Data Collection Survey on Promoting Pre-Disaster Investment in Natural Disaster Prevention in Mongolia

Final Report

June 2024

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS GLOBAL CO., LTD.
TOKYO ELECTRIC POWER SERVICES CO., LTD.

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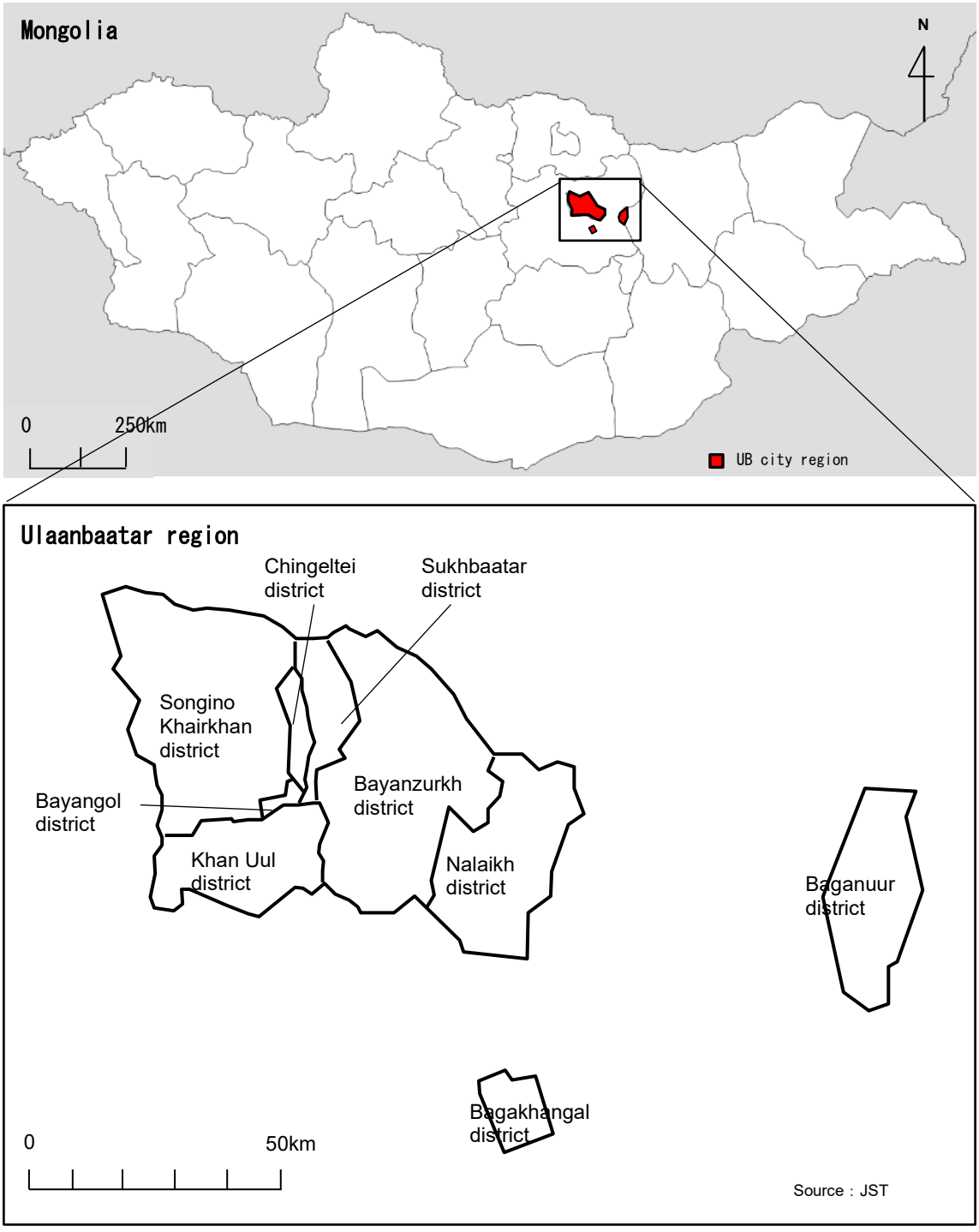
Currency exchange rate
1.00MNT＝0.000382USD＝0.059900JPY
（June 2024 JICA rate）

In this report, all monetary values are denoted in Mongolian currency as MNT and in U.S. dollars as USD, followed by the respective amounts.



Survey Target Map

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Abbreviations

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
BGAN	Broadband Global Area Network
BNbD	Barilgin Norm ba Durem
BD	Barilgin Durem
CDC	Construction Development Center
CTBTO	Comprehensive Nuclear Test Ban Treaty Organization
DB	Database
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EMDA	Emergency Management Department of Aimag
EMDC	Emergency Management Department of the Capital City
GDP	Gross Domestic Product
GIS	Geographic Information System
GUBBG	Geodesy Usnii Barilga Baiguulamjiin Gazar
IAG	Institute of Astronomy and Geophysics
IFRC	International Federation of Red Cross and Red Crescent Societies
IRIMHE	Information and Research Institute of Meteorology, Hydrology and Environment
JICA	Japan International Cooperation Agency
KIGAM	Korea Institute of Geoscience & Mineral Resources
MAS	Mongolian Academy of Sciences
MES	Ministry of Education and Science
M	Magnitudes
MCUD	Ministry of Construction and Urban Development
MNT	Mongolian Tugrug
MOE	Ministry of Energy
MOU	Memorandum of Understanding
MP	Master Plan
MRCS	Mongolian Red Cross Society
MSK	Medvedev-Sponheuer-Karnik intensity scale
MUST	Mongolian University of Science and Technology
NDC	National Dispatching Center
NEC	National Energy Center
NEMA	National Emergency Management Agency
NGO	Non-Governmental Organization
NPTG	National Power Transmission Grid State owned Stock Company

PDM	Project Design Matrix
RC	Reinforced Concrete
SAR	Search and Rescue
SDGs	Sustainable Development Goals
SMS	Short Message Service
UB	Ulaanbaatar
TPP2	Thermal Power Plant No.2
TPP3	Thermal Power Plant No.3
TPP4	Thermal Power Plant No.4
UBEDN	Ulaanbaatar Electricity Distribution Network Company
UBDH	Ulaanbaatar District Heating Company
UBMP	City Master Plan and Urban Development of Ulaanbaatar City
UBUDA	Ulaanbaatar City Urban Development Agency
UNDP	United Nations Development Programme
UN HABITAT	United Nations Human Settlements Programme
UNDRR	UN Office for Disaster Risk Reduction
UEDAS	Urgent Earthquake Detection and Alarm System
USD	United States Dollar
USGS	United States Geological Survey
VSAT	Very Small Aperture Terminal
WB	World Bank
WG	Working Group
WHO	World Health Organization

Chapter 1 Outline of the Survey

1.1 Survey Background

Since 1900, Mongolia has experienced thirteen earthquakes with magnitudes over 7. Notably, the Tsetserleg earthquake (July 9, 1905, M8.1), the Bulnay earthquake (July 23, 1905, M8.2), and the Gove-Altay earthquake (December 4, 1957, M8.3) were all devastating events exceeding magnitude 8 and occurred near the outskirts of Ulaanbaatar (UB), the capital city. Recently, six active faults have been discovered near UB, where about half of the total population, or 1.67 million people, live. The increasing number of earthquakes observed near UB and the rising frequency of perceptible quakes within the city are heightening concerns about seismic risks. Earthquake disasters threaten not only the safety of lives but also hinder economic development, leading to increased poverty among the low-income population. This is particularly critical in UB, which supports most of the country's economic activities, making it essential to minimize damage.

The Japan International Cooperation Agency (JICA) implemented the development planning survey-type technical cooperation " Mongolia, the project for strengthening the capacity of seismic disaster risk management in Ulaanbaatar city (Phase 0)" (2012–2013). This project supported the establishment of a comprehensive earthquake risk map, the review and revision of earthquake disaster prevention plans, and the development of seismic guidelines for medium and high-rise buildings. The survey estimated potential seismic intensities in UB City at MSK (Medvedev-Sponheuer-Karnik) intensity 8-9, identified building damage in UB including the Ger districts, infrastructure such as roads, and lifelines including water supply, sewage, and underground heating pipelines, as well as highlighted fire risks from coal stoves in winter.

Subsequently, the technical cooperation "The project for strengthening the national capacity of earthquake disaster protection and prevention in Mongolia (Phase 1)" was implemented from 2016 to 2019. This phase supported the improvement of administrative capabilities at the National Emergency Management Agency (NEMA), Mongolia's central disaster prevention organization. As a result, the country's first disaster prevention white paper was published. A disaster prevention guideline was approved by a Deputy Prime Minister's decree, and a system for demolishing and rebuilding non-seismic buildings was established. Following this, a survey by the former National Audit Office (GASI) found that out of the buildings in UB, 445 were determined to have high or medium seismic risk. In UB's seismic diagnosis for “Passportization[1]” of buildings, 185 buildings were found to be non-seismic or in need of reinforcement. Additionally, in "Project for Strengthening the National Capacity of Earthquake Disaster Protection and Prevention Phase 2 (Phase 2)" (2022–2026), the seismic retrofitting of public buildings, including government offices and key hospitals necessary for maintaining functions even after a disaster, was prioritized. Technical transfer to relevant ministries and standardization support for design and construction are being advanced, along with seismic evaluations and trial designs for public buildings considered critical by the Mongolian government.

Building on the successes of JICA projects, Mongolia has actively pursued initiatives aligned with "Sendai Framework for Disaster Risk Reduction 2015-2030," including the publication of a disaster prevention white paper, development of local disaster prevention plans, and the revision of the "Disaster Prevention Law" in 2017 to incorporate the concept of "Build Back Better" and other preemptive measures. While these efforts have focused primarily on non-structural (soft) measures and necessary legal frameworks in place, the actual implementation of seismic and isolation construction for public facilities and critical infrastructure has been limited.

On July 6, 2023, a large-scale flood occurred in UB city. Over 100 buildings along the Selbe and Tuul rivers were flooded, causing significant damage to many infrastructural facilities and resulting in a substantial number of evacuees. Despite Mongolia's predominantly dry climate, there has been a trend of annual occurrences of flooding disaster in recent years due to short-term heavy rainfall and

[1] The building summary includes the number of floors, structure, construction year, usage, and seismic performance assessment results, and is used to determine the building's usability.

prolonged rains, despite efforts to plan, measures have not progressed as desired.

In addition to the earthquake disaster that have been cooperatively dealt with so far, the risk of disasters due to abnormal weather conditions such as floods is increasing. The infrastructure and lifelines established during the old socialist era are aging, and significant damage is anticipated in the event of any disaster. Therefore, there is a need to address the vulnerability of critical facilities to disasters.

1.2 Survey Objective

Considering the increased disaster risks due to earthquakes, floods, and other events, we will focus on the aging public buildings, infrastructure, lifelines, and river and urban drainage systems that play a crucial role in disaster prevention. We aim to narrow down high-priority and urgent projects by utilizing the results of development assistance previously conducted by Japan and gather the necessary information to lead to the formation of financial cooperation projects.

1.3 Scope of Survey

1.3.1 Survey Description

This work is carried out based on the implementation process to achieve the objectives of "1.2 Purpose of the Work," while considering the "1.4 Work Implementation Plan and Schedule." The tasks outlined in "1.5 Survey Schedule and Activities" are performed according to the schedule, and reports and other documents are prepared.

1.3.2 Survey Target Area

Mongolia (UB City as the base of the survey)

1.3.3 Related Ministries and Local Government Agencies

The following agencies were targeted as relevant agencies for this project.

Ministry of Construction and Urban Development: Formulate policies for the seismic retrofitting of public buildings, infrastructure, and lifelines, and manage the facilities that have them.

Construction Development Center: Confirm the seismic retrofit design.

Ministry of Education and Science: Manage schools that serve as disaster prevention bases.

Ministry of Health: Manage hospitals that serve as bases during disasters.

Ulaanbaatar City Urban Development Agency: Conduct seismic diagnosis of public buildings in UB City.

Association of Construction Engineers: Promote seismic retrofitting in collaboration with administrative agencies.

Ministry of Energy: Oversee overall power and heat supply.

National Power Transmission Grid State Owned Stock Company: Be responsible for transmission.

Thermal Power Plant No.2, 3, 4: Operate power generation and heating facilities.

City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city: Handle infrastructure development policies and oversee flood measures.

Housing Policy Department of the capital city: Oversee the development of infrastructure and lifelines in Ger districts.

Water supply and Sewerage Authority of Ulaanbaatar city: Manage and operate water supply and distribution facilities.

Information and Research Institute of Meteorology, Hydrology and Environment: Be responsible for the reception and transmission of hydrological information.

National Emergency Management Agency: Act as the national disaster prevention administrative agency for disaster prevention, response, and recovery and reconstruction.

Emergency Management Department of the Capital City: Implement disaster prevention measures in Ulaanbaatar.

Ministry of Digital Development: Oversee legislation and basic infrastructure development in digital advancement, communications, and information technology.

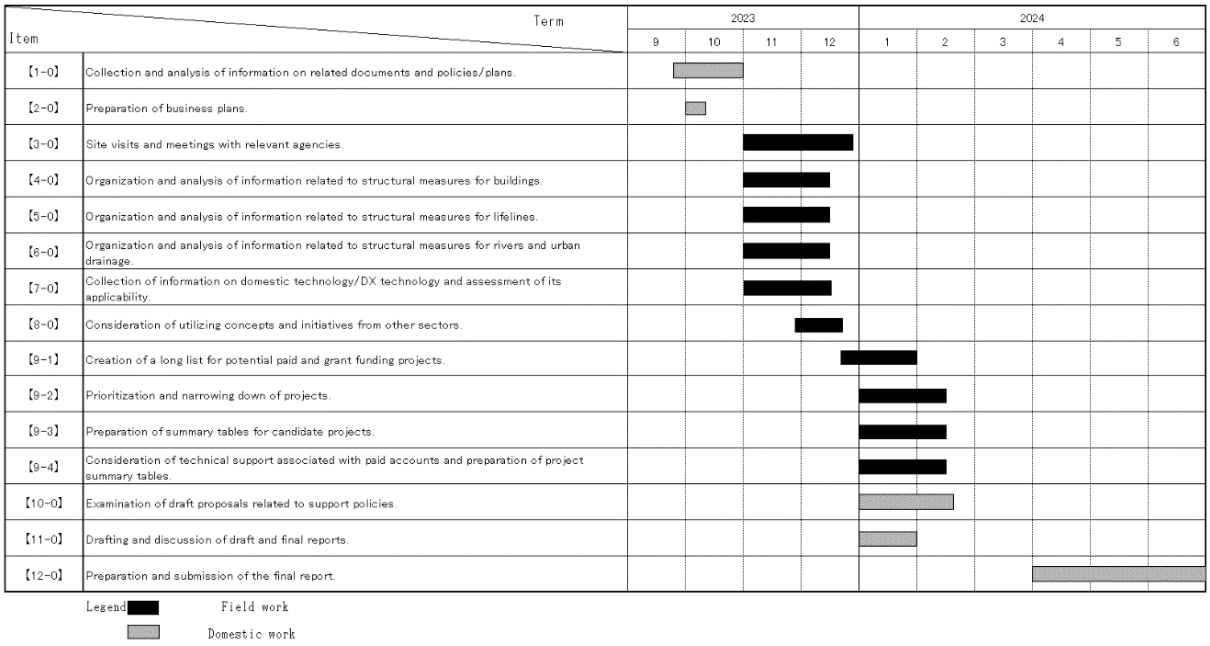
The implementation plan and progress of operations is reported below.

1.4 Survey Implementation Plan and Flow Chart

1.4.1 Survey Schedule

With efficiency in mind for the fieldwork, under the coordination with JICA, the survey team primarily conducted visits and interviews with the target institutions following the workflow shown in Figure 1.4.1.

Table 1.4.1 Survey Schedule



Source: JST

In this project, we conducted field surveys in the target area for about two weeks from early November 2023, then we compiled the survey results and submitted them as a progress report on February 20, 2024. This report covers the findings for the progress up to the end of March and we planned to submit the final report by the end of June of the same year.

The flow chart of the project is shown below.

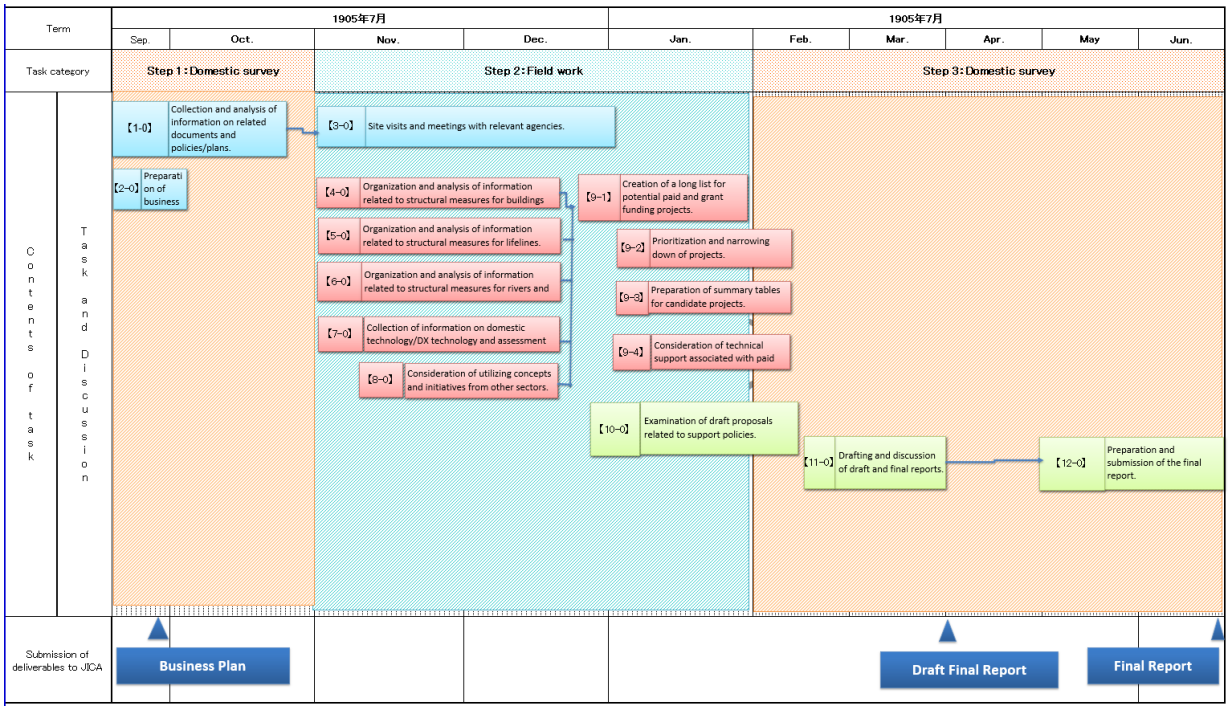


Figure 1.4.1 Flow Chart

1.4.2 Composition of Team Members

Table 1.4.2 Composition of Survey Members

Position	Name
Project Manager／Disaster Prevention Plan & Building Disaster Prevention 1	Kiyotaka Owada
Disaster Prevention Plan & Building Disaster Prevention 2	Seiichiro Fukushima
Disaster Prevention (Plant: Electric Power/Heat Supply)	Tetsuro Sasayama
Disaster Prevention (Plant: Electric Power Transmission and Distribution/Buried Pipes)	Koichi Otsuka
Disaster Prevention (River/Urban Drainage) 1	Kei Kohara
Disaster Prevention (River/Urban Drainage) 2	Hidehiro Takeshima

1.5 Survey Period and Activity

1.5.1 Survey Period

The field survey was schedule from November 6 to November 17, 2023, for 12 days.

Table 1.5.1 Field Survey Schedule

Destination	
11/6	JICA Mongolia Office, NEMA, CDC
11/7	IAG, City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city
11/8	MOE, NEC, Thermal Power Plant No.4, MCUD
11/9	MCUD, The Capital City Education Department
11/10	UBDH, Thermal Power Plant No.2
11/13	Ministry of Finance, Ministry of Economic Development, IRIMIHE, Ministry of Digital Development, Thermal Power Plant No.3, Selbe River Restoration Unit (CDC)
11/14	From Upstream to Downstream of Selbe river
11/15	ADB, GUBBG
11/16	WB, MCUD, MOH, Selbe River Restoration Unit (in CDC)
11/17	Ulaanbaatar City Urban Development Agency

1.5.2 Survey Activity

The following table summarizes the survey content for relevant agencies.

Destination	Discussion
JICA Mongolia Office	Courtesy visits and explanation of the survey policy
NEMA	Status of disaster preparedness stockpile and response to flooding
CDC	Seismic retrofitting standards and regulations
IAG	Support requirements
City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city	MP and Selbe River Restoration Plan
MOE	Involvement in the seismic performance of power facilities
NEC	Activity related to power facilities
Thermal Power Plant No.2	Overview and seismic performance of Thermal Power Plants
Thermal Power Plant No.3	Overview and seismic performance of Thermal Power Plants
Thermal Power Plant No.4	Overview and seismic performance of Thermal Power Plants
MCUD	Seismic Retrofitting Needs for Public Buildings
Ulaanbaatar District Heating Company	Seismic performance of district heating pipelines
Ministry of Finance	Budget for disaster prevention
Ministry of Economic Development	Budget for disaster prevention
IRIMHE	Hydrometeorological observations during flooding, Content and implementation system of information dissemination
Ministry of Digital Development	Status of information dissemination system
ADB	Current status and outlook of projects
GUBBG	Pump station, Management system of drainage network
Water supply and Sewerage Authority of Ulaanbaatar city	Organizational Structure, Maintenance Budget, and Summary of Operations
Ulaanbaatar City Urban Development Agency	Overview of MP and Selbe River Restoration Plan

Chapter 2 Organization of Basic Information on Disaster Prevention in Mongolia

2.1 Social & Economic Conditions

2.1.1 Social Conditions

(1) Administrative Divisions

1) Composition

Mongolia consists of 21 aimags (prefecture), and in 1994, the Orkhon, Govisumber, and Darkhan-Uul aimags were added to the existing 18 aimags.

Mongolia has 22 Khot (cities), including the capital Ulaanbaatar (UB) and the aimag center (aimag capital location) in 21 aimags. Each aimag center has an aimag office, and regional branches of central ministries are responsible for construction, urban development, infrastructure, lifelines, education, health, welfare, the natural environment, and national registration, except for the administrative departments. These aimag centers operate according to the basic development policies and plans of the aimags.

In addition to cities, each aimag in Mongolia is composed of soums (country), totaling 330 soums nationwide. Each soum has an administrative office that provides social services such as operating schools and hospitals.

Soum consists of 5~6 Bag (village).

Table 2.1.1 Administrative division

Administrative division	Number	Remarks
Aimag: Prefecture	21	
Khot: City	22	UB City and 21 aimag capital location
Duureg: District	9	Administrative unit only in UB City
Soum: Country	330	Included in 21 aimags
Bag: Village	1,645	Included in 330 soums
Khoroo	204	The smallest administrative division below the district level

Source: JST based on data from National Statistical Office

Source：https://hsdp.gazar.gov.mn/

Figure 2.1.1 Administrative division

2) Government

The Cabinet is formed by the Prime Minister, appointed by the parliament elected in quadrennial general elections (next in June 2024), who then nominates the ministers. The parliament consists of 76 members elected in the general elections. The executive branch comprises 16 ministries led by ministers appointed by the Prime Minister, along with 25 affiliated agencies. Additionally, there are 4 agencies directly under the Prime Minister, including the National Committee for Physical Culture and Sports and the Intelligence Agency, and 5 under the Deputy Prime Minister, one of which is NEMA.

3) Aimag (Prefecture)

The governor of each aimag is appointed by the Prime Minister and serves a four-year term. The decision-making body is the People's Representative Council, elected by the residents of the aimag. The number of council members is determined by the population of the aimag, ranging from 25 to 41 (and 45 for UB City), as specified by the "Law on Administration, Administrative Units, and Self-Governance."

Aimag administrations consist of professionals dispatched from central ministries. The Disaster Prevention Bureau within each aimag, known as the Emergency Management Department of Aimag (EMDA), is responsible for responding to disasters and accidents. EMDA staff are directly appointed by NEMA, with salaries funded by NEMA but other expenses covered by the aimag.

Additionally, while not administrative divisions, the regions of Eastern, Central, Southern, and Western Mongolia are sometimes used as broad jurisdictional divisions.

4) Capital City (Niislel Ulaanbaatar khot: UB City)

Ulaanbaatar City, as the capital, is designated a special city responsible for the capital's administration, primarily based on coordination among national institutions according to the "Law on the Legal Status of the Capital City of Mongolia, Ulaanbaatar." The decision-making People's Representative Council (45 members) is elected by city residents. The mayor is selected by a majority vote of the Council and appointed by the Prime Minister. While the Mayor's office and the general administration departments are located in the Sukhbaatar district in the city center, most departments have moved to the new government buildings in the Yaarmag district in the southwest of the city.

5) Duureg (District)

The districts are unique administrative units within Ulaanbaatar City, which consists of 9 districts. The district's decision-making body, the District Representative Council (with 25 to 43 members), is elected by the district's residents. The district governor is appointed by the mayor from candidates selected by a majority vote of the Council. Administrative operations are conducted at the district offices, where each has a Disaster Prevention Division, an agency of the UB City Emergency Management Department (EMDC), responsible for disaster and accident prevention and emergency response.

6) Soum (Country)

Soum is a lower administrative division under aimag, and there are 330 soums nationwide. The soum governor is elected by the Soum People's Representative Council and appointed by aimag governor, with a term of four years. The number of members in the Soum People's Representative Council varies with the population: 15 members for populations up to 2,000 and up to 29 members for populations over 9,001.

7) Bag (Village)

The bag is the smallest administrative division under the soum. The candidate for the bag governor, determined by the Bagh People's Congress, is appointed by the soum governor for a term of four years. All eligible voters residing in the bag have the right to participate in the Bagh People's Congress, which has the authority to propose agenda items and veto decisions. The population of a bag is generally around 500 to 1,000 people, and there is a total of 1,645 bag.

8) Khoroo

The khoroo is the smallest administrative division under the district in Ulaanbaatar City, with 204 khoroos across the city. The decision-making body is the full assembly of the khoroo's residents, who have the right to participate in the meetings. Each khoroo has a khoroo office, which handles administrative services.

(2) Population

According to Mongolia's National Statistical Office in 2022, the total population is 3,457,548, with Ulaanbaatar City accounting for 48.9% of this, at 1,691,766 people (Table 2.1.2). Over the decade from 2012, the population growth rate was 20.5%, while Ulaanbaatar's growth rate for the same period was 28.3%. Future population projections by the National Statistical Office estimate 3,767,314 people by 2030 and 4,333,430 by 2040.

Table 2.1.2 Population Trends and Future Projections

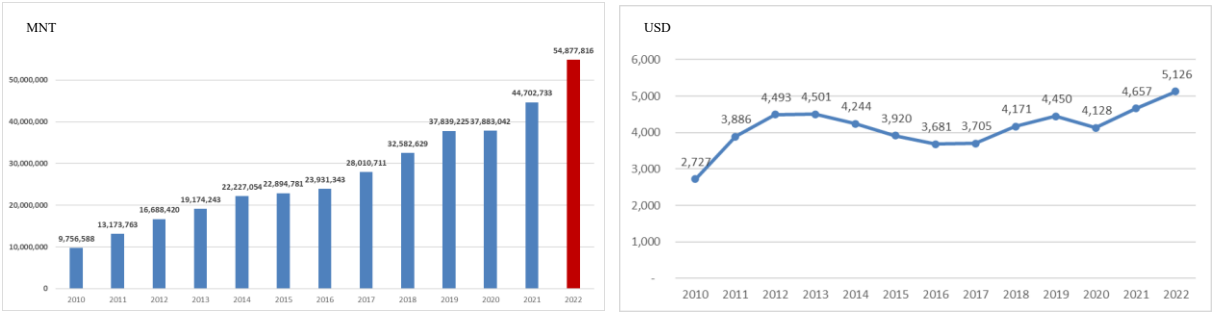
Area	Current population			Estimated population	
	2012	2017	2022	2030	2040
Nationwide	2,867,744	3,177,899	3,457,548	3,767,314	4,333,430
UB City	1,318,130	1,462,973	1,691,766	1,822,010	2,146,360
Growth rate	-17%	-8%	0%	8.9%	25%
Percentage of UB City	45.9%	46.0%	48.9%	48.3%	49.5%

Source: JST based on data from National Statistical Office

(3) Economics

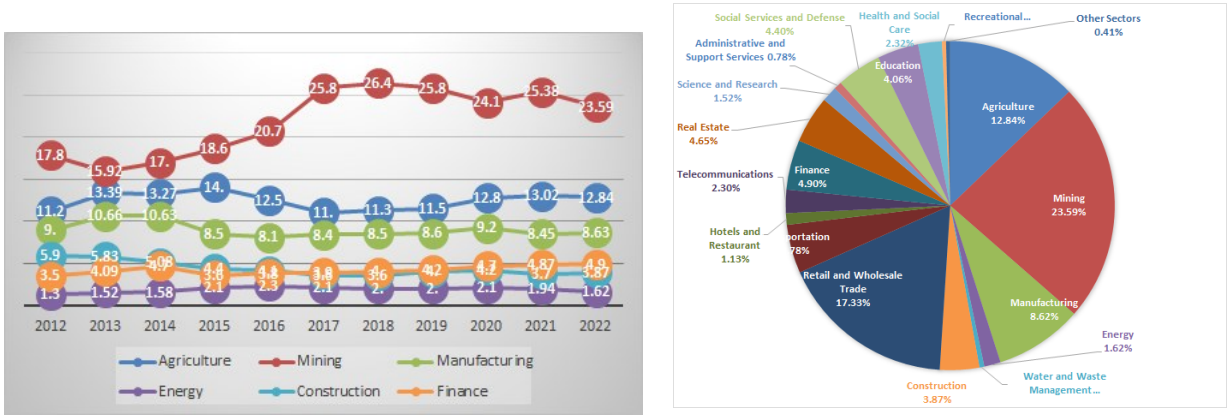
Looking at Mongolia's main economic indicators through GDP, in 2022 it stood at 3 trillion 155 billion 4,739 million yen, marking a 228% economic growth over ten years since 2012. An IMF 'Extended Fund Facility' program was applied in 2017, enhancing foreign reserves, optimizing debt, and strengthening the banking sector to maintain growth. Despite the impact of COVID-19 affecting sectors like food and beverage, tourism, and transportation, with many businesses closing, growth

trends have continued with reduced growth rates in mining and forestry since 2022. As of April 2024, the latest data show a per capita nominal GDP of 5,126 USD for 2022. The GDP share by industry shows mining at 23.59%, followed by wholesale and retail trade at 17.33%, agriculture and forestry at 12.84%, and manufacturing at 8.62%.



Source: National Statistical Office

Figure 2.1.2 Transition of nominal GDP (left), and per capita nominal GDP (right)



Source: National Statistical Office

Figure 2.1.3 Trends in Economic Growth Rate (left), Share of GDP by Industry (right)

2.2 Policies, Plans, and Programs

2.2.1 National Policy & Vision

Mongolia's future plans are outlined in the "Law on Development Policy, Planning, and Management," with the "Long-Term Development Policy of Mongolia" (Vision 2050) as the highest-level plan for a 30-year mid- to long-term development strategy. This includes five-year medium-term development plans that define implementation policies, and annual action plans to execute policies. Additionally, the "New Revival Policy," a goal program to eliminate the impacts of COVID-19 and promote national development, was approved by the parliament in 2021.

(1) Vision 2050: Mongolia's Long-Term Development Policy (Lead Agency: Cabinet of Mongolia)

The decision made by the parliament on May 13, 2020 (Decision No. 52) outlined Mongolia's Vision 2050, which is structured around nine areas: ① Common national values, ② Human development, ③ Quality of life and the middle class, ④ Economy, ⑤ Good governance, ⑥ Green development, ⑦ Safe society, ⑧ Regional development, and ⑨ Ulaanbaatar and satellite cities. This vision assesses the past 30 years since becoming a democratic country in 1990 and sets goals for the next 30 years. The fundamental objectives include increasing the Human Development Index (HDI) to 0.9, raising the happiness index to the level of the top 10 countries globally, and ensuring that 80% of the

population belongs to a middle class with a comfortable living standard. It also aims to increase the GDP by 6.1 times and raise the GDP per capita to 15,000 USD. The document outlines specific goals and anticipated measures for each sector.

Below are the goals related to the sectors relevant to this study.

"④ Economic" Sector

Objective 4.2. "Create an export-oriented economy through promoting the development of priority sectors.", the following policies are envisioned for each implementation stage.

Expected Result in Stage I (2021-2030): To launch an economic structure reform, enhance competitive capacity, and develop import substitution and export-oriented heavy and light industry.

Action Plan: Develop the power generation sector as one of the key economic sectors, develop energy and engineering infrastructure to support economic development, expand power plants, construct electricity transmission lines and substations, introduce new energy sources, achieve self-sufficiency in electricity production by fully meeting domestic electricity demand, and construct a smart grid.

Expected Result in Stage II (2031-2040): To become fully self-sufficient in meeting heavy and light industries' energy and construction production needs and make a transition towards the prevalent development of export-oriented industries.

Action Plan: Support the information technology sector to increase its contribution to the economy, expand thermal power stations, build a stable and independent power system, and introduce smart distribution systems.

Expected Result in Stage III (2041-2050): To advance major economic sectors into the global market and strengthening the foundation of economy.

Action Plan: Introduce solar, wind, biomass, gas, geothermal, fuel cell, and other new energy sources into the power generation sector in alignment with source strength balance, promote policies aimed at supplying electric power to the international market, and increase the proportion of nuclear power generation.

"⑥ Green development" Sector

Objective 6.4 "Contribute to international efforts to mitigate climate change by developing a low carbon, productive and inclusive green economy.", the following policies are envisioned for each implementation stage.

Expected Result in Stage I (2021-2030): To introduce environmentally friendly and efficient clean energy, prevent climate change, and build climate change adaptation capacity through the implementation of green development policies.

Action Plan: Expand the meteorological observation and environmental monitoring network, strengthen the prediction and warning capacity for meteorological disasters to reduce disaster risks, and construct waste recycling facilities at the Aimag Center.

Expected Result in Stage II (2031-2040): To develop smart consumption and productive production.

Action Plan: Revise and implement national disaster risk reduction programs to prevent adverse effects of climate change, establish a green fiscal mechanism, promote international investment, implement comprehensive waste management, introduce zero-emission waste technologies in construction and transportation sectors, and develop facilities for processing, reuse, and recycling of waste using environmentally friendly technologies in these sectors.

Expected Result in Stage III (2041-2050): To continuously strengthen adaptation to climate change and improve sustainable production and consumption.

Action Plan: Implementation of measures to prevent climate change, introduction of a climate change risk insurance system, implementation of green projects aimed at developing renewable energy, reducing greenhouse gas emissions, waste reduction, and improving resource utilization through the United Nations' "Green Climate Fund" and other international investment mechanisms.

"⑦ Safe and secure society" Sector

Objective 7.3 "Enhance the capacity to reduce, prevent and mitigate the potential risks of non-traditional threats and increase the safety of people and society.", the following policies are envisioned for each implementation stage.

Expected Result in Stage I (2021-2030): To enhance regional disaster prevention capabilities.

Action Plan: Enhance local disaster response capacity, establish new food and petroleum warehouses, and coordinate stockpiling and humanitarian aid to improve state resources and instrument preparedness.

Expected Result in Stage II (2031-2040): To consider disaster risks in urban planning, improving national and regional disaster prevention capabilities, and develop disaster-resistant infrastructure.

Action Plan: Reinforce, expand, and rebuild critical urban infrastructure to ensure smooth functionality, create disaster-resistant infrastructure in capital cities and densely populated areas, and introduce and utilize space and other advanced technologies in disaster prevention. This will strengthen national disaster management capacity and elevate it to an international level, alongside developing disaster investigation and research, as well as disaster management.

Expected Result in Stage III (2041-2050): To enhance the capacity to overcome risks and increase the safety of people and society.

Action Plan: Establish a logistics center for humanitarian aid. Deployment of a flight squadron for law enforcement and special agencies[2], gradual procurement of equipment and materials.

"⑧ Regional and local development" Sector

Objective 8.6 "To gradually disperse the population and socioeconomic density of UB City and the central region, establish an appropriate composition of satellite cities, and develop the area as a region with international competitiveness through knowledge-based economic development.", the following policies are envisioned for each implementation stage.

Expected Result in Stage I (2021-2030): To develop production, services, distribution, and food/agriculture in satellite cities.

Action Plan: Increase capacity of regional power generation facilities, establish new power plants to fully meet the growing electricity demand, and build a system to support the sustainable economic growth and efficiency of satellite cities in production, social services, transportation, and distribution. Establish a new logistics center at the new international airport, develop tourism infrastructure based around the new international airport, and establish new science, business, and training centers.

Expected Result in Stage II (2031-2040): Elevate the level of social services provided by the state to international standards.

Action Plan: Expand the transnational railway, set up logistic centers for the transportation and

[2] The text describes measures to establish aerial response units using helicopters, targeting agencies responsible for the military, police, judiciary, prosecution, interior ministries, intelligence, customs, and emergency management. For example, at NEMA, there are units for aerial firefighting of forest fires and for rescue and search operations using helicopters. Similarly, it refers to the establishment of aerial response units within agencies such as the police.

distribution of agricultural and livestock products in satellite cities, develop intensive agriculture, and establish new industrial zones.

Expected Result in Stage III (2041-2050): Development as an international commercial and business hub with advanced technology and innovation based on smart systems.

Action Plan: Plan comprehensive land readjustment for UB City and Tuv Aimag, create a healthy, safe, and comfortable living environment, build an independent power integration system, and make transition to smart systems utilizing renewable energy.

"⑨ Ulaanbaatar and satellite cities" Sector

Objective 9.2 "Develop a comfortable city with balanced ecosystem, low greenhouse gas emissions and green technologies, and ensure a healthy and safe living environment for citizens." outlines the following policies for each implementation stage.

Expected Result in Stage I (2021-2030): To ensure a healthy and safe living environment for citizens and introduce a recyclable, responsible and economical consumption.

Action Plan: To implement "Passportization" of building, identify the quality, seismic resistance, and lifespan of buildings and to reinforce or rebuild at-risk structures. To design and model flood prevention facilities, formulate and implement urban engineering measures MP. To enhance information and communication systems and response management during floods, and carry out proper water resource storage and consumption management.

Expected Result in Stage II (2031-2040): green and smart technology that ensures the city's ecosystem balance.

Action Plan: Protection of urban ecosystems and biodiversity, implementation of sanitation measures such as preventing water resource pollution and protecting underground water zones, reuse of factory wastewater, processing and recycling of ash, sludge, and other waste discharged from power plants, conversion to renewable energy generation in the Gel district.

Expected Result in Stage III (2041-2050): To ensure environmental balance with low greenhouse gas emissions.

Action Plan: Expansion of urban green facilities, implementation of forest protection management, prevention of health damage to residents due to natural disasters such as droughts and floods, and climate change, and implementation of sustainable management of water resources.

(2) Five-Year National Development Plan: (Lead Agency: Cabinet of Mongolia)

1) Main Plan

The Mongolian 2021-2025 Five-Year Development Plan was approved by parliamentary decision No. 23 in 2020, serving as a mid-term implementation plan for Vision 2050. This plan includes selected measures from Vision 2050's nine areas (common national values, human development, expansion of the middle class, stable economic growth, governance, green development, safe society, regional development, and Ulaanbaatar and its satellite cities). Annual action plans are formulated and approved to achieve the goals set by the National Development Five-Year Plan, with the "National Development Plan for 2024" being the latest at the time of this survey.

2) National Development Plan for 2040

Below are the details of the 2024 annual implementation plan aimed at achieving the goals set by the Five-Year Development Plan.

Table 2.2.1 Details of the 2024 annual implementation plan

Project		Progress		Investment		Responsible Ministry
		Current (2022)	Target (2024)	Amount (JPY)	Funding Source	
4. Economy						
Tavantolgoi 450MW Thermal Power Plant and the associated infrastructure		10%	30%	397,268	Private budget	MOE
Capacity Expansion of Thermal Power Plant-3 by 325MW		-	20%	84,353	Foreign aid	MOE
Construction of 90MW Erdeneburen hydropower plant		16%	30%	162,393	National budget, Foreign aid	MOE
Construction of Amgalan heat supply station		30%	100%	19,550	domestic bank loans	MOE
Construction of 300MW Bagakhangai（Buuruljuut）Thermal Power Plant		10%	100%	103,500	domestic and international funds	MOE
Construction of 50MW Choibalsan Thermal Power Plant		51%	100%	48,115	National budget, domestic and international funds	MOE
Construction of Baganuur Thermal Power Plant		5%	20%	106,950	PPP	MOE
Construction of Thermal Power Plants in 10 Aimags		10%	100%	82,929	Foreign aid	MOE
Structural reinforcement of national theaters		-	50%	2,875	National budget	Ministry of Culture
6. Green Development						
“One Billion Tree” National Campaign,	Planting Area	7,100ha	7,900ha	575	National budget	Ministry of Environment and Tourism
	Area of Forest Zone	1,600,000ha	2,000,000ha	587	National budget	Ministry of Environment and Tourism
	Reduction in Forest Loss Area	5%	5%	115	National budget	Ministry of Environment and Tourism
UB City Waste Recycle Project		41%	95%	1,664	Foreign aid	UB City
Construction of Wastewater Treatment Plant		10%	90%	-	Foreign aid	MCUD
7. Safe and Secure Society						
No current nor planned projects in 2024						
8. Regional and local development						
Implementation of investment mechanisms to support industries for food security and stable supply		-	100%	71,410	National budget, foreign aid	Ministry of Food, Agricultur e and Light Industryt
9. Ulaanbaatar and satellite cities						
Selbe River Restoration Plan		0%	100%	288,995	National budget	UB City
Bogdkhan Railway Project		-	10%	211,744	Private budget	Ministry of Road a nd Transport Devel opment
Infrastructure and lifeline works for 55,000 households in Gel Area, UB City (Songinokhairkhan、Chingeltei District)		10%	38%	21,850	National budget	Ministry of Road a nd Transport Devel opment

Source: National Development Plan for 2024

(3) Mongolia 2021-2025 Investment Program (Lead Agency: Cabinet of Mongolia)

The "Mongolia 2021-2025 Investment Program," a supplement to the Five-Year National Development Plan spearheaded by the Cabinet of Mongolia, lists projects that have secured funding or are under consideration. This program outlines 150 projects across the nine areas of Vision 2050.

Below are the main projects listed in the program.

Table 2.2.2 Main projects listed in Mongolia 2021-2025 Investment Program

Project	Target Area	Invest-ment Period (year)	Total Cost (million JPY)	Past Investment (million JPY)		Planned Investment (million JPY)	Funding Source	Responsible Ministry
				End of 2019	2020	2021～2025		
2. Human Development								
Construction of 200 Schools, 273 Kindergarten	National	2021～2024	573,160			573,160	National Budge	Ministry of Education and Science
4. Economy								
Upgrading of Choibalsan Thermal Power Plant by 50MW	Dornod aimag	2020～2022	93,150			93,150	Development Bank	MOE
			29,900		5,750	24,150	National Budget	
Construction of Erdeneburen Hydropower Plant (90MW)	Khovd aimag	2018～2024	470,996		6	470,990	China Loan	MOE
			19,872	417		19,455	National Budget	
Construction of Baganuur Thermal Power Plant	UB City	2015～2024	1,434,587	179,400		1,255,187	PPP	MOE
UB City Wastewater Treatment Plant	UB City	2019～2023	407,447		120,621	286,827	China Loan	MCUD
			20,045	286	6,278	13,480	National Budget	
6. Green Development								
Renovation of UB City Waste Treatment Facilities	UB City	2020～2021	23,999		529	23,470	EBRD Loan	UB City
Renewable energy promotion project	Govi-Altai, Zavkhan, Khuvsgul aimags	2019～2023	65,302	542	944	63,816	ADB Loan	MOE
		2019～2024	33,631	237	13,293	20,101	ADB Grant Aid	
Tuul and Selbe River Flow Increase and Environmental Improvement Project	UB City	2021～2024	97,954			97,954	China Loan	Ministry of Finance
			4,540			4,540	National Budget	
7. Safet and Secure Society								
NEMA Firefighting Equipment Renewal	National	2019～2021	24,525		10,347	14,179	Belarus Loan	Deputy Prime Minister
			4,140	4,140			National Budget	
NEMA Helicopter and Fire Truck Procurement	National	2021～2024	108,457			108,457	France Loan	Deputy Prime Minister
8. Regional and Local Development								
Construction of Thermal Power Plants in 10 Aimags	10 aimags, including Sukhbaatar, Arkhangai, etc.	2019～2022	240,120	2,892	51,167	186,061	Korea Loan	MOE
Econimic Zone Development Project	Economic Zone	2021～2025	48,977			48,977	ADB Loan	Deputy Prime Minister
9. Ulaanbaatar and Satellite Cities								
UBCity Gel Area Development Project – 2	UB City	2019～2022	48,858	7,207	7,363	34,287	ADB Loan	UB City
			60,568		6,594	53,974	ADB Loan	
			93,513			93,513	European Investment Bank Loan	
UB City Sewerage Rehabilitation	UB City	2007～2022	12,538			12,538	Not Confirmed	UB City
			8,091	8,091			UB City Budget	

Source: Five-Year National Development Plan

(4) New Recovery Policy (Leading Agency: Cabinet of Mongolia)

The mid-term goal program established by the 2021 parliamentary decision No. 105 is designed to accelerate "Vision 2050" which was stalled by the pandemic. This ten-year program is outlined with six key measures:

1) Dry Port Regeneration

To improve logistics at border hubs with customs functions, enhance passenger and cargo transport capacities, increase flight numbers for aviation transport, and stimulate exports and tourism.

2) Power Regeneration

To establish and upgrade power generation and transmission facilities, develop appropriate renewable energy, achieve independence in the power sector, and supply electricity to Northeast Asia (including Mongolia, China, Russia, Japan, South Korea, and North Korea) through renewable sources and ultra-high voltage transmission lines, along with developing a natural gas pipeline from Russia through Mongolia to China.

3) Industrial Regeneration

To reduce mining development costs and promote investment, increase mining products developed based on advanced technology, boost heavy industry and exports, identify oil reserves and increase production, secure supplies for domestic oil refineries, and develop agriculture and livestock based on advanced technology and innovation, including blockchain and AI.

4) Urban and Regional Regeneration

To develop public transportation, promote special economic zones, enhance the autonomy of aimag centers, ensure stable growth in agriculture and livestock, and secure domestic food needs and expand exports.

5) Green Development Regeneration

To establish legal frameworks for the efficient execution of the "One Billion Trees" national afforestation campaign aimed at climate change prevention, secure drinking water and water supplies for grazing lands by protecting water resources and develop waste disposal sites in aimags and the capital using environmentally friendly advanced technology.

6) Improvement of National Administrative Efficiency

To digitalize services by government agencies, rationalization of government structure, transition of some national roles to private companies and professional organizations, improvement of national enterprises' effectiveness and governance, and strengthening punishment for corruption and other misconduct by public officials.

(5) “One Billion Trees" national campaign (Leading Agency: Office of the President of Mongolia)

Under Presidential Decree No. 58, the "One Billion Trees" national campaign was established by Cabinet Decision No. 350 in 2021 to enable the planting of one billion trees by 2030, increase forest coverage to 9% of the national territory, and reduce soil degradation, greenhouse gases, and enhance water resources while preventing desertification and climate change. The implementation measures for this afforestation campaign include policy coordination, legal framework enhancement, budget assurance, and public awareness, allocating funds equivalent to 1% of Mongolia's GDP to environmental protection and climate change mitigation.

(6) UB City Digital Transition Plan (Leading Agency: UB City)

In October 2022, the mayor of Ulaanbaatar announced at a briefing for parliament members, ministers, and People's Representative Council members that the city would collaborate with 70 IT companies to enhance residents' quality of life using information technology in various sectors. By 2024, the city aims to improve traffic management, education quality, and public service governance, increase

investment and budgets, prevent corruption, and build a healthy and safe environment for citizens through three main sectors: "Digital Governance," "Smart Traffic Systems," and "Safe City," based on international practices, national characteristics, local habits, and the challenging natural environment.

(7) Government Debt Management Medium-Term Strategy (2023-2025) (Lead Agency: Ministry of Finance)

Approved by Parliament Decision No. 26 on May 6, 2022, this strategy sets out policies for managing debt and risks from 2023 to 2025 with the aim of improving the debt situation. The following policies have been established, and financial issues are deliberated accordingly. Related measures are outlined below:

Policy 1: Enhance the effectiveness of projects implemented through government foreign loans and reduce the budget burden due to the service costs of foreign loans.

- Do not borrow government foreign loans that do not contribute to economic growth and increase exports, support purchases by foreign countries increasing imports, or could burden the balance of payments.
- Use government foreign loans for projects targeting specific economic sectors, except where funding by loans is determined according to the current fiscal year's budget law and has a social impact.
- Do not undertake borrowing under commercial conditions as a measure against budget deficits.

Policy 2: Execute payments by government foreign securities without burdening the economy and the budget.

Policy 3: Strengthen the government's debt management system, adapt it to modern trends, and introduce market risk prevention measures related to government debt into debt management.

- Support projects suitable for sustainable development goals, collaborate with debt products suitable for sustainable development goals as their financing sources, consider their introduction into government debt management measures, prepare with relevant ministries, and educate the public about these measures.

Policy 4: Support the development of the government's domestic securities market and regularize securities trading.

Policy 5: Secure the achievement of Mongolia's long-term economic goals through the issuance of government debt guarantees for the nation's strategic large-scale projects and support to private enterprises, and control debt risks.

Policy 6: Transparency in government debt management

- Publish government debt information quarterly.
- Compile and publish sector-specific national debt information in accordance with standards set by international institutions.

2.2.2 Disaster Prevention Policy, Plan, and Program

(1) National Disaster Prevention Plan (Leading Agency: NEMA)

1) Composition and Disaster Prevention Policy

The national disaster prevention plan, titled "National Plan for Protecting and Rescuing Residents, Property, Livestock, and Animals from Disaster Risks, Disaster Response, and Emergency Recovery" (hereafter, the National Disaster Prevention Plan), was adopted by the Cabinet on October 19, 2015 (Decision No. 416). This decision mandates the Deputy Prime Minister to annually budget the costs for implementing and amending the plan, as well as for training and workshops. It also requires the NEMA Director to progressively promote and educate on the preparedness levels of residents, businesses, and organizations, along with directives (Zaavar) and recommendations (Zuvlumj)[3] for proposed projects. The plan's preamble highlights the need for a comprehensive approach to prevent disasters, reduce vulnerability and risks, and enhance search and rescue (SAR), disaster measures, responses, and recovery activities, given the increasing number and severity of disasters in Mongolia and its regions.

[3] According to the standard organizational documents of the Bureau of Standard Metrology:
Zaavar (Directive): A document that details the structure and procedures for implementing laws and regulations.
Zuvlumj (Recommendation): A document that compiles advice to be reflected in policies and decisions (rules, regulations).

Table 2.2.3 Composition of National Disaster Prevention Plan

National Plan for Protecting and Rescuing Residents, Property, Livestock, and Animals from Disaster Risks, Disaster Response, and Emergency Recovery"
1. Overview
2. Prevention Activities (only sectors of activities are listed)
3. Disaster Alerts (showing procedures for disaster alert transmission)
4. Procurement and Supply System (describing the roles of related ministries)
5. Widespread Evacuation (demonstrating the widespread evacuation system)
6. Humanitarian Support (showing team formation)
7. Disaster Response and Awareness Activities (based on damage assessment results)
8. Disaster Response Plan (showing timelines post-disaster for each type of disaster, including earthquakes)

Source: JST based information provided from NEMA

Regarding disaster prevention, the implementation policy states, "Nationwide disaster prevention activities will be conducted to reduce disaster risks, ensure preparedness, spread disaster prevention knowledge, and cultivate disaster prevention capabilities through training." For implementing disaster prevention activities, it is stated that "This will be done based on national security policies, government disaster prevention policies, community-based national disaster prevention programs, plans to enhance earthquake disaster prevention activities, related laws and regulations, and government policies and programs in various sectors. Government agencies, local political institutions, and all civilian institutions will implement these measures." However, specific policy content is not described.

2) Implementation Status and Issues

While the Disaster Prevention Law was significantly revised in 2017 to enhance preventive activities, the National Disaster Prevention Plan had not been revised. However, work on reviewing it finally began in 2023. In addition to traditional training and workshops, there is a need to concretely demonstrate disaster mitigation measures as part of prevention strategies. Currently, NEMA reports the implementation status of the plan to the Cabinet quarterly. The information is published on the websites of agencies involved in the National Disaster Prevention Plan, making it available to the public. Along with revising the plan, there is a need to further enhance monitoring and public information disclosure in accordance with the revised Disaster Prevention Law and its principles of disaster management.

(2) Local Disaster Prevention Plan (Lead Agency: UB City, Aimags, Soums)

1) Contents

The Local Disaster Prevention Plan, established under the Disaster Prevention Law, outlines disaster measures for UB City, Aimags, and Soums. Currently, it primarily focuses on the roles of disaster-related agencies during emergency responses. It is linked with the National Disaster Prevention Plan, especially in coordinating with national institutions for emergency responses. The plan categorizes necessary actions for all types of disasters as general disaster prevention plans and specifies unique aspects in disaster-specific plans, approved by the leaders of the Capital, Aimags, Soums, and the head of NEMA. In Ulaanbaatar, the plan comes into effect with the approval of both the Mayor of Ulaanbaatar and the head of NEMA.

Here is an example of UB City's general disaster prevention plan.

Table 2.2.4 UB City's General Disaster Prevention Plan

UB City's General Disaster Prevention Plan

1. General Provisions
   - Possible disasters in Ulaanbaatar City
   - Vulnerabilities and risks in Ulaanbaatar (including 9 types of disasters, such as earthquakes)
   - Disaster risk assessment for Ulaanbaatar City
2. Overview of Ulaanbaatar City
3. Capital Emergency Meeting[4]
   - Management structure of the Capital Emergency Meeting
   - Decisions of the Capital Emergency Meeting
   - District Emergency Meetings[5]
4. Capital Disaster Prevention Operations
5. Disaster Alert Transmission System
6. Evacuation System
7. Stockpile Provision
8. Current Status of Human Resources and Equipment
9. Preparedness Measures at Each Level[6] of the Preparedness System
10. Rescue and Response Activities During Disasters
11. Volunteer Activities
12. International Aid
13. Recovery Measures

Source: JST based information provided from EMDC

For earthquakes, UB City has a separate "Ulaanbaatar City Earthquake Disaster Prevention Plan" based on the disaster prevention planning directive (Zaavar, 2018), in addition to the general disaster prevention plan. This includes response measures, prevention measures, and recovery activities in the "Phase 1" pilot municipalities. The pilot municipalities targeted are Umnugovi and Darkhan-Uul Aimags, and Bayangol and Chingeltei districts in Ulaanbaatar.

Below is composition of the Ulaanbaatar City Earthquake Disaster Prevention Plan.

[4] Capital Emergency Conference: An agency responsible for the planning, coordination, and implementation of disaster prevention activities in UB City, as stipulated by the current Disaster Prevention Law Article 26.1.3 (revised Disaster Prevention Law Articles 24 on organizational structure for disaster prevention activities, and 25 on management of disaster prevention activities), and the Capital Emergency Conference Operation Regulations. Positioned directly under the Governor, it is chaired by the Governor and composed of the UB City Deputy Mayor for Urban Development and Investment, UB City Deputy Mayor for Road Transport and Infrastructure, and the Director of the Capital City Planning and Basic Planning Bureau.

[5] District Emergency Conference: Established under the current Disaster Prevention Law Article 26.1.3 (revised Disaster Prevention Law Articles 24 on organizational structure for disaster prevention activities, and 25 on management of disaster prevention activities), this agency is responsible for the planning, coordination, and implementation of disaster prevention activities in each district of UB City, based on the District Emergency Conference Operation Regulations. It is located in the district office, chaired by the District Governor, and composed of the Deputy District Governor for Economic and Social Development, the District Office Director, the Health Center Director, and others.

[6] Under Article 8 of the current Disaster Prevention Law, there are three levels of preparedness: the Normal Preparedness Level, the Enhanced Preparedness Level, and the National Preparedness Level.

Table 2.2.5 Composition of UB City Earthquake Disaster Prevention Plan

UB City Earthquake Disaster Prevention Plan

General Provisions

1. Objectives of the Earthquake Disaster Prevention Plan
2. City Overview, Geography, Social and Economic Conditions
3. Earthquake Risk Assessment
4. Earthquake Vulnerability Assessment
5. Earthquake Hazard[7] Assessment

Chapter 1: Response Measures During Earthquake Disasters

1. Response measures to be implemented by Ulaanbaatar City executives[8] during disasters
2. Orders appointing Capital Emergency Meeting members
3. Contact list of Working Group members active during earthquakes in the Capital Emergency Meeting
4. Schedule of measures to be implemented during earthquake disasters
5. Temporary assembly places during disasters
6. Temporary shelters during disasters
7. Locations for evacuating residents in Ulaanbaatar during an earthquake (widespread evacuation shelters)
8. Road adjustments during disasters
9. Automobile traffic and heliports accepting international humanitarian aid during disasters
10. Cooperation participation of cooperative citizens and volunteers during disasters

Chapter 2: Earthquake Disaster Prevention Measures

1. Urban planning resistant to earthquake disasters
2. Earthquake Disaster Risk Reduction Activity Plan
3. Plan for procurement systems to acquire disaster supplies during earthquake disasters
4. Disaster stockpiles/drinking water, food, medicine, warm clothing, fuel, and lubricants

Chapter 3: Recovery Activities After Earthquake Disasters

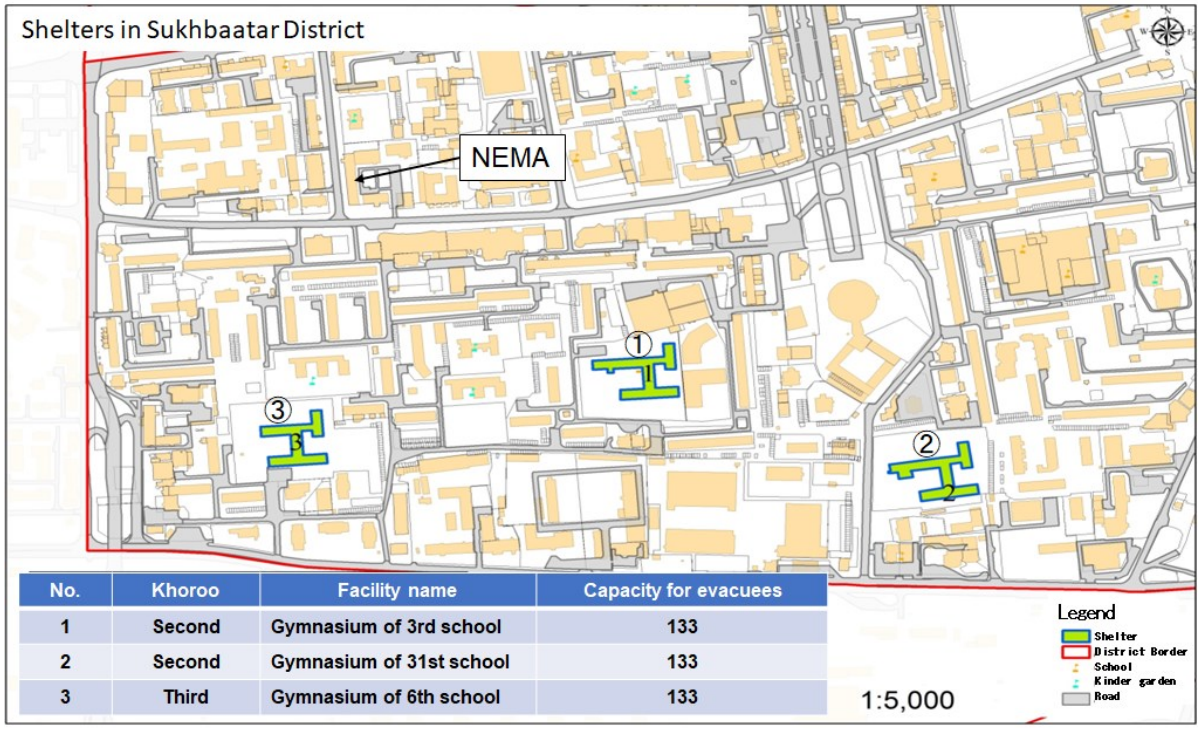
1. Organizational structure and mutual operation of recovery personnel and equipment
2. Disaster emergency response and recovery timeline
3. Policies and current status of personnel and equipment for earthquake disaster prevention activities of the capital's national disaster prevention operations
4. Recommendations (Zuvlumj) for implementation measures of Ulaanbaatar's Earthquake Disaster Prevention Plan

Source: JST based information provided from EMDC

In the UB City Earthquake Disaster Prevention Plan, 84 locations such as schools are designated as evacuation shelters, and the list includes 20 hospitals with more than 200 beds each.

