

# Mine closure plan for the Salkhit silver mine in Mongolia

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## Abstract

*Mongolia is strengthening its governance of the mining and environmental sectors through updating and improvements to laws and regulations. A specific objective is to improve mine closure planning – by standardising planning processes used in Mongolia and improving confidence that land disturbed by mining will have value to local communities after mine closure. Mine closure planning is a new concept for Mongolia, a developing nation, classed by the World Bank as a lower middle-income country. A barrier to mine closure planning is a general lack of capacity within the domestic mining industry. The top three capacity issues are improving skills and knowledge of professionals involved in mine closure planning, companies providing adequate resources to meet the closure planning expectations and enhancing the capacity of stakeholders, especially local citizens, so they can meaningfully participate when engagement occurs. This is especially so for small- and medium-sized mining companies and national consulting firms. Challenges for both government and industry include confusion in understanding laws, lack of experience planning and managing multi-stakeholder engagement processes and meeting stakeholder expectations for socio-economic transition upon the closure of a mine. Capacity building is a key desired outcome of the project, to enable future mine closure planning to be conducted primarily through resources available within Mongolia.*

*The ‘Mongolia: Enhancing Resource Management through Institutional Transformation’ (MERIT) project is funded by Global Affairs Canada. MERIT partnered with the Ministry of Mining and Heavy Industry (MMHI), the Ministry of Environment and Tourism (MET) and Erdenes Silver Resources LLC (ESR) to develop a mine closure plan for the ESR Salkhit mine. The mine has a 5–10 year life expectancy. The MMHI desires to promote international best practice, sensibly aligned to the Mongolian context, into closure planning. The closure plan will be the first to be created and submitted for approval under the regulation ‘Regarding the Approval of the Regulation on Rehabilitation and Closure of Mines and Concentration Plants (2019)’ (MMHI & MET 2019) and will set a standard for future mine closure planning in Mongolia.*

*This paper provides the results of stage 1 of a two-stage project. Stage 1 included a regulatory review, site assessment report, development of mine closure goals and objectives, and a risk assessment. Stage 2 will involve forming a multi-disciplinary team to write the ESR Salkhit mine closure plan. The methodology used to conduct the stage 1 activities, including approaches for capacity building, gender equality and stakeholder engagement is presented. Key results of the project are described, in the context of both government and company experiences of the processes used and the impact the results will have on influencing changes to laws and mining operations. Conclusions will highlight the lessons learned and key areas for improvement.*

**Keywords:** *mine closure, reclamation, rehabilitation, planning, gender equality, capacity building, reclamation goals and objectives, risk assessment, stakeholder engagement*

## 1 Introduction

The ‘Mongolia: Enhancing Resource Management through Institutional Transformation’ (MERIT) project is funded by Global Affairs Canada. MERIT partnered with the Mongolia Ministry of Mining and Heavy Industry (MMHI), the Ministry of Environment and Tourism (MET) and Erdenes Silver Resources LLC (ESR) to develop a mine closure plan for the Salkhit Silver mine, operated by ESR, a state-owned mining company.

The mine closure plan is intended to be a benchmark for the Mongolia mining industry, setting a clear expectation for future mine closure plan submissions.

Mongolia is strengthening governance of the mining and environmental sectors through updating and improvements to laws and regulations. A specific objective is to improve mine closure planning by standardising planning processes used in Mongolia and improving confidence that land disturbed by mining will have value to local communities after mine closure. Regulatory shortfalls include contradictions between the Law on Minerals and the Law on Environmental Impact Assessment regarding closure planning. Capacity issues include the need to improve skills and knowledge of professionals involved in mine closure planning, providing adequate company resources to meet the closure planning expectations and enhancing the capacity of stakeholders, especially local citizens, so they can meaningfully participate when engagement occurs. This is especially so for small- and medium-sized mining companies and national consulting firms. Challenges for both government and industry include confusion in understanding laws, lack of experience in closure planning, lack of experience conducting multi-stakeholder engagement processes and uncertainty about meeting stakeholder expectations, especially for socio-economic transition upon the closure of a mine. Funding for closure planning and mine reclamation is another challenge because realistic closure costs are seldom incorporated into mine feasibility studies or operating budgets.

The project goal is the development of a mine closure plan for the Salkhit mine, and capacity building and gender equality are key objectives of the project. Capacity building for government officials, company representatives, consultants and stakeholders involved in the project is designed to increase their ability, confidence and independence for conducting mine closure planning into the future. Gender equality is aligned to the MERIT goal of ‘...working with partners to ensure equitable access and benefit to project activities, resources and outcomes for women and men in Mongolia’ (MERIT 2016).

The Salkhit mine is in Gurvansaikhan soum of Dundgovi aimag, approximately 380 km south of Ulaanbaatar. The mine lease is 2,888 hectares. In 2021 the proven ore reserve estimate was 3.2 million tons, comprising silver and gold minerals. It is a medium-sized open pit mine with approximately 250 employees and average annual sales of over 150 billion MNT (approximately \$47.6 million USD) (Data Resource LLC 2021). The deposit was first mined in 2013 and taken over by ESR in July 2019. Current depth from the bottom of the open pit to surface is approximately 70 metres. Ore is removed from the open pit by an excavator and transported by truck to a concentrator. The ore is processed by flotation to produce concentrate, which is then exported to China for refining. The mine and facilities are supplied with electricity from the Gobi region’s electricity transmission network. Mine infrastructure includes a concentrator plant, tailings ponds, mine office, worker camps, explosives storage, maintenance shop, water wells, water treatment plant, water pipelines, electrical utilities and other ancillary facilities. A second concentrator plant is under construction with a planned start-up in July 2022. Constructed landforms include the open pit, waste rock dump and overburden dump. The mine has an operating life of 5 to 10 years considering proven reserves.

