March 2014

2030 Water Resources Group

# MONGOLIA:

## TARGETED ANALYSIS ON WATER RESOURCES MANAGEMENT ISSUES

## Disclaimer



## Rights and permissions



## About 2030 Water Resources Group

The 2030 Water Resources Group is a unique public-private-civil society partnership that helps governments to accelerate reforms that will ensure sustainable water resource management for the long term development and economic growth of their country. It does so by helping to change the "political economy" for water reform in the country through convening a wide range of actors and providing water resource analysis in ways that are digestible for politicians and business leaders.

## Acknowledgments

The 2030 WRG wishes to thank all of the companies, organizations, institutions and individuals who have shared their knowledge on water resources in Mongolia to produce this report.

This report has been prepared by PwC and Deltares jointly with the contributions of a large number of people who have enriched this report by offering their time and knowledge during expert interviews, focus group discussions and/or participating at the final conference.



## Authors

Ranen Banerjee (PwC)
Jennifer Möller-Gulland (PwC)
Wim van der Linden (Deltares)
Olga Khardaeva (PwC)
Dr. Matthias Retter (PwC)
Sriram Subramanian (PwC)
Christian Eickmann (PwC)

## Contributors

Dr. Dorjsuren Dechinlhundev (Freshwater Institute)
Tserennadmid Ganbaatar (PwC)
Erdene Disdaabazar (PwC)
Contributors from stakeholder consultations

# FOREWORD

Fast growing economies and populations are putting more and more strains on the world's limited water resources. Competition among different water-dependent sectors—from agriculture to energy generation and industry—can have drastic consequences on water availability and quality. Climate change further aggravates the situation.

Recently, water resource scarcity, including water quantity and quality has been identified as a major risk to economic development and business activities by the World Economic Forum *Global Risk 2014* report. Naturally, these developments also impact civil society and the environment.

In Mongolia, this defining water risk is already a reality and threatens the now prosperous economic growth of the country. The areas at risk are predominantly the economic hub of Ulaanbaatar and the mining hub in the Southern Gobi region. To respond to these challenges, the Government of Mongolia expressed its interest in exploring a partnership with the 2030 WRG, which works at the invitation of governments across various countries. Towards this, a memorandum of understanding was signed between Government of Mongolia and the 2030 WRG on September 16, 2013.

With the establishment of the 2030 WRG Mongolia partnership, our first effort was to compile data and information from across sectors to frame the water debate as it relates to Mongolia's economic growth aspirations today and in the future. We wanted this information to be developed in a clear, compelling and actionable manner, to engage water sector expert and non-expert decision makers, and start a conversation on Mongolia's challenges, and opportunities. Based on this sound data basis, we engaged with stakeholders representing the public and private sectors as well as civil societies to gain a corroborated understanding of Mongolia's water challenges in general and more specificly to each stakeholder group. Recommendations to achieve sustainable water resource management were made in cooperation with the stakeholders during interviews, focus group discussions and a conference.

I am pleased to say that the report has indeed met its objective. From an initial discussion based on this report, the 2030 WRG Mongolia partnership has identified key focus areas for our future work, and is now working to formalize the working groups to take forward the debate and practical action. This is however only the beginning of a long journey toward water security that will require coordinated and collective action in order to identify and implement solutions that will help to preserve our precious water resources for future generations to come. I hope to see even more stakeholders engage with the 2030 WRG Mongolia partnership in the immediate and near future.

We would like to thank all people who have contributed valuable input to this report by offering their time and knowledge during expert interviews, focus group discussions and/or participating at the final conference. It was a pleasure working in this constructive and results-driven atmosphere and we look forward to continuing our joint work in the future.

**Anders Berntell**
Executive Director
2030 Water Resources Group

# CONTENTS

The appendices can be accessed in the online version which will be can be downloaded from the 2030 WRG website (www.2030wrg.com).

FIGURES



TABLES

# EXECUTIVE SUMMARY

Under the auspices of the 2030 Water Resources Group, a team of experts from PwC and Deltares jointly undertook a targeted analysis of Mongolia's water challenges as well as opportunities to subsequently raise awareness, mobilize, and engage "new actors" from the private sector and civil society for sustainable water activities. The project objective was to provide the basis for supporting the Government of Mongolia in initiating and catalyzing reforms designed to ensure sustainable water resources management, and thus enable long-term economic development.

Besides building a knowledge base on the key challenges, underlying issues and opportunities Mongolia currently faces with respect to its water management, the emphasis was on involving and incorporating opinions from key stakeholders through face-to-face interviews and focus group discussions. More than 50 stakeholders were consulted from the private and the public sectors, as well as from civil society.

## Assessing the Scale and Urgency of Mongolia's Water Resources Challenge

On a national scale, Mongolia does have sufficient water by volume and quality to support its population and its economic development. On a local scale, however, serious water challenges which can threaten the country's economic and social development can be found in the urban and economic hub of Ulaanbaatar and in the mining hub of the Southern Gobi region.

Alarmingly, modelling Ulaanbaatar's future water demand shows that in all scenarios, the water demand will exceed the current water supply capacity before the year 2021. In the high water demand scenario, Ulaanbaatar's demand will even exceed the maximum available resources within seven years (Figure 1). Existing water resources are vulnerable to pollution. The water supply and wastewater infrastructure is in need of a major overhaul in order to meet the current demand and protect the environment. The wastewater treatment plants, in particular, are operating beyond the design capacity in terms of quantity and quality of effluents.

With the mining industry rapidly developing as the backbone of the Mongolian economy, large new mines are being explored or have recently become operational in the Southern Gobi region. Water demand projections show that expected water demand could exceed available resources in the high water demand scenario before 2030. However, in all scenarios high water risks can be expected at the local level, including quantity and quality, as increased water demand from mining and industrial activities puts a strain on locally limited water resources. Future effects of extensive groundwater extractions are yet to be understood. Competing, future water demands hold strong potential for conflicts between mining companies, herders and local communities dependent on groundwater resources.

## Identifying the Challenges which Hinder Sustainable Water Management

To understand the underlying causes hindering sustainable water management and to identify options to address them, this report analyzes the key challenges and interests of key stakeholders in relation to water resources. These stakeholders were grouped into four categories: 1) public sector, 2) non-governmental organizations (NGOs)/international organizations/international donor agencies, 3) private sector (focus mining), and 4) private sector (focus industry in Ulaanbaatar).

Stakeholder consultations led to the identification of the key challenges including: lack of coordination, weak or unenforced regulations, lack of stakeholder engagement, and infrastructure deficits, as well as other technical and financial challenges. It became apparent that all stakeholder groups face problems due to unclear institutional responsibilities and a lack of coordination between institutional bodies (intra-governmental as well as cross-sectoral), weakly enforced laws and regulations and a lack of capacity in the water-related areas. In addition, integrated planning and sound decision making are undermined by the lack of (publicly) available data and sound knowledge on water resources management.

In a nutshell, the private sector in Ulaanbaatar mainly faces challenges caused by the lack of implementation and enforcement of laws and regulations, and the resultant uncertainties thereof, rather than from concrete challenges related to water resources (quantity or quality). On the other hand, the private sector in the Southern Gobi region (mining) faces challenges predominantly related to the potential lack of water resources and competing demands, while regulatory challenges pose additional hindrances.

## Role of the Private Sector: Sustainable Water Management as a Business Case

Given Mongolia's water challenges, companies will potentially face significant risks which can affect their business at the core. Turning sustainable water management into an integral part of their core business strategy will not only lead to mitigating risks, but will also have the potential to maximize the company's profit.

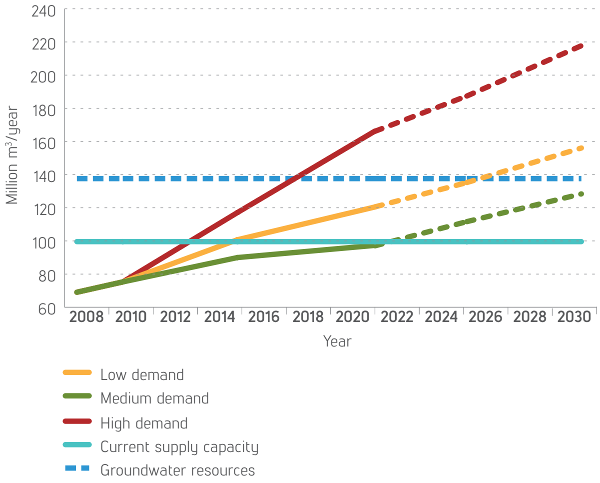
Future risks and opportunities are categorized into physical water risks, regulatory water risks and reputational water risks. With a widening water supply demand gap and increased regulation as a response to the gap, these risks are likely to increase exponentially and cumulate in future. Reputational risks increase along with an increasing water supply demand gap and increased regulation, calling for action now.

Activities furthering sustainable water resource management have been identified as business cases, i.e., leading to profitable returns, during the stakeholder consultations. However, while the potential for additional profitable activities is vast, constraints were identified which hindered their implementation. The disabling factors can be summarized by a lack of (financial) incentives, absence of legal frameworks, lack of specific standards and regulations, an uncertain political planning horizon, low degree of public awareness around (future) water challenges and insufficient stakeholder cooperation. Addressing these disabling factors can serve as quick wins towards sustainable water management by mobilizing the support of the private sector.

# Recommendations for the Way Forward

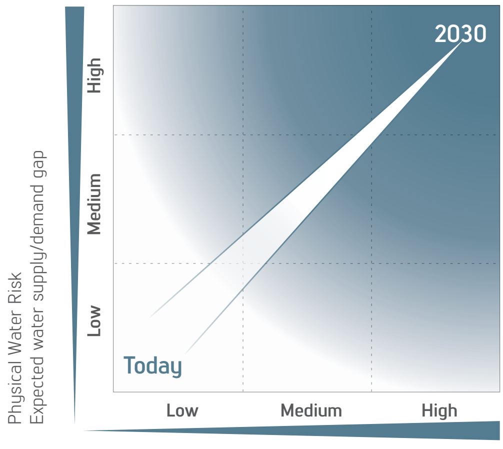
To work towards addressing Mongolia's water challenges, it is key to address the underlying causes, rather than just the symptoms. Recommendations on the key focus areas and future work streams are presented in this report. These include improving the data basis and scientific understanding of water resources in Mongolia, undertaking a hydro-economic analysis to identify a range of cost-effective, practical solutions and priorities, leveraging the potential of water economics in order to design incentives for sustainable water resource management, working towards organizational and institutional clarity of responsibilities and strengthening capacities at all levels of the government and, finally, to support setting up a multi-stakeholder platform with priority work streams for inclusive decision making and efficient knowledge transfers. Addressing these focus areas will provide a solid basis for and enable sustainable water resources management, with which Mongolia can achieve its social and economic growth aspirations.

Figure 1: Water Supply and Demand Gap in Ulaanbaatar




Source: Tuul Water Basin Integrated Water Management Plan, New Ulaanbaatar City Master Plan, PwC/Deltares calculations

Figure 2: Increasing Physical and Regulatory Water Risks Require Action Before 2030



# CHAPTER 1. Background

The 2030 Water Resources Group (2030 WRG) is a unique public-private-civil society collaboration and transformative initiative, designed to catalyze action on water resources reform within water stressed countries or provinces in developing economies.

The 2030 WRG structures processes for water sector professionals to engage major water users from the private sector with government and civil society leaders and trigger a change in their desire and momentum for collective action on sustainable water resources management. By helping to develop clear, compelling and actionable economic information on the water challenge for non-expert decision makers and activating structured multi-stakeholder and locally-owned processes the 2030 WRG aims to help the government and long-term development partners take policy reforms or public-private programs and projects forward. The ultimate aim of such reforms and/or actions is to close water demand/supply gaps.

To respond to these challenges, the Government of Mongolia expressed its interest in exploring partnership options for sustainable water resources management in Mongolia with the support of the 2030 WRG. Towards this, a memorandum of understanding was signed between the Government of Mongolia and the 2030 WRG on September 16, 2013. A work plan is currently being developed with the Ministry of Environment and Green Development.

In order to effectively align and catalyze the work of the Ministry of Environment and Green Development, as well as of the 2030 WRG, a consulting project for a *"Targeted Analysis on Water Resources Management Issues in Mongolia"* was commissioned to an international team of PwC India, Mongolia, and Germany[1] and Stichting Deltares (Deltares).

## 1.1 Objective

The objective of this project is to undertake a targeted analysis, which aggregates various sets of existing public data and delivers key messages targeted to Mongolian private sector companies and local communities.

This analysis identifies key water resource challenges for Mongolia as a whole and with a specific focus on the economic and urban hub of Ulaanbaatar and the mining region in Southern Gobi. Further, the underlying causes which hinder sustainable water resource management in Mongolia from materializing are identified. The drivers and potential for sustainable water resource management as a business case are illustrated and corroborated with case studies on companies that are already leveraging benefits from these business cases. The analysis further identifies key factors which limit the full potential of the private sector addressing the water resource challenge. Finally, next steps and recommendations are put forward to address Mongolia's water resource challenge.

Based on the targeted analysis, this project will raise awareness, mobilize and engage "new actors" from the private sector and local communities to engage in sustainable water activities, and in the partnership between the 2030 WRG and the Government of Mongolia.

To avoid duplication of efforts and to streamline the suggested next steps with the ongoing initiatives, an overview of recently completed and ongoing initiatives around water resources management has been compiled as part of the project work. These results will be presented in section 1.3.

# 1.2 Our Approach

Our approach strikes a balance between building a sound basis on available data sources, secondary literature and former projects, and expanding this basis via multiple stakeholder consultations, including interviews and focus group discussions.

## 1.2.1 Building on Sound Data

The availability of comprehensive, integrated and up-to-date hydrological information for water resources planning is restricted across the country. The most comprehensive hydrological water resource and water use data originates from two research projects, namely the Strengthening Integrated Water Resources Management in Mongolia project (IWRM project) and the Integrated Water Resources Management—Model Region Mongolia project (MoMo).[2] Given the geographical focus of this project covering the national scale, Ulaanbaatar and the Southern Gobi region data is mainly taken from the IWRM project and the resulting and recently approved Integrated Water Management Plan of Mongolia for all the 29 Mongolian Water Basins, and more specifically for the Tuul Water Basin.[3] Where adequate, data from other secondary sources has also been used.

## 1.2.2 Going Beyond the Known: Multi-stakeholder Consultations

Stakeholder consultations were used to understand stakeholder-specific risks and challenges related to Mongolia's water resource challenge as well as to identify the underlying causes and potential solutions.

Stakeholders were identified based on their influence and impact on water resource issues in Mongolia, as well as on their vulnerability with respect to future water resource challenges. In total, 30 in-depth interviews were conducted with key stakeholders, equally representing the private sector, the public sector and civil society.

Stakeholder interviews were based on stakeholder-group-specific questions, including:

- Stakeholders' views and role related to water resources management
- Identification of stakeholder risks and challenges, and the bottlenecks while aiming to run sustainable (business) operations
- Stakeholders' views on actual and possible solutions to these challenges

For a comprehensive list of consulted stakeholders see Appendix 2.

## 1.2.3 Verifying and Expanding Knowledge: Focus Group Discussions

In total, three focus group discussions (FGDs) were undertaken, each focusing on specific stakeholder groups: (1) the private sector with focus on mining companies, (2) the private sector with focus on non-mining industry in Ulaanbaatar, and (3), NGOs, international development agencies and international organizations.

In particular the objectives of the FGDs included the following:

- Introducing the findings of past stakeholder interviews and receiving feedback on them (**sounding**)
- Gathering additional information from new stakeholders which could not be covered in prior interviews (**increasing scope**).
- Raising awareness and involving more stakeholders (**increasing awareness**)
- Providing a platform for stakeholders to identify common issues and to connect (**allowing for communication**)
- Receiving information on stakeholder interrelations or dynamics (**understanding dynamics**)

In addition, a stakeholder mapping exercise was performed with each stakeholder group in order to identify the stakeholders' perception of the interest and influence of all stakeholder groups in working towards sustainable water resource management. The results can be found in Appendix 5. An overview of the participants' feedback can be found in Appendices 3 and 4, respectively.

# 1.3 Findings on the Completed and Ongoing Initiatives around Water Resources Management in Mongolia

To date, 44 recently completed and ongoing water-related initiatives, programs and projects were identified based on a secondary literature review, stakeholder interviews and focus group discussions. Despite this level of activity, there remains a lack of a nationwide overview and coordination of these initiatives: neither governmental coordination nor coordination from donor and international agencies is taking place. In order to avoid duplication of efforts and to streamline the suggested next steps with the ongoing initiatives, an overview of the recently completed and ongoing initiatives has been compiled.

Figure 3: Overview of the Recently Completed and Ongoing Water Management Initiatives


Source: PwC and Deltares.

Most initiatives are supported by international organizations, agencies and NGOs. Water programs are primarily funded by the Asian Development Bank (ADB), International Finance Corporation (IFC), and the United Nations Development Program (UNDP). In addition, development agencies from donor countries, including Australia, Japan, Germany, and the Netherlands provide funding for water-related projects. NGOs, such as the WWF Mongolia, are actively involved in developing sustainable water-related projects.[4] Figure 3 provides an overview of completed and ongoing initiatives with respect to water management—categorized by focus area.[5]

## 1.3.1 Focus Region: Ulaanbaatar

**Japan International Corporation Agency (JICA)** and **Korea International Cooperation Agency (KOICA)** are engaging in the development of water resources for residents of Ulaanbaatar. JICA (2011-ongoing) is currently developing new water resources in Gachuurt, including a water pipeline to the north-east reservoir in Ulaanbaatar City. This project seeks to provide water supply for residents of gher areas and new apartment areas. KOICA (2011-2014) is constructing wells and insulating water reservoirs in the Yarmag area to support stabilizing water supplies in Ulaanbaatar.

The **World Bank, ADB, Swiss Agency for Cooperation and Development (SDC)** and **Action contre la Faim (ACF)** are actively working on improving sanitation and drinking water access for residents of the gher districts. While SDC and ACF (2009-ongoing) are focusing on highly decentralized solutions, such as ecotoilets, the ADB (2011-ongoing) is extending and upgrading appropriate and affordable water supplies as well as wastewater collection in subcenters located in gher areas. The World Bank funded project (2011-2015) is providing more water kiosks, most of which are supplied by water mains instead of by truck. Further, a pilot project will install water and sewer connections to individual households to better understand how to increase connections and how to operate a localized wastewater treatment plant on a larger scale.

**KCAP** (2010) undertook a pilot project applying a new patented technology—the Eco Bio Block1 by Koyo Inc.—in selected wastewater treatment plants in Ulaanbaatar City which proved to improve water purification by 30 percent (KCAP, 2010).

Research activities and ecological education in cooperation with local communities around Ugii nuur, a lake and Ramsar site close to Ulaanbaatar, were undertaken as a model project for the conservation of wetlands and ecosystems and their sustainable use (**JICA**, 2005–2010).

A number of strategic assessments on Ulaanbaatar's water sector and beyond have been conducted. The **ADB** (2010–2013) conducted a strategic analysis of Ulaanbaatar's urban development and assessment of infrastructure provision, including recommendations on institutional reforms. **JICA** (2012–2013) recently completed a study on the strategic planning for the water supply and sewerage sector in Ulaanbaatar City which will re-examine the current situation based on the achievements of existing master plans, including feasibility studies on suggested actions and prioritizations of projects. The exposure and effect of toxic metals in Ulaanbaatar's drinking water has been assessed by the **University of Michigan** and the **University of Mongolia** (2011). The **WHO** (2004–2006) undertook an hydrological and hygienic assessment of spring water in Ulaanbaatar City, followed by a selection of springs which should be protected and upgraded. A consortium consisting of the **Mongolian Water Center, Deltares and others** (2007–2012) undertook a project to strengthen the water sector in Mongolia through Integrated Water Resources Management, including capacity building, institutional strengthening of the (then) Water Authority, development of the National Integrated Water Resource Management Plan and a more detailed plan for Tuul River Basin. The **municipality of Ulaanbaatar** has set up a Ulaanbaatar City Action Plan for 2013–2016, which also addresses water, wastewater and sanitation issues.

### Private Sector Initiatives

**Vitens Evides International** entered into a water operator partnership with **Ulaanbaatar Water Supply and Sewerage Authority** (USUG) with the objective of strengthening USUG's sustainable water management in terms of financial management and improvement of operations (2007–2010). The **Beverage Industry Environmental Roundtable (BIER),** a coalition of beverage industry companies and supporting partners, works together on a variety of environmental and stewardship initiatives including water conservation (see Chapter 4).

## 1.3.2 Focus Region: Gobi

In 2009 the **World Bank** completed the study on "Assessing Groundwater in the Southern Gobi region" (2009), which provides information on water supply and demand on the *aimag* level. The above-mentioned consortium consisting of the **Mongolian Water Center, Deltares and others** (2007–2012) also assessed water supply and demand for the river basins in the Gobi region. Mining companies also engage in hydrogeological investigations in the proximity of their (planned) mines.

The Canadian Government, European Bank for Reconstruction and Development (EBRD), IFC and 2030 WRG have designed and are delivering a ground water management training to a broad group of stakeholders, focused in the Gobi region, to build a common foundation of knowledge on water issues and to facilitate dialogue on water among companies, communities, government and civil society. As part of the project "Strengthen Groundwater Management in Southern Mongolia" the **World Bank** and **AUSAID** (2012–2016) seek to develop public capacity in groundwater resources management and to set up a small Groundwater Management and Information Unit. Further, one Water Basin Council and three Water Basin Authorities will be established in the three aimags of Dornogovi, Omnigovi and Dundgovi. Particular synergies can be expected between the initiatives of the IFC/the World Bank/AUSAID and the 2030 WRG (see Chapter 4).

### Private Sector Initiatives

Mining companies, such as **Oyu Tolgoi** and **Energy Resources LLC,** engage in community development programs—providing missing infrastructure—and community engagement programs—environmental monitoring programs (see Chapter 4).

Other than the BIER and the cooperation between the Canadian Government, EBRD, IFC and the 2030 WRG in the Gobi region, no multi-stakeholder platforms focusing on water have been identified.

# CHAPTER 2. Setting the Scene: Water Management Situation In Mongolia

## 2.1 Institutional Setting

Mongolia became a parliamentary republic in 1992 with a democratic government and representative members of the State Great Khural (Parliament) elected for a period of four years. Administratively, the country is divided into 21 *aimags* (provinces) and one municipality (the capital city). Aimags are further sub-divided into 329 *soums* (districts) and 1,568 *bhags* (local bodies). The capital city is divided into nine districts and 132 *khoroos*. From a water resources management perspective, Mongolia is divided into 29 Water Basins.

