Elk Valley Water Quality Plan 2022 Implementation Plan Adjustment Overview

July 2022

Teck


Teck operates on the traditional territory
of the Ktunaxa Nation in ʔamakʔis Ktunaxa.

About this Document

The 2022 Implementation Plan Adjustment (IPA) Overview provides a summary of Teck's most recent plans and progress implementing the Elk Valley Water Quality Plan (EVWQP). The EVWQP is a long-term plan with the goal of stabilizing and reducing the trend of selenium and other constituents and improving the health of the watershed, while at the same time allowing for continued sustainable mining in the region. It includes historical background on water quality challenges, how the EVWQP was developed, how science is used to adapt the plan, site-specific challenges, water treatment progress to date and future treatment plans.

The **2022 IPA** provides a schedule of treatment capacity to:

- Mitigate impacts on the environment and meet regulatory and permit compliance
- Support the objectives of the EVWQP
- Guide the data collection, engineering, design, permitting, construction, commissioning and operations of Teck's future treatment facilities
- Meet Teck's internal sustainability objectives, values and policies
- Support sustainable mining

2022 IPA highlights include:

- Bringing more water treatment online faster, compared to the **2019 IPA**
  - A fourfold increase in water treatment capacity in 2022, compared to 2020
  - An eightfold increase in water treatment capacity by 2027, compared to 2020
- Advancements in new water treatment technologies, including utilizing Saturated Rock Fill, and progress toward breakthrough source control technologies to prevent constituents from entering the watershed
- Achieving one of the primary objectives of the EVWQP: stabilizing and reducing the selenium trend in the Elk Valley, including in the Koocanusa Reservoir

The full 2022 IPA can be found **here**.

The Regional Water Quality Model can be found **here**.

1. The Journey

Background

Water quality in the Elk Valley is connected to a long history of mining in the region. For more than 120 years, the Elk Valley has been home to steelmaking coal mining operations. The mining process generates large quantities of leftover rock that contain naturally occurring constituents such as selenium, an element that is essential for human and animal health in small amounts. Water from precipitation and runoff flows through leftover rock and carries selenium and other constituents to the local watershed. If present in high enough concentrations, these constituents can adversely affect aquatic health. Our goal is to stabilize and reduce the trend of selenium and other constituents to help support the ongoing health of the watershed, while allowing for continued sustainable mining in the region. We are committed to protecting water quality in the Elk Valley now, and for generations to come.

Early Research to Understand the Challenge

Elevated selenium was first identified at Fording River Operations in 1995. This led to the initiation of the Elk Valley Selenium Task Force that began as an industry table involving three operating companies in the Elk Valley, and expanded to include regulators and Indigenous governments. This group did much of the early research into the effects of selenium and the strategies to mitigate effects. In 2001, the B.C. Government established a water quality guideline for selenium. In late 2008, Teck purchased and consolidated full ownership of the Elk Valley operations. From 2008 to 2010 we advanced research, and in 2010 we established a comprehensive research and development program, commenced development of regional scale management plans and began to formalize site-specific effects thresholds.

From 2011 to 2013, Teck piloted four active treatment technologies at our Line Creek Operations and multiple treatment options at Fording River Operations. These pilot projects helped us understand the technology best suited to remove selenium and nitrate from the water while managing risk to sensitive aquatic environments.

In 2012, Teck drafted the Valley-Wide Selenium Management Plan. This was the first cumulative effects

management plan focused on water quality in the Elk Valley and was based on more than a decade of scientific work. It proposed environmental management levels of selenium for protection of aquatic health and outlined a treatment plan to meet those levels. The Valley-Wide Selenium Management Plan formed the foundation of what would later become the Elk Valley Water Quality Plan (EVWQP).

In April 2013, the B.C. Ministry of Environment issued Ministerial Order No. M113 (the Order). The Order provided the necessary regulatory framework for Teck to develop an area-based management plan to identify actions to manage water quality downstream of our steelmaking coal mines in the Elk River watershed and the Koocanusa Reservoir.

Developing the Elk Valley Water Quality Plan

Between 2013 and 2014, Teck developed the EVWQP with input from the public, Indigenous governments, provincial and federal governments, independent technical experts and other stakeholders. The EVWQP includes water quality limits that aim to stabilize and reduce the trend of selenium and other constituents from mining, and support the ongoing health of the watershed.
Teck submitted the EVWQP to the Minister of Environment in July 2014 and it was approved in November that same year. The EVWQP included an Initial Implementation Plan (IIP). This was the original water treatment mitigation plan established to achieve location-specific water quality limits for selenium, sulphate, nitrate and cadmium in surface water at specific locations throughout the Elk Valley and in the Koocanusa Reservoir. The IIP is updated every three years based on evolving science and experience. This is done through the development of an Implementation Plan Adjustment (IPA). The previous IPA was completed in 2019.