The Law of Mongolia on Environmental Impact Assessment requires a mine license holder to submit a mine closure plan at least three years prior to the project or activity closure. The MMHI desires to promote international best practice into the Salkhit mine closure plan, sensibly aligned to the Mongolian context. The closure plan will be the first to be created and submitted for approval under the regulation ‘Regarding the Approval of the Regulation on Rehabilitation and Closure of Mines and Concentration Plants (2019)’ (MMHI & MET 2019) and will set a standard for future mine closure planning in Mongolia.

This paper describes the activities and results of stage 1 of a two-stage project. Stage 1 included a regulatory review, mine site assessment report, development of mine closure goals and objectives and a risk assessment. Stage 2 will involve forming a multi-disciplinary planning team to write the mine closure plan. The methodology used to conduct the stage 1 mine closure planning activities are described, including approaches used for capacity building, gender equality and stakeholder engagement. Both government and company perspectives of the planning processes used are presented, including anticipated impact the results will have on influencing changes to laws and mining operations. Conclusions highlight the learnings from stage 1 of the project including improvements applicable in stage 2.

## 2 Methodology

MERIT managed the project from its office in Ulaanbaatar, Mongolia. Local MERIT staff organised and led stakeholder sessions and all government relations. International consulting firm CPP Environmental Corp. (Alberta, Canada) acted as international advisor, providing technical advice and project support. National consulting firm QMC LLC conducted specific technical tasks. Except for the international advisor, the MERIT project team comprised Mongolian citizens and consultancies. A web-based project management system was used to create, assign and track progress on tasks, including storage of and collaboration on all project documents and data. MERIT provided all translation services for meetings and documents either in-house or through local contractors. MERIT, MMHI, MET and ESR signed an agreement for the Salkhit mine closure planning project, defining the intent and outcomes, general roles and responsibilities and partner support by either direct investment or in-kind contributions. Stage 1 of the project commenced on 1 September 2021 and was completed on 30 April 2022. Stage 2 activities, not included in this paper, commenced on 15 June 2022.

Capacity building was conducted throughout all tasks and stakeholder engagement sessions. The purpose of capacity building was to establish a common understanding of mine closure among team members and stakeholders, to either improve their skills, increase their knowledge or enhance their understanding of closure planning. Capacity building techniques included providing one-on-one guidance, delivering informative presentations about mine closure, distributing information through newsletters and blogs, introducing international best practices, informing on national laws and regulations and observing mining practices through organised tours. Specific capacity building techniques were applied depending on individual, team member or stakeholder group needs. Question and answer opportunities with the international advisors were provided to task team members and stakeholders on a regular basis.

Methods used to conduct stage 1 project work are discussed by two categories, stakeholder engagement and stage 1 project tasks.

### 2.1 Stakeholder engagement

MERIT developed a stakeholder engagement plan that included a stakeholder map (Figure 1), used to determine stakeholder participation and to plan effective engagement methods. For example, key stakeholders, defined as categories 1 and 2, are those who have a high interest in mine closure because the project results will have a direct impact, either on them personally or upon the organisations and companies they represent. Within these two categories, key stakeholders in professional roles (in either government or industry), received targeted, pertinent information designed to inform, educate and assist them to better conduct their mine closure responsibilities related to their roles. Key stakeholders who are local citizens and herders received information about mine operations, the mine lifecycle and reclamation approaches, so they can better understand and subsequently provide input into mine closure planning. General stakeholders defined as categories 3 and 4, are those who have a medium to low interest in mine closure. Some general stakeholders may have high influence on project outcomes (category 3); however, they are not directly impacted by the Salkhit mine operations. General stakeholders were routinely provided information through media and other methods for their voluntary consumption. Stakeholders in all four categories were provided with contact information of a MERIT representative, whom they could contact for additional information or to provide feedback.

<b>1. HIGH INTEREST AND HIGH INFLUENCE</b> <i>Strategy: Manage closely</i>	<b>2. HIGH INTEREST AND MEDIUM TO LOW INFLUENCE</b> <i>Strategy: Exchange information</i>
<u>At Central Level</u> <ul style="list-style-type: none"> <li>• MMHI</li> <li>• MET</li> <li>• GASI</li> <li>• MRPAM</li> <li>• Erdenes Silver Resources LLC</li> </ul> <u>At Local Level</u> <ul style="list-style-type: none"> <li>• Dundgovi Aimag Governor’s Office</li> <li>• Aimag CRKH</li> <li>• Aimag Environmental Department</li> <li>• Aimag Specialized Inspection Department</li> </ul>	<u>At Central Level</u> <ul style="list-style-type: none"> <li>• Water Agency</li> <li>• Ministry of Forests</li> <li>• Environmental Research and Education Center (MET)</li> <li>• Association of Environmental Specialists</li> <li>• Other Professional Associations (EA, EIA, FS etc.)</li> </ul> <u>At Local Level</u> <ul style="list-style-type: none"> <li>• Soum Government</li> <li>• Elgen and Chuluut Bag Governors</li> <li>• Soum CRKH</li> <li>• Bag Citizens (Elgen and Chuluut)</li> <li>• Community Groups (Gurvansaikhan Association)</li> <li>• Ongi and Taats RBA</li> </ul>
<b>3. MEDIUM TO LOW INTEREST AND HIGH INFLUENCE</b> <i>Strategy: Anticipate and meet needs</i>	<b>4. LOW INTEREST AND MEDIUM TO LOW INFLUENCE</b> <i>Strategy: Monitor and keep contact</i>
<u>At Central Level</u> <ul style="list-style-type: none"> <li>• Ecological Police Department</li> <li>• EITI Board</li> <li>• MNMA</li> <li>• AMEP</li> <li>• UNDP/EPG</li> <li>• Sustainability East Asia, Mongolia</li> <li>• National NGOs</li> </ul> <u>At Local Level</u> <ul style="list-style-type: none"> <li>• Aimag Tax Office</li> <li>• Aimag level NGOs</li> <li>• Aimag Emergency Management Department</li> <li>• Aimag Labour and Social Welfare Department</li> <li>• Aimag Land Office</li> <li>• Aimag level media agencies</li> </ul>	<u>At Central Level</u> <ul style="list-style-type: none"> <li>• National Geological Agency</li> <li>• National Agency Meteorology and Environmental Monitoring (MET)</li> <li>• NEMA</li> <li>• Other metal mining entities</li> </ul> <u>At Local Level</u> <ul style="list-style-type: none"> <li>• Aimag Citizens</li> <li>• Other Soum Citizens</li> </ul>

**Figure 1 Stakeholder map used by MERIT to inform decisions on stakeholder engagement and participation**

Consultation guidelines (MERIT 2017) were used to make decisions on the design, monitoring and evaluation of engagement activities. The guidelines include considerations for gender equality and diversity to ensure a full range of cultural, social, and economic factors were represented in the stage 1 engagement plans.

