KUMTOR
КУМТОР

centerra GOLD

ENVIRONMENT AND SUSTAINABILITY REPORT **2017**

ABOUT KUMTOR MINE

Kumtor Mine is the largest western-operated gold mine in Central Asia and has been operating since 1997, having produced approximately 11.5 million ounces of gold by the end of 2017. Kumtor Gold Company CJSC (KGC or the Company) is the concession holder for the Kumtor deposit.

The Kumtor open pit mine is located approximately 350 kilometers southeast of the capital Bishkek and 60 kilometers north of the border with the People's Republic of China. It is at an altitude of 4,000 meters above sea level in a partially glaciated permafrost zone in the Central Tien Shan Mountains. 2017 marked the twenty first year of the Kumtor Mine operation in the Kyrgyz Republic, and the fourteenth year under the parent company Centerra Gold Inc. (Centerra). The current life of the Kumtor Mine is until 2026.

About Centerra

Centerra is the parent company, which owns 100% of KGC. Centerra is a publicly listed, Canadian-based gold mining company engaged in operating, developing, acquiring, and exploring gold properties in North America, Asia and other emerging markets worldwide. The Company is the largest Western-based gold producer in Central Asia.

Centerra has two flagship assets, the Kumtor gold mine in the Kyrgyz Republic and the Mount Milligan gold-copper mine in British Columbia, Canada. Centerra also owns four late-stage development properties; its 100% owned Öksüt Gold Project in Turkey, the Kemess Project in British Columbia, Canada, which includes the Kemess Underground and the Kemess East gold-copper projects, the Gatsuurt Gold Project in Mongolia, and a 50% interest in the Greenstone Gold Property which includes the Hardrock Gold Project in northwestern Ontario, Canada. Centerra owns Thompson Creek Metals since 2016 and a well-established, fully integrated Molybdenum Business consisting of an operating metallurgical processing facility and two primary molybdenum mines, which are currently on care and maintenance. The Company also has active exploration joint ventures and exploration properties in Armenia, Canada, Mexico, Nicaragua, Sweden and Turkey.

"Kyrgyzaltyn" Open Joint Stock Company, a state owned entity, is Centerra's largest shareholder, owning 77,401,766 common shares, representing 26.53% of Centerra's outstanding common shares. Additional information on Centerra is available at SEDAR (**www.sedar.com**) and on the Company website (**www.centerragold.com**).

About this Report

This document is the Kumtor Annual Environment and Sustainability Report (AESR or Report) for the 2017 financial year (ending December 31, 2017). This report is focused on the Kumtor Mine in the Kyrgyz Republic. Performance data include only Kumtor's own operations, unless noted otherwise, although the policies of Centerra and Kumtor apply to both employees and contractors. Financial metrics are reported in US dollars (USD) unless otherwise stated. This report has been prepared in accordance with GRI Standards: Core option. For each specific sector various indicators set in GRI's Mining and Metals Sector Supplement (see **www.globalreporting.org**). are disclosed. KGC has been reporting under GRI G3 standards from 2012 and switched to GRI G4 reporting standards from 2015. The previous report of the Company was based on 2016 financial year and was published in September 2017 and is also available on our corporate website.

This is in addition to addressing the key reporting requirements contained in Kumtor's Environmental Management Action Plan. In determining the scope, content, and boundaries of this report, we considered an important evaluation process described in the Governance Section of this report. Pay attention to our "Cautionary Note Regarding the Forward-Looking Statement" on the inside back cover. This report will also be available in the Russian and Kyrgyz languages. As we continue to further improve our systems and approaches, we welcome your comments and suggestions on how we can further improve our annual environmental and social reporting and practices. You can find contact details on the back cover of this report.

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MESSAGE FROM THE PRESIDENT

The progress we have achieved as well as the challenges we faced in 2017 are described in this report. We have signed the Strategic Agreement with the Kyrgyz Republic Government, exceeded our forecasted operating performance, and introduced a new enterprise management system.

The Company successfully implemented the planned build-up of the tailings dam, and completed the mine site clearing for the purpose of recycling the stored materials. Safety remains our top priority, and in 2017 all employees and contractors were trained on the Work Safe | Home Safe (WSHS) new leadership program. The program is aimed at promoting leadership, transfer of skills to change behaviour and increasing commitment to change.

Contribution to the Country Economy

KGC remains an enterprise that makes a significant contribution to the economy of the Kyrgyz Republic. In 2017, our production activity accounted for 21.1% of aggregate industrial output and 9.7% of GDP. Payments in the Kyrgyz Republic in 2017 amounted to $269 million, with aggregate payments since 1994 totalling $3.4 billion. KGC is the largest taxpayer and largest employer in the private sector of the Kyrgyz Republic. As at the end of 2017, the Company employed 3,485 Kyrgyz

> KGC remains an enterprise that makes a significant contribution to the economy of the Kyrgyz Republic

citizens, or 97% of the total number of the full-time workforce. In 2017, we continued to reduce the number of expatriate employees, attracting more and more local professionals, including in the top management of the Company. Payments made in the Kyrgyz Republic in 2017 amounted to more than $117 million in the form of wages and benefits to employees and contractors. By 2017, results the Company was recognized as the best employer of the year and received a prize from the US Chamber of Commerce in the Kyrgyz Republic.

Increasing Local Procurement

We believe that a strategic approach to procurement in the local market will not only benefit our Company, but also contribute to the development of local communities by creating jobs and developing the economy of the Issyk-Kul region. We continue to promote and support local business and in 2017 our Company spent about $ 60 million on local procurement.

Interaction with Stakeholders

The Kumtor Ambassadors program, launched in 2015, continues to involve employees and contractors in social projects implemented in the Issyk-Kul region and in other regions of the country. We have volunteered more than 4,000 hours to social work and participated in more than 30 charitable and mentoring events.

The Company management on a regular basis conducts a constructive dialogue with representatives of local communities, in the person of the public and youth leaders, local authorities and representatives of small business. At regular meetings, the Company reports on plans, listens to requests and makes decisions. The Company constantly increases cooperation with all interested parties.

Investing in Communities

In this report, we describe some of the activities that we voluntarily initiated, and their results. Moreover, since 2009 the KGC deducts 1% of gross revenue to the Issyk-Kul Development Fund. In 2017 our contribution to the Fund was $6.4 million, making a total of $60 million contributed since 2009. In June 2016, all the social investment payments were suspended due to an interim order of the Inter-District Court of Bishkek, which banned KGC from transferring any of its assets. Until October 2017, when the court order was released the Company was unable to finance development projects because of the decision of the inter-district court to prohibit the transfer of assets to third parties.

Geotechnical Safety

The Kumtor mine ore body and related infrastructure are located under the moving glaciers or subjected to their impact. Since the approval of the Kumtor project in 1994, plans for the removal of ice (necessary for the safe operation of the mine) have become an integral part of the annual mining plans that are subject to approval by the relevant authorities of the Kyrgyz Republic. As further described in the Report, we involve leading local and international experts and use advanced technologies for monitoring and assessing geotechnical safety and implementing the activities necessary to ensure the proper level of safety of Kumtor mine sites.

Health and Safety

We adhere to the policy that no job is so important for which you can neglect the safety rules. Throughout the year, we implemented the WSHS program and trained all employees, contractors and trainees.

Unfortunately, despite our efforts, an accident occurred in the area of maintenance of heavy equipment. A heavy equipment maintenance mechanic in an unauthorized attempt to repair a truck malfunction was fatally injured because of violations of a number of safety rules.

We have conducted an investigation and review of the accident, existing controls and activities with safety experts. Overall, our safety performance is better than in the mines in some industrialized countries and we are always committed to ensuring our employees return home safely after every shift.

Environment and Biodiversity

We consider a responsible approach to environmental management as one of the most important components of our activities. So, in 2017, we spent about $7.2 million for environmental assessment and protection. This includes the costs of monitoring (both at the mine and in the region) the quality of water, air, biodiversity, soil and sediment, radiation and waste management. In 2017, we continued to improve waste management practices and put into operation compost for the treatment of biowaste and their further use in research on mine closure. The Company attaches great importance to the conservation of biodiversity in the region; and from the very beginning of production activities cooperated with stakeholders specializing in environmental protection, in particular, participating in the establishment of the Sarychat-Eertash State Nature Reserve (SENR) in 1995. We continued our partnership with the Fauna and Flora International, the international biodiversity organization with the longest history of existence, in order to support biodiversity conservation projects implemented in the territory of the SENR. KGC is proud of its support in this area and the fact that since the beginning of mining operations, the number of key species of wild animals such as snow leopard and Marco Polo sheep has increased.

Life of Mine

The total amount of proven and probable gold reserves at the Kumtor mine as of December 31, 2017 is 4.5 million ounces (57 million tonnes, at 24 g/t). The current life of the mine involves the development of an open-pit mine by the end of 2023, with processing of the remainder of mined ore until 2026.

Looking Forward

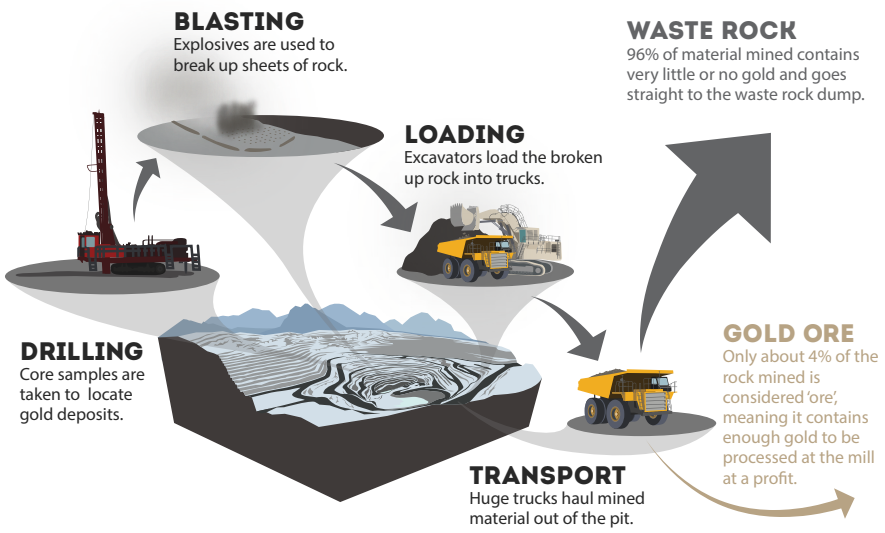
Kumtor successfully implemented various initiatives throughout the year for the purpose of continuous improvement. It is important for KGC to meet our production targets, requirements of safety, environmental and social responsibility. Kumtor mine gold production in 2018 is expected to be from 450,000 to 500,000 ounces.

We look forward to your feedback on the report and welcome comments on how we can improve our sustainable development and environmental protection in future.

Daniel Desjardins, President,
Kumtor Gold Company

MINING PROCESS

Gold is found in the territory of the deposit in the form of finely disseminated pyrite. The mine development is performed through open-pit mining, that is, with the use of standard methods of drilling, blasting, loading and transportation in the open pit.



The Kumtor mine is equipped with the most modern mining fleet. The open pit has 99 Caterpillar trucks with a lifting capacity of from 145 tons to 185 tons, 9 drilling rigs and 14 excavators operating regularly. To maintain the infrastructure in the open pit, there is support equipment: 16 bulldozers and 11 graders. Workers travel to the open pit in KamAz trucks; known colloquially as bus trucks.

DRILLING

Drilling is a very important stage in metal mining, since geologists should accurately determine the average gold grade in the ore before the commencement of the large-scale works at a site. Depending on this, the further process will determine whether to perform the gold ore production or not. The drilling rigs operating in the open pit are able to drill to a depth of up to 12.5 meters. The average penetration rate is 120 rotations per minute. Nearly 230 holes are drilled in the open pit during one shift. The drilling process in the mine is not only a part of geological exploration works aimed at determining gold grade but the first stage of blasting in the open pit as well.

BLASTING

Blasting in the open pit breaks apart the topmost rock. The rock in the permafrost zone is hard and impossible to transport without blasting. After assessing where to blast, the zone is closed off. A network of holes are drilled, and explosives connected to a detonator are placed inside. Later an explosive with detonator is placed into these holes. Meeting safety requirements when firing the charge is of paramount significance for all employees involved in the works in the open pit. Before the explosion, the mine foreman ensures the withdrawal of employees and heavy vehicles from the open pit to a safe distance.

LOADING

After clearing roads, the excavators drive up to the scene of blast. Two types of excavators operate in the mine. The biggest one is Hitachi EX3600-6. The excavators load the ore onto the mining trucks.

TRANSPORTATION

To reach gold bearing ores, it is required to perform mining stripping, that is, removing the bare rock layer. The trucks which transport waste rock unload it on the special dumps. The trucks which transport gold bearing ore follow a different route: they transport the ore to the mill where it is ground to suitable sizes and delivered to the factory by belt.

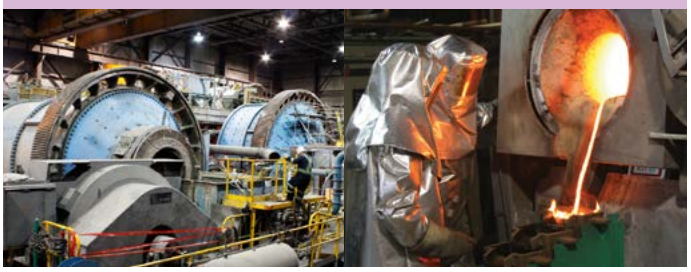
FACTORY

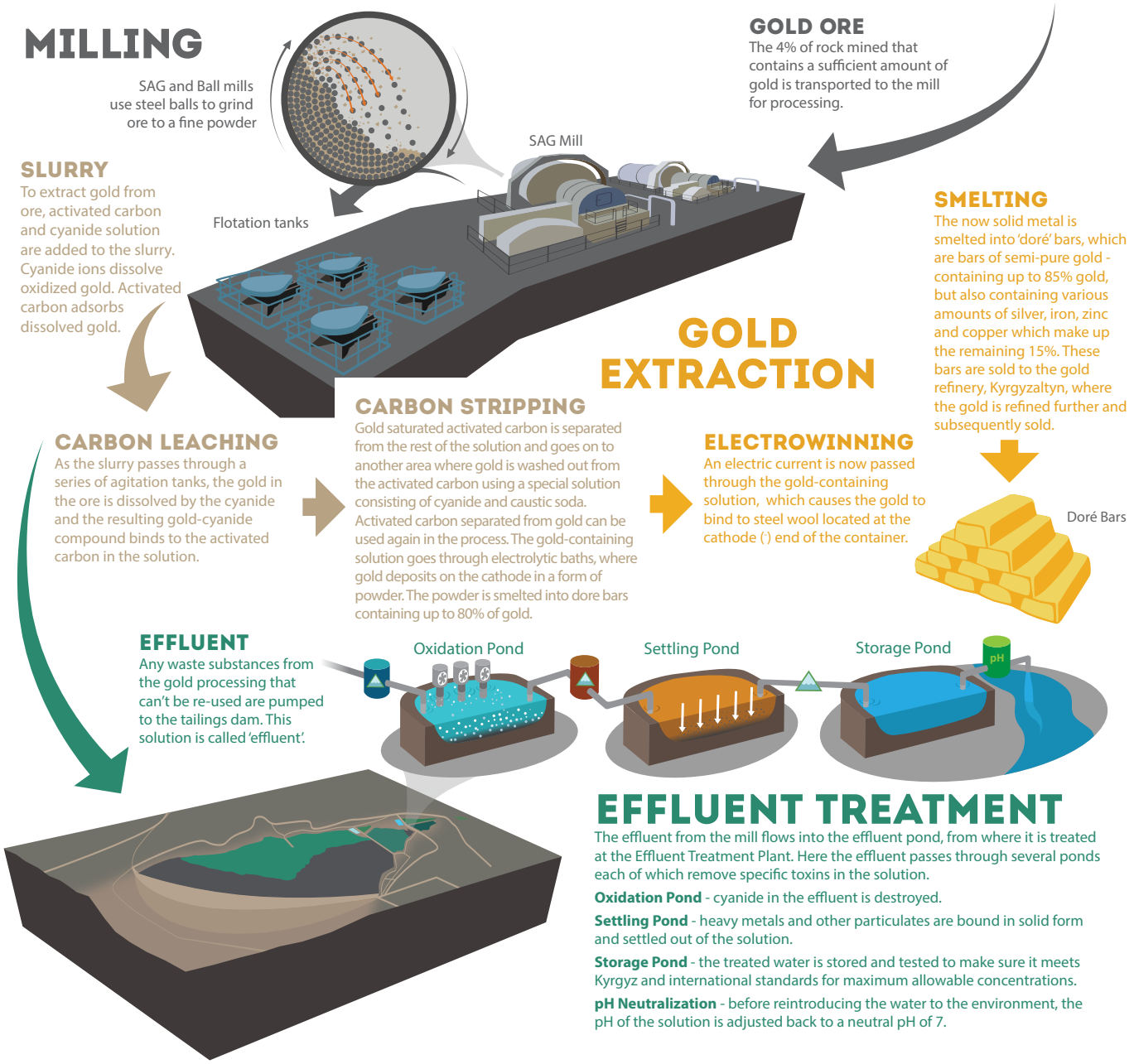
Ore is delivered to the primary crusher and then to the daily storage ore stockpile. From the stockpile, ore is delivered to the mill for further grinding.

For a more effective ore processing, an ultra-fine grinding mill (ISA Mill) was installed in the mill in 2005. Before leaching, the concentrate is ground from 100 nm to 20 μm (99% of solids are less than 20 μm, for comparison: diameter of gold atom is 28 nm). Gold is extracted from the ground ore using a "carbon-in-leach" technology.

The mill's rated throughput is between 17,000 to 19,000 tons of ore per day. The entire production process is automated involving just 16 people per shift to operate the entire mill.

The dore bars produced in the Kumtor mine are purchased by Kyrgyzaltyn OJSC for further processing at Kara-Balta refinery, as stipulated by the Gold and Silver Sales Agreement concluded by Kumtor Gold Company, Kyrgyzaltyn OJSC and the Government of the Kyrgyz Republic. The exclusive right to sell refined gold and silver both in the Kyrgyz Republic and abroad is held by Kyrgyzaltyn alone.





ENVIRONMENTAL AND SUSTAINABILITY SNAPSHOT

Pillar	2017 Targets
Project Benefits	■ Reduce All-In Sustaining Cost Per Ounce to 843 (US$/oz)
Health & Safety	■ TRIF = 0.30 or lower ■ Work Safe – Home Safe Leadership program fully implemented by end of Q3
Environment	■ No Reportable Spills higher than a Level 2 ■ Progress in achieving ICMI compliance to CNwad discharge limits.
Community	■ Zero days of material business interruptions ■ Develop protocol between Issyk-Kul Development Fund, regions, and KGC for future social and economic projects by the end of Q2 ■ Increase involvement levels in Kumtor Ambassadors Program by 10% (hours) over 2016

Target outcome and Comment on Target	2018 Targets
■ All-In Sustaining Cost per Ounce equalled to 698 (US$/oz) ■ 562,749 ounces of gold produced in 2017	■ Achieve All-In Sustaining Cost Per Ounce to 733-815 (US$/oz) ■ Produce 450,000 – 500,000 oz
■ TRIFR = 0.14 ■ Work Safe – Home Safe Leadership program fully implemented by end of Q3	■ Reduce TRIFR ■ Second phase of Work Safe – Home Safe -Visual Felt Leadership Program fully implemented by the end of Q3
■ One reportable spill of diesel fuel in the result of road accident on Sary-Moinok pass ■ A number of laboratory tests on alternative cyanide reagent for the Mill were undertaken	■ No Reportable Spills > Level 2 ■ Progress in achieving ICMI compliance to CNwad discharge limits ■ Progress in MAD compliance to ammonia discharge limits ■ Update Biodiversity Management Strategy and Plan & Contributing to Closure Planning
■ Zero days of material business interruptions ■ Protocol between Issyk-Kul Development Fund, regions, and KGC was developed by the end of Q2 ■ More than 4,000 hours dedicated for corporate volunteering by KGC employees in 2017	■ Zero days of material business interruptions ■ Progress in continuing development of protocol between Issyk-Kul Development Fund, regions, and KGC for future social and economic projects by the end of Q2 with projects for 2018 approved by the end of Q4 ■ Increase involvement levels in Kumtor Ambassadors Program by 20% (hours) over 2017

BUILDING A **TEAM-BASED CULTURE** OF EXCELLENCE THAT **RESPONSIBLY DELIVERS SUSTAINABLE VALUE** AND **GROWTH**.

We believe that how we conduct business and how all employees act in fulfilling their job responsibilities are fundamental to achieving our vision **to build a team-based culture of excellence that responsibly delivers sustainable value and growth**.

While Kumtor's ultimate objective is to deliver value to our shareholders, integrity and ethics will be the foundation for everything we do. In endeavouring to achieve our vision we will follow our core values of:

BE RESPONSIBLE MINERS

- Meet all government regulation and internal governance standards.
- Ensure we actively and transparently engage our people and the communities around us.
- Minimize the potential for adverse impacts that may arise from our operations to levels as low as reasonably achievable, taking into account social and economic factors.

DELIVER RESULTS

- Strive for operational excellence, safe production and be accountable for our results.
- Be a leading performer among our peers with regard to shareholder value, business ethics, workplace safety, environmental protection and community economic development.

STRIVE FOR CONTINUOUS IMPROVEMENT

- Continually improve the management of our operations so we may respond to the economic, environmental and social expectations of our stakeholders, including our employees, communities, shareholders, governments and the public.
- Challenge the status quo, embrace change and search for new ways to grow our business.

WIN AS A TEAM

- Committed and highly engaged.
- Recognize contributions and efforts of each team member.
- Results focused.

We believe our strong commitment to our vision and these values will continue to make Kumtor the employer of choice and the business partner of choice by governments, state-owned enterprises and special interest groups in the countries we operate in.

As an international company, we respect the different needs and values of people and their cultures and operate with a high level of transparency to ensure stakeholder confidence.

1.1 | GOVERNANCE MODEL

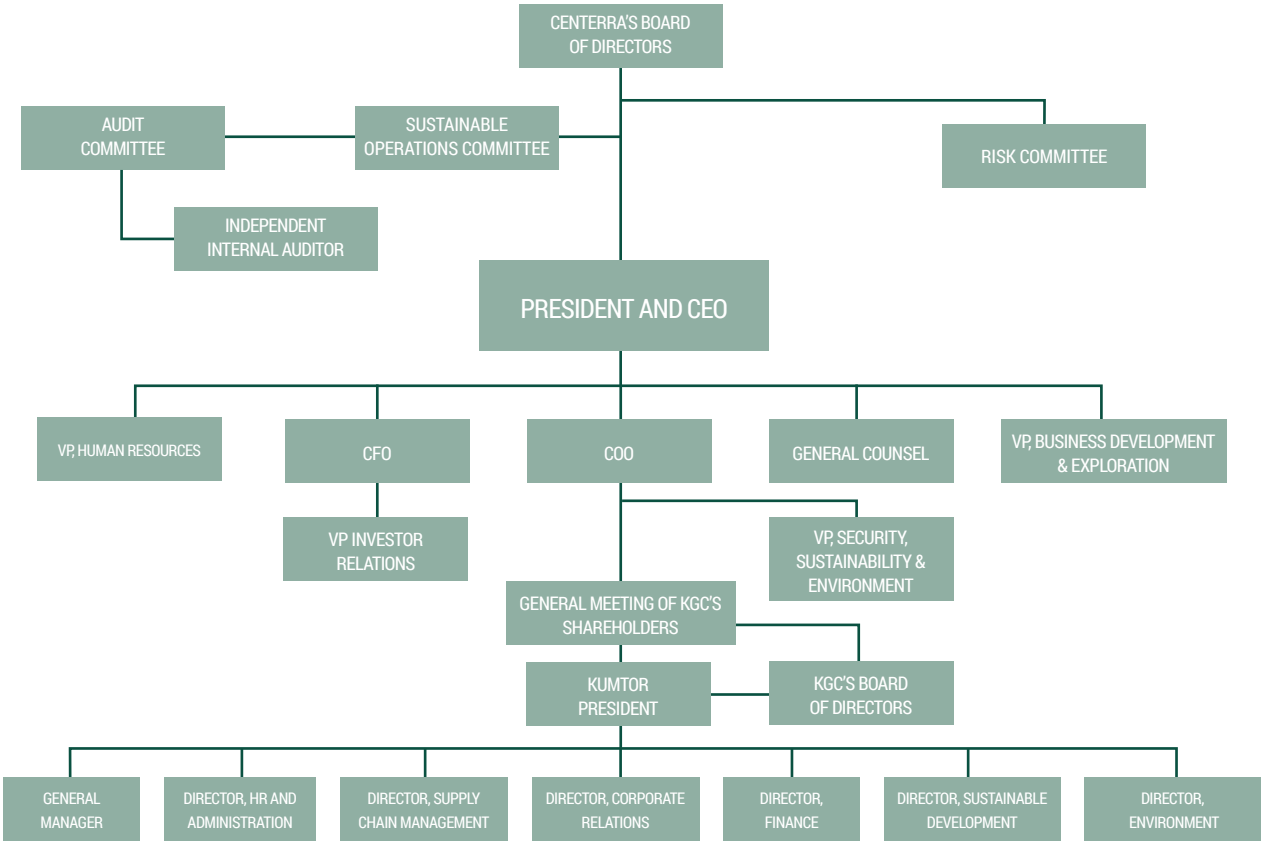


Fig. 1.1 Corporate Governance Structure (January 1, 2018)

KGC operates under the governance and standards set by its parent company Centerra Gold Inc. (Centerra), which believes that sound and effective corporate governance is essential for all of its activities. Centerra Gold Inc. has two Board committees specifically tasked with reviewing governance issues: the Sustainable Operations Committee and the Audit Committee. We have adopted practices and procedures to ensure that Centerra's governance principles are followed at KGC. We expect directors, management, officers, and employees to conduct themselves in accordance with the highest ethical standards. These are detailed in three key policies:

1. Code of Ethics for officers and employees;
2. Code of Ethics for directors;
3. International Business Conduct Policy for all directors, officers and employees.

KGC develops formal Policies and Procedures for setting performance with internal and external standards, meeting legislative responsibilities and promoting the long-term success of the Company. The policies support KGC values and specifies the framework within which KGC operates in the following areas:

- **Operational Health and Safety.** KGC ensures provisions for safe performance and operation during all phases of our operations. KGC recognizes the protection of the health and safety of its employees, contractors, and the public along with responsible environmental management as being its highest corporate priorities. We are committed to the safety motto that **"no job is so important that we cannot take the time to do it safely."** Key commitments in our policy include:
  - Compliance with applicable laws and regulations of the jurisdictions in which we operate, and generally accepted international industry practices;
  - Providing employees and contractors with a working environment that is free of uncontrolled hazards. We continuous work at identifying and eliminating or controlling potential risks to the health and safety of employees, contractors, and the public to levels

as low as reasonably achievable, taking social and economic factors into account;

- Achieving continual awareness of, and improvement to, our overall Health, Safety, and Environment (HSE) performance.

- **Environmental Management.** KGC is committed to complying with applicable laws, regulations and standards and minimizing potential environmental impacts due to our operations. KGC has in place an Environmental Management System (EMS) designed to monitor the effects of its operations on the environment, and compliance with permits and other requirements. The system provides for scheduled monitoring, implementing engineering controls, and establishing performance requirements in line with good international mining practice and local regulations.
- **Compliance.** KGC has a comprehensive system to ensure compliance with laws, regulations and Company policies, which is described further in the relevant section of this Report.
- **Transparency and Reporting.** Actual results and Company activity is reported regularly through the parent company Centerra as well as on the company website (**www.kumtor.kg**). Centerra is a publically traded company with shares listed on the Toronto Stock Exchange. It is subject to rigorous regulations regarding transparency and reporting. Starting in 2017, Centerra became subject to legislation in Canada (the Extractive Sector Transparency Reporting Act – or "ESTMA") which requires extractive sector companies (like Centerra) to disclose on an annual basis payments made to Governments in its operations. Centerra's filings can be found at its website (**https://centerragold.com/responsibility**).
- **Operational Excellence.** KGC has Standard Operating Procedures that describe the activities necessary to complete tasks in accordance with standards and regulations for running the operation. Policies stand as control measures for known or potential risks. However, in today's changing environment and variety of emerging risks, KGC uses an Enterprise Risk Management System to support its business activities and to safeguard shareholder value. The risk management system is designed to ensure that risks are systematically identified, rigorously assessed, prioritized consistent with KGC's risk appetite, and effectively managed to eliminate unwanted impacts.

The Code of Ethics for Directors requires Centerra's directors to promptly report all actual, potential, or perceived conflicts of interest to the corporate secretary, who is in turn required to bring such potential conflicts to the attention of the Nominating and Corporate Governance Committee. Directors may not participate in discussions, deliberations, or decision-making for matters in which they have a conflict of interest. All new directors are required to review and accept the Code of Ethics for Directors, and to certify compliance on an annual basis.

Our external memberships and commitments provide an opportunity to learn from, and align our activities with, good international industry practice. Centerra became a Supporting Company of the Extractive Industries Transparency Initiative (EITI) in 2011.

The EITI is a coalition of governments, companies, civil society, investors, and international organizations. It promotes improved governance in resource-rich countries through the verification and publication of all KGC payments to governments, as well as government-reported revenues from oil, gas, and mining. Centerra has played an active role in promoting the EITI in the Kyrgyz Republic and Mongolia. Our operations were among the first to establish, report, and help improve EITI infrastructure in their respective countries. For more information on Centerra's submissions, visit eiti.org/Kyrgyz Republic and eiti.org/Mongolia.

Centerra is also a member of the World Gold Council (WGC). The Council's members regard the management of the local environment and relationships with local communities as paramount considerations during the lifetime of any mine project.

In 2013, Centerra Gold adopted and implemented the WGC's Conflict-Free Gold Standard. In doing so, Centerra acknowledges that operating responsibly and maintaining the trust of our stakeholders requires us to demonstrate that the gold we produce has been extracted in a manner that does not fuel unlawful armed conflict or contribute to serious human rights abuses or breaches of international law.

Centerra is a signatory to the International Cyanide Management Code for the Manufacture, Transport, and Use of Cyanide in the Production of Gold. This Cyanide Code was developed by a multi-stakeholder steering committee under the guidance of the United Nations Environmental Program and the predecessor of the International Council on Mining and Metals.

The objective of the Cyanide Code is to improve the management of cyanide used in gold mining and assist in the protection of human health and the reduction of environmental impacts.

Environmental Claims

Starting in 2012, KGC received claims from various Kyrgyz regulatory authorities alleging, among other things, noncompliance with Kyrgyz environmental legislation. These claims allege damage and seek compensation totalling approximately, $465 million (at applicable exchange rates when the claims were commenced). Centerra and KGC believe that such claims are without merit and have vigorously defended such claims in the Kyrgyz Republic courts and in international arbitration.

In September 2017, Centerra and KGC entered into a strategic agreement to settle all outstanding matters affecting the Kumtor Project (the "Strategic Agreement"), including the claims discussed above. In September 2017, the claim in the amount of approximately US$200 million) commenced by one of the regulatory authorities was terminated. In March 2018, the other claims commenced by a separate regulatory authority were terminated (upon the application of the relevant regulatory authority), although KGC understands that such regulatory authority has since filed applications to re-open these claims. Centerra and KGC will continue to dispute these claims.

KGC and Centerra are continuing to work with the Government of the Kyrgyz Republic to ensure the satisfaction of various conditions precedent for the Strategic Agreement by its current longstop date of July 23, 2018.

Compliance

The Compliance and Projects Department (C&P) was established by the Company in 2012 to ensure compliance with the requirements of the KR legislation, with international standards of the industrial operation and in order to provide continuous and safe operation of the Kumtor mine. The C&P Department has 11 staff members under the supervision of the Director, who reports directly to the General Manager. The C&P Department interacts with all KGC structural departments and is guided by acting KR legislation, generally accepted international standards, Restated Investment and Concession Agreements and Strategic Agreements on for the Kumtor Project. Specialists of the C&P Department monitor changes in KR legislation and identify the risks that can potentially affect the Company's activities. In accordance with the KR legislation, the C&P Department ensures that all required permits and licenses for all Company activities are obtained in a timely manner.

In addition, the C&P Department:

- Assists other structural departments of the Company with drafting their respective contracts;
- Obtains all necessary permits for the design and construction of mine site infrastructure facilities;
- Obtains approvals of the design documentation and organizes commissioning of newly constructed facilities upon their completion;
- Assists design companies in obtaining approvals/expert opinions for Mine Development Plans/Designs and for the standards of pollutants emissions/discharges and wastes disposal for the mine site and BMY;
- Provides technical assistance during update and/or introduction of new internal documentation for the Company in accordance with the requirements of KR legislation and international regulations;
- Organizes calibration of measuring equipment used at the mine site or BMY. The C&P Department ensures uninterrupted operations of the mine and BMY facilities through maintaining regular communication with the authorized state bodies in the field of subsoil, natural resource use, construction, sanitary and epidemiological control, technical supervision, as well as with the KR Ministry of Economy, Ministry of Interior, State Communication Agency and the KR Ministry of Emergency.

The C&P Department constantly updates the following permits issued by different KR ministries and agencies:

- Permit to carry out blasting operations in the pits;
- Permit to store explosive materials at the Kumtor Mine site;
- Permit to use explosive materials;
- License for production and selling of the explosive materials;
- License for importation of the explosive materials and Sodium Cyanide;
- Permit to carry out mining operations within the Concession Area;
- Permit to store, the weapons used for site security purposes at the Kumtor Mine site;
- Approvals of the transportation routes,
- Permits for transportation and storage of hazardous cargo,
- Certificates for the vehicles and drivers used for transportation of hazardous cargo,
- Permits to transport oversize and heavy cargo;
- Permit to use and store reagents and medical drugs at Kumtor Mine site and Bishkek Medical Center.
- License for the disposal, storage, burial, destruction of toxic waste materials and substances, including radioactive waste.
- Permit to dispose waste into the environment, including toxic waste;
- Permit for emission of waste products from the stationary sources of pollutant into the atmosphere;
- Permit for the discharge of treated industrial and domestic effluents;
- Permit to operate radio sets, radio frequencies to ensure reliable communication between KGC facilities;
- Permit to use X-Ray devices and equipment with sources of ionizing radiation;
- Kyrgyz Visas and Work Permits for KGC expatriate personnel to work in the Kyrgyz Republic;

In December 2017, KGC has obtained from the KR authorities all necessary permits and approvals of the Technical Designs for the Development of the Central, Sarytor and Southwest Areas of the Kumtor mine during the entire life of the mine (LOM), as well as approval of the Environmental Passport and Mine Site Master Plan. In addition, all other permits and approvals for 2018 have also been obtained:

- Mine Plan for the development of the Central Pit;
- Mine Plan for the development of the pebble deposits at the Lysyi Creek Alluvial Cone;
- Wastes disposal at the Kumtor Mine;
- Emission of waste products from the stationary sources of pollutants into atmosphere at the Kumtor Mine and BMY;
- Discharge of treated industrial and domestic effluents at the Kumtor Mine.

Audits, Inspections, Claims

Our Company is subject to regular audits by the KR and international companies and experts. We are also inspected by relevant national authorities and by the audits retained by Centerra and other relevant third parties, which have historically included the European Bank for Reconstruction and Development (EBRD).

Environmental Incidents

Kumtor maintains a system for reporting environmental and safety-related incidents. It is based on a five-tier classification and reporting a system, which allows the Company to classify environmental incidents and spills into reportable and non-reportable. This classification system takes into account the magnitude of environmental impact and the requirements of national laws and other regulations. Senior environmental staff are immediately notified of all incidents; upon receiving such notice, senior environmental staff classify the incident as per the five tiers above. Tier I and Tier II incidents are considered insignificant in terms of scale and severity of impact; therefore, there are no external reporting requirements. There is no requirement to immediately notify KGC President and Centerra's Board of Directors on such minor significance incidents. Incidents classified as Tiers III through V are reported to the Board of Directors and, in many cases, trigger external reporting requirements to relevant local regulatory agencies.

There was one recorded incident in KGC in 2017. In July 2017, a fuel tanker carrying diesel fuel was driving on the road; at some stage, the tanker hit a berm, rode over it and turned over on its left side on the national technological road. This accident resulted in a spill of 10,248 L (8,813 KG) of fuel. The accident was classified as Tier III accident. Since the accident happened on a national road used by the public, relevant government authorities were notified immediately and the investigation of the accident commenced. The comprehensive investigation identified the causes of the accident and resulted in appropriate response measures being taken. The contaminated soil was extracted from the area, with the topsoil replaced as part of vegetation restoration activities. In 2017, there have been 15 non-reportable accidents, which is one less than in 2016 and 14 less than in 2015. These were typically minor spills of fuels that were immediately contained and cleaned up, resulting in no significant or extended impact.

Fig. 1.2 Environmental Incidents and Spills

	2015	2016	2017
Non-reportable spills and environmental incidents (Type I)	28	15	15
Non-reportable spills and environmental incidents (Type II)	1	1	0
Reportable spills and incidents (Type III-V)	0	0	1

1.2 | SUSTAINABILITY MANAGEMENT

While Centerra's ultimate objective is to deliver value to our shareholders, we remain committed to the principles of sustainable development. In endeavoring to achieve our strategic objectives we aim to:

- Be a leader among our peers with regard to business ethics, workplace safety, environmental protection, socio-economic development of communities, and shareholder value;
- Minimize the adverse impact potential of our operations, taking into account social and economic factors;
- Continually improve the management practices at our operations, so we may respond to the economic, environmental and social expectations of our stakeholders, including our employees, communities, shareholders, government authorities and the public;
- As an international company, respect the different needs and values of people and their cultures, and operate with a high level of transparency to ensure stakeholder confidence. We believe our strong commitment to these principles will continue to make Centerra the employer and the business partner of choice wherever we operate.

1.3 | RISK MANAGEMENT AND CONTINUOUS IMPROVEMENT

Kumtor Gold Company (KGC) is committed to enhancing and protecting its tangible (physical or financial) and intangible (employee, stakeholder or organizational) assets through risk management. The Risk Management processes are integrated with the general management of the organization so they are a part of decision-making process. Critical risks and monitoring of their mitigation plan successfully integrated in the day-today activities with the departments managing their own risks identification and monitoring process. Management discusses risks at a Weekly Leadership Meeting, and more significant risks are followed up on monthly Change Acceleration Process (CAP) Team Meetings. Senior Management discusses risks at weekly Steering Committee Meetings, through a Quarterly Critical Risk Review Meeting, and during Annual Budget preparations. The goal is to use the outcome of risk assessment processes in planning, budgeting and cost control to ensure we focus on proactive rather than reactive management strategies.

The key risk events in 2017 related to Permitting and Geotechnical conditions of the pit and dumps as well as the characteristics of the ore that affect the gold extraction:

- **Permitting and Licensing.** Mining operations at Kumtor are subject to various permits and licenses, some of which are obtained on an annual basis or for a fixed term. During 2017 KGC experienced delays in obtaining the necessary permits and approvals for the KGC annual mine plans and certain environmental permits, including the maximum allowable discharge permit, and the Ecological Passport. However, in December 2017, KGC was able to obtain all necessary permits from Kyrgyz authorities, including approvals for mining Central, Sarytor, South-west areas, Ecological Passport, and Mine Master Plan.
- **Geotechnical issues.** Constant ground movement in the pit and dumps is the result of geological and geotechnical ground characteristics, and requires constant vigilance because of the risk it poses to mining operations. It may impact the volume of gold produced, change the sequence of mining operations, increase unloading expenditures, organizing of dewatering, movement or reconstruction of existing infrastructure, reduced slope angles of the central pit and changes in waste rock dump design. Extensive efforts are taken by KGC personnel to impose appropriate measures on adjusting the plan to prevent and anticipate further ground movement. The Company also uses third party geotechnical consultant to review the pit wall, the glacier and waste dump on a quarterly basis.
- **Gold Recovery.** It is not always possible to predict the precise metallurgical parameters of the ore. To minimize this natural effect, KGC conducts continuous metallurgical analysis and utilizes advanced methods to maximize gold recovery. In 2017, KGC continued efforts on increasing efficiency of gold recovery in the mill. In particular, additional grinding equipment and leaching tanks to improve overall recovery were tested. In addition, mill department introduced new flocculants that increased mill production. KGC is always conscious about the environmental impact of its operations. In this regard, during the year mill and environment departments launched a pilot project to decrease cyanide concentration by adding an organic compound into the final tailings, this organic compound creates favorable conditions for growth of microorganisms which destroy cyanide. This has demonstrated promising results, which will be applied in 2018.

Management of risks clearly demonstrates how risk management processes are linked with continuous improvement activities that became part of our daily operation.

Continuous Improvement is one of the four Corporate core values and it is a vital component of continued success. The purpose is to promote a philosophy of continuous improvement in enabling all employees to systematically drive out inefficiencies and embrace improvement opportunities within the Company.

KGC strives for excellence and quality and takes every opportunity to improve and enhance all aspects of its business and focusing on: safe operation, reduced environmental impact, operational excellence, cost effective operation and positive work environment.

Continuous Improvement tools introduced in 2016, namely CAP teams and 3W forms in leading efficient meetings discipline and responsible fulfillment of assigned tasks to relevant teams, have proven to be successful.

In 2017, numerous CAP teams were initiated for various projects, which are categorized by major, minor and quick wins projects within the Company. The most successful projects included Hot Seat Change and Mine Site Cleanup.

Hot Seat Change. This project was implemented to address the haulage fleet requirements to meet mine production targets set for 2017-2019. The objective was to increase mine production without incurring capital expenditures for haul trucks investment, by implementing staggered (hot) shift change through additional hiring of haul truck operators for working during night shift, lunch and other time-off periods. This has resulted in increased daily haul truck utilization hours translated to higher mine production.

- **Mine Site Cleanup.** This project was implemented to address AMEC recommendations in further improving overall environmental condition at the mine site. The cleanup included clearing and decommissioning the industrial waste dump and bone yard area, inspecting and disposing of obsolete items, as well as removing the majority of containers down from the mine site. The cleanup was completed by the end of 2017, resulting in a cleaner workplace environment at the mine site.
- Additionally, during the year, two operational review team (ORT) sessions were conducted with the participation of Centerra group representatives. This was also a successful Continuous Improvement initiative, as brainstorming of ideas, solutions findings and best practices suggestions, in which technical expertise and experiences from Centerra's experts were shared.

1.4 | MATERIALITY ASSESSMENT

In accordance with the GRI Standards, KGC is required to identify and report only on material issues – defined as issues that have a significant impact on KGC's business and are important to multiple stakeholder groups. In order to assess which issues are material, we considered a number of various sources. We based our 2016 materiality assessment on previous year's interviews and workshops, held with Senior Management:

- Opinions of Senior Management and Departments Heads – via several internal meetings and workshops mostly held in 2016, and online survey in 2017;
- Opinions of local communities in Issyk-Kul;
- Risks that were rated as High or Extreme as per the KGC Risk Register;
- Relevant legal obligations of the Company;
- Data from the KGC community relations online database, where we document our engagements with key stakeholders in the region to record all concerns and issues raised, as well as record and track grievances and requests from local communities;
- Internal policies, values, goals and targets;
- Incoming correspondence - to identify key issues raised by Stakeholders via official requests;
- Media coverage of the Company.

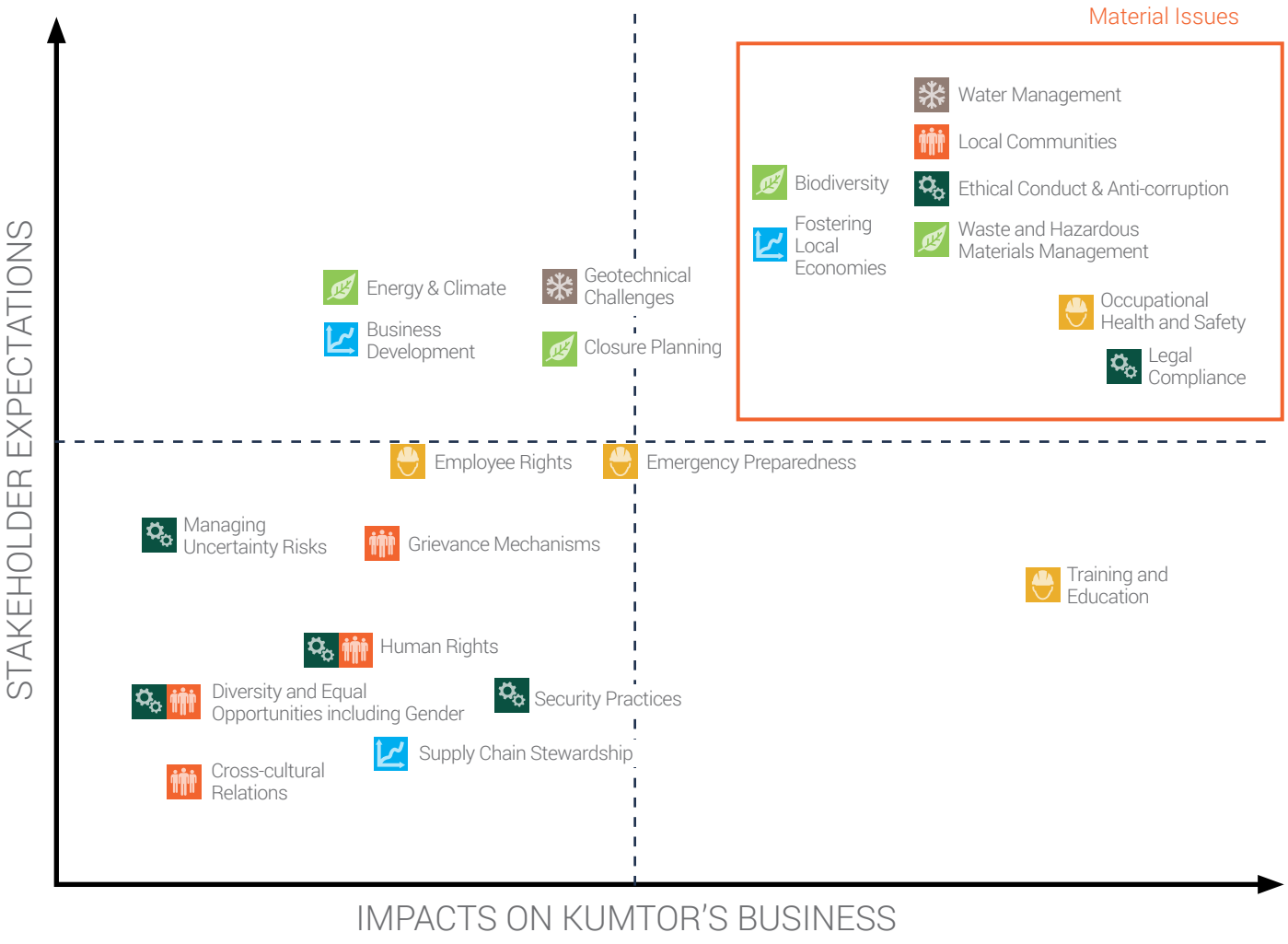
As shown on Figure 1.3 overleaf, the issues shaded red were considered material.

UNITED NATIONS SUSTAINABLE DEVELOMENT GOALS

There are 17 Sustainable Development Goals (SDGs) defined by the international community under the leadership of United Nations in 2015 and which will be valid until 2030. In order to achieve these goals, companies are equally accountable as well as NGOs and governments. As a responsible miner, KGC has defined SDGs related to our operations and impacted communities. We will continue to support the following SDGs in our operations:

- Clean Water and Sanitation;
- Responsible Consumption and Production;
- Good Health and Well-being;
- Decent Work and Economic Growth;
- Industry, Innovation and Infrastructure;
- Partnership for the Goals.

