



Technical Assistance Consultant's Report

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Mongolia: Darkhan Wastewater Management Project

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For the Ministry of Construction and Urban Development, Darkhan-uul *aimag* government, and Darkhan Us Suvag

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Asian Development Bank

Wastewater Management for Darkhan – Project Preparation

L2301-MON: Urban Sector Development Project (Additional Financing)
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Ministry of Construction & Urban Development; Darkhan Us Suvag



Final Report – Appendices (Vol. 1)

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APPENDIX A: OVERALL TERMS OF REFERENCE FOR THE ASSIGNMENT

1. **Municipal wastewater management specialists / team leader and deputy team leader** (international, 3.0 person-months; national, 3.0 person-months). Both experts should have as a minimum a Master's degree in civil or sanitary engineering, and at least 15 years of relevant work experience in the area of wastewater management, treatment, collection system planning, design, construction management, and operation and maintenance (O&M). The expert's will

- (i) Review and assess all relevant government urban and sector development plans, and environmental policies.
- (ii) Analyze current wastewater treatment and management and assess the existing wastewater treatment plant (WWTP) and its O&M, with respect to suitability for rehabilitation and expansion or recommend construction of a new WWTP.
- (iii) Review and confirm population equivalents and growth rates up to 2020, and per capita generation rates, to determine a planning horizon. Review and evaluate the standards or targets for surface water quality and effluent discharge.
- (iv) Conduct peer review of domestic and international best practices wastewater treatment and management including Asian Development Bank (ADB) projects, review alternative plant designs and technologies, and recommend an optimal approach for the WWTP in Darkhan.
- (v) Outline expected impact, outcomes, outputs, inputs, and activities of the project.
- (vi) Develop baseline wastewater management infrastructure and services provision, environmental, and social indicators (including health and other relevant data) for effective monitoring of project performance.
- (vii) Identify current status of sewer pipes and connections and determine target of sewer construction, if needed.
- (viii) Analyze industrial effluents and pretreatment requirements in assessing wastewater strength and assess separation or combination of WWTP operations.
- (ix) Develop and optimize design of the WWTP either as rehabilitation and expansion of the existing facility or as the construction of a new WWTP, optimize efficiency, provide cost estimates determining least cost solution, and reduce land acquisition and resettlement requirements and costs.
- (x) Ensure cross-cutting concerns (resettlement, environment, poverty, social issues, gender, private sector development, and anticorruption) are rigorously addressed.
- (xi) Develop arrangements and plans for management and O&M.
- (xii) Provide terms of reference (TORs) for project implementation consultants.
- (xiii) Prepare detailed procurement plan and appropriate contract packaging, and provide inputs for bid documents for the project following ADB's Procurement Guidelines (2010, as amended from time to time).
- (xiv) Prepare project implementation schedule and detailed implementation arrangements.
- (xv) Coordinate with the other experts and ensure timely preparation of inception, interim, draft final, and final TA reports and their submission to the government and ADB in the below outlined formats and with the respective content:
 - (a) feasibility study for the Darkhan city WWTP, and
 - (b) documentation for the report and recommendation of the President and all required linked documents.

2. **Environment specialist** (international, 1.5 person-months) shall be professionally qualified with a minimum of a Master's degree in environmental engineering or similar related field, and 15 years of relevant work experience in environmental impact assessment (EIA) and environmental management for urban environmental infrastructure projects. The expert will

- (i) Conduct rapid environmental assessment to propose the project's environmental categorization, and list environmental issues to be addressed in the EIA and environmental management plan (EMP).
- (ii) Prepare the EIA and EMP for the project, meeting the requirements and following the format and contents specified in ADB's Safeguard Policy Statement (2009), including the following activities:
 - (a) screen environmental risks and impacts;
 - (b) establish comprehensive baseline information, including accurate description of project

- activities during construction;
- (c) assess potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, and socioeconomic resources in the context of the project's area of influence as defined in appendix 1, para. 6 of the Safeguard Policy Statement;
- (d) perform due diligence of project associated and existing facilities;
- (e) assess risks to physical cultural resources, including physical cultural resources protection planning, if necessary;
- (f) assess potential trans-boundary and global impacts, including climate change;
- (g) establish meaningful public consultation and grievance redress mechanism,
- (h) address occupational and community health and safety (including emergency preparedness and response plans);
- (i) address impacts on local livelihood systems through environmental media;
- (j) assess impact on biodiversity, and related biodiversity conservation and natural resources management requirements;
- (k) ensure compliance with internationally accepted standards and guidelines such as the World Bank Group's Environmental, Health and Safety Guidelines;
- (l) comprehensively analyze project alternatives, including the without-project option; and
- (m) develop an EMP that includes proposed mitigation measures, environmental monitoring and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementations schedule, cost estimates, and performance indicators.
- (iii) Undertake all aspects of environmental work in coordination with the other experts.
- (iv) Recommend environmentally friendly options for project design and construction, including potential use of clean energy sources, reduction of greenhouse gas emissions, and climate change resilient options.
- (v) Advise local government on the EIA requirements specified in the Safeguard Policy Statement.
- (vi) Assist with stakeholder participation, consultation, involvement, and disclosure of relevant information, in accordance with the requirements of the Safeguard Policy Statement.
- (vii) Assess capacity of the local government and implementing agency on environmental assessment, management, and monitoring and recommend capacity building measures.
- (viii) Help develop project-level grievance redress framework covering formal and informal channels, and setting out timeframe and mechanisms for resolving EMP implementation and environmental performance complaints, in accordance with the requirements of the Safeguard Policy Statement.
- (ix) Establish environmental baseline indicators and performance targets for both output and outcome indicators.
- (x) Prepare TOR and budget requirements for EMP implementation support and external EMP implementation monitoring.
- (xi) Present the project EIA findings during the ADB peer review, and revise the consolidated project EIA based on comments received from ADB and external reviewers.

3. **Poverty, gender, and social specialist** (national, 1.0 person-month), shall be professionally qualified, with a minimum of a Master's degree, and at least 10 years of relevant work experience in social sector surveys and analyses and gender, poverty, and social impact assessment, preferably on urban infrastructure projects. The expert will

- (i) Review current poverty reduction policies and regulations related to urban development in Darkhan and Mongolia.
- (ii) Review the poverty situation in Darkhan and in the project area, and assess the project's potential impact on the poor.
- (iii) Prepare consultation and participation plan for the technical assistance phase, as well as the project implementation phase, and conduct key informant, focus group discussions and interviews, survey project beneficiaries by gender and income group, identify vulnerable groups, and estimate beneficiaries falling below the official poverty line.
- (iv) Assist with the formulation of contingent valuation survey.
- (v) Design a questionnaire for household survey; use the survey results to assess the social, gender, and poverty reduction impact; and assist in conducting a distribution analysis.

- (vi) Conduct affordability analysis for the improved services and the beneficiaries' willingness to pay tariffs; and to contribute to and participate in the formulation, implementation, and O&M of the project,
- (vii) Collect and analyze sex-disaggregated socioeconomic baseline data and performance targets, including gender, and use the data to develop a design and monitoring framework (DMF) assuming effective gender mainstreaming.
- (viii) Based on poverty, social, and gender analysis and consultations, assess project impacts and recommend mitigating measures (including labor and HIV/AIDS), and design options to maximize benefits.
- (ix) Prepare the summary poverty reduction and social strategy, social action plan, and gender action plan in accordance with ADB guidelines, including measures to enhance the project benefits.
- (x) Conduct awareness-raising campaign and stakeholder participation workshops to help stakeholders understand and be aware of the social impact of the proposed project and their contribution, opportunities, duties, and responsibilities.
- (xi) Recommend approaches and methodologies to strengthen inclusive and participatory aspects in designing and implementing the project and involve gender-inclusive community participation.
- (xii) Assess the capacity of the local government and implementing agency on poverty, social, and gender impact assessment and recommend required measures for capacity building.
- (xiii) Provide training to the local government and implementing agency in poverty, social, and gender impact assessment, planning, and implementation requirements.

4. With respect to the indigenous peoples safeguard, the expert will conduct a thorough scoping of ethnic minorities in the project area and possible social impacts, propose indigenous peoples safeguard category, in view of Operations Manual section F1 and Safeguard Requirements 3: Indigenous Peoples for the project.

5. **Resettlement specialist** (national, 1.0 person-month) shall be professionally qualified, with a minimum of a Master's degree, and at least 10 years of relevant work experience in social sector surveys and analyses, and resettlement, preferably on urban infrastructure projects. The expert will

- (i) Orient the local government and the implementing agency on the Safeguard Policy Statement requirements and procedures.
- (ii) Assess project impact on land acquisition and resettlement (LAR), and if confirmed that no LAR impact is expected in this project, perform the necessary due diligence.
- (iii) If there is LAR impact, prepare a draft resettlement plan in compliance with the Safeguard Policy Statement, Operations Manual section F1, and Safeguard Requirements 2: Involuntary Resettlement.
- (iv) Conduct resettlement household surveys if any to ensure adequate understanding of social impacts.
- (v) Define categories for impact and compensation eligibility of affected people losing land, housing, and businesses and prepare an entitlements matrix based on the laws and regulations of the Government of Mongolia, and the Safeguard Policy Statement covering compensation and other assistance for all types of impacts to achieve full replacement for lost assets, income, and livelihoods (direct and indirect), if applicable.
- (vi) Identify potential impoverishment risks and vulnerable groups, including those severely affected through loss of land, those with low income, and others (e.g., disabled, elderly, ethnic minorities, unemployed, illiterate, women, and children) and develop special mitigation measures, as required.
- (vii) Identify compensation and rehabilitation options, and develop livelihood economic rehabilitation and improvement programs in consultation with affected people; identify training needs of affected persons based on age group and existing skills and provide skill training so that they can secure jobs; make an assessment of the employment opportunities available and ensure the affected persons get access to these job opportunities; and make an assessment of the social security benefits and support that will be made available to affected persons.
- (viii) Assist the local government and implementing agency in preparing a public consultation and disclosure plan, and initiate a participatory process for preparing and implementing the resettlement plan among the affected persons.

- (ix) Assess and justify that the compensation standards are based on replacement value and the overall resettlement budget is sufficient to acquire the land and implement the resettlement plan based on the proposed entitlements and rehabilitation plan.
- (x) Review the organizational structure and capacity to implement resettlement, and recommend improvements and actions before land acquisition and resettlement.
- (xi) Recommend and assist in arranging a grievance redress mechanism to handle complaints in an effective manner.
- (xii) Prepare an executive summary of resettlement plan and a detailed resettlement implementation schedule that is linked to the overall project implementation schedule, and provide inputs to the project administration manual.
- (xiii) Help the local government develop an internal and external monitoring and evaluation plan, specifying key indicators of progress, mechanisms for reporting, resource requirements, and database maintenance.
- (xiv) Prepare TORs for independent resettlement monitoring and evaluation.
- (xv) Assess the capacity of the local government and the implementing agency for poverty, social, and gender impact assessment and resettlement and recommend required measures for capacity building.
- (xvi) Provide training to the local government and the implementing agency in ADB's resettlement planning and implementation requirements.

6. **Financial and economic specialist** (international, 1.5 person-months) shall be professionally qualified, with a minimum of a Master's degree, and 15 years of relevant work experience in economic and financial analyses, financial management assessment, procurement capacity assessment, governance risk assessment, and procurement for urban infrastructure. The expert will

- (i) Review and help to prepare project cost estimates, and prepare project investment and financing plans.
- (ii) Assess the project's financial viability and sustainability in accordance with ADB's Guidelines for Financial Management and Analysis of Projects and other relevant guidelines.
- (iii) Review and develop cost recovery mechanisms, including options for water tariff reform, and recommend strengthening the project's financial sustainability.
- (iv) Assess financial management capacity of the local government and the implementing agency including their financial management system, accounting rules and practices, administrative procedures, internal control and audit, external audit, and procurement capacity and practices and identify funds flow and disbursement arrangements for the project.
- (v) Conduct economic analysis for the project in accordance with ADB's Guidelines for Economic Analysis of Projects and other relevant policies and guidelines, including economic rationale, demand analysis, least-cost analysis, cost effectiveness analysis, affordability analysis, contingent valuation survey, and household survey including beneficiaries' willingness-to-pay, affordability and distribution analysis, welfare and health impact (separately for the poorest households), contingent valuation, quantification of economic benefits and costs, evaluation of the economic viability of each project component and of the project as a whole, and risk and sensitivity analyses; estimate economic internal rate of return; and conduct sensitivity and risk analysis.
- (vi) Develop economically sound indicators of the health impact of the project, and use the household survey and other relevant sources to develop baseline and performance target indicators.
- (vii) Identify potential project-related risks, from public financial management, procurement, and anticorruption based on procurement assessment and financial management assessment and prepare a governance risk assessment and management plan.
- (viii) Assist the team leader to carry out project appraisal to specify assurances and other conditions attached to the loan.
- (ix) Assist the ADB project economist in finalizing (a) the economic analysis; (b) financial analysis; (c) cost estimates and financing plan; (d) financial action plan; (e) urban and municipal finance reform agenda and associated loan covenants; and (f) assessment of the project benefits, impacts, assumptions, and risks.

7. **Institutional expert** (national, 2.0 person-months) shall be professionally qualified with a minimum of a Master's degree, and 10 years of relevant work experience in city government, financial management

of urban infrastructure. The expert must be familiar with ADB's procedures, guidelines, and publications in relation to procurement, disbursement, DMF and project performance management system, and safeguards policy and procedures. The expert should have good communication, presentation, and training skills. The expert will

- (i) Review institutional arrangements for the project and assess local government and implementing agency staff capacities, and identify capacity gaps of implementing, operating, maintaining, and managing wastewater and related facilities, considering technical, managerial, and administrative expertise.
- (ii) Develop recommendations on institutional organization, staff resources, and responsibilities.
- (iii) Assist the team leader in preparing institutional and regulatory strengthening measures in view of effective planning, management, and implementation of the WWTP and management.
- (iv) Review the organizational structure of the implementing agency and respective line agencies concerned with wastewater management, establish their respective responsibilities and coordination mechanism, and clearly present project implementation arrangements.
- (v) Assist financial experts in financial management and procurement capacity assessments and capacity development program development.
- (vi) Develop a comprehensive capacity development program for project implementation, management, O&M, and environmental management.
- (vii) Design and conduct training workshops to cover ADB procedural requirements, including procurement, disbursement, DMF, project performance management system, EIA and EMP, involuntary resettlement, and indigenous peoples and social assessment,
- (viii) Develop awareness raising programs and implement some awareness events.
- (ix) Prepare TOR for project implementation and long-term capacity development programs under the loan with assistance from sector experts and financial analysts.

APPENDIX B: RESOLUTION ON DARKHAN AS A MODEL CITY

Darkhan will be a “model city”¹



The team developing the program “Model city” was approved by Prime Minister’s decree No 32 on March 26, 2012 for the medium-term. When the member of the team, governor of Darkhan-uul aimag gave an interview, he said that the team, led by Enkhbold.M, the deputy minister, has started working on the program which is aligned with the government’s urban development planning

in the medium-term development strategy planning up to 2021. The budget of 100 million tugriqs for developing the plan “Model city” will be from Prime Minister’s reserve fund was discussed at the government meeting held on April 04. The investment will support the industrial development, road network, infrastructure procurement, survey and the city development program. In relation to implementing the program, the Aimag Governor’s office is responsible for public recommendations through wide range of works like meeting related authorities. A telephone number: 70373694 is provided for getting information and the questionnaire sheets were distributed in all baghs. According to the Prime Minister’s order, the program will be developed within 3 months and it will be sent to the Government Meeting for discussion by the end of June 2012.

¹ Government Press release March 2012

Appendix C: Mongolia's Environmental Policy and Integrated Water Resource Management Plan

Environmental Policy

1. Mongolia has enacted a comprehensive policy and legal framework for environmental assessment and management. It has policies, legislation and strategies in place to manage the protected areas such as national parks, to satisfy its international obligations, and to protect the quality of the environment for the health and well-being of its citizens. The hierarchy of policies and legislative provisions for environmental management in Mongolia comprises the Constitution, international treaties and environment and resource protection laws².

2. The main policy documents are the National Environmental Action Plan of 1996, the State Environmental Policy of 1997, the National Plan of Action to Combat Desertification, the Biodiversity Conservation Action Plan, and the National Plan of Action for Protected Areas, all developed under the MNET auspices, as well as the Mongolian Action Program for the 21st Century. The National Environmental Action Plan was updated in 2000 and the National Action Plan for Climate Change was added in the same year. Several program documents (e.g. National Water Program, National Forestry Program, Program of Protection of Air, Environmental Education, Special Protected Areas, and Protection of Ozone Layer) were also completed in 2000/2001. State policy on EIA was in place in 1998. In addition, other guidance documents with important environmental repercussions were developed under the auspices of other ministries and these include the Roads Master Plan, the Power Sector Master Plan, the Tourism Master Plan, and the Renewable Energy Master Plan. Other documents, such as the annual Human Development Reports have increasingly incorporated environmental aspects.

3. A fundamental principle of the Mongolian state environmental policy is that economic development must be in harmony with the extraction and utilization of natural resources and that air, water and soil pollution will be controlled. In April 1996, Mongolia's National Council for Sustainable Development was established to manage and organize activities related to sustainable development in the country. The country's strategy is designed for environmentally friendly, economically stable and socially wealthy development, which emphasizes people as the determining factor for long-term sustainable development.

Climate Change Policy

4. Mongolia has joined 14 environment-related UN Conventions and Treaties, including the UN Framework Convention on Climate Change (UNFCCC). Nationally, the Mongolian Action Programme for the 21st Century (MAP 21) includes considerations and recommendations related to climate change adaptation and the mitigation of Greenhouse gas (GHG) emissions.

5. In order to comply with the obligations and commitments under the UNFCCC as well as to address challenges relevant to climate change, Mongolia has developed its National Action Programme on Climate Change, which received Government approval in 2000 and was updated in 2010. The action programme includes the national policy and strategy to tackle impacts of climate change and to mitigate GHG emissions. It also sets priorities for action and to integrate climate change concerns into other national and sectoral development plans. In order to fulfil the requirements of the National Programme on Climate Change, an inter-disciplinary and inter-sectoral National Climate Committee has been established by the government and is led by MNET. The Committee coordinates and guides national activities and measures aimed at adapting to climate change and mitigating GHG emissions.

6. Regarding climate change mitigation, the government has undertaken to mitigate GHG emissions through a range of strategies for sustainable development covering different sectors. In the transportation sector, the strategy is 'Efficient management of transportation'. The policies and measures to implement this are: i) Enhancement of national transportation system (railway enhancement and electrification; setting up transit logistics centers) and ii) Eco-transport strategy (efficient traffic management; expansion of public transportation; and promotion of fuel efficient cars)³.

² UNDP. 2008. Institutional Structures for Environmental Management in Mongolia. Ulaanbaatar and Wellington.

³ Mongolia's Second National Communication on Climate Change

7. Regarding climate change adaptation, the government has outlined strategies relating to the following sectors: animal husbandry, arable farming, water resource, human health, and forestry. Each sector has a number of strategies and policies and measures relating to the strategy. In the water resource sector, one of the strategies is 'improved water resource management' and the measure to implement it is 'developing and implementing integrated river basin management policy and plans in the river basins and at national level, coping with desertification'.

A. Integrated Water Resource Management Plan

8. The Government of Mongolia has given a priority to water issues and legalized a basin wide water management approach by revising Mongolian Law on Water. This law states that a "Basin Council consisting of representatives of water users and consumers, government, non-governmental, and specialized or professional organizations will be established for the implementation of the approach". In accordance with the law, Khovd and Buyant River Basin Councils were established in 2009. These are the key rivers in the Tranche 2 and 3 area which is in the Khar lake-Khovd river basin, a sub-basin of the Great Lakes' Depression.

9. The Khar lake-Khovd river basin Integrated Water Resource Management Plan (IWRMP) has been designed specifically for the river basin, facilitated by WWF Mongolia. The management plan was approved by an order of the Minister for Nature, Environment and Tourism in September 2010 and will be implemented in two phases.

10. The IWRMP should be used as a guiding policy for activities in the Project area which may impact on water resources. Discussions with WWF in Khovd confirmed that the Khovd and Buyant River Basin Councils are not yet fully active but they are anticipated to be within the project lifetime and they should be engaged with the project. The main objectives of the IWRMP are:

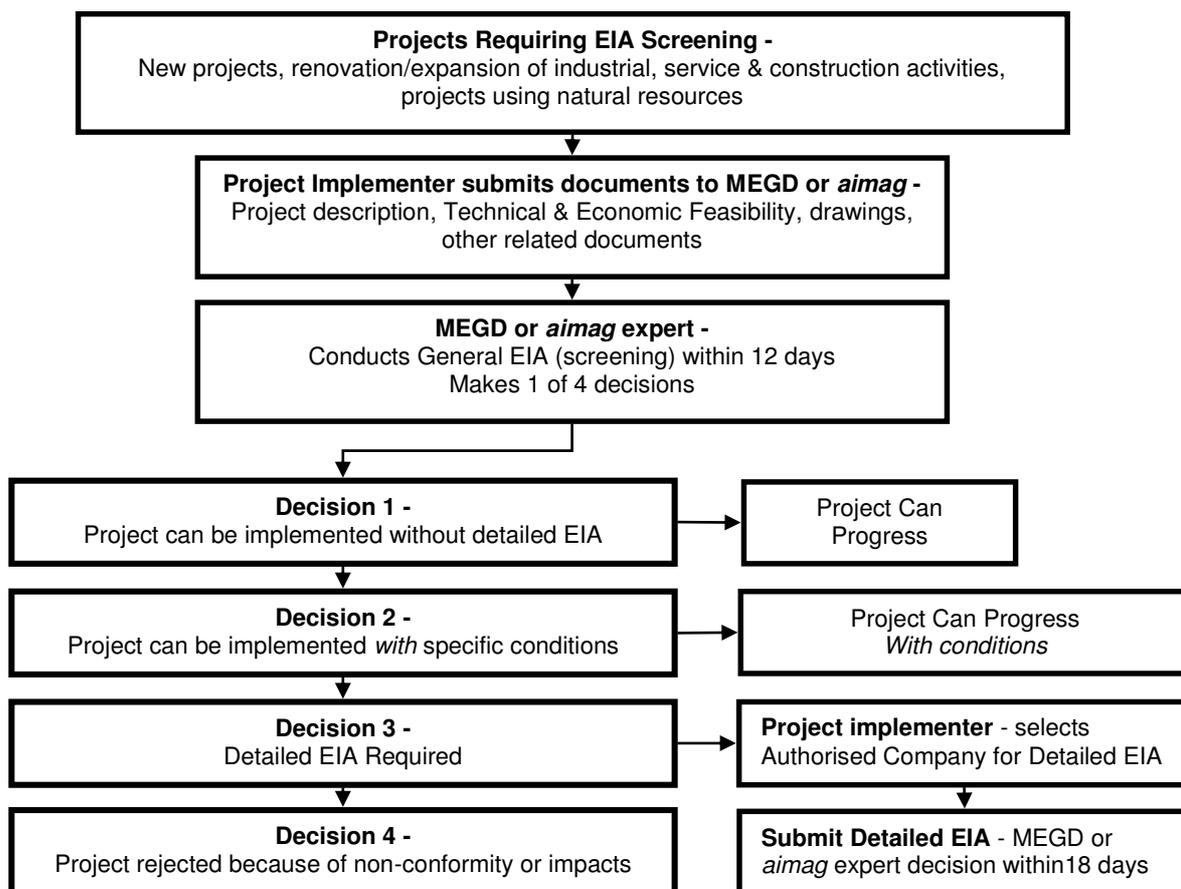
- (i) Ensure sustainable use, protection and restoration of natural resources of the basin with participation of local communities.
- (ii) Ensure sustainable development of socio-economic sectors consistent with water resources, water quality conservation and utilization norms.
- (iii) Create a legal and regulatory framework for the conservation and sustainable use of water resources of the basin and build institutional capacity.
- (iv) Expand scientifically based information sharing platform and public awareness measures on water resource conservation and sustainable use.

11. The activities associated with these objectives which may interact with the project include:

- (i) Renew and update technologies and equipment/apparatus of water treatment plants in Olgii and Khovd towns.
- (ii) Improve waste management in Khovd and Olgii towns and other settled areas.
- (iii) Support and encourage the initiatives and efforts to restore and build livestock enclosures around sources of natural springs.
- (iv) Improve monitoring network on permafrost and glaciers.

12. The IWRMP states that all short term projects, plans, regulations, standards and procedures of the *aimags* and *soums* in the basin will be developed in consistency with the management plan.

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Figure 1: EIA Process in Mongolia

Source: Adapted from Vol. 1 (2001) Compendium of Laws: A Mongolian Citizens Reference Book

13. The type and size of the planned activity define responsibility as either MEGD or *aimag* (provincial) government. There are two types of EIAs defined in the Law:

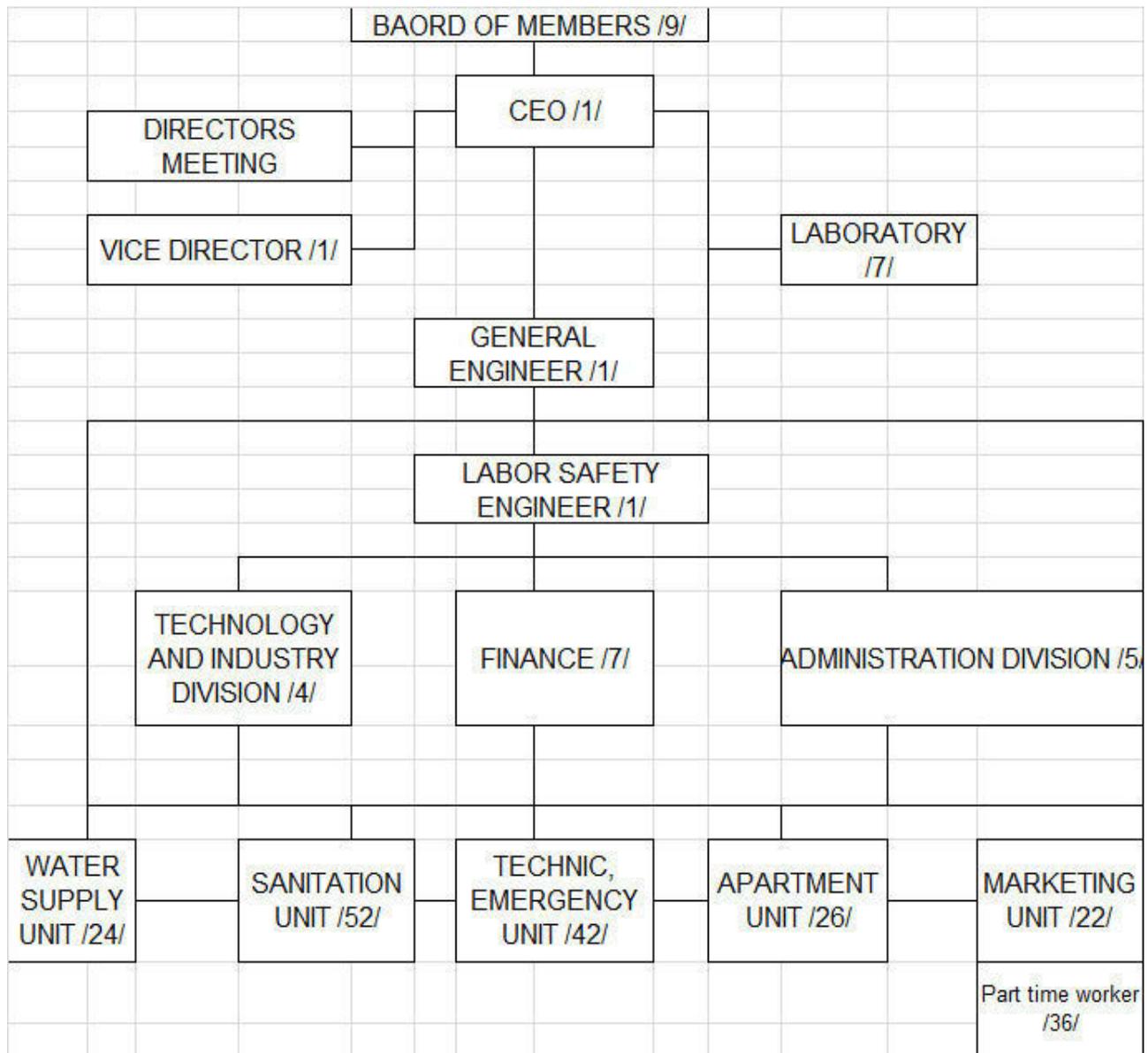
- (i) **General EIA (screening)** - to initiate a General EIA, the project implementer submits to MNET (or *aimag* government) a brief description of the project including feasibility study, technical details, drawings, and other information. The General EIA may lead to one of four conclusions: (i) no detailed EIA is necessary, (ii) the project may be completed pursuant to specific conditions, (iii) a Detailed EIA is necessary, or (iv) project cancellation. The General EIA is free and usually takes up to 12 days.
- (ii) **Detailed EIA** – the scope is defined by the General EIA. The Detailed EIA report must be produced by a Mongolian company which is authorized by the MNET by means of a special procedure. The developer of the Detailed EIA should submit it to the MNET (or *aimag* government). An expert of the organization who was involved in conducting General EIA should make a review of the Detailed EIA within 18 days and present it to MNET (or *aimag* government). Based on the conclusion of the expert, the MNET (or *aimag* government) takes a decision about approval or disapproval of the project.
- (iii) The Detailed EIA must contain the following chapters: (i) Environmental baseline data; (ii) Project alternatives; (iii) Recommendations for minimizing, mitigation and elimination of impacts; (iv) Analysis of extent and distribution of adverse impacts and their consequences; (v) Risk assessment; (vi) Environmental Protection Plan; (vii) Environmental Monitoring Program; and (viii) Opinions of residents on whether the project should be implemented.

APPENDIX D: THE LEGAL STATUS AND STRUCTURE OF US SUVAG

D.1 Establishment history, company's charter, administrative structure, and current status of asset ownership of "Darkhan Us Suvag" Joint Stock Company

1. The locally-owned joint stock company (Us Suvag LLC) was founded on January 15, 2003 by re-establishing the existing local government-owned company responsible for water supply and wastewater management in Darkhan. This was pursuant to the decision of the Citizen's Representative Khural meeting of Darkhan-Uul province of that date, which established the company, with 3,384,431,409 MNT in equity funding, converted into 33,844,314 ordinary shares. However, the resolution did not determine the ownership of shares or company shareholder's rights, so there was a need to revisit the company's charter of that period, and determine on the matter of shareholding and shareholder's rights.
2. While the above decision was issued in respect of the company's restructuring, the newly-established company's name was excluded from the resolution. However, re-establishment was mentioned in the decision by the Citizen's Representative Khural meeting of Darkhan-Uul aimag in February 2012. At this meeting, the company's name was newly re-confirmed as "Darkhan Us Suvag" joint stock company, pursuant to the Darkhan-Uul Citizen's Representative Khural resolution No 20, dated February 14, 2012
3. Based on this resolution No. 20 by the Citizen's Representative meeting of Darkhan-Uul province, the charter of the "Darkhan Us Suvag" Joint Stock Company was approved by the Board of Directors on June 20, 2012. In the 4th chapter of the charter: "Company's capital and shares", it is deemed that 60 percent of company's total shareholding (or 20,306,588 shares) are owned by the citizen's representative meeting (Citizen's Khural) and 40 percent of the shareholding (or 13,537,726 shares) are owned by Governor's Administration Office of Darkhan-Uul aimag.
4. However, the provision of the company law concerning how the approval of the company's charter shall be adopted by a meeting of shareholders, has been violated. Ownership, or its implementation right, shall be decided by the holder of the properties, so the establishment of a charter during the establishment of a joint-stock company should be checked and supervised as provided by law. Moreover, it is required to renew and amend the charter of a company from time to time, pursuant to the new Company Law. In the charter as it currently stands, there are many issues left open, or which are not appropriately defined, including: (i) supervisory council; (ii) management board; (iii) sub-committees; and (iv) designating a secretary to the Board of Directors. These are to be added to the duties or sub-contracted out.
5. During the period since the company changed its status into a joint stock company, fixed assets have been increased in value by 14.1 billion MNT by way of implementation of a number of projects and programs. But this increased value has not been added to the net asset value of the company, but is registered as another part of the owner's property. This makes the company's evaluation, share's ownership and issues of rights implementation.
6. The company has made the first steps in working as an active team having re-arranged the Board of Directors, appointed a new Chief Executive Officer, and changed the administrative team in order to renew the company's management and re-establish the company. (See Figure 1: company's structure). However, as set out in the company's charter, the Board of Directors must be appointed by the shareholders, i.e. 60 percent Citizens Khural and 40 percent Darkhan-Uul government - as representatives of shareholders. However, the citizen's representative Khural has solely made decision and approved the Board of Directors. The Board of Directors then appointed the Chief Executive Officer and concluded the contract, which means that the basic conditions for company governance have been completely violated. However, a proposal has been put to the company's administration and to the Board of Members, to convene a special session of the Board and Company and to begin work immediately on such matters as contracts to be concluded with the Board of Directors and chief and other executives, approval of company's structure at the company's charter and relevant documentation. The administration has supported this proposal.

Figure D.1: Company Personnel



D.2 Human resources and working capacity of the company

7. Out of the total workforce, 69 percent of workers are specialized team members who have working experience of more than 15 years, and 45 percent have been working in unbroken services for “Water Services Authority” Joint Stock Company for more than 15 years. Also, there is a positive trend because the company trains young employees who will hopefully work for the company in future. 45 per cent of total workers are young with experience in this work-place for between 0 and 10 years. (Figure 2: Working experience and employment duration). This shows 13 percent of total workers are under 30 years old, and that the company pays more attention to hiring more younger employees who will hopefully work hard due to the sector featuring the possible implementation of a new project. It is helpful for the company if it will prepare personnel for the project by training them and this will be a method to improve company morale and enthusiasm. (Figure 3 shows age profile of the work-force).

Figure D.2: Employment Duration

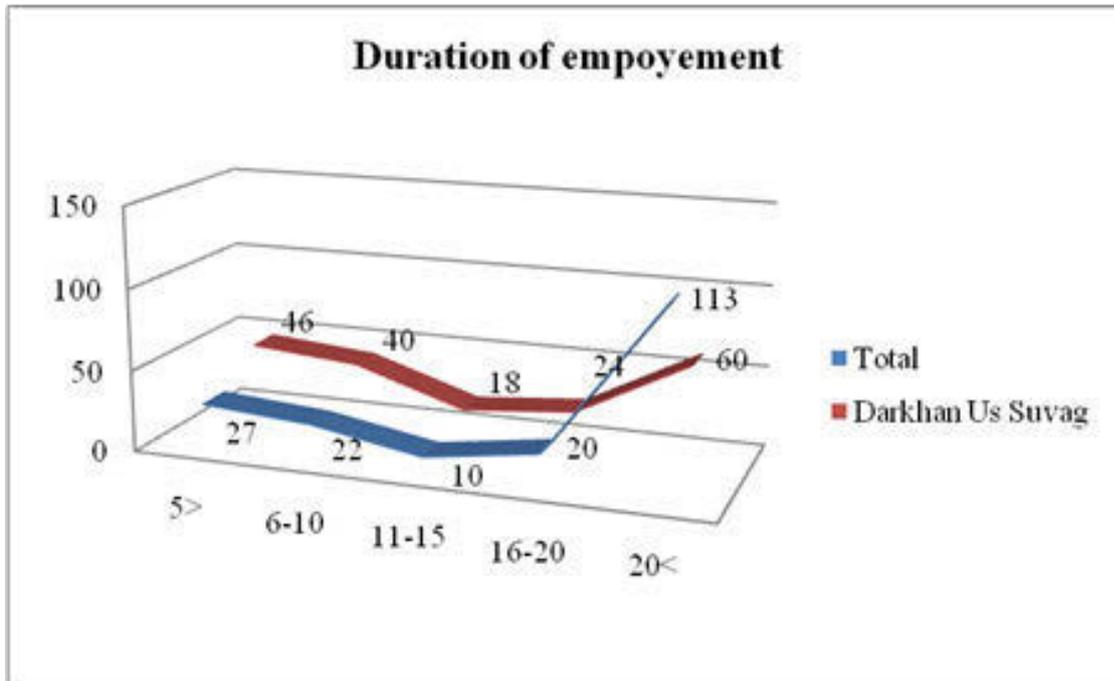
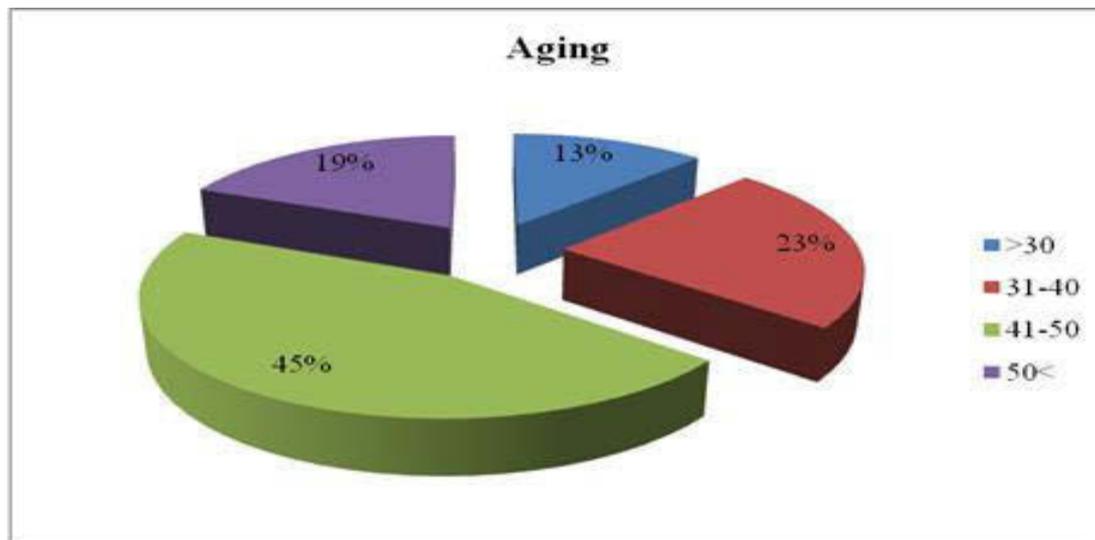
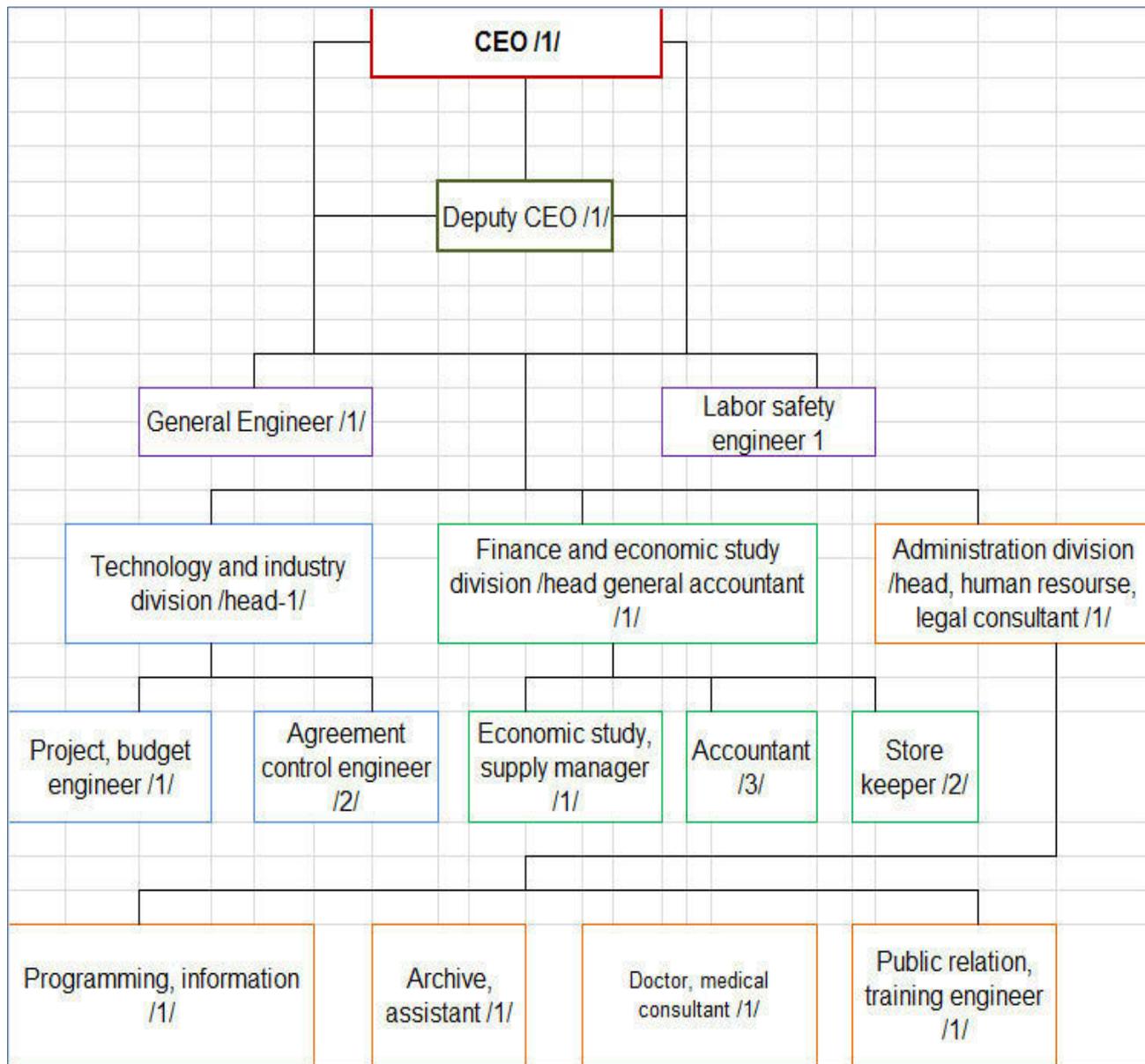


Figure D.3: Age of Workforce



8. There is a high possibility of domestic resources for the “Darkhan Us Suvag” Joint Stock Company being obtained to expand the company’s operational scope, to advance current works and service to new level because 32 percent of total workers are highly educated. It is right to employ specialized engineers outside the normal level of educated workers in accordance with the company’s and sector’s features. The company needs to pay attention to researching how it can employ workers who have graduated with qualifications from schools which specialise in wastewater purification technology and prepare this new generation by way of training them.

