 x 2).[1] This is the third phase project proposed by the 1995 JICA Study on UB City Water Resource, which stated that the water potential of the Central water source is 114,300 m^3/d and that of the Upper water source is 90,000 m^3/d. Phase 1 developed 72,000 m^3/d at Upper water source and in the second phase, 114,300 m^3/d was developed in the Central Water source, both of which were developed under Japanese Grant Aid.
- Based on the WWWMP2020, the Upper source and the Central water source are to be used more by development of water resources at ***Biokombinat*** (66,000 m^3/d) and ***lower Biokombinat*** (92,400 m^3/d) near a New City Center Area. These sources are now being studied for the approved detailed master plans of housing development under the 40,000 housing unit development programs.
- Surface water collecting ***dams on the Terelj River and Tuul River***, which have potential amount from 50,000 m^3/d to 425,000 m^3/d, according to USUG.

When Lower Nalaikh water source is developed, water demand in the higher demand scenario until 2015 will be met. Therefore the water sources other then Lower Nalaikh described above should be studied soon to meet water demand afterwards to 2030.

(iii) **Improvement of water pipes and equipment:** To enhance the supply capacity, the improvement and replacement of dilapidated facilities is needed. Water pipes of a diameter from 150 to 800 mm which were installed before 1960 which contribute much to water leakage, should be replaced.

(iv) **Usage of recycled water:** It is not easy to meet the increasing demand by improvement and develop new water sources. Recycling of waste water shall be promoted, which is discussed in the section on waste water that follows.

[1] This project requires about US$29 million and is requested to Japanese government for a grant aid project in the fiscal year of 2008.

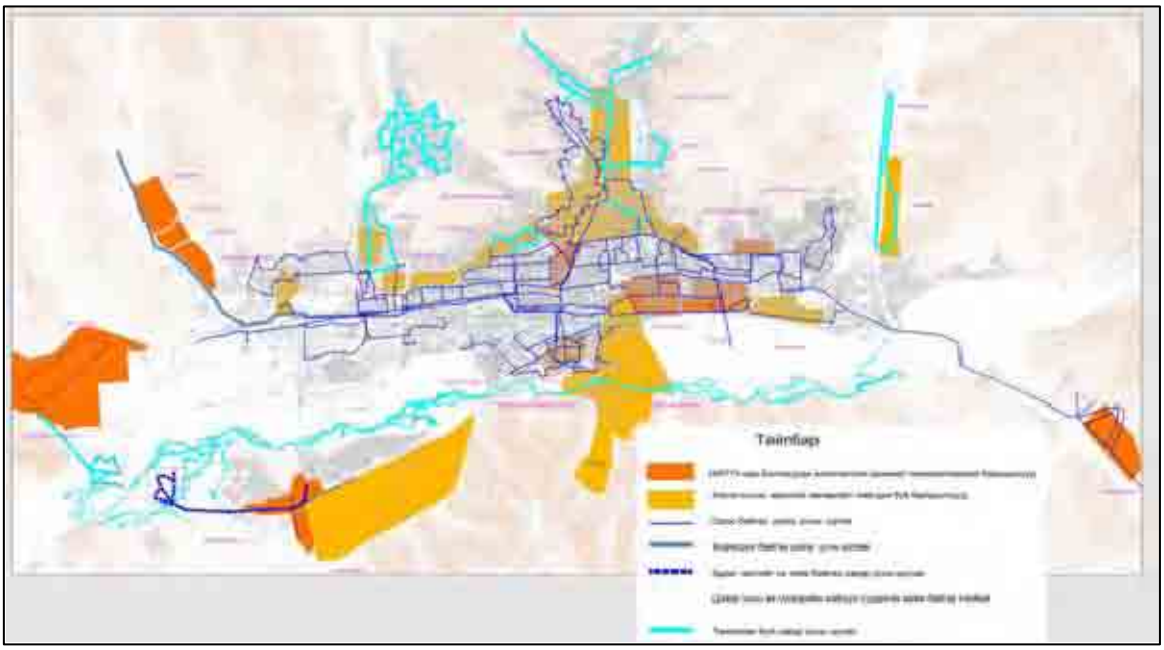
Figure 10.2.2 Locations of Proposed New Water Sources

Source: USUG

Figure 10.2.3 Optional Location of Planned Dam Sites

Source: USUG

Figure 10.2.4 Water Supply Plan in the short term by Detailed Development Plan



Source: UB City

(2) Demand side management

(a) Installation of water meters

Installation of water meters for individual households is an effective way to reduce water consumption because the current water consumption per person for individually-metered households is 125 liters/day, almost half the average. Therefore, installment of water meter to individual household is effective way to reduce water consumption. According to USUG, water meters need to be installed in more than 54,600 households. Four meters are needed for each household, totaling 218,000 sets of water meters.[3]

(b) Campaign of public awareness raising

Water supply is critical to UB City's development because of its limited water resource. It is imperative to conserve water wisely. Water conservation should be promoted among people by campaign activities including educational programs, various PR activities, and so on.

(3) Water tariff revision

Water tariffs shall be revised to improve the financial viability and reduce water demand. The tariff structure should also be revised to ensure equitability between apartment dwellers and residents of the Ger areas (water kiosk users).

(4) Watershed management - Water resource preservation and protection

Water resource preservation and protection programs are important to supply good quality and quantity of water. Since UB city is located close to the Tuul River, many city development activities have been implemented near the water resource area. Therefore,

[3] The estimated cost of this will be US$6.5 million.

the balance between city development and water resource protection is a very important but complex task. Watershed management is described in detail in section 11.3.

(5) Water quality management

Water resources will be protected from pollution and contamination, especially from soil and water contamination caused by inadequate sanitation and waste management. Such measures are discussed in Sections 10.3 Sewerage.

10.3 Sewerage

1) Planning Strategies

An effective sewage treatment system for both domestic and industrial wastewater needs to be urgently facilitated for better environment management and pollution control. The development concepts are as follows:

(a) **Enhancement of Treatment Capacity:** The existing Central Waste Water Treatment Plant (CWWTP) needs to be improved to enhance the treatment capacity; and new wastewater plants also need to be established; the collection pipes and other facilities that are aged and outmoded need to be improved.

(b) **Effective Treatment of Industrial Wastewater:** In order to control water pollution caused by industrial wastewater, it is mandatory to enhance the treatment capacity by improvement of the Khargia Wastewater Treatment Plant or establishment of a new industrial waste water treatment facility. Factories with no connection to any wastewater treatment system should be compelled to connect to the Khargia or a new treatment facility to be developed. Proper monitoring, inspection and enforcement should be undertaken periodically with careful attention and appropriate instructions given to offenders when they face some problems.

(c) **Improvement of Sanitation in Ger areas:** Poor sanitation in Ger area needs to be improved. The first priority is to connect the Ger area to the central sewerage system, or alternatively to provide a new network of smaller-area sewerage sub-systems. If no sewerage system can be provided, groups of a several houses in Ger area need to be provided with effective community-based latrines. For those not treated in any of these ways, individual sanitary equipment must be installed to prevent soil contamination.

2) Planning Target

Both domestic and industrial waste water shall be treated properly. Waste water treatment target shall be set up broadly for three (3) categories as described in planning standard, section 9.2 of Chapter 9..

(i) 100% of waste water of the citizens in the central apartment area should be treated properly with the enhanced waste water treatment facility of either the central or local cluster system;

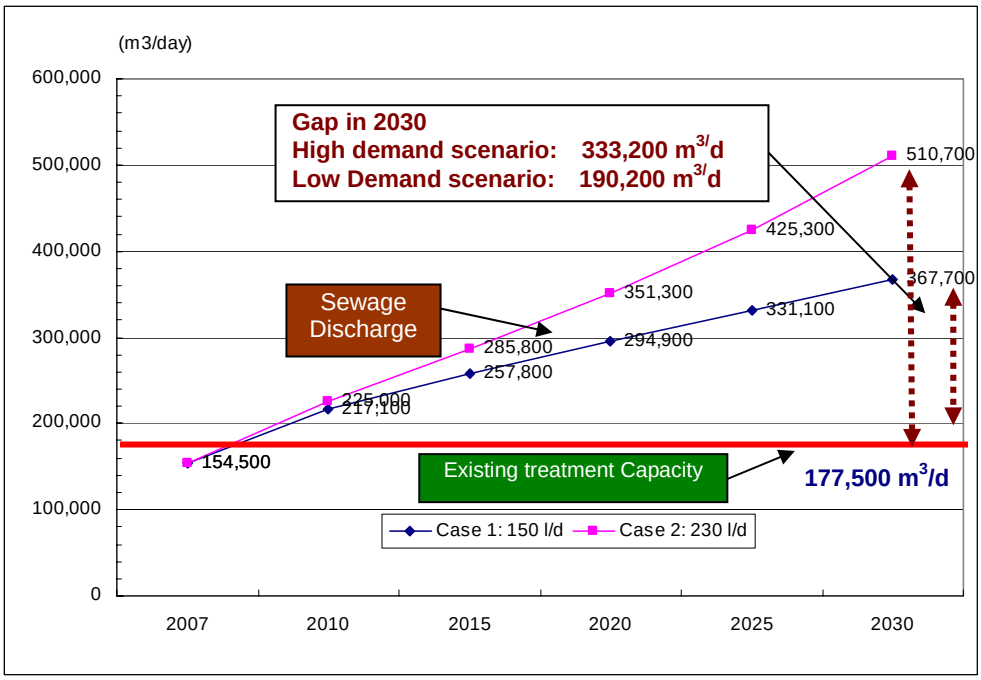
(ii) Waste water in the Ger area shall be treated with (a) local, cluster type of treatment facilities or (b) individual treatment facilities; and

(iii) Industrial waste water treatment by introducing a group treatment system and strong monitoring and enforcement of environmental standards.

3) Demand-Supply Gap

The amount of wastewater is assumed to be the same amount as water supply, which is shown in Figure 10.3.1. The gap between the existing working treatment capacity and waste water discharge in 2030 will be 333,200 m^3/d for the higher water demand scenario and 190,200 m^3/d for the lower water demand scenario. Even in the lower scenario the treatment capacity needs to be more than doubled.

Figure 10.3.1 Waste Water Discharge Forecast



Source: JICA Study Team

4) Proposed Programs

In 2030, waste water discharge from 1.7 million people will be treated. WWWMP 2020 has proposed the capacity expansion of treatment facilities for almost one million people, including non-centralized treatment, on the assumption that 230 L/pers./d is consumed by apartment dwellers.

The amount of waster water treated by the central waste water treatment system, individual cluster systems in new towns and possibly some Ger areas, and small scale system of groups of families and individual treatment equipment shall be further studied based on the future population and housing distribution.

(1) Capacity Expansion

The following are the capacity expansion proposed by the WWWMP 2020. Taking these plans into consideration, further expansion shall be necessary to meet the future demand of 1.7 million people, especially for the higher water demand scenario.

