Burgess Environmental

24 Strathlorne Crescent SW
Calgary, Alberta, T3H 1M8
Telephone: (403) 466-9482
burgessenv@shaw.ca

March 18, 2024

Project #: WILD-01

Wildsight
632 2nd Avenue
Fernie, B.C., V0B 1M0

Attn: Casey Brennan
Simon Wiebe

Dear Sirs:

Subject: Review of Reclamation Security Addressing Selenium Contamination – Teck Coal

Introduction

Accompanying this letter, please find Burgess Environmental Ltd.'s (Burgess') final report titled "*Review of Reclamation Security Addressing Selenium Contamination Teck Coal's Elk Valley Mines*". This report provides a liability estimate to remediate the selenium contamination of water in the Elk Valley that is being caused by Teck Coal's mines, as well as the supporting technical basis to this estimate. Other aspects of reclamation liability associated with these mines, such as surface reclamation, mitigation of other water-borne contaminants, and remediation of used or usable aquifers in the Elk Valley, are not included in this estimate.

This report was distributed in draft form to obtain feedback and comments from key stakeholders. Written feedback was received from Teck Coal in a letter to Wildsight dated March 14, 2024, which is attached to this letter for convenient reference. Verbal feedback was received from the Province during an on-line meeting held on March 15, 2024.

Teck Comments

The following responses are provided to comments made by Teck in its letter dated March 14, 2024:

- Teck states that it "*will have C$1.9 billion of reclamation security in place*" by the end of Q1 2024, which has been confirmed in an email received from the B.C. Ministry of Energy, Mines and Low Carbon Initiative. The value of Reclamation Security of $1.49 billion cited in the Burgess report is based on the Chief Inspector of Mines 2022/2023 Annual Report, and acknowledges that "*this amount is scheduled to increase*". The report has not been changed because I have not been able to access a publicly available document that confirms an increase will occur, or to what amount.
- Teck repeatedly references the B.C. Major Mines Reclamation Security Policy (Interim), and states, "*We encourage you to review the current policy if you are working to produce an accurate comparator to those numbers*". While it may be reasonable for Teck to disagree with certain aspects of how this Policy was interpreted in the Burgess report, for Teck to imply that this Policy was not followed is misleading and incorrect. This Policy was specifically referenced as a

supporting basis for the estimate eight times in the main report, nine times in Appendix A (the description of the liability estimate), and in a meeting with Teck held on March 7, 2024.

- Teck states that, "*simplified assumptions for annual water treatment operating costs . . . result in an overestimation*". As stated in the Burgess report, the annual costs for operation and maintenance of the water treatment facilities are based on my experience and judgment. Information regarding Teck's costs for operating and maintaining these facilities was specifically requested from Teck, and was not provided. It is also noted that the costs incurred by Teck to operate the existing water treatment facilities may not be appropriate or representative in calculating its Reclamation Security because the presumption of the estimate (and Policy) is that these facilities will be operated by a third party, without the benefit and efficiencies associated with an operating mine, and without some or all of the operating know-how and experience that Teck has accumulated over the past 10 years.
- Teck further states that, "*not treating water treatment capital costs consistent with government policy; which contributes ~$800M to the overestimation*". The capital cost of treatment was included in the Burgess estimate for two reasons. First, it is my understanding that capital costs for water treatment should be included in the reclamation liability cost estimate, and that the Chief Permitting Officer has the discretion to exclude those capital costs from the Reclamation Security. Second, the Chief Permitting Officer's discretion appears to be based, at least in part, on the mine operator meeting its schedule, which in Teck's case, it has not. The discretion of the Chief Permitting Officer in this matter is clearly acknowledged in the Burgess report; "*the Policy guidelines (B.C., 2022a, Table 1) allows the Chief Permitting Officer to exclude the capital costs of water treatment facilities under certain circumstances*".
- Teck implies that the application of the 4% discount rate identified in the government policy should include a four-year lag, although it is not entirely clear what is meant by this comment. The Burgess estimate assumes that capital costs would be incurred in Year 1, as would operation and maintenance costs for existing water treatment facilities. The rationale for this assumption is that selenium concentrations in the Elk River valley will immediately start to exceed the water quality targets if the mines go into receivership and those facilities stop operating. It is assumed that the Province would be under intense pressure to remedy this situation, and would contract this work as a priority.

Teck goes on the state, "*we have constructed four water treatment facilities to date with capacity to treat 77.5 million litres of water per day, a four-fold increase from treatment capacity in 2020. The plan is working, selenium concentrations have stabilized and are now reducing downstream of treatment*." I agree, and it is recognized in the Burgess report, that the new treatment facilities are likely to have a positive effect on selenium concentrations in the Elk River watershed. Teck was specifically requested to provide the most recent water quality data relative to model predictions so that information could be incorporated into the report. That information has not been provided.

B.C. Ministry Comments

During our conference call on March 15, 2024, representatives of the Ministry of Environment and the Ministry of Energy, Mines and Low Carbon Initiative suggested that we review the Elk Valley Water Quality Plan 2022 Implementation Plan Adjustment (2022 IPA) prior to finalizing our report, and that the current model predictions and data are more relevant than the 2014 and 2017 model predictions and data included in the Burgess report.

As requested, we have reviewed the 2022 IPA and agree that it provides additional implementation detail and is well supported by technical analyses and assessments that is generally included in the reports that were previously reviewed. In this regard, both Teck and the Province are to be commended. Teck's plans, as communicated in a 2023 update, which is consistent with the 2022 IPA, were adopted (without modification) to calculate the selenium-related liabilities. Only selenium-related water treatment facilities planned to be constructed through 2027 were included in this estimate, and they were assumed to be constructed within Year 1 of the calculation. If this estimate was adjusted to reflect the timing of new treatment facilities, as specified in the 2022 IPA, the result would be to defer some of the capital and operating costs by 1 to 3 years. This would result in a reduction of the total calculated liabilities by less than 10%. This was not done for two reasons. First, and as previously stated, the pressure to address selenium contamination in the Elk River would be very high should the mine operator default on its obligations. Second, the current state and scheduling of new facility construction is not always clear in reading the Teck reports that are made publicly available.

Notwithstanding the above, questions remain that could result in higher than predicted costs and liabilities. These questions include, but are not necessarily limited to, the following:

- Will the concentrations of selenium leaching from Teck's mines remain consistent with model assumptions as the mines age and expand?
- Will the saturated rock fills continue to perform in accordance with design assumptions, over the long term?
- Is it possible and practical to efficiently capture selenium contaminated water as the number and capacities of the water treatment facilities expand?

Aspects of these questions are identified and assessed as "*key uncertainties*" in the 2022 IPA.

We agree that the 2020/2022 model reliability is improved and that the current data, in particular the data collected in late 2023 and early 2024, are most relevant to evaluating the efficacy of the existing treatment facilities and the updated model. Significant reduction in selenium concentrations in the Elk River watershed were predicted, and are expected to occur in 2024. Water quality data for this period was not available at the time the Burgess report was prepared and (as noted above) has been requested from Teck. The 2014 and 2017 model predictions were included in the Burgess report to evaluate the reliability of past model predictions. As stated in our report, the most recent model update is expected to be more reliable and representative, but there is insufficient data to verify this. Many years of data will be required to evaluate the efficacy of the current model, and there are many variables at play regarding selenium leaching from Teck's mines.

Letter Closure

I trust that the accompanying report meets your current needs, and appreciate having the opportunity to provide our services on this project. If you have any questions or further information requirements, please contact the undersigned.

Yours sincerely,

BURGESS ENVIRONMENTAL LTD.

Gordon J. Johnson, M.Sc., P.Eng.
President

Review of Reclamation Security Addressing Selenium Contamination Teck Coal's Elk Valley Mines

Submitted to:
Wildsight

Date:
March 18, 2024

Burgess Environmental Ltd.
24 Strathlorne Crescent SW
Calgary, Alberta, T3H 1M8
Telephone: (403) 466 9482
Email: burgessenv@shaw.ca

Author:
Gordon J. Johnson, M.Sc., P.Eng.

Burgess Environmental

Table of Contents

List of Tables

List of Inserts

List of Inserts (continued)

List of Figures

SUMMARY OF OPINIONS

Wildsight retained Burgess Environmental Ltd. (Burgess) to estimate the costs to remediate the selenium contamination in the Elk Valley watershed that is emanating from Teck Coal's mines (**Figure 1.1**), which is the subject of this report. Wildsight is specifically concerned that Teck's Reclamation Security (B.C., 2022a) is adequate to cover the cost of remediating this selenium contamination, which is expected to leach out of these mines for many decades (Teck, 2014, PDF page 4 of 290), and potentially centuries.

The cost estimate to remediate the selenium contamination emanating from Teck's mines is $6.4 billion, which is summarized in **Table E.1** and presented in detail in **Appendix A**. It is understood that the associated Reclamation Security owing can be reduced by up to 25% because Teck's mines have been operating for more than five years, and are expected to operate for at least five more years (B.C., 2022a). This estimate excludes other reclamation requirements, such as surface reclamation and the remediation of other water-based contaminants.

Table E.1
Cost Estimate for Mitigation of Selenium Contamination

Reclamation Requirement	Cost	
Elkview	$	1.03 billion
Line Creek	$	1.86 billion
Fording River	$	2.88 billion
Greenhills	$	0.56 billion
Elk Valley Monitoring	$	0.07 billion
Total Reclamation Security	$	6.40 billion
Net Reclamation Security	$	4.80 billion

This cost estimate was calculated in general accordance with the B.C. (2022a) Policy guidelines regarding calculation of Reclamation Security. It is based on continued operation of Teck's existing facilities and programs for selenium remediation, the construction and operation of those planned through 2027 by Teck (2023g), and achieving the water quality targets proposed by Teck (2014). No additional measures were assumed to be required to remediate the selenium contamination. This assessment is based on the following:

- data, information, reports, and plans made available to the public by Teck Coal
- data, information, reports, and plans made available by the B.C. government
- publicly available information, including technical analyses completed by others

- the experience and judgment of the author
- a visit to the Elk Valley watershed completed in February 2024

It is further noted that the Mines Act provides the Chief Permitting Officer with discretion regarding the amount and type of Reclamation Security that is required of a major mine operator, and that the Policy guidelines (B.C., 2022a, Table 1) allows the Chief Permitting Officer to exclude the capital costs of water treatment facilities under certain circumstances. The capital costs for water treatment included in this estimate amount to approximately $800 million.

In addition to completing this cost estimate, Wildsight asked Burgess to respond to the following questions.

1. **Does the selenium contamination in the Elk River originate from Teck's mine operations in the Elk Valley?**

Yes. In 2010, Teck formed a stakeholder outreach program to address water quality in the Elk Valley. A Ministerial Order to address this contamination was issued to Teck by the B.C. government in 2013. A formal Elk Valley Water Quality Plan was published by Teck (2014), and has been modified since that time (Teck, 2023g).

Review of the surface water and groundwater quality data published by Teck for its mining operations in the Elk Valley indicate a common and definitive pattern of selenium contamination emanating from these mines. Groundwater and surface water samples collected at these mines routinely measure selenium concentrations more than 2 orders of magnitude higher than B.C. (2023a) water quality guidelines and expected background concentrations. High concentrations of selenium are measured in the watersheds draining these mines, which are gradually diluted in the major water courses (e.g., Fording River and Elk River) as non-impacted creeks and streams confluence with these major water courses (see **Section 5**).

2. **Are Teck's current measures adequate for remediating the selenium contamination?**

No. **Table 1.1** summarizes the chronology of Teck Coal, implementation of the Elk Valley Water Quality Plan, and changes to that Plan. By the end of 2023, Teck was operating active water treatment facilities at its Line Creek and Fording River Mines, and had commissioned a saturated rock fill treatment facility at its Elkview Mine. Teck was also constructing a saturated rock fill treatment facility at its Fording River Mine, which was scheduled for commissioning in 2023 (Teck, 2023c). The total current water treatment capacity in the fall of 2023 was approximately 47,500 m^3/day (Teck, 2023g). Review of water quality information collected at the Order

Stations in the Elk Valley watershed through 2022 indicates that selenium concentrations were continuing to increase at all seven Order Stations and regularly exceeded the water quality targets developed by Teck (2014) at four of the seven Order Stations (see **Section 5**). Based on extrapolation of data trends, exceedances of these water quality thresholds at some of these Order Stations are expected to occur more frequently and to a higher degree in the future if additional treatment facilities are not constructed.

Teck's total water treatment capacity of 47,500 m^3/day represents only a small fraction of the water impacted by Teck's mine operations, and operating levels are often below the design capacities (B.C., 2024). The total area disturbed by Teck's mining operations exceeds 16,000 hectares, and most of this area is covered by mine spoil (see **Section 3, Table E.2**). Assuming an average annual precipitation of approximately 950 mm (Teck, 2022a, PDF page 23 of 241) and annual evapotranspiration of 250 mm (Teck, 2023, PDF page 75 of 241), Teck's total treatment capacity represents less than 20% of the total annual volume of precipitation water that infiltrates mine affected areas. Additional surface water from upstream of the mine-affected areas flows through Teck's waste rock valley fills, which convey comparatively larger quantities of water through Teck's mines and are additional sources of selenium contamination (Teck, 2014). Increasing the treatment capacity is warranted, as Teck (2023g) has committed to do as part of its water quality plan update.

3. Are Teck's planned measures adequate for remediating the selenium contamination?

Possibly. Teck plans to add additional treatment facilities between now and 2027 (see **Table 1.1**), resulting in a total treatment capacity of 150,000 m^3/day (Teck, 2023g). This represents an approximate tripling of the current treatment capacity, which is equivalent to approximately one half of the precipitation water that seeps through the mine spoil piles, annually (see response to **Question 2**). It should also result in significantly higher capture of selenium contamination emanating from Teck's mines, which was estimated to be less than 20% (see **Figure 5-3, Section 5-3**) in 2022. According to Teck, water quality at Order Stations is improving in early 2024, although these data have not yet been made available.

The overall effectiveness of these systems has been predicted using a water quality model, which was first used to predict water quality in Teck's (2014) Elk Valley Water Quality Management Plan, and was updated in 2017 (Teck, 2017) and 2020/2022 (Teck, 2020). The original model underestimated the increase in selenium concentrations in the Fording and Elk Rivers by significant margins, at least in part because treatment systems were completed later than planned (see **Table 1.1**). The updated model predicts a reversal of selenium concentrations in the Elk River once these facilities are commissioned; however, this reversal is not yet evident in the measured concentrations (see **Section 6**) through mid-2023. Also, a significant proportion of mine-impacted water will continue to flow, untreated and unabated, into the Elk Valley watershed, even after commissioning of these additional water treatment facilities.

4. **Is the current Reclamation Security for Teck's Elk Valley coal operations sufficient to fund the selenium remediation requirements?**

No. In 2023, Teck Coal provided $1.49 billion of Reclamation Security financial assurances to the B.C. government for its Elk Valley mine operations, which is based on a total financial liability estimate of $1.91 billion (B.C., 2023b, Appendix C). Although this amount is scheduled to increase, it represents less than 25% of the cost of selenium remediation calculated in this report.

The financial assurances currently provided by Teck do not appear to be reasonable or sufficient when considering Teck's past expenditures. By the end of 2022, Teck had spent $1.45 billion (Teck, 2023h) on selenium remediation, had only constructed 30,000 m^3/day of treatment capacity, and had only operated most of that treatment capacity for one or two years. Teck plans to build 150,000 m^3/day of treatment capacity and will be required to operate those facilities for many decades. It will also need to continue its monitoring, community outreach, and research initiatives throughout this period (i.e., many decades).

5. **Are the selenium remediation requirements the only mine reclamation obligations covered by Teck's Reclamation Security?**

No. The B.C. (2022, PDF page 8 of 24) Policy states, "*reclamation security is intended to cover the cost of reclaiming a site in the event that a mining company defaults on their obligation to do so or becomes insolvent. Costs that must be considered include those necessary to: close and maintain infrastructure such as tailing dams and waste rock dumps; construct, operate and maintain water treatment plants, waste cover systems and other required mitigations; re-contour the site, prepare the surface, place a suitable growth medium, revegetate the site, and implement on-going monitoring and surveillance programs*". The following major reclamation costs have yet to be incurred by Teck, and are not included in the cost estimate for selenium remediation:

- The vast majority of the mine site surface reclamation (approximately 80%, or more than 13,000 hectares) still needs to be completed (**Section 3, Table E.2**). Monitoring and maintenance of the areas that have been revegetated is also required.
- Rehabilitation of water courses will be required in the mined areas. Although many of these water courses have been permanently filled with mine waste rock, others that have been affected (**Section 3**) will need to be rehabilitated to support aquatic life, as

these water courses did before mining. Rehabilitation of streams outside of the mines is also required as a result of the precipitation of calcium carbonate in these streams.

- Groundwater remediation is required. The selenium emanating from the Teck mine operations has contaminated aquifers that are used for domestic supplies to Fernie and Sparwood (see **Section 2.5**), as well as private landowners. These aquifers require remediation to support their continued and future use.
- The mines have also resulted in nitrate, sulphate, calcium carbonate, and other heavy metals contamination of water. Remedial actions are also required to address these contaminants in the Elk River watershed.

Table E.2

Summary of Mine Area Disturbance

Mine	Area Disturbed (ha)	Mine Spoil (ha)	Area Revegetated (ha)	Area Remaining	Source
Elkview	4,501	3,036	1,290	3,211	Teck, 2023a
Line Creek	2,700	1,620	600	2,100	Teck 2023b
Fording River	5,250	3,730	770	4,480	Teck, 2023c
Greenhills	2,933	1,900	450	2,483	Teck, 2023d
Coal Mountain	1,050	700	290	760	Teck, 2023e
Total	16,434	10,986	3,400	13,034	

Can the Province of British Columbia increase the amount of Reclamation Security required from Teck?

Yes. The Mines Act (B.C., 2023b) provides the following authorizations regarding the Reclamation Security required of a major mine operator (see **Appendix A**).

- Subsection (4) provides the chief permitting officer the legal authority to determine the amount and form of financial security required from Teck for (a) mine reclamation, and (b) protection of, and mitigation of damages to, watercourses.
- Subsection (5) gives the chief permitting officer the ability to require annual changes to the security so that funds are available over the life of mine to cover the costs to reclaim and close the mine, to mitigate impacts to the environment, and to fulfill the conditions of the permit and any orders relating to reclamation and the protection of watercourses.
- Subsection (7) provides the chief permitting officer with the ability to change the reclamation security requirements for a mine at any time if it is deemed necessary.

1 INTRODUCTION

1.1 Background

Teck Coal has initiated a process to sell its metallurgical coal mining and processing business (Elk Valley Resources) to Glencore PLC, with a minority stake being sold to Nippon Steel Corporation and continued minority ownership being maintained by Posco Steel Corporation. Wildsight is concerned that appropriate Reclamation Security, which is required by the Major Mines Reclamation Security Policy (B.C, 2022), is in place to cover all of the costs for reclamation of these mines, considering this transfer of ownership. By 2023, Teck Coal had set aside $1.5 billion of Reclamation Security to cover the unplanned closure of its British Columbia (B.C.) coal mines (B.C., 2023b, Appendix C).

Wildsight is specifically concerned that the Reclamation Security is adequate to cover the cost of remediating selenium, which is leaching out of Teck Coal's active and closed mines (**Figure 1-1**), and is expected to continue to leach out of these mines for many decades (Teck, 2014, PDF page 4 of 290), and potentially centuries. By 2022, Teck had reportedly spent over $1.4 billion trying to reduce selenium contamination (Teck, 2023g); however, the concentrations of selenium in the Elk River watershed continued to increase (USGS, 2022, PDF page 2 of 4; **Section 5**). Wildsight has retained Burgess Environmental Ltd. (Burgess) to assess this issue, and provide an independent, third-party estimate of the costs to remediate the selenium contamination emanating from Teck Coal's mines, based on available information.

1.2 Objective and Scope

The objective of this assessment is to estimate the financial liabilities to Teck Coal that are associated with the selenium contamination emanating from its coal mine operations in southeast B.C. The B.C. (2022, PDF page 8 of 24) Policy states, "*reclamation security is intended to cover the cost of reclaiming a site in the event that a mining company defaults on their obligation to do so or becomes insolvent. Costs that must be considered include those necessary to: close and maintain infrastructure such as tailing dams and waste rock dumps; construct, operate and maintain water treatment plants, waste cover systems and other required mitigations; re-contour the site, prepare the surface, place a suitable growth medium, revegetate the site, and implement on-going monitoring and surveillance programs*". As such, the cost of mitigating selenium contamination emanating from Teck Coal's mine operations accounts for only a portion of Teck's reclamation liabilities; surface reclamation of the mines and the remediation of other water pollutants (Teck, 2014, PDF page 4 of 290) also need to be addressed, but are not included in this estimate.

The scope of this assessment includes a review of the relevant background information, which provides the supporting basis for the Reclamation Security estimate and includes the following:

- background information
- a description of the Elk Valley watershed
- a summary of the regulatory basis related to selenium contamination
- descriptions of Teck Coal's mine operations in the Elk Valley, including information relevant to the selenium contamination for each operation
- detailed analyses of the selenium concentrations in surface water and groundwater of the Elk Valley watershed
- assessment of Teck's existing and planned measures to remediate selenium contamination

The Reclamation Security estimate and its supporting basis are presented as **Appendix A**.

1.3 Reliance Materials

This assessment is based on the following:

- data, information, reports, and plans made available to the public by Teck Coal
- data, information, reports, and plans made available by the B.C. government
- publicly available information, including technical analyses completed by others
- the experience and judgment of the authors
- a visit to the Elk Valley watershed completed in February 2024

A large body of information has been developed by Teck Coal, some of which has been submitted to B.C. regulators, which has not been made available publicly. Examples would include, but are not necessarily limited to, regulatory reporting, internal studies and research, and detailed reclamation cost information. This liabilities estimate would benefit from being provided access to this information.

1.4 Selenium Contamination Mechanisms and Water Quality Criteria

The source of selenium is the rock surrounding the coal seams that are mined. This rock influences background concentrations, and where disturbed and placed as waste rock, releases elevated levels of selenium to the receiving environment. Release mechanisms from the waste rock include transformation of selenium to soluble forms (primarily as selenate) via contact with oxygen and water (SAP, 2010, PDF page 34 of 233).

Once released, selenium follows pathways (mine drainage channels, streams, near-surface groundwater) to the receiving environment, unless it is attenuated through reduction to less soluble forms (selenite, elemental selenium, or selenide) in low flow, low oxygen environments (such as marshes and saturated sediments). Receptors in the receiving environment include aquatic organisms such as algae, bottom-dwelling and water-column invertebrates, and fish. These receptors can take selenium up into their tissues directly from water or sediment, or from food. Wildlife (including amphibians, birds, and mammals) that eat aquatic organisms are part of the aquatic-based pathways, and can also be exposed to selenium via water, sediment, or food. Other wildlife such as elk and bighorn sheep are part of terrestrial-based pathways where selenium is taken up by plants growing on waste rock. The plants are, in turn, consumed by wildlife. Humans are receptors in both aquatic and terrestrial systems; exposure may be via drinking water, consumption of fish, or consumption of plants or wildlife (SAP, 2010, PDF page 35 of 233).

Selenium exists naturally in low concentrations (typically < 1 ug/L) in unaffected waters of the Elk Valley. At higher concentrations, it can have a severe impact on ecosystems as it tends to bioaccumulate in the aquatic environment. Oxides of selenium are stable throughout the entire pH scale, making selenium available in the form of selenate (SeO_4^{2-}) and selenite (SeO_3^{2-}) in aquatic ecosystems. Standards have been set to limit the concentration of selenium in surface water that supports aquatic life, as well as drinking water (Ali and Shrivastava, 2021). The maximum concentration set by the World Health Organization (WHO) for selenium in water fit for consumption is 50 µg/L, and the European Union (EU) uses an even more precautious value of 10 µg/L. The United States Environmental Protection Agency (USEPA) has placed a regulatory limit of 3.1 and 1.5 µg/L for water lotic and water lentic ecosystems respectively (USEPA, 2016). B.C. (2023a) has published a water quality guideline of 2 ug/L for the protection of freshwater aquatic life.

Teck's (2014, PDF page 4) Elk Valley Water Quality Plan states, "*to access the coal, large quantities of . . . waste rock, are mined and placed in piles within and adjacent to the mine pits. Water from both precipitation and runoff flows through these rock piles and carries selenium and other substances, including cadmium and sulphate as well as nitrate from blasting residue, into the local watershed. Geochemical study indicates waste rock piles continue to release selenium for a very long period of time. Waste rock placed decades ago continues to release selenium at a steady rate today, and is expected to continue doing so for many decades more*" (**Figure 1-2**).

As a result, Teck's mine operations have contaminated the Elk River, and many of its major tributaries (Fording River, Line Creek, Michel Creek), with selenium. **Section 5** summarizes the selenium impacts to surface water and groundwater in the Elk River Valley. This contamination is not constrained to the Elk River and its tributaries. The Elk River flows into the Kootenay River/ Lake Koocanusa. Below the Libby Dam (and the downstream extent of Lake Koocanusa), the Kootenay River flows through Montana and Idaho, and back into Canada where it flows into Kootenay Lake and its subsequent confluence with the Columbia River at Castlegar.

The impacts to water quality in the Kootenay River system that have been caused by Teck Coal's Elk Valley operations have been measured approximately 100 km downstream of the confluence of the Elk River and Lake Koocanusa (Storb et al., 2023, PDF page 12 of 16), from samples collected from the Kootenay River downstream of the Libby Dam.

1.5 Mitigating Measures

Teck has implemented, or is implementing, measures at its mine operations that are designed to reduce the amount of selenium that leaches into the water systems, or remove the selenium that has leached into water (**Table 1.1**). The primary method being implemented to reduce selenium leaching include source controls and water diversions. Methods that have been implemented to remove selenium from water include active water treatment and saturated rock fills. Active water treatment plants have been constructed at Line Creek and Fording River Mines; saturated rock fill treatment has been pilot-tested and implemented at the Elkview Mine, and recently began operating at the Fording River Mine.

Source Controls

Source control techniques are being investigated and piloted, such as the use of geomembrane covers for waste rock piles, 'naturalized covers' to increase evapotranspiration, and suboxic zones. A geomembrane is a protective layer that can be put on top of a rock pile or other source of mine waste rock. A suboxic zone is a rock disposal area that's engineered to keep oxygen away from waste rock. These techniques prevent waste rock from contacting air and water, which reduces the release of selenium and other substances (B.C., 2024). Teck was ordered to investigate geomembrane covers as a result of a Fisheries Act ruling (Canada, 2020), as an option for reducing selenium contamination of the Elk Valley watershed.

Diversions

Diversions direct clean water, such as streams, away from and around mining areas, and especially waste rock dumps that are the primary source of selenium leaching. This helps keep water clean and reduces the amount of water needing treatment. Diverting water away from these areas prevents the water from leaching contaminants such as selenium.

Active Water Treatment

Teck has constructed and commissioned active water treatment facilities at its Line Creek and Fording River mines. They work by pumping the water through tanks containing bacteria that remove the selenium and nitrate from the water. The removed substances are pressed into a solid and disposed in a landfill. Teck's first active water treatment facility began operating in

2018 at the Line Creek Mine. Monitoring showed that treatment removed significant amounts of selenium. It also showed that some of the selenium changed into a form that could more easily accumulate in aquatic life (Teck, 2023a). Teck tested technologies and found a chemical treatment process called advanced oxidization, which prevented the selenium from changing form and was added to the Line Creek water treatment facility (B.C., 2024).

Saturated Rock Fill

Saturate rock fill treatment involves the following steps (see **Insert 1-1**):

- selenium-contaminated water is pumped from the mine to the saturated rock fill
- reagents are added to the stimulate organic reactions
- inoculated water is injected into and seeps through the saturated rock fill
- treated water is pumped out of the saturated rock fill

Treated effluent is discharged into an effluent retention pond where it re-equilibrates with atmospheric conditions. If the pond water quality meets discharge water quality criteria, it is discharged to the receiving environment; if not, it is recycled and discharged back to the flooded source pit (Mackie et al., 2022).

Insert 1-1: Saturated Rock Fill Treatment Schematic (Source: Mackie et al., 2022)

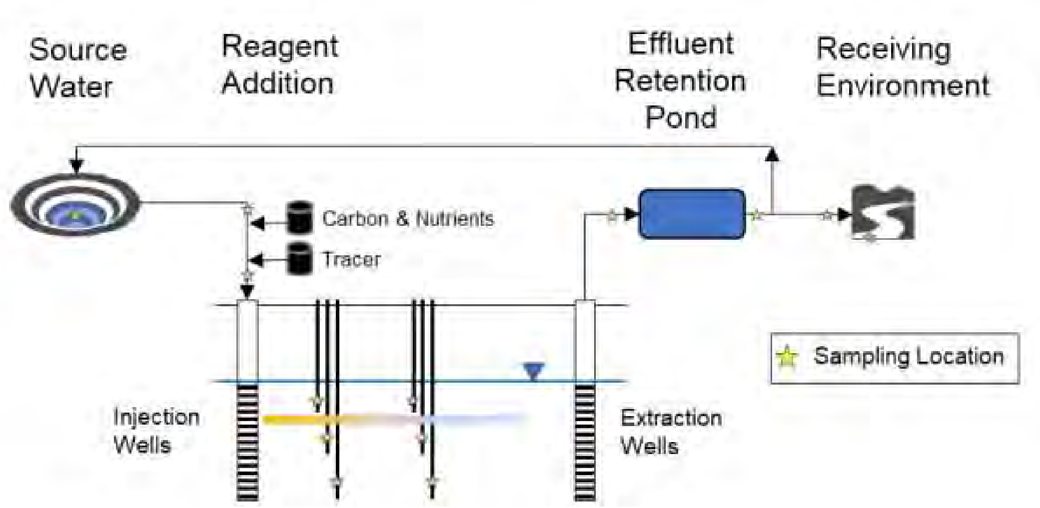
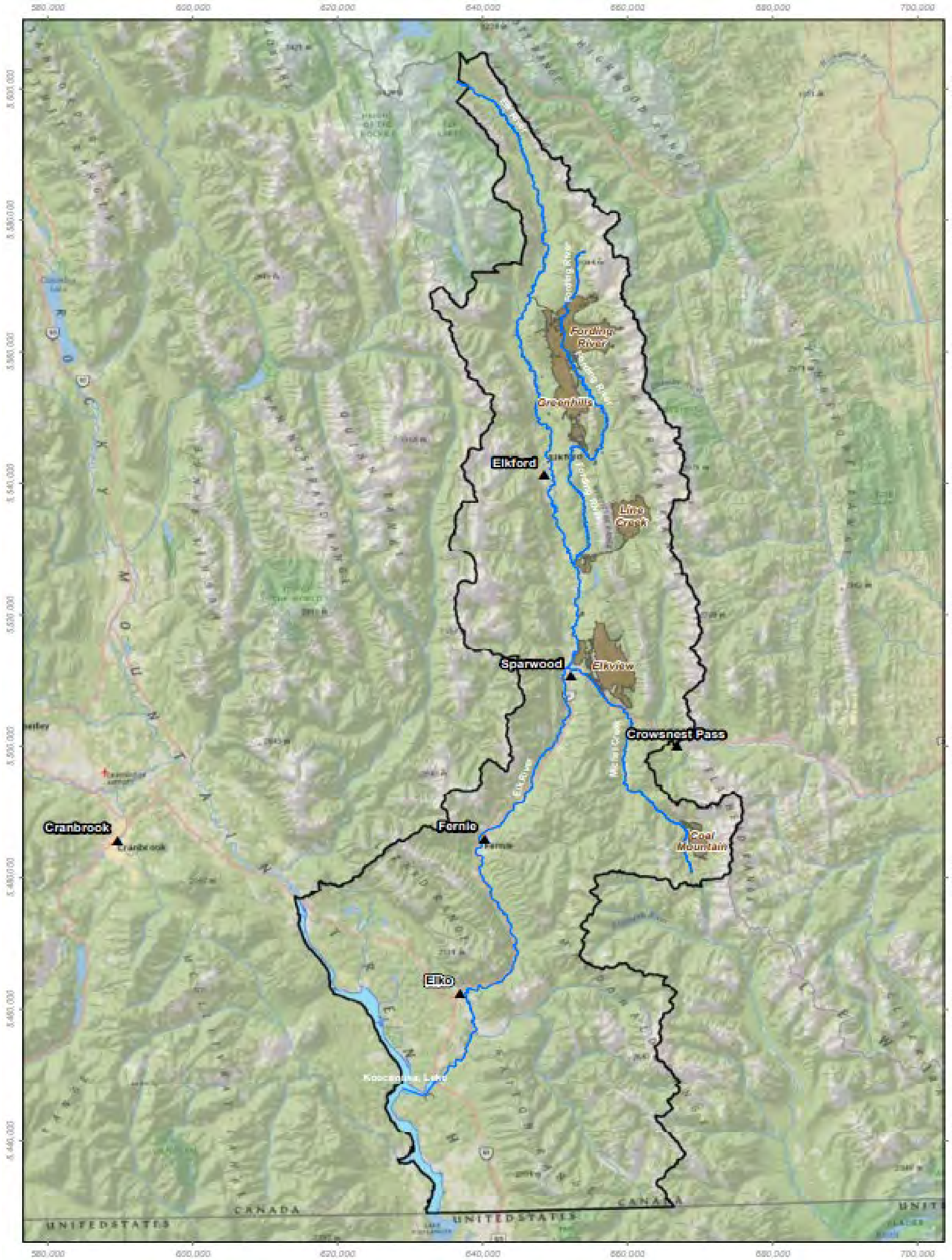


Table 1.1

Chronology of Elk Valley Coal Mining and Selenium Management

Time Frame	Actual Action	Planned Action	Concentration of Selenium in Elk River downstream of Michel Creek
1890's	Elkview u/g mine commences	--	< 1 ug/L (assumed)
1900's	Coal Mountain u/g mine commences	--	No record
1940's	Coal Mountain open pit commences	--	No record
1960's	Elkview open pit commences	--	No record
1970's	Fording River commences	--	No record
1980's	Line Creek/Greenhills commence	--	<1 ug/L
1990's	Selenium contamination identified as an environmental concern and monitoring commences	Selenium monitoring commences	1 to 3 ug/L
2000's	Studies	Studies	3 to 5 ug/L
2010	Strategic Plan for Teck Coal	Strategic Plan for Teck Coal	5 ug/L
2011 to 2012	Planning	Planning	5 to 7 ug/L
2013	Ministerial Order 113	Planning	8 ug/L
2014	Elk Valley Water Quality Plan	WTP 1 Line Creek - 7,500 m^3/day	10 ug/L
2015	--	--	10 ug/L
2016	--	--	11 ug/L
2017	--	--	10 ug/L
2018	WTP 1 Line Creek - 7,500 m^3/day	WTP 2 Fording - 20,000 m^3/day	12 ug/L
2019	--	--	12 ug/L
2020	SRF 1 Elkview - 10,000 m^3/day	SRF 1 Elkview - 30,000 m^3/day	12 ug/L
2021	SRF 1 Elkview - 10,000 m^3/day	--	13 ug/L
2022	WTP 2 Fording 10,000 m^3/day	--	14 ug/L
2023	WTP 2 Fording 10,000 m^3/day	SRF 2 Fording - 30,000 m^3/day	13 ug/L
2024	SRF 2 Fording 30,000 m^3/day	--	No record
2024 to 2027	TBD	WTP 3 Line Creek - 20,000 m^3/day WTP 4 Greenhills - 7,500 m^3/day SRF 3 Fording - 30,000 m^3/day SRF 4 Elkview - 15,000 m^3/day	No record

WTP – Water Treatment Plant; SRF – Saturated Rock Fill



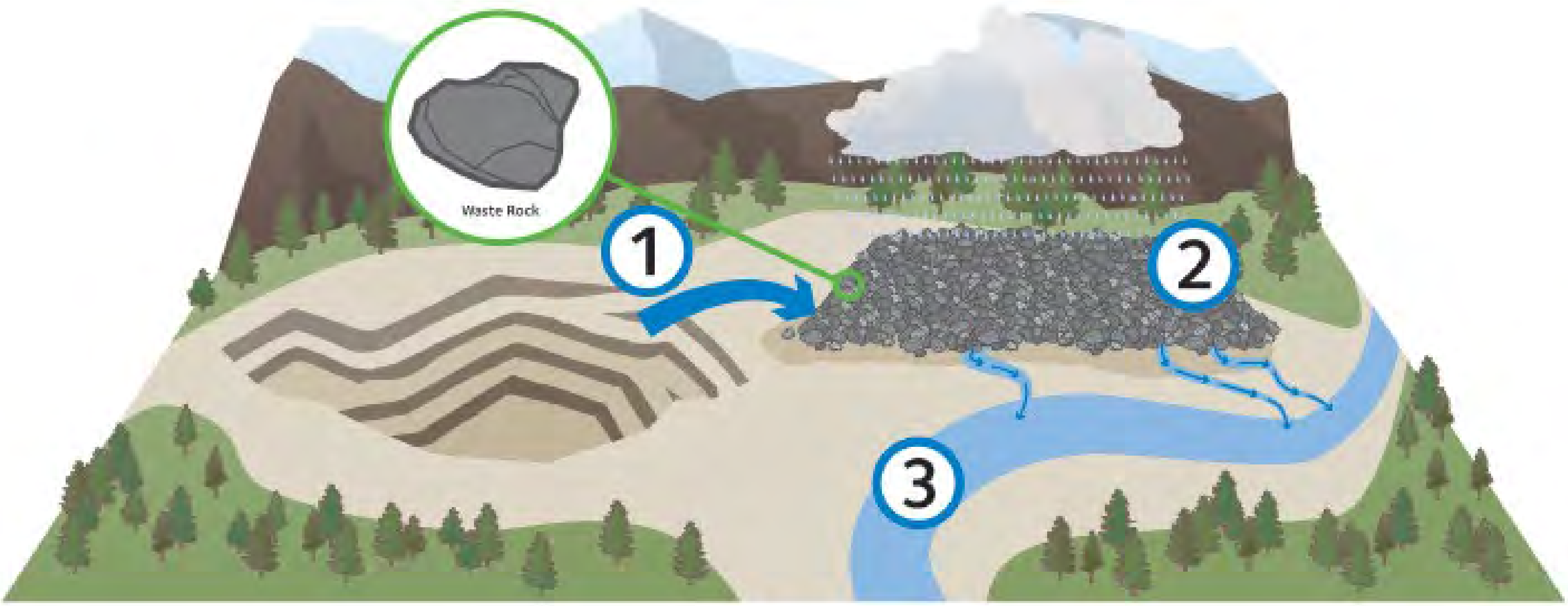
WILDSIGHTT

SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Teck Coal Mines in Elk River Watershed

(Source: Teck, 2014)

BURGESS ENVIRONMENTAL	Date: 3/9/2024	Scale:
	Project No.: SULP-01	Figure No.: 1-1



1. Waste Rock placed in spoil piles
2. Precipitation and runoff flow through these spoil piles
3. Impacted water flows into the local watershed

WILDSIGHT SELENIUM RELATED RECLAMATION LIABILITIES TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA		
Selenium Leaching from Waste Rock Source: Teck, 2014		
BURGESS ENVIRONMENTAL	Date: 3/9/2024	Scale:
	Project No.: WILD-01	Figure No.: 1-2

2 SETTING

2.1 Physiography and Drainage

The following description of the Elk River watershed was extracted from Section 3.2.1 of the 2020 Elk Valley Regional Water Quality Model Update – Annex B (Teck, 2022a).

