Initial Environmental Examination

Project Number: 37697

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Mongolia: Darkhan Wastewater Management Improvement Project

Prepared by the Ministry of Roads, Transportation, Construction and Urban Development of Mongolia for the Asian Development Bank. This is a revised version of the draft originally posted in August 2014 available on http://www.adb.org/projects/documents/darkhan-wastewater-management-project-iee.

CURRENCY EQUIVALENTS

(as of 19 November 2014)

Currency unit	–	togrog (MNT)
MNT1.00	=	$0.0005
$1.00	=	MNT1,878.50

ABBREVIATIONS

ADB	–	Asian Development Bank
AP	–	Affected Person
BOD	–	Biological Oxygen Demand
EA	–	Executing Agency
EHSO	–	Environmental Health and Safety Officer
EMP	–	Environmental Management Plan
EIA	–	Environmental Impact Assessment
ESS	–	Environmental and Social Specialist
GHG	–	Greenhouse Gas
GOM	–	Government of Mongolia
GRM	–	Grievance Redress Mechanism
HSMP	–	Health and Safety Management Plan
IEE	–	Initial Environmental Examination
IFAS	–	Integrated Fixed-film Activated Sludge
IWRMP	–	Integrated Water Resource Management Plan
MEGD	–	Ministry of Environment and Green Development
MCUD	–	Ministry of Construction and Urban Development
MNS	–	Mongolian National Standard
MoMo	–	Integrated Water Resources Management for Central Asia: Model Region Mongolia
MRTCUD	–	Ministry of Roads, Transportation, Construction and Urban Development
NGO	–	Non-Governmental Organization
NO2	–	Nitrogen Dioxide
PCB	–	Polychlorinated Biphenyl
PCU	–	Public Complaints Unit
PIU	–	Project Implementation Unit
PM	–	Particulate Matter
PMU	–	Project Management Unit
POP	–	Persistent Organic Pollutants
PPE	–	Personal Protective Equipment
PSC	–	Project Steering Committee
RCAG	–	Research Center of Astronomy and Geophysics of the Mongolian Academy of Sciences
SE	–	Supervising Engineer
SOx	–	Sulphur Oxides

SO2	–	Sulphur Dioxide
SPS	–	ADB Safeguard Policy Statement
UNEP	–	United Nations Environment Program
UNFCCC	–	United Nations Framework Convention on Climate Change
WCS	–	World Conservation Society
WFPF	–	Water Financing Partnership Facility
WHO	–	World Health Organization
WWF	–	World Wildlife Fund

WEIGHTS AND MEASURES

^{o}C	–	degree celsius
dB	–	decibel
km	–	kilometer
KWh		Kilowatt hour
m	–	meter

NOTES

In the report, “$” refers to US dollars.

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I. EXECUTIVE SUMMARY

A. Introduction and Purpose

1. This Initial Environmental Examination (IEE) has been prepared for the proposed Darkhan Wastewater Management Improvement Project, Mongolia (the project). The project targets environmentally sustainable urban development and improved living standards in Darkhan City, Mongolia. The project will contribute to a more balanced national urban system and strengthened urban-rural relationships through contribution to the development of a second tier city in the country. The project will support improvement of the city's wastewater management, its central wastewater treatment plant (WWTP), sewer system, and pumping stations. The project will support institutional development, training, project management support and policy dialogue including on water and wastewater tariff, and on sanitation.

2. Darkhan Uul-Aimag has a registered population of 92,000 and an urban population in Darkhan City (Darkhan Soum) of 72,000, of which estimated 40% live in ger areas. The city is located 220 kilometers (km) north of Ulaanbaatar and 130 km south of the Russian border. Darkhan enjoys favorable conditions for farming and is rich in mineral deposits. It was founded as an industrial hub in 1961, and situates at the Trans-Mongolian rail line and an ADB supported road that connects Ulaanbaatar with Darkhan and the Lake Baikal region. Few industrial investments were made in recent years. 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 identified Darkhan to become a national model city for urban sustainability and liveability with a vision of "smart and green city" by 2028 and funded an Urban Development Master Plan, now under preparation. [1] 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. 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, resulting in increased wastewater flow.[2] Investment in infrastructure is needed to meet this present and future demand from improved and expanded urban services and to support clustering of new businesses and industries.

3. The city's wastewater treatment plant (WWTP) and sanitary sewer system and pumping stations, were built in 1965 and partially updated and expanded in 1987, and are in urgent need of rehabilitation, repair and/or replacement. The WWTP was significantly overdesigned with a capacity of 50,000 cubic meters per day (m^3/d) and was never fully utilized. It currently operates at 8,000 to 10,000 m3/d (summer and winter) with peak flows of 12,000 m^3/d. Many components are under-utilized or unused and dilapidated, with some operating units in a state of serious disrepair. The pumping stations and some of the sewer mains are in urgent need of replacement or repair. Sanitation in *ger* areas is currently in the form of on-plot pit latrines causing soil and groundwater pollution. Wastewater is not collected in *ger* areas and plans for incremental extension of the network are being prepared for domestic financing. The WWTP treats domestic sewage together with non-toxic industrial wastewater and some industrial pre-treatment plants remove toxic elements (i.e., from sheepskin processing, approximately 5% of total industrial wastewater flow). Breakdowns of the current system cause untreated wastewater to discharge into the Kharaa River.

4. Darkhan's centralized water supply system was recently improved and service in *ger* areas is

[1] The terms of reference for the urban development master plan are presented in Appendix 6.
[2] Industrial development projections are presented in para. 48.

through water kiosks, some of which are connected to the central water supply, and in some areas, kiosks are replenished by trucks. Improvement of water supply and sanitation and incremental expansion of the centralized pipe networks into *ger* areas are under preparation under a technical assistance project by the Cities Development Initiative for Asia (CDIA).

5. The proposed project is aligned with the *Government Action Plan* (2012–2016) which includes objectives of (i) improving centralized wastewater systems in *aimag* centers, (ii) enforcing the Law on Water Supply and Sewer Use (2011), and (iii) supporting the expansion of industrial development in Darkhan. The project is aligned with ADB's Strategy 2020 with its objective of inclusive economic and environmentally sustainable growth, and the project follows ADB's Urban Operational Plan[3] aiming at inclusive, green, and competitive cities. The project supports ADB's Mongolia country partnership strategy, 2012–2016. Lessons learned will be considered from previous and ongoing ADB urban and water sector projects in Mongolia.

B. Project Impact, Outcome, and Outputs

6. The project impact will be improved urban living conditions and improved environment in Darkhan City and the Kharaa River basin. The project outcome will be improved wastewater collection and treatment for domestic and industrial users in Darkhan City. The indicative outputs include:

(1) **Output 1:** Modern central wastewater treatment plant (WWTP) with a total treatment capacity of 20,000 m^3/d through structural renovation and partially new construction, and full new equipment installation with a new, efficient treatment process meeting national effluent standards constructed and operating in Darkhan;

(2) **Output 2:** Improved wastewater collection system with 1,800 meters of replaced sewer lines, and two structurally renovated, newly equipped pumping stations operating in Darkhan;

(3) **Output 3:** Institutional development, training, and sector policy dialogue to increase institutional capacity in utility project management, planning, procurement, implementation, operation, monitoring and improved efficiency of utility service provision.

C. Environmental Due Diligence, anticipated impacts, mitigation measures

7. **Categorization, due diligence.** The Project was classified as category B for environment by the Asian Development Bank (ADB). An initial environmental examination (IEE), including an environmental management plan (EMP), was prepared by the TA consultant on behalf of the Ministry of Roads, Transportation, Construction and Urban Development (MRTCUD)[4], the Executing Agency (EA) for the project. The EMP is presented in **Appendix EMP** of this IEE, and in Attachment 1 of the project administration manual (PAM).

8. Domestically, the project was subject to general environmental impact assessment (GEIA) by the Ministry of Environment and Green Development (MEGD). The GEIA conclusion has required the preparation of a detailed EIA (DEIA). The DEIA was prepared by a licensed EIA institute (Environ LLC), and submitted to MEGD for review and approval. The DEIA was approved by MEGD in June 2014.

9. **Anticipated environmental benefits and impacts.** The project will have substantial

[3] ADB. 2013. Urban Operational Plan 2012–2020.

[4] On 7 October 2014, the Parliament of Mongolia adopted a consolidation of ministries. The Ministry of Construction and Urban Development (MCUD) and the Ministry of Roads and Transportation (MRT) were consolidated into the MRTCUD.

environmental and socioeconomic benefits. The strengthening of Darkhan's municipal wastewater collection and treatment capacity will provide protection and improvement to Kharaa River's water environment, which is key to the sustainability of Darkhan's socio-economic development. The wastewater treatment plant will remove significant amounts of pollutants, including COD (3,000 tons per year); BOD (1,700 tons per year); nitrogen (330 tons per year); and phosphorous (42 tons per year). Findings of the IEE and DEIA show that the project does not have any predicted significant, long term or irreversible impacts on the physical, biological or socio-economic environment. The project will have short-term impacts during construction which can be mitigated to an acceptable level through mitigation measures which seek to reduce the potential for harm to the environment and human health. Dust and noise generated by sewer line rehabilitation activities will be a nuisance to nearby residents. Discharge of wastewater from construction sites could potentially pollute the Kharaa River. Mitigation measures defined in the EMP relate primarily to implementing good construction practice as well as meeting the particular needs of the project area through consultation with affected people:

(1) The impacts on soil will be mitigated through a number of measures which will control the impacts in relation to (a) soil erosion, through managing slopes, cut faces and re-vegetation; (b) soil contamination through managing use and storage of potentially polluting materials; (c) borrow pits through appropriate siting and restoration.

(2) Mitigation measures to protect sensitive receptors from air emissions and dust include (a) management of stockpiles to reduce dust; (b) good construction site practices to suppress dust; (c) covering materials during transport; and (d) siting plant for production of concrete or pavement surfaces away from receptors.

(3) Potential impacts on surface and groundwater resources may occur through accidental release of pollutants. Since the project will rehabilitate some of the existing structures of the WWTP, a key issue during construction is the sequencing of construction works to ensure continuous treatment of inflowing wastewater. Mitigation measures include (a) adequate WWTP capacity to be maintained at all times; (b) controlled storage and management of all chemicals and wastes, and (c) spill management plan to be developed.

(4) The potential impacts arising from solid waste production and disposal will be mitigated through a number of activities including (a) application of the waste hierarchy at all times; and (b) appropriate storage and containment of wastes including potential PCB wastes and PCB containing equipment which may be present in old transformers in the pumping stations. This will require a specific PCB assessment and management plan.

(5) The potential noise impacts will be mitigated through measures which include (a) source control; (b) siting noise generating activities such as concrete mixing away from receptors; and (c) operating within reasonable times and in consultation with affected people.

(6) In order to minimize the risk to community health and safety at construction sites, the focus will be on clear signage, using machinery only in day light and where possible keeping members of the public out of construction areas.

(7) The civil works contractors will implement adequate precautions to protect the occupational health and safety of construction workers and will appoint an Environment Health and Safety Officer (EHSO) to develop, implement and supervise a Health and Safety Management Plan (HSMP), as well as ensure that the requirements of the EMP are implemented.

(8) Potential short-term traffic disturbance around the important market area in Old Darkhan will be

mitigated through consulting with relevant *aimag* officers on the timing of the road excavation, and signage to warn motorists of when the road closures may be needed.

10. During operation, no significant environmental impact is anticipated. Comprehensive training and appropriate technological design will contribute significantly to reducing operational risks of the project. Prior to commissioning of the WWTP, a series of tests will be conducted to ensure proper functioning of the WWTP and ability to achieve Mongolian discharge standard. A SCADA system including wastewater quality monitoring devices for real-time monitoring of key parameters (COD, TP, NH_4-N) will be installed at the WWTP. Odor and noise generating facilities will be equipped with containment facilities. Daily check, repair and maintenance procedures will be instituted for all wastewater treatment facilities/equipment. In order to avoid pipe freezing and bursting, the depth of the pipe will be determined by a cold weather engineering specialist. Us Suvag as WWTP operator will regularly inspect the pipes and ensure the packed earth is in good condition. WWTP sludge will be dewatered through filter press, and disposed of in existing on-site sludge drying beds (60-ha storage capacity, see Figure III-3), to be partly rehabilitated under the project. An emergency preparedness and response plan will be formulated and put in place before the WWTP becomes operational. The emergency preparedness and response plan will address, among other things, training, resources, responsibilities, communication, procedures, and other aspects required to respond effectively to emergencies associated with the risk of accidental discharges. The discharge of treated effluent will have no significant impact on the water quality of the Kharaa River.

11. **EMP implementation responsibilities.** The EMP specifies the roles and responsibilities of key project stakeholders (including MRTCUD, the PMU, Us Suvag LLC, Darkhan-Uul aimag, the PIU, MEGD, State Professional Inspection Agency, contractors, and loan implementation environment consultants) in overall environmental management:

(1) MRTCUD as executing agency has the overall responsibility for compliance with safeguards plans. A project management unit (PMU) within MRTCUD will manage the procurement process, including but not limited to: (i) updating the IEE and EMP after detailed design (as needed), including submission to ADB for clearance and web-disclosure; (ii) overseeing incorporation of EMP recommendations into the bidding documents; (iii) ensuring the procurement of environmentally responsible contractors; (iv) ensuring that DEIA approval by MEGD has been secured prior to the awarding of civil works contract.

(2) The PMU will procure the services of loan implementation environment consultants (LIEC) to provide support in (i) project preparation including updating the project EMP; (ii) training; (iii) regular environmental quality monitoring (air, surface and ground water, and noise) in compliance with the monitoring plan; (iv) annual project EMP progress reporting; and (v) identifying environment-related implementation issues and necessary corrective actions.

(3) A project implementing unit (PIU) will be established under Darkhan Uul-Aimag Government (DAG, the Implementing Agency) to handle day-to-day activities under the project. The PIU will be staffed with at least one safeguard staff (PIU-SS). Under the guidance of the LIEC, the PIU-SS will be responsible for the supervision of the implementation of the EMP, including (but not limited to) (i) setting up and coordinating the grievance redress mechanism (GRM, see below); (ii) monitoring contractors to ensure adherence to the project EMP and the contractor EMPs; (iii) preparing quarterly reports on project EMP implementation to the PMU; (iv) coordinating consultation with local stakeholders as required, informing them of imminent construction works, updating them on the latest project development activities, GRM, etc.; and (v) coordinating the conduct of periodic environment monitoring by licensed monitoring entities, as defined in the monitoring program.

(4) Civil works contractors (3 contracts) will be required to formulate contractor EMPs with complete management systems for adverse impacts, e.g., dust control, noise control, traffic management, addressing as minimum the requirements of the EMP (Appendix EMP) and the DEIA. The contractor EMPs will be renewed on a yearly basis, submitted to PIU and PMU for review, and to MEGD for approval. To ensure that the contractors comply with the EMP provisions, the PMU will prepare and provide the following specification clauses for incorporation into the bidding procedures: (i) a list of environmental management requirements to be budgeted by the bidders in their proposals; (ii) environmental clauses for contractual terms and conditions; and (iii) the full project EMP and DEIA in Mongolian.

D. Consultation, information disclosure, grievance redress mechanism (GRM)

12. **Environmental grievance redress mechanism.** Environment safeguards related complaints or disputes will be handled in accordance with the grievance redress mechanism (GRM) established for the project. The PIU will coordinate the environment GRM, with support of the LIEC. The GRM is defined in the EMP, and links to the social safeguards GRM.

13. **Consultation, information disclosure.** The stakeholder consultation process conducted during the development of the IEE, particularly with Darkhan *aimag* and Us Suvag, demonstrated that the project has local support as it will result in benefits in terms of the long term environmental and social sustainability of Darkhan's WWTP. In compliance with ADB's Safeguard Policy Statement (2009), environmental information related to the Project was and/or will be disclosed as follows: (i) this initial environmental examination (IEE) is disclosed on ADB's project website (www.adb.org), and is available for consultation in the PIU's and PMU's office; (ii) the detailed environmental impact assessment (DEIA) approved by the Ministry of Environment and Green Development (MEGD) is disclosed on the MEGD website; and (iii) annual reports on project's compliance with the EMP will be available at www.adb.org.

E. Risks and assurances

14. Risks and risk mitigating measures have been identified in the risk assessment and risk management plan. One of the risks is damage to the wastewater treatment process from the discharge of potentially toxic wastewater from new industries that will locate in Darkhan. To mitigate the risk, the Government will ensure to enforce the 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". The project will also support Darkhan Us Suvag with (i) developing mechanisms to effectively monitor industrial wastewater composition before it enters the public sewer system; (ii) strengthening emergency measures to ensure toxic flows are retained and/or diverted so they do not enter the sewer system[5]; and (iii) advising existing and new industries on optimal technology solutions for their respective industrial processes in case of potential toxic effluents.

15. The Government, MRTCUD and Darkhan-Uul Aimag government have assured ADB that implementation of the project shall conform to all applicable ADB policies including those concerning anticorruption measures, safeguards, procurement, consulting services, and disbursement as described in detail in the project administration manual and in the draft loan agreement. In addition to these standard assurances, the Government has agreed with ADB on a series of assurances, defined

[5] The current system includes an overflow from PS1 conveying wastewater via an existing channel to a large fly ash containment pond. The emergency system, including online monitoring of industrial wastewaters, will be strengthened through the MoMo Phase III project, to be financed by the German Government in 2015, and through project output 3 (project implementation support, institutional advice for setting industrial wastewater monitoring online monitoring; see Terms of Reference in the Appendix to the EMP)

in the draft project agreement (and listed in conclusion chapter).

F. Structure of the Initial Environment Examination (IEE)

16. This IEE report is structured as follows:

(1) *Executive Summary* – outlines important facts, major findings, and recommended actions of this IEE;

(2) *Policy, Legal, and Administrative Framework* – presents the national and local legal and institutional framework within which the IEE is carried out. It describes the environmental categorization by ADB and MEGD;

(3) *Description of the Project* – provides a detailed description of the project, including project location and components and implementation schedule;

(4) *Description of the Environment (Baseline Data)* – defines relevant physical, biological, and socioeconomic conditions within the project area. ADB SPS (2009) requires environmental assessments to address induced impacts and risks to (i) physical; (ii) biological; (iii) socioeconomic including physical cultural resources in the context of the project's area of influence; and (v) potential trans-boundary and global impacts, including climate change;

(5) *Anticipated Environmental Impacts and Mitigation Measures* – predicts and assesses the project's likely positive and negative direct and indirect impacts to physical, biological, socioeconomic, and physical cultural resources in the project's area of influence; identifies mitigation measures and any residual negative impacts that cannot be mitigated;

(6) *Analysis of Alternatives* – examines alternatives to the proposed project site, technology, design, and operation, including the no project alternative;

(7) *Information Disclosure, Consultation, and Participation* – describes the process undertaken during project design and preparation for engaging stakeholders, including information disclosure and consultation with affected people and other stakeholders and addressing the comments raised in consultation;

(8) *Grievance Redress Mechanism (GRM)* – presents the GRM established to handle grievances and complaints arising during project implementation. It defines GRM entry points, timeframe and institutional responsibilities within the GRM.

(9) *Environmental Management Plan (EMP)* – defines the mitigation measures, performance indicators, environmental monitoring requirements, institutional responsibilities, training activities related to environmental management, reporting requirements, and a mechanism for feedback and adjustment.

(10) *Conclusion and Recommendation* – summarizes the major environmental impacts and mitigation measures and concludes on the environmental soundness of the project.

(11) *Appendixes* – includes the EMP; a description of existing water supply, sewerage system, pumping stations, and wastewater treatment facility; a wastewater treatment plant reconstruction sequencing and design layout; an audit of Darkhan wastewater treatment

plant; details of pump station and sewer network rehabilitation requirements; and a wastewater treatment plant alternative analysis.

G. Conclusion

17. The IEE concludes that the project will not have any significant, long term or irreversible impacts on the physical, biological or socio-economic environment. The project will have short term impacts during construction which can be mitigated to an acceptable level through mitigation measures which seek to reduce the potential for harm to the environment and human health. These measures relate primarily to implementing good construction practice as well as meeting the particular needs of the project area through consultation with affected people. Good practice through comprehensive training and appropriate technological design will also contribute significantly to reducing the operational impacts of the project.

18. The project will have significant positive environmental benefits. It will lead to improved water quality in the Kharaa River as the effluent quality from the WWTP will be significantly improved over the long term. The use of modern technology and replacement of the outdated and broken equipment will lead to better wastewater and sludge management which will benefit the environment and the residents of the city. Category B for environment is confirmed. The project is feasible from an environment safeguards point of view.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. Mongolia's Environmental Policy

19. **Policy framework.** Mongolia has enacted a comprehensive policy and legal framework for environmental management. It has policies, legislation and strategies in place to manage the protected estate, 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 five layers ranging from the Constitution to international treaties, and to environment and resources protection laws. [6]

20. The main policy documents include the National Environmental Action Plan of 1996, updated in 2000; the State Policy for Ecology of 1997; the National Plan of Action to Combat Desertification, updated in 2010; the Biodiversity Conservation Action Plan of 1996 (now the Rare Animals Protection Plan of 2012); and the National Plan of Action for Protected Areas, all developed under the Ministry of Environment and Green Development (MEGD) auspices, as well as the Mongolian Action Programme for the 21st Century, developed by the National Council for Sustainable Development in 1996. The National Action Plan for Climate Change was added in 2000 and updated in 2011. Several program documents, e.g., the National Water Program (updated in 2011), National Forestry Program; Program of Protection of Air; Sustainable Development Education Program (2009-2019); Special Protected Areas; and Protection of Ozone Layer; were also completed at the turn of the decade. 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.[1]

21. The overarching policy on environmental resources and their protection is set out in the 1992 Constitution of Mongolia. Proceeding from, and conformable to, the Constitution, the Government of Mongolia (GoM) has enacted a series of environmental laws, regulations and standards. Among these, the Law on Environmental Protection and Law on Environmental Impact Assessment provide the core framework and general procedure and guidelines on environmental assessment.

[6] Institutional Structures for Environmental Management in Mongolia. August 2008. UNDP.

Table II-1: Relevant Environmental Laws in Mongolia

Law	Year	Purpose
Law on Subsoil	1988	Regulates relations concerning the use & protection of subsoil in the interests of present and future generations.
Law on Special Protected Areas	1994 (2004)	Regulates relations concerning the use & taking of areas under special protection (natural conservation parks, natural complex areas, natural reserves & national monument areas).
Law on Land	1994 (2012)	Regulates the possession & use of land by a citizen, entity & organization, & other related issues. Articles 42/43 provide guide on removing possessed land & granting of compensation relative to removing.
Law on Environmental Protection	1995 (2012)	Regulates "relations between the state, citizens, economic entities & organizations in order to guarantee the human right to live in a healthy and safe environment, have ecologically balanced social and economic development, & for the protection of the environment for present & future generations, the proper use of natural resources & restoration of available resources". Its Article 7 requires the conduct of natural resource assessment & environmental impact assessment to preserve the natural state of the environment, and Article 10, the conduct of environmental monitoring on the state and changes of the environment.
Law on Air	2012	Regulates the protection of the atmosphere to provide environmental balance & for the sake of present & future generations. Allows Government to set standard limits to emissions from all sources. Provides for the regular monitoring of air pollution, hazardous impacts & changes in small air components such as ozone and hydrogen.
Law on Forests	2012	Regulates relations for protection, possession, sustainable use & reproduction of the forest in Mongolia. Defines prohibited activities in protected forest zones & their regimes & conditions when undertaking allowed activities in the utilization zone forests & their regimes.
Law on Natural Plants	1995	Regulates the protection, proper use, & restoration of natural plants other than forest & cultivated plants.
Water Law	2012	Regulates relations pertaining to the effective use, protection & restoration of water resources. Specifies regular monitoring of the levels of water resources, quality & pollution. Provides safeguards against water pollution.
Law on Water Pollution Fees	2012	Introduces fees payable for pollution of water resources
Law on Plant Protection	1996 (2007)	Regulates the inhibition, protection, inspection of pasturelands & plants.
Law on Buffer Zones	1997	Regulates the determination of special protected area buffer zones & the activities. Article 9 requires the conduct of detailed environmental assessment for the establishment of water reservoirs or construction of floodwalls or dams in buffer zones for special protected areas.

Law	Year	Purpose
Law on Environmental Impact Assessment	1998 (2012)	Regulates "relations concerning protection of the environment, prevention of ecological imbalance, the use of natural resources, assessment of the environmental impact and decision-making on the start of a project". It sets out the general requirements and procedures for project screening and conduct of environmental assessment and review.
Law on Sanitation	1998	Governs relationships concerning maintenance of sanitary conditions, defining the general requirements for sanitation in order to ensure the right of an individual to healthy & safe working & living conditions, ensuring normal sanitary conditions, & defining the rights & duties of individuals, economic entities & organizations with this respect.
Law on Protection of Cultural Heritage	2001	Regulates the collection, registration, research, classification, evaluation, preservation, protection, promotion, restoration, possession and usage of cultural heritage including tangible and intangible heritage.
Civil Code of Mongolia	2002	Its Article 502 stipulates the liability for damage to environment.
Law on Wastes	2012	Governs the collection, transportation, storage, & depositing in landfills of household & industrial waste, & re-using waste as a source of raw materials to eliminate hazardous impacts of household and industrial waste on public health & the environment. Undertakings that generate significant amount of wastes must dispose of the wastes in designated landfills that meet prescribed standards.
Law on Disaster Protection	2003 (2012)	Regulates matters relating to the principles & full powers of disaster protection organizations & agencies, their organization & activities, as well as the rights & duties of the State, local authorities, enterprises, entities & individuals in relation to disaster protection.
Law on soil protection and prevention from desertification	2012	Regulates matters related protection of soil deterioration, reclamation, and prevention from desertification
Law on fauna	2012	Regulates matters related protection of animals, growth and development, breeding, rational use of its resources.

Note: (year last amended)

22. **Water and wastewater sector strategy.** The laws of Mongolia which govern water use have been revised and consolidated, and new laws have been adopted over recent years. The Law of Mongolia on Water dated 22 April 2004 ("Old Water Law") has been replaced with a revised version of the Law of Mongolia on Water dated 17 May 2012 ("Water Law"). The Law of Mongolia on Fees for Use of Water and Minerals has been consolidated with other laws on the use of natural resources and is replaced with the Law of Mongolia on Natural Resources Use Fee dated 17 May 2012 ("Natural Resources Use Fee Law"). On 17 May 2012, the Law of Mongolia on Water Pollution Fees was newly adopted to introduce fees payable for pollution of water resources ("Water Pollution Fees Law"). [7]

23. The overall effect of these changes is that under the Water Law, the Government has the authority to determine the intrinsic environmental value of water resources for each region or river

[7] Based on: Revision of Environmental Laws in Mongolia and its impact on the mining sector, October 2012, Hogan Lovells, Ulaanbaatar.

basin. Currently, governmental resolution No. 302 dated 26 October 2011 sets out the intrinsic environmental value for each river basin in amounts ranging from MNT 800 to MNT 2651 per cubic metre for surface water, and MNT 1510 to MNT 9440 per cubic meter for sub-surface water (groundwater). The fee will be payable on a monthly basis and the user must also submit an annual report for water use fees.