(a) **Central Waste Water Treatment Plant (CWWTP):** Based on the WWWMP 2020, the CWWTP is planned to be improved from the existing treatment capacity of 177,500 m^3/day to 326,000 m^3/day.

(b) **New Waste Water Treatment Plant**, **including local cluster waste water treatment system:** In addition to the expansion of CWWTP, several new facilities are proposed as shown in Table 10.3.1 below. When these treatment facilities are developed by 2020, the forecast amount of wastewater, or 295,000 m^3/day will be able to be treated; however towards 2030 when the demand will reach 510,000 m^3/d in the higher demand scenario and 368,000 m^3/d in the lower demand scenario, the treatment

capacity will be short to meet the demand. Therefore, additional waste water treatment facilities should be developed to meet the demand for either scenario.

Table 10.3.1 Enhancement of Treatment Capacity proposed by WWWMP 2020

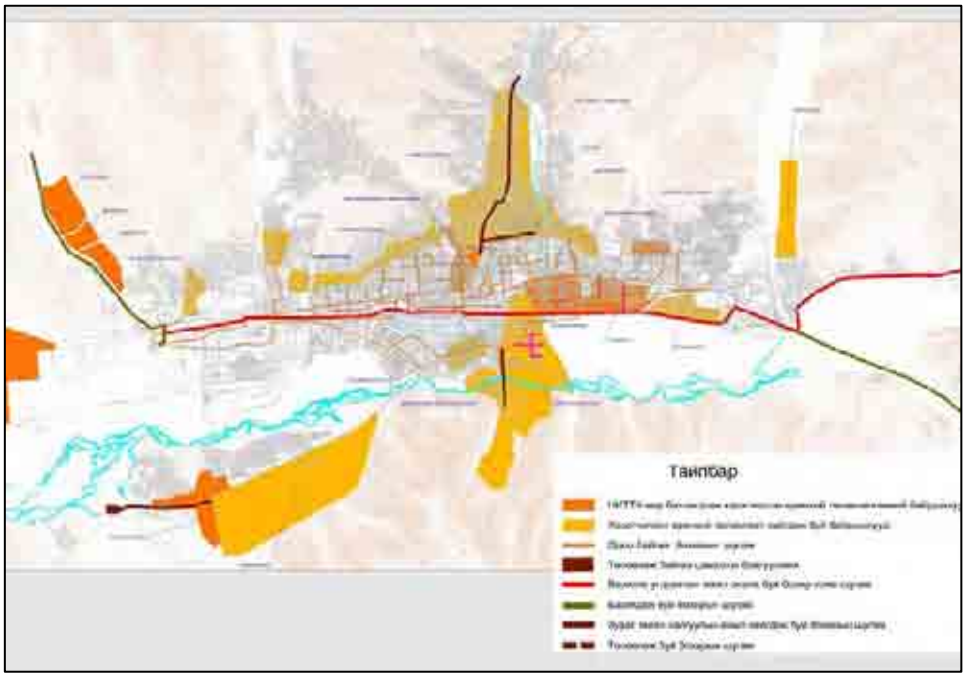
	Connected population	Capacity (m^3/day)
Central	766,000	417,500
New City central	71,000	19,000
Yarmag	80,550	17,500
Bagakhangai	25,000	6,400
Airport	18,000	5,500
Bayanzurkh	4,000	1,030
Nairamdal	415	550
Biokombinat	995	400
Total	965,960	467,880

Source: WWWMP2020

(c) **Replacement and Expansion of existing collectors and new collectors:** As seen in Chapter 4, a 158 km sewer discharge system[4] and 110 km of pipelines has been used since 1959. These old sewer pipes experience high levels of leaking waste water and need to be replaced by new pipes.

To meet the future demand, some sections of collectors should have their discharge capacity expanded. In the short term, the approved detailed master plan of 12 projects under the 40,000 housing unit projects plan includes some new collector construction and expansion of pipes.

Figure 10.3.2 Waste water Treatment in the short term by Detailed Development Plan



Source: Ulaanbaatar City

[4] The World Bank, p. 241

(2) Domestic Sewerage of Ger Area and Summer Camps

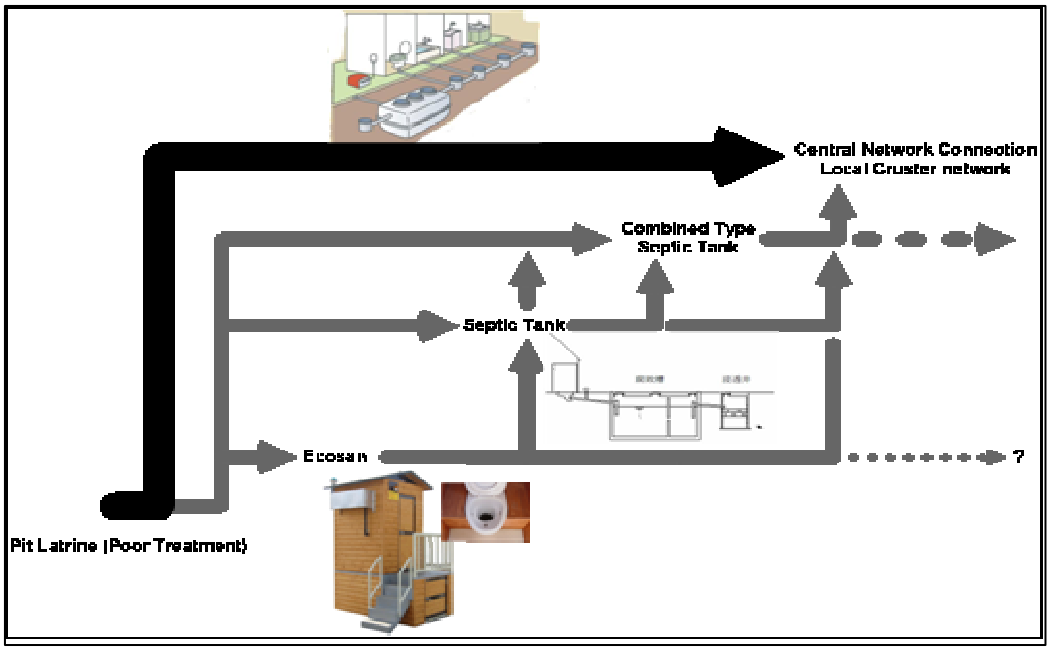
The biggest problem for sanitation is that a huge volume of untreated wastewater is discharged, especially from Ger areas where dwellings are not connected to the central sewerage network. The current wastewater treatment capacity meets demand from apartment areas; however, it is likely to be difficult to cover further demand that would be created by rapidly expanding Ger areas due to the shortage of the network extension. Therefore it is urgent to rehabilitate and extend the pipeline network. In addition, it is necessary to expand capacity and build new wastewater treatment facilities.

However, such large scale developments require huge investments and will take a long time to plan and implement. The rapid population increase in Ger areas has already accelerated water pollution. Therefore it is proposed:

- To develop a small or medium cluster sewerage network in time for housing construction program, and
- To mitigate inadequate treatment in Ger areas urgently from civil minimum point of view.

For the implementation of the above measures, a step-by-step approach, shown in Figure 10.3.3 is proposed.

Figure 10.3.3 Concept of Step-by-Step Approach on Wastewater Treatment



Source: JICA Study Team

In this approach, the following treatment techniques are temporarily proposed:

- **ECOSAN, shield type pit latrine**: This countermeasure is recognized as a minimum requirement for short-term or urgent introduction. Even though its efficiency may not be so drastic, it can be expected to decelerate rapid water pollution by the existing poor treatment. Especially this measure can be applicable to low income residents, peri-urban, or summer houses.

- **Septic Tank**: Septic tanks may be the first step to introduce a flush toilet with adequate water treatment. Septic tanks basically treat black water only, and are not suitable to install in densely populated areas.
- **Combined-type septic tank**: Combined-type septic tanks can treat not only black water but also gray water. This system is useful in middle or high density areas and areas near rivers. Basic technique is almost the same as regular sewerage system; hence the combined-type septic tanks can be used for development of a local cluster network system. In addition, this system can generate recycled water.
- **Central network or local cluster network**: development of a large scale sewerage network is the most effective solution; however, it is costly and takes a long time. Therefore local cluster network is recommended.

Due to the low density and being far from the central area, an individual sanitation system such as septic tank and shield type pit latrine is recommendable for improvement of sanitary condition in the tourist camps. In case of tourist camp areas in the Urbanization Control Area (UCA) and summer house areas in the north, any discharge of untreated water shall be prohibited to protect water quality.

(3) Industrial Wastewater Treatment

Industrial wastewater treatment is also suitable to introduce as a cluster type network because the wastewater treatment required depends on the type of industry (i.e., composition of the sewage). It is required to apply proper treatment technique in accordance with the composition of the sewage. Table 10.3.2 shows general treatment techniques by pollutant.

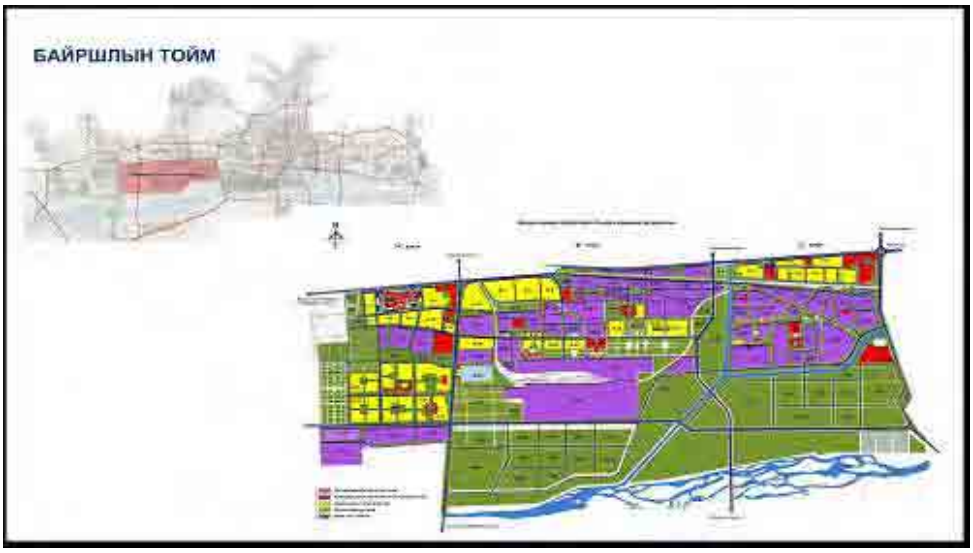
Table 10.3.2 General Techniques of Treatment of Polluted Water

Component	Category of Industry	General technique
Suspended Solid	Steel, Paper/pulp, Dyeing/textile and Food Industry	Screening, Filtration, Coagulation
Oil & Grease	Petrochemical, Steel, Dyeing/textile Industry	Oily water separating, Pressure levitation
Phenol	Petrochemical, Metal plating Industry	Activated sludge, adsorption
Cyanide	Petrochemical, Machinery manufacturing, Metal plating industry	Chlorine degradation
Chromium	Machinery manufacturing, Dyeing/textile, Metal plating industry	Oxidation-reduction, Ion exchange, Electrodialytic separation
Heavy Metal	Petrochemical, Machinery manufacturing, Steel, Metal plating industry	Coagulation, Filtration, Ion exchange, Electrodialytic separation
VOC (Volatile Organic Compounds)	Cleaning, Machinery manufacturing	Activated carbon adsorption
Mercury	Mining	Ion exchange

Source: JICA Study Team

As already mentioned in Chapter 4, the existing industrial zone in Ulaanbaatar city has not managed industrial wastewater well, and the industrial wastewater treatment plant, the Khargia Industrial WWTP, has not been operated properly due to its outdated and dilapidated facilities. UPRDI has a plan to redevelop the Central Industrial Zone with a concept plan as shown in Figure 10.3.4.