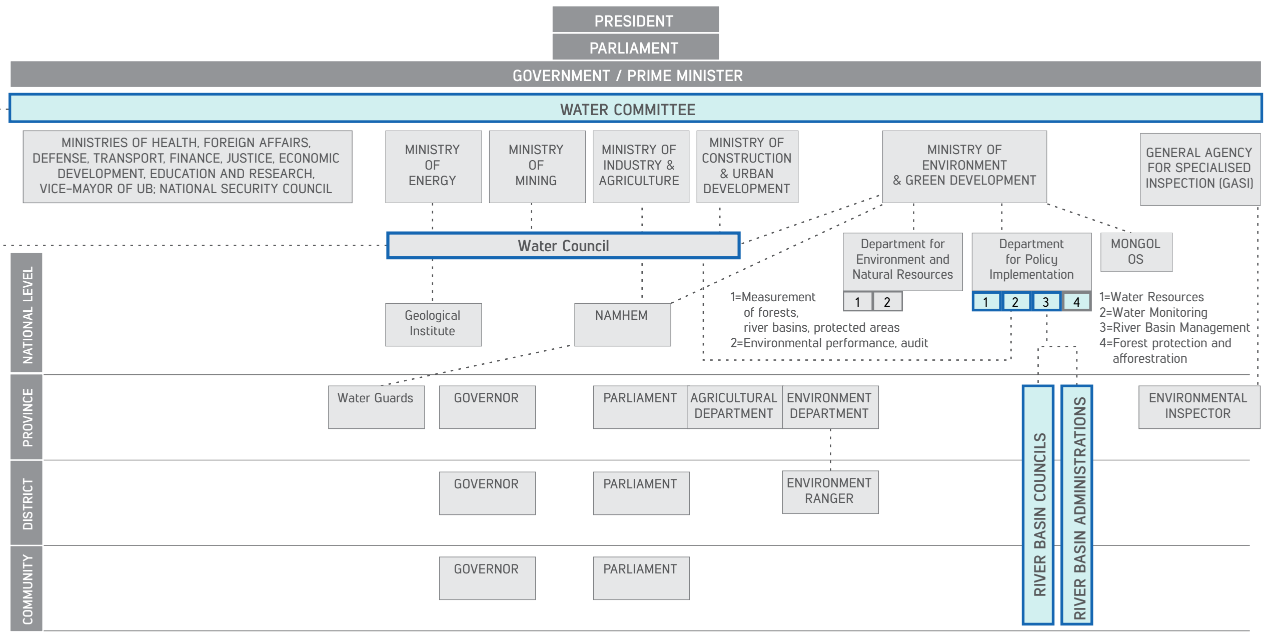
### 2.1.1 Organizational Structure of Mongolia's Water Management

A government restructuring in 2012 has considerably changed the organizational structure of water sector management in Mongolia. The new organizational structure is shown in Figure 4. It illustrates that the primary responsibility for water resources management lies with the Ministry of Environment and Green Development. Other ministries, state departments and non-governmental organizations are also involved in usage planning of water resources. An overview of their respective functions can be found in Appendix 7.

The concept of integrated water management (IWM) has been introduced in Mongolia in order to improve planning and ensure a coordinated usage of water resources. The IWM approach shifts the focus from a primarily supply-oriented and engineering-based approach to a demand-oriented, multi-sectoral approach. Key principles of the IWM include a participatory approach, recognition of the economic value of water, and emphasizing sustainability, and the principle of subsidiarity, that is, delegating decisions to the lowest practical level.

As part of this process, Water Basin organizations have been formally established in 20 of the 29 Water Basins, such as the Tuul, Orkhon, Khovd and Onon basins. Currently, **two Water Basin organizations** (Water Basin council and the Water Basin administration) are fully active for **water resource management** at the basin level.

Figure 4: Organizational Structure of Mongolia's Water Management




Source: Dombrowsky, I., A. Houdret and L. Horlemann (2014): Evolving Water Basin management in Mongolia? In: Huitema, D., Meijerink, S. (Eds.): The Politics of Water Basin Organisations. Edward Elgar, Cheltenham.

## 2.1.2 Economic Instruments

The **Water Law (2012)**, promulgated by the Parliament of Mongolia in August 2012, serves as an umbrella law for water resources management and provides a legal basis for the existing institutional setting within the water sector. Other key legislation complementing the Water Law in defining the responsibilities of water management institutions in Mongolia are as follows:

- Law on Use of Natural Resources (2012)
- Law on Water Pollution Fees (2012)
- Law on Use of Water Supply and Sewage System in Urban and Settlement Areas (2011)
- Law on Prohibition of Mineral Exploration and Exploitation in Runoff Source Areas, Forest Areas and Protection Zone of Water Body (2009)

These laws provide the legal basis for charging consumers for the use of water, discharge of wastewater and collecting penalties for exploitation and violation of rules. As a result, the following economic instruments have been introduced, with varying degrees of implementation and enforcement:

- **Water service charges:** Water consumers and users are required to pay water service charges to the responsible water suppliers, for example, to USUG in Ulaanbaatar, if water is received from the central infrastructure. Charges apply for the actual water used, with the majority of water consumers and users having metered water connections. Charges are specified in the Law on Urban Water Supply, Sanitation and Sewerage Use (2011).
- **Usage charge for natural reserves:** The water use fee charges water users, while water consumers are exempted from paying water use fees. The fee for water usage is calculated as a percentage of the ecological-economic value of water in the basin and is paid on a monthly basis. The Government of Mongolia determines the base indicator for the ecological-economic value of water in each Water Basin with the help of the Water Basin administration (Water Law 2012, Article 9, 10). Water users and consumers are classified into various groups based on the purpose of water usage. The ecological-economic value for a particular user or consumer group is calculated using group-specific indicators provided by the Government of Mongolia. The ecological-economic value of water also differs based on the source of water, that is, surface and ground water. Water users who re-use wastewater after treatment, purify and process water for household consumption and collect water from sources such as snow, rain, and floods for agriculture and animal husbandry are provided limited exemption from water usage fees (Water Usage Fee and its Waiver, 2013, resolution 326). The usage charge is specified in the Law on Use of Natural Resources (2012). The water charge is collected by aimag tax authorities, the revenues are transferred to aimag budgets. The revenue of the water usage charge amounted to 5.3 billion MNT in 2011. This is a strong increase when compared to water usage charge revenue in 2002, which amounted to 235.6 million MNT. An overview of water usage charge revenue per aimag over the period of 2002-2011 can be found in Appendix 8.
- **Wastewater charge:** Charges apply for all parties responsible for polluting waters (Water Law, 2012, article no. 25.1). Fees need to be paid for wastewater discharged to the environment directly or to a central wastewater treatment plant (Law on Water Pollution Fees, 2012, article no. 5.1) Exemptions are made if the wastewater is treated to an acceptable standard and is reused for production and service purposes (Law on Water Pollution Fees, 2012, article no. 8.1). The fee shall be based on the ecological-economic assessment of the government, which is specific to each water basin, but shall lie within given limits (Law on Water Pollution Fees, 2012, article no. 7.1 and 7.2). The Ministry of Environment and Green Development shall define the limits for pollutants for factories and service sector units which produce less than 50 $m^3$ of wastewater per day. The Ministry shall work with relevant government agencies in determining the pollution limits based on the water usage norm and capacity of factories and service sector units. Any violation of the pollution limits set by the government authorities shall lead to penalty and remedial action by the user or the consumer (Law on Water Pollution Fees, 2012, article no. 6.2 and 10).
- **Water pollution fee:** If the wastewater discharged exceeds the pollution limits, an environmental inspector shall determine the charges to be paid, depending on an assessment of the expert. The payment amount will be three times the standard rate for each released substance or pollutant based on an ecological and economic assessment (Water Law, 2012, article no. 25.2).
- **Impermeable surface charge fee**: A fee shall be paid for the area of impermeable surfaces (Water Law, 2012, article no. 25.4).

### Distinction Between Water Users and Consumers

The Water Law classifies individuals and companies into water users and water consumers based on the purpose for which water is required (Water Law 2012, articles 3.1.27, 3.1.28, 26). **Water consumers** are citizens, economic entities and organizations utilizing water or the water environment for non-profit purposes such as drinking, household needs, herding and agriculture, whereas **water users** are those who use water or the water environment for profit in the industry and services sectors.

The Law on Water Pollution Fees (2012) and the government resolution on regulating impermeable surface water charges have yet to be implemented. Thus, the related economic instruments are not yet fully enforced as they are envisioned in the descriptions above.

## 2.1.3 Licenses and Permits

Both water consumers and water users are required to apply to government agencies for a water use permit or license. The license is evaluated and approved by different government agencies based on the quantity of water required by the user or the consumer (see Table 1). The water use licenses are given for a period of 10 years which can be extended by another five years (Water Law 2012, article no. 28.8). In the case of applications for the use of water of more than 100 $m^3$ per day, the applicant is required to enclose the environmental impact evaluation report with the application.

Table 1: Responsibilities for Water Use Licensing[6]

| Water use per day | Authority for evaluation and issuance of report | Licensing authority for approval |
|---|---|---|
| 0 to 50 m$^3$ | Environmental authority of city and aimags | Governors of soums and districts |
| 50 to 100 m$^3$ | Water Basin administration | Environment department in aimags and the capital |
| Above 100 m$^3$ | Ministry of Environment and Green Development | Water Basin administration |

Source: Water Law 2012, article no. 28.4 and 28.6.

All entities discharging wastewater need to apply for a wastewater discharge permit. The permit is evaluated and approved by different government agencies based on the quantity of wastewater being discharged.

Table 2: Responsibilities for Wastewater Discharge Permits[7]

| Wastewater discharge per day | Assessment authority | Licensing authority for approval |
|---|---|---|
| 0 to 50 m$^3$ | Water Basin administration | Governors of aimag or the soum |
| Above 50 m$^3$ | Ministry of Environment and Green Development | Water Basin administration |

*Source: Water Law 2012, article no. 24.2.*

# 2.2 Mongolia: National Overview

## 2.2.1 The Water Resources Situation

For most of its area, Mongolia possesses a highly continental, semi-arid to arid climate, characterized by low precipitation and therefore low water availability. Perennial rivers are found in the northern part of the country, but are lacking in the dry southern part, the Gobi area. River runoff in the summer is variable and depends on the amount of rainfall in the summer months with contribution from the ice and snow collected in the mountains during the winter season. In an average year (50% probability), surface water is estimated to cover 2,091 million m$^3$, while more conservative estimates for a dry year indicate surface water amounts to 1,294 million m$^3$.[8] Lakes in Mongolia store approximately 75 percent of the total fresh water resources, with Lake Khuvsgul alone storing 75 percent of the total water volume in these lakes. Other large freshwater lakes include Buir Lake, Khar Lake and Khar-Us Lake.

Groundwater is recharged by infiltrating river water or rainfall. In the dry south, recharge is almost negligible and deep groundwater is found in the so-called fossil (non-recharged) groundwater reservoirs. Groundwater is available all year around from shallow and sometimes deep wells, the quality of groundwater varies depending on the location of the source. In more than 100 of 326 soums, groundwater does not meet drinking water quality standards and requires treatment. The quality of natural groundwater in the Gobi and Dornod regions is found to be of lesser quality than in the other regions. Explored and approved groundwater resources in Mongolia amount to 623.4 million m$^3$ per year, whereas the potential exploitable groundwater, that is sources which still require exploration and approval, are estimated to amount to 10,627 million m$^3$ per year. Thus, significant potential exploitable groundwater exists in Mongolia which allows for further exploration of water resources in water basins facing water supply issues.[9]

Climate change has a clear effect on temperatures which, according to official records, are rising. The average temperature is predicted to rise by 4.0 to 4.5° C towards the year 2100.[10] This has already strongly reduced the size of the ice caps in the mountains, thereby affecting rivers fed by glaciers, and will also increase evaporation and cause an increased dryness of the soils. The effect on summer rainfall is predicted to be small, but incidents of heavy rainfall may become more frequent. This together with the increased variability in rainfall may well change the availability of water during various seasons and successive years. It may be concluded according to model studies that the effect of climate change on water resources is not easy to predict, and it may be positive or negative, and not be the same in all parts of Mongolia.

## 2.2.2 Current and Future Water Demand

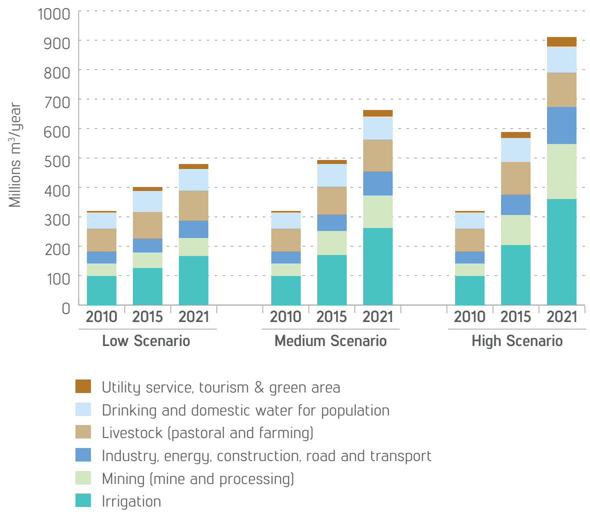
Currently, the agricultural sector is the largest water user in Mongolia with irrigation accounting for 30 percent and livestock for 23.5 percent of the total water demand. Mining accounts for 12.7 percent of the water demand, but is likely to become the major water user in the future. Water consumption is highest in the Tuul and Orkhon water basins, accounting for 27.6 percent and 13.5 percent of total water use in Mongolia respectively.

Given Mongolia's considerable mineral reserves and the strong economic growth of its neighbors, China and Russia, the IMF predicts Mongolia's GDP growth rate to reach 11.7 percent in 2014 and stabilize around 6.2 percent by 2018.[11] Since this GDP growth will be mainly pushed by mining activities in the Southern Gobi region, and the resultant higher levels of economic activity in the economic hub of Ulaanbaatar, considerable impacts on water management can be expected.

Reflecting future uncertainties, water demand projections have been made based on three development scenarios (low, medium and high economic development) for the years 2015 and 2021 in alignment with the current government policies and documents.[12] The composition of current water demand (2010) and projected water demand for the years 2015 and 2021, following the three economic development scenarios, are presented in Figure 5.

In 2021, the total water demand is projected to increase by 50 percent in the low economic development scenario, double (over 106%) in the medium economic development scenario, and triple (over 184%) in the high economic development scenario. In all scenarios, the underlying drivers are increased water demand by mining, industry and irrigation.

Figure 5: Water Demand Projections for Mongolia Across Development Scenarios




Source: National Water Management Plan of Mongolia (2013)

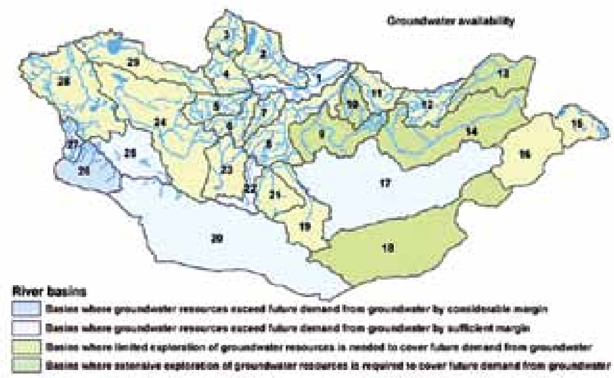
## 2.2.3 Critical Issues Related to Water Supply and Demand

Contrasting the nationwide available resources with the projected water demand scenarios (low, medium and high), it becomes apparent that resources by far exceed demand in 2010, 2015 and 2021.[13]

However, given the high geographical variability of water supply and the concentration of water demand centers, a local focus on assessing the water supply and demand gaps is critical. Figure 6 and Figure 7 illustrate the coverage of the water demand by the available surface- and groundwater resources for the 29 Water Basins.

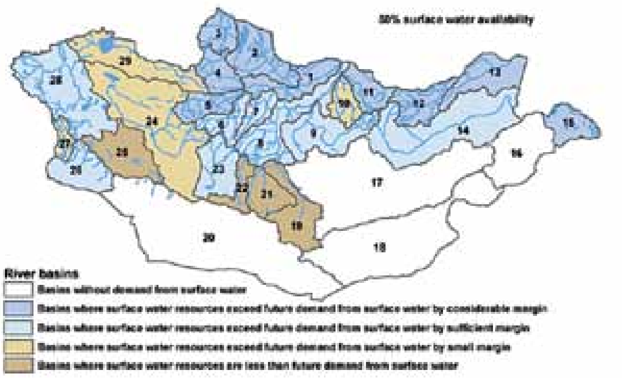
As Figure 6 illustrates, the available groundwater resources exceed the future demand from groundwater in all basins. Further exploration of groundwater resources is expected to be required in 22 out of the 29 basins, where future demand exceeds 50 percent of the groundwater resources. Extensive exploration activities to cover future demand from groundwater are expected in five of these 22 water basins in the central and eastern part of the country. Water demand from surface water is sufficiently covered in 17 out of 25 Water Basins in a medium year and in 14 out of 25 Water Basins in a dry year (see Appendix 12). Thus, the surface water availability is insufficient to cover demand in 8 Water Basins in an average year and in 11 Water Basins in a dry year.

Figure 6: Available Groundwater Resources and the Future Demand for Groundwater




Source: National Water Management Plan of Mongolia (2013).

Figure 7: Available Surface Water Resources and the Future Demand for Surface Water




Source: National Water Management Plan of Mongolia (2013).

## Main Overarching Issues in a Nutshell[14]

Currently, Mongolia does have sufficient water, by volume, to support its population and economic activities and is likely to continue to have in the future also. The main issue is that this water is not available at the right place, in the right moment and in the required quality. The overall main issues include:[15]

- **Provision of safe drinking water and optimal wastewater treatment:** The infrastructure needed for sufficient and safe provision of water to users is far from being adequate.
- **Conservation of water resources:** Factors such as growing population, urbanization and industrialization, combined with an increase in mining activities and irrigated agriculture place demands on the water resources system.
- **Pollution of water resources:** Locally, pollution of surface water, for example, from mining activities and inadequate wastewater treatment, is already a major issue.
- **Sufficient and clean water for the environment:** Increased demands on water resources resulting in changing flows, combined with increased water pollution is impacting aquatic and riparian ecosystems.
- **Restoration of water resources:** Improvement of water resources after damage caused by overuse or neglect.
- **Hazards due to floods, droughts, *dzuds*[16] and other disasters:** Inadequate preventive means result in serious impacts for the population and livestock.
- **Capacity building for water management:** Capacity development is required for national and local governmental institutions.
- **Monitoring and research for water management:** Currently, water resources are insufficiently monitored and understood.
- **Data and information management:** Currently, data on water resources management is not centrally available to the stakeholders or the key decision-makers.
- **Public awareness of water management and public participation:** There is a lack of public awareness about the importance of water management and the role that various stakeholders are expected to play in it. Further, the current centralized and government dominated system of water management does not provide incentives for users to participate.
- **Insufficient financing for infrastructure (capital and O&M costs) and recurrent costs for water management institutions:** The Water National Programme estimates the investments in the water sector until 2015 to exceed 3 trillion MNT (one-third of Mongolia's GDP in 2010), excluding O&M costs of existing infrastructure.
- **Transition of institutions for water management to the new market economy:** Institutions and legislation are still immature and need to further develop their capabilities, especially in the field of IWRM.

# 2.3 Urban and Economic Hub of Ulaanbaatar

Ulaanbaatar is the capital city of Mongolia and is also its cultural, industrial and financial center. Most of the country's GDP is generated within this urban and economic hub. With a population of over 1.1 million inhabitants, more than one-third of Mongolia's population lives in this area, making it by far the largest city in the country. Located in the Tuul Water Basin at an elevation of about 1,300 meters, it is often described as the coldest capital in the world, with average annual temperatures around -2.4°C.

## 2.3.1 The Water Resources Situation

The city of Ulaanbaatar supplies water to the population and industry predominantly from groundwater resources, which is abstracted from the alluvial aquifer in the Tuul River valley. Several well fields are exploited by the Water Supply and Sewerage Company (USUG) of Ulaanbaatar. In addition, some industries and power stations meet their water demand with private well fields.

The permeability of the alluvial sediments permits large abstraction rates from wells and the infiltration potential of water from the river is good. While the abstraction of groundwater is continuous, groundwater recharge from the river is only possible in seasons apart from the winter season, during which the Tuul River freezes. This winter period is critical since water is abstracted from storage, and groundwater levels show a drop. Groundwater abstractions are therefore limited by the storage capacity of the aquifer and the length of the winter period.

The river provides a reliable source of water, since it has stable minimum flows which are generated in the forested catchment located in the protected areas of Khan Khentii and Gorkhi Terelj. However, direct use of surface water from the river is negligible (less than 1% of the total water usage). Currently, plans to build a reservoir upstream of Ulaanbaatar (Tuul Complex) are being made in order to supplement the drinking water supply and replace (a portion of) the groundwater resources.

## 2.3.2 Current and Projected Water Demand

The water supply to the population is either organized centrally by the USUG, or by private connections and public water kiosks. Of the 301 water kiosks, 256 water kiosks are not connected to the centralized water supply network and receive water supplies by water trucks. Industrial water demand is met from the central water supply network or private sources. In 2010, 42 percent of Ulaanbaatar's population was provided with improved sanitation.

The average water use by private connections is high (in 2011 it was estimated at 204 liters per person per day). The average water use has decreased over the years (from more than 300 liters per person per day in 2004) due to the installation of water meters, but is still high compared to other capital cities (130 to 160 $m^3$ per day). The average water consumption of the *Ger* area[17] residents using water from kiosks is estimated at 5 to 10 liters per person per day, which by contrast is below the minimum consumption levels as recommended by the World Health Organization.