Since the 2019 IPA, Teck has made progress towards stabilizing and reducing the trend of selenium and other constituents. In addition to operation of the West Line Creek Active Water Treatment Facility (AWTF) at our Line Creek Operations (completed in 2014), we have doubled treatment capacity at our Elkview Saturated Rock Fill (SRF). Construction has also been completed on the Fording River Operations South AWTF (20 million litres per day treatment capacity) and the Fording River Operations North SRF Phase 1 (9.5 million litres per day treatment capacity). There will be an additional 20.5 million litres per day of constructed treatment capacity with completion of the Fording River Operations North SRF Phase 2 by the end of 2022. At Fording River Operations, the Kilmarnock Water Diversion has been constructed and is conveying up to 86 million litres of water per day. Clean water diversions can reduce the volume of water affected by leftover rock, thereby reducing the amount of water that needs to be treated.

Adaptive Management Based on Science and Data

The Elk Valley Water Quality Plan (EVWQP) is designed to be adaptive and to incorporate new findings and respond to change. As such, we are constantly researching new technologies to help meet our water quality goals faster and more efficiently. We have a comprehensive research and development program that has led to breakthrough technologies such as Saturated Rock Fill (SRF) water treatment facilities. The first SRF was constructed and piloted at Elkview Operations, with water treatment beginning in 2018 and currently operating with the capacity to treat up to 20 million litres of water per day. The first phase of Teck's second SRF is now commissioning, and the second phase is under construction at Fording River Operations.

Other innovative work is being advanced by our research and development team on source control options designed to prevent the release of selenium and nitrate from leftover rock in the first place. Teck is currently constructing a suboxic zone, which is a form of source control, at our Elkview Operations in an area called Cedar North.

While Teck has had many successes in implementing the EVWQP, we have also faced challenges in meeting some short- and medium-term water quality limits. We discovered the presence of a previously unknown species of selenium in the outflow from our West Line Creek AWTF. We had to develop new solutions to understand and respond to this challenge. This temporarily paused water treatment at the West Line Creek AWTF and delayed construction of the Fording River Operations South AWTF — which was also slowed due to COVID-19 impacts — while we further studied and refined the technology. While the delay slowed our initial implementation, these findings proved extremely valuable, as the facilities are now operating as planned, achieving near-complete removal of selenium and improving water quality, demonstrating the effectiveness of the adaptive management approach.

Major Improvements in Water Quality

The EVWQP is the largest water quality management program of its kind in the world, and is improving water quality. Teck's water treatment facilities are achieving approximately 95% removal of selenium and nitrate from treated water. This year, we expect to achieve one of the primary objectives of the EVWQP: stabilizing and reducing the selenium trend in the Elk Valley. We expect further significant reductions of selenium and nitrate as additional facilities come online and as additional sources are treated. We are on track to have capacity to treat up to 77.5 million litres of water per day in 2022, a fourfold increase in treatment capacity over 2020. To date, Teck has spent more than $1.2 billion implementing the EVWQP. Between 2022 and 2024, we plan to invest up to $750 million more in work to protect the watershed.

About Teck's Elk Valley Operations

Teck's operations in the Elk Valley produce among the lowest carbon-intensity steelmaking coal in the world. This is an essential resource for steel production, which is required to support the global transition to net-zero greenhouse gas emissions. In total, Teck's Elk Valley operations sustain 30,000 jobs and contribute $1.5 billion annually to government revenues. Teck's operations directly employ more than 4,000 people in the region who are committed to protecting the environment.

2. About the Elk Valley Water Quality Plan

The EVWQP identifies the water quality mitigation required to stabilize and reduce concentrations of selenium, sulphate, nitrate and cadmium downstream of Teck's mines. The EVWQP guides water quality management in the Elk Valley and has four environmental objectives, including:

- Protecting aquatic ecosystem health
- Managing bioaccumulation of mine-related substances in the environment
- Protecting human health
- Protecting groundwater

The EVWQP was developed in cooperation with governments in Canada and the United States, Indigenous governments, communities, independent scientific experts and others. It was approved by the B.C. Government in 2014.

That same year, the B.C. Ministry of Environment issued Permit 107517 (the Permit) under the *Environmental Management Act*, which includes water quality concentration limits for selenium, sulphate, nitrate and cadmium in the creeks and rivers downstream of operations. Teck is required to monitor water quality at more than 130 locations in the Elk Valley and within the Koocanusa Reservoir. The purpose of this monitoring is to evaluate water quality and to allow for the early detection of emerging water quality concerns. Monitoring results are used to inform management decisions for the protection of aquatic and human health.