Fig. 1.3 Materiality Matrix



Legend: Areas of Impact

- Environmental responsibility
- Economic responsibility
- Health and safety
- Governance
- Social responsibility
- Glaciers and water management

Fig. 1.4 List of Identified Material Aspects and Boundaries

Material Aspects	Impact Inside organization	Impact Outside organization	Relevance outside the organization
Water Management	×	×	Minimizing impact of our operations on the environment at the mine site is one of the KGC's main objectives. We comply with the Kyrgyz Republic (KR) and international standards and follow the Good International Industry Practice (GIIP) in our operations.
Biodiversity	×	×	
Waste and Hazardous Materials Management	×	×	
Legal Compliance	×	×	KGC complies with KR legislation and is working closely with the KR Government to resolve number of outstanding matters, including environmental claims and claims made by the General Prosecutor.
Ethical Conduct and Anti-Corruption	×	×	According to the Transparency International Corruption Perception Index the KR is ranked high among the countries most prone to corruption. KGC has a zero tolerance policy for unethical behaviour and has always been committed to fair and transparent operation.
Fostering Local Economies		×	Our economic performance plays significant role in the Kyrgyz economy, providing 9.7% of GDP in 2017, jobs for more than 3,000 people, supporting local producers and investing into local communities.
Local Communities	×	×	Constructive dialogue with the local communities is a key to our successful cooperation and uninterrupted operations.
Occupational Health and Safety	×		Our employees receive regular health checks and support, are provided with high quality safety clothing, and receive health and safety trainings to protect themselves and co-workers. Our motto is "No job is so important that we cannot take time to do it safely".

1.5 | BUSINESS ETHICS

Recent high-profile corruption and bribery in the industry and increasing diligence on the part of regulatory agencies means that corruption in many developing countries has increased the risks of non-compliance and the related damage to organizational reputation. According to Transparency International Corruption Perception Index, Kyrgyzstan is ranked high among the countries most prone to corruption.

KGC has a zero-tolerance policy for unethical behavior and has always been committed to fair and transparent operation, supported by our Code of Ethics and International Business Conduct Policy (collectively, the "Policies"). These policies regulate KGC's business conduct with Public Officials, interactions with others and include important concepts such as preventing conflicts of interest between parties of the Company including engaging in improper activities with suppliers and others that do business with the Company.

These Policies provides an ethical framework for employee decisions, actions and behaviour. It outlines the principles for appropriate conduct and explains the standard of behavior expected.

These Policies contribute to creating a workplace culture that encourages and supports staff to identify and declare conflicts of interests so that they can be managed in an open and transparent way. Our employees provide formal acknowledgment of awareness on these Policies, as this subject is an important component of our commitment to conduct business in an ethical and lawful manner.

The Company has also established internal financial and other controls to (a) prevent corrupt payments from being made, (b) detect any such payments that are made, and (c) defend KGC actions if challenged by enforcement authorities. KGC requires accurate documentation from all of our partners. KGC maintains records that accurately reflect all transactions — payments, expense reimbursements, gifts, business entertainment, disbursements, commission payments, fees and other dealings with prospective customers, agents, subsidiaries and other affiliates.

Centerra has established a Compliance Hotline to allow employees and other stakeholders to anonymously submit in good faith allegations of non-compliance with our Policies. The Compliance Hotline is available in English/ Russian (among other languages) and can be accessed at **www.clearviewconnects.com**. The Hotline is confidential and available 24 hours a day and is operated by a third party provider.

TRAINING ON INTERNATIONAL BUSINESS CONDUCT POLICY, CODE OF ETHICS AND ANTI-CORRUPTION PROGRAMS

In 2017, a total of 9 sessions were held (both for expatriates and Nationals in English and Russian) at Kumtor. A total of 125 employees attended training at Kumtor.

The training objective was to raise employee awareness regarding Anti-Corruption legislation and Centerra's Anti-Corruption programs including the International Business Conduct Policy and the Code of Ethics.

Topics presented included:

- **Centerra's Policies on Code of Ethics & International Business Conduct**
  - Conflict of interest
  - Confidentiality
  - Compliance with Laws
  - Compliance with good disclosure practices
  - Anti-bribery & accounting provisions
  - Prohibited & allowed payments
  - Due diligence in third-party relationship
  - Indication of corruption ("Red Flags")
- **Risks and potential impact to the Company, its employees and partners**
- **Compliance Hotline repoting**
- **Annual certification of compliance**

Our objective is to conduct this training on an annual basis, and to ensure that all employees receive in-person training at least once every 3 years (if not more in high risk areas).

> "KGC has a zero tolerance policy for unethical behavior and has always been committed to fair and transparent operation"

HONESTY & INTEGRITY

HOW WE CONDUCT BUSINESS IS IMPORTANT TO US

As Kumtor employees you agreed to comply with two important policies*, discussed below.

Non-compliance with these policies can result in **disciplinary actions**, including reprimands, demotions, suspensions and **dismissal of employment**.

Non-compliance with these policices may be contrary to applicable laws.

1. CODE OF ETHICS AND GIFT REGISTRY POLICY:

Conflict of Interest

A conflict of interest can occur when an employee has a private interest in the outcome of a business decision.

If there is any doubt whether a conflict of interest exists, talk to your supervisor, any member of management, or submit questions anonymously and confidentially via the Compliance Hotline (see below).

If you have an actual conflict of interest, disclose it in writing to the Vice President, Human Resources.

Don't make any actions or decisions that may create a conflict of interest between you and Kumtor.

Confidentiality

As a Kumtor Company employee, you receive a lot of information about it.

Don't disclose any confidential information about the Company to any member of the public, whether orally or in writing.

Don't speak to the media in the name of Kumtor without permission to do so.

2. INTERNATIONAL BUSINESS CONDUCT POLICY:

Improper Payments

Don't pay, offer, promise any money or thing of value to any Public Official (Government members, employees of any gov. department, ministry/agency, etc., see the full definition in the Policy) in order to obtain/retain contracts, business or any other advantage for Kumtor. This includes money, gifts, entertainment, kickbacks, loans, rewards, the provision of facilities or services at less than full cost, and an advantage or benefit of any kind (whether from corporate funds or assets, or personal or other funds or assets).

Report immediately, if asked to make an Improper Payment. No one will suffer a demotion or penalty for refusing to make an improper payment, even if it results in adverse consequences to Kumtor.

"Books & Records" Provisions

Kumtor is required to make and keep books, records and accounts which accurately and fairly reflect the transactions and dispositions of its assets, and to devise and maintain a system of internal controls.

Record transactions in conformity with accepted methods of financial recording.

Record transactions in ways that permit the preparation of statements in accordance with international financial reporting standards.

Don't misrepresent, conceal or falsify financial books or records.

HOW TO REPORT IF YOU HAVE A CONCERN?

YOUR SUPERVISOR

HR DIRECTOR
deon_badenhorst@kumtor.com

CENTERRA GOLD (for concerns beyond Kumtor management)
yousef.rehman@centerragold.com

COMPLIANCE HOTLINE
www.clearviewconnects.com

Within North America (toll-free):
1-866-841-8609

Outside North America:
1-647-438-1938

clearview-centerra
(audio only)

ClearView Connects™
P.O. Box 11017
Toronto, Ontario
M1E 1N0
Canada

AUDIT COMMITTEE CHAIR

To Centerra Gold headquarters. In a sealed envelope marked **"Private and strictly Confidential - Attention: Chair of the Audit Committee of Centerra Gold Inc."**

Our Compliance Hotline is available in English, Kyrgyz (on-line only) and Russian.

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2 ECONOMIC VALUE

2.1 | ECONOMIC PERFORMANCE

KGC is the largest private sector employer and taxpayer in the territory of the Kyrgyz Republic. In 2017 KGC operations accounted for 9.7% of GDP and 21.1% of aggregate industrial output.

Payments made within the Kyrgyz Republic in 2017 were $269 million. Total payments within the Kyrgyz Republic since 1994 have now reached $3.4 billion. Our strategic community investment programs in 2017, described in the Social Responsibility section, were $916,000.

We continue to contribute 1% of gross revenue to the Issyk-Kul Development Fund for support of social and community projects. The Fund is controlled by the government and is under supervision of local authorities with the aim to develop social infrastructure such as schools, clinics and kindergartens in Issyk-Kul Oblast. In 2017 we paid $6.4 million to the Fund.

In addition, the Kyrgyz government, through the state owned mining company Kyrgyzaltyn OJSC, remains the largest single shareholder of Centerra Gold, owner of KGC. By the end of 2017, KGC employed 3,485 people, including contractors, with Kyrgyz nationals making up more than 97% of full-time staff, which is detailed further in the People section.

Fig. 2.1 Kumtor's Share of GDP (%)*

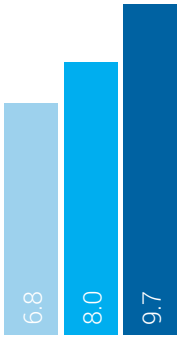


Fig. 2.2 Kumtor's Share of Total Industrial Output (%)*

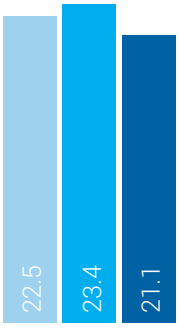
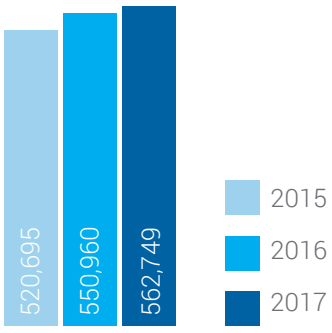


Fig. 2.3 Gold Production Statistics



** Kumtor's macroeconomic impact in the Kyrgyz Republic*
SOURCE | Kyrgyz Republic National Statistics Committee

> "Total payments within the Kyrgyz Republic since 1994 have now reached $3.4 billion"

Fig. 2.4 **Direct Economic Value Generated and Distributed**[1]

Indicator	2015	2016	2017
Economic Value Generated			
Revenues from gold sales	601,737,459	683,327,685	685,163,279
Other income [2]	5,029,607	1,926,887	4,069,740
Economic Value Distributed			
Operating costs (goods and services)[3]	233,060,926	190,818,481	206,804,840
Corporate administration costs	-	-	-
Exploration costs	-	-	-
Capital expenditure [4]	64,642,771	75,778,978	78,745,280
Other operating costs [5]	1,572,558	2,304,654	2,469,333
Employee and contractor wages and benefits	105,111,954	108,861,856	117,237,524
Payments to providers of funds (shareholders) [6]	-	135,000,000	400,000,000
Taxes and royalties	84,633,058	96,292,724	96,729,304
Community donations and investments	2,203,078	1,176,986	1,035,343
Payments to Cancer Support Fund			7,000,000
Economic value retained [7]	115,542,721	75,020,894	(220,788,605)

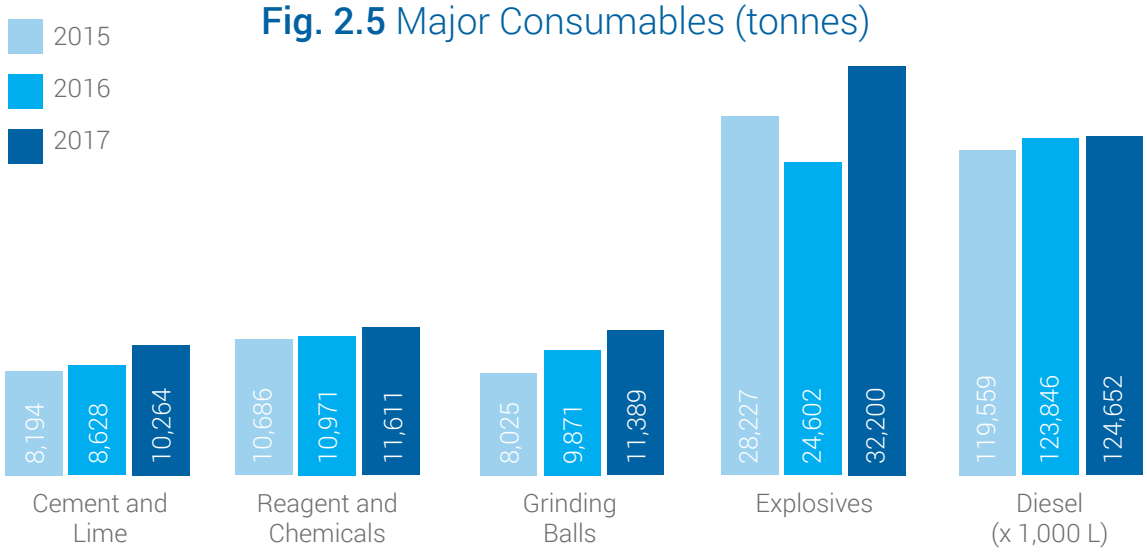
Notes:

1. *Data has been prepared on an accrual basis and non-cash costs have been omitted.*
2. *Other income includes income from financial investments, sale of assets, and other services.*
3. *Includes capitalized overburden stripping costs.*
4. *Excludes capitalized overburden stripping costs.*
5. *Includes by-product sales (silver).*
6. *Represents dividends in the amount of $400.0 million, which were declared and settled in 2017 form the accumulated retained earnings.*
7. *Defined as 'direct economic value generated' less 'economic value distributed'.*

Consumption of Materials

Mines are large consumers of supplies and materials for both the operations and the working community. Efficient use of materials is essential for both economic and environmental reasons. The major raw materials consumed include diesel fuel, explosives, lime, reagents and chemicals (including cyanide) used in the milling and leaching processes, and grinding balls to crush the ore. We also consume significant quantities of other non-renewable materials such as fuel, lubricants, grease and explosives.

Fig. 2.5 Major Consumables (tonnes)



2.2 | LOCAL PROCUREMENT

One of KGC priorities is to procure goods in the local market. But the goods and services should meet strict criteria, which we bear in mind when considering such factors as market sustainability, quality and price.

We believe that KGC strategy for local procurement creates significant economic benefits for Kyrgyzstan at the local, regional and national levels. Making procurement in the local market results in new jobs and sources of income, acquisition of new skills and technologies and helps in establishing vital local enterprise networks as well. Thus, local procurement provides direct possibilities for creating common benefits both for KGC and the communities where the Company operates. For more detailed information on local procurement strategy, see the company website in the section "Procurement and logistics" **(www.kumtor.kg/en/procurement_logistics/)**.

To maintain a continuous production, we procure more than 11,000 products supplied by nearly 600 enterprises operating in the territory of the Kyrgyz Republic. For more than 9 years 100% of food products are procured in the local market. We will discuss our partners - the local producers - below.

Throughout the calendar year, KGC continuously engages nearly 1,100 employees of various trades and qualifications on a contractual basis. The survey showed that the major part (nearly 88%) of the contracting organizations that we engage reside in the Issyk-Kul province. The majority of workers are the Jety-Oguz district residents - 48%, the Ton district residents - 14% and the residents of other districts in the Issyk-Kul province - 26%.

Taking into account a relative continuity of the scopes of seasonal works for contracting organizations and the well-proven processes of recruiting workers and equipment from nearby towns and villages new potential service providers should be well equipped, have good experience and be competitive.

We actively inform potential suppliers, disseminate our requirements and advise on the criteria that should be met in order to get a higher chance of entering into partnership with KGC.

Fig. 2.6 **Local Procurement in Context**

	Units	2015	2016	2017
Total Payments for Goods and Services[#]	USD	279,731,777	256,188,105	266,126,258
Local Payments for Goods and Services[#]	USD	59,336,002	58,439,328	60,385,333
Local Payments for Goods and Services as % of Total	%	21	23	23

[#] *These figures include the fees paid to the Kyrgyzaltyn Refinery*

> "Since 2008 100% of food products are purchased within the Kyrgyz Republic"

LOCAL PROCUREMENT

CHALLENGES OF PROCURING GOODS LOCALLY:

Businesses are informal
- not registered
- not paying taxes
- not keeping good records
- not using bank facilities

Poor health and safety practices
- danger of food-borne illnesses
- products do not comply with international standards
- no certification

Small production capacity
- unable to supply large business demand
- no export potential

High production cost
- unable to compete with bigger, more efficient enterprises abroad

Low cash-flow
- unable to survive if they get paid 30 days after invoicing (standard for big businesses)

HOW KUMTOR IS HELPING:

Requires good business practices
- licensing and registration
- paying taxes
- record keeping
- use of bank facilities
- compliance with international health and safety standards & provide training

Helping businesses development
- fostering relationships with other development partners such as EBRD, who can help finance businesses
- helping businesses to harness national resources
- participating in meetings of International Business Council, Association of local businesses JIA, GIZ Office in KR

Pays more for local goods in the short run
- allows small businesses to compete for lucrative contracts
- provides stable revenue for businesses to grow and improve

Flexible Supplier Payment System
- paying faster, sometimes even in advance

EFFECT ON THE LOCAL ECONOMY:

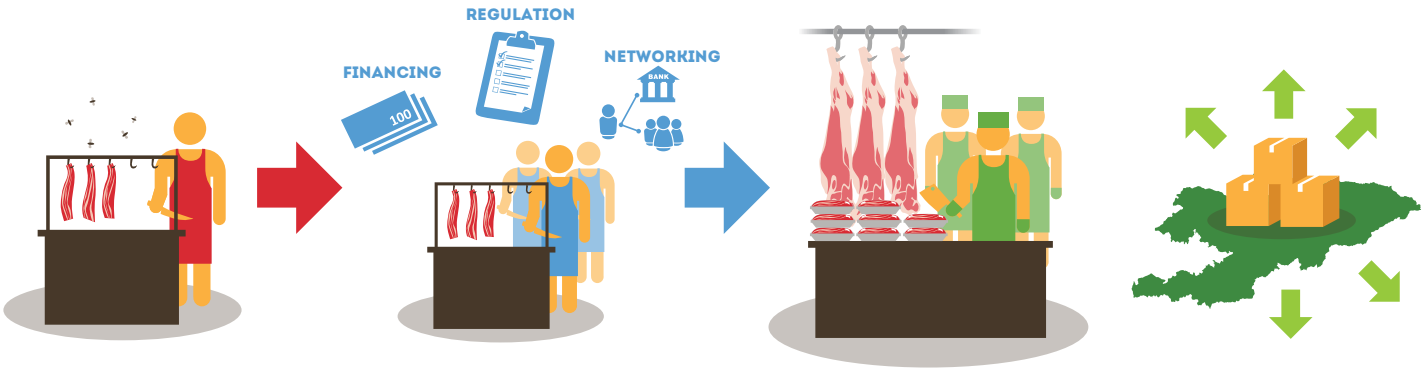
Formalization of business practices
- reduces corruption
- provides government revenue to pay for roads, schools, etc...
- job creation

Implementation of Health and Safety Standards
- lower risk of food borne illnesses
- access to new markets which have similar standards

Bigger production capacity.
- ability to supply larger companies
- potential to export surplus products
- ability to support themselves after mine closure

Business Growth
- stronger, more self-sustaining economy

Competitiveness
- ability to compete with larger, more affluent enterprises for Kumtor contracts



Who is eligible to be a supplier?

- Businesses who meet Kumtor's health and safety standards;
- Businesses who are licensed by the government and approved by Kumtor;
- Businesses who are not likely to have a conflict of interest, of any kind, with Kumtor.
- Businesses who can provide competitively priced goods and services on a sustainable basis.

Kumtor prefers dealing with local goods manufacturers vs. importing from abroad when possible.

C1. Local Enterprises
- Located in the in Jeti-Oguz, Tong or Ak-Suu Raion.
- Most preferred

C2. Regional Enterprises
- Located in the wider Issyk-Kul Oblast.
- Second preference

C3. National Enterprises
- Located in the Kyrgyz Republic.
- Third preference

C4. International Enterprises
- Last resort - used only if products can't be supplied from within the country
- Foreign enterprises twinning with local Kyrgyz enterprises to develop a local business, preferrably in the Kumtor Impact Region.

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KUMTOR
КУМТОР

Since the regions have little experience in cooperation with large-scale projects or modern mining enterprises, we face a number of difficulties with supplying goods and rendering services like most international mining companies that operate in them. Nevertheless, we support potential suppliers in the local market that cooperate with us and help them overcome these barriers. In 2017, nearly 15 items of goods and services previously procured in the international markets were displaced with domestic goods and the local suppliers' base increased.

We are convinced that making procurement in the local market provides significant benefits not only for the Company but the local market as well. This is one of the most efficient ways for the Company to retain its social work license, strengthen relationships with the Kyrgyz Government and improve the efficiency of the Company's supply chain. The primary objective of KGC Procurement department is to increase volumes and range of goods and services procured by KGC in the local market, which pursues common benefits both for the Company and the country as a whole. We also set a goal for ourselves – to leave a positive legacy, which in future will become a driving force of the extractive sector and related industries.

Despite the constant effort we make to improve the local market, there are still many goods and services that are not produced or not available in the Kyrgyz market. Specialist operational equipment and related services, large dump trucks, spare parts from the manufacturer, tires, main consumables and chemicals may serve as an example. In spite of our being a major consumer of fuels and lubricants, we have to import a major part of them.

Our total expenditures on goods and services in 2017 made up nearly $266 million. About $60 million of this sum was spent on procurement in the territory of the Kyrgyz Republic.

Leaving a Positive Legacy

The current estimated age of the Kumtor mine is until 2026. We want our positive impact on the Kyrgyz economy to continue after the time specified. We do everything possible to ensure that the local suppliers use our cooperation to develop their business and diversify the customer base. Many of our suppliers highlight that the contract for supply KGC with products is a mark of quality that makes their production more attractive for other customers. We must be sure that in 2026 when the mine will have been closed, there won't emerge any socio-economic difficulties which will force a large number of suppliers to cease their activities. Therefore, we help the entrepreneurs to develop without relying on KGC as their sole client.

We want our suppliers to become more successful and keep creating new jobs and possibilities for the local communities. Realizing their need for current capital, we make quick payment to the suppliers, often within several days, and in certain cases (for example, with supply of the equipment with a long production period) we provide prepayments.

Balykchy Marshalling Yard

Balykchy Marshalling Yard (BMY) is a central transport hub intended for transit storage of materials, which are delivered by train and trucks. The materials are delivered to the Kumtor mine by trucks with the use of mainly MACK trucks (KGC) and the vehicles of contracting organizations (as required).

- On average 218 rail cars and 60 haul trucks come in BMY for month.
- Every day BMY sends approximately 22 haul trucks with goods and materials to the mine. Usually such convoy consists of 11 trucks with fuel, 6 trucks with ammonium nitrate, 1 truck with lime, while the rest haul trucks transport sectional containers with the equipment and chemicals.
- Our own fleet has 48 trucks. Moreover, we daily engage 1-2 trucks of the contracting organizations.
- The distance from BMY to the mine is 250km, which means that the total distance the Company's trucks cover for month is 341,000km, the volume of fuel transported is about 10 million litres.

BMY has a fuel farm with truck filling station, six tanks with volume of 12,000m^3, two tanks for 100m^3 to fill the trucks with fuel oil and one tank with volume of 200 m^3 for gasoline in its territory. Moreover, there are warehouses, vehicle repair shops, administrative buildings and one guest house as well. 207 people work in BMY. The Company's strategy is to recruit the employees who reside in Balykchy and nearby villages. We procure materials and goods in Balykchy, consume maintenance services and the services required to meet daily production requirements of BMY and guest houses.

GROUP OF LOCAL SUPPLIERS VISITED KUMTOR MINE

A group of local suppliers of Kumtor Gold Company visited the mine as part of the information visit. The chance to join the excursion was given as a gesture of encouragement to the companies that gained the reputation of reliable suppliers of quality goods and services.

Twelve suppliers from Issyk-Kul and Chui oblasts had an opportunity to take a look at the process of gold mining and production. The group visited the open pit, the gold mill, the residential camp, as well as the new repair workshop for heavy mining machinery. Some of the suppliers represented the food industry, therefore they were shown the work of the canteen and food storages. Suppliers also had the opportunity to see how and where the goods, materials and services purchased from them were used, and to assess their importance in the production chain.

"I am glad that I saw the whole process with my own eyes. When you read the news, you cannot imagine the way the things are going. I am impressed with the scale of operations and proud that I am also the part of the chain that supports continuous operation of the country's leading enterprise. Now I will tell the others that we have such a high-tech enterprise in Kyrgyzstan," the Raw Materials Manager of Ak-Jalga CJSC Kairbek Kojogulov said.

3 PEOPLE

3.1 | WORKPLACE PRACTICES

We value each of our employees and their professionalism, and strive to maximize the development of their abilities, talent, and energy in a working environment that allows them to make a personal contribution to the common cause.

Employment of Personnel

Kumtor Gold Company plans staffing requirements and improves the professional level of its employees; ensuring effective operation of the enterprise. KGC seeks to hire employees meeting the established qualification criteria for production expertise, as well as theoretical and practical training.

We continue to increase the percentage of the Kyrgyz Republic citizens among the Company staff, raising it from 95% in 2011 to 97% by the end of 2017.

Labour Compensation

The company establishes a system of labour remuneration that allows attracting and retaining highly qualified personnel, as well as ensuring decent payment for individual and collective labour of employees.

Staff salaries far exceed the average for Kyrgyzstan: in 2017, the minimum wage in the KGC was thirteen times higher than the minimum wage in Kyrgyzstan. An indication that local employees are satisfied is the desire of many of them to stay in our Company for a long time.

Employee Benefits

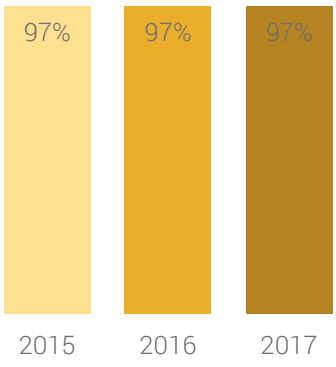
Our employees enjoy the following benefits:

- Funds for health improvement (vouchers to resorts, material assistance for treatment, membership cards to gym halls, etc.);
- Allowances for the celebration of employee anniversaries, in connection with retirement, when entering into the first marriage, at the birth / adoption of the child;
- Home improvement loans;
- Vacation pay for health improvement of employees;
- Funeral allowances and many other benefits.

Fig. 3.1 **Standard National Entry Level Wages and Those Paid by Kumtor**

	Units	2015	2016	2017
Kyrgyz minimum wage per hour	KGS	5.80	6.33	7.14
Kumtor entry-level wage per hour	KGS	78.20	86.2	94.62
Kumtor entry-level to Kyrgyz minimum wage ratio	Ratio	13:1	14:1	13:1

Fig. 3.2 Proportion of Kyrgyz Citizens as Full-time Staff



BEST EMPLOYER OF THE YEAR

In 2017 Kumtor Gold Company was recognized as the best employer of the year and awarded the "Honorary Partner of the American Chamber of Commerce" among numerous members of the Chamber in the Kyrgyz Republic.

The independent jury evaluated the nominees for a variety of factors, including indicators such as the provision of social package to employees, training opportunities, work experience and career advancement, workplace safety, employee turnover, and other.

Collective Agreement

The collective contract signed between the trade unions and the KGC administration is part of the overall system contributing to the effective and responsible management of the Company's activities.

The collective contract signed between the five trade union committees (currently existing in the Company) and the KGC administration, entered into force on January 1, 2017 and is effective until December 31, 2018) and covers 84% of employees. This Contract covers a wide range of issues, including labour compensation, inflation increase, work schedule, health and safety, benefits for employees and their families, as well as labour dispute resolution. In turn, the labour collective assumed the obligation to perform job duties qualitatively and safely, observe labour discipline, not carry out illegal strikes, etc. The Collective Contract stabilizes and guarantees labour relations at the largest gold mining company in Kyrgyzstan for the next two years.

Fig. 3.3 Employee Demographics at KGC

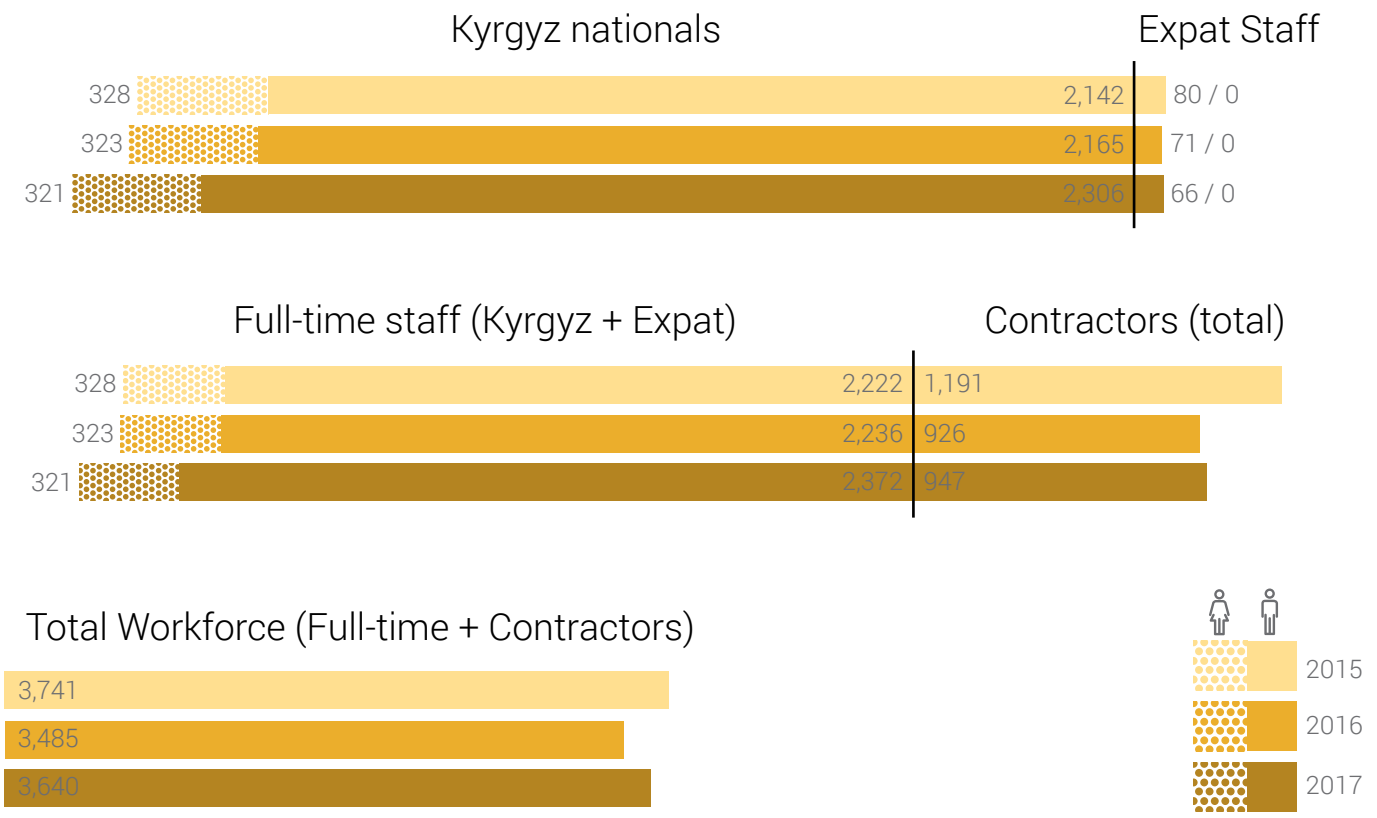


Fig. 3.4 Total Local Workforce by Region and Gender

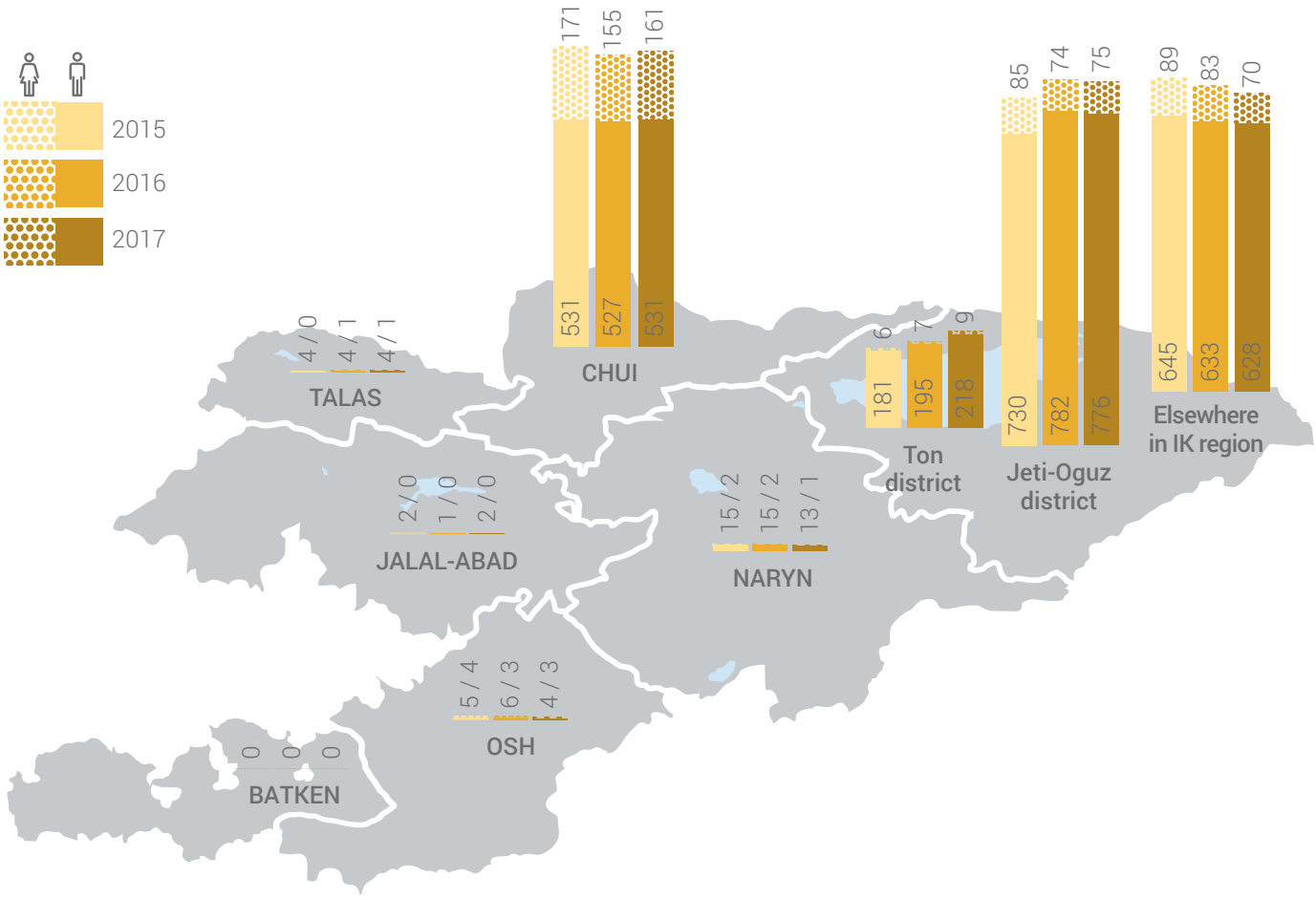


Fig. 3.5 Number of Contractors by Region and Gender

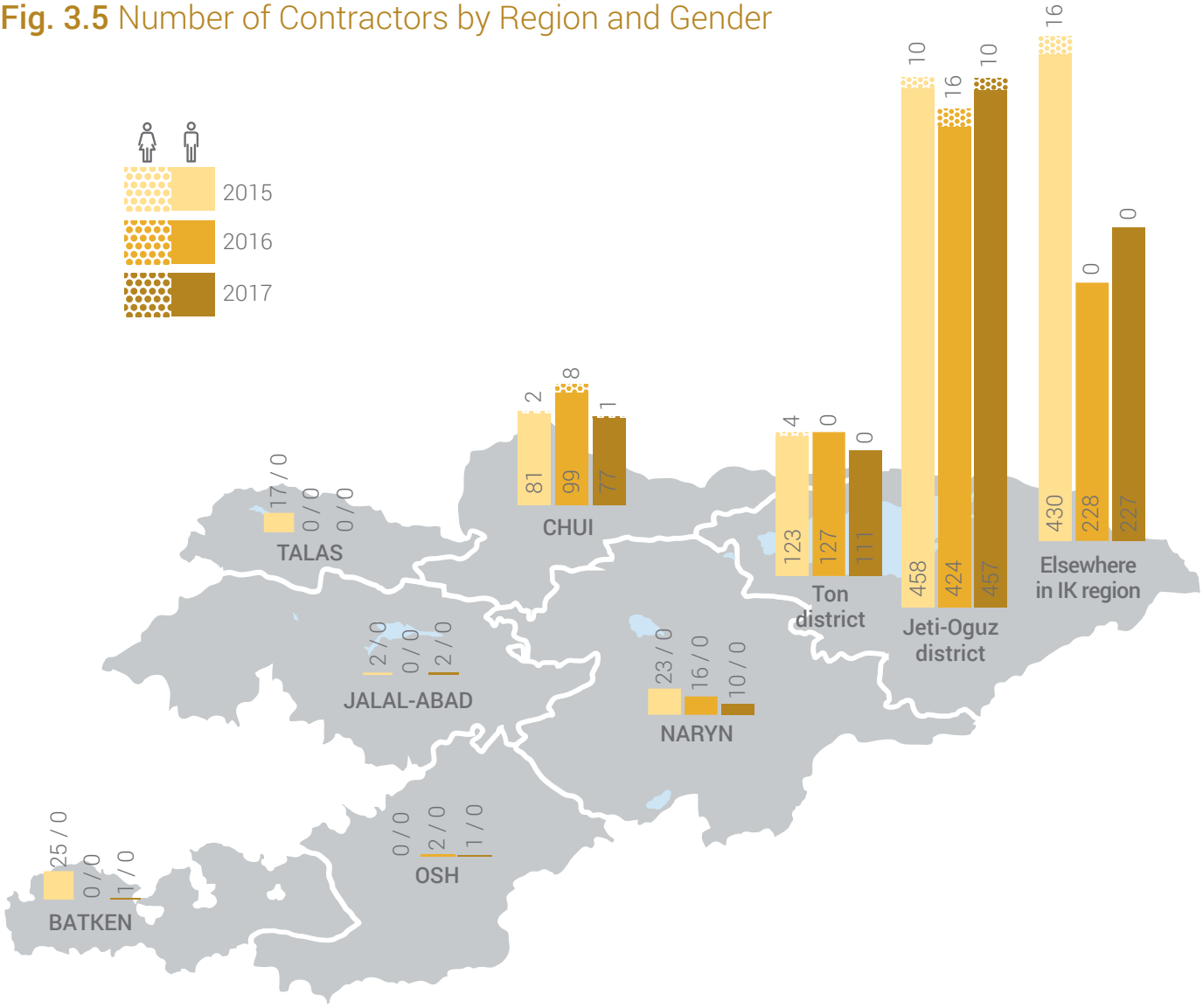


Fig. 3.6 Total Number and Rates of New Employee Hires and Employee Turnover by Gender and Region

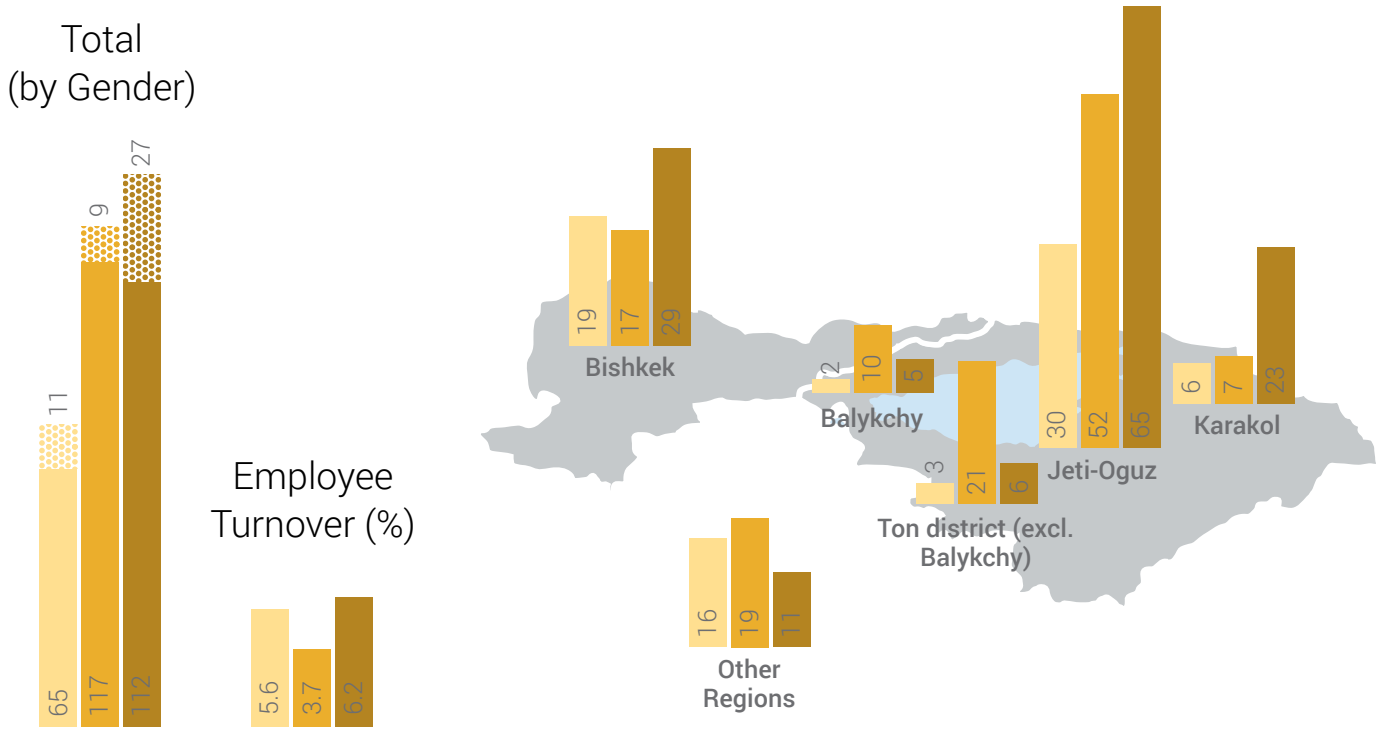
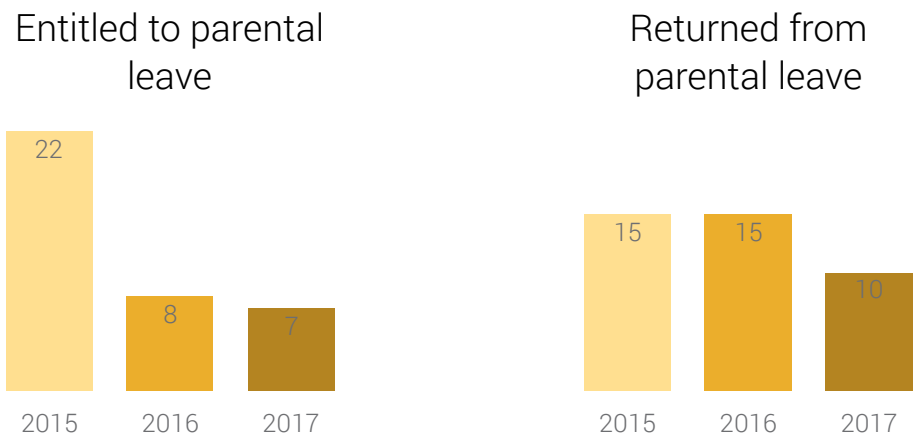


Fig. 3.7 Return to Work and Retention Rates After Parental Leave (Female Employees)



Recruitment Process

KGC has a policy to ensure its recruitment process is open, transparent and fair, as defined in the Policy and Procedure documents on National Employment and Recruitment and Selection. We have clear criteria on defining who is eligible for consideration, and we operate a clear and open recruitment process. Depending on the position, candidates must meet minimum education and qualification requirements and pass appropriate medical examinations to demonstrate fitness and good health given the high altitude conditions at the mine site. Some positions require specialized state-issued certificates, for example, for drilling and blasting work. Our recruitment process covered in the infographic on the next page.

KUMTOR HIRING PROCEDURE

The Company has adopted the following procedure for selecting candidates:

FIND INTERNAL CANDIDATES

We give current employees, who are interested, the chance to apply for an open position first.

WHEN QUALIFIED INTERNAL CANDIDATES CANNOT BE IDENTIFIED, A FORMAL RECRUITMENT CAMPAIGN IS HELD.

EMPLOYMENT OPPORTUNITY ANNOUNCEMENT

Advertising for an open position is done through media (newspaper, TV, web). If necessary, position announcements are distributed in local communities. The Sustainable Development department uses all possible channels to notify the community through local administration.

ATTENTION!

Employment at Kumtor is not for sale.

You should not have to pay anyone.

Please contact 0800 223-23-23 or 0312 90-07-07 if you are approached with a job for money offer. Such offers are illegal and go against Kumtor policy.

APPLICATION

Application forms are available at all Company offices - located in Bishkek, Karakol and Balykchy.

Applicants must have the minimum required qualifications, skills, and experience to be considered.

INTERVIEW

The top candidates whose skills, education, and experience best fits the position will get interviewed.

SELECTION

Based on the selection process results, the most suitable candidate's applications are provided to the management for approval.

Before employment, a successful candidate must undergo a medical examination and training on occupational health and safety.

KUMTOR
КУМТОР

Employee Training

General Safety Induction and Initial Health, Safety and Environment Instruction and First Aid Training is provided to all new KGC employees, students and contract partner employees. In addition to the initial training, refresher training is conducted annually covering topics such as; general workplace safety, first aid, firefighting, emergency response, workplace hazardous materials safety, transportation of dangerous goods, defensive driving, forklift truck operation, work permits, radiation hazards, vessels under pressure, working in confined spaces, handling cyanide and other chemicals, hearing protection, frost bite, hypothermia and a variety of other important safety topics.

- Mandatory and Compliance Safety training totalled 66,111 hours for the year 2017 for more than 3,700 employees students and contractors;
- Sessions for new employees students and contract partner employees – 24,889 hours;
- Annual Refresher Sessions – 25,014 hours;
- Red Crescent First Aid Certification Training – 16,208 hours;
- Work Safe | Home Safe Workshops – 33,520 hours.

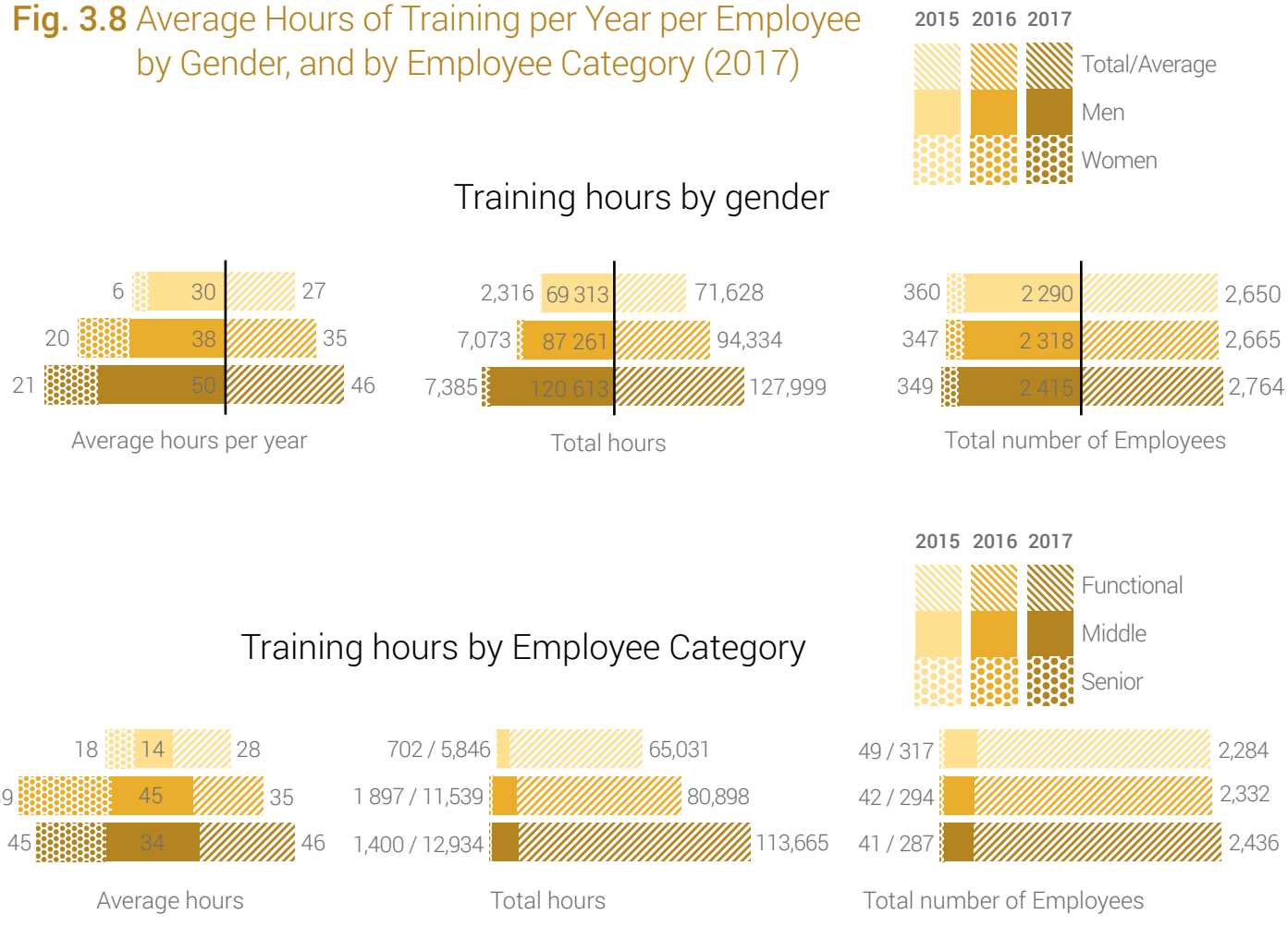
During 2017 KGC invested approximately $3.0 million for the training of employees, students and contract partner employees, which is an increase to the $2.9 million spent in 2016. KGC employs 40 full-time dedicated training staff and also utilizes the services of external training providers, such as Red Crescent Society of Kyrgyzstan, Training Centre under the State Agency of Geology and Natural Resources, Alfa Leader, Borusan Makina and several other local and international training providers.