[7] The seismic intensity categories established by IAG in 1999 are being used, but there is a need to reflect the revised 2017 edition.

[8] Executives: Members of the Capital Emergency Conference and directors of EMDC or higher.



Source: EMDC

Figure 2.2.1 Example of an Evacuation Shelter Map (Sukhbaatar District of UB City)

2) Implementation Status and Issues

【Aimag】

Local disaster prevention plans outside Ulaanbaatar City are developed according to the template provided by NEMA, and their content follows the National Disaster Prevention Plan, with notably brief mentions of prevention. The revised Disaster Prevention Law clearly positions prevention, and the "Phase 1" project created guidelines for regional earthquake disaster prevention plans, leading to the development of such plans in Darkhan-Uul and Umnugovi Aimags. Moving forward, revisions should proceed in line with the review of the National Disaster Prevention Plan.

【UB City】

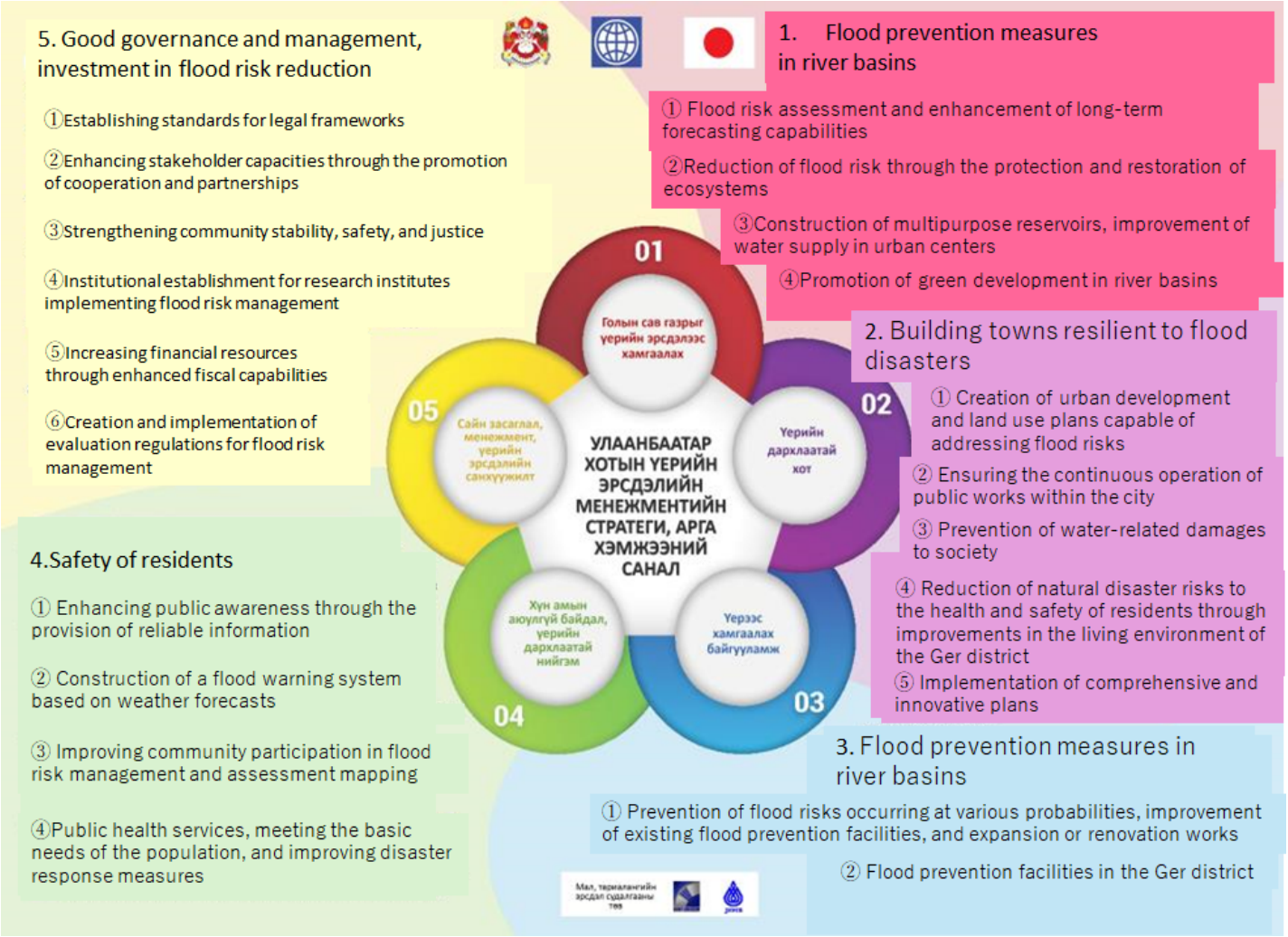
- Earthquake disaster prevention plans were developed for Chingeltei and Bayangol districts during "Phase 1," but it is hoped that this will expand to other districts in the future.
- Additional designated temporary shelters and evacuation shelters are necessary because the current ones are insufficient. Assessments of seismic resilience based on the new assumed seismic intensity categories should be conducted before further designations of temporary shelters are made.
- As an earthquake risk mitigation strategy, it is necessary to promote seismic reinforcement and rebuilding of structures at high earthquake risk.
- It is essential to improve the knowledge and capabilities of EMDC and other Ulaanbaatar City disaster prevention agencies regarding the management system during earthquake disasters.

(3) Flood Risk Assessment & Preparation of Flood Risk Management Strategy of UB

1) Content

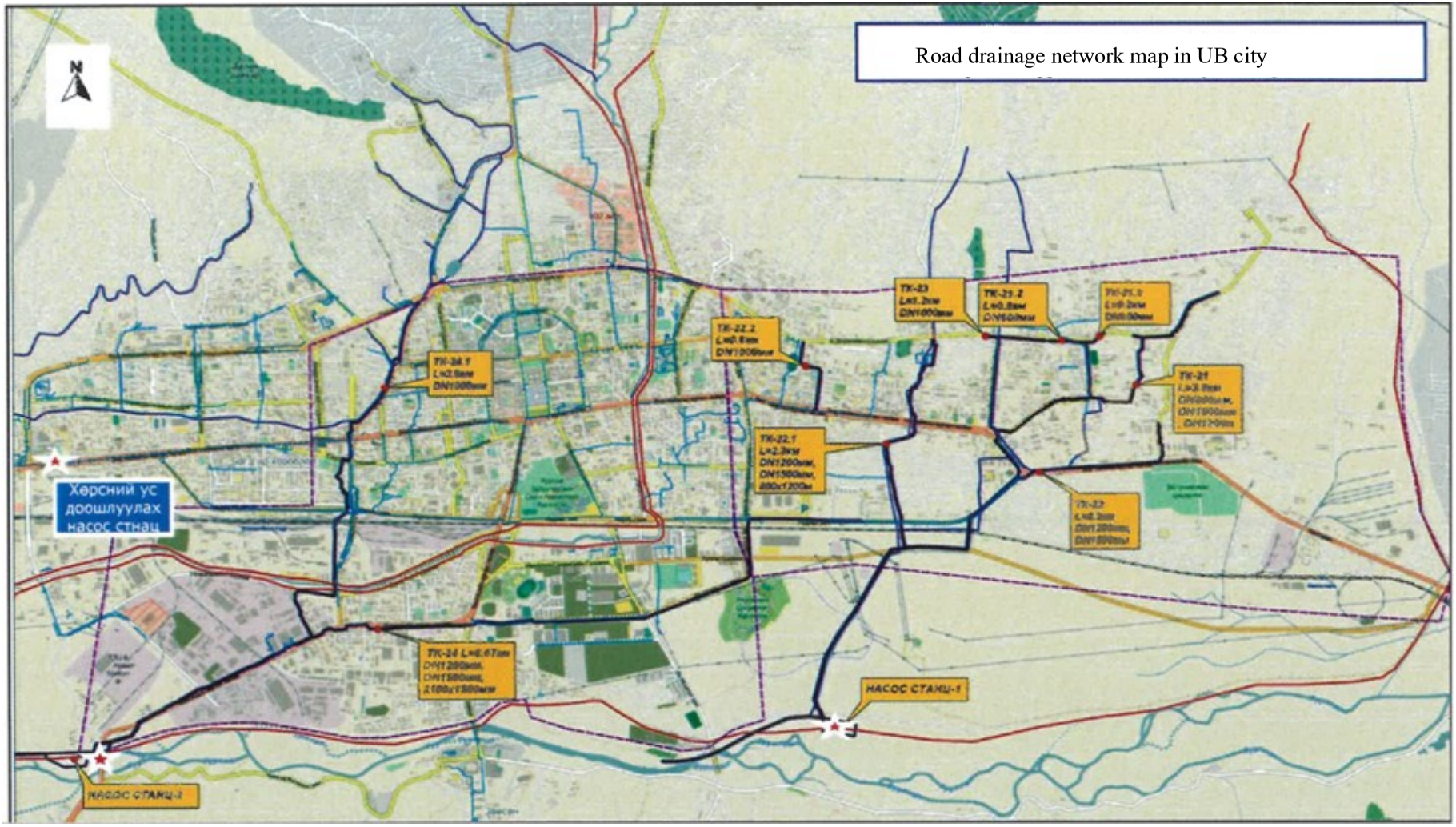
Formulated in 2015 with a goal for completion by 2023, this plan assessed the current state and strategies for UB City's River structures and urban drainage facilities. It detailed the development of 136 km of riverbank structures, 146.5 km of drainage for road structures, and the renovation of

existing facilities. The strategy includes 5 policies, 21 strategies, and 280 implementation measures, totaling a project cost of 82.3 billion yen. The 5 policies include (1) river area protection, (2) building a flood-resilient city, (3) developing flood prevention facilities, (4) ensuring residents' safety and establishing a flood-resilient society, and (5) promoting good governance and management with investments to reduce flood risk. The causes of flooding include reduced flow capacity due to presence of bridges and sedimentation along the Selbe River. To address these deficiencies, measures such as dredging for secure river capacity and the establishment of flood prevention facilities are proposed. Additionally, it recommends eliminating illegal construction on land and building detention basins to reduce flood risk. 87% of the project cost is allocated to facility development, with the remaining 13% covering expenses like elevation mapping and personnel costs. The "Master Plan for City Engineering Preparation Measures " was developed as an action plan for this strategy.



Source: City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city

Figure 2.2.2 Flood Risk Assessment & Preparation of Flood Risk Management Strategy of UB



Source: City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city

Figure 2.2.3 Maintenance Network of Road Drainage Facilities

(4) Master Plan for City Engineering Preparation Measures (Leading Agency: UB City, Contacting Agency: MCUD)

1) Overview

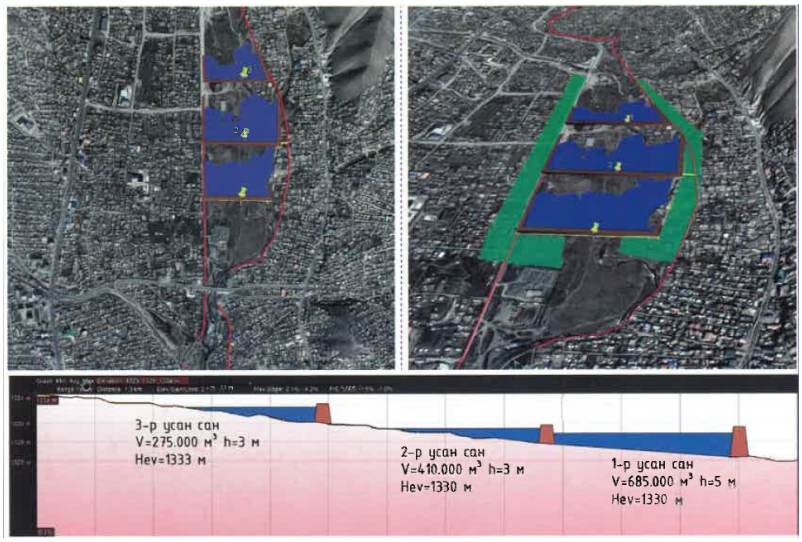
The Urban Engineering Countermeasures Master Plan (MP) is an implementation plan that consolidates the policies for flood prevention, rainwater drainage, and groundwater measures. Based on the "Ulaanbaatar City Flood Risk Assessment and Flood Risk Prevention Strategy," detailed foundational surveys were conducted to plan the measures and estimate the project costs, and it was formulated in 2023. This MP was created considering Vision 2050 and the subsequent Urban Development MP, targeting the year 2040. For river flood measures, the plan includes establishing new detention basin at upstream of the Selbe River, renovating existing flood prevention channels, and constructing new floodway.

As basic design guidelines, for the Selbe River's design flow of 288 cubic meters per second, the plan involves using a catchment basin to approximately peak cut 130 cubic meters per second, and setting the design flow for the mid and lower river courses at about 160 cubic meters per second, to conduct the channel design accordingly.

This MP considers previous policies such as "UB 2020 Master Plan and Development Approaches for 2030, (MP2020)[9]" "General Development Plan of Ulaanbaatar until 2040" and "UB City Road Network Development Mid-Long-Term MP (UBRD2030)[10]," as well as relevant land and construction laws and other related laws, standards, and regulations. Prioritization for updates is scheduled in four phases: 2023-2025 (red), 2026-2030 (green), 2031-2035 (pink), and 2036-2040 (blue).

i. Detention Basin Development Plan

The detention basin is planned to be constructed in the middle of the Selbe River, specifically in Sukhbaatar District's 13th and 14th khoroo, to prevent flooding and regulate flow, especially as this area frequently experiences high water levels. The basin is designed to have a capacity of 1.37 million cubic meters, a water surface area of 21.7 hectares, and a depth ranging from 2.5 to 4 meters.



Source: Master Plan for City Engineering Preparation Measures

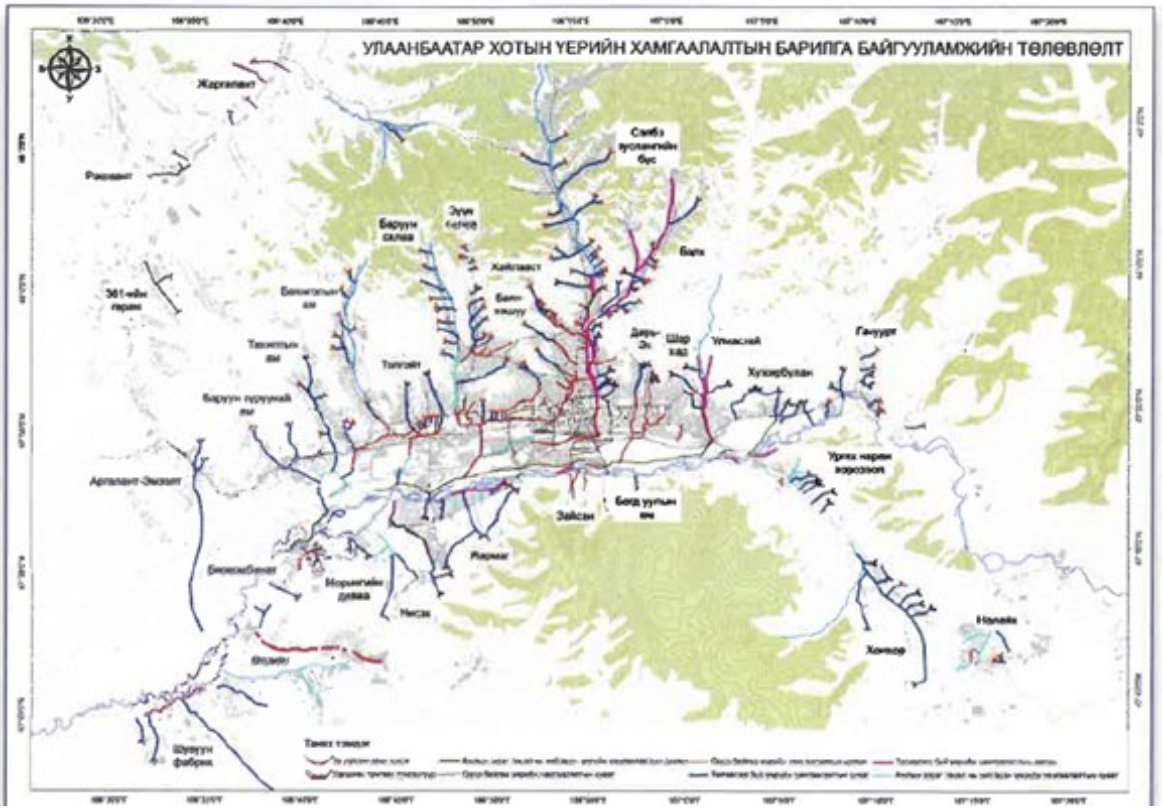
Figure 2.2.4 Selbe Detention Basin

[9] Following the "Ulaanbaatar Urban Planning Master Plan" conducted by JICA in 2007, the local government formulated its own Master Plan (MP), which was approved by the parliament on February 8, 2013 (Resolution No. 23).

[10] This plan targets road development in Ulaanbaatar by 2030 and was created in November 2018 by the Ulaanbaatar City Road Development Bureau and the Ulaanbaatar City Urban Development Research Institute.

ii. Construction and Improvement of Floods Prevention Facility

From 1970 to 2021, 107.6 km of flood prevention facilities were built at 58 locations around Ulaanbaatar City to prevent mudslides. However, certain areas in UB City still experience flooding due to unconstructed facilities, and there are plans for constructing 345 km of flood prevention channels, 23 km of flood prevention embankments, and levees. Due to mudslide-induced aging of facilities and debris accumulation, timely renovations are necessary. As of 2023, 168 km of flood prevention facilities have been constructed, with some flood measures now part of the Selbe River Restoration Plan.

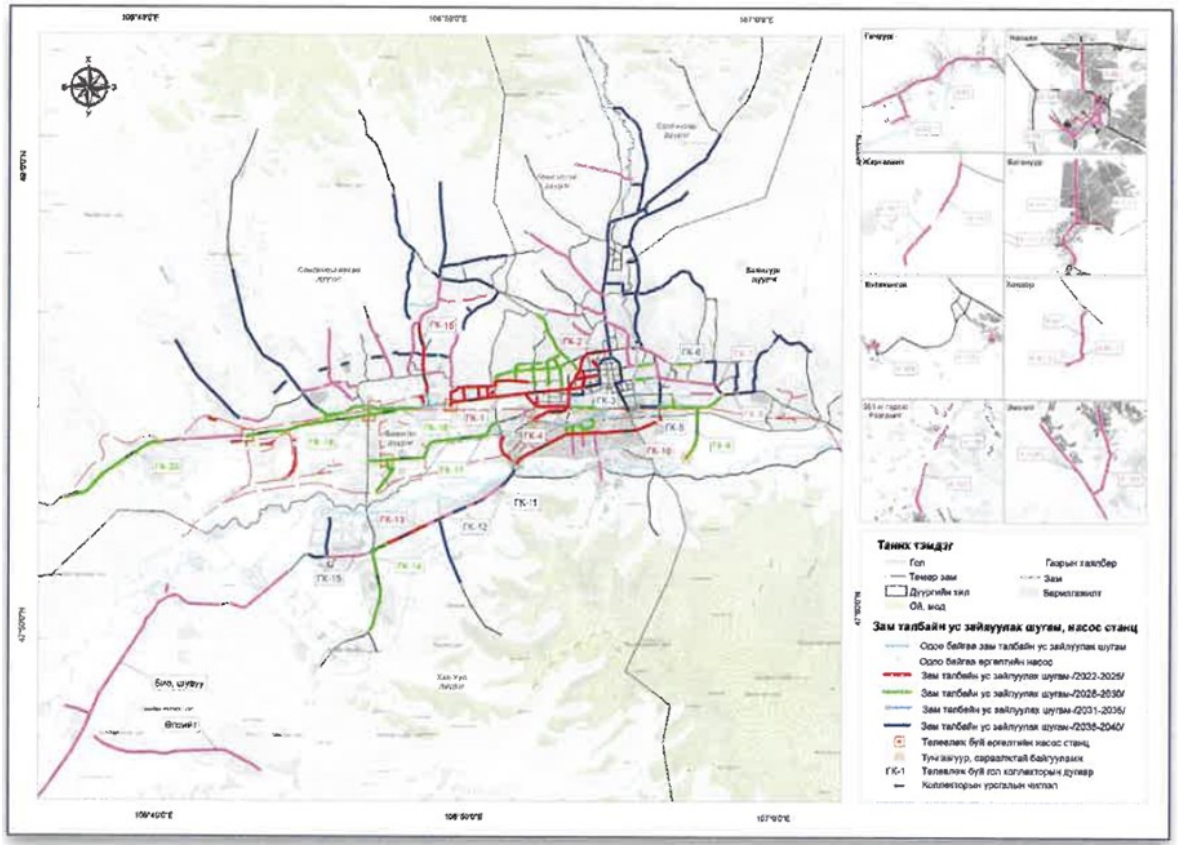


Source: Master Plan for City Engineering Preparation Measures

Figure 2.2.5 Flood Prevention Facilities in Ulaanbaatar City

iii. Improvement and Construction of Road Drainage Facilities

In Ulaanbaatar City, 169 km, or 16% of the 1,100 km of roads, have stormwater drainage facilities. About 70% of the road drainage pipes were installed before 1990, and 60% of them are clogged with trash and mud. Measures for road drainage include renovating existing drainage pipes, installing new ones, and repairing the pipes that lead to the inflow of pump stations.



Source: Master Plan for City Engineering Preparation Measures

Figure 2.2.6 Road Drainage Facilities planned to improve and construct

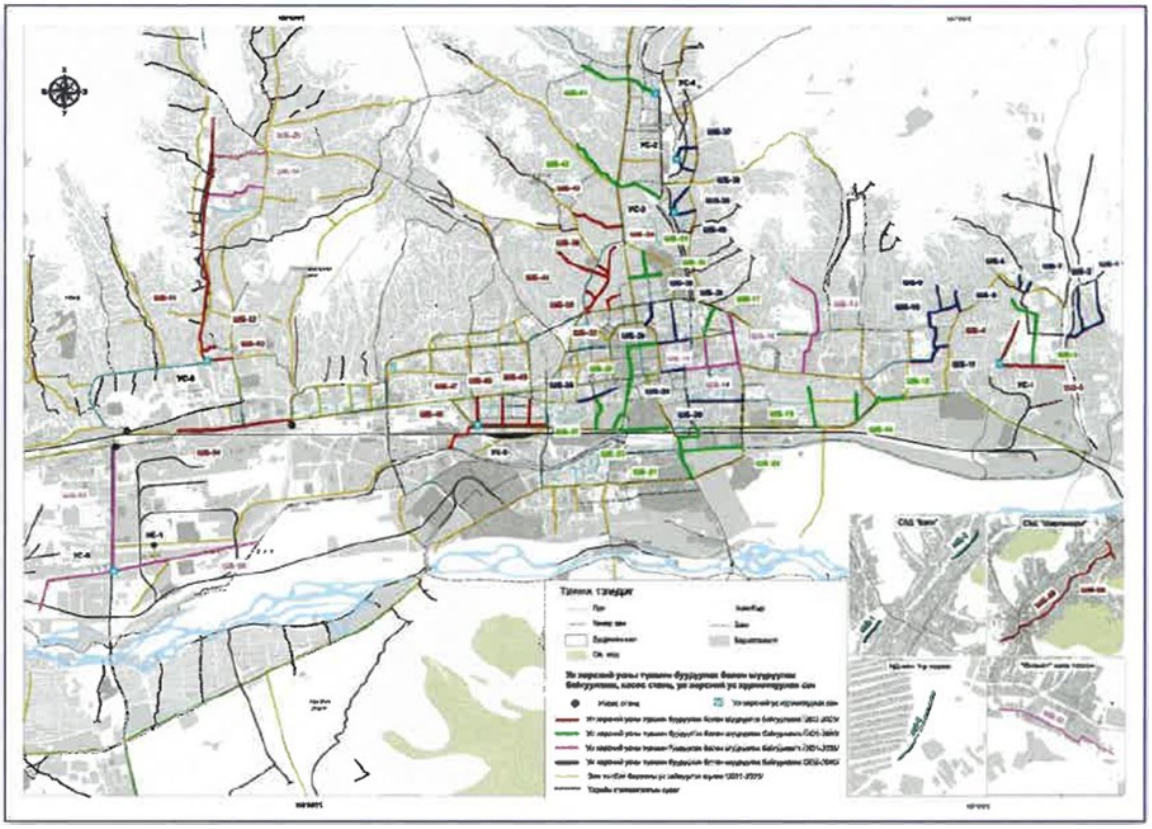
Table 2.2.6 Drainage System Under Renovation Plan

Bayangol District	Bayanzurkh District	Songinokhairkhan District	Sukhbaatar District	Khan-Uul District	Chingeltei District	Total
17.7 km	15.5 km	8.6 km	9.9 km	8.8 km	4.7 km	65.2 km

Source: JST based on Master Plan for City Engineering Preparation Measures

iv. Improvement and Construction of Underground Water Infiltration Facilities

As a measure against groundwater drainage, the plan mainly involves the installation of new underground water infiltration facilities. In UB City and its satellite cities, there are plans to install 58 km of underground water infiltration facilities at 59 locations, groundwater collection shafts at 7 locations, a pump station at one location, and to construct preventative embankments at 3 locations where groundwater freezes in winter.



Source: Master Plan for City Engineering Preparation Measures

Figure 2.2.7 Network of Underground Water Infiltration Facilities in UB city

The total project cost is estimated at approximately 285.833 billion yen, with the breakdown provided in the table below. Initially, the project was to be financed by bonds issued by Ulaanbaatar City, but due to delays in the start date, it has been carried over to the 2025 fiscal year. As of January 2024, the funding source remains undecided. Additionally, this plan is not included in the 2024 national budget project list.

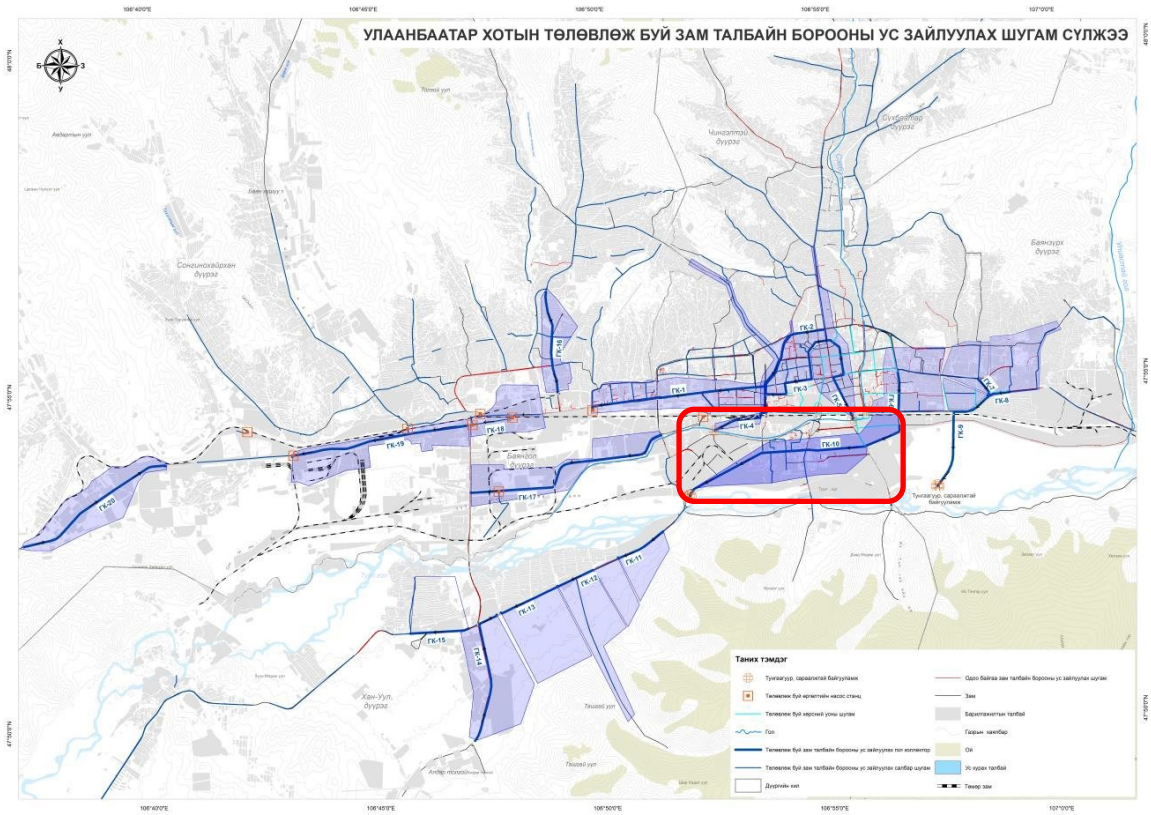
Table 2.2.7 Settlement of Project Costs as of 2023 (Project Costs, by Implementation Stage)

Item	Project Cost (million JPY)
Flood Prevention Measures	236,078
Road Drainage Measures	32,350
Underground Drainage Measures	11,054
Cost for Relocation and Eviction, etc	6,350

Source: JST based on Master Plan for City Engineering Preparation Measures

2) Verification of the Validity of the Drainage Facility Renovation Plan

As a design policy for the drainage facilities, they assume a 1-year probability of 20-minute rainfall intensity (18 mm/h) as a given condition. They calculate the runoff to each water channel from the catchment area using the Russian method and determine the design capacity of the drainage pipes. The catchment areas and pipe networks indicated in the master plan are shown in Figure 2.2.8.



(Bule Thick line: Drainage Channels planned for Renovation, Blue Area: Catchment area)

Source: Master Plan for City Engineering Preparation Measures

Figure 2.2.8 Renovation and Construction of Road Drainage Channels in UB City

The catchment area and calculated runoff for each drainage channel are shown in the table below.

Among the drainage channels planned for renovation, we will pick up K-10 (surrounded in red), which is relatively close to the city center of UB City and has a catchment area independent from other channels, to verify the validity of the renovation plan.

Table 2.2.8 Catchment area and calculated runoff for each drainage channel

Pipe No.	Drainage area (ha)	Calculated Runoff (m^3/s)
1	386	8.78
2	123	1.40
3	140	2.80
4	-	4.80
5	230	5.00
6	290	3.20
7	135	2.50
8	240	3.40
9	440	6.90
10	450	6.70
11	120	1.70
12	280	4.00
13	360	5.20
14	440	6.30
15	200	3.10
16	185	3.03
17	-	3.37
18	-	3.2
19	-	5.87
20	-	4.61

Table 2.2.9 Overview of Renovation Plan of Road Drainage channel in MP

No.	Pipe	Detail	Pipe Size (Planned)	Pipe Size (Existing)	Pipe type (Planned)	Pipe Length
14	K-10	From the intersection west of the Dunjingaravi Shopping Center (market), through Ikh Khuree Street, Niislel Khuree Avenue, and Chingis Avenue, discharging effluent into the Tuul River from the east side of Yaarmag Bridge.	2000×1800	φ600	Reinforced Concrete	6.34 km

Source: Master Plan for City Engineering Preparation Measures

i. Verification Method

We calculate the maximum planned stormwater runoff using the Rational Method, determine the flow velocity from the cross-sectional area of the planned pipe, and verify the validity of the renovation plan by comparing it with the target velocity for stormwater pipes (0.8 m/s to 3.0 m/s).

$$Q = \frac{1}{360} C \cdot I \cdot A \quad \cdots ①$$

where:
Q: Maximum planned stormwater runoff (m³/s)
C: Runoff coefficient
I: Rainfall intensity (mm/h) corresponding to the time of concentration (t)
A: Catchment area (ha)

ii. Verification Condition

(1) Runoff Coefficient

Refer to the table below for the runoff coefficient and assume a value of 0.50 based on satellite imagery.

Table 2.2.10 Standard Values for General Runoff Coefficients by Usage

Commercial areas and similar residential areas with very few permeable surfaces within the premises	0.80
Industrial areas with some outdoor workspaces and permeable surfaces, as well as residential areas with small gardens	0.65
Medium-density residential areas such as public housing complexes and neighborhoods with many single-family homes	0.50
High-end residential areas with many gardens and suburban areas with a significant amount of farmland remaining	0.35

Source: Master Guidelines and Explanations for Sewerage Facility Planning and Design, Part 1, 2019 Edition

(2) Rainfall Intensity

In a previous Basic Design Study Report[11] on the Project for Improvement of the Roads in Ulaanbaatar, the rainfall intensity formula for a 12-year probability in UB City was derived as follows.

$$I_{12} = \frac{1121}{(t + 9)} \quad \cdots ②$$

I_{12} : Rainfall Intensity for a 12-year probability (mm/h)
t : Time of Concentration (min)

[11] Basic Design Study Report on the Project for Improvement of the Roads in Ulaanbaatar

a. Time of Concentration

Time of Concentration is determined by the sum of the inflow time and the flow time.

b. Inflow Time

Inflow time is assumed to be 10 minutes based on the table below.

Table 2.2.11 Standard Values of Inflow time

Common use values in Japan				American Society of Civil Engineers	
High-Population Density Area	5 min	Trunk Sewer	5 min	Densely populated areas with full paving and sewer systems	5 min
Low-Population Density Area	10 min	Branch Sewer	7~10 min	Developing areas with relatively small gradients	10~15 min
Average	7 min			Residential areas on flat terrain	20~30 min

Source: Master Guidelines and Explanations for Sewerage Facility Planning and Design, Part 1, 2019 Edition

c. Flow Time

Assuming a flow velocity of 1 m/s and a pipeline length of 6.34 km from Table 2.2.9, the flow time is calculated to be 105 minutes.

The time of concentration is the sum of the inflow time and the flow time, which is 10 minutes + 105 minutes = 115 minutes. Therefore, substituting t =115 into equation ②, the 12-year probability rainfall intensity for 115 minutes (I_{12}^{115}) is found to be 9.04 mm/h.

(3) Catchment area

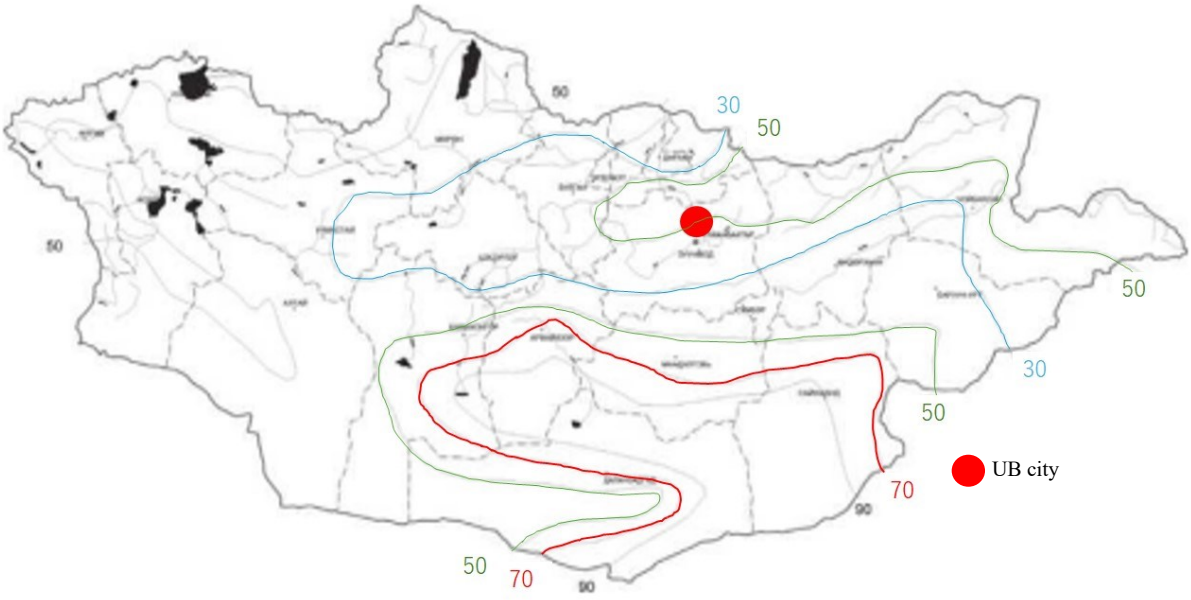
The catchment area was measured to be approximately 460 hectares, as identified in the figure below based on the area illustrated in Figure 2.2.9.

Source: JST

Figure 2.2.9 Catchment Area in Satellite Imagery (K-10)

(4) Summary of Condition

In the MP, the 1-year probability rainfall intensity is used for the renovation plan, so the conversion ratio from the 12-year probability needs to be calculated. The MP defines the 1-year probability 20-minute rainfall intensity (I_1^{20}) as 50 L/(s·ha) (equivalent to 18 mm/h) from Figure 2.2.10.



Source: MP for City Engineering Preparation Measures

Figure 2.2.10 1-year probability 20-minute rainfall intensity (I_1^{20})

Using equation ②, the 12-year probability 20-minute rainfall intensity (I_{12}^{20}) is calculated to be 38.66 mm/h. Therefore, the conversion ratio from the 12-year to the 1-year probability is 46.56%.

Using the aforementioned ratio, the 1-year probability 115-minute rainfall intensity (I_1^{115}) is calculated to be 4.21 mm/h, as shown in Table 2.2.12.

Table 2.2.12 Summary of Rainfall Intensity Condition

Reference	20 min rainfall intensity	115 min rainfall intensity
Previous Report（12-year probability）	38.66 mm/h	9.04 mm/h
Master Plan for City Engineering Preparation Measures（1-year probability）	18 mm/h	**4.21 mm/h**
	Ratio：46.56 %	

Source: JST

iii. Verification Result

By substituting C = 0.5 , I = 4.21 , and A = 460 into equation ①, the stormwater runoff Q is derived to be 2.69 m³/s. Based on the planned pipe dimensions from Table 2.2.6, the cross-sectional area of the drainage is 3.60 m². With a rectangular channel and a safety factor of 0.9, the effective cross-sectional area S is 3.24 m².

Thus, the flow velocity V is Q / S = 2.69 m^3/s / 3.24 m^2 = 0.83 m/s.

Given that rigorous calculations require over 20 years of time-series rainfall data and field surveys of the catchment area, this assessment was approximated using satellite imagery and past data. However, the obtained flow velocity is within the range of 0.8 m/s to 3.0 m/s, suggesting that the planned pipe dimensions are generally reasonable.

(5) Selbe River Restoration Plan (Leading Agency: Office of the mayor of Ulaanbaatar city, MCUD)

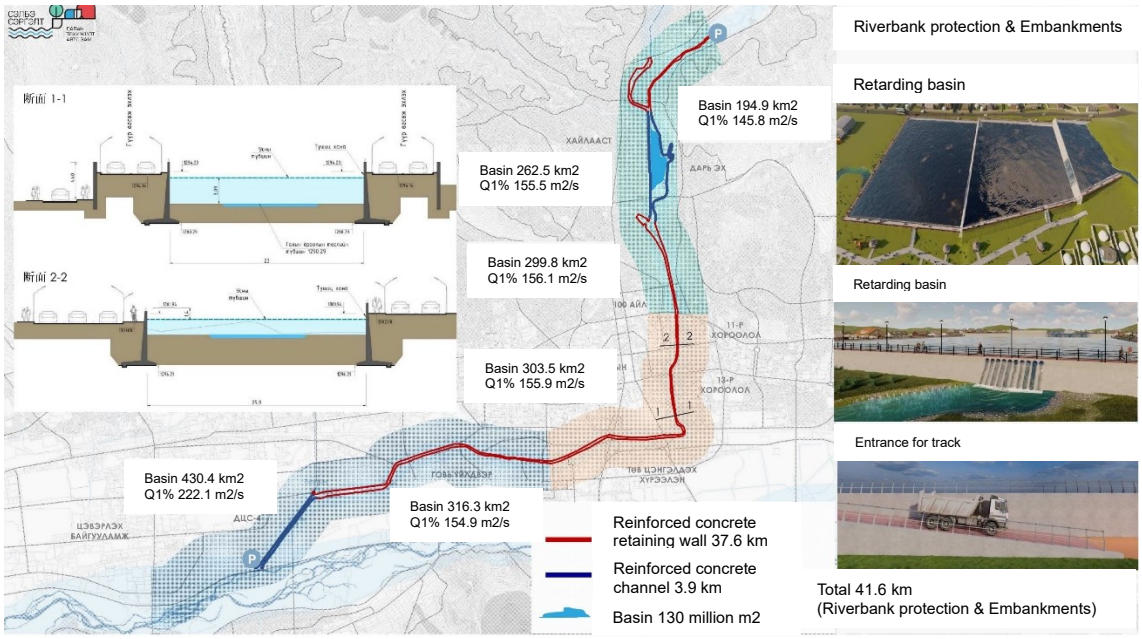
1) Overview

Based on Mongolian Prime Ministerial Order No. 70 issued in April 2023, planning began in May 2023 under a directive from the Mayor of UB City. The plan targets the area from near Dambadarjaa Bridge in the upper Selbe River to the confluence with the Tuul River, planning construction of detention basins and embankment stabilization along the Selbe River (total length 41.6 km).

This plan is a comprehensive development project that includes road improvements and urban engineering measures under the Master Plan, as well as surrounding area development. To alleviate serious traffic congestion in UB city, the construction of a bypass road along the Selbe River, bridges, underpasses, a bus terminal, roads for vehicles, and pedestrian paths are also planned. Furthermore, the original plans for reservoirs and embankment works that were scheduled in the urban engineering Master Plan are being followed, with revisions being made to the scale of the reservoirs and the construction of embankment levees, after which the project costs have been recalculated and designs updated.

The Selbe River Restoration Plan divides the project area into three main packages:

1. **Upper Selbe River (Package 1: Green)** - From near Dambadarjaa Bridge to Ikh Toiruu Bridge, focusing on both embankment stabilization and detention basin construction.
2. **Lower Selbe River (Package 2: Blue)** - From Engels Street Bridge to the confluence with the Tuul River (road construction extends to Sonsgolon Bridge), with embankment stabilization and expansion at two bottlenecks to prevent river flooding.
3. **Middle Selbe River (Package 3: Red)** - Between Packages 1 and 2, focusing on embankment stabilization and rectifying the main bottleneck at a curved section of the river.

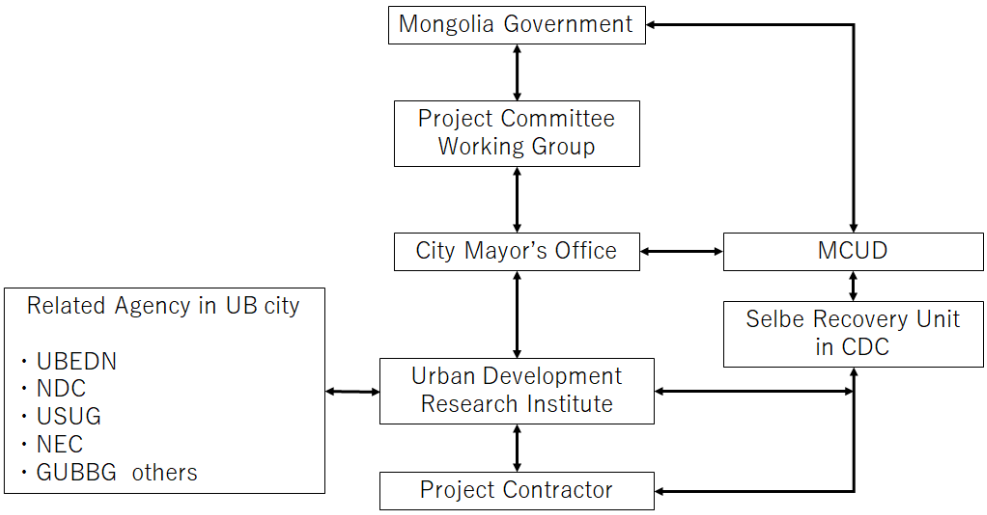


Source: MCUD Selbe Recovery Unit

Figure 2.2.11 Target Area Map in Selbe River Restoration Plan

2) Organization and Structure

The " Selbe Recovery Unit " established within the MCUD manages the formulation of the Selbe River Restoration Plan. However, the survey work has been commissioned to the Urban Planning Research Institute by the Mayor's Office of Ulaanbaatar, and local consultants are conducting it. The " Selbe Recovery Unit " is also expected to coordinate the implementation of the project.



Source: MCUD Selbe Recovery Unit

Figure 2.2.12 Project Structure

3) Project Cost

Based on past performance and design contents, the project costs have been estimated for each package. The total cost for river improvement projects is approximately 26.2 billion yen.

Table 2.2.13 Summary of Project Cost for Selbe River Restoration Plan

Project/Package	Package 1	Package 2	Package 3	Total (JPY)
Embankments and Levees	7,859,281,382	7,270,586,358	11,071,682,670	26,201,550,410
Roads	3,659,913,447	2,908,600,497	2,160,030,214	8,728,544,158
Bridge and Underpass	6,157,134,572	15,970,665,667	21,343,605,424	43,471,405,663
Surrounding Development	370,493,156	943,784,527	931,647,275	2,245,924,958
Relocation Costs	2,432,250,000	2,639,250,000	126,500,000	5,198,000,000
Lifelines	1,757,784,606	1,536,174,141	3,837,055,220	7,131,013,967
Total (yen)	22,236,857,164	31,269,061,190	39,470,520,802	92,976,439,156

Source: MCUD Selbe Recovery Unit

(6) General Development Plan of Ulaanbaatar until 2040 (2040 MASTER PLAN) (Leading Agency: UB City)

The Ulaanbaatar City Urban Development Master Plan (MP) is scheduled for approval in the autumn session of the 2024 National Assembly, targeting the year 2040.

1) Disaster-Related Measures

Urban planning measures related to disaster prevention include setting new regulated areas in Ulaanbaatar City, revising partial plans for summer house areas, identifying zones that exceed the population density stipulated in urban planning building standards, and establishing new building construction restricted areas.

The goal in disaster prevention is to create an "adaptable city," focusing on reducing disaster risks and enhancing disaster management, including flood prevention facilities and road drainage measures outlined in the urban engineering measures MP. Additionally, the plan aims to reduce the evacuation target population per shelter from 13,000 in 2020 to 3,000 by 2040 by increasing the number of buildings that can be used as shelters and relocating 70% of residents from high flood-risk areas. Comprehensive programs for non-structural measures, enhancing evacuation strategies during disasters, and improving communication systems are also highlighted.

2) Structural Measures

For earthquake disaster prevention, Ulaanbaatar City is advancing the understanding of building seismic capacity through the passportization of buildings, planning to compensate for the shortage of shelters by reinforcing 239 school buildings, among others. However, there has been no precedent for reinforcing school buildings, and progress is anticipated. For flood measures, the current 148 km of river embankments is planned to be expanded to 308.9 km by 2040. Urban drainage will increase from 170.5 km to 510.8 km, and underground drainage infiltration facilities from 16.5 km to 98.7 km. The estimated project costs are outlined in the table below.

Table 2.2.14 Estimated Project Costs in 2040 MASTER PLAN

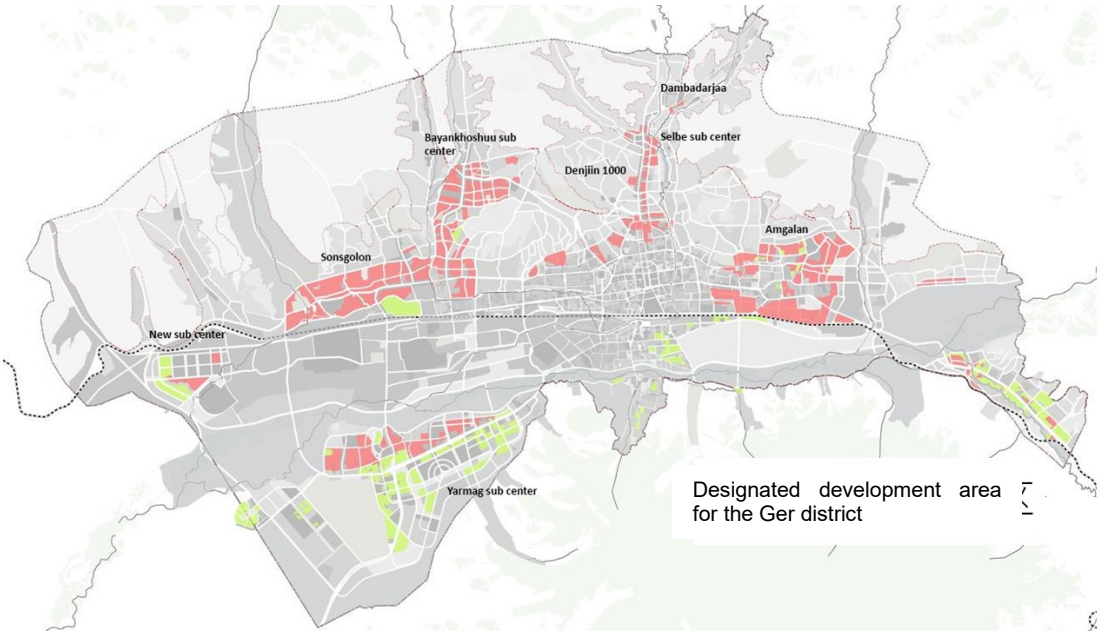
Item	Project Cost（JPY）
Buildings (public facilities, housing, industrial and service facilities, agricultural facilities)	5,359,000,000,000
Infrastructure and Lifeline Facilities (electricity, heat supply, water supply and sewerage, telecommunications, rivers)	2,041,250,000,000
Road Facilities (including railways)	684,250,000,000
Greening Failities	40,250,000,000
Afforestation Projects	46,000,000,000
Total	8,142,000,000,000

Source: JST based on General Development Plan of Ulaanbaatar until 2040

However, as this Master Plan has not been officially formalized as of April 2024, no budgetary provisions have been made.

3) Gel Area Redevelopment

The Gel area is outlined in the "Gel Area Redevelopment Plan" as part of the future development strategy and implementation plan, highlighting the redevelopment of 24 Gel area residences and block roads, as well as electricity, heat, and water infrastructure within Ulaanbaatar. The map showing the planned redevelopment districts and the sub-centers that will serve as local hubs is presented in Figure 2.2.13. (note that the map described only 8 main places of redevelopment area). The individual "Gel Area Redevelopment Plan" will be officially formalized separately by UB City.



Source: General Development Plan of Ulaanbaatar until 2040

Figure 2.2.13 Location Map of Gel Area Redevelopment

2.3 Laws and Regulations

2.3.1 Regulations relating to Disaster Prevention

Provisions related to earthquake disaster prevention were extracted from the Disaster Prevention Law and related laws.

(1) Disaster Prevention Law (Lead Agency: NEMA)

1) Structure and Content

The law was revised to emphasize prevention as well as disaster response. The revisions were considered in light of the outcomes of the 3rd UN World Conference on Disaster Risk Reduction held in 2015, and the amended Disaster Prevention Law was enacted on February 2, 2017. Subsequent amendments were made in 2020, 2021, 2022, and 2023. The composition of the Disaster Prevention Law is outlined below.

Table 2.3.1 Composition of Disaster Prevention Law

Field	Disaster Prevention Law Preparation	
Prevention (Mitigation, Reduction, Preparation)	Chapter 2: Disaster Prevention Activities - Article 6: Pre-disaster Activities - Article 7: Disaster Risk Assessment - Article 8: Disaster Prevention Planning - Article 9: Disaster Risk Reduction - Article 10: Ensuring Disaster Preparedness	- Article 11: Preparedness Levels and Transition during Pandemics - Article 12: Conducting Disaster Audits - Article 13: Implementing Disaster Training - Article 14: Construction of the Disaster Database
Emergency Response	Chapter 3: Activities During Disasters - Article 15: Activities During Disasters - Article 17: Identification of Affected Areas (almost common) - Article 19: Mobilization of Personnel and Equipment, Evacuation	- Article 16: Disaster Communication, Early Warning Implementation - Article 18: Search and Rescue - Article 20: Removal of Disaster Damages
Recovery	Chapter 4: Emergency Recovery Activities (newly added) - Article 21: Emergency Recovery Activities (newly added)	
Disaster Management	Chapter 5: Coordination and Management of Disaster Activities - Article 22: Organizational Structure of Disaster Activities - Article 24: Disaster Personnel and Equipment	- Article 23: Operation and Management of Disaster Activities
Duties and Authority	Chapter 6: Authority of Disaster Management Organization - Article 25: Authority of the Parliament - Article 26: Authority of the Government of Mongolia - Article 271: Authority of the Emergency Council - Article 29: Role of the National Administrative Agency in charge of Emergencies - Article 31: Authority of Local Governments - Article 33: Role of Disaster Management Services	- Article 25: Authority of the National Security Council - Article 27: Authority of National and Regional Committees - Article 28: Authority of the Minister in charge of Emergencies - Article 30: Authority of the Head of the National Administrative Agency in charge of Emergencies - Article 32: Authority of the Governor

Field	Disaster Prevention Law Preparation	
Rights and Duties of Corporations and Residents	Chapter 7: Rights and Duties of Corporations, Residents - Article 34: Rights and Duties of Corporations - Article 36: Rights and Duties of Disaster Volunteers	- Article 35: Rights and Duties of Non-Governmental Organizations - Article 37: Rights and Duties of Residents
Humanitarian Support	Chapter 8: Humanitarian Support in Disaster Activities - Article 38: Domestic Humanitarian Support, Aid - Article 40: Coordination of International Humanitarian Support	- Article 39: International Humanitarian Support - Article 41: Suspension of International Humanitarian Support
Legal Status of Emergency Agencies	Chapter 9: Legal Status of Emergency Agencies and Their Staff - Article 42: Organization Structure of Emergency Agencies - Article 44: Role of Emergency Agencies - Article 46: Uniforms, Ranks, and Insignia of Emergency Agency Staff - Article 48: Duties of Emergency Agency Staff - Article 50: Guarantees for Emergency Agency Staff in the Execution of Duties	- Article 43: Flag, Symbols of Emergency Agencies - Article 45: Staff of Emergency Agencies - Article 47: Rights of Emergency Agency Staff - Article 49: Pensions, Subsidies Issued to Emergency Agency Staff
Disaster Budget Measures	Chapter 10: Disaster Budget Measures - Article 51: Disaster Budget Measures	
Miscellaneous	Chapter 11: Miscellaneous (newly added) - Article 52: Penalties for Violators of Disaster-Related Laws	

Source: JST

2) Implementation Status

NEMA needs to address the newly added provisions in the revised Disaster Prevention Law and also enhance its capabilities.

i. Regarding prevention (mitigation, reduction, preparation), newly added as Chapter 2, it is necessary to demonstrate how these activities will be conducted.

ii. While the current Disaster Prevention Law positions risk assessment methods under the Disaster Vulnerability and Risk Assessment Implementation Rules (Cabinet Decision No. 176 of 2006), no specific methodologies are detailed, leading to a lack of implementation at all levels (Aimag, city, khoroo). The revised Article 8 of the Disaster Prevention Law grants NEMA the authority to conduct disaster risk assessments, with the authorized organizations performing these assessments upon request from administrative bodies, businesses, and individuals according to the "Disaster Risk Assessment Regulations" approved by Cabinet Decision No. 190 of 2020.

iii. Local disaster plans merely follow the template, lacking thorough consideration of disaster scenarios, disaster training content, and emergency response structures. Guidelines for disaster plans under Article 9 of the revised law require showing specific measures related to prevention (mitigation, reduction, preparation), as well as detailed methods for monitoring and plan management.

iv. For the issuance of certificates of building use and passportization, it is necessary to utilize the seismic diagnosis guidelines for different building structures formulated in "Phase 1" to conduct seismic assessments of buildings, infrastructure, and lifelines.

(2) Construction Law (Lead Agency: MCUD)

1) Structure and Content

The Construction Law was established in 2008 and significantly amended on February 5, 2016. It stipulates the principles of construction projects, verification of buildings, audits of construction projects, production of materials, management of construction works, and the commencement of use of constructed facilities. The Ministry of Construction and Urban Development oversees these regulations.

Earthquake Disaster Prevention-Related Provisions of the Construction Law

Chapter 2: Construction Works and Types of Buildings

- Article 6: Acceptance of International Technical Rules and Standards
  - 6.1 For matters not specified in the Mongolian construction standards, international and foreign construction standards, rules, and specifications apply.

Chapter 3: Basic Requirements of Construction Projects

- Article 10: Classification of Buildings
  - 10.1 Buildings are classified as:
    - 10.1.1 Buildings that do not require construction permits
    - 10.1.2 Buildings of low complexity
    - 10.1.3 Buildings of medium complexity
    - 10.1.4 Buildings of high complexity
    - 10.1.5 Buildings of especially high complexity
- Article 11: Principles of Construction Projects
  - 11.1 The following principles apply in construction projects:
    - 11.1.1 Ensure structural safety: The materials and structure of buildings must be stable and not harm the health, life, property, or environment of residents during construction and use.
    - 11.1.4 Ensure human safety: Buildings must be designed to protect against physical and chemical hazards, harmful organisms, radioactivity, high frequencies, and other harmful substances.
    - 11.1.5 Ensure safety of building users: Buildings must be designed to not harm human health or life during use, have fire resistance, and ensure a stable supply of electricity and energy.
- Article 12: Requirements for Design Drawings
    - 12.1.5 Measures must be taken to prevent and protect human life, health, and the environment from construction accidents and fires, and to enable evacuation in case of natural disasters or accidents.

Chapter 4: Special Permits for Construction Projects, and Construction Permits

- Article 25: Verification of Building Design Drawings
  - 25.2 Design drawing verification is conducted for:
    - 25.2.1 Buildings of classifications 10.1.2, 10.1.3, 10.1.4, 10.1.5 in areas with seismic intensity of 7 or more.
    - 25.2.2 Buildings of classifications 10.1.4, 10.1.5 in areas with seismic hazard less than 7.

Chapter 5: Management and Coordination in the Construction Sector

- Article 35: Full Authority of Governors of Aimags and the Capital
    - 35.1.4 Verify, register, and passportize the use status of buildings in the area.
- Article 40: Obligations of Construction Contractors
  - 40.1 Construction contractors have the following obligations:
    - 40.1.3 Take measures to prevent buildings from irresistible and unforeseen disasters.
- Article 46: Obligations of Owners and Users of Buildings
  - 46.2 When assessing damage to buildings caused by natural disasters, irresistible forces, or accidents,

base it on whether the conditions for using the building are ensured.