Figure 10.3.4 Concept Plan for the Central Industrial Zone

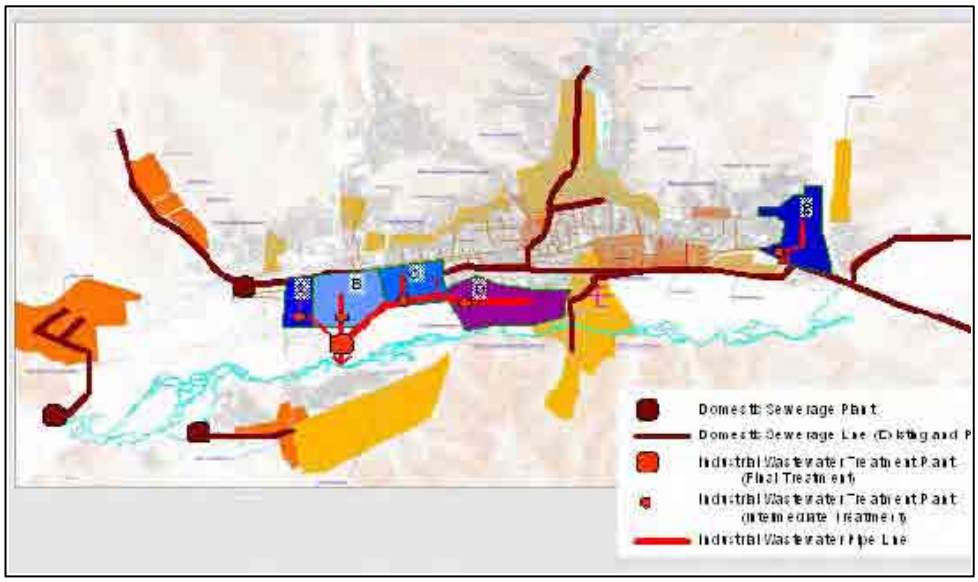


Source: UPRDI, 2008

Improvement of the industrial wastewater treatment system, either rehabilitation of the Khargia Industrial WWTP or construction of new facilities is strongly required. The waste water treatment process shall be decided taking into consideration polluting constituents in the waste water. It is temporarily proposed to establish a two-step treatment system as shown in Figure 10.3.5.

The first step targets specific elements, especially toxic substances depending on the type of industry, and then the remaining more common constituents and domestic wastewater from other businesses and houses located in the industrial zone wastewater catchment can be treated in the second step. Figure 10.3.5 shows the concept of the industrial wastewater treatment system based on a cluster network.

Figure 10.3.5 Concept of Industrial Wastewater Treatment System



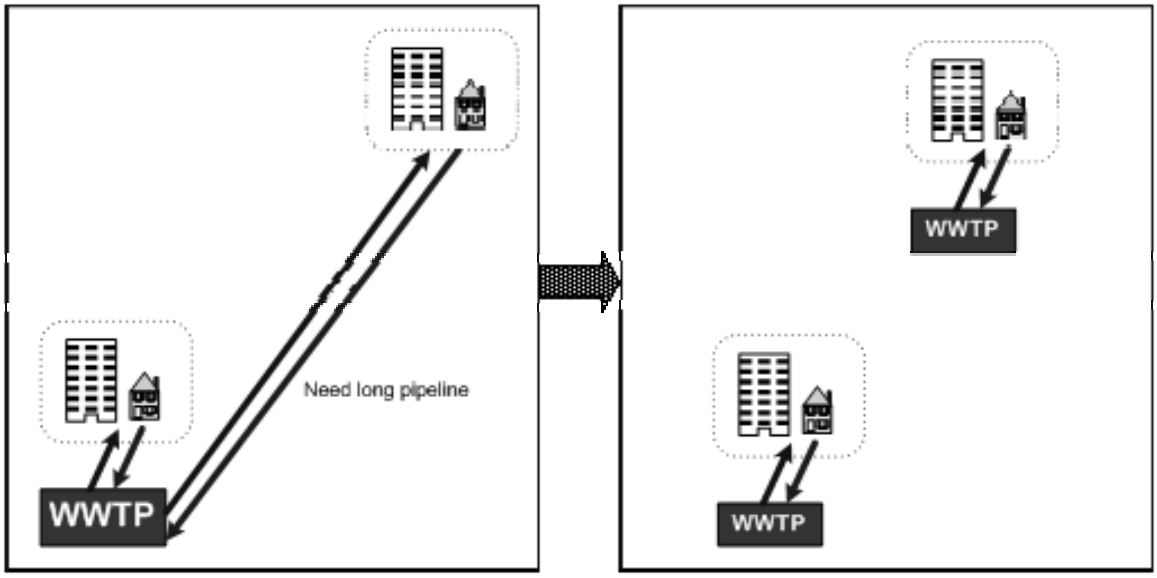
Source: JICA Study Team

(4) Other Options of Wastewater Treatment

(a) Water Recycling

One of the merits of a cluster type sewerage network system is the ease of applying a water recycling system because the length of sewer pipes can be minimized as illustrated in Figure 10.3.6.

Figure 10.3.6 Water Recycling Network from Central to Cluster Type



Central Network Type Cluster Network Type

Source: JICA Study Team

Recycled water is usually used for flushing toilets, car washing, watering plants, etc. Furthermore, most industrial water, which is used for cooling water and cleaning of machinery, generally does not need to meet as high quality standards as drinking water; therefore water recycling is applicable in the industrial zone.

A new approach to water recycling has been started recently by a private company named Tuul Songino Water Resource Complex. The project consists of the following components:

- To treat a 36 million m^3 of wastewater per year from the CWWTP into recycled water which the electric power plants will use instead of the underground water they use currently; and
- To purify a 100,000 m^3/d of underground water currently used by the power plants and supply it as drinking water to the households of UB City.

(b) Sewage Sludge Treatment

Generally, sewage sludge treatment involves the following process:

Dewatering → Drying → Incineration or disposal.

However, sludge treatment of the existing CWWTP rarely functions in practice. The sludge left in the dewatering area beside the CWWTP generates odor, dust, and water contamination. Therefore it is necessary to develop and reform the system for adequate sludge treatment.

In addition, in many countries, sewage sludge is recycled after treatment. Table 10.3.3. explains sludge treatment techniques.

Table 10.3.3 General Techniques for Sewage Sludge Treatment

Technique	Purpose
Methane fermentation	Fuel energy for burning
Drying, compost	Fertilizer, soil conditioner
Solidification, fusion	Aggregate, concrete, paving

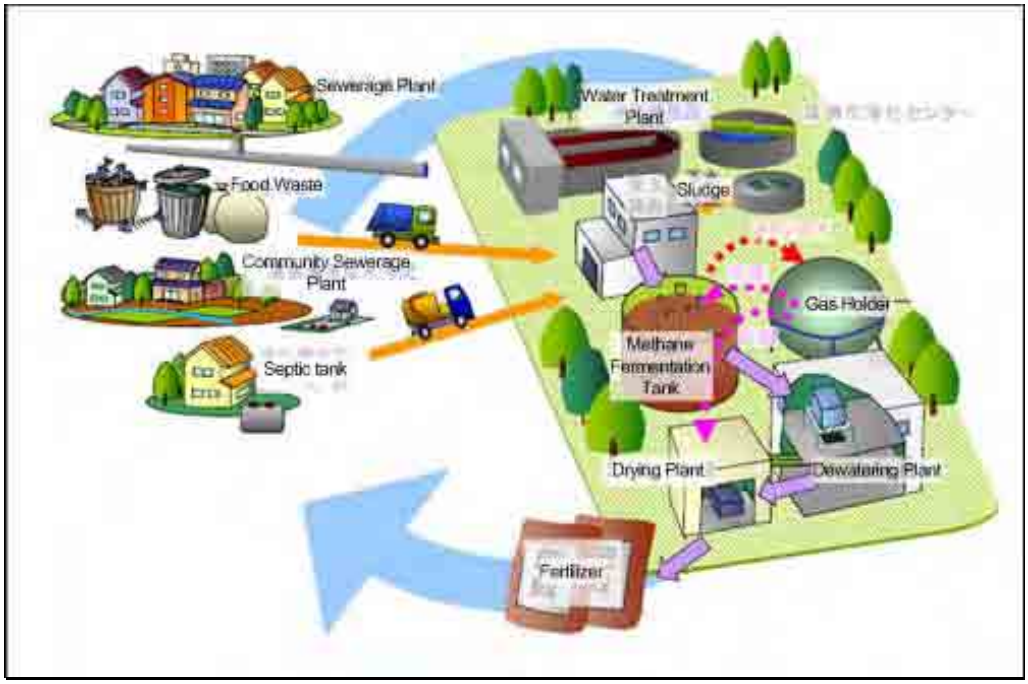
Source: JICA Study Team

(c) Electric Generation by Sewage Sludge

Recently biomass energy has attracted considerable public attention as a countermeasure against global warming and towards recycling-oriented society. Sewage sludge is one form of biomass energy that can generate methane gas, though methane gas generated from sewage sludge has only a negative image so far.

Figure 10.3.7 shows an example of a biomass energy system project in Tamasu City, Ishikawa Prefecture, Japan. In the system, various sources of biomass generated in the city (sewage sludge, food waste, etc.) are used for methane fermentation and then electric power is generated for operation of facilities.