The total value of $3.0 million includes all cost associated with training from all KGC departments and includes all costs incurred with employing training staff, maintaining facilities, contracts with local and international providers, etc.

The three training facilities located in Karakol, Balykchy and Bishkek continued their operation allowing KGC employees, students and contract partner employees the opportunity to attend any required training during their off-duty time in a location close to their place of residence. This has proved to be cost and time efficient in terms of process optimization as well as being more convenient for the employees.

All KGC leaders, engineers, technicians and many of the workers also attend training programs and receive certification from the Inter-Branch Training Center under State Committee of Industry, Energy, and Subsoil Use of the Kyrgyz Republic, in hazardous operations, in accordance with the law of the Kyrgyz Republic.

Fig. 3.8 Average Hours of Training per Year per Employee by Gender, and by Employee Category (2017)



2017 professional development opportunities for employees included:

- Educational financial assistance and leave is available to employees to obtain higher education degrees at institutes of higher learning, some examples of this are roles requiring technical diplomas, or where a second higher educational would be beneficial for an employee to advance their career in the Company;
- Overseas short program learning opportunities, in business, management, employee development and other role-specific programs are arranged for employees allowing them to increase skills and to perform more effectively in their roles. This training would normally be part of the employees' individual development plan and a part of the overall KGC succession plan;
- Overseas technical learning opportunities in skills development specific to operational departments designed to equip employees with the technical skills to keep up with a changing technological environment;
- In 2017, Professional Development training of KGC Supervisors and Managers continued to be a focus for the Company to further develop and enhance managerial skills within the leader team. Several local businesses offering supervisory skills development, effective management techniques and the coaching and mentoring process were utilized.
- Team building and coaching/mentoring sessions for mid-level and senior-level managers providing a venue to build comradery and a sense of working together to achieve the Company's business plan. These workshops and sessions are facilitated by a local Professional Development coach under contract with KGC.

Apart from investing in the education and training of current employees, KGC has programs designed for the younger generation – our potential future workers. In agreement with Technical School #27 and Technical School 91, KGC sponsored Red Crescent First Aid Training for the 2017 Regional Scholarship recipients. After completing the eight-hour training session, each participant is awarded a First Aid Certificates that is valid for 2 years.

The Regional Scholarship Program for students completing high school, and keen to pursue a vocational career, has been running since 2000. More information about the Scholarship program is available in the Social Responsibility Section of the Report.

GRADUATE DEVELOPMENT PROGRAM

KGC introduced the two-year Graduate Development program in 2006, intended to attract high caliber postsecondary graduate students whose areas of study are closely related to the mineral extraction industry.

Recent graduates are eligible to apply for the program that allows them the opportunity to gain practical experience by applying their theoretical knowledge and expertise in the workplace. They are also given opportunity to become familiar with the interaction of departments within the company and the structure of KGC and Centerra Gold Inc.

This Graduate Development Program has been instrumental in KGC's ability to recruit, develop and retain many talented graduates that have chosen employment with KGC following completion of the program.

Since inception of the program 77 graduates have been recruited, with 56 gaining full-time positions or continuing to participate in the program, including 4 that are now in leadership positions.

3.2 | OCCUPATIONAL HEALTH AND SAFETY

When mining at the high altitude of 4,000 meters, the major challenges are living and working in a cold climate and reduced oxygen levels. Average annual temperature is minus 8°C with a minimum as low as minus 38°C.

KGC employees receive regular health checks and support. They are provided with high quality safety clothing, and receive health and safety training to protect themselves and co-workers. We record and analyze incidents and near misses. The Company has an emergency response team that performs regular training exercises. The motto of the Company is: **"No job is so important that we cannot take time to do it safely."**

Medical Screening and Wellness

Employees of the Company undergo annual medical examinations in various medical institutions of our republic, where they receive a conclusion about their health, on the basis of which they are issued a permit to work in the highlands. To assist with these examinations, KGC has several contracts with local state hospitals in Bishkek and Issyk-Kul regions. Employees are not allowed to work without the annual medical examination and work permit, which is issued for a period of 12 months. In 2017, 2,870 employees passed annual medical examinations, 334 passed pre-employment screening, 179 employees were referred for special medical examinations and 33 employees were classified as medically unfit to work at the high altitude mine site. The KGC Medical Department conducts partner seminars twice a year with doctors from medical institutions engaged in medical examinations of employees. The purpose of these meetings is to receive feedback, improve the quality of medical examinations, eliminate problems, complaints and seek rational proposals. It is not uncommon for such meetings to invite professionals from the National Center for Cardiology and Therapy to advise regional doctors on the tactics of treating mountain diseases, as well as diagnosis and therapy of cardiac patients. Thus, by improving the quality of medical examinations, the medical department contributes to the health of employees.

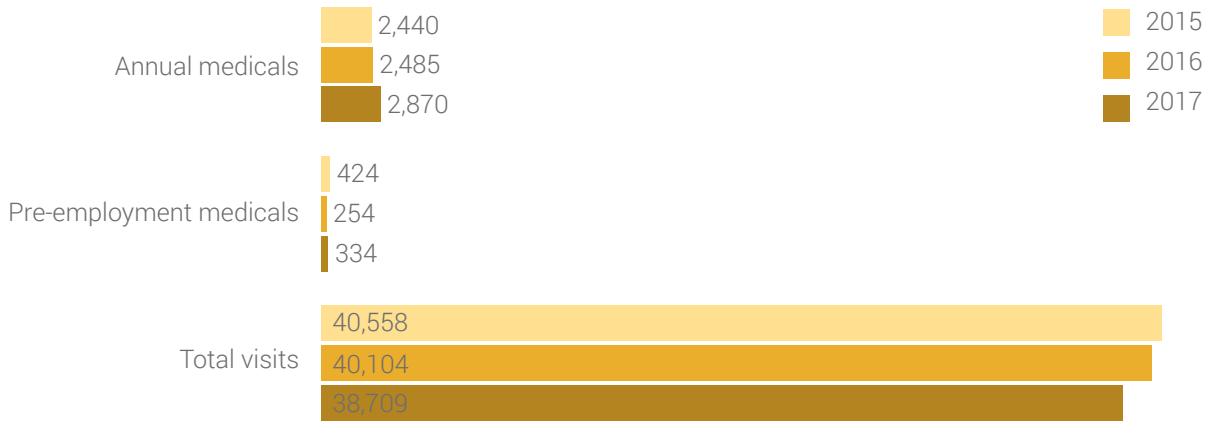
KGC maintains medical clinics in Bishkek, at the Balykchy Marshaling Yard and at the mine site, with trained medical staff. Doctors with high qualifications regularly undergo training both at local and international advanced training courses. They provide medical care not only to the company's employees, but also to contractors, persons who have arrived with short-term visits from different countries of the world.

All visitors receive medical checks at the Bishkek clinic to verify their fitness to work at the mine. On arrival at site, they receive a further check, and if necessary, treatment is given if any symptoms of acute mountain sickness (AMS) arise.

Our monitoring shows that upper respiratory tract infections remain the principal cause of illness and work absence. Every year, preventive health programs are implemented to motivate our employees to strengthen their health and improve their overall well-being. So, in the framework of the flu prevention vaccination program in 2017, 600 employees voluntarily underwent influenza vaccination.

Since 2017, a hygienic occupational physician who oversees the hygiene of nutrition and work has been recruited in the staff. For every meal, a wide choice of high quality, freshly prepared food is available, providing for personal and cultural preferences, and entirely sourced from the local companies.

Fig. 3.9 Medical Screening and Visits



WORK SAFE - HOME SAFE

The implementation and rollout of Centerra's Vision, Values and the Work Safe | Home Safe program was completed in July of 2017 with more than 3775 KGC employees, students and contract partner employees participating. Work Safe | Home Safe is a Safety Leadership program that establishes and fosters a culture where individuals are responsible to take ownership of their personal safety and the safety of those working around them to ensure that everyone returns home safely after every shift. One very important tool from the program that all participants have actively embraced is the "STOP Conversation", which is used when some is seen to be doing something unsafe or in and unsafe situation.

Accident Reporting

The Company implements a program that identifies, records, assesses and controls accidents, risks, hazards and Near Misses. When any employee observes or identifies a risk, a hazard or a Near Miss in an operational area, they are required to complete an industrial hazards or near miss form and submit it to the Occupational Health and Safety Administrator and Coordinator on risk management. Experts assess the degree of risk and take the required measures to eliminate a source of a hazard or a Near Miss to reduce the degree of risk and exclude the likelihood of an accident in the future. Our key health and safety statistics are shown in the table below. We have a Joint Occupational Health and Safety and Environment Protection Committee, which includes representatives from various departments, organizational units, services and contractors employees by various locations of the Company.

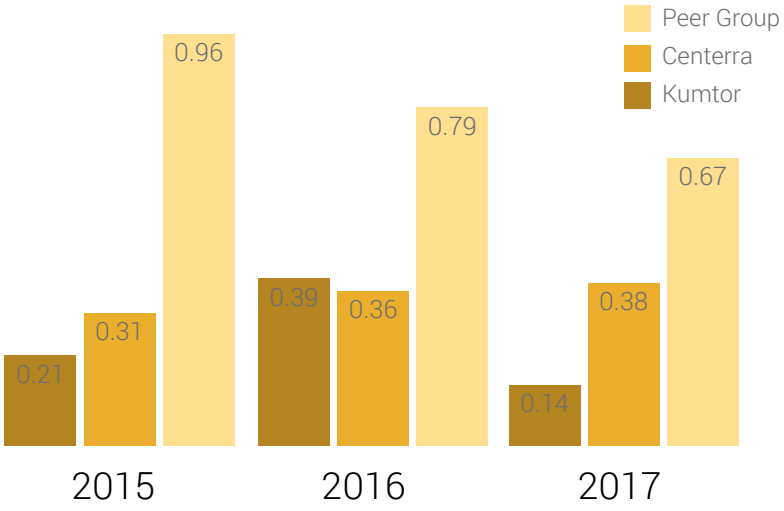
Fig. 3.10 Key Health and Safety Statistics#

	Units	2015	2016	2017
Hours worked	Hours	5,734,240	5,712,626	5,882,917
Lost Time Injuries (LTIs)	Number	3	9	1
Medical aid	Number	3	2	1
First aid	Number	16	17	13
Days lost to injury	Days	52	6,349	6,026
LTI frequency rate	No. of LTIs per 200,000 hours worked	0.10	0.33	0.03
LTI severity rate	Lost time days per 200,000 hours worked	1.81	222	204.86
Reportable Injury Frequency Rate (RIF)	No. of Reportable Injuries per 200,000 hours worked	0.21	0.39	0.14
Incidents with Property damage	Number	31	31	28

 # See Glossary for definitions of key terms

**The discrepancy in data on the number of lost days due to injuries with lost time incidents (LTI) for 2017 compared to 2016 is due to the fact that the lost time injuries were 8 less in 2017 than in 2016. Unfortunately, in April 2017, a fatal accident occurred on the heavy equipment maintenance site. In accordance with international norms, an automatic calculation of 6,000 lost person-days was implemented due to the fatal accident and 26 lost person-days due to the lost time injury.*

Fig. 3.11 Reportable Injury Frequency Rate: KGC/Centerra vs Peer Group



Centerra is a member of the global Mining Safety Round Table group (Peer Group) consisting of other global mining companies that are all mostly based in North America but do business across the globe. Peer group members meet 3 to 4 times a year to exchange and share mine safety best practices as well as research and test innovative technologies for the mining industry. In addition, if/when one of the members is having difficulty with a particular issue, possible solutions are discussed and shared. TRIF Rates are shared on a bi-yearly benchmarking exercise.

Reducing Vehicle Incidents

A special focus for employee awareness remained, as for previous years, on vehicle incidents with collisions and over-turning vehicles in the mine pit considered the most significant risks. Our goal is to achieve a zero incident rate. The following table shows the key vehicle accident statistics for the past three years, which we post on information boards around the mine site alongside photographs of recent incidents as a regular reminder of the constant need for care when driving. We also continue to improve driver skills and awareness through job assessments and training.

Currently we are in the process of reducing Light Vehicle permits/licenses in the pit in an effort to reduce the risk of Heavy Equipment and Light Vehicle interaction. As a result of a decrease in the number of road users the roads in the pit became even more secure. Thus, in 2017 we managed to avoid collisions of vehicles with the pit equipment.

Cyanide Transport and Handling

Cyanide is an essential chemical for gold extraction, which must be transported to site. In 1998, there was a cyanide spillage incident during transportation from the Balykchy Marshalling Yard to the mine site. An independent International Scientific Commission review was carried out shortly afterwards. The report concluded there were no serious or lasting environmental impacts, including no short or long-term damage to Lake Issyk-Kul, and there were no reported deaths that could be attributed to cyanide exposure.
The full report can be downloaded from the Kumtor website **www.kumtor.kg**. Since April 2012 Kumtor is certified by the International Cyanide Management Institute (ICMI) for transportation of cyanide from the Balykchy Marshalling Yard to the mine site in accordance with the International Cyanide Management Code.

Fig. 3.12 Vehicle Incident Reduction Program (total number of incidents)

	2015	2016	2017
Overall vehicle accidents	12	11	14
High-potential injury risk - light vehicle accidents	2	3	1
In-pit heavy versus light vehicle collisions	2	2	0
Injuries due to vehicle accidents	1	1	1

Emergency Prevention and Response

We have Joint Environment and Occupational Health and Safety Committee, consisted of 326 representatives from management, employees, and contractors from various locations of the Company. Our voluntary emergency response team consists of three teams at the Kumtor mine and one team at the BMY. The 24-hour mine team includes a medical doctor, is equipped with an ambulance, an emergency car, a fire appliance and extensive emergency response equipment at the mine site. The BMY team consists of a mobile emergency rescue vehicle, an ambulance, and extensive emergency response equipment. We review and update our emergency response plans annually, provide training and conduct periodic drills. Our mine rescue practices and training programs are aligned with best international industry standards.

Emergency Team Trainings

The emergency response team members from all Kumtor mine site locations go through Emergency prevention training sessions and exercises every Saturday, between 1 p.m. and 6 p.m. (5 hours) and two times per month at the Balykchy Marshaling Yard (3 hours).

In 2017, we conducted 52 training sessions at the mine, and 26 sessions at BMY, totalling 260 and 78 hours respectively, as well as special circumstance sessions at the mine site simulating various types of emergencies: cyanide and chemicals spills and dispersal, vehicle accidents, injuries, fires, etc. (six sessions at the mine site and five sessions at the BMY).

Additionally, every year, team members are trained in a specialized Training Center under the Ministry of Emergency Situations of the Kyrgyz Republic where they receive special certificates upon successful completion of the training. Command-post exercises for threats and emergencies are held at the district level with participation of the Kumtor emergency response team every third year. Our team also participates in the republican annual contest of rescuers and always takes prizes.

> “Our voluntary emergency response team consists of three teams at the Kumtor mine and one team at the BMY”

4.1 | ENVIRONMENTAL RESPONSIBILITY

We consider responsible environmental management an important part of our business.

Environmental Expenditures

We operate a full-time Environment Department of 25 people at the mine site. Total annual expenditure on environmental management (including capital expenditure) was $7.2 million in 2017 for a range of activities including monitoring, laboratory analyses, external consultants, waste disposal, emissions treatment, water treatment and environmental impact prevention/minimization.

Focused Environmental Studies and Projects

In 2017, we continued a range of focused environmental projects aimed at improving our environmental management practices, as well as our understanding of the natural ecosystem and our impact of operations upon it. These studies involved staff of the KGC Environment Department working with international consultants, scientists from the Kyrgyz National Academy of Sciences, postgraduates and specialists from the Kyrgyz National Agrarian University and other higher educational institutions of the country.

These projects included:

- Continued monitoring of traffic and dust concentrations in the Barskoon Valley in accordance with international standards;
- A variety of fauna surveys and hydro biological researches within the KGC concession area including observations of population of Marco Polo sheep, mountain goats, wolves, and foxes;
- Continued studies into the potential risk of CN impacts on biodiversity around the tailings management facility – as part of demonstrating compliance with the International Cyanide Management Code;
- Further cooperation with NGO "Flora and Fauna International" (FFI) to improve biodiversity conservation and management measures in the Sarychat-Eertash State Nature Reserve (SCER);
- Continued research into appropriate rehabilitation techniques for disturbed lands, including expansion of rehabilitation trial plots and development of strategies to increase storage life and viability of stripped topsoil;
- Continued research into the use of wetlands to reduce concentrations of ammonia and heavy metals in the waste rock dump runoff and the ETP discharge;
- Formation of a CAP Team to investigate and implement opportunities to reduce waste management costs and the amount of waste landfilled at the mine site;
- Monitoring of glaciers and meteorological conditions on the KGC concession area and in the basins of the Arabel and Uchkol Rivers;
- Controlled lowering of the water level in Petrov Lake to prevent a Glacial Lake Outburst Flood (GLOF).

Fig. 4.1 **KGC Environmental Protection Expenditures and Investments (USD)**

	2015	2016	2017
Waste disposal, emissions treatment	3,456,740	3,803,376	4,593,077
Pollution Prevention & Environmental Management Costs	3,344,100	3,018,788	2,633,312
Environmental Capital Projects	0	105,100	0
Total	6,800,840	6,927,264	7,226,389

> Total annual expenditure on environmental management was $7 million in 2017

USE OF BIOREMEDIATION METHOD TO REDUCE CONTENT OF OIL PRODUCTS IN SOILS (TEST WORKS)

The key priorities in improvement of KGC waste management strategy are reduction of negative impact on the environment and effective use of land resources.

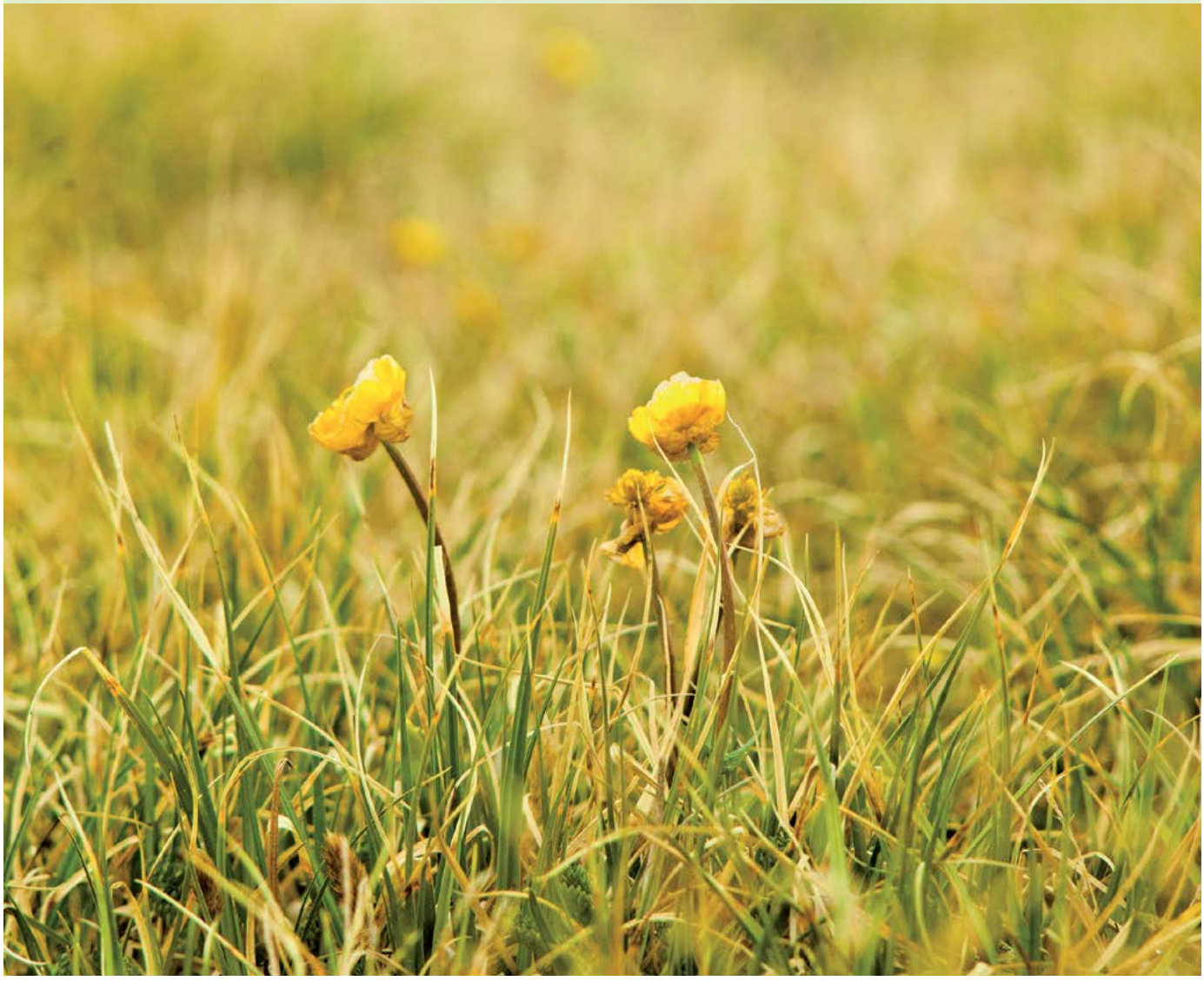
Among numerous anthropogenic contaminants received by the environment, oil products are in the first place. As a result of overloading, significant interruptions of self-purification processes may occur. Natural restoration of contaminated environment takes long time.

When contamination level is 5g/kg, auto remediation of oil-contaminated soils lasts from 2 to 30 years or more. This environmental problem is of particular importance due to the extent of contamination when soil excavation and ex-situ restoration (beyond the contaminated area) are impossible.

The main role in in-situ-remediation (within the contaminated area) belongs to the biological factor – the activity of microorganisms participating in petroleum hydrocarbons utilization and transformation processes.

Percentage of oil products in the Oily Rags Landfill waste is 2-15%. Currently, a bioremediation method is used to reduce content of oil products in contaminated soils. This method helps minimize technological operations, as well as contributes to land restoration and rational use of land resources.

In 2017, with KGC financial assistance, KTU "Manas" students conducted an analysis of contaminated soil to determine the content of oil products in the site landfill with a purpose of its further reclamation. It was found that the content of oil products was 10,440 mg/kg. With support of the project supervisor, the students also conducted a bioremediation analysis using local microorganisms. In 2016, in laboratory conditions, the content of oil products was reduced from 10,440 to 3,097 mg/kg, or by 70%. In 2017, scientific works continued, but already in the field, directly on site. The use of this method helped achieve destruction of oil products up to 90.1%. In 2018, the works will continue directly at the Landfill.



PILOT- AND DEMONSTRATION-SCALE TESTS OF TAILINGS SUPERNATANT

While the INCO SO_2/Air cyanide destruction process employed at the Effluent Treatment Plant (ETP) has been effective for 20 years, the ammonia produced by this process makes it challenging for Kumtor to comply with its Total Ammonia discharge criterion. To address this, the feasibility of using biochemical cyanide treatment process referred to as the "cyanohydrin process" was studies in 2017. The primary benefit of the cyanohydrin process for Kumtor is that, unlike many other cyanide destruction methods, this process destroys cyanide without producing ammonia or nitrate. The principal of this method is in applying a certain amount of organic carbon (glucose or fructose) and phosphoric acid.

Following preliminary test work, a series of pilot-scale tests was conducted at the mine in July 2017. Full- and pilot-scale tests amended with organic carbon showed a significant decrease in cyanide concentration without the production of ammonia.

4.2 | ENVIRONMENTAL MONITORING

Our monitoring programs follow both national and international standards, and include:

- Water quality and flow;
- Effluent quality and flow;
- Biodiversity;
- Air quality;
- Waste streams;
- Acid rock drainage;
- Meteorology.

Locations of the key monitoring points are detailed on the next page (Figure 4.3).

Fig. 4.2 **Description of Key Water Quality Sampling Points**

Station Name	Location Description
W1.1	Petrov Lake outflow – Kumtor River Head Waters (alpine glacier fed lake – elevated Al, Fe)
W3.4	Lysyi Creek before joining Kumtor River
W1.3	Kumtor River after confluence of Lysyi Creek and just before ETP discharge
TPX	End of tailings spigot – discharge into Tailings Management Facility (TMF) pond. Discharge point moves along dam wall.
T8.1	Tailings Pond (feed to ETP)
T8.4	ETP discharge point into Kumtor River (MAD limits apply)
W1.4	Between Kumtor bridge and flume 1km downstream from ETP discharge
SDP	Treated sewage discharge point into Kumtor River (MAD limits apply)
W4.1	Head water of Arabel-Suu diversion ditch (background level)
W4.2	Lower Diversion Ditch (LDD)
W4.3.1	Discharge of Upper Diversion Ditch (UDD) sediment pond to Kumtor River
W2.6	New Chon-Sarytor Creek in Central Valley before joining Kumtor River
POR1	Pit water collection sump before discharge to Kichi-Sarytor Creek
SWS.3	Kichi-Sarytor Creek before joining Kumtor River
SWW1	Meltwater from Sarytor glacier
W1.5.1	Kumtor River, just downstream from Kumtor Concession Area (voluntary compliance point)
W6.1	Arabel-Suu River, 6km from Kumtor Concession Area (background level)
W1.6	Kumtor River, 17 km from Kumtor Concession Area (before confluence with Taragay River)
W1.7	Taragay River, 40 km from Kumtor Concession Area (Kumtor + Kashka-Suu + Maitor Rivers)
W1.8	Naryn River in Naryn City, approximately 230km downstream from Kumtor Concession Area
W1.8F	Naryn River just after Naryn City
P5.2N, P5.3	Potable (treated drinking) water - Camp and mill

Fig. 4.3 Key Environmental Monitoring Locations

Meteorological monitoring

We have a mutually beneficial arrangement with the Agency of Hydrometeorology under the KR Ministry of Emergency Situations. The Kumtor meteorological station is a part of the national weather network, which provides weather forecasts, important for safe and efficient operation in the extreme climatic conditions on site. The new automatic meteorological station was constructed and commissioned in 2016. The old station installed in 1999 was decommissioned in 2017. This new station collects and exports data to MP5 database, in accordance with Canadian Atmospheric Environment Services protocols. The Saskatchewan Research Council in Canada is contracted to calibrate sensors and ensure they function correctly.

Hydrological Flow Monitoring

We track hydrological flows of the main water bodies within the concession area: Kumtor River and its principal tributaries (including Chon-Sarytor, Kichi-Sarytor and Lysyi Creeks), Petrov Lake, and the Upper and Lower Diversion Ditches that divert the Arabel River around the tailings management facility. The Kumtor River flow generally peaks between May and September each year. In 2017, a peak of 30.67 m^3/s was recorded on July 11. The total annual flow in the Kumtor River recorded at the flume within the concession area was 118.26 million m^3 and the flow at the End of Mixing Zone (also called W1.5.1), the KGC's main water quality compliance point, was estimated to be 180.91 million m^3. These variations are not considered significant in the context of normal year-to-year fluctuations (see Fig. 4.4). We also monitor water levels in Petrov Lake, which serves as the fresh water source for Kumtor Mine site. The highest recorded level was 3,733.20 m above sea level in July 2017 (compared to 3,732.54 m in 2016) and the lowest was 3,731.39 m at the end of December 2017 (compared to 3,731.51 in 2016). As the Kumtor River flows downstream after leaving the concession area, it receives additional flow from many tributary streams and rivers. At the nearest town Naryn, located approximately 230 km downstream of the mine, the flow increases to an estimated 2,340 million m^3 per year. Our water use at the mine site has no measurable impact on river flows at Naryn since the volume extracted each year from Petrov Lake represents just approximately 0.2% of average annual flow at Naryn. The treated effluents discharged back to the Kumtor River also reduce the net extracted volume (Fig. 4.5).

Water Quality Monitoring

We follow a comprehensive program of sampling and analyses for water quality based on a network of more than 30 stations. The key stations are listed and described in Figure 4.2 in this section, with locations shown on an aerial photograph of the concession area (Fig. 4.3 and in Figure 4.5). Water quality results and associated discussion are in a separate section of this report: Water Quality and Compliance.

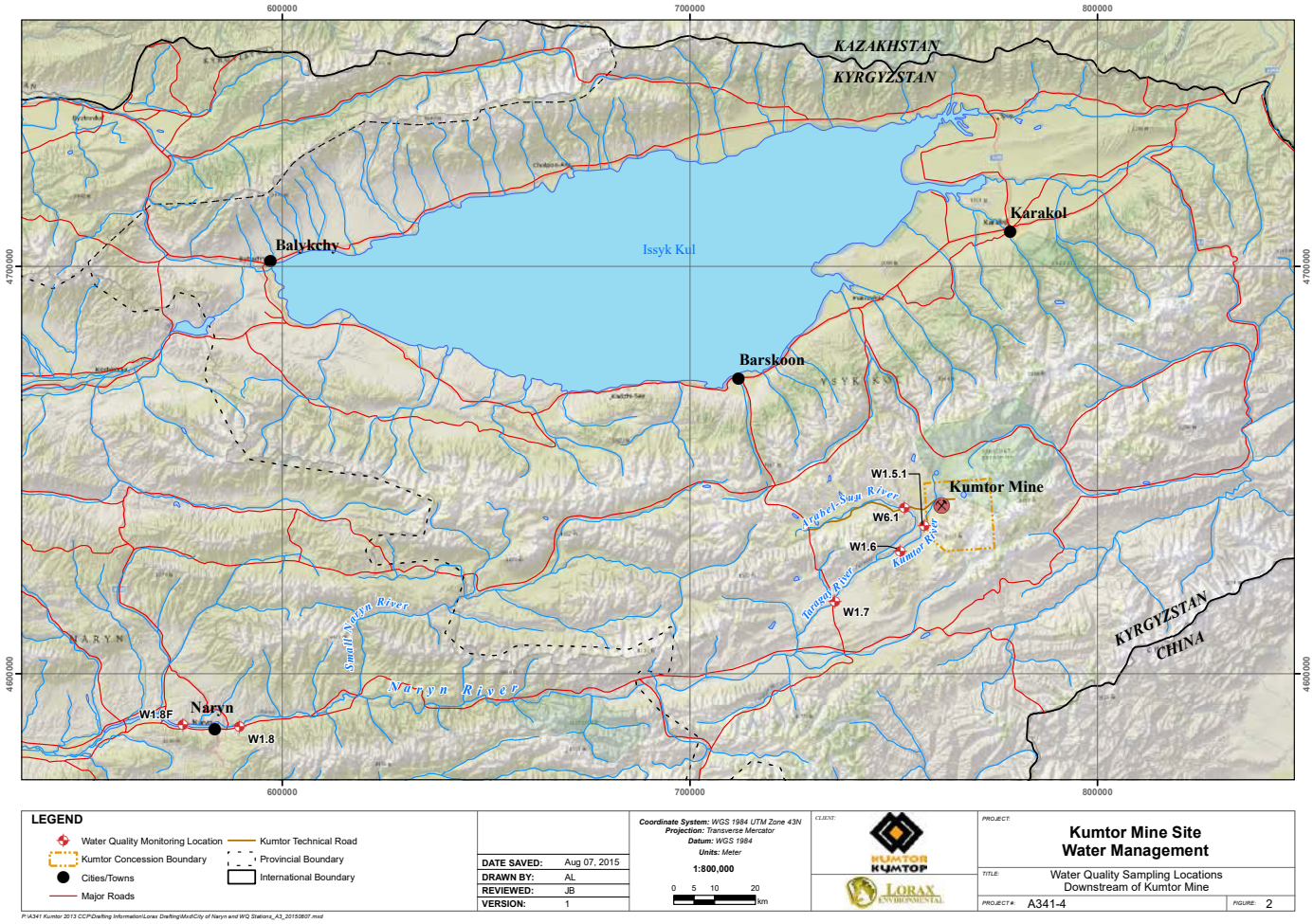
ENVIRONMENTAL DATA MANAGEMENT SYSTEM

To minimize the risk of human error and ensure quality control of data, in 2016 we adopted a comprehensive and integrated Environmental Data Management system, MP-5. This helped to automate the data collection process as much as possible. Field data is now entered directly using iPads and synchronized later in the office. External laboratory reports are directly imported into the database. Some environmental monitoring instrumentation (river and creek flows, weather etc) imports data directly into the MP5 database. The system helps to analyze and integrate data quickly and accurately, and report on compliance against environmental standards. Warning and compliance levels have been established in the system to ensure any data, which is outside of specified ranges, leads to an alert emailed to responsible employees and management. The majority of environmental data is now entered directly into the system, minimizing the risk of human error and leading to the removal of most paper templates and spreadsheets from use.

Fig. 4.4 **Kumtor River Flow**

Monitoring station	units	2015	2016	2017
Annual Flow in Kumtor River at flume (W1.4)	m^3/year	159,247,771	107,553,394	118,264,372
Annual Flow in Kumtor River at compliance point (W1.5.1)	m^3/year	197,085,788	131,030,653	175,911,331
Annual Peak instantaneous flow in Kumtor River at Flume	m^3/s	36.72	16.6	30.67
Peak daily flow in Kumtor River at Flume (W1.4)	m^3/day	3,172,608	1,433,376	2,649,888

Fig. 4.5 Water Quality Sampling Stations Downstream of Kumtor Mine



Quality Assurance and Control

Most of our analyses are contracted to a professional external laboratory, Stewart Assay and Environmental Laboratories LLC (SAEL), part of the international ALS group. SAEL is located in Kara-Balta in the Kyrgyz Republic. We also maintain an on-site laboratory to support operational control. We routinely review our sampling program and processes, updating them as appropriate. Our monitoring program includes a formal Quality Assurance and Quality Control (QA/QC) program for collection and handling of samples. This includes duplicate samples, blind samples, and blank samples, as well as calibration and documentation of instruments and procedures. As part of quality control, samples are sent to expert local and international laboratories including Stewart Assay and Environmental Laboratories LLC (SAEL in Kyrgyz Republic), Saskatchewan Research Council (Canada), and Lakefield Research Laboratories (Canada). Lakefield Research specializes in cyanide chemistry and analysis.

> “To minimize the risk of human error and ensure quality control of data, in 2016 we adopted a comprehensive and integrated Environmental Data Management system”

4.3 | BIODIVERSITY

Our Commitment

We are committed to our obligations to preserve natural biodiversity, reduce negative impact of operations on the environment during operation of the mine and cooperate with our partners to increase biodiversity. Further information is available on our website via the link below from where our full Biodiversity Management Strategy and Plan (2012) can be downloaded: **www.kumtor.kg/en/environment-protection/biodiversity**.

Regional context

The Tien Shan mountain range is one of the longest in Central Asia, stretching approximately 2,800 km through mostly the Kyrgyz Republic and China. The peculiarity of the region is in its unique biodiversity. Moreover, it is home to a number of endangered animals, including snow leopard and the Marco Polo sheep (Argali).

The snow leopard is an important cultural symbol in Central and South Asia and features widely in local folklore. Like the snow leopard, an aquatic plant in the *Ranunculus* family (*Hedysarum kirgizorum*), endemic species of dandelion (*Taraxacum syrtorum*) and a tulip (*Tulipa tetraphylla*) are included in the Kyrgyz Red Data book. Glacier-fed rivers, including the Kumtor River, which originates from the Petrov Lake, form part of an important ecosystem service for a broader range of communities in the Kyrgyz Republic and for the Kumtor Mine itself. The Tien Shan region also contains significant grasslands, which provide carbon storage and sequestration services.

Ecosystem services

Ecosystem services are the benefits that people and businesses derive from ecosystems. Kumtor Mine is remote, with no villages close to its boundaries that could be impacted by operations at the mine site.

The nearest village, Ak-Shyirak, with a population of approximately 120, is located approximately 80 km from the mine in another valley. Agricultural activities for the Ak-Shyirak community, such as crop growing, are very limited due to the harsh high altitude climate. Their livelihoods rely on grazing sheep, goats, and other livestock, in addition to government-funded support. There is also seasonal sheep grazing in the valleys leading to the Kumtor Mine site.

While there is little scope for KGC's operations to negatively impact ecosystem services of Ak-Shyirak, our support – alongside contributions by other key nature conservation players – for biodiversity conservation (see below) is expected to generate positive benefits for the wider region.

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WILDLIFE MONITORING ON THE TAILINGS MANAGEMENT FACILITY

In 2017, the daily wildlife census monitoring program continued on the KGC TMF. The program was developed to identify and count all avian and mammalian wildlife on the TMF and its immediate surrounds, and confirm that the facility was not having an adverse effect on wildlife. The daily monitoring is undertaken by trained KGC environmental personnel, with regular review and supervision by a recognized expert in the Kyrgyz Republic. The monitoring data is also reviewed by an independent internationally recognized ornithologist. Observations around the TMF were completed on 362 days out of possible 365 days in 2017 – which equates to 99.7% daily coverage. Table 4.6 presents a summary of the daily wildlife observations. The information is presented as 'bird-days' and 'mammal-days' which provide a comparative parameter and quantitative measure of the TMF usage or occupancy by wildlife. It is calculated by multiplying the number of animals (birds or mammal) seen by the number of days on which they were seen. This is valuable in the context of the TMF as it presents a broad measure of potential contact of wildlife with the tailings and supernatant water and exposure to their cyanide content. In 2017, four mammal species were recorded on the TMF (Grey Marmot, Red Fox, Wolf and Argali) and 30 species of birds – predominantly made up of wildfowl and waders. Two bird carcasses were recorded during the year – a duck and a grey heron (the same number was recorded in 2016). In both cases these are widespread species that died most likely by natural reasons or were attacked by predators. The duck's death was caused by its poor physical condition aggravated by severe weather conditions, while the weakened grey heron became easy prey for vultures. It is unlikely that the birds' exhaustion was caused by the impact of the TMF.

In summary, the extreme weather conditions and low food resources at the high altitude TMF continue to present a low-visitation and unsuitable habitat for birds and other wildlife. For most of the year, the TMF pond remains frozen, preventing wildlife exposure to the supernatant water. Monitoring indicates that the Kumtor TMF system continues to present a relatively low cyanosis risk to avian or other wildlife despite the periodic elevated cyanide concentrations in the tailings. The daily wildlife census monitoring program will continue in 2018.

Fig. 4.6 **Summary of wildlife observations on the TMF:**

Indicator	Total
No. of days No wildlife observed	188/362
No of days mammals observed	85/362
No. of mammal days 2017	196
No. of mammal days 2016	201
No. of mammal days 2015	446
Max. mammal group size seen	11
No. of birds observed	127/362
No. bird days 2017	1,499
No. of bird days 2016	1,111
No. of bird days 2015	6,505
Max. bird flock size seen	150

KGC'S SUPPORT TO THE SARYCHAT-EERTASH NATURE RESERVE (SCER)

KGC has cooperated with Fauna & Flora International (FFI) to deliver biodiversity conservation and management in the SCER and the wider surrounding Central Tien Shan landscape area of Kyrgyzstan. The two parties have signed a Memorandum of Understanding (MoU) to act as a platform for cooperation. As part of a five year commitment, in 2015 KGC provided financial support of $50,000 to enable FFI to work with the SCER administration and local stakeholders to develop and deliver effective conservation actions in line with the updated SCER Management Plan. Activities in 2017 were built on the achievements of previous years and took forward priority actions from the Management Plan.

SARYCHAT-EERTASH STATE RESERVE MANAGEMENT PLAN

The SCER Management Plan that was first developed by FFI with earlier support from IFC/EBRD and ongoing support from KGC, was approved in the summer of 2016. Now the reserve staff can officially rely on and be guided by the activities included in the management plan that was designed with inputs from Sarychat-Eertash management and staff, as well as international and local specialists in relevant fields.

TRAINING ON WILDLIFE MONITORING SCHEME

In 2017, the project activity was focused on strengthening the potential of field workers. The training developed by scientists from the KR National Academy of Sciences (NAS KR) in 2015 was improved after feedbacks received from rangers in the course of the training sessions held in 2016. Another two-day training was held in June 2017 and included both theoretical and practical modules during which employees were familiarized with the biology and ecology of animals and birds inhabiting the nature reserve, identification of species by various signs, including tracks, and methods for fauna monitoring. Refresher training on the use of GPS-navigator and maps was held.

GRANTS FOR POSTGRADUATE STUDENTS

In 2017, a tender was announced for a grant program to conduct biodiversity research in the nature reserve. A total of 12 applications was submitted by various universities of the Republic. After selection and interviews, two projects received such grants. The first group conducted a biochemical analysis of water resources in the Sarychat-Eertash Nature Reserve and the Kumtor Valley. Currently, hydrological, water and zoobenthos samples are collected for analyses from 18 sampling stations. Results of analyses will be used to update the Reserve Management Plan. The second group of botanists studied vegetation using advanced methods of analysis. The group is expected to provide results of ecological and floristic monitoring of plant species, assess the human impact on the local flora, identify the distribution area of medicinal and odoriferous plants, as well as other vegetation species.

STUDY OF VERTEBRATE ANIMALS AND BIRDS AT THE KUMTOR MINE AND ON ADJOINING AREAS

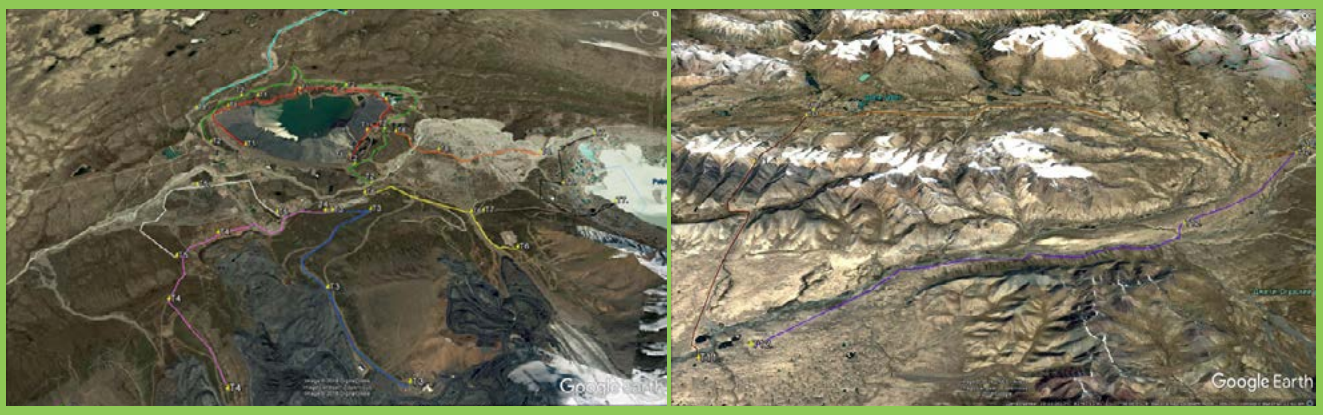
Objectives of the study included the following: assessment of quantity of animals and birds; identification of species composition of vertebrate animals and birds, distribution by habitats, characteristics of stay at the habitat, abundance of species (population density), common species, population trends (natural dynamics); assessment of impact of the mine's activity on vertebrate animals and birds, especially on protected species – rare, endemic, endangered, listed in the Red Book species; identification of especially valuable habitats – areas of mass reproduction of specially protected species, foraging areas, rest areas of migratory species, migration routes; identification of animal species especially sensitive to the mine's operations.

Wildlife census was conducted on the pre-determined transects where location (start and end of transect) was recorded by the GPS-navigator (Fig.4.7). 10-zoom binoculars and 60-zoom telescope were used to identify to species level and count animals.

When signs of vital activity of mammals (burrows, tracks, excrements, etc.) were found, mammals were identified to species level. But in many cases, presence of mammals on site was visually observed. Presence of individual species of animals was recorded by various signs of their stay – paw prints on snow or ground, food remnants, flocks or feathers, paths, burrows and lairs, etc. An aerial census was conducted with the use of a quadcopter DJI Inspire 2, X5S. The apparatus flew around the areas of possible wildlife habitats and after that made photo and video recordings of the identified habitats.

During the entire period of observations in 2017, 4 species of mammals with 1,389 individuals were recorded at the mine, and 4 species of mammals with 608 individuals were recorded outside the mine.

Industrial development of the Kumtor deposit is an example of one of the most advanced industries where animals are strictly protected and not exposed to any anthropogenic impact. Despite the fact that heavy equipment constantly operates at the mine's area, animals, especially ungulates and predators, are not afraid of the presence of human activity, i.e. disturbance factor does not affect animals. On the contrary, in some cases during the hunting season wild animals move from the nearby hunting farms to the mine's area where they are safe. This indicates that the Kumtor mine operations does not have any adverse impact on wildlife.



4.7 *Map of census route (transect) within the mine*

STUDY OF VEGETATION COVER AT THE KUMTOR MINE AND IN BARSKOON GORGE

To study vegetation cover of the deposit, a field expedition was organized, study areas of which included the mine itself and its surrounding area.

The purpose was to study the current condition of flora, to identify the main patterns and factors of impact on the environment at the Kumtor deposit, to determine impact of the mine's activity on rare and endemic plant species, to determine impact of dust on the vegetation in Barskoon gorge, to determine the need for further measures to reduce the negative impact, to provide recommendations on plant species suitable for use as a screen for protection against dust.

Description of vegetation was based on 100m^2 plots. Plants growing within the same community outside the plot were also taken into account. No less than six plots in total were set up within one community, the results of which were summarized (Fig.4.8). Abundance of species was estimated according to the Drude scale.

IMPACT OF KGC ACTIVITY ON VEGETATION COVER OF THE DEPOSIT

It should be understood that vegetation cover is affected in the production zones where vegetation cover is destroyed in the course of industrial operations necessary for development of the deposit. However, vegetation cover is not significantly affected outside the production zones, even in close proximity to roads, facilities and the mine itself.

This is evidenced by a good preservation of vegetation cover of the deposit which does not differ from that on the areas outside the mine, being often even in a better condition. All people and vehicles move through the territory of the mine on existing roads with almost no one moving beyond the roads. Vegetation cover on the territory of the mine is stressed by the activity of wild animals which are its only users because grazing of domestic animals on the territory of the mine is not permitted and domestic animals graze outside the mine.

4.8 *Areas of flora and vegetation study in Barskoon gorge*

IMPACT OF DUST ON VEGETATION IN BARSKOON GORGE

The road from Barskoon village is used by KGC transport, the frontier patrol covering At-Bashy village over Suek pass and Jetimi range. It is also used for herding cattle to summer pastures and back, as well as by tourists visiting Barskoon Gorge. The road serves many other purposes and people beyond KGC. During the study, visual dustiness of plants in Chychkan gorge was found. Leaves, visually covered with dust, were found only on plants growing directly near the road. It is apparent that dust on them comes directly from wheels of passing vehicles. No dust was found on plants growing more than one meter from the road. This is due to significant precipitation in this gorge, as well as measures taken by KGC to reduce the level of dust produced on the road. The plants growing directly by the road receive most of dust thereby protecting the remainder of the plants. However, the observations have shown that dust does not have a significant impact even on the plants growing directly by the road (figure 4.9).

Measures taken by KGC to reduce the amount of dust produced (daily road surface watering) appear to be sufficient to ensure preservation of the surrounding vegetation.