"*The Elk River watershed . . . is a mountainous watershed in the interior continental regions of British Columbia and has its headwaters at Elk Pass in Elk Lakes Provincial Park at the British Columbia – Alberta border* (**Figure 2-1**)*. The Elk River watershed area is approximately 4,450 km^2 . . . . The watershed ranges in elevation from approximately 750 metres above sea level (masl) at the mouth of the Elk River to 3,450 masl at the summit of Mount Joffre. Characterized by rugged terrain of the Front and Border Ranges of the Rocky Mountain, the Elk River watershed is north-south oriented, and the Elk River flows generally south-southwest through the towns of Elkford, Sparwood and Fernie, discharging into the Koocanusa Reservoir approximately 120 km downstream of Teck's mining operations. Koocanusa Reservoir is located partly in British Columbia and partly in the State of Montana; it was formed by the construction of the Libby Dam on the Kootenay River. Major tributaries of the Elk River include the Fording River, Michel Creek, and the Wigwam River."* Minor tributaries of the Elk River that have been impacted by Teck's operations include Line Creek, Erickson Creek, and Dry Creek.

2.2 Climate

The following description of the climate of Elk River watershed was extracted from Section 3.2.2 of the 2020 Elk Valley Regional Water Quality Model Update – Annex B (Teck, 2022a).

"The climatic regime of the Elk River watershed is characterized by a continental climate with strong seasonality in precipitation and temperature (**Figure 2-2**). *Accordingly, snow accumulates through the winter season and melts over the spring months (March, April and June)* (sic)*, with the rate of melt influenced by local variation in elevation, hillslope, aspect and land cover. Warmer temperatures in the summer are typically accompanied by relatively low precipitation, and fall months are characterized by moderate temperatures and increased precipitation."*

The data indicates that the average annual precipitation in the upper valley is between 800 and 900 mm per year, and that the average daily temperature varies between -10°C and +13°C. Average temperatures will be lower and average rainfall will be higher in the mountain valleys where Teck operates its mines. Most of the precipitation (or an estimated 950 mm per year, Teck, 2023a, PDF page 23 of 241) that falls on the mine areas is affected by mining (infiltration or runoff) before flowing to the Elk River.

2.3 Geology

Bedrock Stratigraphy

The coal-bearing strata of Elk Valley belong to the Kootenay Group, which is of Jurassic and Cretaceous age, and includes, in ascending order, the Morrisey, Mist Mountain, and Elk Formations. The coal-bearing strata are located within the Mist Mountain Formation. The Kootenay Group is underlain by the Jurassic Period Fernie Formation, and is overlain by the Cadomin Formation of the lower Cretaceous Blairmore Group (**Figure 2-3**). Each of these formations is described below and the group form the dominant bedrock units associated with Teck's mine operations.

The Fernie Formation consists primarily of shale, with interbedded sandstone and carbonate layers, and a basal phosphorite. The uppermost unit in the Fernie Formation is known as the Passage Beds, and consists of interbedded shale and sandstone, with the sandstone beds becoming thicker and more frequent near the top of the Fernie Formation where it transitions into the Kootenay Group (Grieve, 1993, PDF page 16 of 179).

The Morrisey Formation is the basal sandstone unit of the Kootenay Group and includes the lower Weary Ridge member and the upper Moose Mountain member. The Weary Ridge is the less resistant of the two and is characterized by orange-brown weathering. It consists of argillaceous and ferruginous quartz sandstone with interbedded layers of siltstone. The more resistive Moose Mountain member is ridge forming and is a prominent marker of the base of the potential coal-bearing strata of the Mist Mountain Formation. The Moose Mountain member is composed of quartz-chert sandstone, with local occurrences of chert conglomerate. Thin carbonaceous interbeds may also be present. Regionally, the Morrisey Formation varies in thickness from 20 to 80 metres (Grieve, 1993, PDF page 17 of 179).

The Mist Mountain Formation abruptly and conformably overlies the Mouse Mountain member of the Morrisey Formation, and contains the economically minable coal deposits of the Elk Valley. It consists of interbedded coal, shale, siltstone, and sandstone, with coal comprising between 8 and 12 percent of the total thickness. Folding and faulting has caused local thinning and thickening of the coal seam, which can be up to 13 m thick (Grieve, 1993, PDF page 18 of 179).

The Elk Formation overlies the Mist Mountain Formation at the top of the Kootenay Group, and is similar to the Mist Mountain Formation with some important differences. The Elk Formation does not contain economically viable coal seams, and contains sapropelic coals in addition to humic coals. The Elk Formation also contains sandstone layers of greater thickness and lateral extent than the Mist Mountain Formation. The sandstone layers within the Elk Formation also weather to a more orange colour than the sandstones of the Mist Mountain Formation. It varies in thickness from approximately 30 to 600 m in the area of Teck's mine operations (Grieve, 1993, PDF page 18 of 179), and is commonly ridge forming above Teck's coal mining operations.

The Cadomin Formation within the lower Cretaceous Blairmore Group is exposed at several locations in the Elk Valley, and is a prominent, massive pebble to cobble conglomerate unit, generally forming one or more continuous cliffs or ledges (Grieve, 1993, PDF page 18 of 179) near the mountain peaks in the mining areas.

Structural Geology

The Elk Valley is situated in the Front Ranges of the southern Canadian Rocky Mountains, which is characterized by north to northwest trending, flexural slip folds, and southwest to west dipping thrust faults parallel to the folds. These structures were produced by compressional forces associated with the Late Cretaceous – early Tertiary orogeny. Later in the Tertiary Period, an extensional period occurred, which resulted in normal faulting along existing and new fault lines.

The coal fields are part of the Lewis thrust fault that resulted in horizontal displacement of approximately 19 km. Folding of the Lewis fault took place during movement on an underlying, younger thrust. Outcrop expressions of subsurface folds in the Lewis thrust include the Alexander Creek syncline, a major structural feature associated with the economically viable coal deposits. These coal deposits have generally been preserved and thickened in the structurally low (core) areas of the Alexander Creek syncline (Grieve, 1993, PDF page 57 of 179).

The structural and outcropping geology along the east side of the Elk River Valley is shown in **Figure 2-4**.

Quaternary Geology

Quaternary geology refers to unconsolidated materials deposited during and since the glacial periods that inundated the Elk Valley. The primary Quaternary deposits in the region include the following:

- glacial till, which is deposited on the bedrock surface and is most prevalent nearer the valley bottoms
- glacial lacustrine and fluvial deposits formed as the glaciers melted and glacial lakes formed in the valley bottoms
- post-glacial alluvial deposits, which have accumulated in the Elk River Valley and its major tributaries
- colluvial deposits on the mountain slopes and at the foot of steep outcrops

Quaternary deposits are typically thin or absent in the upland areas, although significant thicknesses have accumulated on benches and in depressions in the upland areas. Organic soils, weathered bedrock (saprolite), and lacustrine sediments are also present in the region, but are typically isolated and limited in depth and extent. Uplands water courses are typically steep, have eroded into bedrock, and flow seasonally.

Glacial stratigraphy and geomorphology of the bottom areas of the Elk Valley support the existence of at least one major ice advance. Glacial Lake Elk, formed within the Elk Valley from meltwaters released by this glacier, was dammed initially by an ice plug from the Rocky Mountain Trench glacier at a point near Morrissey and subsequently less than 3 km up-valley from Elko. The lake drained in at least three stages as the Rocky Mountain Trench glacier melted, which resulted in rapid erosion of glacio-lacustrine deposits along the flanks of the Elk River Valley (George et al, 1987).

2.4 Hydrogeology

Groundwater Circulation

In the uplands areas of the Elk Valley, including the areas of Teck's mine operations, rainfall and snowmelt infiltrates into the shallow groundwater systems that include colluvium, near-surface fractured bedrock, and waste rock associated with the Teck mines. Most of this groundwater discharges to the seasonal drainages that ultimately flow into tributaries of the Elk River (**Figure 2-5**). In active mining areas, large proportions of this water flow through waste rock and valley fills. Colluvial deposits in these uplands areas are often thin, have limited areal extent, and become saturated during periods of high runoff. Accordingly, the residence time of water in the ground is relatively short, with velocities on the order of hundreds of metres per year. Groundwater recharge and discharge are approximately equal and the proportion of runoff that infiltrates the ground can be highly variable. Estimates of groundwater recharge vary from less than 10% to over 40% of total precipitation (Teck, 2022a, Section 3.3.5).

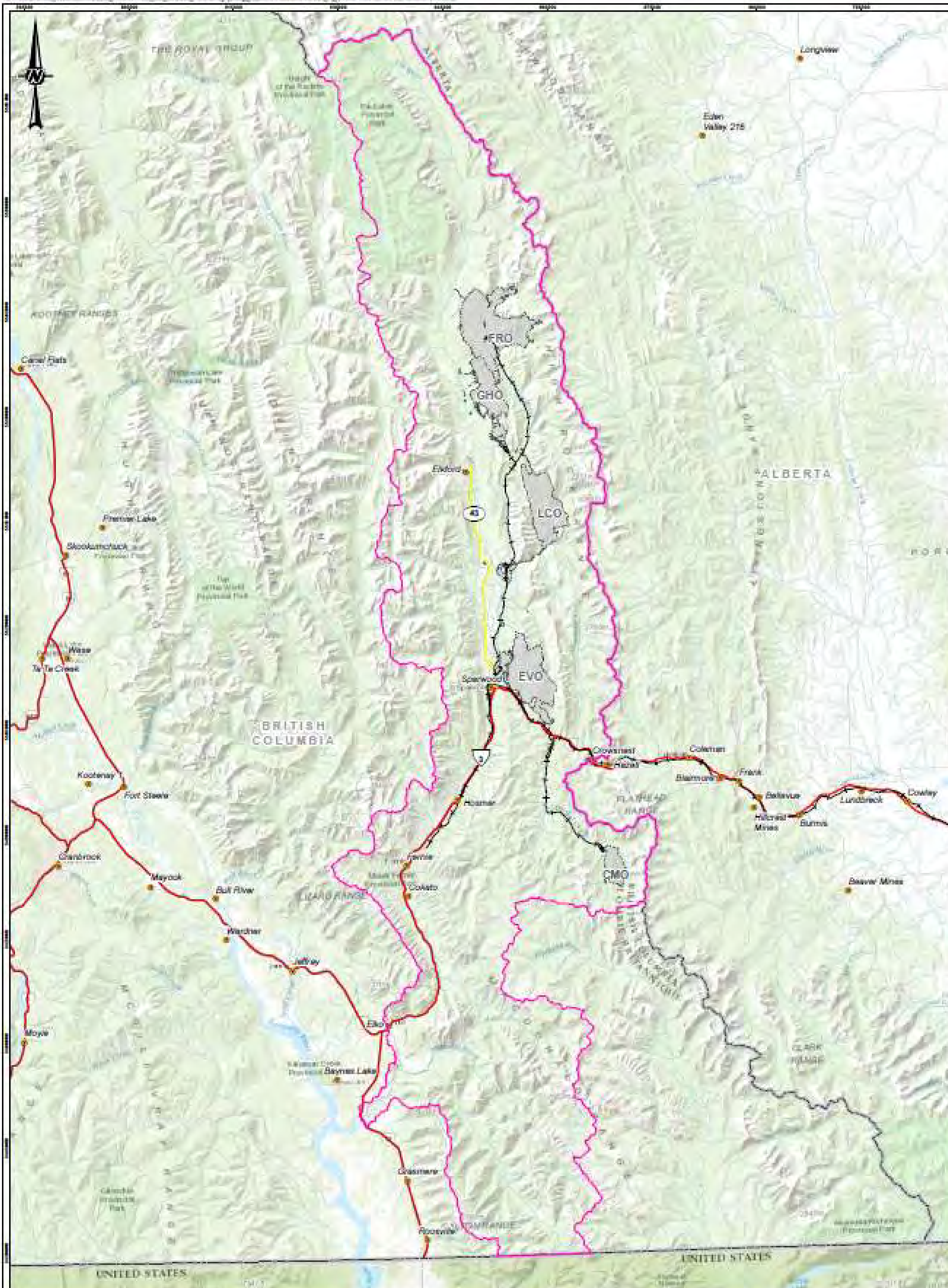
Exposed waste rock and mine spoil piles typically have little or no vegetation cover, which results in reduced evapotranspiration compared to areas not affected by mining. Runoff is negligible and precipitation water not lost to evaporation or sublimation infiltrates the waste rock and mine spoil (Teck, 2022a, Section 3.4.4).

The proportion of water that recharges the competent bedrock aquifers is much lower and groundwater flow velocities can be much slower, on the order of 1 meter per year (Teck, 2022a, Section 3.3.6). Given the high degree of faulting, folding, and fracturing of rock in Elk Valley (see **Section 2.3**), zones of preference groundwater flow in deeper bedrock are also likely to occur.

At the floor of the Elk River Valley, within the historical floodplain of the Elk River, the volumes of groundwater in circulation and the residence time for that groundwater in the valley aquifers is much greater. The primary aquifers are within the alluvial sediments deposited by the Elk River, which can discharge into, or be recharged by, the river.

Groundwater Use

Groundwater is used by individual residents, municipalities, and farms throughout the Elk Valley. The primary municipal users are Elkford, Sparwood, and Fernie. In 2022, Fernie obtained 13% of its 3.2 million m^3 annual water needs from groundwater sources, and 87% from the Fairy Creek (City of Fernie, 2022). Sparwood obtains all of its municipal water supply from groundwater sources, and used 1.7 million m^3 of water in 2022 (District of Sparwood, 2023). Elkford also obtains all of its water from groundwater sources, and used 1.2 million m^3 of water in 2022 (District of Elkford, 2022).



LEGEND

- CITY/TOWN/COMMUNITY
- CANADIAN PACIFIC RAILWAY
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- MINE PERMIT BOUNDARY
- ELK RIVER WATERSHED BOUNDARY

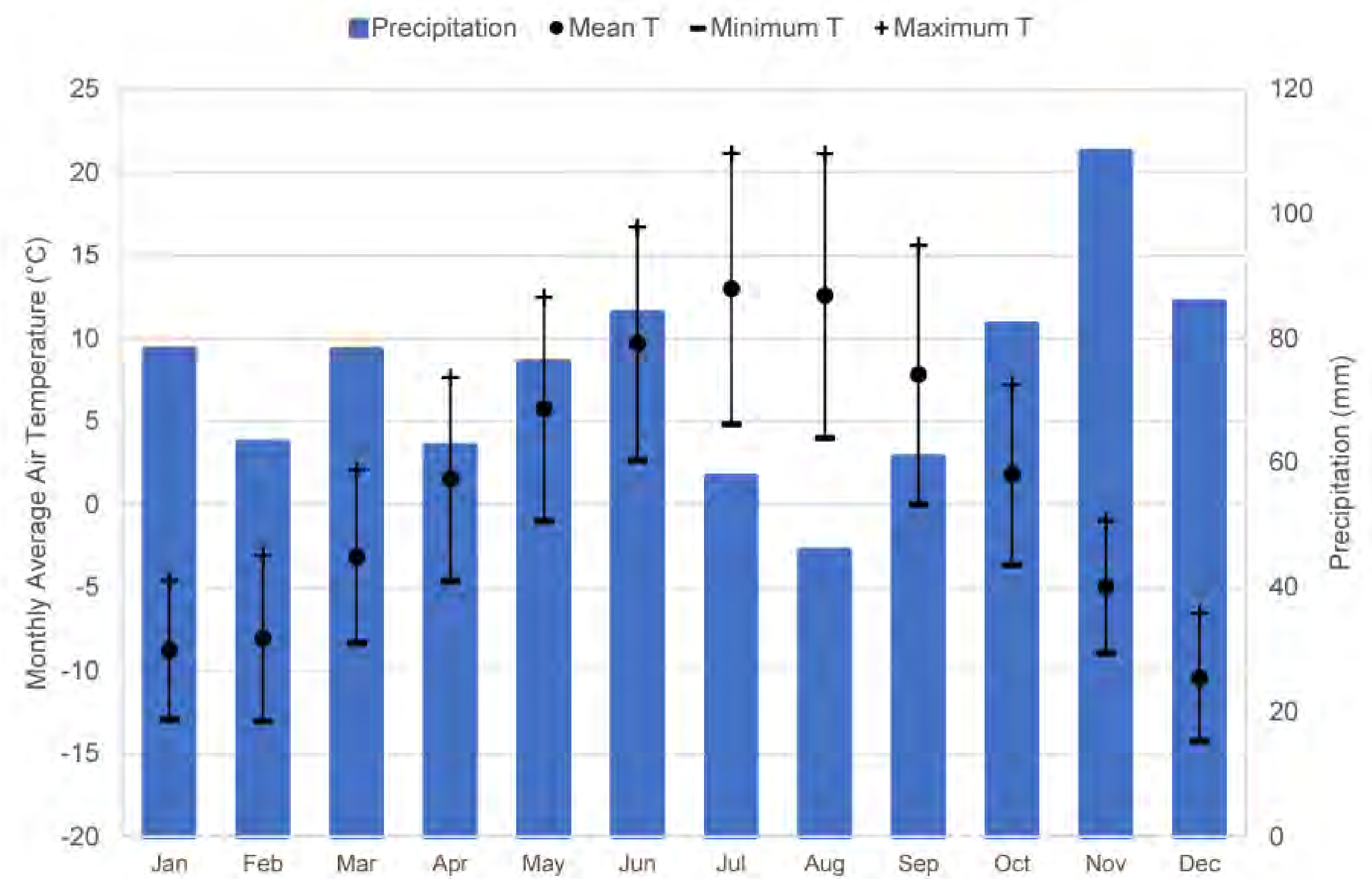
WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Elk Valley Watershed

Source: Teck, 2022

BURGESS ENVIRONMENTAL

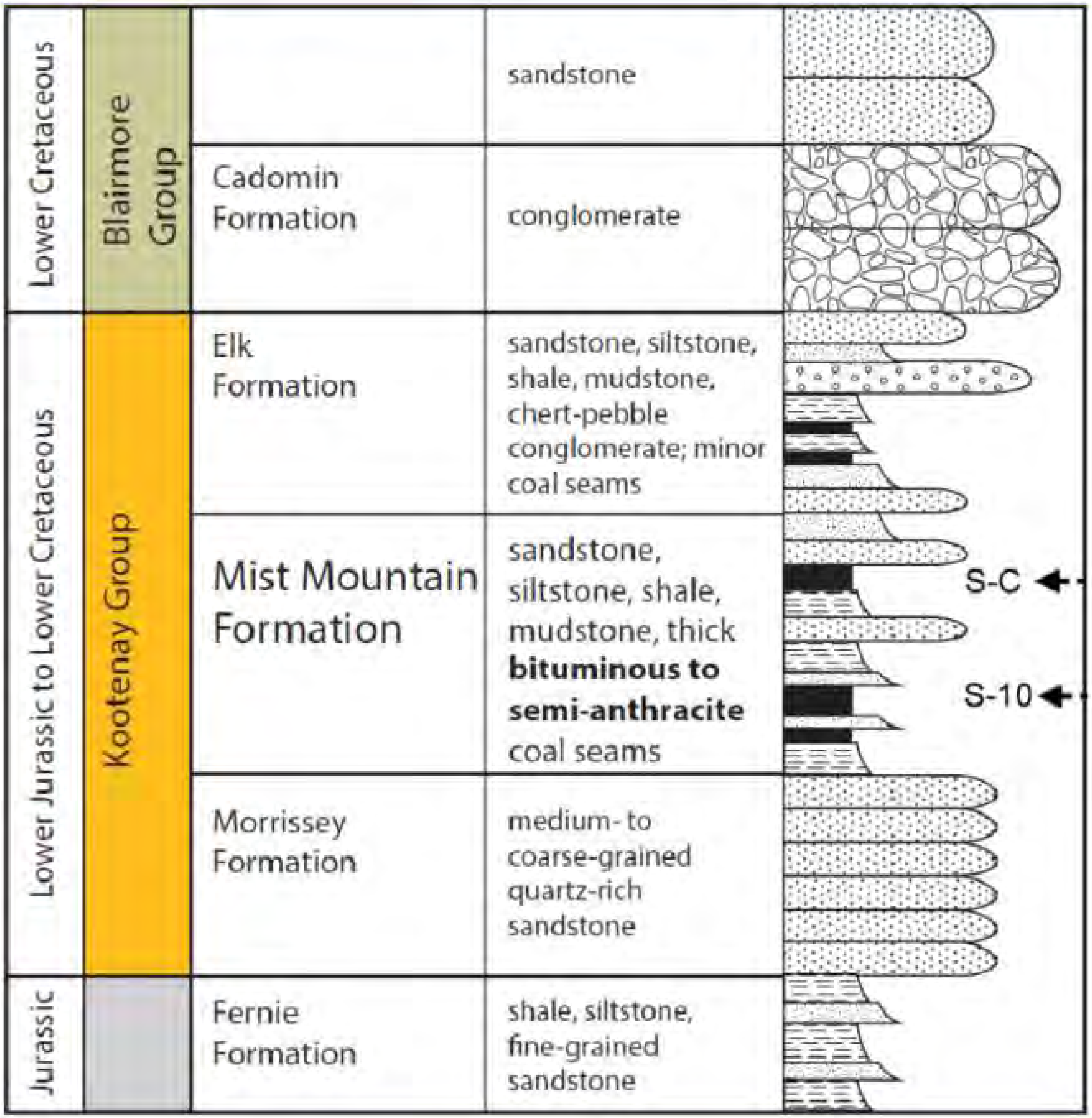
Date: 3/9/2024	Scale:
Project No.: WILD-01	Figure No.: 2-1



Based on data recorded at the Sparwood climate station from 1980 to 2019, in-filled, and then adjusted to account for elevation differences between Sparwood climate station (1,138 masl) and the average elevation of the Elk River watershed (1,777 masl).

°C = degrees Celsius, T = Temperature.

WILDSIGHT SELENIUM RELATED RECLAMATION LIABILITIES TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA		
Climate of Elk Valley (Source: Teck, 2022)		
BURGESS ENVIRONMENTAL	Date: 3/9/2024	Scale:
	Project No.: WILD-01	Figure No.: **2-2**

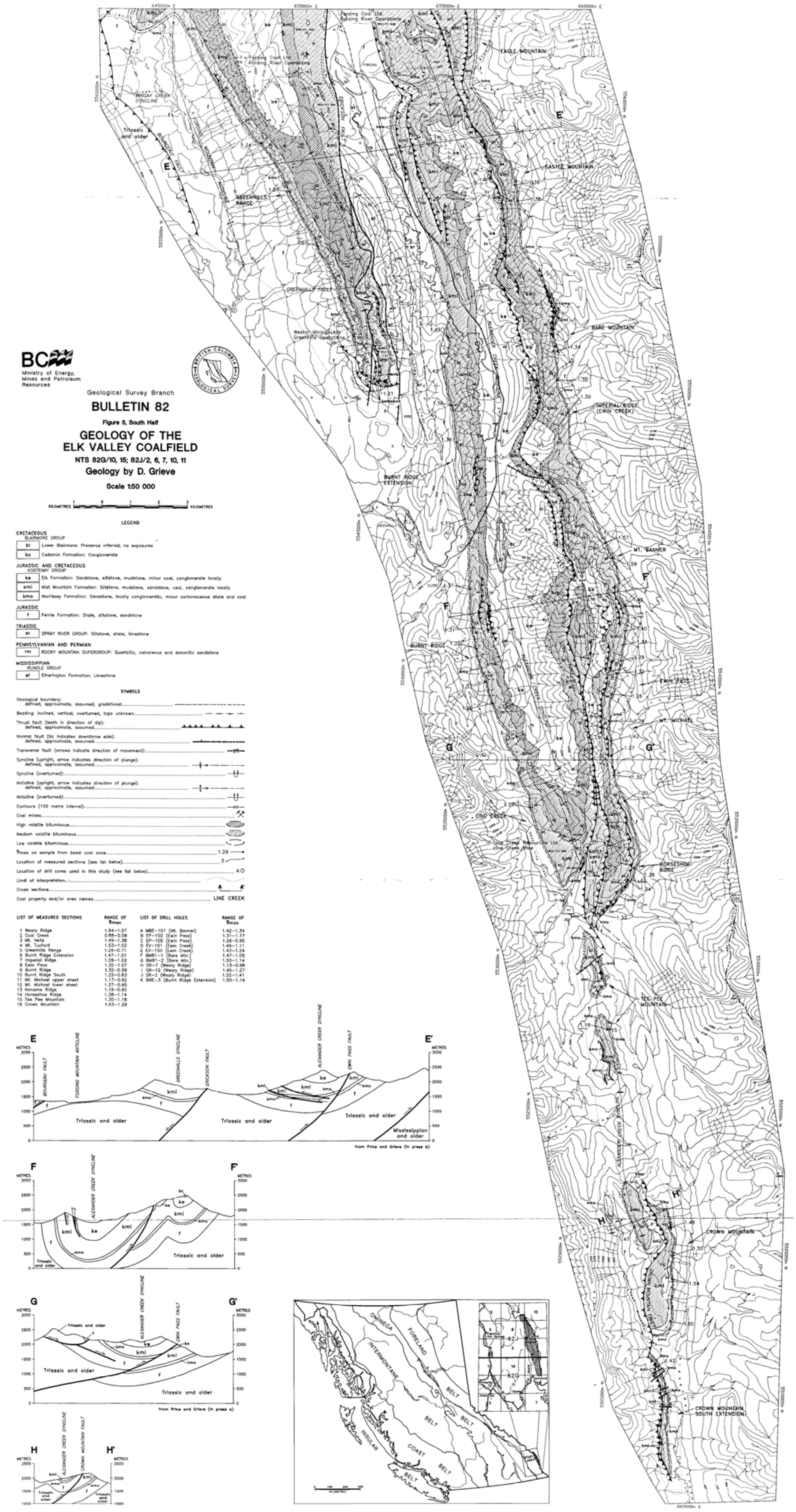


WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Lithologic Section of Kootenay Group
(Source: Edress and Abdel-Fatah, 2021)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:
Project No.: SULP-01	Figure No.: **2-3**

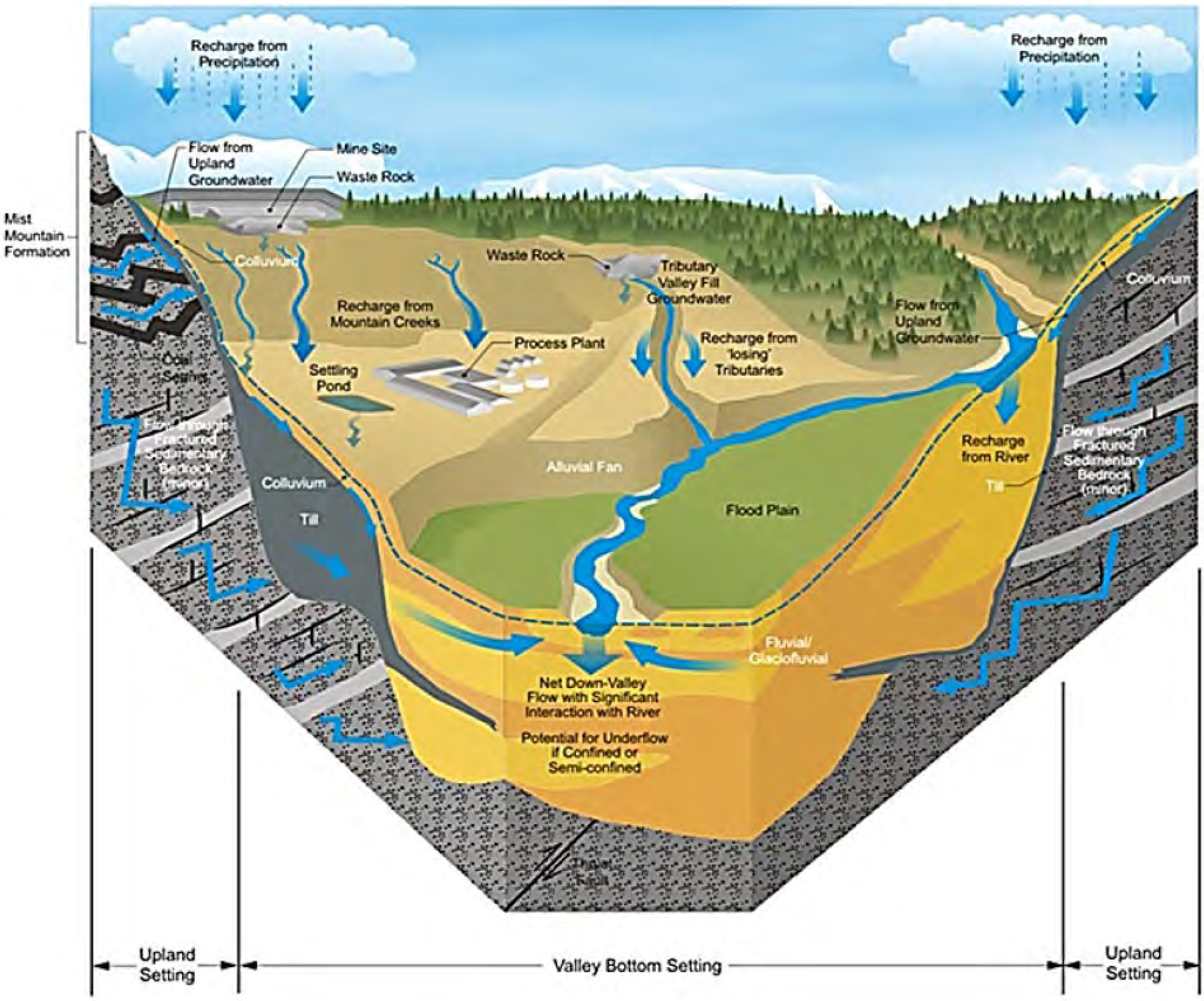


WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Geology of the East Side of Elk Valley
Source: Grieve, 1993

BURGESS ENVIRONMENTAL

Date:	Scale:
3/9/2024	
Project No.: WILD-01	Figure No.: 2-4



WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Conceptual Groundwater Model
(Source: Teck, 2022)

BURGESS ENVIRONMENTAL	Date: 3/9/2024	Scale:
	Project No.: SULP-01	Figure No.: 2-5

3 WATER QUALITY OBJECTIVES

3.1 B.C. Approved Water Quality Guidelines

B.C. (2023) has published approved water quality guidelines (WQGs), which represent safe levels of substances that protect different water uses, including: drinking water, recreation, aquatic life, wildlife, and agriculture. These WQGs are updated on a periodic basis as additional information becomes available.

WQGs provide policy direction to those making decisions affecting water quality. Although WQGs do not have any direct legal standing, once approved, BC WQGs must be considered in any decision affecting water quality made by the Ministry of Environment and Climate Change Strategy. WQGs are used to assess water quality and may be used as the basis for determining the allowable limits in waste discharge authorizations. Exceeding a WQG does not imply that unacceptable risks exists, but rather that the potential for adverse effects may be increased and additional investigation may be required (B.C., 2023).

WQGs have been also been determined for long-term chronic, short-tern acute exposure, and on an interim basis.

Long-term chronic (i.e., “average”) WQGs are intended to protect the most sensitive species and life stage against sub-lethal and lethal effects for indefinite exposures. An averaging period approach is used for these WQGs. This approach allows concentrations of a substance to fluctuate above and below the guideline provided that the short-term acute is never exceeded and the long-term chronic is met over the specified averaging period (e.g., 5 samples in 30 days).