All products produced for stakeholder engagement were distributed in both Mongolian and English. Documents were generally first developed in English and translated into Mongolian, but there were some exceptions, for example, presentations developed by ESR were in Mongolian and translated into English. All newsletters, blogs and publicly distributed information were in both languages. The reason for this is to inform a broad audience about the project. MERIT’s Facebook page has followers from many countries. Also, the project is funded by Global Affairs Canada, so publishing information in English enables transparency to the Canadian public on the work being undertaken and the results of the investment.

### 2.1.1 *Key stakeholders*

Key stakeholders included those defined in the stakeholder map (Figure 1) as category 1, high interest and high influence stakeholders and Category 2, high interest and low influence stakeholders. Engagement of key stakeholders was conducted by direct means, through information sessions and formal meetings. Monthly project update meetings were held from September 2021 to April 2022. At the monthly meetings, in addition to progress updates, presentations were made to build a common level of knowledge within the group on mine closure importance, planning processes used and the application of best practices. In the monthly meetings, emphasis was placed on explaining planning processes and having open discussion to share ideas, comments, and suggestions. To further key stakeholder understanding of the mining industry, a tour of the Oyu Tolgoi (OT) Mine in Mongolia was organised for key stakeholders to observe the operating practices, safety practices, environmental management procedures and closure planning processes of a large international operator. In addition, formal meetings were held with individuals of influence to provide detailed information, advice, and suggestions related to their position and job responsibilities. For example, MERIT organised one-on-one meetings with the MMHI Minister, Deputy Minister and Ministry Directors to provide suggestions for updates to the Mongolian Law on Minerals. All stakeholder engagement included components of capacity building in support of a broad MERIT objective to influence change and improve responsible resource development in Mongolia. Project capacity building objectives were achieved through providing professionals and government leaders with examples of mine closure laws and practices from other mature resource extraction jurisdictions, suggesting methods for implementation of new laws, providing examples of mine closure outcomes achieved in other countries, touring mine sites and by providing reference resources.

### 2.1.2 *General stakeholders*

General stakeholders included those defined in the stakeholder map (Figure 1) as category 3, medium interest and high influence stakeholders and category 4, low interest and low influence stakeholders. Engagement for general stakeholders was conducted using three main methods. The first method was the monthly publication of a newsletter which provided project progress updates and technical information, explained project activities, and provided technical and policy briefs on broad topics relevant to the project, such as climate change. Newsletters explained in layperson terms the processes used to conduct closure planning work, the importance of the work, and the results of each task. The second method was television interviews of MERIT team members and project sponsors (MMHI and ESR) for broadcast on a national news channel. The team member interviews were conducted at the Salkhit mine site, during a stakeholder engagement session, by a national news station. The third method was the use of the MERIT Knowledge Portal (<http://portal.merit.mn/>), and blog (<https://www.facebook.com/MERIT.mn>), which were used to inform the public of stakeholder sessions, including the purpose of each session and the project activities and outcomes the session covered. The blog is used for all MERIT projects and allows stakeholders to access information at their leisure, become more knowledgeable of MERIT projects, including mine closure, and be informed of available reference documents. Contact information is provided for those seeking additional information.

## 2.2 **Project tasks**

Stage 1 of the Salkhit mine closure planning included four tasks, being regulatory review, environmental site report, mine closure goals and objectives development, and risk assessment.

In addition to technical work, methods used to conduct each task included capacity building and gender equality approaches. Capacity building was critical to fulfil project objectives of improving abilities of local professionals to conduct mine closure planning independently and to introduce best practices that enhance the responsible development of resource extraction in Mongolia. Methods focused on education of team members in technical approaches, introduction of relevant international best practices, and application of formal work processes to improve efficiency. In all tasks, capacity building was critical to bring team members to a common level of understanding; without it, they could not effectively contribute to the work. Gender

equality was implemented by applying key gender considerations described in the consultation guidelines (MERIT 2017) into the design and implementation of all task work.

Table 1 summarises the team member roles that were common to each of the four tasks. Specific methods for each of the four stage 1 tasks are discussed in the following sections.

**Table 1 Summary of primary task team member roles applicable to all stage 1 mine closure planning tasks**

Task team member	Primary role
MERIT	Contract administration, project management, gender equality approaches, communications, translation of documents and for meetings, project documentation, issue management, stakeholder relations, government relations, community relations
International advisor	Manage technical work, conduct technical work, lead capacity building sessions, introduce international best practices, provide international mine closure examples, technical review of all products, strategic support to MERIT
National consultant	Conduct assigned technical work, apply local knowledge and practices, report writing, assist MERIT with local government and industry relationships
Erdenes Silver Resources	Review draft products, provide feedback, provide site specific information, provide mine data, acceptance/approval of final products

### 2.2.1 Regulatory review

The regulatory review task team was led by the international advisor. The task was contracted to a national mining consultancy, who assigned a senior mine engineer and a junior environmental technician to conduct the work. MERIT provided a team member with knowledge of Mongolian environmental laws and standards to assist the team. ESR technical staff and management participated in the team meetings and reviewed final documents for their acceptance.