4.9 *Absence of dust on the needles of fir-tree growing directly near the road*

CONCLUSION

Flora of the Kumtor Mine (from 1993 to 2013) consists of about 180 species, and in adjacent areas the number increases to 208 species from 33 families.

The 2017 survey did not show any significant differences in the flora composition. The flora composition was supplemented with one more species – *Stellaria irrigua Bunge*, which was not found during the initial survey. One more species of lichen belonging to the genus *Aspicillia*, was also found but was not identified to species level.

During the survey of areas adjacent to the road in Barskoon gorge 70 species of vascular plants were identified. A thorough survey of flora in Barskoon gorge requires repeated visits to the gorge in different vegetation periods.

Significant impact of KGC activity on vegetation cover was not identified. Uncontrolled grazing of cattle, as well as recreational load, have a much greater impact on vegetation cover.

Impact of dust on vegetation cover is mitigated by regular road surface watering.

Planting of various species of willow *(Salix spp.)* can be recommended as a protection against dust generation. As an additional row of plants to fill the space between trunks of willow trees, sand thorn bushes *(Hippophae turkestanica (Rousi) Tzvelev.)* can be planted.

Vegetation cover beyond the production area within the Kumtor mine territory is not exposed to any significant impact.

Flora at the mine and on surrounding areas include two species listed in the KR Red Book – *Allium semenovii Regel* and *Tulipa tetraphylla Regel*, as well as a conditional endemic species of Kyrgyzstan – *Taraxacum syrtorum Dzan*.

Any impact of KGC on *Allium semenovii Regel* и *Tulipa tetraphylla Regel* was not identified. These species do not require any special protection measures. *Taraxacum syrtorum Dzan*. is exposed to a certain impact, however, the main habitats of this species within site boundaries are located beyond the territory of active production.

IMPACT OF KGC ON RARE AND ENDEMIC PLANT SPECIES

Flora composition of the deposit and surrounding areas includes two species of plants listed in the KR Red Book (KR RB) - *Allium semenovii Regel* (Fig. 4.10) and *Tulipa tetraphylla Regel* (Fig. 4.11) as well as a conditional endemic species of Kyrgyzstan – *Taraxacum syrtorum Dzan* (Fig. 4.12).

4.10 *Allium semenovii Regel*

Allium semenovii Regel. Although compilers of the Red Book did not have any data on numbers of this species, it was included in the KR RB. Within the KGC mine area, this species was found by us only in mountains on the left side of the Kumtor River flowing out from the Petrov Lake where actual KGC activity is not conducted and, therefore, threat to this species does not exist in the KGC impact zone.

4.11 *Tulipa tetraphylla Regel*

Like the above-mentioned species, compilers of the Red Book did not have any data on numbers of this species, but *Tulipa tetraphylla* was included in the KR RB. Within its habitat, the species is abundant enough, and given that it is not decorative enough, real threat to this species from humans does not exist. Despite all the above, this species is included in the KR RB. However, within the KGC impact area, this species was found only in forest belt in Barskoon gorge by Usupbaev A. Real threats to this species in Barskoon gorge do not exist because it grows apart from the road.

4.12 *Taraxacum syrtorum Dzan*

Taraxacum syrtorum Dzan belongs to conditional endemics of Kyrgyzstan.

Unfortunately, it is impossible to take any measures to protect this species. However, even with complete extinction of this species within the KGC area (which is unlikely, because most of plants are concentrated in the areas that are not currently exposed to direct impact), this species will continue to grow in many other regions of Kyrgyzstan.

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- Davletbakov A. Study of vertebrate animals and birds at the Kumtor Mine and on adjoining area. Bishkek, 2017;
- Lazkov G. Study of vegetation cover of the Kumtor Mine and Barskoon gorge. Bishkek, 2017.

Fig. 4.13 **Regional Fauna Species with Conservation Status Identified Within the Study Area***

Common Name	Latin Name	Kyrgyz Red Book (2006)	IUCN Red Book	Kumtor Concession	SCER
		Mammals			
Snow leopard	*Uncia Uncial*	Critically Endangered	Endangered	Yes	Yes
Brown bear	*Ursus Arctors*	Locally Rare	Least Concern	No	Yes
Mountain sheeps	*Ovis Ammon*	Vulnerable	Near Threatened	Yes	Yes
Pallas's cat	*Otocolobus Manul*	Near Threatened	Near Threatened	No	Yes
Stone marten	*Martes Foina*	Lower Risk/Least Concerned	No	Yes	Yes
Eurasian lynx	*Lynx lynx*	Near Threatened	Least Concern	Near	Yes
		Birds			
Golden eagle	*Aquila Chrysaetos*	Near Threatened	Least Concern	Yes	Yes
Lammergeyer	*Gypaetus Barbatus*	Near Threatened	Least Concern	Yes	Yes
Saker Falcon	*Falco Cherrug*	Endangered	Endangered	Yes	Yes
Black Stork	*Ciconia Nigra*	Near Threatened	Least Concern	Yes	Yes
Whooper swan	*Cygnus Cygnus*	Least Concern	Least Concern	Near	Yes
Eurasian Black Vulture	*Aegypius Monachus*	Near Threatened	Near Threatened	Yes	Yes
Himalayan Griffon	*Gyps Himalayensis*	Least Concern	Least Concern	Yes	Yes
Demausel Cranes	*Anthropoides Virgo*	Near Threatened	Least Concern	Yes	Yes
Eastern imperial eagle#	*Aquila heliaca*	Vulnerable	Vulnerable	M	M
Eurasian Eagle Owl	*Bubo bubo*	Least Concern	Least Concern	Near	Yes
Ibisbill	*Ibidorhyncha struthersii*	Vulnerable	Least Concern	Near	Yes

Note: *SCER is Sarychat – Eertash Nature Reserve; IUCN is the International Union for Conservation of Nature.*

** In 2016, KGC improved the technical equipment of specialists conducting wild animals and birds monitoring near the mine. More powerful optical surveillance equipment was purchased, photo and video equipment updated. Moreover, the frequency and duration of animal observation was increased. This allowed to detect and register six species of animals (rendered in bold) included in the red book and the IUCN list.*

 # M – marked on a span (seasonal migrant).

4.4 | ENERGY USE AND CARBON EMISSIONS

Energy consumption

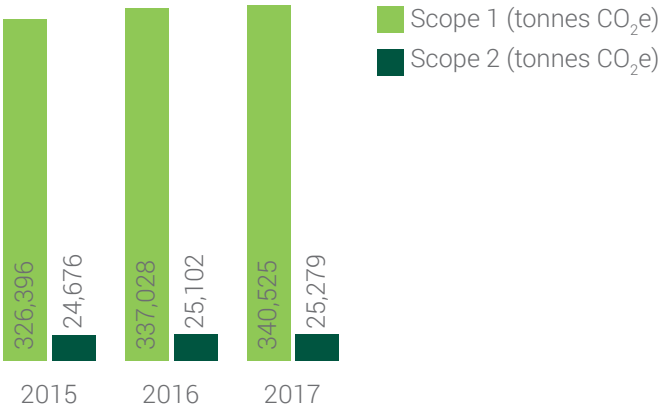
Our large-scale mining operation is a significant consumer of fuel and electricity. Fuel represents over 20 percent of our commodity and service-related purchases. However, wherever feasible, we use electricity. The most energy intensive operation is the mill, representing approximately 75 percent of our electricity consumption. The Kyrgyz Republic generates more than 70 percent of its electricity through hydropower. In fact, the Kyrgyz Republic is a leading producer and exporter of hydroelectric energy in the Central Asia region, due to its mountainous terrain and abundant water resources. The major source of the power supplied to KGC is from the Toktogul Reservoir located on the Naryn River. This means that our specific GHG footprint generated from electricity is relatively low. It also means that efforts that reduce or replace our fuel consumption with grid power offers the greatest value in terms of reducing our GHG emissions. We continue to calculate and monitor our greenhouse gas (GHG) emissions, and explore ways to reduce them as part of energy conservation measures. Our calculations include our three main sites: the Kumtor mine, Balykchy Marshalling Yard, and Bishkek head office. However, the mine represents around 98 percent of energy use, and the only site using explosives. We include explosives in our GHG emission calculations as it was determined to be a significant component of the total emissions.

Fig. 4.14 Electricity, Fuel and Explosive Consumption (Kumtor Mine)

GHG emissions and intensity

Scope 1 (direct) total GNG emissions in 2017 are higher by 1% compared to 2016, mainly because we have slightly increased the use of fuel and explosives in the pit. Scope 2 (indirect) total emissions in 2017 are comparable to 2016. Kumtor's GHG intensity, a measure that normalizes GHG emission to gold production, is less than the previous periods, despite a slight increase in total GHG emissions but a higher gold production.

Fig. 4.15 GHG Emissions



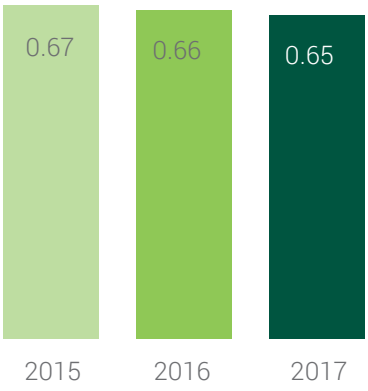
Energy conservation measures

We aim to lower our GHG intensity by reducing our specific energy consumption and by increasing energy efficiency. We switch from diesel generators to grid electricity, wherever and whenever feasible, for such uses as mine-site lighting, dewatering pumps, and other equipment. This reduces both costs and our GHG footprint. After the mill, our truck fleet is the largest energy consumer. Our program of reducing vehicular-related fuel consumption has the benefit of reducing use of energy and carbon-intense consumables. For example, we are transitioning to more fuel-efficient engines and have a proactive program to reduce the need for, and occurrence of, running engines on parked vehicles. We have also implemented energy conservation measures ranging from the installation of low wattage, high efficiency lighting systems, better insulation in camp buildings, and encouraging behaviour changes. However, such activities do not make a material difference to our GHG footprint due to the fact that these energy uses are very small, compared to major operational energy use, and because electricity already has a low GHG intensity. We continue to explore approaches that may help reduce our energy and GHG intensity but because electricity is already mostly from renewable sources, the scope is limited.

External reporting

As in previous years, KGC's carbon footprint is reported through Centerra's participation in the Carbon Disclosure Project. This is an independent international not-for-profit organization that tracks and reports corporate information pertaining to climate change. The data for individual companies is publicly available.

Fig. 4.16 GHG Intensity Ratio



> "We take measures to save energy - from installing appliances with low power consumption, better insulation in living quarters to changing our employees' thinking"

4.5 | AIR EMISSIONS

Road dust, dispersed by moving cars and trucks, is the main source of observed and measurable air emissions along the access road passing through the Barskoon Valley. Concerns have also been raised about mine dust deposition on nearby glaciers.

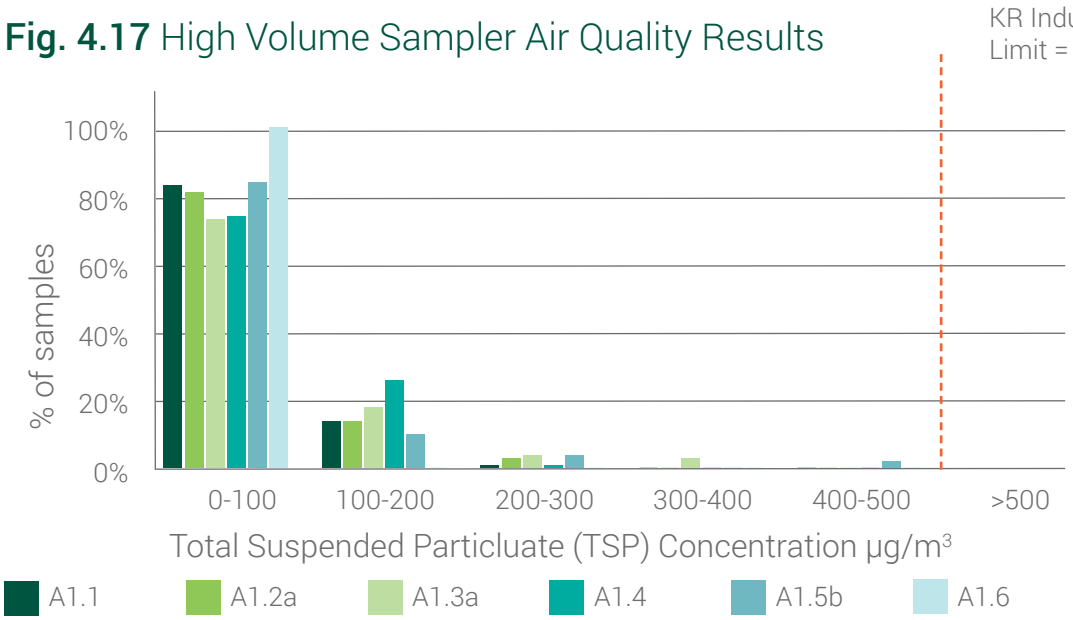
Air Quality at the Mine

We constantly monitor the air quality at the mine and provide relevant reports. This effort is supported by six large-volume samplers located around the mine site to measure total suspended particles in the air (TSP) levels. In 2017, the TSP concentration at all monitoring stations was below the Kyrgyz 24-hour limit of 500 µg/m³ for industrial zones. Our analysis of the historical data indicates that in the spring, the increase in the level of TSP is generally related to commencement of tailing dam works. Selected TSP samples are also analyzed for cyanide, sulphur, arsenic, nickel, selenium, zinc, uranium, radium-226, and strontium-90. Consistent with previous results, the 2017 monitoring data, which are presented in the Appendix, demonstrate that the indicators are below the relevant threshold limit values. KGC has Maximum Allowable Emission (MAE) limits for pollutants emitted into the atmosphere.

Actual emissions are compared against the MAE limits (Figure 4.18) and calculated based on a variety of operational data, including:

- Volume of ore mined and deposited at waste rock dumps;
- Annual average consumption of all types of explosives (ANFO, emulsion);
- Total number of days for processing;
- Specific consumption of ANFO and emulsion per 1 m 3 of processed rock;
- Size fraction of rock in the waste rock dumps and ore in the ore stockpiles;
- Average humidity of rock in the pit;
- Number and types of pit machinery and equipment;
- Total volume of consumed diesel fuel and gasoline (lead-free), including stationary sources;
- Average operating efficiency of dust-gas collecting units at the Mill, Crusher, Assay Laboratory, Mobile Batch Plant (data on instrumental measurements);
- Average concentration of pollutants in emissions from the Mill, Crusher, Emulsion Plant, Assay Laboratory (data on instrumental measurements);
- Work hours of emission sources of on-site main and auxiliary facilities;
- List of areas and volumes of dumped mine rock in waste rock dumps and ore stockpiles etc.

Fig. 4.17 High Volume Sampler Air Quality Results



Note: *TSP is total suspended particulates, Kyrgyz 24-hour TSP compliance limit for industrial zones is 500 µg/m³. Monitoring station locations change occasionally along with changing footprint of the mine.*
Only annual average results are shown for locations with more than 6 months of data.

Fig. 4.18 **Comparative emission data at the Kumtor mine and MAE (t/year)**

Pollutant	MAE Standard 2017	Actual 2017
Dust that contains SiO_2 20-70%	912.3382	783.5938
Hydrogen cyanide	0.0008	0.0008
Sodium hydroxide	0.3627	0.07346
Calcium oxide dust (lime)	1.4690	1.9641
Carbon (soot)	0.09228	1.23278
Welding aerosol	0.433391	0.354798
Manganous oxide	0.058833	0.047929
Tetrafluorosilane (fluorides)	0.0194	0.015653
Hydrocarbon	3.75573	10.00873
Carbon oxide	47.83855	66.03125
Nitrogen dioxide	297.10872	85.02892
Hydrogen fluoride (fluorides)	0.051646	0.040897
Lead and its inorganic compounds	0.00144	0.0015
Sulfur dioxide	1.17532	6.52672
Ammonia	0.8028	0.3433
Hydrochloride	0.0000257	0.000077
Silica compositions	0.0194	0.015653
Nitrogen oxide	0.07329	0.07329
Hydrocarbons (by kerosene)	2.37934	2.37934
Total	**1,267.98**	**957.99**

According to the composition and the volume of pollutants emitted into the atmosphere, the mine site is classified as the first category hazard. Emissions of non-stationary sources are calculated according to methodological instructions based on actual data (operational factors) of the previous period. As shown in Table 4.18, in 2017 a total of 957.99192 tons of pollutants were released into the atmosphere from sources in the work sites, most from operations in the pit. The major part of emissions was due to blasting operations, the release of calcium oxide and inorganic dust as a result of ground hauling and loading operations. The greatest part of emissions into the atmosphere from the gaseous pollutants is accounted for nitrogen dioxide. In the concession area, the maximum concentration of the earth surface is 0.2 of the MAE standard. The maximum concentration of the remaining pollutants does not exceed 0.3 of the MAE standard. According to the calculations, the Kumtor mine impact on the atmosphere is estimated as moderately significant. Based on the concentration of pollutants on the earth surface, we can say that outside the concession area, none of the pollutants exceeds the MAE limits. To reduce this effect, work areas are moistened during mining and other operations at the mine, including ground hauling and loading operations. The stoping faces are also moistened, before and after blasting. Taking into account the fact that the Sarychat-Eertash State Reserve is located in the vicinity of the mine site, regular monitoring of air is conducted in the north-eastern part of the concession area and in the northwestern part of the reserve.

Dust Level in the Barskoon Valley

Transport of employees to the workplace, as well as delivery of consumables and other materials is carried out on a technological route that passes through the Barskoon Valley and is served by KGC. The route leads to several settlements, including the village of Ak-Shyirak, summer pastures and hunting farms in high-mountain valleys, Sarychat-Eertash nature reserve, tourist routes also take place here. The road is used not only for mine supply delivery but also by local residents, researchers, hunters and tourists.

In order to avoid an increase in the dust level in the Barskoon Valley, we continued watering the road with more than ten water tankers, daily servicing the road. As in previous years, to determine the total number of suspended particles in air (TSP) in the summer of 2017, three large-volume samplers were installed. In the Barskoon gorge there was no exceedance of the maximum permissible emission norm of 100 μg/m^3 . To confirm that the company vehicles do not fully influence the level of dust, in autumn 2014 a sensor was installed in the gorge, fixing any vehicles passing at a speed of more than 10 km/h. Also, along the entire technological route, dust counters, instruments for measuring the dust content in the air, were installed before the mine site, and since 2015 the data are being monitored. The results of the measurements show that the selected air samples meet all international criteria for dust precipitation and sanitary and hygienic indicators.

According to the survey, conducted by G.A. Lazkov, Doctor of Biological Sciences NAS of the KR, it was determined that the KGC activities do not have a significant effect on the vegetation cover of the Barskoon gorge. Uncontrolled grazing and recreational loads have a much greater impact.

Residents of some villages in the Issyk-Kul region say that dust and other emissions occurring at the mine have a negative impact on them. However, the mine site is separated from these villages by a mountain range, and the distance to them exceeds several tens of kilometres along the radius, which excludes the impact of the mine on the purity of the atmosphere in this area. Burning of rubbish and other uncontrolled air emissions are known to be commonplace in these village areas, and therefore, a much more likely source of emissions.

> “Following stakeholder concerns about dust levels in the Barskoon Valley, we expanded our road watering activities and continued monitoring dust levels”

Fig. 4.19 **Dust Monitoring in the Barskoon Valley (μg/m³)**

Sampling Points (Stations)	Jul 2015	Aug 2015	Jul 2016	Aug 2016	Jul 2017	Aug 2017
#1	88	71	30	41	31	41
#2	78	58	37	89	20	89
#3	47	71	50	59	12	59
Recommended MAC*	100	100	100	100	100	100

Note: *#1 sampler was located 50 m south of the road from the upper Kamaz truck monument; #2 sampler was located 100 m to the north from the road, towards the Barskoon River; #3 sampler was located 50 m to the north of road, opposite to Kamaz truck monument, towards Barskoon River.*

** Recommended KR maximum admissible concentration (MAC) standard for populated areas*

4.6 | WASTE MANAGEMENT

KGC understands the importance of minimization of negative impact of waste on the environment and operates in compliance with Good International Industry Practice. We are committed to the ongoing improvement of our waste management strategy.

Waste Management Strategy

In 2013, KGC developed an integrated waste management strategy with input from international consultants. This strategy includes principles such as minimizing the negative impact of waste on the environment and effective use of financial resources spent on labour and purchase of equipment. In 2017, KGC achieved the previously set objectives for waste management, namely:

- 100 % recycling of industrial waste;
- Reduction of the volume of solid domestic waste to be landfilled by 50%;
- 100 % recycling of food waste from the camp kitchen on site.

Major Waste Streams

Three major types of waste (not including waste rock and tailings) result from the mine operation: solid domestic waste, industrial and hazardous waste. Solid domestic waste includes food waste, various types of packaging, as well as other out-of-service household items. Industrial waste includes scrap metal, waste tires, plastic, waste oil and fluids, and other low hazard waste, generated in large volumes and subject to recycling and further use as a secondary raw material. Hazardous waste includes packaging materials, polypropylene bags and wooden boxes used for transportation of toxic agents, batteries, mercury lamps, medical waste and expired reagents. An important part of effective waste management is the accurate recording of waste generation. In previous years, KGC used mainly visual observation as a method of recording the volume of waste generation. Starting from 2017, all waste taken out to landfills or for processing are weighed.

Improvement of Waste Handling Practices

Reducing the negative impact on the environment and the effective use of financial resources related to waste management are the key priorities in improving our waste management strategy. As part of the implementation of the strategy objectives, KGC seeks for partners able to provide waste processing/recycling services, contributing to reduction in waste volumes disposed at site landfills.

Since 2014, not a single kilogram of industrial waste has been disposed on site. Scrap metal, plastic, rubber, wood, paper, waste oil and other waste are removed from the mine to our local partners to reuse and recycle. The reuse of scrap metal in the production of grinding balls is of particular note. The local company “Vulkan Plus” produces different size steel balls used for ore grinding at the Mill. In 2016, KGC spent $4.5 million on the purchase of grinding balls, which demonstrates KGC’s commitment to support local producers and suppliers. Solid domestic and hazardous waste are disposed at two landfills commissioned in 2015.

These landfills were designed and constructed in full compliance with all engineering and environmental requirements of the KR applicable regulatory documents. When designing and constructing the landfills, the following factors were taken into account: prevention of negative impact on ground and surface water, minimization of pollutant emissions into the atmosphere, preservation of pasturelands, effect of runoff and melt water on generation of leachate products and their safe utilization, and prevention of negative impact on local fauna. The landfills are operated in full compliance with the approved design and required environmental, sanitary and technical standards. Operation of the landfills involves placing and compacting the waste in batches, followed by covering the waste with a 20-30 cm soil layer to prevent access by wild animals. According to the mine closure plan, the whole area of landfills is subject to reclamation.

WASTE GENERATION AT THE MINE IN 2017

In compliance with KR environmental legislation, as well as high regulations and standards of environmental responsibility, KGC, as the owner of waste, is committed to ensure safe recycling or utilization of its waste, as well as continuous improvement of its waste management systems/processes/practices in order to minimize negative impact on the environment.

In 2017, the mine produced 10,052.4 tonnes of industrial waste, but for the fourth year in row, KGC recycled 100% of this. Separate collection of all industrial waste at all key locations on site and at BMY made it possible to eliminate the need for the temporary Industrial Waste Sorting area, which, in turn, resulted in a significant cost-saving due to reduction in labour and equipment previously involved in these areas. Currently, all industrial waste is collected separately into corresponding containers and tanks, which as soon as filled, are removed from the mine avoiding unnecessary loading/ unloading and sorting operations.

In 2017, the mine produced 817.9 tonnes of solid domestic waste. In 2016, KGC committed to reduce volume of solid domestic waste to be buried in the Kumtor Mine landfill by 50%. The main purpose of the program is to reduce negative impact of waste on the environment and extend the life of the Solid Domestic Landfill. Such reduction in volumes of solid domestic waste has become possible through introduction of separate collection and further recycling of this waste.

Solid domestic waste can be segregated into three main categories: 1) Biodegradable waste – food; 2) Recyclable items – plastic, paper, glass, metal; 3) Non-recyclable items – multilayer packaging, domestic waste, etc. At the same time, biodegradable and recyclable waste can be relatively easily recycled and reused. Thus, taking into account composition of solid domestic waste, it is easy to see that if separate collection of waste is organized, about 75% of waste volume can be recycled and reused, and only 25% can not be recycled. It means that volume of solid domestic waste to be buried can be reduced 3-4 times. In 2016, the mine generated about 4.9 tonnes of solid domestic waste per day. In 2017, implementation of separate waste collection resulted in reduction of volume of solid domestic waste to 2.24 tonnes per day. Introduction of separate collection and recycling of solid domestic waste will make it possible to reduce this volume to 1.6 tonnes per day.

Processing of biodegradable waste at the mine

As part of implementation of the strategy to optimize waste management system, as well as to reduce volume of waste to be buried at the Kumtor Mine, in 2017, KGC introduced a partial separate collection and recycling of solid domestic waste in the camp. In particular, a four-component separate collection of waste was introduced in the camp kitchen. Waste was divided into: 1) food waste, 2) recyclable packaging (plastic, cardboard, glass, metal), 3) used vegetable oil, 4) non-recyclable waste. About 2 tonnes of solid domestic waste are generated in the camp kitchen per day, of which only one third is waste that cannot be recycled easily, two thirds can be recycled without the need for burial of waste in the site landfill.

In 2017, a biodegradable waste processing station, or compost unit, was designed and constructed. Food waste is processed by aerobic decomposition producing compost – an organic fertilizer that will be used for restoration of fertile properties of top soil, reclamation of disturbed fertile soil areas. Laboratory tests confirmed that the chemical-biological composition of the final product – compost – fully complies with the properties of organic fertilizers. In this way, about 1 ton of food waste is processed per day.

Recyclable waste is sent to processors of plastic, paper and metal. This has made it possible to reduce the amount of waste to be buried on site 2-2.5 times and, therefore, extend life of the waste landfills, reduce negative impact on the environment, reduce expenses for maintenance of landfills and partially solve the problems with wild animals feeding on food waste.

The biodegradable waste processing station project underwent all stages of designing, government assessment, and obtained a construction permit. In 2018, an official commissioning of the facility is expected. It should be noted that this is the first such project in Kyrgyzstan demonstrating a high level of environmental responsibility of KGC.

In 2017, the mine produced 545 tonnes of hazardous waste, of which 116.5 tonnes were shipped off site for recycling by a specialized company. Hazardous waste includes various packaging materials used for transportation and storage of toxic chemicals, car batteries and other types of batteries, mercury-containing lamps, medical waste, as well as ground contaminated with hazardous materials. Chemicals packaging materials are buried on site in the authorized Hazardous Waste Landfill, commissioned in 2015. Car batteries are collected separately and shipped off site for recycling, which was done in 2017. In addition, collection of other types of batteries was started – AA batteries, typically used in communications and computer equipment. As this type of hazardous waste accumulates, it is shipped off site to Bishkek for safe utilization by a specialized company. In 2017, with assistance of local companies, KGC started the process of utilization of oily rags and big bags. In general, in 2017, KGC considerably improved its waste management practices, adhering to the main priorities for reduction of negative impact on the environment, effective use of financial resources and introduction of the best waste management practices.

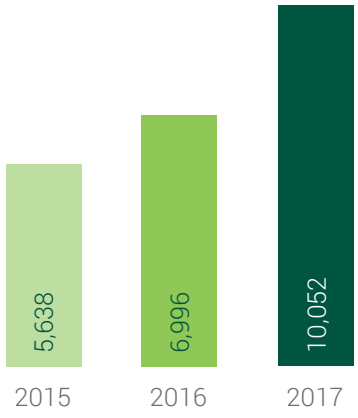
4.20 **KGC Waste Generation 2017 (tonnes)**

	Generated	Disposal Method
Industrial Waste		
Metal	7,511.2	100% Recycled
Paper	97.2	Partially recycled since 2015
Wood	425.4	100% recycled and donated to local communities
Plastic	300.4	100% Recycled
Oil	1,718.2	100% Recycled
Total	***10 052.4***	
Hazardous Waste		
Packaging	438.0	Landfilled
Oily rags	87.8	Landfilled
Batteries	18.4	100% recycled*
Mercury lamps	0.8	Temporarily stored
Total	***545.0***	
Tires		
Used tires	947.8	100% recycled

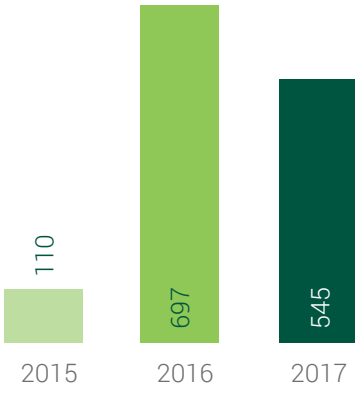
***Note:** An additional 7.6 tonnes of batteries were recycled from temporary storage areas.*

Fig. 4.21 Waste Produced at Kumtor Mine Site (tonnes)

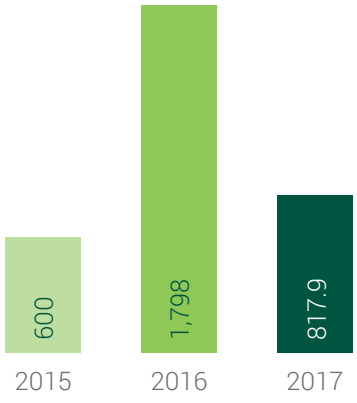
Industrial Waste



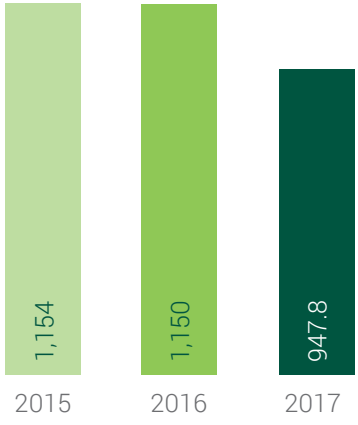
Hazardous Waste



Domestic Waste



Waste Tires



4.7 | UNPROCESSED WASTE ROCK

As typical for most open pit mining projects, KGC must remove a large volume of unprocessed (waste) rock and other materials in order to safely access the ore. The waste rock is deposited in agreed designated locations and is routinely monitored for its impact on the environment.

Waste Rock Dumps

In accordance with the KR Law on Subsoil Protection, as well as standards of industrial safety, waste rock dumps must have sufficient storage capacity, and be located at a minimum distance from a mining cutback. Mined waste rock should not be placed in areas with mineralization, hinder mining operations in the pit, and ought to be formed according to the safety requirements. In addition, dumping methods and equipment in use at a waste dump should ensure the required waste rock dumping rate without interruption, and comply with limitations on dump capacity whilst maintaining dumping costs at the lowest level and labour/equipment productivities at the highest level. Modeling and assessment of waste dump stability is performed by specialists of the Geotechnical Structure Stability Laboratory of the Geomechanics and Subsoil Use Institute under KR NAS based on KGC's monitoring data.

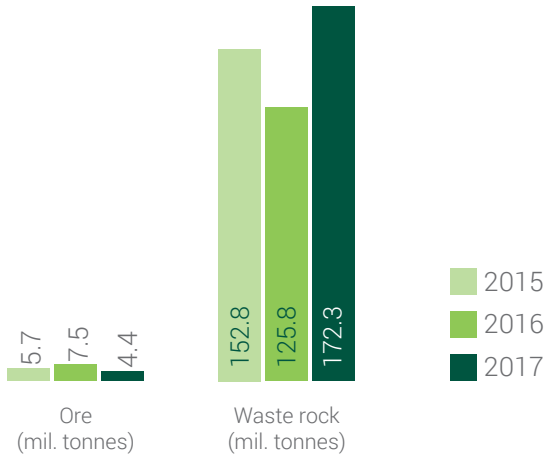
Waste Rock Movement

KGC continues to monitor potential deformations of soil and ice throughout the mine, as well as work on handling ice and dumps of rock and waste rock to ensure safe mining operations and timely relocation of the affected infrastructure. In 2016, the company continued to implement special measures aimed at reducing the rate of dump deformations and associated risks. In particular, the reduction of waste placed in the Chon-Sarytor valley, through a more even distribution of loads, construction of water drainage systems, and the introduction of an automatic monitoring system.

Acid Rock Drainage Analysis

Acid rock drainage (ARD) describes contaminated water that can be generated from water contacting the sulfur containing waste rock. The issue of acid formation is directly related to both mining and post closure period. KGC has routinely monitored for ARD risk since the initial environmental impact assessment, taking into account the ore body, waste rock, and tailings. A number of independent assessments by international consultants concluded the ARD risk from KGC is low due to the high carbonate content in dumps, which neutralizes acidity. A long-term ARD evaluation is a part of the mine closure planning.

Fig. 4.22 Key Production Statistics



4.8 | TAILINGS MANAGEMENT

Tailings are liquid and solid materials, also called slurry, that remain after extraction of economically interesting metals and minerals from crushed and processed ore.

Tailings of the Kumtor mine are transported through a 6.7-kilometer slurry pipeline from the mill to the tailing management facility (TMF), where they are deposited, settled, and stored. The liquid component is treated before discharge and the solid component retained in the tailing pond until further reclamation and mine closure activities. The Kumtor TMF consists of two slurry pipelines (main tailings line and a spare one), a tailings dam supported by a buttress and a shear key, monitoring equipment and instruments, an effluent treatment plant, and two diversion ditches to direct surface water around the TMF. In addition to general tailings management, two important aspects are monitored and controlled: (i) cyanide containing solutions, which are securely contained within the TMF, and (ii) dam stability. These issues are discussed below.

Cyanide Residue Management

The concentration of cyanide in the TMF is routinely monitored. In the tailings pond there is a natural disintegration of the chemical, or its decomposition, as a result of a chemical reaction and exposure to ultraviolet radiation. The liquid component is further treated by the effluent treatment plant (ETP) to reduce cyanide and metals for safe discharge to the environment. More discussion of the cyanide concentrations discharged to the external environment is provided in the Water Quality and Compliance section.

Geotechnical Monitoring and Stabilization

The dam is constructed and managed to safely retain tailings. The dam is 3,050 meters long with a maximum height under its crest of 40.5 meters at an elevation of 3,670.5 meters above sea level. The dam is constructed primarily of dense granular fill and of the local ground. The dam surface is covered with an HDPE liner (a strong impermeable synthetic material) from the upstream slope to the toe of the dam, and then 100 meters into the tailings pond. This liner extends into the permafrost to minimize seepage through the dam. The height of the dam is increased over time to ensure sufficient volume for tailings storage. Along with the increase of the pond volume, the existing buttress downstream of the dam is also expanded, which helps to increase the strength and stability of the structure. In 2016, the crest of the dam was increased to a height of 3,670.5 m. Some movement of the KGC dam was first observed in 1999, and since then, Kyrgyz specialist organizations and international engineering experts have been consulted on management and mitigation. In response, a shear key and buttress were constructed along the downstream toe to reduce, and eventually eliminate, the movement of the dam. Since 2006, a tendency of horizontal displacement velocity reduction has been observed. A branched network of sensitive instrumentation is installed to detect and record any movements in the dam structure. In 2017 operations on the shear key expansion were carried out at the dam lower edge for further expansion of the dam from the downstream toe. Compliance with timelines for periodic topping of the tailings dam, construction of the shear key and the buttress will ensure increase of the dam overall stability. To implement the planned activities ensuring the dam stability at 3, 674.0 m crest level, a sequence of construction operations has been developed, starting from 2017 to 2020. Dam building operations and the technological process of tailings impounding are carried out in accordance with ecological, economic and technical standards and fulfillment of safety conditions.

Tailings Balance

Accurate knowledge of what enters and leaves the TMF, and the volumes of liquid and solids it contains, are an important part of safe management. We survey the extent and depth of the pond, and track the volume of tailings entering the TMF and volume of water leaving it, after the ETP and by evaporation from the pond surface. Tailings slurry, 49% consisting of solids, is continuously added to the TMF throughout mill operations (most of the year). Water treatment and removal (via the ETP) occurs only during summer months when the pond and Kumtor River is not frozen - usually May to October. Therefore, TMF water volume peaks in spring and reaches its lowest level at the start of winter.

Fig. 4.23 **Tailings Dam Monitoring Instrumentation (number of instruments)**

Type	Purpose	2015	2016	2017
Inclinometers	Measure horizontal displacement	50	45	50
Settling plates	Identify dam base settlement	28	26	32
Piezometers	Measure water levels in dam body and base	32	32	33
Thermistors	Dam body and base temperature	48	47	48

Fig. 4.24 Key Characteristics of Kumtor's Tailings Management Facility (TMF)

	Units	2015	2016	2017
Tailings discharged to Tailings Pond	mil. m^3	7.93	8.30	8.36
Net tailings remaining in Tailings Pond per year	mil. m^3	3.53	6.04	4.98
Total cumulative tailings in Tailings Pond at year end	mil. m^3	72.27	78.31	83.29
Total free water in Tailings Pond at year end	mil. m^3	3.89	5.73	6.55
Elevation of Tailings Dam Wall crest	masl	3,667.0	3,670.5	3,670.5
Peak water level in Tailings Pond during year	masl	3,661.73	3,663.68	3,664.86
Minimum water freeboard (dam crest level - peak water level)	m	5.27	6.82	5.66

Note: *masl = metres above mean sea level*

Conclusions Of External Experts

Geotechnical monitoring data is analyzed by the Scientific Laboratory on Geotechnical Objects Stability. Overall tailings dam condition is assessed as suitable for operation. The international Engineering Company, Golder Associates Ltd. conducted inspection of the condition and safety of the TMF dam, providing recommendations for changes and improvement where appropriate. Their report for October 2017. concluded: "The visual inspection of the tailings dam and appurtenances of the Kumtor site generally indicated that the structures were in good condition and were functioning as required. It is recommended to continue with annual TMF inspections by third party technical consultants, in view of continuous construction process of the tailings dam. KGC is doing an effective job of carrying out routine inspections, preparing monitoring records, reading instrumentation, and implementing the necessary procedures or improvements to operate the facility in a safe manner".

Fig. 4.25 Water Balance in TMF (m^3)

	2015	2016	2017
Free water at start of year (January 1)	4,160,134	3,890,450	5,730,850
Water added in tailings	5,929,047	6,086,506	6,174,299
Net precipitation/runoff less evaporation	789,677	1,308,441	470,340
Water remaining in tailings voids	-1,696,810	-1,878,304	-1,861,268
Water discharged from Tailings Pond to Effluent Treatment Plant	-4,827,216	-4,028,844	-5,026,168
Adjustment based on bathymetric survey	-464,382	+352,600	+1,057,985
Free water at the end of year (December 31)	3,890,449	5,730,850,	6,546,038

> “The visual inspection of the tailings dam and appurtenances of the Kumtor site generally indicated that the structures were in good condition and were functioning as required”

4.9 | MINE CLOSURE

Conceptual Closure Plan

The recent life of mine plan is for open-pit mining to end in 2023 and milling operations to conclude in 2026. As agreed with Kyrgyz authorities and outlined in the Environmental Management Action Plan (EMAP), KGC is required to update the Conceptual Closure Plan (CCP) for the operation every three years, and complete a Final Closure Plan (FCP) two years prior to closure. This approach allows for a period of testing and monitoring for several years to evaluate the various options provided by the CCP, and time to consider any changes to the environmental, regulatory and social environment that may have occurred over the life of the mine. KGC has prepared CCP's in 1999, 2004, 2008, 2011, 2013 and most recently in 2016. The latest CCP covers the existing components of the Kumtor operations including the open pits, waste rock dumps, tailings management facility and related water treatment facilities, and the mill complex and associated mine infrastructure. Closure and land use objectives of KGC include:

- materially comply with regulatory requirements;
- minimize residual environmental impacts;
- ensure mine site features are geotechnically stable;
- ensure the protection of public health and safety;
- return the land to suitable post-mining land use;
- identify and mitigate social risks/impacts on the community, the business and the overall success of the closure process.

All CCPs have been previously submitted to the relevant Kyrgyz regulatory agencies for their information and in 2016, the conceptual closure plan was also provided to the Government's international technical advisors involved in the ongoing negotiation to restructure Kyrgyzaltyn's ownership in Centerra and Kumtor.

CCP Update

The 2016 update to the CCP is based on the 2013 CCP, and incorporates new data and information, changes to the life-of-mine (LOM) plan, an analysis of closure risks, and changes to the environmental and social sphere of the project. The primary closure consideration will be the long-term stability of the TMF and the waste rock dumps. Key changes to this CCP update include the following:

- TMF design event – The Probable Maximum Flood (PMF) has been calculated for the tailings management facility (TMF) and is used as the design event for the closure of the TMF.
- TMF cover – The TMF cover has been modified to a single layer of inert waste rock crushed in the mill circuit to a size less than 5 mm diameter.
- Waste Rock Dump configuration – It is assumed that the final dump configurations will comply with predictions by the Institute of Geomechanics and Subsoil Use (IGSU) under the KR NAS (2013).
- New facilities (admin, camp, landfill) – Closure actions for several new facilities constructed since the 2013 CCP have been incorporated, including new camp and administration buildings and a new landfill.
- Post-closure land use – An analysis of sustainable post-closure land uses for each area and facility of the site has been included.
- Social closure considerations – This CCP considers the social and socio-economic context of closure of the Kumtor mine.
- Closure Cost Estimate – The cost estimating methodology used in this update is based on first engineering and cost principles. In preparation of the reclamation and closure cost estimate the standardized reclamation cost estimator (SRCE) developed for mining industry in the USA and approved by the US state and federal regulatory authorities was used.

During the development of this plan, additional data collected since 2013 was evaluated to update and confirm conclusions and closure actions presented in the 2013 CCP. In particular, KGC reviewed the available hydrological, hydrogeological and geochemical data, and pit and dump configurations. This review confirmed the general closure actions identified in the 2013 CCP are appropriate and resulted in only minor changes to the pit lake refilling curves and pit overflow channel alignments that do not affect the actions required for, or schedule or cost of closure.

Also, in 2017 Kumtor continued to implement the scientific program to research and develop the most effective methods for land reclamation. The program includes collecting native plant seeds and establishing trial plots with disturbed topsoil to test proposed seed species, topsoil addition rate, seeding rate and requirements to fertilizers. The studies are conducted by the Kyrgyz National Agrarian University named after Skryabin K. I.

Funding Closure Liabilities

As outlined in the 2016 CCP, the uninflated life of mine closure cost is estimated at $56.7 million. It is estimated it would cost $54.4 million to rehabilitate the known impacts and disturbance as of December 31, 2017. Kumtor is required to re-calculate closure liability on an annual basis, in accordance with International Financial Reporting Standards to take account of future discount and inflation rates.

In 1995, Kumtor established a reclamation trust fund to accrue cash funds for mine closure liabilities. This is funded by sales revenue, annually in arrears. As of December 31, 2017, the balance in the fund was $26.4 million, with the remaining cost to be funded over the life of the mine. On September 11, 2017, the Company has entered into a comprehensive settlement agreement with the Government of Kyrgyz Republic. Once all the proceedings set forth by the agreement are met, Kumtor is to fund $6.0 million on an annual basis into the reclamation trust fund until a minimum of $69 million.

> In 2017, KGC continued implementing a scientific program to study and develop the most effective land reclamation methods

THE PROGRAM OF SOIL AND VEGETATION STUDIES

KGC is carrying out a program of soil and vegetation studies at the Kumtor mine with the purpose of further reclamation of disturbed lands. The program includes field expeditions to both the mine site and adjoining areas, as well to high-mountain valleys of the Kyrgyz Republic. The aim of the expeditions is to identify plant species suitable for reclamation works at the mine site. Studies, field expeditions, analyses of soil and vegetation at the mine are conducted by KGC Environment Department employees in cooperation with representatives from the Kyrgyz National Agrarian University named after Skryabin K. I., national experts in the sphere of agronomy and soil science are also involved. Representatives of the University has been conducting studies at the mine since 2012. The scientific program on the most effective reclamation methods includes collection of local plants and seeds, as well as establishment of trial plots with different soils and conditions.

The program of soil and vegetation studies is a set of measures aimed at improving environmental conditions and restoring lands, suitable for land use in post-closure period. After all the work is done, the restored lands and surrounding areas should become optimally organized and stable balanced landscapes for further use.

5 GLACIERS AND WATER MANAGEMENT

5.1 | WATER USE AND TREATMENT

We use water for operational activities (mostly in the mill), as well as for domestic use (drinking and sanitary) in the mine camp, offices, and workshops. Water is removed from the mine pit in order to ensure safe and stable operations.

Our main water management responsibilities are:

- Providing safe drinking water for our employees;
- Removing water and moving ice from the open pit to ensure safe access to ore, and stable and safe working conditions;
- Ensuring water returned to the natural environment is safe and meets specified quality criteria;
- Managing run-off to reduce sediment load entering local creeks and rivers.

An information brochure describing Water Management at KGC can be downloaded from our website at: **www.kumtor.kg/en/environment-protection/water-management**.

Water Sources

We have two primary sources of water at the mine site. Most of the water we use is extracted from Petrov Lake. We also pump large volumes of water from the open mine pit, some of which we use at the mill, thus reducing our demand from Petrov Lake. In 2017, we extracted approximately 5.21 million m³ of water from Petrov Lake, which was very similar to the previous year (5.25 million m³). In 2017, we pumped a total of 26.02 million m³ of water from the pit, including groundwater and glacier melt water. Of this, 1.14 million m³ was used in the mill with the remaining volume (approximately 24.88 million m³) discharged to the environment.

Operational Water Use

Our main use of water is as process water in the mill, for crushing the ore and processing it to produce gold. In 2017, the Mill used 5.01 million m³ from Petrov Lake, 1.14 million m³ collected from the mine pit and 6.19 million m³ of 'make-up' water. The use of pit water, which reduces our demand on water from Petrov Lake, has increased from zero in 2011 to 1.14 million m³ in 2017. The total amount of water used at the Mill increased by approximately 100,000 m³ in 2017, but this was all sourced from the Pit, so the amount of raw water sourced from Petrov Lake actually decreased in 2017 compared to 2016.

Drinking Water

We also use treated water from Petrov Lake for domestic uses (drinking and sanitary) in the mine camp, the mill, and other facilities. Domestic water use in 2017 was about 0.2 million m³, representing just 3.8% of the freshwater we collect from Petrov Lake. Drinking water quality is monitored to ensure its safety and compliance.

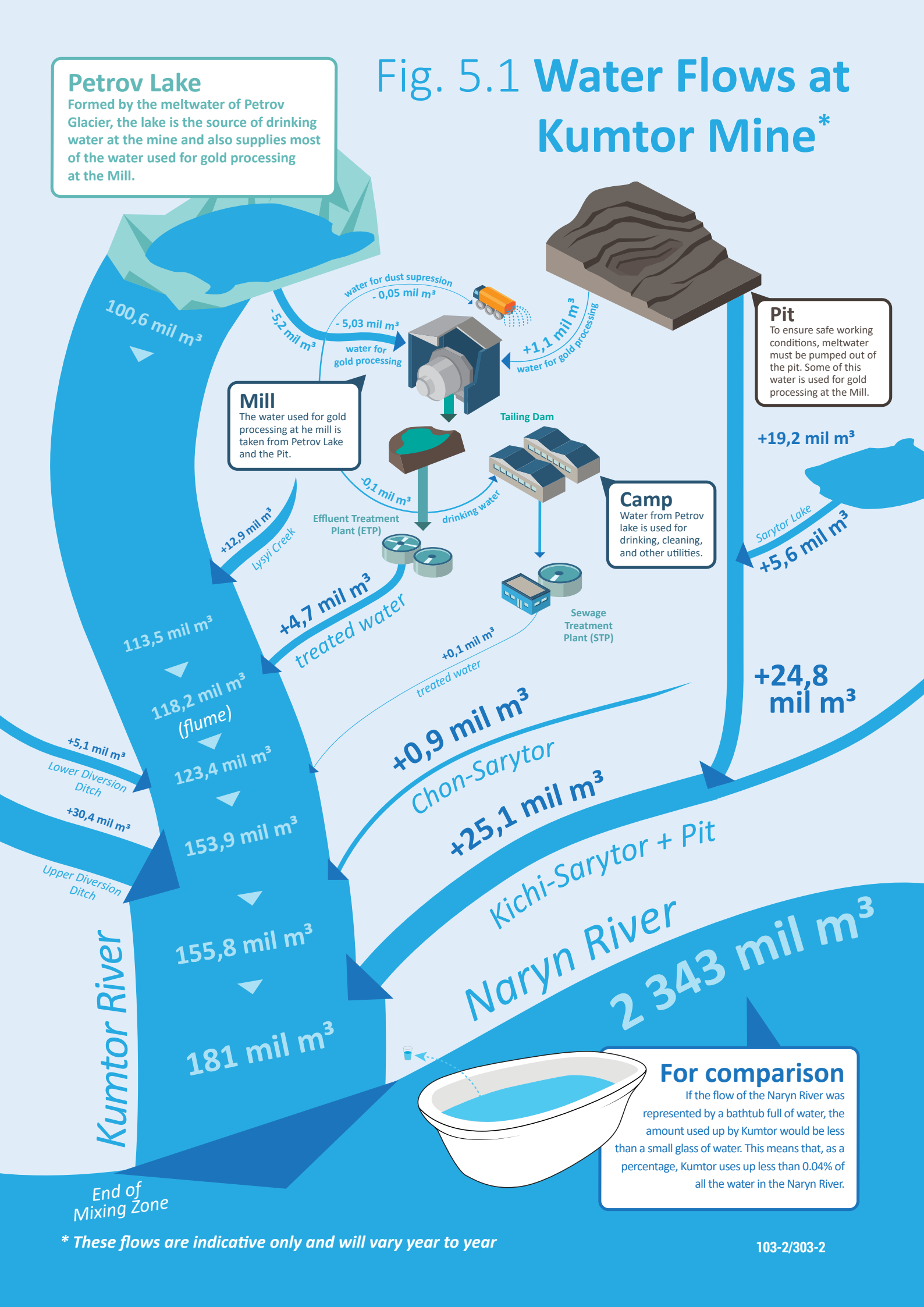
Pit Dewatering

We collect and discharge large quantities of water as a necessary part of our pit-dewatering program to keep the pit stable and safe. Some dewatering occurs throughout the year, but most occurs during the summer period when large quantities of glacial melt water collects in the open pit. The majority of the pit water is discharged to the environment.