Figure D.4: Company’s Administrative Structure



APPENDIX E: CONDITION AND REHABILITATION INVENTORY OF WATER SUPPLY & SEWER PIPELINES IN DARKHAN

Main Water Supply pipelines and branch water supply pipelines in use and under rehabilitation

| Pipeline material | Diameter | Length | Year of construction | Years of operation | Category | Status of Operation | Explanation and location |
|-------------------|-----------|--------|----------------------|--------------------|----------|---------------------|---|
| steel pipe | DN500-600 | 4.7km | 1965 | 48 | Special | In use | Replacement along the road, at back of block IV-1 in New Darkhan |
| steel pipe | DN500-600 | 20km | 1990 | 23 | | | |
| plastic pipe | DN500-600 | 0.3KM | 2011 | 2 | | | |
| cast-iron pipe | DN500-600 | 30km | 1965 | 48 | | | |
| cast-iron pipe | DN500-600 | 1km | 1990 | 23 | | | |
| steel pipe | DN400-300 | 2km | 1965 | 48 | | | |
| steel pipe | DN400-300 | 8km | 1965 | 48 | | | |
| steel pipe | DN100-250 | 29km | 1965 | 48 | | | |
| steel pipe | DN100-250 | 0.12km | 2010 | 3 | | | |
| plastic pipe | DN100 | 2.7km | 2005 | 8 | | | |
| steel pipe | DN200 | 0.14km | 2010 | 3 | | | |
| steel pipe | DN200 | 0.74km | 2010 | 3 | | | |
| steel pipe | DN200 | 0.14km | 2011 | 2 | | | |
| steel pipe | DN200 | 30km | 1990 | 23 | | | |
| cast-iron pipe | DN150-250 | 54km | 1965 | 48 | | | Partial replacement of DN100, and replacement of DN200 to HDPE pipelines funded by ADB loan in bagh-7 |

Water supply pipelines in districts

| Pipeline material | Diameter | Length | Year of construction | Years of operation | Category | Status of Operation | Explanations and position |
|-----------------------|----------|--------|----------------------|--------------------|----------|---------------------|--|
| steel pipe | DN50 | 3km | 1965 | 48 | Special | In use | Replacement of DN50 in necessary pipelines |
| steel pipe | DN50 | 6.5km | 1990 | 23 | | | |
| steel pipe | DN50 | 1km | 2005 | 8 | | | |
| steel pipe | DN80 | 1km | 1965 | 48 | | | |
| steel pipe | DN80 | 3km | 1990 | 23 | | | |
| steel pipe | DN100 | 12.5km | 1990 | 23 | | | |
| steel pipe | DN100 | 5.6km | 2005 | 8 | | | |
| plastic pipe | DN150 | 7.9km | 2011 | 2 | | | Replacement funded by Japanese grant In bagh-5,6 |
| Total: 223.2km | | | | | | | |

Main sewer pipelines and branch sewer pipelines

| Pipeline material | Diameter | Length | Year of construction | Years of operation | Category | Status of Operation | Explanations and position |
|-------------------|------------|--------|----------------------|--------------------|----------|---------------------|---------------------------|
| steel pipe | DN600-1000 | 0.1km | 1965 | 48 | Special | In use | |
| concrete pipe | DN600-1000 | 41km | 1990 | 23 | | | |
| steel pipe | DN400-300 | 2km | 1965 | 48 | | | |
| steel pipe | DN400-300 | 0.5km | 1990 | 23 | | | |
| cast-iron | DN300-400 | 6km | 1965 | 48 | | | |
| clay | DN100-250 | 32km | 1965 | 48 | | | |
| cast-iron | DN200-250 | 11.8km | 1965 | 48 | | | |
| Clay | DN200-250 | 27.5km | 1965 | 48 | | | |
| asbestos cement | DN200-250 | 3.5km | 1965 | 48 | | | |
| Clay | DN150 | 35km | 1965 | 48 | | | |
| cast-iron | DN150 | 0.6km | 1965 | 48 | | | |

Sewer pipelines in districts

| Pipeline material | Diameter | Length | Year of construction | Years of operation | Category | Operational or not | Explanations and position |
|-------------------|-----------------------|--------|----------------------|--------------------|----------|--------------------|---------------------------|
| cast-iron | DN50 | 14.2km | 1965 | 48 | Special | In use | |
| cast-iron | DN50 | 8km | 1990 | 23 | | | |
| cast-iron | DN50 | 3.7km | 2005 | 8 | | | |
| cast-iron | DN100 | 12.4km | 1965 | 48 | | | |
| cast-iron | DN100 | 5km | 1990 | 23 | | | |
| cast-iron | DN100 | 7.2km | 2005 | 8 | | | |
| cast-iron | DN150 | 13km | 1990 | 23 | | | |
| | Total: 223.5km | | | | | | |

The system network is shown in Figure E.1 below.

APPENDIX F: GOVERNMENT OF MONGOLIA WASTEWATER DISCHARGE STANDARDS

Appendix F.1: Wastewater Discharges to the Environment

Acceptable content of chemical and biological substances in effluent treated wastewater for discharge to the environment. (Standards MNS 4943:000)

| No | Substances | Measuring unit | Maximum allowance |
|----|---|----------------|------------------------|
| 1 | Water temperature | C | 20 |
| 2 | Hydrogen ion activity (pH) | - | 6-9 |
| 3 | Odour | Sense | No bad smell |
| 4 | Suspended solids (SS) | mg/l | 50 |
| 5 | Biochemical Oxygen Demand (BOD) | mg/l | 20 |
| 6 | Chemical Oxygen Demand (COD) | mg/l | 50 |
| 7 | Permanganate | mg/l | 20 |
| 8 | Dissolved Salt | mg/l | 100 |
| 9 | Ammonia Nitrogen (NH ₄) | mg/l | 6 |
| 10 | Total Nitrogen (TN) | mg/l | 15 |
| 11 | Total Phosphorous (TP) | mg/l | 1.5 |
| 12 | Organic Phosphorous(DOP) | mg/l | 0.2 |
| 13 | Hydrogen Sulphide (H ₂ S) | mg/l | 1 |
| 14 | Total Iron (Fe) | mg/l | 1 |
| 15 | Aluminum (Al) | mg/l | 0.5 |
| 16 | Manganese (MN) | mg/l | 0.5 |
| 17 | Total Chromium (Cr) | mg/l | 03 |
| 18 | Chromium+6 (Cr+6) | mg/l | Not specified |
| 19 | Total cyanide (CN) | mg/l | 0.05 |
| 20 | Free cyanide (CN) | mg/l | 0.05 |
| 21 | Copper (Cu) | mg/l | 0.3 |
| 22 | Boron (B) | mg/l | 0.3 |
| 23 | Lead (Pb) | mg/l | 0.1 |
| 24 | Zinc (Zn) | mg/l | 1.0 |
| 25 | Cadmium (Cd) | mg/l | 0.03 |
| 26 | Antimony (Sb) | mg/l | 0.05 |
| 27 | Mercury (Hg) | mg/l | 0.01 |
| 28 | Molybdenum (Mo) | mg/l | 0.5 |
| 29 | Total Arsenic (As) | mg/l | 0.01 |
| 30 | Nickel (Ni) | mg/l | 0.2 |
| 31 | Selenium (Se) | mg/l | 0.02 |
| 32 | Beryllium (Be) | mg/l | 0.001 |
| 33 | Cobalt (Co) | mg/l | 0.02 |
| 34 | Barium (Ba) | mg/l | 1.5 |
| 35 | Strontium (Sr) | mg/l | 2 |
| 36 | Vanadium (V) | mg/l | 0.1 |
| 37 | Uranium (U) | mg/l | 0.05 |
| 38 | Mineral oil | mg/l | 1 |
| 39 | Fat oil | mg/l | 5 |
| 40 | Surface active agents | mg/l | 2.5 |
| 41 | Phenol (C ₆ H ₅ OH) | mg/l | 0.05 |
| 42 | Trichloretilen | mg/l | 0.2 |
| 43 | Tetrachloretilen | mg/l | 0.1 |
| 44 | Remained chlorine (Cl) | mg/l | 1 |
| 45 | Faecal coliforms | No/100ml | Not occurring in 1 ml. |

Explanations:

1. The maximum standard allowance can be higher depending on concentration of pollutants in receiving water, but added mineral pollution concentration should not exceed 20% of the natural mineral concentration.
2. If concentration of pollutants in the receiving water body is low, the mineral concentration of discharge should not be higher than 3 times the natural level of mineral pollution.
3. When effluent water is discharged to the lakes, ponds, or rivers, the mineral concentration can be reduced by 5 times.

Appendix F.2: Wastewater Discharges to a Public Sewer**JOINT ORDER OF THE MINISTER OF INFRASTRUCTURE, ENVIRONMENT AND HEALTH AND SOCIAL WELFARE**

January 10 1997

No a/11/05/A/18

Ulaanbaatar city

ALLOWED LIMITS OF INDUSTRIAL WASTEWATER COMPOSITION BEFORE LETTING EFFLUENTS INTO THE CENTRAL WASTEWATER TREATMENT SYSTEMS

Endorsement of Guideline

Based on the articles 15.3 in the law on environment protection and 21.3 in the law on water, to meet the wastewater treatment plant technology requirements, it has been ordered:

1. To endorse the “Regulation on allowed limits of industrial wastewater composition before letting effluents into the Central Wastewater treatment systems” as Annex (attached).
2. To authorize Ulaanbaatar city Governor’ Office, Public Utility Service Organization (Jigmid. B), Environment Protection Agency (Banzragch.S), Professional Inspection Agency (Damdinsuren. A), and Labour and Social Welfare Monitoring Agency to monitor the maximum allowance and take measures for organizations whose effluents cause the wastewater treatment plant operation to deteriorate and ensure the actualization of this order.
3. To ignore the order approved by the Ministry of Public Utility Service and the Ministry of Water and the Ministry of Health, 244/197/219 on August 26, 1980, which this order replaces.

MINISTER OF INFRASTRUCTURE

NYAMDAVAA.G

MINISTER OF ENVIRONMENT

ADIYASUREN.TS

MINISTER OF HEALTH AND SOCIAL WELFARE

ZORIG.L

Allowable limits of industrial wastewater composition before letting effluents into the Public Sewers and Central Wastewater Treatment Systems

| No | Parameters | In UB | In other urban areas |
|----|---------------------------------|---------------|----------------------|
| 1 | Suspended solids (SS) | 400.0 | 500.0 |
| 2 | Biochemical Oxygen Demand (BOD) | 200.0-400.0 | 250.0-500.0 |
| 3 | Chemical Oxygen Demand (COD) | 400.0-800.0 | 500.0-1000.0 |
| 4 | Copper | 0.5-1.0 | 0.5 |
| 5 | Petroleum | 0.07-0.1 | 5.0 |
| 6 | Sulphate | 1355.0-1500.0 | 1500.0 |
| 7 | Sulphide | 10.0 | 10.0 |
| 8 | Nickel | 0.5-0.65 | 0.65 |
| 9 | Lead | 0.07 | 0.1 |
| 10 | Chromium+6 | 0.27-0.5 | 0.2-0.5 |
| 11 | Total Chromium | 2.5-5.0 | 2.5-5.0 |
| 12 | Zinc | 1.0 | 1.0 |
| 13 | All types of washing chemicals | 5.0-10.0 | 10.0-20.0 |
| 14 | Phenol | 0.5-1.0 | 1.0 |
| 15 | Cadmium | 0.032-0.1 | 0.1 |
| 16 | Cyanide | 0.08-1.5 | 0.1-1.5 |
| 17 | Ammonia | 10.0-15.0 | 10.0-20.0 |
| 18 | Total Nitrogen | 30 | 30 |
| 19 | Hydrogen ion activity | 6.5-8.5 | 6.5-8.5 |
| 20 | Chlorine | 900.0-1000.0 | 1000.0 |
| 21 | Iron | 0.27-1.0 | 0.5-1.0 |
| 22 | Hydrogen ion | 0.2 | 0.2 |
| 23 | Synthetics | 25.0 | 25.0 |
| 24 | Sulphur paint | 0.45 | 0.5 |
| 25 | Water temperature | 15-40C | 30C |
| 26 | Arsenic | 0.1 | 0.1 |
| 27 | Mercury | 0.005 | 0.005 |
| 28 | Cobalt | 0.1 | 0.1 |
| 29 | Fat oil | 10.0-25.0 | 15.0-25.0 |
| 30 | Silver | 2.0 | 2.0 |
| 31 | Selenium | 0.1 | 0.1 |
| 32 | Organic phosphorous | 0.4 | 0.4 |
| 33 | Total hydrocarbon | 0.04 | 0.04 |
| 34 | Aluminum | 0.5 | 0.5 |

Explanations:

The permitted value is estimated when using biological treatment technology for industrial wastewater composition. It is for designing and water consumption.

APPENDIX G: DEVELOPMENT COORDINATION

1. The urban water supply and wastewater sector has been one of the strategic foci of donor and lender assistance in Mongolia since the mid-1990s. Due to the challenges posed by fast urbanization, and the resultant rapid growth – particularly in Ulaanbaatar - the capital city has received much of this assistance. However, in recent years additional attention has been given to the secondary cities of Erdenet and Darkhan, and to aimag centres – particularly in the relatively fast growing areas of south-eastern Gobi. Within Ulaanbaatar and the other cities and larger aimag centers, focus has been on water supply (and to a lesser extent wastewater management) and on ger area upgrading and redevelopment.

2. The ADB has been a leading partner in the Urban Development sector in Mongolia. Until recently, the focus of ADB's urban development assistance was entirely on secondary cities. However, since 2010, this focus has widened to include urban services and ger area development in Ulaanbaatar. Apart from the ADB, the other major development partners providing assistance to Urban Development in Mongolia are the World Bank, Japan International Cooperation Agency (JICA), United Nations Human Settlements Programme (UN-HABITAT), the United States' Millennium Challenge Account (MCA), and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Other donors and lenders who have provided assistance in the urban water and wastewater sector are Deutsche Zusammenarbeit (KfW), Dutch Aid, the German Ministry of Education and Research and French Aid. Table 1 provides an overview of support to the Urban sector and water and wastewater sectors since year 2000.

| Development Partner | Project Name ^a | Duration | Amount (\$ million)* |
|--|--|--------------|----------------------|
| Urban Development Theme⁴ | | | |
| ADB | TA 3406-MON: Housing Sector Finance | 2000-2001 | 0.60 |
| | Loan 1847-MON: Housing Finance Sector Loan | 2001-2008 | 15.00 |
| | TA No. 3685-MON: Integrated Development of Basic Urban Services in Secondary Towns | 2001-2002 | 0.70 |
| | Grant No. 9015-MON: Improving the Living Environment of the Poor in Ger Areas of Mongolia's Cities | 2002-2005 | 2.20 |
| | Loan 1907-MON: Integrated Development of Basic Urban Services in Provincial Towns Project | 2002-2009 | 20.10 |
| | TA No. 4352-MON: Urban Development and Housing Sector Strategy | 2004-2006 | 0.35 |
| | TA No. 4632-MON: Urban Development and Housing Project | 2005-2007 | 0.60 |
| | Loan 2301-MON: Urban Development Sector Project | 2006-2015 | 35.23 |
| | Grant No. 9106-MON: Community-Driven Development for Urban Poor in Ger Areas | 2007-2012 | 1.50 |
| | TA No. 7216-MON: Southeast Gobi Urban and Border Town Development Project | 2008-2010 | 0.40 |
| | Grant No. 0204-MON: Southeast Gobi Urban and Border Town Development Project | 2010-2015 | 15.00 |
| | TA No. 7970-MON: Ulaanbaatar Urban Services and Ger Areas Development Investment Program | 2012-2013 | 1.70 |
| | Loan No. 45007-003: Ulaanbaatar Urban Services and Ger Areas Development Investment Program | 2013-ongoing | 163.70 |
| World Bank | TA: City Development Strategies for Secondary Cities | 2003-2005 | 0.25 |
| | Loan: Second Ulaanbaatar Services Improvement Project | 2004-2012 | 22.98 |
| | Grant: Community-led Infrastructure Development for the Urban Poor in Ulaanbaatar | 2004-2011 | 1.98 |
| | Grant: Community-led Infrastructure Development for the Urban Poor in Ulaanbaatar Phase 2 | 2011-2015 | 2.77 |
| Government of France | Ulaanbaatar City Master Plan 2020 | 2005-2006 | Euro 0.5 |
| JICA | TA: Preparatory Study on City Master Plan and Urban Development Program of Ulaanbaatar City | 2007-2009 | JPY 4.50 |

⁴ Themes and Sectors taken from the ADB website: <http://www.adb.org/focus-areas>

| Development Partner | Project Name ^a | Duration | Amount (\$ million)* |
|---|--|-----------|----------------------|
| United States | Grant: Property Rights Project (Millennium Challenge Account) | 2007-2013 | 27.15 |
| UN-HABITAT | TA: Sustainable Urbanization in Mongolia (Sustainable Cities Programme Support) | 2005-2008 | 0.10 |
| | TA: Citywide Pro-poor Ger area Upgrading Strategy and Investment Plan of Ulaanbaatar City (funded by Cities Alliance) | 2005-2010 | 0.50 |
| | Grant: Community Led Ger Area Upgrading in Ulaanbaatar (funded by the Government of Japan) | 2009-2013 | 5.80 |
| GIZ | Integrated Urban Development | 2006-2012 | Euro 8.38 |
| Water and Wastewater Sector | | | |
| ADB | TA No. 7591-MON: Ulaanbaatar Water and Sanitation Services and Planning Improvement | 2010-2012 | 0.60 |
| World Bank | TA: Low Cost Sanitation for the Urban Poor (Sanitation, Hygiene and Wastewater Support Service) | 2005-2006 | 0.05 |
| | TA: Water and Wastewater Master Plan of Ulaanbaatar 2020 (funded by the Government of France) | 2005-2006 | Euro 0.73 |
| JICA | Grant: Programme for Ulaanbaatar Water Supply Development in Gachuurt | 2011-2016 | JPY 33.00 |
| | TA: Study on the Strategic Planning for Water Supply and Sewerage Sector in Ulaanbaatar City in Mongolia | 2012-2013 | JPY 1.90 |
| | Grant: Programme for Darkhan Water Supply Development | 2010-2013 | JPY 4.60 |
| French Aid | Loan: Support to the development of the wastewater treatment plant extension at Orkhon aimag | 2010-2014 | Euro 10.00 |
| Dutch Aid | Institutional and operational support to USAG in Ulaanbaatar | 2007-2011 | Euro 1.40 |
| KfW | TA: design of WWTP for Nisekh District ,Ulaanbaatar | 2009-2011 | Euro 1.00 |
| German Aid: Federal Ministry of Education and Research | TA: Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo); including pilot project for Darkhan WWTP | 2006-2013 | Euro 8.00 |
| Korean Aid | Support to wastewater management in Ulaanbaatar | 2013-2015 | 0.25 |
| Spanish aid | Review of rehabilitation requirements for Ulaanbaatar WWTP | 2009-2010 | XXX |
| UNDP | Water Operator Partnerships in Asia – Ulaanbaatar Case Study | 2010-2012 | Euro 1.70 |
| Energy Sector | | | |
| ADB | TA No. 7462-MON: Ulaanbaatar Clean Air | 2009-2012 | 0.50 |
| | TA No. 7502-MON: Ulaanbaatar Low Carbon Energy Supply Project Using a Public-Private Partnership Model | 2010-2012 | 1.50 |
| World Bank | TA: Improved Household Stoves in Urban Centers - Global Environment Facility | 2001-2007 | 0.75 |
| | Loan: Ulaanbaatar Clean Air Project | 2012-2017 | 21.89 |
| United States | Grant: Energy and Environment Project (Millennium Challenge Account) | 2007-2013 | 43.96 |
| Capacity Development (Theme) | | | |
| JICA | TA: The Project on Capacity Development in Urban Development Sector in Mongolia | 2010-2013 | JPY 3.20 |
| | TA: Capacity Development Project for Air Pollution Control in Ulaanbaatar City | 2010-2013 | JPY 4.00 |

* JPY figures are in 100 million.

3. Since 2000, the ADB has provided technical and financial assistance in urban development, water, energy and transport sectors that have supported the development of cities and towns in Mongolia in line with GoM's development priorities and in support of the achievement of MGDs. Prominent TA and grants include those on 'Housing Sector' (2000-2001), 'Improving the Living Environment of the Poor in Ger Areas of Mongolia's Cities' (2002-2005, funded by Japan Fund for Poverty Reduction – JFPR), 'Urban

Development and Housing Sector Strategy' (2004-2006), 'Community-Driven Development for Urban Poor in Ger Areas' (2007-2012, funded by JFPR), 'Southeast Gobi Urban and Border Town Development Project' (2008-2010), 'Ulaanbaatar Clean Air' (2009-2012), 'Urban Transport Development Project' (2012-2013), and Ulaanbaatar Urban Services and Ger Areas Development Investment Program (2011-2013). These have led to several loan and credit projects including 'Housing Finance Sector Loan' (2001-2008), 'Integrated Development of Basic Urban Services in Provincial Towns Project' (2002-2009), 'Urban Development Sector Project' (2006-2015), Southeast Gobi Urban and Border Town Development Project' (2011-2016) and 'Urban Transport Development Investment Program' (2012-2022, MFF).

4. The World Bank has also been an active lender in the urban development sector in Mongolia, although with more of a focus on Ulaanbaatar. It implemented the 'Ulaanbaatar Services Improvement Project' (USIP-1, 1997-2003) and the 'Second Ulaanbaatar Services Improvement Project' (USIP-2, 2004-2012) to extend and improve water supply systems in a number of ger areas in Ulaanbaatar. Funded by the Japan Social Development Fund, the World Bank implemented the 'Community-led Infrastructure Development for the Urban Poor in Ulaanbaatar' (2004-2011) that improved community infrastructure in six ger areas. The success of this project led to the preparation and ongoing implementation of 'Community-led Infrastructure Development for the Urban Poor in Ulaanbaatar – Phase 2' (2011-2015).

5. In the Water and Sanitation sector, the World Bank conducted a study on 'Low Cost Sanitation for the Urban Poor' (2005-2006, supported by the Sanitation, Hygiene and Wastewater Support Service), and prepared the 'Water and Wastewater Master Plan of Ulaanbaatar 2020' (2005-2006) that was funded by the Government of France.

6. Until 2010, the ADB and World Bank coordinated their Urban Development-related assistance through the ADB focusing on support for secondary and smaller cities and aimag centres, and the World Bank largely focusing on Ulaanbaatar. Since 2010, and in discussion with the World Bank, the ADB has also started providing development assistance to Ulaanbaatar city, notably through policy advisory TA on 'Ulaanbaatar Water and Sanitation Services and Planning Improvement' (2010-2012), 'Urban Transport Development Investment Program' (now an MFF-2012 to 2022) and 'Ulaanbaatar Urban Services and Ger Areas Development Investment Program' (2012-2013). However, the ADB continues to focus support on urban areas outside of Ulaanbaatar through its on-going Urban Development Sector Project, and Southeast Gobi Urban and Border Town Development Project. Both these projects are supporting: (i) development in the waste and wastewater sectors and (ii) water sector institutional reform and capacity development.

7. JICA has been an active bilateral donor in the urban development sector, particularly in the areas of urban planning, water supply and urban transportation. It conducted the 'Study on City Master Plan and Urban Development Program of Ulaanbaatar City' (2007-2009) that provided technical inputs to the revision of the Ulaanbaatar City Master Plan with a 2030 perspective. This is being followed by a TA 'Project on Capacity Development in Urban Development Sector of Mongolia' (2010-2013). A sizeable grant supports the 'Programme for Ulaanbaatar Water Supply Development in Gachuur' (2011-2016) which is under implementation. JICA is currently conducting a 'Study on Implementation of Ulaanbaatar Urban Transport Project' (2011-2013); which may lead to a loan on 'Ulaanbaatar Metro Project' that will support 11.1 km of elevated and 6.6 km of underground rapid transportation network.

8. JICA is conducting a "Study on the Strategic Planning for Water Supply and Sewerage Sector in Ulaanbaatar City" (2012-2013), which aims to review Water Supply and Sewerage System Master Plans with a target year of 2030, and make proposals to improve water supply and sewerage environmental status, including implementation of the prioritized projects. In its Interim Report, the Study identified 'the improvement and expansion of Ulaanbaatar's Central Wastewater Treatment Plant' as the prioritized project, but it is understood that this might be reconsidered during the finalization of the Study (to be completed in Q3 of 2013). In the recent past, JICA has supported water supply projects both in Ulaanbaatar and in other major cities and aimag centres. In Darkhan, JICA supported the Water Supply Improvement Project (2008 to 2012) which rehabilitated water supply wells, replaced water supply pumps, constructed water kiosks in ger districts and replaced 8 km of transmission and distribution pipeline.

9. In the wastewater sector, technical and financial assistance has been provided by a number of bilateral agencies. The French Government has supported the design of, and is providing the equipment for, an extension of the wastewater treatment plant at Erdenet in Orkhon aimag by 20,000 cum/day. This uses an activated sludge system. KfW has supported the development of proposals for a new WWTP at

Nisekh in Ulaanbaatar for which the preliminary designs (also using an activated sludge system) is now complete. While originally planned for funding by KfW, it is understood that this project will now be funded directly by Government. Mongolia's state-owned water authority Mongol Us has announced that it is introducing water and wastewater treatment technologies from Korea with the aid of a grant, and based on an MoU established in January 2013. Pilot water treatment systems have been installed at locations in Ulaanbaatar, featuring a sand filter, UV and chlorination elements.

10. Of particular significance in the wastewater sector in Darkhan is the work being carried out under the 'Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo)' project supported by the German Ministry for Education and Research. The objective of the MoMo project is to implement an Integrated Water Resources Management (IWRM) strategy in Mongolia, focussing on the catchment of the Kharaa river. The basic concept of the project is to take an integrated view of all water uses and protection of freshwater resources, including the development of measures and their implementation using trans-disciplinary management approaches. The specific river catchment of the Kharaa river, and the city of Darkhan which lies on the river, provide a representative range of water problems (impact of global climate change, over-exploitation of water resources, diffuse pollution, mining, water supply and wastewater treatment in rural and urban areas, protection of ecological functions and nature conservation), which are being addressed through the program. In Darkhan this has included investment in the construction, operation and monitoring of a pilot scale Sequencing Batch Reactor wastewater treatment system at the existing Darkhan wastewater treatment plant.

11. Lessons learned from prior assistance to the urban and water and wastewater sectors include:

- (i) Institutional weakness is a key constraint to timely and efficient execution of projects, and to long-term sustainability of the assets created.
- (ii) Local capacity constraints are exacerbated by a highly centralized system of government. Related to this is the delineation of functions and intergovernmental fiscal relations which constrain the ability of local government to plan and manage public sector investments.
- (iii) Local level infrastructure investments remain largely at the discretion of the central government, and local officials lack the budgetary and human resources to maintain infrastructure properly and effectively respond to constituents' needs.
- (iv) Incentives and resources for local governments to strengthen services are limited. These weaknesses may have been reinforced by interventions which have been executed centrally and maintained and operated locally.
- (v) The proposed project addresses the opportunity for greater local involvement in project planning, design and implementation, and the issue of capacity constraints and poor incentives for quality service provision at the local level.
- (vi) In considering the adoption of a design and build (D&B) procurement modality the project has the opportunity to try to eliminate problems experienced in prior ADB loans where there is difficulty in assigning responsibility for deficiencies when infrastructure is turned over to local authorities.
- (vii) Projects have had limited and variable success in raising tariffs, resulting in under-funding of operation and maintenance. The support of ADB and other donors has focused on rebuilding assets in a variety of urban sub-sectors, but has placed less emphasis on building the institutions and systems required to ensure these assets are maintained and operated efficiently. Given the acute needs in urban areas in the 1990s, the emphasis on building and rehabilitating assets was probably justified. Today, it is clear that Mongolia lags behind other former socialist countries in institutional reform and strengthening, and risks wasting resources on infrastructure that is not well maintained and managed.

APPENDIX H: TERMS OF REFERENCE FOR GENERAL PLAN TO MAKE DARKHAN A MODEL CITY

Approved by ERDENE BUREN.R
STATE SECRETARY OF MCUD

TERMS OF REFERENCE – DEVELOP THE DESIGN OF A GENERAL PLAN TO MAKE DARKHAN A NATIONAL “MODEL CITY”

1. The Plan should be based on the following relevant documents:

- “The National Program and Millennium Development Goals” approved by Parliament decree No 12 in 2008;
- “New Development medium term target program” approved by Parliament decree No 36 in 2010;
- “Mongolian Government 2012-2016 Action Program” approved by Parliament decree No 37 in 2012;
- Action plan of Mongolian Government 2012-2016 Action Program implementation approved by Government decree No 120 in 2012;
- Law on 2013 state budget;

2. Overview:

- **Objective of the consulting services:** The aim is to develop a plan to make Darkhan city, Darkhan-Uul aimag a Model city of Mongolia under “Smart city”, “Green city” projects.
- **Territory:** 4,000sq.km
- **Location:** Darkhan is located in the north west, 220km from Ulaanbaatar, and lies in the Orkhon and Selenge’s vast river valleys, along the Kharaa river bank in Burkhan valley and 700 meters above sea level. It has a continental dominated climate. It is located along the trans-Mongolian railway linking Russia and China.
- **Current situation:** The city of Darkhan’s area is 98,000 hectares with a population of 71,784 by the 2012 census. Darkhan Thermal Power Plant Joint Stock Company (DTPP) has a capacity to heat at a rate of 1196 gcal/h and provides 48 MW of power. There are 4 Mobile Operators and several Internet Service Providers. The master plan for development of Darkhan up to 2020 was approved by Government decree No 205 in 2005.
- **Duration of developing plans:** 2013–2028 (the first phase of planning from 2013-2018 and 2018-2028 for the long-term strategic plan)
- **Duration of design:** 8 months

3. Agenda for the planning solution:

- **Basic solution:**
 - Develop planning solutions for the establishment of a Smart City and define the principles of development.
 - Define development approaches for “Model city” under “Smart city” and “Green city” projects having suitable environment for city residents and meeting the requirements of industries and small entities in the city.
 - Review legislation and carry out survey for “Model city” and develop an organizational structure for the project in the administration office.
 - Prepare the plan to enable the city to host an oil refinery plant using high technology, a metallurgical factory, a construction material factory, light industries and food industries, fast-growing agriculture, transport, logistics, science and education sectors.
 - Develop business action plans and policies to implement general plans stage by stage.
 - Develop marketing plans and estimate all preliminary investment costs and prepare the list of required projects and programs.
 - Prepare detailed investment cost and financial baselines for implementing the general plan.

- Define the land tenure and city locational requirements based on a baseline survey and comprehensive city evaluation.
 - Define optimum management organizational structures to improve the city management and renew the system of land use and boundary of developed area.
 - Develop a strategic plan to be aligned with: Mongolian social and economic approaches; regional and urban development; and neighboring provinces and soums' development plans, to make Darkhan at the same level of development as Ulaanbaatar.
 - Include new residential zones in the general plan aligned with industrial park plans and other sectors' documentation.
 - Develop and apply a new city registration and address system.
- **Developing economic and social infrastructure plans:**
- Set up economic sector organizational structure, work force projections, and basic category of employment according to the first phase up to 2018, and up to 2028.
 - Develop plans for the number of the pre-school and school pupils in 2018 and up to 2028.
 - Develop plans and estimate capacity of full hospital service with 100% for each phase by meeting requirements.
 - Develop plans for the types of apartments and houses required and provide detailed housing proposals based on family needs, housing demand and supply.
- **Developing streets, road, and transport network plans:** Develop plan aligned with Mongolian roads and railways united network. Current streets, roads, transport network and engineering infrastructure will be extended as follows:
- Develop plans for traffic speed projections on main paved roads connecting Ulaanbaatar, Erdenet and Darkhan.
 - Develop plans of transit facilities on highway going through Darkhan to Altanbulag and Zamin-Uud.
 - Develop plans for establishing a new auto station and railway station.
 - Develop plans for parking lot demand and needs.
 - Develop plans for city main road network, pedestrian roads and bicycle roads.
 - Develop plans for public transportation service as follows:
 - *Develop optimum solution for public transportation service and management;*
 - *Choose and apply efficient technologies in the public transport sector and choose environmentally friendly transportation;*
 - *Use advanced information technologies in urban public transportation systems.*
- **Developing engineering network plans:** Increase the capacity of Darkhan Thermal Power Plant in alignment with further demand and needs and establish reliable power source. Utilize heating engineering of tunnel-based networks
- Develop plans for connection of one-story-buildings and cottages to central water supply, sewage and heating networks;
 - Develop plans for extension of water supply sources and review and study on replacing facilities;
 - Apply bio-nanotechnologies in the city wastewater treatment plant and increase the plant's capacity. Develop plans to establish a new wastewater treatment plant in the industrial area, in the south part of the city. Develop plans to ensure effluent treated wastewater achieves 100% quality standard;
 - Develop plans and prepare detailed calculations for reusing gray water, and for solar and other renewable energy;
 - Develop plans for rehabilitation of Darkhan Electricity Distribution Network and substations, replacing these with modern facilities, cable lines, and valves and install auto-monitoring and remote controls.
 - Develop plans for establishing Internet connection substations, applying digital system and constructing a new television tower.
 - Develop plans or building flood and drain systems, and drainage lines, storm water drainage, storage ponds and extending wastewater pumping stations or constructing a new pumping station under the framework of engineering.

- **Developing sustainable environmental management plans:** Develop plans for applying green land to create healthy, safe and comfortable environment, protect the environment, and provide the residents with healthy food.
 - Develop plans to increase the area of green land and establish parks;
 - Develop plans to take measures on deforestation, sand movement by wind; Develop plans to improve water management as follows:
 - Use surface water resources;
 - Treat wastewater and recycle it;
 - Use surface water resources and reserved water or purified wastewater for uses except for drinking;
 - Use effluent treated water for heating system in Thermal Power Plant;
 - Apply treatment plant technologies in industries and small business entities to pre-treat their factory wastewater and implement the system “Polluting factories must pay”;
 - Develop plans for pond areas;
 - Set up river protection boundary;
 - Develop plans for setting up protected areas along the Kharaa river bank, constructing recreational centers to create a comfortable environment;
 - Develop plans for taking measures to reduce air pollution, water pollution and soil pollution in Ger districts;
 - Set up waste management systems by applying high technologies based on non-polluting chemicals;
 - Develop plans for waste management mechanisms/system collection and transportation and construct new waste recycling factories and power plants (produce energy by recycling waste at high temperature at centralized waste disposal sites).
 - Develop plans of establishing cemeteries, crematoriums, religion teaching centers, offering centers and custom centers.

4. Phase for design:

- **Developing design and document approval plans:** Develop plans with the client under “Regulations on urban development documentation and expertise” based on Darkhan city economic and social projections, territory features and resources.
- **Review baseline urban development plan:** According to “Law on urban development” article 12.9, make an assessment of the territory, population, society, economy, environment, infrastructure and others to be carried out in the city.
 - Geographical layout M1:5,000;
 - Engineering and geology study;
 - Water source study;
 - Urban development comprehensive assessment;
 - Engineering source and network study;
 - Social and economic study;
 - Evaluation of previous plan implementation
- **Developing design plans:** Develop general plans to make “Model city” of Mongolia based on baseline urban development plans and urban development complex assessment, under approved terms of references in developing design.
 - Design
 - Regional development overview and city area scheme M1:25,000
 - Area overview M1:10,000
 - Urban development comprehensive assessment M1:5,000
 - Zone, road, transport network, infrastructure service M1:5,000
 - Area attributes and dedication and types of zones M1:5,000
 - Architecture and space planning M1:5,000
 - Preparation work for engineering, vertical planning and hazardous zone boundary M1:5,000
 - Design of engineering network M1:5,000
 - Heating supply M1:5,000
 - Water supply and sanitation M1:5,000

- Electricity supply M1:5,000
- Communication installation M1:5,000
- City center zone plan, and panorama M1:1,000, etc.
- Explanatory notes /4 volumes/
 - Provide evidence of design and approaches adopted;
 - Assessment of engineering-ecology and landscaping;
 - Key analysis of urban development, assessment, comprehensive assessment of urban development, advantages and disadvantages and relative comparison of options, definition of impact features on development and economic analysis, etc.
- Layout M1:2,000

Recommendations from related organizations: Evaluate recommendations from aimag and soum Resident's Representatives' Meeting, aimag and soum Governor's Office and related ministries during the planning phase, engage with the communities under the procedure "Urban development plan to be discussed with community"

5. Suggestions on design and approval:

- Make proposals with the organizations on terms of reference for design stage;
- Introduce the plan and discuss with the members from urban planning and architecture meeting under MCUD;
- Engage state expertise on general documentation assessment and make general assessment;
- Introduce the plan project and discuss with the members from science and technology committee meeting under MCUD;
- Approve the plan by Government Resolution based on law on urban development article 6.1.4.

READ BY:

Mergenbayar.G

The head of Strategy Policy Planning Department, MCUD

REVISED BY:

Bayarbat.Ts

The head of Land Administration Urban Development Policy Implementation Department, MCUD

DONE BY:

Dondma.E

Urban Development Specialist from MCUD

Urban Development Specialist from MCUD

Sarnai.B

Urban Development Specialist from MCUD

Sumkhuu.Ya

APPENDIX I: PROPOSED OIL REFINERY IN DARKAN

State to own 51 per cent of Darkhan Petroleum Refinery

Mongolia Economy and Finance: May 18 2013

During its regular cabinet meeting on Saturday, the government has decided that state ownership of the Darkhan Petroleum refinery will be no less than 51 percent.

Construction of the Darkhan Petroleum refinery will be funded by loans from Japanese Banks and financial institutions. The government said it is critical that the legal and management issues of the refinery be resolved immediately to secure 51 percent ownership.

The Minister of Mining, D.Gankhuyag, was instructed to arrange meetings with stakeholders to discuss securing the state's share. He will also be responsible for granting the new refinery, the country's first, a special permit to produce petroleum based products as the Darkhan Petroleum Factory LLC.

Darkhan Petroleum broke ground in 2011 and is expected to be operational by 2015.

Mongolia to build first oil refinery in Darkhan-Uul

Bloomberg: January 18, 2013



Japan-based Toyo Engineering and other unnamed local companies will be building Mongolia's first oil refinery by 2015 at a cost of \$600m.

The first refinery to be constructed in the Darkhan city, in Darkhan-Uul Province is expected to have a capacity to process two million metric tons of oil per year.

Mongolia is undertaking the project with the intention to reduce the country's dependency on Russian imports for gasoline and other oil products, reported Bloomberg.

In February 2013, the companies are scheduled to discuss the funding aspect of the project with some Japanese banks. The investment in the facility can reportedly be reimbursed in four years.

Construction of the refinery is anticipated to be completed in three years, and the domestic production is expected to reduce the gasoline prices by 6% to 8%.

With no domestic refining facility, almost all of Mongolia's gasoline and oil products are imported from Russia.

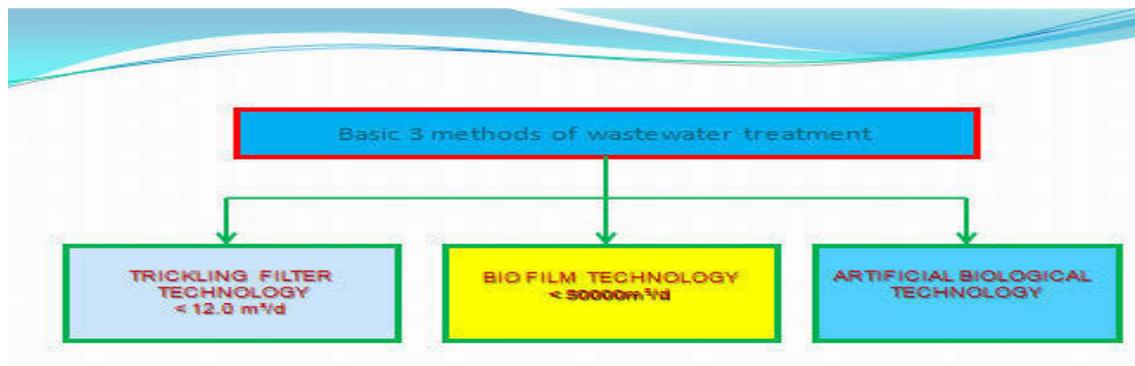
APPENDIX J: DESIGN AND MONITORING FRAMEWORK

| Design Summary | Performance Targets and Indicators^a with Baselines^b | Data Sources and Reporting Mechanisms | Assumptions and Risks |
|---|---|--|--|
| Impact Sustainable urban environment in Dharkan city and the Kharaa River Basin | By 2020 (base 2010/2013) Kharaa river water quality improved from Grade X to Grade Y year-round | Socioeconomic surveys taken at beginning and completion of the project Government records – Darkan-uul aimag environment office ADB, PPAR | Assumption Government's commitment to improve wastewater operation and management remains strong Risk Population growth falls significantly behind forecast, reducing demand |
| Outcome Improved wastewater treatment and management for domestic and industrial users in Darkhan city | By 2018 (project completion) Incidence of wastewater treatment plant downtime reduced from 10% (2013) to 1% of time Domestic & industrial wastewater treatment capacity increased from 10,000 m ³ /d to 20,000 m ³ /d. Incidence of effluent standards exceedence by Darkan WWTP reduced from 20% (in 2013) to 2% at EoP | PUSO operational records Project implementation and monitoring report ADB PCR Darkan-uul aimag environment office Meterological Institute of Darkhan-Uul | Assumption Mongolia's economic development remains strong Risk Darkhan city industrial development stays significantly short of expectations with potential negative impacts on financial performance of wastewater management |
| Outputs 1.1 Wastewater treatment plant rehabilitated and expanded or new WWTP constructed and operating 1.2 Pump stations rehabilitated and damaged sewer lines replaced 2.1 Capacities in wastewater management strengthened | By 2018 (project completion) Darkhan WWTP rehabilitated and installed with IFAS system and 15,000 m ³ /d of wastewater treated with effluent meeting national standards at 20% reduction in operating cost. Primary and Secondary pump stations operating efficiently, avoiding overflow at 10% reduction in operating cost. 13,000 household/industry connections operating and 20% benefitting poor households Utilization of reclaimed water increased from 0 tons/day to 10,000 tons/day Tariff affordability analysis conducted, and subsidy mechanism established New operational and financial management systems launched at Darkhan PUSO (baseline: single entry system) Environmental monitoring to monitor effluent quality is regularized | Project implementation and monitoring reports ADB loan review and midterm review missions ADB PCR End of project household socio-economic survey Us Suvag customer records Us Suvag financial records | Assumptions National and local government commitments to implement project remain strong Implementing agency is adequately staffed and fully engaged in a timely manner to support activities Contractor performance is timely and satisfactory Risk Unforeseen difficult construction conditions i.e., severe weather conditions or natural disaster |

| Design Summary | Performance Targets and Indicators ^a with Baselines ^b | Data Sources and Reporting Mechanisms | Assumptions and Risks |
|---|--|--|-----------------------|
| <p>2.2 Implementing agency/PUSO staff trained</p> <p>2.3 People trained in health and environment</p> | <p>training sessions on financial management, O&M, etc., of WWTP for 12 implementing agency staff (gender disaggregated)</p> <p>5 public awareness events on public health, environmental management, etc. attended by 100 residents (sex disaggregated)</p> | | |
| <p>Activities with Milestones</p> <p>1.1 Establish Darkhan PIU and working arrangements, procedures, and responsibilities for subproject (2014).</p> <p>1.2 Finalize detailed designs (including 3rd part quality assurance for WWTP); obtain approvals; and award works, goods, and service contracts (2015–2016).</p> <p>1.3 Rehabilitate and equip WWTP (2016–2018).</p> <p>1.4 Rehabilitate and Equip Pump stations</p> <p>1.5 Replace sewer lines</p> <p>2.1 Assess capacity development needs, and develop training and public awareness programs (2014–2015).</p> <p>2.2 Provide implementing agency staff training and public awareness raising events (2014–2017).</p> | | <p>Inputs</p> <p>ADB:</p> <ul style="list-style-type: none"> • \$15 million investment project financing (for civil works; equipment; implementation, supervision, and training; financial charges during construction) • TA for project preparation engaging consultants • Fact finding, loan negotiation, and review missions • Training to implementing agency on ADB procedures <p>National and local governments:</p> <ul style="list-style-type: none"> • \$5 million counterpart funds (civil works (contribution of existing structures), land acquisition and resettlement, environmental protection, contingencies, and others) • Sub-project agreement between MCUD and Darkhan-Uul aimag • Sub-loan agreement between MoF and Darkhan-Uul aimag • On-lending arrangements between Darkhan-Uul aimag and Darkhan Us Suvag • Loan management arrangements • Establish and maintain project offices at all levels • Operation and maintenance budget and staffing | |

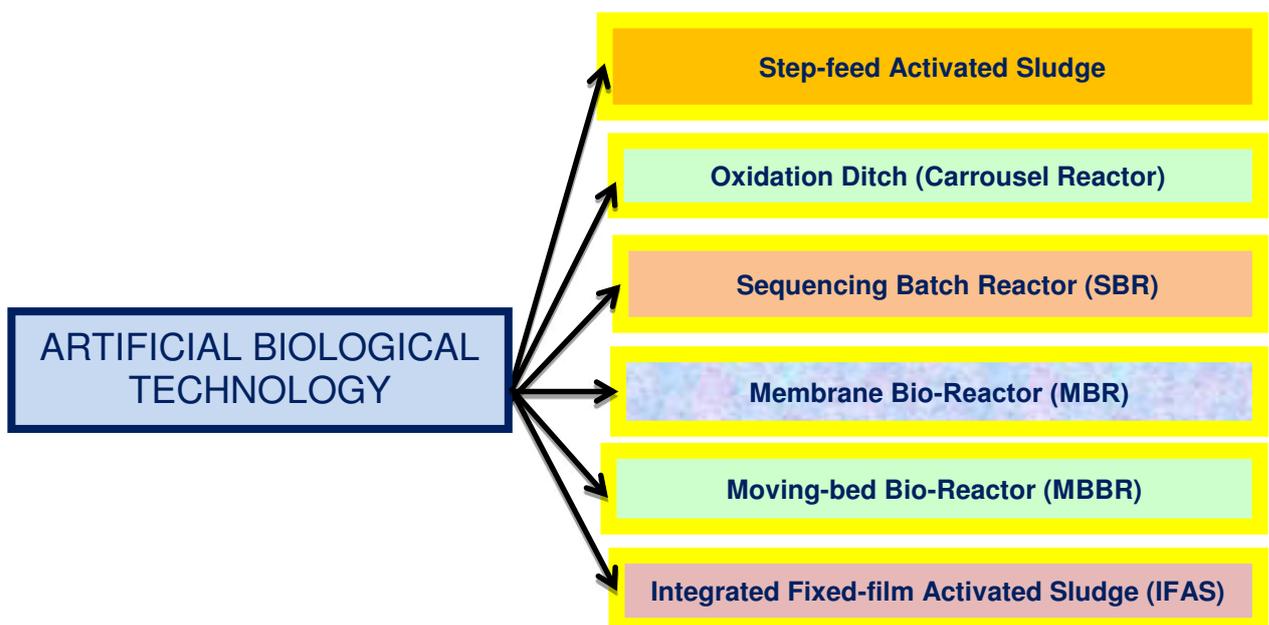
APPENDIX K: TECHNICAL CHARACTERISTICS OF SHORTLIST OF WASTEWATER TREATMENT PROCESSES

There are three predominant methods of wastewater treatment used widely in many countries and which are continuing to be developed and improved. These can be broadly categorised into the three classifications below.