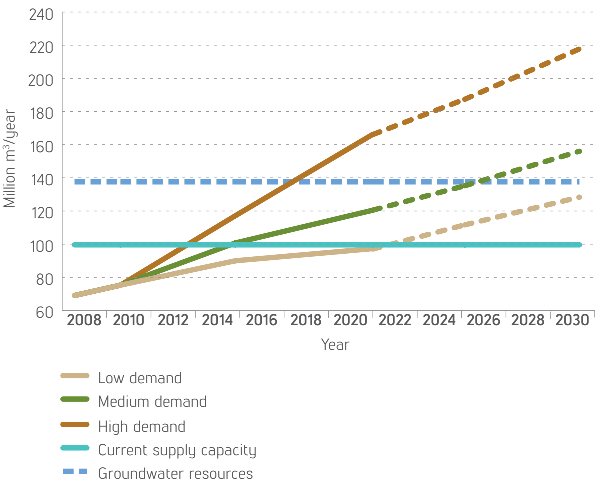
In 2010, the highest water demand came from providing drinking water and domestic water for the population (46%), and 32 percent of the water was consumed for industrial uses.

Similar to the national overview, future water demand for Ulaanbaatar has been projected based on the three economic development scenarios—low, medium and high economic development[18] Future water demand in 2021 is projected to increase by 20 percent, 49 percent and 101 percent in the low, medium and high economic development scenarios respectively. The main drivers for this increase are predominantly the rising industrial water demand, followed closely by increased necessity of providing drinking water for the population.

Figure 8: Water Demand Projections for Ulaanbaatar[19]


Source: Tuul Water Basin Integrated Water Management Plan.

Figure 9: Water Supply and Demand Gap in Ulaanbaatar[20]




Source: Tuul Water Basin Integrated Water Management Plan, New Ulaanbaatar City Master Plan, PwC/Deltares calculations.

Note: Water resources include all approved groundwater resources at Ulaanbaatar including up-stream area. Available surface water resources (estimated at 29.9 million m³/year) are not included, as infrastructure solutions need to be found to make these resources usable. The water demand projections until 2021 are based on Tuul Water Basin Integrated Water Management Plan. Projections beyond 2021 are based on the average annual increase in water demand from the projections used in the New Ulaanbaatar City Master Plan (JICA, 2013).

## 2.3.3 Critical Issues Related to Water Supply and Demand

Contrasting maximum available resources and current water supply capacity within Ulaanbaatar with the projected water demand (under low, medium and high scenarios), it becomes apparent that the current supply capacity, i.e., water which can be supplied given the current infrastructure, is insufficient to meet the projected demand in all scenarios (see Figure 9). In case of the high and medium water demand scenario, water demand is expected to exceed maximum available resources between the years 2015-2021 and 2021-2025 respectively. In order to increase the maximum available resources by using surface water, distribution network improvements to minimize losses and additional infrastructure construction needs to be undertaken. There are options such as dams as part of the Tuul Complex which are being considered, but are yet to be finalized.

The projected water demand has consequences pertaining to wastewater management. The volume of sewage water for the year 2025 in Ulaanbaatar is estimated to be around 230,000 m³/day.[21] The capacity of existing sewage treatment facilities is approximately 170,000 m³/day necessitating the planning and implementation of new wastewater treatment infrastructure.

**Key take-away messages:**

- Water demand exceeds current supply capacity in all scenarios.
- Water demand in the high demand scenario even exceeds maximum available groundwater resources.

## In a Nutshell[22]

**Water demand exceeds supply capacity in the near future:** The increase in the population of Ulaanbaatar puts a strain on the available water resources with respect to quantity and quality and requires the application of an effective and integrated management of the resources and the supply.

**Integrated assessment of resources:** In the future, increased demand will have to be covered by available surface and groundwater resources. To understand the impact of increased surface water use on groundwater recharge, an integrated study is required.

**Protection of water resources:** The existing water resources are threatened by (irreversible) over-use and pollution. The location of the groundwater resources along the Tuul River are particularly vulnerable to pollution from discharge of liquid and solid wastes. The uncontrolled disposal and leaking of chemical wastes especially endangers the water quality in the alluvial aquifer. Some production wells in the industrial area in Ulaanbaatar operated by USUG already were closed down for drinking water production. Further, a decline in the groundwater levels was reported due to ongoing abstractions exceeding the recharge rate.

**Improvement of water supply and sewerage infrastructure:** The infrastructure is in need of a major overhaul to improve the quality and efficiency of the network, as well as an expansion to unconnected households, assimilating them within the network.

**Drinking water and sewage connections in the Ger districts.** Roughly two-thirds of Ulaanbaatar's population lives in Ger districts, i.e., areas wihout access to drinking water and sewerage infrastructures. The inhabitants suffer from limited access to water kiosks (restricted opening hours and at times long walking distances) and lack of improved sanitation.

**Moving Ger residents to apartments:** As a part of the Comprehensive National Development Strategy based on the MDGs, 70 percent of the population in cities and settlement areas shall be supplied with water from the water supply network by 2015. Moving Ger residents to apartment areas and connecting kiosks in the Ger areas of Ulaanbaatar to the water supply network are policies supporting this objective. In Ulaanbaatar 75,000 to 80,000 apartments are planned, which will considerably increase the water demand.

**Improvement of wastewater treatment plants:** Most industrial wastewater is discharged to the central sewerage system without prior treatment. This has disrupted the functioning of the central wastewater treatment plant, which was designed for purely domestic sewage and consequently is heavily polluting the Tuul river. In addition, the current capacity of the central wastewater treatment plant is not sufficent for future wastewater discharges.

**Control of water usage from private wells:** The increase in the number of wells used for the water supply of private companies or other private enterprises causes larger drawdowns at the end of the winter season. A monitoring system on water abstractions from private wells has yet to be enforced, making an integrated assessment of resources difficult.

**Financial viability of the water service provider (USUG):** Due to inherited debt and low water service charges, the USUG business model is not financially sound. It is unable to finance the required infrastructure investments and its revenues from service operations do not cover the operating costs.

# 2.4 The Mining Hub in Southern Gobi

The mining industry is rapidly emerging as the backbone and the leading sector of the country's economy. In 2010, there were about 200 mining projects that received a license from the Mineral, Natural Oil Authority to perform mining activities. Large mines are developing and have recently started operations in South Gobi, such as Oyu Tolgoi (copper) and Tavan Tolgoi (coal), along with (planned) value-adding industries which require the development of new water sources.[23] The water resource system has to support this activity by providing, where possible, the water needed while satisfying competing water demands from the mining-urbanization-herder nexus.

Figure 10: The Three Water Basins and Mining Locations in the Southern Gobi


Source: National Water Management Plan of Mongolia (2013).
Note: Purple lines indicate administrative boundaries. Blue lines indicate Water Basin boundaries (17, 18, 20)

The Southern Gobi is divided administratively into three aimags (Omnogovi, Dornogovi and Dundgovi) and three Water Basins, namely the Umard Goviin Guveet-Khalhiin Dundad Tal, Galba-Uush-Dolodiin Govi, and Altain Uvur Gobi Basins. Main economic activity and competing demands occur in the Umard Goviin Guveet-Khalhiin Dundad Tal and Galba-Uush-Dolodiin Govi Basins. Thus, the focus of this analysis is on these water basins[24] (see Figure 10).

The management of the groundwater in the Gobi region is important to ensure sustainable economic development, protect the livelihoods of the local population and to maintain areas with high ecological value. Understanding the water resources system requires knowledge on the hydrogeology of the South Gobi as well as on water usage and the existing water resources and environment.

The following data is based on the National Water Management Plan of Mongolia (2013). However, additional studies (e.g., from the World Bank (2010) and McKinsey) have been conducted. As the water resource and demand projections vary, we undertook a comparative assessment which can be found in Appendix 11.

## 2.4.1 The Water Resources Situation

The semi-arid area of Southern Gobi has no perennial rivers although dry river beds may become seasonal rivers post heavy showers. The sandy sediments of these dry rivers are recharged during such events providing a reliable shallow water source.

Groundwater to a large extent was not much in use due to its salinity, but is now increasingly used to ensure a supply to the new mines. These deeper groundwater resources are fossil groundwater deposits which generally do not receive recharge.

The Orkhon-Gobi water transfer project is planned to supply water supply to the mines from the Orkhon river to the South Gobi through a pipeline which is more than 700 km long. Once completed, it is expected to transport 2.5 $m^3$/second of surface water. The project includes a 62 meter high dam with a reservoir and a 30 MW power plant. The dimensions and complexity of this project are considerably larger than any such project undertaken in Mongolia before. Besides the technical risks of undertaking such a first-of-its-kind project, there are multiple cost/benefit analyses, such as economic feasibility and environmental impacts of this project, that need to be thoroughly studied, assessed and weighed against alternative solutions.

## 2.4.2 Current and Projected Water Demand

The largest single water users in the Southern Gobi are the mines. They either abstract groundwater for their mining operations or pump shallow groundwater to de-water the mines. Most abstract deep brackish groundwater which may be treated to reduce the salt content. The groundwater abstracted to de-water the mines generally has a lower salt content and may be used in the mining process for wetting roads or other purposes. Recycled water is increasingly applied to reduce the abstracted quantities. The mining industry needs water for their operations, however, the new cities and value-adding industries that grow around the mining sites also need to be provided with water.

The towns and settlements in the area and the nomadic herders generally use shallow groundwater for drinking water and livestock water supply. This water ranges from being fresh to slightly brackish and its suitability as drinking water is locally deficient. Also, high levels of arsenic are reported in some locations.[25] The nomadic herders move around in search of pasture and water.

Similar to the national overview, future water demand has been projected based on three economic development scenarios (low, medium and high economic development).[26]

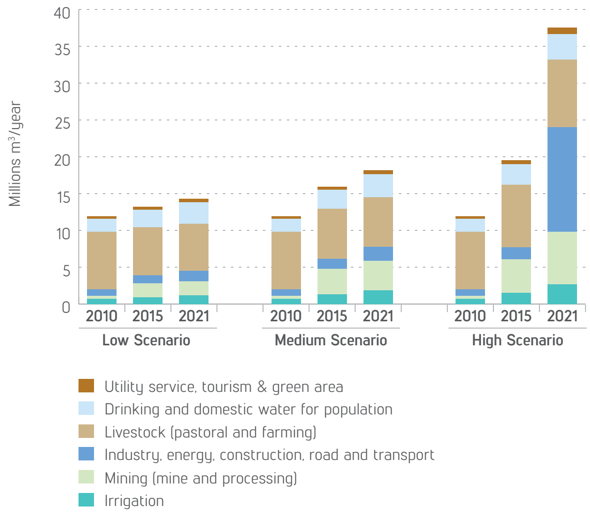
Future water demand in Galba-Uush-Doloodiin Govi Water Basin in 2021 is projected to increase by 350 percent, 720 percent and 912 percent in the low, medium and high economic development scenarios, respectively (see Figure 11). The high increase in water demand is driven by the newly developed mines, namely Oyu Tolgoi, Tavan Tolgoi and Tsagaan Suvarga.

Future water demand in the Umard-Goviin-Guveet-Khalkhiin Dundad Tal water basin in 2021 is projected to increase by 20 percent, 50 percent and 120 percent in the low, medium and high economic development scenarios respectively (see Figure 11). The main driver for this increase is predominantly an increase in water demand from mining. Livestock currently has the highest water demand in this basin but this is not expected to change significantly. In order to increase the value-add of Mongolia's mining products, the Government has decided to construct the "Sainshand" industrial complex where coke, metal, coal, copper smelting and construction material industries will be located. This will be constructed between 2015 and 2019. The water demand for the development of this industrial complex will require additional groundwater resources, which is included in the high development scenario for 2021. Investigations are underway to find suitable resources although these may not be found near the urban center.

Figure 11: Water Demand Projections for Galba-Uush-Doloodiin Govi Water Basin

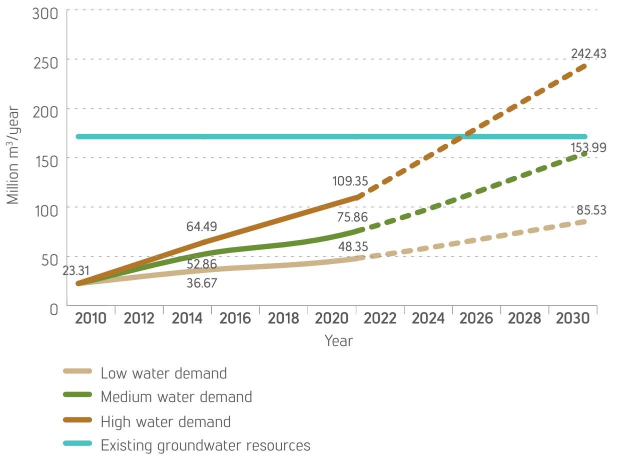

Source: MEGD: Integrated Water Management Plan of Mongolia, 2013

Figure 12: Water Demand Projections for Umard-Goviin-Guveet-Khalkhiin Dundal Tal Water Basin




Source: MEGD: Integrated Water Management Plan of Mongolia, 2013; PwC/Deltares calculations.
Note: Projected industrial water demand from the industrial complex Sainshand (11.2 million m³/year) was included in the high economic development scenario. No estimates for medium and low water demand were made due to a lack of data.

Figure 13: Projected Demand and Actual Supply in the Southern Gobi




Source: MEGD: Integrated Water Management Plan of Mongolia, 2013; PwC/Deltares calculations.

Note: 2021–2030 projections are based on additional PwC/Deltares calculations. They are estimated using sector-specific average annual growth rates in water demand during 2010–21. Following the World Bank report' assumptions (2010) that most of the mines in the region will reach their planned extraction capacity by 2015, beyond which water demand will increase at an annual rate of 10%, a growth rate of 10% pa has been assumed for all scenarios in the mining sector. Since livestock growth rate has been negative during 2010–21 (low & medium scenario) due to occurrence of dzuds, average annual growth of livestock during 2015–21 has been used for projections. The projected average annual growth rate used to estimate 2030 water demand of the industrial sector under high growth scenario excludes the additional water requirements of Sainshand industrial complex. The gross water demand for Sainshand, however, has been included in the high water demand scenario in addition to the IWM calculations.

## 2.4.3 Critical Issues Related to Water Supply and Demand

The water demand projections and existing groundwater resources for the Southern Gobi are presented in Figure 13. The Southern Gobi projections include the overall values for the three Water Basins, namely the Umard Goviin Guveet-Khalhiin Dundad Tal, Galba-Uush-Dolodiin Govi and Altain Uvur Gobi basins.

Assuming the groundwater resource availability remains at the current level, it can be estimated that water demand will exceed available water resources between 2021 and 2030 under the high water demand growth scenario. Under the low and medium scenarios, existing groundwater resources are expected to meet demand.

However, it needs to be stressed that while the overall water resources and demand balances at the regional level of the Southern Gobi do not show a gap for the low and medium water demand growth scenarios, high water risks are expected at the local level including quantity and quality. In some cases, however, water can be or needs to be sourced over long distances. For example, for the mine Oyu Tolgoi the distance to the nearest groundwater source, Gunii Hooloi, is about 50 km. In addition, whether the abstraction of groundwater is from deep aquifers or from shallow aquifers will also have differential impact on other users and the environment. Thus, water risks are highly localized and the impacts can differ strongly between stakeholders (groups) in the same area.

It needs to be noted that the data situation in the Southern Gobi is difficult, thus estimates need to be treated with care. Existing reports on water supply and demand projections, such as the World Bank assessment (2010) and the assessment undertaken by McKinsey provide varying estimates. According to the World Bank (2010) there is "enough groundwater to sustain projected development until 2020" in the Southern Gobi, while McKinsey projects a water supply/demand gap.[27] A comparative assessment on the projections can be found in Appendix 11.

## In a Nutshell[28]

The mining industry leads the present economic growth. The increase in mining activities puts a strain on the limited available water resources and requires the application of an effective and integrated response for management of the resources and the supply. The challenges related to achieving an optimal water supply for all water users is summarized below:

**Limited locally available water resources:** The main issues critical for water resources management in the Southern Gobi are the limited local resources, the effects of pumping deep groundwater, and the poor quality of both the shallow and the deep groundwater. Use of groundwater is permitted within 40 to 60 percent of the storage.[29] A particular challenge at the moment is sourcing sufficient water for the industrial complex Sainshand as well as a potential water supply/demand gap in the high water demand growth scenario in the Southern Gobi.

**Water quality:** The natural quality of the groundwater exceeds minimum drinking water norms in many locations. Treatment of the water is an option but not in all cases due to the costs and complexity of the treatment technologies.

**Competing water uses: the mining–urbanization–herders nexus:** The possible effect of the abstraction of the deep groundwater on the shallow groundwater is an important issue because the local population depends on the shallow water sources to serve herding and irrigation activities. Conflicts between these stakeholders occur frequently, although a number of mining companies have introduced inclusive stakeholder programs.

**Scientific information on groundwater interactions:** In many locations thick clay deposits separate the deep and shallow groundwater and hydrogeologists predict no effect. But the accuracy of these predictions will be confirmed only after deeper groundwater is used. The monitoring of groundwater levels and groundwater quality therefore is important. The availability of groundwater resources now and in the future should be determined using integrated modelling and other techniques to forecast the possible use of the water resources; models are to be updated once monitoring data becomes available, especially after groundwater abstraction has started.

**Plans to augment water supplies with surface water:** Surface water diversion from the Orkhon River and the Kherlen River is being considered to augment the limited groundwater resources. These diversion projects may have significant hydrological and environmental impacts on the rivers, and will require large investments and high operational costs.

**Non-compliant companies and ninja miners:** While most international companies pay close attention to and comply with international standards on water resource management, a lack of enforced regulation allows loopholes to exist for some companies which have negative impacts on the environment (abstraction, wastewater discharges, etc.).

# CHAPTER 3. Identification of Underlying Causes Hindering Sustainable Water Management

To understand the underlying causes hindering sustainable water management and to identify options to address these, this report analyzes key challenges and interests of major stakeholders in relation to the water resources challenge. These stakeholders were grouped into four categories: 1) public sector, 2) NGOs, international organizations, international donor agencies (IDA), 3) private sector (focus mining), and 4) private sector (focus industry in Ulaanbaatar).

Figure 14: Mapping the General Challenge Categories of the Stakeholder Groups


Source: PwC and Deltares.

The public sector and the NGOs, international organizations, and international donor agencies work at the national level, while the stakeholders from the private sector work locally and face very different challenges. Thus, the private sector was further differentiated by region and its focal business area.

Stakeholders within each group face similar challenges, identification of which provides the first step in addressing and solving the water resource challenge for the long term rather than just addressing the "symptoms".

The stakeholder consultations led to the identification of four key challenge areas verified by a secondary literature review and during the focus group discussions (Figure 14):

It became apparent that integrative planning and sound decision making for all stakeholders is impeded by the lack of publicly available data and sound knowledge on water resources management. In addition, all stakeholder groups face problems due to unclear institutional responsibilities and lack of coordination between institutional bodies (intra-governmental as well as cross-sectoral), inadequate law and regulation implementation and a lack of capacity in water-related areas, and also the lack of a solid, generally accepted database. However, each stakeholder group faces these challenges from a different perspective and has additional, unique challenges.

The challenges specific to each stakeholder group are presented below.

## 3.1 National Scale

The public sector mainly faces challenges in implementing and enforcing laws and regulations, whereas these challenges directly create those of the NGOs, international organizations and IDAs. Coordination is a key challenge for both stakeholder groups, as are stakeholder consultations and creating public awareness. Technical challenges are in some cases addressed jointly between these stakeholder groups and should thus be analyzed considering the perspective of these other stakeholder group.

### 3.1.1 Public Sector

#### Coordination Challenges

- In 1986 the duties of the Ministry of Water were divided into five separate ministries, while additional agencies and committees were also involved in water management, leading to **institutional complexity**. In addition, the **lack of coordination** between these institutions at national and local level leads to **unclear responsibilities**, **incoherent policies** and **a lack of enforcement**.
- In addition, lack of coordination between ministries and agencies results in institutions following their own agendas and protecting their data which **obstructs all integrative planning processes** in the sector. Particularly the Tuul Water Basin Management Plan is perceived to be unsupported by institutions besides the Ministry of Environment and Green Development and the Tuul Water Basin Administration, calling for the appointment of a coordinator with sufficient authority.
- More power has been devolved to the regions and local governments. In this transition phase, capacities at the local governments need to be developed and procedures need to be put in place. Currently, the division of **responsibilities** between the local and national level and their coordination **are unclear**.
- While IWM focuses on a **participative approach**, multi-stakeholder platforms, including with the private sector, are yet to materialize.

#### Regulatory Challenges

- Setting the **right incentive levels** for sustainable water use while **managing tradeoffs** between competing uses proves to be difficult. For example, while it is commonly understood that industrial water prices need to be increased, the Ministry of Mining boycotted the Ministry of Environment and Green Development's suggestion to increase the water tariff several times, arguing that this will damage the competitiveness of the industry. Finally, they mutually agreed to increase the tariffs by about two to three times.
- **Economic instruments** are based on a water valuation methodology which is outdated (pre-1996) and not fully transparent. Thus, there is no sound platform to set tariffs and fees and provide incentives to sustainable water management.
- While the Water Law (2012) and accompanying regulations have been passed, **their implementation and enforcement** still lags behind. Guidelines, which detail the roles and responsibilities of institutions as well as the processes related to fee structuring, collecting and utilizing the proceeds, are yet to be established. **Monitoring** needs to be expanded. As a consequence water users currently have no financial incentives for sustainable water resources management.
- **Capacity building and training of water specialists** is lagging behind on all levels and in all institutions, which has significant impacts on the design, implementation and enforcement of regulations and consequent sustainable water management.

#### Stakeholder Challenges

- In general, there are obstacles to obtaining **information from stakeholders on on-going activities and data** due to lack of coordinating activities and reluctance from stakeholders to share data.
- Design, implementation and enforcement of laws, regulations and policies are in most cases carried out without consulting the relevant **stakeholders**. As a consequence these may not be accepted, hindering enforcement.
- Differing degrees of capacity across stakeholder groups impedes the design, implementation and enforcement of laws, regulations and policies due to **frequent and fundamental misunderstandings**.
- There is a strong need to **create awareness** based on accurate information about the importance of sustainable water management and hygiene among the public.

#### Technical Challenges

- The existing **infrastructure**, particularly the wastewater treatment plants, are **falling into disrepair** and will require a complete renewal. Instead—due to the budget constraints—infrastructure is improved in a piecemeal manner which in the long run is neither sustainable nor cost-effective.
- With 60 percent of Ulaanbaatar's population living in Ger districts which have been spontaneously organised, a

substantial challenge lies in identifying (financially) **sustainable infrastructure solutions** which fit the climatic conditions.