Figure 10.3.7 Example of Description of Biomass Energy Project



Source: Ministry of Land, Infrastructure and Transportation, Japan, Tamasu-shi Isikawa Prefecture

10.4 Power Supply

1) Planning Strategy

Planning strategies proposed for the power supply sector are as follows:

(a) Enhancement and Improvement of Supply Capacity: The existing power supply capacity shall be enhanced by the following measures:

(i) Reduction of Technical Losses – the power supply system suffers from a huge volume of technical losses in the distribution to customers due to the use of inefficient coal-based power plants and the old and outmoded distribution facilities, which need to be urgently replaced or improved;

(ii) Improvement of sub-stations - New sub-stations will be constructed in several areas which are overloaded and short of supply;

(b) Establishment of New Sources of Power and Heating: To meet the growing demand, a new source of power needs to be established based on the land use plan and socio-economic framework. The location and size of the new source needs to be studied.

(c) Development of an Effective Financial Structure: To pursue the financial viability of the power and heating related entities, a tariff structure that reflects cost recovery needs to be considered. This is also expected to help curb demand.

(d) Study of new energy sources: Options should be studied to diversify energy sources away from the dependence on coal. Energy source options are 1) solar, 2) biomass, 3) garbage, 4) hydro, and 5) nuclear.

2) Planning Target

Electricity shall be supplied to ***all citizens*** within the urbanization promotion area. The power supply should be well planned to control the unplanned expansion of settlement on the fringe of Ger areas of the urbanized area.

3) Demand-Supply Gap

In 2030, the power demand is forecast to reach 6,551 million kWh and peak load will be 1,328 MW, while the total installed capacity of the present power supply of TPSs 2, 3, and 4 is 709.5 MW, and the operational capacity is 554.7 MW. The demand will exceed the capacity of the Central Electric System, 786 MW.

The capacity will be able to meet the demand until 2016 if the current capacity is maintained for a while. However, the TPS-2 is due to be retired in several years and the TPS-3 will also be retired by 2015. Taking into account the retirement schedule of these aging plants, the new power plant will be required before 2015.

The capacity with a total of 896 MW is expected to be installed up to 2030. This means that two more power stations with the same supply capacity as TPS-4 should be developed by 2030.

Table 10.4.1 Electricity Demand Forecast

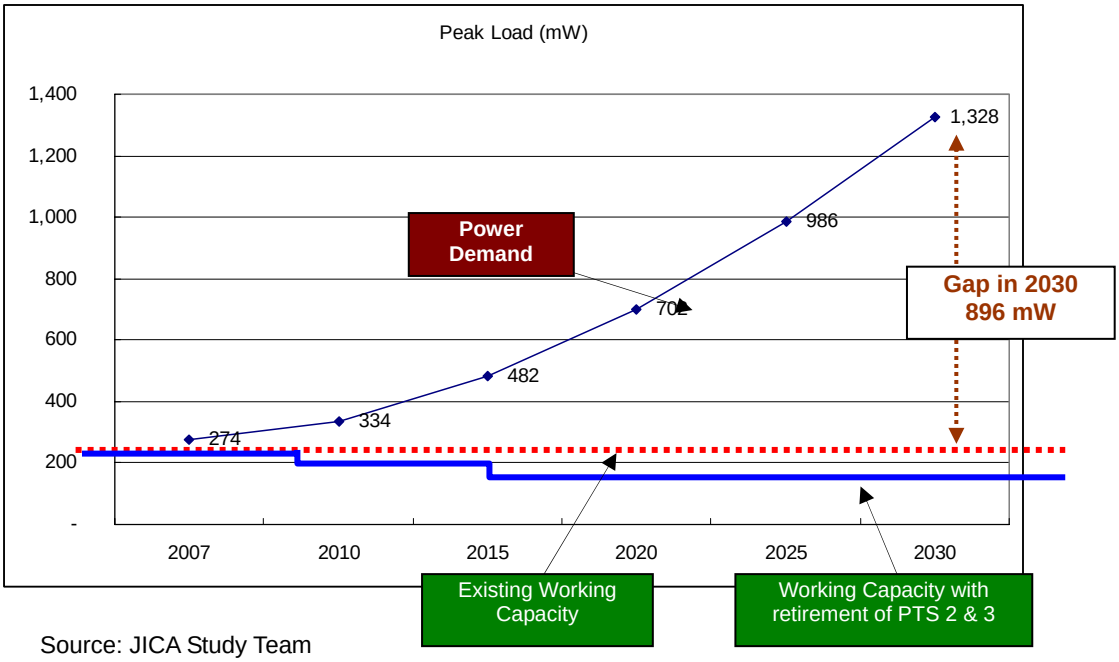
	unit	2007	2010	2015	2020	2025	2030
1. Yearly Total Demand	Mil. kWh	1,321	1,649	2,378	3,462	4,864	6,551
2. Yearly Total consumption	Mil. kWh	1,016	1,357	2,108	3,116	4,378	5,896
-Entities	Mil. kWh	683	944	1,578	2,460	3,590	4,968
-Ger area	Mil. kWh	181	181	156	128	94	57
-Apartment area	Mil. kWh	153	232	374	528	694	871
3. Yearly Electricity loss	Mil. kWh	305	292	270	346	486	655
Loss ratio to total	%	23.1%	17.7%	11.4%	10.0%	10.0%	10.0%
4. Domestic consumption	Mil.kWh	1.00	1.00	1.00	1.00	1.00	1.00
5. Yearly consumption per household							
Ger area per household	kWh	1,860	2,054	2,149	2,244	2,339	2,435
Apartment area	kWh	2,102	2,162	2,262	2,362	2,463	2,563
Ratio (Ger/Apartment)		0.89	0.95	0.95	0.95	0.95	0.95
6. Peak Load							
Peak load	mW	274	334	482	702	986	1,328
Peak load ratio		0.207	0.2027	0.2027	0.2027	0.2027	0.2027

Source: JICA Study Team

Assumptions and methods used for the forecast

1. Yearly Total Demand = D(t)
   D(t)= De(t)+ Da(t) + Dg(t) + L(t)
   Where :
   De(t) = Power demand of Entity in year *t*
   Da(t) = Power demand of Apartment houses in year *t*
   Dg(t) = Power demand of Ger Area houses in year *t*
   L (t) = Power loss in year *t*
   t = year
2. De(t) = Demand of Entity in year
   Demand of entities is estimated by the following formula based on multiple regression analysis using data from 2001 to 2007:
   $De(t) = 4.96067 \times t^2 - 19839.94\ t + 19837626$
   $r^2 = 0.998$ (standardized r^2)
3. Da(t) = Demand of Apartment houses
   Da (t) = Da(t-1) x (Ra(t-1, t) x PCa (t)
   where:
   Da(t) = Power demand of Apartment houses in year *t*
   Da (t-1) = Power demand of Apartment houses in year *t*-1
   Ra (t-1, t) = Growth rate of number of apartment households between (*t*-1) and t
   PCa(t) = Average power consumption per apartment households in *t* estimated
4. Dg(t)
   Dg(t)= Dg(t-1) x rg(t,t-1) x (power consumption per Ger household)
   Where:
   rg(t,t-1) =growth rate of Ger households between years of (*t*-1) to t
   Power consumption for apartment household and Ger household is estimated based on the trend between 2002 to 2007, and the Ger's is capped by 95% of that of apartment household.
5. L(t) = Loss of power in year of t = D (t) x average loss ratio
   Average loss ratio is assumed to decrease from 0.23 to 0.1 in 2030 constantly.
6 . Peak Load
   Peak load is calculated by the following formula:
   Peak load (t) = D(t) x Average Peak Load ratio
   Average peak load ratio between 2002 to 2007, 0.2027, is employed as a ratio.

Figure 10.4.1 Electricity Peak Load



Source: JICA Study Team

Table 10.4.2 Capacity of Central Electricity System

Name	Design capacity (MWt)	Working capacity (MWt)	Construction Year	Name of Company
Ulaanbaatar Thermal Power Station -2	21.5*	17.6	1961 – 1969	"Thermal Power Station -2"
Ulaanbaatar Thermal Power Station -3	148.0	105.1	1968 – 1982	"Thermal Power Station -3"
Ulaanbaatar Thermal Power Station -4	540.0	432.0	1983 – 1991	"Thermal Power Station -4"
Sub-total	**709.5**	**554.7**		
Darkhan Thermal Power Station	48.0	38.6	1966, 1986	"Darkhan Thermal Power Station"
Erdenet Thermal Power Station	28.8*	21.0	1987 - 1989	"Erdenet Thermal Power Station "
Total	**786.3**	**614.3**	-	

Source: UB Electricity Distribution Com.

4) Proposed Programs

(1) Enhancement of Supply Capacity

(a) Development of a New power Source

The peak load will be 1,328 MW in 2030 compared with the present 554.7 mW working capacity and 709.5 mW design capacity for TPSs 2, 3, and 4 in UB, and 614.3 mW working capacity and 786.3 mW design capacity for the Central Electricity System (CES).

The capacity will be able to meet the demand in 2016 if the current capacity is maintained. However, the TPS-2 is due to be retired in several years and the TPS-3 will also be retired up to 2015. The supply capacity from TPS-4 alone will then decrease to 540 mW. Taking into account the retirement schedule of these aging plants, new power plants will be required before 2017. However, if reserve capacity is considered, a new power source needs to be constructed earlier than that.

Predicted power demand in the years around 2020 is shown in the table below. The demand ranges from just below the current working capacity of the three (3) Power Plants in UB City, 554 mW, to the design supply capacity of CES, 786 mW. The requirements for meeting the electricity demand will be further studied in relation to the whole demand and supply balance of the Central Electric System.

Table 10.4.3 Peak Load of Power

Year	2016	2017	2018	2019	2020	2021	2022
Peak load (MW)	518	559	604	652	702	754	808

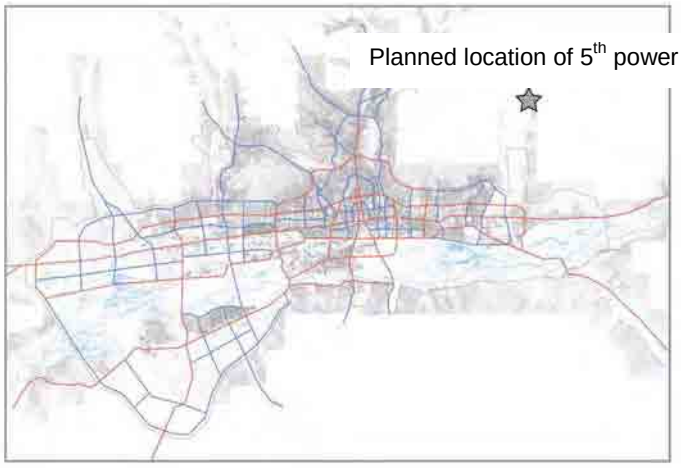
Source: JICA Study Team

The 5th Power Plant is now being offered for international bidding.[5] The location is near the Ulastai River in the east part of UB City. The power supply capacity is 300 MW. The project is planned be implemented in three phases from 2010 to 2012, with one third of the scaled developed each year. Construction is planned to be started in 2009. The location proposed by the government is on environmental sensitive area. Therefore environmental study is strictly needed before implementation of the project.