Chapter 7: National Technical Audit of Buildings

- Article 47: National Technical Audit of Buildings
  - 47.2 The authorized agency conducting the national audit of buildings will perform the following audits:
    - 47.2.1 Audit the quality of construction, improvement, and repair works of buildings.
    - 47.2.7 Audit the reasons for accidents involving falling, damage, and lifting facilities (elevators, cranes, etc.).
    - 47.2.9 Audit the quality at the completion of construction works.
- Article 49: Certificates of Use and Passportization of Buildings
  - 49.1 Based on Article 48.1, the authorized agency conducting the national audit of buildings issues a certificate of use within 7 business days based on the conclusion of the use permission committee[12].
  - 49.2 Certificates of use for buildings are of the following types based on quality and safety levels:
    - 49.2.1 Newly established buildings: green
    - 49.2.2 Buildings that need repair or improvement as revealed by passportization: yellow
    - 49.2.3 Buildings confirmed by passportization as not meeting use requirements: red
  - 49.3 The strength and integrity level of buildings in use are passportized by the authority cited in Article 35 and the appropriate certificate is issued by the authority in Article 49.1.
  - 49.4 If the buildings shown in Article 49.2.2 are repaired or improved to meet use requirements, the authority in Article 35 permits the start of use and issues a green certificate as shown in Article 49.1.

2) Implementation Status

The application for confirmation when constructing new buildings is stipulated, with the Construction Development Center (CDC) functioning as the confirmation agency. The passportization is carried out by the Urban Development Bureau in the capital and by branch agencies of MCUD at the Aimag level. For new buildings, seismic design according to the design seismic intensity is prescribed. For existing buildings, since there are no provisions for seismic diagnosis or reinforcement, clarification through revision of the Construction Law or a new law is being considered by MCUD.

(3) Fire Safety Law (Principal Agency: NEMA)

1) Overview:

The Fire Safety Law was enacted in 1999 and amended on July 2, 2015. It defines the rights and obligations of enterprises, organizations, and citizens regarding fire safety and coordinates their implementation. The law specifies fire prevention, firefighting activities, and fire inspections, with NEMA as the overseeing body.

[12] Located within the Ministry of Construction and Urban Planning, it plays the role of determining whether buildings are fit for use. It is composed of the head of the relevant bureau within the Ministry of Construction and Urban Planning, and representatives from consulting, design, and construction companies. It is established under the "Regulations for the Start, Continuation, and Commencement of Use of Construction Works" (Cabinet Decision No. 151 of 2012).

Earthquake Disaster Prevention-Related Provisions of the Fire Safety Law

Chapter 2: Policy and System for Ensuring Fire Safety by the National Emergency Management Agency

Article 4: Basic Policy of the National Emergency Management Agency

4.1 Comprehensive management and coordination of tasks to prevent, respond to, and extinguish facility or forest disasters, and conducting national fire inspections.

Article 5: National Fire Inspection

5.1 The National Emergency Management Agency conducts the national fire inspection based on the laws regarding inspections.

5.3 The Director of the National Emergency Management Agency is the National Chief Fire Inspector and appoints and dismisses the National Senior Inspectors and Inspectors.

Chapter 4: Ensuring Fire Safety

Article 20: Standards Related to Fire Safety

20.4 Fire safety standards in construction are approved by the Emergency Management Agency in consultation with the Minister for Emergency Situations and the Minister for Construction and Urban Development, and fire safety regulations in the construction sector are developed in consultation with relevant agencies.

Article 21: Fire Safety Requirements in the Design and Inspection of Buildings and Facilities

21.6 The National Emergency Management Agency has the right to audit architectural designs and the results of design confirmations.

Article 22: Fire Safety Requirements in Products

22.1 The National Emergency Management Agency drafts a list, classification, and flammability level [13] of combustible products, which is approved by the National Standardization Committee[14].

Chapter 5: Registration, Investigation, and Research of Fires

Article 24: Registration, Investigation, and Research of Fires

24.2 The National Emergency Management Agency analyzes the results of the national fire registration to determine the fire prevention and national inspection policies and develop policies.

2) Implementation Status

Fire safety standards require that the National Emergency Management Agency (NEMA) audits building, and facility designs for fire safety during confirmation. The investigation into the causes of fires is also conducted by NEMA's Disaster Investigation Research Institute.

(4) Urban Development Law (Main Agency: MCUD)

1) Overview

The "Urban Development Law" was revised in 2008 to outline the formulation of development plans for aimags, soums, and bags. It specifies the structure of the plan, key points to include, approval methods, and the rights and obligations related to implementation.

Article 3.1.9 defines "urban infrastructure engineering measures" as flood control, landslide

[13] Combustible Materials Classification:
Combustible materials are divided into three flammability levels:1: Highly Dangerous 2: Dangerous 3: Dangerous at High Temperatures

[14] A committee established within the Standards and Metrology Agency under the Deputy Prime Minister defines various standards according to international standards and sets measurement units according to the International System of Units.

prevention, snow reinforcement, embankments, water channels, bridges, and road development.

Article 6.1.4 states that the nation will approve the UBMP2040 for regional development in local areas.

Article 10 outlines the roles of chief engineers in aimags and the capital within urban development policy, including the formulation and implementation of policies (Article 10.1.2), and the survey, design, execution, and coordination of urban infrastructure engineering measures (Article 10.1.3).

2) Implementation Status

In addition to the national development plan, development plans at the aimag, soums, and bags levels have been formulated. For infrastructure, the UBMP2040 sectoral plan, the UB City Urban Engineering Measures Master Plan (MP), has been developed.

(5) National Stockpile Law (Main Agency: NEMA)

1) Overview

The National Stockpile Law, enacted on July 5, 2007, and partially amended in 2015, regulates the procurement, storage, transportation, updating, use, and financing of national stockpile supplies and materials. NEMA oversees this law.

Earthquake Disaster-Related Provisions in the National Stockpile Law

Article 4: National Stockpile

4.1: The national stockpile is classified into strategic, military, disaster, and local categories.

Article 5: Purpose of Stockpile Supplies and Materials

5.1: Stockpile supplies and materials are used for disaster response.

Article 6: Procurement of Stockpile Supplies and Materials

6.1: The procurement of strategic and disaster stockpile supplies and materials is coordinated by the national emergency agency, based on government-defined locations, items, and quantities.

6.3: Procurement of national stockpile supplies and materials, other than for strategic and military mobilization, is regulated by the law concerning the purchase of goods, works, and services with national and local funds.

Note: There are several other disaster-related provisions in this law.

2) Implementation Status

Central and local governments have national stockpile warehouses managed by NEMA. Agreements with related ministries and private companies, including food manufacturers, are partially established for their stockpiles.

(6) Road Law (Main Agency: Ministry of Road and Transport Development)

1) Overview

The Road Law governs the construction, repair, maintenance, preservation, use, financing, and auditing of roads and road facilities, and is managed by the Ministry of Road and Transport Development. It was enacted in 1998 and partially amended in 2016.

Earthquake Disaster-Related Provisions of the Road Law

Chapter 2: Full Authority of the Road Authorities

Article 5: Full Authority of the National Road Agency

5.1.5 Defines technical rules (Durem), standards (Juram), machinery, and technical instructions (Zaavar)[15] related to the construction, repair, maintenance, and management of road facilities, ensuring they are safe and do not adversely affect the health of the public, especially people with disabilities.

Article 6: Full Authority of Aimags, Capital's Governor, Soums, and Districts

6.1.6 In case of natural or other sudden disasters causing damage or malfunctions to roads and road facilities, the aimags, the capital's governor, soums, and districts coordinates assistance from local businesses, organizations, and residents to facilitate urgent repairs under compensatory conditions.

Article 8: Duties of the National Road Auditor[16]

8.1 The national road auditor conducts audits of roads.

8.2.5 Audits the compliance with rules (Durem), regulations (Juram), standards (Norm), technologies (Teknologi), and standards (Standard) related to the construction, repair, maintenance, and preservation of roads and road facilities.

Chapter 3: Road Network

Chapter 4: General Requirements for Construction, Repair, Maintenance of Roads and Road Facilities

Chapter 5: Road Fund

2) Implementation Status

Maintenance of facilities related to earthquake disaster prevention is conducted according to rules and regulations related to the maintenance of roads and road facilities in Chapter 4. However, inspections for maintenance do not specifically include earthquake-related items.

(7) Water Law (Main Agency: Ministry of Environment and Tourism)

1) Overview

The roles of river basins in utilizing and protecting water resources, as well as managing water resources, are defined by the boundaries of the river basins and the responsibilities of the basin authorities. Article 4 of the Water Law stipulates "comprehensive management of water resources," and Article 4.10 states that a "Basin Authority" shall be established in the basins specified under this law's Article 10.1.2. It lists "water facilities" as infrastructure for the regulation, storage, transmission, distribution, supply, purification, water quality improvement, groundwater extraction, flood prevention, and disaster prevention related to water basins. The roles of related institutions for water facilities are defined as follows.

- Article 10: Rights of the Central Government Agency for Environment: Develops regulations

[15] According to the document standards of the Standards and Metrology Agency, the definitions of rules, regulations, etc., in the table are as follows:
Durem (Regulations): A document that sets out the authorities, basic principles, organizational structures, and principles of interaction with other agencies or bodies.
Juram (Provisions): A document that specifies the order and procedures to be followed in specific tasks or activities.
Zaavar (Instructions): A detailed document that outlines the systems and procedures for implementing laws and regulations.
Teknologi (Technology): Methods related to construction techniques and processes.
Standard (Standards): Specifications for materials and construction methods.

[16] Staff of the Ministry of Road and Transport Development are appointed by the Minister of Road and Transport Development.

and instructions for the use and ownership of hydraulic facilities in cooperation with other central government agencies.

- Article 16: Rights of the National Water Agency: Reviews and confirms hydraulic facility construction projects.
- Article 20: Rights of the River Basin Committee: Can recommend halting construction if a specialist institution confirms that a design adversely affects water resources.
- Article 21: Rights of Water Specialist Institutions: Submits designs and reports of hydraulic facilities to the water information database.
- Article 22: Restricts construction within 50 meters of rivers, lakes, and ponds to protect these areas.
- Article 32: Public construction related to water facilities is authorized by the central government agency responsible for construction and urban development.

2) Implementation

The Basin Management Bureau implements basin management plans, maintains a water resource database, and handles applications and permits for boreholes and piping related to drinking water, setting water intake and discharge points within the river basin and managing water resource usage regularly.

(8) Energy Law (Leading Agency: Ministry of Energy)

1) Overview

The Energy Law regulates the generation, transmission, supply, and operational command of electricity and thermal energy, as well as energy facility construction and energy consumption activities using energy resources. Chapter 3 specifies that individual licenses are required for activities like generation, transmission, distribution, and retail of electricity and heat, as well as for energy facility construction and gas supply. The government-appointed Energy Regulatory Commission sets requirements for obtaining licenses and has the authority to issue and revoke them. License holders must trade energy at approved prices, and the Commission also reviews and approves rates proposed by license holders. Additionally, the Central Power Control Center (NDC) manages power and heat supply through major networks, and the starting and ending dates of the heating season are determined by a central administrative body.

Structure of Energy Law

- Chapter 1: General Provisions
- Chapter 2: State Authority Related to Energy
- Chapter 3: Licenses
- Chapter 4: Pricing and Fees
- Chapter 5: Relationship Between Suppliers and Consumers
- Chapter 6: Management and Responsibility

2) Implementation Status

Renewable energy and nuclear power are governed by separate laws. The latest amendment in January 2023 introduced restrictions on the sale and transfer of licenses, additional documentation requirements for obtaining licenses, and conditions for license suspension and cancellation.

(9) National Audit Law (Leading Agency: Ministry of Audit and Inspection)

1) Overview

National Audit Law, established in 2002 and partially revised in 2015, defines the legal basis and system for national audits and coordinates their implementation. The 2023 revision dissolved the National Audit Agency, transferring its functions to audit bureaus within various ministries.

Earthquake Disaster-Related Provisions of National Audit Law

Chapter 1

Article 5: General Basis and Provisions for Audits

5.2: Planned and unplanned audits are conducted based on guidelines established by authorized officers[17].

5.3: If it is confirmed that there is a direct or indirect risk of significant danger or major damage to human life, health, or the environment, specialized audits and the decision of the authorized officer of the national emergency agency can conduct audits without the guidelines stated in this law under 5.2.

5.4.1: Based on the damages and outcomes affecting human life, health, environment, and social safety, the audit targets are classified into small, medium, and large risks.

Article 9: Full Authority of the Special Audit Agency

9.3: The special audit agency has the following full authority:

9.3.3: Set standards, audit sheets, and criteria for conducting audits based on the audit policy, including regulations, instructions, formats, methods, specifications, and risk classifications.

Article 10: Full Authority of Special Auditors

10.9.7: If it is confirmed that there is direct or indirect damage to human life, health, or the environment, or there is a potential for such damage, the operation, industry, service, or activity can be completely or partially stopped until the damage or negligence is eliminated. Necessary objects will be disinfected to remove the hazard, usage of the particular buildings or equipment will be stopped, and the sale of the products will be prohibited, removed, or repurposed as decided. These actions will be made public and announced to the public.

2) Implementation Status

Due to the increasing risk of earthquakes, the role of the audit function, mandated by Article 10 to issue usage permits based on "direct or indirect damage to human life, health, or the environment, or the potential for such damage," is becoming increasingly important in assessing building safety.

2.4 Implementation Period and Related Organizations for Disaster Prevention

2.4.1 Disaster Prevention Structure in Mongolia

Mongolia's disaster management policy is formulated and directed by the National Security Council. Earthquake countermeasures are coordinated and adjusted at the national level by the Earthquake Prevention Subcommittee of the National Committee for Disaster Risk Reduction.

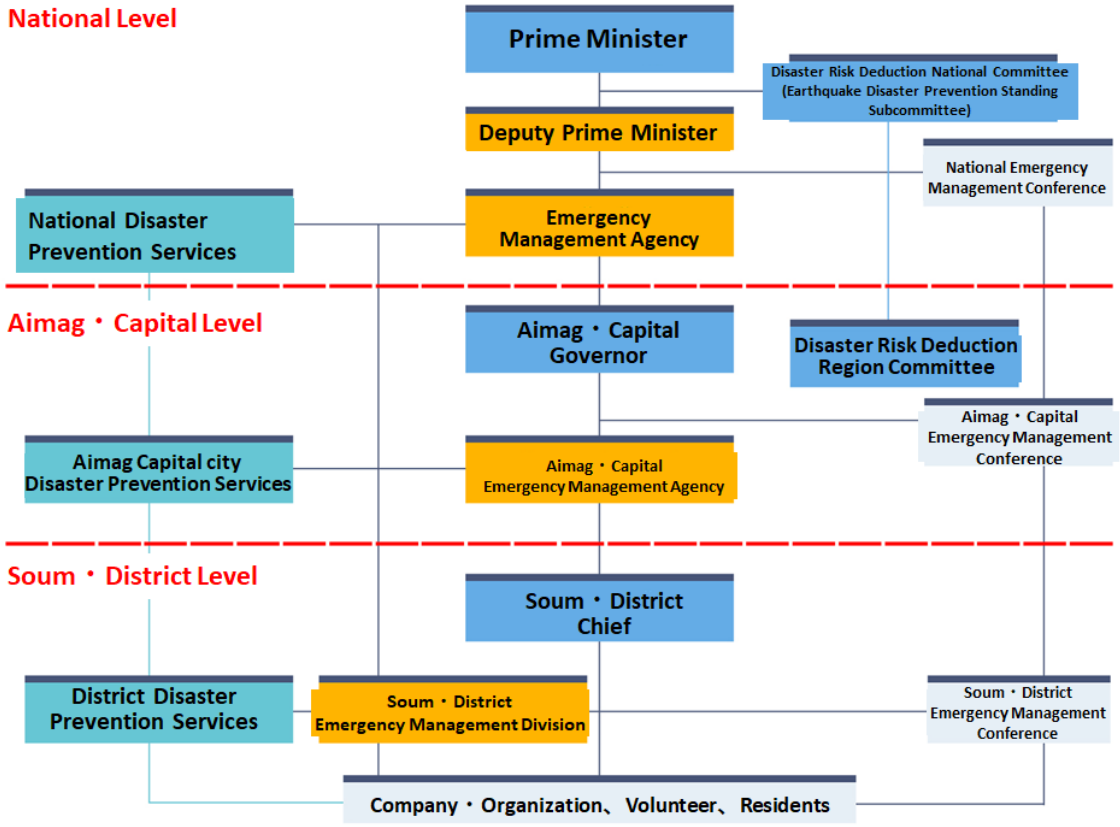
In normal times, the National Committee for Disaster Risk Reduction is the highest-level disaster management agency, with regional committees at the Aimag level.

In emergencies, the National Emergency Committee, chaired by the Deputy Prime Minister, is convened for immediate disaster response and recovery. Additionally, the function to review plans, rules, and regulations related to disaster prevention, response, and recovery is held by disaster management organizations within each ministry and agency.

NEMA oversees national disaster management and also acts as the secretariat for the aforementioned subcommittee and national committee. In UB City, there is the Capital Emergency Management Department (EMDC), and in Aimags, the Emergency Management Departments (EMDA), both

[17] Authorized officers: Auditor General of the National Audit Office, Deputy Auditor General, Director of the Audit Bureau, Director of the Aimag Audit Bureau, Director of the Capital Audit Bureau.

serving as secretariats for their respective regional committees. NEMA oversees local emergency management agencies and is responsible for fire, rescue, and national reserves.



Source: NEMA

Figure 2.4.1 Disaster Prevention Structure in Mongolia

2.4.2 Counsil relating to Disaster Prevention

(1) National Security Council

1) Organization Content

The National Security Council is established based on the "Law on National Security" (2001), as a national consultative body that formulates comprehensive policies to ensure national security, coordinates their implementation, and audits the policy implementation.

2) Composition

The council is chaired by the President and consists of the Prime Minister and the Speaker of the Parliament, with the secretariat located within the Parliament building.

(2) National Committee for Disaster Risk Reduction (Normal and Emergency Times)

1) Organization Content

Established by Cabinet Decision No. 350 in 2022 under Article 27 of the Disaster Prevention Law, with the Prime Minister as chairman and NEMA as the secretariat. It plays a role as an institution that implements strategies for disaster risk reduction at the national level, disaster recovery and reconstruction, mutual cooperation between the government and private sector, and public participation, and secures the necessary budget.

2) Composition

The committee is chaired by the Prime Minister and consists of 20 national-level disaster prevention agencies.

Table 2.4.1 Composition of National Committee for Disaster Risk Reduction

Chairman: Prime Minister of Mongolia

Vice Chairman: Deputy Prime Minister of Mongolia

Members:

- Minister of Justice
- Minister of Road and Transport Development
- Minister of Natural Environment and Tourism
- Minister of Defense
- Minister of Construction and Urban Development
- Minister of Food, Agriculture and Light Industry
- Minister of Digital Development and Communications
- Minister of Energy
- Minister of Health
- Deputy Minister of Economic Development
- Deputy Minister of Foreign Affairs
- Deputy Minister of Finance
- Deputy Minister of Education and Science
- Chief Advisor to the Deputy Prime Minister
- Director of the National Emergency Management Agency
- Director of the Strategic Studies Institute of the National Security Council
- Director of the Cabinet Secretariat
- President of the Mongolian Chamber of Commerce and Industry
- President of the Mongolian Red Cross Society

Secretary: Director of the Disaster Risk Management Bureau of the National Emergency Management Agency

Note: Ministry names are as of January 2024.

Source: Composition of the National Committee for Disaster Risk Reduction (Appendix 3 of Cabinet Decision No. 350 of 2022)

(3) Earthquake Disaster Prevention Permanent Subcommittee (During Normal Times)

1) Organization Content

The Earthquake Disaster Prevention Permanent Subcommittee, established under Deputy Prime Minister's Order No. 12 of 2023, with the Deputy Prime Minister as chairman and NEMA as the secretariat, develops and monitors national-level earthquake disaster prevention plans, and coordinates among related agencies.

2) Composition

The Deputy Prime Minister serves as chairman, and the committee consists of representatives from 15 national disaster prevention agencies and the Deputy Mayor of UB City.

Table 2.4.2 Composition of Earthquake Disaster Prevention Permanent Subcommittee

Chairman: Deputy Prime Minister of Mongolia

Vice Chairmen:
- Deputy Minister of Construction and Urban Development
- Director of the Emergency Management Agency

Members:
- Deputy Minister of Road Transport Development
- Deputy Minister of Defense
- Deputy Minister of Education and Science
- Deputy Minister of Energy
- Deputy Minister of Food, Agriculture, and Light Industry
- Deputy Minister of Health
- Deputy Secretary of the Ministry of Digital Development and Communications
- Deputy Secretary of the Ministry of Finance
- Deputy Mayor of UB City
- Director of the Land Management, Survey, and Mapping Bureau
- Director of the National Geological Service
- Director of the Astronomical and Geophysical Research Center of the Academy of Sciences

Secretaries:
- Senior Assistant Secretary of the National Security Council
- Director of the Response Bureau, Emergency Management Agency

(Ministry names as of January 2024)

Source: Composition of the Permanent Urban Subcommittee on Earthquake Disaster Prevention (Deputy Prime Minister's Order No. 12 of 2023)

(4) National Emergency Committee (During Disasters)

1) Organizational Details

The National Emergency Committee was established based on Article 23, Section 3 of the Disaster Prevention Law and Cabinet Decision No. 11 of 2008. It plays a role in coordinating and responding to disaster prevention, rescue, response, and urgent recovery measures.

2) Composition

The committee is chaired by the Deputy Prime Minister and includes ministers from disaster-related ministries, deputy minister-level officials, and the Mayor of UB.

Table 2.4.3 Composition of National Emergency Committee

Chairman: Deputy Prime Minister of Mongolia

Vice-Chairman: Director of the National Emergency Management Agency

Members:

- Minister of Environment and Tourism
- Minister of Construction and Urban Development
- Deputy Minister of Road and Transport Development
- Minister of Defense
- Minister of Mining and Heavy Industry
- Minister of Food, Agriculture and Light Industry
- Minister of Labor and Social Protection
- Minister of Energy
- Minister of Health
- Governor and Mayor of UB City
- Chief of the Cabinet Secretariat
- Deputy Minister of Finance
- Deputy Minister of Justice and Home Affairs
- Deputy Minister of Education, Culture, Science, and Sports
- Director of the Communications and Information Technology Agency
- Chief of the General Staff of the Armed Forces
- Director of the Customs General Administration
- Director of the National Police Agency
- Director of the Border Protection Agency
- Chairman of the Nuclear Energy Commission
- Director of the National Audit Office
- Director of the Standardization and Metrology Agency
- Director of Meteorology and Environmental Monitoring Agency
- Secretary-General of the Mongolian Red Cross Society
- Head of Government Press and Public Relations

Secretary: Advisor to the Deputy Prime Minister

(Ministry names are as of January 2023)

Source: Composition of the National Emergency Management Council (Cabinet Decision No. 16 of 2012)

(5) National Disaster Management Operations (During Normal Times & Disasters)

1) Organizational Details

National Disaster Management Operations were defined in Cabinet Decision No. 81 of 2015. They form a task force of relevant ministries for disaster management, aligning with policies and development plans in their respective fields to develop disaster prevention, response, and recovery plans (Disaster Management Plans). They also conduct disaster risk assessments and risk reduction measures, oversee national budgeting, expenditures, and evaluations for disaster management activities, and create compliance rules, regulations, and guidelines related to disaster management. Additionally, they are responsible for gathering information and reports necessary for preventive activities like training, disaster alerts, and disaster response from administrative and local governments and central and regional disaster management agencies and building databases.

2) Composition

Under the command of the Deputy Prime Minister, the National Disaster Management Operations are composed of national-level disaster management agencies, with each minister acting as the head of disaster management operations and having designated responsibilities within their respective ministries for carrying out disaster management tasks.

Table 2.4.4 Related Ministries and Agencies for National Disaster Prevention Duties

No.	National Disaster Management Duty	Related Ministries and Agencies	Minister/Director
1	Assessment and reporting of natural disasters and chemical hazards	Ministry of Nature, Environment and Tourism	Minister of Nature, Environment and Tourism
2	Disaster prevention duty related to construction and urban development	MCUD	Minister of MCUD
3	Disaster prevention tasks related to roads and transportation	Ministry of Road and Transport Development	Minister of Road and Transport Development
4	Disaster prevention tasks related to mining and heavy industries	Ministry of Mining and Heavy Industry	Minister of Mining and Heavy Industry
5	Disaster prevention tasks related to human and social security	Ministry of Labour and Social Protection	Minister of Labour and Social Protection
6	Disaster prevention tasks related to food, agriculture, and animal husbandry	Ministry of food agriculture and light industry	Minister of food agriculture and light industry
7	Disaster prevention tasks related to fuel and energy	MOE	Minister of MOE
8	Disaster prevention tasks related to health	Ministry of Digital Development and Communications	Minister of Health, Labour and Welfare
9	Disaster prevention tasks related to information and communication	Ministry of Digital Development and Communications	Minister of Digital Development and Communications
10	Disaster prevention tasks related to auditing and radiation monitoring	Central Government Audit Department	Deputy Chief Auditor of the Central Government Audit Department
11	Disaster prevention tasks related to maintaining order	National Police Agency	Director of National Police Agency
12	Disaster prevention tasks related to advertising and promotion	Cabinet Office	Deputy Prime Minister of Cabinet

Source: Organization Structure for National Disaster Prevention Duties (Cabinet Decision No. 347 of 2018)

2.4.3 Administrative Organization for Disaster Prevention

(1) National Emergency Management Agency (NEMA)

1) Organization

NEMA was established in 2004 based on Government Resolution No. 1, integrating the National Committee for Civil Defense, the Firefighting Bureau, and the National Stockpiling Agency. NEMA has regional emergency bureaus in all 21 aimags and the capital. Its internal organization includes:

- **Response Management Bureau**: Handles disaster emergency response, communications, and alarms. The Disaster Response Early Warning Center manages disaster information transmission and alarm broadcasting.
- **Policy and Planning Bureau:** Responsible for policy, planning, and foreign relations.
- **Firefighting Bureau:** In charge of firefighting and fire prevention.
- **Administration Bureau:** Manages organizational administration and personnel.
- **National Stockpiling Bureau:** Oversees national stockpiling, humanitarian support, and warehouse management.
- **Prevention Bureau:** Manages national prevention operations, including disaster education and training for schools, community target groups[18], and NEMA staff.

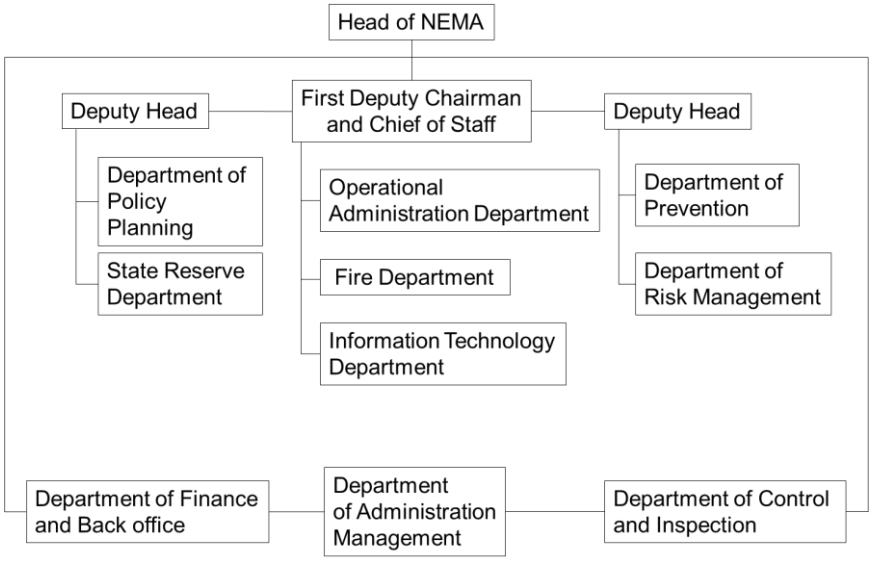
[18] This refers to school students and teachers, local residents, and staff of local government offices such as district offices and khoroo offices.

- **Risk Management Bureau:** Focuses on disaster risk management systems, enhancing legal frameworks related to disaster risk assessment, and monitoring and evaluating risk assessment activities.
- **Finance and Logistics Bureau:** Handles budget, finance, procurement, investment, and equipment acquisition.
- **Audit Bureau:** Responsible for monitoring, evaluating, and internal auditing of disaster prevention activities.

Additional units include the Disaster Research Institute at the headquarters and Life Rescue Squads located at one national level, one in UB City, and 5-6 in each aimag, with a Mining Rescue Squad outside UB City. There are about 30 national stockpile warehouses nationwide.

2) Staffing

NEMA's internal staffing is structured to include 113 personnel.



Note: The Disaster Research Institute, Fire and Rescue Brigade, Mining Rescue Brigade, and National Stockpile Warehouses are affiliated institutions of NEMA.

Source: NEMA

Figure 2.4.2 Organization Structure of NEMA

3) Business & Budget

NEMA's budget for the year 2023 is 2.94928 billion yen. The budget for 2023 is presented in the table below.

Table 2.4.5 Budget for NEMA (2023)

Item	Budget（JPY）
Operating Expenses	2,494,958,577
Facility Maintenance Costs	57,486,469
Capital Expenditures	454,325,000
Total	2,949,283,577

Source: shilendans.gov.mn

(2) Ministry of Construction and Urban Development (MCUD)

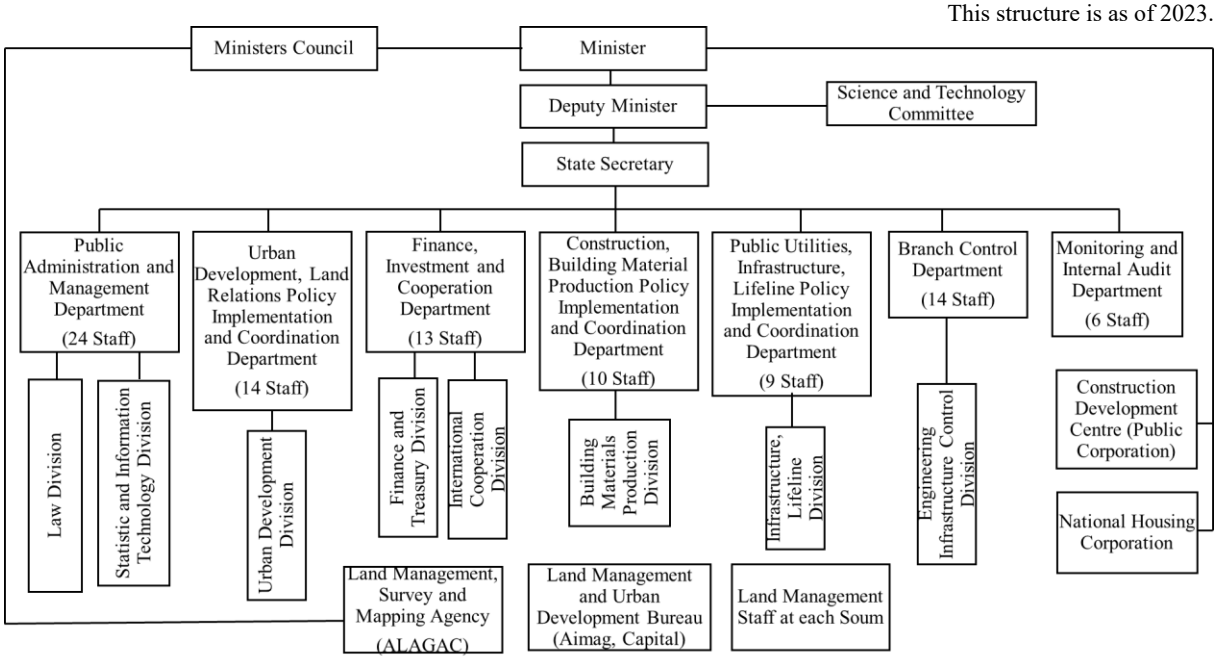
1) Organization

Organization structure of MCUD is shown in Figure 2.4.3. The responsibility of each bureau is

follows;

- **National Administrative Management Bureau:** Coordinates relations with the Parliament, Government, other national administrative agencies, regional governments, and local administrative bodies, providing necessary advice and information.
- **Development Policy, Planning, and Urban Development Bureau:** Formulates and implements policies and plans for urban development, land issues, surveying, mapping, construction, building materials production, housing, public works, and infrastructure according to Mongolia's long-term development policies and government policies.
- **Finance and Investment Bureau:** Oversees the national budget, foreign loans, and investment projects approved under the portfolio of the Minister of Construction and Urban Development.
- **Construction and Building Materials Production Policy Implementation Coordination Bureau:** Provides specialized management and coordination for the implementation of government policies, laws, rules, regulatory documents, and standards in the fields of construction, public works, housing, and infrastructure.
- **Public Facilities, Infrastructure, and Lifeline Policy Implementation Coordination Bureau:** Develops integrated policies for the use and maintenance of public facilities, public housing, and infrastructure lifelines, ensuring coordination with relevant agencies.
- **Monitoring, Evaluation, and Internal Audit Bureau:** Monitors and analyzes the implementation of laws, policies, programs, plans, and projects within the framework of supervision of construction, urban development, land issues, housing, and public utilities, producing final reports and conducting monitoring and internal audits.
- **Sectoral Audit Bureau:** Develops plans based on the results of construction sector audits and risk assessments, publishes audit targets, approves implementation plans and guidelines, coordinates audits with other departments, and manages specialized and methodological coordination.

This structure is as of 2023.



Source: MCUD

Figure 2.4.3 Organization Structure of MCUD

2) Staffing & Functions

National Administrative Management Bureau: 24 staff
Development Policy, Planning, and Urban Development Bureau: 14 staff
Finance, Investment, and Cooperation Bureau: 13 staff
Construction and Building Materials Production Policy Implementation Coordination Bureau: 10 staff
Public Facilities and Infrastructure Policy Implementation Coordination Bureau: 9 staff
Sector Audit Bureau: 14 staff
Monitoring, Evaluation, and Internal Audit Bureau: 6 staff

3) Business & Budget

Ministry of Construction and Urban Development's budget for 2023 is detailed below:

Table 2.4.6 Budget for MCUD (2023)

Item	Budget（JPY）
Operating Expenses	598,679,000,000
Capital Expenditure	23,304,348,000,000
Foreign loans and aid-related expenditures	287,500,000,000
Total	24,190,526,000,000

Source: https://legalinfo.mn/mn/detail?lawId=16532001935011

(3) Construction Development Center (CDC)

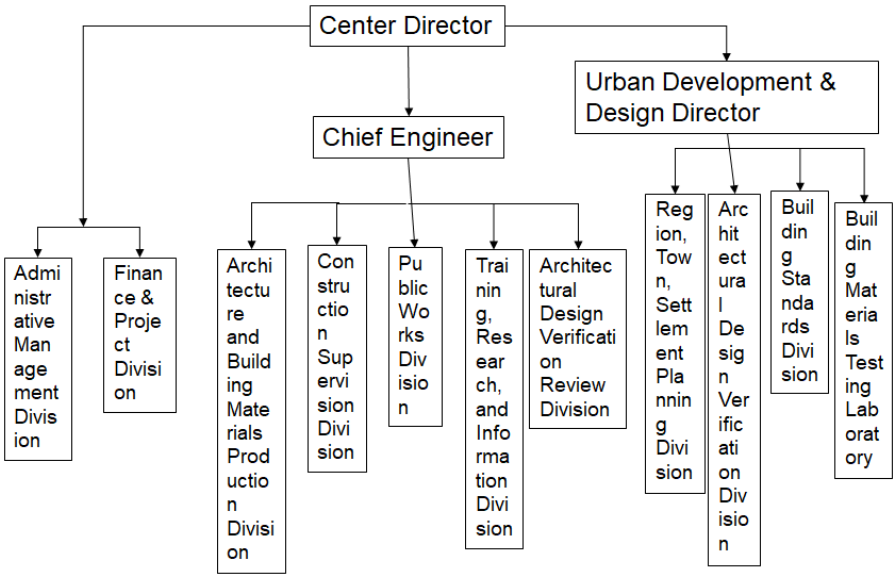
1) Organization

The Construction Development Center (CDC), an affiliate of the MCUD, establishes building standards and regulations, and conducts confirmation procedures. Its functions include:

- Implementing construction sector laws, regulations, and the government's action plan.
- Developing construction standards and rules.
- Conducting building confirmation reviews.
- Providing training for construction workers and technicians.
- Building databases for the construction sector.
- Implementing policies in public utilities.
- Ensuring labor safety in the construction sector.
- Technically supervising projects and measures in the construction sector implemented by the national budget.
- Researching and building databases related to the implementation of policies, projects, and programs in the construction sector.
- Testing building materials.

The organizational structure is shown in Figure 2.4.4.

This structure is as of 2023.



Source: CDC

Figure 2.4.4 Organization Structure of CDC

2) Staffing & Functions

Total number of Staff is 183 as of Dec. 2023.

3) Business & Budget

CDC's budget for 2023 is detailed below:

Table 2.4.7 Budget for CDC (2023)

Item	Budget (JPY)
Total Revenue	581,931,343
Total Expenditure, (Break down shows below)	572,288,085
Salary Fund	361,185,533
Depreciation Expense	45,116,823
Total Profit	9,643,258
Net Profit	9,643,258
Dividends of Government Assets	25,965,008
Investments	33,677,460
Total Liabilities	875,709,503
Receivables	1,872,473
Total	2,517,032,744

Source: https://shilendans.gov.mn/organization/56029

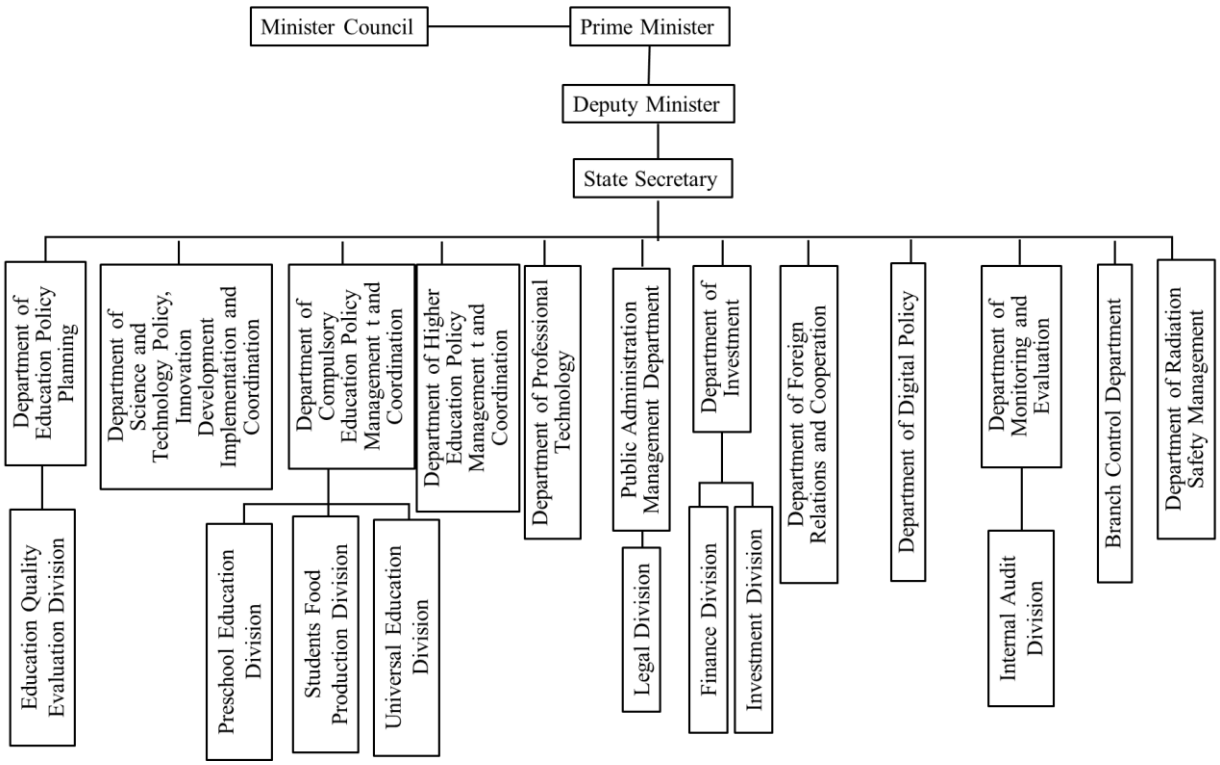
(4) Ministry of Education and Science (MES)

1) Organization

The organization structure of the Ministry of Education and Science (MES) and the staffing numbers for each department (with exact numbers currently unclear due to departmental restructuring) is shown in Figure 2.4.5. The department responsible for implementing and managing education policies for each level of school is the Basic Education Policy Management Coordination Bureau (elementary, middle, and high schools), including its Pre-school Education Section (kindergartens), and the Higher & Professional Education Policy Management Coordination Bureau (universities and other specialized schools). The Financial Investment Bureau is the department involved in the development

of schools and kindergartens, and it is responsible for budgeting the costs necessary for the construction and renovation of schools, kindergartens, and student dormitories.

This structure is as of 2023.



Source: MES

Figure 2.4.5 Organization Structure of MES

2) Staffing & Function

As an educational administration handling school education, higher education, and the promotion of science, there has been a push to reform the primary and secondary education curriculum to align with international standards. Since the 2014-2015 academic year, the transition from an 11-year to a 12-year education system has been made. A "Core Curriculum," analogous to Japan's learning guidelines, has been developed and implemented to enhance educational content. The total number of staff is 114. Regarding school construction, the MES receives requests for the construction and renovation of educational facilities such as schools, kindergartens, and dormitories from all over the country and processes them for inclusion in the national budget in accordance with the Budget Law.

3) Business & Budget

The National Budget Law for FY 2024, approved on November 10, 2023, specifies in Article 6 that the total budget expenditures for the budget administrators (ministers of each ministry) and their affiliated and related agencies are set. The 2023 budget for the Ministry of Education and Science is as follows:

Table 2.4.8 Budget for MES (2023)

Item	Budget（JPY）
Operating Expenses	148,047,000,000
Capital Expenditure	30,434,000,000
Loan	1,830,000,000
Total	178,481,000,000

Source: https://legalinfo.mn/mn/detail?lawId=16532001935011

Operating expenses of MES is shown in the table below.

Table 2.4.9 Breakdown of the Operating Expenses of MES (2023)

Economical Category	Approved Annual Budget (JPY)	Budget reporting period performance（JPY）
Goods and Services cost（Salary）	387,842,416	382,204,113
Total Expenditure	409,900,118	403,078,489

Source: https://shilendans.gov.mn/organization/4308

The 2023 budget for the Ministry of Education and Science, as of the end of November, indicates that over 96% of the total annual expenditures are related to personnel costs.

The 2022 budget of the MES for the construction of schools, kindergartens, universities, specialized schools, and dormitories is shown in Table 2.4.10.

Table 2.4.10 Construction/Renovation Budget for MES (2022)

No.	Facilities	No. of Project	Total Cost (JPY)	Amount spent in 2022 Annual Budget (JPY)
1	School	23	6,304,000,000	1,330,000,000
2	Kindergarten	33	3,884,000,000	1,174,000,000
3	Educational Complex	3	626,000,000	192,000,000
4	Dormitory	8	1,391,000,000	193,000,000
5	Sport Center	6	381,000,000	49,000,000
6	University	1	402,000,000	21,000,000
7	Educational Institute	1	98,000,000	70,000,000
8	Vocational school	1	17,000,000	17,000,000
9	Renovation	6	195,000,000	68,000,000
10	Maintenance	1	9,000,000	9,000,000
11	Equipment	16	582,000,000	480,000,000
12	Pipe network Maintenance	1	21,000,000	21,000,000
合　計		100	13,910,000,000	3,624,000,000

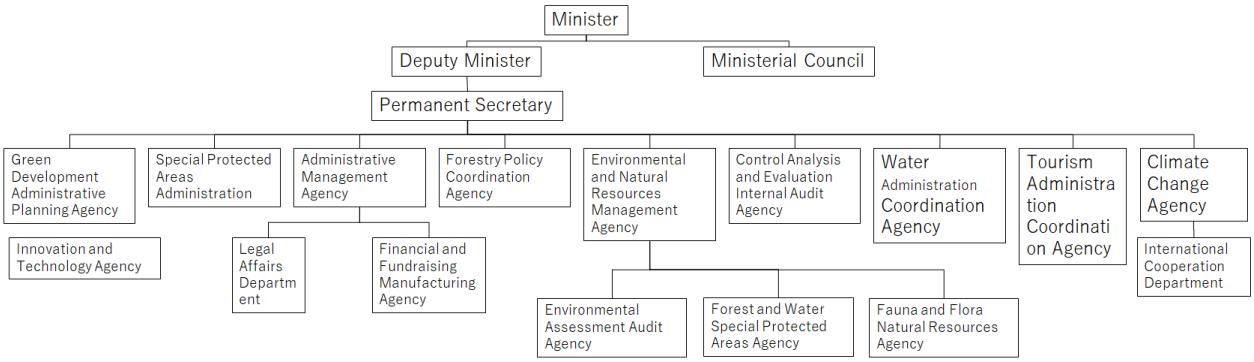
Source: MES

(5) Ministry of Environment and Tourism（MET）

1) Organization & Staffing

The Ministry of Environment and Tourism aims to maintain environmental stability through economic growth and social development that do not disrupt ecosystem balance, ensuring the proper use of natural resources, and creating opportunities for natural regeneration. The Water Administration Coordination Bureau manages water resources, protection of their areas, policies related to water resources, and inter-sectoral coordination, and oversees the Basin Authorities under the Water Law. The organizational chart of the MET is shown below.

This structure is as of 2023.



Source：MET

Figure 2.4.6　Organization Structure of MET

2)　Business & Budget

The 2023 budget for the MET is approximately 2.3 billion yen, with the main breakdown shown below.

Table 2.4.11　Budget for MET（2023）

Item	Budget（JPY）
Operating expenses	512,898,386
Salaries	147,887,062
Contractual expenses	1,639,463,671
Total	2,300,249,119

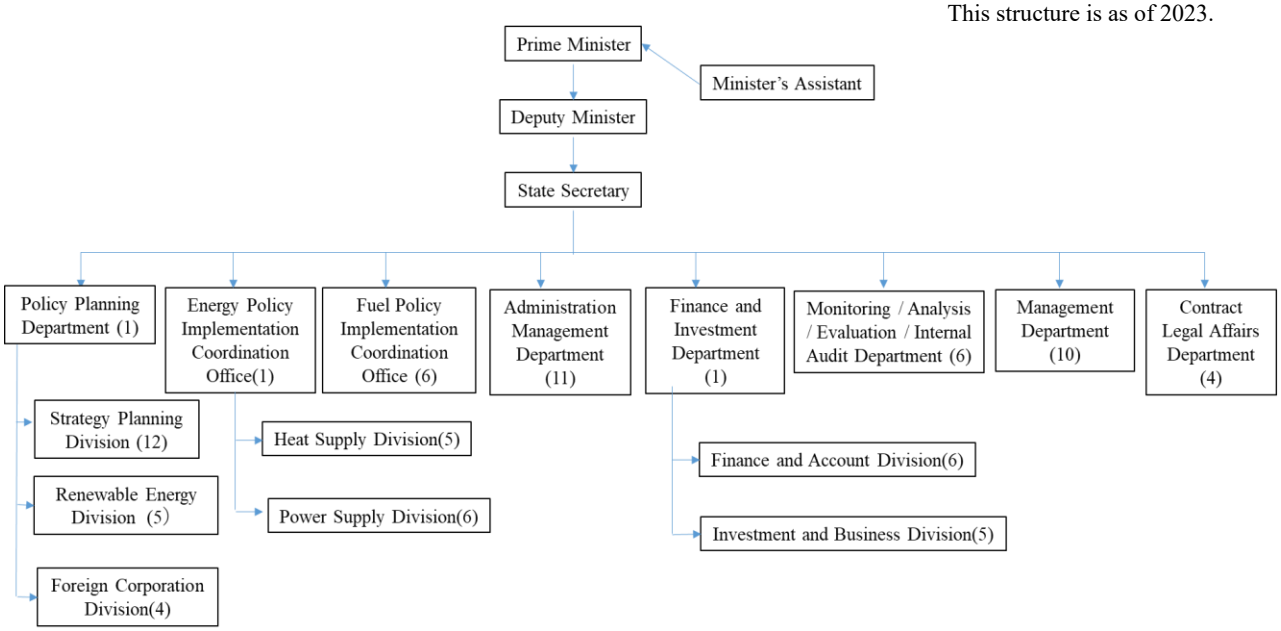
Source：MET

(6)　Ministry of Energy

1)　Organization & Staffing

The Ministry of Energy in Mongolia develops the fundamental policies and plans for the energy sector, manages procurement and prioritizes individual projects. Key departments include the Policy Planning Department, which drafts legislation related to fuel and renewable energy, the Energy Policy Implementation Coordination Room, responsible for managing energy sources and ensuring operational safety, and the Fuel Policy Implementation Coordination Room, which secures fuel for power stations and oversees coal mining and development. The organizational structure of the Ministry of Energy is shown in Figure 2.4.7.

This structure is as of 2023.



Source: MOE

Figure 2.4.7 Organization Structure of MOE (each number indicates staff member)

2) Business & Budget

The 2024 budget for the Ministry of Energy is 7.427 billion yen for operating expenses and 11.802 billion yen for capital investment. The total value of construction projects in 2024 (including carryovers from previous years and future allocations) is 30.025 billion yen, with 22.792 billion yen continuing from the previous year. New construction projects starting in 2024 total 6.979 billion yen, including 13 new projects for constructing thermal power stations and related infrastructure, totaling 1.37045 billion yen.

Overview of 2024 budget for MOE is shown in Table 2.4.12.

Table 2.4.12 Budget for MOE

			2024 Total budget (JPY)	2024 Total budget for construction project (JPY)
Ordinary Expenses of MOE			7,427,000,000	—
Capital Investment			11,802,000,000	—
	Construction		11,548,000,000	30,025,000,000
		On-going	8,506,000,000	22,792,000,000
		New	3,042,000,000	6,979,000,000
	Repair		13,000,000	—
	Purchase		241,000,00	—

※The repair and purchase costs within the normal operating expenses and capital investments of the Ministry of Energy are part of the single-year budget.

Source: MOE

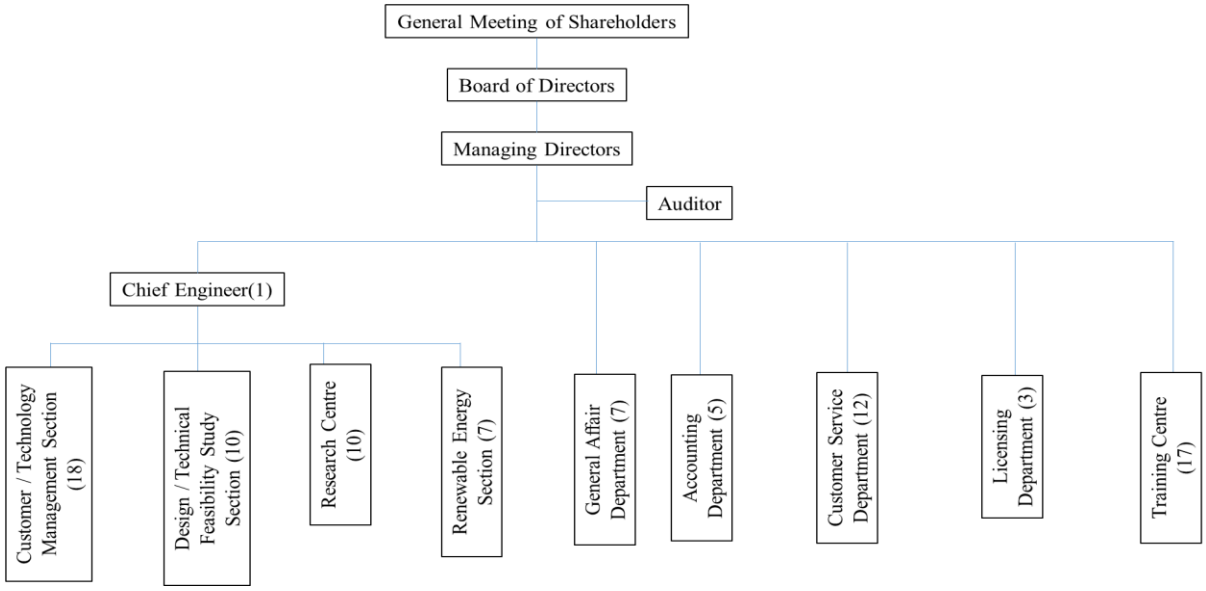
(7) National Energy Center (NEC)

1) Organization

In the energy sector, technical supervision of projects funded by national budgets and domestic or foreign investments is carried out, along with the technical operation of factories and companies. This includes preliminary evaluations and assessments for issuing special licenses for the construction of new energy sources and pipelines, as well as the installation and maintenance of boilers and pipelines. The construction structures within power plants are verified by the Construction Development Center (CDC), while the National Energy Center (NEC) handles the inspection of equipment at design and completion stages based on the "Design Standards and Regulations for Buildings in Seismically Active Areas (BNbD 22-01-01-2021)." However, as all equipment for thermal power is manufactured abroad, NEC conducts its inspections assuming the equipment meets the design standards for the seismic intensities noted on the plans, without further investigation beyond checking compliance with seismic standards against the plans.

Organization structure of NEC is shown in Figure 2.4.8 .

This structure is as of 2023.



Source: NEC

Figure 2.4.8 Organization Structure of NEC (each number indicates a staff member)

(8) Ulaanbaatar District Heating Company (UDHC)

1) Organization

The UB City district heating system operates, maintains, expands, and updates facilities, and sells thermal energy to customers. The total number of staff is 390.

2) Business & Budget

It owns 370 km of district heating pipelines and 10 pump rooms, with a total cost in 2021 of 7,073 million yen.

For the district heating supply from the 2nd, 3rd, and 4th thermal power plants and the Amgalan Heating Plant, Mongolia's total electricity demand in 2022 was 10,340.1 million kWh, with 8,178.6 million kWh produced domestically, and the shortfall imported from Russia. About 90% of the domestic generation is from combined heat and power thermal plants, with the remainder from diesel and renewable sources like wind and hydro. The 7,428.5 million kWh from thermal plants, around 80%, is supplied by the three UB City power plants (TPP2, 3, 4).

The fuel for these plants is primarily coal, with 8,723.6 kilotons used in thermal generation this year. While coal is domestically produced, other fuels like LPG and petroleum-based fuels are imported.

Including these power plants, Amgalan, and smaller dedicated heating boilers (HOBs), Mongolia produced 11,929.3 GCal of heat (hot water, steam) in total. UB City's district heating system is entirely supplied by these three power plants and Amgalan, with a capacity of 2,318 GCal/h in 2022. Details of UB City's main power and heating plants are shown in Table 2.4.13, and the organizational chart and main steam system of the 4th power plant are shown in Figure 2.4.9 and Figure 2.4.10 respectively.

Table 2.4.13 Overview of the main thermal power plants and heating plants in UB City

Thermal Power Plant - 2					
Boiler	**Capacity**	**Operation Start**	**Turbine**	**Capacity**	**Operation Start**
#1	35t/h	1961	#1	6MW	1961
#2	(35t/h)	2018	#2	6MW	2015
#3	35t/h	1961	#3	12MW	1969
#4	75t/h	1969	Installed Capacity of Heat Supply		60Gcal/h
#5	(75t/h)	1969	No. of Staff		310

Remark: Boiler #2 and #5 are not in operation

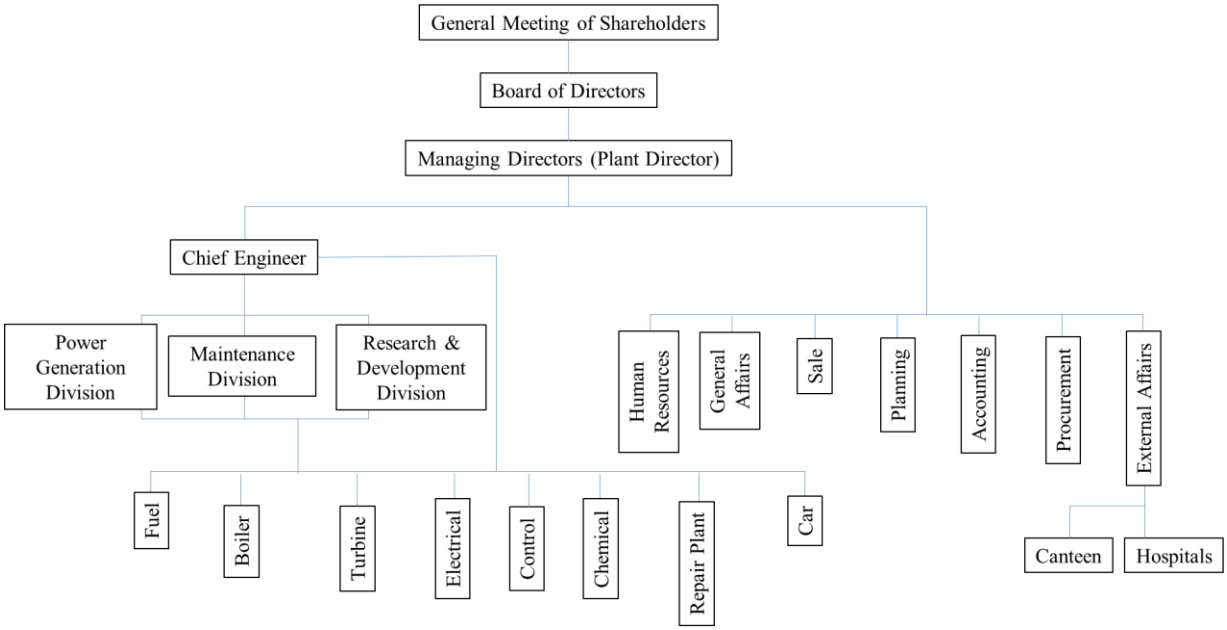
Thermal Power Plant - 3					
Boiler	**Capacity**	**Operation Start**	**Turbine**	**Capacity**	**Operation Start**
#1	75t/h	1968	#1	12MW	1973
#2	75t/h	1969	#2	12MW	1973
#3	75t/h	1969	#3	12MW	1974
#4	75t/h	1969	#4	12MW	1975
#5	75t/h	1973	#5	25MW	1977
#6	75t/h	1975	#6	25MW	1977
#7	220t/h	1976	#7	25MW	1978
#8	220t/h	1977	#8	25MW	1979
#9	220t/h	1978	#9	50MW	2014
#10	220t/h	1979			
#11	220t/h	1979			
#12	220t/h	1980	Installed Capacity of Heat Supply		585Gcal/h
#13	220t/h	1981	No. of Staff		1001

Thermal Power Plant - 4					
Boiler	**Capacity**	**Operation Start**	**Turbine**	**Capacity**	**Operation Start**
#1	420t/h	1983	#1	100MW	2022
#2	420t/h	1984	#2	123MW	2022
#3	420t/h	1984	#3	123MW	2022
#4	420t/h	1985	#4	123MW	2022
#5	420t/h	1986	#5	100MW	1990
#6	420t/h	1987	#6	80MW	1991
#7	420t/h	1990	#7	123MW	2015
#8	420t/h	1991	Installed Capacity of Heat Supply		1373Gcal/h
			No. of Staff		1480 (2021 Present)

Amgalan				
Boiler	**Capacity**	**Operation Start**		
#1	116MW	2015		
#2	116MW	2015		
#3	116MW	2015	Installed Capacity of Heat Supply	300Gcal/h
#4	116MW	Anticipated in 2024	No. of Staff	192

Source: STATISTICS ON ENERGY PERFPRMANCE 2022/ ENERGY REGULATORE COMMISION and CURRENT STATE OF HEAT SUPPLY, GET OUT OF THE PROBLEM METHODS/ULAANBAATAR HEAT NETWORK"STATE-OWNED JOINT STOCK COMPANY

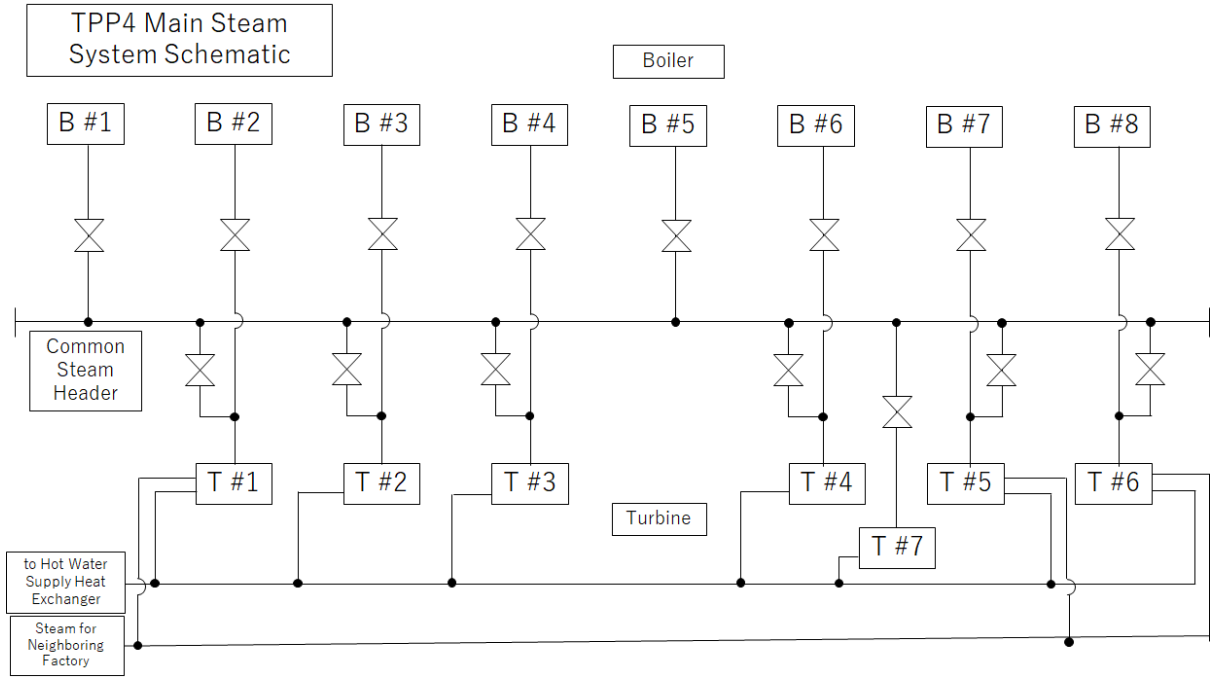
This structure is as of 2023.