24. In the wastewater sector, to implement the "polluter pays" principle in terms of water resources, the Water Pollution Fees Law introduces fees payable by entities and organizations that pollute water resources, and sets out the maximum and minimum amount of water pollution fees per polluting substance type.[8] The Government will set the specific fees payable in each water drainage basin taking into account the volume and quality of the water resources contained therein.

25. **Urban environmental policy and strategy.** There is no specific Government policy relating directly to urban environmental matters. The Government's overall policy for environmental protection, including the following of EIA procedures for public sector project proposals, provides the urban environmental protection framework.

26. The Government is promoting urban greening as part of the reforestation and green agenda of the Ministry for Environment and Green Development (MEGD). This builds on the statutory provisions within the urban planning laws of Mongolia which set out minimum requirements for public open space which are in turn reflected in the development tables accompanying each master plan (including the current Master plan for Darkhan). As with all ex-soviet countries, the guidelines for development set out very prescriptive requirements assigning areas in percentage terms – including those for green space. In this context, the Soum Government of Darkhan is proposing the establishment of an urban green zone between the built-up areas of Old and New Darkhan and the Kharaa River as part of its "smart and green city" concept.

27. **International conventions.** Mongolia is a party to the international environmental conventions and protocols. It has passed state laws that implement the terms of these international conventions, with provision that: "If an international treaty to which Mongolia is a party is inconsistent with this law then the provisions of the international treaty shall prevail".

Table II-2: Relevant International Environmental Conventions

International Convention / Protocol	Year of Party
World Heritage Convention	1990 (a)
United Nations Framework Convention on Climate Change	1993 (r)
Kyoto Protocol	1999 (a)
Convention on Biological Diversity	1993 (r)
United Nations Convention to Combat Desertification	1996 (r)
Vienna Convention for the Protection of the Ozone Layer	1996 (a)
Montreal Protocol on Substances That Deplete the Ozone Layer	1996 (a)
Washington Convention on International Trade in Endangered Species of Wild Fauna & Flora (CITES)	1996 (a)
Basel Convention on the Control of Transboundary Movements of the Hazardous Wastes and Their Disposal	1997 (a)

[8] This sub-divides polluting load by: low density substance; organic substance; minerals; heavy metals; and toxic substances, but does not assign an acceptable value or fee rate for exceedence to each.

International Convention / Protocol	Year of Party
Ramsar Convention on Wetlands of International Importance	1998 (e)
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	2001 (r)
Stockholm Convention on Persistent Organic Pollutants	2004 (r)

Note: (a) accession; (e) entry into force; (r) ratification.

28. **Climate change policy.** Mongolia has joined 14 environment-related UN Conventions and Treaties, including the UN Framework Convention on Climate Change (UNFCCC). Nationally, the Mongolian Action Program for the 21st Century (MAP 21) includes considerations and recommendations related to climate change adaptation and the mitigation of Greenhouse gas (GHG) emissions. 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 Program on Climate Change, which received Government approval in 2000 and was updated in 2010. The action program 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 fulfill the requirements of the National Program on Climate Change, an inter-disciplinary and inter-sectoral National Climate Committee has been established by the government and is led by MEGD. The Committee coordinates and guides national activities and measures aimed at adapting to climate change and mitigating GHG emissions.

29. Regarding *climate change mitigation*, the government has undertaken to mitigate GHG emissions through a range of strategies for sustainable development covering different sectors including energy, waste, transportation and agriculture. Of specific relevance to the project is the strategy for ' Improvement of energy efficiency in Industry'. Policy measures which will implement this strategy relate to (i) equipment efficiency improvements and good housekeeping; and (ii) technology changes.[9] The energy efficiency gains of the project are fully aligned to the policy.

30. Regarding *climate change adaptation*, the government has outlined strategies relating to the following sectors: animal husbandry, arable farming, water resources, 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’. Another target area is the strategy for 'improved water quality' to be implemented through 'advancing the level of water purification and sewage water treatment plants in urban areas'. The project fully supports this policy measure.

B. Environmental Impact Assessment Requirements

31. The project is subject to the environmental safeguards requirements of both Mongolia and those of the ADB. These requirements are defined in the next two sections.

(1) Environmental Assessment Requirements of the ADB

32. Safeguard requirements for all projects funded by ADB are defined in ADB SPS (2009). SPS 2009 establishes an environmental review process to ensure that projects undertaken as part of programs funded through ADB loans are environmentally sound, are designed to operate in compliance with applicable regulatory requirements, and are not likely to cause significant environmental, health, or

[9] Mongolia’s Second National Communication on Climate Change

safety hazards. SPS 2009 is underpinned by the ADB Operations Manual, Bank Policy (OM F1, 2010). The policy promotes international good practice as reflected in internationally recognized standards such as the *World Bank Group's Environmental, Health and Safety Guidelines*[10].

33. SPS 2009 environmental assessment requirements specify that:

(i) At an early stage of project preparation, the borrower/client will identify potential direct, indirect, cumulative and induced environmental impacts on and risks to physical, biological, socioeconomic, and cultural resources and determine their significance and scope, in consultation with stakeholders, including affected people and concerned NGOs. If potentially adverse environmental impacts and risks are identified, the borrower/client will undertake an environmental assessment as early as possible in the project cycle. For projects with potentially significant adverse impacts that are diverse, irreversible, or unprecedented, the borrower/client will examine alternatives to the project's location, design, technology, and components that would avoid, and, if avoidance is not possible, minimize adverse environmental impacts and risks;
(ii) The assessment process will be based on current information, including an accurate project description, and appropriate environmental and social baseline data;
(iii) Impacts and risks will be analyzed in the context of the project's area of influence;
(iv) Environmental impacts and risks will be analyzed for all relevant stages of the project cycle, including preconstruction, construction, operations, decommissioning, and post-closure activities such as rehabilitation or restoration;
(v) The assessment will identify potential trans-boundary effects as well as global impacts; and
(vi) Depending on the significance of project impacts and risks, the assessment may comprise a full-scale environmental impact assessment (EIA) for category A projects, an initial environmental examination (IEE) or equivalent process for category B projects, or a desk review.

34. Other key requirements of SPS 2009 include:

(i) *Environmental Management Plan.* The borrower/client will prepare an environmental management plan (EMP) that addresses the potential impacts and risks identified by the environmental assessment.
(ii) *Consultation and Participation.* The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.
(iii) *Information disclosure.* The borrower/client will submit to ADB the following documents for disclosure on ADB's website: (i) a draft full EIA/IEE (including the draft EMP) at least 120 days prior to ADB Board consideration; (ii) the final EIA/IEE; (iii) a new or updated EIA/IEE and corrective action plan prepared during project implementation, if any; and (iv) semi-annual environmental monitoring reports.
(iv) *Grievance Redress Mechanism.* The borrower/client will establish a mechanism to receive and facilitate resolution of affected people's concerns, complaints, and grievances about the project's environmental performance.
(v) *Monitoring.* The borrower/client will monitor and measure the progress of implementation of the EMP.

[10] New Version of the "World Bank Group Environmental, Health, and Safety Guidelines", April 30, 2007, Washington, USA. http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

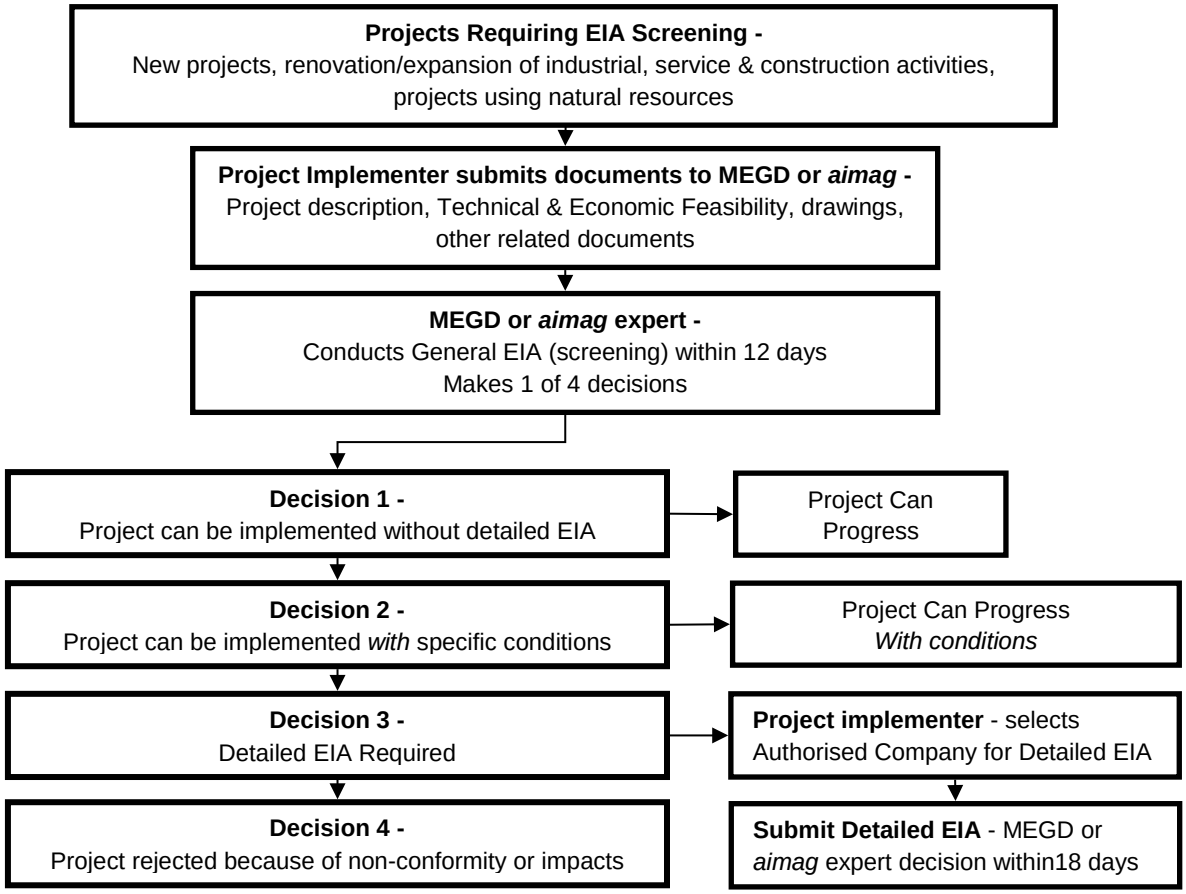
35. This IEE is intended to meet SPS 2009 requirements.

(2) Environmental Assessment Requirements of Mongolia

36. The EIA requirements of Mongolia are regulated by the Law on EIA (1998, amended 2002[11] and amended 2012). The terms of the law apply to all new projects, as well as rehabilitation and expansion of existing industrial, service or construction activities and projects that use natural resources.

37. The most recent amendment to the law was adopted in 2012 and was brought into force in 2013, implemented through a new Environmental Impact Assessment Regulation.[12] The purpose of the EIA law is environmental protection, the prevention of ecological imbalance, the regulation of natural resource use, the assessment of environmental impacts of projects and procedures for decision-making regarding the implementation of projects. The EIA process in Mongolia is summarized in **Figure II-1.**

Figure II-1: EIA Process in Mongolia



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

[11] Law of Mongolia on Environmental Impact Assessments (1998, amended in 2002). Unofficial translation available from http://cdm-mongolia.com.

[12] The new EIA Regulation revokes 2 Regulations and 1 Guideline document which do not meet the requirements of the EIA Law. The revoked legislation is: Regulation on the Environmental Impact Assessment Committee (2006); Guidelines on Formulating EPPs and EMPs (2000); and Regulation on Detailed EIA Appraisal (2006). These regulations are superseded by the EIA Law.

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

(i) **General EIA (screening)** - to initiate a General EIA, the project implementer submits to MEDG (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 MEDG by means of a special procedure. The developer of the Detailed EIA should submit it to MEDG (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 MEDG (or *aimag* government). Based on the conclusion of the expert, the MEDG (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.

C. Environmental, health and safety standards

39. Key standards applied in the DEIA and the IEE include the following: (i) the ambient water quality standard (MNS 4586:1998), Table II-3; (ii) Air quality general technical requirements (MNS 4585:2007), Table II-5; (iii) Groundwater quality standard (MNS 900:2005), and the WHO Guidelines for Drinking-water Quality, Fourth Edition (2011), Table II-4; (iv) Soil Quality, Soil Pollutant Elements and Substances Standard (MNS 5850:2008), Table II-6; (vi) Ambient Noise Standard (MNS 4585:2007), Table II-7; and (vii) the occupational health and safety standard (MNS 5002:2000). These standards are described below.

Table II-3: Ambient surface water quality standard MNS 4586:1998

Parameter	MNS 4586-98	
pH		6.5-8.5
DO	mgO/l	not less than 6&4 *
BOD	mgO/l	3
NH_4-N	mgN/l	0.5
NO_2-N	mgN/l	0.002
NO_3-N	mgN/l	9
PO_4-P	mgP/l	0.1
Cl	mg/l	300
F	mg/l	1.5
SO_4	mg/l	100
Mn	mg/l	0.1
Ni	mg/l	0.01
Cu	mg/l	0.01
Mo	mg/l	0.25
Cd	mg/l	0.005
Co	mg/l	0.01
Pb	mg/l	0.01
As	mg/l	0.01
Cr	mg/l	0.05
Cr^{6+}	mg/l	0.01
Zn	mg/l	0.01
Hg	mg/l	0.1
Oil	mg/l	0.05
Phenol	mg/l	0.001
Active and washing substances	mg/l	0.1
Benzapyren	Mkg/l	0.005

* DO >6 mgO/l for summer time and DO >4 mgO/l for winter time

Table II-4: Groundwater quality standard MNS 900:2005

Parameter	MNS 900:2005		WHO Guidelines for Drinking Water Quality, Fourth Edition. 2011	
Na^+	mg/l	200		None established
K^+	mg/l	200		None established
Ca^{2+}	mg/l	100		-
Mg^{2+}	mg/l	30		-
$S0_4^{2}$	mg/l	500		None established
HCO_3	mg/l	-		-
CO_3^{2}	mg/l	-		-
Cl	mg/l	350	mg/l	5
P	mg/l	0.7-1.5		-
Br		-		None established
Test, by mark	mg/l	2		-
Color	degree	20°		None proposed
Odor	mark	2		-
pH		6.5-8.5		None established
Electric Conductivity Y S/st		-		-
General Minerals		1000		-
Hardness	mg-eqv/l	7		None established
Acidity potential	mB			-
Solid remains	g/l	1		-
NH_4	mg/l	1.5		None established
NO_3	mg/l	50	mg/l	50
NO_2	mg/l	1	mg/l	3
PO_4	mg/l	3.5		-
As	mg/l	0.01	mg/l	0.01
Fe	mg/l	0.3		None established
Pb	mg/l	0.03	mg/l	0.01
Ni	mg/l	0.02	mg/l	0.07
Cr	mg/l	0.05	mg/l	0.05
Cu	mg/l	0.1	mg/l	2
Zn	mg/l	5		None established
Mn	mg/l	0.1		None established
Cd	mg/l	0.003	mg/l	0.003
Hg	mg/l	0.0005	mg/l	0.006
B	mg/l	0.5	mg/l	2.4
Ba	mg/l	0.7	mg/l	0.7
Mo	mg/l	0.07		None estabished
Se	mg/l	0.01	mg/l	0.04
E.coli or thermotolerant coliform bacteria		-		Must not be detectable in any 100 ml sample.

MNS 900:2005, Drinking Water Hygienic Requirement and Qualtity Control is the stadard used for groundwater supply, which is the source for drinking water supply in Mongolia.

Table II-5: Ambient air quality standard MNS 4585:2007

Parameter	MNS 4585:2007		EHS Guidelines. World Health Organization (WHO). Air Quality Guidelines Global Update, 2005)	
SO_2	24-hour	20	24-hour	125 (Interim target-1)
				50 (Interim target-2)
				20 (guideline)
	10 minute	500	10 minute	500 (guideline)
NO_2	1-year	30	1-year	40 (guideline)
	24-hour	40	24-hour	-
	20-min	85	1-hour	200 (guideline)
PM_{10}	1-year	50	1-year	70 (Interim target-1)
				50 (Interim target-2)
				30 (Interim target-3)
				20 (guideline)
	24-hour	100	24-hour	150 (Interim target-1)
				100 (Interim target-2)
				75 (Interim target-3)
				50 (guideline)
$PM_{2.5}$	1-year	25	1-year	35 (Interim target-1)
				25 (Interim target-2)
				15 (Interim target-3)
				10 (guideline)
	24-hour	50	24-hour	75 (Interim target-1)
				50 (Interim target-2)
				37.5 (Interim target-3)
				25 (guideline)
CO	Average in 1 hour	30g/m3	No standard	

Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

Table II-6: Soil quality standard MNS 5850:2008

Parameter	MNS 5850 :2008			
	Soil Mechanical Composition			Maximum Acceptable Amount
	Clay	Loamy	Sandy	
Pb	100	70	50	100
Cd	3	1.5	1	3
Hg	2	1	0.5	2
As	6	4	2	6
Cr	150	100	60	150
Cr^{6+}	4	3	2	4
Sn	50	40	30	50
Sr	800	700	600	800
V	150	130	100	150
Cu	100	80	60	100
Ni	150	100	60	150
Co	50	40	30	50
Zn	300	150	100	300
Mo	5	3	2	5
Se	10	8	6	10
B	25	20	15	25
F	200	150	100	200
CN	25	15	10	25

Table II-7: Ambient noise standard MNS 4585:2007

	Maximum allowable noise limit (hourly measurement), 1hr LA_{eq} in dB(A)	
Standard	**Day** (07:00-22:00)	**Night** (22:00-07:00)
IFC Guideline: Industrial/ Commercial	70	70
IFC Guideline: Residential/ Institutional/ Educational	55	45
MNS 4585:2007	60	45

Source: Oyu Tolgoi EIA 2012

40. Mongolian National Standard for Ambient Noise MNS 4585:2007 sets an allowable limit for noise in daytime at 60 dB, and night at 45 dB, with night being 10pm-6am according to the Act on Labor. These standards can be compared to the more detailed WHO guidelines which recommend that indoor noise levels should not exceed 30 dB (average equivalent over 8 hours LA_{eq}) and 45 dB (maximum for an individual noise event), and outdoor sound levels should not exceed 50 dB LA_{eq}. Comparison is made with IFC standards in Table II-7, which shows that IFC guidelines are slightly more stringent that the national standard for residential day time permissible levels.

41. The **standard for wastewater discharge** to water bodies (MNS 4943:2011) has been recently revised (2011) and now aligns quite closely with European Standards. It appears to be both consistent with international standards and appropriate for Mongolian conditions (Table II-8). The standard for wastewater discharge to a public sewer (Regulation number No a/11/05/A/18: Allowed Limits of Industrial Wastewater Composition Before Letting Effluents into the Central Wastewater Treatment Systems) is older (1997) and based on Russian standards (Table II-9).

Table II-8: Standard for wastewater discharge to water bodies (MNS 4943:2011)

№	Parameter	Measuring unit	Maximum allowance
1	Water temperature	C	20
2	Hydrogen ion activity (pH)	-	6-9
3	Odor	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 (NH4-N)	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 (H2S)	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	Fhenol (C5H2OH)	mg/l	0.05
42	Threchloretilen	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.

Table II-9: Allowable limits of industrial wastewater composition before letting effluents into the public sewers and central wastewater treatment systems (Regulation No a/11/05/A/18)

№	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

42. **Occupational health and safety standard (MNS 5002:2000).** Article 16 of the National Constitution of Mongolia states that every employee has the right to 'suitable conditions of work'. The government adopted a National Program for Occupational Safety and Health Improvement in 2001 and national standards are also adopted such as the National Standard on Occupational Health and Safety MNS 5002:2000 which support the Occupational Safety and Health Law 2008 which sets out policies, rules and regulations on occupational safety and health, and the most common requirements for workplace safety.

III. DESCRIPTION OF THE PROJECT

A. Justification and Rationale

43. The project targets environmentally sustainable urban development and improved living standards in Darkhan City, Mongolia. The project will contribute to a more balanced national urban system and strengthened urban-rural relationships through contribution to the development of a second tier city in the country. The project will support improvement of the city's wastewater management, its central wastewater treatment plant (WWTP), sewer system, and pumping stations. The project will support institutional development, training, project management support and policy dialogue including on water and wastewater tariff, and on sanitation.

44. **Outdated wastewater treatment facility.** The city's wastewater treatment plant (WWTP) and sanitary sewer system and pumping stations, were built in 1965 and partially updated and expanded in 1987, and are in urgent need of rehabilitation, repair and/or replacement. Two out of three sedimentation tanks are no longer functioning leading to the primary sedimentation treatment being overloaded. Rusted bar screens allow the flow of debris into the system, and creates a risk to pipes and pumps. The WWTP was significantly overdesigned with a capacity of 50,000 cubic meters per day (m3/d) and was never fully utilized. It currently operates at 8,000 to 10,000 m3/d (summer and winter) with peak flows of 12,000 m3/d. Many components are under-utilized or unused and dilapidated, with some operating units in a state of serious disrepair.[13] In summer and autumn of 2012, regular aeration blackouts were observed which lasted in excess of a week.[14] This led to a loss of activated sludge and negatively influenced the treatment efficiency. The WWTP treats domestic sewage together with non-toxic industrial wastewater and some industrial pre-treatment plants remove toxic elements (i.e., from sheepskin processing). Breakdowns of the current system cause untreated wastewater to discharge into the Kharaa River.

45. **Sewer network, pumping stations in need of replacement.** The pumping stations and some of the sewer mains are in urgent need of replacement or repair. Us Suvag maintains that some 40% of the sewer network is in need of rehabilitation or replacement, and there is evidence of significant infiltration (and thus also exfiltration) from the sewer network. It is reported[15] that there is a significant increase in inflows to the WWTP during periods of intense rainfall, indicating significant ingress of storm water into the system. This suggests there is also significant ex-filtration which has the potential to pollute groundwater resources. Based on the differential between water consumption and sewage flows, there are estimates that infiltration of groundwater and surface water into the sewer system is of the order of 25%.[16]

46. **Low energy efficiency.** Inefficiencies in the treatment plant mean that energy is being wasted unnecessarily. The cost of energy for the WWTP is currently approximately 60% of Darkhan Us Suvag's annual budget. The current energy use[17] equates to approximately 1.3 KWh/m^3 which is considered inefficient by WWTP design experts. Although Mongolia is currently largely meeting its energy needs domestically, primarily through seven coal fired power plants, thirteen hydro power plants and small size solar and diesel generators, about 13% of electricity, mostly during peak demand, is

[13] ADB. Application To Access Water Financing Partnership Facility (WFPF) Resources For Direct Charges, 2013.
[14] P2Mberlin. Terms of Reference: Main Trunk Sewer and Central Wastewater Treatment Plant for Darkhan, Mongolia, 2013
[15] Us Suvag flow records at the Central WWTP
[16] Source: Milojevic, Nikola, Klaus-Jochen Sympher, Matthias Schütz, and Martin Wolf, MoMo Technical Report No 6 Integrated Wastewater Management in Central Asia – MoMo Model Region, 2011
[17] Based on data for August 2013 from Darkhan Us Suvag

imported from Russia Federation. With the high increase of the final energy consumption in recent years and the projections for further increase, there are expectations that the future electricity demand will not be met with the existing generation capacity.[18] Therefore taking opportunities to reduce domestic energy consumption will be beneficial to Darkhan city's local energy demands.

47. **Increased pressure from urban development.** Darkhan Uul-Aimag has a registered population of 92,000 and an urban population in Darkhan City (Darkhan Soum) of 72,000, of which estimated 40% live in ger areas. The city is located 220 kilometers (km) north of Ulaanbaatar and 130 km south of the Russian border. Darkhan enjoys favorable conditions for farming and is rich in mineral deposits. It was founded as an industrial hub in 1961, and situates at the Trans-Mongolian rail line and an ADB supported road that connects Ulaanbaatar with Darkhan and the Lake Baikal region. 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 identified Darkhan to become a national model city for urban sustainability and livability. 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. 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, resulting in increased wastewater flow. Investment in infrastructure is needed to meet this present and future demand from improved and expanded urban services and to support clustering of new businesses and industries.

48. **Increased industrial wastewater.** Darkhan city currently has a number of industries which produce wastewater requiring treatment. The level of industrial activity is projected to increase in Darkhan, meaning additional and effective wastewater treatment will be required. Discussions with the *aimag* Land Administration Department[19] confirmed that within the last five years, applications and approvals for both commercial and housing developments have rapidly increased. Although industrial wastewater is pre-treated by the key producer (tannery) before it enters the WWTP, it still requires further treatment in the WWTP before it can be discharged. Darkhan *Nekhii* is a well-known sheepskin tannery making products for domestic and export markets. In 2010, with funding from the Czech government, a pre-treatment plant opened for use by the tannery. Additional industries in Darkhan which produce wastewater include Darkhan Metallurgical Plant which produces steel products from reprocessing metal and steel scraps and has a production capacity of 100,000 tons per year. In addition, a new ore processing plant and wool processing factory were built in the industrial area in 2013, although not yet operational. Additional industries sited in the industrial area include meat processors, a flour mill, cement and brick factories, and a timber processing plant in Old Darkhan. An oil refining industry is also planned for the industrial area although the current status of this plan is unknown. This demonstrates that there is a likelihood that industrial wastewater volumes will increase in the future.[20]

49. **Kharaa River pollution control**. The main water body in the project area, the Kharaa River has elevated nitrogen and phosphorous levels as the removal of these contaminants from the WWTP is inefficient. Due to the dilution capacity and turnover processes in the river, the nutrient levels are moderate. This has led to limited detectable impact on the ecology of the river.[21] However it is possible that at times of low-flow and with an increase in housing and industry, the impacts on the river arising

[18] Energy Charter Secretariat, 2011 In-Depth Review of Energy Efficiency Policies and Programmes: Mongolia
[19] Mr Munkh-Erdene J, Head of Land Administration; Mr Olonbayar KH, Senior Land Officer, meeting 19/09/13
[20] Wastewater flow projections for the period 2015-2040, including industrial wastewater flows, are presented in Appendix 1.
[21] MoMo. 2009. Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo). Kharaa River Case Study Main Findings Summary Report.

from the current WWTP would become more significant and the environmental sustainability will be compromised. This is increasingly likely as the outdated wastewater treatment technology becomes progressively more unreliable with age. The development of an efficient and effective WWTP will ensure that in the future, those relying on the Kharaa River as a raw drinking water source are not affected by poor water quality. This includes nomadic herders who graze their livestock on the Kharaa River flood plain, and residents of *ger* areas in the flood plain.[22] The nomadic herders are generally the poorer members of the population, and as such, are less able to withstand health shocks which may be associated with health impacts from poor water quality.