The volume of water inflow into the open pit zones in 2017 is significantly different from the values of the previous years primarily due to the beginning of the water drainage works in the Northeast and the Sarytor areas. In addition, the volume of water inflow in the central pit has significantly increased. The surface-stream flow of the latter is affected not only by climatic factors and atmospheric precipitation, but also by the proximity of glacial zones.

Fig. 5.1 Water Flows at Kumtor Mine*

Petrov Lake
Formed by the meltwater of Petrov Glacier, the lake is the source of drinking water at the mine and also supplies most of the water used for gold processing at the Mill.



For comparison
If the flow of the Naryn River was represented by a bathtub full of water, the amount used up by Kumtor would be less than a small glass of water. This means that, as a percentage, Kumtor uses up less than 0.04% of all the water in the Naryn River.

** These flows are indicative only and will vary year to year*

103-2/303-2

Fig. 5.2 **Water Usage at Kumtor Mine Site**

	Units	2015	2016	2017
Sources of Water				
Total Water Extracted from Petrov Lake	mil. m³	5.76	5.25	5.21
Pit water pumped to the Mill	mil. m³	0.64	1.01	1.14
Pit water pumped to the environment	mil. m³	10.9	12.75	29.24
Water used for Domestic Purposes				
Water Used for camp domestic purposes	mil. m³	0.15	0.13	0.13
Water Used for Mill domestic purposes	mil. m³	0.02	0.02	0.02
Water used for Process/Mill				
Raw water used at Mill (from Petrov Lake)	mil. m³	5.32	5.06	5.03
Total water used at Mill (Petrov Lake + Pit water)	mil. m³	5.96	6.07	6.17
Water internally recycled at Mill	mil. m³	5.33	6.50	6.19
Ore Feed to Mill	tonnes	5,782,419	6,303,032	6,245,870
Raw Water Intensity Ratio	litres/tonne Mill Feed	921	803	805
Water used for Dust Suppression				
Water used for dust suppression	mil. m³	0.26	0.04	0.05
Wastewater Discharged to Environment				
Treated wastewater discharged from ETP	mil. m³	4.84	4.14	4.75
Treated wastewater discharged from STP	mil. m³	0.12	0.10	0.10
Net water usage	mil. m³	0.79	1.01	0.36

Sewage Treatment

Sewage wastewater is treated at the sewage treatment plant (STP) before discharge to the environment. This uses standard processes of biological treatment and disinfection (chlorination). The biological treatment removes the 'oxygen demand' of organic matters, which would otherwise use up oxygen in the river and reduce its quality. Chlorination eliminates potentially harmful bacteria. Although challenging to operate in extreme conditions - high altitude with low oxygen and harsh weather conditions, treatment is achieved successfully through careful calculations and management. During freezing winter conditions, treated sewage is stored in a holding pond prior to gradual discharge during summer. In 2017, approximately 0.1 million m³ of sewage was treated and discharged.

Industrial Wastewater Treatment

Industrial wastewater containing residual cyanide is a component of tailings slurry discharged by gravity flow from the mill to the tailings management facility (TMF).

The liquid component of tailings (approximately 51% of the slurry by weight) is pumped to and treated at the Effluent Treatment Plant (ETP), for compliance with the established standards – Maximum Allowable Discharge (MAD), before discharge to Kumtor River. Due to the freezing winter conditions, the treatment and discharge of wastewater is restricted only to the warmer season, typically from May to October.

The main concerns of community regarding wastewater from the Kumtor Mine are related to cyanide, a highly toxic chemical used routinely in the processing of ore to recover gold. In 2017, 12.42 million m³ of tailings were produced and discharged into the tailings pond. The solid component is retained in the TMF, while the majority of liquid component is pumped to and treated at the ETP to reduce concentrations or remove elevated contaminants. We use the patented INCO treatment process, and operate one of the largest cyanide treatment plants outside of North America.

In 2017, approximately 5.026 million m³ of industrial wastewater from the tailings ponds was treated, that is 0.998 million m³ more than in 2016.

Water Use Intensity

Extraction of water from Petrov Lake for the mine's needs has no measurable impact on average annual lake water level.

Total water extraction from Petrov Lake of 5.21 million m³ in 2017 represents approximately 4.95% of its natural outflow to Kumtor River. We then returned 4.85 million m³ as treated wastewater (STP plus ETP), thus making the net impact on Kumtor river flow near neutral.

The gold recovery technology used at the Kumtor Mine and severe climatic conditions limit our ability to increase our water use intensity by recycling effluents from our tailings pond. Studies have shown that even low levels of cyanide in the tailings pond would adversely affect our gold recovery process. All year round operation of the Effluent Treatment Plant is impossible because of climatic conditions. Since July 2012, we have been using water from pit dewatering in the mill. As a result, we are seeing a decreasing trend in the water use intensity of our operation, reflecting the positive impact of in-mill recycling and using an increasing proportion of water from pit dewatering.

Managing Run-Off

We continue to improve the management of surface run-off (precipitation and ice melt) to reduce the risk and prevent possible contamination. Pumps are installed at the toes of Davydov, Lysyi and Sarytor glaciers and pipeline system was constructed around the waste rock dumps. Melt water is diverted to Kichi-Sarytor and Lysyi Creeks. We also constructed a number of settlement ponds in Lysyi and Chon-Sarytor Creek beds for settlement of solid particles. Flume stations with automatic calculation of water flow and data import directly to the MP-5 database were constructed at the Kumtor River and Lysyi Creek.

5.2 | WATER QUALITY AND COMPLIANCE

Drinking Water

The water we use at the mine site for standard domestic use (for drinking, food preparation, personal hygiene and general cleaning of the mine camp and offices) is regularly tested against Kyrgyz, Canadian and World Health Organization (WHO) drinking water standards.

End of Mixing Zone

We sample and test water quality at over 30 points across the Concession area, which are listed and shown in the Environmental Monitoring Section. Sampling points are selected from a combination of legal obligations and additional commitments related to our environmental management responsibilities and programs. Our main compliance point is where surface water converges downstream of our operations, below where treated water is discharged to the river and shortly after leaving the concession area (as shown in Figure 4.3). This point, designated as W1.5.1, and referred to as 'End of Mixing Zone', was selected by KGC to be protective of the intent of the Environmental Management Action Plan (EMAP) and the water quality in the Kumtor River. Any exceedance of water quality criteria at W1.5.1 triggers us to examine the data at W1.8, the monitoring point 1 km upstream of Naryn City, which is the nearest to the mine downstream community consuming the water. Results for 2017 are presented in the bar chart, which includes the Kyrgyz maximum allowable concentration (MAC) limits recommended for water bodies providing public water supply.

Overall, the glacial origin of surface water sources in the Kumtor project area results in them having elevated sediment loading (suspended solids), visible in the generally milky appearance of the water. This sediment loading influences the total concentration of metals (aluminum, copper, iron, zinc). This naturally elevated background condition was documented in baseline monitoring prior to the start of KGC mining operations.

Elevated background concentrations are also reflected in water quality results from Petrov Lake, the source of Kumtor River located upstream of the mine. The presence of sediments and associated metals is not indicative of poor environmental performance of Kumtor mine. Kyrgyz water quality standards refer to total metal concentrations, whereas international environmental water quality standards are more commonly based on dissolved metals, which is more indicative of environmental impact and associated risks. We consider these aspects when evaluating water quality at KGC.

The average total nickel concentration (0.026 mg/L) exceeded the MAC limit (0.020 mg/L) in several samples collected in 2017. It should be noted that the Kyrgyz MAC limits for total nickel is lower than guidelines for aquatic life, livestock, and irrigation approved by other relevant jurisdictions. For comparison, the Canadian Council of Ministers of the Environment (CCME, 2008) approved nickel guidelines for livestock (1 mg/L) and irrigation (0.200 mg/L).

Nickel criteria for aquatic life are typically more stringent than those for livestock or irrigation. However, both the Canadian Council of Ministers of the Environment (CCME) and the United States Environmental Protection Agency (US EPA) account for water hardness as an ameliorating factor for nickel toxicity. For example, the CCME approved aquatic life guideline for nickel would be 0.150 mg/L at the mean annual water hardness measured at W1.5.1 in 2017 (229 mg/L as $CaCO_3$). A reasonable lower-bound limit for the nickel guideline may be calculated as 0.096 mg/L using the minimum hardness measured at W1.5.1 in 2017 (100 mg/L as $CaCO_3$).

The US EPA nickel guidelines for aquatic life are applied as Maximum and Continuous allowable limits (US EPA, 1995). The Maximum concentration represents the short-term or acute limit, while the Continuous concentration represents a long-term or chronic limit. At the minimum 2017 measured water hardness of 100 mg/L (as $CaCO_3$), the Maximum concentration for nickel is 0.470 mg/L and the Continuous concentration is 0.052 mg/L.

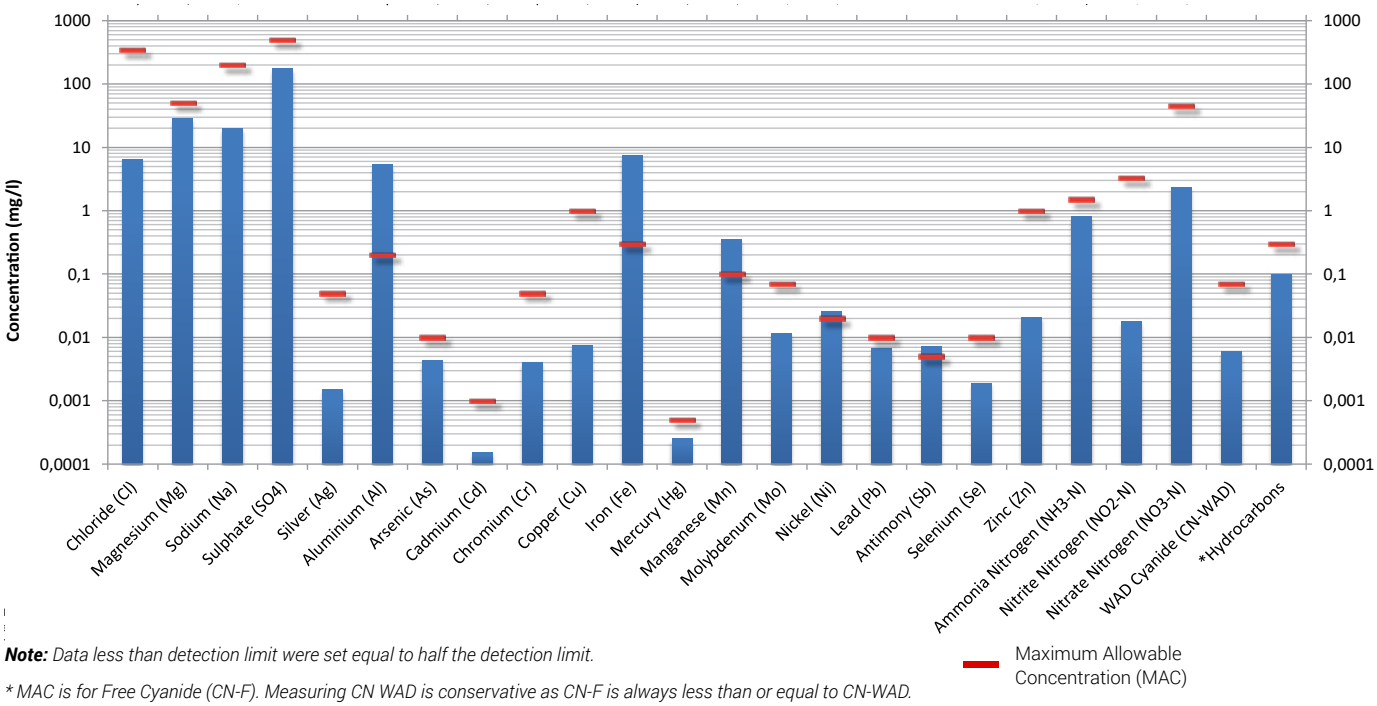
Given the above, it is expected that the nickel concentrations at the EOMZ in 2017 did not result in adverse effects to aquatic life, livestock, or agriculture that may have received this water.

A review of results from 2017 shows the average total aluminum and iron concentrations exceeded the MAC standards. However, they remained consistent with the naturally high background concentrations in the region, which can be of the same order or higher. These results do not represent a significant risk to human health or the environment, as iron effects are mainly aesthetic (taste, visual appearance). These are some of the most abundant metals in the Earth's crust, and therefore not unusual to see at these concentrations.

The average total manganese concentration (0.36 mg/L) marginally exceeded its MAC Communal Use standard (0.1 mg/L) in 2017 at the End of Mixing Zone. It should be noted that manganese occurs naturally in the environment, produced by erosion and weathering of rocks and minerals. The concentrations observed do not represent a significant

> “Our drinking water is safe and compliant;
> All our wastewater is treated and is environmentally safe before discharge”

Fig. 5.3 2017 Water Quality Data in the Kumtor River at the End of the Mixing Zone and Kumtor Concession Area (location W1.5.1)



Note: *Data less than detection limit were set equal to half the detection limit.*

** MAC is for Free Cyanide (CN-F). Measuring CN WAD is conservative as CN-F is always less than or equal to CN-WAD.*

*** Hydrocarbon fractions F1 (C6-C10) to F4 (C34-C50) were analyzed individually and all measured at less than laboratory method dection limit. The value reported above (0.1 mg/L) represents half of the highest detection limit (0.2 mg/L for F3 and F4). Other fractions had lower detection limits.*

risk to human health or the environment, as manganese effects are primarily aesthetic in humans and livestock.

According to the EMAP, KGC is required to consider international and, particularly, Canadian guidelines when interpreting water quality data. Presently there is no Canadian guideline for the maximum concentration of manganese allowable to protect livestock. There is a Canadian aesthetic guideline of 0.05 mg/L for distribution systems, which is not based on toxicity but rather potential problems in restricted flow devices in water lines (Olkowski, 2009). Ministry of Health Canada also assigns an aesthetic objective for human drinking water at 0.05 mg/L based on taste and staining of laundry and plumbing fixtures (Health Canada, 2014). There are no Canadian Environmental Quality Guidelines or United States Environmental Protection Agency (US EPA) guidelines for the protection of aquatic life or livestock (CCME, 1999). British Columbia has a chronic guideline for protection of freshwater aquatic life of 0.7 mg/L in soft water (mg/L as $CaCO_3$) and higher guidelines in higher hardness water (Nagpal, 2001). The average manganese levels in 2017 were well below the BC guideline for protection of aquatic life from long-term exposure.

The antimony concentration (average of 0.062 mg/L) exceeded the associated MAC limit (0.005 mg/L) in 2017. In light of this, Kumtor retained CanNorth consultants from Saskatoon, Canada, to complete a risk assessment for potential environmental and human exposure to antimony downstream of the Kumtor Mine. It was concluded that this antimony level was "well below levels associated with potential effects on aquatic receptors and thus are not a concern for the health of the aquatic environment". The predicted antimony concentration in 2017 also shows values below the threshold reference value (TRV) for mammals, suggesting that the antimony concentration for 2017 is not toxic to them. Unfortunately, a quantitative assessment is not possible for birds due to a general lack of available toxicity data for birds exposed to antimony. With respect to human health, the Kyrgyz Republic does not have a drinking water guideline for antimony. However, CanNorth (2017) notes that the World Health Organization (WHO, 2011) has derived an antimony drinking water guideline of 0.020 mg/L for the protection of human health.

While the 95th percentile for 2017 does not exceed the WHO drinking water guideline, CanNorth also considered other pathways of exposure (e.g., consumption of fish) through the comparison of an intake to a TRV. The TRV for antimony was selected from the United States Environmental Protection Agency (US EPA) Integrated Risk Information System (IRIS) database. Exposures were then calculated for adults, children and toddlers that were assumed to be potentially influenced as part of a shepherd family living seasonally downstream of Kumtor near the Taragay River. The calculated intakes were "well below TRV levels" for 2017 indicating that antimony concentrations "do not represent a cause for concern from a human health perspective" (CanNorth, 2017). Notwithstanding the conclusions above, Kumtor is committed to identifying and mitigating the source of antimony released to the Kumtor River. For example, Kumtor voluntarily requested the addition of an antimony discharge limit from the Effluent Treatment Plant (ETP) in 2017, and has already begun studying treatment and mitigation options.

Effluent Treatment Plant Discharge

Given the extreme climate conditions at the mine site, KGC's effluent treatment plant (ETP), which treats the effluents contained in the tailings management facility (TMF), generally operates between June and October each year (when water is not frozen). In 2017, the average discharge rate was about 1,489 m³/h.

During the water treatment season, the Kumtor River, which receives treated discharge from the ETP, is not frozen and exhibits significant flow volumes. In 2017, the maximum water flow of the Kumtor River was recorded at 28.05 m³/s in July, and the minimum flow was 0.77 m³/s during the discharge period.

In 2017, the ETP discharge water quality results are presented in Figure 5.4 (note logarithmic scale). The results are compared to the MAD standards and discussed below.

The results show that concentrations of cyanide in the treated effluent discharge, as well as certain other key parameters met their respective MAD standards. However, the average total ammonia (as N) concentration (23.9 mg/L) slightly exceeded its MAD standard (23.48 mg/L). This is not considered to represent any significant risks to the environment.

In 2017, the quality parameters of the STP treated wastewater complied with the established (MAD) and were at the level of past years values. There was a slight exceedance (1.8% of the established MAD) for the "total ammonia" indicator. As a result of the taken measures, we managed to reduce the concentration of total ammonia in the STP treated wastewater by 14%, compared to 2016.

Sewage Treatment Plant Discharge

In 2017, the average generation of wastewater and sewage was approximately 279 m³/day. The annual average STP discharge water quality met all required MAD standards, except for the total ammonia value (6.2 mg/L) which exceeded its approved MAD standard (2.03 mg/L) as shown in Figure 5.5.

External Water Quality Testing

Our operations are routinely subject to inspections by local government agencies, who notify us of any concerns identified. We then respond and address these concerns accordingly.

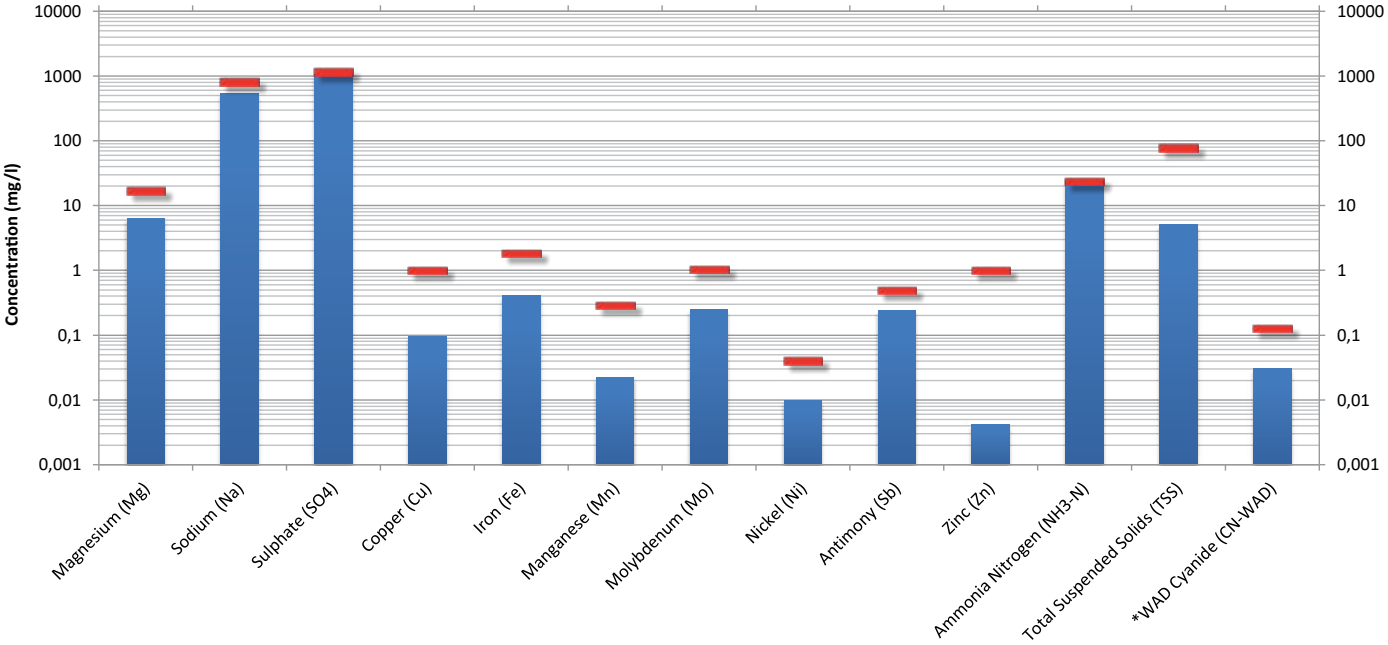
Monthly and Historic Results

Average monthly monitoring results are presented in the appendix to this report. Monitoring results from previous years are presented in the past annual environment reports, which are also available on KGC's website.

References:

Canadian Council of Ministers of the Environment (CCME), 2008. Canadian Water Quality Guidelines (CWQG). Accessed at: https://www.ccme.ca/files/Resources/supporting_scientific_documents/cwqg_pn_1040.pdf; United States Environmental Protection Agency (US EPA), 1995. 1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water. Accessed at: https://nepis.epa.gov/Exe/ZyPDF.cgi/20002924.PDF?Dockey=20002924.PDF.; The key parameters of our drinking water are compliant with these standards, and therefore safe for all relevant uses.

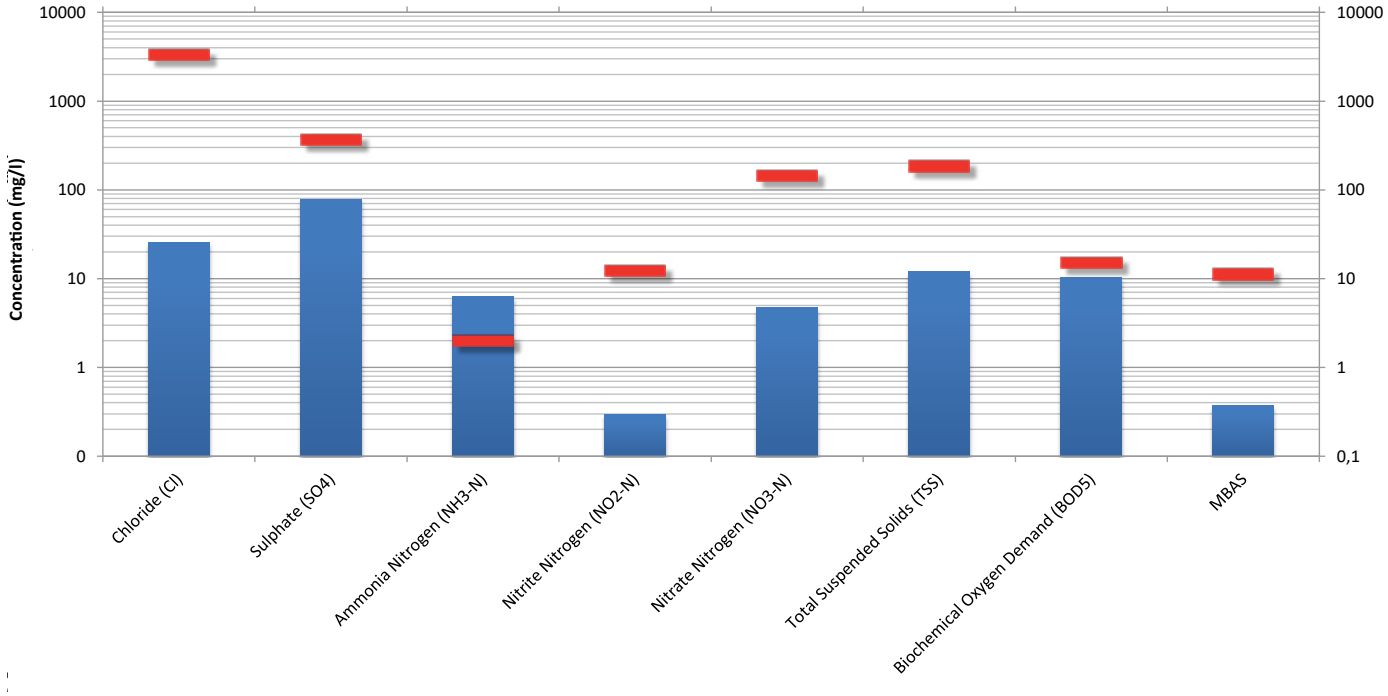
Fig. 5.4 2017 Water Quality Data at the Discharge Point of the Effluent Treatment Plant (location T8.4)



Note: *Data less than detection limit were set equal to half the detection limit.*

** MAC is for Free Cyanide (CN-F). Measuring CN WAD is conservative as CN-F is always less than or equal to CN-WAD*

Fig. 5.5 2017 Water Quality Data at the Discharge Point of the Sewage Treatment Plant (location SDP)



Note: *Data less than detection limit were set equal to half the detection limit.*

5.3 | GLACIER MANAGEMENT

Kumtor's high altitude mining operation is in close proximity to active glaciers, with part of the ore deposit and associated infrastructure extending beneath or affected by moving glaciers. Ice removal is required to provide safe access to ore and has been an approved part of mining since 1994. It is small compared to natural melting.

In response to stakeholder concerns and emerging legislation seeking a ban of glacial ice removal in the Kyrgyz Republic, we describe relevant information on our practices and put our impacts in the context of regional and global trends.

Ice Unloading

As visible in the aerial photo in the Environmental Monitoring section of this report (Figure 4.3), parts of five active glaciers are present within the Kumtor Concession area (Davydov, Lysyi, Sarytor, Petrov, Bordu). Ice is also present in extensive ice fields in the southern and eastern part of the concession area. The continuation of mining at Kumtor depends on our ability to manage and remove the ice in the vicinity of the open pit and other infrastructure throughout the life of the mine. We have also adjusted our practices over the years. In response to concerns raised by some stakeholders, we no longer deposit waste rock on glaciers and now segregate waste rock and ice and avoid co-disposal. Ice removed by Kumtor as part of its mining process is deposited back on other ice fields. In 2017, approximately 4.4 million tonnes of ice was removed and placed subsequently in the isolated areas. Ice removal will need to continue in the future to provide ongoing safe access to the ore body as mining progresses.

Environmental Context

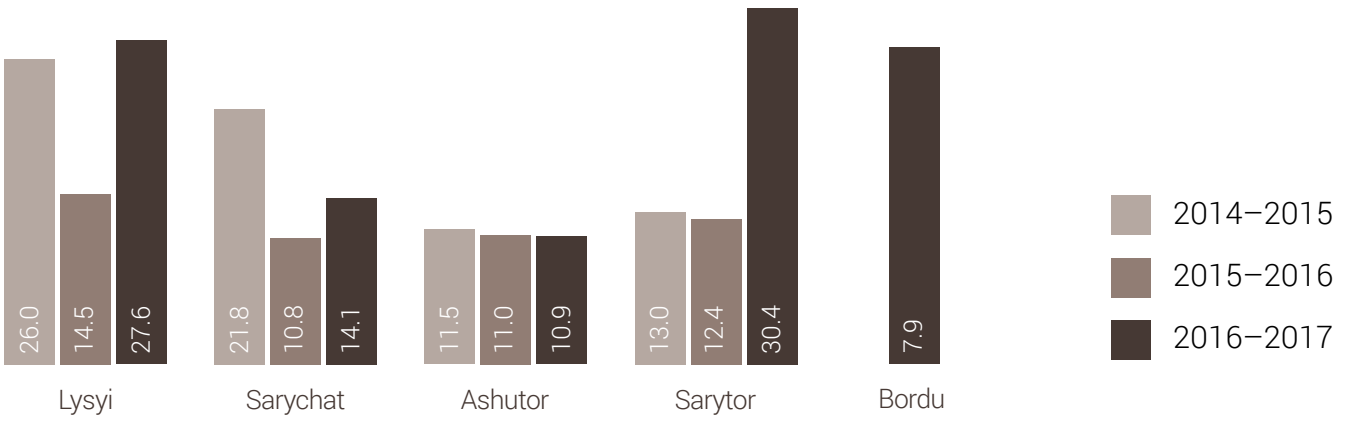
The impact of climate change has been observed in Central Asia over the past century. According to the United Nations Development Programme (UNDP), nearly 1/3 of the glacial area of Central Asia has disappeared since 1930, including the glaciers of the Kyrgyz Republic. The Kyrgyz government's 2009 submission to the United Nations Framework Convention on Climate Change (FCCC) reports that total glacier volume in year 2000 had reduced by about 20% since the 1960s. The same report predicts that, for the most likely climate change scenarios, the area of glaciation will reduce by between 64 and 95% between years 2000 and 2100. It is estimated that approximately 200 million tonnes of ice is lost each year on the Ak-Shyirak mountain massif (on which Kumtor is located) due to climate change effects (Petrakov, 2013).

Glacier Monitoring

The nature of all glaciers is for them to move steadily downhill, much like a very slow-moving river. The movement of the Davydov and Lysyi glaciers has been monitored since 1995, before mining started, with Sarytor glacier included in recent years. Glacier flow rates typically follow a seasonal pattern, being faster in warmer months and slower in winter. The Davydov glacier moves faster compared to the Lysyi and Sarytor glaciers, although its overall movement is not specifically monitored because ice is regularly unloaded from its base. Comparison of the retreat of the observed glaciers for the periods 2014-2015, 2015-2016 and 2016-2017 is shown in Fig. 5.6

In 2014, Kumtor constructed an in-pit retaining buttress to reduce the movement rate of the south arm of the Davydov Glacier. Regular monitoring has shown this has been an effective engineering solution, and has reduced the quantity of ice that needs to be removed to ensure

Fig. 5.6 Retreating Glaciers Comparison (m/year)



pit safety. In 2014, we commenced a long-term (2014-2018) glacier and hydro-meteorological monitoring program covering KGC concession area and basins of Arabel and Uchkol rivers. The studies are conducted by the Institute of Water Problems and Hydropower under KR NAS with involvement of experts from MGU (Moscow State University, Russia). The monitoring program aims to assess the status of glaciers and trace the dynamics of their change (movement rate, linear retreat, and surface depression) and reflective properties of their surfaces (albedo) within the area of immediate anthropogenic impact by KGC and comparison of obtained data with similar observations undertaken on glaciers located at significant distances from the mine. Further information is contained in the case study in this chapter.

Regulatory Context

Measures to manage glaciers and ice have been a feature of mining operations at Kumtor from the beginning of the project in 1994, and the subject of frequent Kyrgyz regulatory oversight and approval, as well as review by international technical and environmental experts.

In November 2017 amendments regulating the operations on Davydov and Lysyi Glaciers were introduced into the KR Water Code.

Fig. 5.7 Average Glacier Movement Speed (m/day)

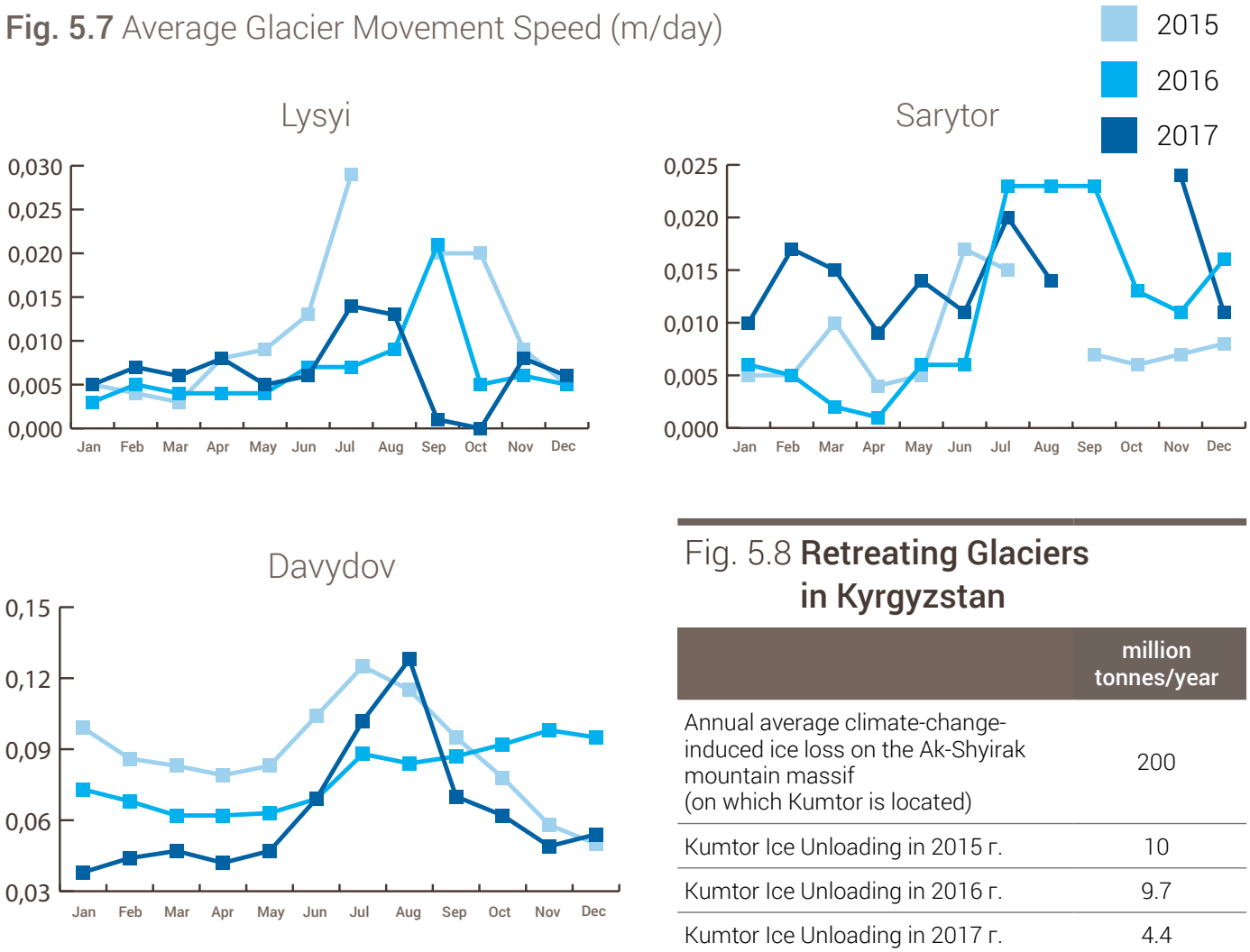


Fig. 5.8 **Retreating Glaciers in Kyrgyzstan**

	million tonnes/year
Annual average climate-change-induced ice loss on the Ak-Shyirak mountain massif (on which Kumtor is located)	200
Kumtor Ice Unloading in 2015 г.	10
Kumtor Ice Unloading in 2016 г.	9.7
Kumtor Ice Unloading in 2017 г.	4.4

GLACIER RESEARCH AND ASSESSMENT OF TECHNOGENIC IMPACTS ON AK-SHYIRAK MASSIF GLACIERS

Studies of the Ak-Shyirak massif glaciers have been conducted for more than 140 years. As a result of the studies it was found that the area of glaciation of the Ak-Shyirak massif in the late 1950s - early 1960s was 436 km^2 (Katalog lednikov SSSR [Glacier Catalogue of the USSR] 1969, 1970). In 2016, KGC continued funding the glacier research covering the glaciers within and outside the KGC concession area. The study was conducted by two research groups. One group was represented by the Kyrgyz Institute of Water Problems and Hydropower (IWPH) of the KR National Academy of Sciences and the second group was represented by the research experts from the Moscow State University named after M.V. Lomonosov (MSU) and Institute of Geography, Russian Academy of Sciences (IG RAS). Studies conducted by IWPH scientific team in 2017 continued research from previous years 2014-2016 and based on the approved by both parties expanded glacier and hydro-meteorological monitoring program covering KGC concession area. The monitoring program aims to assess of natural (due to global warming) and technogenic (caused by the Kumtor mine activities) factors affecting the shrinkage of glaciers in KGC concession area.

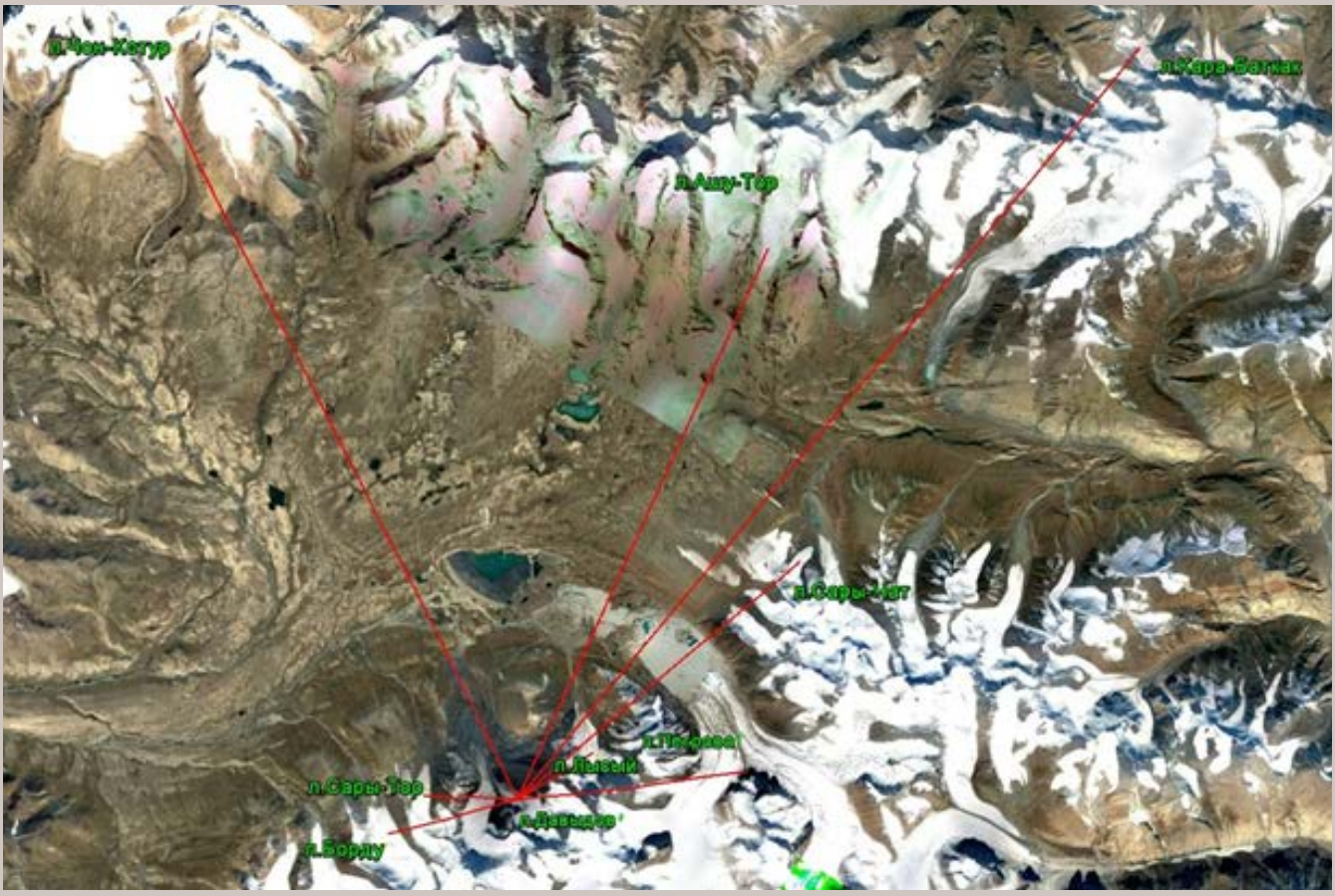
The main conclusions from the observations in 2017

In 2017, from all observed glaciers of a northern macroslope of the Ak-Shyirak ridge (Sarytor, Lysyi, Sarychat, Bordu) the Lysyi glacier underwent the greatest ablation. For the period 2014-2017, all the observed glaciers underwent a persistent retreat of the front tongue sections. This can be most associated with such natural causes as the apparent global warming. In 2014-2017 the highest movement rate was recorded at glaciers Sarychat and Ashu-Tor (11.2 m / year and 11.0 m / year, respectively).

In general, according to the calculations of the air temperatures adjusted in one line made by the Tian-Shan-Kumtor Weather Station, the average annual air temperature increase trend made up 1.20C for the period of 1930-2017.

The increased dust concentration in seasonal snow of the Sarytor glacier in 2017 in comparison with 2016 possibly may be related to the technogenic activities – beginning of mining operations in 2017 at a new pit (within the Sarytor valley). This year spectral assay results confirmed the 2016 report conclusion that the increased contamination with dust of the Lysyi glacier is a result of the technogenic impact of the mine. The main technogenic dust contamination sources are the waste rock dumps, adjoining the glacier.

Research of glaciers surrounding the Kumtor Mine will be continued in 2018.




VITALITY
ENVIRONMENT

5.4 | PETROV LAKE WATER BALANCE

Water balance of the Petrov Lake was estimated based on data of water flow in the river, as well as consumption and discharge of water to determine the total volume of water used at the Mill in 2017.

To determine the impact of water intake by the Kumtor Mine on water balance of the Petrov Lake, the Company took measurements at points of water outflow from the lake. We used readings from sensors installed immediately at the Petrov Lake for measurement of water level fluctuations, water meters at the water supply pipeline to the Mill, data taken from the Kumtor River flume, as well as measurements of precipitation and evaporation.

Volume of water flow measured at the Kumtor River flume is determined by:

- Volume of treated effluents discharged from Effluent Treatment Plant (ETP);
- Inflow of water from the Lysyi Creek;
- Volume of precipitation;
- Inflow of glacial melt water into the Petrov Lake;
- Inflow of spring meltwaters or surface waters into the Petrov Lake.

Total inflow into the Petrov Lake is estimated using the following formula:

$$V_{Inflow} = V_{Water\ according\ to\ Kumtor\ River\ flume} - V_{Water\ discharged\ from\ ETP} - V_{Lysyi\ Creek\ Flow} + V_{Water\ consumption\ by\ the\ Mine} - P_{Precipitation} + E_{Evaporations\ from\ the\ Lake} \pm V_{Lake\ water\ volume\ fluctuations.}$$

Outflow calculation

Kumtor River. Volume of inflow into the Kumtor River is obtained by summing outflow from the Petrov Lake, discharge from ETP, and Lysyi Creek flow. Kumtor River flow in 2017, according to measurements at the flume comprised 118.26 million m^3 for the period from May to October.

Effluent Treatment Plant. Volume of water discharged from ETP is determined by summing up readings of flowmeters installed at the pump station #3. Total volume comprised 4.75 million m^3 (for the period from May to October).

Lysyi Creek. Lysyi Creek flows into the Kumtor River upstream of the flume. Total flow of the Lysyi Creek throughout the season comprised 12.89 million m^3.

Consumption of water at the Mill, Camp and other facilities. The total water consumption by the Mill and the camp was measured by flow meters at the pump station on Petrov Lake and the Potable Water Treatment Plant (WTP). In 2017, the total volume of consumed water by all the facilities at the Mine was 5.21 million m^3.

Precipitation. Volume of water evaporated from the surface of the Petrov Lake was calculated according to Meyer's equation (equation for determination of evaporation from water surface). Evaporation from the surface of the Petrov Lake throughout May to October comprised 148.2 mm or 0.60 million m^3. This value does not contradict the data of Molchanov A. M., who notes that evaporation from the surface of mountain lakes in the area of the Petrov Lake is below 400 mm/year *(Molchanov A. M., "Central Asian Lakes", Gidrometizdat, Leningrad, 1987)*.

With precipitation of 258 mm, the level of water in the Petrov Lake increased by 0.258m, or the volume of water in the lake increased by 1.04 million m^3.

Changes in volume of accumulated water. When comparing the start and end of the year, the level of water in the Petrov Lake decreased by 0.09m – from 3731.50 to 3731.41m.

Final Calculations. The total calculated inflow into Petrov Lake in 2017 was:

$$V_{inflow} = V_{Kumtor\ River}\,(118{,}26) - V_{Lysyi\ Creek}\,(12{,}89) - V_{ETP}\,(4{,}75) + V_{Mine}\,(5{,}21) - P_{Precipitation}\,(1{,}04) + E_{Evaporation}\,(0{,}60) - V_{Lake\ water\ volume\ fluctuations}\,(0{,}09) = 105{,}3\ million\ m^3.$$

This calculated volume of inflow into Petrov Lake was slightly higher than that calculated in previous years. In fact, a major part of the calculated inflow increase, as compared to calculations of previous years, is due to a warmer weather throughout the season at the Mine.

The volume of water consumed by all facilities at the Mine in 2017 comprised 4.95 % of total water inflow into the Petrov Lake.

Conclusion. The volume of water consumed by the Mine in 2017 comprised 4.95 % of total water inflow into the lake. The above calculations of the water balance demonstrate that the volume of water consumed from the Petrov Lake by the mine facilities for production, domestic use and other needs is negligible.

RISKS OF PETROV LAKE OUTBURST AND PREVENTIVE ACTIVITIES CONDUCTED BY THE COMPANY

Understanding the concerns of state and regulatory authorities, as well as the public, KGC carries out continuous monitoring of water level in the Petrov Lake, water flow in the Kumtor River and readings of thermistors installed at three different points in the natural moraine dam. In addition, prior to development of an engineering design on the controlled lowering of water level in the Petrov Lake and its implementation, the Canadian consulting company "BGC", commissioned by KGC, developed an early warning system for the potential outburst of the Petrov Lake moraine dam, which was successfully introduced. KGC is currently conducting continuous monitoring of this warning system data. The basis of this system is a regular comparison of water flow in the Kumtor River Qact with water flow calculated by the developed mathematical model of dependence between water level in the Petrov Lake and water flow in the Kumtor River Qmod. In case difference between Qact and Qmod exceeds a specified value, it means an extra flow in the Kumtor River caused by infiltration or seepage through the natural dam body.

In 2015, commissioned by KGC, the head of the research and design laboratory "Stability of geotechnical objects", Ph.D. Chukin B.A. developed recommendations for a system of instrumental monitoring of the condition of the Petrov Lake natural dam. KGC is currently conducting monitoring in accordance with these recommendations.

KGC has repeatedly taken steps to develop design solutions for lowering water level in the Petrov Lake. In 2017, commissioned by KGC, JSC "Kyrgyzsuudolboor" developed a design for a stage-by-stage lowering of water level in the Petrov Lake. At the time of writing this report, the design is undergoing the required by the KR legislation expertise and approvals in the relevant state authorities.