Short-term acute (i.e., “maximum”) WQGs are set to protect against severe effects such as lethality (e.g. LC50) or other equivalent measures (e.g., EC50) to the most sensitive species and life stage over a defined short-term exposure period (e.g., 96 hours) (B.C., 2023).

Interim WQGs have also been developed in cases where there are insufficient data available to meet the minimum requirements of a full guideline. The interim WQGs may be upgraded to approved WQG status when the data gap is filled.

Table 3.1 summarizes the current WQGs for selenium and **Table 3.2** summarizes the sampling guidance. Review of the background information presented in **Sections 1 to 3** of this report indicates that each of the Water Use scenarios indicated in these tables are relevant to the selenium contamination that has resulted from Teck’s mine operations in the Elk River Valley. Review of the water quality data presented in **Sections 5 and 6** indicate that these WQGs are exceeded in samples collected from most of Teck’s monitoring locations.

Table 3.1

Water Quality Guidelines for Selenium (Source: B.C., 2023)

Water Use	Long-term Chronic Se WQG	WQG Derivation Method/Approach
Aquatic Life *Water column freshwater & marine* *Alert concentration* *WQG* *Sediment - Alert concentration* *Dietary* *Invertebrate tissue (interim)* *Tissue* (fish) *Egg/ovary* *Whole-body (WB)* *Muscle/muscle plug (interim)*	 1 µg/L 2 µg/L 2 µg/g (dw) 4 µg/g (dw) 11 µg/g (dw) 4 µg/g (dw) 4 µg/g (dw)	*Water column*: Review of previous WQG (uncertainty factor (UF) applied to toxicity threshold); weight of evidence including food web modelling and reported relationships between impacts and Se concentrations in water. *Sediment*: Weight of evidence; lowest published toxicity thresholds, no UF applied; insufficient data for full WQGs at this time. *Dietary:* Weight of evidence; lowest published toxicity thresholds, no UF applied; insufficient data for full WQGs at this time. Invertebrate tissue as surrogate for aquatic dietary tissue. *Egg/ovary:* Combination weight of evidence and mean of published effects data with an UF of 2 applied; *Whole-body*: previous WB WQG compared with published literature, mean of published effects data with UF (2) applied and weight of evidence; *Muscle*: WB translation to derive muscle WQG, no additional UF applied to muscle WQG.
Wildlife *Water column* *Bird egg*	 2 µg/L 6 µg/g (dw)	The *water column* WQG for aquatic life (fish) is adopted for wildlife since dietary accumulation is most critical. *Bird eggs* were used as surrogate for all wildlife; weight of evidence; egg Se most direct/sensitive measure; mallard EC10 with UF of 2 applied.
Livestock *2001 WQG not updated*	30 µg/L	Not updated at this time
Irrigation *2001 WQG not updated*	10 µg/L	Not updated at this time

Table 3.2

Water Quality Guidelines for Selenium (Source: B.C., 2023)

Water Use	WQG for Total Se	Sampling Guidance
Aquatic Life *Water column freshwater & marine* *Alert concentration* *WQG* *Sediment - Alert concentration* *Dietary* *Invertebrate tissue (interim)* *Tissue* (fish) *Egg/ovary* *Whole-body (WB)* *Muscle/muscle plug (interim)*	 1 µg/L 2 µg/L 2 µg/g (dw) 4 µg/g (dw) 11 µg/g (dw) 4 µg/g (dw) 4 µg/g (dw)	*Water*: 30-day average determined as the mean concentration of 5 evenly spaced samples collected over 30 days and measured as total Se. *Sediment*: Mean of ≥ 5 samples collected in a representative area. *Dietary:* Mean concentration ≥ 8 replicate (composite) tissue samples representing an appropriate invertebrate or other prey species. *Egg/ovary*: Mean of ≥ 8 egg or ripe ovary (from 8 individual fish) in a representative area, reported as dry weight. *Whole-body*: Mean of ≥ 8 fish in a representative area, reported as dry weight. *Muscle*: Mean of ≥ 8 muscle tissue samples (from 8 individual fish) in a representative area, reported as dry weight.
Wildlife *Water* *Bird egg*	 2 µg/L 6 µg/g (dw)	*Water*: 30-day average determined as the mean concentration of 5 evenly spaced samples collected over 30 days and measured as total Se. *Bird egg*: Mean of ≥ 8 eggs (from 8 individual nests) in a representative area, reported as dry weight. A statistical analysis could also be used to determine a more specific sampling design.
Livestock *2001 WQG (not updated in 2014)*	30 µg/L	*Water*: A maximum WQG not to be exceeded.
Irrigation *2001 WQG (not updated in 2014)*	10 µg/L	*Water*: A maximum WQG not to be exceeded.

Companion Document to: Ambient Water Quality Guidelines for Selenium Update (B.C., 2014) provides the supporting bases for these guidelines. The selenium WQGs were developed based on the most sensitive species (birds and fish) and lentic (slow moving) waters, which are more biologically productive and reducing conditions that increase the uptake of selenium by benthic organisms. The Companion Document states, "*the development of the Se WQGs recognized the need to protect the most sensitive hydrologic units (i.e., lentic areas) within an exposed watershed, since fast moving (lotic) streams are connected with, and have within them, slower moving, depositional (lentic) areas such as pools, back-eddies, back-channels, lakes, and wetlands*".

On a provincial basis, the BC WQG for selenium of 2 µg/L (mean concentration over 30 days) is considered protective of all aquatic life. An alert concentration for selenium in the water column of 1 ug/L and above background represents a threshold level of concern for bioaccumulation in the environment (e.g., sediments and biota) (B.C., 2014).

Human health is also an important component of the WQGs and the Companion Document, which states, "*to protect drinking water sources and human health, Se concentrations should not exceed 10 µg /L at any time*". Health-based screening values for selenium in fish tissue were developed for high, moderate, and low fish consumption scenarios. For example, the high consumption screening scenario is applicable to subsistence fishing.

The sediment quality guideline of 2 ug/g has been established as the threshold of concern in suspended and bed sediments, which "*is an important exposure route for organisms at the base of the food web*". Tissue guidelines are established because "*bioaccumulation of Se in tissues is important in determining toxicity. Tissue-based guidelines provide a more direct link between Se exposure and toxic effects*". Guidelines for protection of wildlife focus on birds and sensitive species (amphibians and reptiles). They exclude fish and other freshwater aquatic organisms.

3.2 Teck Water-Quality Targets

Summary of Targets

In response to Ministerial Order M113, Teck has established short-term, medium-term and long-term water-quality targets at Order Stations in the Elk River watershed that have been impacted by its mine operations. B.C. water-quality guidelines (WQGs) for aquatic life have been set as the long-term water-quality target for selenium in Lake Koocanusa. Where long-term concentrations could not meet WQGs, site-specific targets were derived for the Elk and Fording Rivers that were considered protective of aquatic life and achievable (Teck, 2014, PDF page 185 of 290). It is understood that these water-quality targets were accepted by the B.C. regulators, are still in place, and are summarized for selenium in **Table 3.3**.

Table 3.3

Long-Term Water-Quality Targets and Timeframes for Selenium (Source: Teck, 2014)

Location		Order Station	Selenium (ug/L)	Timeframe
MU-1	Upper Fording River	FR4	57	2022
MU-2	Lower Fording River	FR5	40	2023
MU-3	Elk River above Fording River	ER1	19	2014
MU-4	Elk River below Fording River	ER2	19	2023
MU-5	Elk River below Michel Creek	ER3, ER4	19	2014
MU-6	Lake Koocanusa	LK2	2	2014

The derivation of these water-quality targets is described in Section 8 of the Elk Valley Water Quality Plan (Teck, 2014), and are based on aquatic life benchmarks (**Figure 3-1**). These water-quality targets for selenium were derived to achieve the following:

- Fording River: protection of westslope cutthroat trout
- Elk River: protection of brown trout
- Lake Koocanusa: compliance with B.C. WQG

On the recommendation of the advisory committee, brown trout was used to derive the Elk and lower Fording River fish tissue benchmark because, while not present in the system, it is the most sensitive tested species similar to fish found there (Teck, 2014, PDF page 192 of 290). Short-term targets and timeframes for stabilization were also set where selenium concentrations were expected to exceed these long-term targets. Medium-term targets and timeframes were also set to demonstrate progressive improvement in water quality is occurring over time. These targets are summarized in **Tables 3.4 and 3.5**, respectively.

Table 3.4

Short-Term Water-Quality Targets and Timeframes for Selenium (Source: Teck, 2014)

Location		Order Station	Selenium (ug/L)	Timeframe
MU-1	Upper Fording River	FR4	63	2019
MU-2	Lower Fording River	FR5	51	2019
MU-4	Elk River below Fording River	ER2	19	2023

Table 3.5

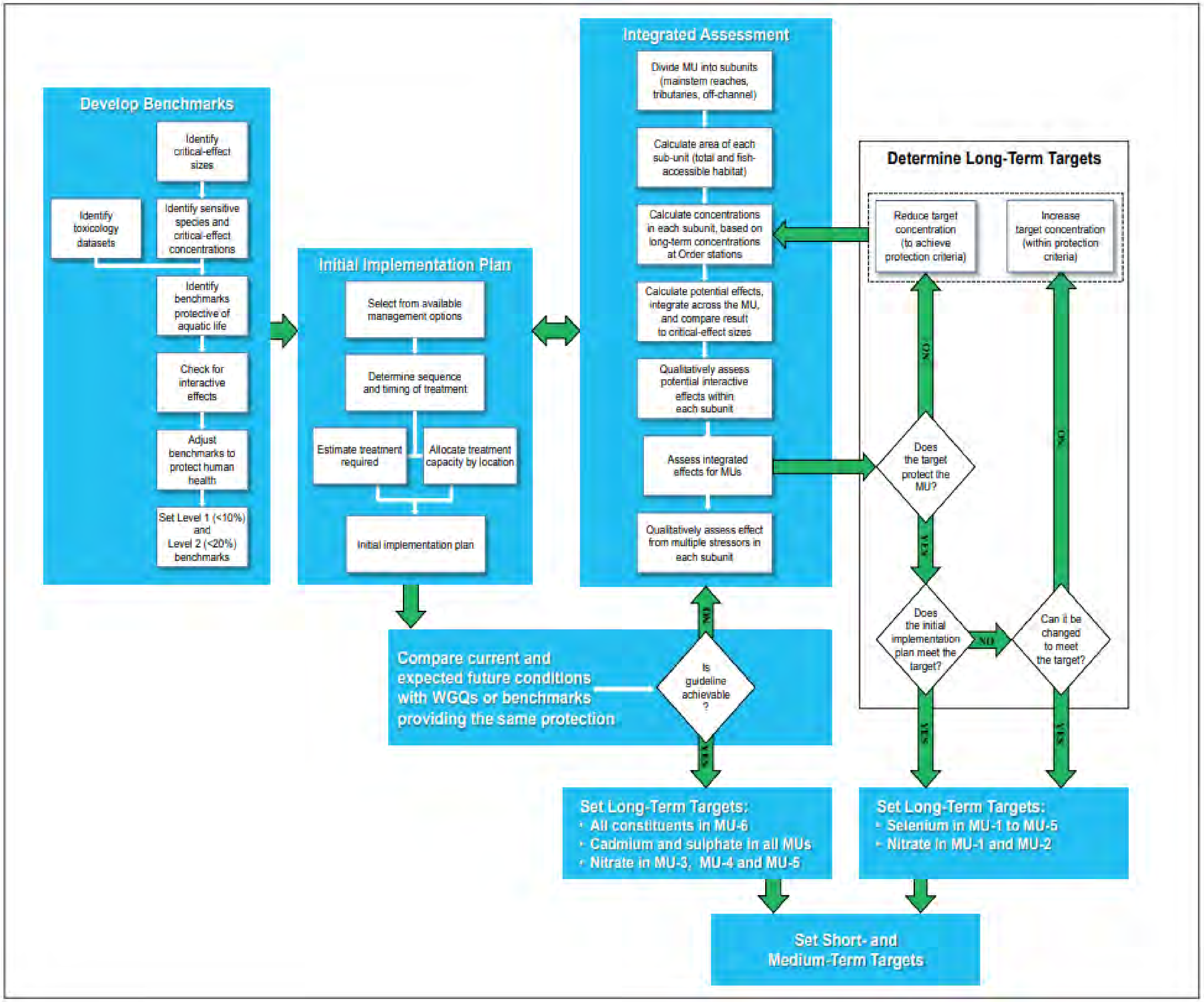
Medium-Term Water-Quality Targets and Timeframes for Selenium (Source: Teck, 2014)

Location		Order Station	Selenium (ug/L)	Timeframe
MU-1	Upper Fording River	FR4	57	2022
MU-2	Lower Fording River	FR5	40	2023

Summary of Supporting Basis

The bench-mark concentration for selenium in water is based on selenium concentrations in tissues of the most sensitive species included in the assessment (Teck, 2014, PDF page 194 of 290). Level 1 and 2 benchmarks were determined for 10% and 20% effect levels determined by laboratory testing. A total of 41 species were considered for selenium: 17 fish, 14 bird, and 10 invertebrates. The westslope cutthroat trout was identified as the most sensitive species in the Fording River and the brown trout in the Elk River (Teck, 2014, Section 8.2).

A two-step bioaccumulation model was developed and used to predict the bioaccumulation of selenium in sensitive species. The Level 1 selenium water-quality benchmark applicable to the upper Fording River is 70 µg/L, which is based on reproductive effects on westslope cutthroat trout. The Level 1 selenium benchmark applicable to the Elk River is 19 µg/L. Interim assessment criteria were then applied to potentially modify these benchmarks. This resulted in a reduction of the long-term water-quality target to 57 ug/L in the upper Fording River, and 40 ug/L in the lower Fording River. The integrated assessment was implemented to account for different water quality conditions in mainstem rivers, mine-influenced tributaries, and tributaries not influenced by mining. This was determined to be a more important factor for the Fording River, which contains a higher proportion of these different water quality conditions than the Elk River.



WILDSIGHT

SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Process for Water Quality Targets

Source: Teck, 2014

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:	
Project No.: WILD-01	Figure No.:	3-1

4 TECK COAL MINE OPERATIONS

4.1 Elkview

General

Elkview Mine (**Figure 4-1a**) is situated north of the Michel Creek valley, approximately three kilometers east of Sparwood, B.C. It has been in operation since 1970, currently produces 9 million tonnes of clean coal per year, and is projected to be in operation through 2041.

The current surface disturbance associated with Elkview Mine is approximately 4,500 ha, of which approximately 1,300 ha is currently reclaimed (revegetated). Over 3,000 ha of the mine area is covered with mine spoil and waste rock, although it is not clear what portion of this spoil area is included in the reclamation areas. According to Teck, waste rock disposal in 2022 occurred in the Erickson Creek watershed, the Michel Creek watershed, and within mine pits (Teck, 2023a).

Hydrology

Mountainous terrain dominates the Elkview Mine site. According to Teck, many pre-mining drainage basins still exist within the Elkview Mine disturbance area. Generally, the mine can be divided into four main drainage areas (**Figure 4-1b**):

- Harmer Creek drainage (north-eastern quadrant),
- Elk River drainage (north-western quadrant),
- Michel Creek drainage (south-western quadrant)
- Erickson Creek drainage (south-eastern quadrant)

Ultimately all drainages associated with the Elkview Mine flow to the Elk River, or to Michel Creek upstream of its confluence into Elk River. Several of the drainages at Elkview Mine have been altered by mining, and as a result, mine runoff flows to mine pits. The following summarizes the characteristics of each drainage area within or in proximity to the Elkview Mine (Teck, 2023a).

- Dry Creek drains into Harmer Creek which drains into Elk River via Grave Creek.
- 6-Mile Creek is a small tributary that flows west from the north end of Elkview Mine and discharges directly to Elk River.
- Balmer and Fennelon Creeks are small tributaries that are not affected by mining activities and are located on the west side of the mine.
- Lower Lindsay Creek flows under coal spoil through a constructed rock drain. The rock drain discharges and infiltrates into the ground near the banks of Elk River.

- The Goddard Creek watershed includes drainage from the raw coal conveyor tunnel, the plant area and the south slopes of the reject coal spoil. It flows into the Lindsay Interceptor Ditch and ultimately into Elk River.
- Otto Creek drains a portion of Baldy Ridge on the western slopes, through Cossarini Creek and discharges to Elk River.
- Erickson Creek drains the eastern side of the Elkview Mine and flows into Michel Creek. A portion of Erickson Creek flow is intercepted and transferred at rates of up to 20,000 m^3/day to the saturated rock fill treatment facility. Treated water is returned to Erickson Creek.
- Gate Creek drains the western side of Natal Ridge including the reclaimed Bodie spoil. Gate Creek has historically received inputs from dewatering of the Natal West Pit either directly from the pit or via the saturated rock fill treatment facility. A large portion of the upper headwaters is diverted around the Bodie spoil in an overland culvert. The diversion reconnects with Gate Creek below the spoil before flowing into the Gate Creek sedimentation ponds.
- Bodie Creek is a highly altered drainage as the majority of the upper catchment and headwaters have been mined out. Bodie Creek receives surface runoff from the slopes and roads located within the drainage area and has also received water from dewatering of the Natal Pit, either directly from the pit or via the saturated rock fill treatment facility.

Existing and Planned Remedial Measures

The Elkview Saturated Rock Fill began full-scale operation on August 14, 2021. The system is designed to treat waters from Erickson Creek and Natal Pit at a capacity of 20,000 m^3/day. It discharges treated effluent to Erickson Creek and to the Bodie Rock Drain (Teck, 2023a, Section 2.2). Expansion to the SRF water treatment system is planned for 2027, which would increase the water treatment capacity of the Elkview Mine to 35,000 m^3/day (Teck, 2023g).

As part of Elkview Mine Local Aquatic Effects Monitoring Program (LAEMP), routine monitoring efforts conducted in September 2021 showed increased selenium concentrations in benthic invertebrate. These increases were not expected and triggered an action response plan that included suspension of the saturate rock fill treatment facility on April 9, 2022. The facility was restarted on October 4, 2022. Summary of findings related to these increases were not found; however, active water treatment facilities at other mining areas in the Elk Valleys have indicated that treatment effluent was composed of chemically reduced forms of selenium that were more readily accumulated (i.e., bioavailable) by aquatic biota than selenate (Teck, 2023a).

Surface Water Quality Monitoring

Teck publishes the measured concentrations of selenium in the effluent from the saturated rock fill treatment facility, as well as the average treatment rate (flow through treatment facility), and mass of selenium removed on a daily basis. This data can be used to calculate the influent concentration of selenium through the reporting period, which is summarized for 2022 in **Table 4.1**.

Table 4.1

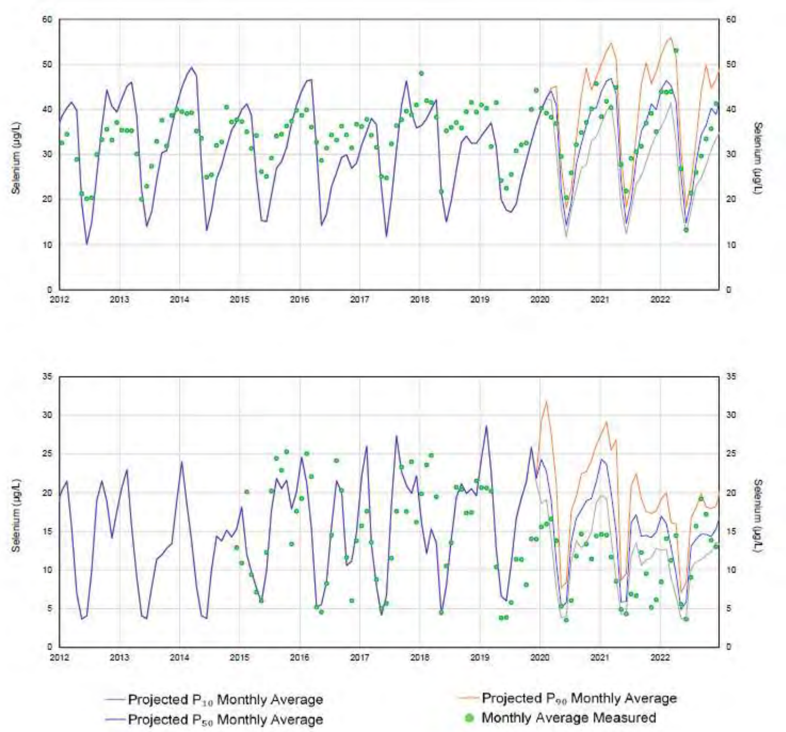
Elkview Operation Saturated Rock Fill Performance (Source: B.C., 2024)

Month	Treatment Rate (m3/day)	Effluent Concentration (ug/L)	Mass Removed (kg/day)	Influent Concentration Calculated (ug/L)
Jan-22	16,528	8.47	2.7	172
Feb-22	15,620	8.28	2.6	173
Mar-22	13,038	5.62	2.4	188
Apr-22	7,367	3.9	1.2	168
May-22	8,475	2.63	1.3	158
Jun-22	9,365	2.39	1.4	149
Jul-22	8,901	2.24	1.4	156
Aug-22	9,504	1.97	1.4	150
Sep-22	8,730	1.83	1.3	148
Oct-22	9,628	1.57	1.4	149
Nov-22	14,708	1.89	2.4	165
Dec-22	15,305	1.94	2.6	174

There are two compliance monitoring points associated with Elkview Operation water quality monitoring, one on Michel Creek and the second on Harmer Creek. Locations of these compliance stations are shown on **Figure 4-1b.** Selenium concentrations measured in 2022 at these compliance points are shown on **Insert 4-1**. It is noted that these compliance monitoring points do not capture all of the mine-impacted water draining from the Elkview Mine.

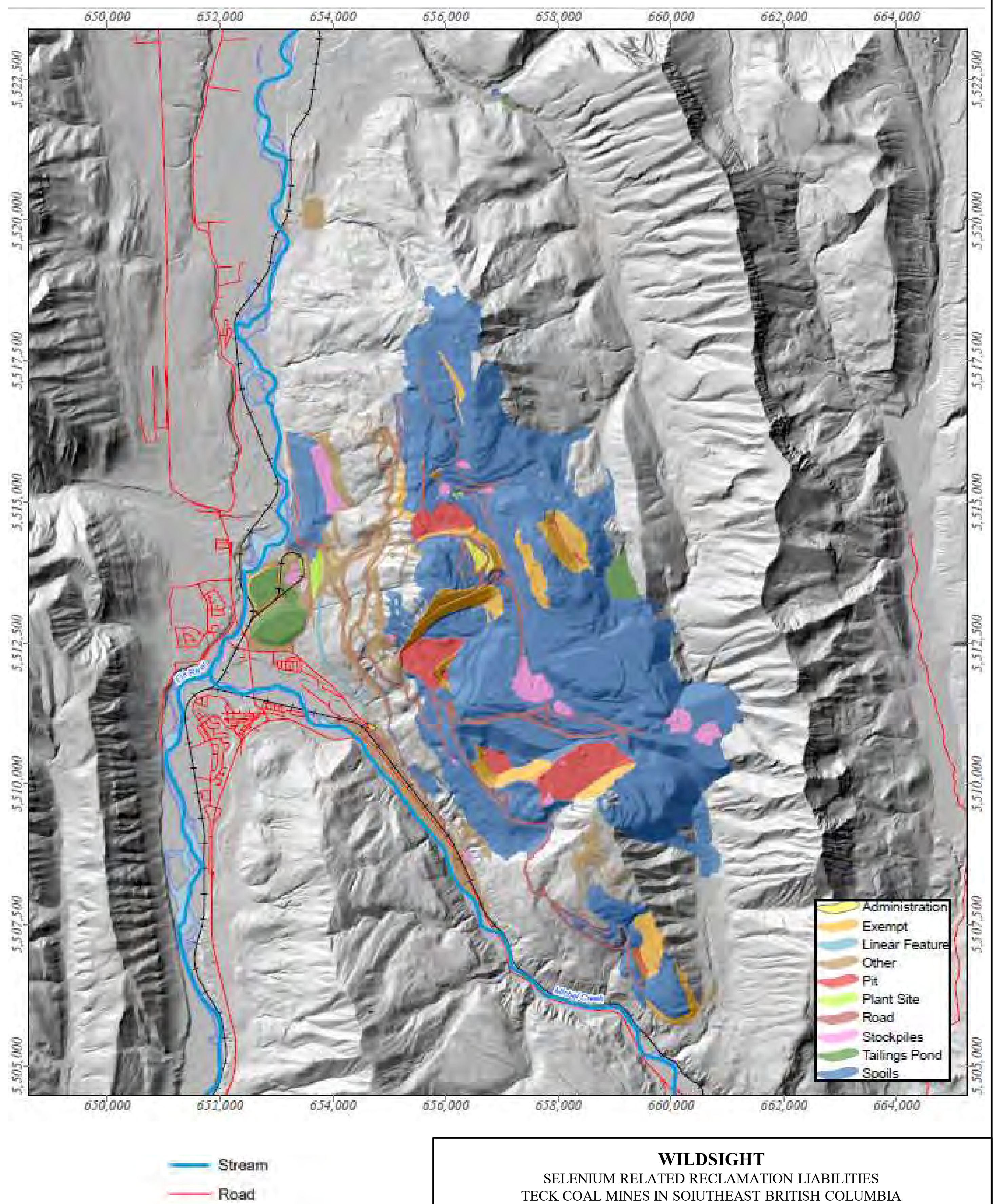
Review of the data shown on **Insert 4-1** indicates that selenium concentrations measured in samples collected from the two compliance monitoring points vary seasonally. Higher concentrations of selenium are typically measured in samples collected during low-flow conditions. Review of these data indicates a slightly increasing trend in selenium concentrations in Harmer Creek, and a slightly decreasing trend in Michel Creek, since approximately 2018.

Insert 4-1: Selenium Concentrations at Compliance Points (upper graph is Harmer Creek, lower graph is for Michel Creek) Source: Teck, 2023a)



Groundwater Monitoring

The spatial distribution of selenium concentrations in water samples collected from the Elkview Mine are shown on **Figure 4-1c** (northwest) and **Figure 4-1d** (southeast). Review of these figures indicates that groundwater impacted by mining operations contains dissolved selenium at concentrations typically between approximately 20 ug/L and 200 ug/L. Conversely, groundwater not impacted by mining operations typically contains dissolved selenium concentrations less than 1 ug/L, although there are a few outliers. Based on the distribution of impacts, it appears that selenium contamination in groundwater may be contributing to selenium contamination in Michel Creek. It also appears that selenium contamination in Elk River has resulted in selenium contamination to groundwater on the west side of Elk River, near Sparwood.

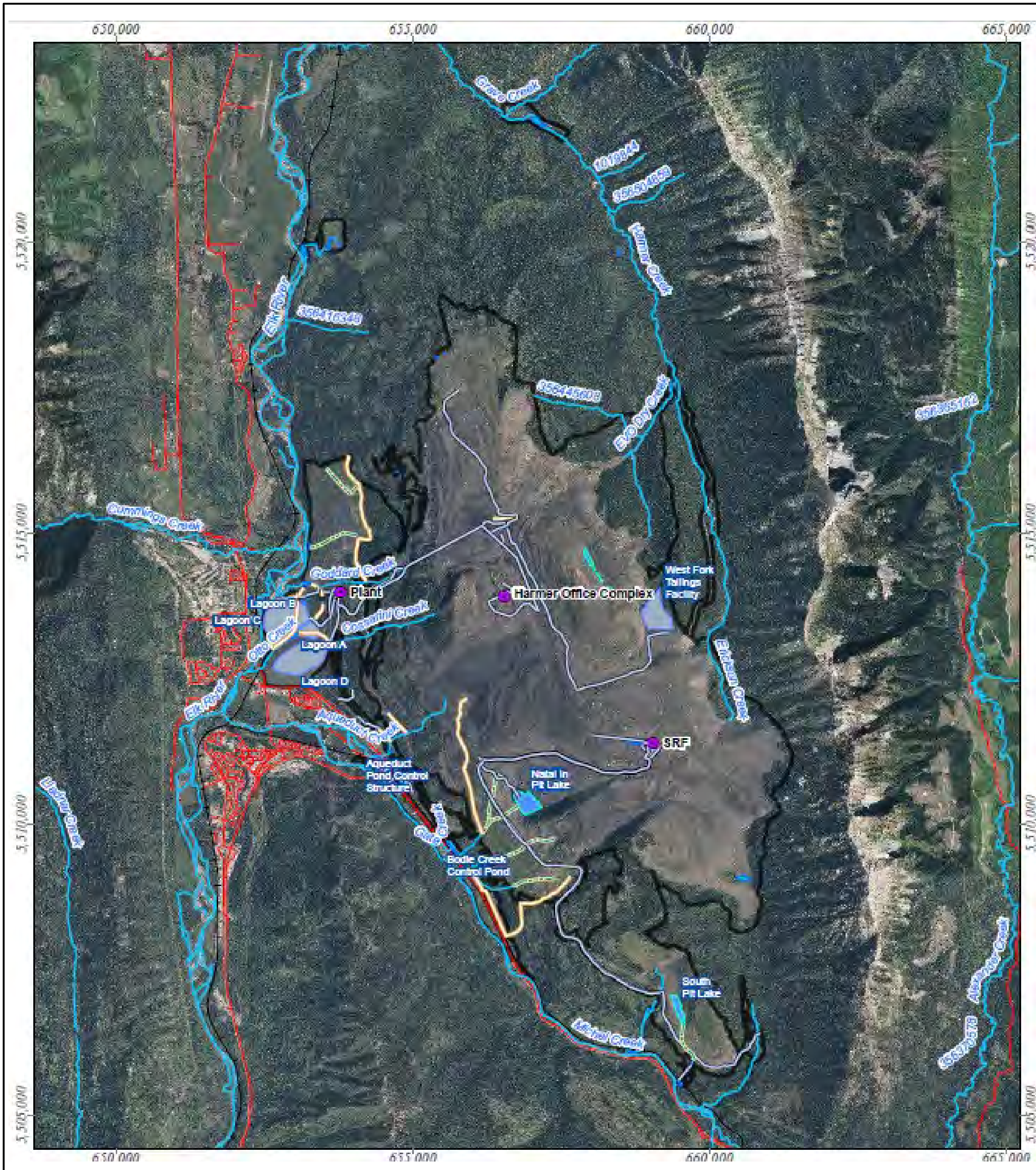


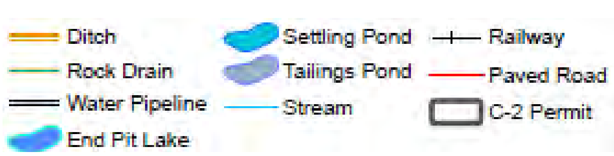
WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Elkview Mine
(Source: Teck, 2023a)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:
Project No.: WILD-01	Figure No.: **4-1a**



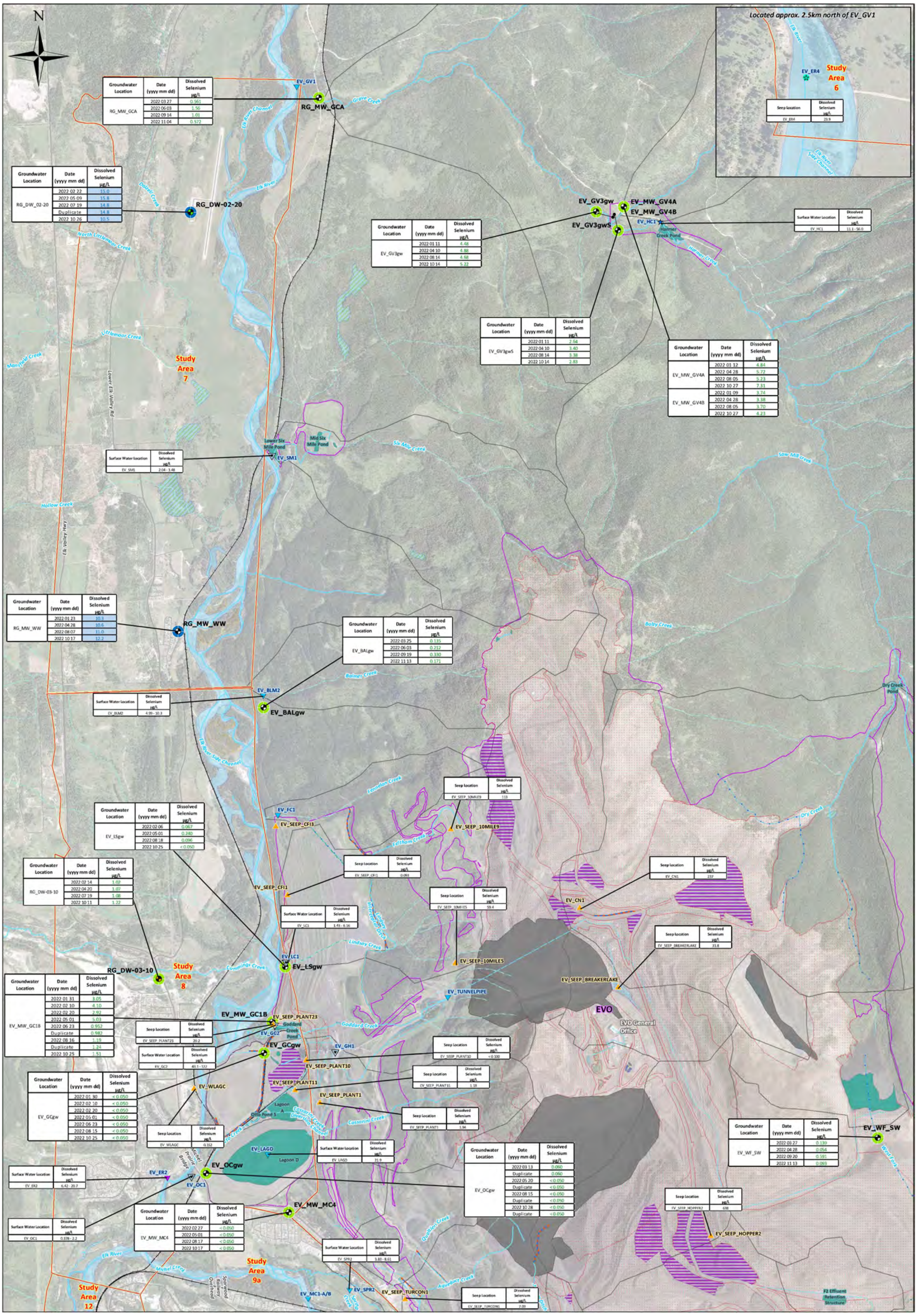


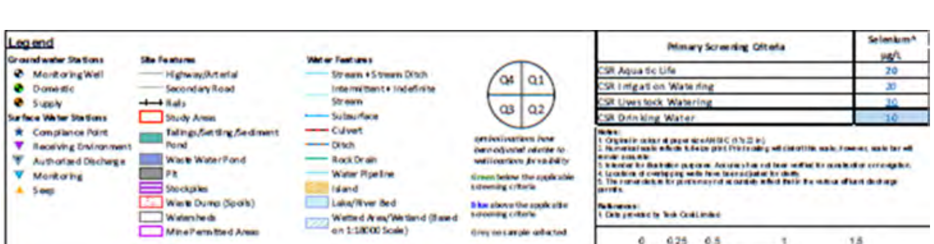
WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Hydrology of Elkview Mine
(Source: Teck, 2023a)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:
Project No.: WILD-01	Figure No.: **4-1b**



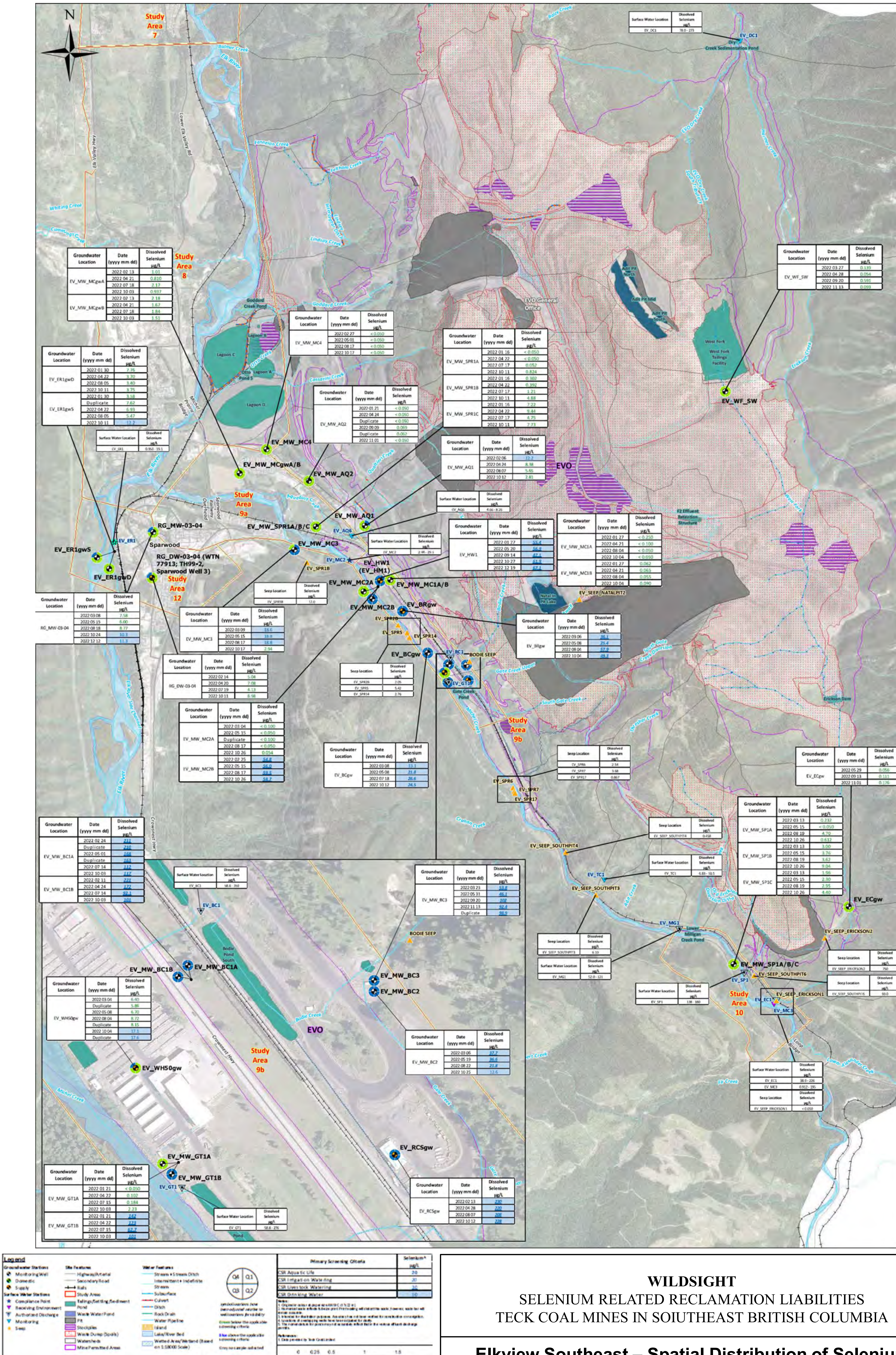


WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Elkview Northwest – Spatial Distribution of Selenium
(Source: SNC, 2023)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:
Project No.: WILD-01	Figure No.: **4-1c**



WILDSIGHT

SELENIUM RELATED RECLAMATION LIABILITIES

TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Elkview Southeast – Spatial Distribution of Selenium

(Source: SNC, 2023)

Date: 3/9/2024	Scale:
Project No.: WILD-01	Figure No.: 4-1d

4.2 Line Creek

General

The Line Creek Mine is located approximately 22 km north-northeast of the Town of Sparwood, and approximately 7 km upstream of the confluence of Line Creek into Fording River (**Figure 4-2a**). By the end of 2021, the total area impacted by Line Creek Mine exceeded 2,600 hectares, with less than 20% of that area classified as reclaimed (Teck, 2022c, Section 2.1). Line Creek Mine is a truck and shovel operation, and blasting is implemented regularly to remove overburden rock and access the minable coal.