- Knowledge about prioritizing and planning infrastructure projects is restricted due to a **lack of enthusiasm for data sharing.**
- Water and wastewater infrastructure projects are **not financially sustainable** due to low water prices that do not cover costs. USUG, the water and wastewater supplier of Ulaanbaatar, is running substantial losses and cannot cover current costs or repay debts which were taken by the government on its behalf. While most institutions support an increase in water prices, the Mongolian Authority of Fair Competition and Consumer Protection oppose these motions.

## 3.1.2 NGOs, IDAs and International Organizations

### Coordination Challenges

- **Institutional complexity,** due to many ministries, agencies, and committees involved in water management, and **lack of coordination between these institutions** at the **national and local level** leads to unclear responsibilities and incoherent policies which aggravates the inefficiencies of project implementation for NGOs, IDAs and IOs.
- Additionally, there is also a **lack of coordination between initiatives**, i.e., the percentage of work covered under such initiatives remains ambiguous making it difficult to frame further plans. There is no central body coordinating current and future donor activities.
- A **gap between planning and implementing government projects** prevents successful implementation of complementary donor projects. For example, the government planned to construct 100,000 households in the Yarmag area, and subsequently KOICA agreed to develop new water supply sources for the Yarmag area. The KOICA project was completed, but the construction of households was delayed, leaving the new water supply sources unused.

### Regulatory Challenges

- The **lack of coordination** between institutions leads at times to conflicting incentives for stakeholders which promote **contrary objectives** to sustainable water resources management. One key objective is to reduce the livestock numbers to sustainable levels. However, subsidies on wool create incentives to increase livestock numbers, leading to adverse outcomes.
- A **long term political planning horizon is lacking** for all sectors and regions, restricting initiatives to short term political cycles. There is a clear preference from the government to complete projects within the four years of its legislative period, leading to the rejection of long-term projects, particularly infrastructure projects, which are more sustainable and cost-effective in the long-run.
- Innovative approaches for addressing water management issues may face challenges in **delayed or nonexistent legal frameworks, hindering implementation**. Particularly projects in the Ger district prove challenging, given the lack of infrastructure, its spontaneous organization and Mongolia's climatic conditions. The Eco-Toilet Project undertaken by the NGO ACF, for example, aimed at composting the excreta and selling this as compost to be financially sustainable for the families using Eco-Toilets. The legislative framework to regulate the composting and reuse has yet to be established. ACF is working with the institutions to put regulations into place to allow selling the compost.

### Stakeholder Challenges

- Discussions on water resource management may be **misused for "own interests",** i.e., promoting their own objectives with respect to water resource management initiatives.
- Many **conflicting stakeholder opinions** may result in inefficient and stagnant policy outcomes.
- Concrete solutions, implementation and enforcement of initiatives may be **inhibited by a lack of capacity from key stakeholders.**

### Technical Challenges

- Mongolia's climate poses **unparalleled challenges to finding innovative infrastructure solutions.** The extreme cold in winter makes it difficult to transfer successful infrastructure solutions from other developing country contexts to Mongolia, necessitating new approaches.
- Multiple uncoordinated donor activities lead to **piecemeal infrastructure improvements** while a complete renewal of the infrastructure in question may prove to be more sustainable and more cost effective in the long term. The Central Waste Water Treatment Plant in Ulaanbaatar, for example, has been upgraded intermittently since its construction in 1963, and has now reached the point of needing a complete renewal, yet small scale improvements continue to take place.
- The identification of key needs and requirements is constrained by a lack of **information sharing** by stakeholders, which makes the establishment of an integrated and comprehensive plan for future water management activities very difficult.

## 3.2 Regional Scale

The stakeholder consultations clearly showed that the private sector—irrespective of the region—faces challenges related to the institutional complexities and lack of coordination between ministries and the national and local governments.

In a nutshell, the private sector in Ulaanbaatar faces challenges mainly caused by the lack of implementation and enforcement of laws and regulations and the resultant uncertainties, rather than from concrete challenges related to the water resource (quantity and quality). On the other hand, the private sector in the Gobi region (mining) faces challenges predominantly caused by the potential lack of water resources, while regulatory issues pose additional challenges.

### 3.2.1 Private Sector Challenges in Ulaanbaatar

#### Coordination Challenges

- **Institutional complexity,** due to many ministries, agencies, and committees involved in water management, and **lack of coordination between these institutions** at the national and local level leads to unclear responsibilities and incoherent policies which impact daily operations.
- Limited **transparency in ongoing as well as future required initiatives** makes it difficult for companies who do want to contribute to sustainable water management to decide on actions. An overview of necessary actions is missing and deters willing companies from supporting initiatives towards sustainable water management.

#### Regulatory Challenges

- Stakeholder consultations made clear that laws and regulations are skewed leading to an **unfair playing field.** Enforcement of environmental regulation is weak, which results in compliance by only selected companies. These companies are mostly subsidiaries of international companies which are required to adhere to environmental regulations as part of their company policies, or (national) companies which need to comply to be eligible for loans from international development banks, such as EBRD, the World Bank, ADB, etc. These additional restrictions and costs can pose a competitive disadvantage to these companies and creates discontent.
- Wastewater charges are **not based on actual usage or actual emissions**. Payments are based on outdated industrial standards. This results in a lack of incentives to invest in wastewater treatment or water reuse technologies even if companies would be otherwise keen to do so.
- A **long term political planning horizon on governmental policies is missing** for all sectors and regions, aggravating the already uncertain financial planning for investments. The uncertainties regarding the timelines and specifications of regulations place additional burdens on company's cost/benefit analyses as well as investment planning.
- There are no agreed standards for measuring or treating wastewater. This **inhibits investments in** wastewater treatment technologies, as companies fear re-investments in case new or conflicting standards will be introduced in the near future. This uncertainty severely inhibits investments which could otherwise promote sustainable water management.

#### Stakeholder Challenges

- In Ulaanbaatar, the **multitude of water users** creates a disincentive to some companies to engage in sustainable water practices. Joining forces to increase the impact and decrease potential competitive disadvantages related to increased costs is likely to prove favorable, however it still remains to be implemented.
- **Discussions on water resource management tend to become political** and may be used to push own interests rather than focusing on overall sustainable water management.
- **Not verified publicly available information**, for example, on the environmental impact of a company's operations, is used to create awareness among the public and can pose considerable challenges to the company and may lead to the loss of its license to operate.
- **Different levels of capacities and knowledge** on different aspects of water management can inhibit successful cooperation between stakeholders and pose challenges to everyday operations.

#### Technical Challenges

- **Appropriate and financially sensible technologies** for re-using water and treating wastewater need to be identified and used. Some companies are willing to invest in environmentally friendly technologies but have problems identifying technologies appropriate for their purposes.
- The identification of key needs and requirements as well as of opportunities is impeded by a **lack of "information sharing"** by stakeholders. To date, most companies do not see the need to join forces, for example, to share a wastewater treatment plant, reuse water of varying qualities or share experiences on suitable technologies.

- **Considerable investments** are required for minimizing the impact on water resources and the environment by operations. The lack of economic incentives does not justify these investments when considering the purely financial motivation, i.e., cutting costs or increasing revenues.

# 3.2.2 Mining-Urbanization-Herder Nexus in the Southern Gobi

## Coordination Challenges

- **Institutional complexity,** due to many ministries, agencies, and committees involved in water management, and **lack of coordination between these institutions** at national and local level leads to unclear responsibilities and incoherent policies which impact daily operations.
- A **lack of coordination between national and local governments** results in local governments (aimag/soum) being unaware of the latest legislation or amendments to laws and regulations or the subsequent implications. As a consequence companies have difficulties in receiving water permits, paying correct tariffs, etc.
- The **institutional complexity** and **lack of coordination** between government levels necessitates mechanisms to coordinate between the industry and the government. Companies are uncertain about contact points within the government and seek outside support when talking to (uninformed) local governments.

## Regulatory Challenges

- **Inconsistent procedures** in requesting water permits and licenses have resulted in delays in receiving water permits and consequently halting production and being charged for maximum allowed water volume licensed, rather than the water actually used by volume (as stated by the regulation). Also **lack of transparency in the licensing process** may lead to preferential treatment in the granting of licenses, creating an unfair playing field.
- Lack of independent certified laboratories leads to uncertainty in wastewater quality and results in **"double standards".** As a consequence, payments of fees and penalties are highly opaque and may create an unfair playing field and lead to unsustainable behavior by some actors.
- A **long term political planning horizon is missing** for all sectors and regions, impeding long-term planning for investments, etc.
- **Common mining standards,** such as on wastewater discharges, still need to be adopted to fit Mongolia's situation. The challenge is not adopting excessively high standards that endanger the competitiveness of the industry, but to gradually phase in increasingly high standards to allow companies to adapt in a given timeframe.

## Stakeholder Challenges

- Mining companies face **resistance from herders and other locals** who fear unsustainable use of scarce water resources.
- While a number of companies are stressing responsible use of water resources, some irresponsible companies **damage the image of the mining industry** as a whole. This, in combination with water being a highly political topic in the Gobi region, can result in government resolutions as reaction damaging the entire mining industry. Recently the Gobi Aimag passed a resolution which banned all groundwater usage in the region by 2016; a detrimental resolution to all mining operations in that region. Following protests, this resolution was suspended in late 2013 by the Ministry of Mining.
- Water resource use is a highly politicized and emotionally charged topic and discussions are not always factual. A lack of sound analysis allows discussions on water resource management to be **misused for selfish interests.**
- **Capacity gaps** between stakeholders—mining companies, national and local governments—aggravate the lack of cooperation and impact daily operations.

## Technical Challenges

- Sufficient water supply is a key challenge in the Southern Gobi region to say nothing of protecting the unique ecosystem. Thus, **appropriate and financially viable technologies** for re-using water and treating wastewater need to be identified and used.
- The identification of key needs and requirements is constrained by a **lack of sharing information,** for example on new water resource explorations, by stakeholders.
- **Considerable investments** are required for minimizing the impact on water resources and the environment by mining operations. Thus, a predictable planning horizon is key to further investments to promote sustainable water resources management.

# CHAPTER 4. Sustainable Water Management as a Business Case

The private sector plays an integral role in working towards sustainable water management in Mongolia. Not only is the private sector a main water user and (currently) polluter, it also has the financial resources to potentially have a significant impact on improving the water resources situation.

Acting as profit-driven entities, companies need to mitigate water-related risks of the future, find ways to reduce costs and increase revenue streams. In the following sections, a range of potential business cases supporting these objectives while furthering sustainable water management are introduced. In addition, constraints which hinder some of these business cases from materializing in Mongolia are analyzed.

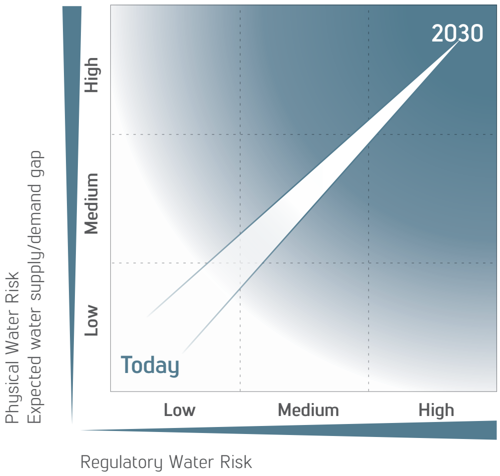
These business cases are defined as profitable investment opportunities undertaken by economic agents. Other activities around sustainable water management, e.g., driven by corporate social responsibility, are not the prime focus of this project and are not seen as business cases per se in this analysis.

## 4.1 Sustainable Water Management—An Integral Part of the Core Business Strategy

Given Mongolia's water challenges, as identified in Chapter 2, companies will potentially face significant risks affecting their business at the core. Turning sustainable water management into an integral part of the core business strategy will not only lead to mitigating the risks, but also have the potential to maximize the company's profits.

Future risks and opportunities can be categorized into physical water risks, regulatory water risks and reputational water risks. With changing water supply/demand and increased regulation these risks are likely to increase exponentially and cumulate in future (see Figure 15). Reputational risks increase along with an increasing water supply/demand gap and increased regulation.

Figure 15: Increasing Physical and Regulatory Water Risks Require Action Before 2030




Source: PwC and Deltares.

### 4.1 Physical Water Risks

As described in Chapter 2, Ulaanbaatar's future water demand alarmingly shows that in all scenarios, the water demand will exceed the current water supply capacity before the year 2021. In the high water demand scenario, Ulaanbaatar's demand will even exceed the maximum available resources within seven years. Existing water resources are vulnerable to pollution. The water supply and wastewater infrastructure is in need of a major overhaul in order to meet the current demand and protect the environment. In particular, the wastewater treatment plants are operating beyond their design capacity in terms of quantity and quality of effluents. Without action, companies operating in Ulaanbaatar will face the risk of not having sufficient water in quantity and quality for their operations.

In the Gobi region, groundwater resources are expected to satisfy water quantity demand within the region, but the increased water demand from mining activities and value adding industries puts a strain on locally limited water resources. While uncertainty in

**BEST PRACTICE 1: SECURING WATER FOR THE FUTURE BY OPTIMAL WATER USAGE**

Water is a limited resource in Gobi and hence it is in the interest of the mining companies to optimize the use of water, for example, by recycling water. As such, **Energy Resources LLC** has constructed a sludge belt-press for their coal wash plant which enables them to extract water from sludge and to reuse it in the coal wash plant. Similarly, **Oyu Tolgoi** realizes that their project could be limited by a insufficient water, so they are very water conservative and have implemented a number of measures along the process steps to conserve and recycle water.

**BEST PRACTICE 2: RECYCLING WATER TO SAVE COSTS AND REDUCE FUTURE WATER DEPENDENCY**

The gold mining company **Boroo Gold** found it profitable to invest in recycling water at tailing ponds by separating solid components and liquid. Recycling of tailing pond waste water is a conservation program that on the operations side recycles pond water back into the process where it is used again in the milling circuit. This recycling has the additional benefit of limiting the use of fresh water and reducing the volume of the water that is stored in the tailings pond. Less stored water in the pond prolongs the operational life of the pond and reduces the need to enlarge the pond as frequently, saving significantly on mine expenses. Smaller dams have the additional benefit of reducing the overall footprint of the pond disturbance. Within one year 46% of water usage could be reduced, saving Boroo Gold around US$ 640,000 annually.

**BEST PRACTICE 3: SECURING SUSTAINABLE ACCESS TO WATER SOURCES**

**Herder groups** were formed to manage the environment focusing on the water sources. This project was supported around Erdenet, Darkhan and Ulaanbaatar by the construction of groundwater wells. The project can be divided in three groups:

- Where herders are not interested in maintaining groundwater wells as rivers are nearby.
- Where herders are interested in the management of water sources as there aren't any rivers nearby.
- Where the herder groups have an efficient leader who manages to convince them about maintaining such resources and the proximity to rivers doesn't count as much.

This demonstrates that successful groups do not need support from the government. Their "business case" is clear and provides them with the incentives to sustainably manage their water resources. This model may also be successful in achieving development of the pastures which do not have a direct water source (40%), especially in the western and southern aimags.

the data on existing groundwater and water demand projections aggravate a clear projection, it is evident that companies operating in this region need to take action now to have sufficient water resources in required water quality levels available for future usage.

**Drivers for companies:**

- Risk of disrupted, reduced or terminated production due to insufficient water (quantity/quality).
- Risk of higher costs related to sourcing and treating water in alternative ways.
- Risk of disruptions in key supply chains of inputs.

**Lucrative business cases:**

- Investments in water efficient technologies to reduce water demand.
- Investments in wastewater treatment and recycling technologies to decrease dependency on external water supplies (in quantity and quality).
- Investments in wastewater treatment—even if unsuitable for future re-use in own operations—to trade to other companies with lower quality water demands or to the government for watering green areas.

## 4.1.2 Regulatory Water Risks

The need for regulation increases with the degree of the water resource challenge and the desire for sustainable water resources management. This can include the introduction of standards and regulations prescribing, e.g. wastewater effluent qualities and maximum allowable abstractions, and economic instruments such as water service charges, water usage charges, water pollution fees and wastewater charges.

While regulatory and economic instruments have already been introduced in Mongolia (see section 2.1), the implementation and enforcement are still rather weak. Further, regulations are not yet very strict, nor have the economic instruments reached levels which would incentivize changes in (economic) behavior.

However, recent institutional changes, such as the restructuring of the water sector and the introduction of the new Water Law in 2012 have demonstrated the will and determination of the government to take stronger action against unsustainable water use practices. The resolution on limiting groundwater explorations and extractions in Umnugobi province has provided a first glance at the potential risks related to regulatory changes in Mongolia on a company's operations (see Box below). Furthermore, proposals under discussion to move the tanning and cashmere producing companies further downstream in Ulaanbaatar due to water pollution from their effluents would result in significant costs for these companies.

### Restricting Groundwater Abstractions in the Gobi?

As a reaction to the conflicts related to competing uses of water for mining and local communities, the Khural of the Umnugobi province passed a resolution in July 2013 which would prohibit groundwater extraction for mining purposes from 2016 onwards and stop groundwater exploration from August 2013. This resolution would have negatively affected the most significant mines for Mongolia's economic development—Tavan Tolgoi and Oyu Tolgoi.

Following protests from mining companies (which were disputed in the courts) and the national government, this resolution was suspended at the end of 2013. However, this proves the importance of stakeholder involvement and the very real regulatory risks related to water.

**Drivers for companies:**

- Risk of losing license to operate
- Risk of suffering from increased costs related to water usage and wastewater discharge, thus reducing profit margins, becoming uncompetitive or being driven out of business
- Risk of having to undertake significant investments to meet regulatory requirements

**Lucrative business cases:**

- Include aspects of water efficiency, water treatment and recycling as part of decision process for new investments in technologies. Thinking ahead of the regulator will save costs of expensive re-investments.
- Practice sustainable water resource management to avoid necessity of (painful) regulatory measures.
- Cooperate with government to identify most effective regulatory practices which would not unnecessarily disrupt businesses' operation.
- Use compliance with environmental and social standards to be eligible for loans from certain (development) banks which offer lower interest rates. Major banks in Mongolia are increasingly considering environmental impacts (or are planning to) prior to granting financing.

### BEST PRACTICE 4: RECYCLING WATER TO SAVE WATER USAGE CHARGES

A number of **mining companies** see an additional incentive in recycling water by saving on water usage fees calculated per cubic meter of abstracted water. By recycling water, companies reduce abstractions. The stakeholder consultations have shown, however, that this fee cutting incentive does not apply to all companies equally and seems to be haphazardly implemented and enforced at a local level.

### BEST PRACTICE 5: COMPLIANCE WITH THE ENVIRONMENTAL STANDARDS TO QUALIFY FOR FOREIGN BANK LOANS

A number of international (development) banks, such as IFC and EBRD require the debtors to comply with certain environmental and social standards. This proves a viable incentive for some companies, such as a **national bottler** and **Gobi Cashmere Corporation**, to comply with environmental regulations. Paying water and wastewater usage fees and adhering to standards beyond national regulations, without enforcement by the national government, is a part of this compliance. The result is a win-win situation with the companies receiving loans under more favorable conditions and society and nature benefiting from the sustainable water management measures.

### BEST PRACTICE 6: SUPPORT IN CAPACITY DEVELOPMENT FOR GOVERNMENTS

The laws, regulations and standards for water resource management issues are still under development in Mongolia. The Mongolian government asked the members of the expatriate mining community to provide information regarding the way regulatory matters are managed in their home jurisdictions and they have subsequently obliged. This information transfer process improves the relationship with the Mongolian regulatory community and assists in the private operations by enhancing the Mongolian regulatory system. For instance, the gold mining company**, Boroo Gold,** supports the Ministry of Environment and Green Development in evaluating the international standards on mixing zones and advises them about the advantages as well as disadvantages of their implementation in the Mongolian context. As a result, the companies are in an improved position to communicate their relevant needs to the regulators. The regulators benefit by taking advantage of the wealth of experience of the mining companies.

**BEST PRACTICE 7: PRE-COMPETITIVE TRAINING BETWEEN COMPANIES IN SUSTAINABLE WATER MANAGEMENT PRACTICES SUPPORTS INDUSTRY BEST PRACTICES**

The **Beverage Industry Environmental Roundtable (BIER)** is a coalition of beverage industry companies and supporting partners that work together on a variety of environmental and stewardship initiatives including water conservation. It provides a forum where beverage producers discuss water issues and debate the related solutions at pre-competitive level. This joint discussion manifests a mutual understanding of good practices but also reduces the risks of "maverick" strategies in terms of environmental dumping of separate beverage producers.

**BEST PRACTICE 8: USING SUSTAINABLE WATER PRACTICES AS A COMPETITIVE ADVANTAGE**

In Ulaanbaatar some of the leading cashmere producers—**Gobi Cashmere Corporation** and **Loro Piana**—have invested in wastewater treatment technologies to minimize their environmental impact. In addition, **Gobi Cashmere Corporation** imports the colors used for dying of the cashmere from Switzerland and Germany made from ecologically friendly ingredients to further reduce the environmental impact. While the companies do not yet receive any financial incentives to treat and reuse their wastewater at this point in time, the reputation of being a producer of ecologically friendly products provides them with a competitive advantage which allows them to charge premium prices and thus justifys the additional investments.

Following the international corporate social responsibility requirements of its international client, the bottling company, **MCS Coca-Cola**, was the first company in Ulaanbaatar to invest in a wastewater treatment plant. Today, all the wastewater is treated according to international standards. The treated wastewater is discharged into the central sewerage network. Despite treating the wastewater, the company is obligated to fully pay for it, which eliminates any financial advantage to the company. The aim behind the whole exercise is to introduce world standards, maintain a good reputation and indirectly benefit from the improved brand value.

### 4.1.3 Reputational Water Risks

*"Water is the mother of all living,"* as Mongolia's president Elbegdorj mentioned during a speech in Davos in 2014. Water is a highly emotional and politicized issue all over the world. However, in Mongolia, the connection to nature is still very much preserved in the culture and daily lives of the majority of the Mongolians. This increases the importance of public opinion on water issues can pose a direct risk to operations if a company is accused of unsustainable practices. In areas with highly competitive uses of water, such as in the Gobi region, conflicts on who uses how much water and with what impact are likely to develop with negative effects for the company. This can include negative publicity with consequent lower sales or impacts on financing, enforcement of regulatory measures (see Box on p. 29) or disruptions in operations, due to protests, etc.