50. **Fit with Mongolian policy**. The work is aligned with the Government's 2012–2016 Action Program, which includes objective of: (i) improving public utility services and networks in provincial centers; and (ii) supporting the significant expansion of industrial development in Darkhan city. The activity will further support the Ministry of Finance's strategy for the development of Darkhan as both an industrial center and as a "model city for urban livability" for Mongolia.[23]

51. **Fit with ADB country partnership strategy**. The proposed intervention aligns with the ADB country partnership strategy, 2011–2015 for Mongolia, and is consistent with ADB's Water Operational Plan in Mongolia through its objectives of: (i) supporting innovative approaches to wastewater treatment technologies under Mongolian conditions; and (ii) supporting urban utilities sector reform and capacity development. It is in alignment with the impacts, outcomes and outputs supported by the country partnership strategy, and will contribute to the achievement of millennium development goal targets in providing improved access to satisfactory sanitation. Urban development was first included as a distinct sector in 1992 in the ADB Mongolia Country Strategy. However, the link between the urban sector and the overall country strategy was not strong. In an attempt to strengthen this strategic linkage, the 2004 country strategy and program sought to reorient the urban strategy toward the provision of those services fundamental to achieving MDG targets. The 2012-2016 Country Strategy continues on this trajectory with a strong emphasis on infrastructure and access to basic services. The Components which contribute to this goal and are included under this project are: (i) improved infrastructure planning; (ii) provision of physical infrastructure (including wastewater treatment): and (iii) institutional and service delivery reform and capacity development.

B. Project Impact, Outcome, and Outputs

52. The project impact will be improved urban living conditions and improved environment in Darkhan City and the Kharaa River basin. The project outcome will be improved wastewater collection and treatment for domestic and industrial users in Darkhan City. The indicative outputs include:

(1) **Output 1:** Modern central wastewater treatment plant (WWTP) with a total treatment capacity of 20,000 m^3/d through structural renovation and partially new construction, and full new equipment installation with a new, efficient treatment process meeting national effluent standards constructed and operating in Darkhan;

(2) **Output 2:** Improved wastewater collection system with 1,800 meters of replaced sewer lines, and two structurally renovated, newly equipped pumping stations operating in Darkhan;

(3) **Output 3:** Institutional development, training, and sector policy dialogue to increase institutional capacity in utility project management, planning, procurement, implementation, operation,

[22] Sigel K. 2010. Environmental sanitation in peri-urban ger areas in the city of Darkhan (Mongolia): A description of current status, practices, and perceptions.

[23] Merged from Ministry of Finance and Ministry of Economic Development in October 2014.

monitoring and improved efficiency of utility service provision.

53. The project is operating in the context of an existing sewerage network, wastewater treatment plant (WWTP) and industrial wastewater pre-treatment plant. The existing system (WWTP, sewer system, pumping stations) is described in **Appendix 1**. The current wastewater treatment plant adopts a conventional activated sludge process arrangement (Figure A1.4). The sewer network has of total length of 223.5 km made up of about 97 km of trunk main, 2 km of rising main, and the remainder in secondary sewers and connectors. The condition of the network is variable, as many of the pipes are almost 50 years old.[24] An industrial wastewater pre-treatment plant has been in operation in the industrial area in Old Darkhan since 2010. The main user of the treatment plant is the tannery; the plant precipitates chromium from tannery effluent which is then discharged to the sewer system for further treatment and the central WWTP. At the point of discharge to the WWTP, the water quality meets relevant Mongolian standards. This is confirmed by the *aimag* Environment Protection Agency and Us Suvag.

54. The project outputs and activities are described in more detail in the following sections.

C. Output 1: Modern wastewater treatment plant (WWTP)

55. Output 1 comprises a new wastewater treatment plant for Darkhan which will treat all wastewater from residential areas in New and Old Darkhan and all wastewater (pre-treated and un-treated) wastewater from the Darkhan industrial area. The planning horizon is 2040. The new WWTP will be constructed within the same footprint of the existing WWTP (see Figure III-2) except that it will occupy a smaller area, reusing only some of the structural elements of the existing plant. The WWTP is located in *bagh* 3 (sub-district). The current site is approximately 2.1 km x 0.64 km, with an area of approximately 136 ha. This is an adequate land area for Output 1. The new WWTP is designed to produce an effluent which complies with the newly established standard for wastewater discharge to water bodies (MNS 4943:2011)[25], and will have the following characteristics:

(1) 2 streams with a total treatment capacity of 16,000 m^3/d (plus a 8,000 m^3/d standby stream) (approximately 150,000 population equivalent at Darkhan flow rates)[26]; The wastewater treatment system will comprise: (i) rehabilitation of the existing inlet works and pump station and new preliminary treatment works (screening and sand, grit and grease removal); followed by (ii) primary settlement in the rehabilitated exiting primary clarifier (one of three); (iii) biological treatment in an integrated fixed film activated sludge bioreactor (IAFS) which will combine the features of activated sludge and fixed biofilm technologies in a series of reactor tanks fabricated from a single steam of the rehabilitated and reconstructed existing ASP biological reactor; and (iv) secondary settlement on one of the existing secondary clarifiers (rehabilitated); and then (v) ultra-violet disinfection[27] and discharge for effluent polishing in the rehabilitated maturation ponds; and finally (vi) discharge to the Kharaa river. The key steps in the IFAS plant are shown in Figure III-1. A photograph of the WWTP site is given in Figure III-4.

[24] A full inventory of sewer network pipes including age of pipes is presented in Appendix 4. The project will finance the replacement of 1,800m of bypass main and tertiary sewers identified as key priorities by the Darkhan Us Suvag.

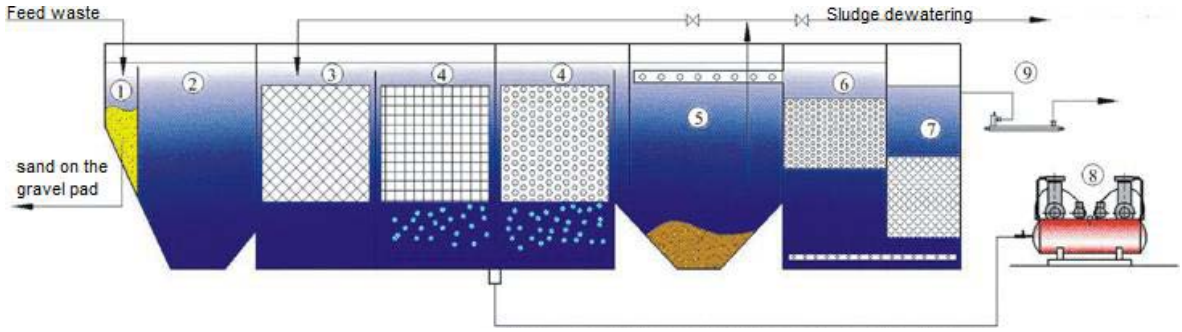
[25] See Table II-8

[26] The capacity of the WWTP was established based on water demand and wastewater flow projections for the period 2015-2040, presented in Appendix 1.

[27] UV disinfection was selected for the following reasons: (i) there are significant concerns associated with chlorination including the production of potentially hazardous byproducts (chlorinated organic compounds), toxicity concerns from chlorine residual for the biota in receiving surface waters, and the potential hazards associated with handling the chlorine at the treatment plant; and (ii) unlike chlorine, UV does not pose disinfection byproducts, toxicity, or hazardous materials concerns.

(2) A filter press will be introduced to reduce sludge volume prior to discharge to sludge drying beds (60ha storage capacity, see Figure III-3). The biological wastewater treatment process will produce a well-mineralized sludge which will be dewatered using the filter press from which it will be conveyed to the sludge drying beds. This can ultimately be reused as organic fertilizer.

(3) A layout for the proposed treatment configuration is provided at Figure III-3 which highlights in blue those elements which will be rehabilitated and transformed as an IFAS system. The arrangements for maintaining treatment capacity during rehabilitation and reconstruction of the new plant will involve temporary use of the other treatment units which are currently not utilized. The process and sequencing for this is provided at **Appendix 2**. Unused parts of the old WWTP (which will continue operation during project implementation) will be retained for possible future use in expansion, including the primary sedimentation tanks, aeration tanks, recycling sludge tanks, mechanic shop, and laboratory-office (Figure III-3).



Notes:
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

Source: ADB. Wastewater Management for Darkhan – Project Preparation, L2301-MON Interim Final Report

Figure III-1: IFAS Plant Technology

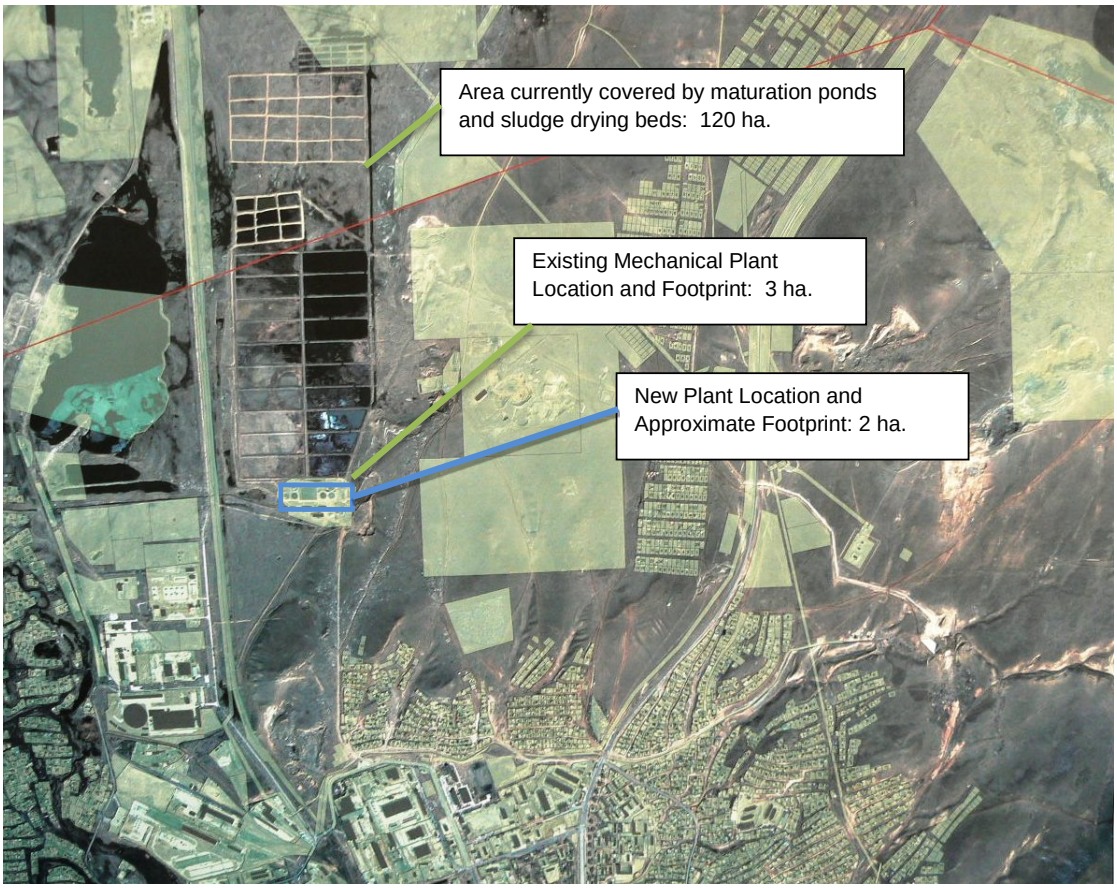
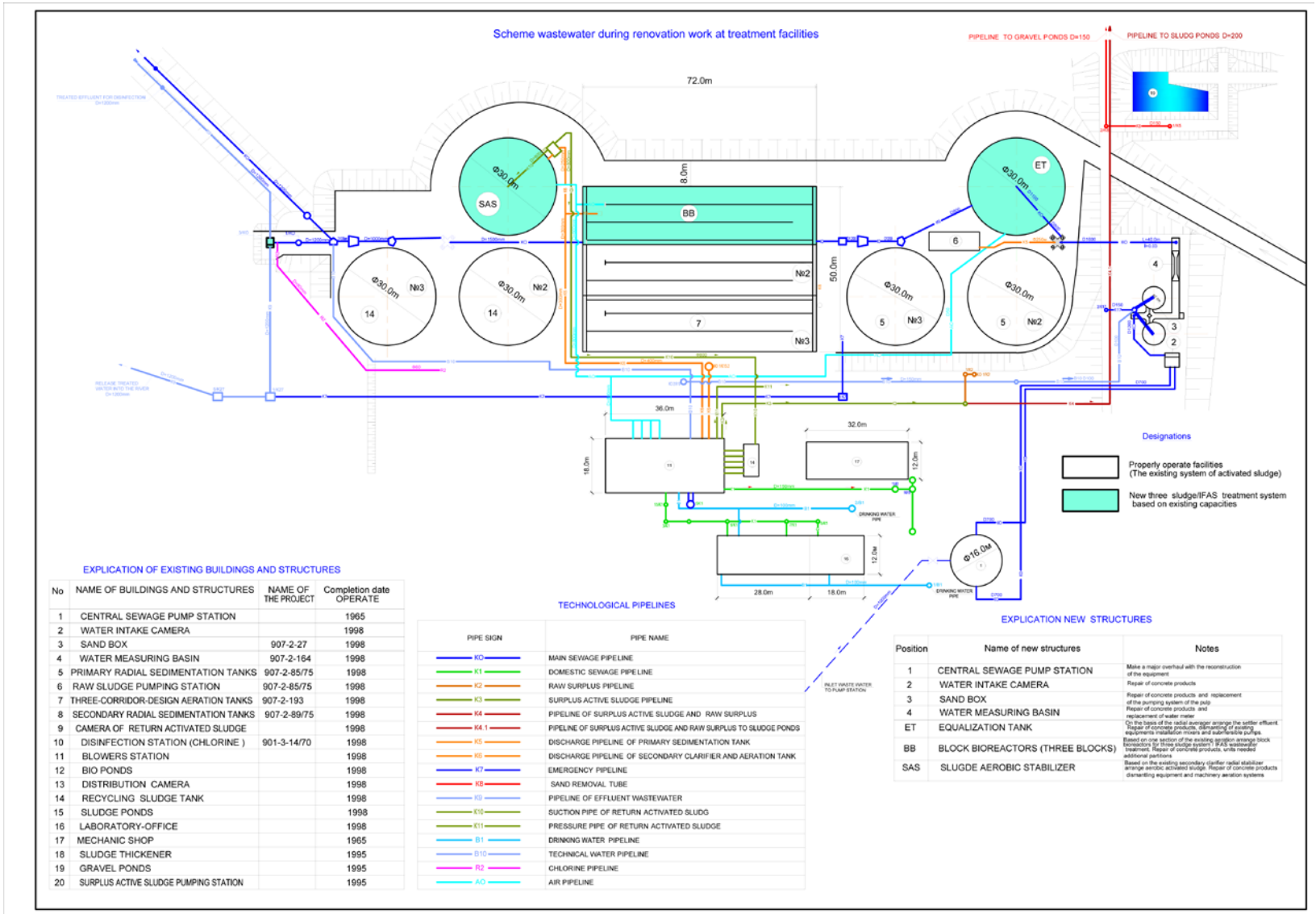


Figure III-2: Location and approximate footprint of proposed new WWTP



EXPLICATION OF EXISTING BUILDINGS AND STRUCTURES

No	NAME OF BUILDINGS AND STRUCTURES	NAME OF THE PROJECT	Completion date OPERATE
1	CENTRAL SEWAGE PUMP STATION		1965
2	WATER INTAKE CAMERA		1998
3	SAND BOX	907-2-27	1998
4	WATER MEASURING BASIN	907-2-164	1998
5	PRIMARY RADIAL SEDIMENTATION TANKS	907-2-85/75	1998
6	RAW SLUDGE PUMPING STATION	907-2-85/75	1998
7	THREE-CORRIDOR-DESIGN AERATION TANKS	907-2-193	1998
8	SECONDARY RADIAL SEDIMENTATION TANKS	907-2-89/75	1998
9	CAMERA OF RETURN ACTIVATED SLUDGE		1998
10	DISINFECTION STATION (CHLORINE)	901-3-14/70	1998
11	BLOWERS STATION		1998
12	BIO PONDS		1998
13	DISTRIBUTION CAMERA		1998
14	RECYCLING SLUDGE TANK		1998
15	SLUDGE PONDS		1998
16	LABORATORY-OFFICE		1998
17	MECHANIC SHOP		1965
18	SLUDGE THICKENER		1995
19	GRAVEL PONDS		1995
20	SURPLUS ACTIVE SLUDGE PUMPING STATION		1995

TECHNOLOGICAL PIPELINES

PIPE SIGN	PIPE NAME
K0	MAIN SEWAGE PIPELINE
K1	DOMESTIC SEWAGE PIPELINE
K2	RAW SURPLUS PIPELINE
K3	SURPLUS ACTIVE SLUDGE PIPELINE
K4	PIPELINE OF SURPLUS ACTIVE SLUDGE AND RAW SURPLUS
K4.1	PIPELINE OF SURPLUS ACTIVE SLUDGE AND RAW SURPLUS TO SLUDGE PONDS
K5	DISCHARGE PIPELINE OF PRIMARY SEDIMENTATION TANK
K6	DISCHARGE PIPELINE OF SECONDARY CLARIFIER AND AERATION TANK
K7	EMERGENCY PIPELINE
K8	SAND REMOVAL TUBE
K9	PIPELINE OF EFFLUENT WASTEWATER
K10	SUCTION PIPE OF RETURN ACTIVATED SLUDG
K11	PRESSURE PIPE OF RETURN ACTIVATED SLUDGE
B1	DRINKING WATER PIPELINE
B10	TECHNICAL WATER PIPELINE
R2	CHLORINE PIPELINE
AO	AIR PIPELINE

EXPLICATION NEW STRUCTURES

Position	Name of new structures	Notes
1	CENTRAL SEWAGE PUMP STATION	Make a major overhaul with the reconstruction of the equipment
2	WATER INTAKE CAMERA	Repair of concrete products
3	SAND BOX	Repair of concrete products and replacement of the pumping system of the pulp
4	WATER MEASURING BASIN	Repair of concrete products and replacement of water meter
ET	EQUALIZATION TANK	On the basis of the radial averager arrange the settler effluent. Repair of concrete products, dismantling of existing equipments installation mixers and submersible pumps.
BB	BLOCK BIOREACTORS (THREE BLOCKS)	Based on one section of the existing aeration arrange block bioreactors for three sludge system's IFAS wastewater treatment. Repair of concrete products, units needed additional partitions
SAS	SLUGDE AEROBIC STABILIZER	Based on the existing secondary clarifier radial stabilizer arrange aerobic activated sludge. Repair of concrete products dismantling equipment and machinery aeration systems

Figure III-3: Treatment plant layout as new integrated fixed-film activated sludge treatment plant

From left to right: WWTP buildings, pumping house, area towards Kharaa river

Figure III-4: Existing WWTP facilities

D. Output 2: Improved wastewater collection system

56. Output 2 comprises the replacement and/or rehabilitation of existing sewer pipes, pumps and ancillary works which are currently broken or beyond their useful economic life, located at various points within the city network. All works will follow existing pipeline alignments, or be located at existing facilities (e.g. pump stations). Sub-components will include: (i) replacement of 1,800m of bypass main and tertiary sewers; and (ii) rehabilitation of 2 pumping stations:

(1) **Sewer replacement**: (i) tertiary sewers at primary south pumping station: 1,400m x 1 m dia. (see below); (ii) tertiary sewers at old Darkhan hospital No. 2: 300m x 0.3 m dia.; and (iii) bypass main at secondary pumping station: 100m x 0.8 m dia.;

(2) **Rehabilitation of secondary pumping station**: The basic structure of the pump house is sound, so the project will carry out the following: (i) full rehabilitation of the existing building – adding surface treatments; (ii) full replacement of pumping facilities (duty and standby units); (iii) replacement of ventilation system (including both inlet and outlet piping); (iv) replacement of power supply system; (v) provision of automated remote control facilities to connect with the overall remote control system panel; and (vi) replacement of facilities including screens and manual lifting equipment.

(3) **Rehabilitation of south pumping station:** Based on the Government's policy to establish an industrial park in the southern part of Darkhan in the late 1980s, the 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. In addition a section of 1,400 m of gravity flow pipeline is not installed at the pumping station. This needs to be installed to enable the pump station to operate. The basic structure of the pump house is sound, so the project will support the following activities: (i) full rehabilitation of the existing building – adding surface treatments; (ii) full replacement of pumping facilities (duty and standby units); (iii) replacement of ventilation system (including both inlet and outlet piping); (iv) replacement of power supply system; (v) provision of automated remote control facilities to connect with the overall remote control system panel; (vi) replacement of facilities including screens and manual lifting equipment.

57. The location and context of Output 2 sub-components is shown in Figure III-5 to Figure III-11. Details of pumping stations and sewer network rehabilitation activities are presented in **Appendix 4**.

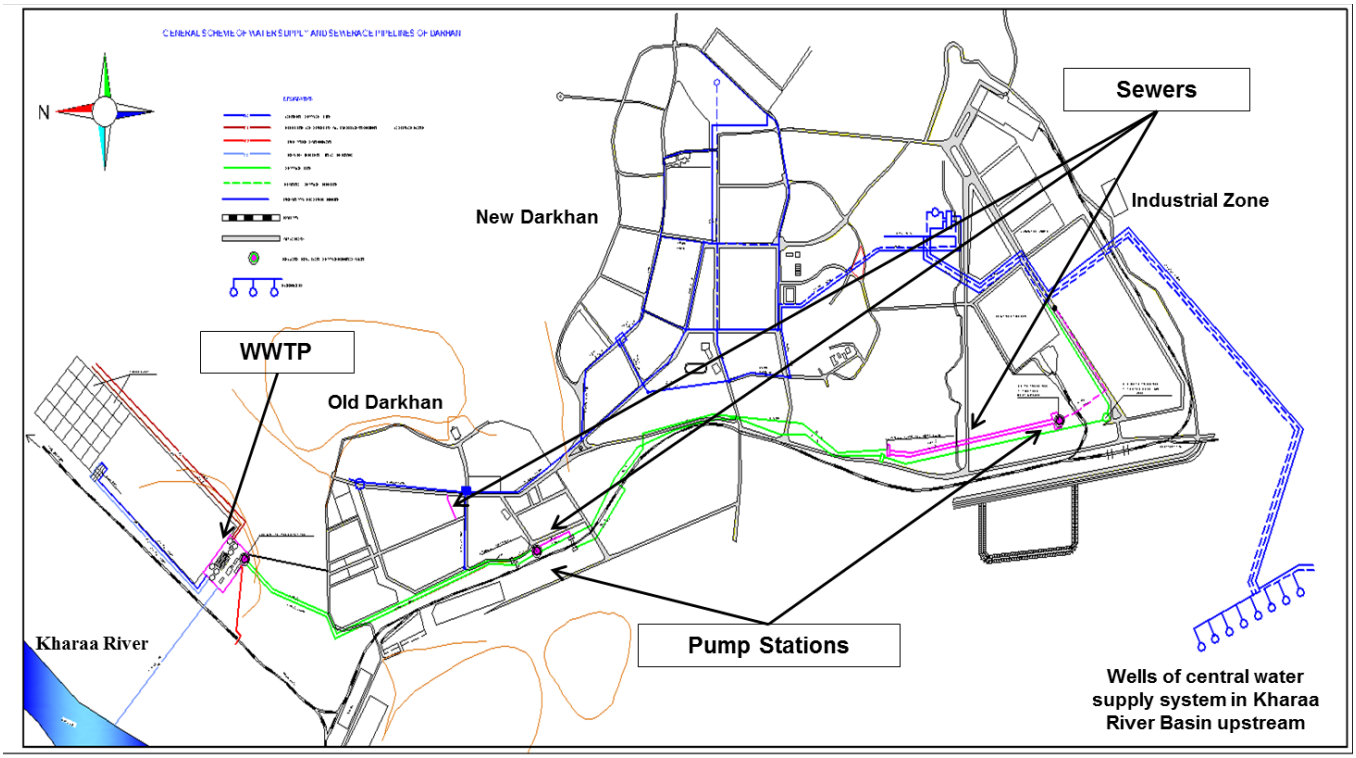


Figure III-5: Location of project interventions in Darkhan City. *Source: ADB Study Team*

Figure III-6: South Pumping Station Tertiary Sewer. *Source: Google Earth, ADB Study Team*

General area Pumping station Access road and ger

Figure III-7: South Pumping Station. *Source: ADB Study Team*

Figure III-8: Tertiary Sewers Old Darkhan Hospital. *Source: Google Earth, ADB Study Team*

Route of Pipeline (from left to right): School (exposed inspection chamber, Inspection chamber, Apartment area

Figure III-9: Tertiary Sewers Old Darkhan Hospital. *Source: ADB Study Team*

Figure III-10: Secondary Pumping Station. *Source: Google Earth, ADB Study Team*

Unused Tertiary pipe | Tertiary pipeline | Secondary Pumping Station

Figure III-11: Secondary Pumping Station. *Source: ADB Study Team*

E. Output 3: Institutional development and capacity building

58. Under Output 3, the project will provide expert support for project management and implementation. It will provide support for institutional enhancement and capacity development in utility management, operation and service provision, detailed technical design and construction supervision, strengthen project management unit and project implementation unit capacities. The project will include policy dialogue on (i) water and wastewater tariff reform to achieve cost recovery, (ii) sanitation improvements including in ger areas, (iii) solid waste management. It will support public awareness campaigns on environmental management, sanitation and solid waste management. It will also provide training, seminars, workshops, and study tours on project management, utility operation and maintenance, financial management, procurement, project monitoring and evaluation. A piggy-back technical assistance will further support institutional development of utility service provision, strategic planning, and operation improvements. The packages under Output 3, including the terms of reference, are defined in the project administration manual (PAM).

F. Project Area of Influence, Project Implementation Schedule

59. The project sites were visited in September 2013 and April 2014 for the preparation of this IEE with particular attention paid to: (i) sensitive natural environmental receptors such as water bodies and wildlife habitats; (ii) sensitive human receptors; and (iii) cultural and heritage sites. The project's area of influence was defined based on the definition provided in ADB's Safeguard Policy Statement (2009) as follows:

(1) **Primary project site(s) and related facilities:** These include the WWTP site in Darkhan, three sections of sewer pipe which are to be rehabilitated along a government right of way near Darkhan hospital, and the secondary and industrial area pumping stations owned by Darkhan *aimag*.

(2) **Associated facilities that are not funded as part of the project**: Under ADB's Environment Safeguards Sourcebook, Associated Facilities are those which are "not funded as part of a project but whose viability and existence depend exclusively on the project". The sewerage network is an existing facility which is not reliant on the project (improvements to the WWTP, 1.1 km of tertiary sewer rehabilitation and pumping stations upgrades). The sewerage network is currently functioning adequately and issues with the existing sewerage network have been identified by Us Suvag and will be addressed as part of their regular and planned maintenance. Therefore it is concluded that there is no facility that depends exclusively on the project. However, there are several facilities which classify as "existing facilities" in accordance to ADB's Safeguard Policy Statement (2009), including: (i) the existing WWTP; (ii) the existing wastewater pumping stations; and (iii) the existing sewer network. For these existing facilities, audits have been conducted, presented in **Appendix 1**, **Appendix 3 and Appendix 4**. The audit for the WWTP was conducted by the State Professional Inspection Agency as well as a private company specialist in concrete structures.

(3) **Areas and communities potentially affected by cumulative impacts from further planned development of the project**: The communities around the project area are principally those industries and houses closest to the WWTP and residents and businesses close to the area which may be affected by noise, during replacement of sewer pipes. Regarding further planned development of the project and its potential impacts, the project, when completed, will not require further development however in the future, the WWTP and sewerage network will require maintenance which will be carried out by the Us Suvag.

(4) **Areas and communities potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location**: It is not anticipated that the WWTP and related improvements will cause any unplanned developments. It is a site-specific project that is not likely to cause additional developments in the city, rather additional developments (housing and industry) will benefit from the project.