6 SOCIAL RESPONSIBILITY

6.1 | STAKEHOLDER ENGAGEMENT

Effective stakeholder engagement is essential for us to manage our social responsibility. We have established structured processes to effectively listen to and communicate with our stakeholders, including regulators, shareholders, employees, local communities, small businesses, and the general public.

The process also includes bringing stakeholders together. Many of the projects described in this section have brought together communities, other supporting partners, the international aid community (see case study boxes), and government representatives.

The decision made by the Bishkek Inter-District Court restricting KGC to transfer assets is no longer in force starting from September 2017. The decision was taken upon the appeal by SIETS and is connected to the environmental claims of the State Agency. By the date of publishing of this report all claims were settled under the terms of a new agreement concluded with the KR Government. Most of the projects recommenced operations and resumed work by the end of 2017.

Engagement context

Our approach to engagement reflects our desire for respectful and meaningful dialogue within the complex social and political context of the Kyrgyz Republic. This context means that public and media interest in the KGC activities remains high.

Structured Dialogue

Our local engagement is maintained through our four Regional Information Centres, which have been established in the Jeti-Oguz and Ton districts, and in Balykchy town. The main objective of the Centres is to provide information about KGC to local residents. This includes information related to our hiring procedures, human-resources policies and job vacancy information. Community relations officers attend local community events, monitor the implementation of development projects funded by KGC, and act as a point of first contact for members of local communities. In addition to these structured activities, other types of formal and informal engagements occur on a regular basis across our host communities, with a range of other stakeholders such as community leaders, community organizations, local small businesses, and farmers. To ensure partnerships based on consensus we initiated an establishment of Regional Committees in Jeti-Oguz, Ton and Balykchy. Committee members are local authorities, heads of village councils, representatives of civil society organizations, members of different unions. In these meetings, KGC management raises issues about operations and defines plans of investment projects in liaison with local communities. Decisions are made together with the representatives of each Committee so that KGC's investments meet expectations and needs of communities. Regional Committee meetings take place every quarter.

Public Communication

Adhering to the information transparency policy and main principles of the Extracting Industries Transparency Initiative (EITI), KGC recognizes the importance of providing accurate and objective information on the Company and satisfying the information needs of all stakeholders. Effective engagement with all stakeholders is highly important for us in terms of social responsibility management.

In 2017 we continued to host one-day mine site visits for interested parties. In recognition of the increased interest in KGC's activities, we update our corporate website (**www.kumtor.kg**) in three languages (English, Russian, and Kyrgyz) on a regular basis. On the website, we post news releases, downloadable reports, and media articles that feature KGC. Stakeholders can also have an access to the information describing our business, and our environmental and social responsibility activities. We commission films about our activities that we post on our website and through social media channels, such as Youtube and Facebook (as **Kumtor Gold Company**). On a regular basis, we produce a corporate newsletter, In Touch, and occasional brochures on specific issues, such as environmental and operational safety (all of them are available on our website). We have a free telephone number to allow members of the public to contact us, in order to express a concern or request information, and we also have an email address for this purpose, or can be contacted via our website. On a quarterly basis, we produce special issues of regional newspapers in Kyrgyz and Russian languages about our activities and distribute them in focus areas.

> In order to ensure cooperation on the basis of mutual consent, we initiated the opening of regional committees in Jeti-Oguz and Ton districts, as well as in Balykchy

Kumtor Ambassadors Program

In 2017, Kumtor Ambassadors Corporate Volunteering Program continued to unite the Company employees from all the company departments and introduced them to local communities in the region where the Company conducts its operations. In 2017, employees put their collective efforts and volunteered more than 4,000 hours to various charity activities. The Program was of particular importance for the regular company partners, since almost all the year the court decision to ban the company assets transfer was in force.

On a regular basis, we organize mine site visits for stakeholders, including representatives of state bodies, Government, local authorities, partner organizations, as well as teachers and students from various educational institutions. The Program for such groups usually includes a visit to the main work areas: Camp, Mill, open pit, Petrov Lake, Tailings Management Facility and water treatment stations. Department Managers accompany the groups to the relevant sites and discuss the emerging issues on the spot. We will continue organizing such mine site visits for all stakeholders.

Since our Marshalling Yard is located in Balykchy, the Marshalling Yard staff conducts Open House Days for local schoolchildren, where children are familiarized with the work process and have their questions answered. As part of the Kumtor Ambassadors Program, KGC staff also assist the Sustainable Development Department in capacity building of local community representatives involved in community investment projects implemented in the Region. On a quarterly basis, we continued to hold meetings of the Supervisory Board of microcredit agencies with KGC managers being the Board members in the areas of sustainability, finance and risk. They help to maintain proper functioning and monitor the implementation of agreed programs in order to improve the performance of all three microcredit agencies.

We continued our cooperation with the International Business Council (IBC) and took part in all meetings of its Board. IBC is the largest multi-sector organization that unities the leading mining companies. Throughout the year, within the framework of the GIZ Regional Programme "Mineral Resources for Development", the Sustainable Development Department employees as well as representatives of the Training and Environment Departments participated in bi-monthly meetings on various topics, including the environment, public relations and training. KGC HR Department representatives took part in the Business Advisory Council (BAC) for the AUCA School of Entrepreneurship and

Business Administration (SEBA). The SEBA BAC aim is to help the Entrepreneurship and Business Administration Department of the American University in Central Asia to maintain and deepen ties with the business community and other stakeholders. BAC meetings will be held twice a year. We took an active part in the events of the KR Chamber of Commerce and Industry, as well as the American Chamber of Commerce, where the company was recognized as 2017 Best Company to Work For and awarded with AmCham Service Award based on the 2017 performance results.

Issyk-Kul Regional Development Fund

KGC contributes 1% of gross annual revenues to the Issyk-Kul Development Fund. This fund is governed by an oversight and steering committee (independent of KGC), which includes local government representatives and NGOs. The fund is designed to develop the socioeconomic infrastructure of the Issyk-Kul Region in accordance to local and regional government priorities. Since the creation of the fund in 2009, KGC has invested more than $60 million into projects as diverse as kindergartens, schools, sports clubs, and irrigation infrastructure across the Issyk-Kul region. We understand that the Fund continues to be criticized for lack of transparency and that some stakeholders are expressing concerns about selection of projects and application of the IKDF resources. We are aware of these concerns and continue to encourage the fund to be more transparent, and work closely with Transparency International (a global coalition against corruption) on this issue.

Fig. 6.1 Annual Contribution to Issyk-Kul Region Development Fund

units	2015	2016	2017
Million US$	7.1	6.2	6.4

KGC intends to assist the authorities of the Issyk-Kul region who have been raising concern of the future of IKDF and jointly are developing a new mechanisms that allocate a portion of deducted funds to a post-closure period and divert funds to a more sustainable and profit-oriented projects. Over the year we have been working on development of a mechanism that will improve the IKDF's procedures to ensure that the projects meet the following criteria:

- comply with the transparency principles (rational and efficient use of funds excluding corruption);
- be sustainable (use funds with account of Mine Closure);
- be targeted at improving the quality of life (include more profit-generating projects and have sustainable social infrastructure).

KGC has a seat at the IKDF Supervisory Board and has a right to coordinate 50% of overall funds to ensure a transparent and fair spending of the selected projects in the interests of social and economic development of the Issyk-Kul region, especially of communities located on the southern coast of Lake Issyk-Kul, including Balykchy town. The Supervisory Board meetings take place once in a quarter.

Impact Assessment

Apart from regular monitoring and evaluation processes embedded in each project and donation supported by the company, we regularly conduct impact assessment and perception study in our focus areas – Jeti-Oguz, Ton and Balykchy. In 2016 the local research company have conducted a planned two-year perception survey in the region basing on our order. In 2017, we continued gathering results with the local research company. Our Stakeholder Engagement Strategy and Plan are based on these studies and quarterly review of major stakeholders and their concerns, documented in internal system, updated by regional community relations officers, and members of other departments dealing with publicity. Based on analysis and studies we have formulated a summary of stakeholder concerns (see Fig. 6.2).

KGC Grievance Mechanism

As the major company operating in the Kyrgyz Republic, KGC receives complaints and requests ranging from dust burden because of KGC trucks movement to job requests and hospital or road construction requests. We maintain an open dialogue with all stakeholders and listen to rational ideas. The measures taken by the company with regard to the dust on the technological road are described in the Environmental Monitoring Section. KGC also experienced temporary road blocks in 2012 and 2013, but none in 2014-2017. Protests typically involved demands for a greater distribution of the mine's profits and benefits. Negotiations between Centerra and KR Government actively continued in 2017 and ended up with signing of a new agreement that involved settlement of all disputes.

Grievances on sustainability issues are dealt in accordance with the accepted grievance acceptance mechanisms. In 2017 KGC received 3 grievances and resolved all of them during the year. We understand the importance of raised concerns and their timely resolution. The Company will continue to dedicate its efforts to mitigate related risks.

KGC's Sustainable Development Department has four information centres in the Issyk-Kul region, and community representatives and local authorities contact our CROs for any information. In their turn, they report all issues raised by communities to the SD Director.

We have a free phone line available, our grievance acceptance mechanisms are available in all regional information centres. We try to resolve each raised issue and concern, and provide requested information for every stakeholder group. All environment-related issues can be directly sent to the Environment Director via **environment@kumtor.com**. All grievances and issues raised are also reported directly to the KGC senior management.

Fig. 6.2 **Summary of Stakeholder Concerns**

Stakeholders	Topic	Report Section Where Discussed
Kyrgyz Republic Government and Parliament	■ Changing legal agreements ■ Claims and changes to the legislation (glaciers, Water Code) ■ Project benefits ■ Waste Management and permits for new waste dump	■ President's Message ■ Economic Responsibility ■ Waste Rock and Ice ■ Social Responsibility
Various Commissions, Government Agencies and Local Communities	■ Economic benefits ■ Environmental impacts ■ Waste rock management ■ Tailings dam displacement ■ Impacts on glaciers ■ Glacial lake outburst flood ■ Mine closure and its funding	■ President's Message ■ Economic Responsibility ■ Social Responsibility ■ Environmental Sections ■ Case Studies ■ Tailings Management ■ Waste Rock and Ice ■ Mine Closure
Local Communities, Youth, Vulnerable Groups	■ Employment opportunities ■ Environmental impacts ■ Water resources ■ Community support, projects and donations	■ President's Message ■ Social Responsibility ■ Local Procurement ■ Water Use and Treatment
Local Businesses	■ Supplying goods and services	■ President's Message ■ Economic Responsibility ■ Local Procurement ■ Social Responsibility
Employees and Contractors	■ Employment conditions ■ Benefits ■ Health, safety and well-being	■ President's Message ■ People ■ Occupational Health & Safety
Conservation NGOs	■ Environmental impacts ■ Biodiversity strategy ■ Mine closure	■ President's Message ■ Environment sections ■ Mine Closure

6.2 | COMMUNITY INVESTMENT PROJECTS

We believe in importance of providing assistance to local communities in reaching their goals to develop the local economy and well-being of Issyk-Kul citizens.

The Mine Closure will undoubtedly have a direct impact on region's economy, therefore a structured and well-planned approach in community development projects is a high priority, since it is a vital component in maintaining our social license to operate.

The current life of the Kumtor mine is expected to end in 2026. Given its size as a major employer, taxpayer, and purchaser, mine closure is expected to bring with it a negative economic impact in the Issyk-Kul region and across the country. In order to reduce this impact, the strategy of our community investments is to promote and develop a more diverse economy which will not be over-reliant on KGC. We work in partnership with a number of international and local organizations to maximize the impact of our community investments. The partnerships focus mainly on the southern shore of Issyk-Kul Lake. Projects are developed taking into account stakeholder input, community needs, company risks, and availability of an experienced partner that can deliver against expected outcomes. Within the framework of implementing its programs in the region, the Company strictly follows the Sustainable Development Strategy of the Issyk-Kul Region that includes four main areas:

1. Support to business growth and diversification (especially small businesses and entrepreneurs).
2. Support to development of the agricultural sector.
3. Youth and educational projects.
4. Environmental protection projects.

A key criterion for project selection is the principle of sustainability, which refers to the lasting effects of the project beyond the end of KGC's funding. If a project cannot be deemed to be sustainable and able to continue - or continue to generate benefits - beyond our funding period, then it will not be selected for implementation.

Fig. 6.3 **Sponsorships & Sustainable Development Projects**

units	2015	2016	2017
Million US$	2.0	0.7*	0.9*

* *From June 2016 until October 2017, KGC was unable to finance development projects because of the decision of the interdistrict court to prohibit the transfer of assets to third parties.*

REGIONAL SCHOLARSHIP PROGRAM

The Kumtor Regional Scholarship Program provides students completing high school and wishing to pursue a vocational career the opportunity to apply for one of 20 Scholarships. The successful applicants are under full scholarship that includes tuition, accommodation, meals and a monthly stipend while they attend Technical Vocational School #27 or Technical School #91 in Bishkek.

In 2017 , full scholarships were awarded to 12 students to study at Technical School #91 where they graduate with the profession of Cook/Baker.

Technical School #27 has worked closely with KGC to establish a program that incorporates school based instruction with practical training in the Heavy Duty workshop or the Mill Maintenance area at the Kumtor Mine site.

Currently KGC is sponsoring 28 students at Technical School #27, with 8 in the first year, 8 in the second year and 12 in the third year The program takes 3 years to complete with graduates earning the profession auto mechanic.

Supporting Businesses

We support the development of local businesses in a number of ways. The most important one is based on our policy of supporting local procurement and encouraging new local suppliers to supply goods and services, as described in the Local Procurement section. However, we are aware of the risk for individual suppliers to become overly dependent on business with KGC. Therefore, we work with suppliers to support them in improving business processes (such as quality management systems) and encourage them to seek additional customers apart from KGC. Another important initiative is our micro-financing and credit program, which supports and enables local microcredit agencies in Jeti-Oguz, Ton, and Balykchy by offering favorable lending rates for small enterprises and farming businesses. The interest rates of these programs are the lowest in Kyrgyzstan. Between 2006 and 2017, KGC invested more than $4 million. We are working hard to unite international organizations that invest in the Issyk-Kul Region to develop a comprehensive approach in addressing regional development issues. We continued to purchase a range of natural jams from JICA's One Village – One Product Program members from different communities of Issyk-Kul. Equipment purchased by KGC in 2013 is still used by local producers in terms of both OVOP program and Karagat+ Project, which also continued its work in 2017.

Donations and Charitable Support

In addition to our sustainable community development programs, we provide one-off donations, usually in form of in kind equipment or services. We receive many requests for support from across the country. Donation requests and proposals are reviewed on a monthly basis by our donations committee consisting of the company management representatives under the chairmanship of the KGC president. All donation applications are reviewed to approve they meet the selection criteria specified by our Donations Policy and Company procedures. KGC conducts follow up monitoring visits on a regular basis to ensure that the donations are used for the intended purposes.

See the infographics on next page for the applications review mechanism, which is also available online in our web-site.

Some of the examples of KGC donations made in 2017 include:

- Sponsorship for the Elderly Day celebrations in Issyk-Kul region;
- Purchase of hockey equipment for children from orphanage house;
- Supply of musical equipment, books, and toys for kindergarten of Tamga village;
- Purchase of 75 tonnes of coal for educational center Kut Bilim in Karakol city;
- Transfer of tents, sleeping bags, saddles for the Public Foundation Wild Kyrgyzstan to develop their business;
- Purchase of fifty ice skates for hockey team and ice dance group for Jeti-Oguz youth organization;
- Food packages for children with special needs of Balykchy, Ton, and Jeti-Oguz region;
- Co-funding renovation works in class rooms for kids diagnosed with autism;
- New Year gifts for children from orphanage houses, rehabilitation centers, and vulnerable families of Balykchy city, Ton and Jeti-Oguz districts.

DONATIONS PROCEDURE

As a socially responsible company, KGC annually allocates funds to help local communities in need. KGC strictly adheres to the Corporate Donations and Sponsorship Policy aimed at poverty alleviation, increasing living standards of local population, and improvement of social and economic situation in Issyk-Kul region and the country in general. The help rendered by KGC serves to contribute to the development of local communities and provide support to vulnerable groups.

1. FILING A REQUEST

To ensure timely and fair request processing the requester of charitable and sponsorship support should follow set standards.

2. SUBMITTING A REQUEST

The letter of request shall be filed on official letterhead of organization or local government body signed and stamped by the head.

3. REGISTRATION AND NOTIFICATION

Document Control Department (DCD) of the Company registers an application and assigns it an internal number. The applicant may contact DCD to query the application status.

4. VERIFICATION

Sustainable Development specialists evaluate the applications for the possibility to include them into the protocol of the Donations Committee. Applications that fail to comply with the Company policies and go against its principles will be screened and not submitted for review of the Committee. Such applicants will be sent official letters of regret.
Applications that passed preliminary assessment go through additional verification that may require several initial meetings at site to have an insight into the applicant's activities.

5. DONATION COMMITTEE MEETINGS

Every month the Company holds a meeting of the Donation Committee, comprised of senior management and chaired by the KGC President to decide on allocation of funds to applicants.

6. RESPONSE

As per the Donations Committee decision, all applicants receive notification letter.

REQUESTS SHOULD INCLUDE THE FOLLOWING INFORMATION:

- Name, address and contact phone numbers of the organization;
- Organization registration number;
- Aims and goals of the organization;
- Purpose of the event or activity for which the financial support is being requested;
- Expected results and estimated benefits for the company;
- Type and amount of requested support;
- Description of the way how the support is going to be used.

Donation is provided as a property, defrayal of expenses for works and services, and in very rare cases transfer of money assets.

During the review process priority is given to requests from Issyk-Kul region.

A LETTER OF REQUEST IS ACCEPTED:

- **In regional info-centers of the Company** (Kyzyl-Suu village, building of the State District Administration; Bokonbaev village, building of the State District Administration; Balykchy town, 374A Frunze Str.);
- **In offices of the Company** (Bishkek city, 24 Ibraimov Str., Floor 10; Karakol town, 1G Karasaev Str.; Balykchy, 9 Naryn roadway);
- **Via postal address:** Kumtor Gold Company, 24 Ibraimov Street, 10th floor, Bishkek, 720031;
- **Fax:** 0 (312) 591 526
- **E-mail:** info@kumtor.com

KGC DOES NOT PROVIDE DONATIONS TO:

- Individuals or companies, rather than local community organizations and groups;
- Compensate travel and medical costs;
- Finance private business;
- Support religious or political goals;
- Finance corporate advertising of organizations requesting for help;
- Covering membership fees in any organization.

NEGATIVE RESPONSE

In case of negative decision, the applicant is suggested other possible sources of funding.

POSITIVE RESPONSE

In case of positive decision, shortly after the notification letter, the Company gets into contact with the applicant to clarify the details.

IMPLEMENTATION

Our donations are not made in cash but rather through goods or equipment procured by Kumtor and provided to the recipients.

MONITORING

At any given time, KGC is eligible to monitor the designated use of funds. Upon revealing any violations, KGC will assume measures accordingto Company policy.

KUMTOR
КУМТОР

GLOSSARY AND ABBREVIATIONS

Albedo - is the coefficient of spectral whiteness (reflection) of surface used as a key parameter in climate surveys to estimate the Earth's energy budget, radiation transfer in earth-atmosphere system and glacier balance.

ARD - Acid rock drainage is a term used to describe the outflow of mine waters that have been acidified by contact and exposure to rocks, reducing the pH levels which, in turn, can release and mobilize metals into the environment.

Biodiversity - Short for "biological diversity," the variability among living organisms and the ecosystems of which they are part. This includes diversity within species, between species, and within ecosystems.

BMY - Balykchy Marshalling Yard.

CAP - Change Acceleration Process.

Capacity Building - Activities and initiatives that strengthen the knowledge and skills of individuals and improve structure and processes such that communities can grow and develop in a sustainable way.

CCP or MCP - Conceptual Closure Plan (see also Closure Plan).

CG - Centerra Gold Inc.

CJSC - Closed Joint Stock Company.

Closure Plan - A plan designed to ensure public safety and restore the physical, chemical, and biological quality of the area disturbed by mining to an acceptable level. It must aim at leaving the area in such a way that the rehabilitated property does not become a burden to society after the mining operation is over.

Code of Ethics - A policy that sets out Centerra's dedication to upholding high moral and ethical standards and specifies basic business conduct and behaviour.

Collective Bargaining Agreement - An agreement between a company and one or more workers' organizations or, in absence of such organizations, the representatives of the workers duly elected and authorized by them in accordance with national laws and regulations.

Corporate Responsibility - A form of corporate self-regulation integrated into a business model where companies embrace the responsibility forth impact of their activities on the environment, consumers, employees, communities, and stakeholders.

Currencies - Kyrgyz som (KGS): 2017 average exchange rate 1 USD = 68.87 KGS.

Cyanide - A chemical compound containing carbon and nitrogen used to dissolve gold from ore.

Derived Air Concentration (DAC) - A derived limit on the activity concentration in air (in Bq/m^3) of a specified radionuclide - calculated such that a typical worker, breathing air with constant contamination at the DAC while performing light physical activity for a working year, would receive the annual limit on intake for the radionuclide in question.

EBRD - European Bank for Reconstruction and Development.

Economic Value Retained - Component of GRI Economic Indicator EC1 and calculated as economic value generated less economic value distributed (see also **www.globalreporting.org** for further details).

EITI - Extractive Industries Transparency Initiative.

EMAP - Environmental Management Action Plan.

Engagement - A process of contact, dialogue, and interaction that ensures all parties of interest are informed and participate in decisions that affect their future.

Environmental Assessment -The process of identifying, predicting, evaluating, and mitigating the biophysical, social, and other relevant effects of development proposals prior to making major decisions and commitments.

Environmental Incident - An event that has caused or could cause environmental harm. Ranges in scale and severity from Type I (Insignificant) to Type V (Catastrophic).

Environmental Management System (EMS) - A framework developed by an organization to help improve its environmental performance by taking environmental considerations into account when making decisions and managing risks.

ETP - Effluent treatment plant.

First Aid Injury (FA) - A work related injury that requires first aid treatment.

GDP - Gross Domestic Product.

GHG - Greenhouse gas - Emissions commonly reported as CO_2 equivalents (CO_2e).

GIIP - Good International Industry Practice. Defined in the International Finance Corporation Environmental, Health and Safety Guidelines for Mining as "the exercise of professional skill, diligence, prudence and foresight that would be reasonably expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally. The circumstances that skilled and experienced professionals may find when evaluating the range of pollution prevention and control techniques available to a project may include, but are not limited to, varying levels of environmental degradation and environmental assimilative capacity as well as varying levels of financial and technical feasibility."

Global Reporting Initiative (GRI) - A global network based organization that has developed a widely used sustainability reporting framework consisting of principles and indicators to measure and report on an organization's economic, environmental, and social performance (see also www.globalreporting.org for further details and definitions of the GRI framework and indicators).

Governance - A set of processes, customs, policies, laws, and institutions affecting the way a company is directed, administered, or controlled.

Hazard - A source of potential damage, harm, or adverse effects on something or someone under certain conditions at work.

HSE - Health, Safety and Environment.

ICMI - International Cyanide Management Institute.

IFC - International Finance Corporation, a member of the World Bank Group.

ISO - International Organization for Standardization, the world's largest developer of voluntary International Standards.

ISO 31000 standard - Standard developed by ISO Technical Management Board Working Group.

IWP & HP - Institute of Water Problems and Hydropower.

IUCN - International Union for Conservation of Nature.

JSC - Joint Stock Company.

KR NAS - Kyrgyz National Academy of Sciences.

KGC - Kumtor Gold Company.

Local Suppliers - Suppliers based in the same country as the operation that they supply.

Lost Time Injury (LTI) - A work related injury resulting in the employee being unable to attend work on the next calendar day after the day of the injury. If a suitably qualified company medical professional advises that the injured person is unable to attend work on the next calendar day after the injury, regardless of the injured person's next rostered shift, a lost time injury is deemed to have occurred. Site and company medical advisors will determine when a lost time injury is no longer recorded as a lost time injury. This includes fatalities.

LTI Frequency Rate - Number of LTIs x200,000/hours worked.

LTI Severity Rate - Number of days lost to injury x200,000/hours worked.

MAC - Maximum allowable concentration standards which apply at KGC's surface water quality compliance point (referred to as W.1.5.1) downstream of the Kumtor Mine.

MAD - Maximum allowable discharge standards which apply to treated effluent discharges from the effluent treatment plant and the sewage treatment plant.

MAE - Maximum allowable emission standards which apply to airborne emissions from Kumtor.

Materiality - The threshold at which an economic, environmental or social issue or indicator becomes sufficiently important that it warrants disclosure in the corporate responsibility report.

Medical Aid (MA) - A work related injury or illness that requires medical treatment administered by an off-site physician or by a registered medical personnel. Site and company medical advisors are to be consulted and a final decision as to how a medical aid injury is to be managed will be determined by the company medical team in consultation with senior site management.

Millimeter/Millimetre (mm) - International System unit of length, 1000th of a metre.

NGO - Non-Governmental Organization, a not-for-profit group largely funded by private contributions and operating outside of institutionalized government or political structures. NGOs focus on environmental, social, and economic issues at local, regional, national and international levels.

Near Miss - An event not causing harm, but has the potential to cause injury.

Oblast - Administrative division, which in English translates as province or region.

OJSC - Open Joint Stock Company.

Open Pit - A mine where the minerals are mined entirely from the surface.

Ore - A naturally occurring solid material (usually rock) from which a metal or valuable mineral can be extracted profitably.

QA/QC - Quality assurance and quality control program for collection, handling, and analysis of samples to ensure a consistent approach and accurate results.

Reclamation - The restoration of a site after the completion of mining or exploration activity.

Reportable Injury - The sum of the number of Medical Aid Injuries and Lost Time Injuries in a given period.

Reportable Injury Frequency Rate (RIFR) - Number of Reportable Injuries per 200,000/Hours Worked

Responsible Mining - A comprehensive and transparent minerals activity that respects the rights of all stakeholders, especially those of local people, operates safely, protects the environment, minimizes the impact on human health, embraces the best international practices, and upholds the rule of law while generating benefits for host countries (see also Corporate Responsibility).

SAEL - Stewart Assay and Environmental Laboratories LLC (part of the ALS international group of laboratories), located in Kara-Balta, Kyrgyz Republic.

SAEPF - State Agency of Environment Protection and Forestry.

SCER - Sarychat-Eertash Reserve, a strictly protected Zapovednik neighbouring Kumtor Concession. Sometimes referred to as SCEZ, with Zapovednik replacing Reserve. Zapovednik is a work of Russian origin meaning protected wilderness.

SEDAR - System for Electronic Document Analysis and Retrieval.

Significant Spill - Any spill that is Level III or higher, as defined by Centerra's incident reporting system, Level III spills are significant enough that they must be reported to Centerra's Board of Directors.

SME - Small or medium sized enterprise, referring usually to small businesses. Definitions vary, but typically they have less than 50 employees.

Stakeholder - Any person or group of people who may be affected in a good or bad way by the financial, safety, environmental, and social aspects of our operations and those who have an interest in or an influence on our activities.

Stakeholder Engagement -The communication with stakeholders, through various means, to find out what social and environmental issues matter most to them, with a view to a company improving decision-making and actions to address these concerns.

STP - Sewage Treatment Plant.

Sustainable Development - As used in the report Our Common Future (also known as the Brundtland Report): "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (see also Corporate Responsibility). Kumtor develops mineral deposits in a manner that does not restrict communities' efforts to sustain themselves and strives to catalyze economic activity that promotes long-term sustainability among our communities and their surroundings.

Sustainability - An approach to decision-making that integrates economic, environmental, and social considerations (see also Corporate Responsibility).

Tailings - The material that remains after recoverable metals or minerals of economic interest have been removed from ore through milling.

Threshold Limit Values (TLV) - The level/concentration of a chemical substance to which it is believed a worker can be exposed day after day for a working lifetime without adverse health effects.

TMF - The Tailings Management Facility is the combination of infrastructure to hold and manage semi-liquid tailings so as to avoid negative health and environmental impacts, consisting of delivery infrastructure, storage ponds, holding dam, water and waste treatment facilities, and discharge facilities for treated effluent.

TSP - Total suspended particulates.

USD - US Dollars.

WTP - Water Treatment Plant.

PERFORMANCE DATA

Economical and Operational Indicators

	2015	2016	2017
Gold Produced (kg)	16 195.40	17 136.78	17 503
Gold Sold (kg)	17 453.80	16 993.15	17 111
KGC's share in KR GDP (%)	6.8	8.0	9.7
KGC's share in the aggregate industrial output	22.5%	23.4%	21.1%

Direct economic value generated and distributed[1]

	2015	2016	2017
Revenues from Gold sales	601,737,459	683,327,685	685,163,279
Other income [2]	5,029,607	1,926,887	4,069,740
Operating costs (Goods and Services) [3]	233,060,926	190,818,481	206,804,840
Corporate administration costs	-	-	-
Exploration costs	-	-	-
Capital expenditure [4]	64,642,771	75,778,978	78,745,280
Other operating costs [5]	1,572,558	,2,304,654	2,469,333
Employee and contractor wages and benefits	105,111,954	108,861,856	117,237,524
Payments to providers of funds [6]	84,633,058	96,292,724	96,729,304
Taxes and Royalties	-	135,000,000	400,000,000
Community donations and investments	5,114,257	2,203,078	1,176,986
Payments to Cancer Support Fund			7,000,000
Economic value retained [7]	115,542,721	75,020,894	(220,788,605)

Notes:

1) *Data has been prepared on an accrual basis and non-cash costs have been ignored.*
2) *Other income includes income from financial investments, sale of assets, and other services.*
3) *Includes capitalized overburden stripping costs.*
4) *Excludes capitalized overburden stripping costs.*
5) *Includes by-product sales (silver).*
6) *Represents dividends in the amount of $400.0 million, which were declared and settled in 2017 form the accumulated retained earnings.*
7) *Defined as 'direct economic value generated' less 'economic value distributed'.*

Major consumables

	2015	2016	2017
Cement & lime	8,194	8,628	10,264
Reagents & chemicals	10,686	10,971	11,611
Grinding balls	8,025	9,871	11,389
Diesel (x1000 litres/yr)	119,559	123,846	124,652
Explosives	28,227	24,602	32,200

Local procurement in context

	2015	2016	2017
Total Payments for Goods and Services[#]	279,731,777	256,175,620	266,126,258
Local Payments for Goods and Services[#]	59,336,002	58,426,843	60,385,333
Local Payments for Goods and Services as% of Total	21%	23%	23%

[#] These figures include the fees paid to the Kyrgyzaltyn Refinery

Environmental Performance Indicators

	2015	2016	2017
Direct Energy Consumption (GJ)			
Diesel (litres/yr)	119,540,637	123,846,319	124,651,982
Petrol (litres/yr)	397,081	409,574	395,842
Explosives (tonnes/yr)	28,227	24,602	32,698
Indirect Energy Consumption (GJ)			
Electricity (GJ/yr)	1,021,070	1,034,037	1,041,539
Electricity (MWh)	283,631	287,233	289,316
Direct GHG Emissions (Scope 1) (tonnes CO_2e)	326,396	337,028	340,525
Indirect GHG Emissions (Scope 2) (tonnes CO_2e)	24,676	25,102	25,279
GHG intensity ratio (tonnes CO_2e/oz gold)	0.67	0.66	0.65

Kumtor Mine Emissions Table (tonnes/year)

Pollutant	MAE Standard 2017	Actual 2017
Dust that contains SiO_2 20-70%	912.3382	783.5938
Hydrogen cyanide	0.0008	0.0008
Sodium hydroxide	0.3627	0.07346
Calcium oxide dust (lime)	1.469	1.9641
Carbon (soot)	0.09228	1.23278
Welding aerosol	0.433391	0.354798
Manganous oxide	0.058833	0.047929
Tetrafluorosilane (fluorides)	0.0194	0.015653
Hydrocarbon	3.75573	10.00873
Carbon oxide	47.83855	66.03125
Nitrogen dioxide	297.10872	85.02892
Hydrogen fluoride (fluorides)	0.051646	0.040897
Lead and its inorganic compounds	0.00144	0.0015
Sulfur dioxide	1.17532	6.52672
Ammonia	0.8028	0.3433
Hydrochloride	0.0000257	0.000077
Silica compositions	0.0194	0.015653
Nitrogen oxide	0.07329	0.07329
Hydrocarbons (by kerosene)	2.37934	2.37934
Total	**1,267.98**	**957.99**

Waste management

	2015	2016	2017
Industrial waste - total (tonnes)	5,637	6,996	10,052.4
Industrial waste - recycled (tonnes)	5,562	8,828	10,083.2
Hazardous waste - total (tonnes)	110	697	545.0
Hazardous waste - recycled (tonnes)	13	5*	116.5
Waste Tires	1,154	861.5	947.8

***Note:** An additional 7.6 tonnes of batteries were recycled from temporary storage areas.*

Water Use and Treatment (mil. m^3)

	2015	2016	2017
Sources of Water			
Total Water Extracted from Petrov Lake	5.76	5.25	5.21
Pit water pumped to the Mill	0.64	1.01	1.14
Pit water pumped to the environment	10.9	12.75	29.24
Water used for Domestic Purposes			
Water Used for Camp domestic purposes (from Petrov Lake)	0.15	0.13	0.13
Water Used for MIll domestic purposes (from Petrov Lake)	0.19	0.02	0.02

Water Use and Treatment (mil. m^3)

	2015	2016	2017
Water used for Process/Mill			
Raw water used at Mill (from Petrov Lake)	5.32	5.06	5.03
Total water used at Mill (Petrov Lake + Pit water)	5.96	6.07	6.17
Water internally recycled at Mill	5.33	6.50	6.19
Ore Feed to Mill	5782,419	6,303,032	6,245,870
Raw Water Intensity Ratio (Litres/tonne)	921	803	805
Water used for Dust Supression			
Water used for Dust Supression	0.09	0.04	0.05
Wastewater Discharged to Environment			
Treated wastewater discharged from ETP	4.84	4.14	4.75
Treated wastewater discharged from STP	0.12	0.10	0.10
Net water usage	0.79	1.01	0.36

Social Performance Indicators

	2015	2016	2017
Training Hours by Gender			
Average/Employee	27.02	35.4	46.31
Total Employee Training Hours	71,628	94,334	127,999
Total Number of Employees	2,650	2,665	2764
Average/Female Employee	6.43	20.38	21.16
Total Female Employee Training Hours	2,316	7,073	7,385
Total Number of Female Employees	360	347	349
Average/Male Employee	30.26	37.64	49.94
Total Male Employee Training Hours	69,313	87,261	120,613
Total Number of Male Employees	2,290	2,318	2415
Training Hours by Employee Category			
Average/Senior Management	14.32	45.17	34.15
Total Training Hours Provided to Senior Management	702	1,897	1,400
Total Number of Senior Management	49	42	41
Average/Middle Management	18.44	39.25	4506
Total Training Hours Provided to Middle Management	5,846	11,539	12,934
Total Number of Middle Management	317	294	287
Average/Funtional Employee	28.47	34.69	46.66
Total Training Hours Provided to Funtional Employees	65,031	80,898	113,665
Total Number of Funtional Employees	2,284	2,332	2436

Social Performance Indicators

	2014	2015	2016
Health and Safety			
Annual medicals	2,398	2,440	2,485
Pre-employment medicals	238	424	254
Total visits	43,837	40,558	40,104
Reduction in overall vehicle accidents	17	12	11
Reduction in high-potential injury risk - light vehicle accidents	4	2	3
In-pit heavy versus light vehicle collisions	4	2	2
Injuries due to vehicle accidents	2	1	1
Hours worked	5,981,799	5,734,240	5,712,626
Lost time injuries (LTI's)	4	3	9
Medical aid	3	3	2
First aid	16	16	17
Days lost to injury	6,093	52	6,349
LTI frequency rate	0.13	0.10	0.33
LTI severity rate	203	1.81	222.48
Reportable Injury Rate (RIF)	0.23	0.21	0.39
Incidents w/Property damage	38	31	31

**The discrepancy in data on the number of lost days due to injuries with lost time incidents (LTI) for 2017 compared to 2016 is due to the fact that the lost time injuries were 8 less in 2017 than in 2016. Unfortunately, in April 2017, a fatal accident occurred on the heavy equipment maintenance site. In accordance with international norms, an automatic calculation of 6,000 lost person-days was implemented due to the fatal accident and 26 lost person-days due to the lost time injury.*

Employee Demographics

	2015	2016	2017
Standard national entry level wages and those paid by Kumtor			
Kyrgyz minimum wage per hour	5.80	6.33	7.14
Kumtor entry-level wage per hour	78.20	86.20	94.62
Kumtor entry-level to Kyrgyz minimum wage	0.54	14,:,1	13,:,1
Staffing at the Kumtor Mine (as at Dec each year)			
Kyrgyz national (Total)	2,470	2,488	2,627
-men	2,142	2,165	2,306
-women	328	323	321
Expat staff (Total)	80	71	66
-men	80	71	66
-women	0	0	0
Full time staff Total (Kyrgyz + Expat)	2,550	2,559	2,693
-men	2,222	2,236	2,372
-women	328	323	321
Contractors (Total)	1,191	926	947
Total staff (Full time staff + Contractors)	3,741	3,485	3,640
Proportion of Kyrgyz national as full time staff	97%	97%	97%
Total Number and Rates of New Employee Hires and Employee Turnover by Gender and Region			
Bishkek	19	17	29
Bakykchi	2	10	5
Karakol	6	7	23
Jeti-Oguz	30	52	65
Ton	3	21	6
Other Regions	16	19	11
Women (from all)	11	9	27
Total	87	126	139
Employee Turnover (%)	5.64	3.7	6.2
Return to Work and Retention Rates After Parental Leave (Female employees)			
Entitled to parental Leave	22	8	7
Returned from parental leave	16	15	10

GRI CONTENT INDEX

Economical and Operational Indicators

Indicator	Description	Omissions
GRI 101: Foundation 2016		
GRI 102: General Disclosures 2016		
Organizational Profile		
102-1 Name of the organization	About Kumtor Mine (p.2)	-
102-2 Activities, brands, products, and services	About Kumtor Mine (p.2); Environment and Sustainability Snapshot (p.10-11); Economic Value (p.24)	-
102-3 Location of headquarters	Contacts (p.123)	-
102-4 Location of operations	About Kumtor Mine (p.2)	-
102-5 Ownership and legal form	About Kumtor Mine (p.2)	-
102-6 Markets served	About Kumtor Mine (p.2)	-
102-7 Scale of the organization	Environment and Sustainability Snapshot (p.10-11); Economic Value (p.24-25); Workplace Practices (p.34)	-
102-8 Information on employees and other workers	Workplace Practices (p.32-33)	-
102-9 Supply chain	Local Procurement (p.26-29)	-
102-10 Significant changes to the organization and its supply chain	No significant change has been occured neither in company's operational or financial structure nor supply chain;	-
102-11 Precautionary principle or approach	Disclaimer Regarding Forward-Looking Statements (p.123)	-
102-12 External initiatives	Governance (p.14-15)	-
102-13 Membership of associations	Governance (p.14-15)	-
Strategy		
102-14 Statement from senior decision-maker	Message From the President (p.4-6)	-
Ethics and Integrity		
102-16 Values, principles, standards, and norms of behavior	Business Ethics (p.22-23), Values (p.13)	-
Governance		
102-18 Governance structure	Governance (p.14-15)	-
Stakeholder Engagement		
102-40 List of stakeholder groups	Stakeholder Engagement (p.91)	-
102-41 Collective bargaining agreements	Collective Bargaining (p.31)	-
102-42 Identifying and selecting stakeholders	Stakeholder Engagement (p.88-91)	-
102-43 Approach to stakeholder engagement	Stakeholder Engagement (p.88-91)	-
102-44 Key topics and concerns raised	Environmental Claims (p.15); Risk Management and Continuous Improvement (p.18); Stakeholder Engagement (p.90-91)	-
Reporting Practice		
102-45 Entities included in the consolidated financial statements	About This Report (p.2)	-
102-46 Defining report content and topic boundaries	About This Report (p.2); Materiality Assessment (p.19-21)	-
102-47 List of material topics	Materiality Assessment (p.19-21)	-
102-48 Restatements of information	No restatements made in information given in previous reports.	-
102-49 Changes in reporting	About This Report (p.2)	-

Indicator	Description	Omissions
102-50 Reporting period	About This Report (p.2)	-
102-51 Date of the most recent report	About This Report (p.2)	-
102-52 Reporting cycle	About This Report (p.2)	-
102-53 Contact point for questions regarding the report	Contacts (p.124)	-
102-54 Claims of reporting in accordance with the GRI Standards	About This Report (p.2)	-
102-55 GRI content index	GRI Content Index (p.103-106)	-
102-56 External assurance	Disclaimer Regarding Forward-Looking Statements (p.123)	-

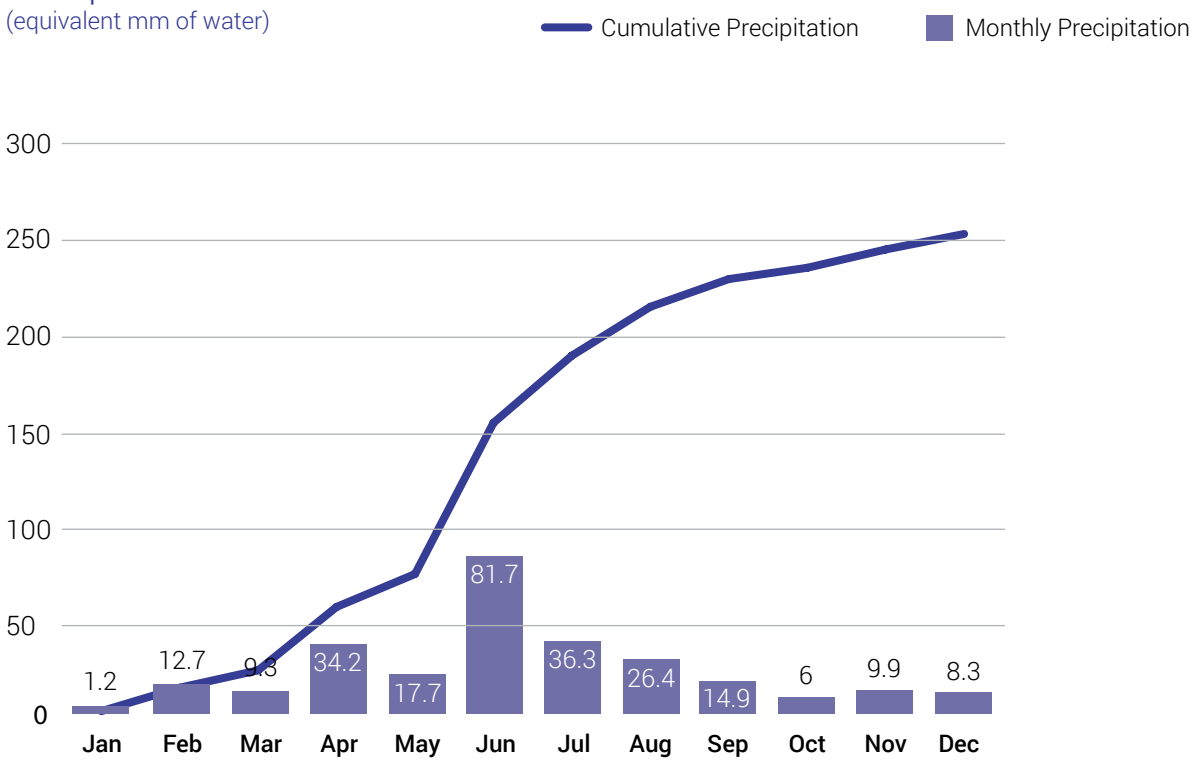
	Material Issues		
	Indicator	Description	Omissions
	Water Management		
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Environmental Responsibility (p.42); Water Use and Treatment (p.72)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18-19); Environmental Monitoring (p.46-49)	-
GRI 303: Water 2016	303-1 Water withdrawal by source	Water Use and Treatment (p.72-75)	-
	303-2 Water sources significantly affected by withdrawal of water	Water Use and Treatment (p.72-75)	-
	303-3 Water recycled and reused	Water Use and Treatment (p.72-75)	-
GRI 306: Effluents and Waste 2016	306-1 Disclosure 306-1 Water discharge by quality and destination	Water Use and Treatment (p.72-75)	-
	Biodiversity		
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14-15); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Environmental Responsibility(p.42); Biodiversity (p.50)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18-19); Environmental Monitoring (p.46-49)	-
GRI 304: 2016	304-1 Operational sites owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas	Biodiversity (p.50-56)	
	304-2 Significant impacts of activities, products, and services on biodiversity	Biodiversity (p.50-56)	
	304-4 IUCN Red List species and national conservation list species with habitats in areas affected by operations	Biodiversity (p.56)	-

Indicator	Description	Omissions	
	Waste and Hazardous Material Management		
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Environmental Responsibility (p.42); Waste Management (p.62-64)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18); Environmental Monitoring (p.46-49)	-
GRI 306: Effluents and Waste 2016	306-2 Waste by type and disposal method	Waste Management (p.64); Performance Data (p.100)	
	306-3 Significant spills	Environmental Incidents (p.17)	
G4 Sector Supplement	G4-MM3	Unprocessed Waste Rock (p.64); Tailings Management (p.66-68)	
	Legal Compliance		
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19);	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18-19)	-
GRI 307: Environmental Compliance 2016	307-1 307-1 Non-compliance with environmental laws and regulations	Legal Compliance (p.16-17)	-
	Ethical Conduct and Anti-Corruption		
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Business Ethics (p.22-23)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.16)	-
GRI 205: Anti-Corruption 2016	205-2 205-2 Communication and training about anti-corruption policies and procedures	Business Ethics (p.22-23)	-
	Fostering Local Economies		
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Local Procurement (p.26-29)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18-19)	-
GRI 201: Economic Performance 2016	201-1 201-1 Direct economic value generated and distributed	Economic Performance (p.24-25)	-
GRI 204: Procurement Practices 2016	204-1 204-1 Proportion of spending on local suppliers	Local Procurement (p.26)	-

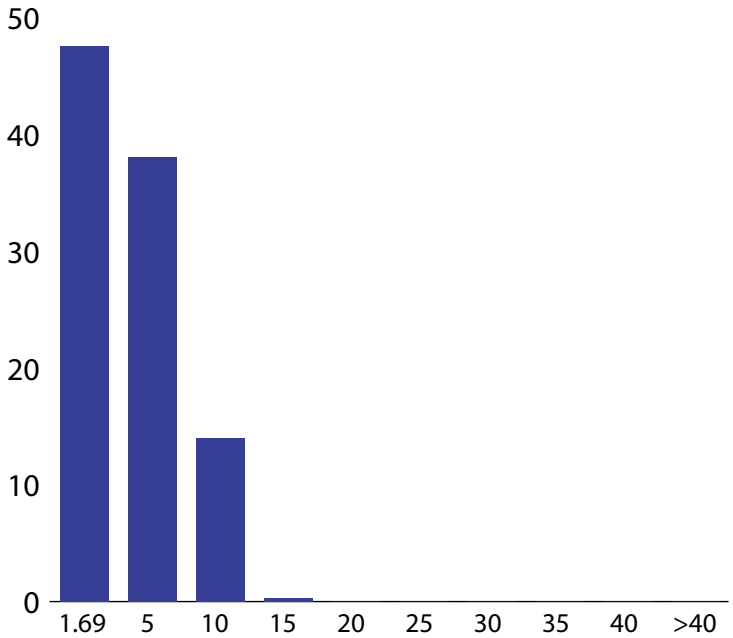
	Indicator	Description	Omissions
	Local Communities		
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Stakeholder Engagement(p.88-91)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18-19)	-
GRI 413: Local Communities 2016	413-1 Operations with local community engagement, impact assessments, and development programs	Stakeholder Engagement(p.88-91);	
	Occupational Health and Safety		
GRI 103: Management Approach 2016	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Collective Bargaining (p.31); Health and Safety (p.38-41)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18-19)	-
GRI 403: Occupational Health and Safety 2016	403-2 Types of injury and rates of injury, occupational diseases, lost days, and absenteeism, and number of work-related fatalities	Health and Safety (p.39)	-
	403-3 Workers with high incidence or high risk of diseases related to their occupation	Health and Safety (p.38-41)	-
	403-4 Health and safety topics covered in formal agreements with trade unions	Collective Bargaining (p.31)	-