With this project, demand until 2015 shall be met and for demand after 2015, a further power plant shall be needed. Towards 2030, an additional power supply source should be developed. Accordingly, a study of a new power plant should be started soon.

[5] The deadline for the bidding was extended until January 2009 from November 2008.

Figure 10.4.2 Rough Location of the 5th Power Station planned by the Government



Source: Ministry of Fuel and Energy

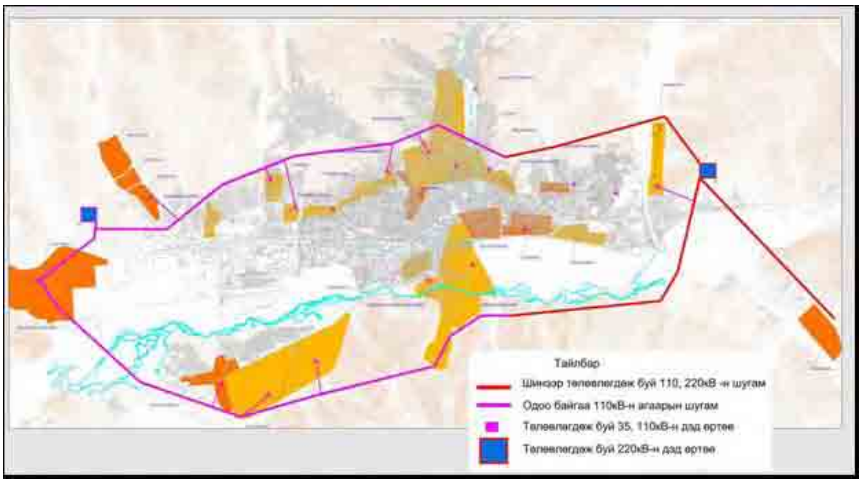
(b) **Improvement of Distribution Network and Sub-stations**

There are 16 sub-stations located in UB City to serve about one million people. Toward 2030, population of UB will be almost doubled from 967,000 in 2007 to 1,733,000 in 2030. Then, the number of sub-stations will also be doubled to serve growing demand.

In addition to the long term demand, in the short-term there is an urgent need for power supply for the priority projects of the 40,000 housing unit program, whose detailed plans have already been approved, as well as the increase in housing in the city in general.

Currently, 11 housing projects have been approved out of 29 proposed projects, and 5 of the 11 have already started at 7th Khoroolol, 14th Khoroolol, TV & Radio, Bayangol, and Buynt Khaan. The first three are Ger area redevelopment projects and the other two are new town developments. To meet the power demand for these short-term projects, the power supply network, including sub-station development are on-going as shown in Figure 10.4.3.

Figure 10.4.3 Existing, On-going, and Planned Development Projects in the Power Sector



Source: Ulaanbaatar City

(2) Effective financial structure

As described in Section 4.8.3, the average unit revenues for typical costumers in UB City suggest that a 60% tariff raise is required for residential customers and 10-30% for industrial and commercial customers to pursue the financial viability of the power sector.[6] Therefore, financial structure including private sector involvement in operation of the power supply and distribution should be studied.

(3) Study of energy source diversification

It is necessary to diversify the coal-based energy source to multiple energy sources from the viewpoint of environment, global warming, and energy security. The following are options to be considered for diversification.

(a) **Oil and Gas:** Introduction of oil and/or gas based energy is one option for diversifying the energy source. Current oil (gasoline) cost is approximately 0.07 – 0.1 Tg/kcal, which is higher than coal, approximately 0.01 Tg/kcal. In Mongolia, oil exploration started in 1994, and approximately 180,000 barrels of petroleum was exported in 2005. Additionally an exploration of the potential for coalbed methane will be started by Canada. Therefore it is expected that oil and gas based energy use becomes feasible due to a reducing price gap and higher efficiency of introducing new technology.

(b) **Renewable Energy:** Solar power generation has already been introduced in rural Mongolia; hence it may be one option. In UB City, solar power was introduced by the GTZ in their Eco Town project.

(c) **Biomass Energy:** It is proposed to introduce electric power generation by sewage sludge (see Section 10.3 “Sewage”), and Refuse Derived Fuel (RDF) power generation (see Section 10.6 “Solid Waste Management”); these technologies can contribute to the mitigation of global warming and environmentally friendly development.

(d) **Hydropower:** In UB city, water supply is one of the biggest urban issues; accordingly dams are under consideration for water supply. The dams could be designed for multiple purposes, including power generation.

(e) **Nuclear power:** Nuclear power is another option as a source of clean energy (as a countermeasure against global warming). According to the International Atomic Energy Agency (IAEA), the uranium reserves of Mongolia are ranked 14th in the world at 62,000 tons of Identified Resource. The Undiscovered Resources are estimated at about 1.39 million tons, the world largest. The development of nuclear power is an option that needs to be considered for the future.

[6] The World Bank, p. 108, originally referred from Economic Consulting Associates (ECA), 2005, “Mongolia: Financial Recovery Plan for Mongolia's Energy Sector.”

10.5 Heating

Planning strategies for the heating sector are as follows:

1) Planning Strategies

(a) **Enhancement of supply capacity**: Enhancement of the heating supply capacity by improving the outdated facilities is strongly needed. Presently, 74 km (26% of a total of 282 km) of pipes are more than 30 years old and 59.2 km (21%) are dilapidated and cannot be used. This 133.2 km of pipelines should be renovated to supply heat efficiently. In addition, heat transmission loss and network loss, accounting for 19.3% of the total heat produced, should be reduced. Also the distribution capacity shall be enhanced to meet the increasing demand in development zones.

(b) **Establishment of New Sources of Power and Heating**: The capacity to meet the increasing demand will be insufficient within a few years. The existing installed capacity is 1,695 Gcal/h with operational capacity of 1594 Gcal. The Central Heating System Connecting capacity is 1448.7 Gcal/h.
To meet the growing demand, a new source for power and heating needs to be established. ***The 5th power plant*** is planned to be constructed on the eastern side of the City, even though there is still dispute about the location of the power plant and need for further study.

(c) **Improvement of heating system in Ger area:** A single solution cannot be practical to improve heating systems in Ger area, thus, a comprehensive approach is necessary. First, expansion of connection of the central heating system to Ger areas needs to be pursued where the networking is technically and financially feasible. Second, if the first solution is not applicable, a community-based solution should be pursued through construction of small heating systems for groups of households in Ger area as part of ***a block utility center*** for water, sanitation, and heating. Thirdly, if the second approach is difficult, individual solutions should be pursued, including the dissemination of ***fuel-efficient stoves*** newly improved under donors' assistance. The Government should address its strong support with a policy to encourage individuals to replace stoves with the new improved types, providing special subsidy or financial arrangements for purchase. The subsidy will be rational in consideration of the savings to social costs from the reduction of pollutants.

(d) **Introduction of a Cluster Supply System for New Development Area:** For efficient heating supply, a cluster heating system needs to be studied as an alternative to connection to the central heating system by expanding the network pipes. The cluster system with zonal service catchments is thought to be more economically efficient and safer than a huge centralized system, provided the economy of scale makes it feasible.

(e) **Development of Effective Financial Structure:** To pursue financial viability of the power and heating related entities, a tariff structure which reflects cost recovery needs to be considered. This is also expected to contribute to curbing the demand. Heating is sold for 2500 Tg./Gcal to end users and 13,123 Tg./Gcal to industries, whereas the production cost of 1 Gcal of heating is 8,000 Tg at TPS and is sold to the District Heating Center for 4,000 Tg.

(f) **Energy conservation:** Energy conservation can be achieved to some extent by introduction of heat-efficient buildings; furthermore, apartment buildings need to be improved for better heat efficiency, especially windows.

2) Planning Target

The planning target is to connect apartment dwellers to the central heating system or local cluster systems and to promote cleaner energy in the Ger areas by improvement of fuel and stoves for air pollution.

3) Demand-Supply Balance for Additional Residential Development

In 2007, 1448.7 Gcal is connected to the central system out of the operational capacity of 1,594 Gcal/h and installed capacity of 1685.1 Gcal/h. At this moment, the reserve capacity is 236.4 Gcal, which can be additionally used for further connection.

Based on the population and housing demand forecast, the net additional heating demand for housing (apartments and detached houses) is estimated as follows: Regarding heating, because of data available at hand, heating demand for apartment residents has been calculated based on average unit heat load of *1.62 Gcal/h per 1,000 persons* which is the heat load used in calculations for development of the 40,000 housing unit projects and also used in UBMP2020 to estimate the heating load in 2020.

Heating Loss, around 30% in 2007, is assumed to be reduced to 15% in 2030.

This demand does not include any additional heating demand for non-housing buildings because data are still under request from the related agencies. Once the data is available, such heating demand will be calculated for the future demand.

Table 10.5.1 Heat Load for Additional Apartment Housing (Apartment and Detached Houses with Infrastructure)

(Unit: Gcal/h)

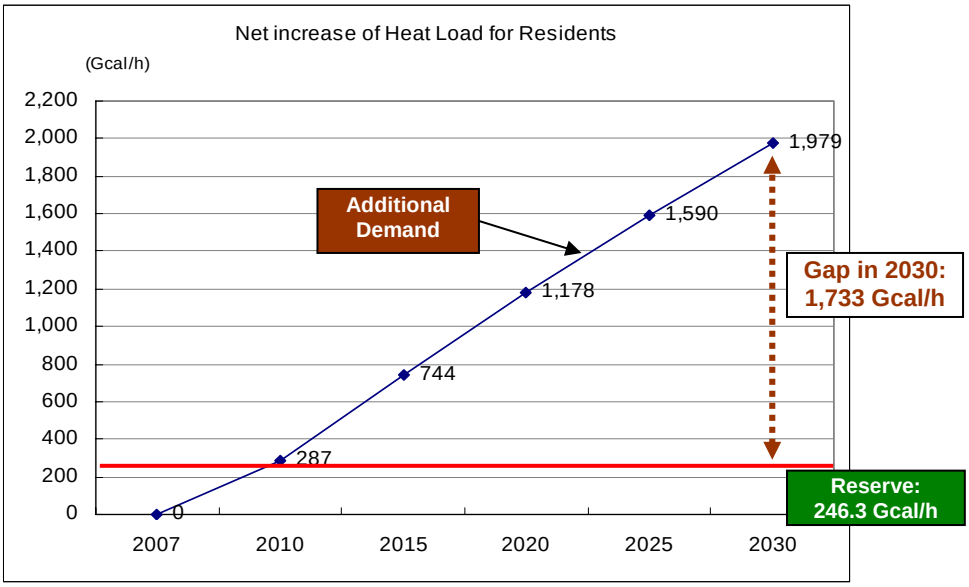
	2007	2010	2015	2020	2025	2030
Net increase of Heat Load for new apartments and detached houses	0	287	744	1,178	1,590	1,979

Notes: 1) Figures do not include the heating demand increase of facilities.
2) Heating load for apartments in 2007 is calculated as 1.62 Gcal/h for 1000 persons.
Source: JICA Study Team

Heating demand shall increase as shown in the figure below, increasing by 1,979 Gcal/h in 2030 from 2007 for the additional housing. The gap between the demand-supply is 1,716 Gcal/h, which is more than the present total heating capacity.
The figure does not include the heating demand for other uses like facilities, industrial factories and so on, because of data availability at this moment. Once data are available, the demand forecast shall be revised reflecting such demand.