The desired outcomes of the regulatory review were twofold. First, to develop an understanding of the Mongolian mine closure regulatory requirements, and second to develop a concordance table for the Salkhit mine closure plan, based on applicable laws and regulation. The concordance table provides a comprehensive list of all regulatory requirements applicable to mine closure planning at a national, regional and local level. It will be used to demonstrate to the regulator, upon submission of the plan for approval, that all statutory requirements have been met.

Bi-weekly task team meetings were scheduled with the national consultant to track progress, manage the task, conduct capacity building and provide feedback. MERIT researched applicable laws, regulations, standards, and regional and local land use plans applicable to the Salkhit mine closure plan. The international advisor provided examples of concordance tables used in Canada and Australia to MERIT and the national consultant, to illustrate content and demonstrate how concordance tables are used. It was explained that concordance tables are fundamental in guiding the application or plan content development, from engineering, technical, scientific, and socio-economic and stakeholder engagement standpoints. Three benefits of using a concordance table were explained:

1. Provides a framework for the mine license holder to organise the closure plan content (i.e. a table of contents can be designed considering the regulatory requirements in the concordance table).
2. Allows the mine license holder to check the closure plan for completeness prior to submission of the plan for approval.
3. Assists the regulator in reviewing completeness of the closure plan submitted for approval.

The national advisor was tasked to develop the concordance table based on Mongolian laws, regulations, policies and standards. MERIT and the international advisor reviewed the draft and final products. The final concordance table was presented to ESR and the key stakeholder group by the national advisor.

### **2.2.2 Environmental site condition report**

The environmental site condition report task team was led by the international advisor. The task was contracted to a national mining consultancy, who assigned a senior mine engineer and a junior environmental technician to conduct the work. MERIT provided a team member with knowledge of Mongolian environmental laws to assist the team. ESR environmental technicians and managers participated in the team meetings and reviewed final documents for their acceptance.

The environmental site condition report is meant to document the existing environmental baseline data, annual monitoring data and current site conditions of the Salkhit Mine in one comprehensive report. The task included developing spreadsheets of environmental baseline and annual monitoring data for soils, vegetation, surface water, groundwater, air and tailings. The report provided a snapshot of the environmental conditions, infrastructure, available reclamation materials and surface disturbance of the mine as of November 2021. Data gaps were identified with the intention that they would be filled, where possible, through additional sampling and analysis in stage 2 of the closure planning project. The purpose of the environmental site condition report is to provide the mine closure planning team with sufficient information of the current mine conditions to develop the Salkhit mine closure plan in stage 2 of the project. The report was also used to inform the stage 1 risk assessment task.

This task commenced with the international advisor acquiring satellite imagery and LIDAR for the mine lease for mapping purposes. The MERIT environmental team member assisted the national consultant to obtain available environmental baseline information, annual monitoring data and reports related to the Salkhit Mine. ESR worked closely with MERIT and the national consultant to provide available data. The national consultant reviewed all collected information and copied and organised baseline and annual monitoring data into an MS Excel™ spreadsheet. The national consultant and international advisor met frequently to analyse and discuss the quality of the existing data. The international advisor provided all mapping services required to portray site conditions spatially. The national consultant wrote the environmental site condition report and prepared the data spreadsheet. MERIT and the international advisor reviewed the draft and final versions of the report, providing feedback on report content, report structure, data gaps and recommendations. The international advisor conducted a final quality control and quality assurance review of the report prior to its submission to ESR for their acceptance. The national consultant presented the report to ESR and the key stakeholder group.

### **2.2.3 Mine closure goals and objectives development**

The mine closure goals and objectives task team was led by the international advisor, who also conducted all capacity building initiatives associated with this task. The national contractor assigned a senior mine engineer to support the work. MERIT and the national contractor co-facilitated the goal and objective discussions. The national consultant also assisted MERIT in government and industry relations. MERIT provided three team members, one with knowledge of Mongolian environmental laws, one specialising in stakeholder engagement and a member responsible for coordinating local government and community level engagement in Gundovi aimag (the province in which the mine is located). MERIT scheduled and performed all logistics for the working sessions. ESR technical staff, community relations representatives and management participated in the team meetings and all working group sessions. ESR was responsible for reviewing the goals and objectives recommended by the working group for acceptance.

The mine closure goals and objectives development was conducted through engagement with a large, multi-representative working group of over 30 members. The group comprised of federal, provincial (aimag) and district level (soum) government representatives, representatives from the General Agency of Special Inspections (GASI), representatives from ESR, local citizen representatives and local herders. The purpose of

the stakeholder group was to develop closure goals and objectives for recommendation to ESR to accept and include in the mine closure plan.

Eight working sessions were conducted, incorporating an educational focus in early sessions and facilitation of the work and group decisions in the latter sessions. A key early step was to inform and educate the working group members on the mining activities, operating processes, facilities and infrastructure at the Salkhit mine, because few of the members had been onsite. A tour of the Salkhit mine site was incorporated into the task so members could observe site conditions and operations in person, prior to providing their final advice. Education of the stakeholder group to bring all members to a common level of understanding was considered critical to enable meaningful discussions.

The importance, purpose and use of goals and objectives for mine closure planning was emphasised throughout the task. Decision criteria was developed for assessment and selection of the final goals and objectives for the Salkhit mine. Below is a summary of the eight-session work plan for mine closure goal and objective development. The working group was directly involved in the first six sessions.

- Session 1** Introduced the working group members. Explained the mine closure planning process and purpose, including the development and use of goals and objectives in closure planning. Provided information on the current mine status, future operations and potential for progressive reclamation.
- Session 2** Started developing goals. Provided examples of closure goals from other mines (internationally). Facilitated a brainstorm session and generated ideas. Ensured all participants understood the importance of goal setting and use of goals in closure planning.
- Session 3** Facilitated decision processes to narrow down goals. Too many goals add complexity and may be contradictory. Discussed and considered the pros and cons of shortlisted goals. Introduced assessment criteria for goal selection. Implemented goal assessment process by the working group.
- Session 4** Presented results of the goal assessment process. Facilitated decision process towards a final suite of goals. Obtained majority support from working group on the recommended goals (final acceptance of closure goals resides with ESR).
- Session 5** The international advisor developed and presented draft reclamation objectives to the working group and explained the meaning and purpose of the objectives, including how they will be used to guide both closure planning and reclamation monitoring. Introduced criteria for assessing objectives. Implemented objectives assessment process by the working group.
- Session 6** Toured the Salkhit mine site and concentration plant. Presented the results of the objectives assessment process. With consideration of the objective assessment results, discussed and fine-tuned the closure objectives with the working group. Facilitated a decision from the working group on the final closure goals and objectives to recommend to ESR.
- Session 7** The MERIT team presented the recommended goals and objectives to the key stakeholders and obtained feedback.
- Session 8** The MERIT team presented, explained and recommended the closure goals and objectives to ESR senior and executive management for their consideration and approval.