There are two types of water quality limits in Permit 107517: Site Performance Objectives (SPOs), which apply at Order Stations, and compliance limits, which apply at compliance points. The water quality limits are science-based and were set to protect aquatic and human health. In total, there are seven Order Stations and seven compliance points and each one has specific limits for selenium, sulphate, nitrate and cadmium. The compliance points and Order Stations are water quality monitoring locations, and the compliance points are set closer to Teck's mine operations than the Order Stations.

The locations of the Order Stations and compliance points are identified in Figure 2. Please note that one of the locations (GH_FR1) is both a compliance point and an Order Station.

Regional Water Quality Model

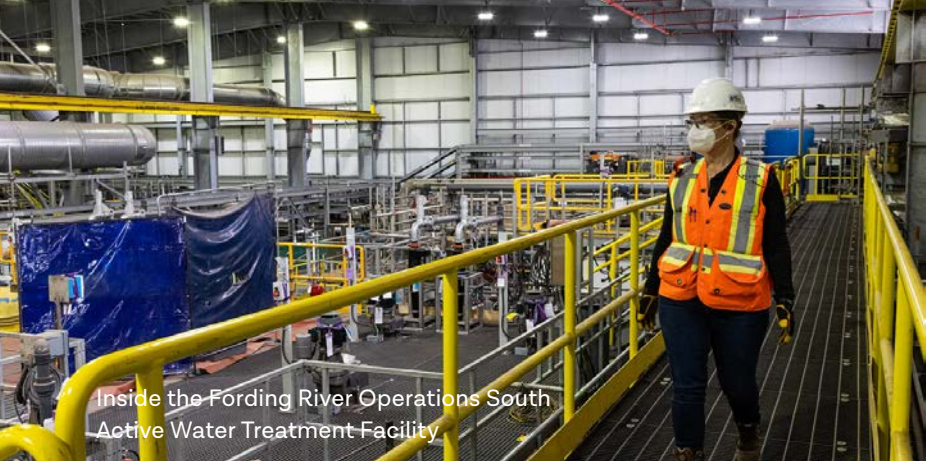
In 2014, Teck developed the Regional Water Quality Model (RWQM) to predict how historical, current and future mining activities will affect water quality in the Elk Valley. Teck used the RWQM to support the development of the EVWQP.

The RWQM is updated every three years to meet the requirements outlined in Permit 107517 and the *Mines Act* C Permits. These permits also require the water treatment mitigation plans to be updated every three years.

Teck is constantly advancing its understanding of the environmental setting of our mines and how they influence downstream water quality. Through this understanding, we add new, proven treatment technologies to our mitigation options. These new findings are incorporated into the RWQM updates and are then factored into the updates for the Implementation Plan Adjustment (IPA).

The 2020 RWQM can be found **here**.

There have been two updates to the IPA since the development of the Initial Implementation Plan (IIP). The water treatment mitigation plan presented in this summary document is the 2022 IPA.



Inside the Fording River Operations South Active Water Treatment Facility

Treated water outflow at Elkview SRF Treatment Facility

3. Significant Progress Improving Water Quality

Since 2014, we have made significant progress treating water in the Elk Valley. We have built and are operating our first water treatment facility at our Line Creek Operations as well as our second facility at our Elkview Operations. In 2020, we doubled the size of the Elkview water treatment facility. We have also completed and are operating our third water treatment facility at our Fording River Operations. In addition, our fourth water treatment facility is commissioning at our Fording River Operations. Later in 2022, Teck will have capacity to treat up to 77.5 million litres of water per day, a fourfold increase from our treatment capacity in 2020. See Figure 1 and Table 1.

In addition to treating water, preventing constituents from entering the watershed in the first place and reducing the need for water treatment is a priority for Teck. Best practices for water management and blasting have been implemented to help reduce the release of constituents. Teck is also working to incorporate water quality considerations earlier in the mine planning process to minimize impacts where possible.

Research and Development: Breakthrough Innovations for Water Treatment and Source Control

We are constantly researching new technology, and we have more than 25 research and development projects underway to help reach our water quality goals. Breakthrough technologies from this research and development include:

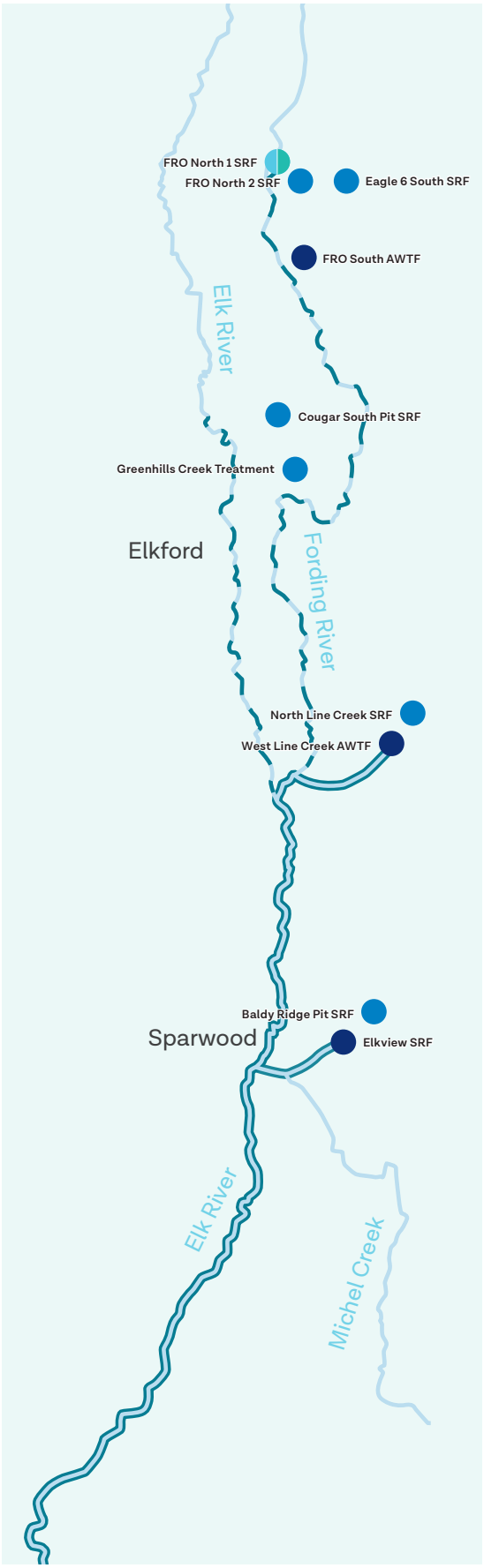
Saturated Rock Fill (SRF): SRFs use naturally-occurring biological processes in former mining areas that have been backfilled with rock and saturated with water to remove selenium and nitrate. Water for treatment is first injected into the SRF. Natural bacteria then convert dissolved forms of selenium into a solid form which remains securely stored in the SRF and nitrate becomes an inert nitrogen gas which is safely released. The treated water is then pumped out of the SRF and returned. SRF treatment offers significant benefits. SRFs are quicker to build and less complex to operate, have lower capital and operating costs, treat larger volumes of water, use less energy and have a smaller environmental footprint. More information on the effectiveness of SRFs can be found in our research paper **here**.

Nitrate reduction: Our research and development program led to the development of a new nitrate prevention technique that uses liners that prevent nitrate from blasting from coming in contact with water. This technique has been applied across our operations in the Elk Valley and the majority of blast holes now utilize a liner that prevents nitrate from blasting from entering the watershed, protecting water quality.

Suboxic zones: The development of suboxic zones is the next step in our evolution of managing water quality. By modifying our rock placement, we are looking to reduce air flow and create a low oxygen environment that, if successful, may reduce the amount of selenium and other constituents leaving leftover rock and entering the watershed. Teck is currently constructing the Cedar North suboxic zone at Elkview Operations and is planning to construct our second suboxic zone at Fording River Operations in 2023.

Teck also continues to evaluate other source control options that can be incorporated into planning and operations. We will look for opportunities to trial these methodologies.

Figure 1: Water Treatment Facilities Locations and Treatment Capacity (Selenium and Nitrate)*



Fording River Operations (FRO)

FRO South AWTF

2022
20 million litres per day†

FRO North 1 SRF

Phase 1	Phase 2	Phase 3
2022	2022	2025
9.5 million litres per day	30 million litres per day total	40 million litres per day total

FRO North 2 SRF

2026
20 million litres per day

Eagle 6 South SRF

2032
6.5 million litres per day

Greenhills Operations (GHO)

Greenhills Creek Treatment

2027
3 million litres per day

Cougar South Pit SRF

2042
3 million litres per day

Line Creek Operations (LCO)

West Line Creek AWTF

Completed
7.5 million litres per day

North Line Creek SRF

Phase 1	Phase 2	Phase 3
2025	2030	2033
12.5 million litres per day	22.5 million litres per day total	40 million litres per day total

Elkview Operations (EVO)

Elkview SRF

Phase 1	Phase 2	Phase 3	Phase 4
2021/2022	2023	2027	2036
20 million litres per day	24 million litres per day total	39 million litres per day total	42 million litres per day total