Coal is transported by conveyor along the mine access road to the processing area that is located adjacent to the confluence of Line Creek and Fording River (**Figure 4-2a**). The processed coal is loaded into railcars that convey the coal to ports on the Pacific Coast for export. Over 3 million tonnes of clean coal is produced by the Line Creek Mine, and approximately 90 million tonnes of waste rock is generated each year (Teck, 2022d, Table 2-3).

Hydrology

Line Creek Mine is contained almost entirely within the Line Creek watershed. Line Creek flows through the mine development area and confluences with Fording River in the Elk River Valley, immediately northwest of the coal processing area of the Line Creek Mine, and approximately 1 km upstream of the confluence of Fording River into Elk River.

There are three main tributaries of Line Creek, namely Tornado Creek, West Line Creek and South Line Creek. The West Line Creek watershed has been almost entirely disturbed by Teck's mining activities. The main Line Creek drainage, West Line Creek, Dry Creek, and Tornado Creek channels have been filled with mine waste rock immediately upstream of their confluence with South Line Creek. The watershed areas of these creeks, which flow through waste rock drains, exceed the area of the Line Creek Mine that is affected by mine spoil (**Figure 4-2b**). Most of the waste rock disposal is currently occurring in the Dry Creek Valley. In 2021, a waste rock dump failure involving approximately 2 million m^3 of mine spoil buried a 435 m segment of Dry Creek above the rock drain (Teck, 2023b, PDF page 36 of 130).

Existing and Planned Remedial Measures

The West Line Creek Active Water Treatment Facility was commissioned in 2018 and treats up to 7,500 m^3/day water from West Line Creek and Line Creek. The average daily flow through the West Line Creek AWTF in 2022 was 6,762 m^3/day, which is consistent with the average daily treated flow in 2021. Teck's permits assume that facility operates, and discharges treated water to the environment 95% of the time, with 5% downtime for maintenance and repairs. In 2022, the AWTF removed a total of 595 kg of selenium and 35,015 kg of nitrate, which is also consistent with the performance in 2021. Teck plans to expand this facility by December 31, 2025 to treat water from North Line Creek, which will increase the treatment capacity to 17,500 m^3/day. An active water treatment system with a treatment capacity of 10,000 m^3/day is also planned for Dry Creek and is projected to be operational by 2027 (Teck, 2023g).

Surface Water Quality Monitoring

Teck publishes the measured concentrations of selenium in the effluent water treatment facility, as well as the average treatment rate (flow through treatment facility), and mass of selenium removed on a daily basis. This data can be used to calculate the influent concentration of selenium through the reporting period, which is summarized for 2022 in **Table 4.2**. Additional information made available by Teck indicates that selenium contamination is highest in the West Line Creek watershed (**Insert 4-2a**).

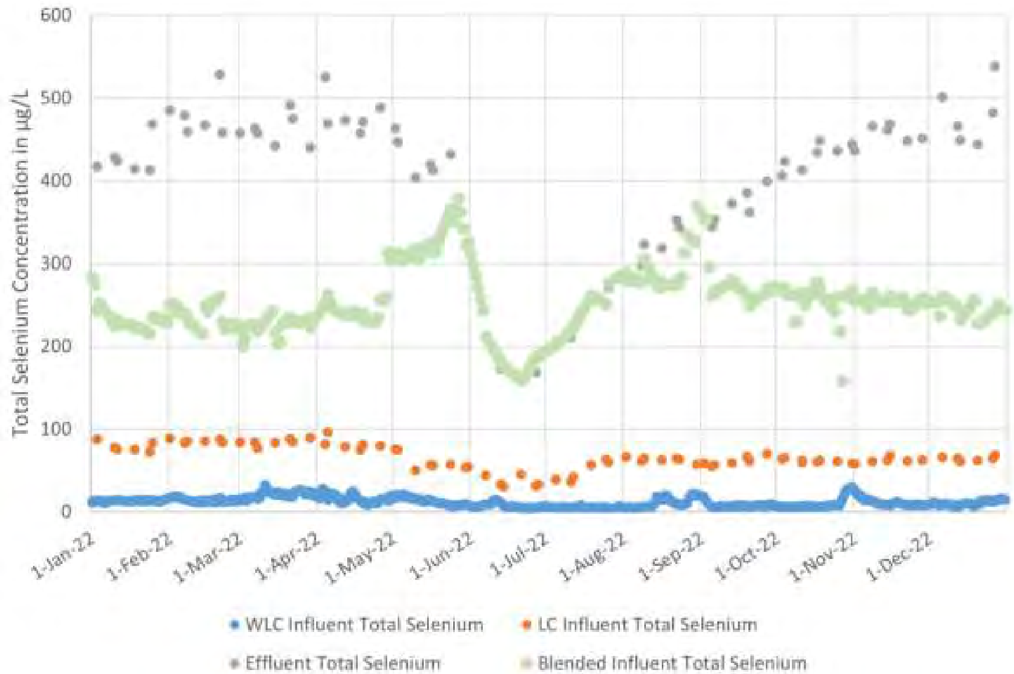
Line Creek Mine monitors selenium concentrations at its downstream compliance point in Line Creek, as well as in Dry Creek, downstream of the sedimentation ponds in the Elk River valley. Average monthly measurements of selenium concentrations versus those predicted by Teck's model are shown in **Inserts 4-2b/c**, respectively. Review of these inserts shows relatively diminishing concentrations of selenium in samples collected from Line Creek since 2018, and dramatically increasing selenium concentrations in samples collected from Dry Creek.

Table 4.2

Line Creek Water Treatment Facility Performance (Source: B.C., 2024)

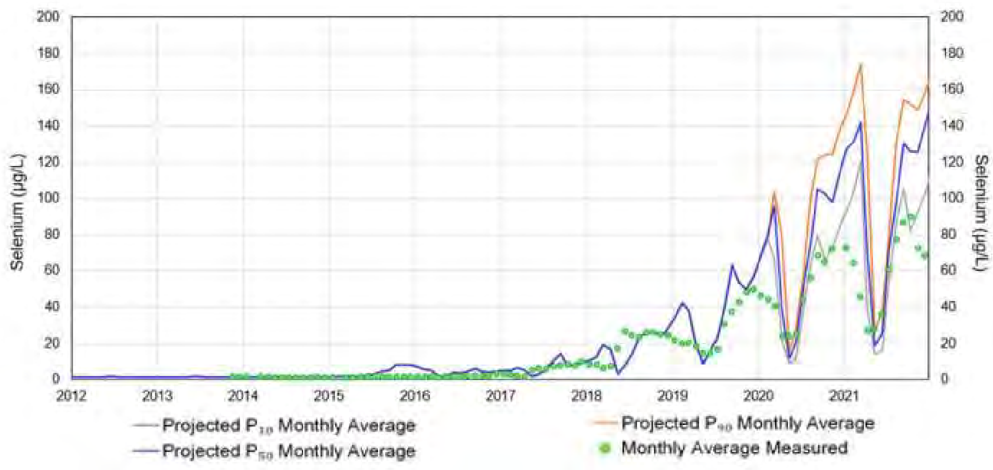
Month	Treatment Rate (m^3/day)	Effluent Concentration (ug/L)	Mass Removed (kg/day)	Influent Concentration (ug/L)
Jan-22	7,253	13	1.5	220
Feb-22	7,359	13	1.6	230
Mar-22	7,519	21	1.5	220
Apr-22	7,293	16	1.7	246
May-22	6,650	13	1.9	299
Jun-22	4,571	7	0.8	186
Jul-22	4,370	5	0.9	204
Aug-22	6,473	11	1.8	284
Sep-22	7,175	8	1.9	274
Oct-22	7,555	9	1.9	255
Nov-22	7,545	11	1.8	254
Dec-22	7,557	10	1.8	244

Insert 4-2a: Line Creek Mine Water Treatment (Source: Teck 2022f)



Insert 4-2b: Line Creek Water Quality Monitoring (Source: Teck, 2023b)

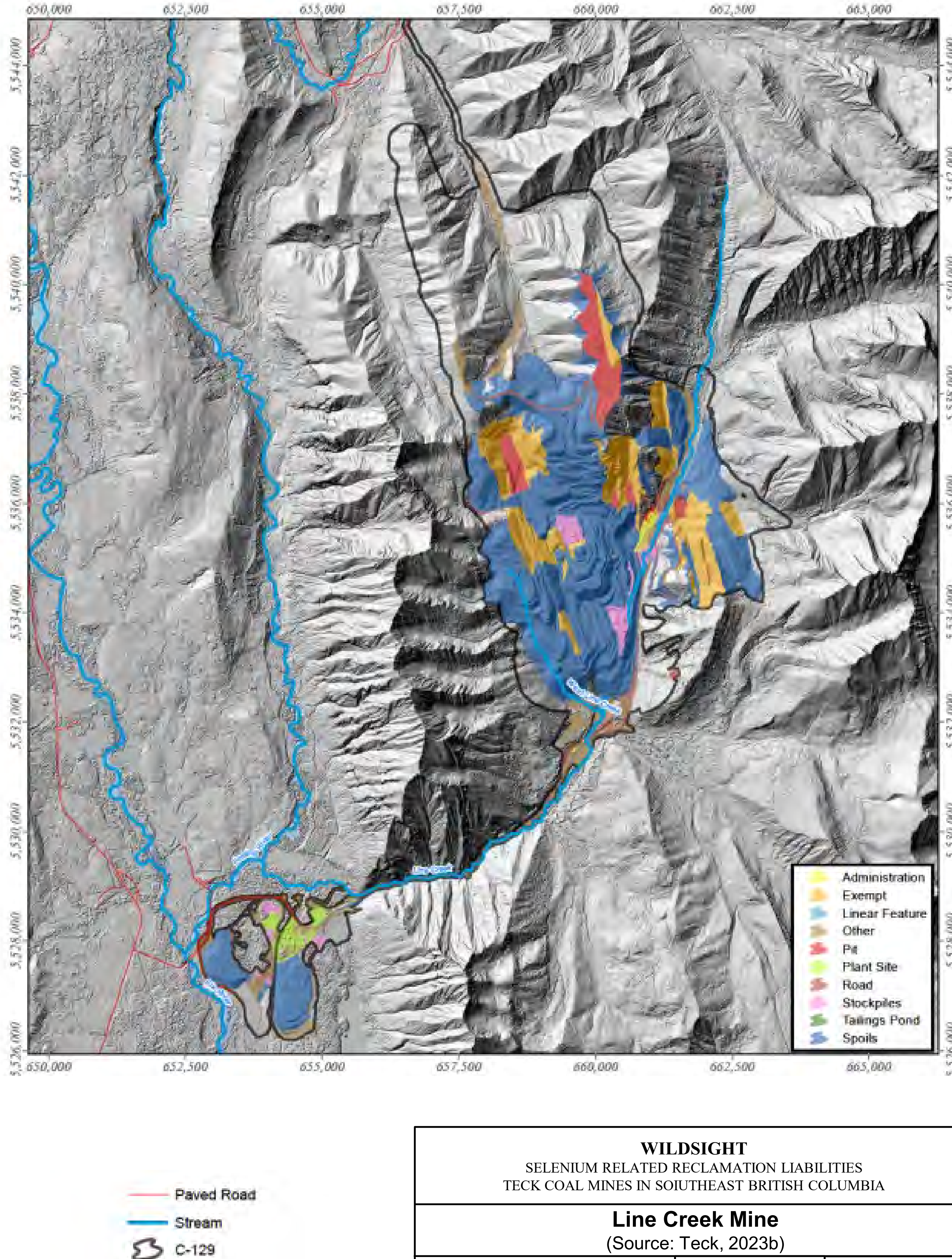
Insert 4-2c: Dry Creek Water Quality Monitoring (Source: Teck, 2023b)



Groundwater Monitoring

The waste rock dumps, mine spoil, and coal stockpiles provide the primary surface aquifers in the mine development area. Groundwater flow through these waste dumps is very rapid and discharges to one of the main drainages within the mine described above. Inspection of **Figure 4-2a** indicates that these materials are present over about ¾ of the mine development area.

The spatial distribution of selenium concentrations in water samples collected from the Line Creek Mine are shown on **Figure 4-2c**. Review of this figure indicates that groundwater impacted by mining operations contains dissolved selenium over a wide range of concentrations, from approximately 10 ug/L, to over 500 ug/L. Conversely, groundwater not impacted by mining operations in the region typically contains dissolved selenium concentrations less than 1 ug/L, although there are a few outliers. Based on the distribution of impacts, it is not clear to what degree selenium contamination in groundwater may be contributing to selenium contamination in surface water within the mine area, or vice versa.

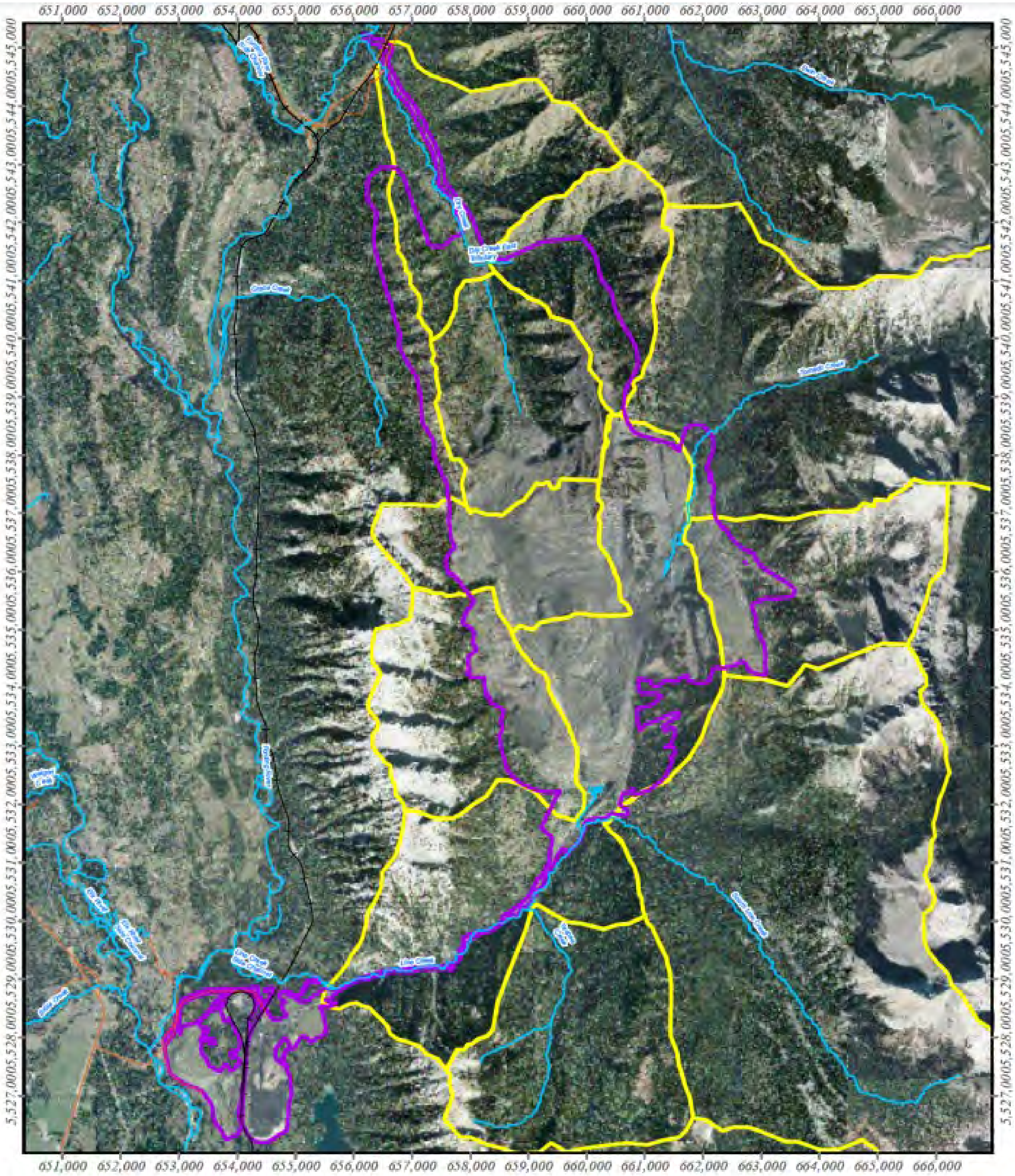


WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Line Creek Mine
(Source: Teck, 2023b)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:	
Project No.: WILD-01	Figure No.:	**4-2a**



WILDSIGHT

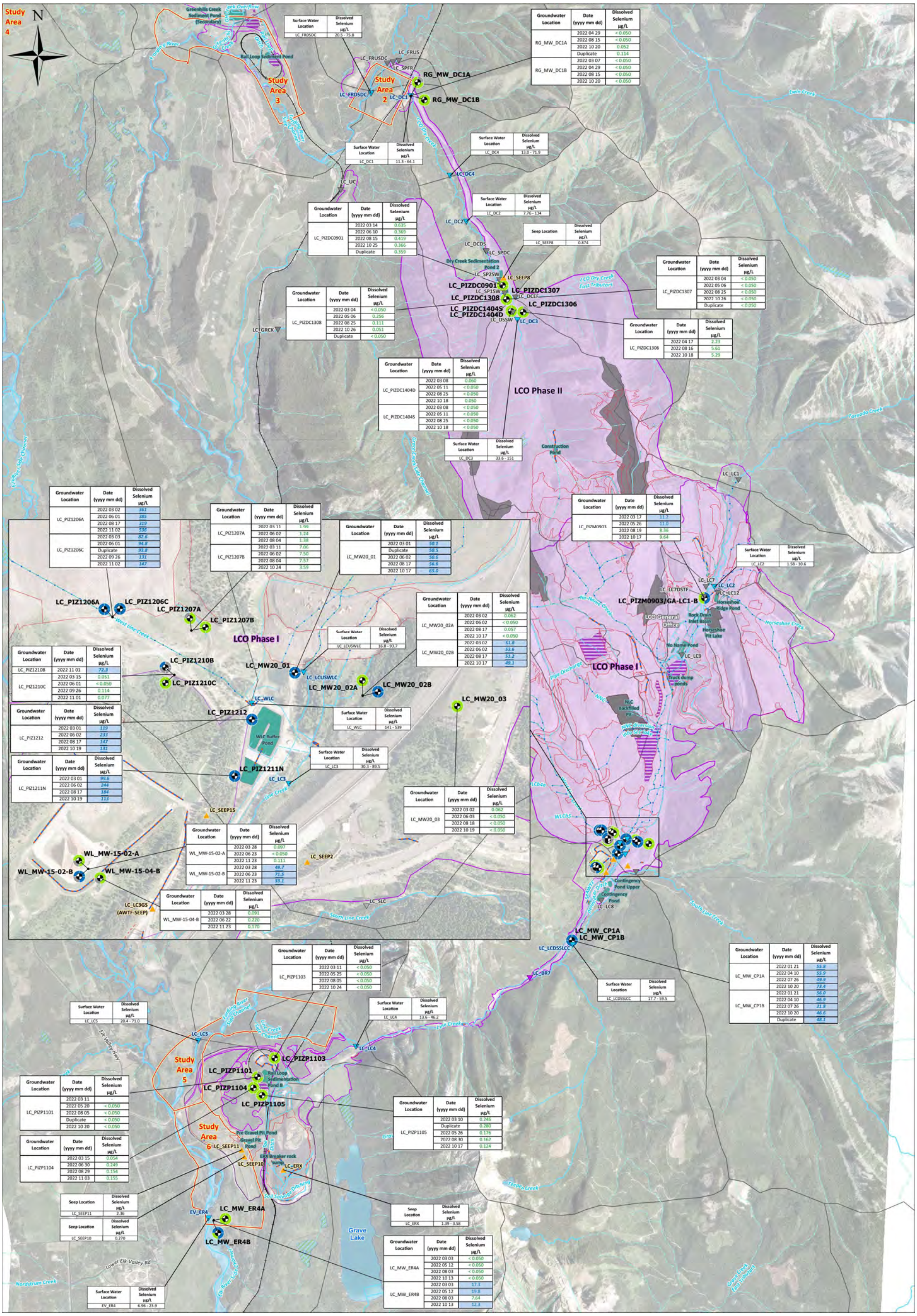
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

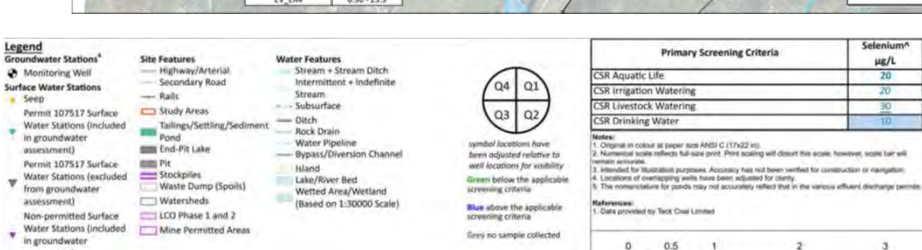
Hydrology of Line Creek Mine

(Source: Teck, 2023b)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:
Project No.: WILD-01	Figure No.: 4-2b





WILDSIGHT

SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Line Creek – Spatial Distribution of Selenium
(Source: SNC, 2023)

Date:	Scale:
3/9/2024	
Project No.: WILD-01	Figure No.: **4-2c**

BURGESS ENVIRONMENTAL

4.3 Fording River

Mine Operations

Teck's Fording River Mine is located approximately 29 kilometers northeast from the community of Elkford, British Columbia (**Figure 4-3a**), with a total of approximately 23,000 hectares under license, of which approximately 7,000 ha have been permitted for mining related activities. The truck and shovel mining operations commenced in 1972, and the current annual production capacities of the mine and preparation plant are approximately 10 million tonnes of clean coal. Mining currently occurs in the Swift and Eagle Mountain areas, which are projected to operate until approximately 2026 and 2040, respectively. The coal reserves in Eagle Mountain, Swift, Turnbull, and Castle are expected to support mining through 2064 (Teck, 2023c, Section 1.1). By the end of 2022, the Fording River Mine had disturbed an area of approximately 5,350 ha, of which 3,730 ha were covered by mine spoil and 770 hectares had been revegetated (Teck, 2023c, Table 2-1).

Hydrology

Fording River Mine is located in the upper Fording River watershed, which covers an area of 42,600 ha that is topographically diverse and ranges in elevation from approximately 1,430 masl at the lowest portion of the valley to more than 3,000 masl. Fording River originates near Mount Maclaren on the British Columbia/Alberta border and flows south to its confluence with Henretta Creek at the northern end of the Fording River Mine. From there, it flows through the mine and confluences with several smaller tributaries that also flow through the mining area. The river confluences with Chauncey Creek, which is not affected by mining, downstream of the mining operations. Below Chauncey Creek, main tributaries to Fording River include Todhunter Creek, Ewin Creek, Dry Creek and Greenhills Creek. Based on review of aerial imagery, all of its tributaries within the mine area, appear to flow through waste rock and mine spoil (**Figure 4-3b**).

Current and Planned Remedial Measures

In Q4 2021, Teck began commissioning the Fording River South water treatment facility. The facility entered the operational phase in Q3 of 2022, and removes nitrate and selenium from Swift Creek/Cataract Creek and from Kilmarnock Creek, and discharges treated effluent to Fording River and to Kilmarnock Creek.

Teck has constructed a saturated rock fill with a treatment capacity of up to 30,000 m^3/d, to remove nitrate and selenium in water from Clode Creek, Swift Pit, and North Spoil areas. In December 2022, the saturated rock fill was mechanically completed, commissioning occurred in 2023, and the facility was operating in 2024. The treated water is to be discharged to Clode Creek.

Teck invested approximately $30 million, focused on improving the effectiveness of water treatment technologies and on investigating long-term solutions for managing water quality at the source. Specific to the Fording River Mine, the 2022 research program included the development of a detailed suboxic zone design for the Swift North Spoil (Teck, 2023c). Saturated rock fill treatment facilities having a treatment capacity of 30,000 m^3/day are planned for the north portion of the Fording River Mine, and are scheduled to be operational by 2027 (Teck, 2023g).

Surface Water Quality Monitoring

Teck reports the measured concentrations of selenium in the effluent water treatment facility, as well as the average treatment rate (flow through treatment facility), and mass of selenium removed on a daily basis. This data can be used to calculate the influent concentration of selenium through the reporting period, which is summarized on a monthly basis for 2022 in **Table 4.3**. **Insert 4-3a** shows the measured versus predicted selenium concentrations measured at the Fording River Compliance Point.

Insert 4-3a: Water Quality Monitoring at Fording River Compliance Point (Source: Teck, 2023c)

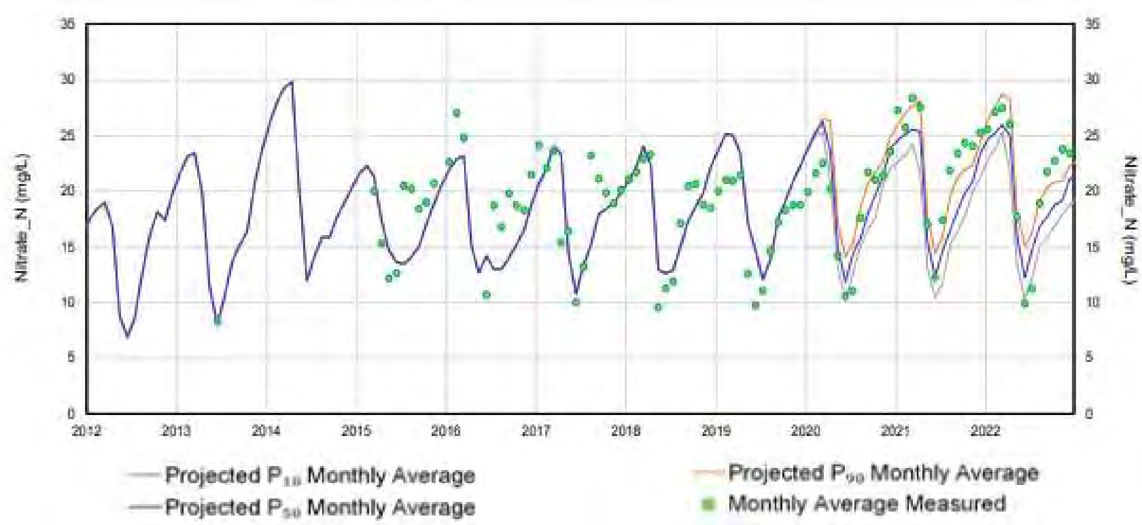


Table 4.3

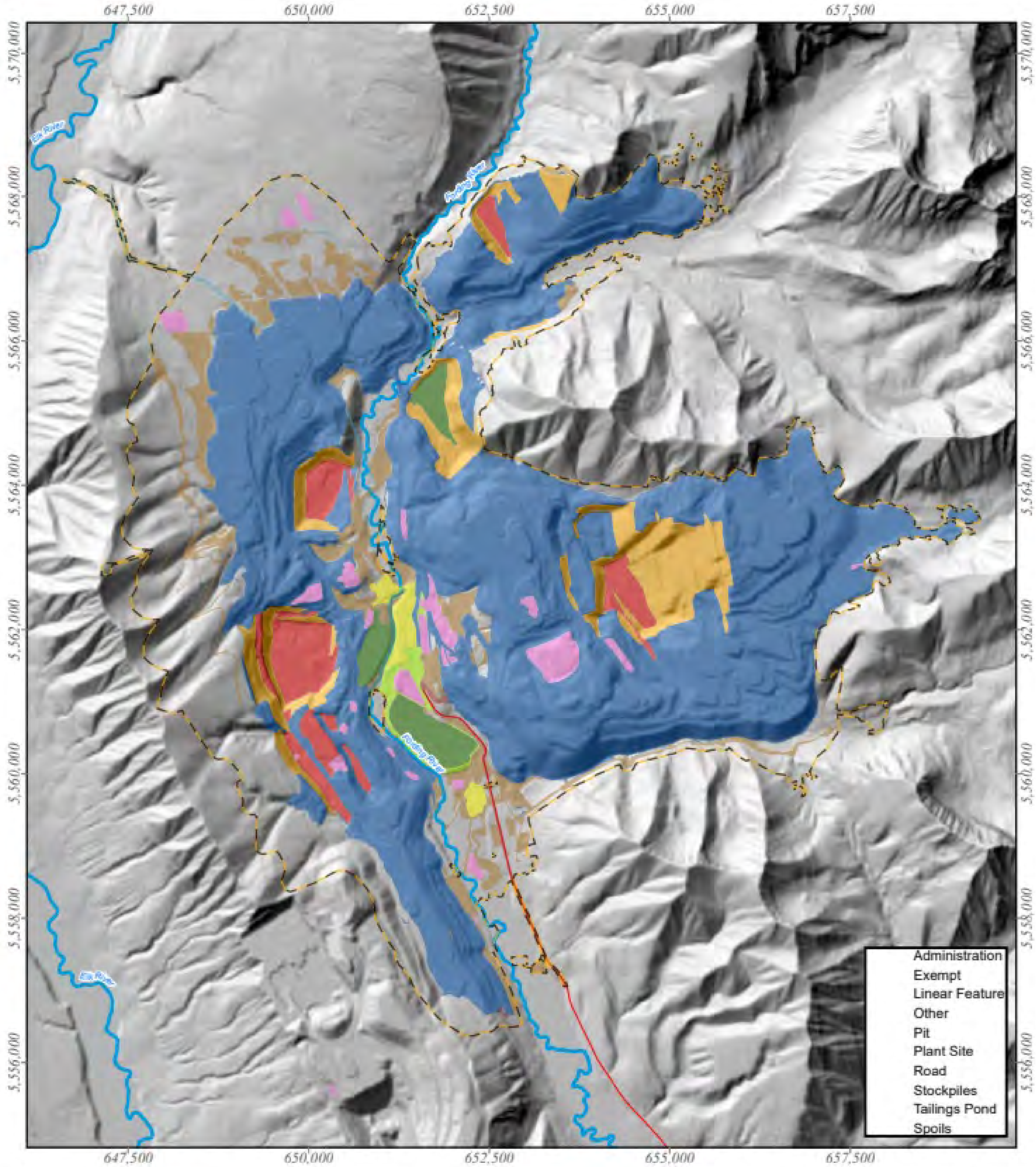
Fording River Water Treatment Facility Performance (Source: B.C., 2024)

Month	Treatment Rate (m3/day)	Effluent Concentration (ug/L)	Mass Removed (kg/day)	Influent Concentration Calculated (ug/L)
Jan-22	2,869	25.4	1.5	548
Feb-22	3,146	21.4	1.7	562
Mar-22	4,914	24.7	2.9	615
Apr-22	5,602	24.4	2.7	506
May-22	8,332	17.9	3.5	438
Jun-22	9,794	15.6	3.9	414
Jul-22	8,038	10.3	2.4	309
Aug-22	7,793	15.2	3.1	413
Sep-22	12,305	21.6	4.8	412
Oct-22	13,353	20.5	6.0	470
Nov-22	10,602	19.9	5.0	492
Dec-22	9,739	20.2	5.0	534

Groundwater Monitoring

The Fording River Mine also implements groundwater and seepage water monitoring to comply with its operating permit. 29 wells (2 supply wells and 27 monitoring wells) and seepages are included in the water quality monitoring programs for the mine. Widespread contamination of groundwater by selenium, as well as other order constituents, has been measured in the mine-affected areas.