#### **2.2.4 Risk assessment**

The risk assessment task team was led by the international advisor. A contracted national mining consultancy provided a senior mining engineer and socio-economic specialists to input into the identification of risks. MERIT provided a team member with an environmental background to assist with communications, logistics and facilitation of the working sessions. ESR technical staff and management participated in the working sessions, inputted into risk identification, and assessed risks. ESR executive managers were responsible for acceptance of the risk assessment final report.

The risk assessment identified and assessed inherent risks that can impact the achievement of the closure goals and objectives. Inherent risks are those that are assessed prior to the application of risk controls. The risks were assessed using consequence and likelihood criteria to obtain a risk score. Five risk types were scored for each risk statement: public health and safety, environmental, operational, reputational and financial/legal. The outputs of the risk assessment will be used by closure planners in stage 2 of the project to develop controls to manage the risks, thereby mitigating the risks and improving the probabilities of achieving the reclamation objectives and goals.

The international advisor developed the risk assessment criteria, risk matrix, scoring template and risk statements prior to holding work sessions with ESR. The methods used to design and conduct the risk assessment closely followed Tool 8 risk/opportunity assessment and management (ICMM 2019), with consideration of ISO13000 risk management guidelines (ISO 2018), Australia mine closure planning guidelines (Department of Mines and Petroleum 2015) and the professional experience of the international advisor on oil sands and coal mines in Alberta, Canada. The national consultant defined socio-economic risk vulnerabilities to support the risk identification process.

In addition to the Environmental Site Condition Report, described in Section 2.2.2, internal reports provided by ESR (written in Cyrillic script and not translated) were reviewed by ESR to understand areas of vulnerability and previously identified risks. Examples of these internal reports included the *Environmental Baseline Report (2016)*, *Environmental Impact Assessment Report (2020)* and the *Geotechnical Risk Assessment of Pit Walls (2021)*.

The international advisor defined ten vulnerability categories: geotechnical stability, soil, groundwater, surface water, tailings, public safety, resources, climate change, socio-economic and post-closure. Risks were identified within each category and risk statements developed. ESR management and technical team members were provided the opportunity to review and amend the risk statements, add risks, or delete risks that did not apply to the mine.

Stakeholder engagement was not conducted for the risk assessment. However, many concerns about mine closure risks were brought forward by stakeholders during the mine closure goals and objectives engagement and these were documented and incorporated into the assessment.

MERIT and the international advisor worked with the ESR team in two sessions to conduct the risk assessment. The first work session was held over half a day at the ESR head office. During this session, key managers and specialists were provided an overview of the risk assessment tools, process and risk statements.

The second work session was held over 2.5 days at the Salkhit mine site, involving MERIT representatives, the international advisor, and ESR mine managers and technical team members responsible for conducting the risk assessment. The ESR team had previous experience conducting risk assessments for occupational health and safety purposes; however, this was the first time formally assessing mine closure risks. The first three hours of the work session involved education of the ESR team on why risk assessment for mine closure is important, how risks are identified, explanation of the scoring criteria and risk matrix, and instruction on use of the risk scoring template. To conduct the assessment, the team divided into two groups: a mine engineering group and an environmental group. The mine engineers assessed risks associated with geotechnical stability and those requiring professional engineering assessment. The environmental group assessed risks associated with soils, water, contamination, vegetation establishment, and climate change. The public safety and socio-economic risks were assessed by the entire group. After the risks were scored, the international advisor summarised the results by total risk score.

On the final day of the second work session, the entire ESR team reviewed the results of the risk assessment, which were listed highest to lowest by total risk score. The team determined 10 of the risks needed to be reassessed, as they felt the total risk scores were either too high or too low and the scores were adjusted. Consensus on the assessment results was attained at the end of the work session.

Two final steps were taken to close the risk assessment task. First, MERIT and the international advisor presented the results of the risk assessment to the ESR board of directors and to senior and executive

managers for their review and acceptance. Secondly, upon agreement by the ESR executive, MERIT presented the summary risk assessment results to the key stakeholders.

### 3 Results

This section reports the outcomes of the stakeholder engagement and task work described in Section 2. The results from stakeholder engagement are discussed first, followed by discussion of the results for each of the four stage 1 project tasks. Stakeholder engagement for this project exceeded the current standard practice in Mongolia. Feedback from stakeholders suggested the effort applied to stakeholder engagement resulted in a strong understanding and buy-in towards the stage 1 project results.

#### 3.1 Stakeholders

Results differ between the key stakeholder and general stakeholder groups. Each are discussed separately in the following sections.

##### 3.1.1 Key stakeholders

Monthly project update meetings were held between September 2021 and April 2022 with key stakeholders, totalling eight meetings. At each meeting key stakeholders were informed on the progress, completed tasks and next steps of the project. Capacity building was an important aspect of preparing key stakeholders to meaningfully contribute to the closure discussions. The following is a summary of the capacity building activities that were conducted within key stakeholder meetings.

**Introduction to mine closure:** Presented roles and responsibilities in the planning process, mine closure and reclamation basics, benefits of mine closure planning and mine closure and reclamation definitions. Purpose was to educate key stakeholders on mine closure process, why closure planning is important and expectations of their participation.