60. **Project area of influence**. Based on the above, the area which may potentially be affected by the project can be considered as: (i) "main project areas of influence", covering component sites (footprints) and areas within 200 m from their edges. 200 m is the potential reach of noise and dust which is likely to have an impact on human receptors which are the most sensitive receptors in the project area; and (ii) "extended areas of influence" which includes borrow areas/quarry sites, waste disposal sites, access routes to and from component sites and the resources in close proximity to them, sources of water for construction use, resource use and sources of labor, as well as the Kharaa River as receiving water body. Table III-1 shows the potential receptors and resources which may be influenced by impacts from the project at each component site.

Table III-1: Potentially Affected Receptors and Resources in Output Sites

Output	Affected Resources and Distance (meters)
Output 1 - Central WWTP	Soil / Ground - contamination and erosion Water - Kharaa River from effluent WWTP operators/staff - noise and dust Air - dust Waste disposal site Resource use - materials and energy
Output 2 - Infrastructure Replacement/Rehabilitation	**Sewer Replacement at old Darkhan hospital** Socio-Economic- Street sellers outside hospital / market and two businesses in apartment blocks (3 m and 20 m) Residents - apartment blocks (20 m) Social services - School (5 m), Hospital (15 m) Cultural Resources - Temple (100 m) Soil / Ground - contamination and erosion Health and Safety - community Resource use - materials and energy
	Sewer Replacement & Power Distribution at Secondary Pumping Station Soil / Ground - contamination and erosion Water - Kharaa River from effluent Air - dust Residents - gers (130 m from pipe, 30 m from pumping station) Socio-Economic - pastureland Health and Safety - community Resource use - materials and energy
	New south pumping station Soil / Ground - contamination and erosion Socio-Economic - pastureland Air - dust Residents - ger (50 m) Health and Safety - pumping station caretaker Resource use - materials and energy

Source: ADB Study Team

61. **Implementation schedule.** The tentative project implementation schedule for the project is set out in the schedule shown in Figure III-1.

Table III-2: Project implementation schedule

Indicative Activities	2014 (Qtr)				2015 (Qtr)				2016 (Qtr)				2017 (Qtr)				2018 (Qtr)			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
A. DMF																				
Output 1																				
Activity 1.1: Prepare employer's requirements and procure Design Build and Operation Assistance for WWTP. Approvals.																				
Activity 1.2: Renovate, construct and install new equipment, commission of WWTP. (2015–2016)																				
Activity 1.3: Start operating and monitoring of WWTP																				
Output 2																				
Activity 2.1: Detailed designs, approvals and procure sewer and pumping station works and equipment																				
Activity 2.2: Construct, commission, and start operating sewers and pumping stations																				
Output 3																				
Activity 3.1: Establish PMU, PIUs and recruit staff																				
Activity 3.2: Project Management and implementation support																				
Activity 3.3: Institutional development																				
Activity 3.4: Provide staff training																				
Activity 3.5: Policy dialogue and public awareness campaigns																				
B. Management Activities																				
Establish PMU, PIUs, PSC, etc.																				
Consultant selection procedures																				
Environment management plan key activities																				
Communication strategy key activities																				
Annual/Mid-term review																				
Project completion report																				

Source: ADB Study Team

IV. DESCRIPTION OF THE ENVIRONMENT (BASELINE)

A. Urban Form, Socio-economic Conditions

62. **Location.** Darkhan is situated at 49°28'08"N; 105°57'27"E approximately 230 km from Ulaanbaatar. The city of Darkhan (now Old Darkhan) was founded in 1961 with construction of New Darkhan commencing one year later. New Darkhan is located about 2 km to the south of Old Darkhan, from which it is separated by a small range of hills. Figure IV.1 shows the location of the two urban centers, the neighboring industrial estate, main ger areas, wastewater treatment plant and Kharaa River. The Kharaa river basin is one of the three drainage basins in Mongolia. Through Lake Baikal 230 km to the North of Darkhan, in the Russian Federation, the basin eventually drains into the arctic ocean.

63. **Administration.** Administratively, Mongolia is divided into 21 *aimags* (provinces) and the capital city Ulaanbaatar. *Aimags* are divided into *soums* which are further divided into *baghs*. The proposed project is in Darkhan-Uul *aimag*, which is divided into 4 *soum*s. The project components are all in Darkhan *soum* which is the most populated of the four *soum*s in Darkhan-Uul. The wastewater treatment plant is owned by Darkhan-Uul *aimag* government but is operated and maintained under an agreement by Darkhan Us Suvag, which is a state-owned company.

64. **Land use.** The current land use for the city is shown in **Figure IV-1**. The figure also shows the *bagh* boundaries; the WWTP is in *bagh* 3 to the north of the city, Old Darkhan. The nearest *ger* housing, or hashaa (plot of land) is approximately 650 m from the WWTP.

65. **Population.** About 85% of the population of Darkhan-Uul *aimag* lives in the city (Darkhan soum) but the population of both the aimag and each of the soums has shown only a very modest increase over the past few years. As Table IV-1 shows, over the past decade, population remained little changed between 2003 and 2009, but following a significant increase in 2010, has shown a decline since then, with a particularly steep decline between 2011 and 2012, and only a slight recovery since then. This suggests that during the period 2003 to 2010 the slow out-migration from Darkhan was being compensated for by the natural population increase.[28] Figures vary as to the proportion of the population of Darkhan soum who live in the centrally planned and serviced apartment areas of Old Darkhan and New Darkhan, and those who live in the peripheral ger areas. Estimates for the former vary from 60% to 69%[29] with the Aimag Land Administration office providing an estimate of 60%. The Aimag Land Administration office indicates that the target is to have 75% of the population living in the centrally planned and serviced areas by 2020. There is a transient population in Darkhan which is not fully captured in the official figures, and for which accurate estimates are not available. This is primarily made up of:

(1) Students: Darkhan is an educational center with ten tertiary educational institutions in addition to 25 secondary schools and 14 kindergartens, and a number of other small vocational training centers. The transient student population during term-time is estimated to peak at about 5,000.[30]

(2) Herders: The number of urban inhabitants rises during the winter months as some herder

[28] Mongolia Human Development Report 2011: From Vulnerability to Sustainability, UNDP, Ulaanbaatar, 2011

[29] The figure of 69% is widely quoted in the MoMo reports and by the Darkhan Us Suvag, but is not verified by the aimag government which provides a figure of 60%. A figure of 65% is used for planning purposes.

[30] Estimate by the office of aimag chief of policy development.

families relocate back to Darkhan after summers spent with their herds. Again, accurate numbers are unknown, but estimated at a few hundred.[31]

66. Based on these additional transient populations, the current population in Darkhan Uul can be estimated to peak at about 100,000 and for Darkhan soum about 82,000. In population equivalent terms, the transient and student population can be estimated to provide a population equivalent of between 4,000 and 5,000.

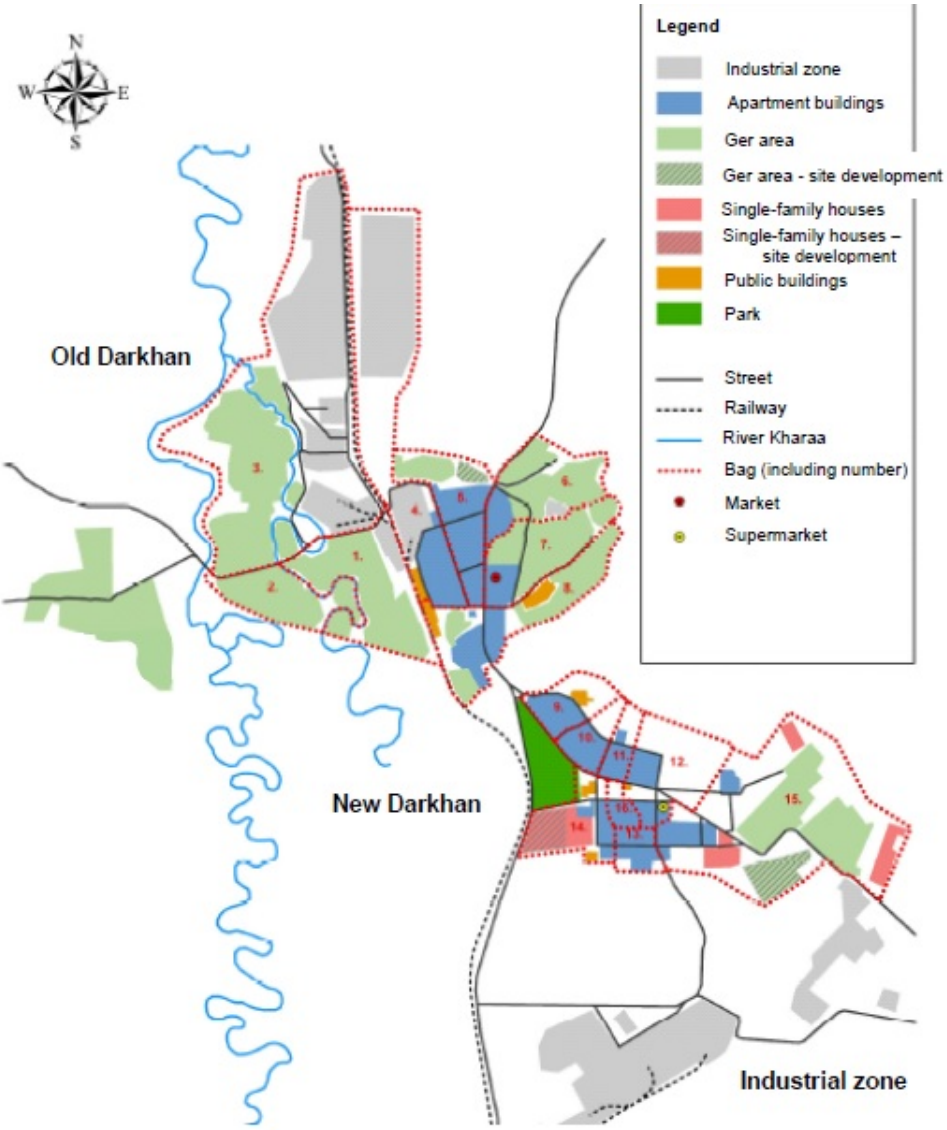


Figure IV-1: Land use, Darkhan city. *Source: K. Sigel (2010)*[32]

67. **Economic Conditions**. Darkhan was established as an industrial city in the 1960s and it continues to be an industrial town. In 2009, manufacturing and mining employed approximately 19,000

[31] Office of the head of Administration; Darkhan Uul aimag.
[32] Sigel, K. (2010) Environmental sanitation in peri-urban ger areas in the city of Darkhan (Mongolia): A description of current status, practices, and perceptions. Helmholtz-Zentrum für Umweltforschung – UFZ Department Ökonom.

people, which is approximately 16% of the *aimag* population.[33] Heavy industries are located close to residential areas of Darkhan. The industrial area, approximately 2 km from Old Darkhan, includes a sheepskin tannery making products for domestic and export markets, a metallurgical plant which produces steel products, a meat processor, a flour mill, cement and brick factories and in old Darkhan there is a timber processing operation. Additional industry is planned, which will afford more employment opportunities. This includes a new ore processing factory which has been built but is not operational, and a new wool processing operation, also not yet operational.

68. **Water and wastewater sector assessment**. A sector assessment is presented in **Appendix 1**. The existing situation with respect to the water and wastewater sectors in Darkhan can be described as problematic, but not critical. Water supply and wastewater management are the responsibility of the Public Urban Services Organization (PUSO) for Darkhan – Darkhan Us Suvag (USAG) - which was established in 1965 and currently has 192 staff of which 40 have an engineering qualification. Darkhan Us Suvag functions as a service organization and a limited liability joint stock company. The company is owned 40 per cent by the aimag government and 60 per cent by the aimag peoples Khural (on behalf of the people of the aimag). The water supply and wastewater assets of the aimag are vested in the Us Suvag LLC.

69. **Poverty**. In April 2012, revised poverty numbers were released for Mongolia according to the World Bank methodology based on the 2011 Household Social Economic Survey conducted by the Mongolian National Statistics Office. According to the joint estimation, poverty headcount index in Mongolia stands at 29.8 percent which is 9.4 percentage points less than in 2010, poverty depth amounts to 7.6 percent which represents a drop of 3.7 percentage points, poverty severity is at 2.8 percent which is 1.8 percentage points less than in 2010. By regions, the poverty headcount index shows that the headcount index in the Central region (in which Darkhan-Uul *aimag* is located) is 27.2 percent, compared to Ulaanbaatar city at 23.5 percent. The data show that for the country as a whole, there is more poverty in rural areas than urban.

70. **Occupational health and safety**. Occupational safety considerations are currently a low priority in Mongolia, given observations on construction sites. Construction workers and maintenance staff can be observed operating without Personal Protective Equipment (PPE). Article 16 of the National Constitution of Mongolia states that every employee has the right to 'suitable conditions of work'. The government adopted a National Program for Occupational Safety and Health Improvement in 2001 and national standards are also adopted such as the National Standard on Occupational Health and Safety MNS 5002:2000.

71. **Community safety related to construction**. The location of the WWTP means that members of the community are unlikely to enter or pass through the WWTP site; it is not close to housing areas or industrial/commercial buildings and does not appear to be used for access. The works required for Output 2 (rehabilitation of pumps and ancillary equipment) may occur in more populated areas, particularly the replacement of sewer pipes at around the hospital in Old Darkhan. However all construction areas in the project should be prepared for managing community health and safety, even if community residents do not appear to be living or working near the construction sites.

72. **Physical cultural resources.** The only cultural site in the project area is the Old Darkhan Buddhist temple, approximately 200 m from Old Darkhan hospital (Output 2, sewer pipe replacement near Old Darkhan hospital). Figure IV-2 shows the temple which can be accessed from several locations. The photograph shows an entrance to the east, 100m from the sewer pipeline (Output 2) to

[33] Sigel K. (2010) Environmental sanitation in peri-urban ger areas in the city of Darkhan (Mongolia): A description of current status, practices, and perceptions

the side of Old Darkhan Hospital. The temple is not a listed cultural heritage site.

Figure IV-2: Old Darkhan Temple, Getsogdarjaalin Monastery. *Source: ADB Study Team*

B. Physical conditions within the study area

a. Topography, Geology, Soil

73. **Topography and Geology**. Darkhan is at an elevation of around 700m above sea level. The east of the city is characterized by rolling hills which are used as pasture land for herders. The west is clearly defined by the Kharaa River and its floodplain which at Darkhan city is approximately 2-3 km wide. The river basin lies in an area where intrusive rocks of leucocratic granite and granodiorite have intruded into sediments. In places where this intrusion has occurred, gold deposits can be found in the Kharaa river basin.

74. Hummocky terrain in the floodplain around Darkhan indicates thermo-karst, which is the thawing of permafrost. Permafrost is characterized by negative temperatures of soils/rocks and occurrence or possible occurrence of underground ice. An active layer is subject to seasonal thawing/freezing, beneath which is a permanently frozen ground. Global warming and anthropogenic impacts intensify permafrost warming and thawing. Permafrost degradation can cause substantial change in water hydrology, damage infrastructure and affect ecosystems. Continuous permafrost lies predominantly in mountain areas with altitude of more than 3,000 m above sea level. Therefore given the altitude of Darkhan (700 m) any permafrost in the floodplain is likely to be sporadic permafrost which occurs in the muddy soil of springs/water bodies.

75. **Soil.** Soil characteristics within the Kharaa basin are identified on a digital soil map which is shown in Figure IV-3. The map shows the project area to be dominated by (i) fluvisols - typically found on flat land associated with flood plains, (ii) kastanozems - are humus-rich soils that were originally covered with early-maturing native grassland vegetation, which produces a characteristic brown surface

layer, found in relatively dry climatic zones.[34] Around the city, where the ground is not covered with vegetation or paved such as in unpaved ger areas, dry friable soils are visible, with gulleying caused by stormwater flow on slopes.

76. The Detailed EIA undertaken for the project included soil sampling at six locations in the project area. The analysis confirmed that samples 1 and 2 are on alluvial soil, samples 3-5 are sandy dark brown soil and sample 5 is a dark brown soil. The results are presented in Table IV-1 and Table IV-2. The Detailed EIA concludes that all the samples tested meet the required Mongolian National Standard relating to soil contamination.

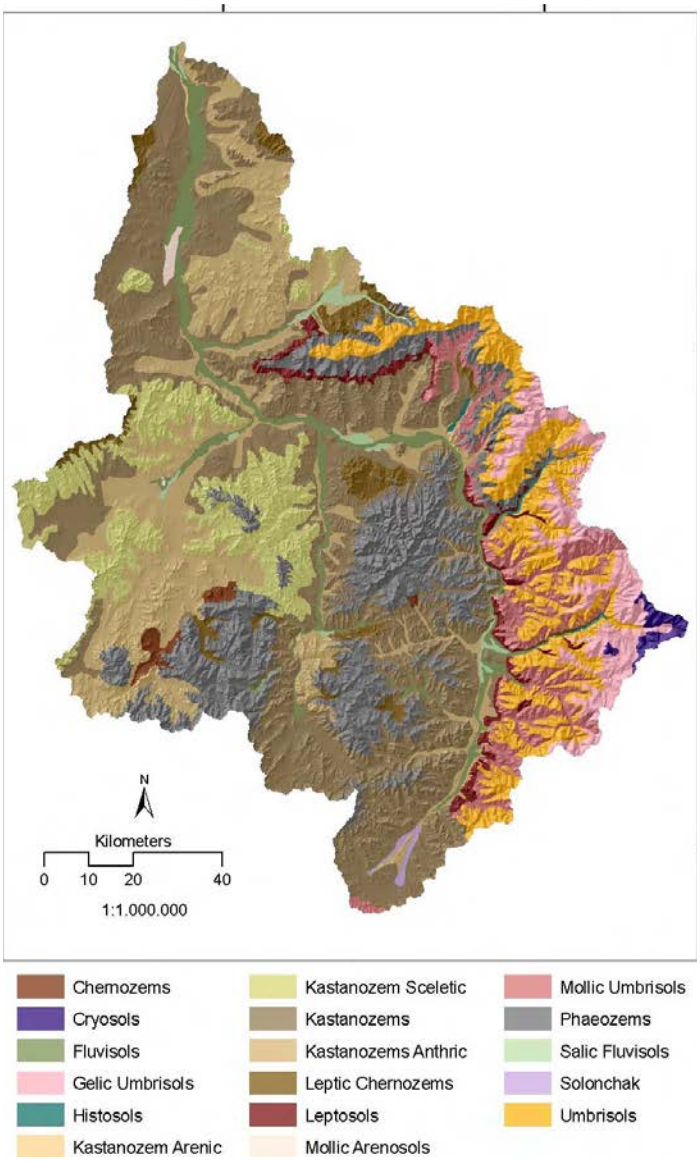


Figure IV-3: Kharaa Basin digital soil map

[34] United Nations Food and Agriculture Organization

Table IV-1: Chemical characteristics of soil samples

Sample Number	Coordinate	pH	$CaCO_3$ (%)	Humus (%)	EC (dS/m)	Mobility (mg/100gr)	
						P_2O_5	K_2O
WWTP-1 River bank	49°30'31.3 105°54'11.5	8.73	0.00	2.073	0.628	1.85	16.2
WWTP-2. River sediment	49°30'31.2 105°54'11.2	8.60	0.00	0.310	0.230	0.14	7.2
WWTP-3. Project area	49°30'24.3 105°55'28	8.40	0.00	6.537	2.512	2.38	31.4
WWTP-4. WWTP area	49°30'28.3 105°55'31.3	8.36	0.00	2.488	0.195	1.954	16.2
WWTP-5. Sludge pond	49°30'33.1 105°55'36.9	7.59	0.00	6.688	0.399	4.26	42.7
WWTP-6. Mountain slope	49°30'22.9 105°56'02	7.95	12.72	2.270	0.840	1.86	30.8
CaCO3 - Calcium Carbonate, EC- Electroconductivity, P_2O_5 - Phosphate (oxide), K_20 - Potassium (oxide)							

Source: Environ LLC. Detailed EIA.

Table IV-2: Heavy metal content of soil samples

Sample number	Heavy metal content mg\kg				
	Chromium	Lead	Cadmium	Nickel	Zinc
WWTP-1. River bank	15.5	20.1	0.23	7.1	187.8
WWTP-2. River sediment	7.9	5.5	0.04	4.7	23.5
WWTP-3. Project area	21.7	18.7	0.08	21.5	200.6
WWTP-4. WWTP area	73.9	12.3	0.05	12.9	94.8
WWTP-5. Sludge pond	60.3	63.8	0.11	8.1	192.7
WWTP-6. Mountain slope	16.9	15.2	0.07	10.6	68.5
Standard (MNS 5850 : 2008)	***150***	***100***	***3***	***150***	***300***

Source: Environ LLC. Detailed EIA.

77. **Land Degradation**. In Mongolia, land is degraded in a number of ways including forest clearance, pasture degradation, damage through mining and chemical pollution. Between 2006 - 2009 annually approximately 110,000 km^2 (approximately 7% of Mongolia's territory) is considered degraded. The majority of this land degradation has occurred in pasture land. However, Darkhan-Uul is shown to have one of the lowest rates of land degradation of all *aimag*s in Mongolia however the main form of degradation is damage to farmland in Darkhan-Uul, see Figure IV-4. In Darkhan-Uul *aimag*, as demonstrated by discussions with the *aimag* Environment Protection Agency officer, deforestation is an issue. This is further supported by the 2011 Human Development Report for Mongolia which states that in some *aimags*, including Darkhan-Uul, if the present rate of deforestation continues, there will be no forests left in three years' time (2014). Currently forests are found in more rural parts of the *aimag*, and are not found near Darkhan *soum.*

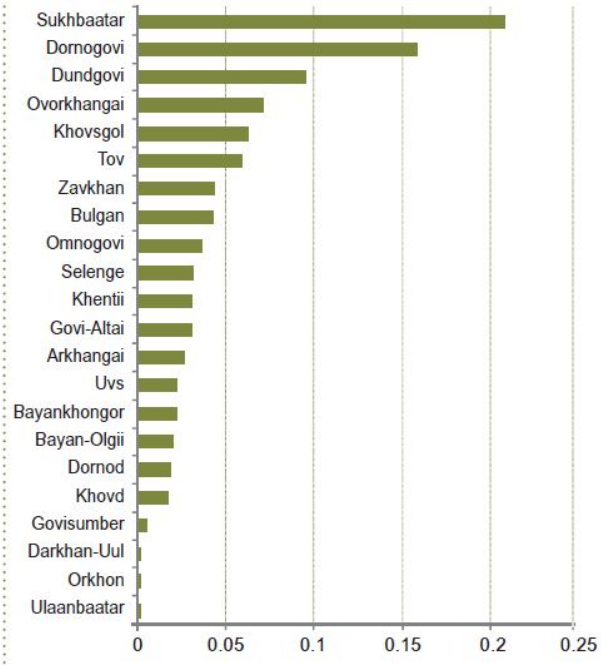


Figure IV-4: Share of *aimag*s in Land Degradation (average 2005-2009)
Source: UNDP (2011) Mongolia Human Development Report 2011. From Vulnerability to Sustainability: Environment and Human Development

b. Climate

78. **Climate**. The Kharaa river basin climate is characterized as a dry winter continental climate. Mean annual temperatures are around 0 °C with long cold winters; mean monthly temperatures in January range from -20 to -25 °C with minimum temperatures reaching - 40 °C. The summer season is short and warm, with average temperatures for July exceeding 15 °C.[35] The Kharaa River is continuously covered with ice between November and March.

79. **Precipitation.** Precipitation data for Baruunkharaa, 80 km from Darkhan city show that the majority falls between June and August in the Kharaa River basin. The relatively low levels of precipitation from November to March mean that snow cover is sparse in the Kharaa basin in winter. Potential evapotranspiration is high during summer; between 85-95% of precipitation is lost through evapotranspiration.[36] Figure IV-5 shows the variation in precipitation in the Kharaa River basin catchment. Specific rainfall data is available for Darkhan Uul, showing that the project area receives about 320 mm of precipitation annually (Figure IV-2), of which over 90% occurs in summer months.[37]

[35] MoMo (2009). Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo) Case Study in the Kharaa River Basin Final Project Report
[36] MoMo (2009). Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo) Case Study in the Kharaa River Basin Final Project Report
[37] Environ LLC (2014) A Detailed Environmental Impact Assessment Report for Expansion Project of Central Treatment Plant in Darkhan-Uul Province [*sic*].

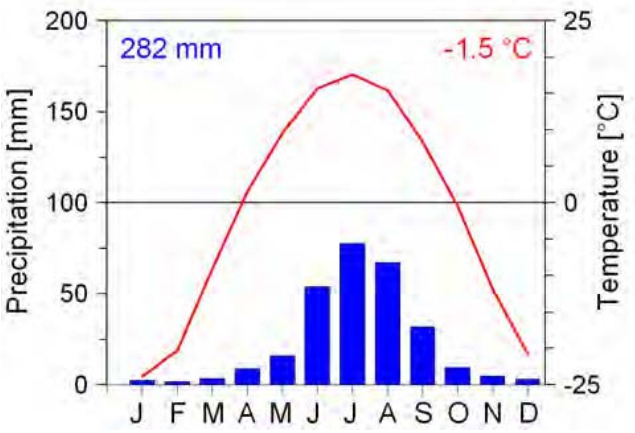


Figure IV-5: Average monthly precipitation and temperature, Baruunkharaa meteorological station

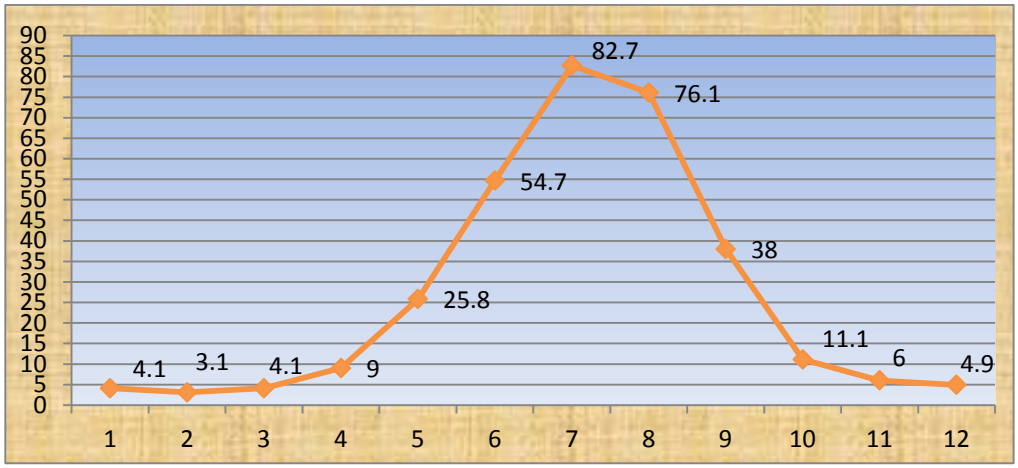


Figure IV-6: Average annual precipitation in Darkhan Uul. *Source: Environ LLC. Detailed EIA.*

80. **Humidity.** The relative humidity in the project area is an annual average of 66% which is one of the most humid areas in Mongolia. Maximum relative humidity in Darkhan is 70-80% during winter, 35-45 % during spring, 55-65% during summer and 40-49% during autumn.