Baldy Ridge Pit SRF

2042
5 million litres per day

Water Treatment Facilities

Legend

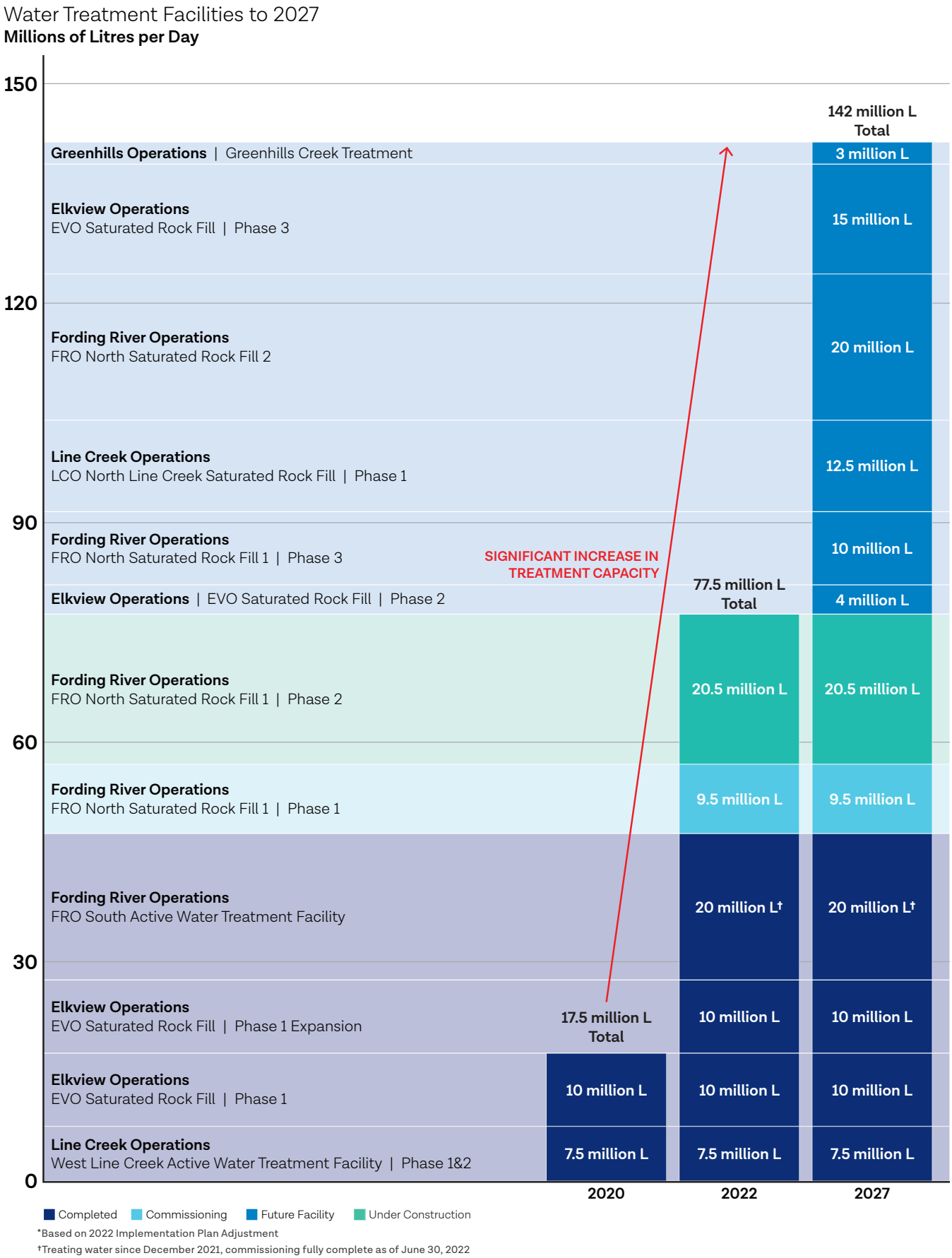
- Completed
- Under construction
- Commissioning
- Downstream reduction in selenium and nitrate
- Future facility
- Future downstream reduction in selenium and nitrate

*Based on 2022 Implementation Plan Adjustment

†Treating water since December 2021; commissioning fully complete as of June 30, 2022