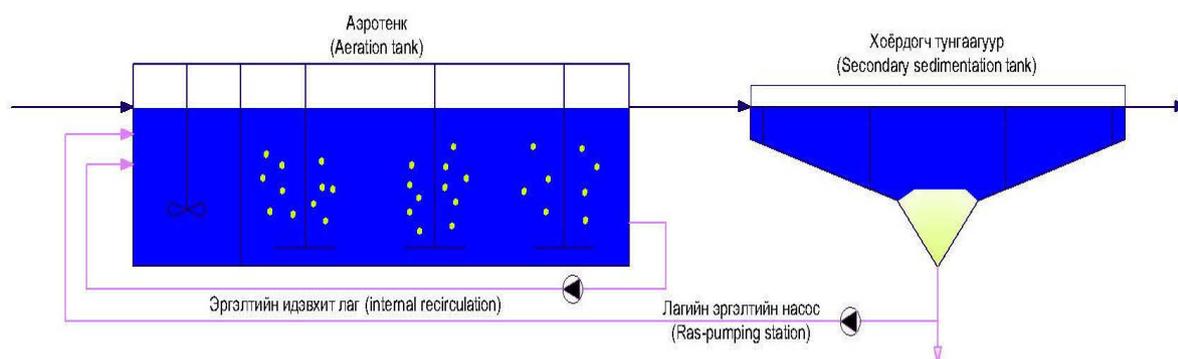
Of these three, both trickling filter technology and bio-film technology are used for smaller plants, and are not systems which have been adopted widely either in Mongolia or the Region. Consequently the focus of evaluation of alternative systems focuses on artificial biological technology.

Of the artificial biological technology options available, the step-feed activated sludge process, which uses micro-organisms which require aeration and oxygen (aerobic organisms), is the most effective technology. Basically, the quantity and effectiveness of micro-organisms in the aeration tank in breaking down organic matter is many hundreds of times greater than micro-organisms in the anaerobic tank. One of the advantages of the step-feed activated sludge process is that it provides an opportunity to avoid potential odour from treatment stages which rely on the anaerobic process, where the intermediate products of digestion can cause the release of the odiferous intermediate products of anaerobic digestion (e.g fatty acids and proteins). While anaerobic processes still have a role in wastewater treatment, the level of effluent treatment achieved is not high enough to meet the required standards, unless in combination with aerobic systems. Problems related to wastewater treatment can be solved through the adoption of a step-feed activated sludge process using a variety of approaches aligned with recent thinking on optimal wastewater management solutions. Artificial biological technology using aeration can be divided into the following systems:



1. Basic Activated Sludge System

Flow diagram for the basic activated sludge system



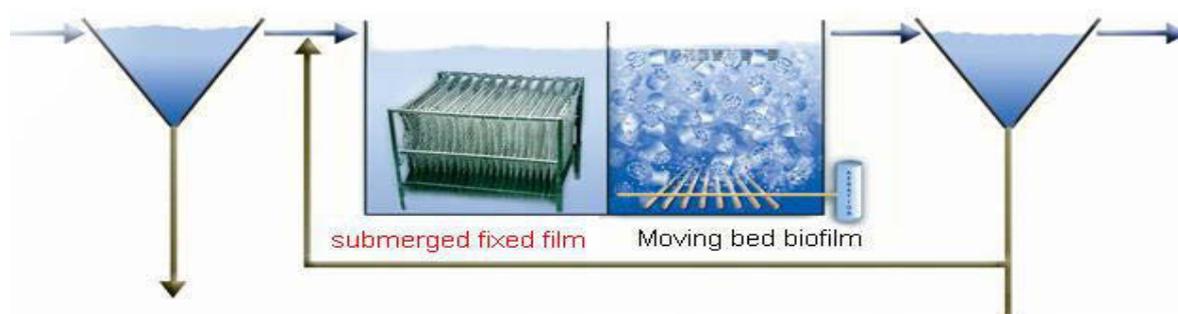
The traditional activated sludge system has been widely used in many countries and for many years, but in view of the treatment limitation of the traditional activated sludge process (ASP), a number of developments have been made to improve this basic process. The main reasons for the efforts to improve the basic activated sludge system are:

1. Nitric oxides, such as nitrites and nitrates, and sulphurous oxides, such as sulphites and sulphates are only poorly decomposed in the traditional activated sludge process. When these elements remain in the treated effluent water discharged to rivers to rivers and lakes, nitrogen and phosphorus oxides are then decomposed in the natural environment which results in undesirable environmental consequences such as algal blooms, which in turn damage aquatic environments. In extreme cases this can lead to eutrophication of water bodies with disastrous impacts on aquatic life.
2. Further problems were experienced with traditional activated sludge plants when the sludge volume index was high, leading to problems maintaining optimal MLSS concentrations, sludge bulking and sludge carry-over. .

As a result, in order to improve the process of decomposition of the oxides of nitrogen and phosphorous through additional aeration, systems were developed which extended the aeration period. However, the disadvantage of this process was that it requires an increase in the capacity of blowers and total volume of tanks – contributing to additional operational and capital costs. In order to resolve these disadvantages, some additional processes were introduced – such as improved decomposition of nitrogen oxide – by changing the ways, rates and locations at which return sludge is returned to the system. Based on progressive system changes and observation, there have over recent years been many changes and technological innovations introduced to the activated sludge system.

In order to eliminate some of the above disadvantages, additional and modified processes such as decomposing nitrogen oxides under anaerobic conditions were introduced. This includes denitrification and nitrification systems (the three sludge system) and mixed variations of activated sludge and biofilm systems such as the moving bed bioreactor (MBBR), and integrated fixed-fill activated sludge (IFAS) process. These combine the activated sludge and fixed film processes in order to improve nutrient removal and reduce sludge volume. These systems are continuing to be developed to improve performance under varying treatment conditions. The figure below shows a graphic of this process.

Moving Bed and Fixed-film Bio-reactors



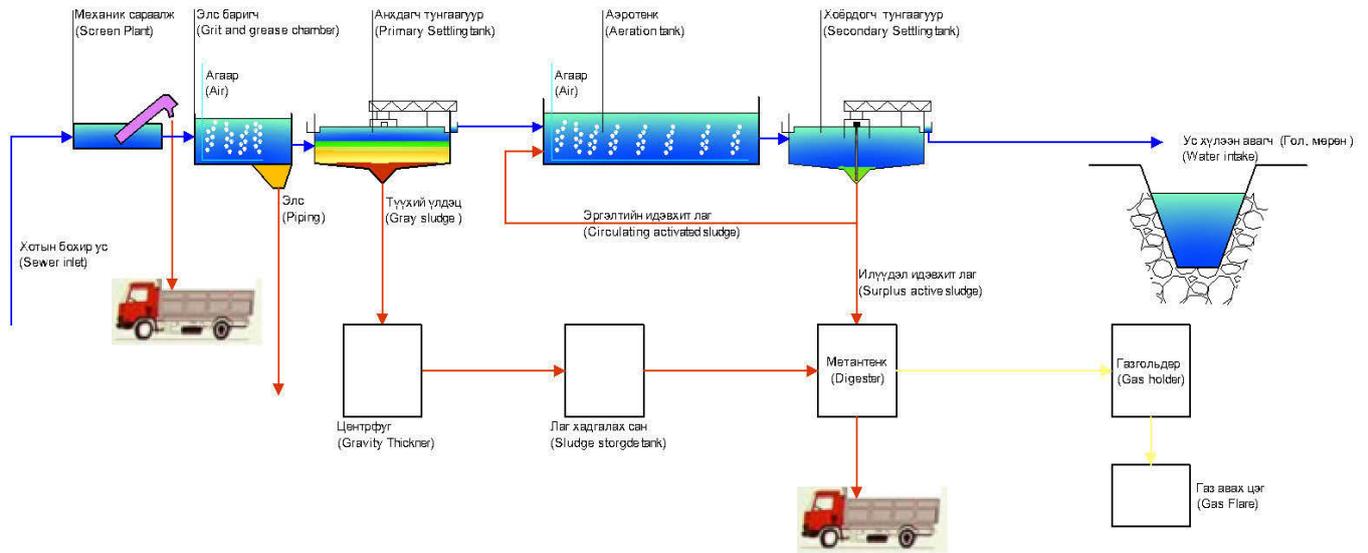
All these systems use the same basic principles as the activated sludge system, and consequently they can all be considered to be developed variations of the activated sludge system. The advantages and disadvantages of all these systems are well covered in the feasibility study for the WWTP in Buyant-Ukhaa, Ulaanbaatar carried out by GITEC Consult GmbH Duesseldorf, Germany⁵ for the construction of a plant of with a capacity of 20,000m³/day. The main advantages and disadvantages mentioned are as follows:

- 1 The advantages of the step-feed ASP technology are that it provides a high level of treatment without the operation complexities inherent in SBR system. Furthermore, raw sludge and excess activated sludge can be used to produce energy through sludge digestion which is both environmentally-friendly and can provide energy through the bio-gas produced which offsets some of the energy costs of operation
- 2 The potential disadvantages of the system are that when extending the capacity of the WWTP there will be a need for additional primary and secondary sedimentation tanks, aeration tanks and other basins, which will add to the cost of modular capacity enhancement. It will also require increases the number of sewage pipelines and other interconnecting pipework and appurtenances.
- 3 In general, activated sludge systems do not provide a high level of nutrient removal, but the step-feed process is designed to improve the nutrient removal performance of the system, so this should not constitute a problem in achieving discharge standards. The addition of anaerobic digestion to generate bio-gas as a resource to reduce energy should be beneficial, but there is some doubt as to the applicability and efficiency of biogas digesters under Mongolian conditions where relatively high water consumption (150 l/c/d) and low organic loads (27 g/c/d) lead to low BOD₅ and SS concentrations in raw sewage (BOD₅ 90-95mg/l, SS ~150mg/l).

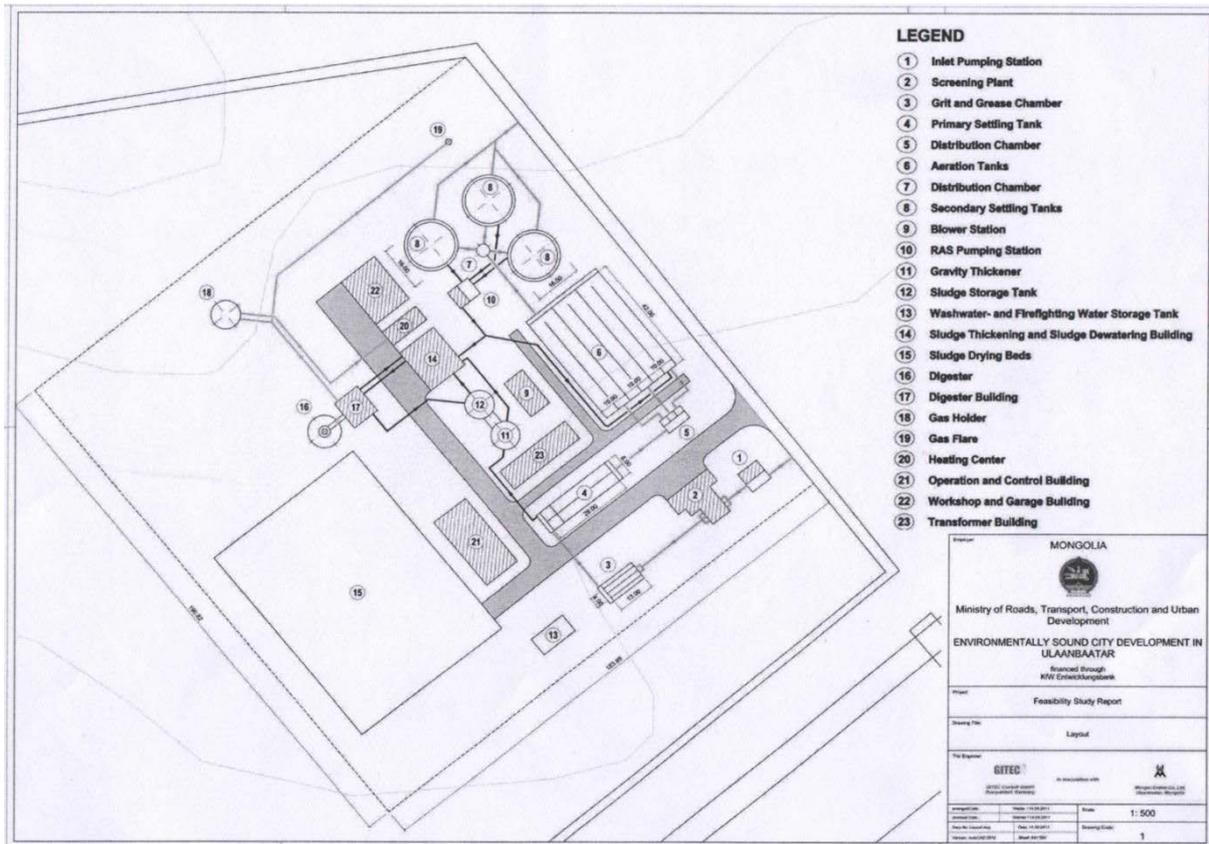
⁵ Environmentally Sound City Development in Ulaanbaatar, Feasibility Study Report, Final Version, Gitec and Mongol Erdem, Ulaanbaatar August 2011.

Layout of WWTP with Modified Step-feed Activated Sludge Technology

САЙЖРУУЛСАН ИДЭВХИТ ЛАГИЙН ТЕХНОЛОГИЙН ЗАРЧМЫН СХЕМ

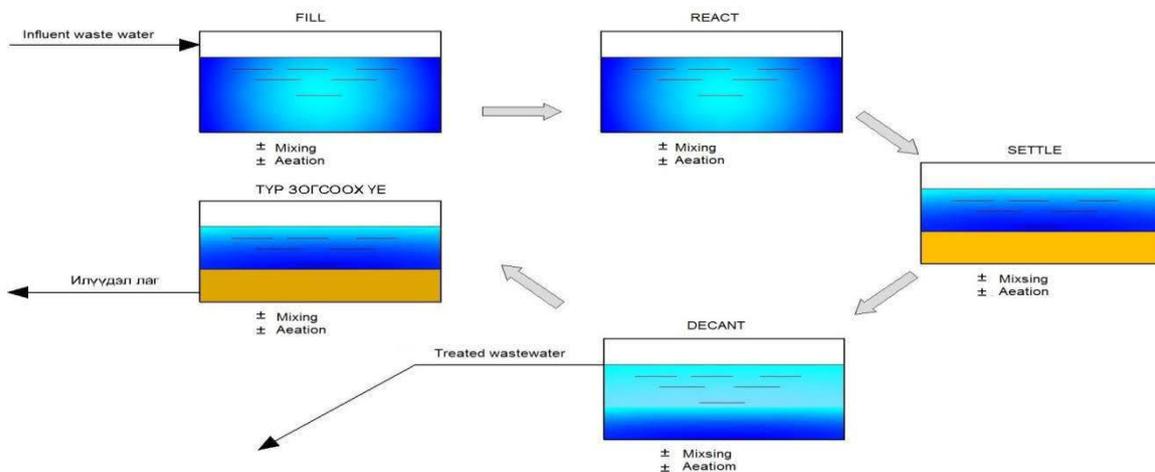


Layout of Step Feed Activated Sludge System, WWTP (20,000m³/d) in Buyant-Ukhaa



2. Sequencing Batch Reactor (SBR)

Major phases of the SBR Operations Cycle



The SBR process is one of those biological treatment processes which have been increasingly adopted in recent years, as it provides a modern and potentially more efficient variation on the activated sludge process. It effectively replaces a physical sequencing of reactors by a single reactor in which the treatment phases are themselves sequenced. In the traditional activated sludge system, influent

wastewater is purified on its passage through several tanks. Under the SBR system, all the treatment phases are carried out in a single tank. Within this basic configuration that can be there can be a number of construction options. The simplest one is one tank with one bioreactor, but for larger flows or to provide greater operational flexibility there can be one tank with 2-3 bioreactors. The SBR system is most suitable for relatively small city or town residential populations and industries. It becomes relatively more expensive compared to other options for very large wastewater flows.

The operation of a SBR is based on the following steps.

1. **Filling:** During the fill phase, influent wastewater enters the tank and neither the mixer nor aeration is active, although under a mixed-fill scenario, mechanical mixers are active. At this stage anoxic conditions are present and nitrogen is released, and at the same time denitrification is promoted and the biomass undergoes a release of phosphorous. During the third phase, both the aerators and the mechanical mixing unit are activated to promote denitrification there is no aeration for certain time, and an anoxic condition is present, which allows both denitrification and nitrification. During this phase, sedimentation is also supported.
2. **React:** No wastewater enters the basin and the mechanical mixing and aeration units are on, and carbonaceous BOD removal occurs in this phase. The duration of this phase makes up half the duration of all phases. The duration of all phases including switching the oxygen on and off and receiving influent wastewater can be timer-controlled or automatically controlled. In general, the duration for all the phases is 6-8 hours.
3. **Settle:** During this phase, no mixing and aeration takes place. Under these conditions, the activated sludge tends to settle as a flocculent mass, forming a distinctive interface with the clear supernatant. The sludge mass is called the sludge blanket.
4. **Decant:** During this phase, a pump or a floating decanter is used to remove the clear supernatant effluent to the outlet arrangements or next treatment stage.
5. **Idle:** This step occurs between the decanting and fill phases. During this phase, excess sludge is pumped out by measured volume to retain optimal sludge concentration.

The Advantages and Disadvantages of the SBR System

The advantages can be summarised as:

1. Excess sludge is minimised.
2. Because all of the operations are carried out in a single tank, the reactor footprint can be minimized.
3. The system is provided with fully automated operation.
4. The aeration device has a timing unit, so there is no need to plan for high capacity aeration.
5. Operation is highly flexible and can accommodate varying ambient temperatures, hydraulic, organic or nutrient loads.
6. There are low pumping requirements as no sludge return is required
7. Compact facilities reduce exposure to weathering
8. Good removal of nitrates at low temperatures and high organic loadings.

The disadvantages can be summarised as:

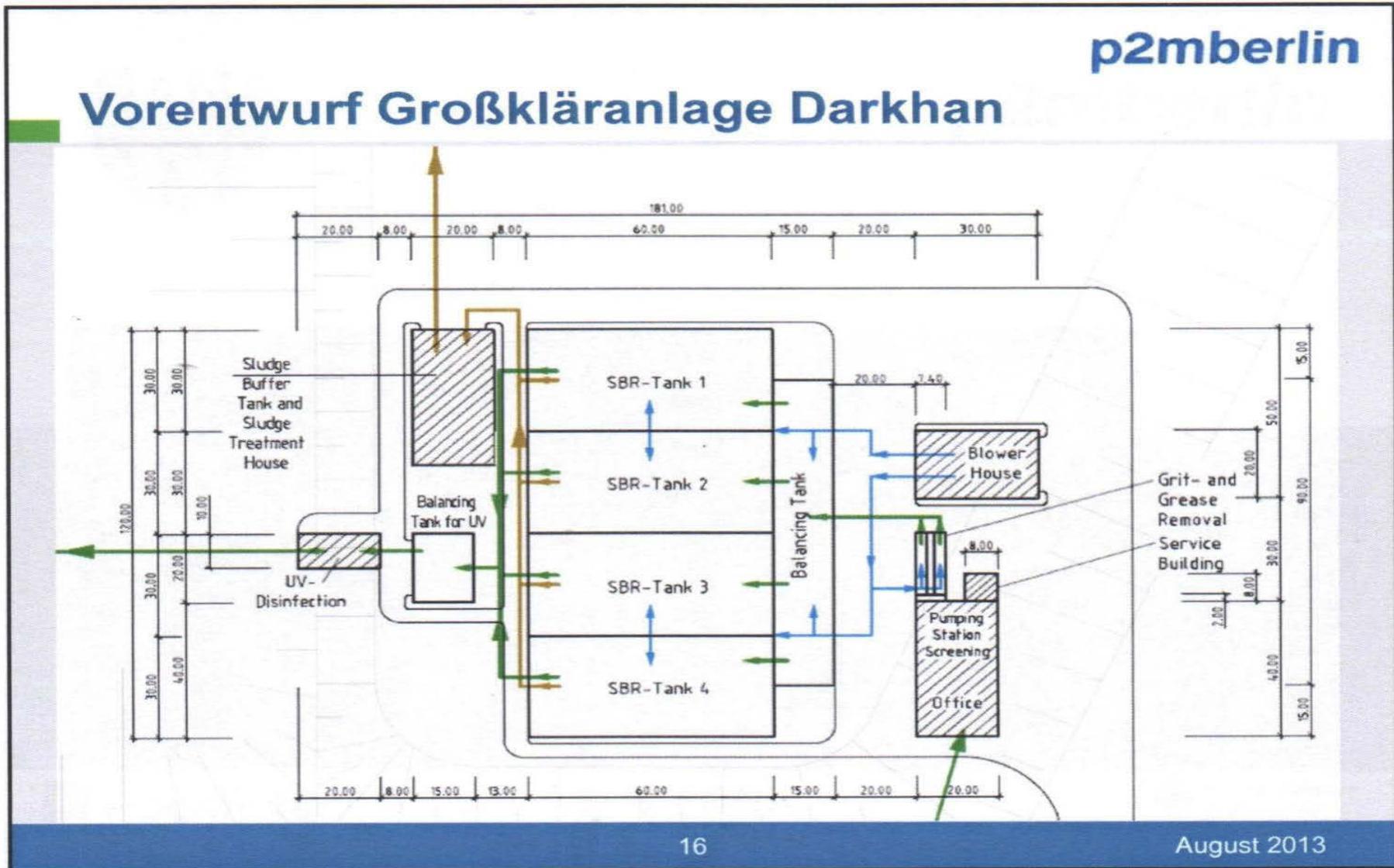
1. A higher level of sophistication is required because the step feed bioreactor is controlled by an automated timing unit.
2. The operation relies on automated systems which demand a higher level of maintenance associated with automated switches, valves and shut offs.
3. Higher cost of maintenance of automated facilities.

4. It is risky to stop the inflow of raw sewage for a lengthy period (for 6-8 hours) during which anaerobic conditions are maintained and water temperature goes down (<10°C) which will impact negatively on the microbial mass.
5. It requires the construction of buildings with oxide-proof materials, and good quality of heat-insulation. Normal reinforced concrete cannot be used and if polypropylene I used it impacts negatively on cost and treatment times.

The MoMo project has been operating a pilot SBR in Darkhan for a period of almost two years. It is proposed to observe this pilot to determine its applicability for the conditions in Darkhan with a view to the development of a full-scale SBR plant⁶.

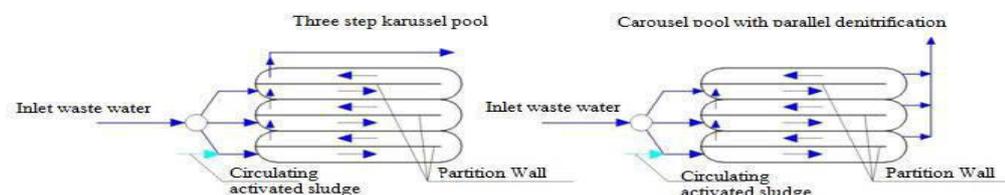
⁶ Source: Heppeler, Jörn. Optimization of the operation of a sequencing batch reactor (SBR) – On the example of the pilot wastewater treatment plant in Darkhan, Mongolia, University of Stuttgart, Stuttgart, 2012

The Sequencing Batch Reactor WWTP Proposed for Darkhan under the Momo Project. The Plant is designed for a flow rate of 20,000 cum/day



3. The Oxidation Ditch or Carrousel system

This is effectively an extended aeration system. In this system there is recirculation of wastewater in a circular ditch or carrousel which allows the operation of two alternate processes: (i) the step-feed mode, and (ii) the simultaneous denitrification mode.



The Advantages and Disadvantages of the Oxidation Ditch System

1. However, it is considered that this system does not represent as good an alternative for Darkhan as either the modified activated sludge or SBR technologies, or other systems which use elements of these two. While from a technical point of view, the system would be able to achieve the required treated effluent quality standards, there are process disadvantages when compared to the modified ASP, SBR and related systems, under the operating conditions experienced in Darkhan.
2. As an extended aeration system, the oxidation ditch aerobically stabilises the activated sludge. This has the advantage that no additional and separated sludge stabilization is required, but has the disadvantages that; (i) the extended aeration systems means that about 25% more energy is used than in either conventional activated sludge or SBR systems; and (ii) the aeration tank volumes required are about 4- 5 times those required by either the modified activated sludge or SDR systems.
3. A further disadvantage of the oxidation ditch system when operating in cold climates is that since the aeration takes place at the surface, the aeration tank depth cannot exceed approximately 3.50m. This combination of large volume requirement and restriction on depth means a very large foot print and thus equally large exposed liquid surface area, leading to rapid cooling of the liquor in winter and thus the risk of freezing. The only way to maintain the required temperature in these circumstances is to enclose the reactor – at a very high capital cost.

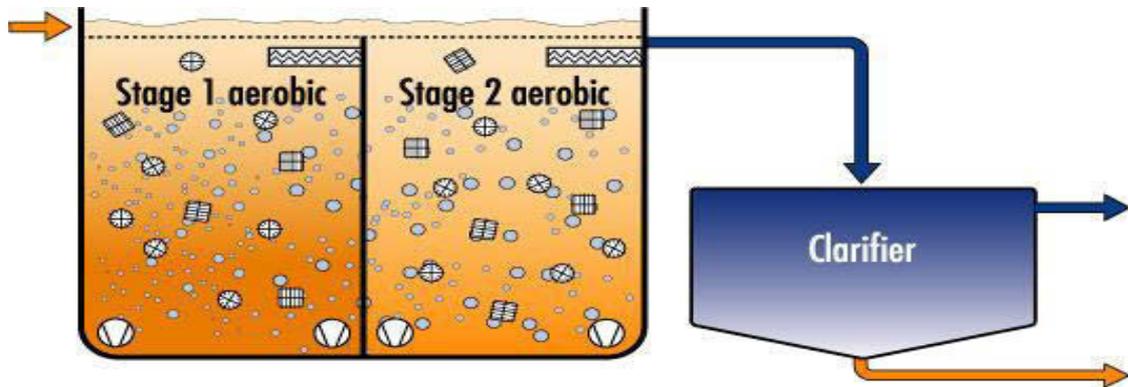
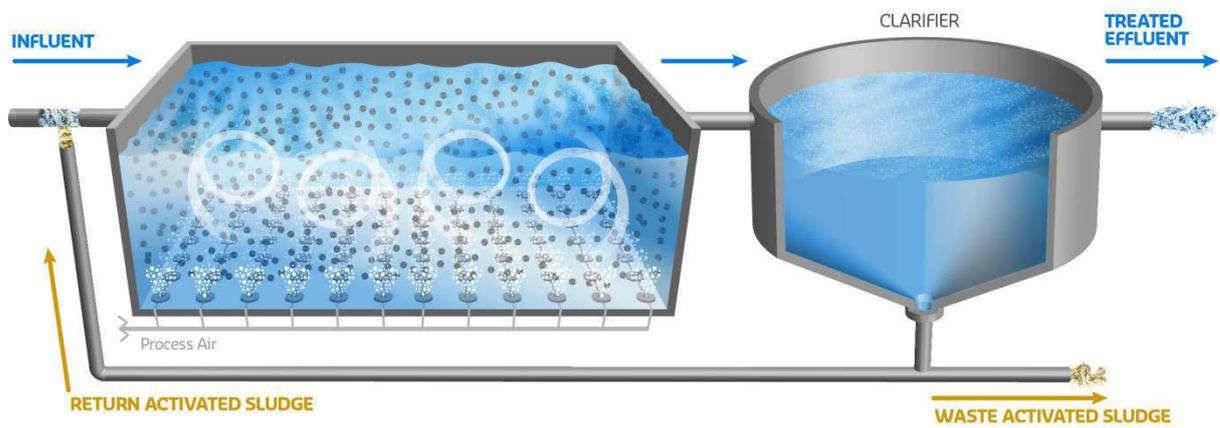
4. Moving Bed Biofilm Reactor (MBBR)

One of the latest biological treatment processes which uses the attached biofilm technology (as adopted in the traditional “trickling filter” treatment systems) is the Moving-bed Biofilm Reactor (MBBR), originally introduced by “Nijhuis Water Technology” company. The principle of this system is that submerged mobile plastic media (polyethylene biofilm carriers see figure below) are introduced into the aeration tank which also functions as an activated sludge bioreactor. These biofilm carriers attract a fixed-film biomass which attaches to the carriers, which due to the aeration are kept suspended in the mixed activated sludge liquor. This causes both an increase in the activated sludge concentration, and improves the quality of the sludge. As a result, the overall volume of the reactor tank can be significantly decreased, and the volume of excess sludge decreases. This in turn provides an enhanced level of treatment.



Moving bed biofilm polyethylene biofilm carriers

OVERVIEW OF MOVING BED BIOFILM REACTOR



Moving bed biofilm technology can be used as a supplementary treatment process to all systems described above as a means to increase the concentration of activated sludge and thus decrease the overall volume of the reactors. Use of this material also promotes reduction of the amount of sludge produced and has the advantage of improving the quality of the final effluent.

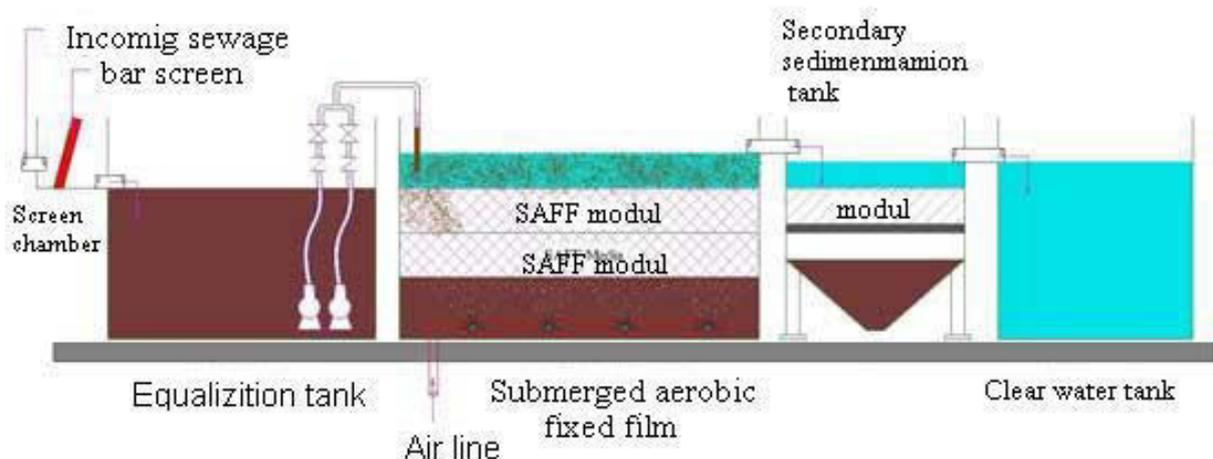
5. INTEGRATED FIXED-FILM ACTIVATED SLUDGE (IFAS)

The integrated fixed-film process uses the same principle as the MBBR, except that whereas the moving bed biofilm media can float and move in the wastewater, integrated fixed-film is immovable and it is attached to the bioreactor container.



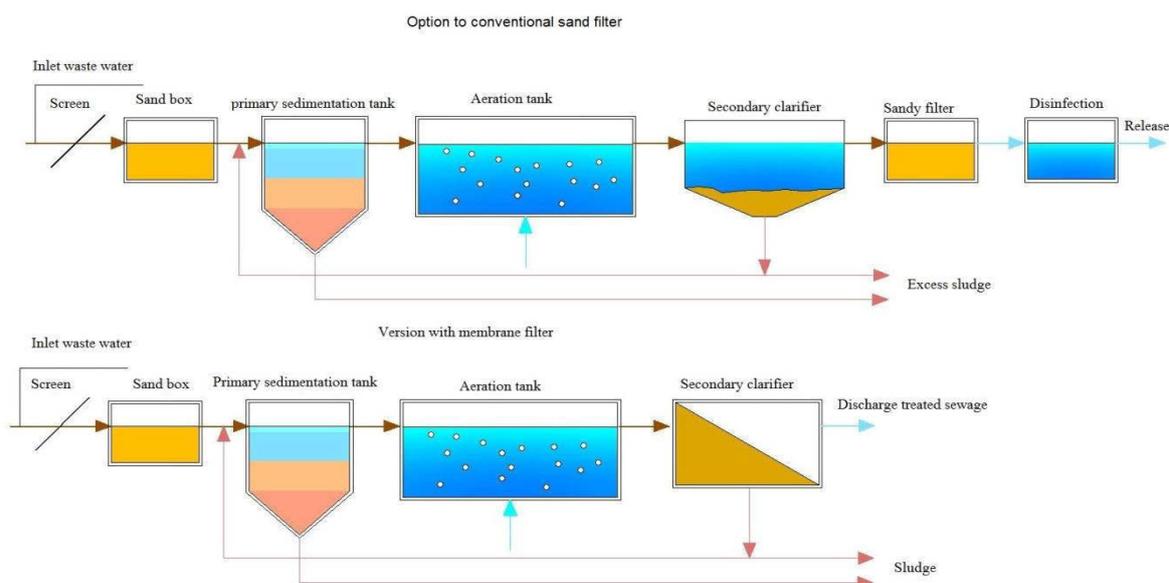
Integrated fixed-film polyethylene media

The benefit of using integrated fixed-film media over suspended mobile Is that the increase amount of attached biofilm per unit volume of reactor can further increase the activated sludge concentration, thus allowing a greater degree of treatment to be achieved in a smaller space, and further reduce sludge production rates. One of the benefits of the IFAS biofilm over the biofilm generated under the MBBR process is that biomass is better able to cling to the plastic media and is thus more stable and consequently allows a higher level of biomass activity. As a result, the IFAS system technology is preferred over the MBBR technology. The diagram below provides a schematic of the IFAS system.



6. Membrane Bio-reactor System

Under the artificial biological technology systems, separating the effluent treated wastewater from activated sludge through the use of a secondary sedimentation tank has been the best method. In addition, to provide further effluent improvement a deep purifying filter has been used to improve the purification of the effluent, although these systems have frequently suffered bad effects from the build-up of bacteria and some fungus increase which adds to the concentration of the activated sludge, but results in blocking of the filter media, thus causing its performance to deteriorate. In order to resolve these problems without having to dramatically increase the area, systems which provide better control of these problems have been developed. One of the technologies which is becoming more widely used in the membrane bio filtration technology.



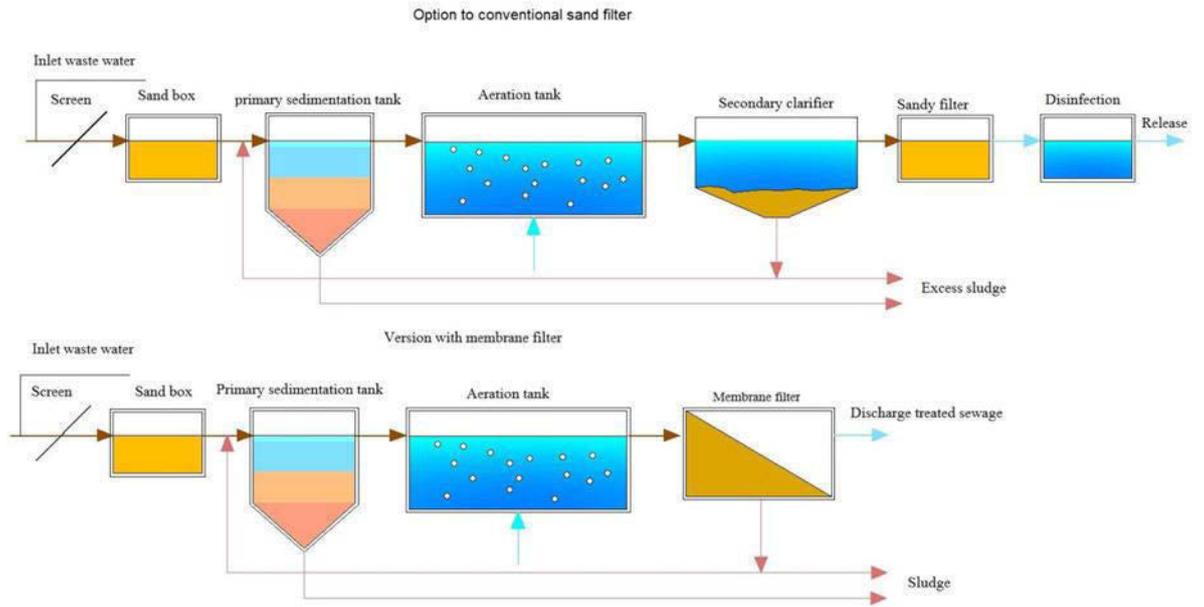
The Advantages and Disadvantages of the Membrane Bio-Reactor

The advantages can be summarised as:

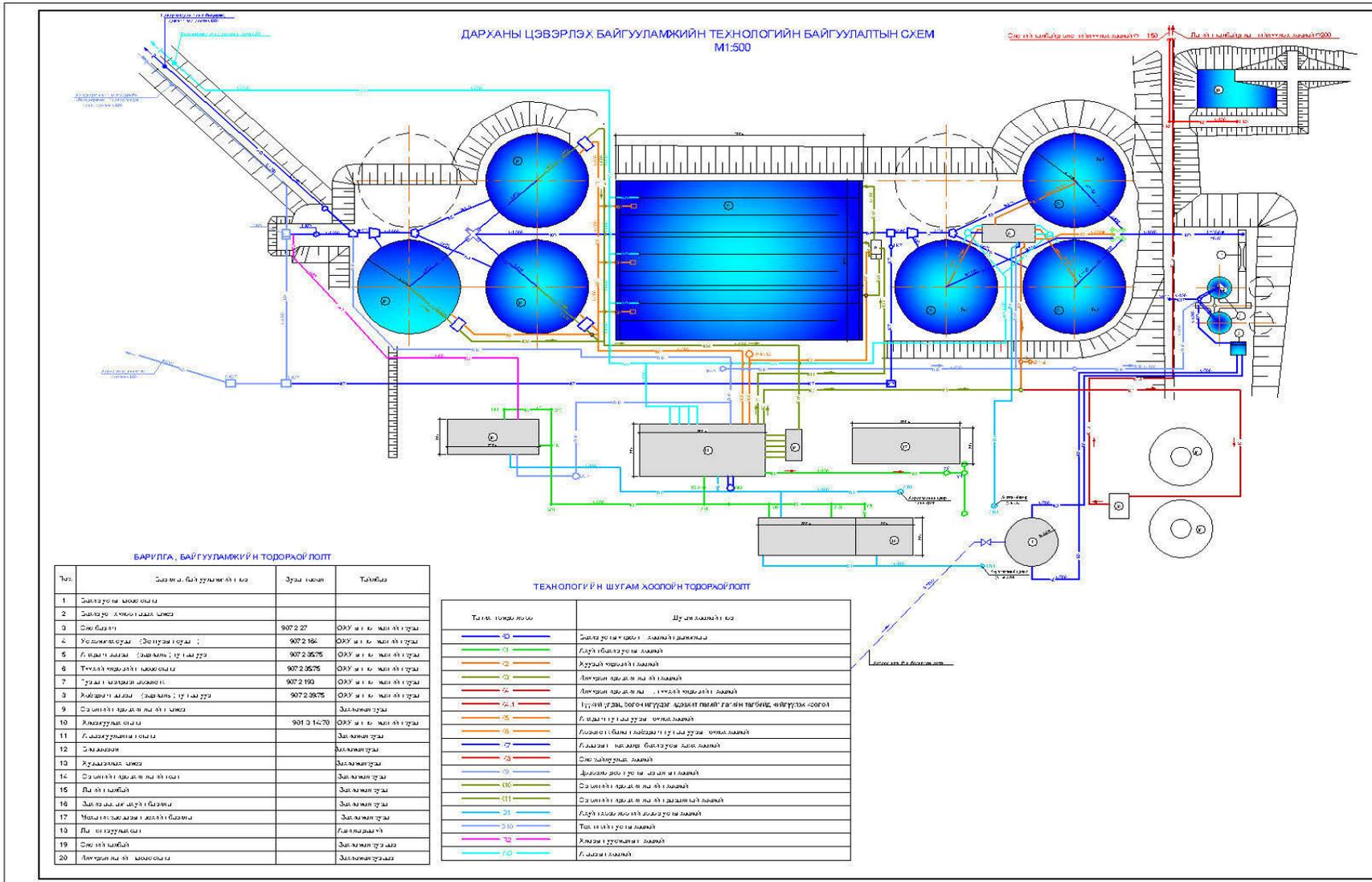
1. It provides a high level of treatment efficiency.
2. By increasing the sludge volume in the aeration tank, it allows greater treatment capacity.
3. It allows the treatment plant to have a small area footprint as there is no need for a secondary sedimentation tank and various tertiary filters.
4. It promotes the reduction of excess sludge.
5. It obviates the need for disinfection facilities for the treated effluent.