**Concordance table:** Presented results of the regulatory review, purpose and benefits of the concordance table. Provided examples of concordance tables. Purpose was to educate key stakeholders on the legal requirements of mine closure.

**Canadian reclamation context:** Provided information about the mine closure processes used in Canada, including financial security programmes. Purpose was to provide key stakeholders examples of best practices and reclamation results.

**Closure goals and objectives:** Presented the importance of goals and objectives to guide mine closure planning. Concepts of socio-economic transition after mine closure were introduced. Purpose was to educate key stakeholders about closure goals and objectives.

**Salkhit mine operations:** ESR presented a description of the mining operations and processing occurring at the mine site. The purpose was to inform key stakeholders of ongoing mining activities.

**Environmental site conditions:** The national consultant presented the findings of the desktop environmental review of the mine site. The purpose was to educate key stakeholders on how knowledge of existing site conditions is important for closure planners to design reclamation activities.

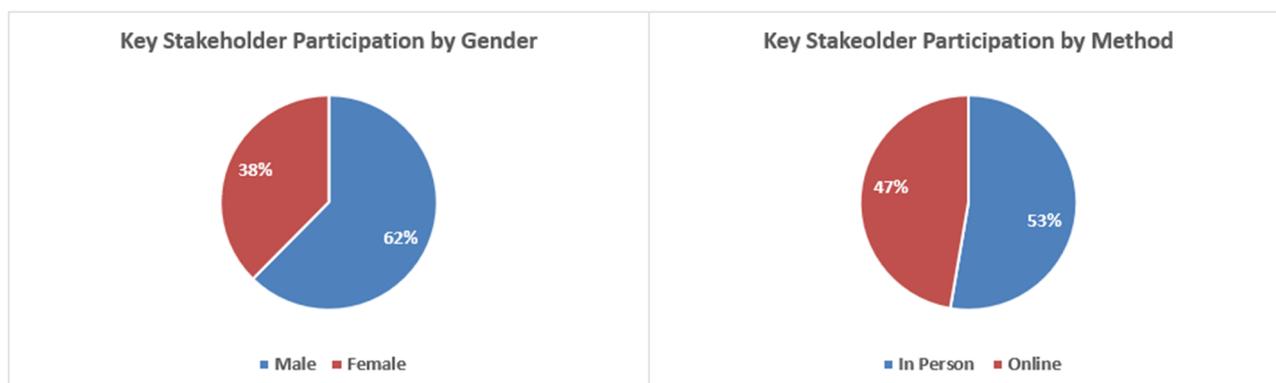
**Risk assessment results:** The international advisor presented summary results of the inherent risk assessment. The purpose was to educate the key stakeholders about the closure risk assessment process, why identifying and assessing risks associated with achieving mine closure goals and objectives is important, and the priority risks for the mine that can impact achievement of the closure goals or objectives.

**Oyu Tolgoi (OT) mine study tour:** MERIT organised a two-day study tour of the OT mine for invited key stakeholders. The tour included presentations by mine representatives of a wide range of information on environmental management, water management, land use, mine closure, reclamation, process safety and occupational health & safety. The purpose of the mine tour was for key stakeholders to learn about mine operations, collaborate in discussion of issues, learn about environmental monitoring and understand the

mine closure process used by the OT mine. A secondary purpose was to improve cooperation between government and mining industry representatives. Many of the key stakeholders were either government officials or representatives of state-owned industry.

Separate from the key stakeholder meetings, MERIT met with the MMHI Minister to provide advice on enhancements to the law on minerals for strengthening mine closure and financial security requirements. MERIT suggested processes the ministry could follow (APEC 2018) to define policy needs and discussed a benchmark reference (IISD 2021) that can be used to determine how the Mongolian mine closure policy framework compares to other nations with mining industries.

Key stakeholder participation, both by gender and method of engagement, was tracked by MERIT. Figure 2 provides a summary of engagement by percent for both indicators. MERIT took all reasonable effort to include females in the key stakeholder engagement, despite the dominance of male employment in the mining industry. The COVID-19 pandemic was occurring at the start of the project in September 2021. Throughout the project, participants were provided options to attend engagement sessions either in person or online, aligned to government pandemic restrictions. By mid-February 2022, the Mongolian government relaxed pandemic restrictions related to public gatherings. The easing of pandemic restrictions resulted in higher in-person attendance near the end of the project on 30 April 2022. This likely explains in-person participation being higher than online participation during stage 1 of the project, contradictory to what one may expect during a pandemic.



**Figure 2 Key stakeholder participation by percent for both gender and method of participation**

### 3.1.2 General stakeholders

Seven monthly newsletters were published from October 2021 to April 2022. The newsletters were published both in Mongolian and English and distributed both in hard copy and electronically. The newsletter content and targeted distribution was designed to inform and educate a broad range of stakeholders, including the public; on mine closure planning, what it involves, and why it is important. Newsletter distribution statistics show that the emailed newsletters (Mongolian and English combined) were opened 1,233 times. The newsletters were also posted on the MERIT Facebook™ page, which has 5,403 followers. Photos and information from engagement sessions and key meetings were posted on the MERIT Facebook page. Information included, topics discussed, and results achieved.

The media interviews for broadcast on a national news channel were conducted onsite at the Salkhit mine. The interviews provided information about the MERIT project, mine closure planning in the broader sense, the benefits of closure planning, the legal requirements for closure planning, and the critical importance of local citizen and community input into closure planning. The interviews included information on the capacity building aspect of the project and how the capacity building was designed to benefit government officials, industry employees, contractors, and local citizens.

## 3.2 Tasks

Results for each of the four stage 1 project tasks described in Section 2.2 are discussed separately in the following sections.

### 3.2.1 *Regulatory review*

The regulatory review resulted in development of a concordance table, listing all regulatory requirements of the Salkhit closure plan. The concordance table will be populated in stage 2 of the project, where the section number and page of the closure plan will be documented for each requirement. Completion of the table will provide assurance to ESR that the plan is complete and meets all regulatory requirements prior to its submission to the government for approval.