Note: cadmium treatment not required

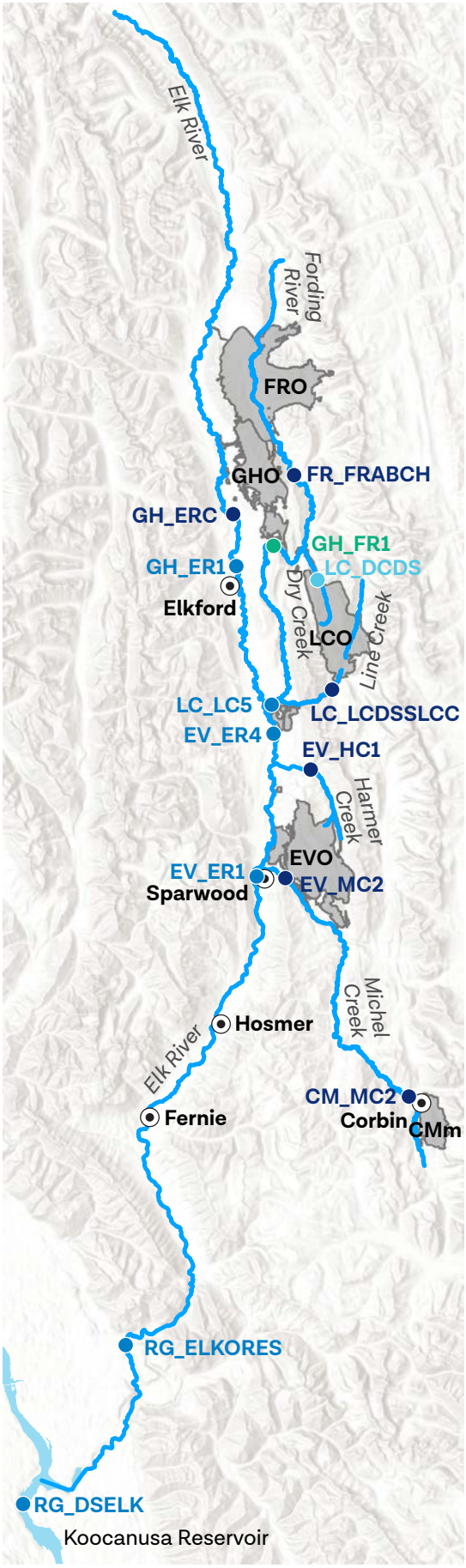
Table 1: Water Treatment Facilities in the 2022 IPA



*Based on 2022 Implementation Plan Adjustment

†Treating water since December 2021, commissioning fully complete as of June 30, 2022

Figure 2: Order Station and Compliance Point Locations



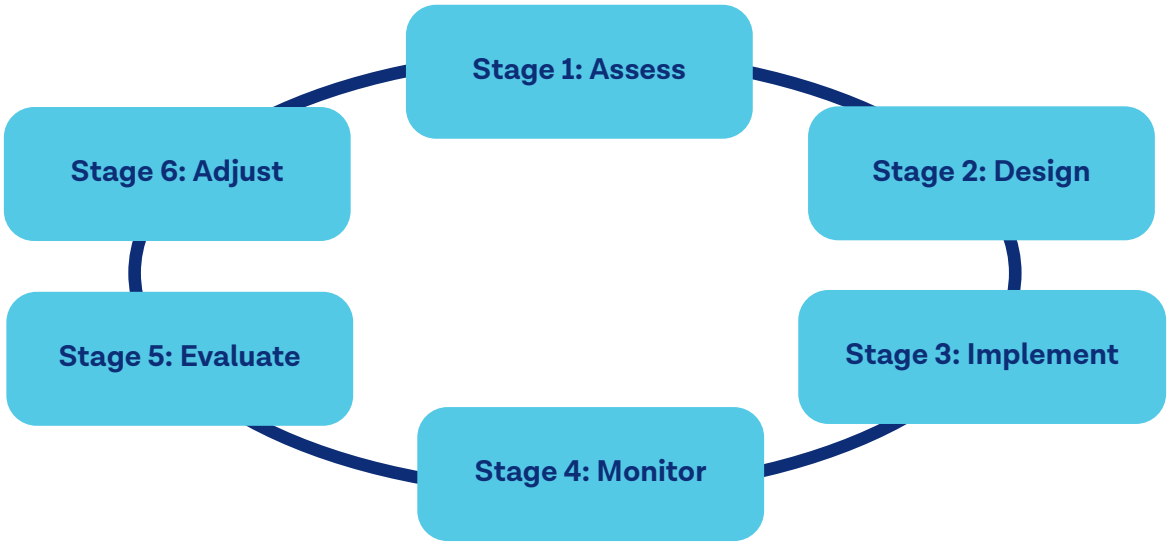
- **Order Stations**
  - GH_ER1 — Elk River upstream of Boivin
  - LC_LC5 — Fording River downstream of Line Creek
  - EV_ER4 — Elk River upstream of Grave Creek
  - EV_ER1 — Elk River downstream of Michel Creek
  - RG_ELKORES — Elk River at Elko Reservoir
  - RG_DSELK — Koocanusa Reservoir downstream of the Elk River
- **Compliance Points**
  - FR_FRABCH — FRO Compliance Point
  - GH_ERC — GHO Elk River Compliance Point
  - LC_LCDSSLCC — LCO Compliance Point
  - EV_HC1 — EVO Harmer Creek Compliance Point
  - EV_MC2 — EVO Michel Creek Compliance Point
  - CM_MC2 — CMm Michel Creek Compliance Point
- **Order Station/Compliance Point**
  - GH_FR1 — Fording River downstream of Greenhills Creek GHO Fording River Order Station and Compliance Point
- **LCO Dry Creek**
  - LC_DCDS — LCO Dry Creek is a compliance monitoring location for water quality with permit limit
- **Teck Operations**
  - FRO — Fording River Operations
  - GHO — Greenhills Operations
  - LCO — Line Creek Operations
  - EVO — Elkview Operations
  - CMm — Coal Mountain mine