The disadvantages can be summarised as::

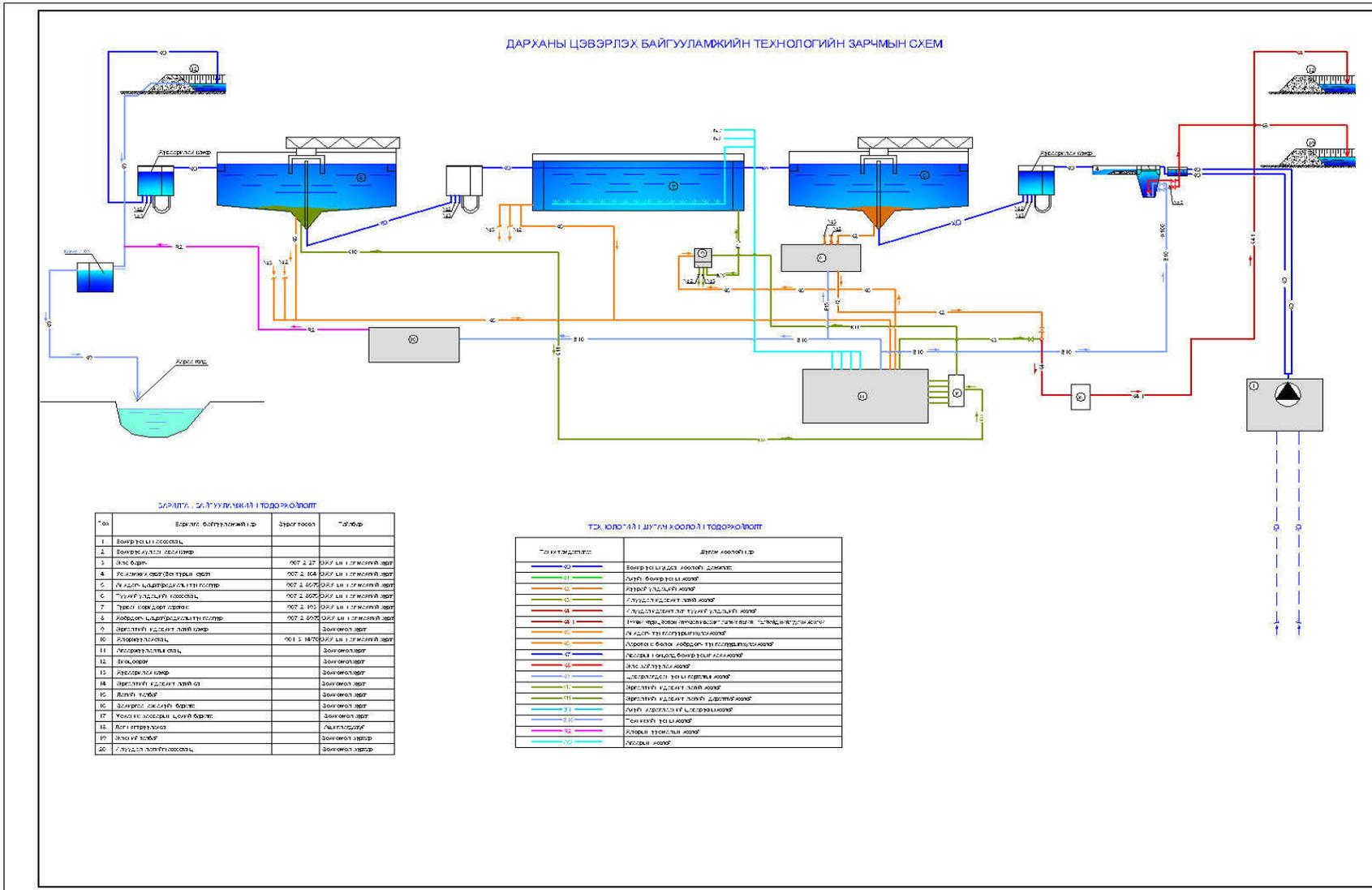
1. Based on experience of using membranes in Mongolia, when there is failure of systems – for instance due to power cuts - the micro filter gets polluted and requires constant cleaning – high maintenance.
2. The membrane cartridges need to be changed often, are imported, and are consequently very expensive.
3. To operate micro filters, vacuum pumps are required and these are considerably more expensive to operate than using secondary sedimentation tanks



5. Using the Existing WWTP for Modified ASP Biological Treatment in Darkhan



6. Darkhan WWTP treatment technology scheme using the Integrated Fixed-film Activated Sludge (IFAS) Process system



7. Rehabilitation of the Existing WWTP

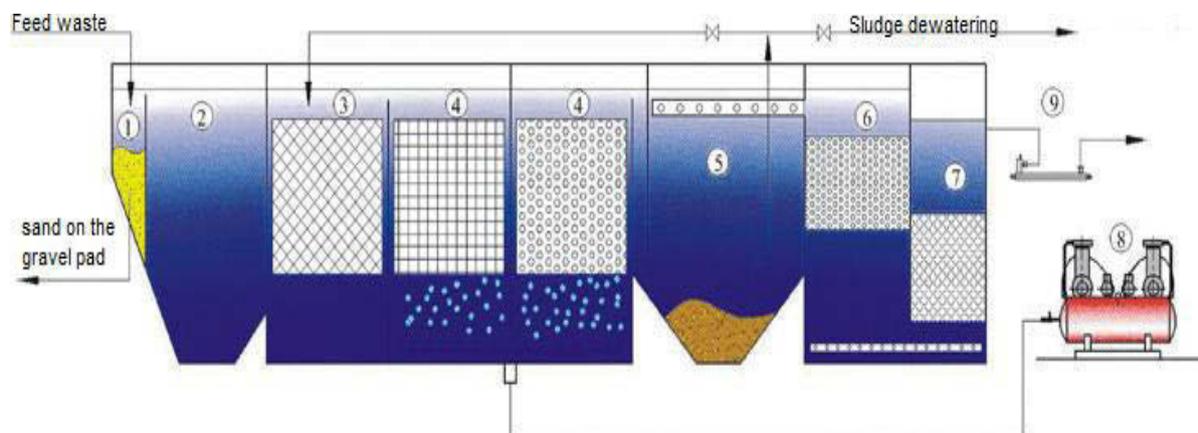
The existing WWTP technology is one of the first activated sludge system constructed in Mongolia and is a standard ASP as mentioned above. It was constructed adopting a Russian design and with a capacity of 50,000m³/day in 1989, but only came into operation in 1997. The existing WWTP receives raw sewage inflow of 6,000 to 13,000 m³/day. The existing WWTP consists of the following structures: (i) a central pumping station with a capacity of 2,400m³/hour; (ii) two circular and horizontal sand and grit channels; (iii) three radial primary clarifiers D=30.0 m, and 72.0x5.0x4.5(h)m; (iv) three aeration tanks; (v) three secondary radial sedimentation tanks D=30.0m; and (vi) nine biological oxidation ponds 80.0x50.0x1.5(h)m. There is also a Chlorine station (not used), a Blower station and several office buildings including laboratory. Raw primary sludge and final sludge removal is to poorly maintained sludge drying beds where it is dried naturally. Sludge does not appear to be re-used.

The facilities are outdated, the structure of the 1997 plant was poorly constructed from the beginning, although the elements (such as the pump station) constructed earlier in 1965 are generally of good construction quality. Of the 1997 units most are eroded and deteriorated. Moreover, its operational cost is high. Consequently, the rehabilitation and expansion of the existing WWTP or the development of a new WWTP is urgently needed.

8. Proposed IFAS System, (a Module Organised Activated Sludge System)

In the late 1980s, Culikov, a Russian scientist and academician, developed a synthetic artificial algae installation in bio reactors. Moreover, the scientist developed the current step-feed bio-reactor method.

Layout of the IFAS treatment technology:



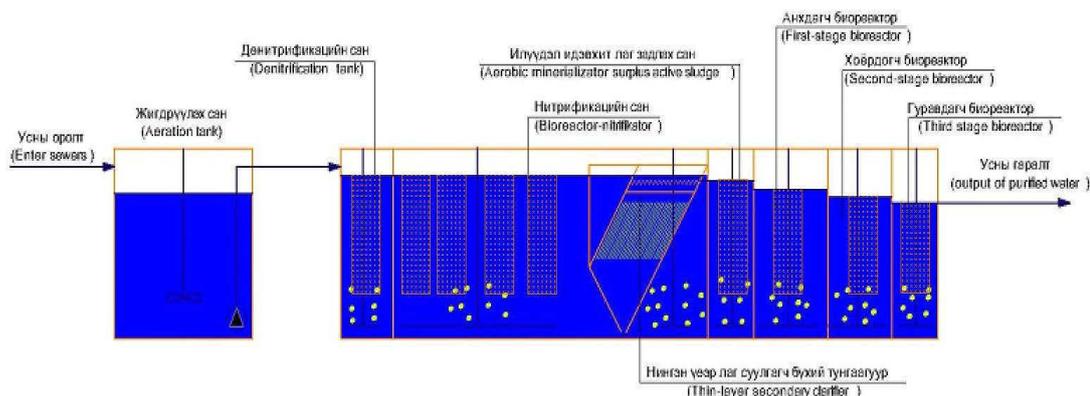
1. Vertical sand and grit removal channel
2. Equalization tank
3. Denitrification tank
4. Nitrification tank
5. Sludge settlement (thin layer module) secondary settlement
6. Primary bio reactor
7. Full treatment bio reactor
8. Aeration equipment
9. Disinfection through ultra-violet lamp

Principles of the operation of the IFAS technology

From the equalization tank, wastewater is pumped and discharged into the full biological treatment tank. The structure of the full biological treatment tank as follows:

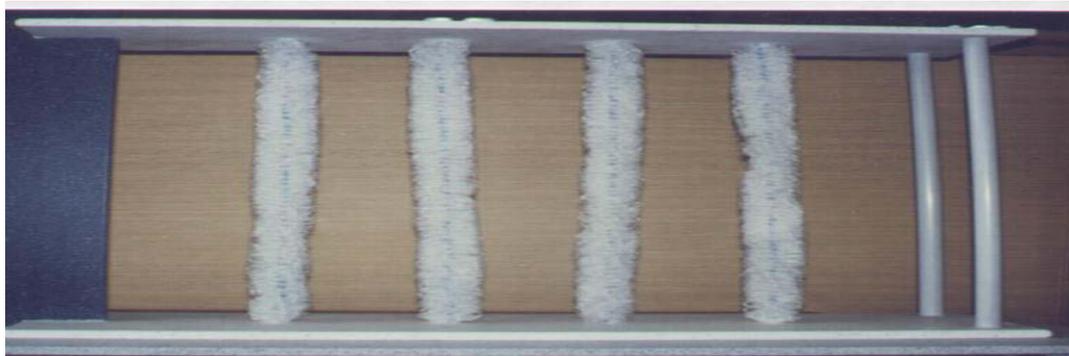
- Denitrification tank
- Nitrification tank

- Thin-layer sedimentation tank
- Full purification bioreactor
- Fine filter



The key feature of this system is to build the wastewater treatment aquatic food chain from the specific bacterial micro-organisms which operate most effectively under different sets of conditions which best suit predatory-feeders, active filter-feeders and bottom-feeders. The objective is to create a value chain or bio-conveyor of a sewage treatment to provide the various types of micro-organisms required to effect full treatment, optimal or near-optimal conditions for their existence and reproduction. This can significantly reduce the amount of work and time required for treatment, and can in turn reduce the amount of sludge that must be processed.

Artificial algae exterior view



The first sludge system works with a high load, mostly of bacterial activated sludge. The sedimentation of this type of activated sludge is not always high. Therefore, it is more efficient to settle the activated sludge onto stable artificial algae and fungus. By this process, there is no need to include a sedimentation stage after the primary sludge system.

The specific speed of oxidation of sludge in the first sludge system is about 40mg BOD (1g of raw sludge substance) per litre hour, and wastewater at the outlet of the system has a concentration of organic contaminants on the BOD level of about 40-60 mg/l. Under the three-sludge system, the concentration of organic matter in the wastewater after the first stage of the cleaning system should be adequate for effective denitrification in the next stage of purification.

The second sludge system reduces the concentration of organic substances in wastewater by BPK20 of 15 mg/l, and removes nitrogen by primary denitrification. The primary denitrification tank uses organic substances in the wastewater, so air consumption at this stage in the treatment process is reduced. The second sludge system uses a set of heterotrophic bacterial microorganisms and also copiotrophic bacterial microorganisms which mineralize the activated sludge to some extent. The process operates at low loads of active sludge and is accompanied by nitrification. It demonstrates the sludges functioning in different ways at each stage of the treatment process – which is the fundamental characteristic of the IFAS system. Therefore, it is necessary to

construct two separate reactor sections of second sludge system to operate on the same activated sludge complex for both denitrification and nitrification. Anoxic conditions are necessary for denitrification, so when mixing sludge with air, the concentration of dissolved oxygen should not be greater than 2 mg/l. However, at nitrification, the concentration of dissolved oxygen should not be greater than 4 mg/l. To achieve this balance, aeration is provided by air-ball diffusers, located on the bottom of the reactors.

The third sludge system is used when BOD is already low and full treatment can be achieved. The microorganism fermentation in the third sludge stage removes the remaining dissolved organic substances and it provides nitrification and mineralization with fermentation. At this time, residual content of SS of about 3 mg/l, and full BOD of about 2 mg/l can be achieved. In addition, ammonium nitrogen is at about 0.4 mg/l. Phosphate concentration can be reduced with activated sludge floatation.

The Advantages and Disadvantages of the IFAS System

Advantages of the IFAS System:

1. It reduces the volume of sludge.
2. It improves the final purification results.
3. It allows the use of automated control systems.
4. It allows not only decreasing the number of independent construction units into one block, but also reduces the overall system volume, reduces the complexity of operation functions, reduces the overall operational costs, but also allowed a modular organization which facilitates adaption of the step feed process.
5. The operation is flexible, so it can accommodate variations in flow rates and concentration.

Disadvantages of the IFAS System:

1. All technology functions are accommodated in separate tanks, so in comparison with the sequencing batch reactor system, it occupies a larger footprint, as reactors are in sequence and construction extends along the direction of flow.
2. Aeration cannot be managed with time, as is the case with the SDR system. Consequently electricity costs are higher than with the SBR system.

Conclusion

The team considers that a consolidated version of the technology of biological treatment systems presented above which is most suitable for Mongolian climate and condition should be adopted. In view of these factors and the requirement for low nutrient in the effluent from the Darkhan facility, the following elements require inclusion:

1. A bio-reactor system which supports both denitrification and nitrification
2. Use of the submerged fixed-film media module
3. In view of the Kharaa river's ecological sensitivity, consider the option of using the existing maturation ponds for fish farming.
4. The wastewater treatment plant should provide for future modular expansion.
5. Reduce the number of reactor tanks (equalization tank, denitrification tank, nitrification tank, settlement tank, bioreactors, deep cleaning facilities and disinfection tank) and the extent of the underground pipe network by combining these functions into a single block so that the entire facility is as compact as possible.

These requirements are best satisfied by adoption of the IFAS process – also known in Mongolia as the Three Sludge System).

It is also proposed that as a fixed biofilm media “artificial algae” should be chosen. This synthetic media for bioreactors was developed in the late 1980s by Culikov, a Russian scientist and academician⁷. The artificial algae is considered to be more flexible than other submerged fixed-films and it has advantages in the attachment of activated sludge. It has been used in the treatment system for Shargaljuut

⁷ He also developed the step-feed activated sludge process

sanatoria, in Mongolia and has also used in a small scale wastewater treatment plant funded by Dutch aid investment.

Summary

Based on the analysis of the technical options above, it is concluded that the following options provide the best solution for the Darkhan WWTP.

1. The existing wastewater treatment plant is treating wastewater of between 6,000 and 13,000m³/day at present. If the industries currently planned for Darkhan are built, the population will grow and wastewater flows will increase. The wastewater treatment plant needs to have the capacity to expand to accommodate this potential growth.
2. The causes of problems with operation in Mongolian conditions include electricity outage, the low ambient temperature, and irregular wastewater flows. Therefore, the system selected should be able to deal with these issues.
3. In order to have stable allowed value of nitrogen and phosphorous in the effluent treated water which is suitable for discharge to the Kharaa River, and so as not to increase the blower's capacity, denitrification and nitrification phases must be planned in the system.
4. During winter months, engineering networks and inspection chambers freeze and this generates a high maintenance cost. Systems which minimise the amount of external pipework and appurtenances need to be introduced.

After this review of all the possible technical options, the treatment technologies which are suitable for the circumstances in Darkhan are as follows:

1. Replace existing activated sludge system by rehabilitating the existing construction to function as a IFAS system
2. Development of a new, modified step-feed activated sludge system (similar to that developed by GITEC Consult GmbH Duesseldorf for Nisekh)
3. Development of a new SBR (similar to that developed as a pilot by the MoMo project)
4. Development of a new three-sludge-system (as developed by Culikov. N.I)

APPENDIX L: STRUCTURAL SURVEY AND REHABILITATION REQUIREMENTS FOR EXISTING CWWTP

AUDIT ASSESSMENT OF STATE PROFESSIONAL INSPECTION AGENCY

01 April 2014

No 06/101/208

Ulaanbaatar city

TO: Housing and Public Utilities Policy Implementation and Coordination Office, MCUD

FROM: State Professional Inspection Agency

SUBJECT: Status of Central Wastewater Treatment Plant Utilization

State Professional Inspection Agency has conducted an audit to seek assessment for the existing wastewater treatment plant operation, equipment and facilities including aeration tanks and reinforcing steel and concrete quality according to the request No 8/760 on 14 March 2014 from Housing and Public Utilities Policy Implementation and Coordination Office, MCUD.

The audit team visited the site accompanied with Enkhtuya.P, Project engineer and Enkhjargal.S, Technology engineer and some other delegates on 20 March 2014.

The existing WWTP started operation in 1987 with a design capacity of 50,000 cubic meters/day. WWTP has 6 sedimentation tanks and there are aeration tanks between the sedimentation tanks. The contractor that constructed the facilities used prefabricated concretes for the external walls in sedimentation tanks and aeration tanks.

Current wastewater inflow is low, /treatment is approximately 6,000-10,000 cubic meters per day/ and operation is inefficient and below capacity, so some equipment is not used currently.

We noted several areas requiring attention. These are summarized below:

1. Some reinforcing steel, valves, rebar, rakes, columns and metal structures in the existing sedimentation tanks and aeration tanks are rusted and destroyed and they don't meet operation requirements.
2. Many of the sidewalls of the internal concrete walls in the sedimentation tanks and aeration tanks are destroyed and leaks from the walls. There are many rebar layers have come out. All of these don't meet the standards of Construction codes of Mongolia 22-01-01*/2006, CCM52-01-10, CCM52-03-05 and MNS3996-2004, MNS228-2004, MNS0831-2006, MNS5771-2006.
3. Many of the external concrete walls made of prefabricated concrete in the sedimentation tanks and aeration tanks are destroyed and several protection columns have fallen and there are many rebar layers have come out. They don't meet the standards of Construction codes of Mongolia 22-01-01*/2006, CCM52-01-10, CCM52-03-05.

Based on the findings, we have summarized the following:

1. Top layer of corridor isolating internal walls made of prefabricated concretes in sedimentation tanks and aeration tanks are destroyed and dilapidated, there are some rebar layers have come out, metals have rust and have some holes and have lost carrying capacity. All of these cause abnormal operation in the further.
2. It is possible to use the external concrete walls made of prefabricated and reinforced concrete in the sedimentation tanks and aeration tanks in the future if there is rehabilitation and replacement.

A copy was sent to the client./Darkhan-Uu suvag company/
STAMPED

Conclusion done by /Sanjmyatav.D/ Senior inspector of construction technical monitoring

Conclusion done by /Tsevelravjaa.S/ Inspector of construction technical monitoring

Findings on WWTP Structure Rehabilitation Requirements by Sika Company



DARKHAN WASTE WATER TREATMENT PLANT
SIKA MONGOLIA LLC

PAUL HOWARTH
SIKA MONGOLIA LLC

BUILDING TRUST 

CONCRETE REPAIR WORKS – PUMP HOUSE



CONCRETE REPAIR WORKS – PUMP HOUSE

- Interior Ceiling
 - Remove any loose material from the interior roof along with the paint
 - Wire brush any loose material from the exposed reinforcing steel
 - Dampen the prepared area and apply MonoTop 610MY as the bonding material with a trowel to a thickness of 1mm
 - While the MonoTop 610MY is still wet apply MonoTop 612 to a thickness of 5mm
 - As soon as the MonoTop 612 has started to set it can be smoothed with a wooden or synthetic trowel
 - **NOTE**, where steel primer is required use Sika MonoTop 610MY and if no steel use Sika Bonding Slurry
- Estimated costs
 - Materials
 - MonoTop 610MY @ 1mm = 8,500 MNT/m²
 - MonoTop 612 @ 5mm = 19,000 MNT/m²
 - Sika Bonding Slurry @1mm = 8,000 MNT/m²
 - Labor – 16,000 MNT/m²

3



CONCRETE REPAIR WORKS – PUMP HOUSE

- Exterior Wall
 - Remove any loose material and paint from the wall in the areas to be patched
 - Square cut the area to be patched and remove the concrete to a uniform depth behind the reinforcing steel
 - Dampen the area and apply MonoTop 610MY as the bonding material with a trowel
 - While the MonoTop 610MY is still wet apply MonoTop 612 with a trowel to fill in the area to be patched. If the patch depth is more than 30mm then the MonoTop 612 needs to be applied in several layers
 - As soon as the MonoTop 612 has started to set it can be smoothed with a wooden or synthetic trowel
- Estimated costs
 - Materials
 - MonoTop 610MY @ 1mm = 8,500 MNT/m²
 - MonoTop 612 = 3,185,000 MNT/m³
 - Labor
 - 324,000 MNT/m³

4



CONCRETE REPAIR WORKS – SAND & GRIT FLUME



5



CONCRETE REPAIR WORKS – SAND & GRIT FLUME

- Completely remove the concrete from the center wall and along the outer wall where required
- Ensure a vertical face is present at the interface between the old and new concrete
- Refurbish the reinforcement as needed
- Install shuttering as required and use Self Consolidating Concrete (SCC) – Sika ViscoCrete 5520

- Estimated costs
 - Materials
 - SCC Concrete = 210,000 MNT/m³
 - Labor
 - 500,000 MNT/m³

6



CONCRETE REPAIR WORKS – CLARIFIER



7



CONCRETE REPAIR WORKS – CLARIFIER

- Interior Repairs
 - Remove the concrete from the interior wall to behind the existing reinforcing
 - Square the existing concrete around the perimeter of the area to be patched
 - Refurbish the reinforcement as needed
 - Install shuttering as required and use Self Consolidating Concrete (SCC) – Sika ViscoCrete 5520
- Estimated costs
 - Materials
 - SCC Concrete = 210,000 MNT/m³
 - Labor
 - 500,000 MNT/m³

8



CONCRETE REPAIR WORKS – CLARIFIER

- Exterior Repairs
 - Scabble the exterior wall in the areas where the reinforcing steel is exposed
 - Wire brush any loose material from the exposed reinforcing steel
 - Dampen the prepared area and apply MonoTop 610MY as the bonding material with a trowel to a thickness of 1mm
 - While the MonoTop 610 is still wet apply MonoTop 612 to a thickness of 5mm
 - As soon as the MonoTop 612 has started to set it can be smoothed with a wooden or synthetic trowel
 - **NOTE**, where steel primer is required use Sika MonoTop 610MY and if no steel use Sika Bonding Slurry

- Estimated costs
 - Materials
 - MonoTop 610MY @ 1mm = 8,500 MNT/m²
 - MonoTop 612@ 5mm = 19,000 MNT/m²
 - Sika Bonding Slurry @1mm = 8,000 MNT/m²
 - Labor – 16,000 MNT/m²

9



CONCRETE REPAIR WORKS – AERATION UNIT



10



CONCRETE REPAIR WORKS – AERATION UNIT

- Repairs
 - Remove the concrete from the interior wall to behind the existing reinforcing
 - Square the existing concrete around the perimeter of the area to be patched
 - Refurbish the reinforcement as needed
 - Install shuttering as required and use Self Consolidating Concrete (SCC) – Sika ViscoCrete 5520
- Estimated costs
 - Materials
 - SCC Concrete = 210,000 MNT/m³
 - Labor
 - 500,000 MNT/m³

11



CONCRETE REPAIR WORKS – SETTLING UNIT



12



CONCRETE REPAIR WORKS – SETTLING UNIT

- Interior Repairs
 - Remove the concrete from the interior wall to behind the existing reinforcing
 - Square the existing concrete around the perimeter of the area to be patched
 - Refurbish the reinforcement as needed
 - Install shuttering as required and use Self Consolidating Concrete (SCC) – Sika ViscoCrete 5520
- Estimated costs
 - Materials
 - SCC Concrete = 210,000 MNT/m³
 - Labor
 - 500,000 MNT/m³

13



CONCRETE REPAIR WORKS – SETTLING UNIT

- Sika Materials Required:
 - Sika ViscoCrete 5520 SCC Concrete = 210,000 MNT/m³
 - SikaMonoTop 610MY = 149,550 MNT / 25kg Bag
 - SikaMonoTop 612 = 41,460 MNT / 25kg Bag
 - Sika Bonding Slurry = 6,400 MNT / kg
 - Sikaflex 11FC = 13,640 MNT / 300ml cartridge

14



APPENDIX M: DETAILS OF PUMP STATION REHABILITATION REQUIREMENTS

This Appendix provides a detailed description and costing for the additional works required to ensure that the wastewater from the three catchment areas of Darkhan (Old Darkhan, New Darkhan and the South Industrial Estate) reach the treatment plant. It describes the priority works, including the provision of a united automated control system to assist in management of wastewater for the whole city system. The other major works are:

- (i) rehabilitation of central pumping station delivering domestic and industrial waste water into the treatment plant (this is at the treatment plant and is thus included as an integral part of the treatment plant works);
- (ii) rehabilitation of the intermediate (or secondary) pumping station No 2 in Old Darkhan (which conveys all wastewater from Old and New Darkhan to the Central Pumping Station);
- (iii) full rehabilitation of the new South Pumping station (the primary pumping station and not operational since it was built in 1989)
- (iv) provision of 1,400 m of gravity flow pipeline sat of 800mm and 1000 mm diameter at new south pumping station;
- (v) 100 m of collectors of 600 mm diameter at new south pumping station;
- (vi) About 300 m of tertiary sewers of 350 mm diameter at bagh-5, in old Darkhan (near to hospital No 2); and
- (vii) Power distribution networks at secondary pumping stations, (Shown in Scheme 1)

1. Central Wastewater Pumping Station

1. The central pumping station was constructed using Russian technology in 1965. The design capacity was 2,400m³/per hour. Since the pumps were replaced by further Russian equipment in 1989, there has not been any further investment.
2. The basic structure of the pump house is sound, so the project will carry out the following:
 - Full rehabilitation of the existing building – adding surface treatments
 - Full replacement of pumping facilities (duty and standby units)
 - Replacement of ventilation system (including both inlet and outlet piping)
 - Replacement of power supply system
 - Provision of automated remote control facilities to connect with the overall remote control system panel
3. Replacement of facilities is shown in table M.1 below

2. Intermediate (Secondary) Wastewater Pumping Station No 2 in Old Darkhan

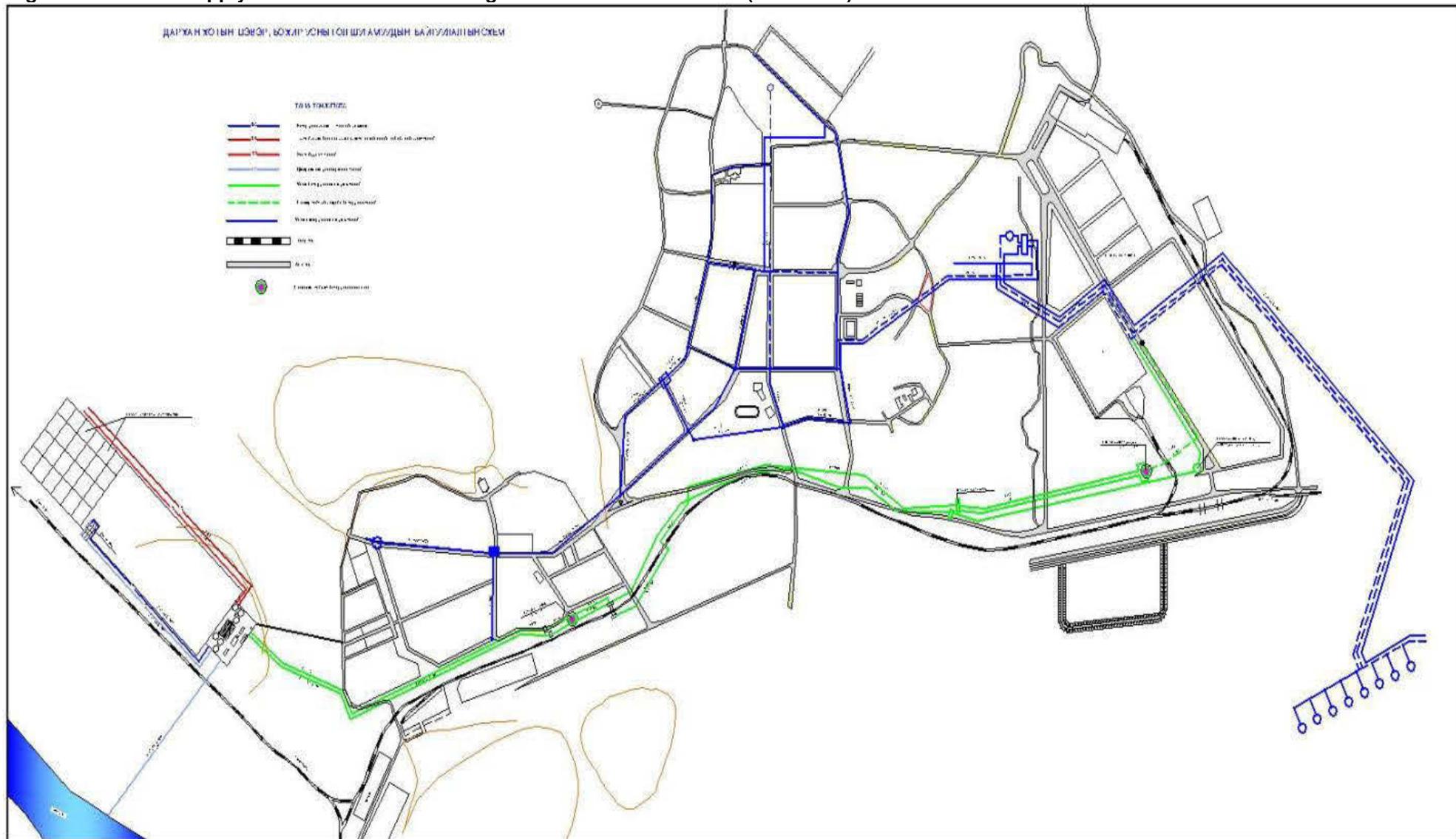
1. As with the Central Pumping station, the secondary pumping station was constructed using Russian technology in 1965, also with a design capacity of 2,400m³/per hour. The pumps were replaced by further Russian units in 1992, since which time there hasn't been any further investment or renovation.
2. The basic structure of the pump house is sound, so the project will carry out the following:
 - Full rehabilitation of the existing building – adding surface treatments
 - Full replacement of pumping facilities (duty and standby units)
 - Replacement of ventilation system (including both inlet and outlet piping)
 - Replacement of power supply system
 - Provision of automated remote control facilities to connect with the overall remote control system panel
3. Replacement of facilities is shown in table M.2 below

3. South Industrial Estate (Primary) Wastewater Pumping Station

1. Based on the Government's policy to establish an industrial park in the southern part of Darkhan in the late 1980s, the new south pumping station was constructed using Russian technology and equipment in 1989. Although the pump station was fully equipped for operation, it has never been used – presumably because the flowrate never exceeded the capacity of the smaller pre-existing pump station, which is now operating at full capacity. The design flow was again 2,400m³/per hour, but since other new industries weren't built, so the pumping station has laid idle and parts have been cannibalised to keep other facilities going. The equipment is now removed or destroyed.

2. In addition a section of 1,400m of gravity flow pipeline is not installed at the pumping station. This needs to be installed to enable the pump station to operate. There is a need to rehabilitate the pumping station since the existing station is (i) running at its full capacity; and (ii) old and dilapidated. Operation of any further industries in the industrial park which generate wastewater will cause the existing pump station to overload.
3. The basic structure of the pump house is sound, so the project will support the following activities:
 - Full rehabilitation of the existing building – adding surface treatments
 - Full replacement of pumping facilities (duty and standby units)
 - Replacement of ventilation system (including both inlet and outlet piping)
 - Replacement of power supply system
 - Provision of automated remote control facilities to connect with the overall remote control system panel
4. Replacement of facilities is shown in table M.3 below

Figure M.1: Water supply and wastewater network general scheme in Darkhan (Scheme-1)



Cost Tables: All specification “or equivalent”**Table M.1: Central Pump Station**

| № | Existing facilities | | | | | | Example of facilities to be used | | | |
|---|---|-----------------------|----------|---|--------------|---|--|---|----------|--------------|
| | Names of facilities, series | Date of Commissioning | Quantity | Technical data | Manufacturer | Current situation | Names of facilities, series | Technical data | Quantity | Manufacturer |
| 1 | Screen MF-1000/1600 | 1968 | 2 | Q=1000m ³ /h; N=...kw/h | Russia | Operational-1 Not operational -1 Requires replacement | Rotating screening drums Channel Monster Model CDD2410-XD2.0 | Q=852m ³ /h N=7kw Weight:665kg | 2 | England |
| 2 | Sewage pump horizontal centrifugal CД800/32 | 1989 | 5 | Q=800m ³ /h; H= 32m; N=132 kw/h | Russia | Operational-3 Not operational -2 Requires replacement | Salvatore Robuschi RD125-25 | Q=500m ³ /h N=100kw Weight:177kg | 2 | Italy |
| 3 | Manual lifting | | | | | No more | Manual lifting | P=1ton | 2 | China |
| 4 | Exhaust ventilation | | | | | | RP60-35/31-4D | Q=1750 m ³ /h N=3.43kw | 1 | Czech |
| 5 | Air intake ventilation system | | | | | | RP70-40/35-4P | Q= 2855 m ³ /h N=2.56kw | 1 | Czech |

Table M.2: Secondary Pump station

| № | Existing facilities | | | | | | Example of facilities to be used | | | |
|---|---|-----------------------|----------|--|--------------|---|--|---|----------|--------------|
| | Names of facilities, series | Date of Commissioning | Quantity | Technical data | Manufacturer | Current situation | Names of facilities | Technical data | Quantity | Manufacturer |
| 1 | Screen MF-1000/1600 | 1968 | 2 | Q=1000m ³ /h; N=...kw/h | Russia | Operational-1 Not operational -1 Requires replacement | Rotating screening drums Channel Monster Model CDD2410-XD2.0 | Q=852m ³ /h N=7kw Weight :665kg | 2 | England |
| 2 | Sewage pump horizontal centrifugal CД800/32 | 1989 | 5 | Q=800m ³ /h; H=32m; N=132 kw/h | Russia | Operational-2 Not operational -3 | Salvatore Robuschi RD125-25 | Q=500m ³ /h N=100kw Weight:177kg | 2 | Italy |

| № | Existing facilities | | | | | | Example of facilities to be used | | | |
|---|-------------------------------|-----------------------|----------|----------------|--------------|----------------------|----------------------------------|--------------------------------------|----------|--------------|
| | Names of facilities, series | Date of Commissioning | Quantity | Technical data | Manufacturer | Current situation | Names of facilities | Technical data | Quantity | Manufacturer |
| | | | | | | Requires replacement | | | | |
| 3 | Manual lifting | | | | | No more | Manual lifting | P=1ton | 2 | China |
| 4 | Exhaust ventilation | | | | | | RP60-35/31-4D | Q=1750 m ³ /h N=3.43kw | 1 | Czech |
| 5 | Air intake ventilation system | | | | | | RP70-40/35-4P | Q=2855 m ³ /h N=2.56kw | 1 | Czech |

Table M.3: South Industrial Estate Primary Pump station

| | Existing facilities | | | | | | Example of facilities to be used | | | |
|---|---|-----------------------|----------|--|--------------|---|--|---|----------|--------------|
| | Names of facilities, series | Date of Commissioning | Quantity | Technical data | Manufacturer | Current situation | Names of facilities | Technical data | Quantity | Manufacturer |
| 1 | Screen MF-1000/1600 | | 2 | Q=1000m ³ /h; N=...kw/h | Russia | It hasn't been operational and has been deteriorated since it was constructed and the technology is outdated, so it requires replacement. | Rotating screening drums Channel Monster Model CDD2410-XD2.0 | Q=852m ³ /h N=7kw Weight:665kg | 2 | England |
| 2 | Sewage pump horizontal centrifugal CД800/32 | | 5 | Q=800m ³ /h; H=32m; N=132 kw/h | Russia | The same condition as the above | Rotating screening drums Channel Monster Model CDD2410-XD2.0 | Q=852m ³ /h N=7kw Weight:665kg | 2 | England |
| 3 | Manual lifting | | | | | The same condition as the above | Salvatore Robuschi RD125-25 | Q=500m ³ /h N=100kw Weight:177kg | 2 | Italy |

| | Existing facilities | | | | | | Example of facilities to be used | | | |
|---|-------------------------------|-----------------------|----------|----------------|--------------|---------------------------------|----------------------------------|--------------------------------------|----------|--------------|
| | Names of facilities, series | Date of Commissioning | Quantity | Technical data | Manufacturer | Current situation | Names of facilities | Technical data | Quantity | Manufacturer |
| | Exhaust ventilation | | | | | | Manual lifting | P=1ton | 2 | China |
| 4 | Air intake ventilation system | | | | | The same condition as the above | | | 1 | Czech |
| 5 | Manual lifting | | | | | The same condition as the above | RP60-35/31-4D | Q=1750 m ³ /h N=3.43kw | | |

Explanation: Q=2,400m³/h “new” pumping station in the industrial area mentioned above will be rehabilitated, so the existing industrial area pump station (Q=300 m³/h) (constructed in 1965) will be decommissioned once the new facility comes on stream.

Table M.4: Work Items for Rehabilitation

| No | Work Items | Unit | Quantity |
|------------------------------------|--|----------------|----------|
| 1. Pumping stations | | | |
| 1.1 Technology | | | |
| 1 | Uninstall mechanical screen МГ-1000/1600 (weight: 3000 kg) | set | 2 |
| 2 | Uninstall mechanical crusher Д-3 (weight: 1480 kg) | set | 2 |
| 3 | Uninstall pump СД800/32 (weight: 2400 kg) | set | 3 |
| 4 | Install a mechanical screen CDD2410-XD2.0(weight: 665 kg(each costs 3500Euros) | set | 2 |
| 5 | Install a pump RD125-25 (weight:177kg) (each costs 5000Euros) | set | 3 |
| 6 | Install a 1Ton payload crane assembly | set | 1 |
| 7 | Install 5Ton payload crane assembly | set | 1 |
| 8 | Uninstall cast-iron valves 300m x 1 m dia. | No | 3 |
| 9 | Install cast-iron valves 300m x 1 m dia. | No | 3 |
| 10 | Install 200x300 steel switch assembly | No | 3 |
| 11 | Uninstall Φ300 lower flange | No | 3 |
| 12 | Install Φ300 lower flange | No | 3 |
| 13 | Uninstall Φ300 non-return valves | No | 3 |
| 14 | Install Φ300 үл non-return valves | No | 3 |
| 15 | Uninstall 200x500 lower steel switch | No | 3 |
| 16 | Install 200x500 lower steel switch | No | 3 |
| 17 | Install cast iron valves 200m x 1 m dia. | No | 3 |
| 18 | Install steel pipes 200m x 1 m dia.; Install e=200mm | No | 3 |
| 1.2 Ventilation System | | | |
| 19 | Install aeration extractor fansRP60-35/31-4D | set | 1 |
| 20 | Install aeration fansRP70-40/35-4P | set | 1 |
| 21 | Install automate valvesLKSX60-35/24 | No | 1 |
| 22 | Install filters VFK60-35 | No | 1 |
| 23 | Install electric heaters EO SX60-35/30 | No | 1 |
| 24 | Soft contact DV60-35 | No | 4 |
| 25 | Air inlet valves PZ60-35 | No | 1 |
| 26 | Air outlet valves PK60-35 | No | 1 |
| 27 | Automate control panel ORE5 | No | 1 |
| 28 | Speed set upTRN 7D | No | 2 |
| 21 | Uninstall aeration pipes 400x400mm | ym | 22.0 |
| 22 | Uninstall aeration pipes 400x550mm | ym | 23.5 |
| 23 | Uninstall aeration pipes 550x550mm | ym | 16.6 |
| 24 | Uninstall aeration pipes 880x500mm | ym | 6.5 |
| 23 | Install aeration pipes 225x225mm | ym | 40.0 |
| 24 | Install aeration pipes 600x350mm | ym | 6.5 |
| 25 | Diversion 600x350 – 225x225 | No | 2 |
| 26 | Taps 225x225- 225x225 | No | 5 |
| 1.3 Construction repairs | | | |
| 27 | Abolish wall plastering at pump station | m ² | 576 |
| 28 | Wall plastering | m ² | 576 |
| 29 | Abolish wall tiling | m ² | 109 |
| 30 | Wall tiling | m ² | 218 |
| 31 | Floor tiling | m ² | 200 |
| 32 | Wall plastering at pumping station | m ² | 576 |
| 33 | Roof repairs at pumping station | m ² | 200 |
| 34 | Replace doors | No | 3 |
| 35 | Replace windows | No | 6 |
| 36 | Replace deflector 600 m x 1 m dia. | No | 5 |
| 1.4 Interior heating system | | | |
| 37 | “KeRmi”radiator FKV220512 (price:177000₸) | set | 12 |
| 38 | Install steel sewage pipes 20 m x 1 m dia. | ym | 22.5 |

| No | Work Items | Unit | Quantity |
|---|---|----------------|------------------|
| 39 | Install steel sewage pipes 15 m x 1 m dia. | ум | 45 |
| 40 | Install steel sewage pipes 25 m x 1 m dia. | ум | 14 |
| 41 | Installation equipment of steel pipes 25 m x 1 m dia. (муфт, контр гайк, изгон) | set | 10 |
| 42 | Installation equipment of steel pipes 20 m x 1 m dia. (муфт, контр гайк, изгон) | set | 30 |
| 43 | Installation equipment of steel pipes 15 m x 1 m dia. (муфт, контр гайк, изгон) | set | 60 |
| 44 | Ventilator 25 m x 1 m dia. | No | 7 |
| 45 | Ventilator 15 m x 1 m dia. | No | 10 |
| 46 | Ventilator 15 m x 1 m dia. | No | 12 |
| 47 | Ялтсан boiler Q=100kw (18.5mil.tug) | set | 1 |
| 1.5 Interior wastewater | | | |
| 37 | “KeRmi” radiator FKV220512 (price:177000₮) | set | 12 |
| 38 | Install steel sewage pipes 20 m x 1 m dia. | ум | 22.5 |
| 39 | Install steel sewage pipes 15 m x 1 m dia. | ум | 45 |
| 40 | Install steel sewage pipes 25 m x 1 m dia. | ум | 14 |
| 41 | Installation equipment of steel pipes 25 m x 1 m dia. (муфт, контр гайк, изгон) | set | 10 |
| 42 | Installation equipment of steel pipes 20 m x 1 m dia. (муфт, контр гайк, изгон) | set | 30 |
| 43 | Installation equipment of steel pipes 15 m x 1 m dia. (муфт, контр гайк, изгон) | set | 60 |
| 44 | Ventilator 25 m x 1 m dia. | No | 7 |
| 45 | Ventilator 15 m x 1 m dia. | No | 10 |
| 46 | Ventilator 15 m x 1 m dia. | No | 12 |
| 47 | Ялтсан boiler Q=100kw (18.5mil.tug) | set | 1 |
| 1.6 Electricity work | | | |
| 57 | Lights | | 100.6 mil.tug |
| 58 | Heavy machine | | |
| 59 | Exterior lights | | |
| 60 | Automate controls | | |
| Tertiary sewers at new south pumping station – 800m x 1 m dia. | | | |
| 1 | Excavation in 1 st class soil | m ³ | 22400 |
| 2 | Manual excavation | m ³ | 550 |
| 3 | Install concrete sewage pipes 800m x 1 m dia. | m | 1400 |
| 4 | Concrete inspection chamber 2000m x 1 m dia. (height~2m) | set | 10 |
| 5 | Back filling | m ³ | 22400 |
| 6 | Site preparation | m ² | 8400 |
| Tertiary sewers at old Darkhan hospital | | | |
| 1 | Excavation in 1 st class soil | m ³ | 1500 |
| 2 | Manual excavation | m ³ | 50 |
| 3 | Install plastic sewage pipes 600m x 1 m dia. | Ум | 250 |
| 4 | Inspection chamber 2000m x 1 m dia. (height~1.5m) | set | 3 |
| 5 | Back filling | m ³ | 1500 |
| 6 | Manual back filling | m ² | 1250 |
| Inlet pipes at secondary pumping station | | | |
| 1 | Excavation in 1 st class soil | m ³ | 400 |
| 2 | Manual excavation | m ³ | 10 |
| 3 | Install concrete sewage pipes 800m x 1 m dia. | Ум | 50 |
| 4 | Back filling | m ³ | 400 |
| 5 | Site preparation | m ² | 300 |

APPENDIX N: ENVIRONMENTAL BASELINE

Presented in separate Volume: Draft Final Report – Appendices (Vol. 2)

APPENDIX O: GRIEVANCE REDRESS MECHANISM

A. Grievance Redress Mechanism Objective

1. A grievance redress mechanism (GRM), consistent with the requirements of the ADB Safeguard Policy Statement (2009) will be established to prevent and address community concerns, reduce risks, and assist the project to maximize environmental and social benefits. In addition to serving as a platform to resolve grievances, the GRM has been designed to help achieve the following objectives: (i) open channels for effective communication, including the identification of new environmental issues of concern arising from the project; (ii) demonstrate concerns about community members and their environmental well-being; and (iii) prevent and mitigate any adverse environmental impacts on communities caused by project implementation and operations. The GRM is accessible to all members of the community.