The spatial distribution of selenium concentrations in water samples collected from the Fording River Mine are shown on **Figure 4-3c** (north) and **Figure 4-3d** (south). Review of these figures indicates that groundwater impacted by mining operations typically contains dissolved selenium at concentrations higher than approximately 50 ug/L, and can exceed 450 ug/L. Conversely, groundwater in the region not impacted by mining operations typically contains dissolved selenium concentrations less than 1 ug/L, although there are a few outliers. Concentrations of dissolved selenium in seep water samples are generally consistent with those of groundwater samples. Based on the distribution of impacts, it appears that selenium contamination in groundwater is contributing to selenium contamination in surface water within the mine area, and vice versa.



C-3
Road
Stream

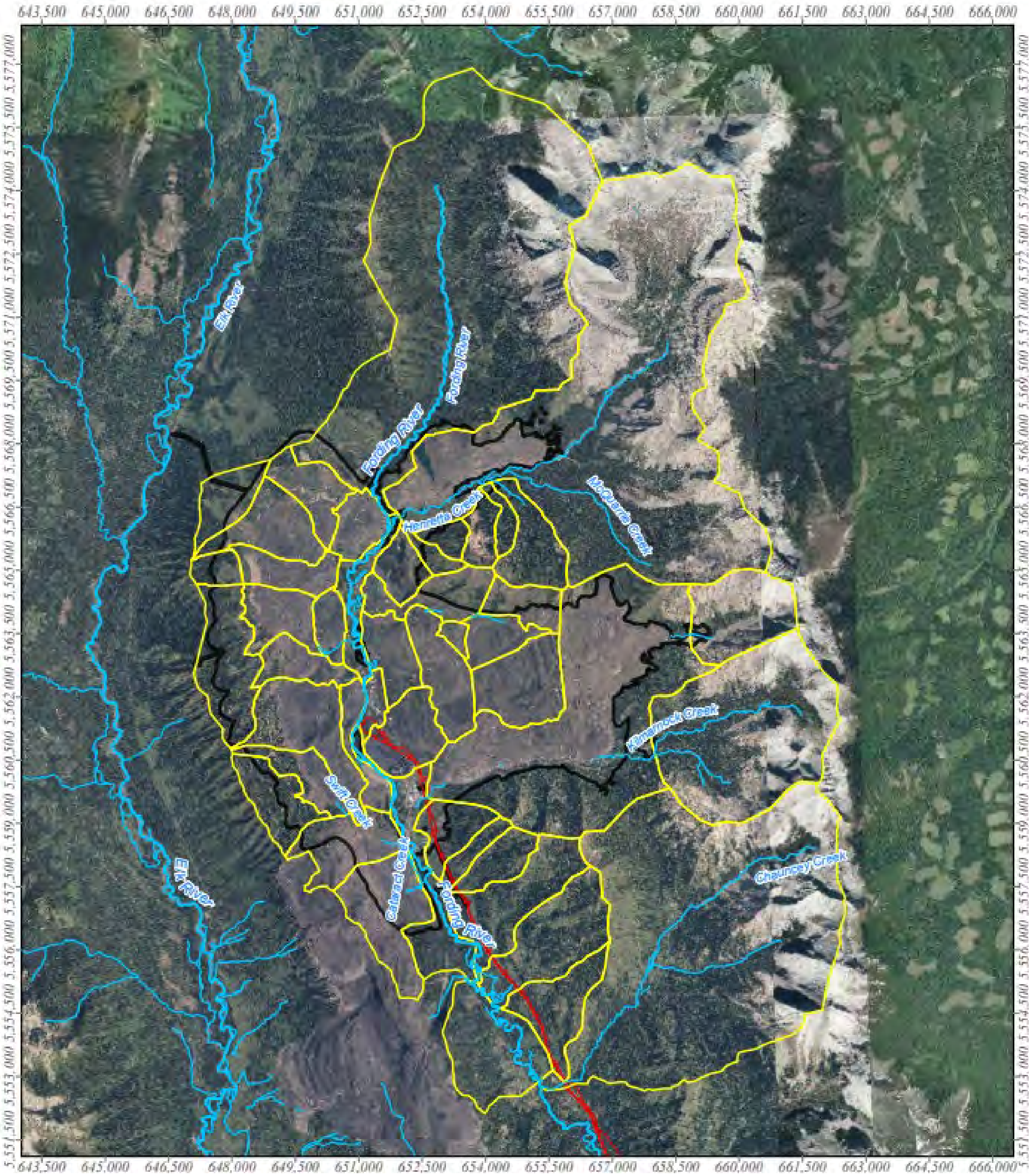
WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Fording River Mine

(Source: Teck, 2023c)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:
Project No.: WILD-01	Figure No.: 4-3a



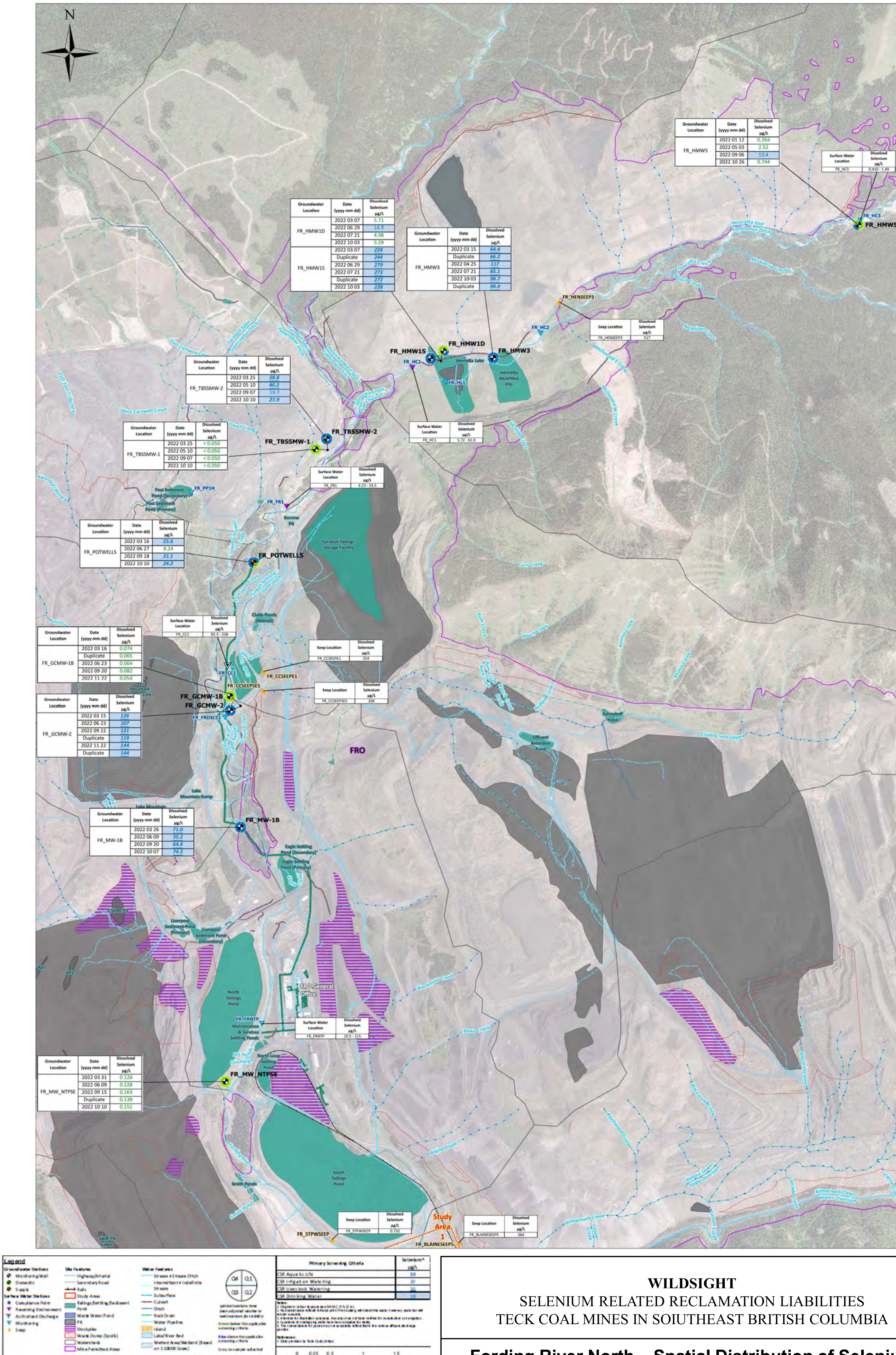
Current Drainage Basin | Road
Stream | C-3 Permit
Railway

WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Hydrology of Fording River Mine
(Source: Teck, 2023c)

BURGESS ENVIRONMENTAL

Date: 3/9/2024
Scale:
Project No.: WILD-01
Figure No.: **4-3b**



WILDSIGHT

SELENIUM RELATED RECLAMATION LIABILITIES

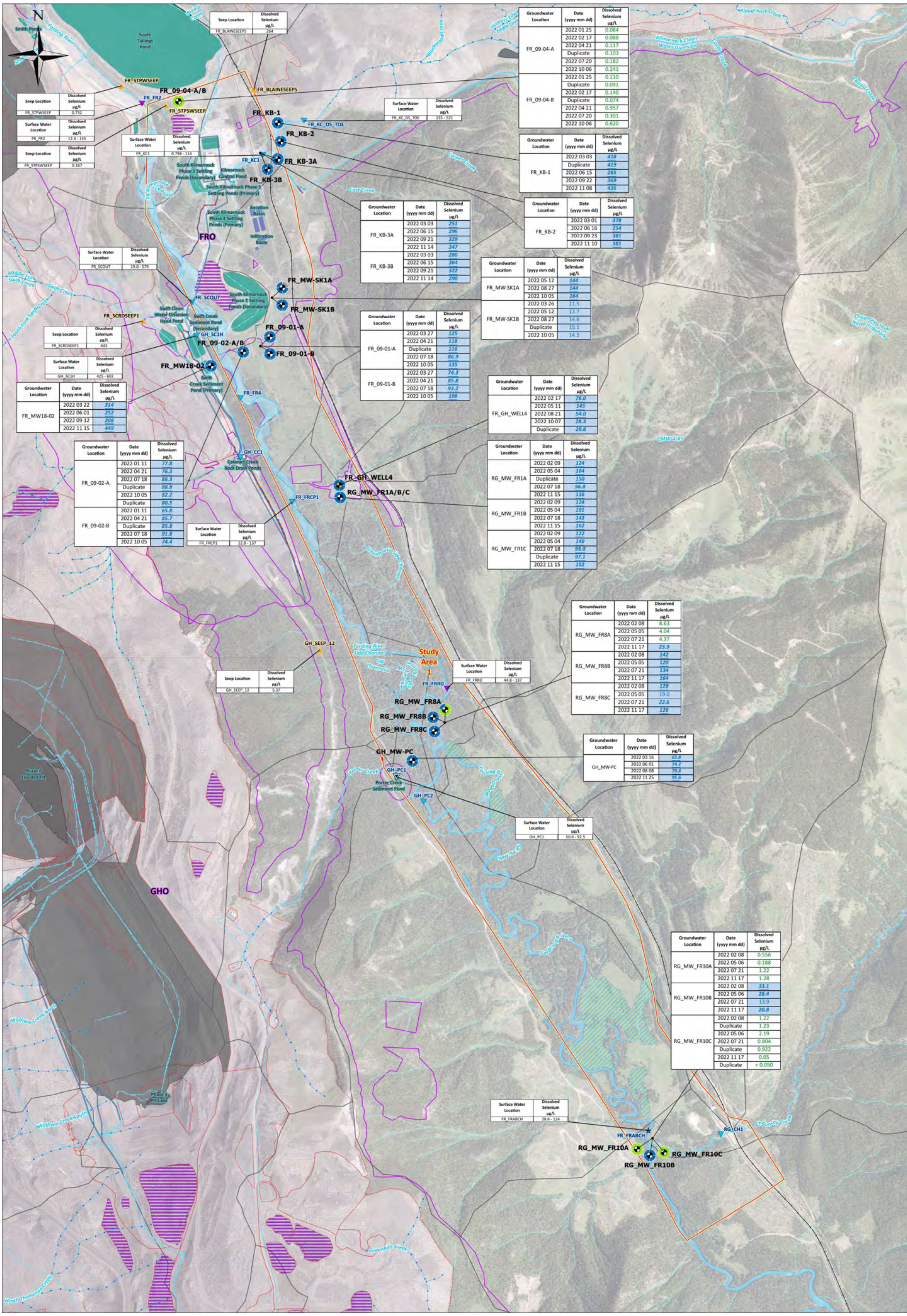
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

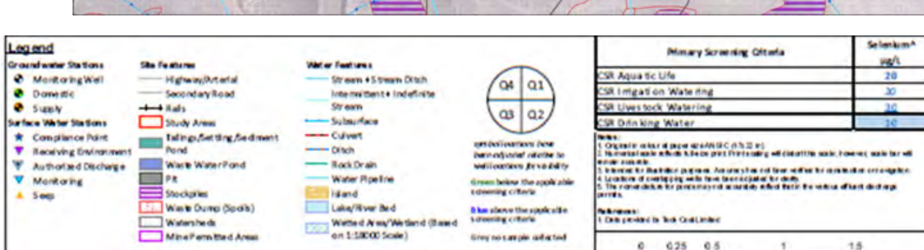
Fording River North – Spatial Distribution of Selenium

(Source: SNC, 2023)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:
Project No.: WILD-01	Figure No.: 4-3c





WILDSIGHT

SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Fording River South – Spatial Distribution of Selenium
(Source: SNC, 2023)

BURGESS ENVIRONMENTAL	Date: 3/9/2024	Scale:
	Project No.: WILD-01	Figure No.: 4-3d

4.4 Greenhills

Mine Operations

Tech Coal Limited's Greenhills Mine is situated between the Elk and Fording River valleys, along the Greenhills Mountain Range, approximately 8 km northeast of Elkford (**Figure 4-4a**). Fording River Mine is located directly north and upstream (via Elk River) of the Greenhills Mine, and the two mines share an overlapping boundary. Raw coal is transported to the Fording River Mine for processing. Greenhills Mine has been producing coal since 1981, and clean coal production capabilities are between 5 and 6 million tonnes per year.

By the end of 2022, operations at the Greenhills Mine had disturbed approximately 3,000 ha of land with a total of 453.2 ha revegetated. 3.7 billion tonnes of waste rock have been removed and 104 million tonnes of coarse coal rejects have been placed in spoil piles that covered an area of 1,900 ha.

The Permitted Mine Life Plan spans 5-years from 2023 through 2027. It is unclear if this timeframe represents the planned life of mine, or if mining is planned to continue past 2027. Over that period, 385 million tonnes of waste will be moved to produce 31 million tonnes of coal. From 2023 to 2026, 66 million tonnes of waste will be spoiled in the Elk River watershed, 27 million tonnes in the Fording River watershed, and 296 million tonnes in-pit (Teck, 2023d).

Hydrology

Greenhills Mine is located on the Greenhills Range, with runoff from the Mine partially draining west towards Elk River, and the remainder east/south towards Fording River.

Western draining tributaries that are monitored as a part of mining operations at Greenhills include Wolf, Willow, Wade, Cougar, Michelson, Leask, Wolfram, and Thompson creeks (as well as one unnamed creek). Leask, Wolfram, and Thompson creeks are impacted by the Greenhills Mine west spoil area. Many of the above creeks contain sedimentation ponds that were constructed to reduce total suspended solids prior to discharge to receiving environments.

Eastern tributaries that drain to Fording River that are monitored at Greenhills include Greenhills Creek and Porter Creek. Mine impacted tributaries of the Greenhills Creek include headwaters from the toe of the East Spoil, the Hawk Seep, and Gardine Creek. Various sediment ponds have been constructed within the eastern tributaries. The headwaters of the Porter creek drainage are impacted by mine waste rock. Branch F tributary is reported to not be affected by mining operations and is monitored as a background station.

The west spoil and west access spoil are in the Elk River watershed, the Cougar 6 backfill spoil is in-pit, and the coal spoils as well as the north and east spoils are in the Fording River watershed.

Existing and Planned Remedial Measures

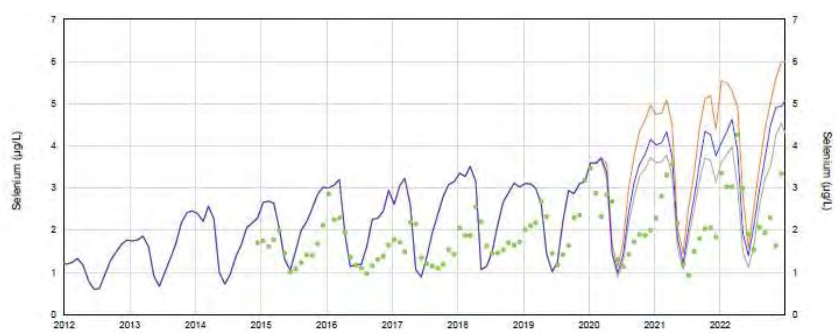
No water treatment systems have been implemented for the Greenhills Mine. An active water treatment facility for Greenhills Creek is planned for 2027, and will have a capacity of 7,500 m^3/day (Teck, 2023g). This treatment system will be located downstream of mine/spoil contact water associated with the east spoil, approximately 5 km upstream of the confluence of Greenhills Creek with Fording River.

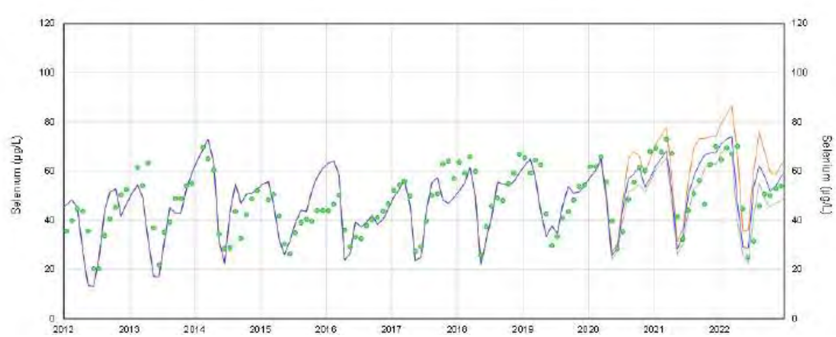
Surface Water Quality Monitoring

There are two compliance monitoring points for the Greenhills Mine water quality monitoring, one on Fording River (205 m downstream of Greenhills Creek), and the second on Elk River (220 m downstream of Thompson Creek). Locations of these compliance stations are shown on **Figure 4-4b.** Selenium concentrations measured in 2022 at these compliance points are shown on **Insert 4-4**.

Review of the data shown on **Insert 4-4** indicates that selenium concentrations measured in samples collected from the two compliance monitoring points vary seasonally. Higher concentrations of selenium are typically measured in samples collected during low-flow conditions. Review of these data indicate an increasing trend in selenium concentrations in Elk River, and much higher concentrations and a slightly increasing trend in Fording River.

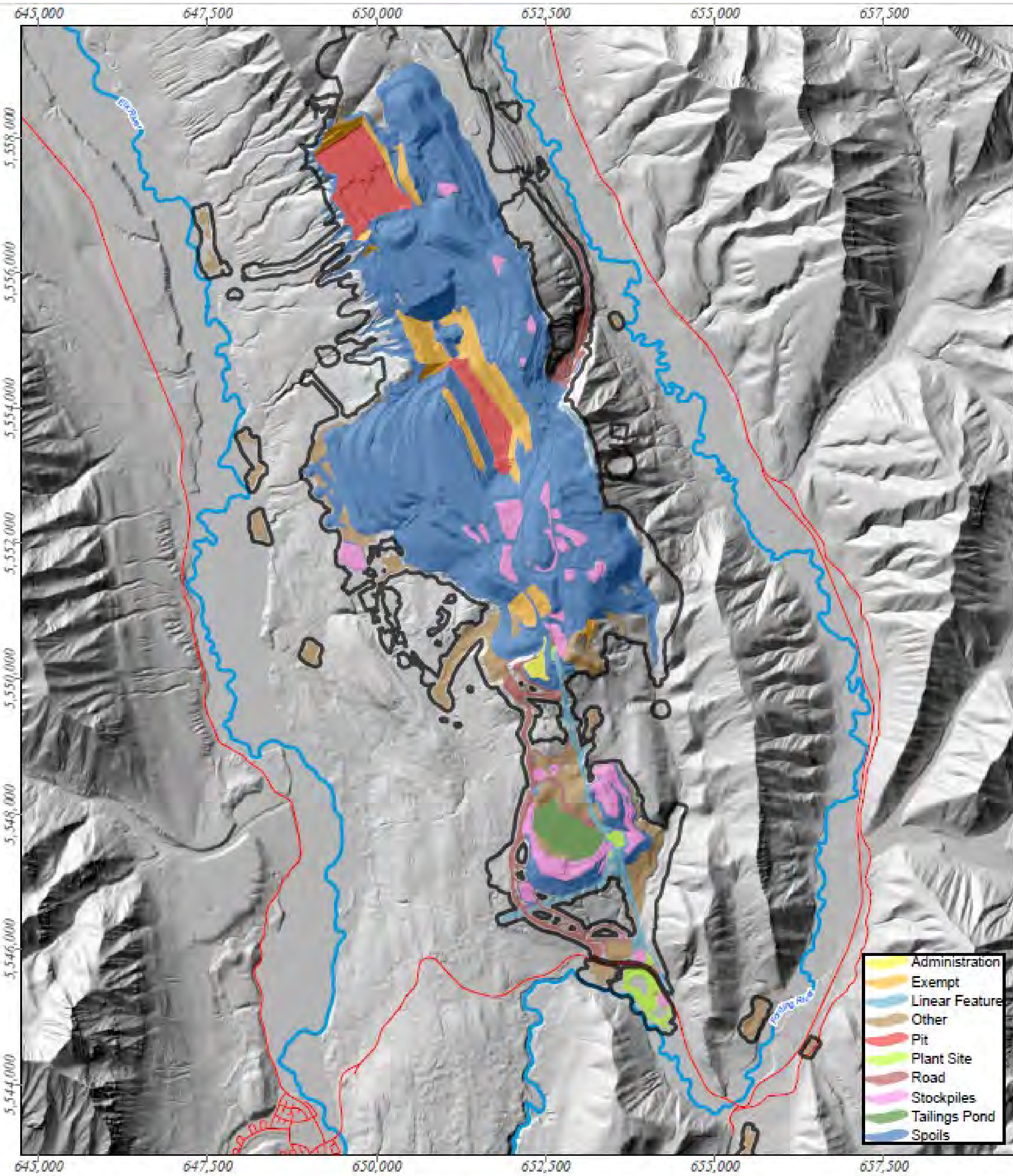
Insert 4-4: Water Quality Monitoring in Elk River (top) and Fording River (bottom) Compliance Points (Source: Teck, 2023d)





Groundwater Monitoring

The spatial distribution of selenium concentrations in water samples collected from the Greenhills Mine is shown on **Figure 4-4c** (east) and **Figure 4-4d** (west). Review of these figures indicates that groundwater impacted by mining operations contains dissolved selenium at concentrations typically between approximately 10 ug/L and 200 ug/L. Conversely, regional groundwater not impacted by mining operations typically contains dissolved selenium concentrations less than 1 ug/L, although there are outliers and it is not always clear which wells are affected by mining and which are not. Concentrations of dissolved selenium in seep water samples are generally consistent with those of groundwater samples. Based on the generally lower dissolved selenium concentrations measured in samples collected from the Greenhills Mine, it appears that selenium contamination in groundwater beneath the Greenhills Mine is not as significant a contributor to selenium contamination in surface water as the groundwater beneath the Fording River Mine.

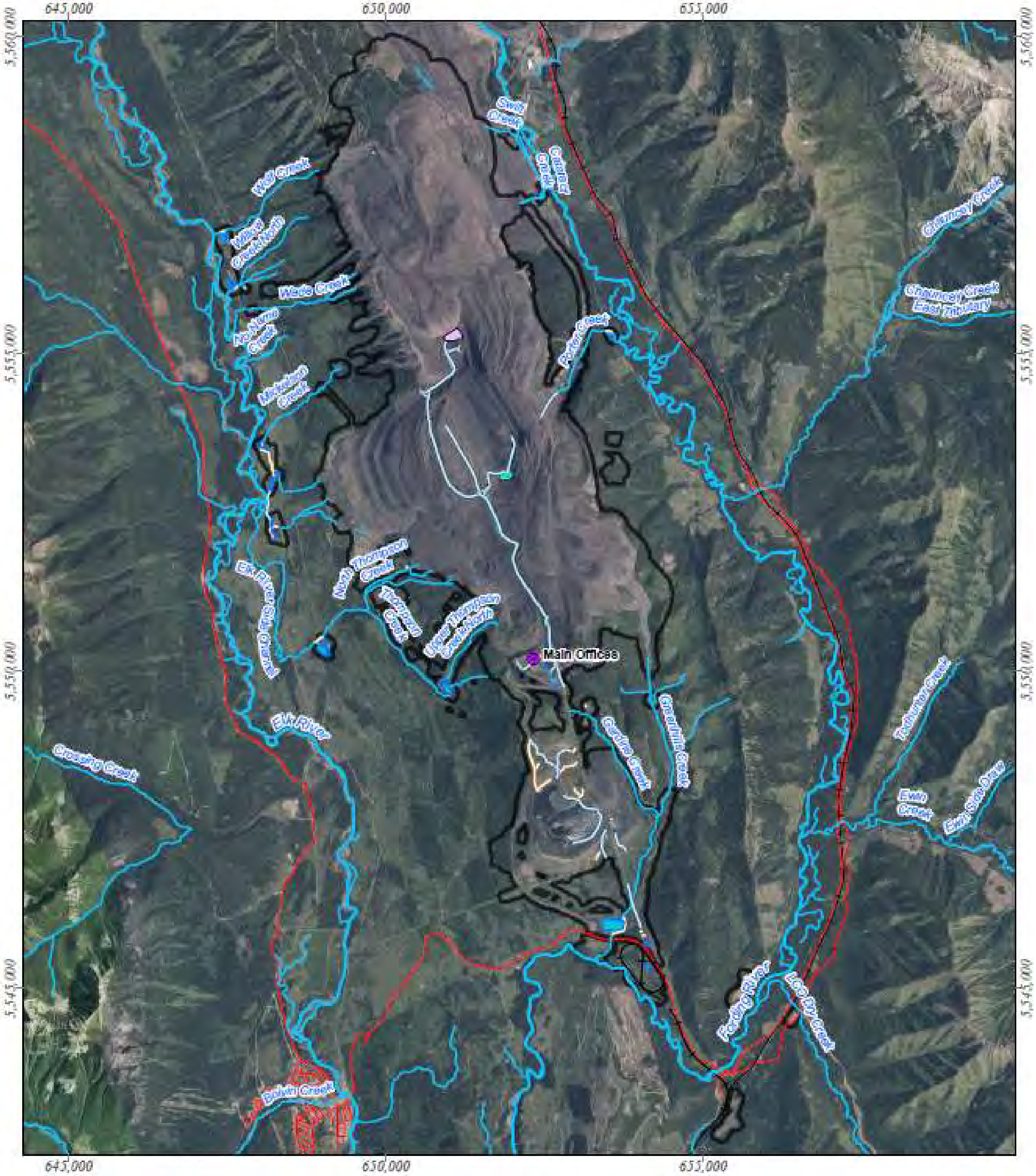


Stream
Road

WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Greenhills Mine
(Source: Teck, 2023d)

BURGESS ENVIRONMENTAL	Date: 3/9/2024	Scale:
	Project No.: WILD-01	Figure No.: 4-4a



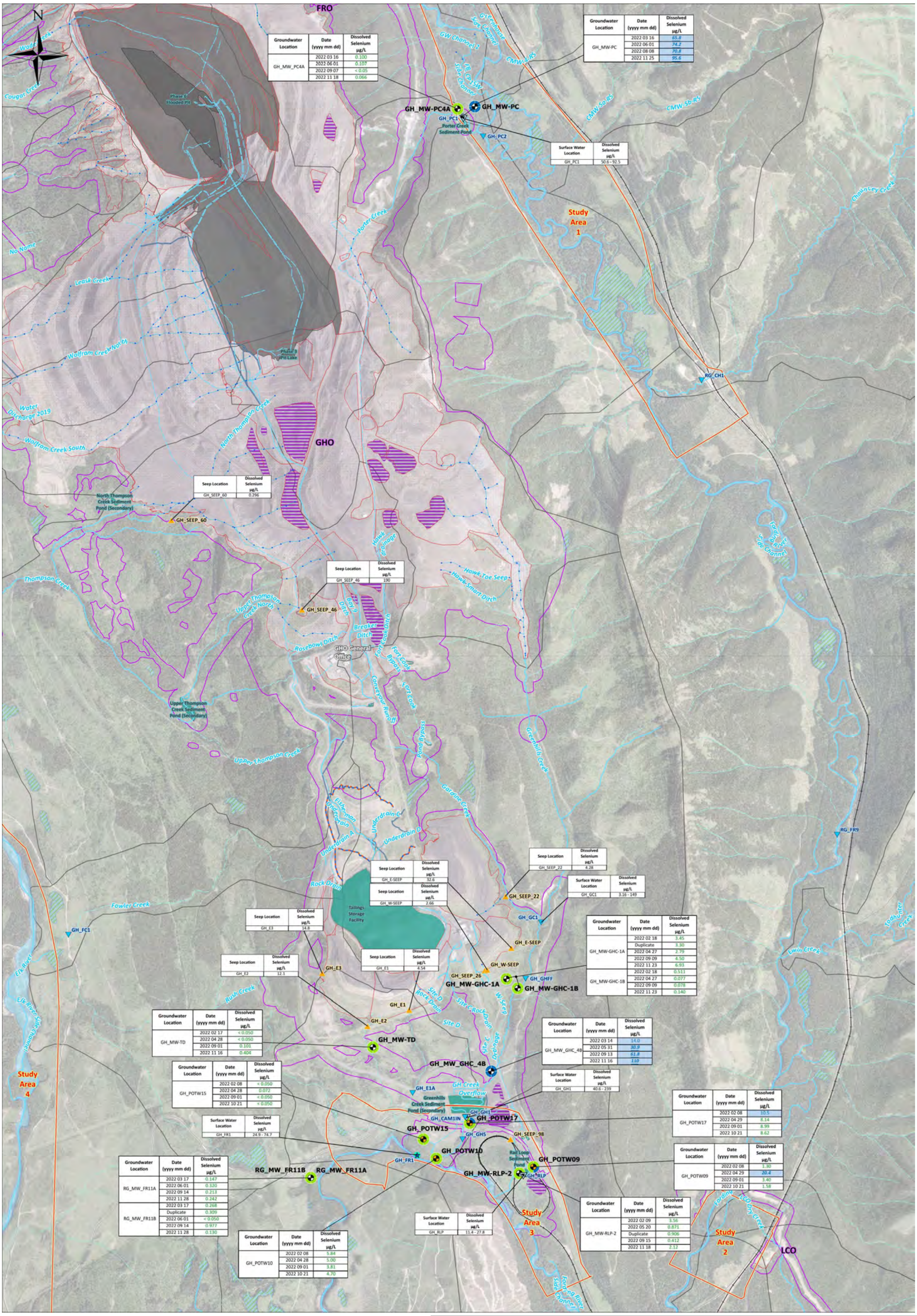
Ditch
Water Pipeline
End Pit Lake
Reservoir
Settling Pond
Stream
Railway
Paved Road
C-137 Permit

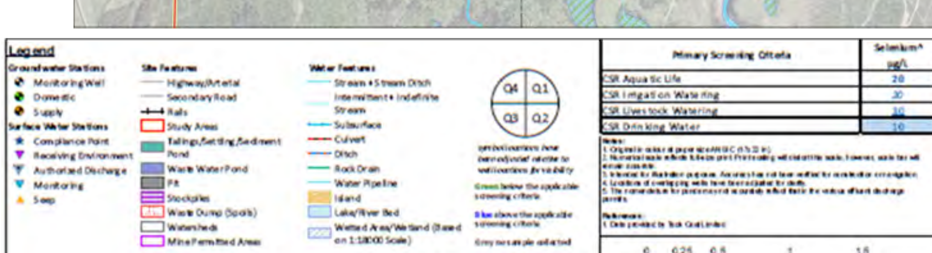
WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Hydrology of Greenhills Mine
(Source: Teck, 2023d)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:
Project No.: WILD-01	Figure No.: 4-4b



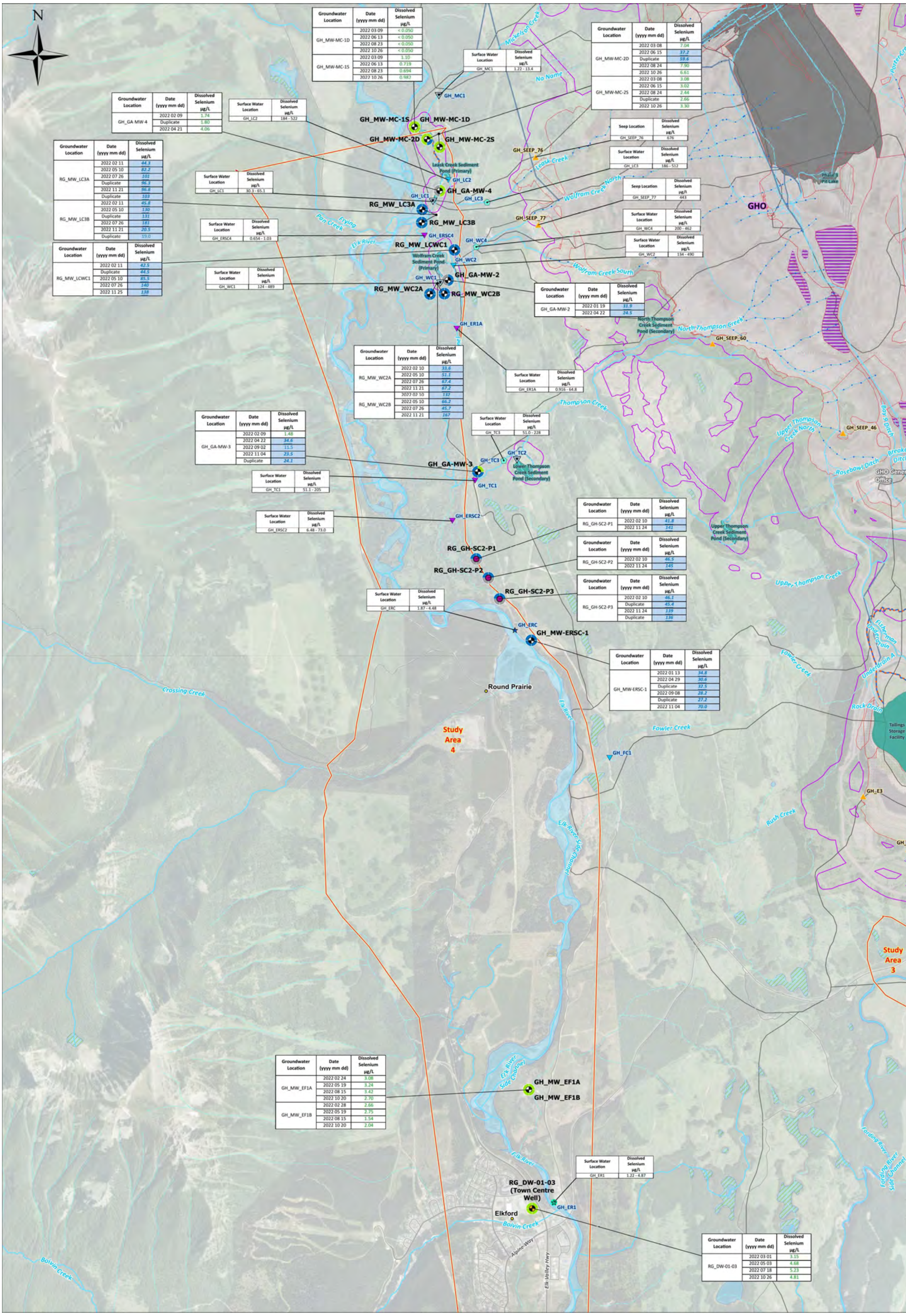


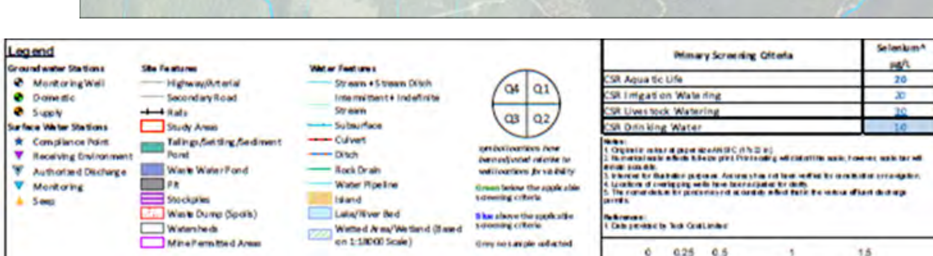
WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Greenhills East – Spatial Distribution of Selenium
(Source: SNC, 2023)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:
Project No.: WILD-01	Figure No.: 4-4c





WILDSIGHT

SELENIUM RELATED RECLAMATION LIABILITIES

TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Greenhills West – Spatial Distribution of Selenium

(Source: SNC, 2023)

BURGESS ENVIRONMENTAL	Date: 3/9/2024	Scale:
	Project No.: WILD-01	Figure No.: 4-4d

4.5 Coal Mountain

Mine Operations

Coal Mountain mine is located within the front ranges of the southern Canadian Rocky Mountains, approximately 25 km southeast of the town of Sparwood, B.C. Mining activities ceased in April 2019 and the Coal Mountain Mine is currently being reclaimed (Teck, 2023e). The Coal Mountain mine is on 520 ha of privately owned land, 2,500 ha of leased land (**Figure 4-5a**). Formerly owned by Esso Resources Canada, and operated by its Byron Creek Collieries subsidiary, Coal Mountain was acquired by Fording Coal in 1994. In 2003, ownership of Coal Mountain was transferred to the Elk Valley Coal Partnership, which was 60% owned by Fording Canadian Coal Trust and 40% by the major Canadian mining company, Teck Cominco. In October 2008, Teck Cominco increased its stake in the Elk Valley Coal partnership to 100% and renamed the company Teck Coal.