81. **Wind Direction**. Based on 30 years of data, the predominant direction of wind in Darkhan is north and the average wind speed is 3.4 m/sec^{-1}. Figure IV-7 shows the wind direction over 30 years and updated data for 2013.

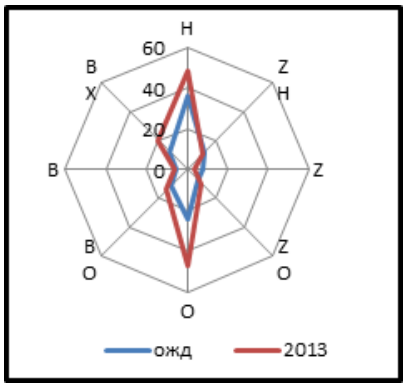
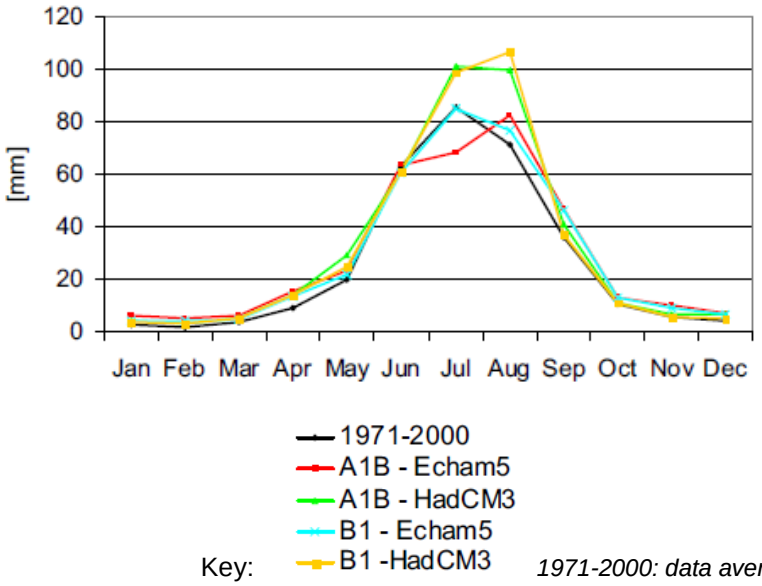


Figure IV-7: Wind Direction, Darkhan.
Source: Environ LLC. Detailed EIA.

82. **Climate variability, climate change projections**. Between 1940 and 2008, evidence shows an increasing trend of winter precipitation and a decreasing incidence of summer rainfall.[38] However for Mongolia, over the longer term, climate models predict that summer rain will increase. Based on appropriate climate models for Mongolia (HadCM3 model of the HADLEY center), results show that the annual precipitation will generally increase. Precipitation in the summer season is predicted to increase by less than 10 percent, which is smaller than the rise in winter precipitation compared to the normal climate. Because of climate change, it is anticipated that winters will become milder and more snowy, while summer will become hotter and drier even though there will be a slight increase of precipitation based on overall climate change predictions. A recent trend of increasing frequency of extreme precipitation events is likely to continue. Specific climate predictions made for the Arctic Ocean drainage basin (in which Darkhan is based) shows that river runoff in the Arctic Ocean basin is predicted to increase by 2-9 mm. However, the projected increase in evaporation from open surface water will exceed the increase in runoff. This will lead to dryer conditions and to an imbalance between inflow and outflow of water bodies.[39] Figure IV-9 shows the predicted changes to precipitation under a number of climate models.



Note: A1B and B1 are greenhouse gas scenarios used for climate change predictions. Based on statistical interpretation of the global climate models outputs, the HadCM3 model of the HADLEY center was the most suitable for the specific conditions of Mongolia.

Figure IV-8: Kharaa River Basin Climate Change Scenarios for Precipitation. *Source: Mongolia Second National Communication on Climate Change and MoMo*[40]

83. These Climate Change predictions are consistent with the findings from the recently developed ADB climate change risk screening tool. [41] Annual mean temperature is projected to increase by 2.3 ^{0}C in the 2031-2040 time period, and by 3.2^{0}C in the 2051-2060 time period. Precipitation is projected to

[38] Mongolia 2nd National Communication for UN Framework Convention on Climate Change.
[39] Mongolia 2nd National Communication for UN Framework Convention on Climate Change.
[40] MoMo (2009). Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo) Case Study in the Kharaa River Basin Final Project Report.
[41] ADB Internal Document. EAER Staff Guidance. Assessing Climate Change Risks in PRC and Mongolia. February 2014 (Draft March 2014).

increase approximately 10% or 30 mm in the 2031-2040 time period. Monthly precipitation increases projected for cold months (October – May) are higher than warmer months (June – September) in relative terms. Projections for the 2051-2060 increase are approximately 15% or 44.8 mm in comparison with the 1961-1990 historical data. During this time frame, a reverse pattern is predicted, with higher precipitation increases projected for warmer months (April to August) than colder months (September to March). The annual PET is projected to increase by 8.1% for the 2031-2040 time period and by 12.0% for the 2051-2060 time period. Annual runoff is projected to increase by 10.6% for the 2031-2040 time period and by 12.2% for the 2051-2060 time period. Predicted changes for other variables, such as humidity and soil moisture are minimal. Due to increased temperatures and higher rates of PET, the probability of droughts is projected to increase. Similarly, chances for severe storm and floods may also increase due to increased precipitation. The probability of *dzud* is more likely to increase due to increases for winter precipitation as projected for 2031-2040.

c. Hydrology, Surface Water Quality

84. **Kharaa River.** Surface water resources in the project area are dominated by the Kharaa River. The existing WWTP is approximately 1.5 km from the river. The Kharaa River Basin is shown in Figure IV-9. The Kharaa river basin is part of the larger Selenge river catchment, shown in Figure IV-10. The Kharaa River is 362 km long and has a mean long-term annual discharge (1990-2008) of 12.1 $m^3 s^{-1}$, measured at the Buren Tolgoi, 23 km from Darkhan city. In the lower end of the drainage basin, in which the project is based, the river flows naturally and is channelized in only a limited number of locations and therefore the river meanders and the floodplain meadow still serves its natural function. The runoff regimes into the Kharaa River are dictated primarily by rainfall distribution; average flow increases to 22 $m^3 s^{-1}$ in August, and decreases to 2.5 $m^3 s^{-1}$ in January and February. However a secondary discharge peak occurs in May melt waters from the Khentii area temporarily raise the water levels.

Figure IV-9: Kharaa River Basin Map.
Source: Priess, J. et al.[42]

Figure IV-10: Selenge River Basin.
Source: MoMo[43]

[42] Priess, J. et al. The consequences of land-use change and water demands in Central Mongolia. Land Use Policy Volume 28, Issue 1, January 2011, Pages 4–10

[43] MoMo (2009). Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo) Case Study in the Kharaa River Basin Final Project Report

85. **Surface water quality.** Long term water quality monitoring data are presented by MoMo[44] for the Kharaa River basin. Darkhan falls in the Kharaa III sub-basin, for which water quality data are presented in Table IV-3. Water quality of all the Kharaa River is monitored weekly by the *aimag* Meteorological Office and the results of the monitoring in comparison with MNS 4586:1998 Water Quality Standards (ambient water quality) are published on their website. Data collected between 21-22 August 2013 by *aimag* Meteorological Office is shown in Table IV-4.

Table IV-3: Kharaa River water quality (*Source: MoMo 2009)*

Parameter	NH4-N (mg/L)	TN (mg/L)	PO4-P (mg/L)	Cl- (mg/L)
Kharaa III sub-basin	0.109	1.08	0.094	8.98
MNS 4586:1998	0.50	10.0	0.10	300
Compliance?	✓	✓	✓	✓

Table IV-4: Kharaa River water quality, Sharingol Bridge, Darkhan (upstream of discharge point), 21-22 August, 2013

Parameter	O_2	BOD	COD	NH_4-N	NO_2-N	PO4-P
Location: Sharingol Bridge, Darkhan (upstream of WWTP)	6.70	1.08	6.5	0.45	0.006	0.103
MNS 4586:1998	*6.0*	*3.0*	*10*	*0.50*	*0.02*	*0.10*
Compliance?	✓	✓	✓	✓	✓	×

Source: Aimag Meteorological Office[45]

86. The Detailed EIA undertaken for the project also presents water quality data for the Kharaa River. The data and a comparison with the Mongolian National Standard are presented in Table IV-5. The table shows that for the data given, the parameters of ammonia (NH4-N) and the Biological Oxygen Demand (BOD) did not meet the standard.

Table IV-5: Kharaa River water quality

Parameter	Kharaa bridge (upstream of WWTP)	Kharaa- Darkhan Meteorological Office (downstream of WWTP)	*MNS 4586:1998*	*Standard is Met*
pH [-]	8.12	8.14	*6.5-8.5*	✓
Solute O2 [mg/L]	9.63	9.67	*6.00*	✓
NH4-N [mg/L]	0.2	1.02	*0.50*	×
NO2-N [mg/L]	0.009	0.019	*0.02*	✓
NO3-N [mg/L]	0.029	1.22	*9.00*	✓
PO4-P [mg/L]	0.043	0.061	*0.100*	✓
BOD5 [mg/L]	2.39	3.02	*3.00*	×

Source: Environ LLC. Detailed EIA

87. **Flooding**. Reduced forest areas in Darkhan-Uul *aimag* may alter water discharge pattern and contribute to increased risks of flooding in the Kharaa River and its tributaries. The Kharaa River does not regularly flood. The most significant flood in recent years was in 1973 when flows of 722 m^3/s were observed. The most recent flood occurred in January 2006 when high rainfall led to the Kharaa River flooding and flowing at 65.9 m^3/s.[46] During intense rainfall events, specific areas of the city are subject to temporary flooding, primarily caused by blocked stormwater channels. The channels are blocked

[44] MoMo (2009). Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo) Case Study in the Kharaa River Basin Final Project Report
[45] Data available on http://www.icc.mn/*aimag*/Darkhan/
[46] http://air.president.mn/en/

with sediment and solid waste. Flooding is exacerbated by the lack of connections to the storm water drainage system; most areas of the city, apart from main roads, have no stormwater flow management.[47] Areas liable to this flooding include old Darkhan's market area, the micro-district in between old and new Darkhan and ger areas built on the flood plain of the Kharaa River, to the west of the railway. The flooding generally lasts for one to two days after a prolonged intense rainfall event. There is no record of floods at the existing WWTP site since it has been put in operation in the 1960's.

88. **Groundwater**. Groundwater in Darkhan is located primarily along the Kharaa River channel and flood plain. The depth to groundwater fluctuates with the season and averages at 3 m. Groundwater resources are abstracted and monitored by Us Suvag. There are 18 groundwater abstraction boreholes in the *aimag* along the Kharaa River valley and about 5 km upstream of Darkhan city, of which currently around five are used for meeting the water use requirements;[48] the current total residential and industrial demand (of about 18,000 m3/d but up to 23,000 m3/d) can be provided from just 5 or 6 production wells. The remainder of the boreholes can be bought into operation by Us Suvag if needed. The wells are located along the Kharaa River and are approximately 70 m deep. The unconfined aquifer is characterized by alluvial sand and gravel with interlaced sandy loam. The main aquifer extends with a width of 10 to 20 km along the Kharaa River, and up to a thickness of 70 m. The groundwater recharge from precipitation is very low in the Darkhan area. The recharge depends on the inflow of groundwater from aquifers of the upper catchment area where precipitation and groundwater infiltration rates are higher. Us Suvag monitors groundwater weekly for between 6 to 18 parameters. Us Suvag confirmed that the groundwater meets the MNS 900:2005 (Mongolian National Standard for potable water). [49] A more detailed description of groundwater resources is presented in **Appendix 1**.

89. **Wastewater treatment plant effluent.** The Meteorological Office[50] of Darkhan-Uul *aimag* is responsible for monitoring the performance of treatment plants in the *aimag*, and the Darkhan WWTP is one of four plants operating within the aimag which are monitored for compliance with national effluent discharge standards. The results from sampling at the points of discharge from the treatment plants to the Kharaa River carried out in the summer of 2013 are shown in Table IV-6. This reveals that despite its operational problems, the Darkhan WWTP delivers an effluent which satisfies the effluent discharge standards on 80% of occasions. This is supported by evidence from *MoMo* which states that "the impact of the wastewater input is detectable [in the Kharaa River] although the nutrient levels are on a moderate level".

[47] MoMo (2009). Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo) Case Study in the Kharaa River Basin Final Project Report
[48] Meeting Ms Sarangerel, Us Suvag Laboratory 26. 09. 2013
[49] Meeting Ms Sarangerel, Us Suvag Laboratory 26. 09. 2013
[50] Source: Darkhan Meteorological Office Data available on http://www.icc.mn/aimag/Darkhan/

Table IV-6: Darkhan-Uul aimag WWTP discharge against quality standard, 21-22 August, 2013

Wastewater Treatment Plant Location	Approximate Distance from Darkhan city (km)	% of effluent samples meeting Standard for wastewater discharge to water bodies (MNS 4943:2011)
Darkhan WWTP	-	80.0
Khongor *Soum* WWTP	25 km	36.9
Salkhit WWTP	35 km	42.9
Sharin Gol WWTP	47 km	70.4

Source: Aimag Meteorological Office[51]

90. The Detailed EIA undertaken for the project also presents quality data for the influent and effluent of the wastewater treatment plant. The data and a comparison with the Mongolian National WWTP effluent standard are presented in Table IV-7. The table shows that for the data given, the parameters of ammonia (NH4-N), phosphorus (PO4-P) and Chemical Oxygen Demand (COD) did not meet the standard.

Table IV-7: Influent and effluent water quality of the WWTP (monitored in Feb 2014)

Parameter	Influent	Effluent	Standard for wastewater discharge to water bodies (MNS 4943:2011)	*Standard is Met*
pH [-]	8.44	8.09	*6-9*	✓
SS [mg/L]	486	5.8	*50*	✓
NH4-N [mg/L]	65	25	*6*	×
PO4-P [mg/L]	7.61	1.98	*0.3*	×
BOD5 [mg/L]	249	13.5	*20*	✓
COD [mg/L]	607.7	99	*50*	×

Source: Environ LLC. Detailed EIA

d. Air Quality, Noise

91. **Ambient air quality.** Air quality is monitored by the Meteorological Institute of Darkhan at an air quality station in Darkhan. Figure IV-11 shows the last 13 years of measurements for sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) in Darkhan. Recently available data (Table IV-8) indicates that air quality met the national air quality standards and meets the WHO standards for 24 hour mean of SO_2 (0.02 mg/m^3) and NO_2 (0.04 mg/m^3).[52] Figure IV-12 shows annual average SO_2 & NO_2 data for Darkhan *soum* against the National Standard MNS 5919:2008.

92. The data in Table IV-8 are for air quality in late summer, which is known to be higher quality than in winter, when the thermal power plant and ger areas of Darkhan emit higher levels of emissions. Therefore the average Figures given in Figure IV-11 are higher, particularly for SO_2, as this includes both winter and summer data; the comparison of these two data sets demonstrates how differences may occur between summer and winter air quality.

93. The environmental assessment undertaken by the Meteorological Office for the National Committee on Reducing Air Pollution[53] concludes that the main cause of air pollution in Darkhan is the power station, as some of the boilers in the thermal power plant are not meeting air quality emissions requirements. This is leading to higher than expected outputs of pollutants such as NO_2 and SO_2 which exceed standards MNS 5919:2008 (emissions from industrial boilers and thermal power plants) by a

[51] Data available on http://www.icc.mn/*aimag*/Darkhan/
[52] The text emphasizes that the data ''indicate'' that standards are met, rather than 'it does' meet the standards as the data available are not 24 hour means, therefore are not directly comparable with the standard.
[53] http://air.president.mn/en/

factor of 1.2 to 1.5 for NO_2, leading to air pollution in Darkhan.

94. The 2011 Human Development Report for Mongolia noted that air quality issues are significant in urban areas. The report made a policy recommendation specifically to reduce the vulnerability of urban residents to urban air pollution in a number of urban areas including Darkhan by improving energy use industries.

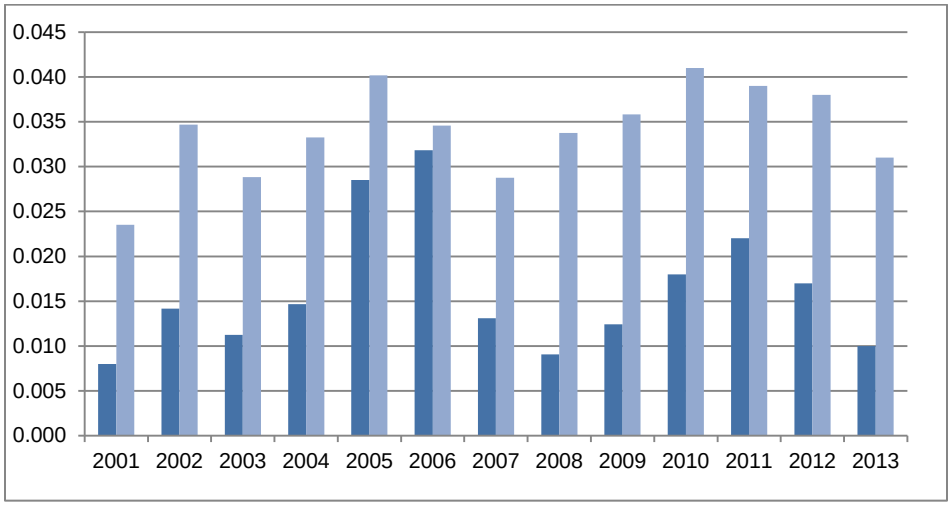
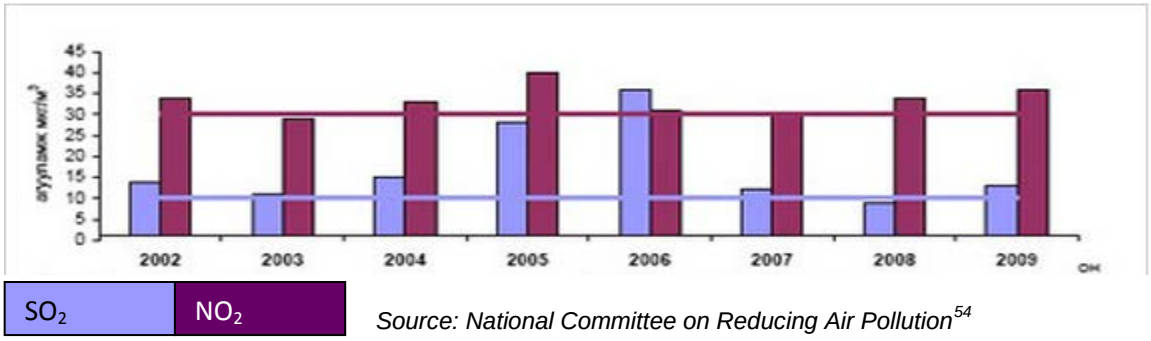


Figure IV-11: Annual average SO_2 and NO_2 concentrations in Darkhan, [mg/m^3] *Source: Environ LLC. Detailed EIA*

Table IV-8: SO_2, NO_2, and Dust, Darkhan (12/09/2013)

	Sulfur dioxide SO_2	Nitrogen dioxide NO_2	Dust
Average	0.003	0.024	0.053
Mongolian Standard 24 hr Mean	0.020	0.040	0.15
Units	mg/m^3	mg/m^3	mg/m^3

Source: Meteorological Institute of Darkhan

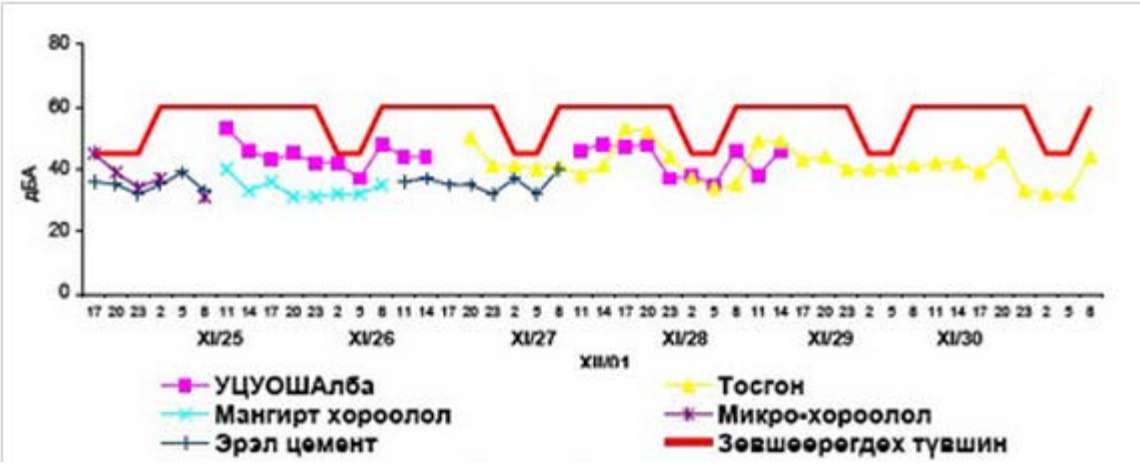


Source: National Committee on Reducing Air Pollution[54]

Figure IV-12: Darkhan *soum* Air Pollution Emission 2002-2009 Annual Average

[54] http://air.president.mn/en/

95. **Acoustic environment.** Noise can affect sensitive receptors such as humans. No regular noise monitoring data were available to inform this study relevant to WWTP site. However noise data are available for a specific study undertaken in November 2012 for an assessment of the environmental condition of Darkhan, undertaken by the *aimag* Meteorological Institute. The data were recorded in five locations, and showed that the daytime average was 30-45 dB (Mongolian National Standard is 60 dB) and night time average is 31-43 dB (Mongolian National Standard 45 dB). Figure IV-13 gives noise monitoring data for five locations in Darkhan.



Key to Locations
Pink - Meteorological Institute, Blue - Mangirt ger district, Black - Erel Cement Factory
Yellow - Tosgon ger district, Purple - Micro district - between Old/New Darkhan
Red line = National Standard
Source: National Committee on Reducing Air Pollution[55]

Figure IV-13: Darkhan *soum* Noise Monitoring Data

C. Ecological resources within the project area

96. **Context.** The location of project output 1 (WWTP) is in an ecologically disturbed environment which has been used as an industrial type site for at least 48 years, i.e., since the WWTP was established. Output 2 (pumping stations, pipes and ancillary works) are in (i) an urban environment, largely devoid of vegetation and other ecological resources and also (ii) in the industrial area of the city, in which heavy industry such as the thermal power plant and tannery are based. In these circumstances, coupled with heavy grazing on the grasslands around the city, available data suggests that flora and fauna in the area to limited and of low ecological value.

97. **Flora and Fauna**. The project area is located in the Mongolian steppe or Mongolian-Manchurian grassland.[56] 59% of the Kharaa River basin area is characterized by grasslands. These grasslands are mainly in the lower reaches of the river, in which Darkhan is located. As the altitude of the basin increases, the vegetation changes to mountain forest steppe zone in the middle reaches and boreal coniferous in the mountainous upper reaches.

[55] http://air.president.mn/en/

[56] World Wildlife Fund. Temperate grasslands, savannas and shrublands; Ecoregions. - http://worldwildlife.org/ecoregions/pa0813

98. The grasslands are currently being threatened by grazing. Sheep-grazing is dominant, although the number of goats raised on the Mongolian-Manchurian grasslands has increased due to the high prices for cashmere wool. Goats eat a wider range of plant species than sheep, forage more aggressively and consume the whole plant; this has contributed to degradation of the grasslands over a widespread area. The flora is dominated by feathergrass (*Stipa baicalensis, S. capillata, and S. grandis*), Sheep Fescue (*Festuca ovina*), *Aneurolepidium chinense*, *Filifolium sibiricuman*, and *Cleistogenes sqarrosa.*[57]

99. World Wildlife Fund (WWF) confirms that the only endemic bird to use the grassland type habitat is the brown eared pheasant and one of the most significant mammals in the grassland is the Mongolian Gazelle (*Procapra gutturosa*).[58] However the IUCN Red Listconfirms that the pheasant is only present in the grasslands of the People's Republic of China and the range of *Procapra gutturosa* does not extend as far north as the grasslands around Darkhan. [59]

100. The Detailed EIA for the project confirmed that although approximately 20 species of birds may use the area around the project site for roosting or transiting, none of the species are on the IUCN red list and those that are present, such as crows and sparrows, are familiar with habitats which have been degraded by human activities. [60] The Detailed EIA also includes information on a number of rodents which are common in Mongolia, such as the house mouse (*Mus musculus*) and Mongolian gerbil (*Meriones unguiculatus*), however the study also concludes that the presence of these mammals cannot be confirmed, and that the habitat is already greatly disturbed by human activities. Therefore, any species present are likely to be those which tolerate disturbance and do not need a habitat with a high ecological value.

101. Ecological assessments of flora and fauna in the Kharaa River basin are presented by *MoMo*. The report states that the analysis of the macro-invertebrate communities along the Kharaa catchment indicated good ecological conditions at most of the sites and an assessment of the fish communities showed a good or very good ecological status at most of the sites sampled. Further information is provided in Figure IV-14.

[57] Ibid.
[58] Ibid.
[59] A global list of endangered species. http://www.iucnredlist.org
[60] Environ LLC (2014) A Detailed Environmental Impact Assessment Report for Expansion Project of Central Treatment Plant in Darkhan-Uul Province [*sic*]

site	Macro-invertebrates average of 5 to 6 metrics	Fish fauna FIBS	Water Quality General parameters		Ecological Status average of MZB, fish and Water Quality	Priority Substances Heavy Metals
Kharaa River Main Channel						
Sug_2	2,0	2,0	2,0		2,0	2,0
Sug_1	2,0	2,0	1,0		1,7	2,0
Kh_8.5	2,0	2,0	2,0		2,0	2,0
Kh_8	1,0	2,0	2,0		1,7	2,0
Kh_7	2,0	2,0	2,0		2,0	2,0
Kh_6	3,0	2,0	2,0		2,3	2,0
Kh_5	3,0	2,0	2,0		2,3	2,0
Kh_4	3,0	2,0	2,0		2,3	2,0
Kh_3	3,0	3,0	2,0		2,7	2,0
Kh_2	2,0	2,0	2,0		2,0	5,0
Kh_1	2,0	2,0	2,0		2,0	2,0

Note: For quality classes: "very good" = blue, "good" = green, "moderate" = yellow, "poor" = orange, "bad" = red. FIBS= German assessment tool

Figure IV-14: Ecological Assessment and Priority Substances. *Source: MoMo (2009). Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo) Case Study in the Kharaa River Basin Final Project Report.*

102. **Protected areas and endangered species.** Darkhan is one of three provinces in Mongolia which does not have any Specially Protected Areas (Strictly Protected Area, National Conservation Parks, Nature Reserves and Monuments). Locally however Darkhan-Uul *aimag* authorities have a local nature reserve status for two local areas of the Kharaa River: (i) Khongor *soum*, the east side of the river bank bagh 1,3; and (ii) Darkhan *soum* the east side of the river bank in *bagh* 2 and 3, 500 m from Ukhaa hoshuu river. These areas were defined by local decisions including (i) the 61st decree of People's Representatives' Meeting in *aimag*, 2007; and (ii) the 4th decree of People's Representatives' Meeting in *Soum*, 2006 respectively. This nature reserve status is not set out in national law, but rather it supports the *aimag* with protecting the natural beauty of an area and therefore is focused on the visual appeal of the area. Discussions with *aimag* Environmental Protection Agency staff confirmed that there are no concerns with rare wildlife species in the area; the main issues dealt with by staff is regarding the illegal collection of fire wood, forest fires and artisanal gold mining. None of these issues will be exacerbated by the project.