1. Proposed Grievance Redress System

2. The proposed GRM follows the existing approach taken for managing complaints about local issues by members of the public in Mongolia. Residents' complaints or concerns are generally taken to *bagh* or *soum* representatives for resolution, therefore this system is proposed for the GRM. The GRM approach also fits with the aimag's existing approach to managing complaints for the public, which is focused on taking complaints to soums. The *aimag* Government confirmed their support for the approach presented in this IEE⁸.

3. In its capacity as the IA, the Darhkan *aimag* will establish a Public Complaints Unit (PCU). The PCU will be established within the PIU prior to construction to deal with complaints from affected people (AP) throughout implementation of the Project.

4. The PIU based Environmental and Social Specialist (PIU-ESS) will be responsible for ensuring the implementation of the GRM at a local level and will staff the PCU. They will be the key contact point for *bagh* and *soum* representatives who may require information about the project or who have an issue they would like to discuss. The PIU and PIU-ESS will issue public notices to inform the public within the project area of the GRM. The PCU's phone number, fax, address, email address will be disseminated to the people at the *bagh* and *soum* levels.

5. The PIU-ESS will have facilities to maintain a complaints database and communicate with the PIU, Site Engineers, Supervising Engineer, Governors of *aimag* and representatives of Darkhan *soum* and affected *baghs*.

2. GRM Steps and Timeframe.

6. Procedures and timeframes for the grievance redress process are as follows and shown in Figure 2.

- **Stage 1: Access to GRM.** If a concern arises, the AP may resolve the issue of concern directly with the contractor/operator however is the issue is successfully resolved, the AP will make his/her complaint known to either the *bagh* or *soum*, whichever level of authority he/she is most comfortable with;
- **Stage 2: Official Complaint to PCU.** The *bagh/soum* representative will submit an oral or written complaint to the PCU. For an oral complaint the PCU must make a written record. For each complaint, the PCU must assess its eligibility. If the complaint is not eligible, e.g. related to an issue outside the scope of the project, PCU will provide a clear reply within five working days to the AP.
- **Stage 3: PCU Complaint Resolution.** The PCU will register the eligible complaint informing the Darkhan *aimag*, the PIU and contractors. Together, the members of the PCU, facilitated by the PIU-ESS will take steps to investigate and resolve the issue. This may involve instructing the Contractor to take corrective actions. The complaint investigation

⁸ Meeting with *aimag* Senior Mr Ravjaadelgerekh Senior Specialist in Engineering - project contact.

will require close collaboration of the PCU members. Within seven days of the redress solution being agreed upon, the contractors during construction and the IAs/operators during operation should implement the redress solution and convey the outcome to the PCU;

- **Stage 4: Stakeholder Meeting.** If no solution can be identified by the PCU or if the AP is not satisfied with the suggested solution under Stage 3, within two weeks of the end of Stage 3, the PCU will organize a multi-stakeholder meeting under the auspices of the head of Darkhan *aimag*, where all relevant stakeholders will be invited. The meeting should result in a solution acceptable to all, and identify responsibilities and an action plan. The contractors during construction and the IAs/operators during operation should implement the agreed redress solution and convey the outcome to the PCU within seven working days;
- **Stage 4: Aimag Governor Resolution.** If the Multi-stakeholder meeting cannot resolve the problem, and the AP is unsatisfied, the PCU will set up a meeting with the *aimag* Governor. If a solution from the Governor is found, it will be implemented.
- **Stage 5: ADB Special Mission.** If the *aimag* Governor is unable find a resolution, the PCU will inform ADB and a special mission will be initiated to resolve the issue. Note that if the APs are still not satisfied with the outcome in Stage 4, they can go through local judicial proceedings.

7. **Reporting.** The PCU will record the complaint, investigation, and subsequent actions and results. The PIU-ESS will include this information in the monthly Environmental Management Plan progress reports. In the construction period and the initial operational period covered by loan covenants the EA will periodically report complaints and their resolution to ADB in the quarterly project progress reports and semi-annual environmental monitoring reports.

8. **Members and Responsibilities of the PCU.** The responsibilities of the PCU are implemented by the PIU-ESS, who is the PCU focal point. In addition to the PIU-ESS, the members of the PCC will be those in a position to resolve complaints and will include representatives of:

- PIU-ESS - focal point of PCU
- Darkhan Uul *aimag*
- Darkhan Us Suvag
- Darkhan *soum*
- Relevant *bagh* representatives

9. The responsibilities of the PCU are as follows:

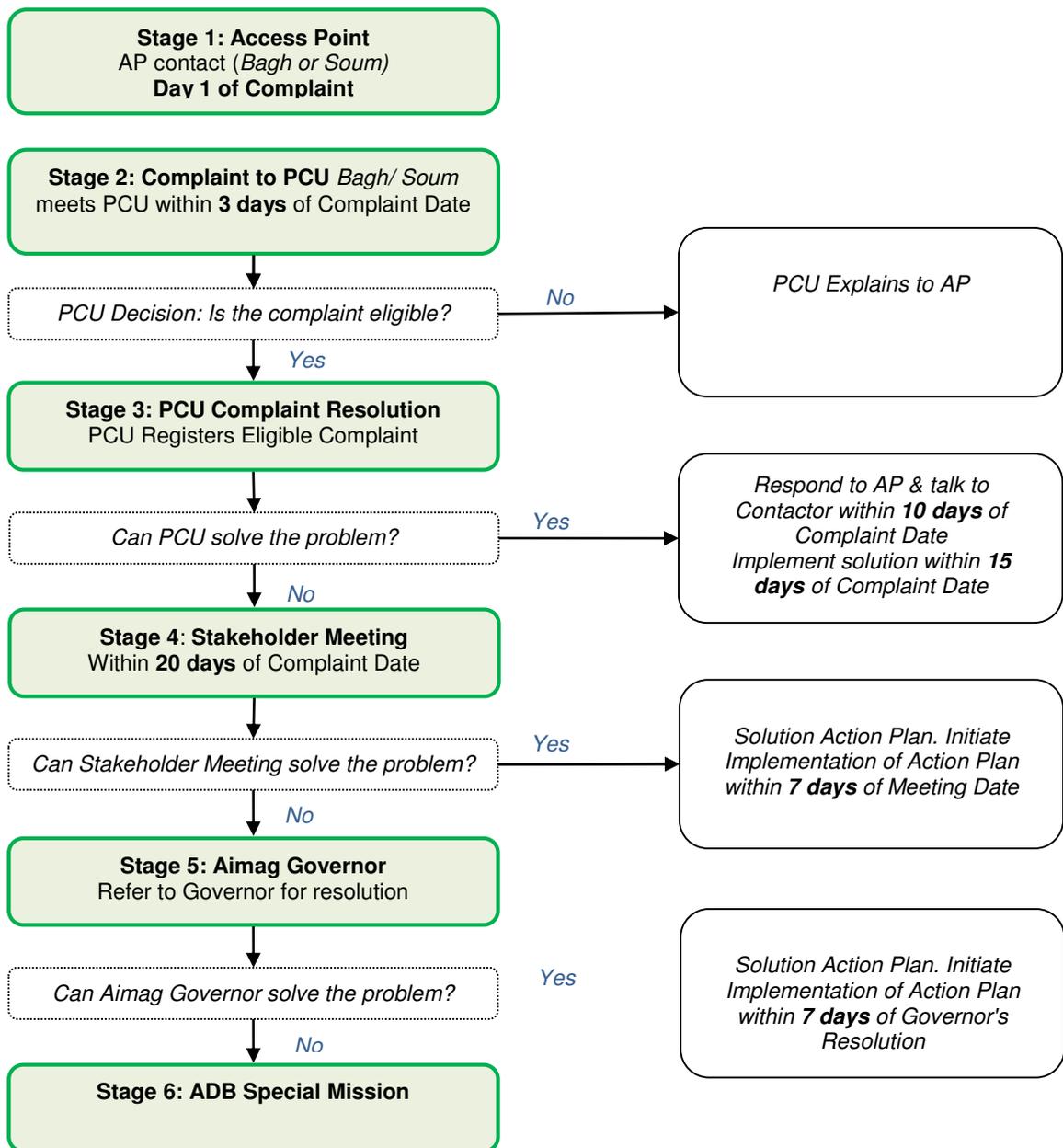
- The PCU will instruct contractors and construction supervisors to refer any complaints that they have received directly to the PCU. Similarly, the PCU will coordinate with local government departments capture complaints made directly to them.
- The PIU-ESS, as the focal point of the PCU, will log complaints and date of receipt onto a complaints database and inform the IA/PIU, Supervising Engineer and the Contractor.
- The PCU, with the Supervising Engineer and the Contractor, will investigate the complaint to determine its validity, and to assess whether the source of the problem is because of project activities, and identify appropriate corrective measures and responsible persons.
- The PCU will inform the AP of investigation results and the action taken.
- If a complaint is transferred from local government agencies, the PIU-ESS will submit an interim report to local government agencies on status of the complaint investigation and follow-up action within the time frame assigned by the above agencies.
- The PCU will review the Contractors response to the identified corrective measures, and the updated situation.
- The PCU will undertake additional monitoring, as necessary, to verify as well as review that any valid reason for complaint does not reoccur.
- The Supervising Engineer will ensure that the measures have been carried out by the Contractors.

10. The tracking and documenting of grievance resolution within the PCU and/or PIU will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) dedicated staff to update the database routinely; (iii) periodic reviews

of complaints so as to recognize grievance patterns, identify any systemic causes of grievances, promote transparency, publicize how complaints are being handled, and periodically evaluate the overall functioning of the mechanism; (iv) processes for informing stakeholders about the status of a case; and (v) procedures to retrieve data for reporting purposes, including the periodic reports to the EA and ADB.

11. **Multi-stakeholder meetings.** The invitees to this meeting will depend on the nature of the complaint. For example if the complaints relate to health, land disputes, or labour issues, the appropriate specialist in this field will be invited to the stakeholder meeting. This may include officers from the Land Administration (land rights issues), Mongolian Chamber of Commerce Policy & Representative (business/commercial issues), Women's Union NGO (gender issues), Health authority (health issues), MEGD (environmental issues), Ministry of Labor & Social Security Officer (labour issues).

Figure 2: Proposed Project GRM



APPENDIX P: PROJECT EXECUTION AND IMPLEMENTATION ARRANGEMENTS

1. The Ministry of Construction and Urban Development of the GOM will be the Executing Agency (EA) of the Project, supported by the existing Project Management Unit (PMU) of the Urban Sector Development Project for Mongolia (Loan 2301-MON) which will extend its existing responsibilities to include the Project. The PMU will continue to be headed by a Project Coordinator (PC). MCUD will be responsible for overall strategic guidance, technical supervision, and execution of the Project and ensuring compliance with loan covenants. The state-level Project Steering Committee (PSC) established for the Urban Sector Development Project for Mongolia (Loan 2301-MON) will provide overall policy guidance on the project and will have full powers to take decisions on matters relating to Project execution. The Project Coordinator is the Member Secretary and the committee is chaired by the State secretary of MCUD. Members of the committee include the Director MED, Director MOF, representatives of the Ministries of Environment and Green Development and Industry and the aimag government of Darkhan-Uul. Once the Project is made effective, the PSC will meet at regular intervals (at least once every 3 months) to review project performance and take decisions on major issues, such as, counterpart funding, implementation bottlenecks, land disputes, special procurement, policy reforms, etc.

2. The PMU will be responsible for: (i) appointing project management consultants, detailed design and construction supervision consultants, (ii) approving the design of the investment components in consultation with the Darkhan-Uul aimag government and Darkhan Us Suvag Company, (iii) assisting the PIU (which will be formed at aimag level to implement the project) in preparation of standard bid documents, monitoring the tendering process and guiding the aimag in bid evaluation and preparation of bid evaluation reports for approval by ADB, (iv) coordination with ADB on matters related to disbursement, (v) monitoring compliance with loan covenants, (vi) supervising project benefit monitoring and evaluation and (vii) maintenance of project documentation and submission of timely reports to ADB. The PMU will be supported by consultants.

3. The PC, supported by the PMU and its consultants will: (i) coordinate all activities under the Project; (ii) be responsible for overall project execution, monitoring, and supervision; and (iii) report directly to the Chairman of the Project Steering Committee (PSC).

4. Implementation of the Urban Environmental Improvement Components (Parts A1 and A2) of the project will be carried out by the Darkhan-Uul aimag government with assistance from MCUD. At the aimag level, MCUD will establish a Project Implementation Unit (PIU) in Darkhan-Uul, headed by a senior engineer or technical specialist experienced in environmental engineering, wastewater management construction and equipment installation as the PIU Project Director. The Director will be responsible for the day-to-day implementation of the respective physical works and equipment packages. Implementation of the institutional reform and capacity development, and project management and implementation support parts of the project (Parts B and C) will be managed by MCUD through the PMU and with assistance from the PMU management support consultants.

5. MCUD will coordinate the activities of the PIU at the aimag level through its management consultants and PMU staff, and will facilitate processing and approvals of designs, contracts and other documents as required at Ministry level. The PMU and PIU will be properly staffed and assisted by consultants with expertise in construction engineering, equipment installation, procurement, contract management, finance and accounting, social and gender development, institutional reform and capacity development, community development, and environmental matters.

5. The PIU will comprise three sections: (i) wastewater treatment plant and services; (ii) environmental safeguards, community awareness and participation; and (iii) finance and administration. With the assistance of consultants, the responsibilities of the PIU shall include: carrying out detailed surveys, investigations and reference and/or detailed designs of the subprojects; (ii), preparation of bid documents, tendering, evaluation of bids and award of the works and supply contracts; (iii) contract administration, supervision and quality control, measurement of works carried out by the contractors and suppliers and certifying payments; (iv) conducting public awareness campaigns and participation programs; (v) responding to grievances; (vi) ensuring compliance with the EMP; (vii) benefit monitoring and evaluation studies and environmental assessment; and (viii) preparation of monthly reports to the

PMU and aimag government. The aimag government will implement the subprojects with technical assistance from the both the PIU and the Darkhan Us Suvag PUSOs.

6. During the project design period, the PMU, in discussion with MCUD, Darkhan-Uul aimag government and Darkhan Us Suvag will determine the detailed arrangements for operation and maintenance of assets created under the project. Through this process, agreement will be reached on which activities will be retained by Us Suvag as those for which they are directly responsible, and those for which they will retain an oversight, supervisory and management role, but which will be contracted out. In addition, discussions will be held with the local community surrounding the treatment plant to explore opportunities for members of the local community to be involved in simple maintenance tasks for the treatment plant area (landscape maintenance, dried sludge reuse or resale as fertilizer, and possibly fish farming in maturation ponds). This agreement will confirm the roles and responsibilities during plant operational phase for:

- Darkhan-Uul aimag government
- Darkhan Us Suvag
- Contractor for construction and installation of the WWTP
- A contracted private sector operator to manage overall plant operations
- Local community group for maintain site landscape
- The figure below indicates the proposed project management and implementation arrangements and the flow of funding under the project.

APPENDIX Q: SOME RECOMMENDATIONS ON FINANCIAL MANAGEMENT AND PROCUREMENT CAPACITY

1. Assessment of procurement current status

This Appendix describes “Darkhan-Us suvag” Joint Stock Company’s documents of 2012 which identify the current status of procurement, difficulties experienced, and some related issues. This includes the decisions of Board of Directors relating to procurement, and some linked documents relating to project investment in 2012 and loans for operation and maintenance.

All issues related to Us Suvag tendering were introduced to the Board of Directors, and on each occasion the decision was based on investment sources, collateral and interest, and was made solely by the Board of Directors. However, in the case of two decisions related to procurement, there was failure to comply with the law on procurement of goods and services using state and locally-owned budget funds. There was a failure to comply with Article 33, (the comparative method), on two occasions:

1. The company purchased a sanitation pump and aeration station through a loan with 1.6 percent interest amounting MNT 30 million for a period of 6 months from Capitron Bank by the approval of Board of Directors’ resolution No 75 on September 9, 2012.
2. Us Suvag should have used open tendering method when they purchased electrical engines, portable welding machines and some other materials with a 1.2-1.4 percent interest rate loan for 12 months amounting to MNT 80 million from Capitron Bank by the approval of Board of Directors’ resolution No 79 on December 13, 2012.

In these transactions, Us Suvag didn’t use the comparative method approved by Mongolian Government decree No 22 of 2006 not to exceed the allowable budget amount by more than MNT 30 million.

It is considered that one of the causes of the shortcomings in procedure is that there is no employee specialized in procurement or with a procurement certification (A3) pursuant to the Article 47.6⁹ of the Law of Mongolia on procurement of goods, works and services using state and local budget funds.

⁹ Article 47.5: Majority of evaluation committee members must be specialized in procurement. Pursuant to the law, dated 9 June 2011, “members” were replaced instead of “majority of evaluation committee members” and this article was changed into 47.6 which law shall become effective from 1 October 2012.

Table Q.1: Us Suvag Loan Reports in 2012

| Loan reports in 2012 | | | | | | | | |
|---------------------------------------|----------------------------------|--------------------------------------|---------------------------------------|----------------|-----------------|-------------------|------------------|---|
| № | Date | Resolution | Loan Amount | Sources | Interest | Collateral | Duration | Purpose |
| 1 | 2012.03.26 | Board of Directors' resolution No 68 | 71,000,000 | TDB | 1.6 | Office | 3 months | Rehabilitate external water supply pipelines, tender security |
| 2 | 2012.04.24 | Board of Directors' resolution No 69 | 50,000,000 | Capitron | 1.8 | Garage | 6 months | Establish an accredited and a portable laboratory, tender security 5% |
| 3 | 2012.07.25 | Board of Directors' resolution No 73 | 357,994,039 | TDB | ? | Office | Up to 2012.09.01 | Install a water softener, tender security 20% |
| 4 | 2012.07.25 | Board of Directors' resolution No 74 | 297,547,737 | TDB | ? | Garage | Up to 2012.08.01 | Establish an accredited and a portable laboratory, tender security 30% |
| 5 | 2012.09.19 | Board of Directors' resolution No 75 | 30,000,000 | Capitron | 1.6 | Garage | 6 months | Purchase engines at pumping station and aeration station |
| 6 | 2012.11.28 | Board of Directors' resolution No 78 | 350,000,000 | TDB | 1.0-1.2 | Office and garage | 12 months | Establish an accredited and a portable laboratory |
| 7 | 2012.12.13 | Board of Directors' resolution No 79 | 80,000,000 | Capitron | 1.2-1.4 | Mechanic shop | 12 months | Purchase materials |
| | | | Total= 1,236,541,776 | | | | | |
| Remaining as of September 2013 | | | | | | | | |
| № | Total project expenditure | Resolution | Remains | Sources | Interest | Collateral | Duration | Pay, explanations |
| 1 | 991,825,875 | Board of Directors resolution No 78 | 304,000,000 | TDB | 1.0-1.2 | Mechanic shop | 12 months | There are no last 3 performances and no data from financial department. |

2. Recommendations on procurement issues

There are two main actions which can be taken to resolve these company difficulties in procurement:

1. The Government of Mongolia “Threshold value” decree No 68 dated 2 March 2013 and an appendix have been attached including implementation guidelines for this decree:
 - Upper ceiling for cost estimate of goods, works or services available under comparison method
 - Upper ceiling for cost estimate of goods, works or services available under direct procurement method
 - Upper ceiling for cost estimate of goods, works or services available under least-cost consultant selection procedure
2. Review the Finance Minister decree No13, dated 15 January 2013 regarding of “Conduct specialized procurement training and certification” and implement the Article 47.6 of Law of Mongolia on procurement of goods, works and services with state and local budget by training employees in procurement (to be included under the project)

By the time of researching project, investment and loans, supervising the employees for training held in local community is a valuable contribution for employees’ future.

APPENDIX R: INSTITUTIONAL REFORM, ORGANISATIONAL DEVELOPMENT, CAPACITY BUILDING AND PROJECT MANAGEMENT SUPPORT

1. While Ministry of Construction and Urban Development (MCUD) as the executing agency plays a major role in guiding and supporting project execution, the project places the Darkhan-uul aimag government and Darkhan Us Suvag at the centre of project implementation. Darkhan Us Suvag will also be responsible for the operation and maintenance of all project assets.
2. At present, the capacity of both the aimag government and Us Suvag to: (i) respond to citizen's demands; and (ii) initiate, plan, deliver and manage urban infrastructure development and improved service delivery is limited. The aimag and soum governments and Us Suvag, currently have limited financial and technical resources, an absence of systems, few staff and inadequate capacity to effectively carry out these tasks. However, with the implementation of the Local Development Fund, aimag and soum governments now have access to funds which they can use at their discretion to support development projects – including those for infrastructure and service provision and improvement.
3. At the same time, although MCUD as the executing agency has experience in the execution of urban development projects, it has previously performed as both executing and implementing agency, delivering completed projects to local governments and providing little in the way of technical assistance, capacity building or training to assist local governments to develop their own urban planning and management capability.
4. The project needs to support a shift in responsibility for urban planning, management and delivery of local infrastructure from the national Government to the local government, with the Ministry moving to perform more of a regulatory, facilitating and supporting role in the sector. This supports Government's move towards fiscal decentralization, and supports the principal of subsidiarity – with local governments and service providers planning and delivering local infrastructure and services. This provides services which are better and more responsive to local needs.
5. The quality, coverage and reliability of service delivery at the *aimag* level is constrained by both the limited financing and nature of existing service delivery arrangements. Us Suvag is just coping in maintaining existing levels of service, but is not in a position to either expand service coverage or significantly improve levels of service to meet either current or expected future demand for services and infrastructure. They are guided by an informal "management contract" which lacks specificity on service quality and coverage targets, dispute resolution, and remuneration. They struggle to recover operating and maintenance costs (currently running at an operating loss of MNT 700 million per annum), and lack access to training and managerial expertise. Furthermore, Us Suvag does not see itself as a service provider with a mandate to go out and win new customers. It is currently very far from being a customer-facing organization.
6. The most fundamental constraint to system sustainability is low tariffs; Us Suvag last increased tariffs in 2010, but the level of income still falls some way short of allowing full cost recovery for services provided. In the past, requests for increases to enable routine operating and maintenance costs to be recovered have frequently been rejected by the aimag Citizens' Representatives Khural (part owners of the company) due to political unpopularity of such adjustments.
7. The Project presents an opportunity to introduce fundamental changes to the institutional framework for water supply and wastewater management service provision in Darkhan, and its regulation. This could be through a number of measures, both long- and short- term, which might include: (i) institutional reform, such as bundling water supply and wastewater management services with other more profitable utilities, such as power and heating; (ii) looking at opportunities for divestiture of all or part of Us Suvag so as to decouple service providers from the aimag government administration and potentially attract private capital and expertise; (iii) introduction of an operating management contract that provides performance-based incentives for the service provider; and (iv) support for the regulatory mechanism at a central level, already partly established, which links tariffs with the prices of key inputs and avoids political involvement in tariff setting.
8. In order to support this institutional development and reform, it is proposed under part B of the project to use the project itself as a vehicle help bring about this change. The proposed project

thus adopts a “drivers of change”-type of approach, whereby the reform and institutional development actions required to underpin the execution of the sector roadmap, and thus the ADB-supported project, form an integral part of the project itself. It is intended that execution of the project will help to drive change in policy areas which are closely related to project execution: the role of national and local government in urban development; urban planning; service delivery and local government finance, in addition to the project management and supervision activities supported under Part C of the project.

9. Part B of the Project will provide financial and technical assistance, consulting services and training to both the Darkhan-uul aimag government and Darkhan Us Suvag Comany to: (i) build aimag government and Us Suvag capacity in planning, development and management of sustainable water supply and wastewater management infrastructure and service delivery; (ii) assist in the transformation of Us Suvag into a more customer-oriented organization which is able to find ways to attract more customers through innovative technical and pricing approaches; (iii) assist Us Suvag in the establishment of a community outreach unit with specific responsibility for extending its services into ger areas and facilitating individual household connections; and (iv) develop the technical skills of Us Suvag employees in the optimal management and operation of the wastewater collection system and new wastewater treatment plant.
10. Under Part C of the project more direct technical assistance and support will be provided to MCUD, the Darkhan–Uul aimag Government, and Us Suvag on: (i) technical oversight and quality control of the detailed design, contract documentation, packaging, tendering and award of the wastewater treatment plant and pump station and sewer rehabilitation packages; (ii) overall project management support to ensure effective project execution and implementation; (iii) assistance with project benefit monitoring and evaluation; (iv) ensuring compliance with project safeguards.
11. Table R.1 below provides a summary of the proposed project management, institutional reform organizational development and capacity building programs, followed by ToRs for consultancy packages. Tables R.2 and R.3 show training programmes for each scope of work.

Table R.1 – Summary of Project Management, Institutional Reform Organizational Development and Capacity Building Components

| Item | Objective and Description |
|--|---|
| Under Part B of the Project: Institutional Reform, Organizational and Human Resource Development (OHRD) and Capacity Building support for Darkhan-Uul aimag government and Us Suvag. | |
| <p>1. Organizational and Human Resource Development (OHRD) and Capacity Building support for Darkhan-Uul government and Us Suvag; Support to Us Suvag on institutional reform towards service delivery focus</p> | <p>Support to MCUD as necessary in its role in the urban sector to develop and guide policy, facilitate, support, regulate, and provide standards for urban local governments, particularly in the water supply and wastewater sectors. Where necessary, assist MCUD in strengthening urban water sector reforms and regulation, and in developing mechanisms for the strengthening of both the regulatory institution and service providers.</p> <p>Using Darkhan as an example, and building on work previously carried out in sector reform (e.g. With ADB support under Loan 2301 and other project interventions), develop options for institutional reform of Us Suvag and similar water service companies. This might include bundling with other services, Kantor model etc., carry out SWAT analysis and in discussion with government and service companies determine preferred approach set out a detailed and sequenced reform road map for short- medium- and long-term reforms.</p> <p>Provide organizational and capacity development support and training to Us Suvag to better equip the company to discharge its functions, in particular with respect to: performance-based strategic and service investment planning; operation and maintenance (particularly with respect to the Wastewater Treatment Plant); financing; cost recovery and customer services. Assist Us Suvag in developing its customer focus to become a more customer-facing organisation.</p> <p>Carry out a review and functional assessment of Darkhan-uul <i>aimag</i> with respect to its water sector service planning and development functions, and where appropriate, develop proposals for organizational strengthening and/or restructuring. In particular support the aimag government and Us Suvag in developing the links between development planning and service provision.</p> <p>As necessary prepare job descriptions, carry out training needs assessments and execute a training and capacity building program. Develop policy recommendations to assist in empowering Us Suvag to be financially secure and technically competent to carry out their remit. Capacity building will be focused on both elected officials and technical staff in creating a better understanding of best urban development and management practice, and building the skills to allow individual staff members to carry out their jobs more effectively.</p> |
| <p>2. Creation, Development and Support to Us Suvag on a new Ger Area Development Support Unit</p> | <p>Assistance to Us Suvag in the ceation of a small unit to take specific responsibility for extension of water supply and wastewater management services – including sanitation improvements – into ger areas. The unit would be the primary user of the parametric model being created under the project to assess technical options for service provision.</p> <p>The consultants would assist Us Suvag in the creation of the unit, in defining its remit and functions and in selecting and raining staff. Assistance would also be provided in developing tools and approaches for the work of the unit.</p> |
| Under Part C of the Project: Project Management Support; Project Benefit Monitoring and Evaluation (PBME) | |
| <p>3. Project management support and quality assurance during design and tendering, and supervision of WWTP.</p> | <p>Technical assistance will provide quality assurance and technical advice to MCUD, Darkhan-Uul aimag government and Us Suvag during all stages of the design, tendering, construction and early stages of operation of the new WWTP.</p> <p>The adviser will: (i) review the detailed designs to ensure that the treatment system proposals are optimised for Darkhan conditions; (ii) ensure that technical specifications for solution proposed are of a sufficiently generic</p> |

| Item | Objective and Description |
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| | nature to attract broad international interest: (iii) ensure that tender documents are in compliance with FIDIC standards and adequate to ensure broad international interest in the tender; (iv) ensure that the contractor is required to support system operation for at least 3 years; (v) assist in pre-qualification of interested consortia; (vi) assist Government in overseeing the tendering, award and contracting process; (vii) assist government in providing top management supervision services; and (viii) assist in overseeing plant commissioning and early operational stages. |
| 4. Project Management Support to PMU and PIU on project management, procurement and supervision, and pump station and sewer rehabilitation design. | Project management support to the executing agency (MCUD) and implementing agencies (Darkhan-uul aimag and Us Suvag). The consultants would be located within both the PMU and PIU and take responsibility for assisting government in timely project execution and implementation, and on-the-job and formal training in matters relating to project design, procurement, management operation and maintenance. The activities covered would include: Project management and monitoring; implementation planning; ensuring detailed designs are prepared and approved; assisting the PIU in procurement of goods, works and services, monitoring, supervision, ensuring compliance with project safeguards and covenants; and assisting in establishing the sustainability of the project outputs. At PIU-level, activities would include: supervision of preparation of detailed designs and tender documents; assistance in tender evaluation and award; project progress and contract monitoring and reporting to the aimag governments, project working groups, and PMU. |
| 5. Project Benefit Monitoring and Evaluation (PBME) | External review of project implementation to assess whether benefits are being realized, and to confirm compliance with environmental (IEE and EMP) and resettlement (LARP) safeguards. Evaluation of outcomes and impacts, and feedback of findings into the project implementation process. |

OUTLINE TERMS OF REFERENCE FOR INSTITUTIONAL, ORGANISATIONAL AND HUMAN RESOURCE DEVELOPMENT AND CAPACITY BUILDING

1. The Government of Mongolia (GOM) intends to procure the consulting services of an international firm to provide Institutional, Organisational and Human Resource Development and Capacity Building (IOHRD&CB) services to Darkhan-uul aimag Government and Us Suvag joint stock company under the Darkhan Wastewater Management Improvement Project (the project). The Ministry of Construction and Urban development (MCUD) is the executive agency for the project, and the Darkhan-uul aimag Government (the aimag Government) and Darkhan Us Suvag Joint Stock Company (Us Suvag) are the implementing agencies for the project. A Project Management Unit (PMU) has been established under the office of the Director General of the Housing and Public Utilities Policy Implementation and Coordination Department, to manage the project, and a Project Implementation Unit (PIU) has been established under the aimag Government to co-ordinate project implementation. The project will be implemented from July 2014 and will be completed by June 2017.
2. An international consulting firm with adequate expertise in institutional reform, organisational development, and capacity building in the water and wastewater sectors and with international experience of this work under projects financed by Asian Development Bank (ADB) and other international financial institutions will be required to carry out the services. The firm will provide consulting services to support the aimag Government and Us Suvag through a process of institutional reform and organisational change, and human resource and capacity development to create a more sustainable institutional arrangement for water and wastewater service planning and service delivery in Darkhan. The assistance will mainly be directed at Us Suvag, as the service provider, but will also assist the aimag in improving its planning and development approval role to optimise service delivery outcomes. Land allocations are currently made without reference to the difficulty and cost of providing services to these new developments.

A. Project Rationale and Description

3. The proposed Darkhan Wastewater Management Improvement Project (the Project) supports the improvement of wastewater collection and treatment facilities in Darkhan. The project supports environmentally sustainable urban development and will promote socially inclusive and economically competitive urban development in Darkhan. The project will contribute to a better-balanced national urban system and strengthened urban-rural relationships through supporting the development of a second-tier city in the country. The project will support improvement of the city's wastewater management system, its central wastewater treatment plant (WWTP), sewer system, and pumping stations. The project will also support institutional and organisational development and capacity development to promote technically and financially sustainable service provision in the city.

B. Rationale

4. **The Context:** Darkhan Uul-Aimag is Mongolia's third largest province with a registered population in 2013 of 94,000 and an urban population in Darkhan City (Darkhan Soum) of 76,000, of which an estimated 40% live in ger areas. Poverty incidence is significant at 27% city-wide and 44% in ger areas respectively. The city is located 220 kilometres (km) north of Ulaanbaatar and 130 km south of the Russian border. Darkhan enjoys favourable conditions for farming and is rich in mineral deposits. It was established as an industrial hub in 1961, and is located on the Trans-Mongolian railway line and on an ADB-supported road that connects Ulaanbaatar with Darkhan, the Russian border, and the Lake Baikal region. However, few industrial investments were made in recent years resulting in a slowing of economic growth and consequently stagnation in population growth.
5. In an attempt to strengthen development of secondary cities, and to mitigate migration to Ulaanbaatar, where almost half of the country's population resides, in 2012 the government determined to promote Darkhan as a national model city for urban sustainability and livability with a vision of "smart and green city" by 2028. In support of this vision, Government is funding an Urban Development Master Plan, which is under preparation and due for completion on 2014. Improvements of existing urban districts and ger areas are planned, as well as urban expansion in

the form of new industrial and residential areas, strengthened academic institutions, and expanded and new public parks and environmental protection zones.

6. By 2020, the registered population in Darkhan Soum is estimated to grow to 83,000 with 75% living in formalized and fully serviced residential districts. These industrial and residential developments will create a significant increase in demand for urban services, including piped water supply, in-turn resulting in increased wastewater flows. Investment in infrastructure is needed to meet this present and future demand from improved and expanded urban services and to support the clustering of new businesses and industries.
7. **The Current Wastewater Management System in Darkhan:** The city's sanitary sewer system pumping stations, and original primary wastewater treatment plant were built in 1965. The wastewater treatment plant (WWTP) was upgraded from primary treatment to biological treatment between 1987 and 1990, with the plant becoming operational in the mid 1990's. The WWTP was significantly oversized with a capacity of 50,000 cubic meters per day and was never fully utilized. It currently operates at an average flow rate of between 8,000 and 10,000 cubic meters per day (average summer and winter) with peak flows of 15,000 cum per day. Many components are underutilized or unused and dilapidated, and the units which are operational are in an advanced state of disrepair. Some sections of sewer main are overloaded or damaged and are in urgent need of replacement or repair. The pump stations are also in need of repair and pumping equipment needs replacement. The pump station currently serving the Industrial estate is frequently overloaded.
8. Sanitation in ger areas is currently in the form of on-plot pit latrines which are unhygienic and cause soil and groundwater pollution. Currently, wastewater is not collected from ger areas and plans for incremental extension of the network to serve ger areas are being prepared for domestic financing. The WWTP treats domestic sewage together with non-toxic industrial wastewater and effluent from some industrial pre-treatment facilities which remove toxic elements (i.e., from a tannery) or excessive organic pollution (i.e. from a slaughterhouse). Breakdowns of the current system cause untreated wastewater to discharge into the groundwater and eventually to the Kharaa River.
9. Us Suvag is responsible for water supply and wastewater management in the city, but suffers from a number of institutional and financial constraints. It currently runs at an operation loss of about MNT 700 million per annum. There are other problems which influence to the company's financial condition such as: (i) an increasing level of technical failures; (ii) a high rate of non-revenue water; (iii) inefficient operation of facilities causing a high level of consumption of electricity; (iv) the poor condition of many sections of the pipe networks; (v) outdated equipment and facilities adopting outdated technology; and (vi) now strategy for obtaining new customers. Us Suvag encountered 233 network failures in 2012 which increased to 273 in 2013. The current price for water supply and sewerage services does not cover the cost of operational and service delivery activities, and customers who request connections to the system are turned away by the company.
10. **Strategic Fit:** The proposed project is aligned with the Government of Mongolia's Action Plan 2012–2016, including objectives of improving centralized wastewater systems in aimag centers, and enforcing the Law on Water Supply and Sewer Use, and supporting the expansion of industrial development in Darkhan City. The project is aligned with ADB's Strategy 2020 with its objective of inclusive economic and environmentally sustainable growth, and the project follows the ADB's Urban Operational Plan supporting the development of inclusive, green, and competitive cities. The project supports ADB's Mongolia country partnership strategy, 2012–2016. Lessons learned from previous ADB urban and water sector projects in Mongolia have been incorporated into the project design and the project supports the sustainability of and complements previous ADB assistance to Darkhan.

C. Impact, Outcome, Outputs and Components

11. The Project impact will be improved urban environment in Darkhan City and improved water quality in the Kharaa river basin. The project outcome will be improved wastewater collection and treatment for domestic and industrial users in Darkhan City. The project outputs will be: (i) a modern and efficient wastewater treatment plant with increased operational capacity from 12,000 to 20,000 cubic meter per day, and meeting national effluent standards, constructed and operating in

Darkhan; (ii) an improved wastewater collection system with 1,800 meters of replaced, enlarged or new sewer lines, and three repaired pumping stations operating in Darkhan; and (iii) institutional and organisational development and capacity building to increase the institutional capacity in utility and project management, planning, procurement, implementation, operation, and monitoring, and enhance the financial sustainability of Us Suvag.

12. The Project Components comprise:

- Component A1: Construction and equipping of a new wastewater treatment plant
- Component A2: Pump station rehabilitation, equipment supply and installation and new sewer line construction
- Component B: Institutional, organisational and human resource development and capacity building support to Darkah-uul aimag and Us Suvag JSC
- Component C comprising: C1 – Incremental Assistance to Project Management Unit; C2 - Incremental Assistance to Project Management Unit; C3 – Consultancy for preparation of employers requirements and contract documentation and assistance in tender of DS&I contract for Component A1; and C4-Project management and implementation support services.

13. A piggy-back technical assistance will further support capacity development on integrated urban planning, industrial cluster planning, and improvement of water use efficiency.

D. Terms of Reference for the Services

14. The present call for expressions of interest refers to consultancy services to provide institutional, organisational and human resource development and capacity building support to Darkahn-uul aimag Government, and more particularly Us Suvag joint stock company.

15. The main output from these consulting services will be a reformed, improved and strengthened institutional capacity for the planning and delivery water supply and wastewater services in Darkhan. The IOHRD&CD program will provide consultancy support to the aimag government and Us Suvag in organizational reform and development to assist in enabling the aimag government and Us Suvag to: (i) better plan for efficient water supply and wastewater management (WSWM) service delivery to support growth; (ii) achieve financial and technical sustainability in WSWM service delivery; and (iii) improve WSWM service delivery efficiency and customer-focus. To improve the chances of success, the consulting team will be fully integrated into the organizations to which they are providing organizational development support.

16. The institutional, organizational and human resource development and capacity building consulting services will be recruited in accordance with ADB's Guidelines on the Use of Consultants (2013, as amended from time to time). The PMU, on behalf of MCUD, will be responsible for engaging consultants through quality- and cost-based selection. Under the consulting services contract, the consultant's activities will focus on the following:

1. Analysis of the Current Situation

17. An assessment and analysis of the current situation with respect to the planning and delivery of water supply and wastewater in Darkhan city would be carried out to include, but not necessarily be limited to the following:

- i. Building on the work carried out under: (a) the ADB-financed PPTA for Wastewater Management Improvement in Darkhan; and (b) the CDIA-financed Water Supply and Sanitation Infrastructure Improvement Project, carry out an assessment of existing organizational, staffing and resource mobilization arrangements at aimag government and Us Suvag levels including:
 - a) Identification of the functions of each department and the reporting lines and levels of authority in the aimag and Us Suvag;
 - b) Carry out an analysis of current and human resource capacities to identify the main gaps and weaknesses including existing staff capacity building and training arrangements;

- c) Conduct a review of the adequacy of existing planning, project preparation and implementation and service delivery arrangements including, budget, equipment and staffing; and
 - d) Conduct a review of financial management arrangements, including budgeting and expenditure plus revenue collection powers and effectiveness.
- ii. Based on the foregoing identify the constraints to improved service delivery and sustainability, the underlying causes of for these constraints whether policy, organizational, financial, technical or which are a combination of these factors, and provide an analysis as to how these issues may be addressed through the Technical Assistance support. Short term recommendations should be designed to avoid major policy interventions which will require either government approval or legislative change.
 - iii. Based on the foregoing prepare a functional profile for WSWM delivery, including service delivery arrangements and work flows, showing key roles and indicating any gaps or overlaps in the roles and responsibilities.

2. Strategic Review

18. In parallel with Tasks 1, a strategic review of sector reforms at the national and local level would be carried out to include, but not necessarily be limited to the following:
- i. Review the progress made and current status of the Governments attempts to reform the water supply and wastewater sector service delivery arrangements in the country, including those supported by MCUD, the State Property Commission, ADB and other donors and IFIs.
 - ii. Discuss progress made and likely future trajectory of sector regulation and reforms with the State Government, the Water Service Regulatory Commission, Agency for Fair Competition and Consumer Protection, aimag Government, Us Suvag and other stakeholders in the sector, and set out the implications of likely future sector reform for the aimag Government and Us Suvag.
 - iii. Review the Water Supply and Wastewater Management Strategy and Investment Plan prepared under the CDIA-supported Water Supply and Sanitation Improvement Project, and determine the institutional and organisational implications of the recommendations made. In particular review the institutional development proposals and options considered and evaluated, and assess the practicality of these in light of national sector reform initiatives, sector regulatory framework and readiness for private sector involvement in the sector and the extent of such involvement.
 - iv. Carry out a brief market sounding to determine the interest in the domestic private sector for entering into private-public partnership in urban water supply and wastewater management sector in Darkhan.
 - v. Prepare a report on the institutional and organisation reform and development options and discuss these with the aimag Government, Us Suvag (Board and executive) and other stakeholders.
 - vi. Based on the outcome of these discussions, develop a roadmap for reform of Us Suvag detailing actions required and the change management approach to be adopted by the consultants.
 - vii. The roadmap should cover both strategic objectives and a time-bound and action-specific organisational and operation reform plan including: (a) a customer-orientated long-term development strategy; (b) measures to improve corporate governance (including ownership changes); (c) organisational structure and operational improvements; (d) strengthening human resources; (e) promoting technical innovation; (f) management system improvements and capacity development; (g) improved services targeting both central and (particularly) ger areas;

(h) increased customer-orientation; and (i) an outsourcing strategy and/or plan for increased private sector participation.

- viii. Obtain approval of the executing agency, PMU, aimag Government and Us Suvag Board of Directors to this institutional development roadmap and associated actions.

3. Organizational Restructuring

19. Based on work under Parts 1 and 2, a preferred option for organisational restructuring and capacity development would be generated to include, but not necessarily be limited to the following:

- i. In coordination and collaboration with the aimag government, develop optimal organizational management structures for Us Suvag to assist in improving its business performance and identify key organisational changes that can provide improved customer relations with government and private customers.
- ii. Provide advice on arrangements for corporate governance including internal controls and internal auditing and how these arrangements can be made more effective; including, as necessary rationalization of the existing Board of Directors for Us Suvag and provide assistance in staffing it, and progressive change in ownership, including options for ESOPs and other private sector stake-holding.
- iii. Develop staffing plans, manpower planning procedures and assessment of staffing requirements. Make recommendations for improvements in manpower planning and assist in the preparation of revised manpower plans in accordance with these recommendations.
- iv. Prepare, agree, and implement a program of management training on operational and financial aspects.
- v. Develop (or review and improve) standards of service with special emphasis on the levels of service provided to customers and value for money, and gain agreement to these.
- vi. Determine institutional and support arrangements required to provide outreach services to customers wishing to connect to the networks, and to help stimulate a demand for Us Suvag services.
- vii. Development (or refinement) of an integrated 3 to 5 year business plan that covers all main activities of Us Suvag. The business plan should incorporate progress towards defined standards of service and a quantification of planned business performance based on the strategic indicators and targets. The plan should also incorporate resourcing needs in terms of operating budget, capital investment, manpower, etc and the resulting pricing implications necessary to meet financial targets.
- viii. Develop and agree a set of strategic performance indicators and targets with which to measure and assess the overall performance of the Us Suvag. These targets and indicators to include, financial, operational, construction, human resources and external relations.
- ix. Using the business plans as a base, develop a draft performance contract between Us Suvag and the aimag government to allow strategic “arms-length” supervision on the part of the aimag government. The arrangement should include mechanisms for the cost associated with the extension of new water supply and wastewater infrastructure and services to be extended into new development areas to be factored into land use and development approvals.
- x. Assist Us Suvag in the development procedures for identifying and prioritizing capital projects and link this process to the preparation of business plans and capital budgets.
- xi. Develop appropriate customer response or effective feedback strategies, and an improved mechanism for Us Suvag to address these.