4. Always Adapting: About the 2022 Implementation Plan Adjustment

Teck was directed under Permit 107517 to develop an Adaptive Management Plan (AMP) to support the implementation of the EVWQP. This was done in order to support the protection of human health and the environment, and to facilitate the continuous improvement of water quality in the Elk Valley.

The 2022 IPA is Teck's third water treatment mitigation plan and the second adjustment since the Initial Implementation Plan. It is a long-term mitigation plan driven by adaptive management. It aims to protect water quality downstream of our operations. It outlines the adjustments made to the water quality mitigation timing and capacity in order to meet the water quality limits set out in the EVWQP. Through the development of the 2022 IPA, Teck provided opportunities to share information and gather feedback from external parties, including the Ktunaxa and other governments.

Adaptive management is a systematic, science-based, rigorous approach to environmental management that, through targeted research, reduces key uncertainties, strives to meet multiple management objectives and adapts management actions. The AMP is guided by six management questions to collectively address Teck's regulatory requirements and the environmental management objectives of the EVWQP. The stages of the adaptive management cycle are: assess, design, implement, monitor, evaluate and adjust. When triggers or unexpected conditions are identified, the response framework within the AMP is followed. This includes a process of notification, confirmation, investigation and adjustment.



5. Permit Compliance

In November 2014, the B.C. Ministry of Environment issued Permit 107517 (the Permit) under the *Environmental Management Act*. The Permit, along with permits from the Ministry of Energy, Mines and Low Carbon Innovation, made many of the actions and commitments described in the EVWQP legal requirements. To maintain compliance with the Permit, Teck must meet requirements including the construction and operation of water treatment facilities according to specified timelines, and the achievement of water quality limits.

Water Quality Limits

Permit 107517 sets water quality concentration limits that are protective of aquatic and human health. There are 14 locations with these limits – seven compliance points with compliance limits at mine sites, and seven Order Stations with Site Performance Objectives (SPOs) located downstream from the mine sites. The location GH_FR1 is both a compliance point and an Order Station (see Figure 2). Concentrations and compliance at these locations are influenced by seasonal variation in flow as a result of snowpack melt and precipitation. At each of these 14 locations, limits step down (become more stringent) over time, as outlined in the long-term water quality objectives set in the EVWQP. Since 2015, water quality has met these limits an average of 95% of the time.

Timelines to achieve the water quality limits were based on the best science and available technology at the time of the development of the EVWQP (2014). At that time, selenium experts were unaware of a critical issue related to water treatment operations and bioavailability of selenium. Further study successfully refined treatment technology, which resulted in a delay of the treatment timeline in our Initial Implementation Plan (IIP). Construction delays were also experienced due to the impacts of COVID-19.

Achieving Compliance

Compliance is currently being achieved and is projected to be maintained at Order Stations located in the Elk River upstream of Boivin (GH_ER1) and at Elk River at Elko Reservoir (RG_ELKORES). Compliance is also being achieved and is projected to be maintained at the Greenhills Operations Elk River compliance point (GH_ERC) and at the Harmer Creek (EV_HC1) and Michel Creek compliance points (EV_MC2 and CM_MC2) at Elkview Operations and Coal Mountain mine, respectively.

We expect to be in compliance for selenium and nitrate at all 14 locations following the commissioning of the Fording River Operations North 1 SRF (Phases 2 and 3), the Fording River Operations North 2 SRF, the Line Creek Operations North Line Creek SRF Phase 1 and the Elkview SRF Phase 3 (see Figure 1 for water treatment schedule).

As treatment comes online, selenium and nitrate concentrations will steadily decrease. Compliance is projected to be achieved in varying years, as summarized in the **2022 Implementation Plan Adjustment**. We expect full compliance to be met and maintained at 11 of the 14 locations by mid-2026. Full compliance is projected to be met and maintained at all 14 locations by mid-2028, since seasonal fluctuations in flow will continue to be a factor until further treatment is operational.