**Drivers for companies:**

- Risk of losing license to operate
- Risk of negative publicity and its consequences
- Risk of triggering regulatory implications (see above)
- Risk of disrupted operations

**Lucrative business cases:**

- Use of sustainable (water) practices as competitive advantage to charge premium prices of products.
- Engagement of communities in activities related to assessing impacts of large water usages, e.g., by involving them in monitoring water tables. This builds trust and avoids or reduces negative perceptions of business activities where not justified.
- Engagement in development programs of potentially affected communities of business activities.
- Capacity development in other companies on sustainable water resources management. This reduces the danger of a "black sheep" having negative impacts on the overall sector.

# 4.2 Constraints in Realizing Potential Business Cases

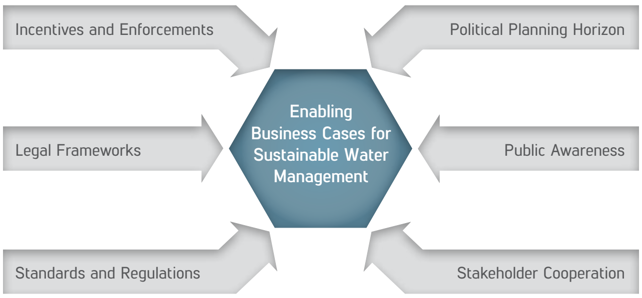
While a number of the activities furthering sustainable water resource management were identified during the stakeholder consultations, only a few could be defined as true business cases, i.e., investments or activities with profitable returns. While the potential for further profitable activities is vast, constraints were identified which hindered their implementation. These constraints are to a large extent a reflection of the underlying causes that are hindering sustainable water management in Mongolia (see Chapter 3). Addressing these can result in mobilizing the support of the private sector which can serve as a quick win in targeting the water resources challenge.

The factors that hindered progress can be summarized into:

- Lack of (financial) incentives
- Missing legal framework
- Lack of specific standards and regulations
- Uncertain political planning
- A low degree of public awareness around (future) water challenges
- Insufficient stakeholder cooperation

A brief description of what is currently preventing the full potential of business cases on sustainable water resource management to materialize is given below:

Figure 16 Factors Which Currently Prevent Business Cases Furthering Sustainable Water Management




Source: PwC and Deltares.

### Incentives and Enforcements


While the economic instruments, such as water service charges, water usage fees and wastewater charges, were introduced with the Water Law (2012), their current design does not provide any incentives for either the sustainable use of water resources or investing in new technologies. In addition, some economic instruments, such as the polluter pays charge for wastewater and the impermeable surface charge, are yet to be implemented.

Among the companies in Ulaanbaatar that have not yet invested in water efficient technologies and recycling technologies, it was frequently stated that the water usage fee and water service charge were too low to justify such investments. While the water service charge and water usage fee are based on the actual water usage (as compared to a fixed amount), a lack of implementation and enforcement results in a number of mining companies paying for the maximum allowed water usage, as is stated on their license, rather than for their actual usage. A capacity problem at the local governmental level and inverse incentives to increase revenues were indicated as causes. However, if the payments are not based on actual usage, the incentives to reduce water usage are minimal.

Similarly, the wastewater fee is currently based on industrial norms rather than on actual discharge. Wastewater discharge is not metered and the standards on wastewater meters are currently being developed and must be approved by the standards authority. The fee does not differentiate between the qualities of the wastewater effluent. As a consequence, users do not have any financial incentive to invest in wastewater treatment technologies or reduce the pollution during production processes in the first place.

Currently, the companies who treat their wastewater are discussing with the government, schemes which will make the treated wastewater usable for companies with low water quality requirements, such as the tanning industries. This service would be financially compensated and will thus act as an incentive for the treatment of wastewater.

## Legal Frameworks


A legal framework is crucial to set the rules of the playing field and allow supportive measures to work towards sustainable water resources management and improving living standards of the population.

At times, measures which haven't been tested in Mongolia require amendments to the legal framework. A concrete example is the program on introducing eco-toilets in the Ger district by the NGO **Action Contre la Faim (ACF).** To make the eco-toilets financially sustainable, it was suggested to empty the collection in predetermined sites for composting and subsequently sell the compost. The revenue from the compost sales could pay for the collection of the excreta. However, currently, there is no legal framework in place to regulate the composting process and specify standards to ensure that the compost can be used safely by third parties. ACF is currently trying to support the government in amending the legal framework to allow for safe and sustainable composting and subsequent use as fertilizer. Due to the novelty of this concept in Mongolia, the categorization of the problem and the subsequent identification of responsibilities within institutions prove to be highly challenging. Currently 370 eco-toilets have been constructed in the Ger district. The composting, however, still needs to be figured out.

Eco-toilets substantially improve the living standards of the users in areas which are not connected to the public water mains and sewerage systems. In addition, the eco-toilets, unlike simple latrines, avoid leakage of excreta into the environment and contribute to sustainable water management.[30]

## Standards and Regulations


As the institutional landscape has changed with the introduction of the Water Law (2012), a high level of uncertainty with respect to current and future rules and regulations persists. Some regulations have yet to be implemented, and the level of enforcement of existing regulations is weak. In addition, the regulations and standards are frequently amended which creates an uncertain playing field for the companies.

Investments in any type of business require a minimum degree of certainty. At the moment, there are no generally agreed standards on wastewater treatment or recycling technologies, nor are there standards or enforced regulations on wastewater effluent quality. As there is a certain notion that the government can introduce these standards in the future, current investments by the private sector in these technologies has been deterred.

The companies that were consulted mentioned that they were interested in investing in the wastewater treatment technologies mostly to fulfill their CSR. However, the lack of national standards keeps them from doing so as they fear the risk of re-investments in case new standards are introduced in future. Some mining companies mentioned that they were obligated to reuse a certain amount of water from their operations. Similarly, for the wastewater treatment technologies, standards have not yet fully been developed. Technologies meeting high international standards need to be approved by the concerned institution and the companies need to prove that their preferred technology is better. This poses as a disincentive for the companies that want to invest in state of the art technologies which have not yet been approved in the Mongolian context.

No standards on water quality for reusing wastewater exist currently. This prevents further usage of wastewater outside of the company's compound. As a consequence, companies in Ulaanbaatar discharge their treated wastewater into the central sewerage system, just as they do with untreated wastewater, foregoing the potential of reusing it for activities with lower water quality requirements by other water users. This gap in regulation prevents any potential arrangements between stakeholders on reusing water.

## Political Planning Horizon


The Government of Mongolia has clearly stated its goal of moving towards a green economy. To achieve this, additional laws, regulations and standards will be put into place and the already existing laws will be tightened to conform with international standards.

Stakeholders are not yet fully aware of what regulatory changes will be made in the future. Allowing for a predictable transition phase for the increased standards and prices (water usage, polluter pays, etc.) gradually will enable the companies to include these factors in their decision making, creating incentives for sustainable investments.

## Public Awareness


The stakeholder consultations in Ulaanbaatar showed that companies mainly work towards sustainable water management to add value to their business model, rather than out of concern about the future availability of (clean) water supplies or an awareness of the repercussions of non-availability of water.

Increased public awareness, apart from acting as an incentive for companies to act responsibly, can also result in the public demanding responsible practices by the private sector.

## Stakeholder Cooperation


In Ulaanbaatar, small companies are collectively responsible for the unsustainable use and pollution of water resources, reducing direct responsibility of each individual company and negating incentives to conserve. This can be overcome by grouping the stakeholders together, identifying the common challenges and objectives and implementing necessary solutions. Joining forces to increase the impact and decrease potential competitive disadvantage related to increased costs would prove favorable for sustainable development.

# CHAPTER 5. Recommendations for the Way Forward

This report outlines the challenges that Mongolia faces in achieving sustainable water management and also detects the underlying causes which prevent the realization of sustainable water resources management by the stakeholder groups.

To address Mongolia's water challenges, it is important to work on the underlying causes, rather than just the symptoms. In this final section of the report, recommendations around the focal areas and future work streams have been provided. Addressing these in the future will provide a solid basis for and enable sustainable water management for Mongolia to achieve its development aspirations.

## 5.1 Improving the Databases and Scientific Understanding of Water Resources

### 5.1.1 The Challenges

- While good quality data relevant for water resource management exists in Mongolia, it is not centrally or easily available for stakeholders not owning this data. The existing data is not being shared between relevant institutions and stakeholders, impeding analysis of the available resources and complicating integrated water resource management. Further, this data is not necessarily verified by standardized criteria nor harmonized which aggravates its usage for sound, fact-based decision making. **A sound, quality assured database—including all relevant and non-classified information—is required to be accessible for all interested stakeholders to enable corroborated, fact-based decision making. Mechanisms which enable and ensure sharing of relevant information between all stakeholders should be put in place.**
- However, knowledge gaps on water resource management still exist which hinder sound decision making. Main knowledge gaps include: the interaction of shallow and deep groundwater in the Gobi Region, the verification of available water resources and water demand in the Gobi Region due to differing forecasts of existing studies, the interaction of surface water and groundwater in Ulaanbaatar, and the impact of the effects of pollution and climate change on water resource availability. **Additional studies to close these knowledge gaps as well as expanding monitoring activities of surface and groundwater resources, as part of integrated water resources assessments, are required.**

### 5.1.2 Recommendations

The suggested activities include:

- Develop a sound database on water statistics and relevant knowledge for water resource management, including information on planned projects relevant to water resource management and (resulting) projected changes in water demand and supply to improve stakeholders' decision basis. This database shall be frequently updated with information from monitoring activities of surface and groundwater resources, be quality assured and harmonized and include relevant metadata to allow for corroborated, fact-based decision making. This database can either collect data centrally, or allow for mechanisms that data from various sources and stakeholders can be easily accessed. The data shall distinguish classified and non-classified data based on Mongolia's legislation, and only the non-classified data shall be made available for all interested stakeholders. The database shall be expanded step-by-step.
- Introduce mechanisms which enable and promote sharing of relevant data and knowledge between all stakeholders, including the public and private sectors as well as civil society.
- Continue and intensify the monitoring of surface water and groundwater resources on quality and quantity. Furthermore, available surface water and groundwater resources should be determined through a continuous integrated modeling and other techniques to plan for the future use of the water resources. Models are to be updated as the monitoring data becomes available, but especially after groundwater abstraction has started.
- Undertake studies—where adequate multidisciplinary water resources development studies to ensure that all the affected aspects are considered—to close existing knowledge gaps which currently hinders sound decision making. The prioritization of research topics should be undertaken following a multi-stakeholder consultation. Suggested research topics include: the interaction of shallow and deep groundwater in the Gobi Region and the recharge and storage mechanisms of groundwater deposits to understand the behavior of this resource, the verification of available water resources and water demand in the Gobi Region due to differing forecasts of existing studies, the interaction of surface water and groundwater in Ulaanbaatar and the impact on water resource availability of effects of pollution and climate change.

## 5.2 Developing Water Economics and Valuation of Water Resources to Set the Right Incentives

### 5.2.1 The Challenges

- While economic instruments, such as water usage fees, water service charges and wastewater fees, have been introduced in the Water Law (2012), there are few incentives for stakeholders to take actions on managing water resources sustainably. The economic instruments are based on an ecological and economic valuation of water resources that is opaque, complex and probably outdated. **The ecological and economic valuation methodology requires a scrutinized overhaul and adjustment, while the economic instruments need to be designed to create incentives on the one hand, and allow sustainable and socially acceptable development on the other.**
- Besides introducing economic instruments, universal implementation and enforcement is essential to reap their benefits. Not all the introduced economic instruments have been implemented, such as the water pollution fee and impermeable surface charge, while the economic instruments which are implemented suffer from weak enforcement and monitoring. **Clear guidelines on the implementation of economic instruments need to be designed and institutional responsibilities, such as fee collection and usage, have to be specified. Enforcement and monitoring schemes need to be designed and implemented.**
- Creating incentives for sustainable water resources management is part of the wider government strategy for green development. **The focus should be on harmonizing both the approaches as well as the resulting methodologies.**

### 5.2.2 Recommendations

An integrated approach for building capacities among all governmental employees is recommended together with supporting the Ministry of Environment and Green Development's methodologies and approaches to designing incentives for a sustainable water resources management. The suggested activities include:

- Training and capacity development for governmental employees, for example, the Ministry of Environment and Green Development, to increase awareness of the concepts and potential of water economics.
- Update ecological and economic valuation guidelines, considering international best practices while adapting these to fit the Mongolian context. Focus shall be on the transparency of the methodology—being as complex as necessary but as user-friendly and understandable as possible.
- Perform the ecological and economic valuation of Mongolia's water resources, applying the updated guidelines (see above).
- Draft adequate, transparent economic incentive structures which can be clearly communicated to the public (such as water usage fees, water service charge, pollution fees, wastewater charges, etc.), including:
  - Assessment of adequate price, tax, subsidy levels distinguished by water uses (i.e., household, mining, industry, agriculture) and considering cost coverage of (planned) investments, as well as the ecological-economic value of water,
  - Conceptual planning and structuring of the economic incentives scheme (institutional and organizational responsibilities for setting, implementing, enforcing, monitoring, collecting and spending revenues from economic incentives),
  - Implementation, enforcement, monitoring and evaluation of economic incentives schemes,
  - Focus should be set on water usage fees for urban households and industry (including mining) and on wastewater/pollution fees for the industry (including mining).
- Undertake a comparative assessment of the international experiences on economic incentive structures and ecological-economic valuation of water resources and the adequacy of adapting the key lessons learned to the Mongolian context.

# 5.3 Identifying Cost-effective Solutions Via Hydro-economic Analyses

## 5.3.1 The challenges

Currently, Mongolia faces a multitude of water challenges, which are addressed by various parties, including the government and international development agencies and organizations, in a partly uncoordinated and piecemeal manner. **Mongolia's water challenges require integrated and comprehensive planning and identification of the most sustainable and cost-effective solutions.**

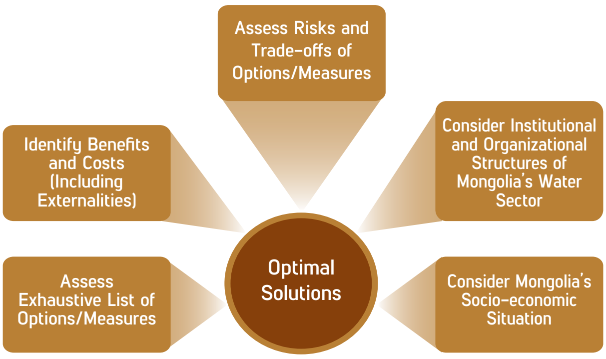
## 5.3.2 Recommendations

A hydro-economic analysis in which a range of practical solutions and priorities to address the water resource challenge in Mongolia are identified.

This hydro-economic analysis should focus on the water resource hot spots in Mongolia, namely:

- Tavern Tolgoi Water Supply Options (groundwater, surface water, multipurpose water supply system), the "Tavan Tolgoi-Balgasiin Ulaan Nuur–Dalanzadgad–Naimdai–Orkhon Water Complex"
- Dolood Govi–Kherlen Water Complex

Figure 17 Approach to identify optimal solutions to address Mongolia's water resource challenge




- Sainshand industrial park—Sain us
- Ulaanbaatar—Central and Upper Source—Far Upper Source-Tuul complex in Ulaanbaatar city (including new drinking water source systems and the upstream catchments of the Tuul Water Basin

In Ulaanbaatar, industrial and domestic water usage requires the most attention. This is the case for finding cost-effective measures to close the projected water supply and demand gap (quantity) in future, but also to considerably reduce water pollution levels. Further, cost-effective measures to increase improved access to drinking water supply and sanitation need to be identified.

In the Southern Gobi, the hydro-economic analysis should focus on cost-effective measures to close the (highly local) water demand and supply gap(s) which are mainly driven by mining activities and increasingly value adding industrial water demands. It is key to consider the mining-urban-agricultural nexus as well as the highly localized demand hot spots in this analysis.

However, to refine the focus and best approach of the hydro-economic analysis, as well as to get an understanding of the data availability, we suggest starting with a scoping study.

The suggested steps of the analysis are the following (not exhaustive):

- Present a range of practical, technological, policy and economic options to meet increased water requirements, improve water quality and contribute towards achieving the millennium development goals related to water and sanitation. The identification of solutions should also consider any existing or planned initiatives, policies and instruments to address the water resources challenge.
- Undertake a cost curve analysis, i.e., assess the water saved/generated per USD/costs incurred by the measure (including capital and operational costs) to identify the most cost-effective measures. It is important to consider potential externalities caused by the assessed measures, e.g., environmental damages, where adequate, and include these internalized costs in the cost calculations.
- Consider the economic costs, benefits and risks related to each option to all the stakeholder groups as well as tradeoffs to these options (e.g., allocations to non-high return sectors which employ a significant proportion of people; water-energy-food nexus, etc.)

- Consider existing policy reform measures and current initiatives, emerging trends (urbanization, economic development plans, climate change, etc.), the current institutional and organizational structures of Mongolia's water sector, as well as Mongolia's socio-economic situation.
- Summarizing this, we propose considering an application of different economic toolbox techniques such as cost-curve analysis, cost-efficiency analysis, cost effectiveness analysis, cost-benefit-analysis, cost-utility analysis as well as supply chain modelling. Furthermore, we propose the utilization of macroeconomic modelling approaches such as Input-Output, Computable General Equilibrium (CGE) and System Dynamic (SD) modelling to derive the necessary input assumptions. Micro economic approaches also support the assessment of the relevant price-quantity relations which are necessary to derive the best possible market intervention.

More specific and refined analysis—wherever necessary—can be built on this analysis. It will form the basis for sound decisions towards water-enabled sustainable development while meeting Mongolia's socioeconomic development objectives.

# 5.4 Building Capacity in the Water Sector

## 5.4.1 The challenges

- Significant capacity gaps on local governmental levels and insufficient communication and cooperation between the national and local governments result in complications in implementing and enforcing laws and regulations. **The capacity of the employees of the local governmental offices needs to be enhanced and the cooperation between national and local levels needs to be improved.**
- Certain capacities still need to be developed in Mongolia. To date no adequate measures to avoid pollution in water source protection zones and zones bordering the recharge areas in Ulaanbaatar exist. Similarly, there are no emergency crisis response plans in place for dealing with water supply situations. **The capacity of the relevant stakeholders to respond to protecting crucial water resources and to respond to emergency situations needs to be developed.**
- The private sector and civil society possess significant knowledge which the public sector needs in order to make informed decisions on rules, standards and regulations so that legislative goals are met, while limiting interference with other stakeholders' activities. For example, industry holds expert knowledge on certain technological processes which would be required to set adequate wastewater treatment standards. **Allowing for mechanisms in which capacity development and knowledge sharing can take place among all stakeholders will prove beneficial for the public and private sectors, as well as for civil society and the environment. However, care needs to be taken that this cooperation results in outcomes which support the common good rather than merely benefitting specific stakeholders'.**

## 5.4.2 Recommendations

The suggested activities include:

- Undertake a capacity needs assessment within the water sector to identify capacity needs/gaps and their nature. Focus should be on capacity gaps in:
  - **Local Government Level:** Application of legal and regulatory water frameworks, including monitoring and enforcement of economic and regulatory instruments.
  - **Central Government Level:** Application of principles of water economics and ecological-economic valuation of water resources, hydro-economic analysis, feasibility studies as well as monitoring and enforcement capacities.
- Identify ways to close these capacity gaps, e.g., by designing a training and capacity development plan for government officials, particularly those operating at local government level. Capacity development support can be requested from international donor and development agencies, such as IFC, JICA, World Bank, ADB and UNESCO which are already working in the water sector in Mongolia.
- Develop standards and requirements (e.g., sanitation facility standards in accordance to international standards) for water source protection zones and zones bordering the recharge areas in Ulaanbaatar, focusing on households located in these areas. Examples for measures could include non-polluting sanitary systems (e.g. Ecotoilets), etc.
- Develop response plans for water supply systems in natural disaster and emergency situations, e.g., earthquakes and chemical spills.
- Improve and increase measures to increase multi-stakeholder participation to support the public sector in reducing capacity gaps in order to improve informed decision making related to water resource management.

## 5.5 Setting up a Multi-stakeholder Platform

### 5.5.1 The Challenges

- The involvement all concerned stakeholder groups is key to successful integrated water resources management. To achieve this precondition, a multi-stakeholder platform is required to provide for this necessary involvement. Currently, Water Basin Councils are being set up on the river basin level to enable public participation in water resources planning, and implementation and monitoring of water use and pollution. However, their effective functioning is still constrained by a range of organizational and financial issues, while the number of participants is restricted to 31 to 45 members, with a low percentage of participants from the private sector. **To provide for successful integrated water resource management, a nationwide multi-stakeholder platform needs to be supported. This should enable the involvement of all concerned stakeholders, including the private sector, civil society and the public sector in decision making. This platform should cooperate closely with the current establishment of Water Basin Councils to complement each other.**

### 5.5.2 Recommendations

Provide for a nationwide multi-stakeholder platform to enable the involvement of all concerned stakeholders, including the private sector, civil society and the public sector. This platform should be the driving force behind implementing recommendations via separate workstreams. It should cooperate closely with the Water Basin Councils and Authorities to avoid interfering in activities at the local level. Given the current high motivation of stakeholders, quick action is recommended to benefit from momentum.

Further stakeholder consultations need to be held in order to identify the most appropriate set-up and objectives for a multi-stakeholder platform and its relevant work streams.

Multi-stakeholder interaction can result in various engagements. The following list lays out the available approaches for multi-stakeholder activity:

- Encouraging efficient water use across a catchment
- Contributing to the development of effective and equitable policy and regulations
- Supporting research, advocacy, and monitoring
- Aiding environmentally and socially responsible infrastructure development
- Sharing or gathering data related to water resources
- Establishing or engaging in participatory platforms and other democratic processes for water governance decision-making or oversight
- Advancing public awareness of water resource issues
- Operating infrastructure ( e.g., wastewater treatment) for community and municipal uses
- Working with communities to improve the access to water services
- Financial assistance for the local water supply and sanitation infrastructure

Based on stakeholder consultations in this project, the greatest potential for improved collaboration are:

- A work stream to address the previously outlined recommendations;
- A work stream in which the private sector and civil society can support the government in setting standards, designing regulations, etc.;
- A work stream which furthers cooperation between the private sector, governments and educational centers for capacity development. The development of training programs at a university and vocational level will help to ensure that the companies and government institutions are provided with personnel or staff capable of carrying out the required tasks;
- A work stream which allows for closer involvement of all stakeholder groups in the decision making processes as a part of the establishment of the Water Basin councils and the Water Basin administrations. Support may be required for technical knowledge, organizational functioning and financial sustainability to make them fully operational.