Source: Thermal Power Plant No.4

Figure 2.4.9 Organization Structure of Thermal Power Plant No.4

This structure is as of 2023.



Source: JST based on Thermal Power Plant No.4

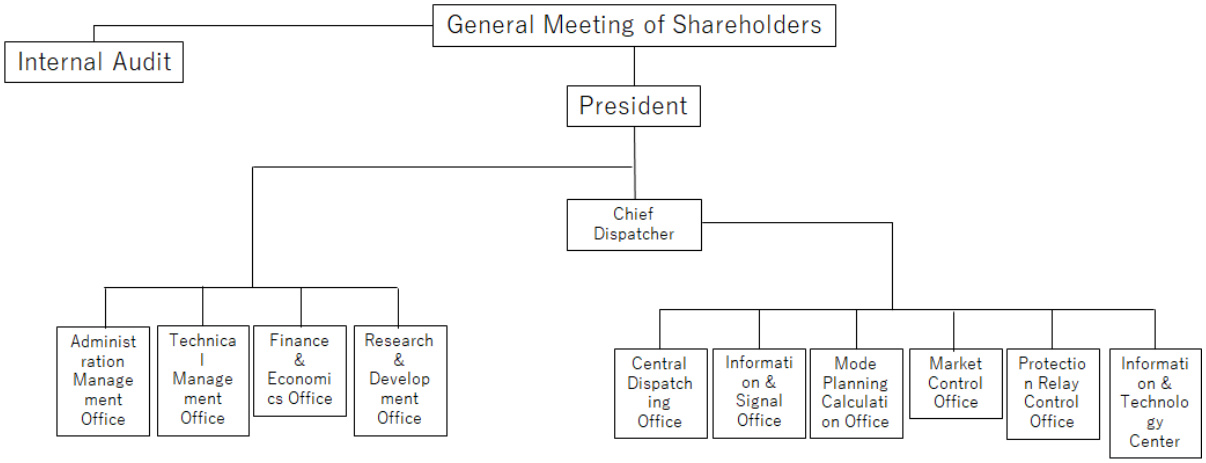
Figure 2.4.10 Main Steam System Overview Diagram of Thermal Power Plant No.4

(9) National Dispatching Center (NDC)

1) Organization

NDC is Mongolia's authority for managing and controlling power and heat supply, overseeing power plants and transmission systems, system planning, demand and supply adjustments, and transmission system operations. Established in 1964 and nationalized in 2001, it operates with 10 sections and 120 staff as of 2021.

This structure is as of 2023.



Source:NDC

Figure 2.4.11 Organization Structure of NDC

2) Business & Budget

NDC's profit and loss statement is shown below.

Table 2.4.14 Profit and Loss Statement of NDC

No.	Technical and Economic indicators		Unit	Planned Amount	Actual Amount	Difference	%
1	Total Revenue	Sales Revenue	JPY	562,259,060.07	561,126,739.19	-1,132,321	99.8%
		Non-operating Revenue	JPY	18,679,450.00	27,302,045.70	8,622,596	146.2%
		Total	JPY	580,938,510.08	588,428,784.95	7,490,275	101.3%
2	Total Expense	Operating Expenses	JPY	485,458,064.97	416,077,799.59	-69,380,265	85.7%
		Investment Return Expense	JPY	77,041,846.04	53,088,351.31	-23,953,495	68.9%
		Non-operating Expense	JPY	18,260,160.00	24,538,299.86	6,278,140	134.4%
		Total	JPY	580,760,071.01	493,704,450.82	-87,055,620	85.0%
3	Pre-tax Profit/Loss		JPY	178,439.00	94,724,334.13	94,545,895	53085.0%
4	Post-tax Profit/Loss		JPY	160,595.09	78,380,112.08	78,219,517	48806.0%
5	Cost per Share of Sales Revenue		JPY	0.06	0.05	0	89.0%
6	Total Receivables		JPY	8,625,000.00	37,100,710.05	28,475,710	430.2%
7	Total Payables		JPY	525,647,750.00	473,608,091.51	-52,039,658	90.1%

Source: NDC

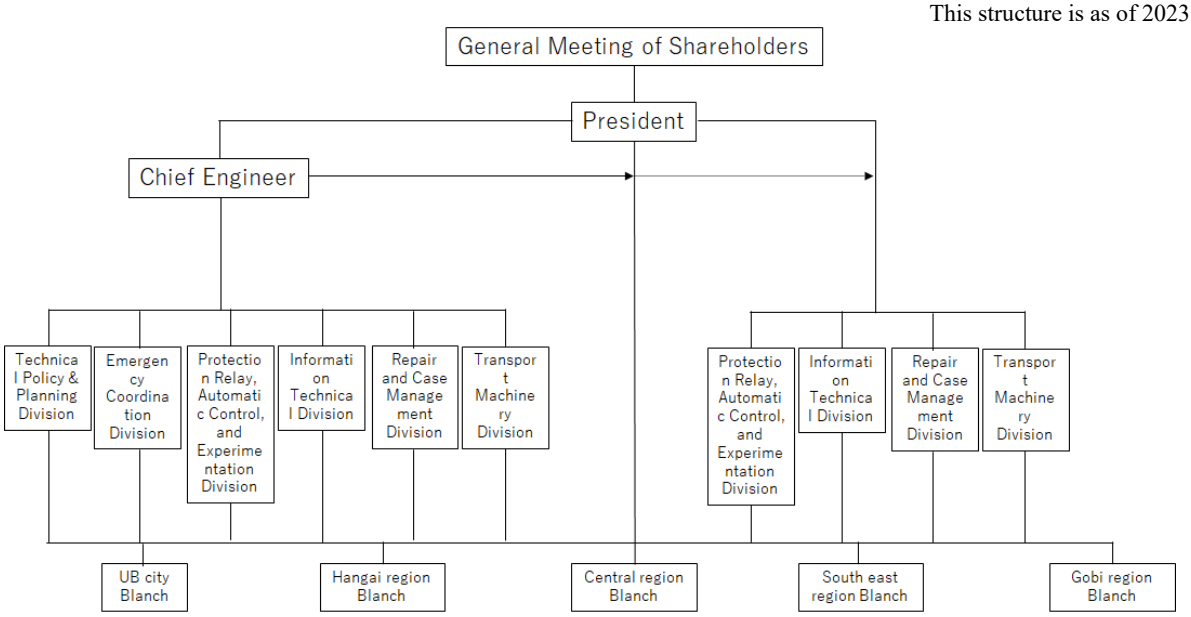
(10) National Power Transmission Grid State owned Stock Company (NPTG)

1) Organization

NPTG oversees 66% of the country's territory, including UB City and 16 aimags. It is a transmission company that plans, builds, maintains, and manages 35kV–220kV transmission and transformation facilities, with a headquarters and five branches. The staff consists of 150 managerial employees at

the headquarters, 409 in the UB branch, 190 in the Hangai regional branch, 210 in the Central regional branch, 212 in the Southeast regional branch, and 121 in the Gobi regional branch, totaling 1,292 employees.

This structure is as of 2023.



Source:NPTG

Figure 2.4.12 Organization Structure of NPTG

2) Business & Budget

UBEDN's profit and loss statement is shown below.

Table 2.4.15 Profit and Loss Statement of NPTG

Indicator		Unit	Actual Amount in 2020	From 2021 Annual Audit Report		
				Planned Amount	Actual Amount	Difference
Total Revenue	Operating Income	JPY	3,033,070,000	3,029,850,000	3,209,770,000	179,920,000
	Oyutolgoi PPA Income	JPY	20,068,420,000	21,643,460,000	21,440,540,000	-202,920,000
	Other Income	JPY	578,110,000	596,510,000	489,040,000	-107,470,000
	Total	JPY	23,679,540,000	25,269,870,000	25,139,400,000	-130,470,000
Total Expense	Operating Expenses	JPY	3,420,560,000	3,745,260,000	3,716,690,000	-28,580,000
	Oyutolgoi PPA Expense	JPY	20,068,420,000	21,643,460,000	21,440,540,000	-202,920,000
	Other Expense	JPY	188,950,000	92,860,000	66,360,000	-26,510,000
	Income Tax	JPY	11,900,000	-	10,010,000	10,010,000
	Total	JPY	23,673,270,000	25,481,640,000	25,223,580,000	-258,060,000
Pre-tax Profit		JPY	JPY	-211,770,000	-84,180,000	127,590,000
Tax Expense		JPY	JPY	-	10,010,000	10,010,000
Net Profit/Loss		JPY	JPY	-211,770,000	-94,190,000	117,590,000

Source:NPTG

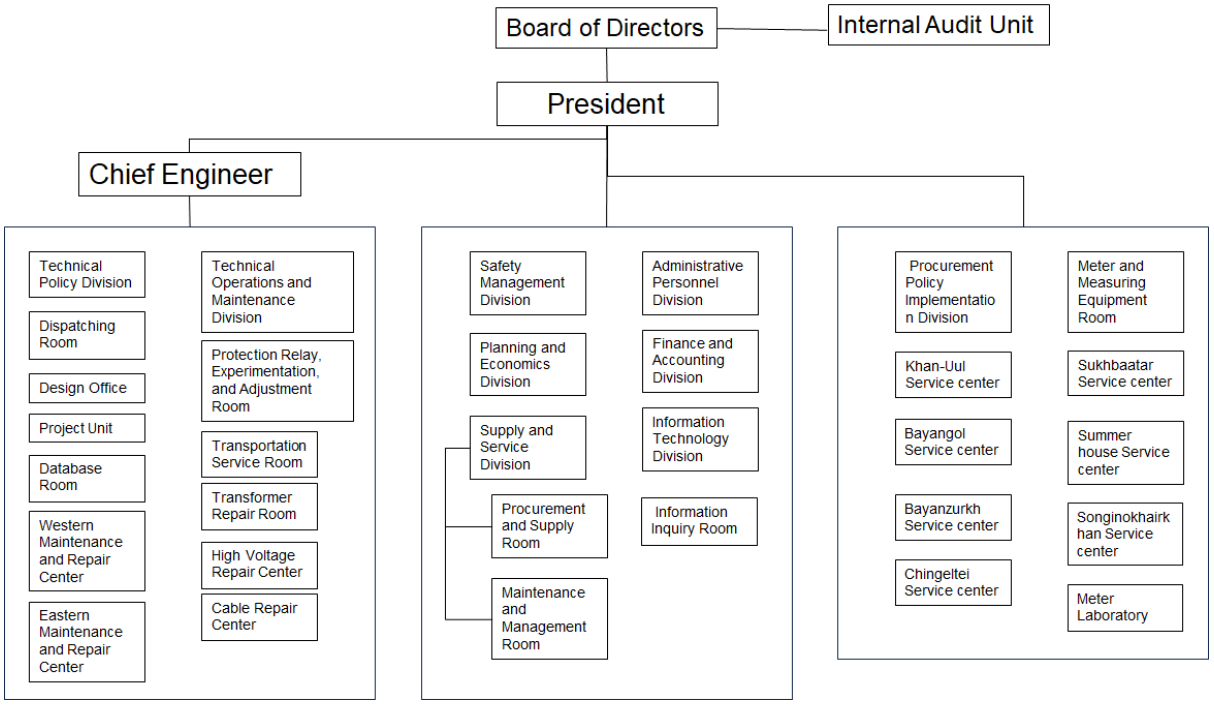
(11) Ulaanbaatar Electricity Distribution Network Company (UBEDN)

1) Organization

UBEDN is a distribution company that purchases electricity from NPTG substations and handles the planning, construction, maintenance, and management of distribution and transformation facilities

under 35kV, as well as electricity sales, in UB City. It comprises 19 departments, has 5 distribution control centers, 9 customer service centers, and an electronic meter research institute, with a total of 1,920 employees.

This structure is as of 2023.



Source: UBEDN

Figure 2.4.13 Organization Structure of UBEDN

2) Business & Budget

UBEDN's profit and loss statement is shown below.

Table 2.4.16 Profit and Loss Statement of UBEDN

Indicator		Unit	Actual Amount in 2020	2021			
				Planned Amount	Actual Amount	Difference	%
Total Revenue	Sales Revenue	JPY	24,308,990,000	26,350,640,000	28,030,040,000	1,679,400,000	6.37%
	Distribution Service Fees	JPY	3,823,690,000	3,606,110,000	3,956,000,000	349,890,000	9.70%
	Non-operating Revenue	JPY	787,060,000	505,940,000	603,870,000	97,920,000	19.35%
	Total	JPY	28,919,800,000	30,462,700,000	32,589,970,000	2,127,270,000	6.98%
Total Expense	HSC Expenses	JPY	24,270,180,000	25,953,030,000	27,506,330,000	1,553,310,000	5.99%
	Operating Expenses	JPY	4,481,210,000	4,432,160,000	4,691,200,000	259,040,000	5.84%
	Non-operating Expenses	JPY	790,110,000	470,010,000	395,720,000	-74,290,000	-15.81%
	Total	JPY	29,532,750,000	30,855,250,000	32,593,300,000	1,738,050,000	5.63%
Pre-tax Profit		JPY	-621,690,000	-392,500,000	-3,340,000	389,160,000	-99.15%
Income Tax Expense		JPY	30,360,000	-	94,130,000	94,130,000	-
Net Profit		JPY	-652,110,000	-392,500,000	-97,520,000	294,980,000	-75.15%
Total Receivables		JPY	3,403,430,000	2,493,140,000	4,525,080,000	2,031,940,000	81.50%
Of which: Electricity Receivables		JPY	1,523,750,000	1,951,550,000	4,281,800,000	2,330,250,000	119.40%
Total Liabilities		JPY	5,114,280,000	5,506,550,000	7,633,530,000	2,126,980,000	38.63%
Of which: Short-term Payables		JPY	1,647,660,000	1,845,750,000	4,246,320,000	2,400,570,000	130.06%
Long-term Debt		JPY	3,466,620,000	3,660,800,000	3,387,210,000	-273,590,000	-7.47%
Investment and Major Repairs		JPY	512,960,000	796,550,000	950,940,000	154.39	19.38%

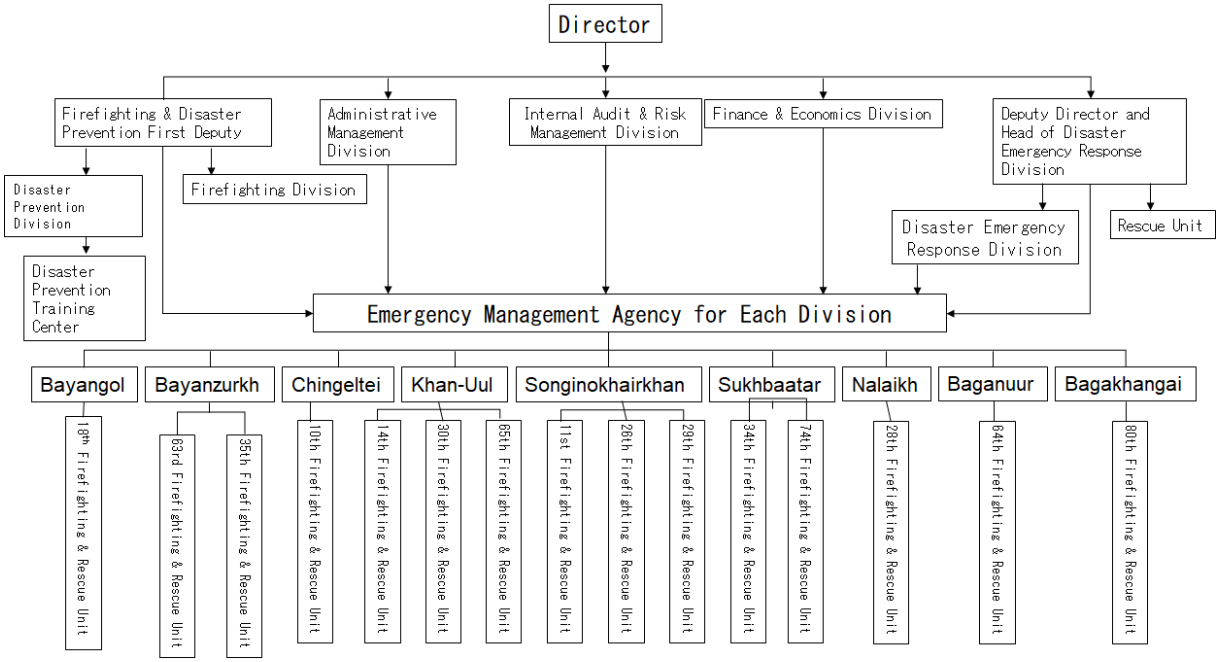
Source: UBEDN

(12) Emergency Management Department of the Capital City (EMDC)

1) Organization

EMDC is NEMA's regional bureau for UB City, primarily responsible for civil defense, firefighting, and stockpiling. It consists of six departments: Disaster Prevention, Emergency Disaster Response, Firefighting, Administrative Management, Financial Economics, and Internal Audit, Evaluation, & Risk Management. It also includes rescue units, nine district emergency offices, and rescue firefighting teams. The Emergency Disaster Response Department handles planning.

This structure is as of 2023.



Source: EMDC

Figure 2.4.14 Organization Structure of EMDC

2) Staffing and Function

EMDC has a total of 918 personnel, over half of whom are firefighters.

3) Business & Budget

The 2023 budget for EMDC is 310.23 million yen, with the main breakdown as follows.

Table 2.4.17 2023 Budget for EMDC

Item	Budget (JPY)
Personnel Expenses	232,854,984
Facility Maintenance Expenses	15,293,839
Facility Maintenance Expenses	6,244,500
Other Operating Expenses	55,836,882
Total	310,230,204

Source:EMDC

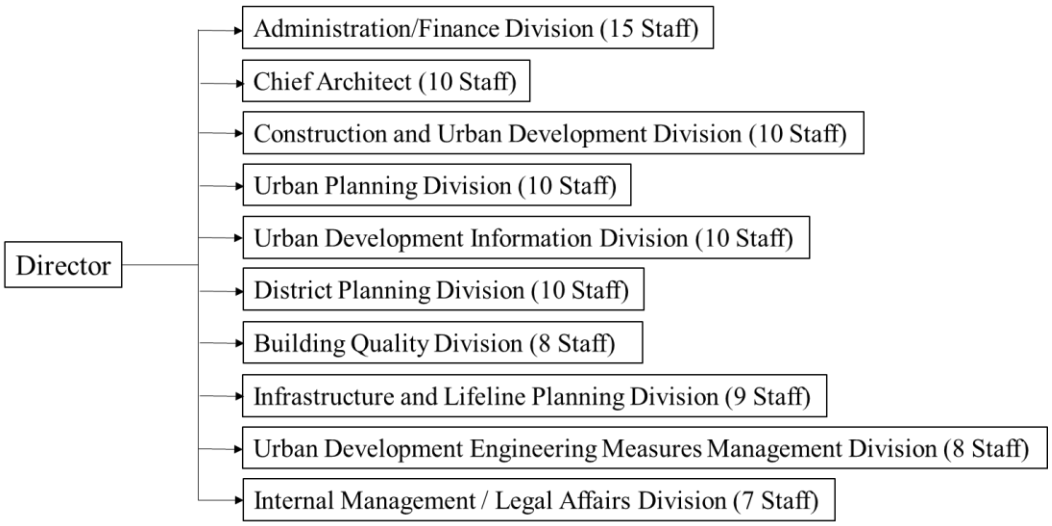
(13) Urban Planning and Research Institute

1) Organization

The Urban Planning and Research Institute is composed of the following ten departments, each overseeing specific activities:

- **Administration & Finance Department**: Implements national civil service and related laws and decisions, achieves the bureau's objectives, roles, and policies, and supports administrative management through methodical support.
- **Chief Architect's Office**: Revises the UB City Development Master Plan to align with general socio-economic requirements, holds professional meetings, and reviews urban development documents like the development master plan and sectoral surveys.
- **Construction & Urban Development Department**: Handles design and specification drafting and approves development-related plans and surveys.
- **Urban Planning Department**: Ensures implementation of sectoral policies and related laws, manages development programs and plans, and advises on land management plans based on urban development strategies.
- **Urban Development Information Department**: Ensures policy implementation in construction and urban development, operates the urban development database, and creates cadastral maps of urban development.
- **District Planning Department**: Implements laws related to urban and rural redevelopment, manages redevelopment projects in the Ger district, and advises on planning and design.
- **Building Quality Department**: Manages building passportization (logging building details and seismic evaluations), assesses building quality and seismic resilience, and advises on facility use changes and structural reinforcements.
- **Infrastructure & Lifeline Planning Department**: Surveys and plans for infrastructure and lifeline accessibility, supply, operation, and current state.
- **-Urban Development Engineering Measures Management Department**: Checks safety, health, and engineering measures around buildings, issues permit for construction work, and enters information about building expansions and demolitions into the urban development database.
- **Internal Management & Legal Affairs Department**: Advises on updates to construction and urban development legal frameworks, checks the legal basis and compliance of contracts, and verifies contract performance.

This structure is as of 2023



Source: Urban Planning and Research Institute

Figure 2.4.15 Organization Structure of Urban Planning and Research Institute

2) Staffing & Function

The Building Quality Department in UB City is responsible for seismic diagnostics of housing and has 8 staff members as of December 2023. They primarily work on passportization of residential buildings in UB City, conducting degradation diagnostics and seismic evaluations in-house. Seismic diagnostics for masonry buildings[19] are nearly complete, and work is ongoing for PC structures. From 2011 to 2022, they passportized 672 residential and 272 public buildings, diagnosing 183 with adequate seismic resilience, 90 needing reinforcement, and 399 lacking seismic resilience. For public buildings, 23 were found to be seismically resilient, 105 need reinforcement, and 144 lack seismic resilience.

Additionally, the Infrastructure & Lifeline Planning Department inspects the safety of UB City's lifelines. The Planning & Survey Department coordinates with disaster management and other agencies to develop the Urban Development Master Plan, with the actual work being carried out by the Institute of Building & Urban Development Research[20].

3) Business & Budget

The budget of Urban Planning and Research Institute is shown below.

Table 2.4.18 2023 Budget of Urban Planning and Research Institute

Item	Budget (JPY)
Maintenance and Management Costs	667,638
Commission Fees	3,134,670
Materials and Consumables (Fuel Costs, Communication Costs, etc.)	2,695,359
Personnel Expenses	122,264,941
Other Operating Expenses	18,296,885
Total	147,069,492

Source: https://shilendans.gov.mn

[19] Buildings constructed by stacking bricks or concrete blocks. Reinforced masonry construction, where brick or concrete block walls are reinforced with reinforced concrete columns and beams, is also included.

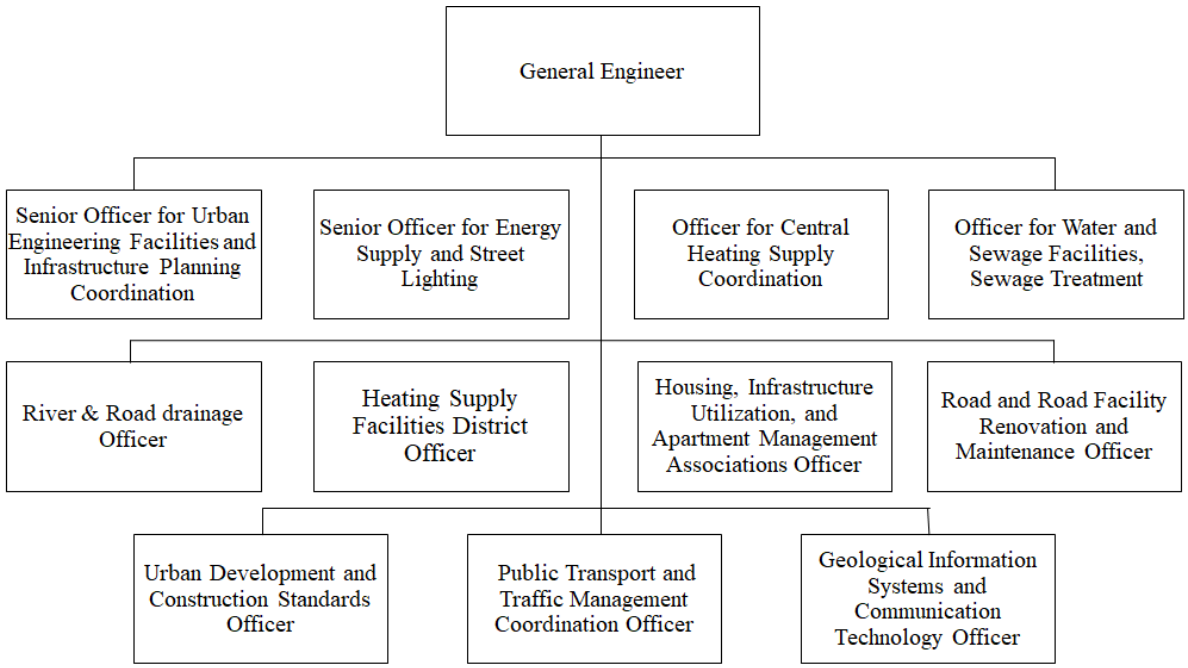
[20] In 2010, it was established as a municipal public corporation attached to the mayor by mayoral decree.

(14) City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city

1) Organization

The City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city is responsible for managing the maintenance, repair, and inspection of flood prevention facilities, road drainage systems, road facilities, bridges, heating supply facilities and pipelines, water and sewer facilities, power supply, street lighting, transmission and distribution lines, communication lines, and the use of residential and public buildings, as well as urban traffic and traffic regulations, according to infrastructure policy. This division is set up separately from the usual Urban Development Bureau that handles regular infrastructure maintenance and is composed of the departments shown in Figure 2.4.16.

This structure is as of 2023



Source: City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city

Figure 2.4.16 Organization Structure of City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city

2) Staffing & Function

The Infrastructure Maintenance Division, with 12 staff members, is responsible for planning, maintaining, and managing urban infrastructure facilities, street lighting, heating supply, water and sewer facilities, flood prevention and road drainage facilities, road facilities, housing and infrastructure facility usage, urban development, public transportation, and geographic information systems.

3) Business & Budget

The budget for the Infrastructure Maintenance Division, which is part of the City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city, is 5,744.86 million yen for the fiscal year 2023.

Table 2.4.19 Budget of City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city (2023)

Item	Budget (JPY)
Maintenance and Equipment Costs	222,741,574
Commission Fees	3,728,641,780
Materials and Consumables (Fuel, Communication, Waste Removal Costs, etc.)	1,318,473,367
Materials and Consumables (Fuel, Communication, Waste Removal Costs, etc.)	471,703,194
Total	5,744,865,538

Source: https://shilendans.gov.mn

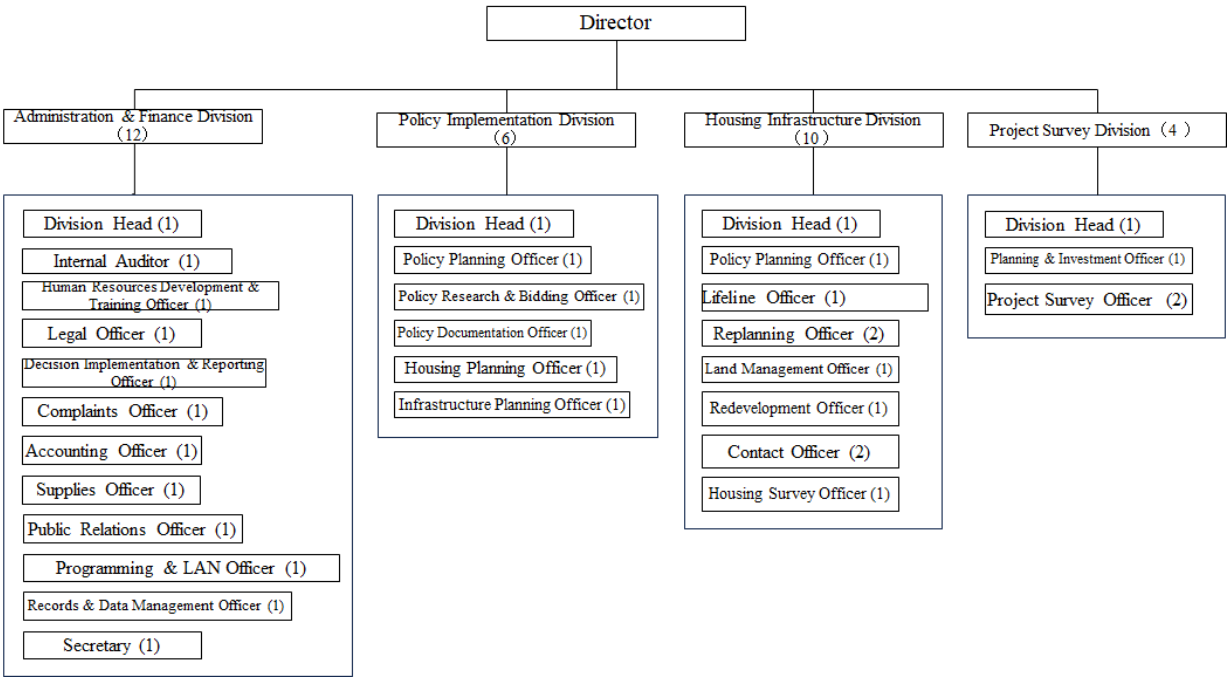
(15) Housing Policy Department of the capital city

1) Organization

The Housing Policy Department of the capital city, established in 2012, coordinates redevelopment projects for the earthquake-vulnerable Ger district. The redevelopment plans, based on the Urban Development Law, include land replotting and construction of collective housing, called "apartmentization," chosen through resident participation. These plans are executed via tripartite contracts involving private developers, residents, and the Housing Policy Department of the capital city.

By early 2022, the project had covered 12,017 households and 48,588 people. The future redevelopment, as per the "Ger District Development Plan," proposes redevelopment of 24 areas, pending approval from the UB City Mayor and Council as of April 2024. The plan aims to supply 21,604 housing units by 2025 under the five-year development policy. Surveys by the Housing Policy Department of the capital city show that 83% of Ger district residents prefer to move to new homes through redevelopment.

This structure is as of 2023



Source: Housing Policy Department of the capital city

Figure 2.4.17 Organization Structure of Housing Policy Department of the capital city

2) Staffing & Function

The Housing Policy Bureau consists of the Administration & Finance Division, Policy Implementation Division, Housing Infrastructure Division, and Project Coordination Division, with a total of 33 staff members.

3) Business & Budget

The budget for Housing Policy Department of the capital city in shown below.

Table 2.4.20 Budget for Housing Policy Department of the capital city (2023)

Item	Budget (JPY)
Land Fees	1,584,303
Advertising and Public Relations Costs	1,437,500
Rental Expenses	3,921,960
Other Expenses Including Personnel Costs	19,178,901
Total	26,122,664

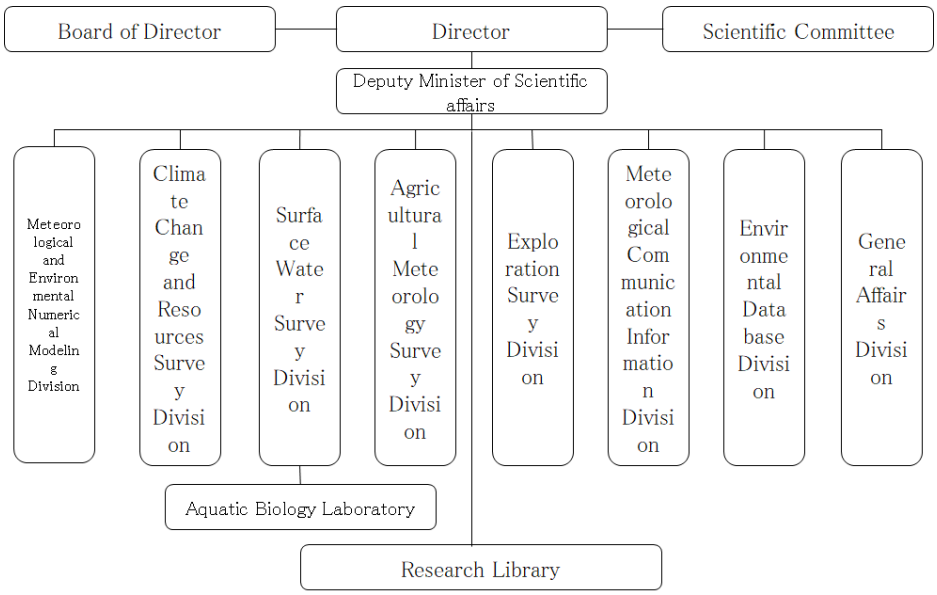
Source: https://shilendans.gov.mn

(16) Information and Research Institute of Meteorology, Hydrology and Environment (IRIMHE)

1) Organization

The Information and Research Institute of Meteorology, Hydrology and Environment, set up under Mongolia's Meteorological and Environmental Observation Agency, is responsible for conducting meteorological and hydrological observations. The organization includes research departments focused on meteorological and environmental monitoring, assessment of impacts on agriculture and pastoralism (including drought forecasting), and information and communication studies. The hydrology is managed by the Surface Water Survey Division and its affiliated Aquatic Biology Lab. The organizational chart is shown in Figure 2.4.18.

This structure is as of 2023



Source: IRIMHE

Figure 2.4.18 Organization Structure of IRIMHE

2) Staffing & Function

The organizational structure of the research institute comprises 99 full-time staff members across 8 divisions. The Surface Water Survey Division includes 12 researchers and specialists. Approximately 200 nomadic residents and locals are contracted as staff at river observation stations across 16 provinces in Mongolia, where they are delegated observation tasks.

3) Business & Budget

The annual budget allocated from the national budget to IRIMHE for the fiscal year 2023 is approximately 139.8 million yen, with a total expenditure of 110.24 million yen as of the end of November 2023. As shown in the table below, about 83% of the annual total expenditure is for staff salaries, approximately 10% for social insurance premiums, and 5% for retirement benefits, making up 98% of expenditures related to personnel costs. Pure research funding and the introduction of new technologies are not budgeted, so research implementation and the introduction of technology and equipment are conducted with donor support and through cooperation with projects and programs.

Table 2.4.21 Breakdown of Budget for IRIMHE (2023)

Budget Category	Amount (JPY)	Percentage
Salaries and Bonuses	115,966,483	82.95%
Employer-paid Social Insurance Premiums	14,495,802	10.37%
Inventory and Consumable Costs	803,528	0.57%
Equipment and Maintenance Costs	937,250	0.67%
Commissioned Work and Fees	257,313	0.18%
Domestic Travel Allowances	221,950	0.16%
Retirement Benefits	7,046,941	5.04%
Fixed Costs Associated with Facility Use (e.g., Electricity Costs)	32,309	0.02%
Regulatory Compliance Costs	37,375	0.03%
Total Expenditures	139,798,951	100%

Source: IRIMHE

(17) Geodesy and Hydraulic facility Agency (GUBBG)

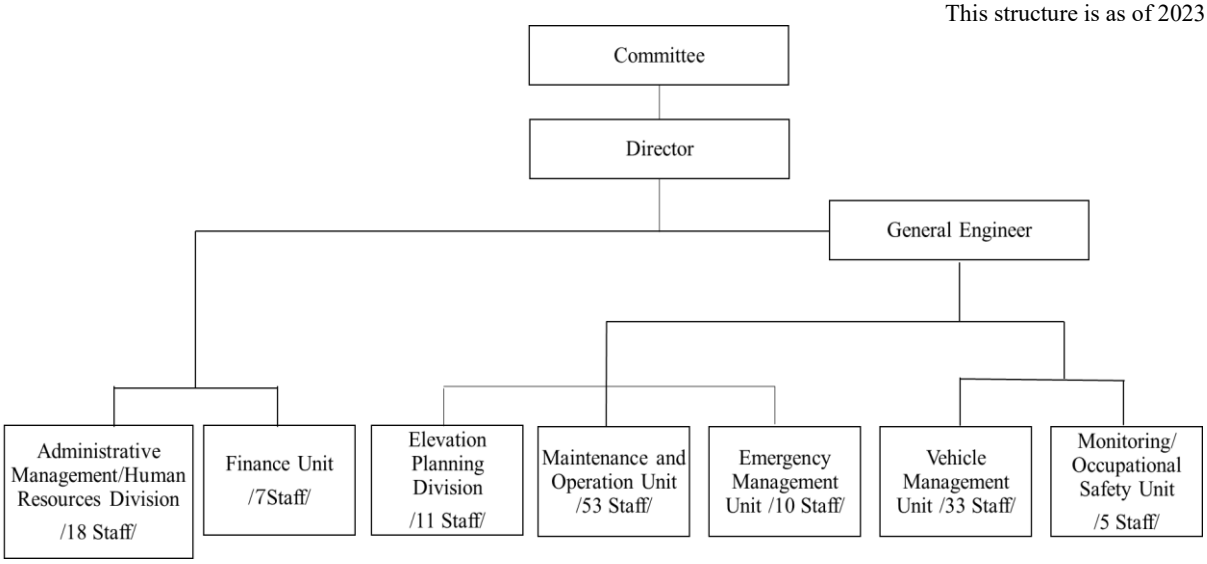
1) Organization

The main duties involve the renovation, construction, and maintenance of flood prevention facilities, road drainage facilities, and underground drainage infiltration facilities. Maintenance frequency is once every three months for pump stations, twice a year for road drainage facilities, and cleaning is conducted over two months for the entire drainage facility area.

2) Staffing & Function

GUBBG consists of two departments and five units, with a total of 120 staff members. Before the forecast of heavy rain, an emergency disaster response team of about 10 people is formed, prepared to work around the clock on standby. The organization structure is shown in the diagram below.

This structure is as of 2023



Source: GUBBG

Figure 2.4.19 Organization Structure of GUBBG

3) Business & Budget

The table below shows the operational costs, maintenance costs, and cleaning costs for flood prevention facilities, road drainage facilities, and underground drainage infiltration facilities over the past four years.

Table 2.4.22 Operational costs, maintenance costs, and cleaning costs for flood prevention facilities

No.	Items	2020 (JPY)	2021 (JPY)	2022 (JPY)	2023 (JPY)
1	Road Drainage Network Maintenance and Management Costs, Cleaning Costs	29,793,907	29,345,878	37,634,409	50,179,211
	Drainage Channel Suction and Removal Costs	5,152,330	5,152,330	8,960,573	13,440,860
	Maintenance Costs	5,376,344	5,376,344	8,064,516	5,376,344
	Pump Station Maintenance and Management Costs			18,817,204	-
	Contingency/Emergency			4,480,287	8,960,573
2	Underground Drainage Network Maintenance and Management Costs	2,240,143	2,240,143	2,688,172	60,000,000
3	Maintenance and Management Costs for Small Pumps for Road and Underground Drainage Channels	12,219,642	12,544,803	12,219,642	17,025,090
4	Maintenance and Management Costs for Groundwater Monitoring Wells	2,036,528	1,792,115	2,036,528	4,704,301
5	Maintenance and Management Costs for Flood Prevention Facilities (Cleaning Operations)	13,440,860	13,440,860	13,440,860	11,200,717
		29,310,228	26,352,944	25,985,663	43,010,753
		5,376,344	5,376,344	5,376,344	5,376,344
6	Maintenance and Management Costs for Flood Prevention Facilities (Renovation and Repair Works)	30,638,172	35,170,251	44,802,867	20,161,290
		13,441,324	8,960,573		
		723,372	672,043		
7	Emergency Work Costs		11,200,717		
	Funding from the Capital Road Fund				
8	Maintenance and Management Costs for Road Drainage Channels and Catchment Areas (for Renovation and Repair Works)	89,605,735	44,802,867	89,605,735	67,204,301
	Total	**239,354,929**	**202,428,212**	**274,112,800**	**249,327,957**

Source: GUBBG

(18) Water supply and Sewerage Authority of Ulaanbaatar city

1) Organization

The Water supply and Sewerage Authority of Ulaanbaatar city is responsible for maintenance, repair work, and operational management of water supply and sewerage system. Monitoring of water supply facilities utilizes the widely used SCADA[21] system, introduced in 2018 with support from the ADB and implemented by a local private company. This system monitors flow rate, pressure, temperature, and well water levels in the water distribution pipelines and wells. Additionally, water quality tests are conducted in water sources, distribution reservoirs, and water supply pipes. The water supply directly pumps groundwater from beneath the permafrost, which is then chlorinated without filtration before distribution.

Table 2.4.23 Targets and quantities of maintenance and management (Water supply)

Water Supply Related Facilities	Quantity
Water Source	10
Water Source Wells	224
Pumping Stations	7
Intermediate Pumping Stations	13
Water Distribution Reservoirs	13
Water Supply Mains	586 km

Source: Water supply and Sewage Authority of Ulaanbaatar city

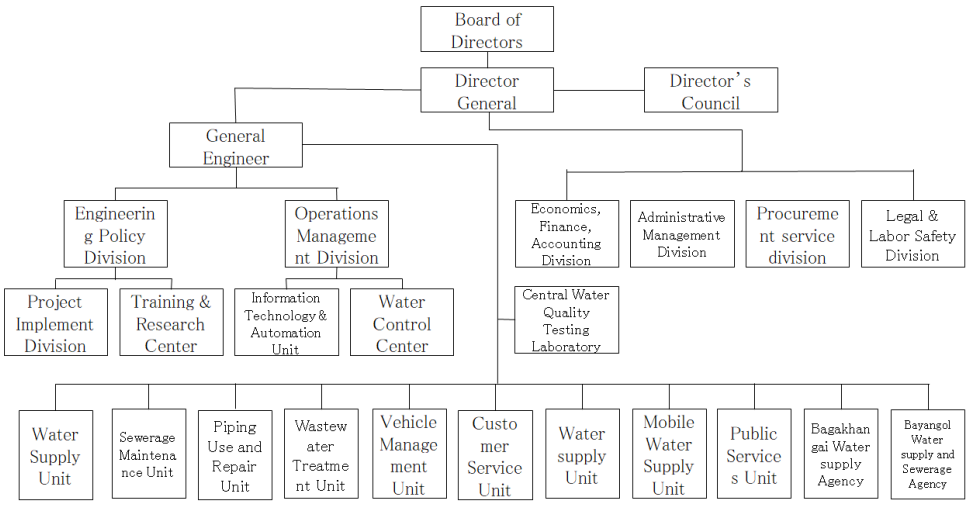
Table 2.4.24 Targets and quantities of maintenance and management (Sewerage)

Sewerage Related Facilities	Quantity
Sewer	282 km
Sewage Treatment Plant (Demestic)	7
industrial Wastewater Treatment Plant	1
Pumping Stations	15
Non-@ermeable Pit Toilets	4

Source: Water supply and Sewage Authority of Ulaanbaatar city

2) Staffing & Function

This structure is as of 2023



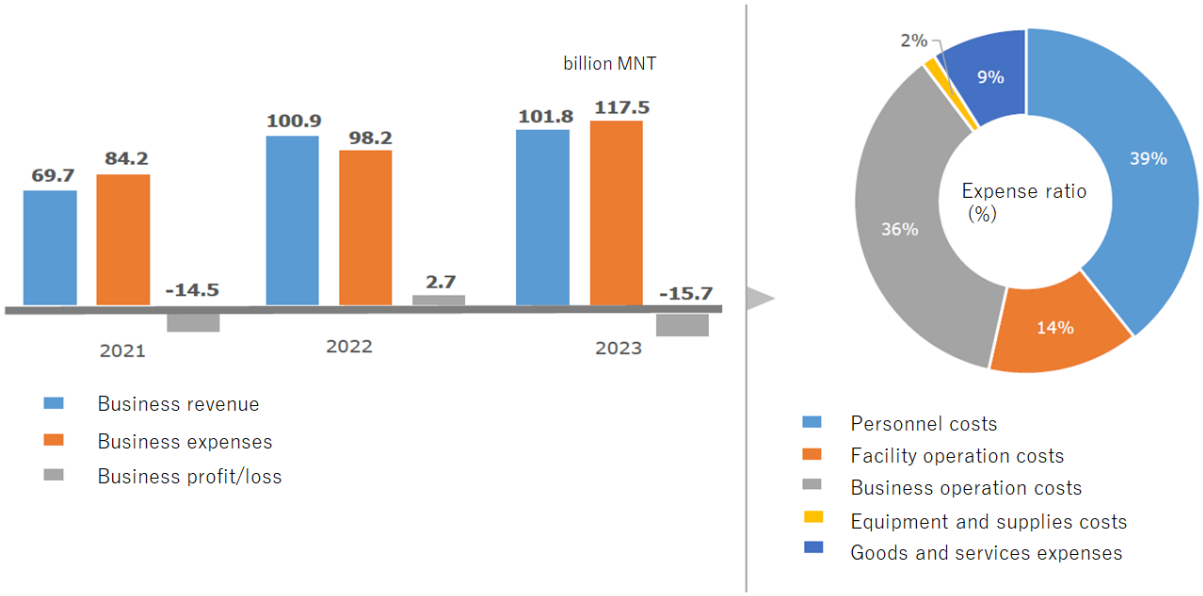
Source: Water supply and Sewage Authority of Ulaanbaatar city

Figure 2.4.20 Organization Structure of Water supply and Sewage Authority of Ulaanbaatar city

[21] A system that aggregates specific data from multiple devices and equipment within a facility to monitor and control them.

3) Business & Budget

The past three years' business income and expenses are shown below. In 2022, there was an average 50% increase in water supply and sewage service fees, and with the consumption of drinking water increasing by 1 million m³ and sewage treatment by 3.8 million m³ compared to the previous year, business revenue increased by 31.2 billion MNT (1.794 billion yen). However, due to a 20% annual increase in all employee salaries from November 2021 to October 2023 and increases of 10-15% in spare parts and inventory costs and nearly 30% in electricity costs due to inflation, annual business expenses have ballooned, resulting in a business loss in 2023. The water and sewage utility has applied for a rate increase to cover the deficit, but significant increases are unlikely due to policy constraints, and the financial situation remains challenging.



Source: Water supply and Sewage Authority of Ulaanbaatar city

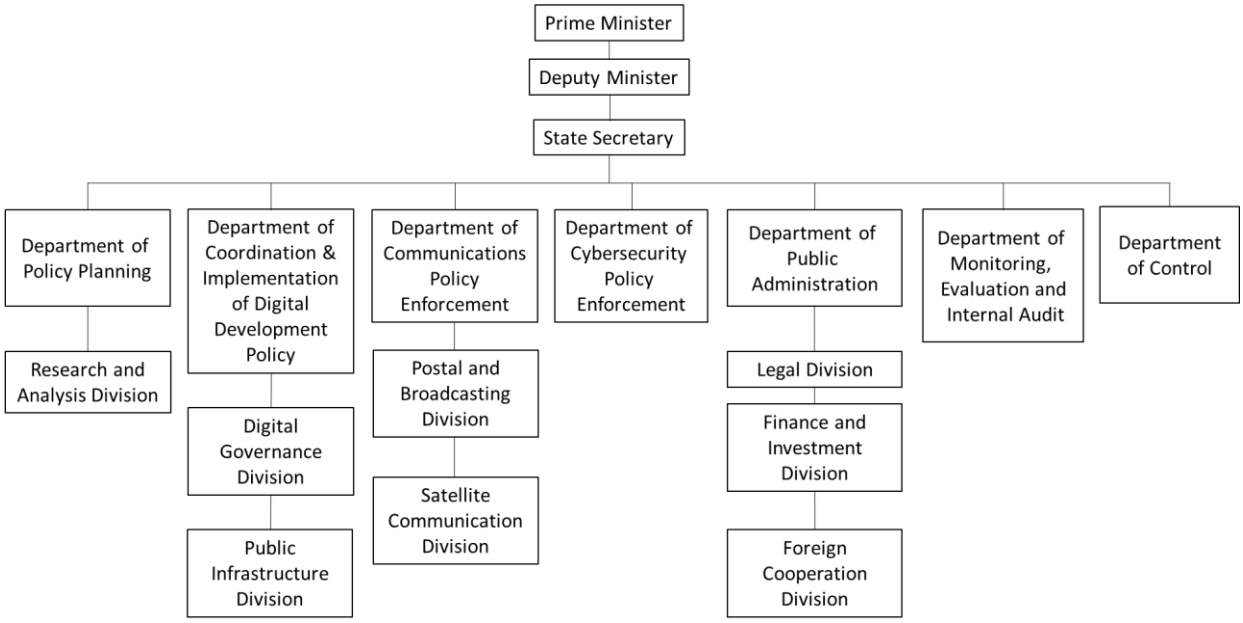
Figure 2.4.21 Budget (Income and Expenditure)

(19) Ministry of Digital Development and Communications

1) Organization

The Ministry of Digital Development and Communications in Mongolia is responsible for enhancing legislation related to digital development, communications, information technology, cybersecurity, satellite communication, and broad-area broadcasting. They are also tasked with developing digital governance based on new technologies and innovations, establishing foundational infrastructure for information and communication, and formulating and implementing strategies and policies to improve national digital literacy and develop IT talent.

This structure is as of 2023



Source: Ministry of Digital Development and Communications

Figure 2.4.22 Organization Structure of Ministry of Digital Development and Communications

2) Staffing & Function

The organizational structure includes:

- Policy Planning Bureau: 10 people
- Digital Development Policy Implementation Coordination Bureau: 14 people
- Communication Policy Implementation Coordination Bureau: 11 people
- Cybersecurity Policy Implementation Coordination Bureau: 4 people
- National Administrative Management Bureau: 23 people
- Surveillance Monitoring, Evaluation & Internal Audit Bureau: 4 people
- Sector Audit Bureau: 5 people.

3) Business & Budget

The budget for Ministry of Digital Development and Communications (2023) is shown below.

Table 2.4.25 Budget for Ministry of Digital Development and Communications (2023)

Item	Budget (JPY)
Maintenance and Equipment Costs	148,599,659
Personnel Expenses	280,739,478
Subsidies (for National and Private Enterprises)	433,983,550
Other Operating Expenses	96,817,057
Total	960,139,744

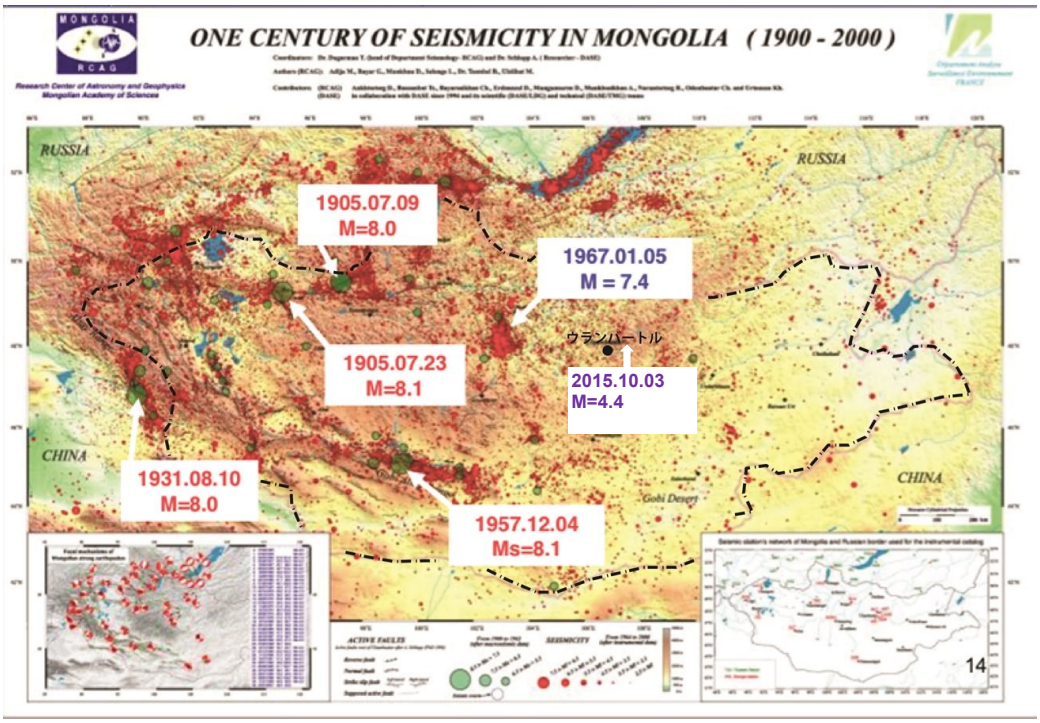
Source: Ministry of Digital Development and Communications

2.5 Status of Hazard Risk Assessment for Earthquakes and Floods

2.5.1 Status of Hazard Risk Assessment for Earthquakes

(1) Past Major Earthquakes

In Mongolia, there have been 13 earthquakes with a magnitude greater than 7 since 1900. Among these, there were major earthquakes exceeding magnitude 8 that occurred twice in 1905, and in 1931 and 1957. Fortunately, the regions near the epicenters had extremely low population densities, so none of these earthquakes resulted in significant disasters. Figure 2.5.1 shows the locations of the epicenters observed since 1900.

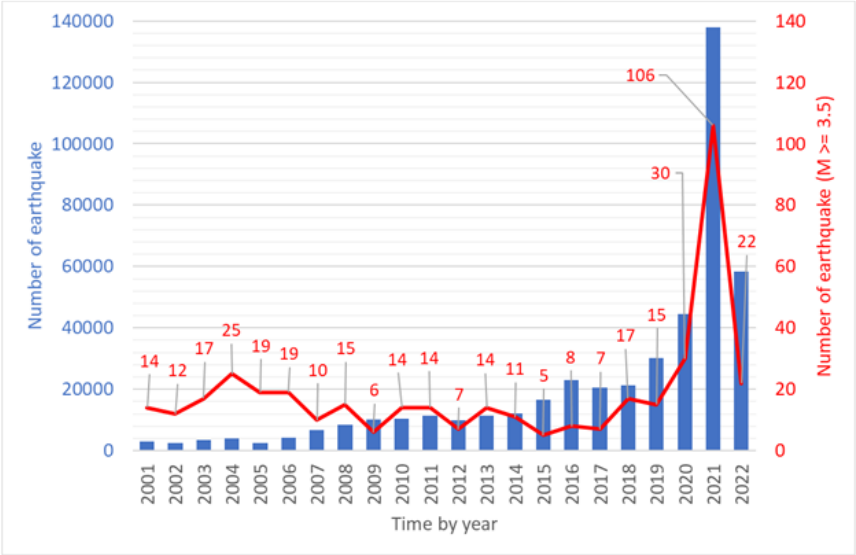


(M: Magnitude, Ms: Surface Wave Magnitude)
Source: Institute of Astronomy and Geophysics

Figure 2.5.1 Distribution Map of Epicenters Observed Since 1900

(2) Current Earthquake Activity

In Figure 2.5.2, the cumulative number of earthquakes observed near UB City since 2001 is shown as a cumulative earthquake occurrence graph. There has been an increasing trend since 2014. Most of these were minor earthquakes that were not felt, but in recent years, there have been six felt earthquakes, including a magnitude 4.4 earthquake that occurred in Shiliin Am in the Uliastai Valley of Bayanzurkh District, UB City, on October 3, 2015, and a magnitude 6 earthquake that occurred in Khuvsgul Aimag in the northern region on January 12, 2021.

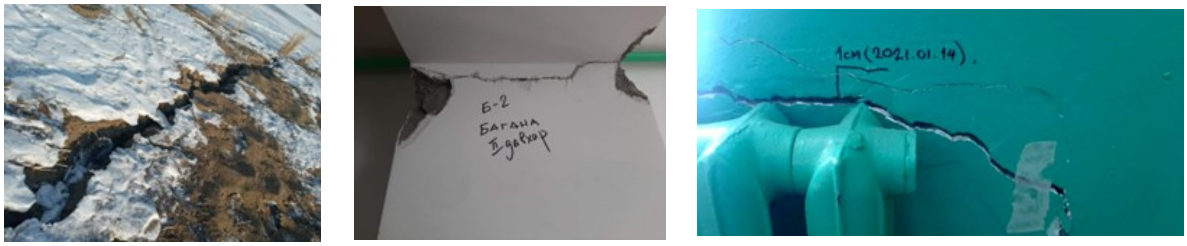


Source: IAG

Figure 2.5.2 The Number of Earthquakes Observed Near UB City Since 2001 (Cumulative Earthquake Occurrence Graph)

(3) Current Earthquake Damage

According to the damage assessment conducted by the audit office and emergency management agency of Khuvsgul Aimag, 11 buildings in Khankh Soum suffered some form of damage, with the total damage amounting to 3,105,000 yen. Additionally, according to the Soum, the total damage amounted to 5,548,750 yen, but there were no human casualties.