APPENDIX

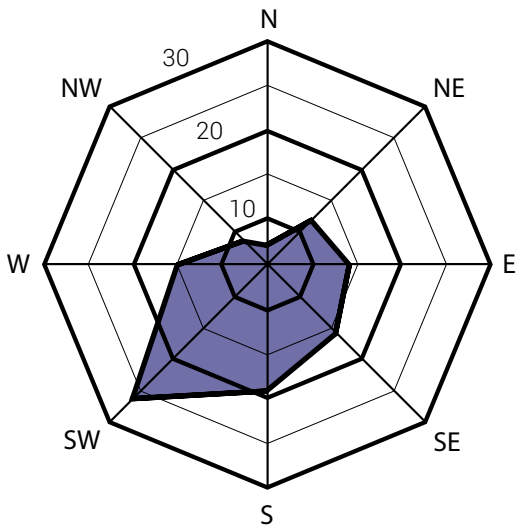
Precipitation 2017
(equivalent mm of water)



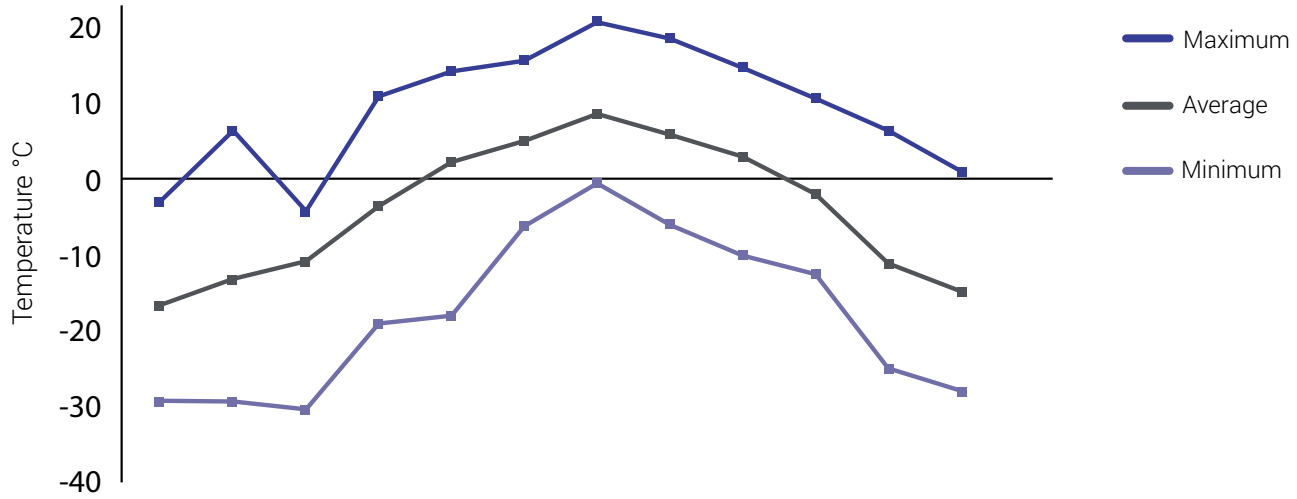
Wind Speed and Direction 2017
(km/hour)



Distribution of Wind Direction 2017 (%)



Average Monthly Temperatures in 2017



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	-32.5	-32.6	-33.7	-21.7	-20.6	-8.1	-2.1	-7.9	-12.2	-14.8	-27.96	-31.1
Maximum	-4.8	5.1	-6.2	9.9	13.4	14.9	20.3	18	13.9	9.6	5.1	-0.6
Average	-19.22	-15.57	-13.1	-5.41	0.75	3.7	7.48	4.58	1.5	-3.72	-13.41	-17.32

Kumtor Weather Station Summary 2017

2017		DAILY AVERAGE READINGS FOR 2017									
				TEMPERATURE °C							
		W. Spd., km/h	W. dir. deg. True N	Avg./h	Max., 5 s.	Min., 5 s.	Rel. hum.,%	Solar rad., KW/m^2	Barom. Press., mbar	Barom. Press., mmHG	hr./rdg. Total precip., mm
JAN	max	29.1	358.2	-6.1	-4.8	-6.4	87.7	646.84	656.2	492.2	
	min	0.0	0.0	-31.1	-28.9	-32.5	20.7	1.640	645.8	484.4	
	avg	5.4	115.0	-19.2	-17.7	-20.7	62.8	111.70	650.9	488.2	
	tot										1.2
FEB	max	33.1	358.9	2.5	5.1	1.0	95.9	696.72	657.9	493.5	
	min	0.0	0.0	-31.8	-30.6	-32.6	28.1	1.690	644.0	483.0	
	avg	7.1	139.2	-15.6	-14.2	-16.9	64.3	150.95	652.1	489.1	
	tot										12.7
MAR	max	16.9	239.0	-2.5	6.2	-6.3	83.2	284.15	657.4	493.1	
	min	3.6	140.1	-22.6	-11.0	-33.7	55.4	72.414	646.2	484.6	
	avg	9.0	184.6	-13.1	-3.8	-21.2	68.9	231.04	650.7	488.0	
	tot										9.4
APR	max	21.9	253.4	1.4	9.9	-4.1	88.5	356.65	660.2	495.2	
	min	4.28	161.5	-12.0	-6.4	-21.7	45.3	178.869	647.6	485.8	
	avg	10.9	213.4	-5.4	2.8	-12.1	69.7	288.79	655.3	491.5	
	tot										34.3
MAY	max	18.9	246.6	6.2	13.4	0.0	84.4	1 650.48	663.5	497.7	
	min	6.2	113.5	-10.4	-0.9	-20.6	43.0	106.010	655.7	491.8	
	avg	11.6	191.8	0.7	7.3	-5.1	65.2	1268.22	659.0	494.3	
	tot										17.8
JUN	max	18.61	242.42	7.2	14.9	2.0	93.6	402.49	661.0	495.8	
	min	3.67	126.74	-1.5	2.8	-8.1	50.3	98.108	655.5	491.7	
	avg	10.80	187.67	3.7	10.0	-1.6	71.2	254.74	657.9	493.5	
	tot										81.8
JUL	max	15.4	247.6	13.0	20.3	5.8	81.0	348.11	661.4	496.1	
	min	6.0	138.7	4.2	8.9	-2.1	50.8	98.629	656.5	492.4	
	avg	9.8	190.8	7.5	14.5	1.0	64.9	270.47	659.0	494.3	
	tot										36.3
AUG	max	16.1	234.7	9.74	18.03	1.96	79.50	318.45	662.4	496.8	
	min	7.4	134.1	0.49	7.36	-7.88	46.52	120.570	655.6	491.8	
	avg	10.1	192.3	4.58	11.95	-2.20	63.14	223.31	658.4	493.9	
	tot										26.4
SEP	max	20.8	242.2	5.0	13.9	-1.8	82.9	258.91	661.1	495.9	
	min	5.5	113.7	-4.9	-1.0	-12.2	44.0	82.925	653.7	490.3	
	avg	10.3	189.8	1.5	8.7	-5.3	61.8	187.53	658.8	494.1	
	tot										15.0
OCT	max	25.0	258.0	-0.4	9.6	-3.9	80.6	204.45	660.6	495.5	
	min	6.3	135.5	-7.0	-2.8	-14.8	35.9	52.651	653.6	490.2	
	avg	11.0	199.8	-3.7	3.3	-9.9	58.8	148.60	657.6	493.2	
	tot										6.1
NOV	max	14.4	203.9	-3.1	5.1	-9.7	89.2	158.36	661.2	496.0	
	min	2.8	78.1	-20.0	-11.3	-28.0	41.7	64.194	651.4	488.6	
	avg	6.1	158.6	-13.4	-4.7	-21.0	64.6	130.16	655.7	491.8	
	tot										9.9
DEC	max	23.9	237.6	-8.2	-0.6	-12.7	82.2	122.30	660.5	495.4	
	min	2.6	66.1	-23.4	-14.7	-31.1	47.2	41.193	648.2	486.2	
	avg	7.3	134.2	-17.3	-9.2	-24.6	66.6	96.61	653.1	489.9	
	tot										8.4
Yearly	Max	33.1	358.9	13.0	20.3	5.8	95.9	1650.48	663.51	497.67	
	Min	0.0	0.0	-31.8	-30.6	-33.7	20.7	1.6	644.0	483.0	
	Avg	11.4	178.5	-5.7	0.9	-11.6	64.4	270.25	655.72	491.83	
	tot										259.3

Radionuclides and Heavy Metals in Dust Samples - Mine Site

Station	Zn (ng/m³)	CN (ng/m³)	S (ng/m³)	As (ng/m³)	Ni (ng/m³)	Se (ng/m³)	U (ng/m³)	Sr-90 (mBq/m³)	Pb-210 (mBq/m³)	Ra-226 (mBq/m³)
TLV[1]	1,600,000	5,000,000	330,000	10,000	200,000	200,000	200,000			
DAC[2]								300,000	8,000	4,000
A1.1	10,200	0.200	24	2.90	10.0	0.160	2.20	0.070	0.001	0.007
A1.2a	1,800	0.200	160	4.30	9.6	0.180	2.20	0.060	0.001	0.006
A1.3a	3,000	0.200	160	5.00	11.0	0.200	2.30	0.060	0.001	0.006
A1.4	5,000	0.200	120	5.70	11.0	0.220	2.30	0.060	0.001	0.006
A1.5a	3,300	0.200	40	5.40	10.0	0.210	2.30	0.070	0.001	0.007
A1.6	3,100	0.200	250	4.90	9.5	0.110	2.00	0.080	0.001	0.008

Notes:

1. TLV's have been sourced from either the Agency for Toxic Substances and Disease Registry (ATSDR), or the Occupational Health & Safety Administration (OHSA). S and Zn TLV's have been adjusted using the molar ratios of SO_2 and ZnO.

2. DAC's have been sourced from the 1999 International Atomic Energy Agency (IAEA) safety standards.

Radionuclides and Heavy Metals in Dust Samples - Barskoon

Station	Zn (ng/m³)	CN (ng/m³)	S (ng/m³)	As (ng/m³)	Ni (ng/m³)	Se (ng/m³)	U (ng/m³)	Sr-90 (mBq/m³)	Pb-210 (mBq/m³)	Ra-226 (mBq/m³)
TLV1	1,600,000	5,000,000	330,000	10,000	200,000	200,000	200,000			
DAC2								300,000	8,000	4,000
Barskoon #1	1,220	0	1200.000	5.900	12	1	2.80	1.0	0.6	0.100
Barskoon #2	7,910	0	1200.000	5.400	14	1	2.40	0.9	1.1	0.100
Barskoon #3	10,000	0	940.000	6.200	15	1	2.90	0.8	1.2	0.080

Notes:

1. TLV's have been sourced from either the Agency for Toxic Substances and Disease Registry (ATSDR), or the Occupational Health & Safety Administration (OHSA). S and Zn TLV's have been adjusted using the molar ratios of SO_2 and ZnO.

2. DAC's have been sourced from the 1999 International Atomic Energy Agency (IAEA) safety standards.

W1.1 Petrov Lake (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C	4.5	5.0	5.2	7.2	4.6	4.7	9.1	7.3	5.8	4.5	0.40	2.8
Conductivity	mS/cm	0.142	0.135	0.138	0.189	0.812	0.117	0.208	0.107	1.65	0.112	0.119	0.150
pH		8.8	8.7	8.6	9.7	8.2	8.3	8.1	8.4	8.0	7.8	8.1	8.3
Major Constituents													
Calcium	mg/L	15.9	17.5	22.5	20.1	9.92	14.2	13.1	11.9	15.1	15.1	16.0	15.4
Chloride	mg/L	0.600	0.800	0.700	0.600	0.500	0.600	0.500	0.500	0.500	0.500	0.500	0.280
Carbonate	mg/L	53.0	49.0	41.0	49.0	29.0	41.0	39.0	37.0	37.0	37.0	40.0	40.0
Bicarbonate	mg/L	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Potassium	mg/L	1.53	1.84	1.90	1.62	0.840	1.23	2.52	1.53	2.30	2.18	1.68	1.58
Magnesium	mg/L	3.03	3.39	4.21	3.72	1.97	2.82	3.45	2.22	3.70	3.74	3.78	3.17
Sodium	mg/L	1.75	2.04	2.12	1.83	0.990	1.44	2.09	1.52	2.30	2.15	1.70	1.80
Sulphate	mg/L	19.0	21.0	21.0	20.0	12.0	18.0	18.0	13.0	16.0	15.0	18.0	17.6
Hardness - Total	mg/L	50.0	55.0	55.0	55.0	32.0	48.0	50.0	42.0	50.0	42.0	48.0	49.0
Alkalinity - Total	mg/L	43.2	40.2	34.0	40.0	24.0	33.2	32.4	30.2	30.2	30.4	33.2	32.2
Total Metals													
Silver - Total	mg/L	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150
Aluminum - Total	mg/L	0.771	0.730	0.800	0.420	0.150	0.650	6.06	11.8	4.67	3.90	0.940	0.630
Arsenic - Total	mg/L				0.000500	0.000500	0.000500	0.00350	0.00500	0.00100	0.00200	0.000500	0.000500
Cadmium - Total	mg/L	0.000150	0.000150	0.000150		0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150
Chromium - Total	mg/L	0.00400	0.0220	0.0240	0.00400	0.00400	0.00400	0.00400	0.0110	0.00400	0.00400	0.00400	0.00400
Copper - Total	mg/L	0.00250	0.00700	0.00250	0.00250	0.00250	0.00250	0.00250	0.00800	0.00250	0.00250	0.00250	0.00250
Iron - Total	mg/L	0.478	0.453	0.494	0.199	0.127	0.632	5.40	8.55	3.28	2.74	0.560	0.354
Mercury - Total	mg/L	0.000250	0.000250	0.000250	0.00500	0.00120	0.000250	0.000250	0.000250	0.00100	0.000250	0.000250	0.000250
Manganese - Total	mg/L	0.0190	0.0200	0.0190	0.0110	0.00900	0.0170	0.129	0.215	0.100	0.0780	0.0320	0.0250
Molybdenum - Total	mg/L	0.00200	0.0210	0.0180	0.00200	0.00200	0.00400	0.00200	0.00200	0.00500	0.00400	0.0100	0.0190
Nickel - Total	mg/L	0.00250	0.0720	0.0620	0.00250	0.00250	0.0140	0.0145	0.0180	0.0150	0.0100	0.0340	0.0630
Lead - Total	mg/L	0.00400	0.00400	0.00100	0.00200	0.00300	0.00100	0.00600	0.00900	0.00400	0.0100	0.00100	0.00100
Antimony - Total	mg/L		0.000500	0.000500	0.000500	0.000500	0.000500	0.000500	0.000500	0.000500	0.000500	0.000500	0.000500
Selenium - Total	mg/L	0.000500	0.000500	0.00400	0.00100	0.00200	0.000500	0.00200	0.000500	0.000500	0.000500	0.000500	0.000500
Zinc - Total	mg/L	0.00400	0.0160	0.0150	0.00200	0.00700	0.00300	0.0190	0.0310	0.0150	0.0130	0.00500	0.00300
Nutrients													
Ammonia - N	mg/L												
Nitrite - N	mg/L												
Nitrate -N	mg/L												
Phosphate as P - Total	mg/L												
Solids													
Turbidity	NTU	75.0	84.0	67.0	72.0	39.0	67.0	129	145	93.0	113	71.0	70.0
Total Dissolved Solids	mg/L	1.00	0.500	1.00	5.00	3.00	5.00	63.0	143	37.0	33.0	2.00	3.00
Total Suspended Solids	mg/L	17.0	11.0	11.0	7.90	5.10	14.0	190	210	110	110	17.0	14.0
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

W1.3 Kumtor River above ETP Discharge (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C				1.2	3.1	4.7	7.6	6.3	5.5	1.0	0.53	0.10
Conductivity	mS/cm				0.473	0.387	0.413	0.326	0.266	0.222	0.295	0.314	0.215
pH					7.9	8.3	8.2	8.2	8.1	8.0	8.2	8.1	8.2
Major Constituents													
Calcium	mg/L				49.6	37.0	30.5	20.7	24.1	23.6	34.6	33.5	25.5
Chloride	mg/L				4.10	2.53	1.50	0.675	0.680	1.03	1.58	2.05	1.00
Carbonate	mg/L				110	82.3	56.0	45.8	47.2	51.0	64.5	71.0	64.0
Bicarbonate	mg/L				0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Potassium	mg/L				2.25	1.82	1.64	2.28	3.10	1.85	2.23	2.04	1.85
Magnesium	mg/L				25.4	19.0	14.7	4.94	7.05	9.51	14.9	16.7	5.66
Sodium	mg/L				3.73	2.77	2.21	2.07	2.87	2.04	2.75	2.64	2.18
Sulphate	mg/L				125	93.0	82.3	25.3	28.6	50.8	71.5	95.0	27.0
Hardness - Total	mg/L				220	163	129	63.8	63.0	83.8	118	146	80.0
Alkalinity - Total	mg/L				88.5	67.0	46.0	37.8	38.6	42.0	53.2	58.5	52.5
Total Metals													
Silver - Total	mg/L				0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150
Aluminum - Total	mg/L				3.36	1.07	1.08	8.33	9.06	5.31	1.87	0.508	0.400
Arsenic - Total	mg/L				0.00400	0.00213	0.00175	0.00500	0.00440	0.00188	0.00150	0.000500	0.00100
Cadmium - Total	mg/L				0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150
Chromium - Total	mg/L				0.00400	0.00533	0.00400	0.00400	0.00540	0.00550	0.00400	0.00400	0.00400
Copper - Total	mg/L				0.00700	0.00367	0.0136	0.00863	0.00660	0.00388	0.00250	0.00250	0.00250
Iron - Total	mg/L				5.10	1.81	1.29	9.84	7.17	4.19	1.34	0.332	0.369
Mercury - Total	mg/L				0.000250	0.000333	0.000250	0.000488	0.000370	0.000250	0.000513	0.000250	0.000250
Manganese - Total	mg/L				0.168	0.143	0.144	0.248	0.190	0.133	0.0478	0.0240	0.0130
Molybdenum - Total	mg/L				0.00200	0.00200	0.00350	0.00350	0.00200	0.00475	0.00400	0.00700	0.0230
Nickel - Total	mg/L				0.0110	0.0238	0.0153	0.0233	0.0154	0.0169	0.0148	0.0223	0.0870
Lead - Total	mg/L				0.00300	0.00833	0.00200	0.00875	0.0228	0.00575	0.00200	0.00150	0.00100
Antimony - Total	mg/L				0.000500	0.000500	0.00100	0.000500	0.000900	0.000500	0.000500	0.000625	0.00100
Selenium - Total	mg/L				0.000500	0.00133	0.000875	0.00200	0.000600	0.000750	0.00263	0.000750	0.000500
Zinc - Total	mg/L				0.0130	0.00767	0.00450	0.0273	0.0260	0.0150	0.00725	0.00625	0.00800
Nutrients													
Ammonia - N	mg/L				0.120	0.0467	0.0600	0.0200	0.0200	0.0300	0.105	0.0200	0.0200
Nitrite - N	mg/L				0.00400	0.00183	0.00200	0.00900	0.000500	0.00350	0.00325	0.00313	0.00500
Nitrate -N	mg/L				0.800	0.767	0.550	0.300	0.340	0.375	0.425	0.475	0.300
Phosphate as P - Total	mg/L				0.110	0.370	0.0375	0.208	0.142	0.0500	0.0150	0.00625	0.0400
Solids													
Turbidity	NTU				296	211	182	121	142	141	176	292	108
Total Dissolved Solids	mg/L				158	469	42.3	366	216	89.8	27.8	8.25	26.0
Total Suspended Solids	mg/L				100	281	33.0	241	284	121	46.0	12.5	12.0
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

W3.4 Lysyi Creek above Kumtor River (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C				1.5	3.3	5.0	6.0	5.6	7.0	0.88	0.50	
Conductivity	mS/cm				1.10	1.16	1.41	1.08	1.01	1.13	1.47	2.06	
pH					8.4	8.2	8.2	8.1	8.2	8.2	8.1	7.9	
Major Constituents													
Calcium	mg/L				126	96.6	158	107	145	135	220	207	
Chloride	mg/L				12.3	7.53	9.53	5.13	4.48	6.15	12.7	14.0	
Carbonate	mg/L				225	148	165	130	134	149	263	353	
Bicarbonate	mg/L				0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	
Potassium	mg/L				4.49	3.06	4.73	3.53	3.85	3.59	6.17	6.66	
Magnesium	mg/L				123	86.3	147	85.7	87.8	88.3	179	193	
Sodium	mg/L				11.3	6.50	6.26	3.80	4.64	4.78	11.0	10.3	
Sulphate	mg/L				540	454	846	435	425	520	943	947	
Hardness - Total	mg/L				775	600	1100	675	625	713	1330	1280	
Alkalinity - Total	mg/L				183	120	135	105	110	122	215	206	
Total Metals													
Silver - Total	mg/L				0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	
Aluminum - Total	mg/L				2.98	17.8	2.05	3.63	3.13	3.93	0.465	0.383	
Arsenic - Total	mg/L				0.00450	0.0163	0.00425	0.00563	0.00520	0.00600	0.00125	0.000500	
Cadmium - Total	mg/L				0.000363	0.000238	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	
Chromium - Total	mg/L				0.00400	0.0230	0.00400	0.00400	0.00400	0.00525	0.00400	0.00400	
Copper - Total	mg/L				0.00388	0.0486	0.0140	0.0100	0.00860	0.00888	0.00250	0.00250	
Iron - Total	mg/L				5.12	33.3	4.13	7.02	5.08	6.89	0.668	0.526	
Mercury - Total	mg/L				0.000250	0.000250	0.000250	0.000250	0.000250	0.000250	0.000250	0.000250	
Manganese - Total	mg/L				0.185	1.21	1.46	1.13	0.561	0.393	0.186	0.184	
Molybdenum - Total	mg/L				0.00525	0.00275	0.00925	0.00850	0.00900	0.00725	0.00800	0.0107	
Nickel - Total	mg/L				0.0235	0.0668	0.103	0.0785	0.0548	0.0423	0.0428	0.0600	
Lead - Total	mg/L				0.00300	0.0240	0.00400	0.00400	0.00400	0.00725	0.00325	0.00133	
Antimony - Total	mg/L				0.000875	0.00275	0.00113	0.000500	0.000900	0.000500	0.000500	0.00133	
Selenium - Total	mg/L				0.00263	0.00425	0.00400	0.00500	0.00310	0.00325	0.00550	0.00267	
Zinc - Total	mg/L				0.0193	0.0728	0.0110	0.0160	0.0112	0.0148	0.00550	0.00733	
Nutrients													
Ammonia - N	mg/L				0.0750	0.225	0.365	0.285	0.168	0.150	0.0750	0.0667	
Nitrite - N	mg/L				0.00363	0.00225	0.00163	0.00613	0.000500	0.00438	0.00363	0.00267	
Nitrate -N	mg/L				3.78	3.28	4.08	2.00	1.92	2.28	3.90	3.93	
Phosphate as P - Total	mg/L				0.0525	0.298	0.153	0.0975	0.118	0.165	0.0100	0.00667	
Solids													
Turbidity	NTU				1100	896	1580	1010	876	943	1910	1830	
Total Dissolved Solids	mg/L				98.0	1470	174	221	187	285	22.0	17.7	
Total Suspended Solids	mg/L				66.0	1140	108	141	96.0	184	22.3	15.0	
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

T8.1 Tailings Pond - Feed to ETP (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C	4.1	3.4	3.6	3.8	4.5	10.0	13	12	10	3.2	2.4	1.8
Conductivity	mS/cm	3.13	3.23	3.49	3.55	2.92	3.11	3.50	3.64	3.36	3.22	3.46	3.78
pH		9.3	8.9	9.0	11	9.4	10	9.9	10	10	9.7	10	10
Major Constituents													
Calcium	mg/L	70.6	75.4	85.1	88.6	61.8	67.7	109	114	101	121	107	97.5
Chloride	mg/L	24.3	26.5	27.0	25.4	16.6	16.9	22.0	23.0	23.3	23.3	27.3	25.4
Carbonate	mg/L	96.7	109	104	84.2	81.8	90.0	100	122	135	135	129	130
Bicarbonate	mg/L	10.0	9.75	14.3	21.8	3.25	2.33	0.500	3.40	0.500	1.88	2.50	5.40
Potassium	mg/L	96.4	101	107	94.8	57.0	56.7	83.1	88.9	85.0	94.0	93.1	86.1
Magnesium	mg/L	7.07	7.74	8.06	7.64	4.15	4.24	6.36	7.00	7.00	8.19	8.15	7.28
Sodium	mg/L	507	542	576	498	312	309	443	465	447	499	496	462
Sulphate	mg/L	978	1030	1030	984	629	710	928	952	963	965	1010	926
Hardness - Total	mg/L	220	223	228	268	221	283	300	310	319	313	338	340
Alkalinity - Total	mg/L	89.3	106	108	106	72.6	76.7	81.5	106	110	113	110	116
Total Metals													
Silver - Total	mg/L	0.0863	0.0703	0.0848	0.0720	0.0533	0.0657	0.0712	0.0684	0.0728	0.0638	0.0810	0.0876
Aluminum - Total	mg/L	0.246	0.250	0.245	0.280	0.160	0.113	0.142	0.168	0.170	0.150	0.155	0.138
Arsenic - Total	mg/L	0.00500			0.00647	0.00425	0.00300	0.00340	0.00440	0.00263	0.00425	0.00425	0.00410
Cadmium - Total	mg/L	0.00117	0.00143	0.000925	0.00106	0.000738	0.000867	0.00102	0.00108	0.00123	0.00100	0.00123	0.00148
Chromium - Total	mg/L	0.0113	0.0153	0.0148	0.00660	0.00400	0.00400	0.00400	0.00400	0.00500	0.00400	0.00400	0.00400
Copper - Total	mg/L	32.1	32.1	31.2	27.9	21.5	25.5	27.7	29.4	26.8	24.3	28.5	33.8
Iron - Total	mg/L	1.09	1.08	1.46	1.71	1.31	0.765	0.371	0.514	0.427	0.355	0.306	0.389
Mercury - Total	mg/L	0.00873	0.00838	0.00875	0.00812	0.00590	0.00530	0.00666	0.00594	0.00758	0.00399	0.00565	0.00576
Manganese - Total	mg/L	0.00900	0.0100	0.0103	0.0160	0.0115	0.0117	0.0154	0.0202	0.0228	0.0255	0.0393	0.0336
Molybdenum - Total	mg/L	0.340	0.349	0.351	0.317	0.231	0.276	0.305	0.335	0.325	0.299	0.363	0.411
Nickel - Total	mg/L	0.582	0.598	0.637	0.566	0.405	0.486	0.551	0.613	0.579	0.488	0.640	0.712
Lead - Total	mg/L	0.00167	0.0148	0.000875	0.00320	0.00175	0.00100	0.00100	0.00240	0.00200	0.00175	0.00175	0.00100
Antimony - Total	mg/L	0.798	0.766	0.832	0.770	0.512	0.470	0.472	0.480	0.452	0.431	0.473	0.500
Selenium - Total	mg/L	0.0273	0.0255	0.0303	0.0286	0.0213	0.0233	0.0254	0.0264	0.0260	0.0273	0.0315	0.0282
Zinc - Total	mg/L	0.00600	0.00725	0.00775	0.0188	0.0205	0.0223	0.0160	0.00900	0.00550	0.00650	0.0105	0.0140
Nutrients													
Ammonia - N	mg/L	18.0	21.3	19.0	22.1	10.2	17.2	16.6	19.0	17.5	18.3	18.3	20.2
Nitrite - N	mg/L	0.385	0.122	0.0453	0.112	0.00613	0.0402	0.0417	0.113	0.210	0.708	0.0420	0.491
Nitrate -N	mg/L	21.0	23.0	21.0	22.4	13.4	14.3	18.0	18.2	18.8	19.3	22.3	19.4
Phosphate as P - Total	mg/L	0.0133	0.0200	0.0225	0.0340	0.0163	0.0233	0.0140	0.0170	0.00625	0.0250	0.0163	0.0400
Solids													
Turbidity	NTU	2180	2200	2210	2200	1700	1930	2060	2010	2010	2190	2250	2450
Total Dissolved Solids	mg/L	1.83	0.625	2.38	7.60	5.25	10.3	2.50	4.00	5.25	6.75	3.50	1.40
Total Suspended Solids	mg/L	1.47	0.550	0.575	7.62	5.91	10.2	4.74	7.48	7.10	8.73	3.45	0.800
Trace Constituents													
Cyanide - Free	mg/L	4.20	5.15	5.28	4.22	6.47	4.03	3.84	3.06	2.23	2.85	3.48	4.38
Cyanide - Total	mg/L	41.5	44.5	45.5	43.6	42.0	36.3	31.2	30.0	27.5	32.5	38.3	41.6
Cyanide - WAD	mg/L	37.5	36.3	39.8	38.2	36.0	33.3	30.4	28.8	26.0	29.5	35.8	39.8

T8.4 ETP Discharge into Kumtor River (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C					3.5	9.8	13	12	9.1			
Conductivity	mS/cm					1.92	2.55	2.92	2.90	3.04			
pH						8.5	7.3	7.5	7.6	7.6			
Major Constituents													
Calcium	mg/L					48.2	45.9	72.6	68.0	50.6			
Chloride	mg/L					18.0	18.0	21.5	22.4	22.8			
Carbonate	mg/L					94.0	67.3	44.0	53.0	60.3			
Bicarbonate	mg/L					0.500	0.500	0.500	0.500	0.500			
Potassium	mg/L					38.7	48.6	78.4	90.3	78.0			
Magnesium	mg/L					7.40	5.68	6.20	6.73	6.43			
Sodium	mg/L					349	390	573	625	550			
Sulphate	mg/L					730	853	1120	1160	1150			
Hardness - Total	mg/L					160	170	198	174	165			
Alkalinity - Total	mg/L					77.0	55.5	36.1	43.4	49.1			
Total Metals													
Silver - Total	mg/L					0.00150	0.00150	0.00150	0.00150	0.00150			
Aluminum - Total	mg/L					0.210	0.240	0.0900	0.0860	0.120			
Arsenic - Total	mg/L					0.00200	0.00150	0.00300	0.00380	0.00188			
Cadmium - Total	mg/L					0.000400	0.000517	0.000940	0.000940	0.00105			
Chromium - Total	mg/L					0.00400	0.00400	0.00400	0.00400	0.00400			
Copper - Total	mg/L					0.146	0.0843	0.0794	0.108	0.0923			
Iron - Total	mg/L					1.57	0.619	0.284	0.258	0.304			
Mercury - Total	mg/L					0.00340	0.00277	0.00502	0.00436	0.00535			
Manganese - Total	mg/L					0.0880	0.0270	0.0146	0.0136	0.0208			
Molybdenum - Total	mg/L					0.139	0.187	0.257	0.285	0.279			
Nickel - Total	mg/L					0.00800	0.0107	0.0122	0.00690	0.0108			
Lead - Total	mg/L					0.00300	0.00100	0.00140	0.00120	0.00100			
Antimony - Total	mg/L					0.157	0.218	0.275	0.280	0.284			
Selenium - Total	mg/L					0.0120	0.0147	0.0208	0.0216	0.0210			
Zinc - Total	mg/L					0.00500	0.00367	0.00380	0.00560	0.00325			
Nutrients													
Ammonia - N	mg/L					15.5	24.3	25.8	27.4	26.5			
Nitrite - N	mg/L					0.0680	0.277	0.390	0.456	0.470			
Nitrate -N	mg/L					7.90	11.0	15.6	16.0	15.8			
Phosphate as P - Total	mg/L					0.0100	0.00833	0.00500	0.00600	0.00500			
Solids													
Turbidity	NTU					1330	1760	2140	2150	2250			
Total Dissolved Solids	mg/L					25.0	9.67	0.875	1.30	5.75			
Total Suspended Solids	mg/L					27.0	9.17	1.96	0.770	2.79			
Trace Constituents													
Cyanide - Free	mg/L					0.0190	0.0227	0.0216	0.0266	0.0305			
Cyanide - Total	mg/L					0.0650	0.150	0.234	0.328	0.323			
Cyanide - WAD	mg/L					0.0220	0.0280	0.0284	0.0312	0.0380			

W1.4 Kumtor River Flume (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C				0.75	3.1	7.6	7.1	5.3	6.9	0.48	0.30	0.10
Conductivity	mS/cm				0.673	0.302	0.805	0.315	0.313	0.464	0.582	0.450	0.235
pH					8.2	8.3	8.2	8.2	8.0	8.0	8.0	8.2	8.0
Major Constituents													
Calcium	mg/L				72.2	34.5	33.9	25.1	28.8	28.9	37.8	43.9	28.5
Chloride	mg/L				7.60	3.03	3.25	1.48	1.86	2.78	3.05	3.25	1.60
Carbonate	mg/L				154	77.5	67.0	51.0	49.6	54.5	76.8	90.5	70.0
Bicarbonate	mg/L				0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Potassium	mg/L				3.74	1.82	5.45	3.41	6.01	6.69	5.50	2.62	2.18
Magnesium	mg/L				42.7	14.5	16.8	8.09	9.03	11.4	14.4	20.7	8.89
Sodium	mg/L				7.20	3.04	34.0	15.2	32.1	39.3	28.8	4.98	3.66
Sulphate	mg/L				188	73.5	153	75.8	92.4	138	125	126	44.0
Hardness - Total	mg/L				323	140	194	95.0	88.0	123	144	191	100
Alkalinity - Total	mg/L				126	63.2	54.8	41.8	40.8	44.8	63.6	74.4	57.0
Total Metals													
Silver - Total	mg/L				0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150
Aluminum - Total	mg/L				0.675	6.82	1.28	10.1	9.92	3.75	1.63	0.380	0.390
Arsenic - Total	mg/L				0.00187	0.00650	0.00200	0.00750	0.00560	0.00138	0.00163	0.000625	0.00200
Cadmium - Total	mg/L				0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150
Chromium - Total	mg/L				0.00400	0.00925	0.00400	0.00400	0.00740	0.00400	0.00400	0.00400	0.00400
Copper - Total	mg/L				0.00388	0.0163	0.0189	0.0170	0.0127	0.00888	0.0113	0.00313	0.00250
Iron - Total	mg/L				1.21	11.5	2.06	13.2	9.49	2.60	1.24	0.389	0.314
Mercury - Total	mg/L				0.00155	0.000250	0.000250	0.000650	0.000420	0.000700	0.000250	0.000388	0.000250
Manganese - Total	mg/L				0.107	0.349	0.207	0.395	0.287	0.0975	0.0525	0.0315	0.0190
Molybdenum - Total	mg/L				0.00375	0.00250	0.0195	0.0108	0.0162	0.0190	0.0150	0.00925	0.0140
Nickel - Total	mg/L				0.0138	0.0250	0.0200	0.0298	0.0226	0.0110	0.0128	0.0348	0.0450
Lead - Total	mg/L				0.00175	0.0108	0.00225	0.0118	0.0160	0.00425	0.00225	0.00125	0.00100
Antimony - Total	mg/L				0.000500	0.000625	0.0188	0.00575	0.0120	0.0174	0.0103	0.00163	0.00200
Selenium - Total	mg/L				0.00113	0.00125	0.00200	0.00125	0.00110	0.00188	0.00300	0.000500	0.00200
Zinc - Total	mg/L				0.00950	0.0348	0.00650	0.0348	0.0320	0.0103	0.00750	0.00600	0.00400
Nutrients													
Ammonia - N	mg/L				0.0500	0.0900	1.86	0.690	1.17	1.67	0.810	0.0600	0.120
Nitrite - N	mg/L				0.00350	0.00463	0.0233	0.00950	0.0249	0.0696	0.0253	0.00375	0.00600
Nitrate -N	mg/L				1.33	0.550	1.38	0.750	1.06	1.35	0.975	0.650	0.400
Phosphate as P - Total	mg/L				0.0388	0.181	0.0750	0.390	0.256	0.0425	0.0150	0.00625	0.00500
Solids													
Turbidity	NTU				440	195	385	198	228	287	272	261	137
Total Dissolved Solids	mg/L				119	534	92.3	544	413	79.8	38.3	9.00	5.00
Total Suspended Solids	mg/L				74.9	246	36.3	313	254	114	40.2	13.0	11.0
Trace Constituents													
Cyanide - Free	mg/L				0.00250	0.00250	0.00388	0.00250	0.00250	0.00363	0.00250	0.00250	0.00250
Cyanide - Total	mg/L				0.00313	0.00250	0.0265	0.0123	0.0324	0.0385	0.0224	0.00250	0.00250
Cyanide - WAD	mg/L				0.00250	0.00250	0.0128	0.00250	0.00780	0.00575	0.00488	0.00250	0.00250

W4.1 UDD at Headwater of Arabel Suu Diversion Ditch (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C						2.8		15				
Conductivity	mS/cm						0.187		0.802				
pH							8.1		8.5				
Major Constituents													
Calcium	mg/L						26.1		18.3				
Chloride	mg/L						9.85						
Carbonate	mg/L						74.0		40.0				
Bicarbonate	mg/L						0.500		0.500				
Potassium	mg/L						0.640		0.700				
Magnesium	mg/L						3.07		2.00				
Sodium	mg/L						2.21		1.30				
Sulphate	mg/L						7.45		4.00				
Hardness - Total	mg/L						80.0		36.0				
Alkalinity - Total	mg/L						61.0		32.8				
Total Metals													
Silver - Total	mg/L						0.00150		0.00150				
Aluminum - Total	mg/L						0.0375		0.170				
Arsenic - Total	mg/L						0.00125		0.00100				
Cadmium - Total	mg/L						0.000150		0.000150				
Chromium - Total	mg/L						0.00400		0.00400				
Copper - Total	mg/L						0.00250		0.00250				
Iron - Total	mg/L						0.226		0.263				
Mercury - Total	mg/L						0.000250		0.000900				
Manganese - Total	mg/L						0.0345		0.0220				
Molybdenum - Total	mg/L						0.00350		0.00200				
Nickel - Total	mg/L						0.0130		0.00250				
Lead - Total	mg/L						0.00100		0.00100				
Antimony - Total	mg/L						0.00125		0.000500				
Selenium - Total	mg/L						0.00125		0.000500				
Zinc - Total	mg/L						0.00300		0.00200				
Nutrients													
Ammonia - N	mg/L						0.0400		0.0200				
Nitrite - N	mg/L						0.00150		0.000500				
Nitrate -N	mg/L						0.0500		0.100				
Phosphate as P - Total	mg/L						0.0100		0.0100				
Solids													
Turbidity	NTU						103		48.0				
Total Dissolved Solids	mg/L						3.00		2.00				
Total Suspended Solids	mg/L						2.95		5.30				
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

W4.3.1 Discharge of UDD Settling Pond into Kumtor River (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C						7.2						
Conductivity	mS/cm						0.0225						
pH							8.1						
Major Constituents													
Calcium	mg/L						31.4						
Chloride	mg/L						13.0						
Carbonate	mg/L						87.0						
Bicarbonate	mg/L						0.500						
Potassium	mg/L						0.805						
Magnesium	mg/L						4.40						
Sodium	mg/L						2.68						
Sulphate	mg/L						11.0						
Hardness - Total	mg/L						95.0						
Alkalinity - Total	mg/L						71.0						
Total Metals													
Silver - Total	mg/L						0.00150						
Aluminum - Total	mg/L						0.160						
Arsenic - Total	mg/L						0.000500						
Cadmium - Total	mg/L						0.000150						
Chromium - Total	mg/L						0.00400						
Copper - Total	mg/L						0.00250						
Iron - Total	mg/L						0.302						
Mercury - Total	mg/L						0.000250						
Manganese - Total	mg/L						0.0170						
Molybdenum - Total	mg/L						0.00200						
Nickel - Total	mg/L						0.0105						
Lead - Total	mg/L						0.00100						
Antimony - Total	mg/L						0.000500						
Selenium - Total	mg/L						0.000500						
Zinc - Total	mg/L						0.00300						
Nutrients													
Ammonia - N	mg/L						0.0200						
Nitrite - N	mg/L						0.00200						
Nitrate -N	mg/L						0.100						
Phosphate as P - Total	mg/L						0.0125						
Solids													
Turbidity	NTU						119						
Total Dissolved Solids	mg/L						12.5						
Total Suspended Solids	mg/L						10.6						
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

W2.6.1 (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C				0.40	2.9	5.8	9.6	9.2	7.0	0.85	1.2	
Conductivity	mS/cm				2.15	2.11	2.06	1.52	1.88	2.51	2.87	3.91	
pH					8.3	8.3	8.3	8.2	8.1	8.0	8.2	8.1	
Major Constituents													
Calcium	mg/L				317	235	255	182	284	325	476	498	
Chloride	mg/L				20.0	17.3	15.3	8.33	14.2	18.0	22.5	24.3	
Carbonate	mg/L				243	195	219	164	195	238	310	343	
Bicarbonate	mg/L				0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	
Potassium	mg/L				21.8	13.9	15.5	11.0	16.8	22.5	33.5	37.6	
Magnesium	mg/L				166	114	123	79.2	129	166	261	283	
Sodium	mg/L				24.4	17.5	18.0	11.2	18.0	22.7	35.6	38.5	
Sulphate	mg/L				990	806	915	476	792	1100	1610	1710	
Hardness - Total	mg/L				1420	1120	1250	894	1120	1560	2260	2480	
Alkalinity - Total	mg/L				199	159	179	135	159	196	253	281	
Total Metals													
Silver - Total	mg/L				0.00213	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00600	
Aluminum - Total	mg/L				1.33	13.2	22.0	114	71.8	2.95	2.69	0.563	
Arsenic - Total	mg/L				0.00288	0.0125	0.0235	0.0900	0.0570	0.00400	0.00450	0.00183	
Cadmium - Total	mg/L				0.000363	0.000863	0.000725	0.00180	0.00144	0.000188	0.000150	0.000233	
Chromium - Total	mg/L				0.00650	0.0133	0.0293	0.178	0.0960	0.00400	0.00400	0.00400	
Copper - Total	mg/L				0.00363	0.0281	0.0705	0.297	0.164	0.00313	0.00525	0.00250	
Iron - Total	mg/L				1.80	18.3	34.7	206	119	3.94	4.10	1.64	
Mercury - Total	mg/L				0.00300	0.000250	0.000313	0.000513	0.000250	0.000550	0.000250	0.000250	
Manganese - Total	mg/L				0.890	1.53	2.29	6.73	4.31	0.559	0.893	1.17	
Molybdenum - Total	mg/L				0.0293	0.0210	0.0358	0.0575	0.0534	0.0438	0.0435	0.0477	
Nickel - Total	mg/L				0.0738	0.0790	0.0828	0.329	0.200	0.0563	0.0955	0.119	
Lead - Total	mg/L				0.00300	0.0218	0.0340	0.150	0.0874	0.00400	0.00475	0.00133	
Antimony - Total	mg/L				0.00238	0.00250	0.00200	0.00163	0.00240	0.00300	0.00225	0.00400	
Selenium - Total	mg/L				0.00400	0.00563	0.00450	0.00575	0.00500	0.00500	0.00550	0.00500	
Zinc - Total	mg/L				0.0120	0.0528	0.0845	0.418	0.251	0.0125	0.0143	0.0113	
Nutrients													
Ammonia - N	mg/L				4.13	2.58	3.33	2.88	2.88	3.60	5.55	6.53	
Nitrite - N	mg/L				0.00725	0.00188	0.00300	0.000500	0.000500	0.00138	0.00425	0.00733	
Nitrate -N	mg/L				62.8	39.9	45.5	23.5	40.6	58.0	89.3	95.0	
Phosphate as P - Total	mg/L				0.208	2.14	4.68	6.35	7.26	0.158	0.128	0.0167	
Solids													
Turbidity	NTU				2200	1680	1830	1340	1700	2270	3330	3730	
Total Dissolved Solids	mg/L				268	3640	7130	12800	10100	249	274	46.7	
Total Suspended Solids	mg/L				167	1960	3250	4650	3250	110	82.5	25.7	
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

POR1 Sump Collection Point for Central Pit Waters Prior to Discharge (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C	2.1			1.2	5.1	3.6	6.1	6.5	3.2	1.9		
Conductivity	mS/cm	0.280			0.770	1.02	0.783	0.211	0.794	0.974			
pH		7.7			7.9	8.2	7.8	8.2	8.1	8.1	8.2		
Major Constituents													
Calcium	mg/L	141			78.5	120	84.9	49.6	106	105	135		
Chloride	mg/L	9.20			5.60	5.80	4.50	1.40	2.65	3.00	9.23		
Carbonate	mg/L	130			80.0	135	100	72.0	113	115	120		
Bicarbonate	mg/L	0.500			0.500	0.500	0.500	0.500	3.25	0.500	0.500		
Potassium	mg/L	4.60			4.41	5.49	2.91	1.46	3.60	3.67	4.74		
Magnesium	mg/L	84.5			32.7	47.6	49.1	24.5	47.8	55.5	61.8		
Sodium	mg/L	35.5			2.82	4.57	2.53	1.43	3.93	5.23	7.71		
Sulphate	mg/L	660			235	360	350	320	290	388	395		
Hardness - Total	mg/L	700			325	525	450	235	400	508	544		
Alkalinity - Total	mg/L	108			65.5	111	81.5	59.3	98.0	93.5	98.8		
Total Metals													
Silver - Total	mg/L	0.00150			0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150		
Aluminum - Total	mg/L	0.219			0.780	10.0	1.08	1.12	0.805	1.04	0.693		
Arsenic - Total	mg/L	0.0290			0.00200	0.0210	0.00200	0.00250	0.00650	0.00200	0.00350		
Cadmium - Total	mg/L	0.000150			0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150		
Chromium - Total	mg/L	0.0100			0.00400	0.0150	0.00400	0.00400	0.00400	0.00533	0.00625		
Copper - Total	mg/L	0.00250			0.00250	0.0360	0.00250	0.00475	0.00525	0.00333	0.00250		
Iron - Total	mg/L	0.191			1.03	24.0	2.11	1.81	0.974	2.84	1.17		
Mercury - Total	mg/L	0.000250			0.000250	0.000250	0.000250	0.000250	0.000250	0.000250	0.000338		
Manganese - Total	mg/L	0.101			0.135	0.836	0.745	0.154	0.115	0.105	0.0680		
Molybdenum - Total	mg/L	0.102			0.0120	0.0140	0.0160	0.00650	0.0165	0.0270	0.0453		
Nickel - Total	mg/L	0.0630			0.0180	0.0670	0.100	0.0260	0.0275	0.0337	0.0535		
Lead - Total	mg/L	0.00100			0.00100	0.0170	0.00100	0.00100	0.00500	0.00133	0.0175		
Antimony - Total	mg/L	0.0620			0.00200	0.00500	0.000500	0.000500	0.00400	0.00867	0.0115		
Selenium - Total	mg/L	0.00200			0.00200	0.00400	0.00200	0.00150	0.00450	0.00267	0.00425		
Zinc - Total	mg/L	0.0200			0.00500	0.0460	0.0160	0.00700	0.00600	0.00567	0.0100		
Nutrients													
Ammonia - N	mg/L	0.200			0.220	1.10	0.180	0.0800	0.0800	0.393	0.160		
Nitrite - N	mg/L	0.00300			0.00200	0.00400	0.00400	0.00125	0.000500	0.000500	0.000875		
Nitrate -N	mg/L	1.20			4.10	6.00	2.30	1.00	1.70	2.53	2.60		
Phosphate as P - Total	mg/L	0.0100			0.0300	0.460	0.0200	0.0275	0.0200	0.0100	0.0125		
Solids													
Turbidity	NTU	1080			456	776	643	549	573	746	776		
Total Dissolved Solids	mg/L	4.00			28.0	653	172	40.5	20.0	36.0	32.0		
Total Suspended Solids	mg/L	7.30			40.0	500	75.0	45.0	26.5	28.0	22.3		
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