Inconsistencies were identified between laws guiding mine closure. There are legal contradictions and gaps between the Minerals Law and the Law on Environmental Impact Assessment regarding deadlines for developing and submitting a mine closure plan to authorities. Also, detailed statutory and regulatory requirements on closure management are not reflected in other relevant laws. These inconsistencies and gaps impact both mining the mining companies and the regulators by causing conflicts in their interpretation and application of the laws.

Capacity building activities for the regulatory review were effective in enhancing the knowledge and understanding of the local consultant and government representatives on the value of a concordance table. This included aligning the closure plan content and outline to regulatory requirements, use of the table as a quality assurance tool to assess completeness and explaining how the table can benefit the regulator in their review of the closure plan for determining compliance.

The national consultant presented the concordance table product to both ESR and the key stakeholders upon completion of the task.

### 3.2.2 *Environmental site condition report*

An environmental summary site condition report for the Salkhit was compiled by the national consultant. A comprehensive workbook of all baseline and environmental monitoring data was produced as an addendum to the report. The site condition report and monitoring data will be available to the closure planning team in stage 2 of the project, for use in developing closure activities and reclamation strategies.

Capacity building activities for the environmental site condition report were extensive. The national consultant assigned to the task was a junior level environmental technician. Extensive one-on-one explanations and guidance were provided by the international advisor to enhance the capability of the national technician assigned to complete the task. The capacity building efforts were successful in enhancing the technician's skill, abilities and knowledge, especially in the organisation, documentation and presentation of environmental monitoring data.

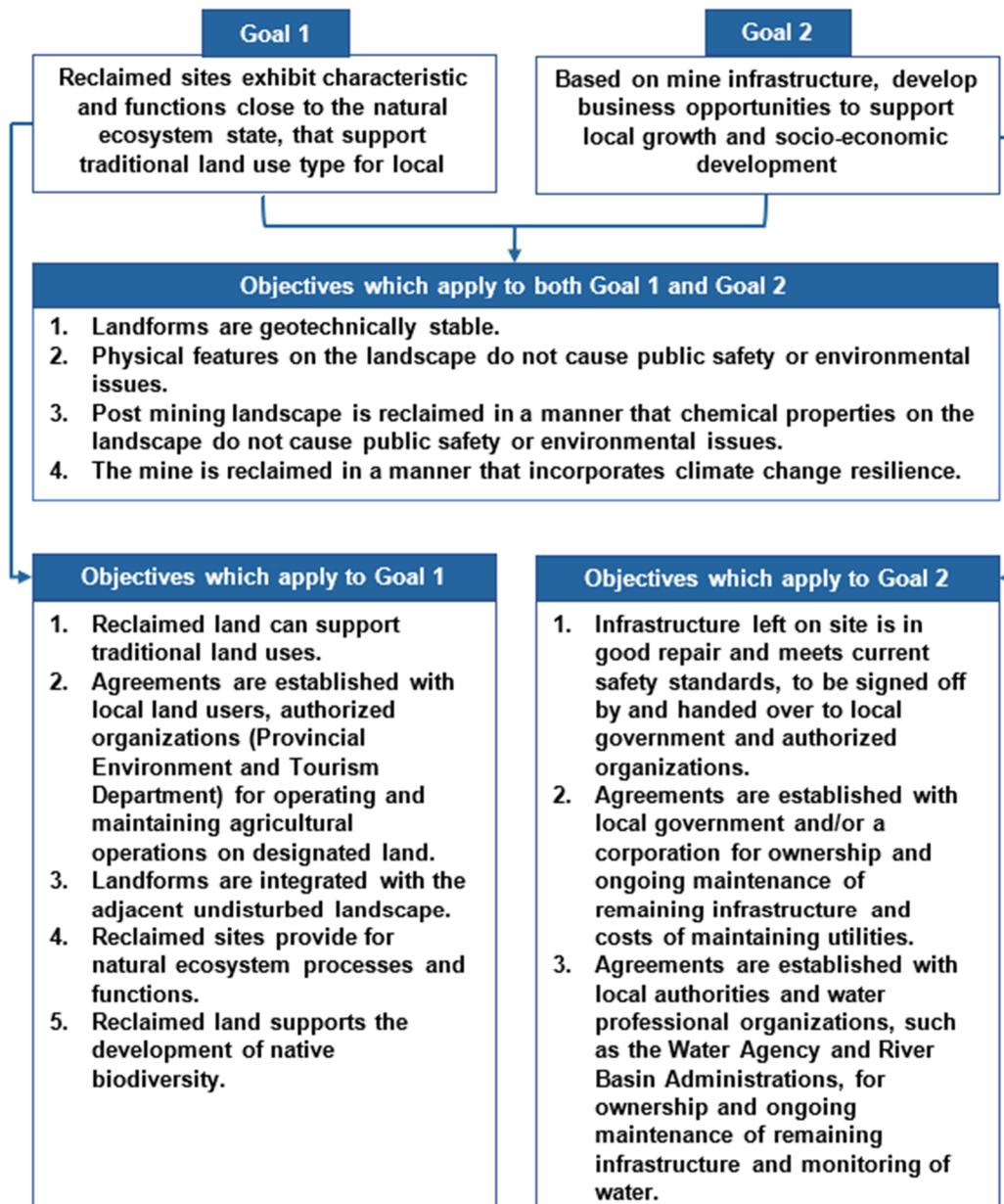
The national consultant presented the site condition report to ESR and the key stakeholders upon completion of the task.

### 3.2.3 *Goals and objectives*

The goals and objectives working group reached consensus on two goals and 12 objectives. Figure 3 presents the two closure goals and associated objectives; four objectives apply to both goals, five objectives are specific to goal 1 and three objectives are specific to goal 2.

Early in the process, ESR prepared and delivered a presentation to the working group, providing a history of the company and the economic and social benefits the Salkhit mine has contributed to Mongolians. ESR described the open pit mine, processing plant and tailings pond. Current environmental monitoring, mine infrastructure, existing mine closure planning and environmental management plans were also presented. This information was meant to establish a context and common understand of the working group prior to discussions about closure goals and objectives.