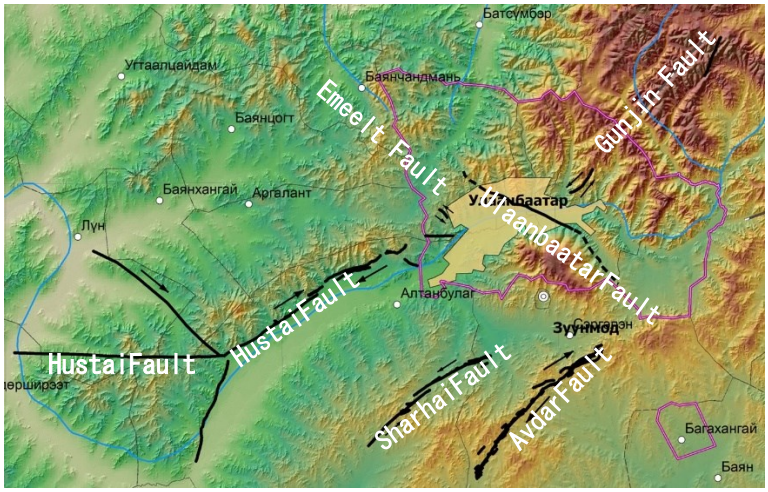
Crack in Ground Damage to Column Crack in Wall

Source: Unuudur (https://www.unuudur.mn/a/143374)

Figure 2.5.3 Damage Cases Caused by the Khuvsgul Earthquake

(4) Seismic Hazard

The seismic forces anticipated in UB City are presumed to be caused by active faults, with currently six active faults recognized (Figure 2.5.4). The characteristics of the active faults indicated in the same figure are presented in Table 2.5.1. The anticipated magnitudes of the active faults range from 5.8 to 7.5.



Source: IAG

Figure 2.5.4 Distribution Map of Active Faults Near UB City

Table 2.5.1 Characteristics of Active Faults used in Establishing New Seismic Intensity Classification by the IAG

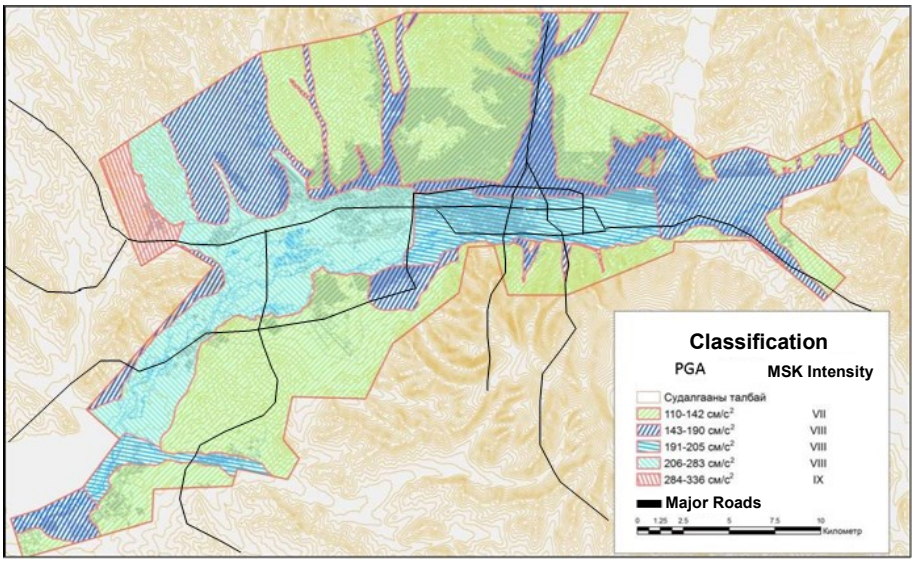
No.	Fault's Name	Distance from Center of UB City (km)	Direction of Slip	Fault Length(km)	Estimated Magnitude	Current Activity Year
1	Hustai	40	Left-Lateral	111	7.5	1000
2	Gunjin	12	Right-Lateral	25	>7	5577-9321
3	Sharhai	42	Left-Lateral	46	5.8-7	1195±157
4	Avdar	42	Left-Lateral	47	6.6-7	<5665±85
5	Emeelt	25	Right-Lateral	35	6.5-7	11000±2000
6	Ulaanbaatar	0	Left-Lateral	50	7.1	

Source:JST based on IAG

(5) Status of Earthquake Risk Map Development

The earthquake risk assessment is supposed to be conducted in accordance with the provisions of the "Disaster Vulnerability and Risk Assessment Implementation Regulations (Cabinet Decision No. 176 of 2006)". However, as specific methods for risk assessment were not provided, it remained unimplemented. In 2017, MCUD commissioned IAG to carry out microzonation for UB City and 12 aimags, corresponding to return periods of 500 years and 2500 years. Subsequently, in the 2023 fiscal year, microzonation was conducted for Umnugovi Aimag and Khuvsgul Aimag. These microzonations are treated as risk assessments. As of April 2023, the remaining seven aimags have been put on hold due to a lack of budget.

The microzonation was primarily conducted by IAG staff who had received training at the International Institute of Seismology and Earthquake Engineering (IISEE) through JICA. The results of the risk assessments are published as seismic risk maps (expected seismic intensity distribution maps). Figure 2.5.5 shows the expected seismic intensity distribution map around UB City. The formulated expected seismic intensity distribution map is attached to the country's seismic design standards, "Seismic Dsign Building Code" (BNbD 22-01-01-2021).



Source: IAG

Figure 2.5.5 The Seismic Intensity Classification Map for Urban area in UB City

(6) Status of Comprehensive Earthquake Risk Map Development in Phase 0 Project

In Phase 0 Project, damage estimations were conducted for two scenarios. Scenario I involves an earthquake occurring on the Hustai Fault, while Scenario II involves earthquakes occurring on the Emeelt and Gunjin Faults. These are currently the only estimations of building damage caused by earthquakes. The results of the damage estimations are presented in Table 2.5.2.

The number of fatalities was evaluated for each mesh (grid) within UB City using the following equation, and then aggregated to obtain the total.

- For Wooden, Brick, and Concrete Block buildings:
  Fatality in mesh = Population in mesh times 0.0676 times building collapse rate in mesh
- Other buildings
  Fatality in mesh = Population in mesh times 0.0167 times building collapse rate in mesh

The coefficients 0.0676 and 0.0167 used in the above equation are values employed in the damage estimation by the Central Disaster Management Council of Japan.

However, it should be noted that the results in the table are based on population and building data as of 2011. With the development of urban areas, it is necessary to conduct a reevaluation of risks to reflect changes in population growth and the status of buildings.

Table 2.5.2 The Building Damage Estimation Results from Phase 0 Project

	ScenarioI		ScenarioII	
	Urban Area	Ger Area	Urban Area	Ger Area
Building Collapse Rateo	48%	81%	22%	29%
Number of Fatality by Building Collapse (Ratio of Casualty to Population)	7,552 (1.45%)	38,063 (5.55%)	3,442 (0.66%)	16,285 (2.37%)

Source: Report of Phase 0 Project

2.5.2 Status of Hazard Risk Assessment for Floods

(1) Flood Occurrence Status

1) Major Floods in the Past

i. July 1966 Flood

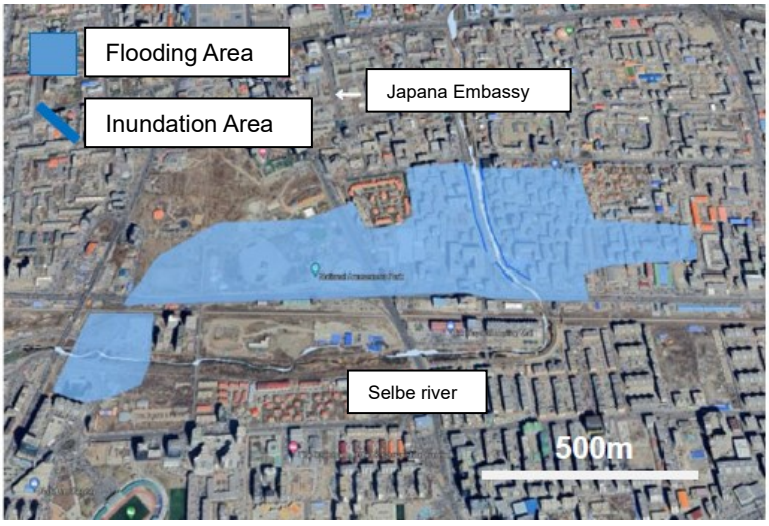
The largest flood to occur within the past 100 years in UB City is considered to be the July 1966 flood. Due to heavy rainfall that started on July 10th, floods from the upper reaches of the Tola River flowed into UB City on July 12th, causing extensive damage primarily along the Tola River. As a result of this flood, the Uliastai Bridge over the Tola River collapsed, and a fully occupied bus traveling on it was swept away. Numerous houses along the Tola and Dondo Rivers were washed away, causing extensive damage with a death toll of 86 people.

Source: Urban Engineering Countermeasures MP Chapter 2

Figure 2.5.6 Flood Damage caused by July 1966 Flood

ii. July 2023 Flood

From July 3rd to 5th, 2023, heavy rainfall of 110.2 mm (with a maximum daily precipitation of 60.6 mm) caused flooding of up to 60 cm in the Selbe River in the city center of UB. According to NEMA, a total of 144 buildings were inundated in an area of 0.65 km^2. However, the overall impact affected over 30,000 households in UB City. The flooded areas are indicated by the blue color in Figure 2.5.7 (based on the interviews to the residents by the local staff.). Additionally, various places along the Selbe and Tola Rivers were flooded due to overtopping, and houses were washed away due to riverbank erosion.



Source: Created by JV based on NEMA information

Figure 2.5.7 Flooded area in the city center of UB caused by the July 2023 Flood

(2) Flood Hydrographs and Flood-prone Areas

1) Verification of flood hydrograph and flow capacity

In the Tola and Selbe Rivers, hydrographs were estimated based on the assumption of precipitation exceeding the 100-year probability as per the Urban Engineering Countermeasures MP. The maximum flow rates are as follows.

Table 2.5.3 Maximum Flow Rates

River	Flow Rates by Probability (m^3/sec)
	1/100(1%)
Tola River (within UB City)	Approx. 2,000
Selbe River (within UB City)	288.67

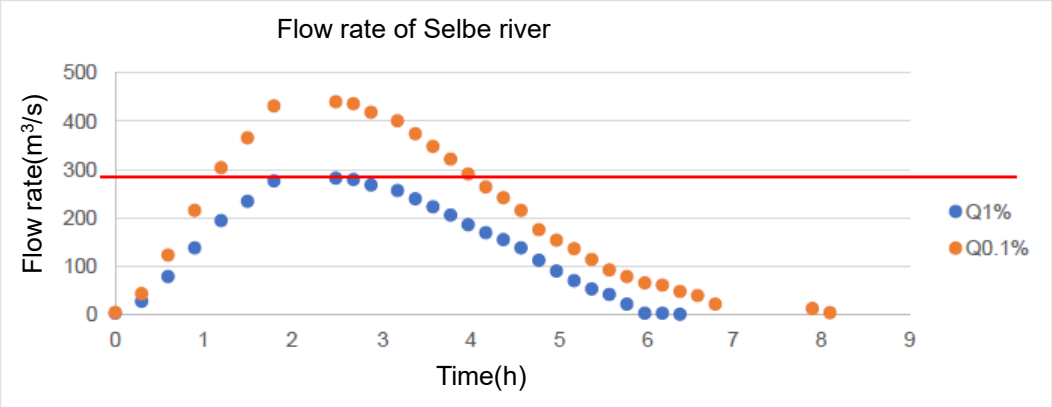
Source: Urban Engineering Countermeasures MP, Sections 3.1.2 and 4.1.3

The calculation method for the flow rates is based on the equation below. some of the flow rates need to be confirmed as the basis for calculation is unknown. Additionally, although interviews with the relevant agencies were conducted regarding the basis for the hydrograph below, the details are still unclear.

$$\phi_r = \frac{1000 \cdot L}{K_r \cdot J_r \cdot F^{\frac{1}{4}} \cdot (\varphi \cdot H_{1\%})^{1/4}}$$

Source: Selbe Recovery Unit

L : River Length
Kr : River Area Coefficient
Jr : River Slope
φ : River coefficient
F : Riverbasin Area
H_1 : 100year return period daily rainfall (125.4 mm)



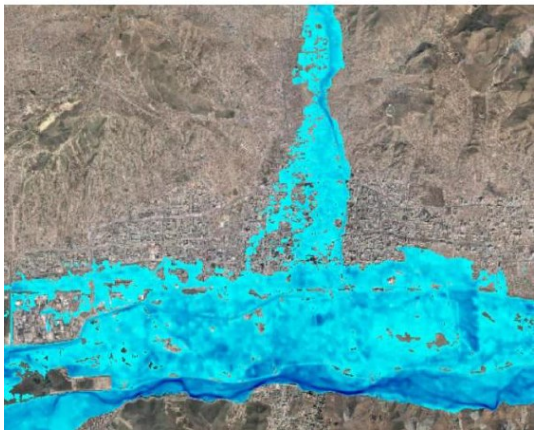
Source: Urban Engineering Countermeasures MP, Section 3.1.2

Figure 2.5.8 Selbe River Hydrograph

2) Flood-prone Areas

Using the DEM model (5m mesh) of the UB city area and the aforementioned hydrograph, flood simulation (with a 100-year probability) was conducted using the HEC-RAS model. Simulation results showed that the Selbe River is expected to flood in the upstream area and flow through the city

center. Currently, the basis for calculating the hydrograph is unclear, and the terrain data used has not been provided, making it difficult to assess the validity of the predicted flood-prone areas. By verifying the validity of the hydrograph and providing terrain data, the validity of the predicted flood-prone areas can be confirmed as well as the flood-prone points. Regarding these flood-prone points, it is also possible to propose them as high-priority candidates for river channel improvements.



Source: Urban Engineering Countermeasures MP, Chapter 4.7

Figure 2.5.9 Predicted flood-prone areas around UB City

2.6 Status of Structural and Non-structural Measures for Disaster Prevention

2.6.1 Structural Measures for Earthquakes

(1) Buildings

1) Seismic Retrofitting

i. Standard for Seismic Retrofitting Design

As for regulations related to building reinforcement, there is the 'Guidelines for Reinforcement Methods using RC and Steel for Masonry Structures (CR31-106-03)' approved by the Ministry of Construction and Urban Development (MCUD). This guideline targets only masonry walls and provides reinforcement methods using angle steel, concrete wrapping, and combined use of steel and concrete wrapping, along with the corresponding reinforcement calculation methods. It should be noted that this guideline is intended for reinforcing deteriorated brick walls and does not provide methods for increasing seismic resistance.

The seismic retrofitting design standards were first developed in Phase 1 Project, consisting of three regulations: 'Seismic Diagnosis and Reinforcement Methods for Existing Masonry Structures (BD-22-105-18),' 'Seismic Diagnosis and Reinforcement Methods for Existing Reinforced Concrete Structures (BD-22-106-18),' and 'Seismic Diagnosis and Reinforcement Methods for Existing Precast Large Panel Structures (BD-22-107-18).' These regulations, denoted as BD, underwent expansion of seismic retrofit methods and additional revisions for seismic retrofit construction in Phase 2 Project.

In addition, in Phase 2 Project, regulations similar to the aforementioned BD are scheduled to be created and approved by 2024 for seismic diagnosis and reinforcement methods for existing steel and existing wooden buildings

ii. Results of Seismic Diagnosis

In Phase 2 Project, seismic diagnoses were conducted in 2023 using the methods established in Phase 1 Project for 10 buildings considered to be important for disaster prevention. The results of these diagnoses, conducted to include these buildings in the long list, are presented in Table 2.6.1.

Table 2.6.1 Summary of Seismic Diagnosis Conducted in Phase 2 Project

Building Name	Structure	Building Block	Iso-Value	Is-Value		Judge
				X-Dir,	Y-Dir.	
No.2 School	Brick Masonry	A Block	0.22	0.132	0.344	NG
		B block		0.303	0.159	NG
		C Block		0.186	0.417	NG
No.20 School	PC	I & III Block	0.22	0.037	0.037	NG
		II Block		0.053	0.053	NG
		IV Block		0.123	0.052	NG
No.2 Building of Mongolian University of Science and Technology	RC	B Block	0.20	0.019	0.019	NG
		D, J Block		0.128	0.027	NG
		E Block		0.131	0.027	NG
No.160 Kindergarten	Brick Masonry	1F Block	0.22	0.546	0.161	NG
		2F Block		0.140	0.352	NG
National Trauma and Orthopaedic Research Center of mongolia	RC	I Block	0.11	0.056	0.106	NG
		II Block		0.089	0.089	NG
		III Block		0.056	0.104	NG
		IV Block		0.066	0.068	NG
		V Block		0.181	0.285	OK
		VI Block		0.252	0.262	OK
National Center for Maternal and Child Health	Brick Masonry	A block	0.11	0.154	0.064	NG
		B block		0.261	0.076	NG
		C block		0.278	0.053	NG
		D block		0.034	0.146	NG
		E block		0.200	0.074	NG
Bayangol Ward Office	Brick Masonry	-	0.22	0.225	0.074	NG
National Emergency Management Agency	Brick Masonry	-	0.22	0.132	0.155	NG
Ministry of Diigital Development and communications (Central Post Office)	Brick Masonry	A1 Block	0.22	0.076	0.043	NG
		A2 Block		0.082	0.049	NG
		A3 Block		0.069	0.105	NG
		B1 Block		0.041	0.054	NG
		B2 Block		0.125	0.102	NG
Meteorological Agency	Brick Masonry	A Block	0.22	0.297	0.085	NG
		AB Block		0.166	0.136	NG
		B Block		0.060	0.237	NG

Source: JST

Before the establishment of seismic retrofit design standards in Phase 1 Project, inspections conducted by the MCUD Department Audit Agency relied on visual inspections and plan reviews. The results of these inspections are shown in Table 2.6.2 and Table 2.6.3.

Table 2.6.2 Summary of Seismic Diagnoses by the MCUD Department Audit Agency (within UB City)

Building Usage	Construction Year			Structure				Seismic Resistance		
	-1970	1970-1990	1990-	RC	PC	Brick	Others	Low: Rebuild	Middle: Retrofit	High: No Measure
School	34	90	140	120	15	142	2	108	92	62
Kindergarten	30	76	216	188	14	116	4	193	94	35
University	11	6	0	2	0	15	0	0	8	9
Hospital	13	26	80	50	1	68	0	39	73	7
Cultural	19	0	3	3	0	5	14	2	16	4
Administrative	16	13	6	6	3	26	0	3	11	21
Residence	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0

Source: MCUD Department Audit Agency

Table 2.6.3 Summary of Seismic Diagnoses by the MCUD Department Audit Agency (outside UB City)

Building Usage	Construction Year			Structure				Seismic Resistance		
	-1970	1970-1990	1990-	RC	PC	Brick	Others	Low: Rebuild	Middle: Retrofit	High: No Measure
School	80	373	253	215	3	404	84	137	426	143
Kindergarten	55	234	363	171	9	396	76	207	354	91
University	10	18	13	4	0	32	5	6	22	13
Hospital	27	193	339	103	3	373	80	147	316	96
Cultural	65	92	148	100	4	172	29	64	153	88
Administrative	8	24	30	10	1	40	11	11	43	8
Residence	0	0	0	0	0	0	0	0	0	0
Others	16	166	65	53	0	152	42	27	162	58

Source: MCUD Department Audit Agency

iii. Response to the Seismic Diagnosis Results

In Mongolia, there is no budget allocation for seismic retrofitting, so there is no result of seismic retrofitting works. The Galleria Ulaanbaatar is sometimes cited as an example of seismic retrofitting because of the carbon fiber wrapping of columns and beams, but this was done to withstand the increased load from the addition of a third floor (originally a two-story printing facility), not to address a lack of seismic resistance.

On the other hand, the following measures have been taken in response to the seismic diagnosis results by the MCUD department audit agency, but seismic reinforcement has not been implemented

Schools and Kindergartens

The Capital City Education Department has rebuilt 168 buildings, and 3 buildings have been taken out of use. The selection of buildings for rebuilding was based on criteria such as “old construction year with wooden floors” and “implementing a three-shift class schedule”, rather than quantitative indicators. There are still buildings that need to be rebuilt, but due to budget shortages, the work cannot be carried out.

Hospitals

Nine hospitals have been rebuilt by the Ministry of Health.

Cultural and Service Facilities

One building has been rebuilt and one building has been demolished. Measures have not been implemented for the remaining seven buildings.

Apartment Buildings

Buildings with a high risk of collapse have been identified.

2) Seismic Design Standards and Building Administration

One of the factors indicating the necessity for seismic reinforcement is the evolution of seismic design standards in Mongolia. The seismic design standards in Mongolia, titled "Seismic Design Building Code (BNbD 22-01-01*/2006)", were initially modeled after the seismic standards of the former Soviet Union. These standards were revised by MCUD in 2006. They encompass requirements for seismic design not only for buildings but also for various structures throughout Mongolia.

Afterwards, starting from 2017 as shown in 2.5.1, seismic intensity zoning maps have been released sequentially, and they have been reflected in the "Seismic Design Building Code (BNbD 22-01-01*/2006)", which came into effect in 2021.

3) Projects and Budgets

As mentioned above, seismic retrofitting measures are not firmly established, leading to a lack of decision-making for implementation by the building and facility management government agencies, and no budgetary provisions have been made.

(2) Infrastructure and Lifelines

1) The Implementation Status of Seismic Diagnosis

i. Seismic Diagnosis Standards

In infrastructure and lifelines, various structures are included. In the earthquake risk assessment guidelines created in Phase 1 Project, bridges were identified as objects that can be individually evaluated. On the other hand, as objects where individual evaluation is difficult and damage quantities relative to the total amount are estimated, roads, water supply systems, sewer systems, hot water pipes, and electricity supply systems were addressed.

For bridges, a damage assessment based on scoring is adopted as a risk assessment, considering factors such as ground conditions, structural form, materials, and anticipated seismic intensity. According to this method, although it is approximate, it is possible to determine whether the bridge is safe or not for the anticipated seismic intensity. Additionally, assessments using the "Bridge Soundness Evaluation Manual" developed as part of the Mongolia National Bridge Maintenance Capacity Enhancement Project are conducted. However, this assessment evaluates the degree of deterioration of the bridge and does not quantify its seismic resistance.

The earthquake risk assessment for roads assumes the number of damaged locations per kilometer for the anticipated seismic intensity, allowing for evaluation based on different types of ground conditions.

The earthquake risk assessment for water supply systems assumes the number of damaged locations per kilometer for the anticipated seismic intensity, allowing for evaluation based on pipe diameter and material. It should be noted that the water supply system being considered is for buried pipelines, and those appearing above ground with sleepers or racks are excluded from consideration.

The earthquake risk assessment for sewer systems assumes the length of damage per kilometer for the anticipated seismic intensity, allowing for evaluation based on material.

The earthquake risk assessment for hot water pipes assumes the number of damaged locations per kilometer for the anticipated seismic intensity, allowing for evaluation based on pipe diameter and material, similar to water supply systems. Additionally, the hot water pipes being considered are buried pipelines, and those appearing above ground with sleepers or racks are excluded from consideration.

The earthquake risk assessment for the power supply system includes poles and overhead / underground lines. For pole assessment, it evaluates the number of damaged poles per 100 poles for the anticipated seismic intensity, considering concrete, wooden, and steel poles. For the risk assessment of overhead/underground lines, the damage length is calculated by multiplying the damage rate corresponding to the anticipated seismic intensity by the length.

For the structures of thermal power plants, seismic performance confirmation is conducted based on the "Seismic Design Building Code (BNbD 22-01-01-2021)". Additionally, there are general requirements specific to the construction of thermal power plants outlined in "General Requirements for Thermal Power Plant Construction MNS 6936 2021". However, regarding seismic performance, these requirements remain qualitative, such as considering not only geological and hydrogeological conditions but also the physical and mechanical properties of the surface and soil when selecting a construction site in seismic zones. There are no standards or criteria specifically addressing the seismic performance of equipment such as boilers and turbines in power plants.

There are no clear seismic standards for distribution and transmission line facilities, and seismic design is not considered for these facilities. Generally, distribution and transmission facilities are primarily designed to withstand wind loads, with the assumption that equipment designed to withstand

wind loads can also withstand loads during earthquakes. In fact, in Mongolia, there have been no major collapses or damages to distribution and transmission facilities due to earthquakes. Although seismic performance evaluations for distribution and transmission facilities have not been conducted so far, there is increasing awareness of disaster prevention, and the necessity for such evaluations is recognized by various facility owners. Therefore, it is expected that these evaluations will be conducted in the future. As for hot water pipes for heat supply, there are no seismic standards in place.

ii. Implementation Status of Seismic Diagnosis and Repairs

Seismic diagnosis has not yet been conducted for infrastructure and lifeline facilities. However, repairs are carried out for any defects discovered during deterioration diagnosis of bridges, tunnels, and concrete structures, and repairs for defects found during inspections of other facilities and structures are also performed. Additionally, defects may be discovered based on reports from residents, in addition to these diagnoses and inspections.

Thermal power plant, TPP2, 3, and 4, have been operational for over 30 to 60 years. Some equipment has undergone facility updates, and prior to the replacement of steam turbines and generators, strength confirmation of turbine generator foundations is conducted. Additionally, periodic replacements of internal pipes in boilers are carried out as needed. However, for facilities such as boiler foundations, boiler and turbine generator buildings, and office buildings where updates are not feasible, the conditions remain largely unchanged from the start of operations, and aging deterioration has progressed. Therefore, each power plant conducts degradation surveys, including seismic performance assessments, for some equipment. The implementation status of these surveys is summarized in Table 2.6.4.

Table 2.6.4 The Implementation Status of Degradation Surveys and Seismic Performance Assessments Conducted by TPP2, 3, and 4

	Implementation period	Object	Result
TPP2	2018	Deterioration survey of service buildings and other structures (built in 1967)	Two buildings were prohibited from use.
	2022	Building deterioration survey	A 12% risk is confirmed according to national standards due to ceiling leaks and soft ground in the foundation.
	No future investigation scheduled.		
TPP3	2016	Risk assessment for natural disasters (qualitative assessment)	There is a high risk of damage to transmission lines, component falls due to strong winds, damage to steam and hot water pipes, building damage, etc., and the risk of flooding in buildings and underground facilities is increasing due to the effects of earthquakes.
	2017	Seismic assessment of chimneys (2 units) and other structures	Both chimneys cannot withstand intensity 8 (MSK seismic intensity) due to aging deterioration.
	2021	#5 turbine generator pedestal deterioration survey	The metal components of the generator foundation have a service life of 16 years, while other reinforced concrete components have a service life of 30 years.
	For the buildings, a re-inspection is scheduled for 2024, along with budgeting for repair costs.		
TPP4	2017	Risk assessment for natural disasters	Confirming response policies for qualitative risks
	2023	A deterioration survey for boiler steel frames, turbine building ceilings, and other equipment foundations was conducted through commissioning to specialists.	Approximately 12% of the surveyed subjects have the following issues: Restoration required for the boiler building steel frames removed during the boiler mill replacement conducted around 2020 Deterioration of the foundation of the coal conveyor belt Roof waterproofing of the turbine building (already implemented)
	2022	Strength assessment of turbine generator pedestals before steam turbine replacement	Facility update completed.
	Risk assessment scheduled for 2024.		

Source: JST

Although necessary repairs are generally carried out as needed, insufficient budgetary allocations at each power plant have resulted in inadequate responses. Limited funds tend to be prioritized for equipment, further constraining the budget for the maintenance of architectural structures.

In TPP3, it has been confirmed that the chimney cannot withstand intensity 8 (MSK seismic intensity) due to aging deterioration. However, as it is a shared facility for multiple units, no fundamental measures have been taken. Furthermore, according to the Technical Inspection Report conducted by the National Dispatch Center (NDC) in August 2022, in addition to technical issues in system operation, there are also concerns raised regarding the increased risk associated with structures due to insufficient periodic inspections of buildings and the occurrence of cracks in building foundations.

Regarding the distribution and transmission line facilities, seismic performance evaluations have not been conducted previously, and equipment repairs based on seismic diagnosis have not been carried out. There are plans to conduct seismic performance evaluations for transmission and distribution facilities in the future, and based on the results, there is a possibility that equipment repairs will be implemented as necessary.

For the hot water supply piping, regular replacements are carried out every 20 to 30 years.

2) Projects and Budgets

For the seismic diagnosis of distribution and transmission line facilities, it is expected that they will be conducted by each facility-owning organization as needed in the future. However, specific implementation plans have not been established at the current time. Therefore, budgets for seismic diagnosis and retrofitting have not been allocated.

2.6.2 Non-structural Measures for Earthquakes

(1) Earthquake Observation and Early Warning

1) Earthquake Observation System

In Mongolia, earthquake observation is handled by the IAG. When an earthquake with a magnitude of 3.5 or higher is observed, the IAG promptly reports the epicenter and magnitude to the NEMA[22].

There are three main observation networks operating in Mongolia:

- Regional earthquake observation network
- The concentrated earthquake observation network for active faults around Ulaanbaatar
- Observation network for earthquake early warning system

In addition to the three observation systems in Mongolia, the monitoring systems of the United States Geological Survey (USGS) and the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) are also managed by the IAG on a 24-hour basis. Backup power sources are installed on-site to ensure operation for 72 hours. However, there are no backup communication lines.

2) Earthquake Observation Network

Seismic observation points, totaling approximately 100 across 15 locations nationwide, transmit earthquake data observed at these points to the IAG via high-speed optical fiber. Table 2.6.5 outlines the status of the main seismic observation points.

[22] The National Disaster Management Plan (National Disaster Prevention Plan), which outlines activities to protect residents, property, livestock, and animals from disaster risks, rescue them, respond to disasters, and undertake emergency recovery activities, was established in 2015.

Table 2.6.5 Observation Network for Earthquake Early Warning System

Types of seismic observation networks	Purpose	Observation targets	Equipment used for seismic measurements	No. of obs. points	Observation area	Cont. connect.	Cont. obs.	Real time	Comm. means	Oper. structure	Start of oper. (year)	Oper. status (%)
Observation network for earthquake early warning system	Disaster prev.	Early warning	CMG-5TC Accelerometer	1	Bulgan Aimag Mogod Soum	○	○	○	Satellite antenna	24 hours	2015	100
	Disaster prev.	Early warning	CMG-5TC Accelerometer	1	Bulgan Aimag Mogod Soum	○	○	○	Satellite antenna	24 時間	2015	100
	Disaster prev.	Early warning	CMG-5TC Accelerometer	1	Bulgan Aimag Mogod Soum	○	○	○	Satellite antenna	24 時間	2015	100
	Disaster prev.	Early warning	CMG-5TC Accelerometer	1	Bulgan Aimag Dashinchilen Soum	○	○	○	Satellite antenna	24 時間	2015	100
	Disaster prev.	Early warning	CMG-5TC Accelerometer	1	Selenge Aimag Tsagaannuur Soum	○	○	○	Satellite antenna	24 時間	2015	100
	Disaster prev.	Early warning	CMG-5TC Accelerometer	1	Selenge Aimag Tsagaannuur Soum	○	○	○	Satellite antenna	24 時間	2015	100
	Disaster prev.	Early warning	CMG-5TC Accelerometer	1	Selenge Aimag Tsagaannuur Soum	○	○	○	Satellite antenna	24 時間	2015	100
	Disaster prev.	Early warning	CMG-5TC Accelerometer	1	Selenge Aimag Khushaat Soum	○	○	○	Satellite antenna	24 時間	2015	100
	Disaster prev.	Early warning	CMG-5TC Accelerometer	1	Dundgobi Aimag Delegertsogt Soum	○	○	○	Satellite antenna	24 時間	2015	100
	Disaster prev.	Early warning	CMG-5TC Accelerometer	1	Dundgobi Aimag Delegertsogt Soum	○	○	○	Satellite antenna	24 時間	2015	100
	Disaster prev.	Early warning	CMG-5TC Accelerometer	1	Dundgobi Aimag Derent Soum	○	○	○	Satellite antenna	24 時間	2015	100
	Disaster prev.	Early warning	CMG-5TC Accelerometer	1	Tuv Aimag Bayantsagaan Soum	○	○	○	Satellite antenna	24 時間	2015	100

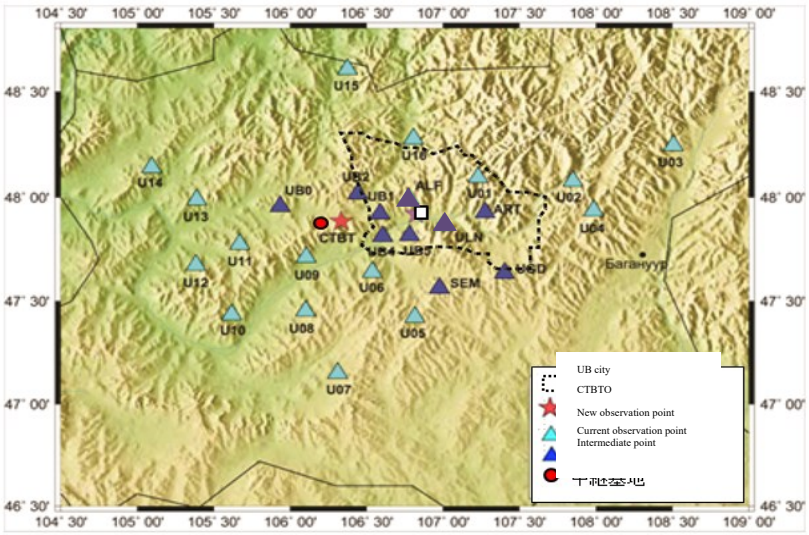
Source: IAG

i. The Concentrated Earthquake Observation Network for Active Faults around Ulaanbaatar

From 1994 to 1999, a broadband seismometer[23] was installed in one location near Ulaanbaatar, and short-period seismometers were installed in five locations. In 2005, six short-period seismometers were installed, and in 2013, sixteen broadband seismometers were installed.

The seismic observation data collected at these points is transmitted to relay stations using a 5GHz long-range wireless LAN for distances up to 20km, and for distances exceeding 20km, a 400MHz wireless communication system is utilized. From the relay stations, the data is then transmitted to the IAG's server in real-time via optical fiber. Figure 2.6.1 shows the location of the observation points.

[23] The broadband seismometer is suitable for observing micro-earthquakes and distant earthquakes due to its high sensitivity and wide frequency response. However, it may become saturated and unable to measure during nearby large earthquakes that cause damage. Strong-motion seismometers are primarily designed to capture significant shaking that leads to damage, while short-period seismometers are suitable for capturing nearby micro-earthquakes.



Source: IAG

Figure 2.6.1 Location of Earthquake Observation Points around Ulaanbaatar[24]

ii. Regional Earthquake Observation Network

The regional earthquake observation network includes array observation, where earthquakes are observed at multiple observation points, and single observation, where earthquakes are observed at individual points. As of September 2016, there are 6 array observation points and 10 single observation points operational throughout the country. At array observation points, 7 to 10 broadband seismometers or short-period seismometers are arranged within a diameter of 2 to 3 km, while broadband seismometers are installed at single observation points. Additionally, 8 strong motion seismometers are installed simultaneously.

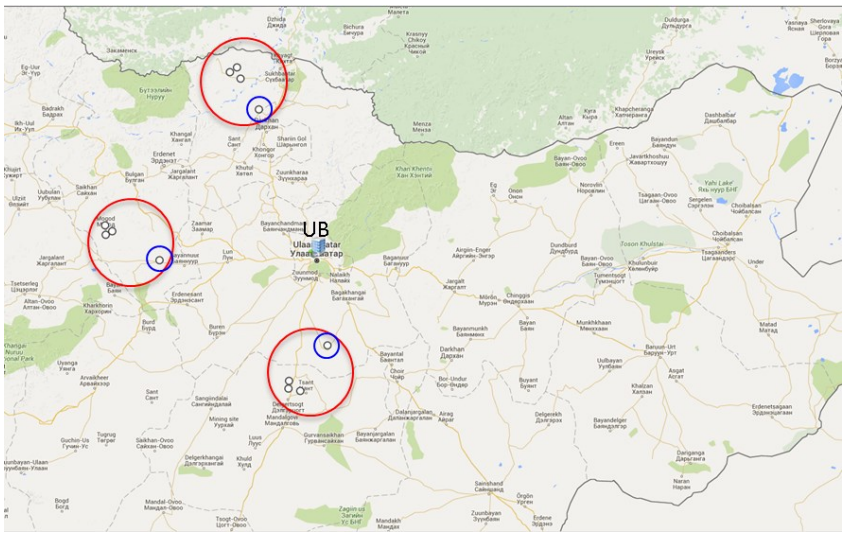
The transfer of earthquake observation data follows the same communication system as described in i) for the UB city area.

iii. Earthquake Early Warning System Observation Network

The observation network for the Earthquake Early Warning System consists of 12 observation points, with four locations established in each of three areas with potential risks to UB city: Deren Soum in Dundgovi Aimag, Mogod Soum in Bulgan Aimag, and Tsagaannuur Soum in Selenge Aimag.

Figure 2.6.2 illustrates the arrangement and specifications of the observation points. Among the four observation points established in each of the three areas, three points are dedicated observation points, while the remaining point serves as a relay base, functioning as both an observation point and a relay point. The seismic waveforms observed by the seismometers at the three observation points are transmitted to the relay base. At the relay base, the seismic waveforms observed by the instruments installed there and those transmitted from the three observation points are analyzed. The analysis results are then transmitted to the IAG server. Subsequent analysis processing is carried out on the IAG server, and if a significant earthquake that may cause damage to UB city is detected, an automatic warning message is transmitted to NEMA.

[24] There is one observation point from the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), with sensors placed along the circumference at inner 500m and outer 1,500m, with the center. While the purpose is the detection of nuclear tests, the operation is managed by IAG, which also handles information processing.



(○: Observation Area, ○: Relay Base, ○: Observation Point)

Source: IAG

Figure 2.6.2 Location of Seismic Observation Point for Earthquake Early Warning System and Specifications

3) Processing of Seismic Observation Data

For routine earthquake observation processing, excluding the early warning system, seismic waveform data transmitted to the server is first automatically analyzed for the earthquake source and magnitude using the SeisComP3 data collection and analysis software. Subsequently, manual analysis is conducted by researchers[25]. The manual analysis utilizes a system called JADE and ONYX, which are French-made (also used in Nepal). Many researchers, including those involved in seismic observation processing mentioned earlier, are proficient in the analysis of earthquake sources and magnitudes using these systems.

4) Earthquake Information Dissemination

In routine earthquake observation processing, it is agreed between NEMA and IAG that when an earthquake with a magnitude of 3.5 or higher occurs, the epicenter and magnitude are promptly reported to relevant agencies, including NEMA. The time required for IAG to determine the epicenter location and magnitude and transmit the information to NEMA is approximately 10 minutes. The communication methods for reporting include email, telephone, and fax.

In Japan, the Japan Meteorological Agency operates a seismic intensity early warning system, which disseminates seismic intensity information for each region within 2 minutes of an earthquake occurrence. In Japan, emergency response activities are initiated based on information from this seismic intensity early warning system. However, there is no equivalent system in Mongolia.[26]

On the other hand, the Earthquake Early Warning System, as described below, automatically transmits information to NEMA within a minimum of 15 seconds of earthquake detection.

The transmission medium is optical fiber, which has sufficient capacity. Since the backbone of the optical fiber is laid underground, it can be considered relatively robust against earthquakes as long as liquefaction does not occur. However, in the event of a communication interruption for any reason, there is no backup line available, which means that alarm data cannot be received.

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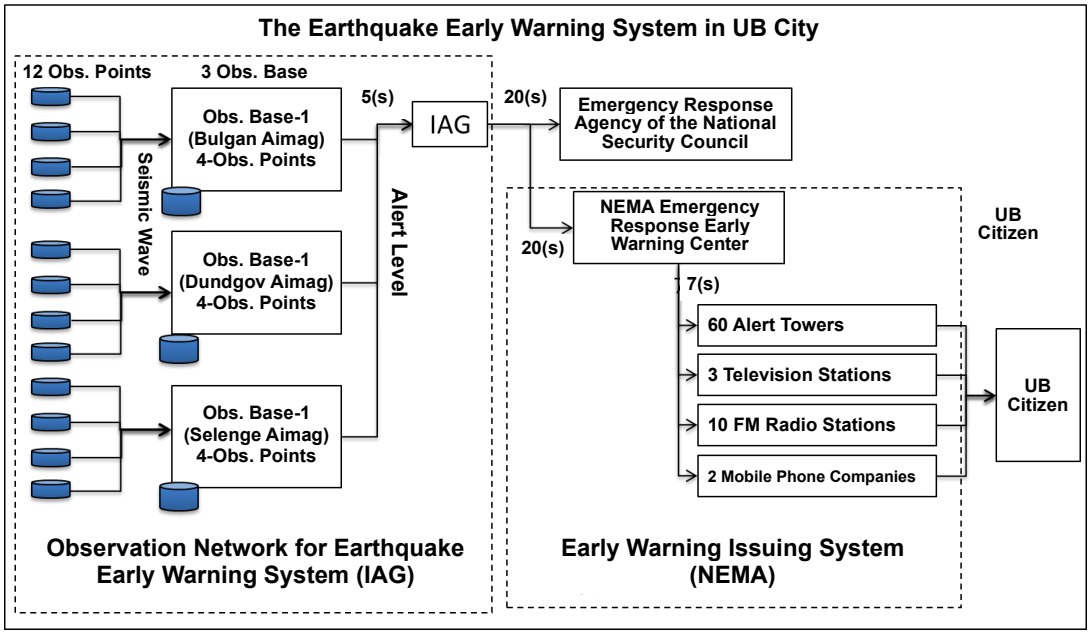
[25] In manual analysis, all seismic waveforms are displayed on a monitor. The arrival times of the P-wave and S-wave are then read from the display, and based on these times, the distance from each observation point to the epicenter is calculated. Finally, the epicenter location is determined. Simultaneously, the amplitude of the S-wave is read, and based on the relationship between the distance to the epicenter, the S-wave amplitude, and the magnitude, the magnitude of the earthquake is calculated.

[26] In Japan, the "Earthquake Early Warning System" has been developed and operated to complement the "Seismic Intensity Reporting System." The "Earthquake Early Warning System" is one of the early warning systems for earthquakes. Instead of providing actual seismic intensity, it issues predicted seismic intensity. Therefore, while its transmission is faster than seismic intensity reporting, there may be larger errors in the seismic intensity information.

5) Earthquake Early Warning System

i. System Overview

Disaster alerts are based on the "Disaster Early Warning Regulations (2011)," and a earthquake early warning system has been established. Figure 2.6.3 illustrates the configuration and information flow of the seismic early warning system targeting UB city. As previously mentioned, 12 observation points are placed in three areas: northwest, west, and south of UB city, with four observation points in each area. The seismic waveforms observed are processed in real-time and sent to IAG. The warning information sent to IAG includes only three levels of relative alerts corresponding to the expected intensity of shaking in UB city. In case of the highest level, 3 (High), the alert signal (indicating alert level = 3) is automatically transmitted to NEMA's Disaster Emergency Response Agency without any manual intervention. A VPN using optical fiber is established between IAG and NEMA, as mentioned earlier. Details regarding NEMA's alert transmission system will be discussed later.



Source: JST based on Overview Diagram of Earthquake Early Warning from "The National Disaster Management Plan (National Disaster Preparedness Plan)" (2015) and Information from IAG

Figure 2.6.3 Configuration and information flow of the seismic early warning system in UB city

The processing algorithm adopted in UB City's earthquake early warning system has been tested and operated by the Korea Institute of Geoscience & Mineral Resources (KIGAM), and is based on the earthquake early warning system called PRESTo developed in Italy. PRESTo utilizes a different algorithm and observation configuration from the Japan Meteorological Agency's (JMA) Earthquake Early Warning system, resulting in different performance. However, fundamentally, like the JMA's Earthquake Early Warning system, PRESTo analyzes the initial motion (P-wave) in real-time to provide rapid hazard (shaking intensity) information for the target area. A comparison with the JMA's Earthquake Early Warning system is summarized in Table 2.6.6[27]

[27] The technical details of the Earthquake Early Warning System by the Japan Meteorological Agency can be found in the document "Technical Reference Materials on the Overview and Processing Methods of Earthquake Early Warnings: Meteorological Agency Seismology and Volcanology Department, 2008," which is available for download at the following address. http://www.data.jma.go.jp/svd/eew/data/nc/katsuyou/reference.pdf

Table 2.6.6 Comparison between UB City's Earthquake Early Warning System and Japan Meteorological Agency's Earthquake Early Warning System

	Earthquake Early Warning System in UB City	JMA's Earthquake Early Warning
Developer	Korean Telecom (Supported by KIGAM)	JMA, NIED, Railway Technical Research Institute
Basic concept	Real-time analysis of the initial micro-motion (P-wave) portion to promptly report the magnitude of shaking in the target area	
System and algorithms served as the foundation	PRESTo (University of Naples, Italy)	UrEDAS (Railway Technical Research Institute, Japan), NIED
Number of observation points	12	Approximately 1000 nationwide
Single-point processing for epicenter estimation	Not feasible	Possible to estimate the epicenter location and magnitude
Multi-point processing	Estimate the epicenter location and magnitude from the arrival time and maximum amplitude of seismic waves, then calculate the expected seismic intensity based on the estimated epicenter location and magnitude	
Contents of alert	Relative alert levels (3 levels: High, Mid, Low) *	Estimated seismic intensity, lead time, epicenter location, Magnitude
Alert update function	Not feasible	Update according to the information refresh
Time from earthquake detection at observation points to the arrival of information at the earthquake warning system**	Within 15 sec.	Within 4 sec.
Total time from earthquake detection at the observation point to issuing the warning.	Within 20 sec.	5～10 sec.
Methods of reporting	SMS, Siren Tower, TV/Radio	TV/Radio, Area Mail, J-Alert, Specialized Terminal
Location of server	One unit (emergency mobile server) at NEMA in UB City	One unit each in Tokyo (main) and Osaka (sub)

* PRESTo has the capability to estimate the epicenter location and lead time, but it is presumed that KIGAM has simplified it for application in UB City.

** In UB City, the alert transmission system is managed by the Disaster Emergency Response Agency (NEMA), whereas in Japan, it is the server of the Japan Meteorological Agency.

Source: JST

ii. Issues and Budget

- **Response to Earthquakes Occurring in the Vicinity of UB City**

As previously mentioned, observation points are installed approximately 200km away from UB City in the northwest, west, and south directions. Therefore, while this system is effective against earthquakes occurring beyond 200km in the northwest, west, and south directions, it is not functional for earthquakes generated by active faults, which has become increasingly active in areas approximately 50km from UB City. It is necessary to implement observation systems, earthquake information dissemination systems, or early earthquake warning systems to mitigate damage from earthquakes occurring in regions closer than 200km from UB City.

- **Introduction of Seismic Intensity Reporting System as the Basis for Emergency Response Activities**

In Japan, the Meteorological Agency's seismic intensity reporting system enables the distribution of seismic intensity within two minutes after an earthquake, allowing for the activation of emergency response activities based on this information. This system relies on a dense network of strong motion sensors, but in UB City, there is only one such sensor installed. Immediately after an earthquake, actual damage reports may not be available, making it difficult to determine which areas of UB City have been most affected without access to seismic intensity information. This lack of data could potentially hinder emergency response activities.

It is desirable to establish a network of strong motion sensors within UB City and develop a system to aggregate seismic intensity information online. This would provide crucial data for assessing earthquake damage and enable more effective emergency response efforts in UB City.

- **Projects and Budgets**

The maintenance and management budget for earthquake observation facilities in the vicinity of UB are shown in Table 2.6.7.

Table 2.6.7 Maintenance and management budget for earthquake observation facilities (fiscal year 2024)

Usage		Budget (JPY)
1	Budget for inspection and maintenance to ensure the normal operation of observation points.	10,614,367
2	Budget for parts and components to ensure the normal operation of observation points.	2,111,803
	Total	**12,726,169**

Source: IAG

6) Implementation Structure for Early Warning System

i. Early Warning Dissemination System

The early warning dissemination system is operated by the Emergency Operation and Early Warning Center of the NEMA Disaster Emergency Response Agency. For earthquake alerts, the system relies on earthquake information sent by IAG as part of the Early Earthquake Warning System to issue alerts

The NEMA's alert dissemination system operates by sending alerts to the citizens of UB based on received alert signals. The means of alert dissemination include SMS to mobile phones, broadcast through three TV stations, ten FM radio stations, and disaster broadcasts through sirens placed at 60 locations within UB city. Communication lines between NEMA and media outlets such as sirens, TV stations, etc., are secured through two systems: satellite communication and shortwave radio broadcasting stations (with four base stations located within UB city). Additionally, as a backup in case the NEMA's alert dissemination server is compromised, one mobile unit is equipped for mobile operations.

The National Disaster Management Plan outlines the overview of alert transmission (NEMA Early Warning Dissemination System diagram in Figure 2.6.3). However, regarding specific agreements between IAG and NEMA concerning earthquake alerts, IAG has not yet received the draft prepared by NEMA. NEMA and the broadcasting media (TV, Mobile, Radio) have entered into agreements (contracts), clarifying the responsibilities for the installation, maintenance, and transmission of alerts within broadcasting stations by NEMA, while media outlets are responsible for securing the necessary equipment installation space and maintaining the environment for broadcasting alerts. However, detailed agreements regarding the specific methods of alert transmission and how to share alert information (such as via fax, email, dedicated lines like hotlines, digital communication, voice communication, radio, frequencies and modulation methods to be used for radio transmission, equipment to be used, whether to resend alert information, if so, at what timing, etc.) have not yet been finalized.

The earthquake early warning system, which serves as the input for the alert dissemination system, is under the management of IAG, the organizational structure of which will be described later.

ii. Organization, Personnel Deployment, and Capabilities

At the NEMA Emergency Operation and Early Warning Center, a team of three staff members operates on a 24-hour basis (with 3 days off after 24-hour continuous shifts). The team consists of personnel responsible for information and communication, disaster coordination, and operations. The information and communication staff member ensures the system's functionality and is prepared to address any disruptions in communication systems. The disaster coordinator is positioned to

coordinate with various stakeholders in the event of a disaster. The operator monitors the system to ensure stable and normal operations.

The earthquake early warning system of the IAG is primarily designed for automatic continuous operation and requires minimal maintenance. However, as it is currently in the testing phase, it is managed remotely via internet access to the system's servers, provided by the developer in South Korea. In the event of any issues, adjustments are made remotely from South Korea.

The current issues with the early warning system can be summarized as follows:

- According to interviews with the Emergency Operation and Early Warning Center director, it has been noted that staff members lack sufficient knowledge and skills in earthquake observation, communication, and disaster management. Therefore, it is necessary for staff members to acquire knowledge and skills in earthquake observation, communication, and disaster management to ensure prompt response in the event of communication issues.
- NEMA and IAG are connected via optical fiber, but there is no backup line.
- In the event of a false alarm from the automatic alarm system, it is necessary to prevent confusion by correctly retransmitting the information and, if missed, manually issuing alarms in a timely manner. However, there is a lack of expertise and experience in these procedures.

iii. Projects and Budgets

- According to the NEMA Disaster Response Agency, there are plans to expand the early warning system to all 21 aimags in Mongolia. However, these plans are still in the conceptual stage and have not progressed beyond that.
- The equipment maintenance budget for the early warning system was 9,576,855JPY in 2023.

2.6.3 Structural Measures for Floods

(1) Fluvial Flood Control Measures

In the upper reaches of the Selbe River, there are no constructed revetments, and the channel has a natural embankment. In the middle to lower reaches that pass through the city, concrete retaining walls have been constructed in some sections of the excavated river channel. However, the excavation height is low, and there is a possibility of flooding. In many areas, there is a large accumulation of sediment, and even in sections where there are some concrete retaining walls outside the excavation area, they become unstable during floods.

(2) Urban Drainage Measures

Structures with flood control functions consist of flood prevention facilities, road drainage pipes, and underground water infiltration drainage pipes (Table 2.6.8). Additionally, similar to the separated sewer system in Japan, stormwater is treated separately and not combined with sewage.

Table 2.6.8 Summary of Urban Drainage Facilities in Mongolia

Facility	Type of Discharge	Management Organization
Flood Prevention Facility	Stormwater, Groundwater	GUBBG
Road Drainage	Stormwater	GUBBG
Underground Infiltration Drainage Pipes	Ground water	GUBBG
Sewer	Domestic / Industrial Wastewater	Water supply and Sewage Authority

Source: JST based on the information from GUBBG

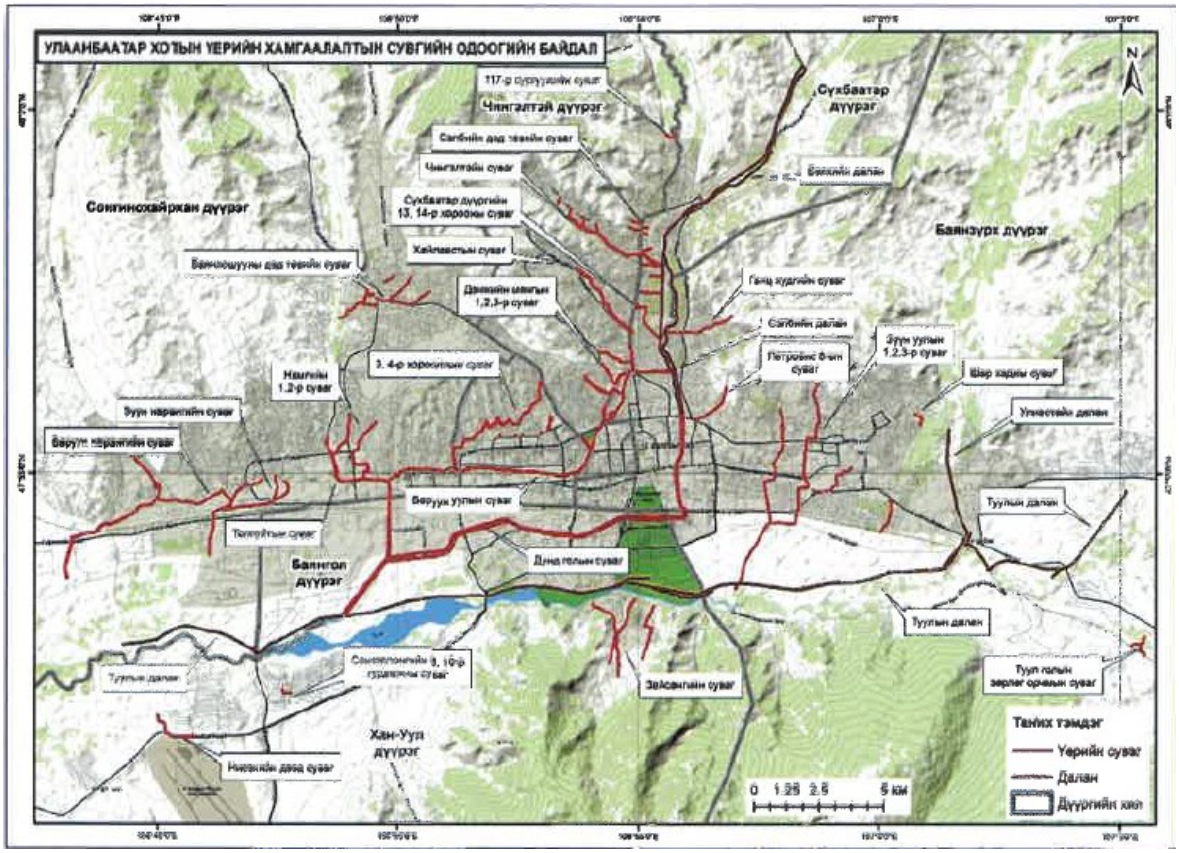
1) Flood Prevention Facility

The flood prevention facilities mentioned here include open channels built in the city for stormwater drainage (referred to as discharge channels) and the natural Selbe River and its tributaries. These flood

prevention facilities are spread throughout UB City, covering a total length of 148 km (Figure 2.6.5). This discussion focuses on the discharge channels among the flood prevention facilities. These channels vary in size and shape, but they are fundamentally rectangular waterways made of concrete or reinforced concrete. Approximately 67% of the flood prevention facilities, or 100 km, were constructed between 1966 and 1987, while the remaining 33%, or 48 km, were built between 1987 and 2020.

Source: JST based on the information from GUBBG

Figure 2.6.4 Discharge Channel



Source: Master plan for city engineering preparation measures

Figure 2.6.5 Network of Flood Prevention Channels in UB City

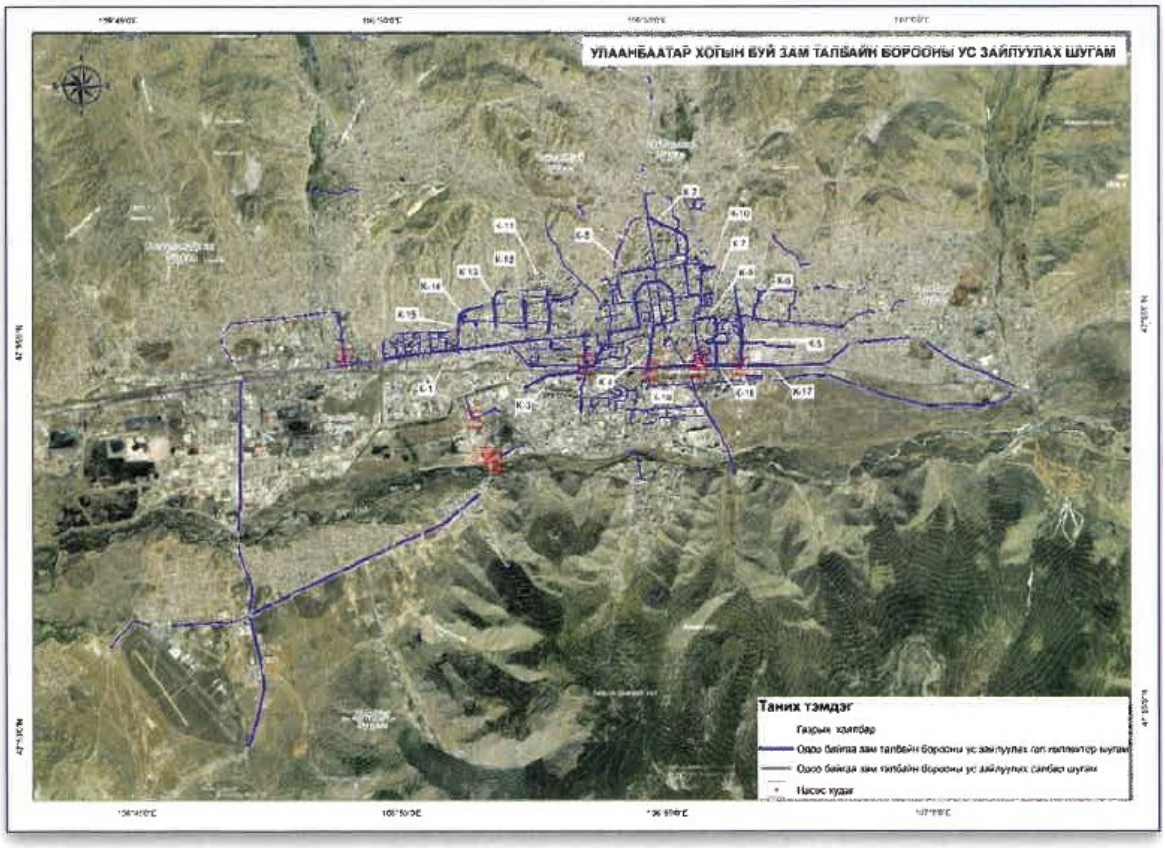
2) Road Drainage Facility

The road drainage facilities are also spread throughout UB City, reaching a total length of 169 km (Figure 2.6.7). Currently, 67% of these road drainage facilities were laid between 1966 and 1987, and the remaining 33% were constructed thereafter. The GUBBG is responsible for the maintenance of

flood prevention facilities, road drainage facilities, and underground drainage infiltration facilities. Annually, they clean the road drainage facilities before the rainy season from spring to summer, and again in the fall as needed after heavy rains.