As shown, additional heating demand for apartments will reach 192 Gcal/h in 2009, 287 Gcal/h in 2010. This means additional heating demand for apartments alone would surpass the present heating capacity.

Figure 10.5.1 Net Increase of Heat Load (Gcal/h) for Apartments and Detached houses connected to Infrastructure



Source: Study Team

4) Proposed Programs

(1) New Heating Supply Source

To meet the increasing demand, a new heating source is essential. In the short term, in 2009 at TPS-4, heating capacity will be expanded by 200 Gcal/h. After this, among some options, the 5th power station is now under study and will be designed to provide 550 to 600 Gcal/h in the eastern area near the Ullastai River in order to supply the existing settlement and new development in the eastern area of the city.

However, this project has not conducted an environmental study even though it is located in a water-resource sensitive area, so it is still controversial. The location of the new heating source shall be carefully studied taking into consideration the protected area and the development direction of urbanization.

Even if there is expansion of supply capacity by 750 Gca/h to 800 Gcal/h in the short-term, further development of heating source will be needed to meet the heating demand in 2018 or 2019, just for the increased demand of citizens and not including other entities like industries and facilities.

To meet the demand in 2030, more than 800 Gcal/h of heating shall be provided for apartment dwellers alone. When the future demand for non-domestic use is included in the calculation, development of the new heating source will appear even more urgent.

(2) Improvement of Distribution Pipes

(a) **Improvement of the existing distribution pipes:**

As shown in Chapter 4, a large part of the distribution pipes are old which need to be replaced by new ones. 74 km of pipes is more than 30 years old and 46.6km is more

than 40 years old. It is urgent to replace them by new pipes to improve heat distribution capacity avoiding leakage.

(b) **Increased Heating Supply Capacity for the Detailed Plan**

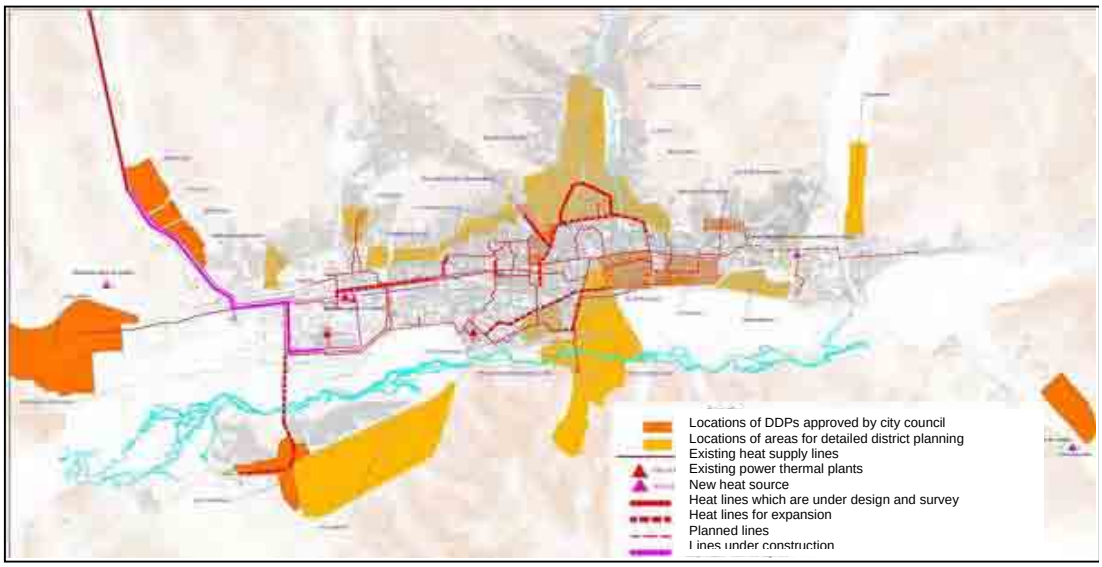
In addition to replacing such old, inoperative pipes, expanding the pipes capacity is also needed to meet the growing demand from the on-going developments.

Heating projects are on-going for the approved eleven (11) development projects of the 40,000 housing unit projects. Figure 10.5.2 shows the on-going and planned projects of the heating sector.

The capacity of distribution network is being expanded and some lines are extended towards outwards to connect the planned new town developments.

However, such extension of the network should be well planned and developed in accordance with the timely expansion of heating supply capacity, including the heating supply expansion of TSP- 4 and further the 5th power station development.[7]

Figure 10.5.2 Planned heating network improvement for the approved Detailed Development Plans



Source: Ulaanbaatar City

(3) Revision of Heating Tariffs

As summarized in Chapter 4, the price of heating is 2,500 Tg./Gcal for households, whose production costs about 8,000 Tg./Gcal at the power plants and is sold to the distribution company for 4,000 Tg./Gcal. The subsidized price structure distorts the cost recovery and financial viability of the heating sector. Therefore it is necessary to rationalize the price structure to recover the cost of production by the sale tariff. The required price increase should be further studied.

[7] The network extended to Bayangol New Town in the west of UB City is planned by the government is under construction; it seems that the distribution company is anxious about the supply capacity of heat to the area.

(4) Promotion of Heat-efficient Housing

Apartment buildings lose almost 36 % of heat supplied to them. GTZ is now researching the technology to improve heat-efficiency of buildings, which improves heat-efficiency by three times better[8]. Such a technology should be promoted for the renovation of re-construction of apartments.

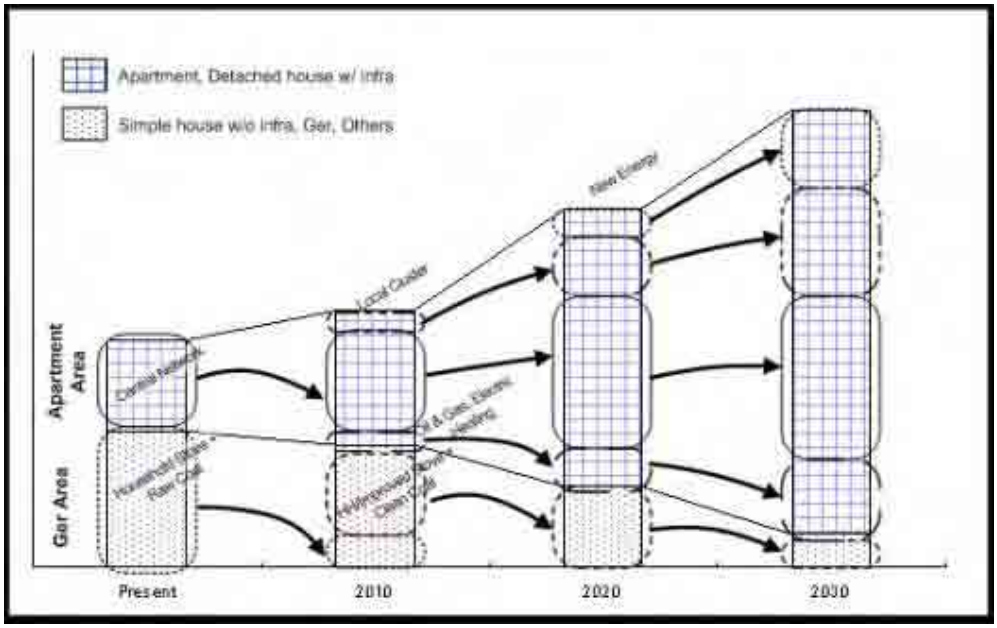
(5) On-site Solution in Ger Area – Improvement of Fuel and Stoves

Heating demand has increased due to the population growth. Ulaanbaatar City has made efforts to enhance heating capacity of the existing power plants, improve the aging pipes, and extend the pipeline network. The 5th power plant is also planned. However, these activities have not satisfied the rapid population growth, especially in Ger areas.

In Ger areas, generally the residents use outdated household stoves using raw coal. Raw coal usually burns inefficiently to generate excessive dust causing air pollution. Thus, heating issues in Ger areas are almost directly related to air pollution.

One of the major policies on heating improvement as well as air pollution mitigation is conversion of Gers to apartment houses, which will cost much and take a long time. Therefore, a “step-by-step approach” is proposed as is the concept in sewerage improvement. The basic concept on heating improvement is explained in Figure 10.5.3.

Figure 10.5.3 Concept of Step-by-Step Approach to Heating Improvement



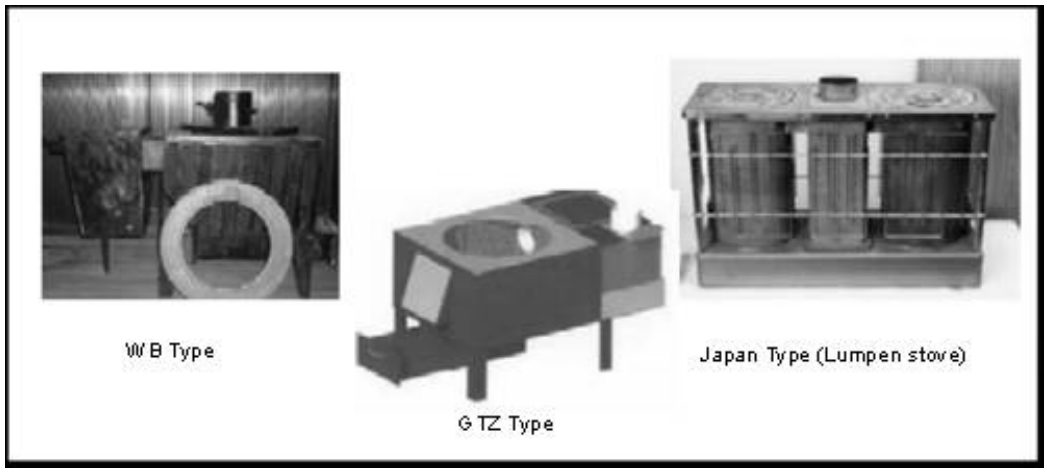
Source: JICA Study Team

[8] Apartments built of normal concrete and blocks consume more than 265 - 400 kwh/m^2/ while the type GTZ researched , 100 kwh/m^2/a; about 3 times heat efficient.