V. ALTERNATIVE ANALYSIS

103. Under ADB's Safeguards Policy Statement (2009) there is a requirement to examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and consider the no project alternative.

A. No Action Alternative

104. **The "No Action Alternative**" addresses the likely consequences of not undertaking the proposed action. For this project, the failure to develop and improve the existing sewerage infrastructure may be an impediment to development of the Darkhan as a livable city and may give rise to pollution of the Kharaa River basin as a result of failing WWTP equipment and a predicted increase in wastewater. The improvement of the WWTP will ensure that the urban environment is 'future proofed' and that new developments both in terms of industry and expansion of the town, do not affect negatively on the environment as a result of increased volumes of wastewater. Therefore, it can be determined that the "No Action Alternative" is not a reasonable option if the future environmental quality in Darkhan and the Kharaa River Basin is to be maintained and improved.

B. Location Alternatives

105. The project seeks to improve the efficiency and performance of the existing sewerage network. The central WWTP is currently in a suitable location; it is on the edge of the town, not close to any residential areas and is well served by the sewerage network of pumping stations and pipes in the city. The current WWTP has a large footprint with enough land to store the drying sludge, as currently happens as well as approximately 90 days of wastewater retention capacity, if required. Therefore given the existing location for the WWTP and the current pipe network that services it, location alternatives are not considered further.

C. Design and Technology Alternatives

106. **Pumping houses - design for reuse**. A key consideration regarding the design of the WWTP is the condition of the existing buildings, in particular the pump houses. The pump houses are in a reasonable condition and the fabric of the buildings is sound. In order to consider the most environmentally and socially sound option for WWTP design, the Waste Hierarchy can be applied (Figure V-1). The Waste Hierarchy is a classification of waste management options, ranging from most preferable (waste prevention) to least preferable (disposal).

107. The design of the WWTP takes into account the current structures at the project sites. The chosen option is to rehabilitate the central, secondary and industrial pumping stations. The alternatives include constructing new buildings, and either leaving the existing pumping stations or demolishing them. However the chosen option, of reusing the existing buildings where possible, is the most environmentally and socially acceptable option as falls under the 'waste prevention' category of the Waste Hierarchy. It is anticipated to be the least resource intensive option as constructing new buildings requires considerable resources, in terms of energy, raw materials and associated embodied

carbon[61].

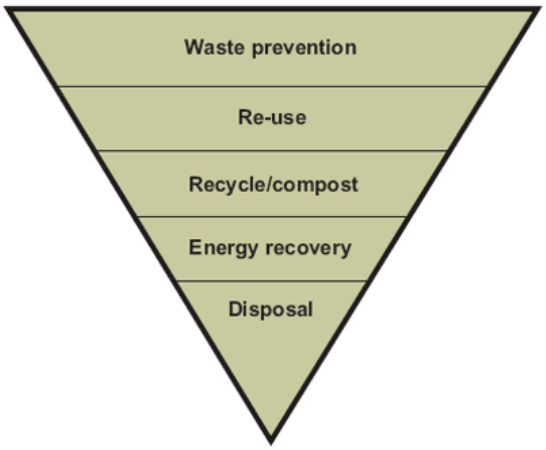


Figure V-1: Waste Hierarchy

Source: Department for Environment and Rural Affairs (UK)

108. **WWTP technology alternatives**. The treatment technologies proposed have been the subject of intensive analysis, based on both international and Mongolian experience of wastewater treatment under condition similar to those found in Darkhan. Wastewater treatment plants are complex systems which rely on a series of sensitive physical, biological and (sometimes) chemical processes to achieve optimal treatment results. While the evaluation of alternative options has narrowed the technology choices to those which are most appropriate for Darkhan, the specific design of the treatment plant, and the way in which it is operated, will need to respond precisely to local conditions and the current and changing nature of the wastewater it will receive, as new generators connect to the wastewater network. Given the context of the Darkhan WWTP, the technology alternatives evaluated as part of the Technical Assistance are narrowed to:

- Option 1. rehabilitation of the existing WWTP as a modified activated sludge process;
- Option 2: construction of a step-feed activated sludge system;
- Option 3: construction of a sequencing batch reactor; and
- Option 4: construction of an Integrated Fixed-film Activated Sludge (IFAS) Plant

109. In terms of environmental risks, there is little difference between the options considered as all, if operated correctly, will offer adequate performance. In terms of costs, the step-feed activated sludge is slightly more expensive and has slightly higher operational cost than the other two systems.

110. The performance of the treatment options is the key environmental and social concern. This includes the adequate mineralization of sludge and the likelihood of accidents or errors in the WWTP operation which may result in the emission of untreated effluent. It is considered that all three options are technically feasible in Mongolia and will be able to meet the necessary effluent standards and sludge mineralization requirements.

111. The client has reviewed the evaluation prepared by the consultants. In addition, Darkhan Uul *aimag* Government and Us Suvag have been given presentations by the consultants on the treatment

[61] Embodied Carbon is the greenhouse gas emissions (usually expressed as carbon dioxide equivalents – CO2e) associated with a product lifecycle; for construction this is the manufacture and transport of the construction materials and components, includes the construction process itself and end of life aspects of the building

system evaluation and the options under consideration. The conclusions and recommendation of this group have been as set out below:

(1) In its meeting held in December of 2013, the MCUD[62] Project Steering Committee concluded that a separate meeting involving MCUD, academia, technical experts and specialists, and Us Suvag should be convened on 27th January 2014 to select the preferred technology for the WWTP;

(2) The expert group met on 27th January 2014, and a presentation was made by the consultant team. However, the group recommended that the MCUD Technical Committee on Water and Wastewater Infrastructure should consider the options and make a recommendation;

(3) On 20th February 2014 a meeting of the MCUD Technical Committee on Water and Wastewater Infrastructure recommended: (i) that the consultants look again at moving bed bioreactor and modified bioreactor options for treatment; (ii) that the existing structures of the WWTP should be rehabilitated if proved to be feasible; and (iii) that a modified activated sludge process technology – such as the IFAS system - should be adopted which is proven suitable for Mongolian conditions;

(4) At the MCUD Steering Committee meeting held on 2nd April 2014 it was concluded that: (i) the proposed design capacity of 20,000 m3/d should be reviewed and confirmed by the consultants based on projections of future wastewater generation rates; (ii) the most appropriate and up-to-date technology should be used for the plant; (iii) the committee supported the adoption of the modified activated sludge process (i.e., Integrated Fixed-film Activated Sludge (IFAS) process) for the Darkhan WWTP, and that the existing structures should be used where feasible, and where consistent with the treatment plant adopting the most modern treatment approaches.

112. As a result of this consultative process, Option 4 (IFAS) was selected, with the reuse of existing buildings. The solution is considered to be environmentally sound; in particular it will produce approximately 1/3 of the sludge as produced by SBR technology and therefore will require smaller volumes of sludge to be treated and disposed of. The effluent quality of IFAS is predicted to be sufficient to adequately meet Mongolian National Standards.

113. A comprehensive description of the technical alternatives for the wastewater treatment process and rehabilitation procedure prepared by the TA consultant is presented in **Appendix 5**.

114. **Wastewater disinfection.** 2 alternatives were considered for effluent disinfection prior to discharge, including UV and chlorine. UV disinfection was selected for the following reasons: (i) there are significant concerns associated with chlorination including the production of potentially hazardous byproducts (chlorinated organic compounds), toxicity concerns from chlorine residual for the biota in receiving surface waters, and the potential hazards associated with handling the chlorine at the treatment plant; and (ii) unlike chlorine, UV does not pose disinfection byproducts, toxicity, or hazardous materials concerns.

[62] In October 2014, MCUD was merged with the Ministry of Roads and Transportation to form the Ministry of Roads, Transportation, Construction and Urban Development.

VI. ANTICIPATED IMPACTS AND MITIGATION MEASURES

A. Environmental Impact Screening

116. The following section screens the potential impacts according to the following factors, and recommends mitigating activities on this basis:

(1) **"Receptor"**: the resource (human/natural environment/economic/social) which is potentially going to receive and have to cope with an impact;
(2) **"Sensitivity"**: ability to cope with an impact and/or its importance to the country of Mongolia. It is generally accepted that human health is always a high sensitivity receptor, however in terms of environmental/natural resources, the sensitivity varies according to the receptor e.g. scrubland with no significant biodiversity is considered less sensitive than a mature forest which supports ecosystems and livelihoods;
(3) **"Magnitude"**: the size of the potential impact. Impacts may be short term and considered low magnitude (e.g. noise or temporary reduction of income during a short construction project) or high magnitude (e.g. the disposal of large quantities of hazardous waste into a water course);
(4) **"Source-Pathway-Receptor"**: Where an impact may occur, but where no receptor is exposed to the impact, no mitigating action will be required. This follows the source-pathway-receptor model, whereby in order for there to be an impact, the pollutant or issue (source) needs to be present, the pathway to a receptor is needed (such as fissures in rocks, or water for human consumption) and a receptor must be present to receive the impact, such as humans, flora or fauna.
(5) **"Residual Impact"**: The impact on a receptor after mitigation is the 'residual impact'. This is key to the assessment of impacts and demonstrates the importance of the implementation of EMP mitigation measures. Table VI-1 shows the matrix used during the screening process to anticipate the *Potential Impact Significance* (PIS). This assists with identifying the most significant and most likely impacts, to be addressed in the Environmental Management Plan (EMP).

Table VI-1: Impact Significance

Receptor Sensitivity & Importance	Magnitude of Impact: LOW	MEDIUM	HIGH
LOW	Low	Low	Medium
MEDIUM	Low	Medium	High
HIGH	Medium	High	High

117. The Potential Impact Significance (PIS) and Residual Impact Significance (RIS) are presented in Table VI-2 to Table VI-4. RIS is the significance of the impact remaining after mitigation has taken place. This more accurately describes the impacts of the project as it is anticipated that the requirements of the EMP will be followed and impacts satisfactorily mitigated. Table VI-2 to Table VI-4 are also in line with the Detailed EIA[63] undertaken in accordance with the laws of Mongolia.

Table VI-2: Impact Screening - Project Design

	Category	Impact Yes/No	Receptor Sensitivity	Magnitude	PIS	RIS
DIRECT IMPACTS						
Physical	Water	Yes	Kharaa River - has ecological value and is a water source. Design must ensure uninterrupted sewage treatment. Medium	Short term during construction until new plant on line. Medium	Medium	Low
Physical	Soil	No	-	-	-	-
Physical	Air	No	-	-	-	-
Physical	Noise	No	-	-	-	-
Physical	Resource Use	Yes	Design will affect energy efficiency, and re-use of existing buildings. Medium	Long term operational implications for energy efficiency. Medium	Medium	Low
Biological	Fauna	No	-	-	-	-
Biological	Flora	No	-	-	-	-
Socio-Economic	Land Acquisition	Yes	Eight businesses will have partial loss of structures. Low	Permanent losses will be compensated. Low	Low	Low
Socio-Economic	Cultural Heritage	No	-	-	-	-
Socio-Economic	Economic Displacement	Yes	Some local businesses may be temporarily affected. Low	Short term. Low	Low	Low
INDIRECT, INDUCED AND CUMULATIVE IMPACTS						
No impacts anticipated resulting from project design/location						

[63] Environ LLC (2014) A Detailed Environmental Impact Assessment Report for Expansion Project of Central Treatment Plant in Darkhan-Uul Province [*sic*].

Table VI-3: Impact Screening – Construction Impacts

	Category	Impact Yes/No	Receptor Sensitivity	Magnitude	PIS	RIS
	DIRECT IMPACTS					
Physical	Soil	Yes	Poor quality soil, not fertile lands. Low	Worst case is medium term if contamination is from chemical spillage. High	Medium	Low
	Flooding	No	-	-	-	-
	Air	Yes	Airborne dust will arise and could affect nearby human receptors. High	Short term, most construction sites will not be close to receptors. Medium	Medium	Medium
	Water	Yes	Kharaa river flood plain - emergency sewer pipe Output 2. Medium	Short term with contamination from construction waste. Low	Low	Low
	Waste	Yes	Poor waste controls could affect soil / water, and public health. High	Hazardous waste may be produced if PCBs are encountered, however quantity is small. Medium	High	Medium
	Resource Use	Yes	Construction resources include fuel and materials such as concrete which may need to be imported. Medium	Relatively small quantities but project will lead to more efficient WWTP. Medium	Low	Low
Biological	Fauna	Yes	Higher fish species in Kharaa river. Medium	Potential contamination from spillages at WWTP but would be diluted by river as construction will not take place near water body. Low	Low	Low
	Flora	No	-	-	-	-
Socio-economic	Cultural Heritage	Yes	Getsogdarjaalin Monastery monks and visitors (Output 2). High	Temporary noise and dust impacts may affect people attending the site. Low	Medium	Low
	Noise	Yes	Noise will impact on the community, particularly hospital residents (Output 2). High	Temporary during construction and construction period near hospital will be brief. Medium	High	Medium
	Community Health &Safety	Yes	Public health and impacts on people from noise, dust and construction sites e.g. open trenches. High	Temporary during construction as construction area will be near a school and housing areas. Medium	Medium	Low
	Economic Displacement and / or Land Acquisition	Yes	These issues are covered in the Land Acquisition and Resettlement Plan which is developed for the project according to SPS 2009.			
	Occupational Health & Safety	Yes	Occupational health. High	Throughout construction, risks may arise. Medium	High	Low
	Utilities Provision	Yes	Limited impact assuming accidental damage only to other services buried near sewer pipes. No district	Assume short term and unlikely impact. Low	Low	Low

	Category	Impact Yes/No	Receptor Sensitivity	Magnitude	PIS	RIS
			heating pipes are near project sites. Low			
	Employment	Yes	Anticipated positive impact as the labor supply (around 50 workers) is likely to be met by the local population.			
	Interruption to pasture land	Yes	Animals out to pasture may be affected by disturbance from project sites in pasture areas (Output 2). Low	Short term during construction. Low	Low	Low
INDIRECT IMPACTS						
Physic -al	Physical resources	No	-	-	-	-
Biolog -ical	Biological resources	No	-	-	-	-
Socio-Economic	Traffic & Journey Times	Yes	Minor journey delays for road users. Low	Short term during single pipe excavation. Low	Low	Low
CUMULATIVE and INDUCED IMPACTS						
Physi cal	Physical Resources	No	-	-	-	-
Biolog -ical	Biological Resources	No	-	-	-	-
Socio-Economic	Noise	Yes	Can affect health for example in hospital patients, Old Darkhan Hospital. High	Hospital near a main road therefore constant level of background noise, but elevated noise short term during pipe excavation. Medium	Medium	Medium

Table VI-4: Impact Screening – Operational Impacts

	Category	Impact Yes/No	Receptor Sensitivity	Magnitude	PIS	RIS
Physical	DIRECT IMPACTS					
	Water	Yes	Kharaa river flood plain – existing emergency sewer pipe above ground[64]. Medium	Pipe is rarely used but needs to be well maintained. Medium	Medium	Low
	Water and Soil	Yes	Inappropriate sludge disposal and poorly mineralized sludge may impact on immediate soil quality, but soil in existing industrial brownfield site. Low	Contamination would be low but over a long period. Medium	Medium	Low
	Water, Soil, Waste & Resource Use, Air Quality	Yes	Positive impacts anticipated on surface water quality given the increased efficiency of the WWTP and sewerage infrastructure.			
Biological	Flora	Yes	Positive impacts for flora and fauna in Kharaa river are anticipated given the increased efficiency of the WWTP and sewerage infrastructure.			
	Fauna	Yes				
Socio-Economic	Community Health and Safety	Yes	Positive impacts anticipated.			
INDIRECT, INDUCED AND CUMULATIVE IMPACTS						
No significant indirect, induced or cumulative impact anticipated resulting from project operation						

118. The screening process showed that following mitigation, related to project design (design phase), the most significant impacts are the temporary economic displacement of 5 street vendors and the need for ensuring continuity of wastewater treatment. The majority of impacts will arise during the construction phase. The most significant impacts may arise from hazardous waste arising and noise and dust arising from excavations which at one project site, is outside a school and a hospital. During operation, no significant environmental impact is anticipated. Through training and appropriate technological design, operational risks of the project can be significantly reduced. The discharge of treated effluent will have no significant impact on the water quality of the Kharaa River.

B. Positive Impact and Environmental Benefits

119. The project will directly benefit about 10,000 households in the apartment areas and 2,000 businesses already connected to the WWTP. The indirect beneficiaries are all residents of Darkhan city. The project will impact household income and well-being of Darkhan city residents through the following mechanisms: (i) increased effectiveness of the Water Supply and Sanitation Company (Darkhan Us Suvag); (ii) extension of business activities; (iii) improvement of health conditions, and (iv) more pleasant environment for residents. Further beneficiaries are those downstream of Darkhan in

[64] The existing above-ground overflow pipe is designed to convey wastewater to nearby existing system of ponds (nearby railway tracks) in case of pump failure at the secondary pumping station.

the Kharaa River basin. The river basin's population and ecology will benefit from any measure which will minimize pollution discharge to the water body. The project will also have significant energy efficiency gains through the use of existing structures (as opposed to the deconstruction of old facilities and construction of new facilities), and through system selection and optimization. Electricity consumption during operation is expected to decrease from today's 1.3 kWh/m3 to 0.9-1.0 kWh/m3, or some 1.7-2.0 million kWh per year. This will result in some 60,000-70,000 USD electricity costs reduction.

120. The development of an efficient and effective WWTP will ensure that in the future, those relying on the Kharaa River as a raw drinking water source are not affected by poor water quality. This includes nomadic herders who graze their livestock on the Kharaa River flood plain, and residents of *ger* areas in the flood plain.[65] The nomadic herders are generally the poorer members of the population, and as such, are less able to withstand health shocks which may be associated with health impacts from poor water quality.

121. Darkhan is considered an industrial city in Mongolia, and the potential attraction of additional industries to the city, will increase the likelihood that industrial wastewater volumes will increase. Current and future industries will benefit from the WWTP as their effluent will be able to be treated centrally in the WWTP, following pre-treatment where required.

C. Impacts Associated with Project Location, Planning and Design

122. Impacts associated with the project location and design focus on the following key areas:

(1) Planning to ensure the current WWTP will remain operational until the new WWTP is operational; and
(2) Resource use: Ensuring that the existing plant and machinery, to the extent possible, are reused in accordance with the Waste Hierarchy (see Figure V-1).

123. **Mitigation measures and actions during design and pre-construction**. The mitigation of impacts from these design issues are as follows:

(1) Careful planning of WWTP rehabilitation and extension works to ensure continuous treatment capacity of existing facility in accordance with the rehabilitation plan defined in Appendix 2;
(2) Design must account for waste management hierarchy philosophy (i.e., where possible existing buildings and machinery shall be reused).

124. Further actions will be implemented in the pre-construction phase to **ensure the project's environment management readiness**. These include:

(1) Appointment of one safeguards staff (PIU-SS) within the PIU to coordinate project EMP implementation;
(2) Contracting of a licensed environmental monitoring institute by the PIU for project specific environmental quality monitoring, developing detailed monitoring plan for pre-construction and construction period (on the basis of the monitoring plan defined in EMP, Table EMP-4), and conduct pre-construction environment quality monitoring;
(3) Updating of the EMP, as required, and incorporated into the detailed to detailed design;

[65] Sigel K. 2010. Environmental sanitation in peri-urban ger areas in the city of Darkhan (Mongolia): A description of current status, practices, and perceptions.

(4) Tender and contract documents to include (updated) EMP requirements;
(5) Develop and implement a grievance redress mechanism (GRM) on the basis of the GRM defined in the IEE, Chapter VIII; and
(6) Consult and inform residents and key stakeholders (including monastery, school No. 15, old Darkhan hospital) regarding construction timing and approach (Output 2).

125. Before the construction starts, the 3 civil works contractors will prepare a **contractor EMPs** (C-EMP) which shall fully respond to the requirements set in the project EMP, and shall include a number of sub-plans, including: (i) soil erosion control plan; (ii) borrow and spoil management plan; (iii) water protection plan; (iv) health and safety risk management plan; (v) spill management plan; and (vi) waste management plan:

(1) The soil erosion protection plan will identify likely areas of soil erosion and the mitigation measures which the contractor will employ to minimize potential erosion around any excavations and construction areas;
(2) The borrow and spoil management plan will specify location of borrow pits, quarries and spoil disposal sites, as needed. Contractors will ensure that (i) borrow areas will be located away from residential areas, water bodies and will avoid valuable pasture/grazing land, (ii) after use borrow pit areas will be graded to ensure drainage and visual uniformity, and (iii) borrow pit restoration will follow the completion of works in full compliance with all applicable standards and specifications;
(3) The water protection plan will include measures to be taken during construction to avoid/mitigate pollution of the Kharaa River arising from construction site drainage (silt), use of chemicals, construction around existing wastewater containing equipment and other potential pollution sources;
(4) The health and safety risk management plan (HSMP): For management of occupational health and safety, the contractor will prepare a HSMP for the construction workers.
(5) The spill management plan will document the specific requirements, protocols, responsibilities, and materials necessary to implement an emergency spill response following an incident;
(6) The waste management plan for construction sites will provide procedures for management of household type waste, hazardous waste, and sewage (if appropriate). It will evaluate the type and quantities of waste, as well as detail arrangements for storage and transportation of the waste to its disposal point. It will include agreements with the *aimag* authorities for waste disposal and consideration of the Waste Hierarchy. The plan will include polychlorinated biphenyl (PCB) assessment and management plan for all pumping station sites. It will include a schedule for disinfection of all waste collection and storage areas.

126. **Utilities Provision**. It is not anticipated that the project will disrupt utilities or any municipal services during construction however excavations associated with sewer pipe replacement at Old Darkhan Hospital (Output 2) may result in accidental interruption to cables or pipes which may be buried near the sewer. The concerned Contractors (2) will consult with relevant *aimag* departments to check location of utilities in advance of construction at all sites.

D. Environmental Impact and Mitigation Measures during Construction

1. Impact on Physical Resources

127. **Impacts on Soil Resources.** Three types of potential impacts on soil are anticipated, including: (i) soil erosion; (ii) soil contamination; and (iii) inappropriate management of borrow and spoil.

(1) Soil erosion: May be caused by excavation of borrow pits, stockpiles and spoils from earthworks during pipe excavation and groundworks for the central WWTP. The factors that are expected to contribute to accelerated erosion in the project area are any exposed soil during periods of rainfall from June to August.
(2) Soil contamination: Localized contamination of soil in the construction phase may result from the inappropriate transfer, storage, and disposal of petroleum products, lubricants, chemicals, hazardous materials, liquids and solid waste. These impacts are particularly associated with construction site chemical storage, and during refueling of plant and equipment.
(3) Borrow and spoil: Borrow will be needed to provide fill for groundworks, particularly associated with adequate coverage of the Secondary Pumping Station tertiary pipes (Output 2) which are above ground and will need adequate protection from cold weather. Spoil will be generated through the excavation of trenches for pipes.

128. **Mitigation of impacts on soil.** The impacts on soil will be mitigated through a number of measures which are defined in the EMP, and which will be incorporated in the bid documents and construction contracts. A summary of the mitigation activities defined in the EMP is as follows:

(1) Soil erosion: (a) soil erosion management plan to be prepared by the contractor before construction starts; (b) minimizing the area of soil clearance; (c) maintaining slope stability at cut faces by implementing erosion protection measures; (d) construction in the flood plain (tertiary pipe at Secondary Pumping Station) should be mainly restricted to the dry season; (e) control silt runoff particularly around tertiary pipe at Secondary Pumping Station; (f) cover soil stockpiles; (g) properly stabilize slopes and re-vegetate disturbed surfaces; and (h) use of temporary berms or other appropriate temporary drainage provisions at construction sites to prevent water eroding cut faces, stockpiles and other exposed areas of soil.
(2) Soil contamination: (a) store chemicals/hazardous products and waste on impermeable surfaces in secure, covered areas with clear labeling of containers and with a tray or bund to contain leaks; (b) regularly remove all construction wastes from the site to approved waste disposal sites; (c) establish emergency preparedness and response plan (Spill Management Plan); (d) provide spill cleanup measures and equipment at each construction site; (e) conduct training in emergency spill response procedures (f) ensure fuel is stored in a tank and vehicle refueling takes place on hard standing, away from sensitive receptors, such as surface water.
(3) Borrow and spoil: (a) Develop and implement borrow and spoil management plan, specifying location of borrow pits, quarries and spoil disposal sites; (b) ensure that borrow areas are located away from residential areas, water bodies and valuable pasture/grazing land; (c) after use, grade borrow and spoil areas to ensure drainage and visual uniformity, and (d) borrow pit restoration must follow the completion of works in full compliance with all applicable standards and specifications;

129. **Impact on air quality.** Moderate temporary air quality impacts during the construction stage of the project could be anticipated because of fugitive dust generation at construction sites for the sections of replaced pipe and at the central WWTP. Minor increases in the level of nitrogen oxides (NO_x) and sulphur oxides (SO_x) from construction plant and machinery are expected. Air quality impacts during construction are likely to result from the following sources:

(1) Emissions from construction machinery and equipment, movement of haulage trucks to all construction sites;
(2) Fugitive dust from stripping of pavement during pipe replacement near Old Darkhan Hospital (Output 2);

(3) Fugitive dust and odor from concrete batching plants required for construction or other plant for manufacture of pavement surfaces when making good after pipe excavation;
(4) Fugitive dust from earthworks such as establishment and use of borrow pits, and back-filling activities;
(5) Fugitive dust from loading, unloading and haulage of spoil for disposal following pipe excavation particularly in areas where human receptors are present such as near Old Darkhan Hospital (Output 2); and
(6) Dust created by wind acting on unprotected surfaces.

130. The key receptor for air quality impacts is people, who would need to be near the construction works before an impact will occur as the impacts will be localized. Air quality issues could affect nearby residential areas at the site of Old Darkhan hospital which also includes a school.

131. **Mitigation of impacts to air quality**. The mitigation measures to protect sensitive receptors from air quality issues are:

(1) Stockpiles must be managed to reduce dust emissions. The location of the stockpiles must be downwind of sensitive receptors. The stockpiles must be sprayed with water before material is moved. If a stockpile is within 300m of dwellings, additional precautions must be taken including using a reusable stockpile cover and fencing to form a high barrier and prevent wind lifting and dispersing;
(2) Construction site management: Water will be sprayed on construction sites and material handling routes where fugitive dust is generated.
(3) Transport of materials: Trucks carrying earth, sand or stone will be covered with tarpaulins or other suitable cover. Construction vehicles and machinery will be maintained to a high standard to minimize emissions (note that local standards do not exist for vehicle emissions)
(4) Manufacturing plants: Site any plants for the production of concrete or pavement covering such as asphalt at least 500 m from the nearest dwelling and locate downwind.