3. Operational Restructuring

20. Options for operational restructuring and capacity development would be carried out to include, but not necessarily be limited to the following:
- i. Prepare an operational procedures manual for Us Suvag systems including operational, financial management, HR, and MIS sections.
 - ii. Review operational practices and procedures of Us Suvag and make recommendations for improvements that will create possible cost savings and/or enhanced performance.
 - iii. Provide guidance in operational standard-setting and in the preparation of operational procedures to improve reliability and consistency in service provision.
 - iv. Develop human resources policies and procedures to improve the skills and performance of the workforce including giving consideration to the processes of: (a) staff appraisal and performance measurement; (b) identification of training needs and delivery of training; and (c) reward mechanisms and a rewards and incentive structure;
 - v. Design and assist in the development of an improved management information systems for Us Suvag to allow senior management to monitor actual company performance in real time against business plans. Provide advice on the broader development of the MIS systems within Us Suvag consistent with the business plan and operational management needs.
 - vi. Undertake a general review of Us Suvag's routine, periodic and emergency maintenance programs and the degree to which these are properly planned and adhered to. Make recommendations on any improvements needed in maintenance planning or resourcing, with a particular focus on preventive maintenance.
 - vii. Review Us Suvag's capability and operational capacity to monitor industrial wastewater discharges and enforce wastewater discharge standards, particularly those relating to Government order No a/11/05/A/18 of January 10 1997 which prescribes the allowable limits of industrial wastewater composition before letting effluents into the central wastewater system. In light of likely increases in industrial wastewater discharges, provide recommendations on how Us Suvag can improve its monitoring of industrial wastewaters and enforcement of industrial wastewater discharge standards.
 - viii. Provide guidance in operational standard setting and in the preparation of operational procedures to improve reliability and consistency in service provision.

4. Improving Financial Management Systems

21. Develop proposals for improved financial sustainability and financial management to include, but not necessarily be limited to the following:
- i. Review the financial information systems and procedures used in Us Suvag and propose modifications to these, including a review of the use of financial information as an aid to management decision taking within Us Suvag, and by the aimag Government.
 - ii. Based on the agreed strategy and roadmap, estimate appropriate annual operation and maintenance budgets based on realistic and affordable requirements over the next 5 and 10 years for each service type, and identify potential revenue sources to cover these costs.
 - iii. Gain Us Suvag agreement to, and prepare a Financial Management Improvement Plan (FMIP) to modernize the financial management arrangements of Us Suvag. The scope of such a plan would include, but not necessarily be restricted to: (a) recurrent and capital budget reporting and controls; (b) improved cost controls; (c) use of job costing and activity based costing as appropriate; (d) development of relevant financial performance indicators and ratios; (e) control of working capital and cash flow; (f) use of financial planning and financial input to business

plans; (g) computerization of systems as appropriate, (h) financial training for financial staff and for non-financial managers; and (i) improvements in financial procedures and regulations.

- iv. Assist in the implementation of the FMIP by assisting in the selection of software for computer based systems for financial and management accounting and other financial systems (payroll, payment of suppliers etc. as necessary). Assist in the preparation of implementation plans for computerized system roll-out and ensure adequate attention is given to: (a) training (basic computer awareness and systems specific); (b) systems testing; (c) transfer of live data; (d) systems security (physical location, hardware and software related) and including disaster recovery; and (e) systems documentation for users and system managers.
- v. Prepare and execute a program of financial training seminars and courses for different levels of accountants and financial managers. The content of this program to depend on the development needs identified in the FMIP.
- vi. Prepare and deliver a series of training courses in financial management for non-financial managers of Us suvag. Such courses should include financial and budgetary control, unit cost accounting, and use of financial ratios.

5. Regulation –Tariff Setting, Billing, and Income Collection

22. Develop proposals for improved service regulation, tariff setting, billing and bill recovery to include, but not necessarily be limited to the following:

- i. Work closely with the aimag government to formalize regulatory and tariff-setting systems.
- ii. Assist the aimag government to develop procedures for the effective regulation of Us Suvag based on agreed business plans and definition of information needs to facilitate proper regulation and supervision by government.
- iii. Develop a methodology for the periodic review of tariffs so that the various interests of the government, customers, and Us Suvag are safeguarded. The methodology should include: (a) compliance with pricing regulations; (b) customer affordability analysis; (c) review of company performance in terms of service and efficiency; (d) providing for the financial viability of the company; (e) review and justification of any cross-subsidization in pricing; (f) results from customer satisfaction and willingness to pay surveys and other public consultation; and (g) setting a defined timetable for price reviews.
- iv. Design for implementation by the PIU in the near term, and Us Suvag in the long term, of a socio- economic survey to regularly measure customer satisfaction with utility services and willingness to pay.
- v. Undertake a review of tariff structures with the objectives of simplifying administration, aiding customer understanding and promoting financial sustainability of Us Suvag.
- vi. Review Us Suvag billing tariff and income collection arrangements and efficiency, and develop an action plan for the improvement of these where either the effectiveness or efficiency of income collection is in need of improvement. This review to include: (a) the extent of computerization and scope for systems enhancement; (b) extent of arrears and mechanisms to reduce arrears and improve promptness of bill payment; (c) need for staff training; (d) management information to aid debt recovery; (e) methods of billing, payment and payment processing; (f) bill layout and explanations given to customers; and (g) benefits and costs of a progressive introduction of “smart metering”.
- vii. From the above review, suggest timetable for phased introduction of improved mechanisms for tariff setting, restructuring, collection, and smart metering.
- viii. Develop proposals for a program of activities to improve public awareness of water supply management, including measures to improve willingness to pay tariffs.

6. Emergency Preparedness and Response Planning

23. Develop an emergency preparedness and response plan to include, but not necessarily be limited to the following:
- i. Assist Us Suvag in the development of an emergency preparedness plan to cover both external (e.g. flood, earthquake), and internal (e.g. power failures, major system failures) emergencies.
 - ii. In particular, work with Us Suvag to prepare a plan to divert industrial wastewater away from the treatment plant in cases of process or pre-treatment failure, and where toxic concentrations in industrial effluents are: (i) not in compliance with standards for discharge to public sewers; and (ii) present a threat to the viability of the central WWTP treatment system. The plan should include arrangements for the temporary discharge, containment and treatment of the effluent to a suitable area – for example the fly-ash disposal ponds for the thermal power plant.
 - iii. Provide a plan which clearly sets out emergency responses by Us Suvag and those departments and individuals responsible for the response actions.
 - iv. Ensure that the emergency preparedness plan is well understood by management and staff across Us Suvag, and carry out training of concerned staff in plan execution.

7. First Stage Reforms and Capacity Building

24. Support the first phase of institutional and organisational reform, and carry out related capacity development to include but not necessarily be limited to the following:
- i. Assist Darkhan-Uul government and Us Suvag in implementing the first stages of the institutional and organizational reform and human resources development plan and associated institutional, operational management and financial management improvements under the approved roadmap.
 - ii. Work directly with Us Suvag staff in introducing organisational and management changes, and carrying out on-the-job training.
 - iii. Carry out formal and in-formal capacity building programs and training sessions (both internally and through use of external training institutions), to develop skills required to accomplish revised organisational and job requirements

E. Finance

25. The total investment requirement for the project is estimated at \$20.65 million. ADB will finance \$18.5 million, of which \$8.5 million will be financed from ordinary capital resources and \$10.0 million from Asian Development Fund resources. MCUD and Darkhan-Uul aimag will provide counterpart funding of \$2.15 million to finance taxes and duties, land acquisition, resettlement, and other miscellaneous costs.

F. Project Implementation Arrangements

26. The executing agency of the project is MCUD. MCUD's office of the Director General of the Housing and Public Utilities Policy Implementation and Coordination Department will be responsible for coordinating program implementation. A PMU will be established under the Project Director (who will be the Director General) which will be responsible for overall management of the project. A Project Steering Committee, chaired by the State Secretary of MCUD and comprising officials from both State and Darkhn Uul aimag governments and representatives of civil society and the private sector, has been established to provide strategic and policy guidance.

27. The project will be implemented by Darkhan-Uul aimag and Us Suvag JSC. The implementing agencies will establish a Project Implementation Unit (PIU) in Darkhan which will be headed by the PMU Project Director. Implementation will be supported by a Darkhan Project Steering Committee and Project Working group comprising members from local government, Us Suvag and civil society (already established). The project will be implemented from July 2014 to June 2017.
28. The PMU will be staffed with: (i) a Program Director (part time), (ii) a Project Co-ordinator (full time – a civil engineer) (iii) a procurement officer, (iv) a financial officer and project accountant; and (iv) full-time administrative support. The PIU will be staffed by (i) the Program Director (part time), (ii) a Project Co-ordinator (full time – a wastewater engineer) (iii) a procurement officer (part time), (iv) a financial officer and project accountant (part time); (iv) a supervision engineer; (v) an environmental officer; (vi) a social development officer; and (vii) full-time administrative support. The PMU will be in charge of the overall management of the project, and the PIU will be responsible for project implementation, both with the support of consultants.

G. Consulting Services

29. The institutional, organisational and human resource development and capacity building services will require 81 person-months of consultants of which 21 person-months are international and 60 person-months are of national consultants and advisers. The consultants will have expertise in the reform and organisational development of water and wastewater utility service companies, water and wastewater company operations, water and wastewater services finance and financial management and accounting, human resources, human resource development, capacity building and training. The international and national financial experts to be engaged must have a recognized professional accountancy qualification, such as Certified Accountant, and background in financial management and accounting. All team members are expected to act as resource persons for the training and development activities. International and national positions required are set out as Table 1. The duration of the assignment is estimated at up to three years between mid-2014 and mid-2017.

Table 1: Personnel Requirements for Project Management and Implementation Support Services

| Description | International | National |
|---|---------------|-----------|
| Team Leader: Organizational Development & Water Sector utilities reform specialist (intermittent) | 12 | - |
| Deputy Team Leader: Organizational Development Specialist | - | 24 |
| Service Delivery Financial Management Specialist | 3 | 12 |
| Human Resource Development Specialists | 2 | 12 |
| Capacity Building Specialists and Trainers | 2 | 6 |
| Other specialists (as required) | 2 | 6 |
| Total | 21 | 60 |

30. The consulting firm will work with the aimag Government, and particularly with Us Suvag, but under the PMU and in cooperation and coordination with the executing agency, PIU, and all the related agencies and departments from the state and aimag governments. Under the supervision and the leadership of the PMU, the Consulting firm will also closely work and coordinate with the following other loan consulting services packages to deliver an integrated organisational reform and capacity development roadmap and program for Us Suvag, which takes into consideration all related institutional, local development and community-level impacts:

- Consultants under Part C4 of the project, providing project management and implementation support to the PMU and PIU and the executing and implementing agencies; and
- Consultants under Part C3 of the Project carrying out preparation of employers requirements and contract documentation and assistance in tender of DS&I contract for Component A1 – the new wastewater treatment plant.

H. Contacts and Links

Responsible ADB Officer: Stefan Rau

Responsible ADB Department: East Asia Regional Department

Responsible ADB Division: Urban and Social Sectors Division (EASS)

Executing Agency: Ministry of Construction and Urban Development

OUTLINE TERMS OF REFERENCE FOR PROJECT MANAGEMENT AND IMPLEMENTATION SUPPORT

1. The Government of Mongolia (GOM) intends to procure the consulting services of an international firm to provide Project Management and Implementation Support services for the Darkhan Wastewater Management Improvement Project (the project). The Ministry of Construction and Urban development (MCUD) is the executive agency for the project, and the Darkhan-uul aimag Government (the aimag Government) and Darkhan Us Suvag Joint Stock Company (Us Suvag) are the implementing agencies for the project. A Project Management Unit (PMU) has been established under the office of the Director General of the Housing and Public Utilities Policy Implementation and Coordination Department, to manage the project, and a Project Implementation Unit (PIU) has been established under the aimag Government to co-ordinate project implementation. The project will be implemented from July 2014 and will be completed by June 2017.
2. An international consulting firm with adequate expertise in project management and implementation support under projects financed by Asian Development Bank (ADB) and other international financial institutions will be required to carry out the services. The firm will provide consulting services to support the MCUD, PMU and PIU in project management and implementation, technical audit, third party quality assurance¹⁰, financial management, compliance with the ADB's Safeguard Policy Statement and GOM's safeguard requirements, assistance in contract supervision and reporting. The firm will also prepare detailed designs, specifications, and contract documentation, and assist in procurement for component A2 of the Project¹¹, and carry out other project support activities as necessary and appropriate.

A. Project Rationale and Description

3. The proposed Darkhan Wastewater Management Improvement Project (the Project) supports the improvement of wastewater collection and treatment facilities in Darkhan. The project supports environmentally sustainable urban development and will promote socially inclusive and economically competitive urban development in Darkhan. The project will contribute to a better balanced national urban system and strengthened urban-rural relationships through supporting the development of a second-tier city in the country. The project will support improvement of the city's wastewater management system, its central wastewater treatment plant (WWTP), sewer system, and pumping stations. The project will also support institutional and organisational development and capacity development to promote technically and financially sustainable service provision in the city.

B. Rationale

4. **The Context:** Darkhan Uul-Aimag is Mongolia's third largest province with a registered population in 2013 of 94,000 and an urban population in Darkhan City (Darkhan Soum) of 76,000, of which an estimated 40% live in ger areas. Poverty incidence is significant at 27% city-wide and 44% in ger areas respectively. The city is located 220 kilometers (km) north of Ulaanbaatar and 130 km south of the Russian border. Darkhan enjoys favourable conditions for farming and is rich in mineral deposits. It was established as an industrial hub in 1961, and is located on the Trans-Mongolian railway line and on an ADB-supported road that connects Ulaanbaatar with Darkhan, the Russian border, and the Lake Baikal region. However, few industrial investments were made in recent years resulting in a slowing of economic growth and consequently stagnation in population growth.
5. In an attempt to strengthen development of secondary cities, and to mitigate migration to Ulaanbaatar, where almost half of the country's population resides, in 2012 the government determined to promote Darkhan as a national model city for urban sustainability and livability with a vision of "smart and green city" by 2028. In support of this vision, Government is funding an Urban Development Master Plan, which is under preparation and due for completion on 2014. Improvements of existing urban districts and ger areas are planned, as well as urban expansion in

¹⁰ For Wastewater Treatment Plant Design, Supply, and Install contract

¹¹ Pump station rehabilitation, procurement and installation of new pumping equipment and installation of new sewer lines

the form of new industrial and residential areas, strengthened academic institutions, and expanded and new public parks and environmental protection zones.

6. By 2020, the registered population in Darkhan Soum is estimated to grow to 83,000 with 75% living in formalized and fully serviced residential districts. These industrial and residential developments will cause significant increase in demand for urban services, including piped water supply, in-turn resulting in increased wastewater flows. Investment in infrastructure is needed to meet this present and future demand from improved and expanded urban services and to support the clustering of new businesses and industries.
7. **The Current Wastewater Management System in Darkhan:** The city's sanitary sewer system pumping stations, and original primary wastewater treatment plant were built in 1965. The wastewater treatment plant (WWTP) was upgraded from primary treatment to biological treatment between 1987 and 1990, with the plant becoming operational in the mid 1990's. The WWTP was significantly oversized with a capacity of 50,000 cubic meters per day and was never fully utilized. It currently operates at an average flow rate of between 8,000 and 10,000 cubic meters per day (average summer and winter) with peak flows of 15,000 cum per day. Many components are underutilized or unused and dilapidated, and the units which are operational are in an advanced state of disrepair. Some sections of sewer main are overloaded or damaged and are in urgent need of replacement or repair. The pump stations are also in need of repair and pumping equipment needs replacement. The pump station currently serving the Industrial estate is frequently overloaded.
8. Sanitation in ger areas is currently in the form of on-plot pit latrines which are unhygienic and cause soil and groundwater pollution. Currently, wastewater is not collected from ger areas and plans for incremental extension of the network to serve ger areas are being prepared for domestic financing. The WWTP treats domestic sewage together with non-toxic industrial wastewater and effluent from some industrial pre-treatment facilities which remove toxic elements (i.e., from a tannery) or excessive organic pollution (i.e. from a slaughterhouse). Breakdowns of the current system cause untreated wastewater to discharge into the groundwater and eventually to the Kharaa River.
9. **Strategic Fit:** The proposed project is aligned with the Government of Mongolia's Action Plan 2012–2016, including objectives of improving centralized wastewater systems in aimag centers, and enforcing the Law on Water Supply and Sewer Use, and supporting the expansion of industrial development in Darkhan City. The project is aligned with ADB's Strategy 2020 with its objective of inclusive economic and environmentally sustainable growth, and the project follows the ADB's Urban Operational Plan supporting the development of inclusive, green, and competitive cities. The project supports ADB's Mongolia country partnership strategy, 2012–2016. Lessons learned from previous ADB urban and water sector projects in Mongolia have been incorporated into the project design and the project supports the sustainability of and complements previous ADB assistance to Darkhan.

C. Impact, Outcome, Outputs and Components

10. The Project impact will be improved urban environment in Darkhan City and improved water quality in the Kharaa river basin. The project outcome will be improved wastewater collection and treatment for domestic and industrial users in Darkhan City. The project outputs will be: (i) a modern and efficient wastewater treatment plant with increased operational capacity from 12,000 to 20,000 cubic meter per day, and meeting national effluent standards, constructed and operating in Darkhan; (ii) an improved wastewater collection system with 1,800 meters of replaced, enlarged or new sewer lines, and three repaired pumping stations operating in Darkhan; and (iii) institutional and organisational development and capacity building to increase the institutional capacity in utility and project management, planning, procurement, implementation, operation, and monitoring, and enhance the financial sustainability of Us Suvag.
11. The Project Components comprise:
 - Component A1: Construction and equipping of a new wastewater treatment plant
 - Component A2: Pump station rehabilitation, equipment supply and installation and new sewer line construction

- Component B: Institutional, organisational and human resource development support to Darkah-uul aimag and Us Suvag JSC
 - Component C comprising: C1 – Incremental Assistance to Project Management Unit; C2 - Incremental Assistance to Project Management Unit; C3 – Consultancy for preparation of employers requirements and contract documentation and assistance in tender of DS&I contract for Component A1; and C4-Project management and implementation support services.
12. A piggy-back technical assistance will further support capacity development on integrated urban planning, industrial cluster planning, and improvement of water use efficiency.

D. Terms of Reference for the Services

13. The present call for expressions of interest refers to project management and implementation support services to be provided to the MCUD, PMU and PIU for the implementation of the Project.
14. The main output from these consulting services will be the efficient and timely execution and implementation of the investment project. Specific outputs will include: (i) a fully-functioning PMU with fully-trained staff and financial and management systems in place; (ii) a fully functioning PIU with fully-trained staff and financial, management and project supervision systems in place; (iii) environmental, social and resettlement due diligence and safeguards reports prepared on time by the PIU and submitted to Government and ADB; (iv) detailed designs, specifications and contract documentation for Part A2 of the project; (v) design, construction and equipment supply and installation on schedule and to required quality; (vi) all relevant GOM and ADB guidelines and regulation are followed; and (vii) all required project documentation and reports are submitted on time to ADB and the Project Steering Committee.
15. The consultants will: (i) establish detailed work schedules and the work load distribution for the PMU and PIU; (ii) provide on-the-job and formal training to PMU and PIU staff on all aspects of project management and implementation; (iii) establish and operationalize the financial management and accounting systems for the investment program, including disbursements; (iv) monitor and ensure the effective implementation of the land acquisition and resettlement plan, the environmental management plan (EMP), and the social action plan (SAP); (v) act as resource persons for the training and development activities of PMU and PIU staff, and officers of Darkhan-Uul aimag and Us Suvag; (vi) provide procurement assistance, and in particular bidding document review, contract bid review and evaluation, and contract management and disbursement review and third party quality assurance for Part A1 of the project; and (vii) update and/or finalize required safeguards documents, including the resettlement plan, initial environment examination or environment impact assessment, and environment management plan in compliance with ADB guidelines and the relevant frameworks agreed between ADB and GOM as necessary and from time to time.
16. The project management and implementation support consulting services will be recruited in accordance with ADB's Guidelines on the Use of Consultants (2013, as amended from time to time). The PMU, on behalf of MCUD, will be responsible for engaging consultants through quality- and cost-based selection. Under the consulting services contract, the consultant's activities will focus on:

1. Project Management

17. Project management tasks include, but are not necessarily limited to:
- iv. Work with PMU and PIU staff to set up institutional framework, operational procedure, document filing system, implementation and monitoring systems, work plan, implementation schedule and budgets using computer based project management tools to guide and facilitate project execution and implementation.
 - v. Set up a mechanism for establishing annual targets for contract awards and disbursement assessment, an efficient contract administration system, and project management procedures based on good practice adopted in other ADB projects.

- vi. As necessary, coordinate activities with consultants working with the PMU and PIU on Part B (Organisational Development and Capacity Building) and Part C3 (Employers Requirements and Tender Support for Components A1) of the Project to ensure optimal and effective utilization of resources.
- vii. Establish a project performance management system (PPMS) in accordance with ADB's policy requirements, project design monitoring framework and planned implementation schedule, including establishing baseline and operational mechanism for data collection, analysis, and reporting.
- viii. As necessary, upgrade and improve the project management information system to: (a) ensure efficient and effective information sharing and coordination about the project management (e.g., procurement, disbursement, construction, safeguard compliance); and (b) monitoring the project's design and monitoring framework through the use of the PPMS.
- ix. Monitor the progress of the project based on PPMS output and provide advance notices to the PMU in case of anticipated problems, and suggest corrective actions.
- x. Assist the executing agency and the PMU in establishing quality assurance and quality control systems and help the PMU to implement and monitor the quality assurance and quality control program to ensure all works are completed in accordance with contract document requirements.
- xi. Provide expert inputs, review, and justification for contract variations and prepare necessary documentations (e.g., a due diligence report) in accordance with GOM and ADB requirements.
- xii. Review procurement documentation, including technical specifications, bill of quantity, bidding documents, bid evaluation procedures, and contract negotiations.
- xiii. Support the PMU and PIU in carrying out contract management and supervision duties during project implementation to include monitoring construction progress, preparing quarterly and annual progress report, reviewing and certifying the contractors' claims for payments, coordinating project implementation among contractors and various stakeholders, and coordinating daily operational tasks.

2. Financial Management

18. Financial management tasks include, but are not necessarily limited to:

- i. Establishing an efficient and effective financial management system for Project implementation (e.g. fund disbursement management, withdrawal application review, and use of loan proceeds and counterpart funds) in accordance with ADB policy and procedural requirements.
- ii. Assist the PMU in preparing financial statements and consolidated financial statements according to relevant project financial covenants, and make necessary arrangement with auditing units to supervise the financial management of the PMU.
- iii. As necessary, assist the PUM in: (a) processing and submitting loan withdrawal claim applications on time and on a regular basis, (b) in obtaining funds from the ADB and Government, and (c) in preparing subproject financing or on-lending agreements.
- iv. As necessary, review the financial situation of the sub-borrowers and assist them in complying with any financial or other loan covenants.

3. Project Accounting

19. Project accounting tasks include, but are not necessarily limited to:

- i. Determining project accounting needs, preparing necessary specifications, and ensuring accounts staff of the PMU and PIU are trained adequately on ADB and GOM financial management and accounting requirements.
- ii. Assist the PMU in maintaining the project accounts with all ledgers and control systems, in preparation of annual budgets, accounting and consolidated audit reports, and generate necessary accounts' reports and financial statements.
- iii. Assist the PMU in: (a) ensuring smooth funds flow from ADB and GOM, (b) to prepare requisite audit reports for each sub-account, (c) preparation of a consolidated audit for all sub-accounts, and (d) in the timely submission of audited project financial statements to ADB.

4. Compliance with ADB safeguard policy statement and Government of Mongolia safeguard requirements

20. Environmental and social compliance tasks include, but are not necessarily limited to:

- i. Review and update of the environmental management plan (EMP), resettlement plans, and SAP.
- ii. Support the PMU and PIU, as necessary, in contracting and managing local environmental monitoring resources for the conduct of periodic environment impact monitoring in compliance with the approved monitoring plan defined in the updated EMP.
- iii. Help the PMU and PIU in establishing management supervision mechanisms for implementation, monitoring, and reporting of the project safeguards issues based on the relevant ADB documentation (i.e., EMP, resettlement plans, and SAP) and provide support for their implementation.
- iv. Help the PMU and PIU to ensure implementation of the SAP requirements by conducting necessary workshops and focus groups meetings.
- v. Conduct compliance monitoring of social and safeguards issues, assist to formulate corrective actions where necessary, and help the PMU prepare safeguards and social development sections of the semi-annual progress report and relevant safeguards monitoring reports (i.e., annual environment monitoring report and semi-annual resettlement monitoring report).
- vi. Ensure safeguards reports are reviewed and approved by ADB and the PMU and disclosed prior to contract award.
- vii. Assist in establishing and managing the grievance redress mechanism, including assistance to the PIU to establish city-level project public complaint units, and to provide training for project public complaint members and grievance redress mechanism access points.
- viii. Assist the PMU, PIU and other concerned agencies to develop reporting formats and establish mechanisms to prepare and submit the environmental safeguards related reports specified in the loan and project agreements.

5. Detailed Design and Contract Document Preparation

21. The consultants will assist the PIU in preparation of the following detailed design and contract documentation tasks:

- i. Assist the PIU in confirming requirements for Part A2 of the project (pumping station rehabilitation; purchase, supply and installation of new pumping equipment and replacement of 1.8 Km of sewer main) and preparation of a short design report for approval of PMU.
- ii. Carry necessary surveys, as required, and prepare detailed design and specifications of works and equipment in accordance with ADB and Government requirements for national competitive bidding (NCB).

- iii. Prepare full contract documentation in accordance with Mongolia and ADB policies and procedures for NCB, and assist the PIU in packaging the contracts and in tendering for the works and equipment supply and installation.
- iv. Assist the PIU in evaluation of tenders, negotiation (as necessary) and award of contract.

6. Procurement, Contract Supervision Assistance, and Third Party Quality Assurance

22. Procurement and contract supervision assistance will include, but not necessarily be limited to:

- i. Assist the PMU and PIU in establishing the capacity to accomplish procurement necessary for project implementation in accordance with Mongolian and ADB policies and procedures, including the identification of responsibilities, requirements for approvals, oversight, documentation and reporting.
- ii. Support the PMU for the procurement of civil works, equipment purchase and installation, consulting services, and other contracts required to implement Part A2 and B of the project.
- iii. Provide technical supports in design review, bill of quantity and bidding document review, technical specification review, and other procurement documents review for Part A2 of the project.
- iv. Provide bidding and procurement process assistance, coordinate with bidding company and other involved agencies, provide assistance in bids review and bid evaluation, bid evaluation report preparation, and other bidding related tasks.
- v. Provide third party quality assurance assistance to the PMU (and consultants under Part C3) in the tender and award process for Part A1 of the Project, and provide expert assistance to the PMU as necessary in contract provisions in relation to the contractor's guarantees and operational assistance elements.
- vi. Develop a contract management system and provide contract management assistance, including procurement plan updating, contract award and disbursement monitoring and management, procurement planning and projections, and other contract management tasks.
- vii. Provide inputs for contract management and procurement to progress reports, project midterm and completion reports, and other project required reports.
- viii. Provide high-level top management supervision support to the PMU in implementation of components A1 and A2 of the project and prepare regular reports of progress and implementation and construction issues for PIU, PMU, the executing agency and Steering Committee.
- ix. Provide project implementation support on technical review, procurement documents review, and review of contract variation requests, due diligence report, and claims and other project management support.
- x. Provide input for the training and capacity development of PMU and PIU staff; coordinate with other team specialists to carry out training program, and provide support to the capacity development activities.

7. Institutional Strengthening and Reporting

23. The institutional strengthening and reporting tasks will include but not necessarily be restricted to:

- i. Collect all necessary information, edit, draft, and submit on time the reports required under loan and project covenants with quality acceptable to the executing agency and ADB.

- ii. Organize and provide training on the skills necessary for construction supervision, project management, implementation of SAP and safeguards plans (EMP and resettlement plans) consistent with ADB requirements.
- iii. Discuss and finalize with the executing agency a training plan, and design an evaluation questionnaire that will gauge the usefulness of the training and capacity building activities and performance of the trainers.
- iv. Provide training on prevention and control of transmittable diseases and HIV/AIDS, and community disturbance to contractors.

8. Project Benefit Monitoring and Evaluation

24. Assistance in project benefit monitoring and evaluation (PBME) will include but not necessarily be restricted to:

- i. Review of project implementation to measure project impacts; evaluate benefits, and assess whether benefits are being realized against the project monitoring and evaluation framework.
- ii. Confirmation of compliance with social, environmental and resettlement safeguards as set out in the summary poverty reduction and social strategy (SPRSS) and environmental management plan (EMP) and land acquisition and resettlement plan (LARP).
- iii. Based on the evaluation, preparation of any adjustments to project implementation required as a result of this evaluation, and feedback of the findings into the project implementation process to the PMU, PIU and Steering Committee.

9. ADB Project Administration Support

25. Assistance in ADB project administration support will include but not necessarily be restricted to:

- i. Prepare basic project information, including updated project scope, implementing schedule, contract management, procurement plan, social and safeguards compliance, and PPMS monitoring for ADB's loan administration missions.
- ii. Support the PMU in processing any changes in project scope, including conducting detailed technical and safeguards audits and prepare any necessary documentations (e.g., due diligence reports).
- iii. Conduct a detailed project review by updating project financial status, project cost tables, financing plan, and financial and economic analysis, and prepare for safeguard reviews for ADB's loan midterm review.
- iv. Collect and consolidate all necessary project information, and prepare for project completion report and ADB's project completion mission.

E. Finance

26. The total investment requirement for the project is estimated at \$20.65 million. ADB will finance \$18.5 million, of which \$8.5 million will be financed from ordinary capital resources and \$10.0 million from Asian Development Fund resources. MCUD and Darkhan-Uul aimag will provide counterpart funding of \$2.15 million to finance taxes and duties, land acquisition, resettlement, and other miscellaneous costs.

F. Project Implementation Arrangements

27. The executing agency of the project is MCUD. MCUD's office of the Director General of the Housing and Public Utilities Policy Implementation and Coordination Department will be responsible for coordinating program implementation. A PMU will be established under the Project Director (who

will be the Director General) which will be responsible for overall management of the project. A Project Steering Committee, chaired by the State Secretary of MCUD and comprising officials from both Sate and Darkhn Uul aimag governments and representatives of civil society and the private sector, has been established to provide strategic and policy guidance.

28. The project will be implemented by Darkan-Uul aimag and Us Suvag JSC. The implementing agencies will establish a Project Implementation Unit (PIU) in Darkhan which will be headed by the PMU Project Director. Implementation will be supported by a Darkhan Project Steering Committee and Project Working group comprising members from local government, Us Suvag and civil society (already established). The project will be implemented from July 2014 to June 2017.
29. The PMU will be staffed with: (i) a Program Director (part time), (ii) a Project Co-ordinator (full time – a civil engineer) (iii) a procurement officer, (iv) a financial officer and project accountant; and (iv) full-time administrative support. The PIU will be staffed by (i) the Program Director (part time), (ii) a Project Co-ordinator (full time – a wastewater engineer) (iii) a procurement officer (part time), (iv) a financial officer and project accountant (part time); (iv) a supervision engineer; (v) an environmental officer; (vi) a social development officer; and (vii) full-time administrative support. The PMU will be in charge of the overall management of the project, and the PIU will be responsible for project implementation, both with the support of consultants.

G. Consulting Services

30. Project management and implementation support services will require 151.5 person-months of consultants of which 19.5 person-months are international and 132 person-months are of national consultants and advisers. The consultants will have expertise in the implementation of water and wastewater services projects, wastewater treatment engineering, water and wastewater services finance, procurement, social safeguards and environmental management, financial management and accounting, and civil works construction and equipment supply and installation supervision. The international and national financial experts to be engaged must have a recognized professional accountancy qualification, such as Certified Accountant, and background in financial management and accounting. All team members are expected to act as resource persons for the training and development activities. International and national positions required are set out as Table 1. The duration of the assignment is estimated at up to three years between mid-2014 and mid-2017.

Table 1: Personnel Requirements for Project Management and Implementation Support Services

| Description | International | National |
|---|---------------|------------|
| Team Leader & Wastewater Treatment Plant Specialist | 12 | - |
| Deputy Team Leader /Resident Engineer | - | 30 |
| Procurement Specialist | 2 | 6 |
| Water Utility Management Specialist | 2 | 6 |
| Financial Analyst / Project Economist | - | 12 |
| Design Engineer | - | 12 |
| Equipment Specification Specialist | 1 | 6 |
| PMBE Specialist | - | 6 |
| Environmental Specialist | 1 | 10 |
| Social Development and Resettlement Specialist | - | 6 |
| SCADA Specialist | 1 | - |
| Structural Engineers | 0.5 | 2 |
| Inspector of Works | - | 24 |
| Surveyors | - | 12 |
| Total | 19.5 | 132 |

31. The consulting firm will work under the PMU and in cooperation and coordination with the executing and implementing agencies, PIU all the related agencies and departments from the state and aimag governments and Us Suvag JSC. Under the supervision and the leadership of the PMU, the Consulting firm will also closely work and coordinate with the following other loan consulting services packages to deliver an integrated wastewater service and wastewater treatment plant design, which takes into consideration all related institutional, local development and community-level impacts:

- Consultants under Part B of the project, assisting in institutional, organisational and human resource development and capacity building for Darkhan-uul aimag government and Us Suvag JSC; and
- Consultants under Part C3 of the Project carrying out preparation of employers requirements and contract documentation and assistance in tender of DS&I contract for Component A1 – the new wastewater treatment plant.

H. Contacts and Links

Responsible ADB Officer: Stefan Rau

Responsible ADB Department: East Asia Regional Department

Responsible ADB Division: Urban and Social Sectors Division (EASS)

Executing Agency: Ministry of Construction and Urban Development

OUTLINE TERMS OF REFERENCE FOR PREPARATION OF DESIGN, SUPPLY AND INSTALL, AND OPERATIONAL ASSISTANCE CONTRACT PACKAGE AND PROCUREMENT SUPPORT

32. The Government of Mongolia (GOM) intends to procure the consulting services of an international firm to provide assistance in the preparation of contract documentation for a Design, Supply, Install and Operational Assistance contract package for the new Darkhan wastewater treatment plant (WWTP) and support in the procurement process. The procurement will be carried out under the Darkhan Wastewater Management Improvement Project (the project). The Ministry of Construction and Urban development (MCUD) is the executive agency for the project, and the Darkhan-uul aimag Government (the aimag Government) and Darkhan Us Suvag Joint Stock Company (Us Suvag) are the implementing agencies for the project. A Project Management Unit (PMU) has been established under the office of the Director General of the Housing and Public Utilities Policy Implementation and Coordination Department, to manage the project, and a Project Implementation Unit (PIU) has been established under the aimag Government to co-ordinate project implementation. The project will be implemented from July 2014 and will be completed by June 2017.
33. An international consulting firm with adequate expertise in the preparation of reference designs and full contract documentation for wastewater treatment plants, and in the provision of associated procurement assistance, under projects financed by Asian Development Bank (ADB), other international financial institutions, governments or the private sector, will be required to carry out the services. The firm will provide consulting services to support the MCUD, PMU and PIU in the preparation of employers requirements, reference designs, performance specification and full contract documentation to international standards using the standard Design, Supply and Install (DS&I) form of contract. The firm will also provide assistance to the executing agency, PMU and PIU in managing and supervising the tender process, evaluating the tenders, negotiating with the preferred bidder as necessary, awarding the contract, and confirming contractual obligations, particularly with respect to contractor's guarantees.

A. Project Rationale and Description

34. The proposed Darkhan Wastewater Management Improvement Project (the Project) supports the improvement of wastewater collection and treatment facilities in Darkhan. The project supports environmentally sustainable urban development and will promote socially inclusive and economically competitive urban development in Darkhan. The project will contribute to a better balanced national urban system and strengthened urban-rural relationships through supporting the development of a second-tier city in the country. The project will support improvement of the city's wastewater management system, its central wastewater treatment plant (WWTP), sewer system, and pumping stations. The project will also support institutional and organisational development and capacity development to promote technically and financially sustainable service provision in the city.

B. Rationale

35. **The Context:** Darkhan Uul-Aimag is Mongolia's third largest province with a registered population in 2013 of 94,000 and an urban population in Darkhan City (Darkhan Soum) of 76,000, of which an estimated 40% live in ger areas. Poverty incidence is significant at 27% city-wide and 44% in ger areas respectively. The city is located 220 kilometers (km) north of Ulaanbaatar and 130 km south of the Russian border. Darkhan enjoys favourable conditions for farming and is rich in mineral deposits. It was established as an industrial hub in 1961, and is located on the Trans-Mongolian railway line and on an ADB-supported road that connects Ulaanbaatar with Darkhan, the Russian border, and the Lake Baikal region. However, few industrial investments were made in recent years resulting in a slowing of economic growth and consequently stagnation in population growth.
36. In an attempt to strengthen development of secondary cities, and to mitigate migration to Ulaanbaatar, where almost half of the country's population resides, in 2012 the government

determined to promote Darkhan as a national model city for urban sustainability and livability with a vision of “smart and green city” by 2028. In support of this vision, Government is funding an Urban Development Master Plan, which is under preparation and due for completion on 2014. Improvements of existing urban districts and ger areas are planned, as well as urban expansion in the form of new industrial and residential areas, strengthened academic institutions, and expanded and new public parks and environmental protection zones.

37. By 2020, the registered population in Darkhan Soum is estimated to grow to 83,000 with 75% living in formalized and fully serviced residential districts. These industrial and residential developments will cause significant increase in demand for urban services, including piped water supply, in-turn resulting in increased wastewater flows. Investment in infrastructure is needed to meet this present and future demand from improved and expanded urban services and to support the clustering of new businesses and industries.
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39. Sanitation in ger areas is currently in the form of on-plot pit latrines which are unhygienic and cause soil and groundwater pollution. Currently, wastewater is not collected from ger areas and plans for incremental extension of the network to serve ger areas are being prepared for domestic financing. The WWTP treats domestic sewage together with non-toxic industrial wastewater and effluent from some industrial pre-treatment facilities which remove toxic elements (i.e., from a tannery) or excessive organic pollution (i.e. from a slaughterhouse). Breakdowns of the current system cause untreated wastewater to discharge into the groundwater and eventually to the Kharaa River.
40. **Strategic Fit:** The proposed project is aligned with the Government of Mongolia’s Action Plan 2012–2016, including objectives of improving centralized wastewater systems in aimag centers, and enforcing the Law on Water Supply and Sewer Use, and supporting the expansion of industrial development in Darkhan City. The project is aligned with ADB’s Strategy 2020 with its objective of inclusive economic and environmentally sustainable growth, and the project follows the ADB’s Urban Operational Plan supporting the development of inclusive, green, and competitive cities. The project supports ADB’s Mongolia country partnership strategy, 2012–2016. Lessons learned from previous ADB urban and water sector projects in Mongolia have been incorporated into the project design and the project supports the sustainability of and complements previous ADB assistance to Darkhan.

C. Impact, Outcome, Outputs and Components

41. The Project impact will be improved urban environment in Darkhan City and improved water quality in the Kharaa river basin. The project outcome will be improved wastewater collection and treatment for domestic and industrial users in Darkhan City. The project outputs will be: (i) a modern and efficient wastewater treatment plant with increased operational capacity from 12,000 to 20,000 cubic meter per day, and meeting national effluent standards, constructed and operating in Darkhan; (ii) an improved wastewater collection system with 1,800 meters of replaced, enlarged or new sewer lines, and three repaired pumping stations operating in Darkhan; and (iii) institutional and organisational development and capacity building to increase the institutional capacity in utility and project management, planning, procurement, implementation, operation, and monitoring, and enhance the financial sustainability of Us Suvag.
42. The Project Components comprise:

- Component A1: Construction and equipping of a new wastewater treatment plant
 - Component A2: Pump station rehabilitation, equipment supply and installation and new sewer line construction
 - Component B: Institutional, organisational and human resource development support to Darkhan-uum aimag and Us Suvag JSC
 - Component C comprising: C1 – Incremental Assistance to Project Management Unit; C2 - Incremental Assistance to Project Management Unit; C3 – Consultancy for preparation of employers requirements and contract documentation and assistance in tender of DS&I contract for Component A1; and C4-Project management and implementation support services.
43. A piggy-back technical assistance will further support capacity development on integrated urban planning, industrial cluster planning, and improvement of water use efficiency.

D. Terms of Reference for the Services

44. The present call for expressions of interest refers to assistance in the preparation of contract documentation for a Design, Supply, Install and Operational Assistance contract package for the new Darkhan wastewater treatment plant (WWTP) and support in the procurement and contracting process. The services will be provided under the guidance of the PMU and in coordination with the executing agency (MCUD), and the PMU.
45. The main output from these consulting services will be the successful execution of a design, supply and install, and operational assistance (DS&I&OA) contract between the Government and a qualified contractor and supplier. The specific outputs from the assistance will be: (i) preparation and approval by the client of a Design Report confirming the scope of Component A1; (ii) the preparation and approval of contract documentation for the DS&I&OA contract tender; (iii) the management of the tender process; (iv) the evaluation of bids; (v) recommendation for award and negotiation with the contractor as necessary; and (vi) the award of contract.
46. The consulting services for assistance in the design, supply and install, and operational assistance contracting for Component A1 will be recruited in accordance with ADB's Guidelines on the Use of Consultants (2013, as amended from time to time). The PMU, on behalf of MCUD, will be responsible for engaging consultants through quality- and cost-based selection. Under the consulting services contract, the consultant's activities will focus on:

1. Preparation of a Brief Design Report

47. The consultants will prepare a brief design project report for approval by the client, to include, but not necessarily be limited to:
- xiv. Review all prior documentation on the proposed WWTP contained in the PPTA reports and loan processing documentation.
 - xv. Review the location of proposed works and the condition of the site and existing infrastructure including underground utilities, infrastructure and facilities (both on- and off-site) and assist the PMU and PIU in reconfirming the design scope and approach.
 - xvi. Ensure that the scope of the WWTP project is within that proposed at feasibility stage and where the scope is altered in any way, fully justify the alteration and assess any financial implications of the change.
 - xvii. In close collaboration with the PMU, PIU and Darkhan-Uul aimag and Us Suvag, prepare a brief Design Project Report (DPR) setting out the approach to be adopted in the design, construction, equipment supply, installation and commissioning, and in the contractor providing early operational assistance for the new WWTP.
 - xviii. Include in the DPR an overview of employer's requirements, reference designs and performance specifications for the project. This will involve compiling and assessing information provided under the project preparation technical assistance and feasibility

studies and arranging it in the draft DPR to reconfirm the technical and financial viability of the approach.

- xix. Submit the DPR to the PMU and PIU for no-objection, discuss as necessary and incorporate any changes required.

2. Preparation of Employers Requirements and Contract Documentation

48. The consultant will assist the PMU and PIU in preparation of employers requirements and contract documentation, including, but not necessarily limited to, the following tasks:
 - v. Based on the approved DPR, finalize the following documents, plus any other documentation required to adequately define: (i) the project elements and (ii) project performance. The contract documentation must ensure that potential tenderers have an adequate and uniform understanding of requirements and can thus tender on a fair and equivalent basis. Documents should include: (i) the information memorandum; (ii) employers requirements; (iii) reference designs; and (iv) performance specifications for the WWTP.
 - vi. Based on ADB's standard contract documentation for Design, Supply and Installation of Plant, and with the addition of the operational assistance element, prepare all contract documents required for the tender process, and to enable a tenderer to submit a bid and effectively design and construct the project, supply and install the equipment, and provide operational assistance to the project.
 - vii. Identify and include any necessary site investigations and soil surveys, and any other provisions likely to be required by the contractor to either enable the works to be completed or allow approval by Government of designs or other intermediate products of the design, supply and install process.
 - viii. Prepare and agree with the client group the tender evaluation criteria to be adopted, including parameters and weightings.
 - ix. Prepare the final bid package and submit to the PMU for approval (tender documents for ICB should follow both ADB procurement guidelines and the Public Procurement Law of Mongolia).
 - x. Assist the PMU in preparation of tender notice and advertisements for tender.
 - xi. Assist the PMU in the preparation of tender administration and evaluation procedures.