SWS.3.1 (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C				0.40	2.0	7.4	4.9	6.5	5.8	3.4	0.40	
Conductivity	mS/cm				0.995	1.32	1.25	0.625	0.934	2.01	2.40	2.76	
pH					8.1	8.0	8.2	8.1	8.2	7.9	8.1	8.1	
Major Constituents													
Calcium	mg/L				63.2	90.5	108	59.9	87.8	146	213	278	
Chloride	mg/L				4.20	4.98	5.75	1.92	2.00	5.78	12.3	23.3	
Carbonate	mg/L				68.0	88.8	110	67.6	79.2	122	163	183	
Bicarbonate	mg/L				0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	
Potassium	mg/L				3.72	2.60	3.59	2.45	2.74	4.39	6.41	8.17	
Magnesium	mg/L				113	175	147	71.7	99.8	271	394	966	
Sodium	mg/L				2.02	3.20	3.54	1.86	2.54	5.40	9.27	15.9	
Sulphate	mg/L				510	796	793	372	428	1110	1630	4150	
Hardness - Total	mg/L				600	913	900	485	535	1360	1870	4780	
Alkalinity - Total	mg/L				56.5	72.9	90.0	55.3	65.3	100	134	149	
Total Metals													
Silver - Total	mg/L				0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	
Aluminum - Total	mg/L				0.580	14.0	6.32	26.4	10.1	0.703	0.459	0.127	
Arsenic - Total	mg/L				0.00200	0.0123	0.00775	0.0334	0.0157	0.00163	0.00275	0.00283	
Cadmium - Total	mg/L				0.000150	0.000213	0.000150	0.000250	0.000240	0.000150	0.000150	0.000150	
Chromium - Total	mg/L				0.00400	0.0193	0.0123	0.0400	0.0116	0.00400	0.00400	0.00400	
Copper - Total	mg/L				0.00250	0.0240	0.0191	0.0556	0.0277	0.00250	0.00250	0.0157	
Iron - Total	mg/L				1.36	25.0	12.0	47.5	26.0	2.39	2.01	1.49	
Mercury - Total	mg/L				0.000250	0.000338	0.000250	0.000470	0.000730	0.00151	0.000588	0.000250	
Manganese - Total	mg/L				1.74	2.00	1.61	1.89	1.38	1.71	1.88	6.25	
Molybdenum - Total	mg/L				0.00700	0.00400	0.0113	0.0130	0.00720	0.0143	0.0248	0.0280	
Nickel - Total	mg/L				0.0610	0.0815	0.109	0.105	0.0742	0.134	0.178	0.503	
Lead - Total	mg/L				0.00100	0.0173	0.00650	0.0266	0.0132	0.00625	0.00100	0.00100	
Antimony - Total	mg/L				0.000500	0.00138	0.00200	0.00110	0.00240	0.00375	0.00475	0.0117	
Selenium - Total	mg/L				0.000500	0.00450	0.00375	0.00400	0.00200	0.00425	0.00650	0.0127	
Zinc - Total	mg/L				0.00700	0.0595	0.0283	0.0856	0.0402	0.00500	0.0120	0.0103	
Nutrients													
Ammonia - N	mg/L				0.280	0.375	0.335	0.280	0.220	0.310	0.245	0.287	
Nitrite - N	mg/L				0.00500	0.00250	0.00388	0.00500	0.000500	0.000500	0.00550	0.0105	
Nitrate -N	mg/L				0.800	1.75	2.83	1.22	1.44	2.40	3.13	6.70	
Phosphate as P - Total	mg/L				0.100	0.624	0.233	0.872	0.818	0.0163	0.0138	0.00500	
Solids													
Turbidity	NTU				875	1950	1320	740	808	1970	2740	7150	
Total Dissolved Solids	mg/L				116	1500	381	1700	900	27.8	35.5	10.0	
Total Suspended Solids	mg/L				120	1390	288	1420	425	38.3	40.5	21.2	
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

SWW1 Sarytor Glacier Lake Outflow at Weir (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C					5.5	3.9	2.5	5.2				
Conductivity	mS/cm					0.595	2.92	1.12	1.10				
pH						8.2	7.9	8.1	8.4				
Major Constituents													
Calcium	mg/L					74.0	146	85.0	84.4				
Chloride	mg/L					0.900	3.90	1.50	1.30				
Carbonate	mg/L					86.0	170	82.0	86.0				
Bicarbonate	mg/L					0.500	0.500	0.500	0.500				
Potassium	mg/L					2.51	3.24	2.35	1.96				
Magnesium	mg/L					25.7	363	122	112				
Sodium	mg/L					1.44	2.84	1.49	1.71				
Sulphate	mg/L					220	1880	550	520				
Hardness - Total	mg/L					300	2130	625	600				
Alkalinity - Total	mg/L					70.0	140	66.5	70.0				
Total Metals													
Silver - Total	mg/L					0.00150	0.00150	0.00150	0.00150				
Aluminum - Total	mg/L					0.580	0.990	35.1	0.740				
Arsenic - Total	mg/L					0.00400	0.00200	0.0550	0.00200				
Cadmium - Total	mg/L					0.000150	0.000150	0.000400	0.000200				
Chromium - Total	mg/L					0.00400	0.00400	0.0460	0.00400				
Copper - Total	mg/L					0.00250	0.00250	0.0480	0.00250				
Iron - Total	mg/L					1.10	2.10	77.5	1.25				
Mercury - Total	mg/L					0.000250	0.000250	0.000250	0.000900				
Manganese - Total	mg/L					0.0400	2.56	3.17	0.717				
Molybdenum - Total	mg/L					0.00200	0.0170	0.00200	0.00700				
Nickel - Total	mg/L					0.00900	0.146	0.116	0.0580				
Lead - Total	mg/L					0.00100	0.00100	0.0410	0.00700				
Antimony - Total	mg/L					0.000500	0.000500	0.000500	0.0170				
Selenium - Total	mg/L					0.00100	0.00500	0.00300	0.000500				
Zinc - Total	mg/L					0.00400	0.00900	0.120	0.00700				
Nutrients													
Ammonia - N	mg/L					0.0200	0.140	0.160	0.0600				
Nitrite - N	mg/L					0.00300	0.0130	0.0200	0.000500				
Nitrate -N	mg/L					0.600	1.30	0.500	0.700				
Phosphate as P - Total	mg/L					0.0300	0.0800	2.60	0.0200				
Solids													
Turbidity	NTU					456	3040	912	921				
Total Dissolved Solids	mg/L					38.0	99.0	3510	26.0				
Total Suspended Solids	mg/L					27.0	35.0	3200	25.0				
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

W1.5.1 Kumtor River Just Downstream of Kumtor Concession Area - Voluntary Compliance Point (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C				1.5	3.5	6.7	7.9	7.7	6.3	1.1	0.30	
Conductivity	mS/cm				0.669	0.463	0.631	0.321	0.409	0.494	0.671	0.619	
pH					8.3	8.1	8.1	8.1	8.1	8.1	8.1	8.3	
Major Constituents													
Calcium	mg/L				63.9	49.3	50.2	34.2	33.5	33.1	64.3	82.8	
Chloride	mg/L				13.0	9.88	10.2	1.90	2.00	3.38	6.23	7.53	
Carbonate	mg/L				99.7	87.0	86.0	57.5	52.0	59.6	97.8	113	
Bicarbonate	mg/L				0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	
Potassium	mg/L				3.83	2.28	4.67	3.23	4.91	9.03	3.75	4.59	
Magnesium	mg/L				29.6	20.4	31.3	15.7	15.1	16.7	41.6	74.7	
Sodium	mg/L				5.94	4.01	28.1	13.2	26.3	45.2	10.4	10.4	
Sulphate	mg/L				165	107	207	100	112	164	229	335	
Hardness - Total	mg/L				282	190	256	133	125	152	306	475	
Alkalinity - Total	mg/L				81.5	71.1	70.9	46.6	42.5	48.8	81.0	92.7	
Total Metals													
Silver - Total	mg/L				0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	
Aluminum - Total	mg/L				1.28	13.2	2.32	10.9	9.36	3.55	1.19	0.340	
Arsenic - Total	mg/L				0.00233	0.00950	0.00300	0.00850	0.00625	0.00140	0.00138	0.00200	
Cadmium - Total	mg/L				0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	
Chromium - Total	mg/L				0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	
Copper - Total	mg/L				0.00250	0.00250	0.0125	0.0136	0.00950	0.00790	0.00425	0.00250	
Iron - Total	mg/L				2.35	21.4	4.17	16.1	10.5	2.59	0.875	0.271	
Mercury - Total	mg/L				0.000250	0.000250	0.000250	0.000250	0.000250	0.000250	0.000250	0.000250	
Manganese - Total	mg/L				0.425	0.667	0.318	0.519	0.346	0.150	0.117	0.343	
Molybdenum - Total	mg/L				0.00467	0.00275	0.0138	0.00925	0.0150	0.0240	0.00750	0.00933	
Nickel - Total	mg/L				0.0250	0.0340	0.0264	0.0310	0.0218	0.0176	0.0178	0.0387	
Lead - Total	mg/L				0.00390	0.0153	0.00400	0.0123	0.00925	0.00500	0.00175	0.00100	
Antimony - Total	mg/L				0.00117	0.000750	0.0116	0.00450	0.00950	0.0188	0.00125	0.00233	
Selenium - Total	mg/L				0.000500	0.00125	0.00190	0.00238	0.000750	0.00200	0.00350	0.00250	
Zinc - Total	mg/L				0.0150	0.0525	0.0122	0.0360	0.0290	0.0100	0.00350	0.00600	
Nutrients													
Ammonia - N	mg/L				0.327	0.205	1.26	0.570	1.06	1.86	0.300	0.260	
Nitrite - N	mg/L				0.00767	0.00888	0.00740	0.00850	0.0228	0.0594	0.00750	0.00467	
Nitrate -N	mg/L				4.40	1.65	2.08	0.900	1.18	2.06	3.00	4.77	
Phosphate as P - Total	mg/L				0.250	0.613	0.0820	0.403	0.255	0.0560	0.0125	0.00500	
Solids													
Turbidity	NTU				412	339	431	230	253	339	449	698	
Total Dissolved Solids	mg/L				368	936	126	665	376	91.4	28.3	3.33	
Total Suspended Solids	mg/L				151	520	72.0	393	315	108	31.7	9.63	
Trace Constituents													
Cyanide - Free	mg/L				0.00250	0.00250	0.00300	0.00250	0.00250	0.00570	0.00250	0.00250	
Cyanide - Total	mg/L				0.00250	0.00250	0.0248	0.0145	0.0333	0.0650	0.00250	0.00250	
Cyanide - WAD	mg/L				0.00250	0.00250	0.0120	0.00250	0.00775	0.0107	0.00250	0.00250	

W6.1 Arabel Suu River - 6km from Kumtor Concession Area (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C					8.7					1.8		
Conductivity	mS/cm					0.678					0.225		
pH						8.3					8.3		
Major Constituents													
Calcium	mg/L					28.9					41.9		
Chloride	mg/L					5.50					4.90		
Carbonate	mg/L					78.0					105		
Bicarbonate	mg/L					0.500					0.500		
Potassium	mg/L					0.790					0.970		
Magnesium	mg/L					3.50					5.51		
Sodium	mg/L					2.09					2.90		
Sulphate	mg/L					15.0					26.0		
Hardness - Total	mg/L					80.0					110		
Alkalinity - Total	mg/L					63.5					84.0		
Total Metals													
Silver - Total	mg/L					0.00150					0.00150		
Aluminum - Total	mg/L					0.260					0.390		
Arsenic - Total	mg/L					0.00100					0.00100		
Cadmium - Total	mg/L					0.000150					0.000150		
Chromium - Total	mg/L					0.00400					0.00400		
Copper - Total	mg/L					0.0290					0.00250		
Iron - Total	mg/L					0.603					0.502		
Mercury - Total	mg/L					0.000250					0.000250		
Manganese - Total	mg/L					0.0290					0.0140		
Molybdenum - Total	mg/L					0.00400					0.00200		
Nickel - Total	mg/L					0.0110					0.00250		
Lead - Total	mg/L					0.00200					0.00100		
Antimony - Total	mg/L					0.00400					0.000500		
Selenium - Total	mg/L					0.00					0.000500		
Zinc - Total	mg/L					0.00300					0.000500		
Nutrients													
Ammonia - N	mg/L					0.0200					0.0200		
Nitrite - N	mg/L					0.00100					0.00400		
Nitrate -N	mg/L					0.200					0.200		
Phosphate as P - Total	mg/L					0.0300					0.0100		
Solids													
Turbidity	NTU					105					132		
Total Dissolved Solids	mg/L					21.0					13.0		
Total Suspended Solids	mg/L					18.0					14.0		
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

W1.6 Kumtor River above Taragay River (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C						5.1	11	4.6	8.4			
Conductivity	mS/cm						0.517	0.269	0.366	0.560			
pH							8.1	8.1	8.0	8.0			
Major Constituents													
Calcium	mg/L						44.9	44.8	35.8	36.9			
Chloride	mg/L						16.0	2.10	2.50	3.80			
Carbonate	mg/L						105	66.0	62.0	70.0			
Bicarbonate	mg/L						0.500	0.500	0.500	0.500			
Potassium	mg/L						3.04	3.18	4.33	6.26			
Magnesium	mg/L						19.6	17.1	13.8	24.3			
Sodium	mg/L						17.8	11.7	23.6	36.9			
Sulphate	mg/L						138	79.0	108	184			
Hardness - Total	mg/L						220	120	130	190			
Alkalinity - Total	mg/L						84.5	54.5	51.0	57.5			
Total Metals													
Silver - Total	mg/L						0.00150	0.00150	0.00150	0.00150			
Aluminum - Total	mg/L						1.38	17.1	6.94	2.76			
Arsenic - Total	mg/L						0.00300	0.0130	0.00200	0.000500			
Cadmium - Total	mg/L						0.000150	0.000150	0.000150	0.000150			
Chromium - Total	mg/L						0.00400	0.00400	0.00400	0.00400			
Copper - Total	mg/L						0.00250	0.0300	0.00250	0.0140			
Iron - Total	mg/L						2.66	28.9	5.33	1.71			
Mercury - Total	mg/L						0.000250	0.00140	0.000250	0.000250			
Manganese - Total	mg/L						0.151	1.01	0.201	0.155			
Molybdenum - Total	mg/L						0.00700	0.00800	0.0150	0.0210			
Nickel - Total	mg/L						0.0110	0.0450	0.0320	0.0130			
Lead - Total	mg/L						0.00100	0.0180	0.00700	0.00100			
Antimony - Total	mg/L						0.00700	0.00200	0.00800	0.0140			
Selenium - Total	mg/L						0.00300	0.00100	0.000500	0.00200			
Zinc - Total	mg/L						0.00700	0.0650	0.0150	0.0100			
Nutrients													
Ammonia - N	mg/L						0.840	0.440	0.940	1.72			
Nitrite - N	mg/L						0.00600	0.0170	0.0240	0.0320			
Nitrate -N	mg/L						1.20	0.700	1.20	1.60			
Phosphate as P - Total	mg/L						0.0900	0.760	0.0900	0.0200			
Solids													
Turbidity	NTU						325	179	257	424			
Total Dissolved Solids	mg/L						134	1130	169	38.0			
Total Suspended Solids	mg/L						55.0	600	200	36.0			
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

W1.7 Taragay River below Kumtor River (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C						6.4	11	6.9	8.8			
Conductivity	mS/cm						0.405	0.242	0.310	0.399			
pH							8.0	8.0	8.1	8.1			
Major Constituents													
Calcium	mg/L						42.6	40.7	36.6	29.3			
Chloride	mg/L						20.0	3.80	3.40	5.20			
Carbonate	mg/L						110	74.0	72.0	88.0			
Bicarbonate	mg/L						0.500	0.500	0.500	0.500			
Potassium	mg/L						1.61	2.26	2.74	3.99			
Magnesium	mg/L						12.3	11.4	9.83	12.2			
Sodium	mg/L						9.64	8.59	12.6	19.0			
Sulphate	mg/L						77.0	53.0	71.0	102			
Hardness - Total	mg/L						180	110	110	140			
Alkalinity - Total	mg/L						90.5	61.0	58.5	71.5			
Total Metals													
Silver - Total	mg/L						0.00150	0.00150	0.00150	0.00150			
Aluminum - Total	mg/L						0.870	9.99	5.30	2.08			
Arsenic - Total	mg/L						0.000500	0.00700	0.00100	0.000500			
Cadmium - Total	mg/L						0.000150	0.000150	0.000150	0.000150			
Chromium - Total	mg/L						0.00400	0.00400	0.00400	0.00400			
Copper - Total	mg/L						0.00250	0.0170	0.00250	0.00250			
Iron - Total	mg/L						1.63	16.3	4.54	1.27			
Mercury - Total	mg/L						0.000250	0.000250	0.000250	0.000250			
Manganese - Total	mg/L						0.0720	0.489	0.131	0.0640			
Molybdenum - Total	mg/L						0.00200	0.00500	0.0120	0.0130			
Nickel - Total	mg/L						0.00600	0.0270	0.0320	0.00600			
Lead - Total	mg/L						0.00100	0.0100	0.00500	0.00100			
Antimony - Total	mg/L						0.00200	0.00100	0.00400	0.00800			
Selenium - Total	mg/L						0.000500	0.000500	0.000500	0.00200			
Zinc - Total	mg/L						0.0100	0.0370	0.0130	0.00400			
Nutrients													
Ammonia - N	mg/L						0.360	0.300	0.460	1.02			
Nitrite - N	mg/L						0.00500	0.0140	0.00800	0.0170			
Nitrate -N	mg/L						0.600	0.500	0.700	1.20			
Phosphate as P - Total	mg/L						0.0500	0.300	0.0600	0.00500			
Solids													
Turbidity	NTU						250	152	186	282			
Total Dissolved Solids	mg/L						65.0	444	101	22.0			
Total Suspended Solids	mg/L						39.0	330	120	29.0			
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

W1.8 Naryn River 1km upstream of Naryn (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C	-0.20	-0.60	-0.40	4.4	8.1	9.7	12	12	9.1	7.4	1.8	0.20
Conductivity	mS/cm	0.395	0.370	0.371	0.364	0.278	0.291	0.266	0.286	0.329	0.378	0.385	0.399
pH		10	7.4	8.1	9.1	9.4	9.0	8.8	8.9	8.4	8.7	8.8	8.8
Major Constituents													
Calcium	mg/L	56.2	50.3	49.9	52.0	42.1	42.1	44.3	48.2	45.9	55.4	50.1	52.9
Chloride	mg/L	5.70	5.50	5.70	6.93	4.58	4.12	2.35	3.00	4.32	5.43	5.83	6.18
Carbonate	mg/L	165	145	145	145	126	119	96.0	111	131	150	144	156
Bicarbonate	mg/L	0.500	0.500	0.500	0.500	1.63	1.80	5.13	1.63	0.500	1.63	3.88	0.500
Potassium	mg/L	1.53	1.46	1.19	2.08	1.51	1.36	1.52	1.81	1.67	1.53	1.53	1.51
Magnesium	mg/L	16.0	14.6	13.8	14.9	11.2	11.4	10.5	12.0	12.9	15.6	14.8	15.8
Sodium	mg/L	8.82	7.88	7.60	9.10	5.28	5.39	5.66	6.21	7.66	8.62	8.16	8.64
Sulphate	mg/L	72.0	65.0	64.0	56.3	41.3	50.8	45.3	53.0	62.4	68.3	64.0	68.4
Hardness - Total	mg/L	200	180	180	175	150	148	133	150	170	188	188	196
Alkalinity - Total	mg/L	143	118	118	120	105	100	85.8	93.9	108	125	124	127
Total Metals													
Silver - Total	mg/L	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150
Aluminum - Total	mg/L	0.103	0.210	0.120	2.04	4.94	1.95	10.6	8.44	1.15	0.145	0.243	0.140
Arsenic - Total	mg/L	0.000500	0.000500		0.00238	0.00425	0.00160	0.00825	0.00750	0.00100	0.00100	0.00138	0.00170
Cadmium - Total	mg/L	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150
Chromium - Total	mg/L	0.00400	0.00400	0.00400	0.00500	0.00400	0.00400	0.00400	0.00775	0.00400	0.00400	0.00400	0.00400
Copper - Total	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00763	0.00250	0.00250	0.00250	0.00250
Iron - Total	mg/L	0.147	0.197	0.222	2.46	7.30	2.89	16.2	12.1	1.53	0.279	0.216	0.169
Mercury - Total	mg/L	0.000250	0.000250	0.000250	0.000250	0.000250	0.000340	0.000250	0.000250	0.000300	0.000250	0.000250	0.000250
Manganese - Total	mg/L	0.0110	0.0110	0.0150	0.0935	0.330	0.109	0.457	0.356	0.0512	0.0158	0.0203	0.0148
Molybdenum - Total	mg/L	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00240	0.00200	0.00275	0.00200
Nickel - Total	mg/L	0.00250	0.00250	0.00250	0.00663	0.0114	0.00990	0.0248	0.0255	0.00390	0.00988	0.00338	0.00340
Lead - Total	mg/L	0.00100	0.00400	0.00100	0.00325	0.00625	0.00280	0.0120	0.0105	0.00300	0.00100	0.00100	0.00100
Antimony - Total	mg/L	0.00100	0.000500	0.000500	0.00175	0.000500	0.000600	0.000500	0.00150	0.000600	0.000500	0.000500	0.000500
Selenium - Total	mg/L	0.000500	0.00200	0.000500	0.00163	0.000500	0.000600	0.00163	0.00363	0.00120	0.00463	0.000875	0.00220
Zinc - Total	mg/L	0.00700	0.00600	0.00700	0.0153	0.0250	0.0162	0.0350	0.0320	0.0166	0.0168	0.00525	0.00290
Nutrients													
Ammonia - N	mg/L	0.0200	0.0200	0.0200	0.0300	0.0350	0.132	0.145	0.150	0.108	0.0200	0.0200	0.0200
Nitrite - N	mg/L	0.00200	0.00400	0.0110	0.0110	0.00525	0.0200	0.0375	0.124	0.00300	0.00138	0.00238	0.00320
Nitrate -N	mg/L	0.700	0.700	0.600	0.600	0.475	0.520	0.500	0.525	0.600	0.750	0.675	0.762
Phosphate as P - Total	mg/L	0.00500	0.0100	0.0100	0.123	0.333	0.148	0.383	0.555	0.0490	0.0138	0.0250	0.0560
Solids													
Turbidity	NTU	261	221	220	226	181	187	168	182	219	245	248	240
Total Dissolved Solids	mg/L	2.00	2.00	8.00	153	940	264	759	934	77.0	3.25	9.50	4.00
Total Suspended Solids	mg/L	1.70	2.30	4.30	92.3	334	106	603	528	55.8	1.71	3.59	3.42
Trace Constituents													
Cyanide - Free	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250
Cyanide - Total	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250
Cyanide - WAD	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250

W1.8F Naryn River below Naryn STP Discharge (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C	-0.20	0.50	-0.30	5.1	9.5	11	13	12	9.8	7.0	3.0	-0.22
Conductivity	mS/cm	0.339	0.376	0.379	0.359	0.290	0.295	0.254	0.295	0.333	0.385	0.430	0.385
pH		9.4	7.5	8.6	8.8	8.8	8.6	8.5	8.7	8.5	8.5	8.8	8.7
Major Constituents													
Calcium	mg/L	56.5	51.9	49.1	52.2	43.5	42.1	43.7	50.5	46.0	53.7	53.7	54.7
Chloride	mg/L	6.70	6.50	6.70	7.75	5.25	4.86	3.78	6.05	5.75	6.85	9.35	8.04
Carbonate	mg/L	165	145	145	149	130	123	90.0	129	135	150	156	160
Bicarbonate	mg/L	0.500	0.500	0.500	0.500	1.63	1.80	14.4	1.88	0.500	1.63	3.38	0.500
Potassium	mg/L	1.53	1.45	1.24	1.99	1.49	1.27	1.57	1.80	1.43	1.55	1.67	1.52
Magnesium	mg/L	16.2	15.0	14.0	14.9	11.5	11.6	10.6	12.6	13.1	15.6	15.9	16.6
Sodium	mg/L	9.79	8.89	8.76	10.1	6.18	6.31	7.05	7.72	8.14	9.76	9.54	10.8
Sulphate	mg/L	75.0	66.0	65.0	58.0	43.3	51.4	46.8	57.3	63.5	67.8	66.0	70.0
Hardness - Total	mg/L	200	180	180	175	155	150	145	168	168	183	203	204
Alkalinity - Total	mg/L	134	120	119	122	110	103	97.5	108	111	124	133	132
Total Metals													
Silver - Total	mg/L	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150
Aluminum - Total	mg/L	0.0820	0.180	0.0700	1.49	4.93	1.92	10.4	9.24	1.04	0.185	0.238	0.148
Arsenic - Total	mg/L	0.000500	0.000500		0.00238	0.00400	0.00130	0.00825	0.00775	0.00110	0.00113	0.00225	0.00190
Cadmium - Total	mg/L	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000188	0.000188	0.000150	0.000150	0.000150	0.000150
Chromium - Total	mg/L	0.00400	0.0100	0.00400	0.00500	0.00400	0.00400	0.00400	0.00725	0.00400	0.00400	0.00400	0.00400
Copper - Total	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00713	0.00360	0.00250	0.00250	0.00360
Iron - Total	mg/L	0.0840	0.206	0.281	1.85	6.89	2.77	16.0	13.4	1.49	0.263	0.154	0.194
Mercury - Total	mg/L	0.000250	0.000250	0.000250	0.000250	0.000250	0.000320	0.000250	0.000250	0.000250	0.000250	0.000250	0.000250
Manganese - Total	mg/L	0.00900	0.0120	0.0140	0.0688	0.262	0.101	0.425	0.374	0.0408	0.0165	0.0188	0.0154
Molybdenum - Total	mg/L	0.00200	0.00400	0.00200	0.00200	0.00200	0.00200	0.00200	0.00250	0.00240	0.00275	0.00300	0.00200
Nickel - Total	mg/L	0.00250	0.00250	0.00250	0.00575	0.00988	0.00650	0.0283	0.0268	0.00560	0.00863	0.00338	0.00250
Lead - Total	mg/L	0.00100	0.00500	0.00100	0.00250	0.00625	0.00240	0.0188	0.00975	0.00280	0.00200	0.00100	0.00100
Antimony - Total	mg/L	0.000500	0.000500	0.000500	0.000500	0.000500	0.000500	0.000875	0.00138	0.000500	0.000500	0.000500	0.000500
Selenium - Total	mg/L	0.000500	0.00200	0.000500	0.00100	0.000875	0.000500	0.00238	0.00150	0.00100	0.00500	0.00550	0.00120
Zinc - Total	mg/L	0.00300	0.00700	0.00600	0.00975	0.0248	0.0120	0.0423	0.0355	0.0176	0.0250	0.00525	0.00530
Nutrients													
Ammonia - N	mg/L	0.100	0.0400	0.0200	0.0800	0.0500	0.124	0.193	0.150	0.188	0.0750	0.0200	0.100
Nitrite - N	mg/L	0.00300	0.00400	0.00800	0.0103	0.00375	0.0216	0.0287	0.252	0.00360	0.00163	0.00263	0.00340
Nitrate -N	mg/L	0.800	0.800	0.700	0.675	0.550	0.680	0.833	1.13	0.780	0.850	1.30	1.06
Phosphate as P - Total	mg/L	0.0100	0.0200	0.0100	0.125	0.280	0.112	0.343	0.383	0.0530	0.0225	0.0225	0.0560
Solids													
Turbidity	NTU	264	234	231	236	195	191	188	216	226	243	276	256
Total Dissolved Solids	mg/L	1.00	4.00	8.00	164	642	176	702	826	75.5	12.5	6.25	3.80
Total Suspended Solids	mg/L	2.00	2.90	4.30	102	330	112	580	589	64.9	3.88	3.14	2.37
Trace Constituents													
Cyanide - Free	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250
Cyanide - Total	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250
Cyanide - WAD	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250

P5.2N Tap Water at the New Camp (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C	13	13	10	11	13	14	15	15	15	9.8	8.1	8.9
Conductivity	mS/cm	0.151	0.193	0.167	0.226	0.193	0.143	0.151	0.122	0.191	0.151	0.118	0.137
pH		7.6	7.6	7.5	7.5	7.7	7.8	7.4	7.6	7.7	7.8	7.8	8.1
Major Constituents													
Calcium	mg/L	17.5	18.5	20.6	18.5	15.4	13.5	18.9	17.0	14.1	15.1	14.2	15.9
Chloride	mg/L	0.900	1.25	1.75	1.32	1.05	1.30	1.36	1.33	1.62	1.53	3.15	1.44
Carbonate	mg/L	28.7	25.0	25.0	26.4	21.5	17.3	25.2	22.3	24.8	29.3	29.8	32.4
Bicarbonate	mg/L	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Potassium	mg/L	1.39	1.54	1.63	1.48	1.17	1.08	1.41	1.40	1.10	1.27	1.30	1.52
Magnesium	mg/L	3.20	3.50	3.77	3.40	2.95	2.79	3.85	2.90	2.87	3.11	3.01	3.27
Sodium	mg/L	1.92	2.43	2.96	2.24	1.88	1.96	2.19	2.34	2.23	2.51	3.79	2.41
Sulphate	mg/L	35.3	36.8	35.8	35.0	31.8	35.0	37.4	27.8	25.8	23.8	23.3	23.8
Hardness - Total	mg/L	53.3	55.0	55.0	55.0	47.3	46.0	54.0	43.8	44.8	44.8	47.3	50.0
Alkalinity - Total	mg/L	23.7	20.4	20.6	21.6	17.9	14.0	20.6	18.4	20.2	24.1	24.4	26.8
Total Metals													
Silver - Total	mg/L	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150
Aluminum - Total	mg/L	0.0548	0.106	0.0600	0.0680	0.0738	0.324	0.0620	0.280	0.202	0.118	0.121	0.166
Arsenic - Total	mg/L	0.000500			0.000500	0.00150	0.000500	0.000900	0.00100	0.000500	0.000625	0.00138	0.000800
Cadmium - Total	mg/L	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150
Chromium - Total	mg/L	0.0113	0.0185	0.0183	0.00540	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400
Copper - Total	mg/L	0.00250	0.00600	0.0155	0.00520	0.00250	0.00250	0.00320	0.00250	0.00250	0.00250	0.00250	0.00410
Iron - Total	mg/L	0.0425	0.101	0.0845	0.105	0.136	0.126	0.0888	0.170	0.406	0.279	0.303	0.119
Mercury - Total	mg/L	0.000250	0.000250	0.000250	0.00120	0.000388	0.000250	0.000300	0.000250	0.000250	0.000250	0.000938	0.000250
Manganese - Total	mg/L	0.00300	0.00550	0.00350	0.00400	0.00325	0.00375	0.00480	0.00700	0.0144	0.0120	0.0108	0.00880
Molybdenum - Total	mg/L	0.00833	0.0170	0.0148	0.00480	0.00275	0.00200	0.00300	0.00250	0.00260	0.00325	0.00425	0.00980
Nickel - Total	mg/L	0.0262	0.0563	0.0500	0.0105	0.00763	0.00675	0.00670	0.00863	0.00630	0.0104	0.0125	0.0342
Lead - Total	mg/L	0.00100	0.00650	0.000875	0.00120	0.00125	0.00100	0.00100	0.00100	0.00100	0.00200	0.00125	0.00100
Antimony - Total	mg/L	0.00283	0.00113	0.00150	0.00120	0.000625	0.000500	0.000500	0.000625	0.000800	0.000500	0.000875	0.000500
Selenium - Total	mg/L	0.000500	0.00138	0.000875	0.000800	0.000500	0.000500	0.00140	0.000500	0.000800	0.00300	0.00113	0.00200
Zinc - Total	mg/L	0.0103	0.0130	0.0145	0.0118	0.0205	0.0145	0.0114	0.0105	0.00580	0.00488	0.0103	0.00620
Nutrients													
Ammonia - N	mg/L	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
Nitrite - N	mg/L	0.00133	0.00125	0.00113	0.000600	0.000500	0.000750	0.000500	0.000500	0.00120	0.00213	0.00188	0.00240
Nitrate -N	mg/L	0.300	0.350	0.300	0.320	0.275	0.275	0.300	0.300	0.280	0.213	0.300	0.298
Phosphate as P - Total	mg/L	0.00500	0.00500	0.00500	0.00600	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00900
Solids													
Turbidity	NTU	77.3	79.3	79.5	74.8	70.5	72.5	85.2	61.0	67.4	65.3	79.5	67.8
Total Dissolved Solids	mg/L	0.625	0.500	0.875	1.20	0.625	1.13	0.500	2.25	1.90	1.63	0.500	0.500
Total Suspended Solids	mg/L	0.350	0.375	0.175	0.370	0.488	0.788	0.300	4.80	2.88	3.00	0.813	0.740
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

P5.3 Mill Kitchen Tap (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C	14	14	10	12	14	16	18	15	15	12	12	10
Conductivity	mS/cm	0.196	0.185	0.151	0.194	0.130	0.132	0.159	0.129	0.179	0.126	0.127	0.130
pH		7.6	7.6	7.4	7.6	7.8	7.7	7.6	7.8	7.5	7.7	7.8	8.0
Major Constituents													
Calcium	mg/L	17.1	18.7	20.7	18.3	13.5	13.9	19.0	16.7	14.4	15.9	14.3	15.9
Chloride	mg/L	1.80	1.58	1.78	1.52	1.90	2.00	1.72	1.23	1.28	1.18	1.90	0.416
Carbonate	mg/L	24.3	23.3	29.0	26.4	22.5	21.5	25.2	21.8	14.8	19.0	20.5	22.2
Bicarbonate	mg/L	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Potassium	mg/L	1.34	1.74	1.60	1.38	1.08	1.10	1.60	1.41	1.13	1.34	1.30	1.39
Magnesium	mg/L	3.16	3.50	3.80	3.35	2.59	2.90	3.85	2.90	2.94	3.25	3.01	3.29
Sodium	mg/L	2.50	2.39	2.74	2.43	2.53	2.50	2.34	2.29	1.98	2.31	2.65	1.72
Sulphate	mg/L	35.7	38.5	34.8	33.4	28.3	31.5	37.2	26.8	33.0	31.5	32.5	32.2
Hardness - Total	mg/L	53.3	55.0	55.0	55.0	44.3	46.5	55.0	43.5	44.6	44.8	49.0	49.8
Alkalinity - Total	mg/L	20.5	18.9	23.8	21.7	18.8	17.9	20.5	18.0	12.0	15.6	17.1	18.3
Total Metals													
Silver - Total	mg/L	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150
Aluminum - Total	mg/L	0.0285	0.0400	0.0900	0.0950	0.0588	0.0275	0.0410	0.153	0.136	0.0613	0.0700	0.0640
Arsenic - Total	mg/L	0.000500			0.000500	0.00150	0.000500	0.000900	0.000750	0.000500	0.000500	0.00138	0.000800
Cadmium - Total	mg/L	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150
Chromium - Total	mg/L	0.00833	0.0153	0.0190	0.00640	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400
Copper - Total	mg/L	0.00638	0.00950	0.00513	0.00560	0.00588	0.00450	0.00550	0.00863	0.0157	0.00975	0.0118	0.0103
Iron - Total	mg/L	0.0623	0.0610	0.0795	0.0524	0.0998	0.0963	0.0910	0.130	0.0894	0.199	0.0935	0.0578
Mercury - Total	mg/L	0.000250	0.000250	0.000250	0.00120	0.000363	0.000250	0.000250	0.000425	0.000250	0.000250	0.000563	0.000250
Manganese - Total	mg/L	0.00300	0.00475	0.00500	0.00400	0.00450	0.00400	0.00620	0.00875	0.00800	0.00625	0.00600	0.00840
Molybdenum - Total	mg/L	0.00500	0.0125	0.0155	0.00880	0.00300	0.00250	0.00260	0.00400	0.00280	0.00325	0.00575	0.00720
Nickel - Total	mg/L	0.0142	0.0458	0.0523	0.0262	0.0100	0.00513	0.00560	0.00988	0.00430	0.00888	0.0184	0.0230
Lead - Total	mg/L	0.00267	0.0100	0.00363	0.00100	0.00100	0.00150	0.00100	0.00100	0.00100	0.00100	0.00150	0.00100
Antimony - Total	mg/L	0.00150	0.000625	0.00100	0.00100	0.000500	0.000500	0.000600	0.000625	0.000500	0.000500	0.000875	0.000500
Selenium - Total	mg/L	0.000500	0.00100	0.00100	0.000500	0.000500	0.000500	0.000900	0.000500	0.000900	0.00300	0.00175	0.000500
Zinc - Total	mg/L	0.0100	0.0193	0.0123	0.0134	0.0153	0.00925	0.0104	0.00925	0.00960	0.00875	0.0120	0.00960
Nutrients													
Ammonia - N	mg/L	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
Nitrite - N	mg/L	0.000833	0.00188	0.000625	0.000700	0.000750	0.000875	0.00100	0.00113	0.000900	0.00100	0.00138	0.00220
Nitrate -N	mg/L	0.333	0.325	0.325	0.340	0.275	0.275	6.64	0.300	0.300	0.300	0.300	0.298
Phosphate as P - Total	mg/L	0.00500	0.00500	0.00500	0.00600	0.00500	0.00500	0.00500	0.00500	0.00600	0.00500	0.00500	0.00900
Solids													
Turbidity	NTU	75.8	82.0	79.0	76.6	65.8	68.3	81.8	68.5	71.0	68.3	77.0	73.4
Total Dissolved Solids	mg/L	0.500	0.500	1.25	1.10	1.38	0.500	1.00	0.500	1.00	0.875	0.500	0.500
Total Suspended Solids	mg/L	0.150	0.200	0.250	0.340	0.550	0.425	0.760	0.450	1.30	0.263	0.313	0.230
Trace Constituents													
Cyanide - Free	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250
Cyanide - Total	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250
Cyanide - WAD	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250

SDP Treated Sewage Discharge into Kumtor River (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C						16	18	18	16	13		
Conductivity	mS/cm						0.698	0.638	0.580	0.555	0.355		
pH							8.1	8.0	8.5	8.3	8.3		
Major Constituents													
Calcium	mg/L						22.1	25.9	23.2	12.9	8.02		
Chloride	mg/L						36.0	30.2	20.8	20.8	16.5		
Carbonate	mg/L						156	93.8	52.8	119	68.0		
Bicarbonate	mg/L						8.63	3.10	7.38	2.30	0.500		
Potassium	mg/L						10.1	8.87	7.50	7.55	5.76		
Magnesium	mg/L						5.49	6.93	5.10	3.34	1.63		
Sodium	mg/L						84.6	55.6	51.7	60.3	48.2		
Sulphate	mg/L						102	79.4	71.5	70.8	47.0		
Hardness - Total	mg/L						77.9	75.0	76.3	48.4	25.5		
Alkalinity - Total	mg/L						142	80.9	54.9	100	56.0		
Total Metals													
Silver - Total	mg/L												
Aluminum - Total	mg/L												
Arsenic - Total	mg/L												
Cadmium - Total	mg/L												
Chromium - Total	mg/L												
Copper - Total	mg/L												
Iron - Total	mg/L												
Mercury - Total	mg/L												
Manganese - Total	mg/L												
Molybdenum - Total	mg/L												
Nickel - Total	mg/L												
Lead - Total	mg/L												
Antimony - Total	mg/L												
Selenium - Total	mg/L												
Zinc - Total	mg/L												
Nutrients													
Ammonia - N	mg/L						8.77	5.80	1.78	9.50	4.75		
Nitrite - N	mg/L						0.116	0.265	0.206	0.203	1.16		
Nitrate -N	mg/L						3.53	0.750	17.6	0.380	1.75		
Phosphate as P - Total	mg/L						2.60	1.96	1.47	1.96	1.60		
Solids													
Turbidity	NTU						375	283	250	200	183		
Total Dissolved Solids	mg/L						8.25	16.6	11.3	13.6	4.50		
Total Suspended Solids	mg/L						9.80	8.38	9.13	12.1	2.90		
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

TPX-FILTER End of Tailings Spigot - Pressure Filtered (2017)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C	14	15	11	14	15	18	19	18	17	16	15	15
Conductivity	mS/cm	4.05	3.98	3.92	3.79	4.23	3.65	3.51	3.41	3.33	3.84	3.00	3.52
pH		12	12	11	12	12	12	11	12	12	12	11	12
Major Constituents													
Calcium	mg/L				502	376	148	162	137	198	248	124	111
Chloride	mg/L				14.0	15.5	16.3	17.2	19.5	21.3	24.5	14.8	18.0
Carbonate	mg/L				0.500	0.500	0.500	5.80	0.500	0.500	0.500	3.38	21.4
Bicarbonate	mg/L				80.0	117	106	216	134	91.8	153	76.3	310
Potassium	mg/L				102	101	98.6	115	115	97.5	114	89.4	97.4
Magnesium	mg/L				0.0250	0.0613	0.0363	0.159	0.0438	0.249	0.0250	0.434	0.0670
Sodium	mg/L				341	630	352	623	600	416	627	355	552
Sulphate	mg/L	785	1060	1730	1620	1780	768	848	688	898	868	653	463
Hardness - Total	mg/L				1380	1160	481	492	336	513	529	341	289
Alkalinity - Total	mg/L				412	436	345	565	567	264	596	208	651
Soluble Metals													
Silver - Soluble	mg/L				0.0300	0.0200	0.0200	0.109	0.0875	0.0159	0.0398	0.0480	0.0635
Aluminum - Soluble	mg/L				0.160	1.31	2.15	2.05	1.55	1.84	1.63	1.59	1.62
Arsenic - Soluble	mg/L				0.00700	0.00600	0.00700	0.00580	0.00800	0.00625	0.00850	0.00700	0.0104
Cadmium - Soluble	mg/L				0.00110	0.000900	0.00125	0.00121	0.00158	0.00198	0.00168	0.00185	0.00232
Chromium - Soluble	mg/L				0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400
Copper - Soluble	mg/L				3.00	5.65	3.39	8.74	15.6	2.25	1.75	1.21	23.3
Iron - Soluble	mg/L				0.244	0.0740	0.110	1.74	0.716	0.278	0.112	0.434	1.97
Mercury - Soluble	mg/L				0.00100	0.00240	0.00558	0.00738	0.00848	0.00463	0.00316	0.00513	0.00463
Manganese - Soluble	mg/L				0.0150	0.000500	0.00138	0.0765	0.00238	0.00638	0.00388	0.0230	0.0238
Molybdenum - Soluble	mg/L				0.240	0.330	0.340	0.333	0.385	0.345	0.339	0.289	0.374
Nickel - Soluble	mg/L				0.187	0.383	0.471	0.968	0.674	0.383	0.511	0.248	1.22
Lead - Soluble	mg/L				0.00300	0.00100	0.00125	0.00120	0.00200	0.00150	0.00200	0.00100	0.00100
Antimony - Soluble	mg/L				0.00400	0.00300	0.244	0.186	0.293	0.196	0.0663	0.597	0.280
Selenium - Soluble	mg/L				0.0220	0.0250	0.0260	0.0242	0.0278	0.0358	0.0310	0.0183	0.0230
Zinc - Soluble	mg/L				0.0280	0.0350	0.0985	0.290	0.125	0.154	0.191	0.659	0.283
Nutrients													
Ammonia - N	mg/L	13.4	10.4	36.9	14.0	19.8	12.6	20.2	20.1	12.6	20.6	12.1	16.9
Nitrite - N	mg/L	0.148	0.140	0.768	0.260	0.0165	0.0183	0.0190	0.000500	0.000500	0.00550	0.00300	0.00560
Nitrate -N	mg/L	34.3	50.2	80.8	30.5	32.3	13.5	33.9	28.5	24.5	28.3	14.3	31.0
Phosphate as P - Total	mg/L				0.0200	0.0238	0.0388	0.0230	0.0150	0.0225	0.00625	0.0100	0.0100
Solids													
Turbidity	NTU				3480	4110	2180	2760	2470	2310	2950	1950	2370
Total Dissolved Solids	mg/L				80.0	56.3	229	48.2	20.0	25.6	52.5	27.8	57.6
Total Suspended Solids	mg/L				5.40	6.15	34.4	9.02	3.44	1.99	7.00	6.03	4.07
Trace Constituents													
Cyanide - Free	mg/L	46.7	47.8	84.5	49.5	46.8	31.8	50.8	53.5	45.3	73.5	44.8	54.2
Cyanide - Total	mg/L	92.0	101	159	108	108	81.0	126	115	98.0	153	122	140
Cyanide - WAD	mg/L	71.5	77.5	126	82.0	79.5	64.5	100	91.5	79.0	135	99.5	121

MAD and MAC Limits

Parameter	Units	T8.4 (MAD Limit)	SDP (MAD Limit)	W1.5.1 (MAC Limit - Communal Use)
Chlorine (Cl)	mg/L		350	350
Magnesium (Mg)	mg/L	50		50
Sodium (Na)	mg/L	808,6		200
Sulphate (SO_4)	mg/L	1904,4	500	500
Silver (Ag)	mg/L			0,05
Aluminium (Al)	mg/L			0,5
Arsenic (As)	mg/L			0,01
Boron (B)	mg/L			0,5
Barium (Ba)	mg/L			0,7
Beryllium (Be)	mg/L			0,0002
Bismuth (Bi)	mg/L			0,1
Cadmium (Cd)	mg/L			0,001
Cobalt (Co)	mg/L			0,1
Chromium (Cr)	mg/L			0,05
Copper (Cu)	mg/L	1		1
Fluorine (F)	mg/L			1,5
Iron (Fe)	mg/L	1,8		0,3
Mercury (Hg)	mg/L			0,0005
Manganese (Mn)	mg/L	0,29		0,1
Molybdenum (Mo)	mg/L	1,014		0,25
Nickel (Ni)	mg/L	0,039		0,02
Lead (Pb)	mg/L			0,01
Antimony (Sb)	mg/L			0,005
Selenium (Se)	mg/L			0,01
Silicon (Si)	mg/L			10
Vanadium (V)	mg/L			0,1
Zinc (Zn)	mg/L	1		1
Ammonia Nitrogen (NH_3-N)	mg/L	23,48	2,5	1,5
Nitrite Nitrogen (NO_2-N)	mg/L		1	3,3
Nitrate Nitrogen (NO_3-N)	mg/L		10,6	45
WAD Cyanide (CN-WAD)	mg/L			0,035
Free Cyanide (CN-F)	mg/L	0,128		
Total Suspended Solids (TSS)	mg/L	77,7	185,6	
Biochemical Oxygen Demand (BOD5)	mg/L		16,83	
MBAS	mg/L		0,5	0,5
Hydrocarbons	mg/L			0,3

Laboratory Detection Limit

Parameter	Units	Method Detection Limit
Major Constituents		
Ca	mg/L	0,05
Cl	mg/L	0,5
CO_3	mg/L	1
HCO_3	mg/L	1
K	mg/L	0,09
Mg	mg/L	0,05
Na	mg/L	0,05
SO_4	mg/L	0,1
T-Hardness	mg/L	1
T-Alkalinity	mg/L	1
Total Metals		
Ag	mg/L	0,003
Al	mg/L	0,03
As	mg/L	0,0003
Ba	mg/L	0,001
Be	mg/L	0,0002
Cd	mg/L	0,0003
Co	mg/L	0,004
Cr	mg/L	0,008
Cu	mg/L	0,005
F	mg/L	0,005
Fe	mg/L	0,001
Hg	mg/L	0,0003
Mn	mg/L	0,001
Mo	mg/L	0,004
Ni	mg/L	0,005
Pb	mg/L	0,002
Sb	mg/L	0,001
Se	mg/L	0,001
Si	mg/L	
V	mg/L	0,006
Zn	mg/L	0,001
Nutrients		
Un-ionized NH_3		
NH_3	mg/L	0,04
NO_2-N	mg/L	0,001
NO_3-N	mg/L	0,1
T-PO_4	mg/L	0,01
TKN	mg/L	
Solids		
Turb-L	NTU	0,35
TDS	mg/L	1
TSS	mg/L	1
Trace Constituents		
CN-F	mg/L	0,005
CN-T	mg/L	0,005
CN-WAD	mg/L	0,005

Cautionary Note Regarding Forward-Looking Statements

Certain information contained or incorporated by reference herein may include "forward-looking-statements" within the meaning of certain securities laws. Such forward-looking statements involve risks, uncertainties, and other factors that could cause actual results, performance, prospects, and opportunities to differ materially from those expressed or implied by such forward-looking statements.

For a detailed discussion of such risks, uncertainties, and other factors, the Management's Discussion and Analysis included in Centerra's most recent Annual Report and Annual Information Form, both of which are available on Centerra's website. Although Centerra believes that the assumptions inherent in these forward-looking statements are reasonable, the reader should not place undue reliance on these statements. Forward-looking information is as of December 31, 2017 Centerra disclaims any intention or obligation to update or revise any forward-looking statements whether as a result of new information, future events or otherwise. The data in this Report has not been independently verified.

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