Open-pit mining, and truck and shovels, were used at Coal Mountain, which was Teck Coal's oldest and longest operating mine. The Coal Mountain mine had a mine capacity of 2.7Mt/y while its washing plant could process up to 3.5Mt/y of run-of-mine coal (Mine Technology, 2024). The coal washing plant was located north of the main mine area, flanking Corbin Creek, and the rail loading area was located downstream of the confluence of Corbin Creek into Michel Creek. Mining encompassed Coal Mountain and the southern flank of a ridge of Mount McGladrey. The total area of surface disturbance at Coal Mountain is 1,050 hectares, 700 hectares of which consists of mine spoil and by the end of 2022, 290 hectares had been revegetated (Teck, 2023e, Table 2-1).

Hydrology

Coal Mountain Mine is located on a steep sided, north-south trending ridge with Michel Creek directly to the west, Corbin Creek to the east, and Andy Good Creek to the north. Pengelly and Scrubby creeks are tributaries to Corbin Creek with confluences located downstream of the Corbin Creek Dam. Corbin Creek and Andy Good Creek are tributaries to Michel Creek. Michel Creek, a tributary of Elk River, has a catchment area of approximately 32 km^2 upstream of its confluence into Elk River. In general, the flow of water is from south to north (Teck, 2023e, Section 4.5).

Most of the Coal Mountain Mine development area drains into Corbin Creek, which flows generally northwest and confluences into Michel Creek downstream of the mine and upstream of the rail loading area associated with the mine. Mine development included dumping mine waste rock in the valley of Corbin Creek and its tributaries; hence, nearly all of the water within Corbin Creek flows through mine waste rock, mine spoil, and/or disturbed mining areas. Michel

Creek flows to the south of Coal Mountain mine before it confluences with Corbin Creek. Only a small portion of the mine development area drains directly into Michel Creek (see **Figure 4-5b**).

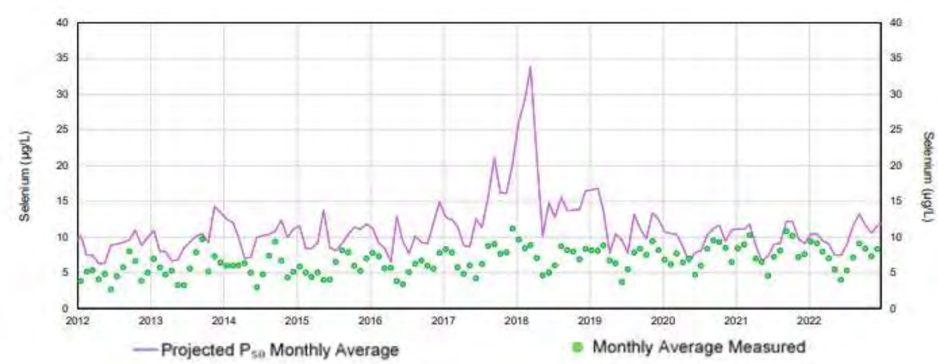
Existing and Planned Remedial Measures

No specific remedial measures are in place to address selenium leaching from the Coal Mountain Mine. The disturbed surface areas of the former mine are currently in the process of being reclaimed (Teck, 2023e). The water management plan for the former Coal Mountain Mine appears to be focused on controlling suspended solids in the discharges to Michel Creek, and maintaining the stability of embankments in mining works associated with the former mine. The Coal Mountain Mine is not a significant contributor to selenium contamination of the Elk River.

Surface Water Quality Monitoring

Water quality is monitored at MC-2, which is the compliance point for the Coal Mountain Mine. Monitoring station MC-2 is located downstream of the confluence of Corbin Creek into Michel Creek. **Insert 4-5** illustrates the measured and predicted selenium concentrations for samples collected at MC-2 from 2012 to 2022. Measured selenium concentrations vary from approximately 2 ug/L to 12 ug/L, with a slight increasing trend through the period. No water quality data are provided for Corbin Creek (Teck, 2023e).

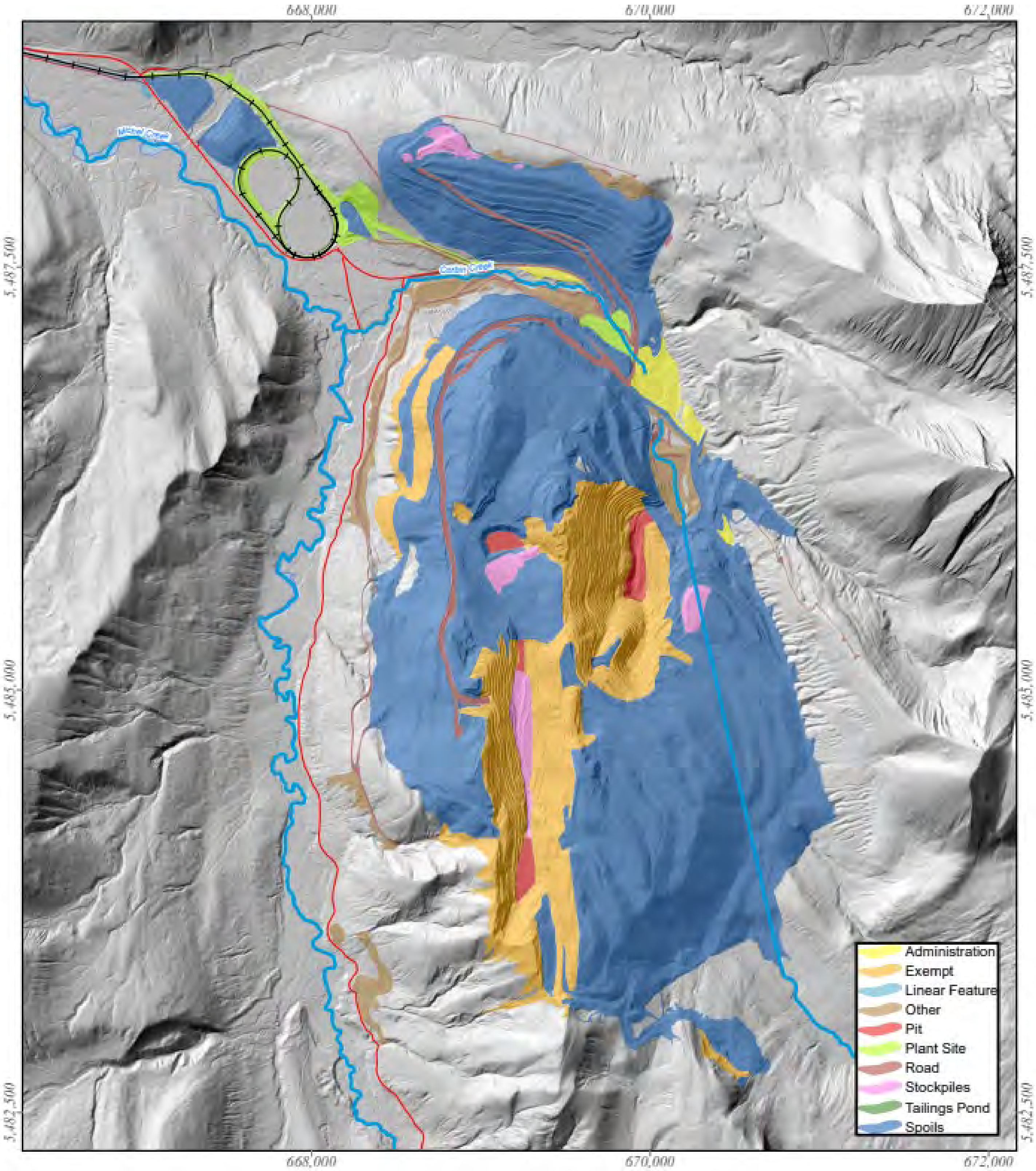
Insert 4-5: Comparison of Monitored Monthly Average Selenium Concentrations to Projected Selenium Concentrations at the Coal Mountain mine Compliance Point (Source: Teck, 2023e)



Groundwater Monitoring

The spatial distribution of selenium concentrations in surface water, groundwater, and seepage samples collected from the Coal Mountain Mine are shown on **Figure 4-5c**. Review of this figure indicates that groundwater at the well locations has not been significantly impacted by mining operations. Groundwater typically contains dissolved selenium concentrations less than 1 ug/L, although there are a few outliers. Higher dissolved selenium concentrations are measured in seep water samples, which impact to water quality in Michel Creek and Corbin Creek.

Groundwater quality is also measured on a regular basis in 19 monitoring wells. Dissolved selenium concentrations at monitoring well MW5-SH were above the screening criteria for the mine and showed an increasing trend as determined by a Mann-Kendall analysis. Increasing trends in selenium concentrations have also been measured in groundwater samples collected from three additional monitoring wells (Teck, 2023e, Section 4.3.2).

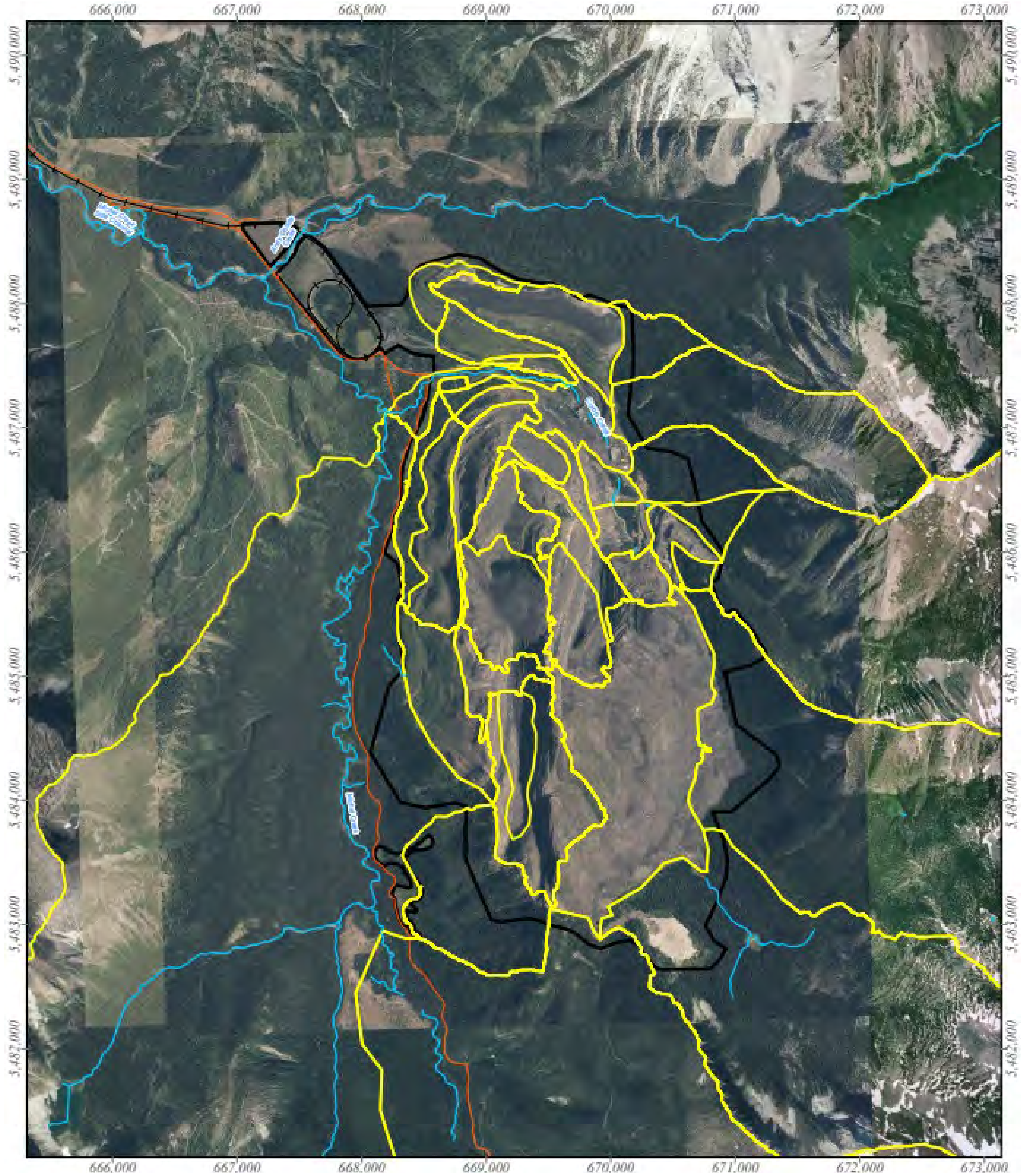


Stream
Road

WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Coal Mountain Mine
(Source: Teck, 2023e)

BURGESS ENVIRONMENTAL	Date: 3/9/2024	Scale:
	Project No.: WILD-01	Figure No.: **4-5a**



Creek
Road
Sump
C-84 Permit
Railway
Current Drainage Basin

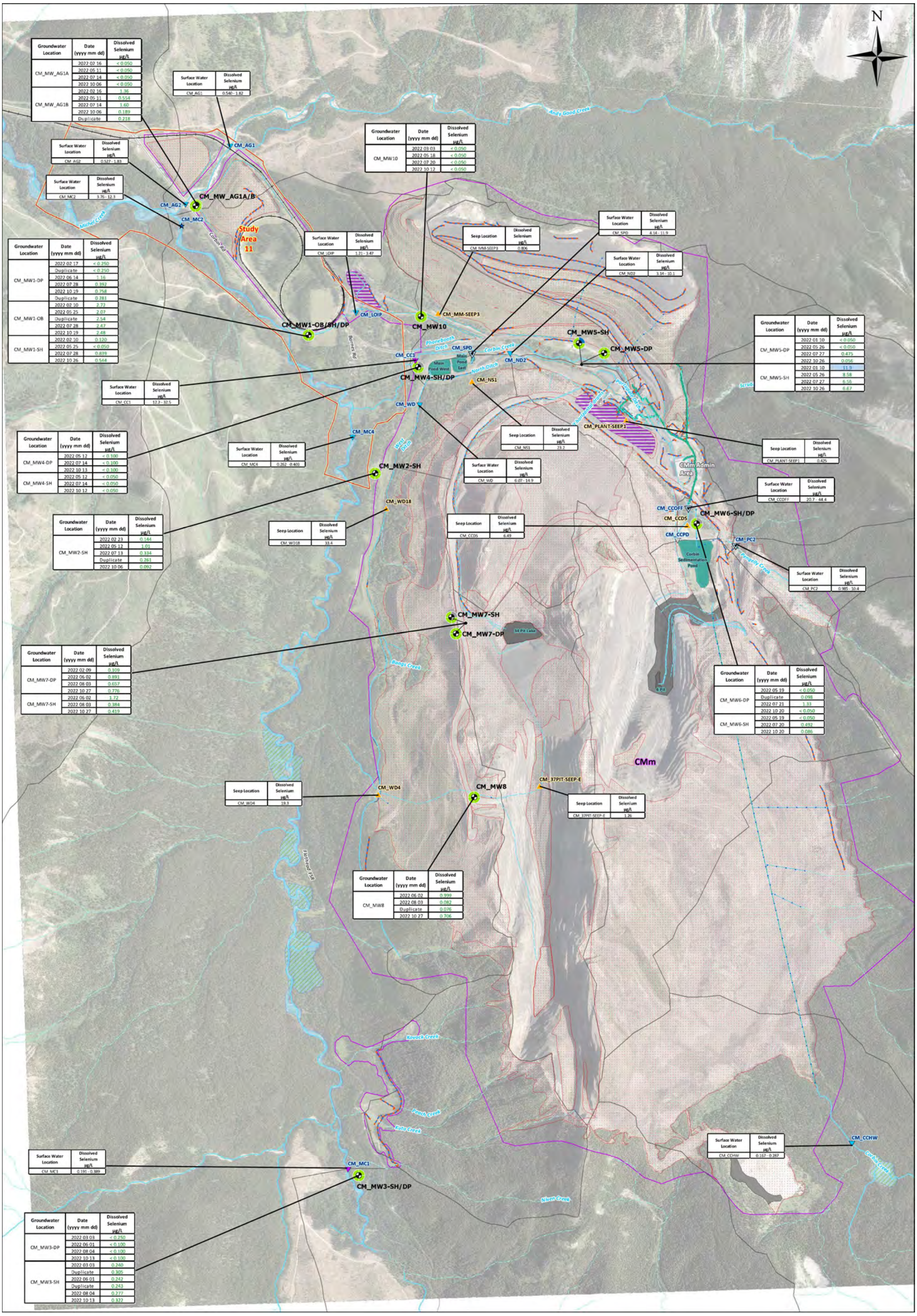
WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Hydrology of Coal Mountain Mine

(Source: Teck, 2023e)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:
Project No.: WILD-01	Figure No.: **4-5b**



Legend

Groundwater Stations
- Monitoring Well

Surface Water Stations
- Compliance Point
- Receiving Environment
- Authorized Discharge
- Monitoring
- Monitoring (Retired)
- Seep

Site Features
- Secondary Road
- Rails
- Tailings/Settling/Sediment Pond
- End-Pit Lake
- Study Areas
- Pit
- Stockpiles
- Waste Dump (Spoils)
- Watersheds
- Mine Permitted Areas

Water Features
- Stream + Stream Ditch
- Intermittent + Indefinite Stream
- Subsurface
- Ditch
- Potable Waterline
- Rock Drain
- Water Pipeline
- Bypass/Diversion Channel
- Lake/River Bed
- Wetted Area/Wetland (Based on 1:10000 Scale)

Q4 Q1 Q3 Q2

symbol locations have been adjusted relative to well locations for visibility

Green below the applicable screening criteria

Blue above the applicable screening criteria

Grey no sample collected

^ Dissolved phase of the parameter is shown in the spatial plot

Primary Screening Criteria	Selenium^ µg/L
CSR Aquatic Life	20
CSR Irrigation Watering	20
CSR Livestock Watering	30
CSR Drinking Water	10

Notes:
1. Original in colour at paper size ANSI C (17x22 in).
2. Numerical scale reflects full-size print. Print scaling will distort this scale; however, scale bar will remain accurate.
3. Intended for illustration purposes. Accuracy has not been verified for construction or navigation.
4. Locations of overlapping wells have been adjusted for clarity.
5. The nomenclature for ponds may not accurately reflect that in the various effluent discharge permits.

References:
1. Data provided by Teck Coal Limited

0 125 250 500 750 1,000 Meters

WILDSIGHT

SELENIUM RELATED RECLAMATION LIABILITIES

TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Coal Mountain – Spatial Distribution of Selenium

(Source: SNC, 2023)

BURGESS ENVIRONMENTAL

Date:	Scale:
3/9/2024	
Project No.: WILD-01	Figure No.: **4-5c**

5 WATER QUALITY DATA

5.1 Order Stations

General

Teck monitors surface water quality at seven order stations, as specified in Ministerial Order No. 113. Order stations are used to monitor water quality within the designated area defined by the Order and ultimately monitor the success of the Elk Valley Water Quality Plan. From downstream to upstream, these Order Stations are as follows (**Figure 5-1**):

- Lake Koocanusa downstream of Elk River (RG_DSELK), impacted by all mines
- Elk River at Elko (RG_ELKORES), impacted by all mines
- Elk River downstream of Michel Creek (EV_ER1), impacted by all mines
- Elk River downstream of Fording River (EV_ER4), impacted by Greenhills, Fording River and Line Creek Mines
- Elk River upstream of Boivin Creek (GH_ER1), impacted by Greenhills Mine
- Fording River downstream of Line Creek (GH_FR1), impacted by Greenhills, Fording River and Line Creek Mines
- Fording River downstream of Greenhills Creek (LC_LC5), impacted by Greenhills and Fording River Mines

Samples analyzed for selenium concentrations are collected on a regular basis, and are averaged over a monthly period for comparison to the water quality targets (**Section 4.2**).

Lake Koocanusa

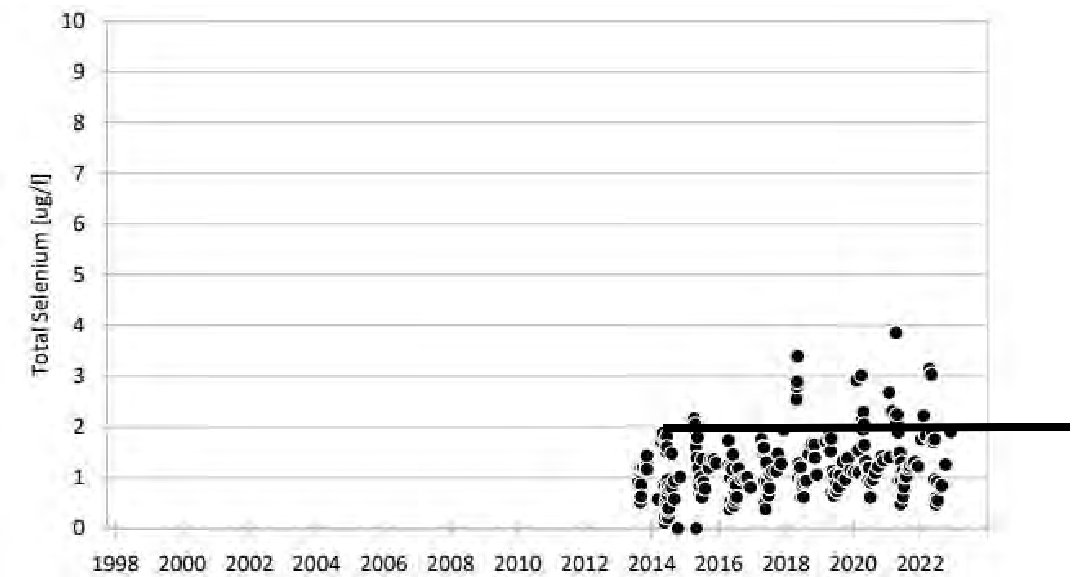
The water quality target for Lake Koocanusa is 2 ug/L, which is the B.C. (2023) surface water quality guideline, and is intended to apply to the measured monthly average concentration.

The average monthly concentrations of selenium measured at the Lake Koocanusa monitoring station from 2014 through 2022 are shown in **Insert 5-1**. Review of the data presented in **Insert 5-1** indicates an increasing trend in measured selenium concentrations as well as approximately 15 exceedances of the water quality target/objective of 2 ug/L.

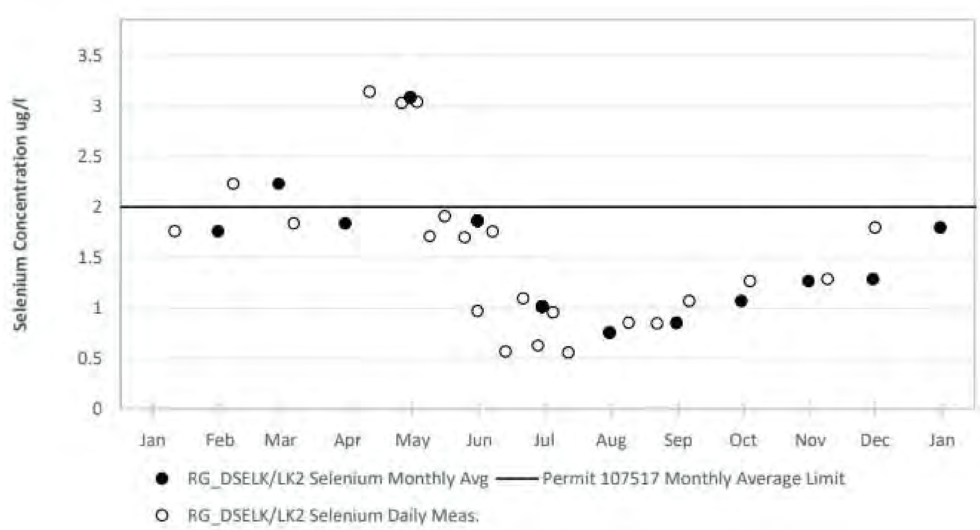
The measured average monthly and daily measured concentrations of selenium in samples collected at the Lake Koocanusa monitoring station in 2022 are shown in **Insert 5-2**. Review of the data presented in **Insert 5-2** indicates that exceedances of the water quality target of 2 ug/L occurred in the early spring, when lake levels and flow were relatively low. The lowest concentrations of selenium were measured in samples collected in the middle of the summer, when lake levels and flow were relatively high, then increased gradually between freshets.

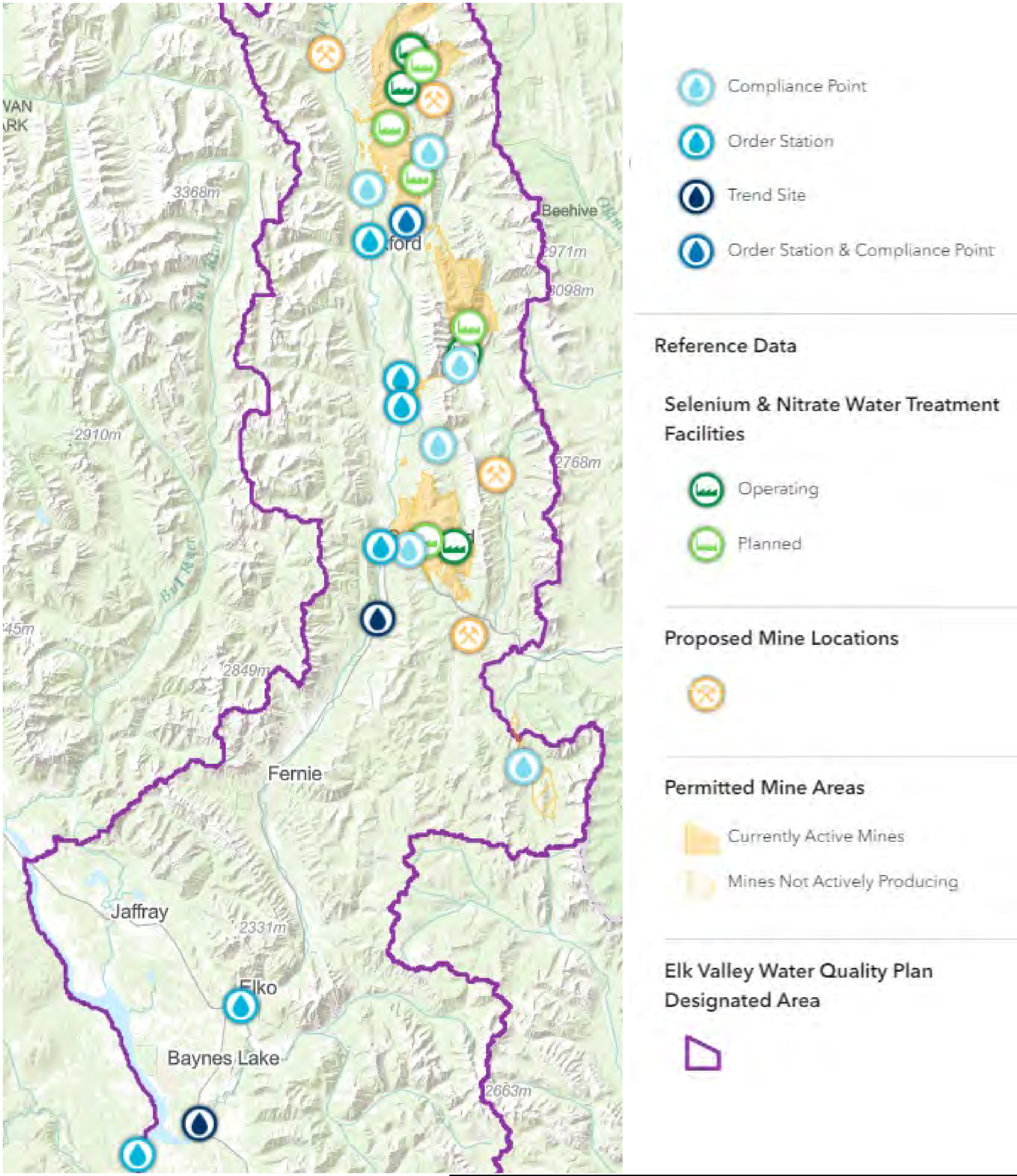
This Order Station is particularly important because it is the location where Teck committed to maintaining selenium concentrations below the B.C. (2023) water quality guideline of 2 ug/L, and it is the final Order Station in the watershed before this water flows into the United States.

Insert 5-1: Total Selenium Concentrations in Lake Koocanusa (RG_DSELK) - 2014 to 2022 (Source: Teck, 2023h, Figure 51)



Insert 5-2: Total Selenium Concentrations in Lake Koocanusa (RG_DSELK) – 2022 (Source: Teck, 2023h, Figure 16)





WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Locations of Order Stations and Compliance Points
(Source: Elk Valley Water Hub)

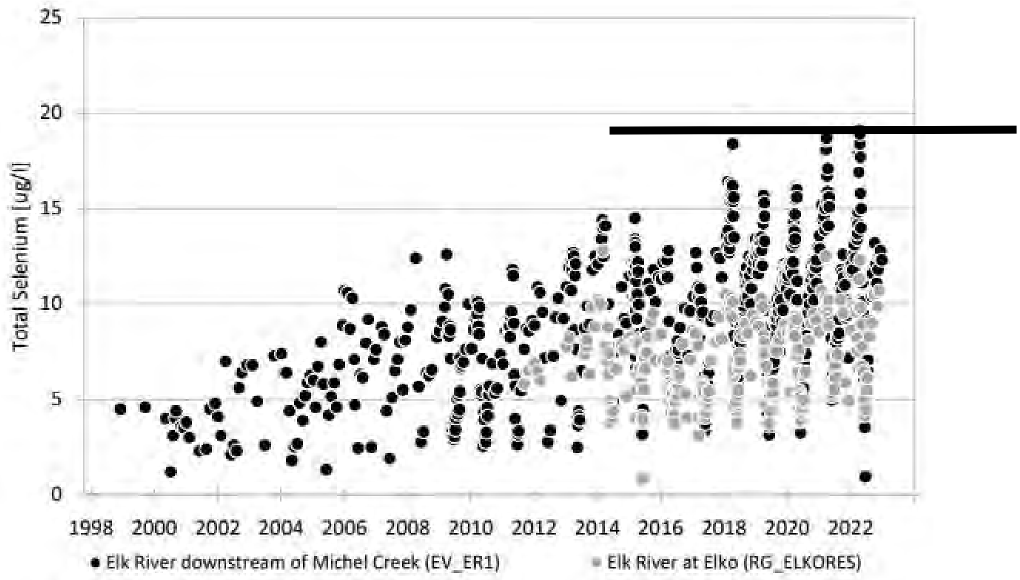
BURGESS ENVIRONMENTAL	Date: 3/9/2024	Scale:
	Project No.: WILD-01	Figure No.: 5-1

Lower Elk River

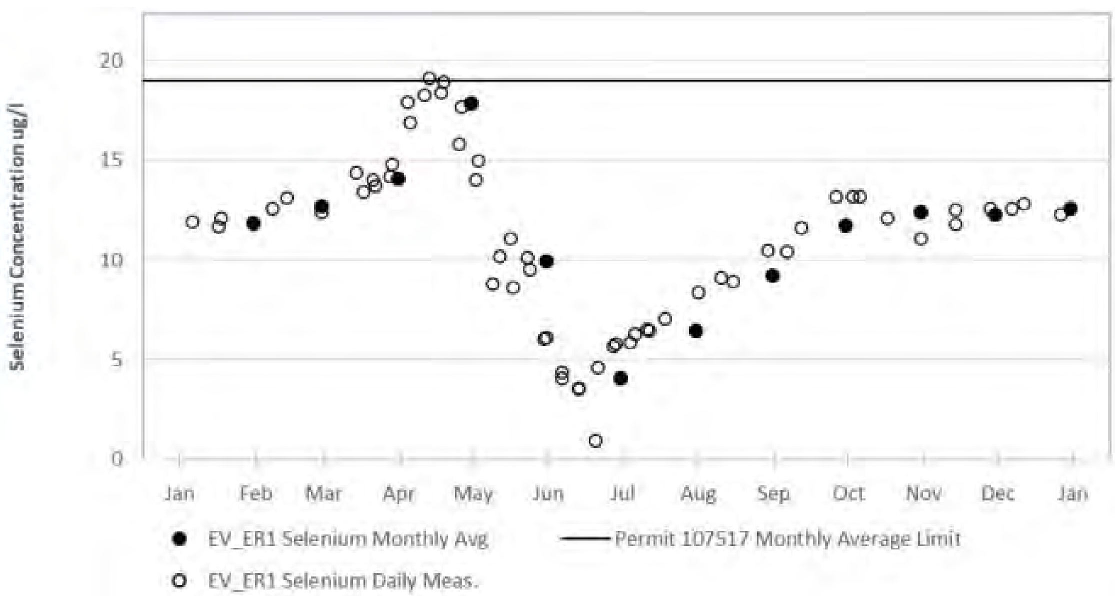
Two of the Elk River Order Stations are located downstream of the effluents of all of Teck Coal's mines in the Elk Valley; the Order Station downstream of Michel Creek (EV_ER1) and at the Elko reservoir, downstream of Fernie (RG_ELKORES). The water quality target for these Order Stations is 19 ug/L (see **Table 4.3**), and was committed to be met by 2014. Monitoring of the Order Station downstream of Michel Creek has occurred since 1999, and of the Elko reservoir since 2012. These data are presented in **Insert 5-3**. Review of the data presented in **Insert 5-3** indicates a steady increase in selenium concentrations measured in samples collected from both Order Stations, with these concentrations approaching and recently exceeding the water quality target downstream of Michel Creek. The upwards trend in measured selenium concentrations indicates that exceedances are likely to occur more frequently in the future unless additional treatment is brought on-line.