Source: Master plan for city engineering preparation measures

Figure 2.6.6 Road Drainage Facility



Source: Master plan for city engineering preparation measures

Figure 2.6.7 Network of Road Drainage Facilities in UB City

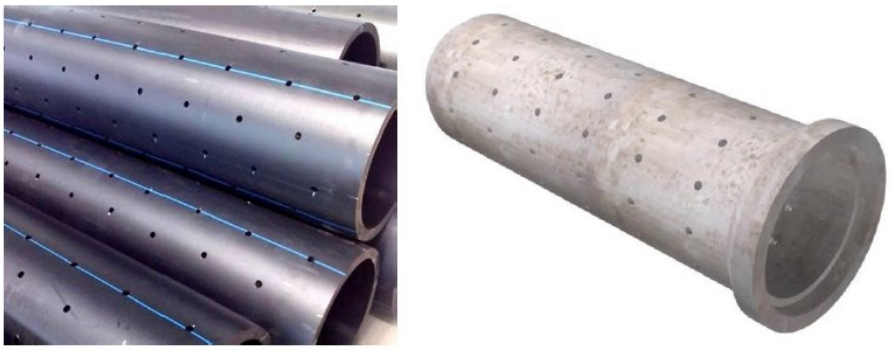
Construction in UB City is rapidly progressing, and many paved roads are being developed simultaneously. This has significantly increased the volume of rainwater on the roads. The central drainage ditches, established based on urban planning from 1980 to 1990, can no longer withstand the current load.

As of August 2021, over 1,100 km of urban roads have been developed, of which about 18% (168.80 km) are equipped with drainage ditches (3,084 catch basins and 3,333 manholes). Additionally, rainwater removal is conducted using one pump station and 10 small pumps. The current road drainage network lacks a unified database. According to information provided by GUBBG, which

manages operations, about 70% of the main trunk drainage channels were established before 1990 based on urban planning and engineering surveys at that time. There are 18 main trunk drainage channels in UB City, with a total length of 33.73 km.

3) Underground water infiltration drainage facility

In the current situation, there are seven major roads and squares in the urbanized area of UB City with rainwater and groundwater drainage infiltration facilities, and their operation and monitoring are managed by GUBBG. In Mongolia, 63% of the land is occupied by permafrost, and in UB City, it is said to be widely distributed at a depth of 2-3 meters underground, creating soil that is difficult for rainwater and meltwater to infiltrate. Therefore, the overflow of underground drainage and accumulation on the surface has become an issue, and facilities to drain groundwater to rivers have been installed. Pipes with perforated structures, like those shown in Figure 2.6.8, are buried underground to allow groundwater to infiltrate and discharge into rivers.



Зураг 29. Хуванцар шүүрүүлийн хоолой; Төмөр бетон шүүрүүлийн хоолой (Жишээ зураг)

Source: Master plan for city engineering preparation measures

Figure 2.6.8 Underground water infiltration drainage pipe

(3) Water Distribution Facility (Water Distribution Reservoir)

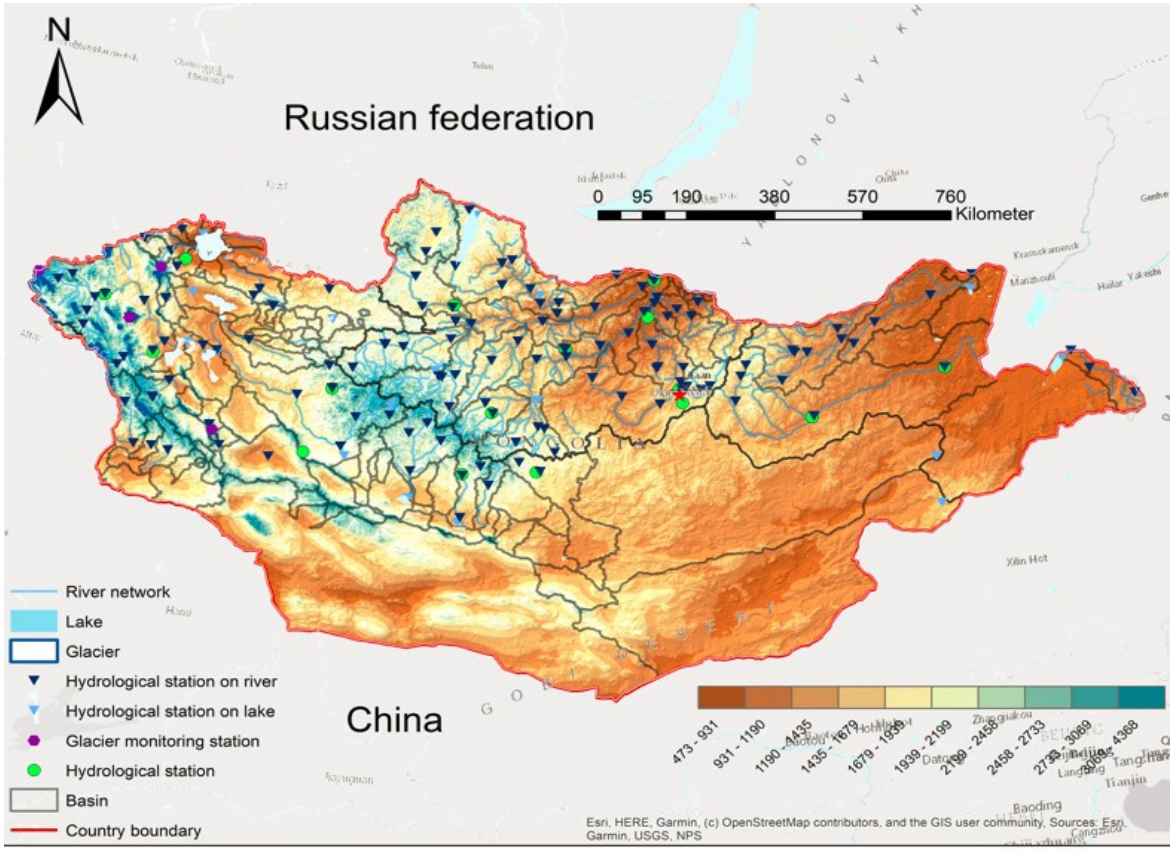
Currently, the population of UB City is estimated to be 1.69 million people (Table 2.1.2), and according to the UB City Water and Sewerage Corporation, the tap water penetration rate is estimated at 84%. The remaining 16% corresponds to satellite cities and ger districts around UB City. In areas where water supply has not yet been extended, water is distributed by trucks. It is estimated that 500,000 households live in the ger districts, and the penetration rate of tap water has not been clarified due to the lack of statistical surveys.

UB City currently has 13 water distribution reservoirs, and the daily water supply volume is 160,000 to 180,000 m^3. The water supply method primarily uses two systems: natural flow from the reservoir or pump pressurization. Currently, despite some water pressure drops, the system can meet demand during peak times (18:00-21:00 with 9,000 m^3/h). However, during this period, the water level in the reservoir decreases rapidly, continuing a high-risk situation of dysfunction.

2.6.4 Non-structural Measures for Floods and Urban Drainage

(1) Observation Measures for River Floods

In 16 out of the 21 provinces in Mongolia where there are rivers and lakes, 158 water level observation stations and measuring devices have been installed along the rivers.



Source: IRIMHE

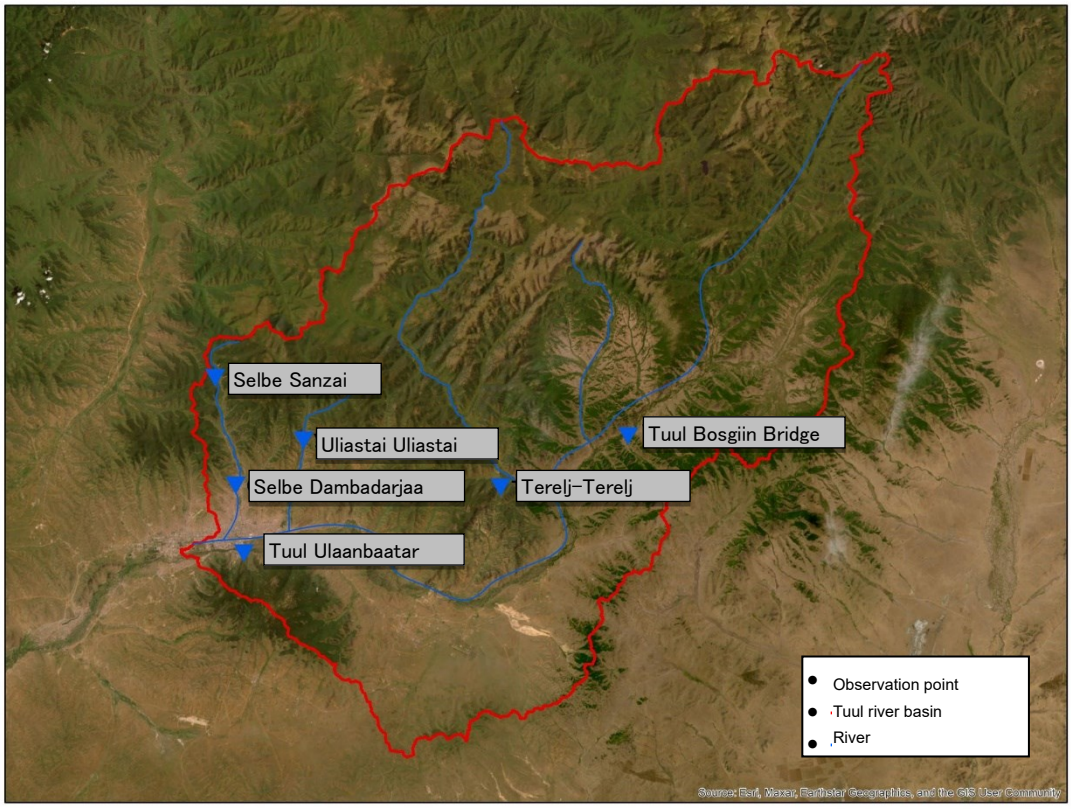
Figure 2.6.9 Location Map of Observation Stations

Currently, there are eight water level observation stations in the Tuul River basin near UB City, including two stations along the Selbe River. The details of the observations are shown in Table 2.6.9, and the locations of the observation points are indicated in Figure 2.6.10 (the positions of Kherlen Baganuur and Ulaanbaatar Urtuu Stations shown in the table, are not indicated on the map and are unknown). The observations are conducted by visual reading by the observers, the observers visit the observation points at 8 AM and 8 PM, measure the water level, water temperature, and other parameters marked with a "+" in the table, and report the results to IRMHE via mobile phones. During periods of rising water levels, observations are conducted every 2-4 hours.

Table 2.6.9 Observation content of the water level observation stations in the Tuul River system

Observation Contents/ Measurement Items	Water Level Observation Station Name							
	Tuul Bosgiin Bridge	Tuul Ulaanbaatar	Tereji Tereji	Selbe Sanzai	Uliastai Ulliastai	Kherlen Baganuur	Ulaanbaatar Urtuu	Selbe Dambadarjaa
Water Level, H in cm	+	+	+	+	+	+		+
Water Level Increase Observation	+	+	+	+	+	+		+
Parallel Counting	+	+	+	+	+	+		+
Water Temperature	+	+	+	+	+	+		+
Ice Phenomena	+	+	+	+	+	+		+
Snow and Ice Depth Measurement, cm	+	+	+	+	+	+		+
Air Temperature	+	+	+	+	+	+		+
Wind and Waves	+	+	+	+	+	+		+
Rainfall	+	+	+	+	+	+		+
Discharge Rate, m^3/s	+	+	+	+	+	+		+
Turbidity Sample								
Sediment Discharge, R								
Hazardous chemicals and pollutants sample		+	+	+		+		
Biological Sample		+	+	+	+	+		
Flood Information	+	+	+	+	+	+		
Normal Information		+	+					
Phenomenon Information		+	+					
Soil Water Level, cm								
Soil Water Temperature								
Soil Water Chemical Composition								
Water Surface Gradient								
Soil Infiltration								
Glacier Observation								
Measurement of snow in fields								
Water Balance Survey								
Sediment Observation								
Riverbed Morphology Survey		+						
Local water and weather information service	+	+	+	+	+	+	+	+
Groundwater ice plate								
Permafrost observation point								

Source: IRIMHE



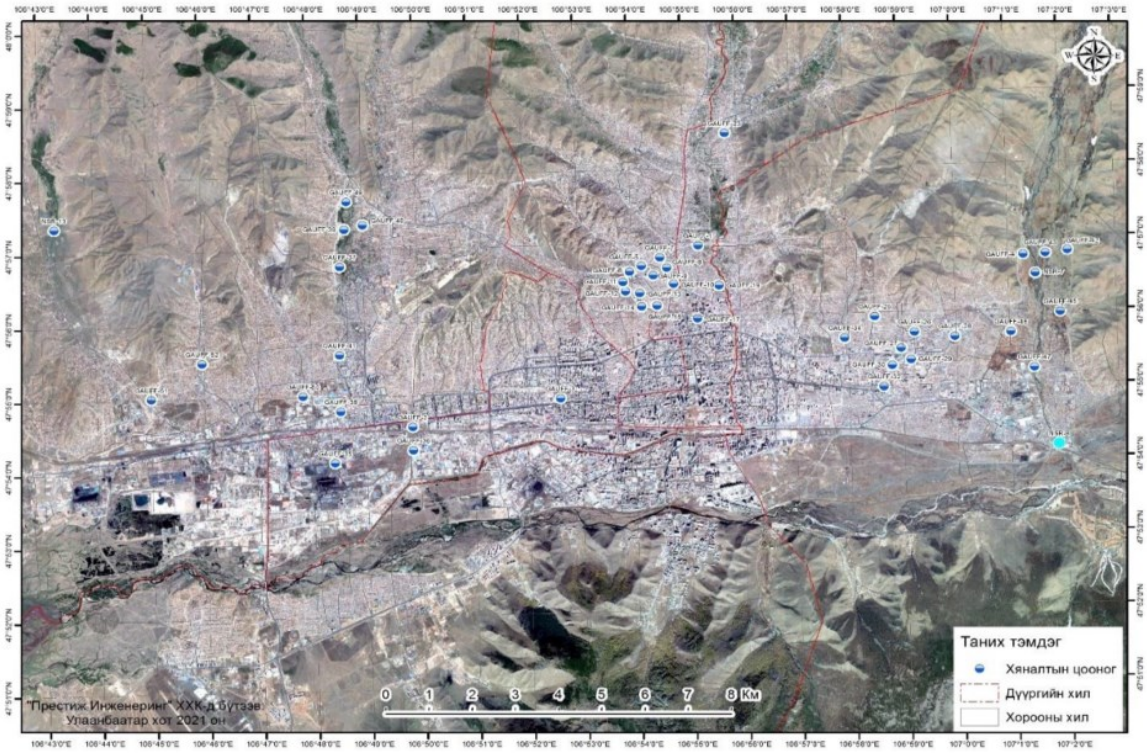
Source: IRIMHE

Figure 2.6.10 Location Map of Observation Points (Tuul River Basin)

(2) Groundwater Levels Observation Well

In UB City, there are 43 groundwater observation wells across six districts, managed by GUBBG, primarily for monitoring and analyzing groundwater levels and quality. These wells were planned and installed by Mongolian private enterprises at the request of the UB City Investment Bureau in 2011, 2014, and plans for 2025. Data from these wells, including groundwater levels and contamination levels, are integrated into a Geographic Information System (GIS[28]). Devices like automatic water level data loggers and membrane-type pressure gauges are installed in these wells to collect long-term data on temperature and pressure, in addition to water levels.

[28] Geographic Information System



Source: Master plan for city engineering preparation measures

Figure 2.6.11 Distribution Map of Groundwater Levels Observation Wells

Source: Master plan for city engineering preparation measures

Figure 2.6.12 Groundwater Levels Observation Wells

2.6.5 Emergency Response System

(1) Emergency Response System

At the national level, after a disaster, according to the provisions of the revised Disaster Prevention Law Article 37, Paragraph 1, Item 4 (under consideration), a Disaster Response Headquarters is established within NEMA (or another ministry depending on the situation), by order of the Deputy Prime Minister, who is the chairman of the National Emergency Committee. This headquarters handles emergency responses and recovery/reconstruction efforts. While there are no fixed standards for the setup and member composition of the Disaster Response Headquarters, it is generally formed immediately after a disaster, with staff from related fields appointed by the Deputy Prime Minister based on the type and nature of the hazard or accident.

Nationally, the Disaster Response Headquarters is composed of members from related ministries, with

the Deputy Prime Minister as chairman. Specialized teams can be formed to tackle each specific measure. Similarly, NEMA forms specific working groups to engage in concrete activities in the event of a disaster, and a draft of NEMA's internal rules is prepared.

Table 2.6.10 Disaster Response in National Level (First Hour Excerpt)

Implementation measures	Post-disaster timing	Responsible agencies	Supporting agencies
Early warning	0 min	NEMA	IAG, Mass media, Cell phone company
Communication of disaster information to residents	30 second – 5 min	NEMA	IAG, Mass media, Cell phone company
Initiation of rescue, firefighting, and order maintenance activities	1 min -2.5 min	NEMA	Information Analysis Department of the National Security Council, National Disaster Management, Intelligence Agency, Military General Staff, Border Guard Agency, Police Agency, Enforcement Agency, Audit Agency
Information transmission from the Chairman of the National Emergency Conference to the National Security Council	1 min -2.5 min	NEMA, IAG, Municipality	
Collection of initial information on earthquake risk	1 min -2.5 min	National Security Council, NEMA	
Current situation assessment	2.5 min -10 min	National Security Council, NEMA	
Verification of personnel and equipment	2.5 min -10 min	NEMA	-
Registration, instructions, and guidance of residents evacuated to designated locations	By 10 min	Municipality	NEMA
Securing roads, entrances, conditions for rescue operations, environmental arrangement	By 10 min	NEMA	-
Search and rescue operations for disaster victims	By 10 min	NEMA	Ministry of Education, Culture, Science, and Sports, Police Agency
Classification of disaster victims, provision of first aid and medical services	By 10 min	Ministry of Education, Culture, Science, and Sports, Police Agency	MCUD, Ministry of Road Transport Development, Ministry of Energy, Ministry of Education, Culture, Science, and Sports, Ministry of Defense, Police Agency, NEMA, National Registration Agency
Establishment of a disaster management headquarters	30 min – 1 hour	National Emergency Conference	Cabinet, National Disaster Management
Elevation of disaster preparedness levels, declaration of emergency, and other related decisions	30 min – 1 hour	National Security Committee, Cabinet, prefectures, Mayor of the capital	Disaster Management Headquarters, NEMA
National, prefectural, and capital disaster management plans, implementation of decisions by the Disaster Management Headquarters	30 min – 1 hour	Disaster Management Headquarters, prefectures, Mayor of the capital	National Emergency Conference, National Disaster Management

Source: NEMA

At the local level, as outlined in the revised Disaster Prevention Law, Article 37, Paragraph 1, Item 2, a disaster response headquarters is established by the order of the governor or other heads of local governments to respond to specific types of disasters. In the case of UB City, following an earthquake, the "Capital Emergency Response Task Force" acts as the disaster response headquarters, established under the Capital Governor's Order A/914 of 2014, to manage emergency responses, recovery, and reconstruction efforts.

Table 2.6.11 Composition of the Task Force for Earthquake Response of the Capital Emergency Council

- Leader
  - Deputy Mayor in charge of Finance & Economy
  - Director of the Capital's Emergency Management Agency
- Members
  - Deputy Mayor in charge of Urban Development & Investment
  - Deputy Mayor in charge of Roads, Transportation & Infrastructure
  - Deputy Mayor in charge of Employment & Welfare
  - Deputy Mayor in charge of Ecology & Green Development
  - Deputy Mayor in charge of Social Development
  - UB City General Manager and Director of the Mayor's Office
  - Director of the Mayor's Office of the Capital
  - UB City Chief Architect and Director of the Capital Urban Planning & Master Plan Bureau
  - Chief of Staff of the Capital Military
  - Director of the Capital Property Bureau
  - Director of the UB City Emergency Response & Coordination Center
  - Director of the UB City Police Department
  - Leader of the Task Force for Flood & Freezing Measures
  - Leader of the Task Force for Facility Fire & Strong Wind Measures
  - Leader of the Task Force for Infectious Disease Outbreak Measures
  - Leader of the Task Force for Accident Response Measures
  - District Mayor of the affected area

Note: Task Force members can have simultaneous membership.

Source: NEMA

(2) Fire Emergency Response System

UB City's fire and emergency response system consists of 15 fire and rescue units under the EMDC. Fire and emergency medical services are dispatched in response to calls from the Police Agency's call center. For the largest unit, the Chingeltei district's 10th Rescue Fire Brigade at the main EMDC building, the setup includes 113 personnel, 2 ladder trucks, 8 pump trucks, and 2 lighting and power supply trucks. The smallest unit, the 11th Brigade in Songinokhairkhan district, consists of 34 personnel, 2 pump trucks, and 1 Russian-made water supply truck. Japan provided grant aid totaling 639 million yen in 2002 for 10 pump trucks, 6 tankers, 1 chemical unit, 1 ladder truck, and other equipment to UB City, and in 2013, an additional 838.8 million yen for 8 pump trucks, 8 tankers, 1 chemical unit, 2 ladder trucks, 3 lighting rescue vehicles, and additional equipment.

(3) Issues

- For the national level emergency response system, the disaster response headquarters' establishment, the arrangement for setting up specialist units, the initial response deployment, and the coordination among organizations are not sufficiently detailed in the national disaster response plan. Therefore, it is necessary to enhance these provisions and regulations.
- To increase the effectiveness of emergency response measures, the various rules and regulations related to emergency response in the disaster plan should be organized, and the specific procedures for response should be comprehensively shown.
- For disaster response, it is necessary to clearly show the communication of disaster area information and the command-and-control system within and outside the disaster response headquarters.

2.7 Trends in Disaster Prevention-Related Technologies

2.7.1 Technologies for Earthquakes

(1) Technologies related to Aseismic Design among others

Seismic design comprises the assessment of ground motion at the construction site of a structure and the evaluation of the structural integrity against the seismic motion.

In Mongolia, ground motion assessment is conducted by IAG. Deterministic evaluation (estimation of ground motion intensity at construction sites based on scenario earthquakes) and probabilistic evaluation (estimation of probability distribution of ground motion intensity from all earthquakes surrounding construction sites) are available. These evaluations are internationally comparable to those of highly developed countries.

On the other hand, the structural integrity assessment is conducted by comparing the member forces obtained from response analysis with the member capacities. These assessments are performed using design software such as LIRA or ETABS, developed in advanced countries. From this perspective as well, sufficient technology is available. However, for structures that cannot be addressed using existing design software, such as seismic isolation or damping structures, there is a need for improvement in technical capabilities and the development of relevant software.

Furthermore, due to the underdeveloped market for seismic diagnosis, the current situation necessitates methods that are almost manual in nature. Therefore, it is difficult to claim that sufficient technical capabilities are currently available in Mongolia. However, it is expected that this issue will be resolved as the market develops.

(2) Technologies related to Construction Works.

In terms of construction technology, it cannot be said that sufficient technical expertise is guaranteed. This is due to the limited construction period imposed by Mongolia's climate, which results in a lack of skilled construction workers. The shortage of construction workers not only leads to a decrease in construction quality but also makes it difficult to acquire new construction techniques. As seismic retrofitting is a relatively new technology in Mongolia, securing construction workers capable of learning and disseminating it is crucial for advancing seismic resilience in the future.

2.7.2 Technologies for Floods

(1) Technologies related to Design

Regarding rivers, it is assumed that there is a certain level of design capability in river measures, as flood analysis and setting of design flow rates are currently being conducted, and river design based on design flow rates is being implemented. Additionally, the ability to carry out 3-D design using BIM/CIM is also presumed, as construction images are created in 3DCG, indicating competence in this area.

(2) Technologies related to Construction Works

Regarding rivers, construction primarily focuses on concrete revetments, including complex cross-section revetments and river facilities. Therefore, it is considered that there is a fundamental construction capability in this area.

2.8 Public Awareness of Disasters

2.8.1 Public Awareness of Earthquakes Disasters

(1) Current Awareness

The earthquake near Khuvsgul in 2021, which was also felt in UB City and caused damage to

buildings in the vicinity, has increased public interest in earthquake disasters. Additionally, the Phase 1 introduction of the earthquake simulation device has contributed to raising awareness about earthquakes among Mongolians, who have very little experience with such events.

(2) Lack of Awareness and the cause

While awareness of earthquakes and their potential disasters is increasing in Mongolia, it is not yet sufficient to advance seismic reinforcement widely. The reasons for this lack of awareness include:

- Insufficient Specific Disaster Awareness: Mongolia has not experienced major urban disasters. There is very low awareness of the extent of damage to buildings and the potential human and economic losses that could occur in the event of a major earthquake in urban or nearby areas. This lack of awareness hinders the development of structural measures.
- Lack of Awareness and Knowledge About Seismic Reinforcement: In Mongolia, rebuilding has been the main approach to dealing with aging buildings for many years. As a result, seismic reinforcement is not commonly considered as a measure for seismic retrofitting. Even when seismic reinforcement is considered, there is a lack of knowledge about its methods and effects, preventing recognition of its economic benefits (cost-effective seismic improvement) and convenience (reducing business interruption), which in turn inhibits the implementation of seismic reinforcement.

2.8.2 Public Awareness of Floods Disasters

(1) Current Awareness

Although the last extensive flood damage in UB City and its surroundings dates back to 1966, the inundation that occurred in the city center in July 2023 has heightened local residents' awareness of flood disasters in UB City.

(2) Lack of Awareness and the cause

Although awareness of flood disasters is increasing, it is still insufficient for advancing flood mitigation efforts. Reasons include:

- Lack of Awareness of Specific Disaster Events: Until recently, flood disasters in UB City were uncommon. Therefore, there is insufficient awareness of the scale and duration of potential economic damage caused by floods.
- Lack of Awareness of Flood Mitigation: Illegal construction in floodplain areas is common. This development can exacerbate flood damage. Despite the city's urbanization, the absence of major flood damage has led to insufficient awareness of the need for flood mitigation, promoting development that includes illegal construction.

2.9 Trends in Support of Other Donors

(1) UNDP

In the UNDP's efforts on disaster management in Mongolia, during Phase I (2002-2004) of the "Project on Strengthening Disaster Mitigation and Management System of Mongolia," the organization supported the establishment of the disaster management law and aided NEMA. Subsequently, until 2016, they implemented up to Phase IV of the "Project on Strengthening Local Level Capacities for Disaster Risk Reduction, Management and Coordination in Mongolia," reviewing disaster prevention, preparedness, and the roles of NEMA and related agencies. They also supported resident disaster prevention training and established an early warning mass messaging

program[29] in 15 target areas[30], testing emergency SMS messaging across 319 localities. Furthermore, in Dornod and Khentii aimags, they supported disaster mitigation initiatives[31] at four localities, establishing a disaster fund for local activities and providing grants for 67 small-scale projects, supplying firefighting equipment like pumps, hoses, and extinguishers.

Post-2016, UNDP's support has included financial aid for the biennial comprehensive disaster prevention training hosted by NEMA since 2019.

(2) United Nations Human Settlements Programme (UNHAVITAT)

UNHABITAT implemented two projects aimed at improving the living conditions in Ger areas of Ulaanbaatar: "The Citywide Ger Area Upgrading Strategy and Investment Plan for Ulaanbaatar" from 2006 to 2010, and "The Community-Led Ger Area Upgrading Project in Ulaanbaatar City in Mongolia"[32] from 2009 to 2013.

(3) Asian Development Bank (ADB)

ADB planned to start the "Strengthening Community Resilience to Dzud and Forest/Steppe Fire" project in October 2016, targeting Dornod, Govi-Altai, Khuvsgul, and Sukhbaatar aimags, with detailed surveys conducted from March 2016. Funded by the Japan Fund for Poverty Reduction, this project aims to improve the livelihoods and reduce poverty among nomadic herders by focusing on dzud and forest fires as key disasters, excluding earthquakes.[33] The project, completed in 2020, supported the formulation of disaster risk management plans at the bag level in these areas, enhancing the communities' resilience to dzud and forest fires. However, ADB has not implemented earthquake-related projects; a planned project in 2022, "Strengthening Integrated Early Warning System," was postponed due to MED policy changes, with implementation currently uncertain.

(4) United Nations International Children's Emergency Fund (UNICEF)

As a member of the Education Cluster, UNICEF, in collaboration with MECSS, has established the "Emergency Response Task Force" within the cluster's activity group. Additionally, UNICEF is part of the Child Protection Sub-Cluster with World Vision, Save the Children, and MECSS, focusing on child protection activities during disasters in Mongolia. In July 2023, following flooding in UB City, UNICEF provided emergency support of $50,000, supplying 10 engine pumps and 450 meters of hose and pipes for draining flooded homes and streets. They also donated medical and first aid kits to the UB City Emergency Response Headquarters and the Emergency Center, aiding in preventing the spread of infections and managing hygiene during the flood.

(5) Micronesia Red Cross Society (MRCS)

MRCS has established Regional Disaster Response Centers in six domestic locations (UB City, Darkhan city, eastern, western, southern, and northern regions) to support local disaster response efforts. MRCS conducts training in both English and Mongolian on initial first aid during disasters for residents and private sector employees (including construction and mining industries) and international organization staff. MRCS also supports NEMA's annual comprehensive disaster prevention training, providing training to 49 disaster prevention officers across seven aimags in 2023. These trained officers, along with local MRCS staff, conducted volunteer training for 330 people.

Following the dzud disaster from December 2022 to February 2023, which affected 11,660 nomadic

[29] According to a UNDP staff member, the system sends weather alerts via SMS by converting meteorological information received from the Meteorological Agency into text format. These alerts are then sent from weather stations located in the soums to random residents' mobile phones. While the aforementioned early warning system only targets UB city and two aimags, this mass messaging program uniquely includes remote areas.

[30] Dornod (Bayan-Uul, Bayandun), Selenge (Mandal, Altanbulag), Bulgan (Selenge, Teshig, I Saikhan), Khentii (Jargaltkhaan, Binder), Dundgobi (Gobi- Ugtaal, Bayanjargalan), Darkhan-Uul (V, VI), Ulaanbaatar (Chingaltei- XVll khoroo, Songinokhairkhan IV khoroo)

[31] Activities related to "promoting the activities and initiatives of residents to respond to disasters caused by climate change" as described in section 3.6.3(3) of the Community-Based Disaster Risk Management National Program.

[32] http://www.fukuoka.unhabitat.org/projects/voices/mongolia/detail08_en.html

[33] Mongolia Country Operation Business Plan（ADB）(http://www.adb.org/documents/mongolia-country-operations-business-plan-2014-2016)

people, support was provided through the International Federation of Red Cross and Red Crescent Societies (IFRC) Disaster Response Emergency Fund. This support included livestock care kits, financial support, and mental health services.

During the July 2023 floods, MRCS assisted with evacuations, distributed aid to 249 affected households, and conducted public awareness campaigns on infectious disease prevention and hygiene management. No further activities or plans have been confirmed since July 2023.

(6) World Vision

World Vision is implementing the "Climate Resilient Communities (CRC)" project from 2022 to 2025, aiming to establish communities resilient to natural disasters through enhanced disaster preparedness and stabilized livestock and agricultural production. The project target areas are UB City, Dornod, Dundgovi, Dornogovi, Govi-Altai, and Uvs provinces. The project involves building disaster management structures and activities to enhance community disaster resilience, strengthening veterinary facilities, introducing community-based risk assessments, and supporting necessary measures for disaster preparedness.

(7) Save the Children

Save the Children conducted humanitarian assistance for nomadic herders and their children in Khovd, Zavkhan, Govi-Altai, Bayankhongor, and Tuv provinces as a support measure for the dzud that occurred in parts of the country. From the end of 2022 to the beginning of 2023, Mongolia experienced severe winter conditions across 70% of the country due to the dzud. As part of this effort, hygiene kits were provided to 2,027 students staying in dormitories across a total of 25 sums in the aforementioned five provinces.

(8) World Bank (WB)

The City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city is implementing the "UB City Flood Risk Mitigation and Sewer Direct Connection & Renovation Technology Introduction Project" from 2024 to 2026. They prepared a proposal in 2023 to request support and cooperation from the World Bank. The total project cost is estimated to be 100 million USD, with 80 million USD allocated for the flood risk mitigation project and 20 million USD for the sewer direct connection and renovation technology project. The project will target the central areas of 6 districts in UB City and the summer house district. The project plans to expand and renovate aging flood prevention facilities and construct new flood prevention structures. Additionally, plans include the renovation and construction of new road drainage systems.

Table 2.9.1 Project Costs and Target Renovation Area of Flood Prevention Faicility and Road Drainage Faicility

No.	Target Restoration Area	Project Cost (JPY)
1	Uliastai River Flood Prevention Facilities, Riverbank Improvement Works	2,069,099,624
2	Shar Khad	582,973,692
3	Ulliastai Revetments	131,786,723
4	Dari-Ekh	439,435,407
5	Bayanzurkh District, Kohoroo No. 11	1,294,394,699
6	Khujir Bulan	1,124,079,612
7	Bio Songino Tuul River	3,134,058,399
8	Bayanzurkh District Road Drainage Channels	2,166,417,501
9	Tankhilt Flood Prevention Revetments	1,455,730,884
10	Chingeltei District, Kohoroo No. 17 Flood Prevention	287,500,000
11	Selbe River Flood Prevention Measures (From Dambadarjaa Bridge to Sharga morit Bridge)	1,725,000,000
12	Central Stormwater Trunk Main (Eastern Region)	3,450,000,000
	Total	17,860,476,540

Source: JST based on the document from City Engineering Facilities Department, Office of the mayor of Ulaanbaatar city

As a result of internal discussions within the World Bank, it was decided to conduct a survey. The

City Engineering Facilities Department, Office of the Mayor of Ulaanbaatar City, submitted a request for implementation to the Ministry of Economic Development and the Ministry of Finance in January 2024, which was approved in April of the same year. The World Bank's survey will be conducted starting in May 2024, during which the target areas and cost estimates will be reviewed.

Chapter 3 Issues Analysis of Disaster Prevention in Ulaanbaatar

In this chapter, we focus on the capital city, where national functions and population are concentrated, and where economic and human losses are significant in the event of disasters. We analyze the challenges in the field of disaster prevention and report a long-list of project proposals as potential measures, prioritized based on urgency and importance.

3.1 Building

3.1.1 Current Status and Issues on Public Buildings

(1) Current Status

Public buildings often serve multiple functions beyond their original purpose, including functioning as emergency response centers or shelters during emergencies. However, with the introduction of seismic diagnosis, it has become clear that the strength of these buildings is insufficient for the anticipated seismic intensity (design seismic intensity). Therefore, addressing whether to rebuild or retrofit these public buildings for seismic resilience has become an issue.

The insufficient seismic resilience can be attributed to two main factors. Firstly, it stems from poor construction quality or the absolute lack of seismic resilience due to substandard construction practices or illegal modifications. Secondly, it results from the revision of Seismic Design Building CODE. This revision has led to an increase in the design seismic intensity compared to the previous standards, approximately one level higher (twice the seismic load) following the revision of Mongolia's seismic standards in 2021.

Considering the difficulties in predicting earthquakes and in securing budgets for new constructions, it is evident that seismic retrofitting, which can swiftly and cost-effectively improve the seismic performance of buildings, is necessary. Seismic retrofitting offers advantages over new construction as it allows for the continued use of existing buildings while enhancing their seismic resilience.

In Phase 2 Project, ten public buildings were selected from the seismic diagnosis list compiled by the MCUD Department Audit Agency (formerly GASI) and the UB City Planning Department. These selections were made based on criteria such as their importance as disaster prevention bases and the representativeness of seismic retrofit methods. Subsequently, using the seismic diagnosis methodology developed in Phase 1 Project, seismic diagnoses were newly conducted for these selected buildings.

(2) Issues

Public buildings serve as disaster response centers for activities such as command and control, emergency medical treatment, and support for affected individuals. Ensuring these functions necessitates that the building remains operational even during disasters. Moreover, when rapid evacuation or movement of occupants becomes difficult during disasters, the continued usability of the building becomes crucial. Therefore, it's imperative to ensure the seismic resilience of hospitals, government buildings, and educational facilities with disaster response functions. Additionally, to maintain the continued use of the building, not only the structural components but also non-structural elements and building systems need to be sound.

It's important to select seismic retrofitting measures keeping in mind several factors: they should be cost-effective compared to new construction, they shouldn't hinder daily operations, and they should be compatible with the design and construction technology available in Mongolia.

3.1.2 Current Status and Issues of Disaster Prevention Facility

(1) Current Status

In Mongolia, the number of natural and man-made disasters increased from 2,547 cases in 2000 to 4,321 cases in 2022, indicating a rising trend. Similarly, the number of fatalities rose from 98 in 2001 to 297 in 2023, tripling over the period. Additionally, the population of UB city accounts for 48.1% of the national population, and its population density nearly doubled from 163 people per square kilometer in 2000 to 328 people per square kilometer in 2022. This increase in population density raises the risk during earthquakes, floods, and other natural disasters.

Therefore, given the concentration of national administrative, scientific, health, industrial, infrastructure, and lifeline facilities and institutions, as well as the active seismicity in UB city, measures for disaster risk reduction, preparedness of personnel and equipment, search and rescue operations, debris removal, and emergency restoration capabilities are being gradually implemented. As part of these efforts, plans are underway to evacuate up to 400,000 people to 33 wide-area evacuation sites covering a total area of 1,430.1 hectares in the event of a large-scale disaster. These sites are being prepared to supply essential goods to the evacuees.

According to the National Reserve Law, it is recommended to stockpile food and other essential supplies for 90 days to meet the needs of the entire population in the event of a disaster. To appropriately stockpile the required quantities of 16 types of food for the population for 90 days, a total of 370,440 tons is needed nationwide, with 180,100 tons required for Ulaanbaatar (UB) city. For the 400,000 people to be evacuated in the event of a disaster, 56,400 tons of food need to be stored in warehouses. The 16 types of food include meat (livestock), fish, poultry, milk (3.2% fat), dairy products (yogurt), wheat flour, wheat products, rice, potatoes, vegetables, legumes, fruits, eggs, vegetable oil, butter (72% fat), and sugars.

Although there are about 100 private companies with ammonia and freon refrigerated warehouses for food storage, it is currently impossible to stockpile food due to the aging of these facilities and damage to the buildings. Additionally, there are no constant-temperature and low-temperature warehouses that meet the MNS 5364:2011 standards[34] for national reserves. The stability and balance of networks for the production and supply of food and goods have been disrupted by global factors such as climate change, the COVID-19 pandemic, and international political situations. Therefore, there is a need for food storage warehouses with refrigeration capabilities to preserve the 16 types of food.

Currently, the stockpile includes 6,300 tons of five items: wheat flour, rice, sugar, meat, and drinking water. The total current warehouse capacity of 8,250 tons does not meet sanitary standards, significantly impacting the quality and safety of the food. NEMA has only one national food storage warehouse, which is insufficient in quantity and lacks constant-temperature and refrigerated storage facilities (an estimated shortage of 50,000 tons).

Moreover, supply of 27.1% of dairy products, 38.2% of wheat products, 38.5% of vegetables, 48.6% of eggs, 67.4% of butter, 98% of chicken, 98.5% of vegetable oil, and 100% of fish and seafood, rice, and sugar in Mongolia are reliant on imports. Consequently, there is a constant risk of shortages if the supply is disrupted.

Establishing food storage warehouses for the 16 essential food items is an urgent priority. Efficient storage facilities that maintain the quality and hygiene conditions of the food and meet technical requirements are needed.

In the case of fuel, it is anticipated that supply from Russia and China could be disrupted during a disaster. Additionally, in 2023, the supply to Mongolia was cut off as a result of sanctions against Russia.

The current petroleum storage facilities are deteriorating, with 50% requiring major repairs and 28% being unusable.

[34] Mongolian standards for warehouse facilities reflect the technical requirements for the receipt, storage, and distribution of goods.

According to NEMA, a minimum of one month's worth of reserves is required as a basis for recovery. As indicated above, in addition to the increasing risk of natural disasters, NEMA also needs to enhance its reserves.

(2) Issues

During disasters, the difficulty of transporting supplies is anticipated, making storage warehouses extremely important as disaster prevention facilities. Currently, Mongolia is advancing the national reserves of fuel and food in preparation for disasters and border closures. The goal is to ensure that 50% of the residents of UB city can stay in evacuation centers for 10 days. Moving forward, it is crucial to not only continue the construction of new facilities to expand capacity but also to renovate and maintain the use of existing warehouses for fuel and food storage.

Furthermore, in the process of renewal, it is essential not only to adhere to the previous specifications but also to update facilities and review operational plans to ensure that they match the functionality of newly constructed warehouses.

3.2 Lifeline

3.2.1 Current Status and Issues concerning Lifeline Facility

(1) Power Generation Facilities and Hot Water Heat Sources

1) Current Status

As mentioned earlier, approximately 70% of the total electricity demand in Mongolia in 2022 is met by three coal thermal power plants (TPP2, 3, 4) located in UB city. Additionally, the hot water supply to the heating system in UB city is entirely provided by the steam turbines of the three power plants and the Amgalan heating station.

The power plant facilities can be broadly categorized into buildings and equipment (generators, turbines, boilers, etc.). The seismic performance required for buildings follows the "Seismic Design Building Code" (BNbD22-01-21). However, TPP2, 3, and 4 were designed outside Mongolia, and the standards adopted there also followed the old Soviet standards (SNiP). Considering that the Seismic Design Building Code BNbD22-01-21 specify a seismic design intensity approximately one level higher than the old standards, and the old standards follow SNiP, it follows that the seismic resilience of the buildings is insufficient compared to the current standards.

On the other hand, in the design of TPP2, 3, and 4, seismic resilience was not required for the equipment. Therefore, it is considered that the seismic performance required by the current BNbD22-01-21 has not been achieved.

2) Issues

Regarding the buildings of thermal power plants, it is considered that the seismic strength of these facilities is insufficient due to revisions in the design seismic intensity and aging. Based on on-site inspections, restoration of structural drawings and investigation of material strength will need to be conducted. After conducting a seismic diagnosis, examination of specific reinforcement methods and the necessary costs will also be done.

(2) Transmission and Distribution Facilities

1) Current Status

In 2023, UBEDN conducted a seismic evaluation of its branch buildings and substation buildings. While many buildings were found to be deteriorating and having seismic issues, and despite the necessity for renovations, they are currently in the phase of sequentially considering renovations without any concrete plans in place. Up until now, no seismic evaluations of power facilities have been conducted, but the necessity of confirming the seismic capacity of these facilities has been

acknowledged, and such evaluations are planned. However, no budget for this has been allocated for 2024. There are no laws, internal standards, or manuals concerning the seismic design of power facilities, and seismic loads are not currently considered in equipment design. Nevertheless, if future seismic capacity evaluations indicate the need for seismic design, the consideration of seismic loads might become necessary.

Additionally, at UBEDN, there are numerous distribution facilities that have significantly deteriorated and require early renovation. A systematic equipment plan is scheduled for these facilities. These renovations are fundamentally aimed at addressing aging, as the facilities no longer possess their original design strength due to deterioration.

On the other hand, in 2023, there were four floods that caused the collapse of 28 35kV utility poles, while foundation reinforcement was carried out on three poles to prevent their collapse. Additionally, 20 substations suffered flood damage. To mitigate flooding, temporary flood barriers were constructed around substations and utility poles, and drainage pumps were used to prevent inundation.

2) Issues

Due to the potential for significant equipment damage and major power supply disruptions in UB City caused by a large-scale earthquake, there has been an increasing recognition of the necessity for earthquake countermeasures in recent years. In response, UBEDN plans to undertake equipment renovations as part of its earthquake countermeasures, and this response is urgent. These renovations are scheduled from 2024 to 2028 and will involve approximately 3,300 35kV utility poles, 10,000 6-10kV utility poles, and 28,000 0.4kV utility poles, with a total budget of 661.3 billion JPY.

On the other hand, while it is not necessary to implement measures for the equipment itself as part of future flood countermeasures, it is essential to procure materials and equipment to prevent damage to power facilities and to shorten the recovery time in the event of large-scale floods in the future.

(3) Transmission and Distribution Facilities

1) Current Status

The hot water piping system is broadly divided into the main pipes running from the power plant (heat source) to the relay station, and the branch pipes from the relay station to the consumers. The former falls under the jurisdiction of MOE, while the latter is under the jurisdiction of MCUD. There are no seismic standards for piping systems (pipes and pipe racks) in Mongolia, and although the initial designs used Russian standards, those also lacked seismic regulations. Consequently, the vulnerability of these systems during an earthquake is unknown, and the current situation requires addressing issues as they arise.

The service life of piping systems is 20 to 30 years, so deterioration due to aging is thought to be negligible. Additionally, most branch pipes are assumed to have high seismic performance as they are buried pipes, and replacement of buried pipes is being carried out as part of WB projects.

On the other hand, there has been no regular replacement or installation of piping racks, and signs of deterioration are visible in some cases. Concerns arise regarding insufficient seismic resilience due to this deterioration.

2) Issues

Regarding the hot water piping facilities, seismic reinforcement of the piping racks is necessary. However, individually diagnosing and designing reinforcements for a vast number of piping racks is not feasible. Therefore, it is necessary to categorize the piping racks based on scale (height and number of supported pipes) and establish standard reinforcement methods for each design seismic intensity.

Therefore, as the initial step, it is advisable to consider and standardize typical reinforcement methods. Furthermore, it is desirable for the reinforcement of piping racks to be carried out based on the established standards.

(4) Communication Facilities

1) Current Situation

Currently, there are analog radio broadcasting relay stations in Umnugovi, Dornod, Dornogovi, Sukhbaatar, and Bayankhongor aimag centers, broadcasting nationwide. Regarding television broadcasting, Mongolia National Television's Channels 1 and 2, along with 16 private broadcasting channels, are digitally broadcast nationwide to 330 sums via optical fiber. Disaster information is sent to each media outlet through the Ministry of Digital Development from NEMA, and while television often has a special frame set up for this, radio broadcasts are optional. The digitalization of radio broadcasting is planned along with the renovation of relay stations, as the analog relay stations in the aforementioned aimag centers were established in 1930 and renewed in 1988, and the equipment has become significantly aged. Network digitalization and relay station expansion are planned in conjunction with future relay station renovations.

For emergency alerts during disasters, reliance is on mobile operators' communication networks, with messages transmitted to each device as text messages via the SMSC (Short Message Service Center). In this network, the SMSC ensures bi-directional communication between the origin and the user, which becomes data-heavy and involves load during mass transmission. Moreover, data transmission occurs to all mobile device users, not just those in the warning issuance area, requiring 8-9 hours for emergency alerts by any operator currently.

2) Issues

The transmission of early warning signals during disasters relies on the networks of mobile operators. Due to network load during disasters and other reasons, it is necessary to introduce a system that utilizes the high penetration rate of smartphones in the Cell broadcast system, which is not affected by the mobile operators' networks, to rapidly convey disaster warnings to residents.

Radio broadcasting, particularly AM broadcasting, has the widest audible range and can reliably transmit information. Therefore, by maintaining the FM and AM radio broadcasting networks digitally, a reliable network for information transmission and reception for residents is established, allowing residents in provincial capitals and remote areas to receive and transmit necessary information simultaneously, smoothly, and quickly. Thus, the digitalization of FM and AM radio broadcasting networks is required.

For the Ministry of Digital Development's disaster management operations, ensuring communication in disaster areas and rapid dissemination of disaster information are extremely important. Since securing communication in disaster-affected areas can take time and delays in restoring communication infrastructure are anticipated, the maintenance of satellite vehicles to instantly send information from disaster-affected areas using satellite communication networks is desirable.

3.3 River

3.3.1 Current Status and Issues concerning Rivers

(1) Current Situation

According to the flood simulation results by the Urban Engineering Measures Plan (MP), during a 100-year flood event, both Tuul River and Selbe River experience significant overflow, resulting in flooding in Ulaanbaatar city. Local surveys reveal that the Selbe River has a width of 20-60 m and a riverbed gradient of approximately 1/400 in the downstream area and 1/150 in the middle reaches. In the July 2023 flood, flooding occurred due to overflow near the meandering section of the Selbe River in the downstream area. However, the simulation results indicate that flooding would occur in the upstream area. Validating the accuracy of the hydrograph for flood simulation and confirming the use of terrain data are necessary. It is also observed that even in the upstream area, there are narrow sections with a river width of 20-30 m.

The embankments and levees are not well maintained. Some areas have embankment heights (or depths of excavated river channels) of only about 2 m (refer to Figure 3.3.1), and there are locations where the river width is narrow, causing bottlenecks (refer to Figure 3.3.3). Although the MP sets the planned discharge as the 100-year flow rate (approximately 290 m^3/s), there are numerous locations in the middle and lower reaches where the flow cannot be accommodated.

Furthermore, the channel widening plan under the MP is not sufficient because development has progressed very close to the channel, and many high-rise residential buildings such as condominiums have been constructed (some of which include illegal development without development permits, and in some cases residential buildings have been constructed in the channel).

(Flooded Area in July 2023 Flood) Embankment height: approximately 1.5m
Source: Survey Team

Figure 3.3.1 River channel condition in the downstream area of the Selbe River

Source: Survey Team

Figure 3.3.2 Bottleneck section in the downstream area of the Selbe River (red arrow)

Source: MP Basic Survey Edition

Figure 3.3.3 Proposed Construction Embankment Area in the Catchment Basin of the Selbe River

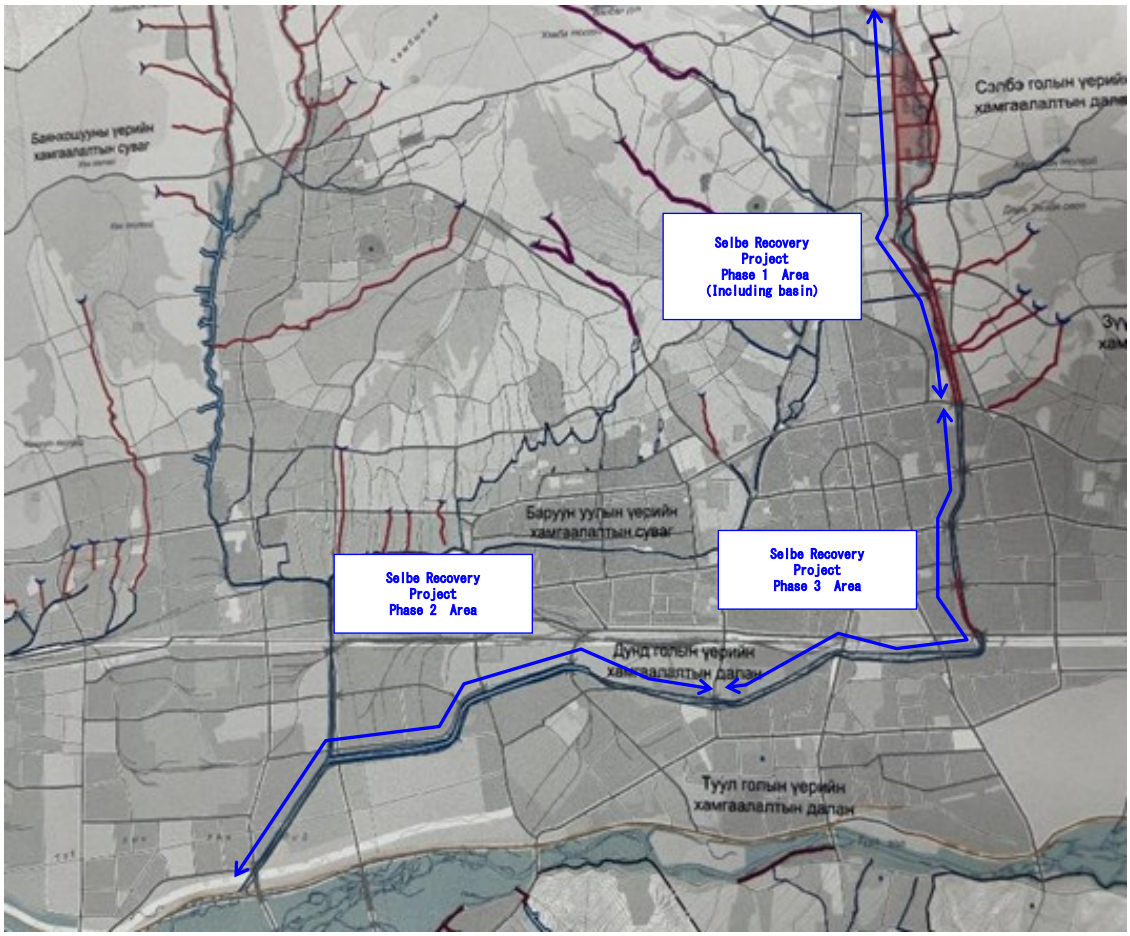
(2) Issues

The current issues are as follows:

- The design flow rate set in the Selbe River Restoration Plan lacks sufficient evidence due to unclear calculation conditions and other factors.
- The setting conditions for the hydrograph used in the flood simulation results lack sufficient evidence due to their unclear nature.

Considering that the Selbe River has a relatively small flow rate and a relatively steep gradient, it is believed that ensuring sedimentation through river channel improvement and enhancing the river's flow capacity can be particularly effective in reducing flood damage.

Currently, flood control measures under the Urban Engineering MP are being continued through the "Selbe River Restoration Plan" and are being re-planned in conjunction with road and regional development. In this project as well, the goal is to improve the flow capacity through river channel improvement for the entire upstream to downstream sections of the Selbe River, which is considered desirable in reducing flood damage.

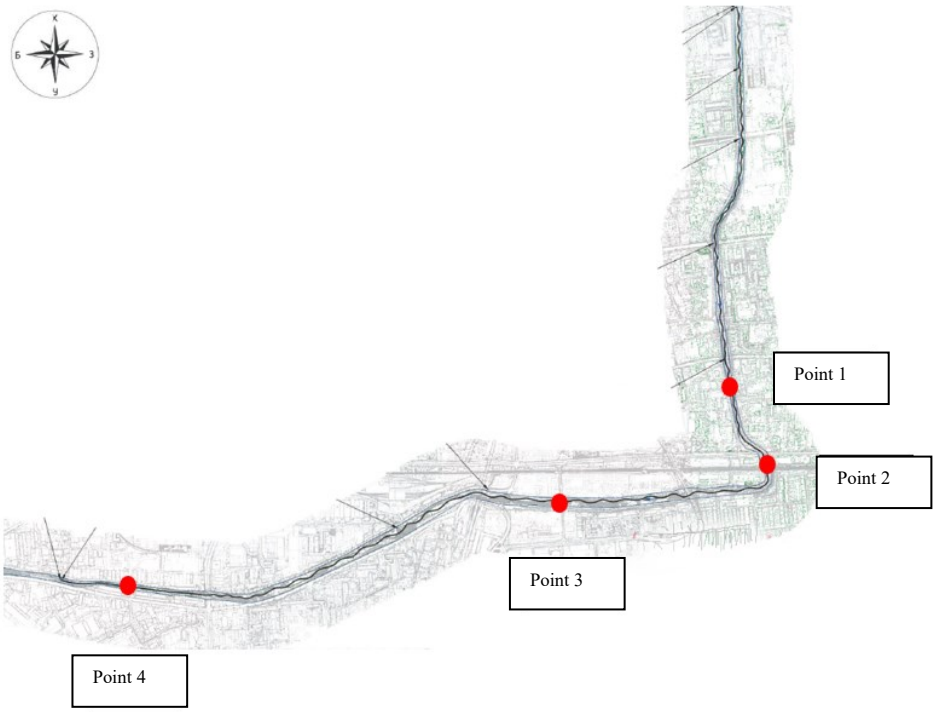


(Planned implementation areas in the Selbe River Restoration Plan)

Source: Created by the survey team based on the Selbe River Restoration Plan materials

Figure 3.3.4 Selbe River Flood Control Measures

Although the planned flow rate is generally set at around 150 m^3/s in the river channel improvement plan, there are bottleneck points in the middle and lower reaches of the Selbe River where the river width is narrow, and the flow capacity is low. The following are four locations that are considered to have particularly low flow capacity.



Source: Created by the survey team based on the Selbe River Restoration Plan Design Drawings

Figure 3.3.5 Plan view of bottleneck points

For these four locations, the flow capacity was calculated assuming an equal flow due to the steep gradient. The results are shown below. (For points 1, 2, 3, and 4, the cross-sections are after improvement. For point 2, the values were set based on on-site surveys.)

Table 3.3.1 Flow Capacity of the Bottleneck Points

	Incline I	Runoff coefficient n	Runoff coefficient S	Wetted perimeter A	Cross-sectional arear R	Velocity V (m/s)	Flow rate Q (m^3/s)
Point 1	0.002328	0.035	31.23	92.98	2.98	2.85	265
Point 2	0.002328	0.035	36.78	77.76	2.11	2.27	177
Point 3	0.002328	0.035	48.98	101.03	2.06	2.23	226
Point 4	0.002328	0.035	29.95	83.75	2.80	2.74	229

Source: Created by the survey team based on the Selbe River Restoration Plan Design Drawings

None of these points have the capacity to accommodate a flow of 288 m^3/s without a detention basin. In particular, the flow capacity at cross-section 2 is low at 177 m^3/s, which is a difference of approximately 110 m ^{3}/s from 288 m^3/s.

The overview of point 2 is as follows: Point 2 is the location where the railway bridge (Mongolia Transversal Railway) crosses the Selbe River. It has a narrow width of about 30 m.

Therefore, the Selbe River Restoration Plan also includes the construction of a detention basin in the upstream area. The current flow rate among others. are summarized as follows:

- The 100-year exceedance probability flow rate of the Selbe River is 288 m^3/s (refer to 2.5.2 (2)),

- The design flow rate of the downstream river channel is approximately 150 m^3/s, and
- The storage capacity of the detention basin in the Selbe River Restoration Plan is approximately 1.3 million m^3.

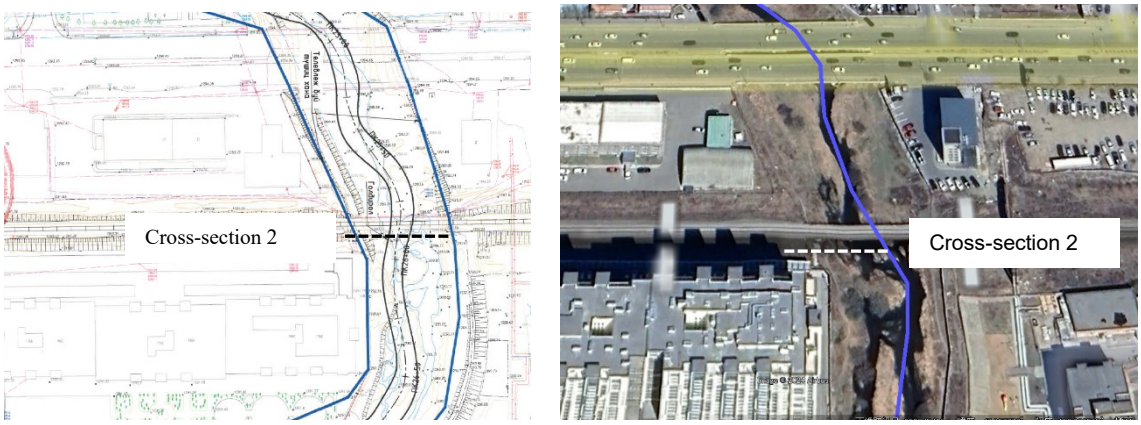
If we assume that the storage capacity of the detention basin of 1.3 million m^3 can reduce the design flow rate to 288-150 = 138 m^3, we can roughly consider that a storage capacity of 10,000 m^3 can reduce the flow rate by $1m^3$.

If the river channel can be widened, the difference from the 100-year exceedance probability flow rate of 288 m^3/s can be reduced by improving the current flow capacity of $177m^3/s$. If this difference is reduced, the required storage capacity of the detention basin can also be reduced, and thus allowing for a smaller basin size.