Further workstreams may be identified as a result of the proposed hydro-economic analysis.

It also must be noted that the Ministry of Environment and Green Development plays a key role in Water Resource Management in Mongolia. Before the elections in 2012 the Water Authority was the government agency dedicated to water-related tasks, but there is currently no specific Water Resources Department within the Ministry. However, the skill sets and personnel still play a key role. Depending on the objective, the institutional set-up, i.e. the participants and location within the institutional framework, are crucial for the successful implementation of such platforms.

# APPENDIX 1. Comparison of the Data Provided by the IWRM and MoMo Projects

## Comparison of the Data Provided by the IWRM and MoMo Projects

| | IWRM<br>(Strengthening integrated water resources management in Mongolia) | MoMo<br>(Integrated water resources management: Model region, Mongolia) |
|---|---|---|
| Involved institutions | • Deltares<br>• Government agencies: Ministry of Nature, Environment and Tourism; Water Authority; Mongolian Water Center<br>• Universities: National University of Mongolia (NUM), Mongolian University of Science and Technology (MUST), Agricultural University of Mongolia<br>• Institute of Hydrology and Meteorology<br>• Geo-ecology Institute | • University of Kassel and Helmholtz Centre for Environmental Research Leipzig<br>• Government agencies: Ministry of Nature, Environment and Tourism and four others; National Agency for Meteorology, Hydrology and Environment Monitoring of Mongolia; Water Authority<br>• Universities: NUM, MUST, Agricultural University of Mongolia<br>• Regional agencies from Darkhan<br>• Darkhan Mongolian Academy of Sciences |
| Funding organizations | Government of the Kingdom of the Netherlands | German Ministry of Education and Research (BMBF) |
| Project duration | Six years<br>(January to October 2007, November 2007 to December 2012) | 6+x years<br>(2006 to 2013, third phase currently under review) |
| Budget | Approximately €6 million | Approximately €8 million |
| Region | Mongolia as a whole with focus on Orkhon and Tuul | Kharaa catchment, with focus on Darkhan and its surroundings |
| Outcomes | Mongolian Integrated Water Management Plan:<br>• Enforce the Water Law and institutional strengthening of the Water Authority<br>• Main water sector's planning document for management measures to be taken by 2015 and by 2021<br>• Capacity building at universities and professional institutes<br>• Water Basin plans (Tuul and Orkhon)<br>The IWRM Water Balance Viewer, a software tool for data provision | Practical realisation of IWRM:<br>• Kharaa Water Basin as representative of the difficulties faced in other river catchments in Mongolia and Central Asia.<br>• Capacity building for planners, decision makers and actors at various levels<br>• Technical solutions, adjusted to the local situations<br>• Water management practices in the mining sector<br>Data provision through hydrological modeling |
| Methodology | • Estimation of the water demand and amount of pollution, using scenario analysis for population and sector growth<br>• Hydrological and geo-hydrological analysis to determine water supply<br>• Impact of climate change scenario analysis<br>• Institutional, legal, and HR assessment<br>• Selection of promising measures to balance supply and demand, prevent pollution, and combinations of alternative strategies | • Impact of global change on the water resources and uses<br>• Nutrient and contaminant fluxes on Water Basin scales<br>• Ecology of streams and rivers<br>• Drinking water abstraction, purification and distribution<br>• Waste water treatment rehabilitation and maintenance of sewerage infrastructure<br>• Capacity building and knowledge transfer |
| Further reference | http://www.deltares.nl/en/project/1406267/strengthening-integrated-water-resources-management-in-mongolia | http://www.iwrm-momo.de/ |

# APPENDIX 2. Participants List: Stakeholder Interviews

| Institution name | Contact name | Category of actors | Position |
|---|---|---|---|
| Action Contre la Faim (ACF) | Pier Francesco Donati; Christian Ferrier | NGO | WASH Programme Manager; Country Director |
| APU JSC | Turbat | Private companies | Environmental Manager |
| Boroo Gold Co., Ltd | Steve McIntosh | Private companies | Environment Director |
| Energy Resources LLC | Ts.Baasandorj | Private companies | Deputy Director, Energy Resources LLC |
| Environmental Office of UB city | Mr Dambasuren | Government department (UB) | Environmental Office of UB city |
| Erdenes Tavan Tolgoi | Batdorj; Ariunsiakhan;Nurbolat | Private companies | Senior Officer Water Supply Project; Environmental Officer; Environmental Officer |
| Gesellschaft für Internationale Zusammenarbeit (GIZ) | Jochem Theis | Development agency | |
| Gobi Cashmere | Davaa | Private companies | Environmental technician |
| Governmental Agency of Construction Development Center | O.Tsedendamba | Government department (central) | Director of Housing and Public Utility Division, Governmental Agency of Construction Development Center |
| International Finance Corporation (IFC) | Rebecca Darling | International institution | Coordinator Groundwater Management Training |
| Japan International Cooperation Agency (JICA) | Kaneda Keiko | Development agency | Project Formulation Advisor |
| Korea International Cooperation Agency (KOICA) | Kyu Cheol Eo | Development agency | Deputy Resident Representative |
| MCS Holding LLC (Coke bottler) | L. Myagmarjav; Ariunjargal J. | Private companies | Managing Director; Coca Cola Mongolia Representative Office |
| Ministry of Environment and Green Development | T.Bulgan | Government department (central) | Director General, Department of Green Development Policy and Planning, MEGD |
| Ministry of Environment and Green Development | Ch. Munkhzul & Khishigjargal Kh | Government department (central) | Director General, Department of Green Development Policy and Planning, MEGD |
| Ministry of Environment and Green Development | B. Gantulga | Government department (central) | Director General, Department of Policy Implementation |
| Ministry of Industry and Agriculture | Baranchuluun | Government department (central) | Senior Officer Crop Production Policy Implementation and Coordination; Professor |
| Ministry of Mining | Otgochuluu | Government department (central) | Director General, Department of Strategic Policy and Planning |
| Mongolian United Herders Association | Baldanochir; Myakhdadag | NGO | Chairman of Association |
| Mongol-Us | Ts.Sosorbaram | Government department (central) | Director |
| Mongolyn Alt (MAK) Group | Sarantuya | Private companies | Senior Environmental Specialist |
| Nestlé SA | Herbert Oberhänsli | Private companies | Economics and International Relations, Nestlé SA |
| Oyu Tolgoi LLC | Mark Newby | Private companies | Environmental manager, Oyu Tolgoi LLC |
| Presiden's office and Parliament of Mongolia | Ts.Badrakh | Government department (central) | Secretary of National Water Committee |
| Presiden's office and Parliament of Mongolia | E.Zorigt | Government department (central) | Environmental Policy Advisor to the President |
| Swiss Agency for Development and Cooperation (SDC) | Johan Ramon; Daniel Valenghi | Development agency | Natural Resource Management Advisor; Head of Programme |
| The Coca Cola Company | Greg Koch | Private companies | Director of Water Stewardship – Corporate Sustainability Office |
| Tuul Water Basin Authority | G.Dolgorsuren | Government department (central) | Head of the Tuul Water Basin |
| UNESCO – Division of Water Sciences – International Hydrological Programme (IHP) | Sarantuyaa Zandaryaa | International institution | Programme Specialist (urban water management and water quality) |
| USAID | Francis A Donovan | Development agency | Head of USAID Mongolia Representative Office |
| Water Supply and Sewerage Authority of Ulaanbaatar city | S.Unen | Government department (UB) | Director of Water Supply and Sewerage Authority of Ulaanbaatar city |

# APPENDIX 3. Participants List: Focus Group Discussions

| DATE: 4 and 5 December 2013, Blue Sky Hotel, Ulaanbaatar | | | |
|---|---|---|---|
| No | Institution name | Guest name | Position |
| 1 | Action Contre la Faim | Pier Francesco Donati | WASH Programme Manager |
| 2 | Action Contre la Faim | Christian Ferrier | Country Director |
| 3 | Ariunsuvraga NGO | Chagnaadorj | Head of Association |
| 4 | Asian Development Bank | Ongonsar Purev | |
| 5 | Association of Public Utility | Purevjav | Head of Association |
| 6 | Geology School of Mongolian University of Technology and Science | D.Oyun | Director |
| 7 | Japan International Cooperation Agency (JICA) | Kaneda Keiko | Project Formulation Advisor |
| 8 | Mongol Ecology Center | Chimgee Ganbold | Director |
| 9 | Mongolian Mining Association | Enkhbold.D | Foreign Affairs Manager |
| 10 | Mongolian United Herders Association | Baldan-ochir | Chairman of Association |
| 11 | Red Cross | Ts. Myadagmaa | Red Cross, Wash Programme Manager |
| 12 | Swiss Agency for Development and Cooperation (SDC) | Ramon Johan | Director of Cooperation; Deputy Country Director |
| 13 | The Nature Conservancy | O.Enkhtuya | Country Director of TNC |
| 14 | World Health Organisation (WHO) | Enkhjargal | WHO, Officer of Environment Health |
| 15 | World Bank | Anthony Arena | Head<br>Responsible for the WB project on Mining and Infrastructure and Establishment of an Electronic Database;<br>Programme specialist |
| 16 | World Wide Fund (WWF) | Chimidochir | CEO, WWF |
| 17 | Anglo American | Ganjargal Gantumur | Country Analyst |
| 18 | Boroo Gold Co., Ltd | Steve McIntosh | Director Environment |
| 19 | Erdenes MGL" LLC | O.Sainbuyan | Executive Director, "Erdenes MGL" LLC |
| 20 | Hunnu Coal Pty Ltd | Enkhtuul Chuluunbaatar | Environmental Coordinator |
| 21 | Mongolyn Alt (MAK) Group | Sarantuya Dashdavaa | Senior Environmental specialist |
| 22 | Mongolyn Alt (MAK) Group | Batzaya Enkhtaivan | Environmental Specialist |
| 23 | Oyu Tolgoi LLC | Mark Newby | Environmental Manager, Oyu Tolgoi LLC |
| 24 | Gobi Exploration | Sengee Ts | Hydrogeologist |
| 25 | Anglo American | Graeme Hancock | President and Chief Representative |
| 26 | Erdenes MGL LLC | Lkhagvajav Altansukh | Financial Analyst |
| 27 | Erdenes MGL LLC | Batbayar | Director of the Mining Department |
| 28 | Erdenes MGL LLC | Sunderiya Batjargal | Lawyer |
| 29 | Chamber of Commerce and Trade | Ganchimeg G | Head of Sustainable Development of Chamber of Commerce and Trade |
| 30 | Loro Piana Mongolia LLC | Ayush Buyanderlger | Managing Director |
| 31 | MCS Coca cola | J. Ariunjargal | Technical Manager |
| 32 | MCS Coca cola | Bayasgalannyam Erdenetsogt | Legal Advisor |
| 33 | MCS Properties | Khosbayar | Environment Manager |
| 34 | Newcom | Narangerel | PA to the Chairman, Mr. Boldbaatar |
| 35 | Sky resort | Urtnasan B | Senior Engineer |
| 36 | Vitafit | Bolorsaikhan | |
| 37 | National Association of Mongolian Agricultural Cooperatives (NAMAC) | Indra | Senior Specialist |

# APPENDIX 4. Focus Group Discussions: Feedback from Participants

PwC requests direct feedback from participants at presentations, seminars, stakeholder meetings, etc. This not only improves the presentation and organizations skill but the services also.

The participants of the focus group discussions provided positive feedback with an average score of 4.35. The scoring system ranges from 1 (disagree) to 5 (fully agree).

| | AVERAGE SCORE 1 = disagree, 5 = fully agree |
|---|---|
| The topics raised at the focus group discussions are relevant and important to Mongolia | 4.88 |
| The focus group discussion met the objectives that were set for it | 4.31 |
| The physical environment supported effective discussion | 4.47 |
| I was given adequate opportunities to express my point of view and share my feedback | 4.44 |
| I have received valuable information and gained insights that would help me in my job | 3.69 |
| The focus group discussion was overall effective | 4.31 |
| TOTAL AVERAGE SCORE | 4.35 |

# APPENDIX 5. Focus Group Discussions: Interest and Influence Mapping Exercise

The group discussion on stakeholder inter-relations and dynamics that was moderated by PwC and Deltares, had the following three interactive sessions:

- o Stakeholders from the private sector: Mining
- o Stakeholders from private sector: Others (Focus on Ulaanbaatar)
- o Stakeholders from NGOs and international organizations

OBJECTIVES: To assess the relevant stakeholder positions based on a broadly accepted mapping.

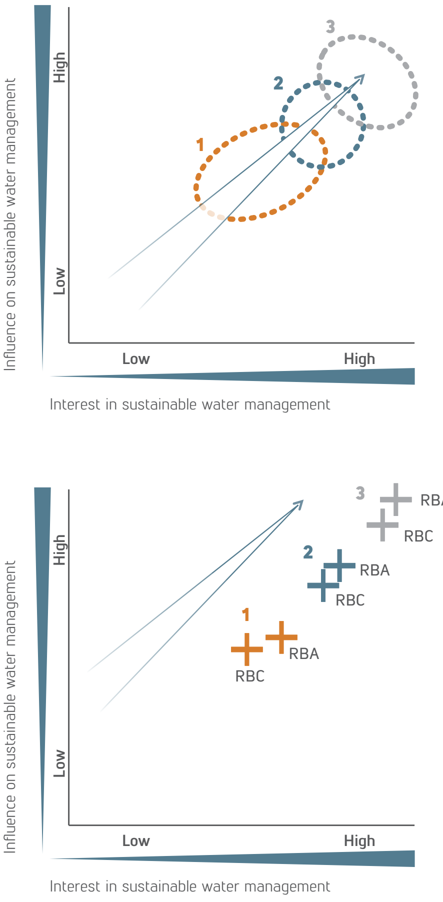
METHOD: The group was asked to judge the level of **interest** and **influence** of a stakeholder group's comprehensive listing.
The set included:

- Agriculture
- Livestock
- Urban Households
- Households: Ger district
- Heavy and Light industry
- Energy
- Mining (in river valleys), mining (outside river valleys)
- Artisanal miners (Ninjas)
- International and national NGOs: Environmental
- National NGOs: Others
- International financial organizations
- National financial organizations
- State Great Khural (Parliament)
- the Ministry of Environment and Green Development
- Ministry of Mining
- Ministry of Industry and Agriculture
- Ministry of Energy
- Ministry of Construction and Urban Development
- Ministry of Finance
- National Water Committee
- Water Council
- Mongol Us
- Water Basin Administration
- Water Basin Council
- Ulaanbaatar City Governor
- Aimag Governor
- Government: Soum and water supply companies.

OUTPUT: The results of the stakeholder mapping highlighted the perception of the three mentioned groups. All three groups differently evaluated the influence and interest of an identical set of stakeholders. The third group, consisting of stakeholders from the private sector identified a very high interest and a very high influence for the set. However, the stakeholders from NGOs, International organizations valued the interest and influence of the identical set as medium to high.

The output of the mapping also provided a defined position of the Water Basin Administration and Water Basin Council. Across the mapping, all three different groups ranked the interest and influence of Water Basins Authorities slightly higher than those of Water Basin Councils, Figure 18 (below). It was interesting to find that the stakeholders from the private sector evaluated the interest of the Water Basin Council and Water Basin Authority higher than the stakeholders from NGOs and international organizations.

Figure 18: Stakeholder Mapping




Source: PwC and Deltares.
Note:
1) The perception of the stakeholders from NGOs, international organizations.
2) The perception of the stakeholders from the private sector: Mining.
3) The perception of the stakeholders from the private sector: Other. RBC is Water Basin Council and RBA stands for Water Basin Authority.

# APPENDIX 6. Selected Water-related Initiatives, Programs and Projects

The following list includes initiatives funded by the international organizations, but reference has also been given to the domestic programes such as the Ulaanbaatar city action plan for 2013 to 2016.

| Institution(s) (financing and executing) | Client (if applicable) | Name of the project | Years | Sector or focus area | Region |
|---|---|---|---|---|---|
| Acacia Water | World Bank | Assessing Groundwater in Southern Gobi Region | 2009 | Water Supply/ Demand, Institutional Assessment | Southern Gobi Region |
| Action Contre la Faim | Government of Mongolia | Improve Access to Water, Hygiene and Sanitation in the Ger Areas in Ulaanbaatar | 2009–2015 | Hygiene, Water Quality | Ulaanbaatar |
| Action Contre la Faim | Ministry of Education–Institute of Educational Research, UNICEF | Hygiene and Environmental Promotion Activities | 2009–ongoing | Hygiene, Environmental Awareness | Ulaanbaatar |
| Asian Development Bank | Municipality of Ulaanbaatar | Ulaanbaatar Water and Sanitation Services and Planning Improvement | 2010–2013 | Road Map Water Sector | Ulaanbaatar |
| Asian Development Bank | Municipality of Ulaanbaatar | Ulaanbaatar Urban Services and Ger Areas Development Investment Program | 2011– ongoing | Development of Communities | Ulaanbaatar |
| Aquaterra, AUSAID, Worldbank | Ministry of Finance, Water Authority | Strengthen Groundwater Management in Southern Mongolia | 2012 – 2016 | Water Management | Southern Gobi Region |
| BMBF, UFZ, Fraunhofer Institute, IGB u.a. | Government of Mongolia | Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo): Phase I | 2006–2009 | Water Management | Kharaa River and Darkhan |
| BMBF, UFZ, Fraunhofer Institute, IGB u.a. | Government of Mongolia | Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo): Phase II | 2012–ongoing | Water Management | Kharaa River and Darkhan |
| BMBF, UFZ, Fraunhofer Institute, IGB u.a. | Government of Mongolia | Integrated Water Resources Management for Central Asia: Model Region Mongolia (MoMo): Phase III | under review | Water Management | Kharaa River and Darkhan |
| FAO | Government of Mongolia | Sustainable Irrigation Management | 2010–2011 | Irrigation | Orkhon |
| Geomin (private) | Czech Development Agency | Management of Water Sources in the Southern Gobi, Mongolia | 2003–2006 | Water Management, Water Supply | Southern Gobi Region |
| Geomin (private) | Czech Development Agency | Water Resources – Orkhon Aimag | 2010–2012 | Water Supply | Orkhon: Zalugiin Gol and Ulaan Tolgoi |
| Geomin (private) | Czech Development Agency | Water Supply of Erdenet City | 2006–2008 | Water Supply | Erdenet |
| GIZ | Ministry of Environment and Green Development | Biodiversity and the Adaptation of Key Forest Ecosystems to Climate Change | 2012–2015 | Biodiversity and Climate Change Adaptation | Khangai Region |
| Hard Hat Services (private) | World Bank | Water Supply Project for Urban Poor in Ulaanbaatar | 2011–2015 | Water Supply | Ulaanbaatar |
| IFC | Government of Mongolia | Water Management Training | 2013–2014 | Water Management | Southern Gobi Region |
| IFC | Government of Mongolia | Mongolia Multi-stakeholder Water Management in Mining (perception survey) | 2013–2014 | Water Management | Southern Gobi Region |
| IFC | Government of Mongolia | Senior Leadership Meetings | ongoing | Water Management | Mongolia |
| JICA | Government of Mongolia | Water Source Development in Gachuurt | 2011– ongoing | Water Supply | Ulaanbaatarand Gachuurt |
| JICA | Ministry of Road, Transportation, Construction and Urban Development | Study on the Strategic Planning for Water Supply and Sewerage Sector in Ulaanbaatar City | 2012–2013 | Water Supply and Waste Water | Ulaanbaatar |
| JICA | Government of Mongolia | Water Basin Management Model Project for the Conservation of Wetland and Ecosystem and its Sustainable Use in Mongolia | 2005–2010 | Water Basin Management and Wetlands | Ulaanbaatar |
| JICA | Ministry of Construction and Urban Development | Project for Improvement of Water Supply Facilities in Darkhan City | 2009 | Water Supply | Darkhan City |
| KCAP | Ulaanbaatar Administration | Waste Water Improvement Pilot Project | 2010 | Waste Water | Ulaanbaatar |
| KOICA | Government of Mongolia | Stabilizing the Water Supply by Building Wells and Insulating Water Reservoirs | 2011–2014 | Water Supply | Yarmag, Ulaanbaatar |

| Institution(s) (financing and executing) | Client (if applicable) | Name of the project | Years | Sector or focus area | Region |
|---|---|---|---|---|---|
| Ministry of Food, Agriculture and Light Industry | | Supporting Development of Irrigation Fields | 2010–2015 | Agriculture | Mongolia |
| Mongolian Water Center, Deltares, Royal Haskoning, UNESCO-IHE | Mongolian Ministry of Nature, Environment and Tourism, Dutch Government | Strengthening Integrated Water Resources Management in Mongolia | 01/2007–12/2012 | Water Management, Capacity Building | Mongolia; Orkhon and Tuul Water Basins |
| Rio Tinto – Oyu Tolgoi | Southern Gobi Administration | Discovering New Water Resources | ongoing | Water Resources | Southern Gobi Region |
| Rio Tinto – Oyu Tolgoi | Southern Gobi Administration | Community water | ongoing | Water Monitoring | Southern Gobi Region |
| SDC | Government of Mongolia | Strengthening the Coping with Desertification Project (CODEP) in Mongolia | 2007–2012 | Water Management, Agriculture | Khovd Aimag |
| SDC, ACF | Government of Mongolia, USUG | Sustainable Ger WASH Services | 2012– ongoing | Water Supply, Hygiene | Ulaanbaatar |
| UFZ | BMBF in the framework of the water research project MoMo | Urban Water Supply and Sanitation in Mongolia: A Description of the Political, Legal, and Institutional Framework | 2012 | Water Supply | Mongolia |
| Ulaanbaator City | | Action Plan for 2013–2016 | 2013–2016 | Water Supply | Ulaanbaatar |
| Ulaanbaator City | | Action Plan for 2013–2016 | 2013–2016 | Water Demand | Ulaanbaatar |
| Ulaanbaator City | | Action Plan for 2013–2016 | 2013–2016 | Flood Protection | Ulaanbaatar |
| Ulaanbaator City | | Action Plan for 2013–2016 | 2013–2016 | Waste Water | Ulaanbaatar |
| UNDP | Government of Mongolia | Improving Water and Sanitation Services in Mongolia | 2008–2013 (ongoing) | Hygiene | Soums of Khovd, Gobi-Altai Aimags |
| UNDP | Government of Mongolia | Improving Water and Sanitation Services in Mongolia | 2008–2013 (ongoing) | Hygiene | Soums of Khovd, Gobi-Altai Aimags |
| UNDP | Government of Mongolia, Adaptation Fund, UNDP | Ecosystem-Based Adaptation for Water Security in Mongolia | 2012–2018 | Ecosystem management | Altai and Eastern Steppe landscapes |
| UNDP – WGF | Government of Mongolia | GoAL WaSH Mongolia | ongoing | Water management | Mongolia |
| Unicef | Government of Mongolia | Water and Sanitation | ongoing | Hygiene | Mongolia |
| University Kassel | Government of Mongolia, NUM | WaterCope | 2011–2015 | Agriculture | Altay-Dzungaria |
| University of Michigan, University of Mongolia | Government of Mongolia | Exposure and Effects of Toxic Metals in Drinking Water | 2011 | Water quality | Ulaanbaatar |
| Vitens Evides International | Ulaanbaatar Water Supply and Sewerage Authority (USUG) | Water Operator Partnership between Ulaanbaatar Water Supply and Sewerage Authority and Vitens Evides International | 2007–2010 | Water supply | Ulaanbaatar |
| Water Agency, National Development and Innovation Committee | Gobi Region Administration | Providing Gobi Region Water Needs from Orkhon River | 2009–2014 | Water supply | Orkhon River, and Bulgan and Khishig-Under Provinces |
| WHO | Government of Mongolia | Healthy Springs in Mongolia | 2004–2006 | Water quality | Ulaanbaatar City and 21 Aimags of Mongolia |
| World Bank | Government of Mongolia | Mining Infrastructure Investment Support Project (Subproject: Groundwater Management) | 2011–2016 | Water management | Mongolia |
| World Bank | Government of Mongolia | A Review of Environmental and Social Impacts in the Mining Sector | 2006 | Water management | Mongolia |
| WWF | Government of Mongolia | Sustainable Water Management as a Climate Change Adaptation Strategy in Western Mongolia | 2008–2009 | Water management | Khovd Water Basin |