3. Assistance with the Tender and Award Process

49. The consultants will assist the PMU in the tender and award of Component A1 involving, but not necessarily limited to, the following tasks:
 - i. Assist the PMU in issuing advertisement for open tender.
 - ii. Assist the PMU in arranging and conducting the pre-tender meeting and site visits as necessary.
 - iii. Assist the PMU in dealing with, and responding to, questions from potential bidders, and ensuring that correct procedures are followed on communications with prospective bidders during the tender period.
 - iv. Assist the PMU with: (i) receipt of bids; (ii) evaluation of bids in strict accordance with the agreed evaluation criteria; and (iii) clarification of any bid provisions, offer of alternative or missing items, caveats, exclusions etc. where necessary.
 - v. Assist PIU with finalising bid evaluation report, and in preparation of recommendation to award and submission to PMU and/or Steering Committee.

- vi. Assist PMU with any contract negotiations required and with agreement and award of contract.
- vii. Design and agree with PMU and PIU the supervision and third party quality assurance program for the works included under Package C4, and assist the PMU as necessary in contractor mobilization.

E. Finance

50. The total investment requirement for the project is estimated at \$20.65 million. ADB will finance \$18.5 million, of which \$8.5 million will be financed from ordinary capital resources and \$10.0 million from Asian Development Fund resources. MCUD and Darkhan-Uul aimag will provide counterpart funding of \$2.15 million to finance taxes and duties, land acquisition, resettlement, and other miscellaneous costs.

F. Project Implementation Arrangements

51. The executing agency of the project is MCUD. MCUD's office of the Director General of the Housing and Public Utilities Policy Implementation and Coordination Department will be responsible for coordinating program implementation. A PMU will be established under the Project Director (who will be the Director General) which will be responsible for overall management of the project. A Project Steering Committee, chaired by the State Secretary of MCUD and comprising officials from both Sate and Darkhn Uul aimag governments and representatives of civil society and the private sector, has been established to provide strategic and policy guidance.
52. The project will be implemented by Darkan-Uul aimag and Us Suvag JSC. The implementing agencies will establish a Project Implementation Unit (PIU) in Darkhan which will be headed by the PMU Project Director. Implementation will be supported by a Darkhan Project Steering Committee and Project Working group comprising members from local government, Us Suvag and civil society (already established). The project will be implemented from July 2014 to June 2017.
53. The PMU will be staffed with: (i) a Program Director (part time), (ii) a Project Co-ordinator (full time – a civil engineer) (iii) a procurement officer, (iv) a financial officer and project accountant; and (iv) full-time administrative support. The PIU will be staffed by (i) the Program Director (part time), (ii) a Project Co-ordinator (full time – a wastewater engineer) (iii) a procurement officer (part time), (iv) a financial officer and project accountant (part time); (iv) a supervision engineer; (v) an environmental officer; (vi) a social development officer; and (vii) full-time administrative support. The PMU will be in charge of the overall management of the project, and the PIU will be responsible for project implementation, both with the support of consultants.

G. Consulting Services

54. Services to provide assistance in the preparation of contract documentation for a Design, Supply, Install and Operational Assistance contract package for the new WWTP, and support in the procurement process will require 25 person-months of consultants of which 10 person-months are international and 15 person-months are of national consultants and advisers. The consultants will have expertise in: (i) the design and performance specification of wastewater treatment plants; (ii) preparation of contract documentation adopting the design, supply and install modality of procurement under FIDIC forms of contract; (iii) advisory services on complex procurement packages; and (iv) operational support for WWTPs. As necessary and appropriate, all team members are expected to act as resource persons for the training and development activities. International and national positions required are set out as Table 1. The duration of the assignment is estimated at up to 9 months between mid-2014 and early-2015.

Table 1: Personnel Requirements for Project Management and Implementation Support Services

| Description | International | National |
|---|----------------------|-----------------|
| Team Leader & Wastewater Treatment Plant Design Specialists | 3 | 3 |
| Wastewater Treatment Equipment Specialist | 2 | 3 |
| Procurement and Contract Documentation Specialist | 3 | 3 |
| Other specialists as required | 2 | 6 |
| Total | 10 | 15 |

55. The consulting firm will work under the PMU and in cooperation and coordination with the executing and implementing agencies, PIU all the related agencies and departments from the state and aimag governments and Us Suvag JSC. Under the supervision and the leadership of the PMU, the Consulting firm will also closely work and coordinate with the following other loan consulting services packages to deliver an integrated wastewater service and wastewater treatment plant design, which takes into consideration all related institutional, local development and community-level impacts:

- Consultants under Part B of the project, assisting in institutional, organisational and human resource development and capacity building for Darkhan-uul aimag government and Us Suvag JSC; and
- Consultants under Part C4 of the project, providing project management and implementation support to the PMU and PIU and the executing and implementing agencies.

H. Contacts and Links

Responsible ADB Officer: Stefan Rau
 Responsible ADB Department: East Asia Regional Department
 Responsible ADB Division: Urban and Social Sectors Division (EASS)
 Executing Agency: Ministry of Construction and Urban Development

Table R.2: Institutional, Organisational and Human Resource Development and Capacity Building: Indicative List of Training Programs and Study Tour.

| Training Program | Scope of Training | Trainer | Trainee |
|---|--|---------------------------------------|---------------------|
| Service and Utility Delivery: Institutional Options | <ul style="list-style-type: none"> • Service Delivery Objectives • Service delivery institutional models • Examples from international experience • The regional and Mongolian context • Separation of regulatory, strategic planning and service delivery roles • Potential role for the aimag government, service delivery entity, consumer and private sector. | Organisational Development Consultant | MCUD, DAG, Us Suvag |
| Utility Company Business and Change Management Plan Preparation | <ul style="list-style-type: none"> • Business plan purpose and structure • Institutional and financial objectives • Change management challenges – corporate governance and management structure, finance, and human resources issues • Transition to a customer-facing organisation • Promoting water supply and sanitation services in ger areas. | Organisational Development Consultant | MCUD, DAG, Us Suvag |
| Water Supply and Wastewater Management Utilities Planning | <ul style="list-style-type: none"> • Urban development and service demand projections • Levels of service and affordability issues • Service supply typology and service delivery innovation • Elements of the plan and sequencing of implementation. • The project cycle and achieving “value for money” in infrastructure investment. | Organisational Development Consultant | MCUD, DAG, Us Suvag |
| Utility Services Financial Management and Cost Recovery | <ul style="list-style-type: none"> • Financial management of utility companies • Affordability, cost recovery and tariff regimes and options • Revenue enhancement, debt management and expenditure control • Financing options for capital improvements. | Organisational Development Consultant | MCUD, DAG, Us Suvag |
| Contracting Out: Management, Procurement and Financing Options and Modalities | <ul style="list-style-type: none"> • Roles for the private sector – form service contracts to divestiture; benefits and risks • Legal and regulatory environment for PPPs in Mongolia • Management, operational and financing options involving the private sector in the Mongolian context. | Organisational Development Consultant | MCUD, DAG, Us Suvag |
| Operation and Maintenance of Water Supply and Wastewater Management Assets | <ul style="list-style-type: none"> • Operational requirements of systems and facilities – the financial & economic case for asset protection • Definition of preventive, routine and periodic maintenance • Lifetime pricing and assessment of economic lifetime of assets • Facilities management • Maintenance planning and resource allocation • Emergency planning and response • A role for the community – with a focus on decentralised and household level systems. | Organisational Development Consultant | MCUD, Us Suvag |

| Training Program | Scope of Training | Trainer | Trainee |
|---|---|--|----------------------------|
| System operation and investment prioritisation | <ul style="list-style-type: none"> • Problem of non-revenue water and its reduction • Prioritising network and facilities replacement and rehabilitation needs • Strategy for extension of networks into ger areas • Innovate techniques for defraying consumer installation costs. | | |
| Environmental and Social Considerations | <ul style="list-style-type: none"> • The importance of environmental, social and safety considerations in investment planning and execution • GoM environmental and social policies, legislation regulations and requirements • Involving the community and other stakeholders in project planning execution and operation. | Organisational Development Consultant | DAG, Us Suvag, Contractors |
| Study tour to examples of efficient WSS institutions in North East Asia (and North America) | <ul style="list-style-type: none"> • Study tour to help understand options for efficient WSS service delivery in small cities • Benefit from understanding experiences of other WSS utilities in similar socio-economic and geographical circumstances (focus on Northern China, Russian Siberia, Northern and Eastern Europe [ex-centrally planned economies] and North America - with assistance of Fairbanks Water Supply and Sewerage Utility Company in arranging and financing the trip to North America) | Organisational Development Consultant; Fairbanks Water Supply and Sewerage Utility Company | MCUD, DAG, Us Suvag |
| Workshops on Key Institutional Development, Change Management and Human Resource Issues | <ul style="list-style-type: none"> • Workshops on key aspects of the institutional development and reform process as necessary and from time to time to include: <ul style="list-style-type: none"> ○ Community involvement in WSS strategies, implementation and management ○ Opportunities for NGO and CBO involvement in water supply and sanitation in ger areas ○ Involving the public – getting the most from public meetings and participation. | Organisational Development Consultant | MCUD, DAG, Us Suvag, |

Acronyms: ADB = Asian Development Bank; DAG = Darkhan Aimag Government; GoM = Government of Mongolia; MCUD = Ministry for Construction and Urban Development; WSS = Water Supply and Sanitation.

Table R.3: Project Management and Implementation Support and Monitoring and Evaluation: Indicative List of Training Programs.

| Training Program | Scope of Training | Trainer | Trainee |
|---|---|------------|--|
| ADB disbursement procedures and financial management | <ul style="list-style-type: none"> • ADB loan disbursement procedures • Roles and responsibilities of stakeholders • Flow of funds and utilisation of loan proceeds • Risks of disbursement delays | MNRM, PMIS | PMU, PIU, MCUD, DAG, Us Suvag |
| Project Financial Management and Financial Audit System | <ul style="list-style-type: none"> • Basic financial management of project and management and implementing agencies. • Annual financial audit requirements – ADB and GoM requirements. | PMIS | PMU, PIU, MCUD, Contractors |
| Procurement and Contract Management | <ul style="list-style-type: none"> • ADB procurement process • Tender document preparation • ADB tender evaluation guidelines • Risks and implications of improper tendering and corrective measures • Variation orders and contract management | MNRM, PMIS | PMU, PIU, MCUD, DAG, Us Suvag |
| Corruption Risks and Anticorruption Measures | <ul style="list-style-type: none"> • Definition, nature and types of corruption • Risks of corruption in project implementation • What to do in case that corruption is identified and mitigation measures • Case studies and international best practice | MNRM, PMIS | PMU, PIU, MCUD, DAG, Us Suvag |
| Construction Management | <ul style="list-style-type: none"> • Construction management: roles of client's representative, resident engineer, site engineers, inspectors etc. • Site supervision, measurement, running bill preparation and checking • Quality control • Quality assurance and third party verification. | PMIS | PMU, PIU, MCUD, DAG, Us Suvag, Contractors |
| Wastewater Treatment Plant Technology | <ul style="list-style-type: none"> • Wastewater treatment technology options and selection • Structural rehabilitation • Wastewater management equipment retrofitting • Effluent polishing and reuse • Sludge treatment and management. | PMIS | PMU, PIU, MCUD, DAG, Us Suvag |
| WASH and Urban Environmental Public Awareness | <ul style="list-style-type: none"> • WASH awareness – water cycle, SWM and personal hygiene • Urban environmental issues and awareness • Programs and initiatives to promote behavioural change with respect to hygiene, sanitation, solid waste disposal and management at household level for apartment and ger area households. | PMIS | PMU, PIU, MCUD, DAG, Us Suvag |
| Sanitation in Ger Areas: Typologies and Solutions | <ul style="list-style-type: none"> • Water supply and sanitation options in ger areas • On-plot sanitation options & the ecosan toilet | PMIS | PMU, PIU, MCUD, DAG, Us Suvag |

| Training Program | Scope of Training | Trainer | Trainee |
|---|--|---------|--|
| | <ul style="list-style-type: none"> • A framework and tool for technology selection – the ger area WSS model¹² • Cost recovery challenges financing options • Role for the community, NGOs and the private sector in ger area sanitation. | | |
| Industrial Effluent Management | <ul style="list-style-type: none"> • Industrial effluent characterisation and risks • Framework for industrial effluent pre-treatment & the polluter pays principle • Effluent management responsibilities • Effluent discharge monitoring and role for utility company • Emergency response | PMIS | PIU, MCUD, DAG, Us Suvag |
| Implementation of EMP and other ADB & GoM environmental safeguards requirements | <ul style="list-style-type: none"> • ADB environmental requirements • GoM environmental policies, legislation and regulation • EMP and environmental monitoring: execution requirements & responsibilities, inspection and reporting, feedback & adjustment • GRM structure, procedures, responsibilities and timeframes • EHS requirements and enforcement | PMIS | PMU, PIU, MEGD, DAG, Us Suvag, Contractors |
| Implementation of LARP, GAP and SAP. | <ul style="list-style-type: none"> • ADB and GoM social, resettlement and compensation requirements • Progress and compliance monitoring and reporting • Grievance procedures and corrective actions | PMIS | PMU, PIU, MCUD, DAG, Us Suvag |
| Project Benefit Monitoring and Evaluation | <ul style="list-style-type: none"> • Project design and monitoring framework • Roles and responsibilities for implementation of project monitoring and evaluation system • Mechanisms for measurement of project outcomes and impacts • Beneficiary surveys on public perceptions of infrastructure and service delivery | PMIS | PMU, PIUs, MCUD, DAG, Us Suvag |
| Workshops on Key Project Issues | <ul style="list-style-type: none"> • Workshops on project progress and execution and implementation issues – as necessary. | PMIS | PMU, PIU, MEGD, DAG, Us Suvag, Contractors |

Acronyms: ADB = Asian Development Bank; DAG = Darkhan Aimag Government; EMP = Environmental Management Plan; GAP = Gender Action Plan; GoM = Government of Mongolia; LARP = Land Acquisition and Resettlement Plan; MEGD = Ministry of Environment and Green Development; MCUD = Ministry for Construction and Urban Development; MNRM = Mongolia National Resident Mission; PIU = Project Implementation Unit; PMIS = Project Management and Implementation Support Consultants; PMU = Project Management Unit; SAP = Social Action Plan.

¹² Model developed under CDIA funded Water Supply and Sanitation Infrastructure Investment Program for Darkhan, CDIA, 2014.

APPENDIX S: LIFETIME COST COMPARISON FOR WWTP OPTIONS.**Table S1.1. Indicative Investment Cost by Expenditure Category – Option 1**

| Category/Item | Civil Works | | Equipment | | Institutional Development | | Project Management Support | | Financing Charges | | Foreign % Total | Foreign incl. Tax | Local incl. Tax | Total incl. Tax | Taxes & Duties | Total excl. Tax |
|--|--------------|-------------|--------------|-------------|---------------------------|-------------|----------------------------|-------------|-------------------|-------------|-----------------|-------------------|-----------------|-----------------|----------------|-----------------|
| | Amount | Category | Amount | Category | Amount | Category % | Amount | Category % | Amount | Category | | | | | | |
| A.1. Wastewater Treatment Plant | | | | | | | | | | | | | | | | |
| Site Preparation | 0.019 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.019 | 0.019 | 0.002 | 0.016 |
| Earthworks | 0.017 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.017 | 0.017 | 0.002 | 0.015 |
| Overall construction work | 1.557 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 1.557 | 1.557 | 0.203 | 1.354 |
| Main treatment plant equipment | - | 0% | 7.045 | 115% | - | 0% | - | 0% | - | 0% | 87% | 6.126 | 0.919 | 7.045 | 0.919 | 6.126 |
| Electrical equipment & control panels | - | 0% | 0.355 | 115% | - | 0% | - | 0% | - | 0% | 87% | 0.309 | 0.046 | 0.355 | 0.046 | 0.309 |
| Automatic control of sewage disposal system | - | 0% | 0.209 | 115% | - | 0% | - | 0% | - | 0% | 87% | 0.182 | 0.027 | 0.209 | 0.027 | 0.182 |
| Interconnecting pipe works | 0.125 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.125 | 0.125 | 0.016 | 0.109 |
| Supply of industrial sewage to the sewage PS | 0.572 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.572 | 0.572 | 0.075 | 0.497 |
| Sewer pipe near 2nd Center of Health Protection | 0.037 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.037 | 0.037 | 0.005 | 0.032 |
| Input pipe to the sewage PS No. 2 | 0.023 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.023 | 0.023 | 0.003 | 0.020 |
| Centralized heat supply of sewage treatment plants | 0.720 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.720 | 0.720 | 0.094 | 0.626 |
| Subtotal (A.1) | 3.070 | 46% | 7.609 | 115% | - | 0% | - | 0% | - | 0% | 62% | 6.616 | 4.062 | 10.679 | 1.393 | 9.286 |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | | | | | | | | | | |
| Reconstruction of the sewage PS South industrial zone | 0.438 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.438 | 0.438 | 0.057 | 0.381 |
| Reconstruction of the main PS No. 1 | 0.438 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.438 | 0.438 | 0.057 | 0.381 |
| Reconstruction of intermediate PS No. 2 | 0.438 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.438 | 0.438 | 0.057 | 0.381 |
| Partial renovation of the sewage PS South industrial zone | 0.033 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.033 | 0.033 | 0.004 | 0.029 |
| Subtotal (A.2) | 1.349 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 1.349 | 1.349 | 0.176 | 1.173 |
| B. Institutional Reform & Capacity Development | | | | | | | | | | | | | | | | |
| Institutional development & capacity building, Other items | - | 0% | - | 0% | 1.405 | 0% | - | 0% | - | 0% | 0% | - | 1.405 | 1.405 | 0.043 | 1.361 |
| Subtotal (B) | - | 0% | - | 0% | 1.405 | 0% | - | 0% | - | 0% | 0% | - | 1.405 | 1.405 | 0.043 | 1.361 |
| C. Project Management Support | | | | | | | | | | | | | | | | |
| Start-up adjustment works | - | 0% | - | 0% | - | 0% | 0.140 | 0% | - | 0% | 0% | - | 0.140 | 0.140 | 0.004 | 0.136 |
| Project management & supervision | - | 0% | - | 0% | - | 0% | 0.726 | 111% | - | 0% | 90% | 0.653 | 0.073 | 0.726 | - | 0.726 |
| Subtotal (C) | - | 0% | - | 0% | - | 0% | 0.867 | 133% | - | 0% | 75% | 0.653 | 0.213 | 0.867 | 0.004 | 0.862 |
| Total Base Cost (A+B+C) | 4.418 | 61% | 7.609 | 105% | 1.405 | 19% | 0.867 | 12% | - | 0% | 51% | 7.270 | 7.028 | 14.298 | 1.616 | 12.682 |
| D. Contingencies | | | | | | | | | | | | | | | | |
| Physical | 0.663 | 182% | 0.480 | 132% | 0.211 | 58% | 0.065 | 18% | - | 0% | 26% | 0.363 | 1.054 | 1.418 | 0.086 | 1.332 |
| Price | 1.662 | 1845% | 0.415 | 460% | 0.349 | 387% | 0.143 | 159% | - | 0% | 4% | 0.090 | 2.479 | 2.569 | 0.190 | 2.379 |
| Subtotal (D) | 2.325 | 513% | 0.894 | 197% | 0.560 | 123% | 0.208 | 46% | - | 0% | 11% | 0.454 | 3.533 | 3.986 | 0.276 | 3.711 |
| E. Financial Charges During Implementation | | | | | | | | | | | | | | | | |
| Interest Charges and Fees | - | 0% | - | 0% | - | 0% | - | 0% | 0.501 | 100% | 100% | 0.501 | - | 0.501 | - | 0.501 |
| Subtotal (E) | - | 0% | - | 0% | - | 0% | - | 0% | 0.501 | 100% | 100% | 0.501 | - | 0.501 | - | 0.501 |
| Total Investment Cost (A+B+C+D+E) | 6.743 | 82% | 8.503 | 103% | 1.964 | 24% | 1.074 | 13% | 0.501 | 6% | 44% | 8.224 | 10.561 | 18.785 | 1.892 | 16.893 |

Table S1.2. Indicative Financing Plan - Option 1

| Financing Plan by Foreign and Local Cost Components | | | | | | | |
|---|------------------|----------------|----------------------|------------------|------------------|--------------------|----------------|
| Category/Item | Total ADB & GOM | | | ADB | | | GOM |
| | Foreign Exchange | Local Currency | Total | Foreign Exchange | Local Currency | Total | Aimag/Us Suvag |
| A.1. Wastewater Treatment Plant | | | | | | | |
| Civil Works | - | 2.669 | 2.669 | - | 1.193 | 1.193 | 1.476 |
| Equipment | 5.753 | 0.863 | 6.616 | 5.753 | - | 5.753 | 0.863 |
| Resettlement | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - |
| Taxes and Duties | - | 1.393 | 1.393 | - | - | - | 1.393 |
| Subtotal (A.1) | 5.753 | 4.925 | 10.679 | 5.753 | 1.193 | 6.946 | 3.732 |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | |
| Civil Works | - | 1.173 | 1.173 | - | - | - | 1.173 |
| Equipment | - | - | - | - | - | - | - |
| Resettlement | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - |
| Taxes and Duties | - | 0.176 | 0.176 | - | - | - | 0.176 |
| Subtotal (A.2) | - | 1.349 | 1.349 | - | - | - | 1.349 |
| B. Institutional Reform & Capacity Development | | | | | | | |
| Capacity Building (MCUD, Aimag/Us Suvag) | - | 1.361 | 1.361 | - | 1.073 | 1.073 | 0.289 |
| Taxes and Duties | - | 0.043 | 0.043 | - | - | - | 0.043 |
| Subtotal (B) | - | 1.405 | 1.405 | - | 1.073 | 1.073 | 0.332 |
| C. Project Management Support | | | | | | | |
| Design and Supervision, PIU Establishment, Tendering | 0.653 | 0.209 | 0.862 | 0.653 | 0.180 | 0.833 | 0.029 |
| Taxes and Duties | - | 0.004 | 0.004 | - | - | - | 0.004 |
| Subtotal (C) | 0.653 | 0.213 | 0.867 | 0.653 | 0.180 | 0.833 | 0.033 |
| Total Base Cost (A+B+C) | 6.407 | 7.891 | 14.298 | 6.407 | 2.446 | 8.852 | 5.446 |
| D. Contingencies | - | 0.863 | 0.863 | - | - | - | - |
| Physical | 0.320 | 1.097 | 1.418 | 0.320 | 0.367 | 0.687 | 0.731 |
| Price | 0.080 | 2.489 | 2.569 | 0.080 | 0.940 | 1.020 | 1.549 |
| Subtotal (D) | 0.400 | 3.586 | 3.986 | 0.400 | 1.307 | 1.707 | 2.280 |
| E. Financial Charges During Implementation | | | | | | | |
| Interest Charges and Fees | 0.501 | - | 0.501 | 0.501 | - | 0.501 | - |
| Subtotal (E) | 0.501 | - | 0.501 | 0.501 | - | 0.501 | - |
| Total Investment Cost (A+B+C+D+E) | 7.308 | 11.478 | 18.785 | 7.308 | 3.752 | 11.060 | 7.725 |
| Financing Plan by Cost Category | | | | | | | |
| Category/Item | ADB Loan | | State/Aimag/Us Suvag | | Total Investment | % Total Investment | |
| | Amount | Category % | Amount | Category % | | | |
| A.1. Wastewater Treatment Plant | | | | | | | |
| Civil Works | 1.193 | 45% | 1.476 | 55% | 2.669 | 14% | |
| Equipment | 5.753 | 87% | 0.863 | 13% | 6.616 | 35% | |
| Resettlement | - | 0% | - | 0% | - | 0% | |
| Environmental Monitoring | - | 0% | - | 0% | - | 0% | |
| Taxes and Duties | - | 0% | 1.393 | 100% | 1.393 | 7% | |
| Subtotal (A.1) | 6.946 | 65% | 3.732 | 35% | 10.679 | 57% | |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | |
| Civil Works | - | 0% | 1.173 | 100% | 1.173 | 6% | |
| Equipment | - | 0% | - | 0% | - | 0% | |
| Resettlement | - | 0% | - | 0% | - | 0% | |
| Environmental Monitoring | - | 0% | - | 0% | - | 0% | |
| Taxes and Duties | - | 0% | 0.176 | 100% | 0.176 | 1% | |
| Subtotal (A.2) | - | 0% | 1.349 | 100% | 1.349 | 7% | |
| B. Institutional Reform & Capacity Development | | | | | | | |
| Capacity Building (MCUD, Aimag/Us Suvag) | 1.073 | 79% | 0.289 | 21% | 1.361 | 7% | |
| Taxes and Duties | - | 0% | 0.043 | 100% | 0.043 | 0% | |
| Subtotal (B) | 1.073 | 76% | 0.332 | 24% | 1.405 | 7% | |
| C. Project Management Support | | | | | | | |
| Design and Supervision, PIU Establishment, Tendering | 0.833 | 97% | 0.029 | 3% | 0.862 | 5% | |
| Taxes and Duties | - | 0% | 0.004 | 100% | 0.004 | 0% | |
| Subtotal (C) | 0.833 | 96% | 0.033 | 4% | 0.867 | 5% | |
| Total Base Cost (A+B+C) | 8.852 | 62% | 5.446 | 38% | 14.298 | 76% | |
| D. Contingencies | | | | | | | |
| Physical | 0.687 | 48% | 0.731 | 52% | 1.418 | 8% | |
| Price | 1.020 | 40% | 1.549 | 60% | 2.569 | 14% | |
| Subtotal (D) | 1.707 | 43% | 2.280 | 57% | 3.986 | 21% | |
| E. Financial Charges During Implementation | | | | | | | |
| Interest Charges and Fees | 0.501 | 100% | - | 0% | 0.501 | 3% | |
| Subtotal (E) | 0.501 | 100% | - | 0% | 0.501 | 3% | |
| Total Investment Cost (A+B+C+D+E) | 11.060 | 59% | 7.725 | 41% | 18.785 | 100% | - |

Table S1.3. Indicative Annual Investment Plan – Option 1

| Category/Item | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Total Cost |
|---|--------------|---------------|--------------|--------------|--------------|--------------|----------|----------|---------------|
| A.1. Wastewater Treatment Plant | | | | | | | | | |
| Civil Works | 0.031 | 1.175 | 1.463 | - | - | - | - | - | 2.669 |
| Equipment | - | 6.126 | - | 0.490 | - | - | - | - | 6.616 |
| Resettlement | - | - | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - | - | - |
| Taxes and Duties | 0.005 | 1.095 | 0.219 | 0.074 | - | - | - | - | 1.393 |
| Subtotal (A.1) | 0.035 | 8.397 | 1.683 | 0.564 | - | - | - | - | 10.679 |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | | | |
| Civil Works | - | 1.173 | - | - | - | - | - | - | 1.173 |
| Equipment | - | - | - | - | - | - | - | - | - |
| Resettlement | - | - | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - | - | - |
| Taxes and Duties | - | 0.176 | - | - | - | - | - | - | 0.176 |
| Subtotal (A.2) | - | 1.349 | - | - | - | - | - | - | 1.349 |
| B. Institutional Reform & Capacity Development | | | | | | | | | |
| Capacity Building (MCUD, Aimag/Us Suvag) | 0.545 | 0.817 | - | - | - | - | - | - | 1.361 |
| Taxes and Duties | 0.017 | 0.026 | - | - | - | - | - | - | 0.043 |
| Subtotal (B) | 0.562 | 0.843 | - | - | - | - | - | - | 1.405 |
| C. Project Management Support | | | | | | | | | |
| Design and Supervision, PIU Establishment, Tendering | 0.036 | 0.036 | 0.327 | 0.463 | - | - | - | - | 0.862 |
| Taxes and Duties | - | - | - | 0.004 | - | - | - | - | 0.004 |
| Subtotal (C) | 0.036 | 0.036 | 0.327 | 0.467 | - | - | - | - | 0.867 |
| Total Base Cost (A+B+C) | 0.634 | 10.625 | 2.009 | 1.031 | - | - | - | - | 14.298 |
| D. Contingencies | | | | | | | | | |
| Physical | 0.092 | 0.978 | 0.272 | 0.076 | - | - | - | - | 1.418 |
| Price | 0.091 | 1.468 | 0.831 | 0.179 | - | - | - | - | 2.569 |
| Subtotal (D) | 0.183 | 2.446 | 1.103 | 0.255 | - | - | - | - | 3.986 |
| E. Financial Charges During Implementation | | | | | | | | | |
| Interest Charges and Fees | 0.006 | 0.073 | 0.096 | 0.107 | 0.108 | 0.110 | - | - | 0.501 |
| Subtotal (E) | 0.006 | 0.073 | 0.096 | 0.107 | 0.108 | 0.110 | - | - | 0.501 |
| Total Investment Cost (A+B+C+D+E) | 0.823 | 13.143 | 3.208 | 1.393 | 0.108 | 0.110 | - | - | 18.785 |

Table S1.4. Indicative Investment Plan and Debt Service Schedule – Option 1

| INVESTMENT PLAN - SLA/OLA Aimag & Us Suvag PUSO | | | | | | | | | | | | | | | |
|---|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|
| Particulars | | %Total | Total | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
| | | | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 |
| Civil Works (CW) | USD mill | 24.2% | 4.418 | 0.035 | 2.700 | 1.683 | 0.000 | 0.000 | | | | | | | |
| Materials & Equipment (M&E) | USD mill | 41.6% | 7.609 | 0.000 | 7.045 | 0.000 | 0.564 | 0.000 | | | | | | | |
| Base Cost A 1 & A.2 | USD mill | 65.8% | 12.027 | 0.035 | 9.745 | 1.683 | 0.564 | 0.000 | | | | | | | |
| Institutional & Capacity Development | USD mill | 7.7% | 1.405 | 0.562 | 0.843 | 0.000 | 0.000 | 0.000 | | | | | | | |
| Project Management Support | USD mill | 4.7% | 0.867 | 0.036 | 0.036 | 0.327 | 0.467 | 0.000 | | | | | | | |
| Subtotal B & C | USD mill | 12.4% | 2.271 | 0.598 | 0.879 | 0.327 | 0.467 | 0.000 | | | | | | | |
| Physical Contingency | USD mill | 7.8% | 1.418 | 0.092 | 0.978 | 0.272 | 0.076 | 0.000 | | | | | | | |
| Price Contingency | USD mill | 14.0% | 2.569 | 0.091 | 1.468 | 0.831 | 0.179 | 0.000 | | | | | | | |
| Project Cost | USD mill | 100.0% | 18.285 | 0.816 | 13.070 | 3.112 | 1.286 | 0.000 | | | | | | | |
| Government | USD mill | 42.3% | 7.725 | 0.187 | 6.413 | 0.864 | 0.261 | 0.000 | | | | | | | |
| ADB before Financing Charges | USD mill | 57.7% | 10.559 | 0.629 | 6.657 | 2.248 | 1.025 | 0.000 | | | | | | | |
| Total Borrowings - OLA | USD mill | 58.9% | 11.060 | 0.635 | 6.730 | 2.344 | 1.132 | 0.108 | 0.110 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Financing Charges, IDC | USD mill | 2.7% | 0.501 | 0.006 | 0.073 | 0.096 | 0.107 | 0.108 | 0.110 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Disbursements/Additions | USD mill | 56.2% | 10.559 | 0.629 | 6.657 | 2.248 | 1.025 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total Investment Cost | USD mill | 100.0% | 18.785 | 0.823 | 13.143 | 3.208 | 1.393 | 0.108 | 0.110 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| DEBT SERVICE SCHEDULE - MOF & Darkhan Uul Aimag/Us Suvag PUSO SLA/OLA | | | | | | | | | | | | | | | |
| Particulars | | %Total | Total | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
| | | | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 |
| | | | | IDC 1 | IDC 2 | IDC 3 | IDC 4 | IDC 5 | IDC 6 | PMT 1 | PMT 2 | PMT 3 | PMT 4 | PMT 5 | PMT 6 |
| Disbursement | USD mill | 95% | 10.559 | 0.629 | 6.657 | 2.248 | 1.025 | 0.000 | 0.000 | | | | | | |
| IDC | USD mill | 5% | 0.501 | 0.006 | 0.073 | 0.096 | 0.107 | 0.108 | 0.110 | | | | | | |
| Operational interest | USD mill | | | | | | | | | 0.221 | 0.212 | 0.202 | 0.192 | 0.181 | 0.171 |
| Principal repayment | USD mill | 100% | 11.060 | | | | | | | 0.484 | 0.494 | 0.504 | 0.514 | 0.524 | 0.535 |
| Debt Service | USD mill | | | | | | | | | 0.705 | 0.705 | 0.705 | 0.705 | 0.705 | 0.705 |
| Loan outstanding | USD mill | | | 0.635 | 7.366 | 9.710 | 10.842 | 10.950 | 11.060 | 10.576 | 10.082 | 9.578 | 9.064 | 8.540 | 8.005 |

Table S2.1. Indicative Investment Cost by Expenditure Category – Option 2

| Category/Item | Civil Works | | Equipment | | Institutional Development | | Project Management Support | | Financing Charges | | Foreign % Total | Foreign incl. Tax | Local incl. Tax | Total incl. Tax | Taxes & Duties | Total excl. Tax |
|--|---------------|--------------|--------------|-------------|---------------------------|-------------|----------------------------|-------------|-------------------|-------------|-----------------|-------------------|-----------------|-----------------|----------------|-----------------|
| | Amount | Category | Amount | Category | Amount | Category % | Amount | Category % | Amount | Category | | | | | | |
| A.1. Wastewater Treatment Plant | | | | | | | | | | | | | | | | |
| Site Preparation | 0.019 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.019 | 0.019 | 0.002 | 0.016 |
| Earthworks | 0.526 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.526 | 0.526 | 0.069 | 0.457 |
| Overall construction work | 8.308 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 8.308 | 8.308 | 1.084 | 7.225 |
| Main treatment plant equipment | - | 0% | 6.784 | 115% | - | 0% | - | 0% | - | 0% | 87% | 5.899 | 0.885 | 6.784 | 0.885 | 5.899 |
| Electrical equipment & control panels | - | 0% | 0.438 | 115% | - | 0% | - | 0% | - | 0% | 87% | 0.381 | 0.057 | 0.438 | 0.057 | 0.381 |
| Automatic control of sewage disposal system | - | 0% | 0.209 | 115% | - | 0% | - | 0% | - | 0% | 87% | 0.182 | 0.027 | 0.209 | 0.027 | 0.182 |
| Interconnecting pipe works | 0.626 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.626 | 0.626 | 0.082 | 0.545 |
| Supply of industrial sewage to the sewage PS | 0.572 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.572 | 0.572 | 0.075 | 0.497 |
| Sewer pipe near 2nd Center of Health Protection | 0.037 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.037 | 0.037 | 0.005 | 0.032 |
| Input pipe to the sewage PS No. 2 | 0.023 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.023 | 0.023 | 0.003 | 0.020 |
| Centralized heat supply of sewage treatment plants | 0.720 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.720 | 0.720 | 0.094 | 0.626 |
| Subtotal (A.1) | 10.831 | 168% | 7.431 | 115% | - | 0% | - | 0% | - | 0% | 35% | 6.462 | 11.800 | 18.262 | 2.382 | 15.880 |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | | | | | | | | | | |
| Reconstruction of the sewage PS South industrial zone | 0.438 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.438 | 0.438 | 0.057 | 0.381 |
| Reconstruction of the main PS No. 1 | 0.438 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.438 | 0.438 | 0.057 | 0.381 |
| Reconstruction of intermediate PS No. 2 | 0.438 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.438 | 0.438 | 0.057 | 0.381 |
| Partial renovation of the sewage PS South industrial zone | 0.033 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.033 | 0.033 | 0.004 | 0.029 |
| Subtotal (A.2) | 1.349 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 1.349 | 1.349 | 0.176 | 1.173 |
| B. Institutional Reform & Capacity Development | | | | | | | | | | | | | | | | |
| Institutional development & capacity building, Other items | - | 0% | - | 0% | 1.405 | 0% | - | 0% | - | 0% | 0% | - | 1.405 | 1.405 | 0.043 | 1.361 |
| Subtotal (B) | - | 0% | - | 0% | 1.405 | 0% | - | 0% | - | 0% | 0% | - | 1.405 | 1.405 | 0.043 | 1.361 |
| C. Project Management Support | | | | | | | | | | | | | | | | |
| Start-up adjustment works | - | 0% | - | 0% | - | 0% | 0.140 | 0% | - | 0% | 0% | - | 0.140 | 0.140 | 0.004 | 0.136 |
| Project management & supervision | - | 0% | - | 0% | - | 0% | 0.726 | 111% | - | 0% | 90% | 0.653 | 0.073 | 0.726 | - | 0.726 |
| Subtotal (C) | - | 0% | - | 0% | - | 0% | 0.867 | 133% | - | 0% | 75% | 0.653 | 0.213 | 0.867 | 0.004 | 0.862 |
| Total Base Cost (A+B+C) | 12.179 | 171% | 7.431 | 104% | 1.405 | 20% | 0.867 | 12% | - | 0% | 33% | 7.116 | 14.767 | 21.882 | 2.606 | 19.277 |
| D. Contingencies | | | | | | | | | | | | | | | | |
| Physical | 1.827 | 513% | 0.469 | 132% | 0.211 | 59% | 0.065 | 18% | - | 0% | 14% | 0.356 | 2.215 | 2.571 | 0.118 | 2.453 |
| Price | 6.504 | 7016% | 0.429 | 463% | 0.349 | 376% | 0.171 | 185% | - | 0% | 1% | 0.093 | 7.360 | 7.453 | 0.326 | 7.127 |
| Subtotal (D) | 8.331 | 1858% | 0.897 | 200% | 0.560 | 125% | 0.236 | 53% | - | 0% | 4% | 0.448 | 9.575 | 10.024 | 0.444 | 9.580 |
| E. Financial Charges During Implementation | | | | | | | | | | | | | | | | |
| Interest Charges and Fees | - | 0% | - | 0% | - | 0% | - | 0% | 0.781 | 100% | 100% | 0.781 | - | 0.781 | - | 0.781 |
| Subtotal (E) | - | 0% | - | 0% | - | 0% | - | 0% | 0.781 | 100% | 100% | 0.781 | - | 0.781 | - | 0.781 |
| Total Investment Cost (A+B+C+D+E) | 20.510 | 246% | 8.329 | 100% | 1.964 | 24% | 1.103 | 13% | 0.781 | 9% | 26% | 8.345 | 24.342 | 32.687 | 3.049 | 29.637 |

Table S2.2. Indicative Financing Plan - Option 2

| Financing Plan by Foreign and Local Cost Components | | | | | | | |
|---|------------------|----------------|----------------------|------------------|------------------|--------------------|----------------|
| Category/Item | Total ADB & GOM | | | ADB | | | GOM |
| | Foreign Exchange | Local Currency | Total | Foreign Exchange | Local Currency | Total | Aimag/Us Suvag |
| A.1. Wastewater Treatment Plant | | | | | | | |
| Civil Works | - | 9.418 | 9.418 | - | 6.511 | 6.511 | 2.907 |
| Equipment | 5.619 | 0.843 | 6.462 | 5.619 | - | 5.619 | 0.843 |
| Resettlement | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - |
| Taxes and Duties | - | 2.382 | 2.382 | - | - | - | 2.382 |
| Subtotal (A.1) | 5.619 | 12.643 | 18.262 | 5.619 | 6.511 | 12.130 | 6.132 |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | |
| Civil Works | - | 1.173 | 1.173 | - | - | - | 1.173 |
| Equipment | - | - | - | - | - | - | - |
| Resettlement | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - |
| Taxes and Duties | - | 0.176 | 0.176 | - | - | - | 0.176 |
| Subtotal (A.2) | - | 1.349 | 1.349 | - | - | - | 1.349 |
| B. Institutional Reform & Capacity Development | | | | | | | |
| Capacity Building (MCUD, Aimag/Us Suvag) | - | 1.361 | 1.361 | - | 1.073 | 1.073 | 0.289 |
| Taxes and Duties | - | 0.043 | 0.043 | - | - | - | 0.043 |
| Subtotal (B) | - | 1.405 | 1.405 | - | 1.073 | 1.073 | 0.332 |
| C. Project Management Support | | | | | | | |
| Design and Supervision, PIU Establishment, Tendering | 0.653 | 0.209 | 0.862 | 0.653 | 0.180 | 0.833 | 0.029 |
| Taxes and Duties | - | 0.004 | 0.004 | - | - | - | 0.004 |
| Subtotal (C) | 0.653 | 0.213 | 0.867 | 0.653 | 0.180 | 0.833 | 0.033 |
| Total Base Cost (A+B+C) | 6.273 | 15.610 | 21.882 | 6.273 | 7.764 | 14.036 | 7.846 |
| D. Contingencies | | | | | | | |
| Physical | 0.314 | 2.257 | 2.571 | 0.314 | 1.165 | 1.478 | 1.093 |
| Price | 0.082 | 7.371 | 7.453 | 0.082 | 4.279 | 4.361 | 3.092 |
| Subtotal (D) | 0.396 | 9.628 | 10.024 | 0.396 | 5.444 | 5.840 | 4.184 |
| E. Financial Charges During Implementation | | | | | | | |
| Interest Charges and Fees | 0.781 | - | 0.781 | 0.781 | - | 0.781 | - |
| Subtotal (E) | 0.781 | - | 0.781 | 0.781 | - | 0.781 | - |
| Total Investment Cost (A+B+C+D+E) | 7.449 | 25.237 | 32.687 | 7.449 | 13.208 | 20.657 | 12.030 |
| Financing Plan by Cost Category | | | | | | | |
| Category/Item | ADB Loan | | State/Aimag/Us Suvag | | Total Investment | % Total Investment | |
| | Amount | Category % | Amount | Category % | | | |
| A.1. Wastewater Treatment Plant | | | | | | | |
| Civil Works | 6.511 | 69% | 2.907 | 31% | 9.418 | 29% | |
| Equipment | 5.619 | 87% | 0.843 | 13% | 6.462 | 20% | |
| Resettlement | - | 0% | - | 0% | - | 0% | |
| Environmental Monitoring | - | 0% | - | 0% | - | 0% | |
| Taxes and Duties | - | 0% | 2.382 | 100% | 2.382 | 7% | |
| Subtotal (A.1) | 12.130 | 66% | 6.132 | 34% | 18.262 | 56% | |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | |
| Civil Works | - | 0% | 1.173 | 100% | 1.173 | 4% | |
| Equipment | - | 0% | - | 0% | - | 0% | |
| Resettlement | - | 0% | - | 0% | - | 0% | |
| Environmental Monitoring | - | 0% | - | 0% | - | 0% | |
| Taxes and Duties | - | 0% | 0.176 | 100% | 0.176 | 1% | |
| Subtotal (A.2) | - | 0% | 1.349 | 100% | 1.349 | 4% | |
| B. Institutional Reform & Capacity Development | | | | | | | |
| Capacity Building (MCUD, Aimag/Us Suvag) | 1.073 | 79% | 0.289 | 21% | 1.361 | 4% | |
| Taxes and Duties | - | 0% | 0.043 | 100% | 0.043 | 0% | |
| Subtotal (B) | 1.073 | 76% | 0.332 | 24% | 1.405 | 4% | |
| C. Project Management Support | | | | | | | |
| Design and Supervision, PIU Establishment, Tendering | 0.833 | 97% | 0.029 | 3% | 0.862 | 3% | |
| Taxes and Duties | - | 0% | 0.004 | 100% | 0.004 | 0% | |
| Subtotal (C) | 0.833 | 96% | 0.033 | 4% | 0.867 | 3% | |
| Total Base Cost (A+B+C) | 14.036 | 64% | 7.846 | 36% | 21.882 | 67% | |
| D. Contingencies | | | | | | | |
| Physical | 1.478 | 58% | 1.093 | 42% | 2.571 | 8% | |
| Price | 4.361 | 59% | 3.092 | 41% | 7.453 | 23% | |
| Subtotal (D) | 5.840 | 58% | 4.184 | 42% | 10.024 | 31% | |
| E. Financial Charges During Implementation | | | | | | | |
| Interest Charges and Fees | 0.781 | 100% | - | 0% | 0.781 | 2% | |
| Subtotal (E) | 0.781 | 100% | - | 0% | 0.781 | 2% | |
| Total Investment Cost (A+B+C+D+E) | 20.657 | 63% | 12.030 | 37% | 32.687 | 100% | |