The bridge shown in Figure 3.3.6 is a railway bridge for the Mongolia Transversal Railway, which carries over 95% of the country's freight transport. It is the only line that connects the east and west sides of UB City, making it a particularly important line. Although careful selection of the construction method is necessary to ensure that the railway operation will not be halted during the construction process such as bridge replacement, excavation and river channel widening will greatly contribute to improving the flow capacity of the river.

(The bridge is a railway bridge for the Mongolia Transversal Railway)
Source: Survey Team

Figure 3.3.6 Overview of Point 2 (from downstream)



Source: (Left) Design Drawing of the Selbe River Restoration Plan, (Right) Survey Team

Figure 3.3.7 Plan and Aerial View of Point 2

Taking these into consideration, it is believed that a combination of river channel improvement, which should be given the highest priority, and the development of detention basin will fully maximize the effectiveness in reducing floods.

3.4 Urban Drainage

3.4.1 Current Status and Issues of Urban Drainage

(1) Flood Prevention Facility, Road Drainage Facility, Groundwater Infiltration Drainage Facility

In July this year, during the flood event, a daily rainfall of approximately 60.6 mm was recorded, which corresponds to 83% of the maximum monthly rainfall of approximately 73 mm/month. According to GUBBG, aside from the overflowed areas (shown in Figure 2.5.7), no significant flood damage occurred in other areas within the city. In UB City, road flooding has been frequent during heavy rain periods and rapid snowmelt. From this, it is inferred that scattered flooding occurred during the flood event. However, it can be concluded that the existing flood prevention and road drainage facilities have sufficient drainage capacity to prevent significant flood damage even with rainfall amounts equivalent to 83% of the maximum monthly rainfall.

On the other hand, the aging of the current road drainage facilities is a concern, with 67% of them having been laid between 1966 and 1987, leading to water leakage and early blockages, making early renovation of the drainage pipes a pressing issue. Additionally, due to the expansion of the ger areas and road paving, the amount of rainwater flowing into the road drainage pipes is increasing. To enhance drainage capacity with a future perspective, it is necessary to expand or establish new flood prevention and road drainage facilities.

Figure 3.4.1 shows the existing underground drainage infiltration facilities in UB City and the areas where flooding due to groundwater is frequent. Currently, about 24 km of underground drainage infiltration facilities are laid in UB City, but their drainage capacity is insufficient, and there are also extensive areas that they do not cover. Flooding due to groundwater causes sinkholes and collapses in residential areas' houses and fences, and the risk of infectious diseases spreading increases as sewage mixes and surfaces. Additionally, during winter, the freezing of groundwater can damage drainage and water supply pipes, posing a risk of nearby residents' homes being submerged during snowmelt, as shown in Figure 3.4.2. To avoid these risks, the establishment and renovation of underground drainage infiltration facilities are necessary.

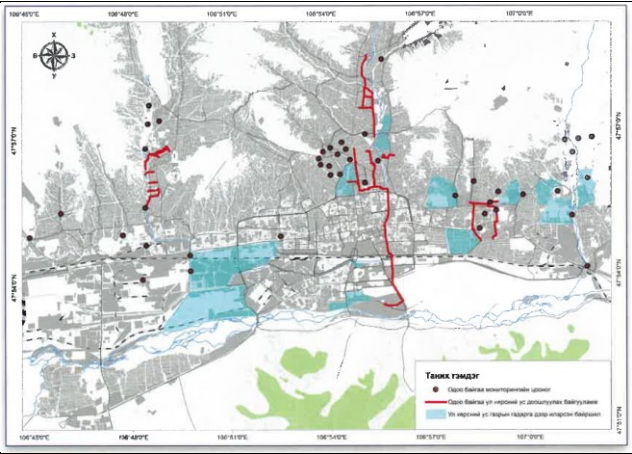


Figure 3.4.1 Network of Existing Groundwater Filtration Drainage Pipes (red line)

Figure 3.4.2 House damaged by Frozen Groundwater

Source: Master plan for city engineering preparation measures

(2) Pump Station

A pump station (PS) is installed within the GUBBG facilities to consolidate road drainage and groundwater on the west side of UB City and pump it to the adjacent drainage channel (see figure below).

Source: JST

Figure 3.4.3 Location and Exterior of Pump Station

At the pump station (PS), the inflow water from the road drainage facilities is collected in a storage tank (170 m³). The operators manually operate the pumps using the control panel while observing the water level to drain the water as needed. Although there are five pumps installed, only four are in operation because one is out of order (see Table 3.4.1). Even under such circumstances, during the flood event in July 2023, the situation was managed by alternating operation of two pumps each, and no significant internal flooding was observed. Rather, the issue was the high-water levels downstream (in the Selbe River and the drainage channel), which required operation to be temporarily halted while the pumping continued.

Table 3.4.1 Operational Status and Property of Installed Pumps

Pump	Discharge rate (m³/min)	Total head (m)	Operational Status
1	86	11	×
2	30	14.8	○
3	20	11.2	○
4	20	11.2	○
5	20	11.2	○

Currently, the drainage channel, which is the discharge destination of the PS, is undergoing renovation. Based on the principle of renovating from the downstream side, the renovation of the PS will be required after the drainage channel is refurbished.

Additionally, since its construction in 1987, this facility has never undergone repairs for the piping, exterior walls, or some of the pumps, leading to severe aging. Therefore, it urgently needs to be renovated.

(3) Water Distribution Facility (Water Distribution Reservoir)

Since 2018, development in the ger districts has been progressing based on the then MP2020 (now Urban Development MP), and the construction of a water supply source has become an urgent issue. Additionally, in UB City, population growth is significant, and the consumption of drinking water is increasing by an average of 2 million m³ per year. The demand for potable water was 150,000 m³/day from 2016 to 2020, but it reached 160,000 to 170,000 m³/day from 2020 to 2023. It is said that the current supply capacity cannot meet the continuously increasing demand for potable water. To supply water to the developing ger districts and increase the water supply volume by 30% across UB City, a plan has been formulated to construct a new distribution reservoir (24,000 m³) adjacent to the existing distribution reservoir (6,000 m³) Located in the 2nd Khoroo of Bayanzurkh district, expanding the reservoir's storage capacity to 30,000 m³. However, the project has not commenced due to difficulties in securing the budget, although the design was approved in 2017. Since potable water is used not only as drinking water but also as hot water for heating, it is deeply related to the lifeline. Therefore,

the establishment of a new distribution reservoir is necessary to improve the water supply capacity looking ahead to the future.

3.5 Emergency Response System for Floods

3.5.1 Current Status and Issues concerning Emergency Response System for Floods

Equipment such as engine cutters, jacks, and rescue support for rescuing survivors from collapsed buildings are each permanently stationed with all 15 of UB City's fire and rescue units. Currently, there is no need to keep such quantities as part of the national reserves. Additionally, no agreements have been made to secure heavy machinery, trucks, etc., but in light of the recent flood event, there is a need to review the emergency response measures.

(1) Emergency Drainage Engine Pump

As disaster emergency response equipment, engine pumps are secured in the national reserve warehouse.

Equipment	Number	Property	Image
Drainage Pump	16	Diameter：80mm Head/Pressure：27 m Depth of suction：8 m Capacity：1210mm	

Source: JST based on information from NEMA

However, during the flood event in July 2023, according to NEMA, the 16 engine pumps held as national reserves were insufficient for the drainage needs, and the government requested pump loans from private companies, including mining companies. During this time, the loan procedures took time, preventing a swift response. Additionally, the pumps were not suitable for pumping the muddy water, causing them to malfunction. Therefore, there is a demand to increase the national reserves of pumps capable of pumping muddy water.

Chapter 4 Analysis of the Applicability of Domestic Technology / Digital Transformation (DX) Technology

In this chapter, we report on domestic/DX technologies that are currently considered adaptable.

4.1 Building

4.1.1 Seismic Retrofitting

In Japan, there are numerous proposals and implementations regarding seismic retrofitting methods for buildings. Depending on the structural characteristics, such as for reinforced concrete (RC) or masonry buildings, additional seismic walls can be installed, while for steel frame buildings, bracing or dampers can be installed. Additionally, there is sufficient accumulation of construction expertise, allowing for the selection of construction methods based on the usage status of the building and the construction period, such as conducting construction while the building is in use (in-place construction).

In aging buildings where seismic retrofitting is necessary, obtaining design drawings can be issues, and structural changes such as installation or removal of openings may be anticipated. To consider the installation of seismic reinforcement elements such as shear walls or bracings, it is essential to understand the current condition of the building, including the presence of openings and the penetration of pipes. Three-dimensional scanning is effective for this purpose, as it allows for accurate measurements, speeding up the creation of architectural and structural drawings required for seismic reinforcement design. It also helps prevent the need for re-surveys due to measurement errors.

Longlist: 1-11, 1-14, 1-15, 1-17, 1-18, 1-20, 1-21

4.1.2 Storage Techniques for Stockpile Warehouses

In Japan, the history of national stockpiling is extensive, and it is possible to leverage the storage techniques employed therein. Additionally, there is abundant expertise in logistics aspects such as the transportation of stored goods, which not only enables efficient maintenance but also provides advantages in the design of buildings and equipment layout to realize it.

Longlist: 1-22, 1-23

4.1.3 Maintaining Architectural Beauty

In Japan, there are many historical buildings, and various seismic reinforcement methods, including base isolation, are often employed to enhance their seismic resilience without compromising their aesthetic appeal. Even in the seismic reinforcement of historical school buildings mentioned in Chapter 3, it is possible to utilize domestic technology to achieve reinforcement while maintaining their aesthetic beauty.

Longlist: 1-16, 1-17

4.2 Lifeline

4.2.1 Hot Water Piping Facilities

In Japan, seismic retrofitting of petrochemical plants is being pursued, and expertise in reinforcement methods for piping racks and the construction processes involved in reinforcement has been accumulated. In particular, conducting reinforcement work while the plant is in operation is deemed essential in Mongolia and can be adequately managed.

Longlist: 1-17, 1-18

4.3 River

4.3.1 Leakage Countermeasures (Detention Basin)

Many water leakage countermeasures have been proposed and implemented in Japan due to the geological characteristics of the country. There are many leakage countermeasures and geological improvement measures that are suited to the characteristics of the ground, and there are many examples of such measures in Hokkaido, where freezing in the underground is known to occur. Therefore, it is believed that these technologies can also be utilized in Mongolia. The accumulation of know-how on construction is also sufficient to enable flexible implementation of countermeasures.

Long List: 3-1

4.3.2 Monitoring and maintenance management measures

High-quality river monitoring and levee maintenance and management measures can be implemented, as there are many examples of various cases and new cases proposed in Japan.

Long List: 3-1, 3-2, 3-3, 3-4, 3-5, 3-6

Chapter 5 Analysis of the Utilization of Projects, Initiatives, and Concepts in Other Sectors

This chapter reports on the analysis of the utilization of projects, initiatives, and concepts in the urban, environmental and climate change sectors.

5.1 Urban Sector

As outlined in section 4.4.12 "Disaster Management Plan" in the UB City Urban Development MP, regarding seismic resistance, there is a shortage of evacuation shelters that can be used during times of disaster. To address this, the plan aims to enhance the seismic resistance of existing schools, thereby increasing the number of evacuation shelters from the current 113 schools to 300 schools in the future. This is the related policy to enhance the seismic resistance of schools.

In addition, in section 4.5.1.2 "Flood Prevention Facilities Plan" of the Urban Development MP, it is proposed to extend the current 148.0 km of flood prevention facilities (90.1 km of drainage channels and 57.9 km of embankments) along rivers including the Serube River, to a total length of 308.9 km (202.2 km of drainage channels and 106.7 km of levees and embankments) by 2040 and to renovate 118.9 km of existing flood prevention facilities.

Regarding urban drainage facilities in UB City, section 4.5.1.3 "Urban Drainage Facilities Plan" indicates that the current length of 170.5 km drainage facilities will be expanded to 510.8 km by 2040. Furthermore, the underground drainage infiltration facilities will be significantly expanded from the current 16.5 km to 98.7 km by 2040, aiming for a rapid improvement in drainage capacity and groundwater infiltration capacity.

5.2 Environment Sector

In Vision 2050, Objective 2.5 states "Create a healthy, comfortable and favorable living environment," and Activity 2.5.11 outlines "Expand and renovate the central wastewater treatment plant of Ulaanbaatar and sanitation facilities of other cities and settlements, as well as pre-cleaning facilities of industrial plants with eco-friendly advanced technology.", which emphasizing on the enhancement of urban drainage.

In the UB City Urban Development MP, section 3.1 "Natural Environment Plan" describes the "Base Frame of Nature and Ecosystems" as "Blue Infrastructure" and stipulates "improving the flow quantify of river, implementing flood control" for the Serube River, and outlined the location of detention basins.

5.3 Climate Change Sector

In Vision 2050, Objective 6.4 aims to " Contribute to international efforts to mitigate climate change by developing a low carbon, productive and inclusive green economy." The Action Plan for 2021-2030 focuses on "Promote environmentally friendly, efficient use and advanced green technology through economic incentives.", and "Adopt and implement a national program on climate change adaptation" It also mentions "Enhance early warning capacity for natural and weather disasters and install radar stations in at least five locations" and "Expand and upgrade the shortwave radio network and mobile communication centers connecting the capital city and aimag centers for use in emergencies and disasters." emphasizing the improvement of weather disaster prediction and warning capabilities.

Chapter 6 Summary of Survey Results

Through on-site investigations and issue analysis, this chapter reports a long list summarizing the project candidates and potential measures.

6.1 Long-List of Candidates for Grant Assistance and Japanese ODA Loan

6.1.1 Building

In this project, from the perspective of pre-disaster investment against natural disasters, buildings that are required to maintain and continue their normal functions during disasters, and buildings that serve as disaster response or evacuation centers, are considered as critical buildings. Government buildings and hospitals fall into the former category, while schools and storage warehouses fall into the latter category.

Furthermore, for these critical buildings, the priority of countermeasures will be set considering the impact of functional loss, the vulnerability of the buildings (urgency of the countermeasures), and the availability of alternative buildings.

(1) Long-List related to Building

1) Hospital

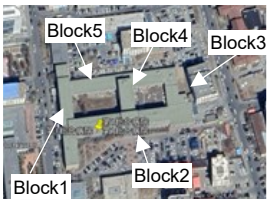
Among the hospital buildings, the following buildings with low seismic resistance are targeted due to their critical role as emergency bases during earthquake disasters. These buildings are required to perform triage and emergency measures when a large number of casualties occur immediately after a disaster, as well as continue providing regular medical services. These buildings are considered extremely important for disaster prevention and are highly recognized by UB City residents, making them highly symbolic.

The National Trauma & Orthopedic Research Center is a crucial disaster prevention base for treating the injured during earthquake disasters. As a specialized hospital for trauma, it is expected that many disaster casualties will be transferred to this hospital, making it central for triage and emergency medical services. Additionally, the transfer of treated and hospitalized patients is difficult, and the maintenance of hospital functions is essential. According to the seismic diagnosis, the seismic resistance of this hospital is inadequate, and seismic retrofitting is an urgent issue.

According to the MOH, the old building of the Second Maternity Hospital is planned to be used even after the construction of a new building. Although the design of seismic retrofit is complete, the work has not been implemented due to budget constraints.

The National Centre for Maternal and Child Health also faces challenges in transferring treated and hospitalized patients, and maintaining hospital functions is essential. While the seismic diagnosis and retrofit design for the obstetrics and gynecology hospital building are complete, the MOH indicates that seismic diagnosis and retrofit design are also necessary for other hospital buildings.

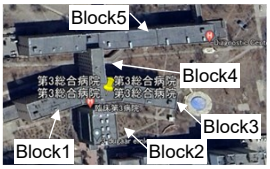
No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-1	The First General Hospital	Seismic retrofit with existing operation of Blocks 1 to 5 Floor area: 22,157 m^2	MOH	Seismic retrofitting	10.99 million USD (1.66 billion JPY)	2026.1-2027.12	Province Budget	Critical as a disaster prevention base, high urgency for seismic retrofitting.	Seismic retrofitting is necessary.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Layout Plan	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 2.2.12 and 9.1.9 Five-year Development Guidelines of Mongolia in 2021-2025, 9.1.1 Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Designated as based hospital, candidate list of seismic retrofitting is being made.

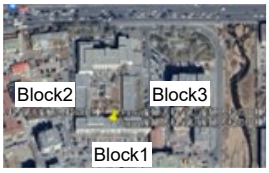
No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-2	The Second General Hospital	Seismic retrofit with existing operation of Blocks 1 to 2 Floor area: 14,348 m^2	MOH	Seismic retrofitting	8 million USD (1.21 billion JPY)	2026.1-2027.12	Province Budget	Critical as a disaster prevention base, high urgency for seismic retrofitting.	Seismic retrofitting is necessary.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Layout Plan	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 2.2.12 and 9.1.9 Five-year Development Guidelines of Mongolia in 2021-2025, 9.1.1 Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Designated as based hospital, candidate list of seismic retrofitting is being made.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-3	The Third General Hospital	Seismic retrofit with existing operation of Blocks 1 to 5 Floor area: 32,140 m^2	MOH	Seismic retrofitting	15.94 million USD (2.4 billion JPY)	2026.1-2027.12	Province Budget	Critical as a disaster prevention base, high urgency for seismic retrofitting.	Seismic retrofitting is necessary.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Layout Plan	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 2.2.12 and 9.1.9 Five-year Development Guidelines of Mongolia in 2021-2025, 9.1.1 Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Designated as based hospital, candidate list of seismic retrofitting is being made.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-4	The First Maternity Hospital	Seismic retrofit with existing operation of Blocks 1 to 3 Floor area: 8,100 m^2	MOH	Seismic retrofitting	6.03 million USD (0.91 billion JPY)	2026.1-2027.12	Province Budget	Critical as a disaster prevention base, high urgency for seismic retrofitting.	Seismic retrofitting is necessary.

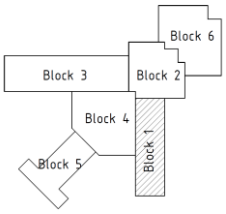
Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Layout Plan	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 2.2.12 and 9.1.9 Five-year Development Guidelines of Mongolia in 2021-2025, 9.1.1 Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Designated as based hospital, candidate list of seismic retrofitting is being made.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-5	The Second Maternity Hospital (Old Building)	Seismic retrofitting for old building Floor area: 1,300 m^2	MOH	Seismic retrofitting	0.97 million USD (0.15 billion JPY)	2026.1-2027.12	Province Budget	Critical as a disaster prevention base, high urgency for seismic retrofitting.	Seismic retrofitting is necessary.

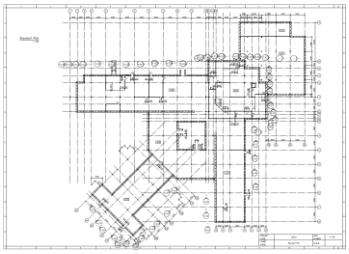
Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 2.2.12 and 9.1.9 Five-year Development Guidelines of Mongolia in 2021-2025, 9.1.1 Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Designated as based hospital, candidate list of seismic retrofitting is being made.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-6	National Trauma & Orthopedic Research Center	Seismic retrofit with existing operation of Blocks 1 to 4 Floor area: 16,163 m^2	MOH	Seismic retrofitting	8.02 million USD (1.21 billion JPY)	2026.1-2027.12	Province Budget	Critical as a disaster prevention base, high urgency for seismic retrofitting.	Seismic retrofitting is necessary.

Figures (Location Plan, Plan View, Schematic View, etc.)



Block Layout


Floor Plan of First Floor

Relevant High-Level Plan	Maturation
Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 2.2.12 and 9.1.9 Five-year Development Guidelines of Mongolia in 2021-2025, 9.1.1 Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Designated as based hospital, 1 of the 10 buildings in the candidate list of seismic retrofitting in Phase 2.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-7	National Centre for Maternal and Child Health (Obstetrics and Gynecology Building)	Seismic retrofit with existing operation of Blocks A to E Floor area: 19,993 m^2	MOH	Seismic retrofitting	2.3 million USD (0.35 billion JPY)	2026.1-2027.12	Province Budget	Critical as a disaster prevention base, high urgency for seismic retrofitting.	Seismic retrofitting is necessary.

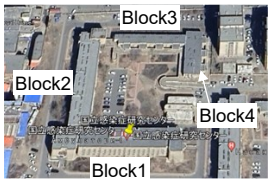
Figures (Location Plan, Plan View, Schematic View, etc.)


Exterior Photo

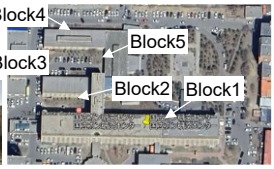

Plan View

Relevant High-Level Plan	Maturation
Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 2.2.12 and 9.1.9 Five-year Development Guidelines of Mongolia in 2021-2025, 9.1.1 Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Designated as based hospital, 1 of the 10 buildings in the candidate list of seismic retrofitting in Phase 2.

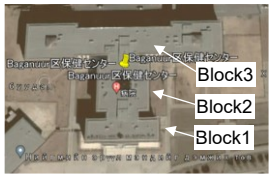
No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-8	National Center for Communicable Diseases	Seismic retrofit with existing operation of Blocks 1 to 4 Floor area: 8,544 m^2	MOH	Seismic retrofitting	4.77 million USD (0.718 billion JPY)	2026.1-2027.12	Province Budget	Critical as a disaster prevention base, high urgency for seismic retrofitting.	Seismic retrofitting is necessary.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Layout Plan	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 2.2.12 and 9.1.9 Five-year Development Guidelines of Mongolia in 2021-2025, 9.1.1 Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Designated as based hospital, 1 of the 10 buildings in the candidate list of seismic retrofitting in Phase 2.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-9	National Cancer Center	Seismic retrofit with existing operation of Blocks 1 to 5 Floor area: 30,356 m^2	MOH	Seismic retrofitting	15.05 million USD (2.27 billion JPY)	2026.1-2027.12	Province Budget	Critical as a disaster prevention base, high urgency for seismic retrofitting.	Seismic retrofitting is necessary.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Layout Plan	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 2.2.12 and 9.1.9 Five-year Development Guidelines of Mongolia in 2021-2025, 9.1.1 Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Designated as based hospital, 1 of the 10 buildings in the candidate list of seismic retrofitting in Phase 2.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-10	Baganuur District Health Center	Seismic retrofit with existing operation of Blocks 1 to 3 Floor area: 20,865 m^2	MOH	Seismic retrofitting	10.35 million USD (1.56 billion JPY)	2026.1-2027.12	Province Budget	Critical as a disaster prevention base, high urgency for seismic retrofitting.	Seismic retrofitting is necessary.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Layout Plan	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 2.2.12 and 9.1.9 Five-year Development Guidelines of Mongolia in 2021-2025, 9.1.1 Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Designated as based hospital, candidate list of seismic retrofitting is being made.

2) Government Facilities

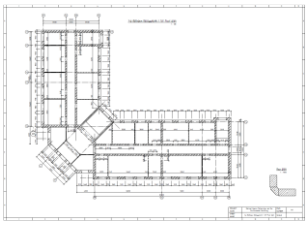
Among the disaster prevention-related ministries, it is necessary to ensure the seismic resistance of buildings that serve as disaster response bases during earthquake disasters. These buildings are highly recognized by UB City residents, making their symbolic value significant.

Meteorological Agency is a key institution for collection and dissemination of disaster prevention information, and its headquarter must be sound to maintain its functions during disasters. However, a seismic diagnosis has revealed that the headquarters building does not have sufficient seismic resistance, making seismic retrofitting an urgent task.

MCUD serves as the base for recovery activities during disasters. A seismic diagnosis conducted by MCUD on its headquarter building is currently underway, and the seismic resistance of the building is expected to be insufficient. Although the government has planned to relocate several ministry buildings to a new office area around the new airport, MCUD plans to continue using the current building as its headquarters.

National Dispatching Center (NDC) manages and controls the country's power supply and heat supply. It is responsible for power plants, transmission systems, grid planning, supply-demand adjustments, and transmission system operations. To ensure the continuity of NDC's operations during disasters, it is necessary to consider the seismic resistance of the buildings.

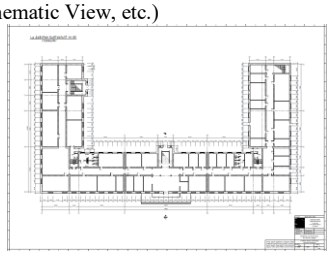
No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-11	Meteorological Agency	Seismic retrofitting of Headquarter of Meteorological Agency Floor area: 3,372 m^2	Bayangol District	Seismic retrofitting	2.51 million USD (0.38 billion JPY)	2026.1-2027.12	Agency Budget	A hub for information and communication during disasters. Low seismic resistance	There is no plan on relocation, the necessity of seismic retrofitting is recognized.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Plan View	Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Serving as the central agency during disaster. 1 of the 10 buildings in the candidate list of seismic retrofitting in Phase 2.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-12	MCUD Headquarter	Adopting seismic retrofitting method that does not take floor rigidity of MCUD Headquarter into consideration Floor area: 9,695 m^2	MCUD	Seismic retrofitting	5.39 million USD (0.81 billion JPY)	2026.1-2027.12	Province Budget	Critical as a disaster recovery base, low seismic resistance	Seismic diagnosis conducted by MCUD on its building is currently underway, the necessity of seismic retrofitting is recognized.

Figures (Location Plan, Plan View, Schematic View, etc.)

Exterior Photo



Plan View

Relevant High-Level Plan

Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 9.2.33

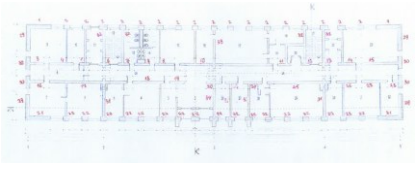
Maturation

Serve as the central agency for infrastructure recovery and reconstruction during disaster events.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-13	NDC Headquarter	Construction of new NDC headquarter near the existing one Floor area: 3,600 m^2	NEMA	New Construction	6.69 million USD (1.01 billion JPY)	2026.1-1027.12	Province Budget	It is crucial for power supply during disasters, and the construction of a new facility is urgently needed.	To ensure power supply during disasters, the construction of this facility is essential.

Figures (Location Plan, Plan View, Schematic View, etc.)

Exterior Photo



Plan View

Relevant High-Level Plan

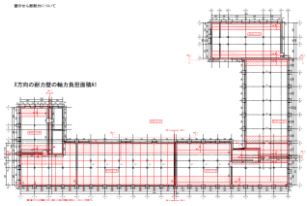
Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 4.2.36

Five-year Development Guidelines of Mongolia in 2021-2025

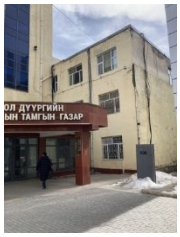
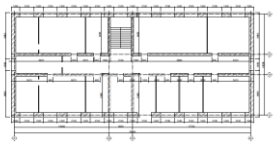
Maturation

It controls all distribution commands. During disasters, it maintains functionality and ensures power supply.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-14	Ministry of Digital Development and Communications	Seismic retrofitting of the hybrid structure of masonry and RC in the Digital Communication Development Ministry Headquarter Floor area: 8,358 m^2	Ministry of Digital Development and Communications	Seismic retrofitting	6.22 million USD (0.94 billion JPY)	2026.1-2027.12	Province Budget	Ensuring the communication infrastructure is crucial during disaster. Given its low existing seismic resistance, it is a promising candidate for the application of advanced domestic technology①.	The necessity of seismic retrofitting is recognized.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Plan View	Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Serving as the central agency during Disaster. 1 of the 10 buildings in the candidate list of seismic retrofitting in Phase 2.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-15	Bayangol District Office	Seismic retrofitting of Bayangol District Office building Floor area: 2,126 m^2	Bayangol District	Seismic retrofitting	1.19 million USD (0.18 billion JPY)	2026.1-2027.12	District Budget	Serve as base for supporting local resident during disaster. Given the limited space, it is a promising candidate for the application of advanced domestic seismic retrofitting technology①.	There is no plan on relocation, the necessity of seismic retrofitting is recognized.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Plan View	Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Serving as the central agency during disaster. It is the only district office expected to continue in use during disaster. 1 of the 10 buildings in the candidate list of seismic retrofitting in Phase 2.

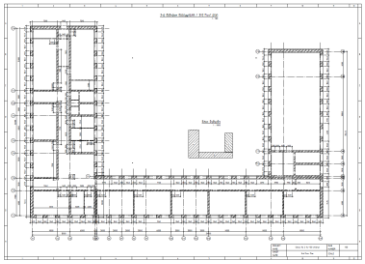
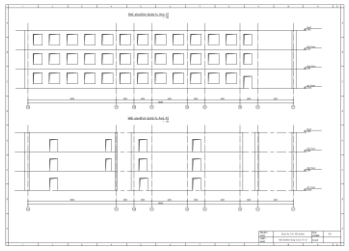
3) Educational Facilities

Schools and kindergartens built before 1970 have been generally rebuilt as per the policy set by the Ministry of Education and Sports, and the reconstruction is nearly complete. However, for buildings constructed after 1971, no actions, including seismic retrofitting, have been taken.

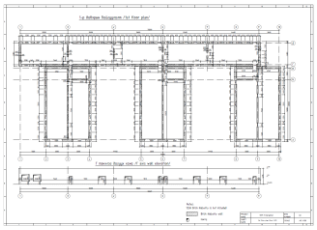
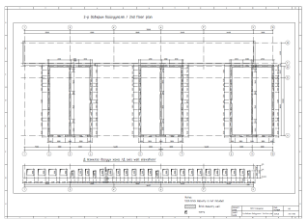
Among the buildings constructed before 1970, the UB City Board of Education has decided to preserve the exteriors of several historically significant buildings, including the First Kindergarten, the 143rd Kindergarten, the First School, the Fifth School, the 23rd School, and the 24th School. These buildings have not been rebuilt but are instead preserved and used. Given their lack of seismic resistance, it is necessary to perform seismic retrofitting while preserving their exteriors.

For maintaining the exterior while enhancing seismic resistance, it is effective to adopt domestic technologies not specified in "Seismic Diagnosis and Reinforcement Methods for Existing Masonry Buildings (BD-22-105-18)." For example, introducing prestressed concrete steel rods into brick walls is considered a promising measure.

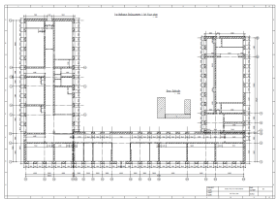
<table>
<tr><th>No.</th><th>Name</th><th>Overview</th><th>Implement-ation party</th><th>Implement-ation type</th><th>Cost Estimation</th><th>Project Period</th><th>Funding Source</th><th>Remark (Comments from JST)</th><th>Comments from Relevant Authority</th></tr>
<tr><td>1-16</td><td>Seismic retrofitting of School</td><td>Seismic retrofitting of historical schools will be carried out using a prestressing method to maintain their exterior appearance.
Four buildings will be targeted.
Floor area: 15,500 m^2</td><td>MES</td><td>Seismic retrofitting</td><td>17.3 million USD (2.61 billion JPY)

3.6 x 4 Schools</td><td>2026.1-2027.12</td><td>Province Budget</td><td>Ensuring the safety of students is crucial during disaster.
It is a promising candidate for the application of advanced domestic technology ① ③.</td><td>In view of the historical value of buildings, it is necessary to perform seismic retrofitting.</td></tr>
<tr><td colspan="6" rowspan="2">Figures (Location Plan, Plan View, Schematic View, etc.)
 
 
Plan View Side View
Target the First School, the Fifth School, the 23rd School, and the 24th School</td><td>Relevant High-Level Plan</td><td colspan="2">Maturation</td></tr>
<tr><td>Policy of Education Ministry of UB City</td><td colspan="2">They will serve as evacuation sites and disaster bases.</td></tr>
</table>

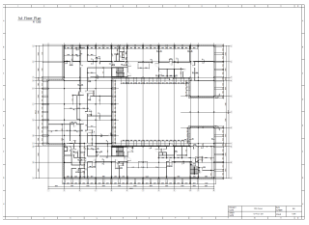
No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-17	Seismic retrofitting of Kindergarten	Seismic retrofitting of historical kindergarten will be carried out using a prestressing method to maintain their exterior appearance. Two buildings will be targeted. Floor area: 2,100 m^2	MES	Seismic retrofitting	3.12 million USD (0.47 billion JPY) 3.6 x 2 Kindergarten	2026.1-2027.12	Province Budget	Ensuring the safety of kids is crucial during disaster. It is a promising candidate for the application of advanced domestic technology①③.	In view of the historical value of buildings, it is necessary to perform seismic retrofitting.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Floor Plan of First Floor  Floor Plan of Second Floor Target the First Kindergarten, the 143rd Kindergarten	Policy of Education Ministry of UB City	Function as temporary evacuation sites and supply distribution centers

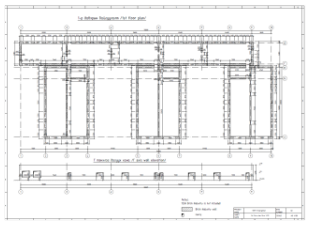
No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-18	Seismic retrofitting of School No.2	Seismic retrofitting of School that would be used as disaster prevention base. Floor area: 4,563 m^2	MES	Seismic retrofitting	1.88 million USD (0.28 billion JPY)	2026.1-2027.12	Province Budget	Utilized as disaster prevention base. Additionally, standards for seismic retrofitting are in place.	To serve as disaster prevention base, urgent seismic retrofitting is necessary.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Floor Plan of First Floor	Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Function as temporary evacuation sites and supply distribution centers. 1 of the 10 buildings in the candidate list of seismic retrofitting in Phase 2.

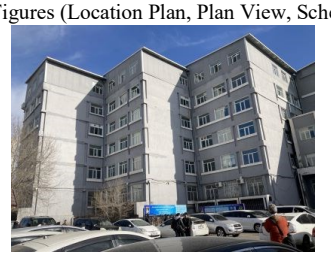
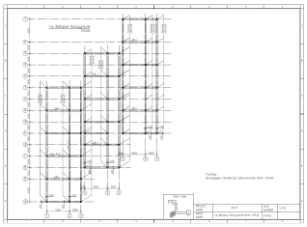
No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-19	Seismic retrofitting of School No.20	Seismic retrofitting of School that would be used as disaster prevention base. Floor area: 6,480 m^2	MES	Seismic retrofitting	3.19 million USD (0.48 billion JPY)	2026.1-2027.12	Province Budget	Utilized as disaster prevention base. Additionally, standards for seismic retrofitting are in place. It is a promising candidate for the application of advanced domestic technology①.	To serve as disaster prevention base, urgent seismic retrofitting is necessary.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Floor Plan of First Floor	Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Function as temporary evacuation sites and supply distribution centers. 1 of the 10 buildings in the candidate list of seismic retrofitting in Phase 2.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-20	Seismic retrofitting of School No.160	Seismic retrofitting of School that would be used as disaster prevention base. Floor area: 1,872 m^2	MES	Seismic retrofitting	1.39 million USD (0.21 billion JPY)	2026.1-2027.12	Province Budget	Ensuring the safety of kids is crucial during disaster. As standard buildings, there is potential for implementation of Japan's domestic technology. It is a promising candidate for the application of advanced domestic technology①.	Urgent seismic retrofitting is necessary.

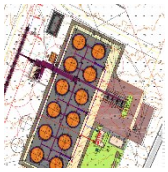
Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Floor Plan of First Floor	Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	Function as temporary evacuation sites and supply distribution centers. 1 of the 10 buildings in the candidate list of seismic retrofitting in Phase 2.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-21	Seismic retrofitting of Building No.2 of Mongolian University of Science and Technology	Seismic retrofitting of School that would be used as disaster prevention base. Floor area: 9,180 m^2	MES	Seismic retrofitting	5.1 million USD (0.77 billion JPY)	2026.1-2027.12	Province Budget	As the top engineering university in Mongolia, there are high expectations for the utilization and implementation of Japan's domestic technology. It is a promising candidate for the application of advanced domestic technology①.	Vulnerable and urgent seismic retrofitting is necessary

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Exterior Photo  Floor Plan of First Floor	Project under Phase 2 of Project for Strengthening the National Capacity of Earthquake Disaster Protection in Prevention in Mongolia	1 of the 10 buildings in the candidate list of seismic retrofitting in Phase 2.

6.1.2 Disaster Prevention Facilities

(1) National Stockpile Warehouse

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-22	National Stockpile Warehouse	To meet the needs of the 1.6 million residents of UB City for two weeks, a new petroleum stockpile warehouse with a capacity of 20,000 m^3 will be constructed in the western part of UB City.	NEMA	New Construction	20 million USD (3.01 billion JPY)	2026.1-2027.12	Agency Budget	It is extremely important as a disaster base. It is a promising candidate for the application of advanced domestic technology ②, related to stockpiling.	The construction of this facility is crucial to ensure the supply of goods during disasters.
Figures (Location Plan, Plan View, Schematic View, etc.)						Relevant High-Level Plan			Maturation
 Conceptual Drawing  Plan View						Vision 2050: 7.3.15, 4.2.16 Cabinet decisions in 23th he State Great Khural of Mongolia (Parliament): 7.3.4 Action Plan of the Government of Mongolia: 4.3.14			The Cabinet decision specifies the stockpiling of 15,750 tons of high-octane gasoline, 24,450 tons of diesel fuel, and 1,500 tons of jet fuel. NEMA's response is urgently needed.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
1-23	National Stockpile Warehouse	To meet the needs of the 1.6 million residents of UB City for one week, a new food stockpile warehouse with a capacity of 21,020 tons will be constructed in the western part of UB City.	NEMA	New Construction	25 million USD (3.77 billion JPY)	2026.1-2027.12	Agency Budget	It is a promising candidate for the application of advanced domestic technology ②, related to food stockpiling, including sanitation management.	The construction of this facility is crucial to ensure the supply of food during disasters.

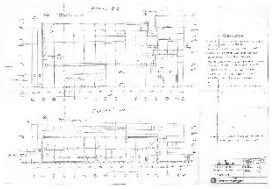
Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Plan View  Conceptual Drawing	Vision 2050: 7.3.15 Cabinet decisions in 23th he State Great Khural of Mongolia (Parliament): 7.3.4 Action Plan of the Government of Mongolia: 4.3.14	The Cabinet has decided on stockpiling 61,000 tons of wheat flour, 1,000 tons of rice, 800 tons of miscellaneous goods, 64 tons of meat, and 20 tons of drinking water. NEMA is responsible for implementation.

6.1.3 Lifeline

(1) Long-List related to Lifeline

1) Power Generation Facilities and Hot Water Heat Sources

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
2-1	Seismic diagnosis of thermal power plant buildings.	Seismic diagnosis of 2nd ,3rd and 4th thermal power plant buildings. Floor area: 63,900 m^2	MOE	Seismic retrofitting	1.5 million USD (0.23 billion JPY)	2026	Province Budget	Ensuring the seismic resilience of power plant buildings is crucial. It is necessary to accurately evaluate the current seismic performance they possess.	With aging thermal power plant buildings, it is necessary to ensure their seismic resilience. However, their current seismic performance has not been determined.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
Seismic diagnosis and retrofitting design: • Material strength assessment (sampling and material testing) • Restoration of structural drawings (on-site measurements and creation of CAD drawings) • Seismic diagnosis • Cost estimation for construction • Development of construction schedule  Existing Plan View	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 4.2.34, 7.3.19 Five-year Development Guidelines of Mongolia in 2021-2025	Deterioration diagnosis has been conducted for the 3rd and 4th thermal power plants, and it is expected that their seismic resistance is insufficient for the current design seismic intensity.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
2-2	Seismic retrofitting of thermal power plant buildings	Seismic retrofitting of 2nd thermal power plant buildings. Floor area: 5,800 m^2	MOE	Seismic retrofitting	8.2 million USD (0.14 billion JPY)	2026	Province Budget	With aging thermal power plant buildings, and building designed under old standards, they do not meet current standard of seismic resilience, necessitating seismic retrofitting.	The areas that are deteriorating due to aging have not been addressed, their current seismic performance has not been determined.

	Relevant High-Level Plan	Maturation
Items to be implemented: • Seismic retrofitting design (including detailed cost estimation and detailed process estimation) • Seismic retrofitting construction	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 4.2.34, 7.3.19 Five-year Development Guidelines of Mongolia in 2021-2025	In 2018, diagnosis of aging was conducted, as a result, two buildings within the facility was prohibited to be used. The design seismic intensity of 7 during construction has now increased to 8, indicating inadequate seismic resistance.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
2-3	Seismic retrofitting of thermal power plant buildings	Seismic retrofitting of 3rd thermal power plant buildings. Floor area: 26,400 m^2	MOE	Seismic retrofitting	37.0 million USD (5.57 billion JPY)	2026	Province Budget	With aging thermal power plant buildings, and building designed under old standards, they do not meet current standard of seismic resilience, necessitating seismic retrofitting.	Due to aging, it is expected that the buildings cannot withstand the new standard seismic intensity of 8. Since a significant portion of the budget is allocated for equipment upgrades, there is not enough budget allocated for building reinforcement.

Items to be implemented:	Relevant High-Level Plan	Maturation
• Seismic retrofitting design (including detailed cost estimation and detailed process estimation) • Seismic retrofitting construction	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 4.2.34, 7.3.19 Five-year Development Guidelines of Mongolia in 2021-2025	In the seismic assessment conducted in 2017, it was determined that due to deterioration, the buildings could not withstand the current design seismic intensity of 8. A re-assessment is planned for 2024 to calculate the repair costs.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
2-4	Seismic retrofitting of thermal power plant buildings	Seismic retrofitting of 4th thermal power plant buildings. Floor area: 31,700 m^2	MOE	Seismic retrofitting	44.4 million USD (6.69 billion JPY)	2026	Province Budget	With aging thermal power plant buildings, and building designed under old standards, they do not meet current standard of seismic resilience, necessitating seismic retrofitting.	

Items to be implemented:	Relevant High-Level Plan	Maturation
• Seismic retrofitting design (including detailed cost estimation and detailed process estimation) • Seismic retrofitting construction	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 4.2.34, 7.3.19 Five-year Development Guidelines of Mongolia in 2021-2025	In 2017, NEMA conducted a risk assessment, but it was focused on deterioration diagnosis and did not include a seismic evaluation. The design seismic intensity during construction was 7, but it has now increased to 8, indicating insufficient seismic resilience.

(The drawings and specifications for the equipment installed during the construction of the 2nd and 3rd power plants have not been found, and no documentation has been found for seismic performance assessment.)

2) Power Transmission and Distribution Facilities

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
2-5	UBEDN Renovation of old electric pole	Replacement and renovation of old electric poles with decreased seismic resistance. 35kV: Approximately 3,300 poles 6-10kV: Approximately 10,000 poles 0.4kV: Approximately 28,000 poles Number of subscribers: Approximately 200,000 people.	UBED	Reconstruction and renovation	559 million USD (84.22 billion JPY)	2026	Province Budget	It is necessary to prioritize based on the degree of facility aging and the impact of damage in the event of collapse.	There is a risk of widespread power outages due to earthquake-induced damage, making early renovation essential for earthquake preparedness.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 4.2.36 Five-year Development Guidelines of Mongolia in 2021-2025	Insufficient seismic resistance due to aging of distribution equipment components has been recognized, and a renovation plan has been formulated with renovations scheduled accordingly.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
2-6	UBEDN Flood control equipment	Procurement of equipment to prevent damage to power distribution facilities and expedite their restoration in the event of large-scale floods.	UBED	Equipment procurement	52 million USD (7.83 billion JPY)	2024.1-2024.12	Province Budget	It is necessary to assess the usage and importance of the equipment.	Prevention of damage and reduction of restoration time are essential during large-scale flood.

List of Flood Control Equipment

No.	Necessary Equipment	Unit	Quantity	Unit Cost Million MNT	Cost Million MNT
1	Bulldozer	no.	1	250	250
2	Foklift	no.	1	102	102
3	Hydraulic excavator	no.	1	450	450
4	Mobile repair vehicle	no.	1	5,580	5,580
5	6/10 kV 2500-3500kVA Mobile Diesel Generator	no.	1	1,800	1,800
6	Helicopter	no.	1	1,800	1,800
7	10/6kV 4000 kVA Transformer	no.	1	160	160
8	Mobile switch	no.	2	80	160
9	10 kV 3 phase*150mm2 Cable	m	400	0.13	52
10	0.4 kV 3 phase*120mm2+1 phase*95mm2 Cable	m	1,000	0.085	85
11	Large capacity drainage pump	no.	10	8.58	85.8
12	Water shoes (long)	Pair	500	0.099	49.5
13	Water shoes (short)	Pair	500	0.132	66
14	Chemical resistance gloves	Pair	100	0.016	1.6
15	Military cost	no.	50	0.095	4.8
16	Raincoat	no.	50	0.030	1.5
17	Winter clothes	no.	50	0.065	3.3
Total					10,651.4

Relevant High-Level Plan	Maturation
Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 7.3.19	Due to insufficient equipment necessary for preventing flooding of distribution facilities and for their restoration in case of flooding during large-scale floods, a list of necessary equipment has been compiled to prevent flood damage and expedite facility restoration.

3) Hot Water Piping Facilities

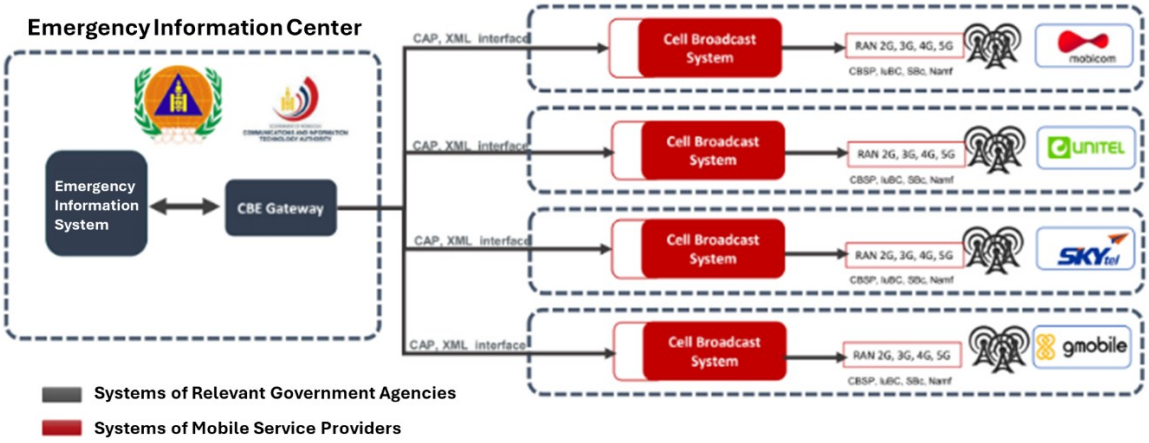
No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
2-7	Review of seismic retrofitting methods and implementation of retrofitting for piping racks	Piping racks are classified based on materials, structure, and shape to determine standard retrofitting measures and implement retrofitting.	MCUD	Seismic retrofitting	6 million USD (0.90 billion JPY)	2025.1-2026.12	Province Budget	It is important to establish standardized reinforcement measures for piping racks where individual evaluations are not suitable.	Ensuring the functionality of the framework supporting the pipes is crucial for reliable hot water supply during disasters.

Pipe Networks Diagram and Exterior Part of Piping Rack	Relevant High-Level Plan	Maturation
	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan, 7.3.19 Five-year Development Guidelines of Mongolia in 2021-2025, 9.3.3	Piping racks are severely aged, and reinforcement is deemed an urgent issue. Prompt assessment of vulnerability is also necessary.

4) Communication Facilities

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
2-8	Cell Broadcast System	Establishment of a system to transmit disaster alerts to mobile terminals via mobile phone networks.	Ministry of Digital Development: NEMA	New Development	5.2 million USD (0.78 billion JPY)	2024-2027	Province Budget	CBS is highly important as a disaster alert system applied to all models and operating systems of smartphones, which are widely used.	It is necessary to have a system that is independent on mobile carriers' networks to transmit disaster alerts to a large number of people simultaneously and rapidly.

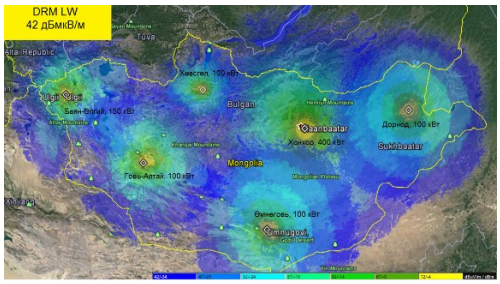
Figures (Location Plan, Plan View, Schematic View, etc.)



Conceptual Figure of System

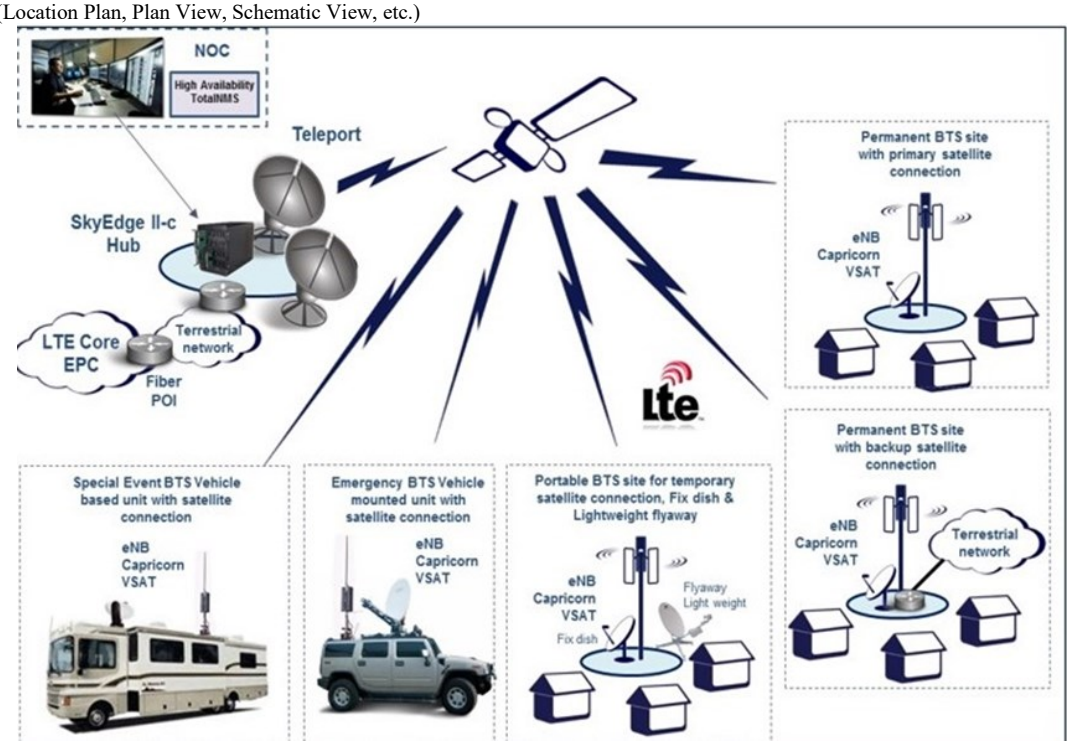
Relevant High-Level Plan	Maturation
Vision 2050: In the Stage III (2041-2050) of Objective 7.5 " The period to develop innovation in electronic information and information technology and enhance national capacity.", point no.3 – Develop innovations by supporting achievements in the field of information and technology and by generating new knowledge, and bring security management capacity closer to that of developed countries. Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan 7.3.20 – Introduce space and other advanced technologies, equipment and tools in disaster prevention, combating and protection activities, strengthen national disaster management capacity and bring it to the international level. 9.2.35 – Become a city free of flood risk by improving information, communication and resource management systems and fully providing engineering preparations in the events of potential disasters and emergencies.	Positioned in Provision' 2022 annual report as a system capable of sending alerts to all mobile terminals without relying on mobile carriers, and deemed extremely important in the NEMA's " Mongolia's National Midterm Review of the Sendai Framework for Disaster Risk Reduction Report (2022)".

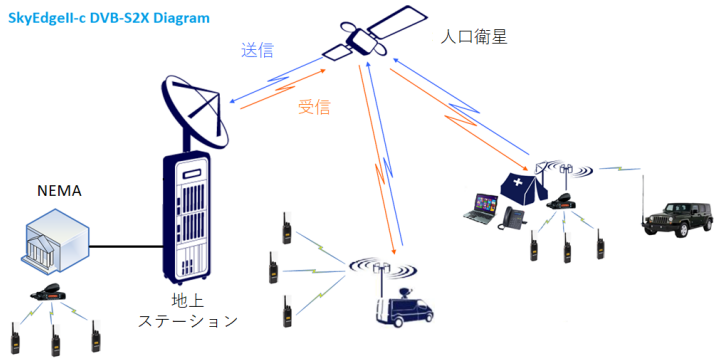
No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
2-9	Reconstruction of FM and AM radio broadcasting networks	Upgrading existing FM and AM stations' communication equipment to digitize and enhance the dissemination of disaster information over a wide area. Target stations: UB City, Govi-Altai, Khuvsgul, Dornod, Umnugovi, Bayan-Ulgii	Ministry of Digital Development	New Development	12.6 million USD (1.90 billion JPY)	2021-2025	Province Budget	This aims to rapidly transmit disaster information to remote nomadic herders and strengthen disaster preparedness by increasing the content broadcasted through digitization.	The digitization of FM and AM radio broadcasting networks is necessary to establish a reliable network for residents to send and receive information.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Conceptual Figure of System	Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan: 7.3.20 – Introduce space and other advanced technologies, equipment and tools in disaster prevention, combating and protection activities, strengthen national disaster management capacity and bring it to the international level. 7.5.21 – Develop disaster research, develop methods and technologies for estimating disaster damage and recovery needs, and develop disaster database and national disaster management. Appendix 1 of Government Resolution No. 275 of 2010, " National program on transition to digital technology from analog of Radio and television broadcasting network"	The promotion of a stable information transmission network covering the entire country within the trend of digital transition is mentioned in the Government Resolution No. 275 of 2010, "National program on transition to digital technology from analog of Radio and television broadcasting network"

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
2-10	Satellite Vehicles	Provision of mobile base station vehicles compatible with VSAT. Quantity: 2 units	Main Party: Ministry of Digital Development : NEMA	New Development	0.33 million USD (0.05billion JPY) For two ※2 台分	2024	Province Budget	This equipment is necessary to enhance disaster response capabilities through the provision of satellite and mobile phone communications in disaster areas.	It is extremely important for the Ministry of Digital Development's disaster preparedness operations to secure communication in disaster areas.

Figures (Location Plan, Plan View, Schematic View, etc.)





Conceptual Figure of System

Relevant High-Level Plan	Maturation
Vision 2050: In the Stage III (2041-2050) of Objective 7.5 " The period to develop innovation in electronic information and information technology and enhance national capacity.", point no.3 – Develop innovations by supporting achievements in the field of information and technology and by generating new knowledge, and bring security management capacity closer to that of developed countries. Vision 2050: Mongolia's long-term development policy 2021-2030 Action Plan 7.3.20 – Introduce space and other advanced technologies, equipment and tools in disaster prevention, combating and protection activities, strengthen national disaster management capacity and bring it to the international level. 7.5.20 – Expand and upgrade the shortwave radio network and mobile communication centers connecting the capital city and aimag centers for use in emergencies and disasters.	Securing communication in affected areas during disasters is mandated as part of the Ministry of Digital Development's disaster preparedness operations and is stipulated in the Information and Communication Disaster Prevention National Business Plan (Minister Order of 2022). It is positioned as essential equipment utilizing satellite communication in the Information and Communication Disaster Prevention National Business Plan 2023 annual report.

6.1.4 River

(1) Long-List related to Rivers

The target area for the Long List is shown in the Figure below.

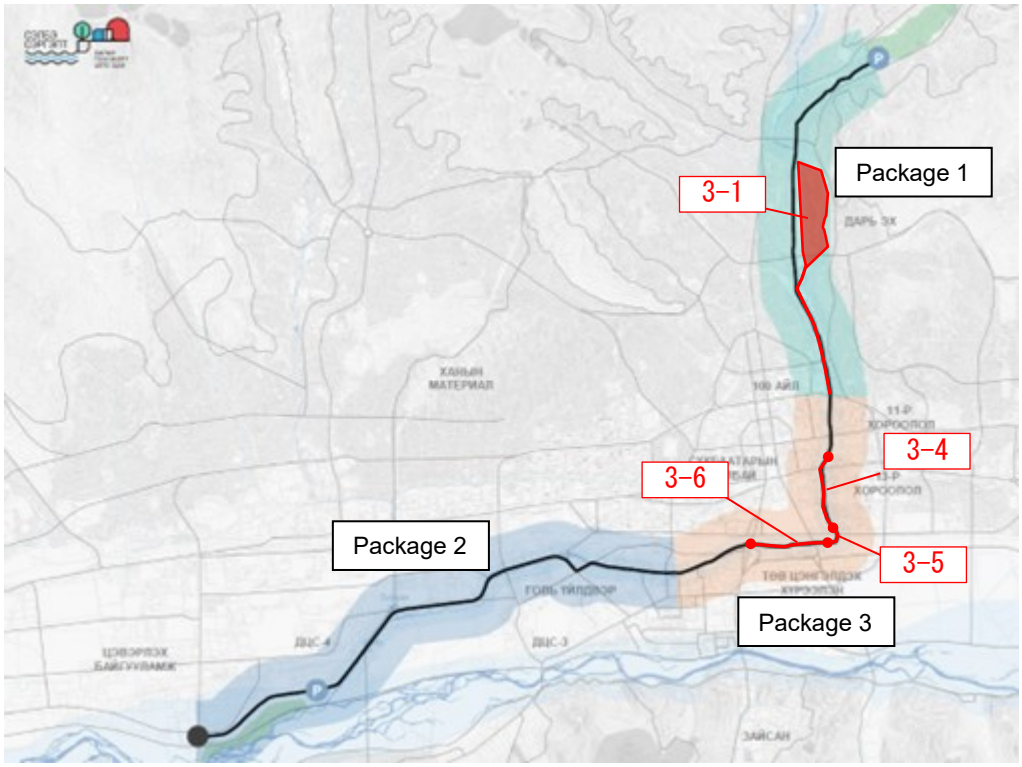
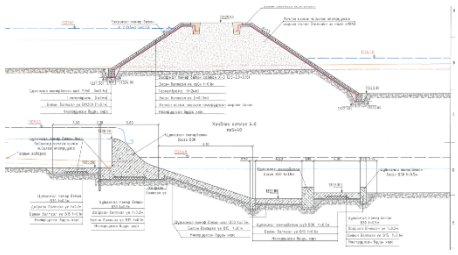


Figure 6.1.1 Target Areas for the Long List of Selbe River

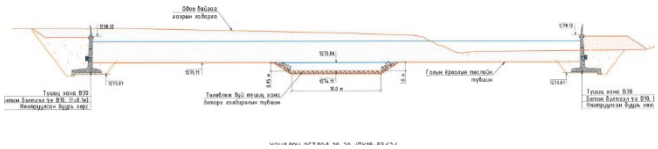
1) Upper Selbe River Basin: Improvement works around the detention basins

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
3-1	• Detention basin Construction • Embankment improvement at downstream of the detention basin (from Chingeltei Waterway Bridge to Ikh Toiruu Bridge)	(1) Reduction of downstream flood risk through detention basin construction (2) River channel improvement downstream of the detention basin	Selbe River Improvement Project	New Construction	32.8 million USD (4.94 billion JPY)	2026.1-2028.12	Province Budget or City Budget	River channel improvement is considered the most effective flood prevention measure for the flood-prone Selbe River, but detention basin construction is also believed to contribute to flood prevention through peak-cutting effects. Furthermore, the utilization of domestic technologies ⑤ and ⑥ is anticipated.	The necessity of flood control is recognized.