The measured average monthly and daily measured concentrations of selenium in samples collected at the Order Stations in Elk River downstream of Michel Creek and at Elko in 2022 are presented in **Inserts 5-4 and 5-5, respectively**. Review of the data presented in these inserts indicates that exceedances of the water quality objective of 19 ug/L occurred just prior to freshet in samples collected from the Order Station downstream of Michel Creek. The lowest concentrations of selenium were measured in samples collected during freshet, when flows are relatively high, then gradually increase until the onset of the next freshet. Measured concentrations of selenium in samples collected at the Elko Order station all complied with the water quality target of 19 ug/L.

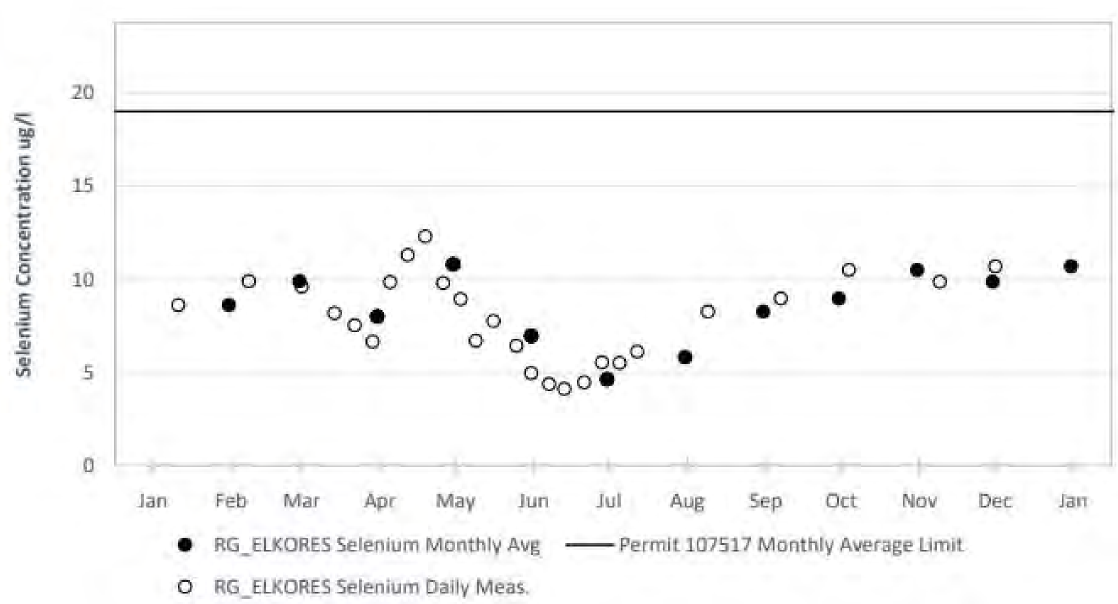
Insert 5-3: Total Selenium Concentrations in Lower Elk River, 1999 – 2022 (Source: Teck, 2023h, Figure 50)



Insert 5-4: Total Selenium Concentrations in Elk River Downstream of Michel Creek – 2022 (Source: Teck 2023h, Figure 14)



Insert 5-5: Total Selenium Concentrations in Elk River in Elko Reservoir – 2022 (Source: Teck, 2023h, Figure 15)

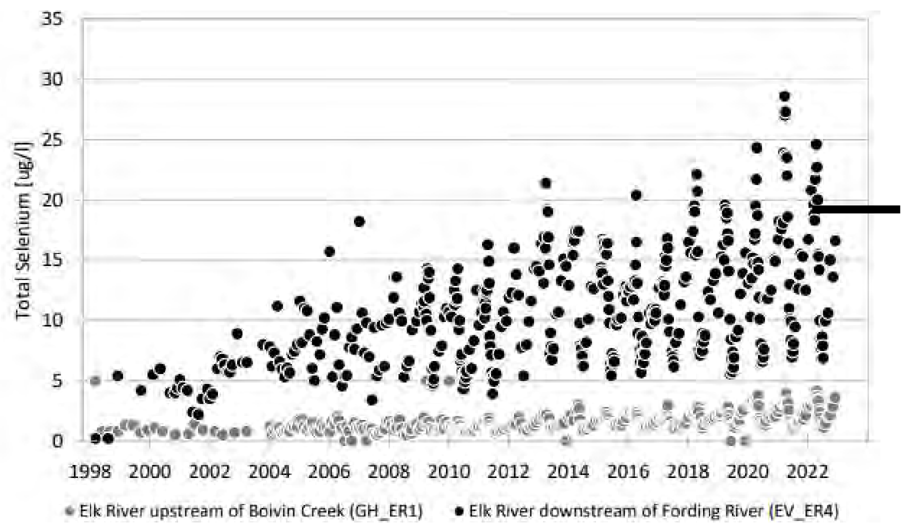


Upper Elk River

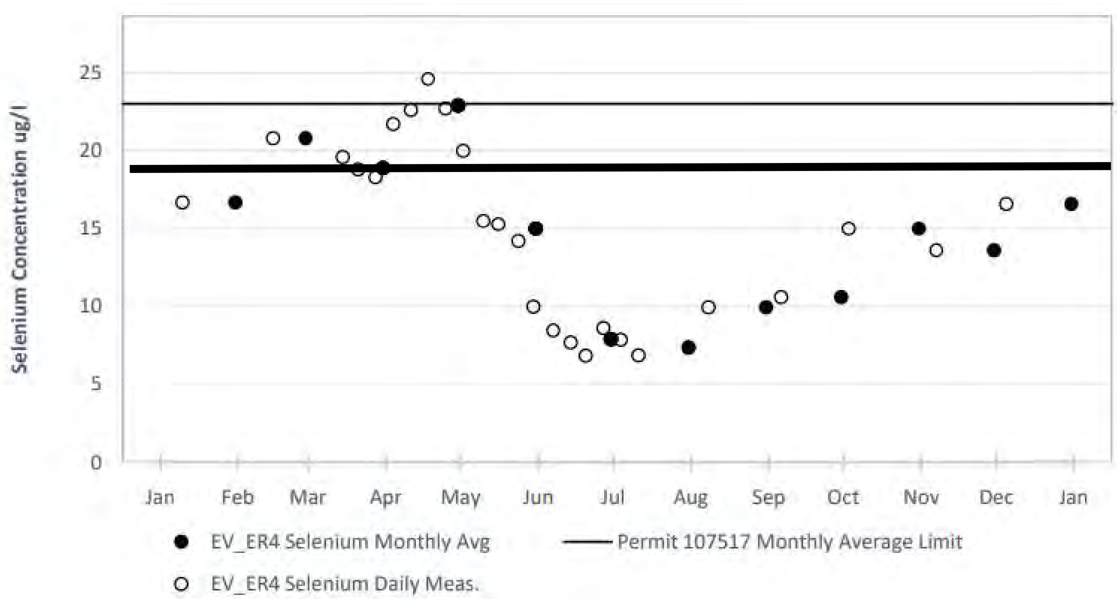
Two of the Elk River Order Stations are located in the upper Elk River, the first upstream of Boivin Creek, above most of the mine affected discharges, and the second below the confluence of the Elk River with the Fording River. The water quality target for these Order Stations is 19 ug/L (see **Table 4.3**), and was committed to be met by 2023. Monitoring of these Order Stations has occurred since 1999 (see **Insert 5-6**). Review of the data presented in **Insert 5-6** indicates minor impact upstream of Boivin Creek. A steady increase in selenium concentrations is evident at both Order Stations, with these concentrations exceeding the water quality target of 19 ug/L consistently in samples collected in 2022 from below the confluence of the Elk River with Fording River. The upwards trend in measured selenium concentrations indicates that exceedances are likely to occur more frequently in the future at the downstream station if additional treatment capacity is not brought on-line.

The average monthly and daily measured concentrations of selenium in samples collected at the Order Stations in the Elk River downstream of Fording River and upstream of Boivin Creek in 2022 are presented in **Inserts 5-7 and 5-8, respectively**. Review of the data presented in these charts indicates that exceedances of the water quality target of 19 ug/L occurred just prior to freshet in samples collected from the Order Station downstream of Fording River. The lowest concentrations of selenium were measured in samples collected during freshet, when flows are relatively high, then gradually increased until the onset of the next freshet. Measured concentrations of selenium in samples collected from the Elk River upstream of Boivin Creek all complied the water quality target of 19 ug/L, although the same seasonal trend is evident. It is noted that the 19 ug/L water quality target for the Elk River Order Station downstream of Fording River was not intended to apply until 2023.

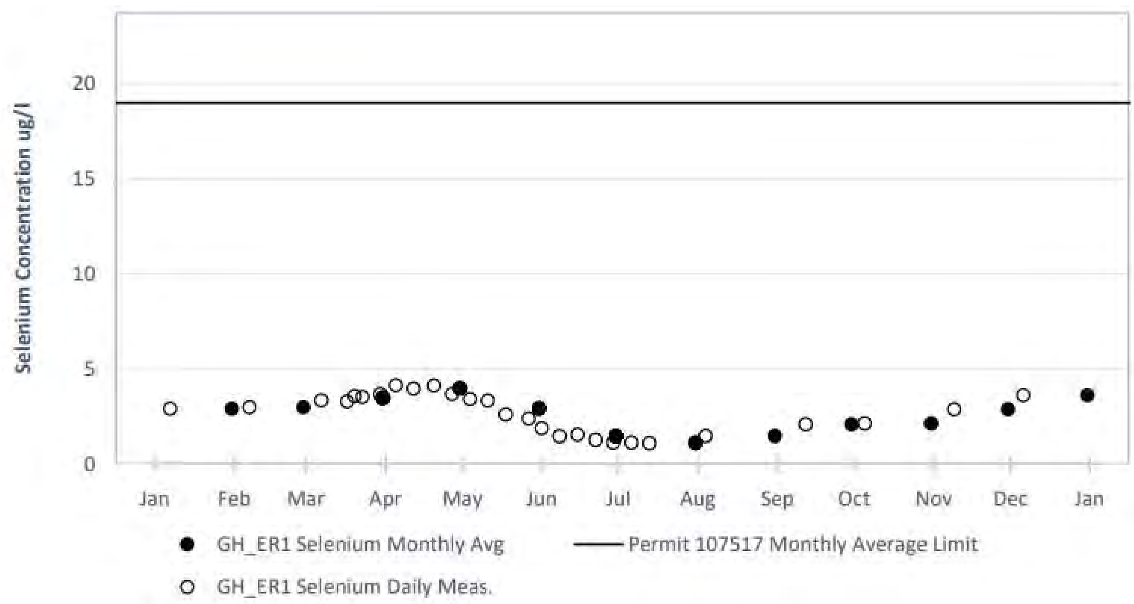
Insert 5-6: Total Selenium Concentrations in Upper Elk River, 1999 – 2022 (Source: Teck, 2023h, Figure 49)



Insert 5-7: Total Selenium Concentrations in Elk River Downstream of Fording River – 2022 (Source: Teck, 2023h, Figure 13)



Insert 5-8: Total Selenium Concentrations in Elk River Upstream of Boivin Creek – 2022 Source: Teck, 2023h, Figure 14)

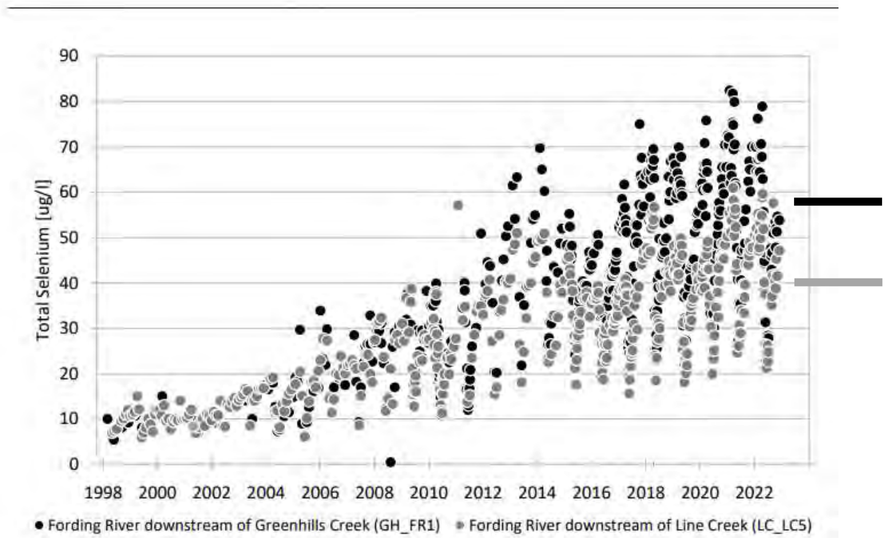


Fording River

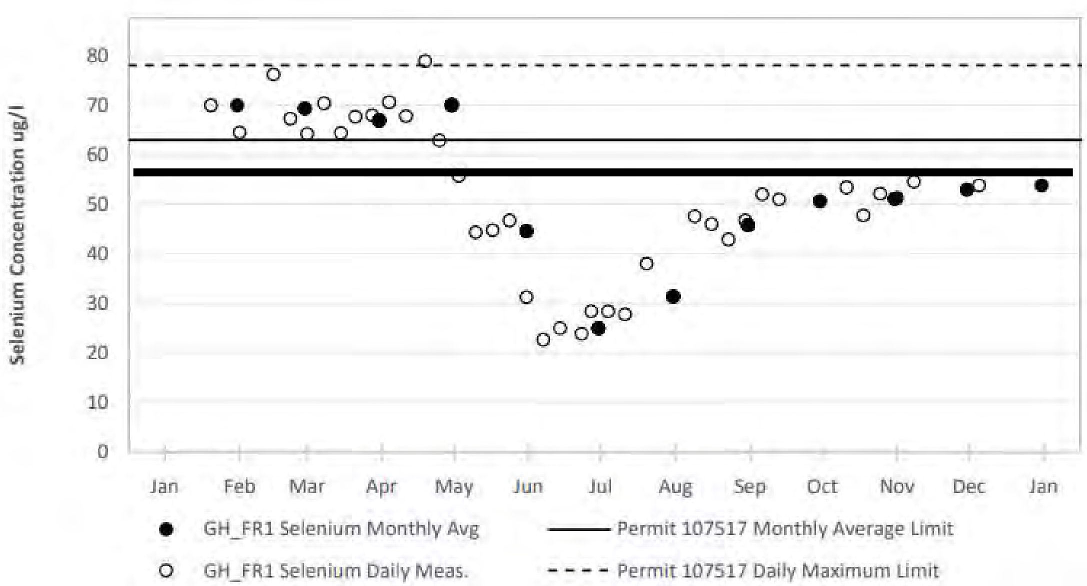
The two Fording River Order Stations are located downstream of Greenhills Creek (downstream of Fording River and Greenhills Mines), and downstream of Line Creek (downstream of the Line Creek Mine). The water quality targets for these Order Stations are 57 ug/L and 40 ug/L, respectively (see **Table 4.3**), and were committed to be met by 2022 and 2023, respectively. Monitoring of these Order Stations has occurred since 1998 (see **Insert 5-9**). Review of the data presented in **Insert 5-9** indicates that total selenium concentrations are steadily increasing at both monitoring points, and that measured selenium concentrations now routinely exceed the respective water quality targets. The upwards trend in measured selenium concentrations indicates that exceedances are likely to occur more frequently in the future and that the mitigations introduced between 2014 and 2022 had little measurable effect through 2022.

The measured average monthly and daily measured concentrations of selenium in samples collected at the Order Stations in the Fording River, downstream of Greenhills Creek and Line Creek, in 2022 are presented in **Inserts 5-10 and 5-11**, respectively. Review of the data presented in these charts indicates that exceedances of these water quality targets occur regularly at both Order Stations, up until freshet, then occasionally in the fall, following freshet. The lowest concentrations of selenium were measured in samples collected during freshet, when flows are relatively high, then increase gradually until the onset of the next freshet. It is noted that the water quality target for the Fording River downstream of Line Creek came into effect in 2023 (Teck, 2014).

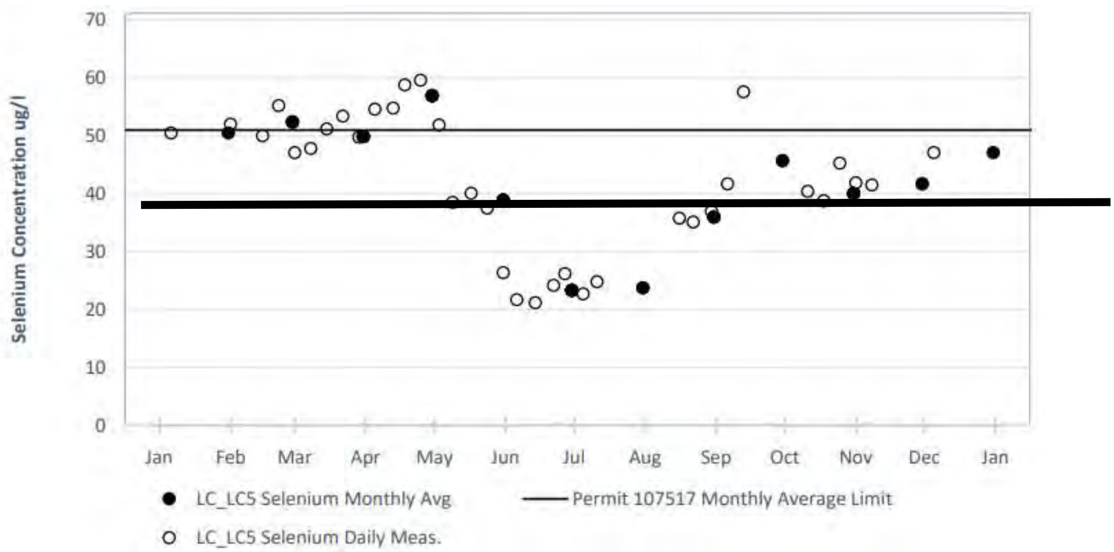
Insert 5-9: Total Selenium Concentrations in Fording River, 1998 – 2022 (Source: Teck, 2023h, Figure 48)



Insert 5-10: Total Selenium Concentrations in Fording River Downstream of Greenhills Creek – 2022 (Source: Teck, 2023h, Figure 10)



Insert 5-11: Total Selenium Concentrations in Fording River Downstream of Line Creek – 2022 (Source: Teck, 2023h, Figure 11)



5.2 Compliance Points

Seven Compliance Points have been established in the Elk Valley and are described in Section 2.1 through 2.7 of Permit 107517. The compliance points are intended to capture and represent all or most point and non-point discharges from Teck mines, which each mine is intended to comply with. Each Compliance Point is meant to reflect the total discharges from the corresponding mine to the receiving environment. Compliance points are subject to the authorized discharge limits specified in Section 2.1 to 2.7 of Permit 107517 and the authorized discharge limits specified in Section 3.3 of Permit 107517 (Teck, 2023h). Generally, from upstream to downstream, these Compliance Points are as follows (**Figure 5-1**):

Table 5.1

Elk Valley Compliance Points and Description

Name	EMS ID	Location Code	Site Description
Fording River Mine - Fording River	E223753	FR_FRABCH	Fording River, 100 m u/s of Chauncey Creek
Greenhills Mine - Elk River	E300090	GH_ERC	Elk River, 220 m d/s of Thompson Creek
Greenhills Mine - Fording River	0200378	GH_FR1	Fording River, 205 m d/s of Greenhills Creek
Line Creek Mine - Line Creek	E297110	LC_LCDSSLCC	Line Creek, 1500 m d/s of WLC AWTF
Elkview Mine - Harmer Creek	E102682	EV_HC1	Harmer Spillway
Elkview Mine - Michel Creek	E300091	EV_MC2	Michel Creek at Highway 3 bridge
Coal Mountain Mine - Michel Creek (U/S of EV_MC2)	E258937	CM_MC2	Michel Creek, 50 m u/s of Andy Good Creek

Selenium authorized discharge limits have been developed on a site-specific basis, associated with each Compliance Point. The authorized discharge limit for each Compliance Point is provided in the **Table 5.2**. They are also shown on the historical selenium data graphs (**Inserts 5-13, 5-15, 5-17, 5-19, 5-21**).

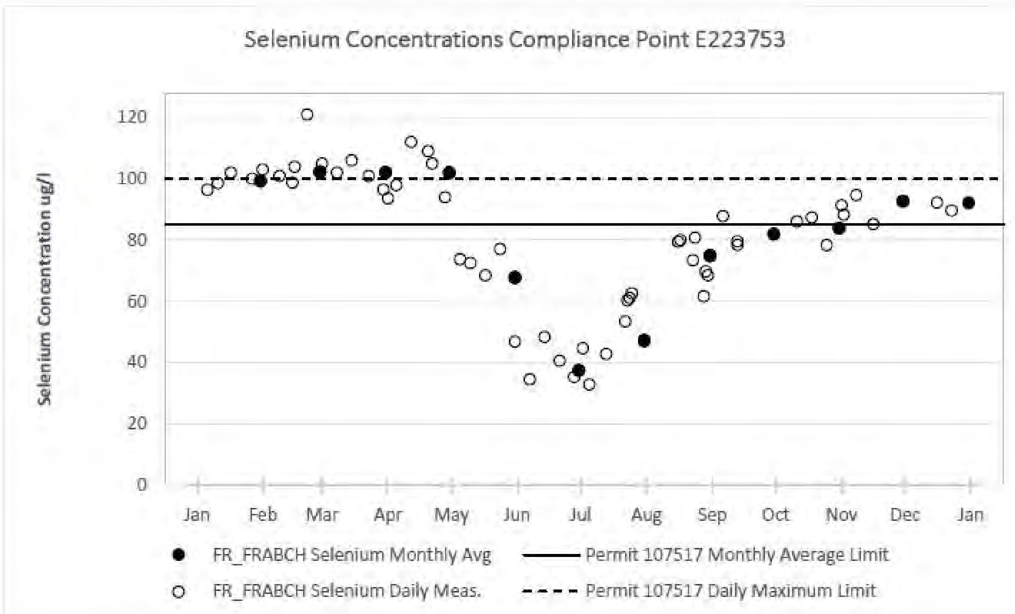
Table 5.2
Elk Valley Compliance Point Authorized Discharge Limits

Name	Short Term	Medium Term	Long Term
Fording River Mine - Fording River	--	85 ug/L	58 ug/L
Greenhills Mine - Elk River	15 ug/L	--	8 ug/L
Greenhills Mine - Fording River	80 ug/L	63 ug/L	57 ug/L
Line Creek Mine - Line Creek	80 ug/L	50 ug/L	29 ug/L
Elkview Mine - Harmer Creek	45 ug/L	57 ug/L	57 ug/L
Elkview Mine - Michel Creek	28 ug/L	20 ug/L	19 ug/L
Coal Mountain Mine - Michel Creek (U/S of EV_MC2)	28 ug/L	20 ug/L	19 ug/L

Fording River Mine

There is one Compliance Point associated with Fording River Mine in Fording River. The current long-term authorized discharge limit is 58 ug/L, reduced from 85 ug/L in late 2023. 2022 selenium monitoring data, as well as historical selenium monitoring data dating back to 2015 are provided in **Insert 5-12** and **Insert 5-13**, respectively. Review of the data presented in these charts indicates that there are consistent exceedances of the medium-term monthly and daily limits. Exceedances of daily and monthly average limits occurs consistently between January through April, after which high freshet flow rates likely dilute selenium concentration below the limit. After this high flow period, between May through August, selenium concentrations consistently exceed monthly average limits between October through to freshet of the following year. Similarly, historical data indicates that authorized discharge limits are not being met throughout the entire year excluding months June through September. Consistent exceedances of the medium-term water quality target (85 ug/L) are observed. The authorized discharge limit for Fording River Mine – Fording River has been reduced to 58 ug/L in 2024, indicating exceedances will be observed throughout the entire year excluding peak freshet flows in late June or early July. Historical data is only available from 2021, this is because the Compliance Point was relocated in March 2021. It is unclear why previous historical data associated with the Fording River Mine Compliance Point was not reported. Accordingly, a consistent trend in selenium concentrations is not established for this Compliance Point.

Insert 5-12: Total Selenium Concentrations at Compliance Point Fording River Mine – Fording River – 2022 (Source: Teck, 2023h)

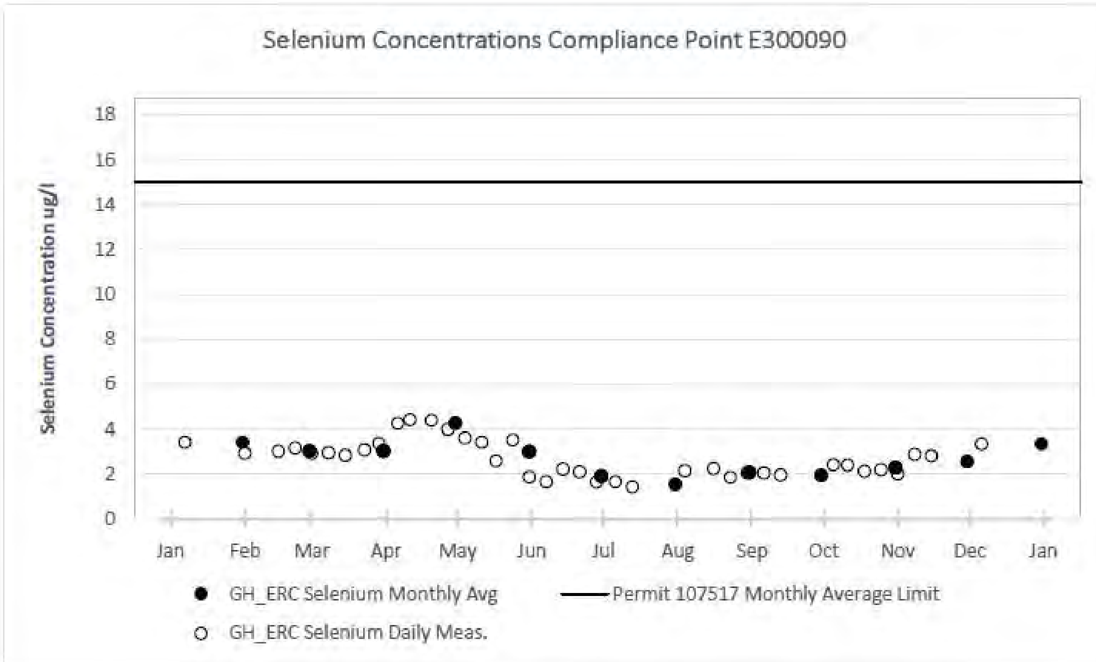


Insert 5-13: Total Selenium Concentrations at Compliance Point Fording River Mine – Fording River – 2021 through 2023 (Source: British Columbia Elk Valley Water Quality Hub – Water Quality Data Dashboard)

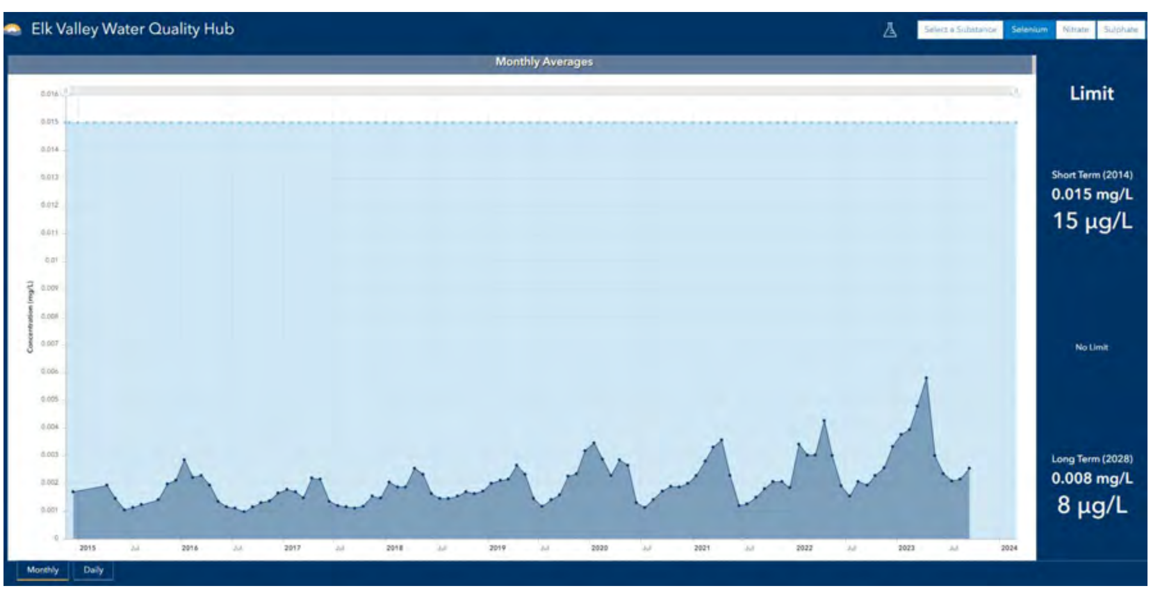
Greenhills Mine

There are two Compliance Points associated with Greenhills Mine, one in Fording River, downstream of Greenhills Creek, and one in Elk River, downstream of Thompson Creek. The Fording River Compliance Point is also an Order Station and is discussed in the previous section. See **Insert 5-10** for Total Selenium Concentrations in Fording River – 2022 and **Insert 5-9** for Total Selenium Concentrations in Fording River, 1998 – 2022. Selenium concentrations at the Compliance Point/Order Station are steadily increasing and are routinely exceeding water quality targets. The Elk River Compliance Station associated with Greenhills Mine has a current selenium authorized discharge limit of 15 ug/L. In 2022 **(Insert 5-14)**, there were no observed exceedances of the authorized discharge limit. Review of historical selenium monitoring data dating back to 2015 **(Insert 5-15)** at the Greenhills Mine – Elk River Compliance Point indicates an increasing trend. The authorized discharge limit at this Compliance Station is decreasing to 8 ug/L in 2028.

Insert 5-14: Total Selenium Concentrations at Compliance Point Greenhills Mine – Elk River – 2022 (Source: Teck, 2023h)



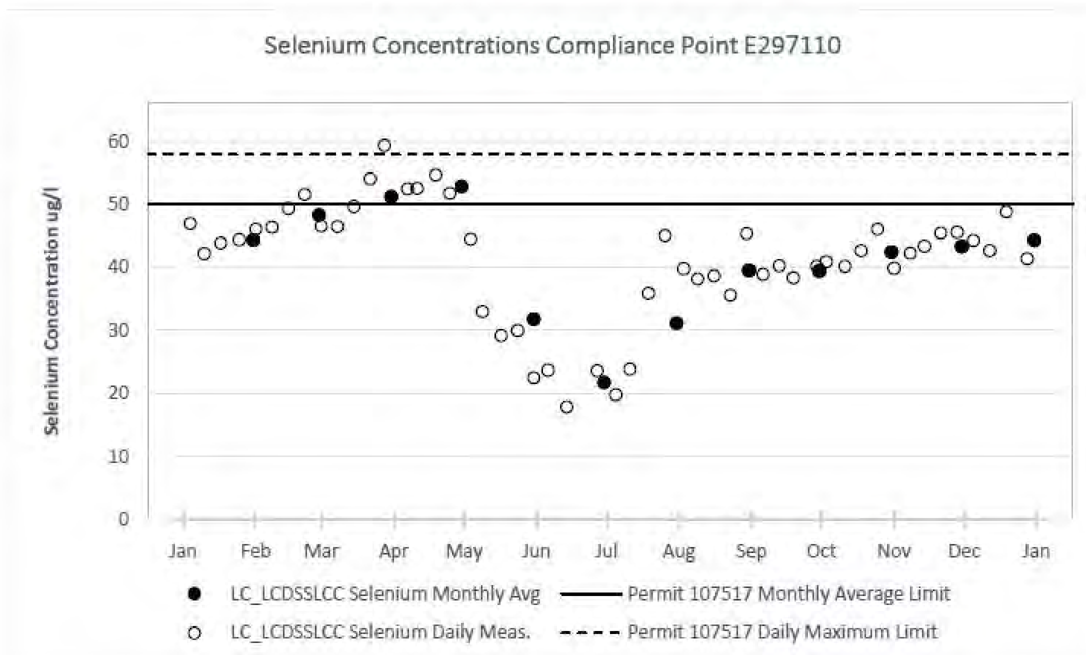
Insert 5-15: Total Selenium Concentrations at Compliance Point Greenhills Mine – Elk River – 2015 through 2023 (Source: British Columbia Elk Valley Water Quality Hub – Water Quality Data Dashboard)



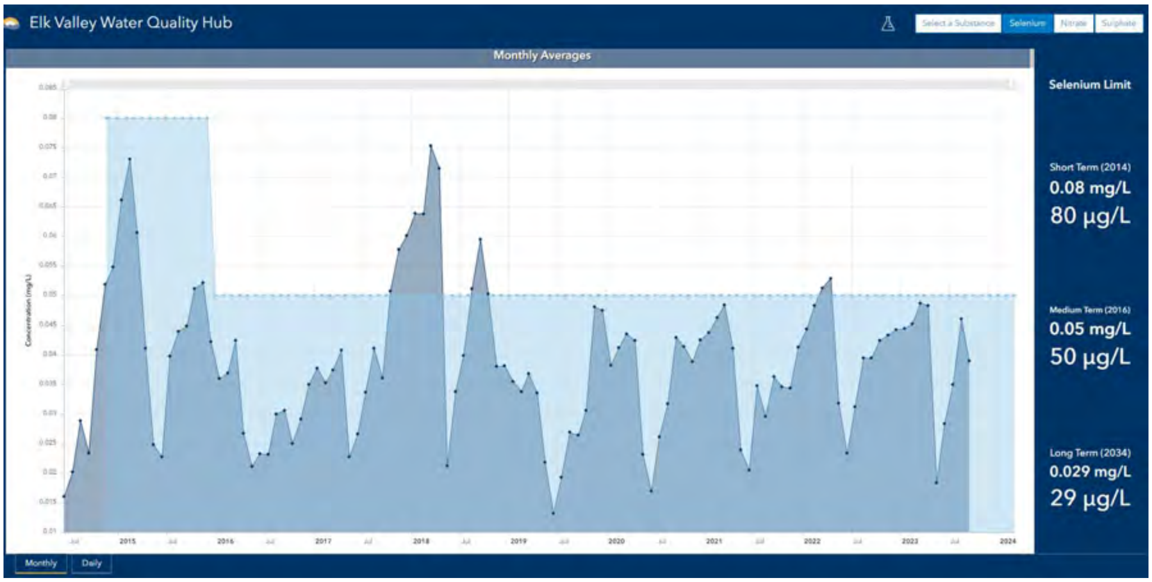
Line Creek Mine

There is one Compliance Station associated with Line Creek Mine and it is located in Line Creek. The current authorized discharge limit at this station is 50 ug/L, lowered from 80 ug/L in 2016. Selenium concentrations in 2022 are shown in **Insert 5-16**. Review of the data presented in this chart indicates that exceedances of the authorized discharge limits occur at the Compliance Point, up until freshet. Selenium concentrations then increase in the fall, following freshet. Historical selenium monitoring data back to 2015 is provided in **Insert 5-17**. Review of this data indicates that there were significant exceedances of authorized discharge limits in 2018 and minor exceedances in 2022. The data suggests a generally flat or stable selenium concentration trend, and a significant decrease is measured selenium concentrations is evident after commissioning of the Line Creek active water treatment facility in 2018.