The capacity building activities for the goals and objectives working group were highly effective. Most importantly, was the realisation by members of the group, of the importance of stakeholder engagement in the closure planning process. The group generally agreed the information provided to them, the level of engagement conducted, and the planning processes used, all contributed to a higher level of understanding about how goals and objectives are used in planning. Comments from group members indicated that the capacity building activities, facilitation and processes used all contributed to a strong buy-in and shared vision of the closure goals and objectives.



**Figure 3 Final Salkhit mine closure goals and objectives, developed by and with consensus of the goals and objectives working group (source Noble-Pattison & Poscente 2022)**

Participation in the goals and objectives working group, both by gender and method of engagement, was tracked by MERIT. Figure 4 provides a summary of engagement by percent for both indicators. Gender participation and impacts of COVID-19 restrictions are explained in section 3.1.1. In person participation in the task was high because the goals and objectives task commenced in late January 2022 and COVID-19 restrictions were relaxed by the government in mid-February 2022. Working group members preferred to

meet in person to conduct the work; however, a two-day meeting and tour of the Salkhit mine as part of the goals and objectives task contributed to higher in person attendance.



**Figure 4 Goal and objective working group participation by percentage for both gender and method of participation**

The international consultant presented the final goals and objectives to ESR and the key stakeholders upon completion of the task. ESR management accepted the goals and objectives for the closure plan.

**3.2.4 Risk assessment**

During the risk assessment, ten categories of vulnerability were defined, each having potential impact on achievement of the closure goals and objectives. A total of 79 risk statements were identified across these categories. Table 2 provides a summary of the number of risks identified for each category.

**Table 2 Risk vulnerability categories and number of risk statements defined for each**

Risk category no.	Vulnerability description	Number of risks
1	Geotechnical stability	24
2	Soil	6
3	Groundwater	2
4	Surface water	4
5	Tailings	4
6	Public safety	6
7	Resources	6
8	Climate change	6
9	Socio-economic	8
10	Post-closure	13

The risk assessment identified inherent risks (i.e. risks prior to the application of risk controls). Of the 65 inherent risks identified in categories 1 to 9, no risks were rated as extreme, nine risks rated as high, 15 risks rated as moderate, 22 risks as low and 19 risks were either insignificant or determined not to be applicable. The top risks in the high and moderate ratings are associated with geotechnical stability, tailings management, contamination of soil and water, and reclamation materials balance. The post-closure risks (category 10) are latent risks and were not assessed at this time. Latent risks are those risks that may occur well after relinquishment of the mine. Category 10 risks will be assessed in stage 2 of the project based on the mine closure strategies proposed in the mine closure plan.

The international advisor worked in person with the ESR technical team throughout the process. Capacity building activities associated with risk assessment proved to be valuable for the ESR technical team. This was the first time they conducted an in-house risk assessment process on the Salkhit mine. ESR technical team member and manager feedback confirmed they benefitted by learning the risk assessment process, especially from the internal discussions and debates they had while assessing the risks.

The MERIT team presented a summary of the risk process and results to the ESR Board of Directors. ESR decided upon the appropriate level of detail for disclosure of the risk assessment to key stakeholders. The importance of transparency and sharing a summary of risks to inform the stakeholders was emphasised, balanced with information that is strictly of internal concern of the company. MERIT and ESR presented a summary of the risk assessment results to key stakeholders. ESR executive specifically spoke to the benefits of doing the risk assessment and how it aligned to their strategic plans and budget decisions.

## 4 Conclusion

Capacity issues are clearly an area that needs to be addressed if Mongolia is to enhance the quality and effectiveness of mine closure planning from that which is presently conducted in the country. The top three capacity issues are: improving skills and knowledge of professionals involved in mine closure planning, companies providing adequate resources to meet the closure planning expectations, and enhancing the capacity of stakeholders, especially local citizens, so they can meaningfully participate when engagement occurs. Increasing capacity will take time, effort and resources from both government and the mining industry.

The regulatory review identified gaps and weaknesses in the Mongolian mine closure regulatory framework. Legal contradictions occur between the Law on Minerals and the Law on Environmental Impact Assessment, both of which have mine closure planning requirements. Where there is a legal requirement, process or guidelines for implementation are often lacking, leaving the law open for interpretation. This causes confusion, not only for compliance by the mining industry, but for enforcement by the regulator. Providing direction and setting clear expectations for implementation of regulatory requirements needs to be considered by government when implementing laws.

Stakeholder engagement conducted in stage 1 was extensive and was unprecedented for mine closure planning in Mongolia. There will likely be concern by the mining industry that such levels of stakeholder engagement are beyond their capabilities, from both resourcing and capacity perspectives. Current laws require stakeholder engagement; direction and guidelines for implementation are lacking. A clear finding of this project is that the investment and effort applied to stakeholder engagement contributed to government, company and stakeholder buy-in of the project results and products. In the opinion of the authors, the effort and investment in stakeholder engagement can save money in the long run. Understanding stakeholder concerns and addressing the concerns early in the planning process can avoid potentially costly escalation of issues. Building strong relationships with impacted stakeholders early in the process, being transparent and seeking stakeholder input into solutions, are important contributors to success.

Gender equality by stakeholders and within working groups was not equally split, being male dominant. The results likely reflect the effort MERIT applied to seek female participation. To improve equality of participation in stage 2 of the project, additional effort will be taken, especially at the local and community levels, to ensure equality in opportunity for input into the planning process.

The participatory and collaborative decision-making processes used in stage 1 proved to be effective, particularly in terms of establishing a shared vision for post-mining land use. Facilitated sessions, application of sound engagement processes and extensive capacity building efforts contributed to this success. The Salkhit mine closure plan will set a standard for the Mongolian mining industry. The processes undertaken in stage 1 identified positive actions to carry forward to stage 2 and identified weaknesses for both the mining industry and the Mongolian government to address.

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