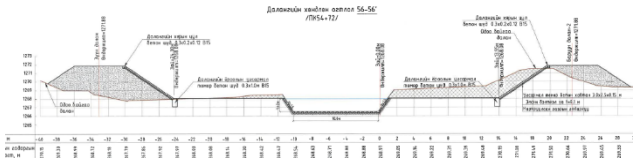
Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Location Plan (Red line)  Schematic View (Cross-section diagram of river at downstream of detention basin) Schematic View (Cross-section diagram of detention basin)	Selbe River Restoration Plan	Drawing preparation has been completed under the Selbe River Improvement Project. It is believed that the installation of a detention basin, along with the implementation of river channel improvement, will enhance flood prevention effectiveness. Consideration needs to be given to the relocation of substations and transmission lines.

2) Lower Selbe River Basin

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
3-2	Riverbank improvement in the downstream area of the Bund River (From Atlai Residential Bridge to Factory Crescent)	River channel improvement (concrete retaining wall) in the downstream area of the Bund River	Selbe River Improvement Project	New Construction	36.7 million USD (5.53 billion JPY)	2028.1-2029.12	Province Budget or City Budget	Due to scattered low embankment heights, the improvement of channel by excavation is effective. Additionally, since there is considerable sediment deposition, the effect of securing flow area through dredging is substantial. The utilization of domestic technology ⑥ is anticipated.	The necessity of flood control is recognized.

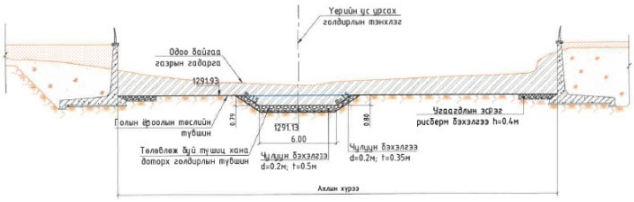
Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
Location Plan (Red line)  Schematic View (Cross-section diagram of concrete retaining wall) 	Selbe River Restoration Plan	Drawing preparation has been completed under the Selbe River Improvement Project.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
3-3	Riverbank improvement in the downstream area of the Bund River (From Factory Crescent) to the confluence with the Tuul River)	River channel improvement (earth embankment) in the downstream area of the Bund River	Selbe River Improvement Project	New Construction	7.9 million USD (1.19 JPY)	2028.1-2029.12	Province Budget or City Budget	Due to scattered low embankment heights, it is effective to improve the channel by excavation. Additionally, since there is considerable sediment deposition, the effect of securing flow area through dredging is substantial. The utilization of domestic technology ⑥ is anticipated.	The necessity of flood control is recognized.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
Location Plan (Red line)  Schematic View (Cross-section diagram of concrete retaining wall) 	Selbe River Restoration Plan	Drawing preparation has been completed under the Selbe River Improvement Project.

3) Middle Selbe River Basin: Improvement works around the curved section

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
3-4	River improvement in the upstream of curved section (From UNESCO Street Bridge to the Railway Bridge)	Securing flow area through dredging and the construction of concrete retaining walls along the upstream of curved section, which is prone to floods.	Selbe River Improvement Project	New Construction	7.4 million USD (1.12 billion JPY)	2026.1-2028.12	Province Budget or City Budget	Due to low embankment level and narrow river widths, it is effective to improve the channel by excavation. Additionally, the utilization of domestic technology ⑥ is anticipated.	The necessity of flood control is recognized.

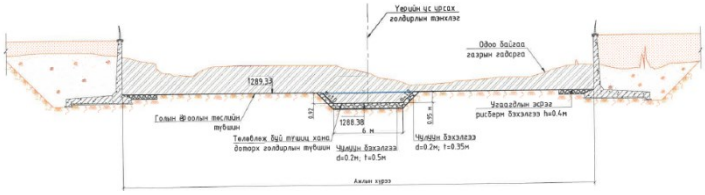
Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
Location Plan (Red line)  Schematic View (Cross-section diagram of concrete retaining wall) 	Selbe River Restoration Plan	Drawing preparation has been completed under the Selbe River Improvement Project.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
3-5	River improvement in the curved section and its downstream (From the Railway Bridge to the Olympic Bridge)	Securing flow area through dredging and the construction of concrete retaining walls along the curved section and its downstream.	Selbe River Improvement Project	New Construction	7.3million USD (1.1 billion JPY)	2026.1-2028.12	Province Budget or City Budget	Due to low embankment level and narrow river widths, it is effective to improve the channel by excavation. Additionally, the utilization of domestic technology ⑥ is anticipated.	The necessity of flood control is recognized.

Figures (Location Plan, Plan View, Schematic View, etc.)

Location Plan (Red line)

Schematic View (Cross-section diagram of concrete retaining wall)



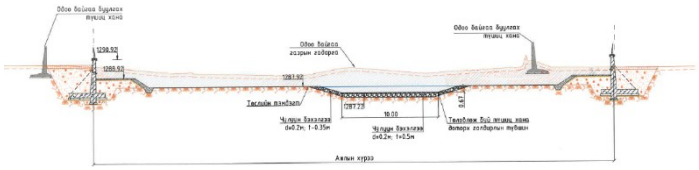
Relevant High-Level Plan	Maturation
Selbe River Restoration Plan	Drawing preparation has been completed under the Selbe River Improvement Project.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
3-6	River improvement in the downstream of curved section (From the Olympic Bridge to Peace Bridge)	Securing flow area through dredging and the construction of concrete retaining walls along the curved section and its downstream.	Selbe River Improvement Project	New Construction	9.5 million USD (1.43 billion JPY)	2026.1-2028.12	Province Budget or City Budget	Due to low embankment level and narrow river widths, it is effective to improve the channel by excavation. Additionally, the utilization of domestic technology ⑥ is anticipated.	The necessity of flood control is recognized.

Figures (Location Plan, Plan View, Schematic View, etc.)

Location Plan (Red line)

Schematic View (Cross-section diagram of concrete retaining wall)



Relevant High-Level Plan	Maturation
Selbe River Restoration Plan	Drawing preparation has been completed under the Selbe River Improvement Project.

6.1.5 Urban Drainage

(1) Long List Related to Urban Drainage

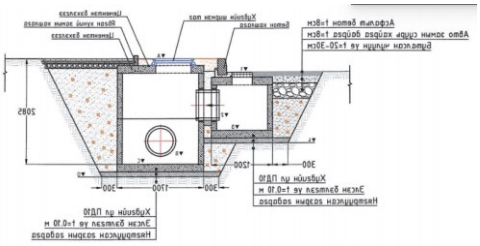
1) Road Drainage Facilities

Road drainage facilities are crucial structures for ensuring urban functionality and safety during flood events. In the MP, prioritization for the renovation of all road drainage facilities in UB City is conducted based on the evaluation criteria outlined in the " Methodological guideline on complete assessment for urban development in urban areas (UBB 30-201-09)". The renovation periods are categorized into the first phase (2023-2025), second phase (2026-2030), third phase (2031-2035), and fourth phase (2036-2040). However, it is necessary to further narrow down facilities within the first phase based on importance and impact, with a focus on areas near public facilities such as hospitals and schools, as well as densely populated areas.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
4-1	Road Drainage System ①	Renovation and New Construction of Road Drainage Facilities	GUBBG	Renovation and New Construction	15 million USD (2.26 billion JPY)	2025.1-2025.12	Province Budget or City Budget	Due to its high population density and numerous public institutions, this area is of great significance.	This drainage system is designated as a priority for renovation in the first phase of the MP, and it would be considered as a candidate for renovation.

Figures (Location Plan, Plan View, Schematic View, etc.)

Drainage route



Cross-section diagram

Relevant High-Level Plan	Maturation
MP for Urban Engineering Preparatory Measures	Since the occurrence of the major flood in 1966, there have been repeated installations and renovations, and this system continues to play a central role in preventing floods and mitigating their impacts.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
4-2	Road Drainage System ②	Renovation and New Construction of Road Drainage Facilities	GUBBG	Renovation and New Construction	2.7 million USD (0.41 billion JPY)	2025.1-2025.12	Province Budget or City Budget	Due to frequent occurrences of flooding, the urgency is high.	This drainage system is designated as a priority for renovation in the first phase of the MP, and it would be considered as a candidate for renovation.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Drainage Route　　Cross-section diagram	MP for Urban Engineering Preparatory Measures	Since the occurrence of the major flood in 1966, there have been repeated installations and renovations, and this system continues to play a central role in preventing floods and mitigating their impacts.

2) Underground Drainage Infiltration Facilities

While the impact of underground drainage infiltration facilities are lesser targets of disaster safety improvements compared to road drainage facilities, they are still important structures due to the risk of outbreaks of infectious diseases and damage to water supply facilities, which could lead to loss of life. In the MP, similar to road drainage facilities, prioritization for renovation and new construction of all underground drainage infiltration facilities in UB City is conducted based on the evaluation criteria outlined in "UBB 30-201-09". The renovation periods are categorized into the same phases as road drainage facilities: the first phase (2023-2025), the second phase (2026-2030), the third phase (2031-2035), and the fourth phase (2036-2040). Since some underground infiltration drainage pipes are connected to road drainage pipes and are planned to discharge underground water into rivers, it is necessary to prioritize renovation not only based on importance and impact but also considering the relationship with road drainage facilities that require high-priority renovation.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
4-3	Underground Water Drainage and Infiltration Facilities ①	Renovation and New Construction of underground drainage infiltration facilities	GUBBG	Renovation and New Construction	1.5 million USD (0.23 billion JPY)	2025.7-2025.6	Province Budget or City Budget	This area has a high population density (approximately 28,000 people/km^2) and many public institutions, making it highly important. Additionally, due to frequent occurrences of flooding from groundwater, the urgency to renovate is high.	This drainage system is designated as a priority for renovation in the first phase of the MP, and it would be considered as a candidate for renovation.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Drainage Route  Cross-section diagram	MP for Urban Engineering Preparatory Measures	Since their installation in 1980, underground drainage infiltration facilities have been expected to play a central role in preventing surface runoff of groundwater.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
4-4	Underground Water Drainage and Infiltration Facilities ②	Renovation and New Construction of underground drainage infiltration facilities	GUBBG	Renovation and New Construction	1.7 million USD (0.26 billion JPY)	2025.7-2025.12	Province Budget or City Budget	Due to frequent occurrences of flooding from groundwater, the urgency to renovate is high.	This drainage system is designated as a priority for renovation in the first phase of the MP, and it would be considered as a candidate for renovation.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Drainage Route  Cross-section diagram	MP for Urban Engineering Preparatory Measures	Since their installation in 1980, underground drainage infiltration facilities have been expected to play a central role in preventing surface runoff of groundwater.

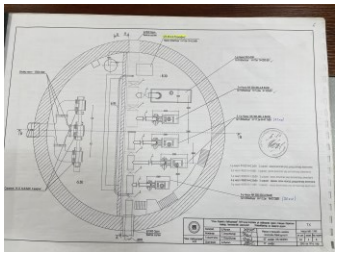
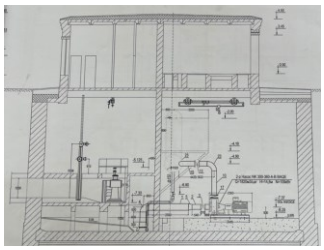
No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
4-5	Underground Water Drainage and Infiltration Facilities ③	Renovation and New Construction of underground drainage infiltration facilities	GUBBG	Renovation and New Construction	2 million USD (0.30 billion JPY)	2025.7-2025.12	Province Budget or City Budget	Due to frequent occurrences of flooding from groundwater, the urgency to renovate is high. Additionally, since the plan is to drain water into road drainage facilities, the renovation has a high synergistic effect.	This drainage system is designated as a priority for renovation in the first phase of the MP, and it would be considered as a candidate for renovation.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Drainage Route  Cross-section diagram	MP for Urban Engineering Preparatory Measures	Since their installation in 1980, underground drainage infiltration facilities have been expected to play a central role in preventing surface runoff of groundwater.

3) Pump Station

Pump stations (PS) are extremely important structures for flood control during periods of increased rainfall. Additionally, due to the expansion of road drainage facilities, renovations are also required at the connection points between the PS and road drainage mains. Furthermore, there is a need to increase the maximum discharge capacity of the pumps. Therefore, in the MP, they are designated as targets for renovation in the first phase (2023-2025).

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
4-6	Pump Station	Renovation of inflow compartment to the PS and partial pump replacements	GUBBG	Renovation and New Construction	0.3 million USD (0.05 billion JPY)	2025.7-2025.12	Province Budget or City Budget	Pump station is an important structures for flood control. Additionally, it has a high relevance to road drainage facilities, such that its renovation results to a significant synergistic effect.	This PS is designated as a priority for renovation in the first phase of the MP, and it would be considered as a candidate for renovation.

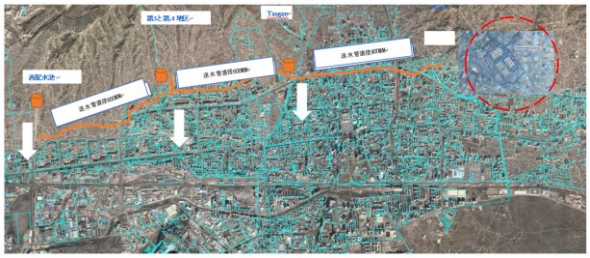
Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Plan View  Section View	MP for Urban Engineering Preparatory Measures	As the only facility in UB City with flood control functions, it has served as the backbone of drainage system since its construction in 1978. Upgrading its functionality is essential for flood prevention measures.

4) Water Supply Facilities (Reservoir)

A plan has been developed to ensure water supply to the Ger district in the northern part of UB City and to increase the water supply for the entire UB City by 30% by expanding the existing reservoir from 6,000 m^3 to 30,000 m^3. Currently, during peak demand hours (18:00 to 21:00), the water demand in UB City reaches 9,000 m^3/hr, posing a risk of dysfunction in the main water supply network from Selbe, Damba, Khailaast, Chingiltei, and Tsaiz-16 to Baga Toiru. To meet the increasing water demand in the future, this reservoir has to be considered as not only crucial for supplying water to the Ger district in the northern part of UB City but also critical for supplying water to the entire UB City.

Additionally, this reservoir is located at a higher elevation compared to other reservoirs in the area, allowing it to supply water to other reservoirs through the connected water supply network. In emergencies, it serves as a solution for addressing depletion in other reservoirs or imbalances in demand. Therefore, being situated at the highest point of the water supply system, this reservoir is the most critical point in the water distribution network and needs to be expanded from a disaster management perspective as well.

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
4-7	Expansion Project for Reservoir in the Northeastern Part of UB City	Establishment of a new reservoir to increase water supply to the ger districts in the northern part of UB City and within UB City itself.	Ulaanbaatar Water Supply and Sewerage Authority	New construction	6 million USD (0.90 JPY)	2025.4-2025.12	Province Budget	This reservoir expansion project holds significant influence on the development plans for the Ger district and is crucial for ensuring stable water supply.	In addition to supplying water to UB City, it is urgent to proceed with the expansion project to reduce environmental burden through hot water supply.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Location Plan of Planned Water Mains  Plan View	Vision 2050: Mongolia's long-term development policy, 6.3, 2021-2030 Action Plan, 9.2.18, New Renewable Policy 5.2, Action Plan for stage 1 implementation 5.2.1, Urban Master Plan 2040	The existing reservoir at this location has the function of supplying water to UB City since its installation in the 1970s. Expanding its storage capacity is expected to meet the increasing demand for water in the future.

6.1.6 Emergency Response Facility for Floods

(1) Long List Related to Emergency Response Facility for Floods

1) Emergency Engine Pumps for Stormwater Discharge (NEMA)

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
5-1	Emergency Engine Pumps	Introduction of Emergency engine pumps (10 units)	NEMA	New procurement	0.05 million USD (0.01 billion JPY)	2025.4-2025.12	Province Budget Agency Budget	These emergency engine pumps are crucial for drainage stormwater during disasters, emphasizing their urgency to procure.	This national stockpile is of high urgency and should be considered as a priority candidate for acquisition.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Reference Photo Product Specifications: Suction × Discharge diameter: 100 × 100 mm Maximum discharge head: 24 m Maximum discharge volume: 1.7 m³ Continuous rated output: 7.3 kW (9.9 PS) / 3600 rpm	Vision 2050: Mongolia's long-term development policy	The conclusion drawn from the EMDC report of the State Emergency Commission after the flood in UB City in July 2023, highlighted insufficient emergency response and equipment. The necessity of pumps for emergency flood response was underscored in the same report.

2) Disaster Response Vehicle (EMDC)

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
5-2	Disaster response vehicles	Introduction of disaster response vehicles (11 units)	EMDC	New procurement	0.7 million USD (0.11 billion JPY)	2024.4-2025.12	Agency Budget	These include firefighting, search and rescue, and other disaster response vehicles. Their urgency is high for responding to forest fires, floods, and other disasters, as well as for personnel and equipment transport, search and rescue operations.	There is a high urgency for vehicles necessary for search and rescue operations, firefighting, and other disaster responses in forests.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Reference Photo [Product Specifications] Top left: Personnel and equipment transport vehicles (4 units) Top right: Forest firefighting vehicles (4 units) Bottom left: Search and rescue vehicles for forests (2 units) Bottom right: Tanker trucks (1 unit)	Vision 2050: Mongolia's long-term development policy, objective 7.3 "Enhance the capacity to reduce, prevent and mitigate the potential risks of non-traditional threats and increase the safety of people and society", 7.3.15 Medium-term strategy for the implementation of the Sendai Framework for Disaster Risk Reduction in Mongolia, no. 3.6	Emergency response vehicles for floods and fires were procured in the 1970s to 1980s, and their service life has already expired. The need for vehicle replacement in emergency response to floods and fires was emphasized by the NEMA Director in a statement to the press on January 25, 2024. During forest fires, agile small firefighting vehicles are considered extremely important according to the Executive Committee of the EMDC.

3) Flood Emergency Response and Water Rescue Equipment

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
5-3	Flood emergency response and water rescue equipment	Introduction of flood emergency response and water rescue equipment	EMDC	New procurement	0.5 million USD (0.08 billion JPY)	2024.4-2025.12	Agency Budget	The urgency is high for responding to disasters such as floods, as well as for personnel and equipment transport, search and rescue operations.	Due to equipment shortages or lack thereof during the floods in July 2023, there is an urgent need for appropriate disaster response.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Reference Photo [Product Specifications] Inflatable lifeboats (4 boats), water and ice rescue equipment (16 sets each), watercraft (3 units), underwater cameras (3 units), decompression chambers (1 unit), life jackets for water rescue team members (20 pieces), wet suits (50 pieces), life jackets (100 pieces), raincoats (30 pieces), chest-high waders (400 pairs), inflatable water barriers, inflatable bridges, flood barriers, polymer sandbags, inflatable tents, drones, generators (220V, 380V), stoves (gas-powered), lighting towers, blowers	Vision 2050: Mongolia's long-term development policy, objective 7.3 "Enhance the capacity to reduce, prevent and mitigate the potential risks of non-traditional threats and increase the safety of people and society", 7.3.15 Medium-term strategy for the implementation of the Sendai Framework for Disaster Risk Reduction in Mongolia, no. 3.6	During the floods in UB city in July 2023, it was concluded at the Capital Emergency Conference that the emergency response and equipment were insufficient. The NEMA Director stated the high necessity for flood response and water rescue-related equipment compliant with international standards, which was publicized in the media on January 25, 2024.

4) Flood Emergency Response and Water Rescue Equipment

No.	Name	Overview	Implement-ation party	Implement-ation type	Cost Estimation	Project Period	Funding Source	Remark (Comments from JST)	Comments from Relevant Authority
5-4	Firefighting and life-saving equipment	Introduction of firefighting and life-saving equipment	EMDC	New procurement	0.4 million USD (0.06 billion JPY)	2024.4-2025.12	Province Budget Agency Budget	The urgency is high for responding to disasters such as fires in forests and urban areas, as well as for search and rescue operations.	There is an urgent need for equipment for search and rescue operations and firefighting as part of disaster response.

Figures (Location Plan, Plan View, Schematic View, etc.)	Relevant High-Level Plan	Maturation
 Reference Photo [Product Specifications] Gun-type nozzle (51mm), rescue ropes, electric chainsaws fireproof clothing	Vision 2050: Mongolia's long-term development policy, objective 7.3 "Enhance the capacity to reduce, prevent and mitigate the potential risks of non-traditional threats and increase the safety of people and society", 7.3.15 Medium-term strategy for the implementation of the Sendai Framework for Disaster Risk Reduction in Mongolia, no. 3.6	There is a high necessity for equipment to ensure preparedness for life-saving response in urban areas. This was highlighted by statements from the NEMA Director following the floods in July 2023 and the fire at a commercial building under construction in September 2014, emphasizing the need for enhanced response capabilities (January 25, 2024). It has been indicated that firefighting emergency response equipment compliant with international standards is necessary, following the approval of the "Specification Requirements for Fire and Rescue Teams" by the EMDC in 2013.

6.2 Short Listing and Prioritization

Based on the long list, a short list will be created through the narrowing down and prioritization of cases. Evaluation criteria for cases (e.g. development effectiveness, investment effectiveness, utilization of domestic technology, and implementation environment, etc.) will be quantified to allow for objective comparison, evaluation, discussion, as well as narrowing down and ranking of cases. In this process, consideration will also be given to the continuity of past technological cooperation and the potential for becoming representative examples of structural measures in the disaster prevention field.

6.2.1 How to make the short list

(1) Evaluation Criteria

Evaluation criteria will focus on the urgency of important facilities, infrastructure, and lifelines in terms of their contribution to disaster prevention against earthquakes and flood disasters. The effectiveness of the measures will be evaluated based on their coordination with higher-level plans and related plans, assessing whether these measures contribute to improving safety and ultimately enhancing the quality of life. This will be understood as the effectiveness of implementation. Additionally, the disaster prevention investment effectiveness will be evaluated based on whether these measures contribute to disaster reduction.

Furthermore, considering practicality, the implementation capacity on the Mongolian side and the presence of rules and regulations to guarantee implementation will be assessed as feasibility. Sustainability will be evaluated based on whether maintenance and management are effectively carried out and whether there are negative impacts on the environment. The degree of Mongolian demand, the background of past studies, will be assessed as maturity.

In addition, the potential of applying domestic technology will be considered as the utilization of domestic technology, and compatibility with aid schemes will be added as an evaluation factor.

Through these evaluations, proposals for candidate projects for Grant Assistance (including Technical Assistance) and projects for Japanese ODA Loan that contribute to strengthening disaster preparedness in UB City and promoting resilient urban development will be made.

The evaluation criteria are as follows:

1) Contribution to Disaster Prevention

- Urgency: Implement as early as possible to address pressing issues, prioritizing implementation ahead of other projects.
- Effectiveness: Contribute to the achievement of higher-level plans, coordination and synergy with other projects.
- Implementation Effect: Improvement in safety, quality of life, and comfort.
- Investment Effectiveness: Contribute to disaster reduction as a disaster prevention investment and reduce the need for post-disaster response.

2) Practicality of the Project

- Feasibility: Implementation capacity of the implementation party, collateral warranties mechanisms.
- Sustainability: Maintenance, management, environmental impact, and risk response prospects after implementation by the implementation party.
- Maturity: Project history, awareness, demands, and needs.
- Utilization of Domestic Technology: Effective utilization of domestic technology and whether it becomes a representative example.
- Compatibility with Aid Schemes.
- Project Cost: Appropriateness and scale of estimated project costs.

(2) Evaluation Method

To narrow down and prioritize the projects, evaluation on the suitability for each evaluation criterion would be based on a five-point scale, to allocate points accordingly.

Table 6.2.1 Evaluation Criteria

Point	Evaluation Criteria
5	Situation improves significantly due to project implementation. Implementation status is very well organized. Urgency, implementation effectiveness, disaster prevention investment effectiveness are very high, with high demand, feasibility, and relevance.
4	Situation improves considerably due to project implementation. Implementation status is organized. Urgency, implementation effectiveness, disaster prevention investment effectiveness are high, with high demand, feasibility, and relevance.
3	Situation improves in certain extent due to event implementation. No specific issues arise during implementation. Urgency, implementation effectiveness, disaster prevention investment effectiveness are moderate, with reasonable demand, feasibility, and relevance.
2	Situation improvement from project implementation is minimal. Potential issues may arise during implementation. Possibility, implementation effectiveness, and demand are not significant, with unclear feasibility and relevance.
1	Implementation may result in maintaining the status quo or worsening a situation. Potential problems may arise during implementation. Low possibility, low demand, low feasibility, and low relevance.

Source: JST

Additionally, the cost estimation is given based on the following indicators:

- ++: Estimation is reasonable, with a large amount (exceeds 35 million USD)
- +: Estimation is reasonable, with an amount between 1 and 35 million USD
- -: Estimation is questionable, with an amount less than 1 million USD

The total score of these indicators is added to the representation. For example: 56++

There are 22 projects after selecting the top 16 in the ranking, as summarized below.

Table 6.2.2 Shortlisted Projects

Investment Project Scoring Sheet Evaluation is on a five-point scale: 1, 2, 3, 4, 5 Evaluation Criteria: ++:>35million USD +:35-1million -:<1.0million

Project No.	No	Project	Evaluation Criteria										Point	Rank
1	1-1	The First General Hospital	5	4	4	4	4	4	4	3	3	+	35 +	7
2	1-2	The Second General Hospital	5	4	4	5	4	4	4	3	3	+	36 +	3
3	1-3	The Third General Hospital	5	4	4	4	4	4	4	3	3	+	35 +	7
4	1-4	The First Maternity Hospital	4	3	4	4	4	4	4	3	3	+	33 +	16
5	1-5	The Second Maternity Hospital (Old Building)	4	3	4	4	4	4	5	3	3	-	34 -	11
6	1-6	National Trauma & Orthopedic Research Center	5	4	4	5	4	4	5	3	3	+	37 +	1
7	1-7	National Centre for Maternal and Child Health	5	4	4	4	4	4	5	3	3	+	36 +	3
8	1-11	Meteorological Agency	5	4	4	3	4	4	3	4	3	+	34 +	11
9	1-16	Seismic retrofitting of School	4	5	4	3	3	3	3	5	3	+	33 +	16
10	1-17	Seismic retrofitting of Kindergarten	4	5	4	3	3	3	3	5	3	+	33 +	16
11	1-22	National Stockpile Warehouse	4	4	3	3	3	4	5	4	3	+	33 +	16
12	1-23	National Stockpile Warehouse	4	4	3	3	3	4	5	4	3	+	33 +	16
13	2-7	Review of seismic retrofitting methods and implementation of retrofitting for piping racks	5	4	4	4	4	3	3	3	3	+	33 +	16
14	2-8	Cell Broadcast System	5	4	4	4	4	3	4	3	3	+	34 +	11
15	3-1	Selbe River Detention Basin	4	5	4	5	3	4	5	4	3	+	37 +	1
16	3-2	Improvement works at lower Selbe River Basin. Zone 1	4	4	4	4	4	3	5	4	3	++	35 ++	7
17	3-3	Improvement works at lower Selbe River Basin. Zone 2	5	4	4	4	4	3	5	4	3	+	36 +	3
18	3-4	Improvement works at middle Selbe River Basin. Zone 1	4	4	4	4	4	3	5	4	3	+	35 +	7
19	3-5	Improvement works at middle Selbe River Basin. Zone 2	4	4	4	5	4	3	5	4	3	+	36 +	3
20	3-6	Improvement works at middle Selbe River Basin. Zone 3	4	4	4	3	4	3	5	4	3	+	34 +	11
21	4-6	Pump Station	4	4	4	4	4	3	4	3	3	-	33 -	16
22	5-1	Introduction of Emergency engine pumps (10 units)	5	3	4	3	5	4	4	3	3	-	34 -	11

Source: JST

6.2.2 Prioritization

(1) Ranking

Based on the evaluation criteria in the previous section, the total scores of the assessment results are calculated, and ranking is conducted. Considering the ranking results, the top-ranked projects are selected. The selection order is determined by setting a certain number of projects to be chosen.

(2) Priority Ranking

The priority of cooperation support is evaluated among the selected top-ranked projects. The priority is determined according to the project scores on urgency, investment effectiveness, and applicability of domestic technology.

6.3 Summary Table of Candidate Projects

A summary table of candidate projects for both Grant Assistance and Japanese ODA Loan is created for the shortlisted projects. This table is intended for use in explanations to the Japanese government and the local government, detailing the background of the project, its necessity, objectives, target areas, expected use of domestic technology, maintenance management system, project schedule, implementation structure, project costs (estimated level), and anticipated development effects.

Table 6.3.1 Summary of Candidate Project

Rank	No.	Project	Background / Overview	Target Area	Objective	Necessity	Domestic Technology	Implement-ation party	Project Period	Development Effects	Cost Estimation (Billion JPY)
1	1-2	The Second General Hospital	Seismic retrofit with existing operation of Blocks 1 to 2 Floor area: 14,348 m^2	Bayanzurkh District	Seismic retrofitting	Critical as a disaster prevention base, high urgency for seismic retrofitting.	General wall reinforcement is expected.	MOH	2026.1-2027.12	Enable safety assurance of hospitalized patients and treatment of injured individuals during disasters.	1.21
1	1-6	National Trauma & Orthopedic Research Center	Seismic retrofit with existing operation of Blocks 1 to 4 Floor area: 16,163 m^2	Bayangol District	Seismic retrofitting	Critical as a disaster prevention base, high urgency for seismic retrofitting.	General wall reinforcement is expected.	MOH	2026.1-2027.12	Enable safety assurance of hospitalized patients and treatment of injured individuals during disasters.	1.21
1	3-1	Selbe River Detention Basin	Construction of detention basin with detention capacity of 1,300,000 m^3 at upper Selbe River Basin.	Sukhbaatar District	New Construction	It is believed to contribute to flood prevention through peak-cutting effects. Furthermore, the utilization of domestic technologies 5 and 6 is anticipated.	Measures against leakage, river monitoring, and maintenance management of embankments.	MCUD, UB City	2026.1-2028.12	Reduction of peak flow volume during floods in the Selbe River	4.94
1	3-3	Improvement works at lower Selbe River Basin. Zone 2	1.8 km River improvement at lower Selbe River Basin. (From Factory Crescent) to the confluence with the Tuul River)	Khan-uul District	New Construction	Due to scattered low embankment heights, the improvement of channel by excavation is effective. Additionally, since there is considerable sediment deposition, the effect of securing flow area through dredging is substantial. The utilization of domestic technology 6 is anticipated.	River monitoring, maintenance management of embankments.	MCUD, UB City	2028.1-2029.12	Prevention of floods through improvement of downstream capacity via river channel restoration, dredging, etc.	1.19

Rank	No.	Project	Background / Overview	Target Area	Objective	Necessity	Domestic Technology	Implement-ation party	Project Period	Development Effects	Cost Estimation (Billion JPY)
1	3-5	Improvement works at middle Selbe River Basin. Zone 2	0.8 km River improvement along the curved section and its downstream. (From the Railway Bridge to the Olympic Bridge)	Sukhbaatar District	New Construction	Due to scattered low embankment heights, the improvement of channel by excavation is effective. The utilization of domestic technology 6 is anticipated.	River monitoring, maintenance management of embankments.	MCUD, UB City	2026.1-2028.12	Prevention of floods through improvement of downstream capacity via river channel restoration, dredging, etc.	1.10
6	1-1	The First General Hospital	Seismic retrofit with existing operation of Blocks 1 to 5 Floor area: 22,157 m^2	Sukhbaatar District	Seismic retrofitting	Critical as a disaster prevention base, high urgency for seismic retrofitting.	General wall reinforcement is expected.	MOH	2026.1-2027.12	Enable safety assurance of hospitalized patients and treatment of injured individuals during disasters.	1.66
6	1-3	The Third General Hospital	Seismic retrofit with existing operation of Blocks 1 to 5 Floor area: 32,140 m^2	Bayangol District	Seismic retrofitting	Critical as a disaster prevention base, high urgency for seismic retrofitting.	General wall reinforcement is expected.	MOH	2026.1-2027.12	Enable safety assurance of hospitalized patients and treatment of injured individuals during disasters.	2.4
6	1-7	National Centre for Maternal and Child Health (Obstetrics and Gynecology Building)	Seismic retrofit with existing operation of Blocks A to E Floor area: 19,993 m^2	Bayangol District	Seismic retrofitting	Critical as a disaster prevention base, high urgency for seismic retrofitting.	General wall reinforcement is expected.	MOH	2026.1-2027.12	Enable safety assurance of hospitalized patients and treatment of injured individuals during disasters.	0.35
6	1-11	Meteorological Agency	Seismic retrofitting of Headquarters of Meteorological Agency Floor area: 3,372 m2	Bayangol District	Seismic retrofitting	Collecting and disseminating disaster information is critical for disaster response. The seismic resistance is low.	Reinforcement construction using steel braces, divided by district.	Meteorological Agency	2026.1-2027.12	Protection of emergency response team bases during disasters.	0.38
6	1-16	Seismic retrofitting of School	Seismic retrofitting of historical schools will be carried out using a prestressing method to maintain their exterior appearance. Four	Sukhbaatar District	Seismic retrofitting	Ensuring the safety of students is crucial during disaster. It is a promising candidate for the application of advanced domestic	Adoption of methods for maintaining aesthetic appearance.	MES	2026.1-2027.12	Ensuring and expanding evacuation sites	2.61

Rank	No.	Project	Background / Overview	Target Area	Objective	Necessity	Domestic Technology	Implement-ation party	Project Period	Development Effects	Cost Estimation (Billion JPY)
			buildings will be targeted. Floor area: 15,500 m^2			technology ф ᠍.					
6	1-17	Seismic retrofitting of Kindergarten	Seismic retrofitting of historical kindergarten will be carried out using a prestressing method to maintain their exterior appearance. Two buildings will be targeted. Floor area: 2,100 m^2	Sukhbaatar District	Seismic retrofitting	Ensuring the safety of students is crucial during disaster. They are promising candidates for the application of advanced domestic technology ф ᠍.	Adoption of methods for maintaining aesthetic appearance.	MES	2026.1-2027.12	Ensuring and expanding evacuation sites	0.47
6	2-7	Review of seismic retrofitting methods and implementation of retrofitting for piping racks	Piping racks are classified based on materials, structure, and shape to determine standard retrofitting measures and implement retrofitting.	Khan-uul, Bayangol District	Seismic retrofitting	It is important to establish standardized reinforcement measures for piping racks where individual evaluations are not suitable.	General seismic reinforcement is expected.	MCUD	2025.1-2026.12	Ensure reliable hot water supply, which is essential for life support during earthquakes.	0.90
6	2-8	Cell Broadcast System	Establishment of a system to transmit disaster alerts to mobile terminals via mobile phone networks.	National	New Development	It is highly important as a disaster alert system applied to all models and operating systems of smartphones, which are widely used.	Construction by conventional methods is expected.	Ministry of Digital Development	2024-2027	Promotion of early warning systems during disasters.	0.71
6	3-2	Improvement works at lower Selbe River Basin. Zone 1	5 km River improvement at lower Selbe River Basin. (From Atlai Residential Bridge to Factory Crescent)	Khan-uul District	New Construction	Due to scattered low embankment heights, the improvement of channel by excavation is effective. Additionally, since there is considerable sediment deposition, the effect of securing flow area through dredging is substantial. The	River monitoring, maintenance management of embankments.	MCUD, UB City	2028.1-2029.12	Prevention of floods through improvement of downstream capacity via river channel restoration, dredging, etc.	5.53

Rank	No.	Project	Background / Overview	Target Area	Objective	Necessity	Domestic Technology	Implement-ation party	Project Period	Development Effects	Cost Estimation (Billion JPY)
						utilization of domestic technology 6 is anticipated.					
6	3-4	Improvement works at middle Selbe River Basin. Zone 1	1.3 km River improvement at middle Selbe River Basin. (From UNESCO Street Bridge to the Railway Bridge)	Sukhbaatar District	New Construction	Due to scattered low embankment heights, the improvement of channel by excavation is effective. The utilization of domestic technology 6 is anticipated.	River monitoring, maintenance management of embankments.	MCUD, UB City	2026.1-2028.12	Prevention of floods through improvement of downstream capacity via river channel restoration, dredging, etc.	1.12
16	1-4	The First Maternity Hospital	Seismic retrofit with existing operation of Blocks 1 to 3 Floor area: 8,100 m^2	Sukhbaatar District	Seismic retrofitting	Critical as a disaster prevention base, high urgency for seismic retrofitting.	General wall reinforcement is expected.	MOH	2026.1-2027.12	Enable safety assurance of hospitalized patients and treatment of injured individuals during disasters.	0.91
16	1-5	The Second Maternity Hospital (Old Building)	Seismic retrofitting for old building Floor area: 1,300 m^2	Sukhbaatar District	Seismic retrofitting	Critical as a disaster prevention base, high urgency for seismic retrofitting.	General wall reinforcement is expected.	MOH	2026.1-2027.12	Enable safety assurance of hospitalized patients and treatment of injured individuals during disasters.	0.15
16	1-22	National Stockpile Warehouse	To meet the needs of the 1.6 million residents of UB City for two weeks, a new petroleum stockpile warehouse with a capacity of 20,000 m^3 will be constructed in the western part of UB City.	Songinokhairkhan District	New Construction	It is extremely important as a disaster base. It is a promising candidate for the application of advanced domestic technology 2, related to stockpiling.	Storage techniques for stockpiling warehouses.	NEMA	2026.1-2027.12	Securing supplies and response to import disruptions from neighboring countries during disasters.	3.01
16	1-23	National Stockpile Warehouse	To meet the needs of the 1.6 million residents of UB City for one week, a new food stockpile warehouse with a	Songinokhairkhan District	New Construction	It is a promising candidate for the application of advanced domestic technology 2, related to food stockpiling,	Storage techniques for stockpiling warehouses.	NEMA	2026.1-2027.12	Securing supplies and response to import disruptions from neighboring countries during disasters.	3.77

Rank	No.	Project	Background / Overview	Target Area	Objective	Necessity	Domestic Technology	Implement-ation party	Project Period	Development Effects	Cost Estimation (Billion JPY)
			capacity of 21,020 tons will be constructed in the western part of UB City.			including sanitation management.					
16	3-6	Improvement works at middle Selbe River Basin. Zone 3	1.2 km River improvement along the downstream of the curved section (From the Olympic Bridge to Peace Bridge)	Sukhbaatar District	New Construction	Due to scattered low embankment heights, the improvement of channel by excavation is effective. The utilization of domestic technology 6 is anticipated.	River monitoring, maintenance management of embankments.	MCUD, UB City	2026.1-2028.12	Prevention of floods through improvement of downstream capacity via river channel restoration, dredging, etc.	1.43
16	4-6	Pump Station	Renovation of inflow compartment to the PS and partial pump replacements	Bayangol District	Renovation and upgrading works	Important structures for flood control. Additionally, it has a high relevance to road drainage facilities, resulting in a significant synergistic effect.	General renovation works is expected.	GUBBG, UB City	2025.7-2025.12	Improvement of drainage function to suppress inundation.	0.05
16	5-1	Emergency Engine Pumps	Introduction of Emergency engine pumps (10 units)	Sukhbaatar District	New procurement	The urgency concerning drainage stormwater during disasters is high.	Assuming equipment equivalent to existing pumps.	NEMA	2025.4-2025.12	Early recovery during flood occurrences.	0.01

"※ The Selbe River project will be omitted from Table 6.3.2 as it will be described later in the section on "Technical Assistance"

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6.4 Consideration of Target Projects

6.4.1 Necessity of Additional Information

The items that require reconfirmation for collaboration on the shortlisted projects are shown below. Subject to the confirmation results, the specifications and project costs may change.

(1) Consideration of Specifications Based on Supplementary Information

[Relevant Project]: Selbe River Flood Control Measure (3-1 Detention Basin, 3-2 Downstream River Improvement Zone 1, 3-3 Downstream River Improvement Zone 2, 3-4 Midstream River Improvement Zone 1, 3-5 Midstream River Improvement Zone 2, 3-6 Midstream River Improvement Zone 3)

As for the design basis for the projects related to the Selbe River Flood Control Measure, it is based on the specifications derived from the preliminary survey results of the Urban Engineering MP published in January 2024 and the Selbe River Restoration Plan released simultaneously. Although the purpose and direction of the measures are within the acceptable range, it is necessary to clarify the following points in detail and revise the design during implementation.

1) Evaluation of Design Flow Rate

It is necessary to confirm the basis for the assumed 100-year probability rainfall of 125.2mm and to verify the calculation basis for computing the design flow rate, parameters such as river length, catchment area, and average gradient within the catchment area should be evaluated for validation of design flow rate calculation.

→ After confirming the conditions, the assumed design flow rate should be evaluated and revised it if necessary.

2) Verification of Cross-Section Design

There are discrepancies between the current conditions shown in the design drawings and the actual current conditions at the bottleneck location near the Narny Road Bridge. Additionally, there have been condition changes in some locations, necessitating a design review of the improvement works.

→ The design should be reviewed and revised after understanding the details of the terrain changes.

3) Assessment of Detention Basin Capacity

After verifying the above-mentioned design flow rate and evaluating the cross-sectional flow rate, it is necessary to evaluate the adequacy of the detention basin's scale and re-examine the flood regulation effect.

→ Evaluate the cross-sectional flow rate, re-examine the flood detention volume, and evaluate the detention basin's design.

4) Coordination with Riverside Land Use

In areas planned for river widening, there are locations where land has already been occupied for use, requiring confirmation to ensure there are no issues.

→ Verify the discrepancies between the current land use conditions and the new river plan.

(2) Update of Project Costs

[Relevant Project]: Seismic Retrofitting (1-1～5, 1-6,7,11,17,18,2-7), Selbe River Restoration (3-～6), Stockpile Warehouse (1-23,24)

For projects involving construction activities, it is necessary to carefully assess the unit construction costs due to the ongoing trend of rising material prices and labor costs in recent years.

→ Careful assessment of construction costs during detailed design and cost estimation.

6.5 Technical Assistance

6.5.1 Necessity of Technical Assistance

For the shortlisted projects related to river flood control, it is also possible to conduct additional investigation projects to clarify the points to be confirmed as indicated in 6.4.1(1). The targeted projects extracted from the shortlist are shown below.

Table 6.5.1 Summary of Technical Assistance Project to be Evaluated

Rank	No.	Project	Background/ Overview	Domestic Technology	Implementation/ Maintenance/ Management Structure	Project Schedule	Development Effect	Cost Estimation (Billion JPY)
1	3-1	Selbe River Detention Basin	Construction of detention basin with detention capacity of 1,300,000 m^3 at upper Selbe River Basin.	Measures against leakage, river monitoring, and maintenance management of embankments.	MCUD, UB City	2026.1-2028.12	Reduction of peak flow volume during floods in the Selbe River	4.94
6	3-2	Improvement works at lower Selbe River Basin. Zone 1	5 km River improvement at lower Selbe River Basin. (From Atlai Residential Bridge to Factory Crescent)	River monitoring, maintenance management of embankments.	MCUD, UB City	2028.1-2029.12	Prevention of floods through improvement of downstream capacity via river channel restoration, dredging, etc.	5.53
1	3-3	Improvement works at lower Selbe River Basin. Zone 2	1.8 km River improvement at lower Selbe River Basin. (From Factory Crescent) to the confluence with the Tuul River)	River monitoring, maintenance management of embankments.	MCUD, UB City	2028.1-2029.12	Prevention of floods through improvement of downstream capacity via river channel restoration, dredging, etc.	1.19
6	3-4	Improvement works at middle Selbe River Basin. Zone 1	1.3 km River improvement at middle Selbe River Basin. (From UNESCO Street Bridge to the Railway Bridge)	River monitoring, maintenance management of embankments.	MCUD, UB City	2026.1-2028.12	Prevention of floods through improvement of downstream capacity via river channel restoration, dredging, etc.	1.12
1	3-5	Improvement works at middle Selbe River Basin. Zone 2	0.8 km River improvement along the curved section and its downstream. (From the Railway Bridge to the Olympic Bridge)	River monitoring, maintenance management of embankments.	MCUD, UB City	2026.1-2028.12	Prevention of floods through improvement of downstream capacity via river channel restoration, dredging, etc.	1.10
16	3-6	Improvement works at middle Selbe River Basin. Zone 3	1.2 km River improvement along the downstream of the curved section (From the Olympic Bridge to Peace Bridge)	River monitoring, maintenance management of embankments.	MCUD, UB City	2026.1-2028.12	Prevention of floods through improvement of downstream capacity via river channel restoration, dredging, etc.	1.43

Source: JST

The current unclear points that need to be clarified in the investigation are as follows:

- Confirmation of the basis for the assumed 100-year probable rainfall of 125.2mm is required. Additionally, the basis for calculating parameters such as river length, catchment area, and average gradient within the catchment area is unclear. These need to be verified to determine the appropriateness of the design flow.
- Near the bottleneck locations, there is a discrepancy between the current conditions shown in the design drawings and the actual current conditions. There are significant changes to the current conditions, which require a review of the construction plan based on the current situation.
- Confirm the appropriateness of the design flow and reconsider the scale, flood regulation volume, and design details of the detention basin.
- Verify whether there are any issues with the planned river widening areas that overlap with existing land use.

As a method of implementation, considering that conclusions have been drawn by the Mongolian side in the Urban Engineering Measures MP, it is recommended to conduct verification and review based on technical dialogue with the Mongolian side. Therefore, it is proposed to consider implementation through development study-type technical cooperation.

6.5.2 Content of Technical Assistance

The following content is anticipated for the Technical Assistance

(1) Purpose

The purpose of this survey is to verify the basic conditions related to flood control measures for the Selbe River basin in UB City, including natural conditions and other fundamental survey content. This includes examining design flow and design conditions for river facilities, aiming to optimize the flood control facilities.

(2) Survey Content

The following items, which were considered in the Selbe River Restoration Plan and the Urban Engineering Measures MP, will be investigated:

- Natural conditions
- Confirmation of observation status
- Verification of basic conditions such as river flow
- Verification of land use conditions
- Verification of design conditions for river facilities
- Project implementation plan
- Confirmation of construction plans (e.g., handling of railways during construction at the railway bridge section)
- Necessity of relocation of residences and facilities
- Future maintenance methods of river facilities

(3) Survey Period

The survey period is assumed to be one year.

(4) Counterpart (CP)

MCUD, Mayor Office of UB City.

Chapter 7 Suggestion for Future Support Policy

In this chapter, we report on the points to consider when implementing the projects selected for the shortlist.

7.1 Points to Consider in Support Across Various Sectors

The perspectives of (1) hazard level, (2) vulnerability, and (3) impact magnitude should be considered in response to natural disasters. For hazard level, attention should be paid to the magnitude of the natural phenomenon (e.g., the intensity of shaking from an earthquake or the extent of flooding) and its range. Additionally, the difficulty of predicting the occurrence and the progression of the event should also be considered. For vulnerability, consideration should be given to the aging of structures and equipment, as well as the differences between the design conditions at the time of their construction and the current conditions. For impact magnitude, attention should be paid to the potential extent of impact if the structures or equipment were to be affected and the difficulty of recovery.

7.1.1 Building

When implementing seismic reinforcement, it is necessary to assess the load capacity of post-installed anchors before their installation, as is commonly practiced in Mongolia for existing brick structures.

For hospital buildings, seismic reinforcement often needs to be carried out while the building is in use, necessitating the adoption of "in-place" construction methods. If in-place construction is not feasible, it is necessary to devise construction plans such as dividing the construction area to minimize disruption to daily operations.

For schools and kindergartens, it is necessary to choose design methods that consider exterior preservation. Additionally, the adoption of special construction methods such as inserting PC steel bars is anticipated, making monitoring during construction essential. Moreover, as they do not have concrete cast-in-place floor slabs, their horizontal rigidity and lateral resistance may be insufficient. Therefore, it is necessary to select horizontal stiffening methods that minimize impacts on the interior.

In selecting retrofitting methods, it is important to apply techniques that can serve as examples for Mongolia's ongoing seismic retrofitting projects and can also contribute to the introduction of domestic technology.

For stockpile warehouses, the efficient management of stored goods, efficient operation of the warehouse, and effective utilization of goods nearing their expiration dates are challenges. To address these issues, it is necessary to establish inventory and data management systems, understand the location of goods within the warehouse, review the layout of goods placement, and ensure the accurate tracking of expiration dates to effectively utilize surplus goods.

7.1.2 Lifeline

To minimize the impact on the foundation, reinforcing piping racks with steel members is a practical approach. Some piping racks may be made of concrete, so it is important to pay attention to the design and construction of joints in such cases.

In reinforcing steel racks, it is necessary to not only install new braces but also reinforce existing columns and beams that have deteriorated due to aging, as appropriate.

7.1.3 River and Urban Drainage

(1) Selbe River Flood Prevention Measures

The 100-year probability peak flow rate of 288 m^3/s needs to be verified since its validity has not been confirmed based on rainfall and other factors.

For the middle and lower reaches, it is believed that the river improvement design at bottleneck sections (especially the railway bridge) does not have the capacity to handle the 100-year probability peak flow rate of 288 m^3/s, and the plan is based on the construction of a detention basin, so its validity needs to be confirmed.

Detailed confirmation of the scale's validity will be necessary for the detention basin based on the verification results of the peak flow rate. Furthermore, the detention basin will require operations such as storage and discharge before and after heavy rainfall through gates, so the establishment of a maintenance management system including the management and operation methods is also required.

In the planning process, considerations need to be given to measures for nearby transmission towers, substations, and other lifeline facilities, as well as handling of the railway during the construction of the railway bridge.

From the perspective of land use in the surrounding area, it is necessary to plan with anticipation for the removal of illegal buildings near the river and coordination with landowners.

(2) Urban Drainage Facility

For the pump stations (PS) selected for the shortlist, when updating the pumps, it is necessary to be aware that due to differences in manufacturers and between old and new models, the size and shape of the compatible pump frames may vary. Therefore, in the short term, it is important to update with pumps that are compatible with the existing ones.

Furthermore, although frequent pipe breakage does not seem to have occurred so far, the existing PS does not have water hammer protection measures such as air valves. When high-power pumps are updated and the pipe flow rate increases, there is a concern about pipe damage due to water hammer. In the future, when updating pipes, valves, and other components, the introduction of measures against water hammer should be considered. Although it depends on the balance with the project cost, adopting pumps with a flywheel can also be effective as a measure against water hammer. In the long term, as the aging of the entire facility becomes more severe, renovations of all equipment and facilities, including the pumps, are required.

7.2 Exploration of Comprehensive Development Study-type Technical Cooperation Support

7.2.1 Necessity of Comprehensive Development Study-type Technical Cooperation Support

Regarding the flood control measures for the Selbe River, referred to as Shortlist 3-1 to 3-6, further survey was proposed for the review in the Master Plan for City Engineering Preparation Measures as part of the considerations related to the Selbe River flood control measures, as indicated in section 6.5, "Technical Assistance" However, based on the results of this study, it is believed that the following issues remain primarily unaddressed in the existing flood control MP.

The following aspects of the existing flood prevention MP need to be confirmed and potentially revised as necessary.

- The Selbe River basin, which encompasses UB City, the capital of Mongolia, is expected to see further urban development and expansion. The progression of urbanization could significantly impact the runoff mechanisms from the basin. However, it is unclear to what extent the existing MP takes into account the effects of future urban expansion and redevelopment. Additionally, changes in rainfall intensity due to climate change could also affect flood flows, but it is unclear how these factors were considered in the planning process. As a flood risk management MP that supports the sustainable development of the city, it is necessary to consider a long-term perspective that looks ahead to the next 20-30 years at least, but this may not have been sufficiently taken into account.
- The awareness of flood-prone areas along the river, regulation of new developments, and land use management to secure river areas have not been sufficiently discussed in connection with urban planning and land use planning. In other words, it is considered that a comprehensive flood

risk management MP that combines structural and non-structural measures to manage flood risks has not been established.

One of the support measures to address these issues could involve Comprehensive Development Study-type Technical Cooperation from the following perspectives:

- Implementation of flood hazard and risk assessments that fully consider the impacts of future urban and regional development, as well as the effects of climate change.
- Practice of flood risk management based on flood hazard and risk assessments, including the development of a comprehensive flood risk management plan that combines structural and non-structural measures, and feedback to urban planning and land use planning.

Based on the above, although a series of evaluations have been conducted within the Urban Engineering Measures MP for the Selbe River basin, if there is a request from the Mongolian side for a comprehensive review of the flood prevention MP or for technical support regarding a comprehensive flood risk management MP, it is conceivable to implement Comprehensive Development Study-type Technical Cooperation.

7.2.2 Contents of Comprehensive Development Study-type Technical Cooperation

The technical cooperation is anticipated to be conducted with the following contents:

(1) Project Name (Tentative)

"National Flood Risk Assessment and Flood Risk Management Project for Key Urban Area"

(2) Objective

Based on the existing documents, a preliminary assessment of the national distribution of flood risks as regional information will be conducted. From there, representative cities and regions will be selected from major urban and regional areas nationwide, considering natural and social characteristics. The project will scrutinize changes in the basin due to natural and social conditions, particularly urban expansion and redevelopment, and assess future flood hazards and risks. Subsequently, UB City and one or two other key cities or regions, where risks are presumed to be high, will be selected to implement flood risk management through the development of a comprehensive flood risk management plan. Guidelines for flood hazard and risk assessment and comprehensive flood risk management plan will be compiled based on project experiences, with consideration for a national rollout by Mongolia after the project's completion.

(3) Output

Output 1: A flood hazard and risk assessment methodology that fully considers the impacts of future urban and regional development and the effects of climate change will be established.

Output 2: A comprehensive flood risk management plan will be developed in the selected key cities and regions.

Output 3: Guidelines related to the flood hazard and risk assessment methodology and the formulation of a comprehensive flood risk management master plan will be prepared.

(4) Survey Period

The survey period is assumed to be three years.

(5) Counterpart (CP)

MCUD, UB City, Related regional governments

7.3 Flexible Management of Financial Assistance

The projects short listed in this survey are being considered for Grant Assistance, but considering the actual situation in Mongolia, we are also exploring the utilization of ODA Loan for projects where it would be effective.

7.3.1 Issues Related to River and Urban Drainage Items Related to River and Urban Drainage

The justification for utilizing Grant Assistance for individual projects can be made based on a comprehensive judgment of the following points:

(1) Project Nature

- Swift response is necessary to prevent the expansion and recurrence of damages in disasters: Urgency and Promptness
- Responding to threats to individual dignity, life, and livelihood from natural disasters, from the perspective of human security: Humanitarian Needs
- The effects extend to surrounding areas, making it difficult to be burdened by only the host country: Broad Scope

(2) Foreign Policy of Our Country

- Contributes to strengthening bilateral relations and enhancing Japan's presence: Diplomatic Perspective
- Aligns with key government strategies such as "National Security Strategy," "Japan Revitalization Strategy," and "Infrastructure Export Strategy": Alignment with Key Policies
- Takes into account international activities including those of other donors: International Perspective

7.3.2 Extraction of Candidate Projects

(1) Evaluation of Candidate Projects

For the shortlisted projects, the suitability of each project has been evaluated using the criteria outlined above, with the following five-level rating system.

Table 7.3.1 Evaluation Criteria for Suitability of Project

Point	Evaluation Criteria
5	Highly Suitable
4	Moderately Suitable
3	Generally Suitable
2	Slightly Insufficient Suitability
1	Highly Unsuitable

Source: JST

The evaluation results are shown in the following scoring table.

Table 7.3.2 Evaluation Result

No	Project Name	Evaluation Items					Point	Rank
		Urgency	Humanitarian	Bilateral Relations/ Presence	Relevance to Key Policies	International Trend		
1-2	The Second General Hospital	5	4	4	3	3	19	9
1-6	National Trauma & Orthopedic Research Center	5	4	4	3	3	19	9
3-1	Selbe River Detention Basin	4	3	4	5	3	19	9
3-3	Improvement works at lower Selbe River Basin. Zone 2	5	3	4	5	5	22	3
3-5	Improvement works at middle Selbe River Basin. Zone 2	4	3	4	5	5	21	8
1-1	The First General Hospital	5	4	4	3	3	19	9
1-3	The Third General Hospital	5	4	4	3	3	19	9
1-7	National Centre for Maternal and Child Health (Obstetrics and Gynecology Building)	5	4	4	3	3	19	9
1-11	Meteorological Agency	5	3	4	3	3	18	19
1-16	4 Schools	4	4	4	3	3	18	19
1-17	2 Kindergarten	4	4	4	3	3	18	19
2-7	seismic diagnosis and retrofitting of retrofitting for piping racks	5	4	4	5	4	22	3
2-8	Cell Broadcast System	5	4	4	3	3	19	9
3-2	Improvement works at lower Selbe River Basin. Zone 1	4	4	4	5	5	22	3
3-4	Improvement works at middle Selbe River Basin. Zone 1	4	4	4	5	5	22	3
1-4	The First Maternity Hospital	4	4	4	3	3	18	19
1-5	The Second Maternity Hospital (Old Building)	4	4	4	3	3	18	19
1-22	National Stockpile Warehouse	4	4	5	5	5	23	1
1-23	National Stockpile Warehouse	4	4	5	5	5	23	1
3-6	Improvement works at middle Selbe River Basin. Zone 3	4	4	4	5	5	22	3
4-6	Pump Station	4	4	4	3	3	18	19
5-1	Emergency Engine Pumps	5	3	4	3	3	18	19

Source: JST

The evaluation results showed that the two projects of National Fuel Stockpile Warehouse and Food Stockpile Warehouse ranked first.

(2) Overview of Candidate Projects and the Country's Situation

The following projects have been extracted as candidate projects of Japanese ODA Loan. Regarding the National Fuel Reserves, although the country is currently constructing its first oil refining plant, the existing storage capacity is insufficient, and aging of facilities is significant. There are concerns about the instability of fuel supply from Russia and China during disasters. Similarly, for the Food

Stockpile Warehouse, the current reserves are quantitatively inadequate, and there are many issues regarding the quality and safety of stored goods. Therefore, considering the urgency of food and fuel supply during disasters, humanitarian considerations, and concerns about unstable supply due to being geographically sandwiched between Russia and China, these projects are worth considering.

Table 7.3.3 Project Candidates of Japanese ODA Loan

No.	Project	Background / Overview	Target Area	Objective	Necessity	Domestic Technology	Implementation/ Maintenance and Management Structure	Project Schedule	Cost Estimation (Billion JPY)
1-22	National Stockpile Warehouse	To meet the needs of the 1.6 million residents of UB City for two weeks, a new petroleum stockpile warehouse with a capacity of 20,000 m^3 will be constructed in the western part of UB City.	Songinokh airkhan District	New Con-struction	It is extremely important as a disaster base. It is a promising candidate for the application of advanced domestic technology ②, related to stockpiling.	Storage techniques for stockpiling warehouses.	NEMA	2026.1-2027.12	3.01
1-23	National Stockpile Warehouse	To meet the needs of the 1.6 million residents of UB City for one week, a new food stockpile warehouse with a capacity of 21,020 tons will be constructed in the western part of UB City.	Songinokh airkhan District	New Con-struction	It is a promising candidate for the application of advanced domestic technology ②, related to food stockpiling, including sanitation management.	Storage techniques for stockpiling warehouses.	NEMA	2026.1-2027.12	3.77

Source: JST

Furthermore, Mongolia is in the following situation, which also meets the requirements for ODA.

[Consideration on the Situation of Mongolia]

- It is difficult to provide Grant Assistance from the perspective of repayment capacity. It is also considered that imposing new debt burdens may not be appropriate: Debt Situation
- Although the income level is statistically high, factors such as a small economy and dependence on a single industry make it vulnerable to international economic fluctuations: Economic Vulnerability
- Due to factors such as a small land area or being located in mountainous regions, the country is vulnerable to changes in the natural environment: Environmental Vulnerability