132. **Impacts to water quality**. Overall the project will improve water quality, however it may impact on surface water quality during construction through primarily accidental contamination particularly on the Kharaa River flood plain (Output 2, tertiary pipe at Secondary Pumping Station) during periods of heavy rainfall (June - August). Also leaving the city without any WWTP during construction would have detrimental impacts on water quality. Construction activities have the potential to contaminate groundwater if accidental spills occur in areas of high water table. Groundwater may be impacted upon should a large spill occur; however an impact on the drinking water quality is unlikely as the groundwater extraction boreholes are around 5 km from Darkhan city and residents do not use their own boreholes or wells for drinking purposes.

133. **Mitigation of impacts on surface and groundwater**. The impacts on surface and groundwater will be mitigated through a number of measures defined in the EMP, and which will be incorporated in the bid documents and construction contracts:

(1) Contractors will be required to develop and implement contingency plans for control of spills of oil and other hazardous substances (Spill Management Plan) as part of the C-EMP;
(2) Adequate WWTP capacity will be maintained at all times throughout rehabilitation of the WWTP in accordance with the rehabilitation stage plan (Appendix 2);
(3) Temporary drainage provision will be provided during construction at the Secondary pumping Station tertiary pipes site to ensure that any storm water running off construction areas will be controlled. This will ensure that potentially contaminated sediment laden water does not impact on the flood plain;

(4) Enclosed drainage around chemical storage areas on construction sites and storage will be on hard standing;
(5) Fuel storage, maintenance shop and vehicle cleaning areas must be stationed at least 300 m away from the nearest water body and will include enclosed drainage to ensure contaminated water does not cause pollution and storage, maintenance and cleaning activities will be on hard standing;
(6) Construction wastes and materials (e.g. fuel) will be properly contained during construction on hard standing and fuel tanks will be located in a bunded area which has a capacity of 110% of the fuel tank. Wastes will be stored in a hard standing area which is protected from rain and wind and waste removed from site and taken to approved disposal facilities.

134. **Waste management and resource use.** Minimizing waste conserves valuable natural resources. Disposal of construction wastes could have adverse impacts on soil, water and health of contractors and the community. Waste streams will include inert construction wastes (e.g. soil, spoil, debris, concrete) and municipal type wastes (construction workers' food and packaging wastes from construction consumables). Hazardous waste may include fuel containers, oil filters, oily rags, but potentially will include Polychlorinated Biphenyls (PCBs) from the transformers which remain in the New South Pumping Station (Output 2). PCBs were widely used as coolant fluids and may be found in older transformers. This would require disposal of PCB contaminated equipment as well as liquids.

135. **Mitigation of impacts from solid waste and resource use.** The potential impacts arising from solid and liquid waste production and disposal will be mitigated through a number of activities defined in the EMP, and which will be incorporated in the bid documents and construction contracts:

(1) Waste hierarchy: Construction will be subject to the waste hierarchy to ensure efficient use and management of resources. The preference is for prevention of waste at source. This means the effective management of materials on site through good house-keeping and work planning, in order to generate less waste. Procurement options will play a role in waste prevention as the procurement of materials which have less packaging for example, would be preferable. Waste minimization is the second preferred option. Reuse or recycling options should be considered prior to disposal, separate containers for recyclables shall be used if there is a market for the materials. Disposal of waste which cannot be reused or recycled shall take place at sites authorized by the aimag authorities.
(2) Storage and containment: Provide appropriate waste storage containers for worker's construction wastes; install confined storage points of solid and liquid wastes away from sensitive receptors, regularly haul to an approved disposal facility; include scope for long term storage of hazardous liquid waste (PCB) which requires high temperature incineration;
(3) Use of contractors: Use a contractor approved by the aimag authorities to remove all wastes from construction sites;
(4) Spoil management: Spoil will be disposed only in sites which are defined in the Borrow and Spoil Management Plan; spoil will not be disposed of on slopes or near pasture land where it may impact on vegetation; rehabilitate and restore spoil disposal sites in accordance with the agreed plan.
(5) PCB assessment: Assessment of likelihood of PCBs being present at pumping-stations prior to works commencing; disposal strategy for PCB arisings which is likely to include incineration for total PCB destruction. Incineration is the only waste management option which destroys PCBs. If this is not viable, PCB contaminated equipment and PCB containing liquid must be stored safely until its destruction can be arranged outside

Mongolia.[66]

(6) General Management: Prohibit burning of waste at all times.

2. Impact on Biological Resources

136. **Fauna and Flora.** The potential impact of construction activities on biological resources is anticipated to be minimal as the environmental baseline showed a lack of flora and fauna in the project area. Overall the project will improve water quality, however it may impact on surface water quality during construction through primarily accidental contamination particularly on the Kharaa river flood plain (Output 2, tertiary pipe at Secondary Pumping Station) during periods of heavy rainfall (June - August). This in turn may impact on higher fish species in the Kharaa River, which are sensitive to changes in water quality. Also leaving the city without any WWTP during construction could have detrimental impacts on water quality. The measures defined under "mitigation of impacts on soil" (para 130) and "mitigation of impacts on surface and groundwater" (para 135) will effectively protect ecological resources during construction activities.

3. Impact on Socio-economic Resources

137. **Cultural Resources**. Output 2 (Old Darkhan Hospital site) is 100 m away from a Buddhist temple (Getsogdarjaalin Monastery). The temple is not a cultural heritage site but is regularly attended by worshippers which will primarily be affected by noise during construction, particularly any excavation works. There may be a limited impact on accessibility, however the temple has several entrances, only one of which is likely to be impacted upon by the construction work. In order to minimize the impacts arising from construction, the concerned contractor together with the PIU will consult with monks in advance of construction. In consultation with the temple monks, the plan for construction will be developed which will not coincide with any culturally significant dates or festivals in order to ensure that temple attendees are not affected. Dialogue to be maintained during construction.

138. **Health and safety.** Health and safety risks to include noise, dust, construction site safety, traffic safety, as well as occupational health and safety. Dust control is discussed in paragraph 129. Other health and safety risks are discussed below.

139. **Noise**. The major sources of noise pollution near the project area are removal and replacement of existing surface materials for pipe excavation, which is close to human receptors and may affect community members. Other noise sources will include the general movement of construction vehicles, rollers during re-surfacing, the haulage of construction materials to the construction sites and the use of generators.

140. Construction activities are expected to produce noise levels up to 90 dB(A) within 5m of the machinery as shown in Table VI-5 which indicates noise levels for construction machinery. For the project, no receptors other than construction workers will be this close to the machinery, and construction workers will use appropriate Personal Protective Equipment (PPE). Output 2 (Secondary pumping station and Old Darkhan Hospital) have receptors (residential areas, hospital, school and businesses) within 20-50m of the construction sites, which may be expected to be subject to noise in the scale of 80 dB(A).

[66] An asbestos and asbestos containing material (ACM) risk screening was conducted during IEE. The assessment concluded that presence of asbestos of ACM at pumping stations was highly unlikely. This was confirmed by environmental inspectors of the Darkhan Uul Department of the State Professional Inspection Agency (SFIA).

Table VI-5: Construction Machinery Noise

Machine Type	Distance to Machinery									
	5 m	10 m	20 m	40 m	60 m	80 m	100 m	150 m	200 m	300 m
Loader	90	84	78	72	68.5	66	64	60.5	58	54.5
Vibratory Road Roller	86	80	74	68	64.5	62	60	56.5	54	50.5
Bulldozer	86	80	74	68	64.5	62	60	56.5	54	50.5
Land Scraper	90	84	78	72	68.5	66	64	60.5	58	54.5
Excavator	84	78	72	66	62.5	60	58	54.5	52	48.8
Roller	87	81	75	69	65.5	63	61	57.5	55	51.5
Mixing Equipment	87	81	75	69	65.5	63	61	57.5	55	51.5

Source: Government of Mongolia. 2011. Initial Environmental Examination (IEE) of the proposed Regional Logistics Development Project.

141. **Construction noise mitigation**. The potential noise impacts will be mitigated through a number of activities defined in the EMP, which will be incorporated in the bid documents and construction contracts:

(1) Source control: Maintain all exhaust systems in good working order; undertake regular equipment maintenance;
(2) Locate sites for concrete-mixing and similar activities at least 300 m away from sensitive areas;
(3) Operate between 8am-6pm only and reach an agreement with nearby residents regarding the timing of heavy machinery work, to avoid any unnecessary disturbances;
(4) Provide advance warning to the community, including residents, school, monastery and hospital on timing of noisy activities. Seek suggestions from community members to reduce noise annoyance;
(5) Public notification of construction operations will incorporate noise considerations; information procedure of handling complaints through the Grievance Redress Mechanism will be disseminated;
(6) Ensure noise monitoring is undertaken near sensitive receptors, particularly dwellings, monastery, school and hospital;
(7) All construction workers to use appropriate Personal Protective Equipment (PPE).

142. Issues relating to **construction site safety** can be mitigated as follows:

(1) Temporary traffic management, road safety awareness: During any works which involve crossing roads and affecting traffic movements (Output 2, Old Darkhan Hospital sewer), road users and pedestrians will be made aware of changes to traffic flows through clear signage in advance of construction and during construction at the site;
(2) Construction site safety: Clear signs will be placed at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials and excavation and raising awareness on safety issues. Heavy machinery will not be used after day light and all such equipment will be returned to its overnight storage area/position before night. All sites will be made secure, discouraging access by members of the public through fencing or security personnel, whenever appropriate. Specific notices will be issued to the School Number 16, opposite Old Darkhan Hospital (Output 2) in order to inform children about construction site safety.

143. **Occupational Health and Safety.** The three civil works contractors will implement adequate precautions to protect the health and safety of construction workers. The occupational health and safety risks will be managed by applying measures in the following order of preference: avoiding, controlling, minimizing hazards, and providing adequate protective equipment. The contractors will undertake the following activities:

(1) Environment Health and Safety Officer: An Environment Health and Safety Officer (EHSO) will be nominated to develop, implement and supervise a Health and Safety Management Plan (HSMP), as well as to ensure that the requirements of the EMP are implemented.
(2) Implementation of HSMP: The EHSO will ensure that the HSMP, submitted to Darkhan aimag prior to construction, is approved and implemented. This includes recording and reporting any occupational health and safety incidents, and reviewing the distribution and use of appropriate Personal Protective Equipment. The HSMP will include the following provisions:

a) *Clean water.* Provide a clean and sufficient supply of fresh water, for construction and for all houses, camps, offices, laboratories and workshops.
b) *Sewage and wastewater.* Provide adequate sanitation facilities at all work sites.
c) *Solid waste.* Provide garbage receptacles at construction sites, which will be periodically cleared and disinfected.
d) *Liquid chemical waste.* Provide receptacles in suitably bunded areas for the storage of liquid chemical waste prior to disposal. Include clear warnings with health risks.
e) *Personal protection.* Provide personal protection equipment (PPE), such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection, in accordance with relevant health and safety regulations, for workers.
f) *Emergency Preparedness and Response.* An emergency response plan to take actions on accidents and emergencies, including public health emergencies associated with hazardous material spills and similar events will be prepared. Emergency phone contacts with hospitals in Darkhan will be established.
g) *Records Management.* A Records Management System that will store and maintain easily retrievable records protected against loss or damage should be established. It will include documenting and reporting occupational accidents, diseases, and incidents. The records will be reviewed during compliance monitoring and audits.
h) *Safety communication.* Ensure that safety, rescue and health matters are given a high degree of publicity to all persons regularly or occasionally at active construction sites. Posters in Mongolian and any other language appropriate for the contractors drawing attention to relevant health regulations will be made or obtained from the appropriate sources and will be displayed prominently at construction sites.

144. **Potential indirect impact during construction: interruption to pasture**. During the excavation of pipes (Output 2 at secondary and industrial pumping stations), there will be disturbance to pasture land along the length of the excavated sections. These sites are in areas where a livestock was seen grazing during IEE preparation. However, given the area of land, the project will affect a minimal proportion of pasture and there is enough land for the animals to graze away from any noise disturbance which may be generated. Mitigation measures include:

(1) A robust GRM which will be signposted at each of the sites in order for those with grazing animals to contact the project if they have a concern with the construction works;

(2) Notices in advance of construction work will be put up to warn residents, including owners of animals, that the work will commence including start/end dates and details of work.

145. **Potential indirect impact during construction: traffic disturbance.** When the WWTP and related infrastructure is constructed, indirect impacts will result in potential longer journey times for traffic passing by the central area of Darkhan including Old Darkhan Hospital as traffic will be temporarily interrupted when the sewer pipe under the road is excavated. The interruption will be short term as the excavation is for a single pipe. The mitigation associated with this impact is:

(1) Contractor to consult with relevant aimag authority on the timing of the road excavation, including departments responsible for transport and traffic police;
(2) Signage to warn motorists of when the road closure will be operational; and
(3) Use of appropriate traffic signals if alternate line traffic is required to maintain access along the road.

146. **Potential negative cumulative impact during construction: noise.** Pipe excavation will cause incremental noise outside Old Darkhan Hospital during sewer pipe replacement. Although this noise is a necessary part of the project implementation, it can be mitigated through:

(1) Consultation with hospital managers regarding advising on timing during the day when excavation may be least disruptive and the overall timing of construction.
(2) Maintaining dialogue with hospital managers and ensuring they are aware of the GRM process throughout the construction process.

E. Environmental Impact and Mitigation Measures during Operation

147. No significant negative environmental impact is anticipated during operation of the project facilities. Comprehensive training and appropriate technological design will contribute significantly to reducing operational risks of the project. Issues pertaining to the operational phase of the project include: (i) the lack of operation and maintenance capacities within Us Suvag LLC; which could result in non-compliance of the WWTP with effluent quality requirements; (iii) odor from WWTP and sludge treatment; (iv) noise produced during wastewater pumping and treatment; (v) pipe freezing and bursting; (vi) pollution of the Kharaa River, also as a result of WWTP malfunctioning and/or breakdown and failure in industrial pre-treatment; and (vii) occupational health and safety requirements.

148. **Treatment performance of the WWTP.** Prior to commissioning of the WWTP, a series of tests will be conducted to ensure proper functioning of the WWTP and ability to achieve Mongolian discharge standard.[67] A SCADA system including wastewater quality monitoring devices for real-time monitoring of key parameters (COD, TP, NH_4-N) will be installed at the WWTP. Daily check, repair and maintenance procedures will be instituted for all wastewater treatment steps. As a part of the design-build-commission contract, the contractor will provide hands-on training to Us Suvag staff to make sure that capacities to operate, monitor and maintain the new facilities are created. In order to avoid pipe freezing and bursting, the depth of the pipe will be determined by a cold weather engineering specialist. Us Suvag as WWTP operator will regularly inspect the pipes and ensure the packed earth is in good condition.

149. **Air quality (odor).** The operation of WWTP would emit odor. Potential odor sources in the WWTP include the intake screen, influent pump room, fine screen, main reactor, sludge filter press house, and sludge drying beds. The sludge filter press will be located indoor with ventilation and odor

[67] Standard for wastewater discharge to water bodies (MNS 4943:2011)

removal facilities. There is currently no settlement within 300 m downwind of the WWTP. No odor impact is expected from the operation of the WWTP, including open drying of dewatered sludge in the sludge drying beds within the WWTP site. Monitoring of H_2S and NH_3 will be conducted quarterly by the Central Laboratory of Environment of Darkhan.

150. **Noise.** Operational noise impact could potentially come from the WWTP, and more importantly, from the pumping houses. Noise levels from equipment range from 80-105 dB(A) according to estimates provided in the DEIA. To mitigate potential noise impacts, building walls with sufficient thickness and acoustic measures such as barriers or sound absorbing materials will be used. Noise monitoring will be conducted quarterly by the Central Laboratory for Environment to confirm compliance with the national ambient noise standard (MNS 4585:2007).

151. **Impact on Kharaa River.** The treated effluent of the WWTP will continue to be discharged to the Kharaa River, using the existing discharge pipeline. In Chapter IV the quality of the receiving water is provided (Table IV-3 to IV-5). The quality of the receiving water includes the effects of low quality discharges of wastewater from the existing WWTP as well as other point- and non-point sources of pollution. The rehabilitated WWTP will act to clean up the Kharaa River by discharging into the water body a treated effluent which is significantly higher in quality than the effluent of the current WWTP (MNS 4943:2011, see Table II-8). The domestic EIA predicts that under normal operating conditions, the impact of effluent discharge on the Kharaa River quality will be acceptable. The amount of treated effluent discharged to the Kharaa River will amount to 1.5% of the annual average flow, and to maximum of 6% of the minimum river flow in January and February. Surface water quality monitoring will be conducted regularly by Us Suvag central laboratory (at least monthly) to confirm that national ambient water quality standard (MNS 4586:1998) is being complied with. The wastewater treatment plant will remove significant amounts of pollutants, including COD (3,000 tons per year); BOD (1,700 tons per year); nitrogen (330 tons per year); and phosphorous (42 tons per year).

152. **Risks of Accidental Discharge, Overload and Emergency Preparedness.** Although the proposed wastewater treatment process is relatively simple to operate, any large complex wastewater treatment plant requires significant technical expertise and management oversight to ensure proper operations. The volume and wastewater characteristics may vary considerably. There is also a non-negligible risk of accidental release of untreated wastewater at the WWTP, due to a possible malfunctioning of the electric, mechanical or control system, or the failure of the treatment process as a result of shock loads or chronic system overload. This risk has been identified and assessed in the FSR and DEIA. The mitigation measures include: (i) retaining of existing pond system with a retention time of approximately 100 days[68]; (ii) provision of dual power supply; (iii) spare parts for key components; (iv) regular inspection and proper maintenance of the WWTP; (v) automated on-line, real-time monitoring of influent and effluent quality; and an in-house analytical lab will be established prior to operation of the WWTP. The major analytical equipment will include the following: wastewater sampler, pH meter, flow meter, conductivity meter, UV/VIS spectrophotometer, DO meter, COD speedy tester, thermostat incubator, electric balance, and centrifuge. An emergency preparedness and response plan will be formulated and put in place before the WWTP becomes operational.[69] The emergency preparedness and response plan will address, among other things, training, resources, responsibilities, communication, procedures, and other aspects required to respond effectively to emergencies associated with the risk of accidental discharges.

153. **Solid Waste.** Primary filtration residue mainly consist of floating solids, discarded plastic, sticks

[68] This retention time will provide ample time to define corrective actions. Temporary mobile pumps would be deployed to pump untreated wastewater into the wastewater treatment process.

[69] Included in the terms of reference of the loan implementation consultant, see Project Administration Manual (PAM) and Appendix to the EMP.

and leaves, and generally contains no toxic and harmful substances. Sludge mainly comes from the grit chamber, oxidation ditch and secondary settling tank. Primary filtration residue will be dried, baled, and transported to designated landfills for burying by semi-closed dump truck. Sludge management is discussed below.

154. **Sludge management.** The inappropriate disposal of sludge has potential to cause pollution to the soil in the WWTP area. WWTP sludge will be dewatered through a filter press (project financed), and disposed of in the existing sludge drying beds, which will be rehabilitated under the project. Sludge quality will be confirmed by obtaining baseline information on the sludge from the current WWTP and testing its chemical content during commissioning. This will enable further options for beneficial sludge use to be investigated. However the existing sludge management is at almost zero cost for Darkhan Uul and Us Suvag. Any future options for beneficial sludge use will need to be economically realistic, as well has safe from an environmental and public health point of view, in order to be sustainable and be implementable by the *aimag* authorities.

155. **Industrial pre-treatment of wastewater.** One of the main risks during project operation is damage to the wastewater treatment process from the discharge of potentially toxic wastewater from new industries that will locate in Darkhan. To mitigate the risk, the Government ensures to enforce the 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". The loan implementation consultant (in close collaboration with the will be strengthened through the MoMo Phase III project, to be financed by the German Government in 2015) will support Darkhan Us Suvag with (i) developing mechanisms to effectively monitor industrial wastewater composition before it enters the public sewer system, (ii) reviewing existing emergency measures that enable toxic flows to be diverted to the existing fly ash storage ponds nearby the industrial zone so it cannot enter the WWTP, and (iii) advising existing and new industries on optimal technology solutions for their respective industrial processes in case of potential toxic effluents.[70]

156. **Occupational Health and Safety.** WWTP operators may be injured by slips, trips and falls on wet floors; by falls into treatment ponds, pits, clarifiers or vats and by splashes of hazardous liquids; they may suffer cuts and pricks from sharp tools, contusions, etc. They are exposed to hazards related to work in confined spaces. The following measures will be implemented to safeguard their safety and health:

(1) use safety shoes or boots with non-slip soles;
(2) wear personal protective equipment and chemical resistant clothing to avoid exposure of skin or eyes to corrosive and/or polluted solids, liquids, gases or vapors;
(3) post safety instructions in each workshop regarding the storage, transport, handling or pouring of chemicals;
(4) check electrical equipment for safety before use; verify that all electric cables are properly insulated; take faulty or suspect electrical equipment to a qualified electricity technician for testing and repair;
(5) wear safety goggles in all cases where the eyes may be exposed to dust, flying particles, or splashes of harmful liquids;
(6) wear respiratory mask in the sludge dewatering and de-odor workshops and when moving and transporting sludge;
(7) obey all safety instructions concerning entry into confined spaces, e.g., check atmosphere for oxygen or for poisonous gases, use respiratory protection equipment if needed, have a co-worker stand guard in case of need for help, etc;

[70] The scope of work is defined in the loan implementation consultant's terms of reference (see Appendix to the EMP).

(8) all workers will undergo periodic examinations by occupational physician to reveal early symptoms of possible chronic effects or allergies; and
(9) health and safety will be incorporated into the regular staff training programs.

157. **Climate risk, adaptation to climate variability and change.** Climate model projections agree that temperatures will increase in the project location (2.0-2.2 degrees) of the lifespan of the project (2050). Precipitation was also projected to increase approximately 10% or 30mm in the 2031-2040 period. Between 1940 and 2008, evidence shows an increasing trend of winter precipitation and a decreasing incidence of summer rainfall. However for Mongolia, over the longer term, climate models predict that summer rain will increase. Based on appropriate climate models for Mongolia (HadCM3 model of the HADLEY center), results show that the annual precipitation will generally increase. Precipitation in the summer season is predicted to increase by less than 10 percent, which is smaller than the rise in winter precipitation compared to the normal climate. Because of climate change, it is anticipated that winters will become milder and more snowy, while summer will become hotter and drier even though there will be a slight increase of precipitation based on overall climate change predictions. A recent trend of increasing frequency of extreme precipitation events is likely to continue. Specific climate predictions made for the Arctic Ocean drainage basin (in which Darkhan is based) shows that river runoff in the Arctic Ocean basin is predicted to increase by 2-9 mm. However, the projected increase in evaporation from open surface water will exceed the increase in runoff. This will lead to dryer conditions and to an imbalance between inflow and outflow of water bodies. These projections are consistent with the findings from the recently developed ADB/EARD climate change risk screening tool[71]: Annual mean temperature is projected to increase by 2.3 ^{0}C in the 2031-2040 time period, and by 3.2^{0}C in the 2051-2060 time period. Precipitation is projected to increase approximately 10% or 30 mm in the 2031-2040 time period. Monthly precipitation increases projected for cold months (October – May) are higher than warmer months (June – September) in relative terms. Projections for the 2051-2060 increase are approximately 15% or 44.8 mm in comparison with the 1961-1990 historical data. During this time frame, a reverse pattern is predicted, with higher precipitation increases projected for warmer months (April to August) than colder months (September to March). The annual PET is projected to increase by 8.1% for the 2031-2040 time period and by 12.0% for the 2051-2060 time period. Annual runoff is projected to increase by 10.6% for the 2031-2040 time period and by 12.2% for the 2051-2060 time period. Predicted changes for other variables, such as humidity and soil moisture are minimal. Due to increased temperatures and higher rates of PET, the probability of droughts is projected to increase.

158. The project's vulnerability to climate variability and change has been reviewed and is considered low in the sense that the project outcome will not be affected by climate change, whereas some of the outputs might be very moderately affected. The projected increase in average and peak precipitation, and the related risk of increased urban stormwater runoff, is addressed by Darkhan aimag through separate pipes for sanitation and storm water. As a result, the impact on the urban water system is expected to be minimal and within the planned capacity for the system. The WWTP will not be affected by increased peak flows. Specific climate risk mitigation measures will be included in the design-build-operate-transfer contract for the WWTP as well as the consulting services under the loan. They include (i) climate proofing of civil works structures (WWTP foundation works) accounting for possible changes in soil moisture that could cause ground subsistence; and (ii) local capacity building for Darkhan Us Suvag to properly monitor, supervise and maintain project facilities, including annual review of maintenance budget to account for potential increases in maintenance requirements.

[71] C. Yeager and H. Zhou: EAER Staff Guidance. Assessing Climate Change Risks in PRC and Mongolia. February 2014

VII. INFORMATION DISCLOSURE AND PUBLIC CONSULTATIONS

A. Information Disclosure and Consultation during Project Preparation

159. **Consultation with Government Officers and Experts**. During preparation of this IEE, individual consultation meetings were held with experts and Government officers (September 2013) in order to discuss the project, obtain baseline data, and identify potential environmental impacts and concerns. The names of those consulted are in Table VII-1. Key activities and discussion points included:

(1) **Consultation with *aimag* Us Suvag LLC:** (i) joint field visits to project sites; (ii) provision of data on aspects of wastewater treatment, industrial wastewater, current and planned activities and environmental monitoring.

(2) **Consultation with *aimag* Meteorological Institute**: (i) data was provided; (ii) the monitoring routine was confirmed; (iii) key environmental problems associated with not meeting national standards (i.e., nitrogen and phosphorous removal).

(3) **Consultation with *aimag* Environmental Protection Agency**: (i) the agency confirmed that it is not aware of any particular current environmental problems which will impact on this project; (ii) the agency staff confirmed that their current key concerns were around the illegal fire wood collection, artisanal mining and forest fires; (iii) provision of information on protected areas, waste management, environmental education.

(4) **Consultation with *aimag* Policy Development Department**: (i) consultation on GRM approach; (ii) provision of baseline data.

(5) **Consultation with *aimag* Land Administration**: (i) land use within Darkhan *soum*, (ii) land use around WWTP (iii) provision of maps and data.

Table VII-1: Officers and Experts Consulted

Name	Role/Department
Ms Enkkhtuya, Project Engineer	Us Suvag LLC.,
Ms. Sarangerel, Head of Laboratory	Us Suvag LLC., Laboratory
Ms Sainsay, Laboratory Engineer	*Aimag* Meteorological Office
Ms Handolgion, Head of Environmental Department	Aimag Meteorological Office
Mr Khurelchuluun, Senior Environment Specialist	*Aimag* Environment Protection Agency
Mr Bayasgalan, Policy Department Chief	*Aimag* Policy Development Department
Mr Ravjaadelgerekh, Senior Specialist	*Aimag* Policy Development Department
Mr Munkh-Erdene , Head of Land Administration	*Aimag* Land Administration
Mr Olonbayar, Senior Land Officer	*Aimag* Land Administration

Source: ADB Study Team

160. **Consultation with residents and affected people.** Public consultation and information disclosure was undertaken twice during the preparation of this IEE. The consultation was facilitated by the company undertaking the Detailed EIA as required under Mongolian law:

161. **Public Opinion Survey on Water Supply and Wastewater treatment** (22-27 January 2014). The consultees were selected from 100 households from apartment residents and 100 households from the *ger* district in Darkhan City. The survey covered the following issues: (i) socio-economic status of survey covered households; (ii) current situation and consumers satisfaction with the current water

supply and waste water treatment services; and (iii) needs for improvement of water supply and wastewater treatment services.