In the incremental approach, the following actions are proposed:

(a) **Improved Stoves:** Stove improvement projects aims at housing heating efficiency, which have been conducted by the international agencies of the World Bank, GTZ and Japan, as well as the Mongolian public and private sectors (see Figure 10.5.4). The improved stoves can save energy. In addition, the improved stoves are relatively low technology and do not require a huge initial cost. Therefore, their adoption is useful as an urgent, short-term countermeasure.

Figure 10.5.4 Examples of Improved Coal Stove



Source: JICA Study Team

Various projects have already dealt with the production and promotion of such improved stoves; however, the increased prevalence of the improved stoves is less than was expected. The major reasons why people do not use the improved stoves are:

- The price of the improved stoves is higher than that of the traditional type.
- Quality of the stoves is not reliable. Some domestically produced stoves do not work at the expected level of efficiency. Accordingly people do not trust the quality of the improved stoves.
- People must know how to use the improved stoves effectively; however, most users do not know how and cannot use the stoves properly and efficiently.

(b) **Improved Coal (Clean Coal):** Raw coal, which contains impurities and has low combustion efficiency, is the major fuel for heating in Ger areas. Production of cleaner coal such as semi-coke and briquettes has been studied by international and Mongolian agencies. Table 10.5.2 shows examples of the quality of semi-cokes produced in “the Study of Semi-coke Briquette Production Plant at Power Plant No. 2” and a Feasibility Study on Clean Coal Technology by New Energy and Industrial Technology Development Organization (NEDO), Japan.

Table 10.5.2 Example of Improved Coal Quality

	Semi-coke Briquette	Raw Coal
then Ministry of Fuel and Energy, 2008		
Dust Emission	0.015 g/m^3 for initial 3 hrs combustion	0.24 g/m^3 for initial 3 hrs combustion
	0.009 g/m^3 for 12 hrs combustion	0.06 g/m^3 for 12 hrs combustion
Caloric Value	> 4,500 kcal/kg	3,000 – 4,500 kcal/kg
	Combustion lasts twice as long as with raw coal	Combustion lasts short time
Household Consumption per year	Approx. 3 tons	Approx. 5 tons
NEDO, 2007		
Dust Emission	Average 0.010 g/m^3	Average 0.128 g/m^3
Non-combustion Ratio	0.71 %	6.20 %

Source: JICA Study Team

However, clean coal is not used much by the UB people. The major reasons are:

- Most clean coal producing companies do not have the technical experience to produce semi-coke of high and reliable quality;
- Price of semi-coke is higher than that of raw coal; and
- Laws and regulations to control the quality of products and to prohibit and/or mitigate air pollution load have not been formulated properly.

This situation is similar to that of the Improved Stoves. Therefore, increased adoption of improved coal use requires a comprehensive approach including technical, financial, and institutional aspects, which is further discussed in section 11.2.

(6) Introduction of Local Cluster Network

It is proposed to introduce a small/medium scale local network, the so called local cluster network, for enhanced efficiency and ease of implementation. The basic concept of introducing the Cluster Type Network System is described below:

- Urbanized area adjacent or close to the existing central network system is connected to the central network.
- Area within the planned expansion area of the central network
- Cluster Type Network System shall be studied and established outside the above-mentioned urbanized area.
- Legal and institutional improvement is necessary to enhance the private sector and/or community to develop and operate local cluster network system.

For the implementation of the local cluster network development, the following issues should be recognized:

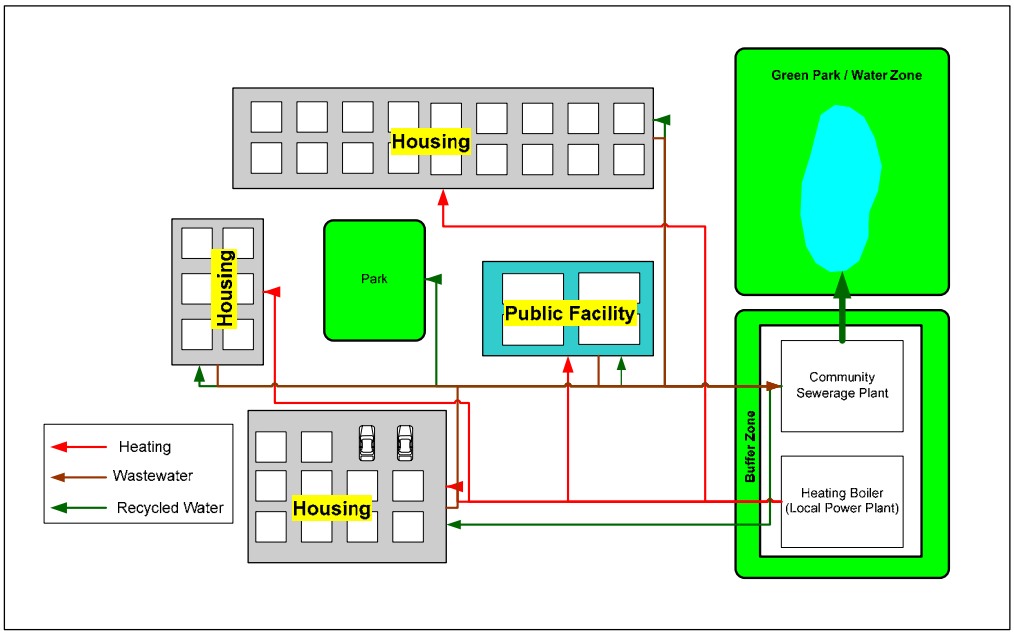
(a) **Financial aspect:** Due to its small scale and less efficient operation compared to the

existing large scale heating supply system, the initial cost of a cluster system will place a burden on beneficiaries and developers. Therefore it is necessary to create a financial support system including subsidies and tax exemptions.

(b) **Supervision and Inspection:** The local network system may be individually operated by organizations other than the central system operator, with some operated by the private sector and some by communities. Without a uniform service standard, the service level of each network would be different. Therefore it is necessary to create a uniform guideline for development of networks and establishment of operators, and it is also necessary to establish a system of inspection and supervision.

Figure 10.5.6 shows a prototype image of Local Cluster Network including not only heating but sewerage and water recycling system.

Figure 10.5.5 Prototype Image of Local Cluster Network



Source: JICA Study Team

(7) Electric Heating

Electric heating is one of the options for heating to alleviate air pollution from the Ger areas. Recently Korea donated 10,000 electric stoves. Additionally Ulaanbaatar City conducted a project to install electric stoves in the Ger area; however, the project was not successful due to low electric distribution capacity. Therefore, improvement of electric supply/distribution capacity might induce the shift to electric stoves from coal stoves.

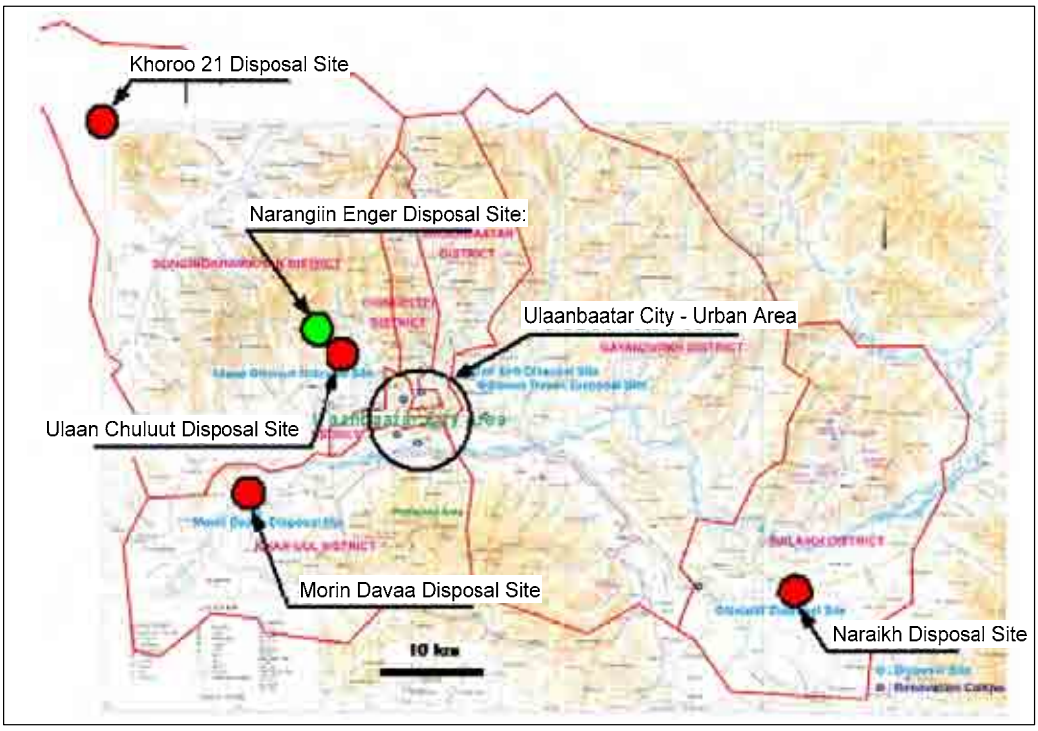
10.6 Solid Waste Management

1) Current Status

JICA conducted a Solid Waste Management Study in 2007, with the planning target year of 2020. According to the Study, the current problems on solid waste management are summarized below:

- Low quality of the collection network due to the lack of equipment and workers. This situation is especially prevalent in Ger areas;
- Low quality of the collection work also causes illegal dumping, which causes pollution of underground water and soil;
- Construction waste is illegally dumped along rivers;
- The existing dumping sites, i.e., Ulaan Chuluut Disposal Site (UCDS), Nalaikh Disposal Site (NDS), Morin Davaa Disposal Site (MDDS) and Khoroo 21 Disposal Site (KH21DS) (see Figure 10.6.1) have been operated as open dumping type disposal sites, not sanitary landfill type; thereby leachate from them has contaminated water and soil;
- There has been no special facility for treatment of medical and toxic waste; and
- A huge volume of coal ash waste is generated from Ger areas, heat-only-boilers and power plants.

Figure 10.6.1 Location Map of Existing Solid Waste Disposal Sites



Source: Recalculated based on the JICA Sold Waste Management Master Plan Project, 2007

2) Demand Projection and Planning Target

Table 10.6.1 summarizes the future demand for solid waste disposal and the proposed schedule for capacity expansion of disposal sites. The JICA Solid Waste Management Master Plan identifies a new disposal site near UCDS, which is Narangiin Enger Disposal Site (NEDS).