Table S2.3. Indicative Annual Investment Plan – Option 2

| Category/Item | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Total Cost |
|---|--------------|---------------|--------------|--------------|--------------|--------------|----------|----------|---------------|
| A.1. Wastewater Treatment Plant | | | | | | | | | |
| Civil Works | 0.474 | 1.175 | 3.108 | 3.108 | 1.554 | - | - | - | 9.418 |
| Equipment | - | 5.899 | - | - | 0.563 | - | - | - | 6.462 |
| Resettlement | - | - | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - | - | - |
| Taxes and Duties | 0.071 | 1.061 | 0.466 | 0.466 | 0.317 | - | - | - | 2.382 |
| Subtotal (A.1) | 0.545 | 8.136 | 3.574 | 3.574 | 2.434 | - | - | - | 18.262 |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | | | |
| Civil Works | - | 1.173 | - | - | - | - | - | - | 1.173 |
| Equipment | - | - | - | - | - | - | - | - | - |
| Resettlement | - | - | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - | - | - |
| Taxes and Duties | - | 0.176 | - | - | - | - | - | - | 0.176 |
| Subtotal (A.2) | - | 1.349 | - | - | - | - | - | - | 1.349 |
| B. Institutional Reform & Capacity Development | | | | | | | | | |
| Capacity Building (MCUD, Aimag/Us Suvag) | 0.545 | 0.817 | - | - | - | - | - | - | 1.361 |
| Taxes and Duties | 0.017 | 0.026 | - | - | - | - | - | - | 0.043 |
| Subtotal (B) | 0.562 | 0.843 | - | - | - | - | - | - | 1.405 |
| C. Project Management Support | | | | | | | | | |
| Design and Supervision, PIU Establishment, Tendering | 0.036 | 0.036 | 0.290 | 0.290 | 0.209 | - | - | - | 0.862 |
| Taxes and Duties | - | - | - | - | 0.004 | - | - | - | 0.004 |
| Subtotal (C) | 0.036 | 0.036 | 0.290 | 0.290 | 0.213 | - | - | - | 0.867 |
| Total Base Cost (A+B+C) | 1.143 | 10.364 | 3.864 | 3.864 | 2.647 | - | - | - | 21.882 |
| D. Contingencies | | | | | | | | | |
| Physical | 0.168 | 0.961 | 0.553 | 0.553 | 0.334 | - | - | - | 2.571 |
| Price | 0.168 | 1.455 | 1.740 | 2.373 | 1.718 | - | - | - | 7.453 |
| Subtotal (D) | 0.336 | 2.416 | 2.293 | 2.927 | 2.052 | - | - | - | 10.024 |
| E. Financial Charges During Implementation | | | | | | | | | |
| Interest Charges and Fees | 0.011 | 0.075 | 0.119 | 0.168 | 0.202 | 0.205 | - | - | 0.781 |
| Subtotal (E) | 0.011 | 0.075 | 0.119 | 0.168 | 0.202 | 0.205 | - | - | 0.781 |
| Total Investment Cost (A+B+C+D+E) | 1.490 | 12.855 | 6.277 | 6.959 | 4.902 | 0.205 | - | - | 32.687 |

Table S2.4. Indicative Investment Plan and Debt Service Schedule – Option 2

| INVESTMENT PLAN - SLA/OLA Aimag & Us Suvag PUSO | | | | | | | | | | | | | | | |
|---|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|
| Particulars | | %Total | Total | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
| | | | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 |
| Civil Works (CW) | USD mill | 38.2% | 12.179 | 0.545 | 2.700 | 3.574 | 3.574 | 1.787 | | | | | | | |
| Materials & Equipment (M&E) | USD mill | 23.3% | 7.431 | 0.000 | 6.784 | 0.000 | 0.000 | 0.647 | | | | | | | |
| Base Cost A 1 & A.2 | USD mill | 61.5% | 19.611 | 0.545 | 9.485 | 3.574 | 3.574 | 2.434 | | | | | | | |
| Institutional & Capacity Development | USD mill | 4.4% | 1.405 | 0.562 | 0.843 | 0.000 | 0.000 | 0.000 | | | | | | | |
| Project Management Support | USD mill | 2.7% | 0.867 | 0.036 | 0.036 | 0.290 | 0.290 | 0.213 | | | | | | | |
| Subtotal B & C | USD mill | 7.1% | 2.271 | 0.598 | 0.879 | 0.290 | 0.290 | 0.213 | | | | | | | |
| Physical Contingency | USD mill | 8.1% | 2.571 | 0.168 | 0.961 | 0.553 | 0.553 | 0.334 | | | | | | | |
| Price Contingency | USD mill | 23.4% | 7.453 | 0.168 | 1.455 | 1.740 | 2.373 | 1.718 | | | | | | | |
| Project Cost | USD mill | 100.0% | 31.906 | 1.479 | 12.780 | 6.158 | 6.791 | 4.699 | | | | | | | |
| Government | USD mill | 37.7% | 12.030 | 0.396 | 6.331 | 1.836 | 2.033 | 1.434 | | | | | | | |
| ADB before Financing Charges | USD mill | 62.3% | 19.876 | 1.083 | 6.448 | 4.322 | 4.758 | 3.265 | | | | | | | |
| Total Borrowings - OLA | USD mill | 63.2% | 20.657 | 1.094 | 6.523 | 4.441 | 4.926 | 3.468 | 0.205 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Financing Charges, IDC | USD mill | 2.4% | 0.781 | 0.011 | 0.075 | 0.119 | 0.168 | 0.202 | 0.205 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Disbursements/Additions | USD mill | 60.8% | 19.876 | 1.083 | 6.448 | 4.322 | 4.758 | 3.265 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total Investment Cost | USD mill | 100.0% | 32.687 | 1.490 | 12.855 | 6.277 | 6.959 | 4.902 | 0.205 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| DEBT SERVICE SCHEDULE - MOF & Darkhan Uul Aimag/Us Suvag PUSO SLA/OLA | | | | | | | | | | | | | | | |
| Particulars | | %Total | Total | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
| | | | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 |
| | | | | IDC 1 | IDC 2 | IDC 3 | IDC 4 | IDC 5 | IDC 6 | PMT 1 | PMT 2 | PMT 3 | PMT 4 | PMT 5 | PMT 6 |
| Disbursement | USD mill | 96% | 19.876 | 1.083 | 6.448 | 4.322 | 4.758 | 3.265 | 0.000 | | | | | | |
| IDC | USD mill | 4% | 0.781 | 0.011 | 0.075 | 0.119 | 0.168 | 0.202 | 0.205 | | | | | | |
| Operational interest | USD mill | | | | | | | | | 0.413 | 0.395 | 0.377 | 0.358 | 0.339 | 0.319 |
| Principal repayment | USD mill | 100% | 20.657 | | | | | | | 0.904 | 0.922 | 0.941 | 0.960 | 0.979 | 0.999 |
| Debt Service | USD mill | | | | | | | | | 1.318 | 1.318 | 1.318 | 1.318 | 1.318 | 1.318 |
| Loan outstanding | USD mill | | | 1.094 | 7.617 | 12.059 | 16.985 | 20.452 | 20.657 | 19.752 | 18.830 | 17.889 | 16.929 | 15.950 | 14.952 |

Table S3.1. Indicative Investment Cost by Expenditure Category – Option 3

| Category/Item | Civil Works | | Equipment | | Institutional Development | | Project Management Support | | Financing Charges | | Foreign | Foreign | Local | Total | Taxes | Total |
|--|---------------|--------------|--------------|-------------|---------------------------|-------------|----------------------------|-------------|-------------------|-------------|-------------|--------------|---------------|---------------|--------------|---------------|
| | Amount | Category | Amount | Category | Amount | Category % | Amount | Category % | Amount | Category | % Total | incl. Tax | incl. Tax | incl. Tax | & Duties | excl. Tax |
| A.1. Wastewater Treatment Plant | | | | | | | | | | | | | | | | |
| Site Preparation | 0.019 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.019 | 0.019 | 0.002 | 0.016 |
| Earthworks | 0.526 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.526 | 0.526 | 0.069 | 0.457 |
| Overall construction work | 6.054 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 6.054 | 6.054 | 0.790 | 5.264 |
| Main treatment plant equipment | - | 0% | 7.097 | 115% | - | 0% | - | 0% | - | 0% | 87% | 6.172 | 0.926 | 7.097 | 0.926 | 6.172 |
| Electrical equipment & control panels | - | 0% | 0.355 | 115% | - | 0% | - | 0% | - | 0% | 87% | 0.309 | 0.046 | 0.355 | 0.046 | 0.309 |
| Automatic control of sewage disposal system | - | 0% | 0.209 | 115% | - | 0% | - | 0% | - | 0% | 87% | 0.182 | 0.027 | 0.209 | 0.027 | 0.182 |
| Interconnecting pipe works | 0.313 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.313 | 0.313 | 0.041 | 0.272 |
| Supply of industrial sewage to the sewage PS | 0.572 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.572 | 0.572 | 0.075 | 0.497 |
| Sewer pipe near 2nd Center of Health Protection | 0.037 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.037 | 0.037 | 0.005 | 0.032 |
| Input pipe to the sewage PS No. 2 | 0.023 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.023 | 0.023 | 0.003 | 0.020 |
| Centralized heat supply of sewage treatment plants | 0.720 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.720 | 0.720 | 0.094 | 0.626 |
| Subtotal (A.1) | 8.263 | 124% | 7.661 | 115% | - | 0% | - | 0% | - | 0% | 42% | 6.662 | 9.263 | 15.924 | 2.077 | 13.847 |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | | | | | | | | | | |
| Reconstruction of the sewage PS South industrial zone | 0.438 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.438 | 0.438 | 0.057 | 0.381 |
| Reconstruction of the main PS No. 1 | 0.438 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.438 | 0.438 | 0.057 | 0.381 |
| Reconstruction of intermediate PS No. 2 | 0.438 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.438 | 0.438 | 0.057 | 0.381 |
| Partial renovation of the sewage PS South industrial zone | 0.033 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.033 | 0.033 | 0.004 | 0.029 |
| Subtotal (A.2) | 1.349 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 1.349 | 1.349 | 0.176 | 1.173 |
| B. Institutional Reform & Capacity Development | | | | | | | | | | | | | | | | |
| Institutional development & capacity building, Other items | - | 0% | - | 0% | 1.405 | 0% | - | 0% | - | 0% | 0% | - | 1.405 | 1.405 | 0.043 | 1.361 |
| Subtotal (B) | - | 0% | - | 0% | 1.405 | 0% | - | 0% | - | 0% | 0% | - | 1.405 | 1.405 | 0.043 | 1.361 |
| C. Project Management Support | | | | | | | | | | | | | | | | |
| Start-up adjustment works | - | 0% | - | 0% | - | 0% | 0.140 | 0% | - | 0% | 0% | - | 0.140 | 0.140 | 0.004 | 0.136 |
| Project management & supervision | - | 0% | - | 0% | - | 0% | 0.726 | 111% | - | 0% | 90% | 0.653 | 0.073 | 0.726 | - | 0.726 |
| Subtotal (C) | - | 0% | - | 0% | - | 0% | 0.867 | 133% | - | 0% | 75% | 0.653 | 0.213 | 0.867 | 0.004 | 0.862 |
| Total Base Cost (A+B+C) | 9.612 | 131% | 7.661 | 105% | 1.405 | 19% | 0.867 | 12% | - | 0% | 37% | 7.315 | 12.229 | 19.544 | 2.301 | 17.244 |
| D. Contingencies | | | | | | | | | | | | | | | | |
| Physical | 1.442 | 394% | 0.483 | 132% | 0.211 | 58% | 0.065 | 18% | - | 0% | 17% | 0.366 | 1.834 | 2.200 | 0.108 | 2.092 |
| Price | 4.901 | 5229% | 0.434 | 463% | 0.349 | 372% | 0.171 | 183% | - | 0% | 2% | 0.094 | 5.762 | 5.855 | 0.282 | 5.573 |
| Subtotal (D) | 6.343 | 1380% | 0.917 | 199% | 0.560 | 122% | 0.236 | 51% | - | 0% | 6% | 0.460 | 7.596 | 8.055 | 0.390 | 7.666 |
| E. Financial Charges During Implementation | | | | | | | | | | | | | | | | |
| Interest Charges and Fees | - | 0% | - | 0% | - | 0% | - | 0% | 0.693 | 100% | 100% | 0.693 | - | 0.693 | - | 0.693 |
| Subtotal (E) | - | 0% | - | 0% | - | 0% | - | 0% | 0.693 | 100% | 100% | 0.693 | - | 0.693 | - | 0.693 |
| Total Investment Cost (A+B+C+D+E) | 15.955 | 188% | 8.578 | 101% | 1.964 | 23% | 1.103 | 13% | 0.693 | 8% | 30% | 8.468 | 19.825 | 28.293 | 2.691 | 25.602 |

Table S3.2. Indicative Financing Plan - Option 3

| Financing Plan by Foreign and Local Cost Components | | | | | | | |
|---|------------------|----------------|----------------------|------------------|------------------|--------------------|----------------|
| Category/Item | Total ADB & GOM | | | ADB | | | GOM |
| | Foreign Exchange | Local Currency | Total | Foreign Exchange | Local Currency | Total | Aimag/Us Suvag |
| A.1. Wastewater Treatment Plant | | | | | | | |
| Civil Works | - | 7.186 | 7.186 | - | 4.752 | 4.752 | 2.434 |
| Equipment | 5.793 | 0.869 | 6.662 | 5.793 | - | 5.793 | 0.869 |
| Resettlement | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - |
| Taxes and Duties | - | 2.077 | 2.077 | - | - | - | 2.077 |
| Subtotal (A.1) | 5.793 | 10.132 | 15.924 | 5.793 | 4.752 | 10.545 | 5.380 |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | |
| Civil Works | - | 1.173 | 1.173 | - | - | - | 1.173 |
| Equipment | - | - | - | - | - | - | - |
| Resettlement | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - |
| Taxes and Duties | - | 0.176 | 0.176 | - | - | - | 0.176 |
| Subtotal (A.2) | - | 1.349 | 1.349 | - | - | - | 1.349 |
| B. Institutional Reform & Capacity Development | | | | | | | |
| Capacity Building (MCUD, Aimag/Us Suvag) | - | 1.361 | 1.361 | - | 1.073 | 1.073 | 0.289 |
| Taxes and Duties | - | 0.043 | 0.043 | - | - | - | 0.043 |
| Subtotal (B) | - | 1.405 | 1.405 | - | 1.073 | 1.073 | 0.332 |
| C. Project Management Support | | | | | | | |
| Design and Supervision, PIU Establishment, Tendering | 0.653 | 0.209 | 0.862 | 0.653 | 0.180 | 0.833 | 0.029 |
| Taxes and Duties | - | 0.004 | 0.004 | - | - | - | 0.004 |
| Subtotal (C) | 0.653 | 0.213 | 0.867 | 0.653 | 0.180 | 0.833 | 0.033 |
| Total Base Cost (A+B+C) | 6.446 | 13.098 | 19.544 | 6.446 | 6.004 | 12.451 | 7.093 |
| D. Contingencies | - | 0.869 | 0.869 | - | - | - | - |
| Physical | 0.322 | 1.878 | 2.200 | 0.322 | 0.901 | 1.223 | 0.977 |
| Price | 0.083 | 5.772 | 5.855 | 0.083 | 3.181 | 3.264 | 2.591 |
| Subtotal (D) | 0.405 | 7.650 | 8.055 | 0.405 | 4.082 | 4.487 | 3.568 |
| E. Financial Charges During Implementation | | | | | | | |
| Interest Charges and Fees | 0.693 | - | 0.693 | 0.693 | - | 0.693 | - |
| Subtotal (E) | 0.693 | - | 0.693 | 0.693 | - | 0.693 | - |
| Total Investment Cost (A+B+C+D+E) | 7.545 | 20.748 | 28.293 | 7.545 | 10.086 | 17.631 | 10.662 |
| Financing Plan by Cost Category | | | | | | | |
| Category/Item | ADB Loan | | State/Aimag/Us Suvag | | Total Investment | % Total Investment | |
| | Amount | Category % | Amount | Category % | | | |
| A.1. Wastewater Treatment Plant | | | | | | | |
| Civil Works | 4.752 | 66% | 2.434 | 34% | 7.186 | 25% | |
| Equipment | 5.793 | 87% | 0.869 | 13% | 6.662 | 24% | |
| Resettlement | - | 0% | - | 0% | - | 0% | |
| Environmental Monitoring | - | 0% | - | 0% | - | 0% | |
| Taxes and Duties | - | 0% | 2.077 | 100% | 2.077 | 7% | |
| Subtotal (A.1) | 10.545 | 66% | 5.380 | 34% | 15.924 | 56% | |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | |
| Civil Works | - | 0% | 1.173 | 100% | 1.173 | 4% | |
| Equipment | - | 0% | - | 0% | - | 0% | |
| Resettlement | - | 0% | - | 0% | - | 0% | |
| Environmental Monitoring | - | 0% | - | 0% | - | 0% | |
| Taxes and Duties | - | 0% | 0.176 | 100% | 0.176 | 1% | |
| Subtotal (A.2) | - | 0% | 1.349 | 100% | 1.349 | 5% | |
| B. Institutional Reform & Capacity Development | | | | | | | |
| Capacity Building (MCUD, Aimag/Us Suvag) | 1.073 | 79% | 0.289 | 21% | 1.361 | 5% | |
| Taxes and Duties | - | 0% | 0.043 | 100% | 0.043 | 0% | |
| Subtotal (B) | 1.073 | 76% | 0.332 | 24% | 1.405 | 5% | |
| C. Project Management Support | | | | | | | |
| Design and Supervision, PIU Establishment, Tendering | 0.833 | 97% | 0.029 | 3% | 0.862 | 3% | |
| Taxes and Duties | - | 0% | 0.004 | 100% | 0.004 | 0% | |
| Subtotal (C) | 0.833 | 96% | 0.033 | 4% | 0.867 | 3% | |
| Total Base Cost (A+B+C) | 12.451 | 64% | 7.093 | 36% | 19.544 | 69% | |
| D. Contingencies | | | | | | | |
| Physical | 1.223 | 56% | 0.977 | 44% | 2.200 | 8% | |
| Price | 3.264 | 56% | 2.591 | 44% | 5.855 | 21% | |
| Subtotal (D) | 4.487 | 56% | 3.568 | 44% | 8.055 | 28% | |
| E. Financial Charges During Implementation | | | | | | | |
| Interest Charges and Fees | 0.693 | 100% | - | 0% | 0.693 | 2% | |
| Subtotal (E) | 0.693 | 100% | - | 0% | 0.693 | 2% | |
| Total Investment Cost (A+B+C+D+E) | 17.631 | 62% | 10.662 | 38% | 28.293 | 100% | |

Table S3.3. Indicative Annual Investment Plan – Option 3

| Category/Item | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Total Cost |
|---|--------------|---------------|--------------|--------------|--------------|--------------|------|------|---------------|
| A.1. Wastewater Treatment Plant | | | | | | | | | |
| Civil Works | 0.474 | 1.175 | 2.215 | 2.215 | 1.107 | - | - | - | 7.186 |
| Equipment | - | 6.172 | - | - | 0.490 | - | - | - | 6.662 |
| Resettlement | - | - | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - | - | - |
| Taxes and Duties | 0.071 | 1.102 | 0.332 | 0.332 | 0.240 | - | - | - | 2.077 |
| Subtotal (A.1) | 0.545 | 8.449 | 2.547 | 2.547 | 1.837 | - | - | - | 15.924 |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | | | |
| Civil Works | - | 1.173 | - | - | - | - | - | - | 1.173 |
| Equipment | - | - | - | - | - | - | - | - | - |
| Resettlement | - | - | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - | - | - |
| Taxes and Duties | - | 0.176 | - | - | - | - | - | - | 0.176 |
| Subtotal (A.2) | - | 1.349 | - | - | - | - | - | - | 1.349 |
| B. Institutional Reform & Capacity Development | | | | | | | | | |
| Capacity Building (MCUD, Aimag/Us Suvag) | 0.545 | 0.817 | - | - | - | - | - | - | 1.361 |
| Taxes and Duties | 0.017 | 0.026 | - | - | - | - | - | - | 0.043 |
| Subtotal (B) | 0.562 | 0.843 | - | - | - | - | - | - | 1.405 |
| C. Project Management Support | | | | | | | | | |
| Design and Supervision, PIU Establishment, Tendering | 0.036 | 0.036 | 0.290 | 0.290 | 0.209 | - | - | - | 0.862 |
| Taxes and Duties | - | - | - | - | 0.004 | - | - | - | 0.004 |
| Subtotal (C) | 0.036 | 0.036 | 0.290 | 0.290 | 0.213 | - | - | - | 0.867 |
| Total Base Cost (A+B+C) | 1.143 | 10.677 | 2.837 | 2.837 | 2.050 | - | - | - | 19.544 |
| D. Contingencies | | | | | | | | | |
| Physical | 0.168 | 0.981 | 0.399 | 0.399 | 0.252 | - | - | - | 2.200 |
| Price | 0.168 | 1.470 | 1.245 | 1.698 | 1.274 | - | - | - | 5.855 |
| Subtotal (D) | 0.336 | 2.451 | 1.645 | 2.098 | 1.526 | - | - | - | 8.055 |
| E. Financial Charges During Implementation | | | | | | | | | |
| Interest Charges and Fees | 0.011 | 0.078 | 0.110 | 0.146 | 0.173 | 0.175 | - | - | 0.693 |
| Subtotal (E) | 0.011 | 0.078 | 0.110 | 0.146 | 0.173 | 0.175 | - | - | 0.693 |
| Total Investment Cost (A+B+C+D+E) | 1.490 | 13.206 | 4.592 | 5.081 | 3.749 | 0.175 | - | - | 28.293 |

Table S3.4. Indicative Investment Plan and Debt Service Schedule – Option 3

| INVESTMENT PLAN - SLA/OLA Aimag & Us Suvag PUSO | | | | | | | | | | | | | | | |
|---|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|
| Particulars | | %Total | Total | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
| | | | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 |
| Civil Works (CW) | USD mill | 34.8% | 9.612 | 0.545 | 2.700 | 2.547 | 2.547 | 1.273 | | | | | | | |
| Materials & Equipment (M&E) | USD mill | 27.8% | 7.661 | 0.000 | 7.097 | 0.000 | 0.000 | 0.564 | | | | | | | |
| Base Cost A 1 & A.2 | USD mill | 62.6% | 17.273 | 0.545 | 9.798 | 2.547 | 2.547 | 1.837 | | | | | | | |
| Institutional & Capacity Development | USD mill | 5.1% | 1.405 | 0.562 | 0.843 | 0.000 | 0.000 | 0.000 | | | | | | | |
| Project Management Support | USD mill | 3.1% | 0.867 | 0.036 | 0.036 | 0.290 | 0.290 | 0.213 | | | | | | | |
| Subtotal B & C | USD mill | 8.2% | 2.271 | 0.598 | 0.879 | 0.290 | 0.290 | 0.213 | | | | | | | |
| Physical Contingency | USD mill | 8.0% | 2.200 | 0.168 | 0.981 | 0.399 | 0.399 | 0.252 | | | | | | | |
| Price Contingency | USD mill | 21.2% | 5.855 | 0.168 | 1.470 | 1.245 | 1.698 | 1.274 | | | | | | | |
| Project Cost | USD mill | 100.0% | 27.600 | 1.479 | 13.128 | 4.482 | 4.935 | 3.576 | | | | | | | |
| Government | USD mill | 38.6% | 10.662 | 0.396 | 6.429 | 1.308 | 1.449 | 1.080 | | | | | | | |
| ADB before Financing Charges | USD mill | 61.4% | 16.938 | 1.083 | 6.699 | 3.174 | 3.486 | 2.496 | | | | | | | |
| Total Borrowings - OLA | USD mill | 62.3% | 17.631 | 1.094 | 6.777 | 3.284 | 3.633 | 2.669 | 0.175 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Financing Charges, IDC | USD mill | 2.4% | 0.693 | 0.011 | 0.078 | 0.110 | 0.146 | 0.173 | 0.175 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Disbursements/Additions | USD mill | 59.9% | 16.938 | 1.083 | 6.699 | 3.174 | 3.486 | 2.496 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total Investment Cost | USD mill | 100.0% | 28.293 | 1.490 | 13.206 | 4.592 | 5.081 | 3.749 | 0.175 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| DEBT SERVICE SCHEDULE - MOF & Darkhan Uul Aimag/Us Suvag PUSO SLA/OLA | | | | | | | | | | | | | | | |
| Particulars | | %Total | Total | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
| | | | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 |
| | | | | IDC 1 | IDC 2 | IDC 3 | IDC 4 | IDC 5 | IDC 6 | PMT 1 | PMT 2 | PMT 3 | PMT 4 | PMT 5 | PMT 6 |
| Disbursement | USD mill | 96% | 16.938 | 1.083 | 6.699 | 3.174 | 3.486 | 2.496 | 0.000 | | | | | | |
| IDC | USD mill | 4% | 0.693 | 0.011 | 0.078 | 0.110 | 0.146 | 0.173 | 0.175 | | | | | | |
| Operational interest | USD mill | | | | | | | | | 0.353 | 0.337 | 0.321 | 0.305 | 0.289 | 0.272 |
| Principal repayment | USD mill | 100% | 17.631 | | | | | | | 0.772 | 0.787 | 0.803 | 0.819 | 0.836 | 0.852 |
| Debt Service | USD mill | | | | | | | | | 1.125 | 1.125 | 1.125 | 1.125 | 1.125 | 1.125 |
| Loan outstanding | USD mill | | | 1.094 | 7.871 | 11.155 | 14.788 | 17.457 | 17.631 | 16.859 | 16.072 | 15.269 | 14.450 | 13.614 | 12.762 |

Table S4.1. Indicative Investment Cost by Expenditure Category – Option 4

| Category/Item | Civil Works | | Equipment | | Institutional Development | | Project Management Support | | Financing Charges | | Foreign | Foreign | Local | Total | Taxes | Total |
|--|---------------|--------------|--------------|-------------|---------------------------|-------------|----------------------------|-------------|-------------------|-------------|-------------|--------------|---------------|---------------|--------------|---------------|
| | Amount | Category | Amount | Category | Amount | Category % | Amount | Category % | Amount | Category | % Total | incl. Tax | incl. Tax | incl. Tax | & Duties | excl. Tax |
| A.1. Wastewater Treatment Plant | | | | | | | | | | | | | | | | |
| Site Preparation | 0.019 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.019 | 0.019 | 0.002 | 0.016 |
| Earthworks | 0.526 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.526 | 0.526 | 0.069 | 0.457 |
| Overall construction work | 5.407 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 5.407 | 5.407 | 0.705 | 4.701 |
| Main treatment plant equipment | - | 0% | 7.045 | 115% | - | 0% | - | 0% | - | 0% | 87% | 6.126 | 0.919 | 7.045 | 0.919 | 6.126 |
| Electrical equipment & control panels | - | 0% | 0.355 | 115% | - | 0% | - | 0% | - | 0% | 87% | 0.309 | 0.046 | 0.355 | 0.046 | 0.309 |
| Automatic control of sewage disposal system | - | 0% | 0.209 | 115% | - | 0% | - | 0% | - | 0% | 87% | 0.182 | 0.027 | 0.209 | 0.027 | 0.182 |
| Interconnecting pipe works | 0.313 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.313 | 0.313 | 0.041 | 0.272 |
| Supply of industrial sewage to the sewage PS | 0.572 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.572 | 0.572 | 0.075 | 0.497 |
| Sewer pipe near 2nd Center of Health Protection | 0.037 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.037 | 0.037 | 0.005 | 0.032 |
| Input pipe to the sewage PS No. 2 | 0.023 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.023 | 0.023 | 0.003 | 0.020 |
| Centralized heat supply of sewage treatment plants | 0.720 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.720 | 0.720 | 0.094 | 0.626 |
| Subtotal (A.1) | 7.616 | 115% | 7.609 | 115% | - | 0% | - | 0% | - | 0% | 43% | 6.616 | 8.609 | 15.225 | 1.986 | 13.239 |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | | | | | | | | | | |
| Reconstruction of the sewage PS South industrial zone | 0.438 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.438 | 0.438 | 0.057 | 0.381 |
| Reconstruction of the main PS No. 1 | 0.438 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.438 | 0.438 | 0.057 | 0.381 |
| Reconstruction of intermediate PS No. 2 | 0.438 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.438 | 0.438 | 0.057 | 0.381 |
| Partial renovation of the sewage PS South industrial zone | 0.033 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 0.033 | 0.033 | 0.004 | 0.029 |
| Subtotal (A.2) | 1.349 | 0% | - | 0% | - | 0% | - | 0% | - | 0% | 0% | - | 1.349 | 1.349 | 0.176 | 1.173 |
| B. Institutional Reform & Capacity Development | | | | | | | | | | | | | | | | |
| Institutional development & capacity building, Other items | - | 0% | - | 0% | 1.405 | 0% | - | 0% | - | 0% | 0% | - | 1.405 | 1.405 | 0.043 | 1.361 |
| Subtotal (B) | - | 0% | - | 0% | 1.405 | 0% | - | 0% | - | 0% | 0% | - | 1.405 | 1.405 | 0.043 | 1.361 |
| C. Project Management Support | | | | | | | | | | | | | | | | |
| Start-up adjustment works | - | 0% | - | 0% | - | 0% | 0.140 | 0% | - | 0% | 0% | - | 0.140 | 0.140 | 0.004 | 0.136 |
| Project management & supervision | - | 0% | - | 0% | - | 0% | 0.726 | 111% | - | 0% | 90% | 0.653 | 0.073 | 0.726 | - | 0.726 |
| Subtotal (C) | - | 0% | - | 0% | - | 0% | 0.867 | 133% | - | 0% | 75% | 0.653 | 0.213 | 0.867 | 0.004 | 0.862 |
| Total Base Cost (A+B+C) | 8.965 | 123% | 7.609 | 105% | 1.405 | 19% | 0.867 | 12% | - | 0% | 39% | 7.270 | 11.575 | 18.845 | 2.209 | 16.636 |
| D. Contingencies | | | | | | | | | | | | | | | | |
| Physical | 1.345 | 370% | 0.480 | 132% | 0.211 | 58% | 0.065 | 18% | - | 0% | 17% | 0.363 | 1.736 | 2.100 | 0.105 | 1.995 |
| Price | 4.498 | 4824% | 0.431 | 462% | 0.349 | 374% | 0.171 | 184% | - | 0% | 2% | 0.093 | 5.356 | 5.449 | 0.271 | 5.178 |
| Subtotal (D) | 5.842 | 1279% | 0.911 | 199% | 0.560 | 123% | 0.236 | 52% | - | 0% | 6% | 0.457 | 7.092 | 7.549 | 0.376 | 7.173 |
| E. Financial Charges During Implementation | | | | | | | | | | | | | | | | |
| Interest Charges and Fees | - | 0% | - | 0% | - | 0% | - | 0% | 0.666 | 100% | 100% | 0.666 | - | 0.666 | - | 0.666 |
| Subtotal (E) | - | 0% | - | 0% | - | 0% | - | 0% | 0.666 | 100% | 100% | 0.666 | - | 0.666 | - | 0.666 |
| Total Investment Cost (A+B+C+D+E) | 14.807 | 176% | 8.520 | 102% | 1.964 | 23% | 1.103 | 13% | 0.666 | 8% | 31% | 8.392 | 18.667 | 27.059 | 2.585 | 24.474 |

Table S4.2. Indicative Financing Plan - Option 4

| Financing Plan by Foreign and Local Cost Components | | | | | | |
|---|------------------|----------------|----------------------|------------------|------------------|--------------------|
| Category/Item | Total ADB & GOM | | | ADB | | |
| | Foreign Exchange | Local Currency | Total | Foreign Exchange | Local Currency | Total |
| A.1. Wastewater Treatment Plant | | | | | | |
| Civil Works | - | 6.623 | 6.623 | - | 4.308 | 4.308 |
| Equipment | 5.753 | 0.863 | 6.616 | 5.753 | - | 5.753 |
| Resettlement | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - |
| Taxes and Duties | - | 1.986 | 1.986 | - | - | - |
| Subtotal (A.1) | 5.753 | 9.472 | 15.225 | 5.753 | 4.308 | 10.062 |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | |
| Civil Works | - | 1.173 | 1.173 | - | - | - |
| Equipment | - | - | - | - | - | - |
| Resettlement | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - |
| Taxes and Duties | - | 0.176 | 0.176 | - | - | - |
| Subtotal (A.2) | - | 1.349 | 1.349 | - | - | - |
| B. Institutional Reform & Capacity Development | | | | | | |
| Capacity Building (MCUD, Aimag/Us Suvag) | - | 1.361 | 1.361 | - | 1.073 | 1.073 |
| Taxes and Duties | - | 0.043 | 0.043 | - | - | - |
| Subtotal (B) | - | 1.405 | 1.405 | - | 1.073 | 1.073 |
| C. Project Management Support | | | | | | |
| Design and Supervision, PIU Establishment, Tendering | 0.653 | 0.209 | 0.862 | 0.653 | 0.180 | 0.833 |
| Taxes and Duties | - | 0.004 | 0.004 | - | - | - |
| Subtotal (C) | 0.653 | 0.213 | 0.867 | 0.653 | 0.180 | 0.833 |
| Total Base Cost (A+B+C) | 6.407 | 12.438 | 18.845 | 6.407 | 5.561 | 11.968 |
| | - | 0.863 | 0.863 | - | - | - |
| D. Contingencies | | | | | | |
| Physical | 0.320 | 1.779 | 2.100 | 0.320 | 0.834 | 1.154 |
| Price | 0.083 | 5.366 | 5.449 | 0.083 | 2.905 | 2.987 |
| Subtotal (D) | 0.403 | 7.146 | 7.549 | 0.403 | 3.739 | 4.142 |
| E. Financial Charges During Implementation | | | | | | |
| Interest Charges and Fees | 0.666 | - | 0.666 | 0.666 | - | 0.666 |
| Subtotal (E) | 0.666 | - | 0.666 | 0.666 | - | 0.666 |
| Total Investment Cost (A+B+C+D+E) | 7.476 | 19.584 | 27.059 | 7.476 | 9.300 | 16.776 |
| Financing Plan by Cost Category | | | | | | |
| Category/Item | ADB Loan | | State/Aimag/Us Suvag | | Total Investment | % Total Investment |
| | Amount | Category % | Amount | Category % | | |
| A.1. Wastewater Treatment Plant | | | | | | |
| Civil Works | 4.308 | 65% | 2.314 | 35% | 6.623 | 24% |
| Equipment | 5.753 | 87% | 0.863 | 13% | 6.616 | 24% |
| Resettlement | - | 0% | - | 0% | - | 0% |
| Environmental Monitoring | - | 0% | - | 0% | - | 0% |
| Taxes and Duties | - | 0% | 1.986 | 100% | 1.986 | 7% |
| Subtotal (A.1) | 10.062 | 66% | 5.163 | 34% | 15.225 | 56% |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | |
| Civil Works | - | 0% | 1.173 | 100% | 1.173 | 4% |
| Equipment | - | 0% | - | 0% | - | 0% |
| Resettlement | - | 0% | - | 0% | - | 0% |
| Environmental Monitoring | - | 0% | - | 0% | - | 0% |
| Taxes and Duties | - | 0% | 0.176 | 100% | 0.176 | 1% |
| Subtotal (A.2) | - | 0% | 1.349 | 100% | 1.349 | 5% |
| B. Institutional Reform & Capacity Development | | | | | | |
| Capacity Building (MCUD, Aimag/Us Suvag) | 1.073 | 79% | 0.289 | 21% | 1.361 | 5% |
| Taxes and Duties | - | 0% | 0.043 | 100% | 0.043 | 0% |
| Subtotal (B) | 1.073 | 76% | 0.332 | 24% | 1.405 | 5% |
| C. Project Management Support | | | | | | |
| Design and Supervision, PIU Establishment, Tendering | 0.833 | 97% | 0.029 | 3% | 0.862 | 3% |
| Taxes and Duties | - | 0% | 0.004 | 100% | 0.004 | 0% |
| Subtotal (C) | 0.833 | 96% | 0.033 | 4% | 0.867 | 3% |
| Total Base Cost (A+B+C) | 11.968 | 64% | 6.877 | 36% | 18.845 | 70% |
| D. Contingencies | | | | | | |
| Physical | 1.154 | 55% | 0.945 | 45% | 2.100 | 8% |
| Price | 2.987 | 55% | 2.462 | 45% | 5.449 | 20% |
| Subtotal (D) | 4.142 | 55% | 3.407 | 45% | 7.549 | 28% |
| E. Financial Charges During Implementation | | | | | | |
| Interest Charges and Fees | 0.666 | 100% | - | 0% | 0.666 | 2% |
| Subtotal (E) | 0.666 | 100% | - | 0% | 0.666 | 2% |
| Total Investment Cost (A+B+C+D+E) | 16.776 | 62% | 10.284 | 38% | 27.059 | 100% |

Table S4.3. Indicative Annual Investment Plan – Option 4

| Category/Item | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Total Cost |
|---|--------------|---------------|--------------|--------------|--------------|--------------|----------|----------|---------------|
| A.1. Wastewater Treatment Plant | | | | | | | | | |
| Civil Works | 0.474 | 1.175 | 1.989 | 1.989 | 0.995 | - | - | - | 6.623 |
| Equipment | - | 6.126 | - | - | 0.490 | - | - | - | 6.616 |
| Resettlement | - | - | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - | - | - |
| Taxes and Duties | 0.071 | 1.095 | 0.298 | 0.298 | 0.223 | - | - | - | 1.986 |
| Subtotal (A.1) | 0.545 | 8.397 | 2.288 | 2.288 | 1.708 | - | - | - | 15.225 |
| A.2. Infrastructure Rehabilitation/Replacement | | | | | | | | | |
| Civil Works | - | 1.173 | - | - | - | - | - | - | 1.173 |
| Equipment | - | - | - | - | - | - | - | - | - |
| Resettlement | - | - | - | - | - | - | - | - | - |
| Environmental Monitoring | - | - | - | - | - | - | - | - | - |
| Taxes and Duties | - | 0.176 | - | - | - | - | - | - | 0.176 |
| Subtotal (A.2) | - | 1.349 | - | - | - | - | - | - | 1.349 |
| B. Institutional Reform & Capacity Development | | | | | | | | | |
| Capacity Building (MCUD, Aimag/Us Suvag) | 0.545 | 0.817 | - | - | - | - | - | - | 1.361 |
| Taxes and Duties | 0.017 | 0.026 | - | - | - | - | - | - | 0.043 |
| Subtotal (B) | 0.562 | 0.843 | - | - | - | - | - | - | 1.405 |
| C. Project Management Support | | | | | | | | | |
| Design and Supervision, PIU Establishment, Tendering | 0.036 | 0.036 | 0.290 | 0.290 | 0.209 | - | - | - | 0.862 |
| Taxes and Duties | - | - | - | - | 0.004 | - | - | - | 0.004 |
| Subtotal (C) | 0.036 | 0.036 | 0.290 | 0.290 | 0.213 | - | - | - | 0.867 |
| Total Base Cost (A+B+C) | 1.143 | 10.625 | 2.578 | 2.578 | 1.921 | - | - | - | 18.845 |
| D. Contingencies | | | | | | | | | |
| Physical | 0.168 | 0.978 | 0.361 | 0.361 | 0.233 | - | - | - | 2.100 |
| Price | 0.168 | 1.468 | 1.120 | 1.528 | 1.165 | - | - | - | 5.449 |
| Subtotal (D) | 0.336 | 2.446 | 1.481 | 1.889 | 1.398 | - | - | - | 7.549 |
| E. Financial Charges During Implementation | | | | | | | | | |
| Interest Charges and Fees | 0.011 | 0.078 | 0.107 | 0.140 | 0.164 | 0.166 | - | - | 0.666 |
| Subtotal (E) | 0.011 | 0.078 | 0.107 | 0.140 | 0.164 | 0.166 | - | - | 0.666 |
| Total Investment Cost (A+B+C+D+E) | 1.490 | 13.148 | 4.166 | 4.607 | 3.483 | 0.166 | - | - | 27.059 |

Table 4.4. Indicative Investment Plan and Debt Service Schedule – Option 4

| INVESTMENT PLAN - SLA/OLA Aimag & Us Suvag PUSO | | | | | | | | | | | | | | | |
|---|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|
| Particulars | | %Total | Total | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
| | | | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 |
| Civil Works (CW) | USD mill | 34.0% | 8.965 | 0.545 | 2.700 | 2.288 | 2.288 | 1.144 | | | | | | | |
| Materials & Equipment (M&E) | USD mill | 28.8% | 7.609 | 0.000 | 7.045 | 0.000 | 0.000 | 0.564 | | | | | | | |
| Base Cost A 1 & A.2 | USD mill | 62.8% | 16.574 | 0.545 | 9.745 | 2.288 | 2.288 | 1.708 | | | | | | | |
| Institutional & Capacity Development | USD mill | 5.3% | 1.405 | 0.562 | 0.843 | 0.000 | 0.000 | 0.000 | | | | | | | |
| Project Management Support | USD mill | 3.3% | 0.867 | 0.036 | 0.036 | 0.290 | 0.290 | 0.213 | | | | | | | |
| Subtotal B & C | USD mill | 8.6% | 2.271 | 0.598 | 0.879 | 0.290 | 0.290 | 0.213 | | | | | | | |
| Physical Contingency | USD mill | 8.0% | 2.100 | 0.168 | 0.978 | 0.361 | 0.361 | 0.233 | | | | | | | |
| Price Contingency | USD mill | 20.6% | 5.449 | 0.168 | 1.468 | 1.120 | 1.528 | 1.165 | | | | | | | |
| Project Cost | USD mill | 100.0% | 26.394 | 1.479 | 13.070 | 4.059 | 4.467 | 3.318 | | | | | | | |
| Government | USD mill | 39.0% | 10.284 | 0.396 | 6.413 | 1.175 | 1.301 | 0.999 | | | | | | | |
| ADB before Financing Charges | USD mill | 61.0% | 16.110 | 1.083 | 6.657 | 2.884 | 3.166 | 2.319 | | | | | | | |
| Total Borrowings - OLA | USD mill | 62.0% | 16.776 | 1.094 | 6.735 | 2.991 | 3.306 | 2.484 | 0.166 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Financing Charges, IDC | USD mill | 2.5% | 0.666 | 0.011 | 0.078 | 0.107 | 0.140 | 0.164 | 0.166 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Disbursements/Additions | USD mill | 59.5% | 16.110 | 1.083 | 6.657 | 2.884 | 3.166 | 2.319 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total Investment Cost | USD mill | 100.0% | 27.059 | 1.490 | 13.148 | 4.166 | 4.607 | 3.483 | 0.166 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| DEBT SERVICE SCHEDULE - MOF & Darkhan Uul Aimag/Us Suvag PUSO SLA/OLA | | | | | | | | | | | | | | | |
| Particulars | | %Total | Total | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
| | | | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 |
| | | | | IDC 1 | IDC 2 | IDC 3 | IDC 4 | IDC 5 | IDC 6 | PMT 1 | PMT 2 | PMT 3 | PMT 4 | PMT 5 | PMT 6 |
| Disbursement | USD mill | 96% | 16.110 | 1.083 | 6.657 | 2.884 | 3.166 | 2.319 | 0.000 | | | | | | |
| IDC | USD mill | 4% | 0.666 | 0.011 | 0.078 | 0.107 | 0.140 | 0.164 | 0.166 | | | | | | |
| Operational interest | USD mill | | | | | | | | | 0.336 | 0.321 | 0.306 | 0.291 | 0.275 | 0.259 |
| Principal repayment | USD mill | 100% | 16.776 | | | | | | | 0.734 | 0.749 | 0.764 | 0.779 | 0.795 | 0.811 |
| Debt Service | USD mill | | | | | | | | | 1.070 | 1.070 | 1.070 | 1.070 | 1.070 | 1.070 |
| Loan outstanding | USD mill | | | 1.094 | 7.829 | 10.820 | 14.126 | 16.609 | 16.776 | 16.041 | 15.292 | 14.528 | 13.748 | 12.953 | 12.142 |