# APPENDIX 7. Responsibilities of Water Sector Institutions

| Institution | Explanation and chief responsibilities of institutions |
|---|---|
| **The State Great Khural**<br>(Parliament) | • Set fees for the use of water resources and for water pollution<br>• Decide on regulation of rivers' discharge modification and transfer–only for major rivers |
| **Government of Mongolia**<br>headed by the Prime Minister | • Define and implement state policy on water<br>• Adopt an integrated water resources management plan<br>• Reach agreements with neighbouring countries on trans-boundary water issues<br>• Establish a national water committee to ensure cross-sector and overall coordination at the national level and monitoring implementation of the National Water Program and the IWRM plan<br>• Decide on the regulation of rivers' discharge modification and transfer–for rivers not classified as major |
| **National Water Committee**<br>established directly under the chairmanship of the Prime Minister | • Includes representation from 13 ministries, the General Agency for Special Inspection, National Security Council, Vice Mayor of Ulaanbaatar and Mongol Us<br>• Monitor the implementation of the National IRWM plan<br>• Enhance the coordination between relevant ministries in cross-sectoral aspects of water management |
| **Water Council**<br>headed by the State Secretary for Ministry of Environment and Green Development | • Includes representation from the Ministries of Energy, Mining, Industries and Agriculture, and Construction and Urban Development; Department of Water Resources and Heads of National Water Committee, Climate Secretariat and Geological Institute<br>• Responsible for review of research and exploration on water resources and approve total and exploitable resources |
| **Ministry of Environment and Green Development**<br>the Water Authority subsumed under the Ministry of Environment and Green Development as per Water Law (2012) | • Creation and establishment of water resources, implementation of measurement programmes, definition of ecological-economic value of water resources, monitoring and analysis of water quality, remediation of water storage, application of water infrastructure (systems), measurement and level sites, sustainable use, as well as setting guidelines of water meters<br>• Approve standard guidelines for the development of Water Basin management plans<br>• Grant or suspend a right for water exploration and research to professional organizations<br>• Implementation of international agreements on trans-boundary water resources<br>• Decide on river discharge modifications and transfers<br>• Monitor the preparation of the national water information database<br>• Approve and implement methods, and guidelines for the estimation and valuation of damages to water resources<br>• Organise research and exploration for water resources and establish their potential reserves for utilisation<br>• Regularly monitor the decisions and authorisations for water uses by the Water Basin Administration, aimags and city departments<br>• Develop water quality and waste water standards<br>• Approve research and exploration activities, drilling wells, establishing and using hydro infrastructure |
| **Local government**<br>Provincial, soum (district) and bagh level administrations | • Approve Water Basin management plan proposals<br>• Coordinate with Water Basin organizations in the implementation of the IWRM plan and other water management functions<br>• Design of projects, determination of financing of projects, approval and monitoring implementation of projects at province level<br>• Prohibit from unauthorised water use for production and unauthorised exploitation of water sources at province and district levels |
| Environmental authorities at province level | • Monitoring of the implementation of the Water Law and creation of water database of provinces and capital<br>• Authorisation, approval of contracts of Water Basin administrations with customers with water consumption between $50m^3$ to $100\ m^3$ per day |
| Rangers and environmental agencies at district level | • Monitoring the implementation of the Water Law in the catchment area and inspection of the violation of the law<br>• Formalising licenses for water use with customers whose consumption level is less than $50m^3$ |
| **Water Basin administration**<br>Government organization under Ministry of Environment and Green Development's Department for Policy Implementation | • Develop draft Water Basin management plans and monitor their implementation<br>• Provide local governors and local parliaments at various levels with professional guidance and support<br>• Operate and maintain a Water Basin database and disseminate required information to the public<br>• Process requests from individual citizens and economic entities to drill groundwater wells and construct drainage systems and forward technical assessment report to competent authorities<br>• Prepare charges for water use fee and pollution fee, based on the law<br>• Determine locations for water supply abstraction and disposal of waste water within the Water Basin<br>• Prepare technical recommendations for the cancellation of licenses for water use and/or disposal of waste water from citizens and economic entities, who violate the legal requirements for water use and disposal of waste water<br>• Propose the establishment of a Water Basin council along with local authorities |

| Institution | Explanation and chief responsibilities of institutions |
|---|---|
| **Water Basin councils**<br>Non-governmental organization with 31 to 45 members with one third representing public administration and parliaments; one third representing NGOs and civil societies; and one third representing water users–industrial and agricultural | • Enable public participation in water resources planning, implementation and monitoring water use and pollution<br>• Submit proposals for the suspension of water use licenses<br>• Advise Water Basin Administration (RBA) on development and implementation of a Water Basin management plan<br>• Communicate citizens' proposals and opinions to RBAs and incidents of violation of the Water Law to competent authorities |
| **Mongol-Us**<br>Public company | • Implementation of water policies defined by separate ministries<br>• Monitoring of groundwater resources<br>• Supervision of construction and management of water source and waste water treatment infrastructure outside Ulaan-baatar financed from the state budget |
| **General Agency for Special Inspection** | • Monitoring water use and pollution by water users and consumers<br>• Enforcing penalties for violation of rules of contract by water users and consumers |

Sources: Dombrowsky, I., A. Houdret and L. Horlemann (2014): Evolving Water Basin management in Mongolia?;
Water Law of Mongolia, 2012; Ministry of Environment and Green Development of Mongolia: Integrated Water Management National Assessment Report – Volume II, 2012

# APPENDIX 8. Overview of Water Usage Charge Revenues, by Aimag

| (in thousand tugrug) | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|
| Arkhangai | 8.555 | 9.556 | 17.818 | 81.267 | 55.504 | 96.909 | 55.104 | 20.527 | 79.835 | 100.620 |
| Baganuur | 1.731 | 1.909 | 1.757 | 3.442 | 9.421 | 8.189 | 8.612 | 8.470 | 98.687 | 154.076 |
| Bayangol | – | – | – | – | – | – | 16 | – | – | 62.292 |
| Bayan-Ulgii | 336 | 763 | 498 | 1.759 | 2.513 | 1.279 | 1.091 | 1.840 | 1.664 | 1.851 |
| Bayankhongor | 9.152 | 16.209 | 15.356 | 95.111 | 97.791 | 41.920 | 61.211 | 102.525 | 82.981 | 70.367 |
| Bulgan | 65.583 | 72.900 | 71.215 | 1.404.228 | 1.380.210 | 1.439.187 | 1.417.849 | 1.597.849 | 1.781.227 | 1.911.273 |
| Gobi-Altai | 2.161 | 2.272 | 2.286 | 3.234 | 3.494 | 4.167 | 7.064 | 6.395 | 11.764 | 55.750 |
| Gobisumber | 1.553 | 1.562 | 1.380 | 2.000 | 2.431 | 3.138 | 5.746 | 6.004 | 206.679 | 189.002 |
| Darkhan-Uul | 20.101 | 10.061 | 16.821 | 91.324 | 62.766 | 111.938 | 143.622 | 72.348 | 202.937 | 182.405 |
| Dornogobi | 3.118 | 3.854 | 4.180 | 7.100 | 7.682 | 14.645 | 18.415 | 22.123 | 36.040 | 77.438 |
| Dornod | 3.489 | 5.823 | 8.249 | 30.077 | 69.836 | 120.604 | 64.687 | 117.016 | 230.797 | 247.462 |
| Dundgobi | – | – | – | 1.167 | 970 | 4.337 | 2.556 | 4.301 | 7.755 | 38.689 |
| Uwurkhangai | 9.160 | 13.263 | 10.518 | 47.235 | 60.373 | 89.222 | 142.608 | 186.249 | 276.746 | 301.929 |
| Umnugobi | 3.967 | 3.149 | 4.422 | 14.316 | 30.503 | 18.717 | 27.606 | 30.239 | 96.763 | 220.986 |
| Zawkhan | 1.606 | 1.688 | 1.409 | 3.206 | 2.081 | 1.692 | 3.732 | 3.041 | 7.486 | 13.052 |
| Nalaikh | 7.616 | 6.924 | 6.789 | 4.722 | 6.932 | 7.909 | 8.783 | 10.284 | 9.983 | 10.437 |
| Capital City | 18.540 | 20.000 | 17.238 | 173.662 | 195.132 | 210.587 | 239.503 | 223.586 | 459.352 | 541.963 |
| Orkhon | 175 | 968 | 267 | 369 | 668 | 1.267 | 1.877 | 1.733 | 2.251 | 5.783 |
| Sukhbaatar | 123 | 685 | 3.571 | 20.451 | 57.363 | 34.738 | 25.584 | 46.738 | 63.776 | 62.758 |
| Sukhbaatar district | – | – | – | – | 1.947 | 717 | – | – | 244 | 6.097 |
| Songinokhairkhan | – | – | – | – | – | – | 1.672 | 909 | 1.212 | 2.204 |
| Selenge | 25.637 | 32.047 | 52.890 | 129.345 | 115.462 | 83.371 | 139.844 | 199.910 | 482.265 | 335.748 |
| Tuw | 37.875 | 41.075 | 32.728 | 476.416 | 550.692 | 498.912 | 367.826 | 289.430 | 421.123 | 494.382 |
| Uws | 1.447 | 4.838 | 1.499 | 10.714 | 8.120 | 11.002 | 9.663 | 8.437 | 8.304 | 14.613 |
| Khanuul | – | 134 | – | 3.138 | 1.822 | 2.403 | 2.947 | 5.648 | 7.180 | 6.913 |
| Khuwsgul | 1.209 | 1.251 | 1.361 | 1.157 | 2.333 | 3.259 | 4.624 | 4.647 | 8.108 | 13.800 |
| Khowd | 300 | 771 | 245 | 2.120 | 1.134 | 6.017 | 774 | 3.568 | 12.501 | 23.670 |
| Khentii | 12.161 | 14.363 | 13.680 | 61.449 | 28.127 | 34.189 | 48.495 | 70.788 | 102.835 | 188.213 |
| TOTAL | 235.595 | 266.064 | 286.176 | 2.669.009 | 2.755.307 | 2.850.313 | 2.811.510 | 3.044.602 | 4.700.491 | 5.333.770 |

# APPENDIX 9. Availability of Water Resources Across Water Basins in Mongolia

| No | Name | Groundwater availability (million $m^3$/year) | | Surface water availability (million m3/year) | |
|---|---|---|---|---|---|
| | | Potential | Exploitable | 50% | 10% |
| 1 | Selenge* | 697.0 | 90.3 | 277.3 | 165.2 |
| 2 | Khuvsgul Lake – Eg | 432.0 | 0.2 | 401.1 | 276.2 |
| 3 | Shishkhid | 206.0 | 0.2 | 39.0 | 29.6 |
| 4 | Delgermurun | 229.0 | 2.7 | 81.0 | 47.6 |
| 5 | Ider | 129.0 | 0.5 | 53.3 | 29.7 |
| 6 | Chuluut | 86.0 | 0.1 | 13.9 | 6.2 |
| 7 | Khanui | 96.0 | 0.2 | 13.9 | 11.8 |
| 8 | Orkhon* | 838.3 | 26.7 | 221.6 | 99.7 |
| 9 | Tuul | 637.7 | 142.8 | 63.1 | 30.5 |
| 10 | Kharaa | 182.0 | 52.6 | 25.9 | 12.8 |
| 11 | Eroo | 239.0 | 0.6 | 196.2 | 112.1 |
| 12 | Onon | 344.0 | 0.6 | 259.0 | 230.8 |
| 13 | Ulz | 320.0 | 26.4 | 22.7 | 3.8 |
| 14 | Kherlen | 721.0 | 43.9 | 59.5 | 28.4 |
| 15 | Buir Lake – Khalkh | 198.0 | 1.1 | 102.3 | 54.9 |
| 16 | Menengiin Tal | 168.0 | 0.1 | 0.0 | 0.0 |
| 17 | Umard Goviin Guveet – Khalkhiin Dundad Tal | 433.0 | 46.7 | 0.0 | 0.0 |
| 18 | Galba – Uush – Doloodiin Govi | 352.0 | 59.0 | 0.0 | 0.0 |
| 19 | Ongi | 294.0 | 5.8 | 1.0 | 0.3 |
| 20 | Altain Uvur Govi | 337.0 | 65.5 | 0.0 | 0.0 |
| 21 | Taats | 61.0 | 0.5 | 0.9 | 0.3 |
| 22 | Orog Lake – Tui | 33.0 | 5.9 | 2.6 | 0.9 |
| 23 | Buuntsagaan Lake – Baidrag | 174.0 | 2.9 | 22.7 | 12.9 |
| 24 | Khyargas Lake – Zavkhan | 892.0 | 10.0 | 44.9 | 22.8 |
| 25 | Khuisiin Govi – Tsetseg Lake** | 493.0 | 8.1 | 0.0 | 0.0 |
| 26 | Uench – Bodonch | 237.0 | 11.3 | 2.7 | 1.1 |
| 27 | Bulgan | 86.0 | 0.0 | 8.3 | 5.7 |
| 28 | Khar Lake – Khovd | 684.0 | 12.7 | 115.8 | 80.8 |
| 29 | Uvs Lake – Tes | 405.0 | 6.1 | 63.1 | 29.8 |
| | MONGOLIA TOTAL | 10,004.0 | 623.4 | 2,091.7 | 1,294.1 |

Groundwater availability: Potential resources based on aquifer properties and renewable resources;

Exploitable resources based on approved groundwater deposits.

Surface water availability is characterised by the two estimates of the possible usable surface water resources generated within the area with a probability of 50% and 10%. 50% means available in an average year, 10% means available in a dry year with probability of once in 10 years;

* Demand of the Erdenet mine is located in Orkhon Water Basin but is supplied by transfer from groundwater resources in Selenge Water Basin and therefore is added to total water demand of the Selenge Basin: 15.118 million m3/year in 2010, 15.5 million m3/year in 2015 and 16 million m3/year in 2021.

** Khuisiin Govi – Tsetseg Lake basin has demand from surface water for irrigation but surface water resource was not estimated.

Data source: MEGD: Integrated Water Management Plan of Mongolia, 2013

# APPENDIX 10. Assumptions Regarding Water Demand Projections

Table 3: Assumptions about various socio-economic variables used for projecting water demand in Mongolia, Ulaanbaatar and Southern Gobi

| | Low scenario | Medium scenario | High scenario |
|---|---|---|---|
| **Drinking water use** | | | |
| Population growth | 2010–2015: 1.17%<br>2015–2021: 1.03% | 2010–2015: 1.38%<br>2015–2021: 1.20% | 2010–2015: 1.51%<br>2015–2021: 1.28% |
| % urban population in 2021 | 69.4% | 70.7% | 71.9% |
| Private connections and connected kiosks | 2015: 45.9%<br>2021: 53.6% | 2015: 48.3%<br>2021: 56.4% | 2015: 53.5%<br>2021: 62.2% |
| Water consumption norm | Similar to medium scenario | For apartment dwellers:<br>200 l/day/person in 2015 and<br>160 l/day/person in 2021;<br>For users of kiosks and protected sources:<br>10–25 l/day/person in 2015 and 15–30 l/day/person in 2021 | Similar to medium scenario |
| **Municipal water use** | | | |
| Utilities growth rate | 0.7% | 1.4% | 4% |
| Services growth rate | 4.5% | 7.6% | 14.5% |
| **Industrial water use** | | | |
| Manufacturing growth rate | 4% | 6.9% | 12.6% |
| Heavy industries growth rate | 4% | 6.9% | 12.6% |
| Construction growth rate | 4% | 6.9% | 10% |
| Energy growth rate | 2.5% | 6% | 10.2% |
| Existing mines<br>New mines | 3% growth<br>50% lower than MMRE estimates | 10.5% growth<br>According MMRE estimates | 23% growth<br>20% higher than MMRE estimates |
| **Livestock water use** | | | |
| Livestock numbers | 5% lower than medium scenario | Projection according MFALI (35.6 million in 2021) | Projection according Davaadorj G. (2010)– 52.6 million in 2021 |
| Consumption norm | Unchanged | Unchanged | Unchanged |
| **Irrigation water use** | | | |
| Irrigated area * | According trend 1998– 2010, 63,000 ha in 2021:<br>2010–2015: 4.8%<br>2015–2021: 4.8% | Projection according MFALI, 92,000 ha in 2021:<br>2010–2015: 9.8%<br>2015–2021: 7.4% | Projection according Davaadorj G. (2010) , 137,000 ha in 2021: 2010–2015: 15.5 % 2015–2021: 10% |
| Crop water requirement | Unchanged | Unchanged | Unchanged |
| **Tourism water use** | | | |
| Water demand growth | 20% lower than medium scenario | 2010–2015: 14.9%<br>2015–2021: 16.5% | 20% higher than medium scenario |
| **Green areas water use** | | | |
| Water use | 20% lower than medium scenario | 2010–2015: 8%<br>2015–2021: 12% | 20% higher than medium scenario |

Note: For projecting future water demand in Mongolia, 2010 has been taken as the base year due to availabilty of sufficient data; the data was incomplete in the year of 2013 during the time of writing. MMRE = Ministry of Mineral Resources and Energy, MFALI =Ministry of Food, Agriculture and Light Industry.

Source: MEGD: Integrated Water Management Plan of Mongolia, 2013

The future domestic water demand is calculated based on predictions of population and type of connections and using water consumption norms. The population of Ulaanbaatar is expected to rise from 1.125 million in 2010 to 1.485 million in 2021 according to the medium scenario. The water consumption per person is assumed to drop to 160 liters per person per day in 2021 for private connections and rise to 20–30 liters per person per day in 2021 for public connections (kiosks). The future water use projections also incorporates the "One Hundred Thousand Household Apartments programme" which required approximately 50,000 m$^3$ of water per day.[31]

# APPENDIX 11. Comparative Analysis of Existing Studies on Water Resource Supply and Demand in the Gobi Region

Various projections for future water demand in Southern Gobi are available from different sources. Two detailed assessments include (1) Integrated Water Management Plan of Mongolia, prepared by Ministry of Environment and Green Development and (2) Groundwater Assessment of the Southern Gobi Region by the World Bank. In addition, McKinsey undertook an analysis which was based on the assessment by the World Bank. The projections included in these reports are presented below:

## Projections as per Integrated Water Management Plan of Mongolia, Prepared by Ministry of Environment and Green Development (2012)

Similar to the national overview, future water demand has been projected based on three economic development scenarios (low, medium and high economic development). Future water demand in Galba Uush Doloodiin Govi Water Basin in 2021 is projected to increase by 350 percent, 720 percent and 912 percent in the low, medium and high economic development scenarios respectively (see Table A1). The high increase in water demand is driven by the newly developed mines, namely Oyu Tolgoi, Tavan Tolgoi and Tsagaan Suvarga.

Table A1: Water Demand Projections & Ground Water Resources for Galba-Uush-Doloodiin Govi Water Basin (million m$^3$/ year)

| Sector | Base | Low scenario | | Medium scenario | | High scenario | |
|---|---|---|---|---|---|---|---|
| | 2010 | 2015 | 2021 | 2015 | 2021 | 2015 | |
| Drinking and domestic water for population | 0.14 | 0.25 | 0.47 | 0.25 | 0.49 | 0.25 | 0.50 |
| Utility service & tourism & green area | 0.00 | 0.10 | 0.21 | 0.11 | 0.26 | 0.12 | 0.31 |
| Industry, energy, construction, road and transport | 0.12 | 0.14 | 0.18 | 0.16 | 0.20 | 0.18 | 0.22 |
| Mining (mine and processing) | 0.51 | 10.87 | 18.43 | 21.73 | 36.86 | 26.75 | 45.46 |
| Livestock (pastoral and farming) | 4.09 | 3.73 | 3.92 | 3.93 | 4.12 | 4.52 | 4.88 |
| Irrigated area | 0.25 | 0.32 | 0.42 | 0.43 | 0.67 | 0.52 | 0.92 |
| TOTAL DEMAND | 5.17 | 15.40 | 23.63 | 26.60 | 42.59 | 32.34 | 52.29 |
| Exploitable GW resources | 59 | 59 | 59 | 59 | 59 | 59 | 59 |

Source: MEGD: Integrated Water Management Plan of Mongolia, 2012 (draft version).