Table 10.6.1 Demand Projection of Solid Waste and Capacity Expansion

Demand Projection Unit: ton/day

		2006	2010	2020	2030
Household and Multiple Waste	Winter	593.6	681.9	894.5	1,454.0
	Summer	276.9	375.2	708.4	1,151.5
Others (Medical, Industrial and Construction)	Winter	146.1	179.9	298.6	475.0
	Summer	208.5	257.1	430.6	690.0
Total	Winter	739.7	861.8	1,193.1	1,929.0
	Summer	485.4	632.2	1,139.0	1,841.5

Disposal Ammount Unit: ton/day

		2006	2010	2020
UCDS/NEDS	Winter	338.4	683.0	935.4
	Summer	483.0	502.0	911.2
MDDS	Winter	18.5	38.0	51.3
	Summer	26.1	28.0	50.1
NDS	Winter	11.3	23.0	0.8
	Summer	16.1	17.0	30.1
KH21DS	Winter	3.8	8.0	10.3
	Summer	5.5	6.0	10.0
Total	Winter	372.0	752.0	997.8
	Summer	530.7	553.0	1,001.4

Source: Recalculated based on the JICA Sold Waste Management Master Plan Project, 2007

The Master Plan aims to “establish adequate solid waste management system harmonizing environmental conservation by 2020”.

Planning targets in the year of 2020 are as follows:

Collection ratio (%)	:	100%
Ratio on inadequate self treatment and illegal dumping (%)	:	0.7% in winter 1.2% in summer
Separated refuse ratio in apartment areas (%)	:	40.4% in winter 48.9% in summer
Recycling ratio	:	16.9% in winter 20.5% in summer
Final treatment measure	:	NEDS: Sanitary landfill level 4 Others: Sanitary landfill level 2

3) Proposed Program

The major proposed programs described in the Master Plan are listed in Table 10.6.2.

Table 10.6.2 Proposed Program for Solid Waste Management

Project	Description	Term
Improvement of Collection Network System	- To raise collection ratio - To install separation refuse system in apartment areas - To develop a maintenance and workshop facility	Short - Medium
Improvement of disposal sites	- To develop the new disposal site at Narangiin Enger as a sanitary landfill level 4 - To improve sanitary level of existing 3 disposal sites up to level 2	Short
Construction of recycling plant	- To develop a recycling plant beside the Narangiin Enger Disposal Site with: - Separating facility and - RDF (refuse derived fuel) factory - To promote private sector to operate recycling business	Short - Medium - Long
Establishment of medical and industrial waste management	- To regulate classification of toxic waste - To prohibit inadequate self treatment and illegal dumping - To develop toxic waste treatment facility	Short - Medium - Long
Promotion and public awareness raising	- To provide guideline for the promotion of the 3Rs - To strengthen the legal system to prohibit self treatment and illegal dumping	Short - Medium

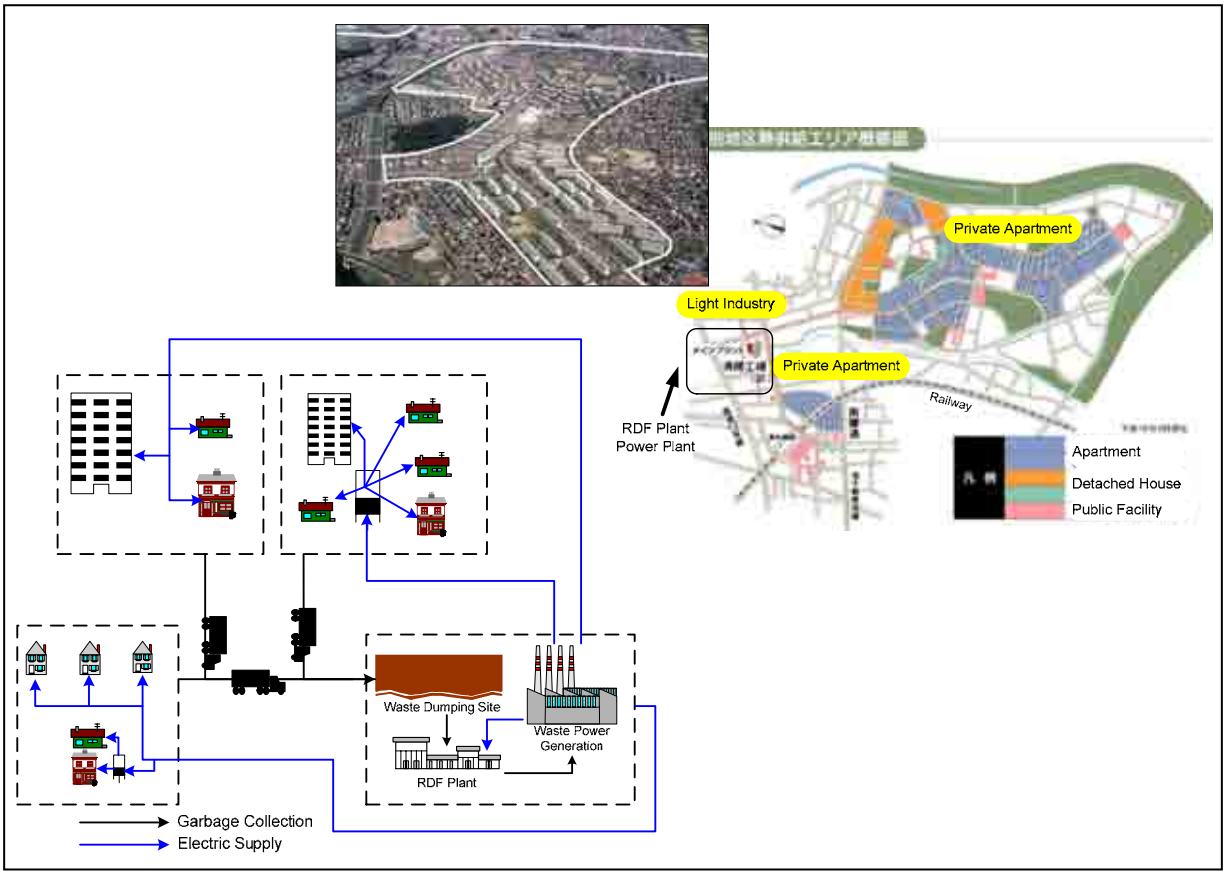
Source: JICA, The Sold Waste Management Master Plan Project, 2007

The planned new disposal site (NEDS) will reach its planned capacity before the target year of the Master Plan of 2020. The Master Plan recommends to start a study for the next new disposal site by 2020, and to promote recycling in order to extend the life of the disposal site. A recycling center including RDF (Refuse Derived Fuel) production facility is strongly recommended to be constructed as soon as possible. It is expected that RDF can contribute not only to reduction of disposal waste but also to creation of a new energy source.

(a) RDF Power Generation

Figure 10.6.2 shows the conceptual design of a power generation plant by RDF and an example in Japan.

Figure 10.6.2 Concept Design of RDF Power Generation System and Example



Source: Sapporo-shi Hokkaido, Japan

Air pollution is one of the most critical problems in Ulaanbaatar city; hence rehabilitation of the outdated HOBs shall be urgently programmed. It is proposed to make a rehabilitation plan of HOBs to apply mixed combustion of coal and RDF.

(b) Recycle of Coal Ash and Construction Waste

Coal burning by electric power plants and HOBs generates huge amounts of coal ash waste. This situation is a critical issue, and it causes dust pollution. The amount of household waste from Ger areas in winter is four times greater than that from apartment areas due to huge amounts of coal ash from household stoves. Most of the ash is illegally disposed of within residential areas.

Coal ash is classified into two (2) types:

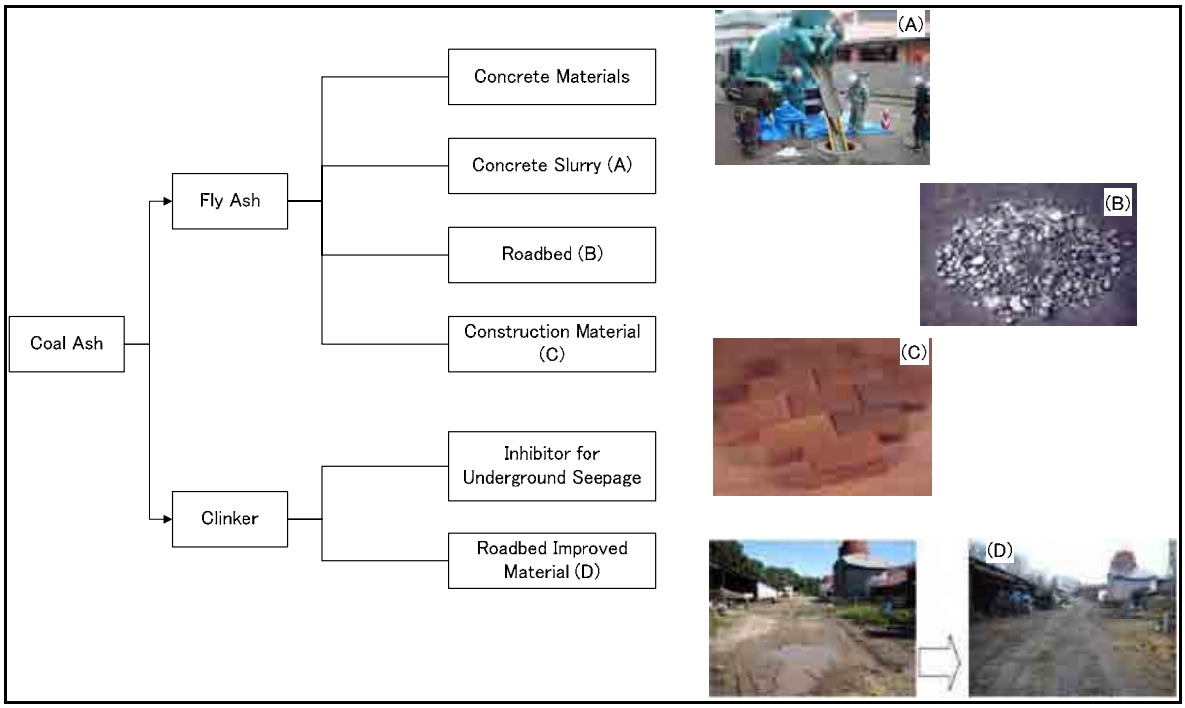
- Fly ash contained in exhaust gas, which is basically trapped by a dust precipitator or discharged to the atmosphere.
- Clinker is residue from boilers. Most coal ash from household stoves is classified in this category.

As shown in Figure 10.6.3, coal ash can be recycled for building materials, roadbed, ceramics, fertilizers, soil improvement. The key issues for enhancing effective recycling of coal ash are:

- Economical efficiency of the recycling technique.
- An effective network for collection and recycling of coal ash and sale and distribution of the products.

Therefore it is recommended to add the function of coal ash recycling to the waste recycling center and to establish sales and distribution network of products.

Figure 10.6.3 Examples of Materials made from Recycled Coal Ash



Source: Home page of Hokkaido Electric Power Co., Inc.