162. The findings from the survey include: (i) for ger area households, poverty incidence is 44.0%, while it is 9.0% for apartment area households; (ii) awareness on information about the water supply and sanitation services in Darkhan city is low; 25% of residents are not aware of the organizations which provide these services; (iii) many residents do not realize that there are problems with the water supply and wastewater services but awareness is lower in apartments; (iv) poor sanitation services was ranked 8th of 12 environmental and social infrastructure issue; (v) no ger area residents is satisfied with the current sanitation situation as opposed to 80% apartment area residents who are satisfied; (vi) air pollution and pollution of Kharaa River were ranked first and second respectively amongst selected environmental and social infrastructure issues; (vii) 64% of respondents supported re-use of grey water e.g. for toilet flushing. In summary the consultation showed a difference between the *ger* area and apartment residents. *Ger* residents are unhappy with their current sanitation and see a need for improved sanitation services, whereas apartment residents are largely satisfied.

163. **Public consultation and information dissemination** (February – March 2014). Consultation took place during the data collection process for detailed environmental impact assessment (DEIA) conducted by the licensed EIA Institute (Environ LLC). Public consultation focused on potential project beneficiaries. Two criteria were considered in selecting the consultees: (i) select and interview those households, whose geographical location is downwind of the dominant wind direction of the proposed wastewater extension project location and current wastewater treatment plant; and (ii) select and interview those households, whose location is around or nearby the WWTP effluent outlet.

164. During the consultation meetings, the project was introduced by Mr. Azjargal, Darkhan *soum* governor and Mr. Batzul, *soum* environmental inspector. Consultees included: (i) Bagh governors, Ms. Tuya, governor of 3rd bagh; (ii) speakers of bagh citizen representatives, Ms. Tungalag, local bagh speaker (Figure VII-1). In addition, residents of affected by the WWTP, covering more than 100 households, were consulted through individual interviews (26-27 February; 10-11 March 2014).

165. Figure VII-2 shows interviews being undertaken with local residents. Local residents were asked a number of questions in relation to their views on the WWTP and potential mitigation measures which could be taken in order to improve any negative impacts. The results of the consultations are given in Figure VII-3 and Figure VII-4.

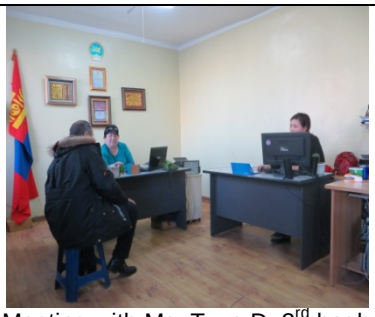
166. The results show that residents are concerned about the negative impacts the existing WWTP is having on quality of life. In particular strong views are expressed on the nuisance caused by the odor from the WWTP (expressed as main concern by 50% of respondents), especially during warm season (75% of respondents).

167. With regards to future needs, respondents expressed the need to extend and/or rehabilitate the existing WWTP, or to build a new WWTP (50% and 18% of respondents, respectively). 25% of respondents expressed the need to control access of people and livestock to the WWTP through fencing and guards.

168. Where appropriate, the recommendations provided during the consultation meetings were integrated into the mitigation measures in this IEE. This includes improvements to the WWTP which will include odor emissions - this is inherently integrated into the project as the use of improved modern technology will improve the mineralization and reduce the quantities of sludge which will reduce the odor particularly in summer. Access to the rehabilitated facilities will be strictly controlled through fencing. In general the project is supported by residents of Darkhan as it will tackle a number of issues

which are a concern to them.

Meeting with Mr. Azjargal B., Darkhan soum governor



Meeting with Ms. Tuya D, 3rd bagh governor, Ms. Tungalag, local meeting speaker, Ms. Munkhtsetseg, social worker of 3rd bagh of Darkhan soum

Mr. Batzul, soum environmental inspector

Figure VII-1: Consultation with local authorities. *Source: Environ, DEIA.*

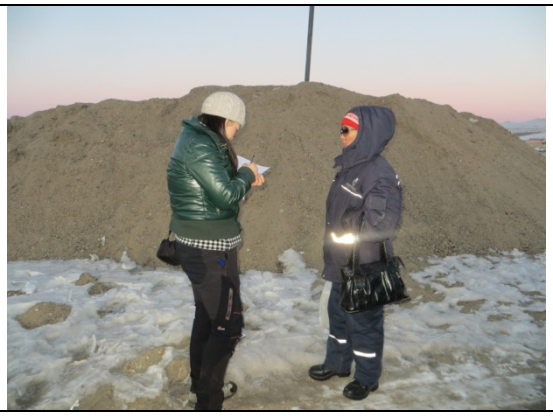


Figure VII-2: Interviews with local residents. *Source: Environ, DEIA.*

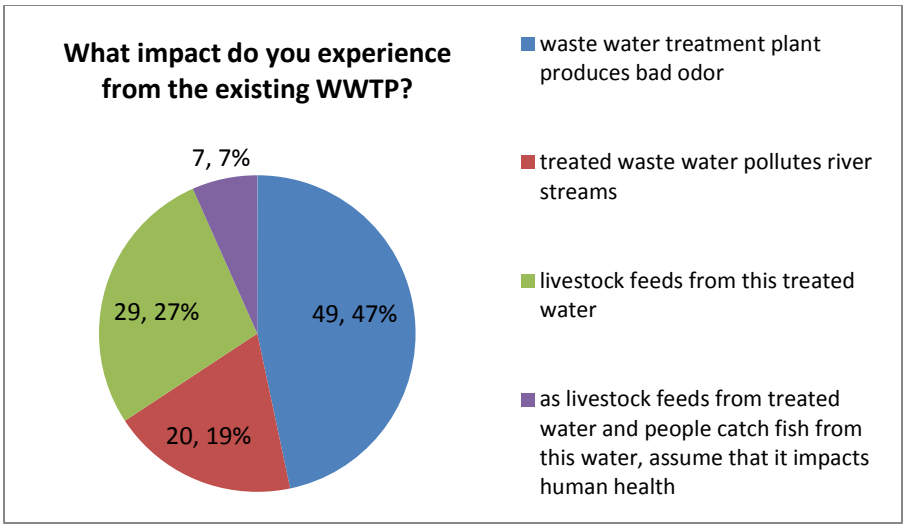


Figure VII-3: Results from consultation interviews, Question 1 - 104 respondents.
Source: Environ, DEIA.

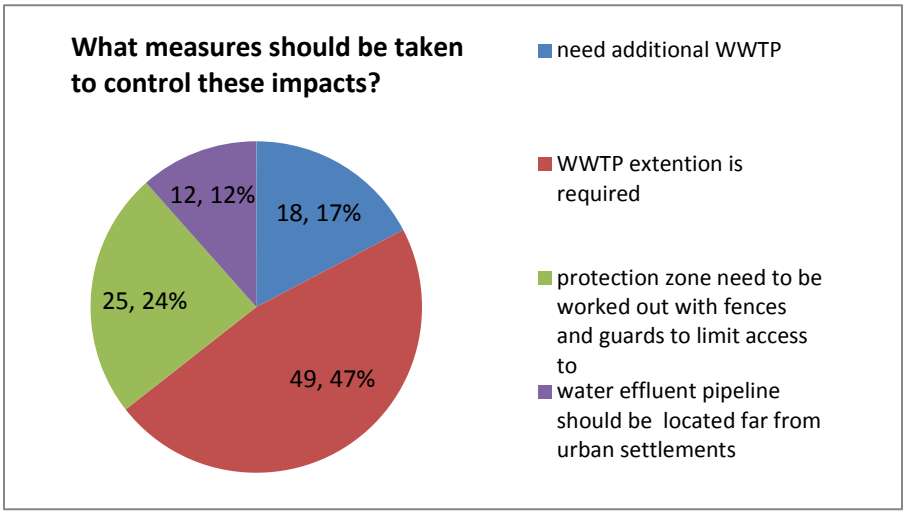


Figure VII-4: Results from consultation interviews question 2, 104 respondents. *Source: Environ, DEIA.*

B. Future Information Disclosure

169. In compliance with the SPS, environmental information related to the project will be disclosed as follows:

(1) the initial environmental examination (IEE) is disclosed on ADB's project website (www.adb.org), and is available for consultation in the PIU's office;
(2) the detailed environmental impact assessment (DEIA) approved by the Ministry of Environment and Green Development (MEGD) is disclosed on the MEGD website; and
(3) semi-annual environment monitoring results and annual reports on project's compliance with the EMP will be disclosed on www.adb.org.

VIII. GRIEVANCE REDRESS MECHANISM

A. Grievance Redress Mechanism Objective

170. 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.

B. Proposed Grievance Redress System

171. 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 *soum*s. The *aimag* Government confirmed their support for the approach presented in this IEE.[72]

172. In its capacity as the IA, the Darkhan *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.

173. The PIU-based Safeguards Staff (PIU-SS) will be responsible for ensuring the setting up and coordination of the GRM at a local level and will staff the PCU. The PIU-SS 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-SS 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. The PIU-SS will have facilities to maintain a complaints database and communicate with contractors, supervision engineers, the environmental inspectors of the Darkhan Uul Department of the State Professional Inspection Agency (SFIA), *aimag* environmental authorities of Darkhan Uul, the PMU, and representatives of Darkhan *soum* and affected *bagh*s.

C. GRM Steps and Timeframe

174. Procedures and timeframes for the grievance redress process are as follows and shown in Figure VIII-1.

(1) **Stage 1: Access to GRM.** If a concern arises, the AP may resolve the issue of concern directly with the contractor, or make his/her complaint known to either the PCU directly, or through the *bagh* or *soum*, whichever level of authority he/she is most comfortable with;

(2) **Stage 2: Official Complaint to PCU.** If a complaint is filed at *bagh/soum* level, the *bagh/soum* representative will submit an oral or written complaint to the PCU. For an oral

[72] Meeting with Mr Ravjaadelgerekh, *aimag* Senior Specialist in Engineering - project contact.

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;

(3) **Stage 3: PCU Complaint Resolution.** The PCU will register the eligible complaint informing the Darkhan *aimag*, the PIU, contractors, the PMU and ADB. The PCU, with support of the loan implementation environment consultant (LIEC), will take steps to investigate and resolve the issue. This may involve instructing the contractor to take corrective actions. Within seven days of the redress solution being agreed upon, the contractor should implement the redress solution and convey the outcome to the PCU;

(4) **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 contractor should implement the agreed redress solution and convey the outcome to the PCU within seven working days;

(5) **Stage 5: *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 to identify a solution.

175. **Reporting**. The PCU will record the complaint, investigation, and subsequent actions and results. The PIU-SS will include this information in the quarterly EMP progress reports to the PMU. 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 annual environmental monitoring reports. The tracking and documenting of grievance resolution within the PCU 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.

176. **Members and Responsibilities of the PCU**. The responsibilities of the PCU are implemented by the PIU-SS, who is the PCU focal point. In addition to the PIU-SS, the members of the PCU will be those in a position to resolve complaints and will include representatives of: (i) PIU-SS - focal point of PCU; (ii) Darkhan Uul aimag; (iii) Darkhan Us Suvag; (iv) Darkhan soum and (v) relevant bagh representatives. 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-SS, as the focal point of the PCU, will log complaints and date of receipt onto a complaints database and inform the IA/PIU and the Contractor.
- The PCU 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-SS 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 contractor's 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.

177. **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 labor 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 (labor issues).

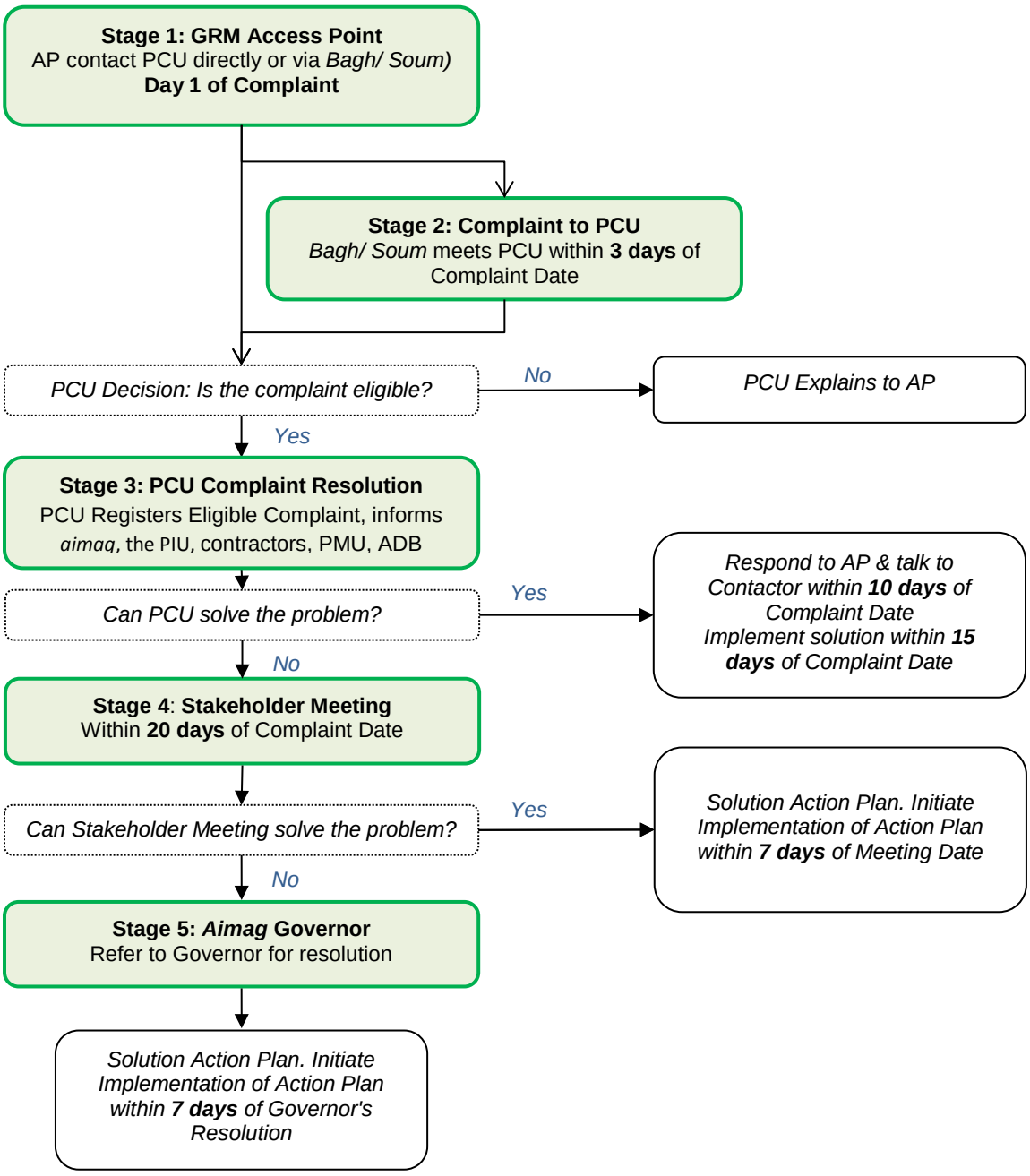


Figure VIII-1: Proposed Project GRM. *Source: ADB Study Team*

IX. ENVIRONMENTAL MANAGEMENT PLAN

178. The environmental management plan (EMP) for the project is presented in **Appendix EMP**. The EMP defines the roles and responsibilities of the institutions involved in EMP implementation. Such institutions will seek to ensure continuous improvement of environmental protection activities during preconstruction, construction, and operation of the project in order to prevent, reduce, or mitigate adverse impacts.

179. The EMP has been prepared in line with ADB's Safeguards Policy Statement (2009). Specific measures are developed in relation to the design, construction and operation of each project output, and the impacts identified in relation to physical, biological, cultural and socio-economic resources, as discussed in Section VI of this IEE.

180. The EMP also defines training requirements (Table EMP-3), monitoring requirements (Table EMP-4), and reporting requirements (Table EMP-5). The mitigation measures to be undertaken during project design, construction and operation are identified in Table EMP-7).

V. CONCLUSIONS

A. Rationale and Benefits

181. Currently Darkhan suffers from an outdated and inefficient wastewater treatment plant which is at the end of its economic life. Due to the dilution capacity and turnover processes in the Kharaa River, the nutrient levels are moderate and there is a limited detectable impact on the ecology of the river, however it is possible that at times of low flow and with a predicted increase in housing and industry, the impacts on the river arising from the current WWTP would become more significant and the environmental sustainability will be compromised. This is increasingly likely as the outdated wastewater treatment technology becomes progressively more unreliable with age. The project will have substantial environmental and socioeconomic benefits. The strengthening of Darkhan's municipal wastewater collection and treatment capacity will provide protection and improvement to Kharaa River's water environment, which is key to the sustainability of Darkhan's socio-economic development. The wastewater treatment plant will remove significant amounts of pollutants, including COD (3,000 tons per year); BOD (1,700 tons per year); nitrogen (330 tons per year); and phosphorous (42 tons per year).

B. Impacts and Mitigation Measures

182. Findings of the IEE and DEIA show that the project does not have any predicted significant, long term or irreversible impacts on the physical, biological or socio-economic environment.

183. **During construction**, the project will have short-term impacts which can be mitigated to an acceptable level through mitigation measures which seek to reduce the potential for harm to the environment and human health. Without mitigation, the principal impacts during construction will be on the sensitive human receptors in particular around old Darkhan hospital, including a school and the hospital itself. Dust and noise generated by sewer line rehabilitation activities will be a nuisance to nearby residents. Discharge of wastewater from construction sites could potentially pollute the Kharaa River. Mitigation measures specified in the EMP will manage the impacts to acceptable levels and an emphasis will be placed on meetings and discussions with affected people, therefore school and hospital administrators/managers will be consulted on the timing of the construction activities. Waste arising is an inevitable consequence of a construction project. There is likelihood that hazardous waste materials will be generated during the refurbishment of the New South Pumping Station and sewer pipes; anticipated wastes include PCBs and oily wastes. In order to manage this sustainably and with least risk to the environment and human health, a robust forward looking Waste Management Plan will be developed and adhered to by the contractor. Surface water quality and effluent will be measured regularly throughout the construction phase.

184. **During operation**, no significant environmental impact is anticipated. Comprehensive training and appropriate technological design will contribute significantly to reducing operational risks of the project. Prior to commissioning of the WWTP, a series of tests will be conducted to ensure proper functioning of the WWTP and ability to achieve Mongolian discharge standard. A SCADA system including wastewater quality monitoring devices for real-time monitoring of key parameters (COD, TP, NH_4-N) will be installed at the WWTP. Odor and noise generating facilities will be equipped with containment facilities. Daily check, repair and maintenance procedures will be instituted for all wastewater treatment facilities/equipment. In order to avoid pipe freezing and bursting, the depth of the pipe will be determined by a cold weather engineering specialist. Us Suvag as WWTP operator will regularly inspect the pipes and ensure the packed earth is in good condition. WWTP sludge will be dewatered through filter press, and disposed of in existing on-site sludge drying beds. In the interests of

good practice, although no evidence has been found to confirm that the existing sludge management practices are impacting negatively on the environment and human health, sludge will be analyzed in order to understand its quality. When the quality of the sludge is known, alternatives to the existing drying beds can be sought which will put it to a more beneficial use.

185. An emergency preparedness and response plan will be formulated and put in place before the WWTP becomes operational. The emergency preparedness and response plan will address, among other things, training, resources, responsibilities, communication, procedures, and other aspects required to respond effectively to emergencies associated with the risk of accidental discharges. The project's impact on the Kharaa River will be positive, as discharge of nutrients will be reduced through increased WWTP treatment efficiency. This will be confirmed through compliance monitoring. The Kharaa River is already monitored by the *aimag* Meteorological Institute. This existing monitoring will be supported with project specific monitoring at the effluent outfall (i.e., within mixing zone), and monitoring of the effluent itself.

186. **Environment management plan (EMP).** An EMP has been defined which specifies the roles and responsibilities of key project stakeholders, including MRTCUD, the PMU, Us Suvag LLC, Darkhan-Uul aimag, the PIU, MEGD, State Professional Inspection Agency, contractors, and loan implementation environment consultants, in overall environmental management. In order to ensure that adequate environmental management capacities are in place during project implementation, the PMU will procure the services of loan implementation environment consultants (LIEC) to provide support in (i) project preparation including updating the project EMP; (ii) training; (iii) regular environmental quality monitoring (air, surface and ground water, and noise) in compliance with the monitoring plan; (iv) annual project EMP progress reporting; and (v) identifying environment-related implementation issues and necessary corrective actions.

C. Consultation, information disclosure, GRM

187. The stakeholder consultation process conducted during the development of the IEE, particularly with Darkhan *aimag* and Us Suvag, demonstrated that the project has local support as it will result in benefits in terms of the long term environmental and social sustainability of Darkhan's WWTP. In compliance with ADB's Safeguard Policy Statement (2009), environmental information related to the Project was and/or will be disclosed as follows: (i) this initial environmental examination (IEE) is disclosed on ADB's project website (www.adb.org), and is available for consultation in the PIU's and PMU's office; (ii) the detailed environmental impact assessment (DEIA) approved by the Ministry of Environment and Green Development (MEGD) is disclosed on the MEGD website; and (iii) annual reports on project's compliance with the EMP will be available at www.adb.org. Environment safeguards related complaints or disputes will be handled in accordance with the grievance redress mechanism (GRM) established for the project. The PIU will coordinate the environment GRM, with support of the LIEC.

D. Risks and Assurances

188. Risks and risk mitigating measures have been identified in the risk assessment and risk management plan. A minor risk is damage to the wastewater treatment process from the discharge of potentially toxic wastewater from new industries that will locate in Darkhan. To mitigate the risk, the Government will ensure to enforce the 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". Further, the project (through output 3) will provide expert support to the government to develop policy mechanisms that ensure industries pre-treat their wastewater in pre-treatment facilities if required

(e.g. through enforcement of fines already provided for by law, but not yet always enforced). The project will also provide expert support to Darkhan Us Suvag with (i) developing mechanisms to effectively monitor industrial wastewater composition before it enters the public sewer system, (ii) enhancing existing emergency measures to avoid toxic flows to be discharged to the WWTP; and (iii) advising existing and new industries on technological options (i.e., pre-treatment requirements and solutions) for their respective industrial processes in case of toxic effluents.[73]

189. The Government, MRTCUD and Darkhan-Uul Aimag government have assured ADB that implementation of the project shall conform to all applicable ADB policies including those concerning anticorruption measures, safeguards, procurement, consulting services, and disbursement as described in detail in the project administration manual and in the draft loan agreement. In addition to these standard assurances, the Government has agreed with ADB on a number of assurances, listed below (subject to final agreement between ADB and the Government of Mongolia):

(1) The Government will ensure or cause the EA to ensure that the preparation, design, construction, implementation, operation and decommissioning of the Project and all Project facilities comply with (a) all applicable laws and regulations of the Government relating to environment, health and safety; (b) the applicable principles and requirements set forth in the ADB's Safeguard Policy Statement (2009) (SPS); and (c) all measures and requirements set forth in the IEE, the EMP, and any corrective or preventative actions set forth in (i) any safeguards monitoring report, or (ii) which are subsequently agreed between ADB and the Government.

(2) The Government, through MRTCUD, will cause the Darkhan-Uul Aimag government to ensure that (a) water supply and wastewater tariff for all users are restructured to cover all costs associated with water supply and sewerage services; (b) the Darkhan Us Suvag, the public urban service organization of Darkhan-Uul Aimag government undertakes annual reviews of tariff and fees; (c) no entity receiving water supply services is exempted from payment of the tariff, or excused for delays in payments without penalty, and (d) a review is conducted of the impact of increase water and sanitation tariff on the poor taking into account the ability of consumers, particularly vulnerable people, to pay for such increases.

(3) Without limiting the application of the SPS or the RP, the Government will ensure or cause the EA to ensure that no physical or economic displacement takes place in connection with the Project until: (a) compensation and other entitlements have been provided to the displaced persons as described in and in accordance with the RP; and (b) a comprehensive income and livelihood restoration program has been established in accordance with the RP.

(4) The Government will make available or cause the EA to make available necessary budgetary and human resources to fully implement the EMP and RP and IPP, if required.

(5) The Government will ensure or cause the EA to ensure that all bidding documents and contracts for works contain provisions that require contractors to: (a) comply with the measures relevant to the contractor set forth in the IEE, EMP and RP, and any corrective or preventative actions set forth in any safeguards monitoring report, or (ii) subsequently agreed between ADB and the Government; (b) make available a budget for all such environmental and social measures; (c) provide the Government with a written notice of any unanticipated environmental, resettlement or indigenous peoples risks or impacts that arise

[73] Phase III of the MoMo project (financed by the German Government) will provide support to Us Suvag in establishing industrial wastewater monitoring system, amongst others.

during construction, implementation or operation of the Project that were not considered in the IEE, EMP and RP; (d) adequately record the condition of roads, agricultural land and other infrastructure prior to starting to transport materials and construction; and (e) reinstate pathways, other local infrastructure, and agricultural land to at least their pre-project condition upon the completion of construction.

(6) The Government will do the following or cause the EA to do the following: (a) submit annual environmental monitoring and semi-annual social safeguards monitoring reports to ADB; (b) if any unanticipated environmental and/or social risks and impacts arise during construction, implementation or operation of the Project that were not considered in the IEE, EMP and RP, promptly inform ADB of the occurrence of such risks or impacts, with detailed description of the event and proposed corrective action plan; and (c) report any actual or potential breach of compliance with the measures and requirements set forth in the EMP or the RP promptly after becoming aware of the breach.

(7) The Borrower, through the EA, IA, PMU and PIU, will not award any works contract which involve environmental impacts until each of MRTCUD, IA, PMU and PIU has incorporated the relevant provisions from the EMP into the works contract(s).

(8) The EA shall cause the Darkhan-Uul Aimag environment authorities to ensure through regular compliance monitoring that industries discharging industrial wastewater to the public sewer network meet the relevant discharge standard, and that the monitoring results are reported to ADB in the annual environment monitoring reports. Furthermore, MRTCUD will ensure that an emergency preparedness and response plan is developed for the wastewater treatment plant, including (but not limited to) the connection of critical units to a standby generator in case of power shutdown.

(9) The EA shall cause Darkhan-Uul Aimag to ensure that sludge drying beds at the wastewater treatment plant will be properly designed for air drying with leachate collection, and that sampling tests are carried out for the sludge from the WWTP on a quarterly basis until approval of the project completion report to determine its suitability, through compliance with the Borrower's applicable standards for either disposal to a sanitary landfill or for beneficial use (urban landscaping).

E. Overall Conclusion

190. The IEE concludes that the project will not have any significant, long term or irreversible impacts on the physical, biological or socio-economic environment. The project will have short term impacts during construction which can be mitigated to an acceptable level through mitigation measures which seek to reduce the potential for harm to the environment and human health. These measures relate primarily to implementing good construction practice as well as meeting the particular needs of the project area through consultation with affected people. Good practice through comprehensive training and appropriate technological design will also contribute significantly to reducing the operational impacts of the project.

191. The project will have significant positive environmental benefits. It will lead to improved water quality in the Kharaa River as the effluent quality from the WWTP will be significantly improved over the long term. The use of modern technology and replacement of the outdated and broken equipment will lead to better wastewater and sludge management which will benefit the environment and the residents of the city. Category B for environment is confirmed. The project is feasible from an environment safeguards point of view.