Future water demand in the Umard Goviin Guveet-Khalkhiin Dundad Tal water basin in 2021 is projected to increase by 20 percent 50 percent and 120 percent in the low, medium and high economic development scenarios respectively (see TableA2). The main driver for this increase is predominantly an increase in water demand from mining. Livestock has the largest water demand in this basin but this is not expected to change significantly.

In order to increase the value-added of Mongolia's mining products, the Government has decided to construct the 'Sainshand' industrial complex where coke, metal, coal, copper smelting and construction material industries will be located. This will be constructed between 2015 and 2019. The water demand for the development of this industrial complex will require additional groundwater resources, which is included in the high development scenario for 2021. Investigations are underway to find suitable resources although these may not be found near the urban center.

Table A2: Water Demand Projections & Groundwater Resources for Umard Goviin Guveet-Khalkhiin Dundad Tal Water Basin (million m$^3$/ year)

| Sector | Base | Low scenario | | Medium scenario | | High scenario | |
|---|---|---|---|---|---|---|---|
| | 2010 | 2015 | 2021 | 2015 | 2021 | 2015 | 2021 |
| Drinking and domestic water for population | 1.83 | 2.45 | 2.88 | 2.58 | 3.08 | 2.79 | 3.35 |
| Utility service & tourism & green area | 0.33 | 0.39 | 0.53 | 0.42 | 0.62 | 0.49 | 0.86 |
| Industry, energy, construction, road and transport | 0.95 | 1.12 | 1.38 | 1.30 | 1.87 | 1.62 | 14.22 |
| Mining (mine and processing) | 0.36 | 1.87 | 1.95 | 3.49 | 3.98 | 4.58 | 7.08 |
| Livestock (pastoral and farming) | 7.83 | 6.49 | 6.41 | 6.83 | 6.74 | 8.53 | 9.17 |
| Irrigated area | 0.73 | 0.92 | 1.22 | 1.25 | 1.92 | 1.50 | 2.65 |
| TOTAL DEMAND | 12.03 | 13.24 | 14.37 | 15.88 | 18.22 | 19.51 | 37.33 |
| Exploitable GW resources | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 |

Source: MEGD: Integrated Water Management Plan of Mongolia, 2012 (draft version); PwC/ Deltares calculations.

Note: Projected industrial water demand from the industrial complex Sainshand (11.2 million m$^3$/year) was included in the high economic development scenario. No estimates for medium and low water demand were made due to a lack of data.

The total water demand in Southern Gobi region (comprising of three basins: Umard Goviin Guveet-Khalhiin Dundad Tal, Galba-Uush-Dolodiin Govi and Altain Uvur Gobi Basins) is presented in Table A3. The demand is expected to rise by 107 percent, 225 percent and 368 percent in 2021 as compared to 2010 under low, medium and high scenario respectively.

Table A3: Water Demand Projections and Groundwater Resources for Entire Southern Gobi (million $m^3$/year)

| Sector | Base | Low scenario | | | Medium scenario | | | High scenario | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2015 | 2021 | 2030* | 2015 | 2021 | 2030* | 2015 | 2021 | 2030* |
| Drinking and domestic water for population | 2.08 | 2.83 | 3.57 | 5.56 | 2.97 | 3.79 | 6.18 | 3.17 | 4.07 | 7.04 |
| Utility service & tourism & green area | 0.36 | 0.54 | 0.84 | 1.66 | 0.57 | 1.00 | 2.30 | 0.67 | 1.30 | 3.73 |
| Industry, energy, construction, road and transport | 1.19 | 1.40 | 1.74 | 2.38 | 1.62 | 2.27 | 3.86 | 1.98 | 14.66 | 35.13 |
| Mining (mine and processing) | 0.93 | 13.59 | 22.08 | 52.06 | 26.93 | 44.24 | 104.32 | 33.42 | 56.72 | 133.75 |
| Livestock (pastoral and farming) | 14.87 | 13.41 | 13.63 | 13.96 | 14.11 | 14.34 | 14.68 | 17.28 | 18.47 | 22.05 |
| Irrigated area | 3.87 | 4.90 | 6.49 | 9.92 | 6.66 | 10.23 | 22.65 | 7.97 | 14.12 | 40.73 |
| **TOTAL DEMAND** | **23.37** | **36.67** | **48.35** | **85.53** | **52.86** | **75.86** | **153.99** | **64.49** | **109.35** | **242.43** |
| **Exploitable GW resources** | **171.2** | **171.2** | **171.2** | **171.2** | **171.2** | **171.2** | **171.2** | **171.2** | **171.2** | **171.2** |

*Source: MEGD: Integrated Water Management Plan of Mongolia, 2012 (draft version); PwC/ Deltares calculations.*

*Note 1: Projected industrial water demand from the industrial complex Sainshand (11.2 million $m^3$/year) was included in the high economic development scenario. No estimates for medium and low water demand were made due to a lack of data.*

*Note 2: 2030 projections are estimated using sector-wise average annual growth rate in water demand during 2010–21. For mining sector, a growth rate of 10% pa has been assumed for all scenarios. Since livestock growth rate has been negative during 2010–21 (low & medium scenario) due to occurrence of dzuds, average annual growth of livestock during 2015–21 has been used for projections. Additional water requirement of Sainshand industrial complex has been excluded while estimating average annual growth rate of industrial sector under high growth scenario.*

Figure A1: Existing Groundwater Resources and Water Demand Projections for Southern Gobi

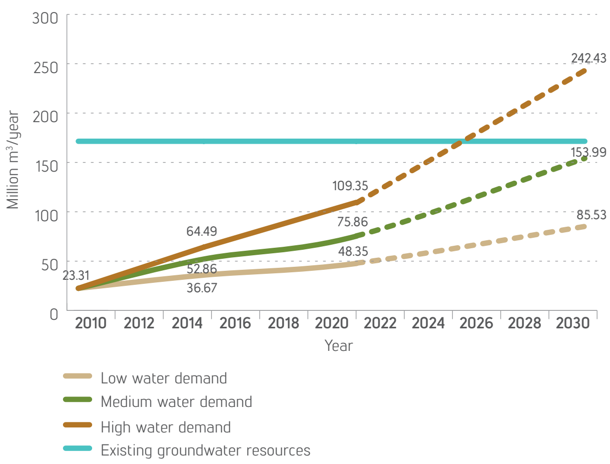



Figure A1 presents the water demand projections and existing groundwater resources for Southern Gobi. Assuming the groundwater resource availability to remain at the current level, we expect that water demand will exceed available water resources by around 2026 under high growth scenario. Under low and medium scenarios, existing groundwater resources will be sufficient to meet demand up to 2030 (and possibly beyond). However, localized water stress remains a high risk.

## Projections as per Groundwater Assessment of the Southern Gobi Region by the World Bank

According to World Bank report, the South Gobi Region (SGR) occupies about 350,000 $km^2$ of area covering the aimags of Dornogovi, Dundgovi, and Umnogobi. Table A4 presents water demand projections for Southern Gobi region based on World Bank's assessment. As presented in the table, water demand is expected to grow by 400 percent in 2020 as compared to water demand in 2005/10. This growth in water demand will be mostly driven by development of the mining sector and mining is likely to emerge as the major consumer of water in the region.

Further, mining development will trigger a population increase (township development) and additional industrial and commercial development, which will further increase demand for water in the future. Though livestock is currently one of the major consumers of water in the region, the demand from this sector is not expected to rise significantly over the years.

The World Bank assessment has assumed that most of the mines in the region will reach their planned extraction capacity by 2015, beyond which water demand will increase at an annual rate of 10 percent.

Table A4: Water Demand Projections for Southern Gobi, Based on World Bank Assessment

| Sector | (million m³/year) | | |
|---|---|---|---|
| | 2005/10 | 2020 | 2030* |
| Mines | 14.6 | 109.5 | 284.01 |
| Industry / Commerce | small | 4.6 | 11.93 |
| Urban water supply | 2.4 | 4.6 | 11.93 |
| Rural water supply | 1.1 | 1.8 | 2.95 |
| Livestock water supply | 11.7 | 18.3 | 28.62 |
| Irrigated agriculture | small | 11.0 | 17.92 |
| Tourism /environment | small | 5.5 | 14.27 |
| TOTAL DEMAND | 31.0 | 155.3 | 371.6 |
| Estimate of Groundwater potential | 200–500 | 200–500 | 200–500 |

Source: Groundwater Assessment of the Southern Gobi Region report by World Bank/ PwC & Deltares calculations (projections 2030)

Note: 2030 projections are based on the assumption that water demand will increase by 10% annually for Mining, Industry/commerce, Urban water supply and Tourism/environment and 5% for Rural water supply, livestock and irrigated agriculture.

Figure presents water demand projections and groundwater estimates for Southern Gobi region. As per the World Bank Assessment, a water demand/supply gap is not expected up to 2020–2022. However, beyond that, groundwater resources may become insufficient to meet the demand, assuming lower range of groundwater estimate.

## Projections as per McKinsey Analysis

The McKinsey study is based on the above mentioned World Bank analysis "Groundwater Assessment of the Southern Gobi Region.[32] These estimates are presented in Table A5.

Table A5: Expected Water Demand in South Gobi, as per McKinsey Analysis

| Sector | Million m³/year | |
|---|---|---|
| | Expected Demand | Estimated Supply |
| Mining | 101.84 | |
| Urban | 12.41 | |
| Livestock | 6.21 | |
| Environment | 9.49 | |
| To be determined (not specified) | 67.16 | |
| GRAND TOTAL | 197.10 | 177.39 |

Source: Securing Mongolia's water future, 2030 Water Resources Group workshop (presentation)

Note: No clear indication on the year was provided. However, given the related analysis are prepared for 2030, it can be assumed that the water demand is projected for 2030 as well

A considerable portion of expected water demand falls under the category "to be determined." This demand is comprised of expected water demands from Sainshand industrial center, other planned value adding industries and power plants which are expected to be constructed to meet increase electricity demands from the new industries.

As can be seen, this analysis projects a water demand/supply gap of 19.71 million m³ per year.

## Comparative Analysis of Projections

A comparative analysis of projections made under MEGD and World Bank report is presented in Table A6. It needs to be noted that the basis of assessment is different for both studies: While the assessment by the MEGD considers the river basins in Southern Gobi as basis, the World Bank report bases its analysis on Aimag level.

It can be observed from the table that water demand projections made by World Bank exceed even the high scenario projections of MEGD. As per MEGD projections, water demand will be ~109 million m³ per year in 2021 whereas as per WB assessment, demand is likely to be ~155 million m³ per year in 2020. Further, WB's water demand projections for mining sector are almost double than that of MEGD's projections for the sector. Similarly, for 2030, WB projection for water demand exceeds MEGD projections under all scenarios.

It should also be noted that there is difference in base demands estimated by the two reports. The base demand in WB assessment is higher by ~7.6 million m³ per year than base demand of MEGD assessment.

Figure A2: Water Demand Projections and Groundwater Potential Estimates for Southern Gobi (WB Report)

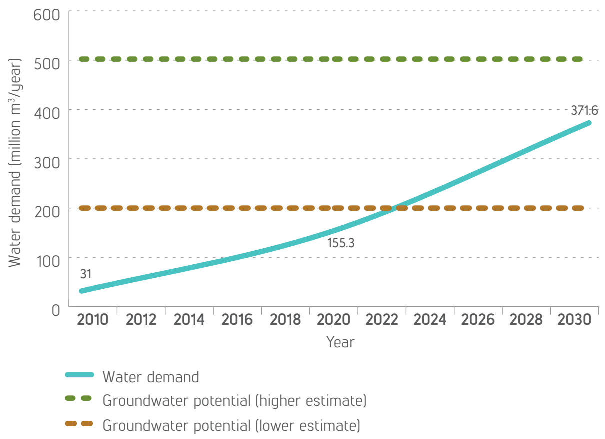


Table A6: Water Demand Projections for Southern Gobi by MEGD and World Bank (million m³/ year)

| Sector | (million m³/ year) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Projections by MEGD | | | | Projections by WB | | |
| | Base | High scenario | | | | | |
| | 2010 | 2015 | 2021 | 2030** | 2005/10 | 2020 | 2030** |
| Drinking and domestic water for population | 2.08 | 3.17 | 4.07 | 7.04 | 3.5# | 6.4# | 14.88# |
| Utility service & tourism & green area | 0.36 | 0.67 | 1.30 | 3.73 | small* | 5.5* | 14.27* |
| Industry, energy, construction, road and transport | 1.19 | 1.98 | 14.66 | 35.13 | small | 4.6 | 11.93 |
| Mining (mine and processing) | 0.93 | 33.42 | 56.72 | 133.75 | 14.6 | 109.5 | 284.01 |
| Livestock (pastoral and farming) | 14.87 | 17.28 | 18.47 | 22.05 | 11.7 | 18.3 | 28.62 |
| Irrigated area | 3.87 | 7.97 | 14.12 | 40.73 | small | 11.0 | 17.92 |
| GRAND TOTAL | 23.37 | 64.49 | 109.35 | 242.43 | 31.0 | 155.1 | 371.6 |

*# sum of rural and urban water supply; *corresponds to Tourism & Environment; ** based on PwC/ Deltares calculations.*

Further, comparing MEGD and WB estimates with McKinsey analysis (presented in Table A7), it can be seen that **McKinsey's projections have underestimated water demand** vis-à-vis water demand projections of MEGD (high scenario) and WB. However, McKinsey's projected water demand is higher than low and medium scenario projections of MEGD.

Table A7: Expected Water Demand in 2030, Based on MEGD, WB and McKinsey Estimates

| Projections as per: | | Water Demand Projections (Million m³/year) | | |
|---|---|---|---|---|
| | | 2020 | 2021 | 2030 |
| MEGD estimates | High | – | 109.35 | 242.43 |
| | Medium | – | 75.86 | 153.99 |
| | Low | – | 48.35 | 85.53 |
| WB estimates | | 155.1 | – | 371.6 |
| McKinsey estimates* | | | | 197.10 |

*No clear indication on the year was provided. However, given the related analysis are prepared for 2030, it can be assumed that the water demand is projected for 2030 as well.

As mining sector is the key factor for difference in 3 set of projections, we have presented an analysis of assumptions for mining sector, as used by MEGD, WB and McKinsey in Table A8.

The water demand for major mines in Southern Gobi has been estimated by MEGD using Ministry of Mineral Resources and Energy (former) (MMRE) estimates. These projects are in various stages of implementation. These estimates have been used to project water demand under medium scenario. For high scenario, growth of new mines has been assumed to be 20 percent higher than MMRE estimates.

The World Bank assessment has assumed that most of the mines in the region will reach their planned extraction capacity by 2015, beyond which water demand will increase at an annual rate of 10 percent.

Thus, it can be observed that due to difference in water projections for individual mines (due to different underlying assumptions), the projections made under the two reports differ. WB's assessment of water demand for Oyu Tolgoi, Tavan Tolgoi and Nariin Sukhait mines significantly exceed the corresponding estimates of MEGD.

Water demand estimates of McKinsey analysis seems to be underestimated for all mines except Shivee Ovoo as compared to the projections of MEGD (High Scenario) and WB. However, total water demand of mining sector projected by McKinsey is quite comparable with corresponding projection of MEGD under medium scenario.

Table A8: Expected Water Demand of Key Mines in Southern Gobi (million m³/year)

| Name of Mine | MEGD assessment | | | | WB Assessment | | | McKinsey analysis |
|---|---|---|---|---|---|---|---|---|
| | Medium Scenario | | High Scenario* | | | | | |
| | 2021 | 2030** | 2021 | 2030** | 2015# | 2020^ | 2030^ | 2030 |
| Tsagaan Suvarga | 9.4 | 22.16 | 11.28 | 26.60 | 4.75 | 7.64 | 19.82 | 19.05 |
| Oyu Tolgoi | 12.9 | 30.42 | 15.48 | 36.50 | 25.55 | 41.15 | 106.73 | 33.43 |
| Tavan Tolgoi | 14.5 | 34.19 | 17.4 | 41.03 | 18.25 | 29.4 | 76.26 | 29.99 |
| Nariin Sukhait | 3.4 | 8.02 | 4.08 | 9.62 | 9.13 | 14.7 | 38.13 | – |
| Shivee Ovoo | 2.4 | 5.66 | 2.88 | 6.79 | – | – | – | 19.43 |
| Choir, Nyalga | 0.5 | 1.18 | 0.6 | 1.41 | – | – | – | – |
| Other mines | – | – | – | – | 7.3 | 11.76 | 30.50 | – |
| TOTAL SOUTHERN GOBI | 43.1 | 101.63 | 51.72 | 121.95 | 65.0 | 104.6 | 271.44 | 101.9 |

* assuming 20% higher growth than MMRE estimates; **assuming an annual increase of 10% during 2021–30;
# assuming most of the mines will reach their planned extraction capacity by 2015; ^assuming an annual increase of 10% during 2015–30
Source: MEGD: Integrated Water Management Plan of Mongolia, 2012 (draft version); Groundwater Assessment of the Southern Gobi Region report by World Bank; Securing Mongolia's water future, 2030 Water Resources Group workshop (presentation); PwC/ Deltares calculations

# ENDNOTES

1 PricewaterhouseCoopers Pvt. Ltd, PricewaterhouseCoopers Advisory LLC and PricewaterhouseCoopers AG WPG (PwC).

2 A comparative overview of these projects can be found in Appendix 1.

3 MEGD: Integrated Water Management Plan of Mongolia, 2013.

4 An overview of the identified initiatives can be found in Appendix 6.

5 Note: Projects can have more than one focus area.

6 Currently, the roles and responsibilities of Mongol-Us are being expanded. This can have an impact on the licensing procedures for water uses above 100 m³ per day.

7 Currently, the roles and responsibilities of Mongol-Us are being expanded. This can have an impact on the licencing procedures for wastewater discharges above 50 m³ per day.

8 The classification for surface water availability does not take into account the volume of surface water flow which should be maintained across the border to China and Russia. The existing agreements with China and Russia deal with protection, utilization and prevention of pollution of trans-boundary waters, but do not specify flow volumes.

9 Surface water and groundwater resources associated with the 29 Water Basins across Mongolia are detailed in Appendix 9.

10 MEGD: Integrated Water Management Plan of Mongolia, 2013.

11 World Economic Outlook, October 2013.

12 The assumptions about growth and development of the underlying socioeconomic factors, including population, water supply coverage, municipal services, industries, mines, livestock, irrigation, etc. are presented in Appendix 10.

13 Water resources include actual exploitable groundwater resources and an average year for surface water availability (50% probability). Please note that this includes all water resources and does not consider the supply capacity (i.e., the amount of water that can be provided given required infrastructure).

14 Please note that the issues are in not listed in order of importance,

15 See National Water Management Plan of Mongolia (2013),

16 A zud or dzud is a Mongolian term for an extremely snowy winter in which livestock are unable to find food through the snow cover and die due to starvation and cold. The economy of Mongolia has long been heavily dependent on pastoral farming, and harsh zuds can cause economic crises and food security issues within the country.

17 Ger is the traditional, tent-like dwelling of the nomads in Mongolia. Ger areas are peri-urban communities located in the outlying districts of major cities. These areas tend to be comprised of thousands of small, fenced-in plots of land, and remain isolated from the main commercial activity and public services.

18 The assumptions about growth and development of the underlying socioeconomic factors, including population, water supply coverage, municipal services, industries, mines, livestock, irrigation, etc. are presented in Appendix 10.

19 Tuul Water Basin Integrated Water Management Plan. Issued in December 2012, Phase 1, 2013-2015; Phase 2, 2016-2021.

20 Tuul Water Basin Integrated Water Management Plan. Issued in December 2012, Phase 1, 2013-2015; Phase 2, 2016-2021; and New Ulaanbaatar City Master Plan, PWC/Deltares calculations.

21 JICA (2013).

22 Please note that the issues are in not listed in order of importance.

23 See National Water Management Plan of Mongolia (2013).

24 Please note that the administrative boundaries of the aimags do not coincide with the boundaries of the Water Basins.

25 MEGD: Integrated Water Management Plan of Mongolia, 2013

26 The underlying assumptions for these scenarios are presented in Appendix 10.

27 World Bank (2010) Mongolia - Southern Gobi Regional Environmental Assessment.

28 Please note that the issues are in not listed in order of importance.

29 MEGD regulation.

30 More information on eco-toilets can be found here: http://acfmongolia.mn/index.php/en/news/18-sanitation

31 Note that only 75,000 apartments are planned to be built in Ulaanbaatar. And on the basis that one household consists of four persons.

32 The source in the presentation is named "World Bank - Groundwater Assessment of Southern Mongolia." However, no such source was identified and given the similarity of content and name, it is assumed that the above mentioned World Bank study is referred to.

# MONGOLIA REFERENCES (PARTIAL LIST)

Government of Mongolia. 2013. *National Water Management Plan.*

JICA. 2013. *New Ulaanbaatar City Master Plan.*

KCAP. 2010.

McKinsey & Company

Ministry of Environment and Green Development (MEGD). 2013. *Integrated Water Management Plan of Mongolia.*

University of Mongolia and University of Michigan. 2011.

World Bank. 2010. *Mongolia—Southern Gobi Regional Environmental Assessment.*

# MONGOLIA ACRONYMS

| | |
|---|---|
| ACF | Action Contre la Faim |
| ADB | Asian Development Bank |
| AUSAID | Australian Agency for International Development |
| BIER | Beverage Industry Environmental Roundtable |
| EBRD | European Bank for Reconstruction and Development |
| FGD | Focus group discussion |
| GIZ | German International Development Agency |
| IDA | International development agency |
| IFC | International Finance Corporation |
| IWRM | Integrated Water Resources Management |
| JICA | Japan International Cooperation Agency |
| KCAP | Knowledge Management Center for Asia and the Pacific (UN-HABITAT Initiative) |
| KOICA | Korea International Cooperation Agency |
| MEGD | Ministry of Environment and Green Development, Mongolia |
| MoMo | Integrated Water Resources Management—Model Region Mongolia Project |
| NGO | Nongovernmental organization |
| SDC | Swiss Agency for Cooperation and Development |
| UNDP | United Nations Development Programme |
| USAID | United States Agency for International Development |
| USUG | Ulaanbaatar Water Supply and Sewerage Authority |
| WHO | World Health Organization |
| 2030 WRG | The 2030 Water Resources Group |