We have prepared the 2022 IPA to achieve full compliance as soon as possible. Our timelines consider design, permitting, construction and operating schedules. Facilities need to fit the specific environment for which they are designed and take into account important site-level information such as water flows and building footprints.

Sulphate compliance is currently met at all 14 locations, and sulphate treatment is planned at Fording River Operations, Line Creek Operations and Elkview Operations. Seasonal fluctuations in flow, prior to treatment being operational, result in the potential for concentrations to be above limits, but full compliance is projected to be met and maintained at all 14 locations in early 2026, following the commissioning of the sulphate treatment.

Addressing Water Quality at Specific Locations

The 2022 IPA is Teck's plan to bring more water treatment online faster to meet water quality limits. Teck has implemented new technology, the latest science, and industry-leading best practices for water management to help reduce the release of constituents across all of our Elk Valley operations.

Fording River Operations and Greenhills Operations

At Fording River Operations and Greenhills Operations, we are working to meet permitted selenium and nitrate concentration limits and requirements under an Environment and Climate Change Canada Direction. We will have the capacity to treat up to 50 million litres of water per day, which treats water from both the Fording River Operations and Greenhills Operations in 2022 as we ramp up water treatment capacity at the Fording River South AWTF and the Fording River North SRF. This work is in conjunction with the operation of the Kilmarnock Water Diversion, which reduces the volume of water affected by leftover rock. In addition, we are planning to test an emerging source control option called suboxic zones at our Fording River Operations.

Through our monitoring program, we also learned that there is more mine-affected water coming from the Kilmarnock drainage at our Fording River Operations than

we originally planned for and understood. To address this, we made design changes to enhance water collection. We also adjusted the future mitigation plans at Fording River Operations to include the collection and treatment of groundwater, in addition to the surface water already targeted for water treatment.

In 2021, Teck successfully completed a pilot of sulphate technologies for use in the Elk Valley that demonstrated over 90% sulphate removal. Fording River Operations will be the second location where Teck implements sulphate treatment at up to 8.5 million litres of water per day. This will be operational in 2026.

Elkview Operations

At Elkview Operations, we have successfully reduced selenium concentrations with the operation of the Elkview SRF at up to 20 million litres of water per day with an expansion in treatment capacity of up to 4 million litres per day in 2023 and up to 15 million litres per day to be completed in 2027. In addition, we are currently constructing a suboxic zone at the Cedar North Spoil.

Line Creek Operations

At Line Creek Operations, in Line Creek, we have successfully reduced selenium concentrations with the operation of the West Line Creek AWTF. We also identified and solved challenges related to selenium compounds in the treated water through the implementation of a new advanced oxidation process (AOP). Nitrate concentrations have been reduced overall with blasting best practices. In order to treat water with higher concentrations of selenium and nitrate at the West Line Creek AWTF, we are installing a pipeline from the Mine Services Area West backfill pit to the West Line Creek AWTF, which will further improve water quality. The next phase of water treatment is in progress at Line Creek Operations. This includes the North Line Creek SRF, which will treat up to 12.5 million litres of water per day (including sources from the Line Creek and Dry Creek watersheds). It is expected to be fully operational at the end of 2025.

We also learned that there is more mine-affected water at Line Creek Operations in West Line Creek than originally understood. Groundwater from this catchment has been included as a source for treatment in this IPA.

Line Creek will be the first location where Teck implements sulphate treatment at up to 2.5 million litres of water per day. This will be operational in 2025.

At Line Creek Operations, in Dry Creek, we are planning to reduce selenium and nitrate concentrations by installing a conveyance and supplementation system that has a capacity of up to 30 million litres of water per day. The schedule for operation is dependent upon regulatory approval of this project.

6. Our Ongoing Commitment to Water Quality

The EVWQP is working. In 2022, Teck will have the capacity to treat up to 77.5 million litres of water per day — a fourfold increase from our treatment capacity in 2020 — with a near-complete removal of selenium and nitrate from treated water. An eightfold increase in water treatment capacity, compared to 2020, is planned to be in place by 2027. We remain focused on our research and development program so that we can create innovative ways to meet our water quality goals and face new challenges head-on.

We are committed to supporting water quality now, and for generations to come. With the 2022 IPA, we will start to see a step change improvement in water quality in the Elk Valley. This year, we expect to achieve one of the primary objectives of the EVWQP: stabilizing and reducing the selenium trend in the Elk Valley.

Click **here** to read the full 2022 Implementation Plan Adjustment.

To learn more and provide feedback, please visit **teck.com/elkvalley** or contact us at:

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- **feedbackteckcoal@teck.com**

If you leave your contact details, we will respond directly to you.