Insert 5-16: Total Selenium Concentrations at Compliance Point Line Creek Mine – Line Creek – 2022 (Source: Teck, 2023h)



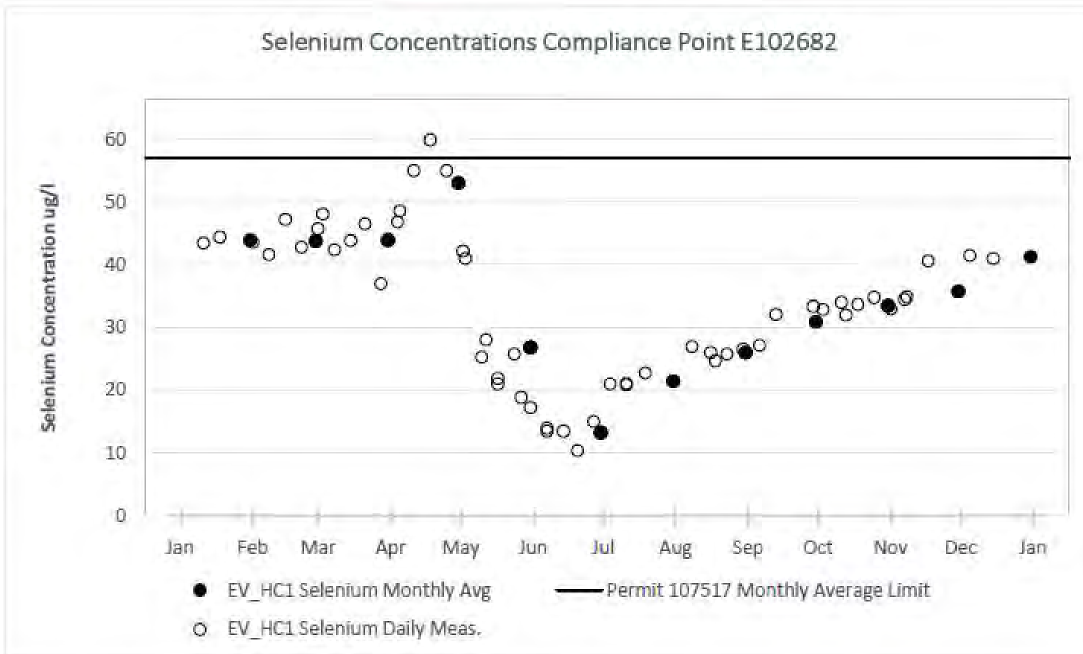
Insert 5-17: Total Selenium Concentrations at Compliance Point Line Creek Mine – Line Creek – 2015 through 2023 (Source: British Columbia Elk Valley Water Quality Hub – Water Quality Data Dashboard)



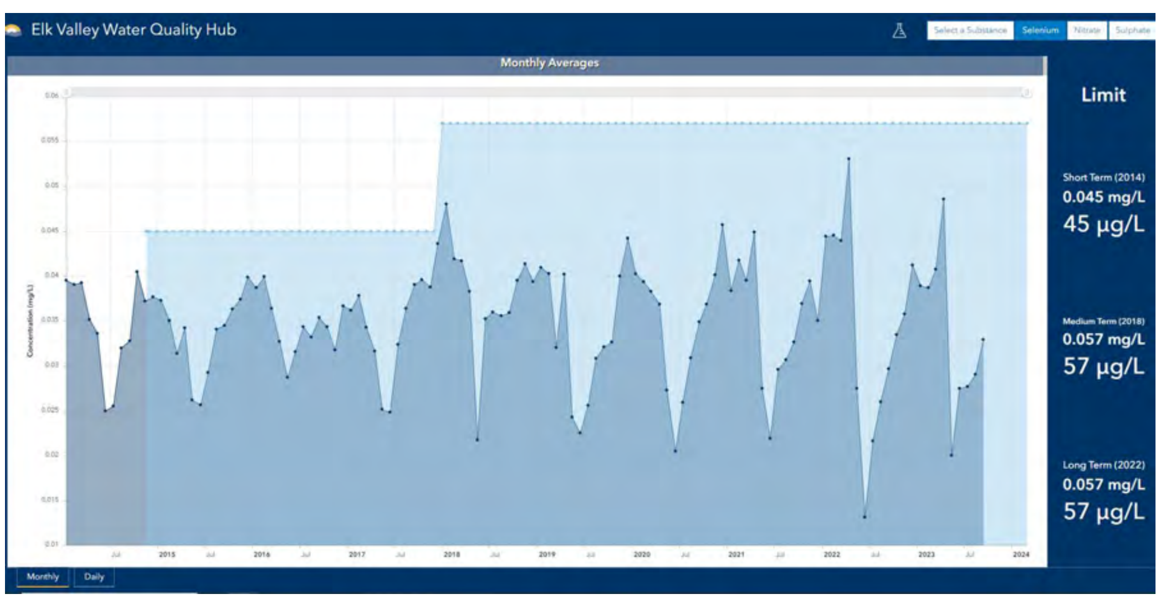
Elkview Mine

Two Compliance Points are associated with Elkview Mine, one in Harmer Creek and one in Michel Creek. The current authorized discharge limits are 57 ug/L and 19 ug/L for Harmer Creek and Michel Creek, respectively. Harmer Creek Compliance Station selenium monitoring data for 2022, as well as historical data dating back to 2015, are provided in **Insert 5-18** and **Insert 5-19**, respectively. Review of this data indicates a single exceedance of the authorized discharge limit was observed in April 2022. Annual selenium trends are consistent with other Order Stations and Compliance Points. It is noted that in 2018, the authorized discharge limit was increased from 45 ug/L to 57 ug/L and remains the long-term target. It is unclear why this limit was increased, and appears to be the only instance of a limit increasing. Selenium concentrations would be consistently exceeding the previous target of 45 g/L, both annually and historically, if this target concentration were left in place. Historically, selenium trends are generally consistent, seemingly becoming more variable over time, with the two highest selenium concentrations occurring in 2022 and 2023. Michel Creek Compliance Station selenium monitoring data for 2022, as well as historical data dating back to 2015, are provided in **Insert 5-20** and **Insert 5-21**, respectively. Review of these data indicates that exceedances of the authorized discharge limit of 20 ug/L occurred in late April, and regularly in fall months (daily measurement only), and that measured concentrations may be decreasing.

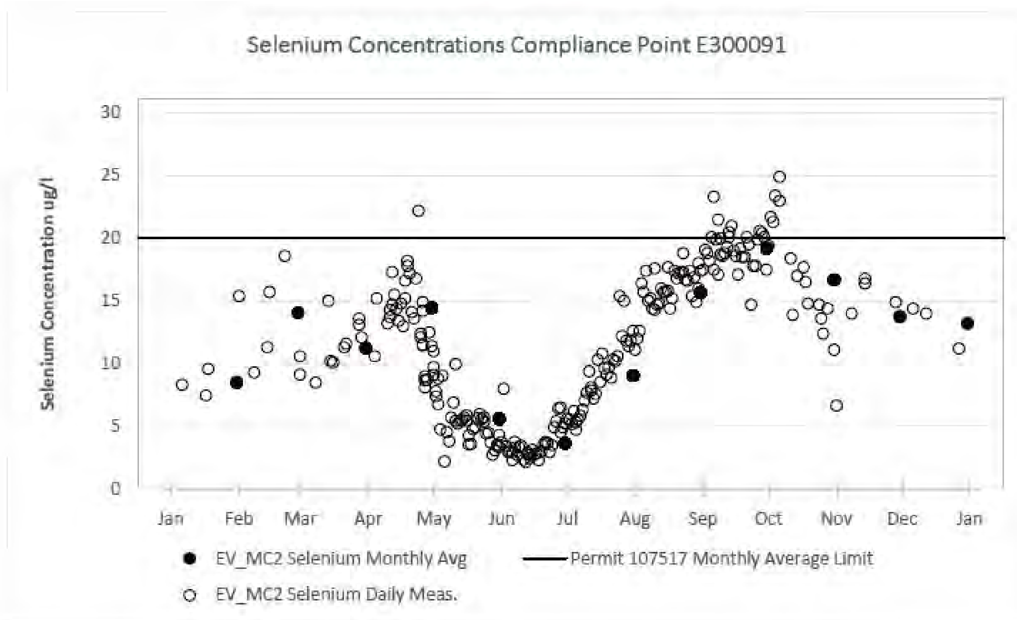
Insert 5-18: Total Selenium Concentrations at Compliance Point Elkview Mine – Harmer Creek – 2022 (Source: Teck, 2023h)



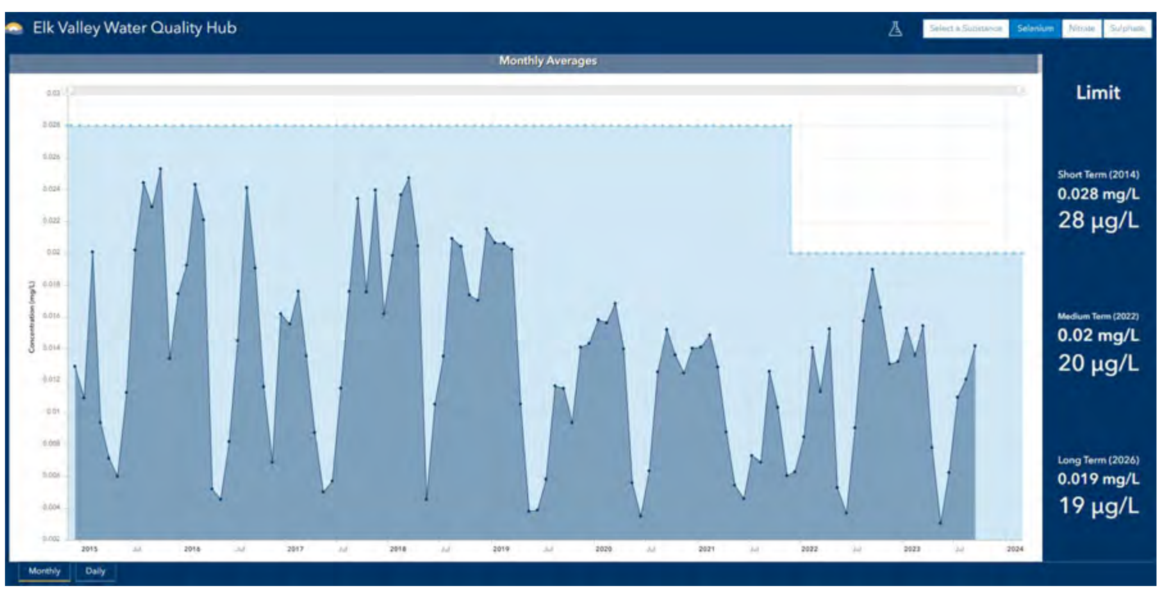
Insert 5-19: Total Selenium Concentrations at Compliance Point Elkview Mine – Harmer Creek – 2015 through 2023 (Source: British Columbia Elk Valley Water Quality Hub – Water Quality Data Dashboard)



Insert 5-20: Total Selenium Concentrations at Compliance Point Elkview Mine – Michel Creek – 2022 (Source: Teck, 2023h)



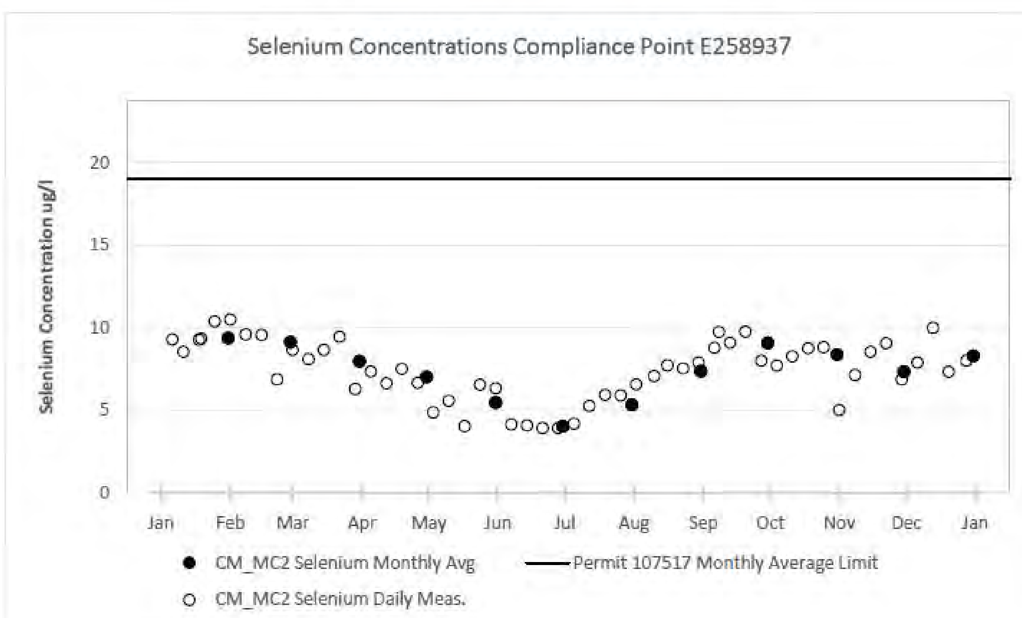
Insert 5-21: Total Selenium Concentrations at Compliance Point Elkview Mine – Michel Creek – 2015 through 2023 (Source: British Columbia Elk Valley Water Quality Hub – Water Quality Data Dashboard)



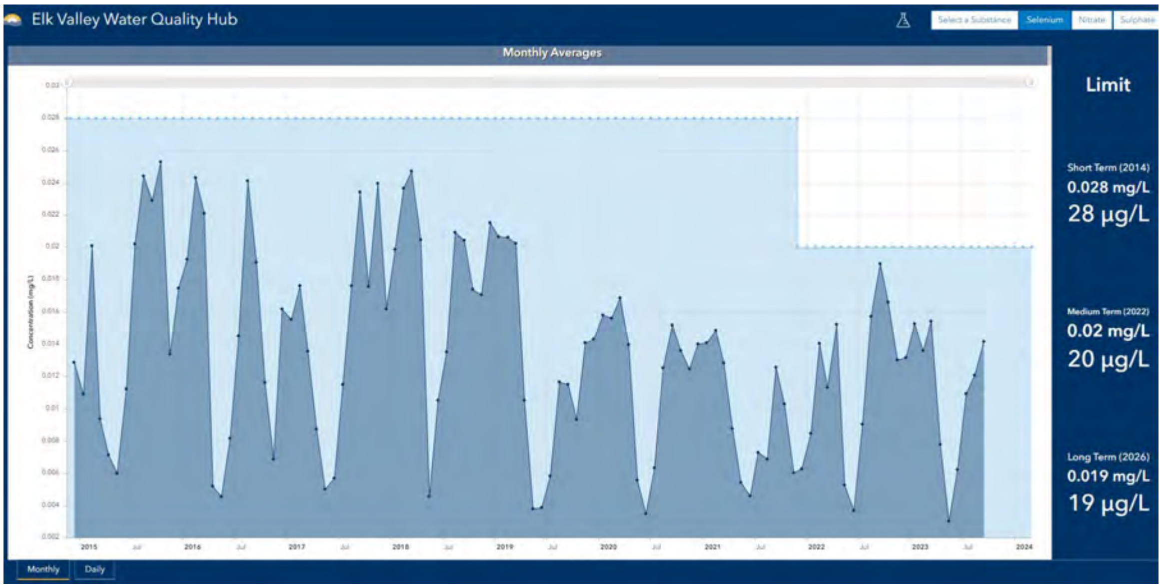
Coal Mountain Mine

One Compliance Point is associated with the Coal Mountain Mine, located in Michel Creek, 50 m upstream of Andy Good Creek. The current authorized discharge limit at this Compliance Point is 20 ug/L, reducing to 19 ug/L in 2026 as the long-term target. 2022 Selenium monitoring data, as well as historical selenium monitoring data are provided in **Insert 5-22** and **Insert 5-23**, respectively. Review of the data presented in these charts indicates that no exceedances of the authorized discharge limit of 20 ug/L were observed in 2022. Seasonal selenium trends are generally consistent with other monitoring stations, the lowest concentrations occurring in samples collected in the middle of summer, when flows are relatively high. Historical selenium monitoring data is available dating back to 2015. Review of this data indicates that selenium concentrations recorded at the Michel Creek Compliance point for Coal Mountain Mine are generally decreasing, however, a rebound effect may be occurring since 2022.

Insert 5-22: Total Selenium Concentrations at Compliance Point Coal Mountain Mine – Michel Creek – 2022 (Source: Teck, 2023h)



Insert 5-23: Total Selenium Concentrations at Compliance Point Coal Mountain Mine – Michel Creek – 2015 through 2023 (Source: British Columbia Elk Valley Water Quality Hub – Water Quality Data Dashboard)

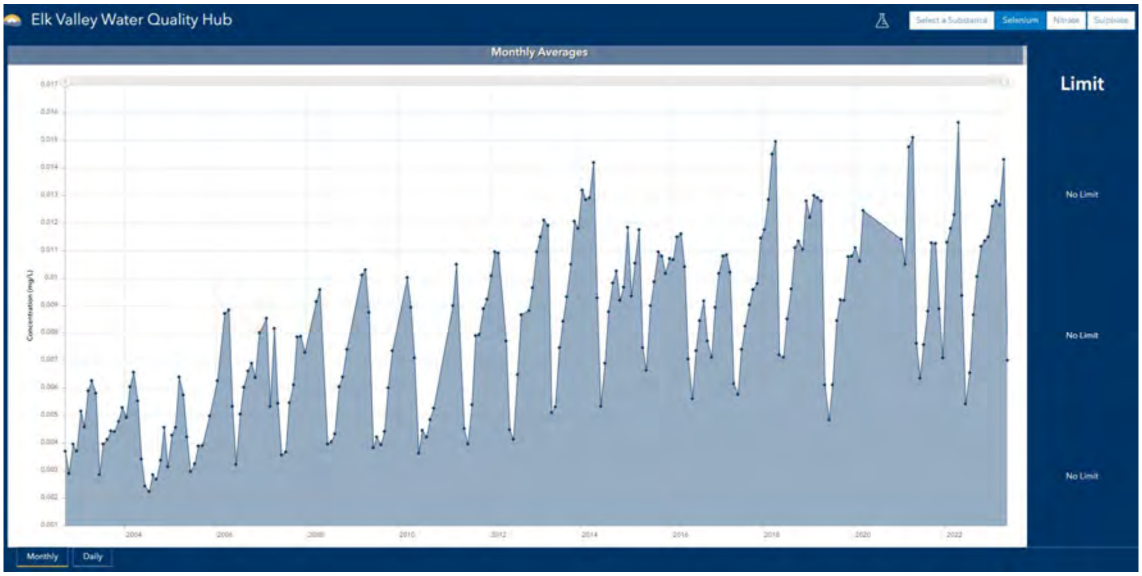


Trend Stations

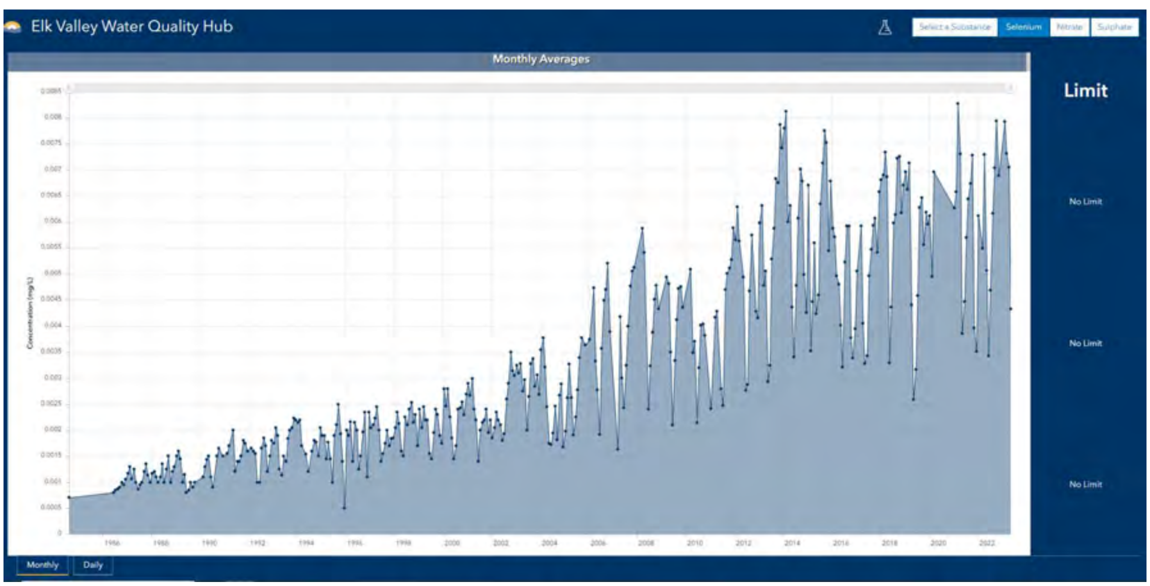
Two Trend Stations are also monitored on a regular basis, which are located on Elk River, downstream of the Town of Sparwood and downstream of Elko. These Trend Station locations are near the Order Stations located on Elk River downstream of Michel Creek, and at Elko, respectively. The data show very similar increasing trends and seasonal fluctuations. The measured concentrations of selenium are below the water quality target of 19 ug/L for Elk River, although the selenium concentrations measured at the Trend Station located downstream of Sparwood are approaching this water quality target.

Notably, the data collected at the Trend Station located downstream of Elko indicate that the measured concentrations of selenium in 1986 were consistently below 1.5 ug/L and were usually below 1.0 ug/L. The background selenium concentrations, and the selenium concentrations in Elk River at this location before mining, would typically have been below 1 ug/L. Current measured concentrations are now commonly 7 to 8 times this concentration. This Trend Station location is significant because it is located immediately upgradient of the confluence of Elk River into Lake Koocanusa.

Insert 5-24: Total Selenium Concentrations at Trend Site: Elk River downstream of Sparwood: 2004 through 2022 (Source: British Columbia Elk Valley Water Quality Hub – Water Quality Data Dashboard)



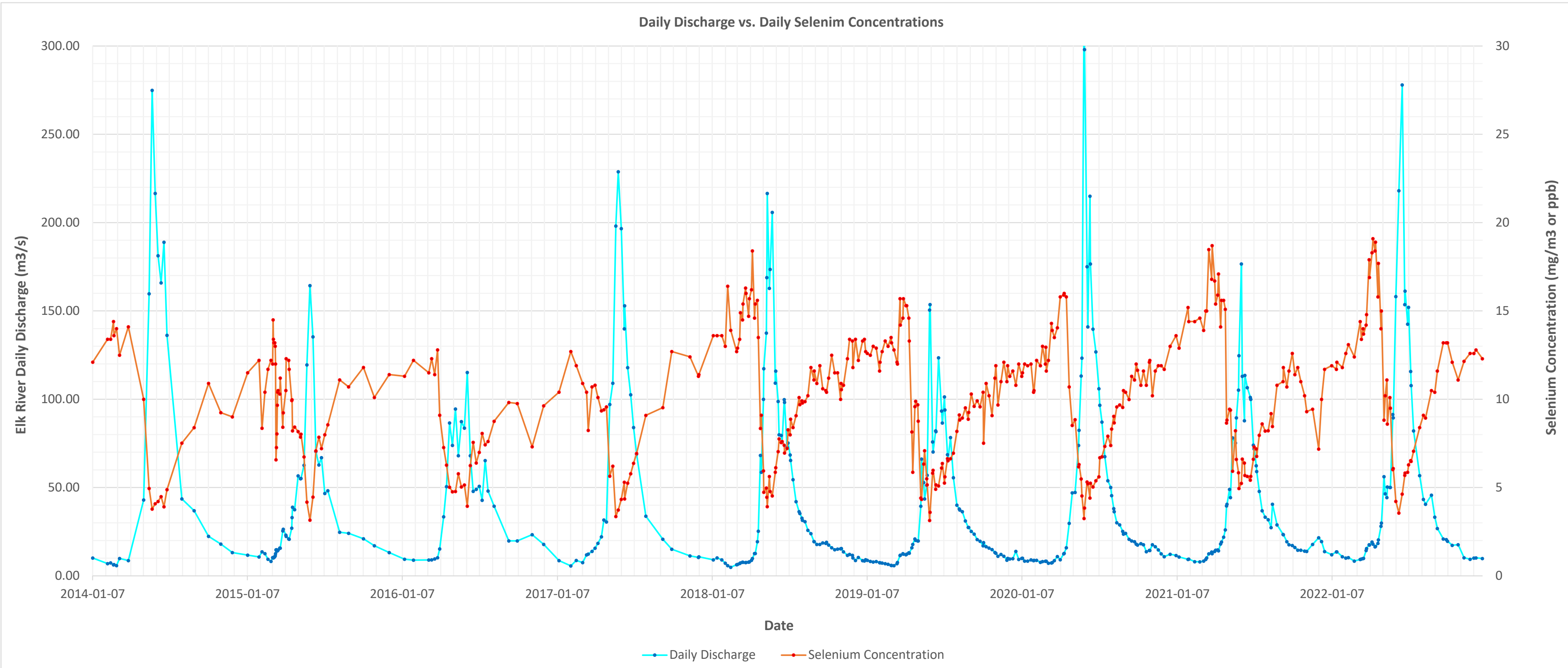
Insert 5-25: Total Selenium Concentrations at Trend Site: Elk River downstream of Elko: 1986 through 2022 (Source: British Columbia Elk Valley Water Quality Hub – Water Quality Data Dashboard)



5.3 Assessment of Surface Water Monitoring Trends and Mass Loading

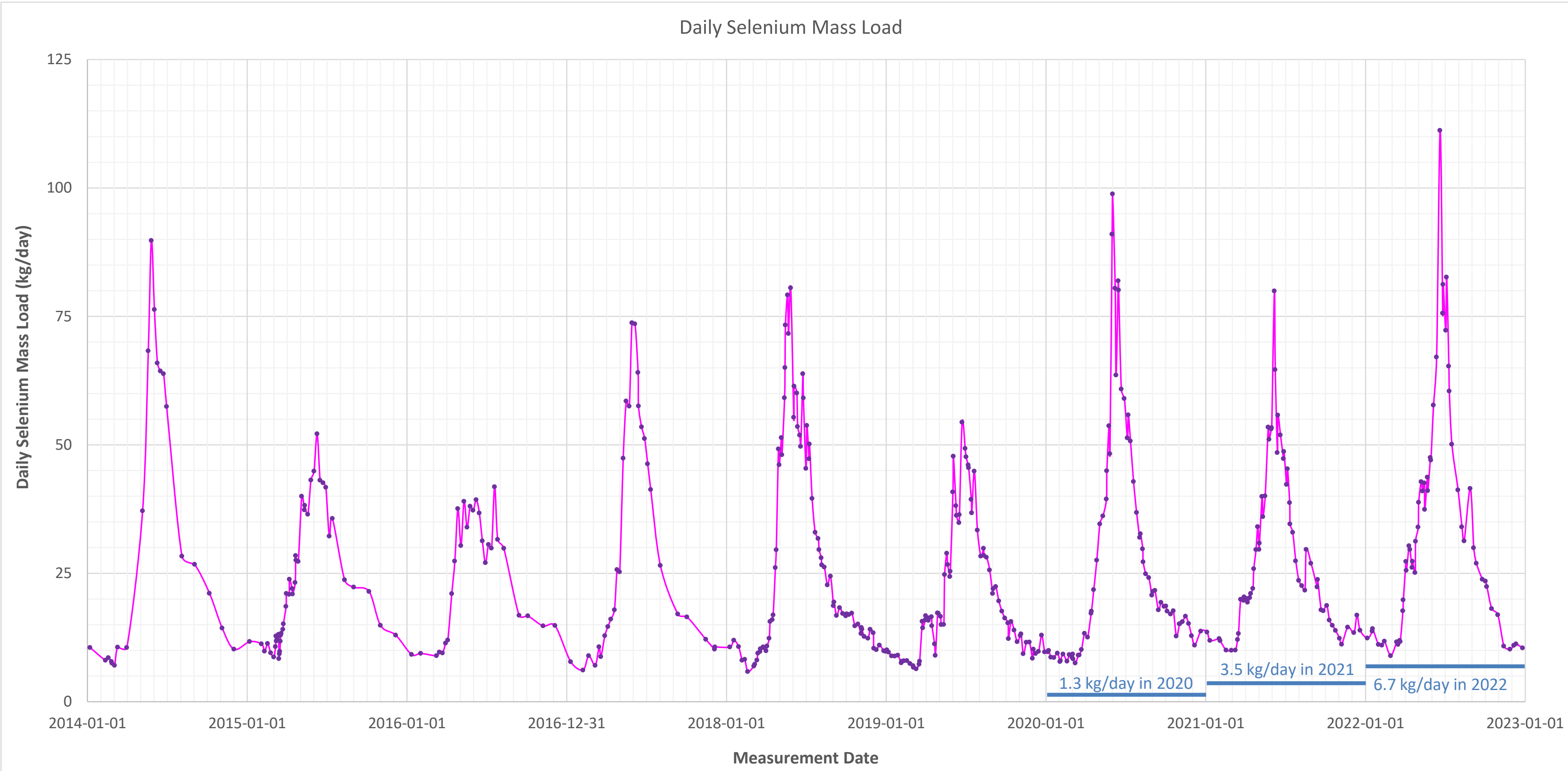
Selenium concentrations in Elk River follow a very predictable seasonal trend, which is depicted in **Figure 5-2** for the Elk River Order Station downstream of Michel Creek. This location was selected because it is the Order Station furthest upstream in Elk River that captures all of the surface water impacts from all of Teck's mines in the Elk Valley. Review of **Figure 5-2** indicates that selenium concentrations fall rapidly at the onset of freshet, then generally increase gradually throughout the year until the onset of the next freshet. This could be the result of mine spoil seepage, and to a lesser extent groundwater, accounting for an increasing proportion of the Elk River flows between freshets, as well as the diminishing dilution effects of freshet, over time, between freshets.

The opposite is the case when considering overall selenium mass loading in Elk River. Review of **Figure 5-3** indicates that peak selenium mass loading occurs during freshet, and then gradually diminishes until the onset of the following freshet. Review of **Figure 5-3** also indicates that the proportion of the mass of selenium removed by the water treatment is low relative to the total selenium mass loading in Elk River. The daily average mass of selenium removed by the water treatment facilities from 2020 through 2022 is superimposed on **Figure 5-3**. Review of **Figure 5-3** indicates that the water treatment facilities removed approximate 5% of the total mine-related loading to the Elk River watershed in 2020, approximately 13% in 2021, and 19% in 2022.



Elk River downstream of Michel Creek

WILDSIGHT SELENIUM RELATED RECLAMATION LIABILITIES TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA		
Flow Rates and Measured Selenium Concentrations		
BURGESS ENVIRONMENTAL	Date: 3/9/2024	Scale:
	Project No.: WILD-01	Figure No.: 5-2



Elk River downstream of Michel Creek

1.3 kg/day in 2020 — Average Daily Selenium Removal Rate

WILDSIGHT SELENIUM RELATED RECLAMATION LIABILITIES TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA		
Selenium Mass Loading		
BURGESS ENVIRONMENTAL	Date: 3/9/2024	Scale:
	Project No.: WILD-01	Figure No.: **5-3**

5.4 Groundwater Data

General

The groundwater monitoring program completed in 2022 by SNC (2023) includes summaries of the site-specific groundwater monitoring programs completed for the 5 mine operations, as well as the regional groundwater monitoring program. This section summarizes the results of the regional monitoring, with specific focus on groundwater used for domestic supplies. The results of groundwater monitoring at individual mines are summarized in **Section 4**.

Selenium contamination of groundwater is relevant to this assessment because most groundwater in the mine areas discharges to tributaries of Elk River. A primary objective of the groundwater monitoring program appears to have been to provide input into the surface water quality model. The regional groundwater monitoring program also provides insight into the selenium contamination of existing and potential groundwater supplies in the Elk Valley.

Background

Background selenium concentrations in groundwater were generally determined as part of the site-specific programs. Dissolved selenium concentrations in background groundwater samples typically varied between non-detect and 1 ug/L, but could exceed 5 ug/L. Increasing concentrations of numerous order constituents (contaminants: selenium, nitrate, sulphate, etc.) were measured at some of these background monitoring well locations (SNC, 2023, Vol. I, PDF pages 7 and 8 of 110), which suggests that groundwater at some of these locations could be affected by mining.

Groundwater Quality Criteria

The screening criteria were established for the following pathways (SNC, 2023):

- Human Health: groundwater for drinking water use was applied as a default value, using the Contaminated Sites Regulation (CSR) for drinking water. The B.C. CSR drinking water criterion for selenium is 10 ug/L. This criterion is lower than that established by Health Canada (2014), as described below.
- Freshwater Aquatic Life: groundwater discharging to aquatic environments was also applied as a default use for wells within 10 m of a high-water mark. The secondary screening values appeared to rely on the water quality targets assigned to specific reaches of the Fording and Elk Rivers.
- Irrigation and Livestock Watering: groundwater for livestock or irrigation watering use were also applied as livestock and irrigation water supplies are sourced from groundwater wells in some locations. These criteria were also used as a surrogate for wildlife watering.

A maximum acceptable concentration (MAC) of 0.05 mg/L (50 µg/L) has also been established for total selenium in drinking water by Health Canada (2014). Selenium is a naturally occurring element which is ubiquitous in the environment. It is generally present in elemental form, or in the form of selenide (Se^{2-}), selenate (SeO_4^{2-}), or selenite (SeO_3^{2-}). Most literature indicates that selenium is not carcinogenic; hence, the MAC for selenium in drinking water is based on chronic, long-term exposure. Selenosis symptoms resulting from chronic exposure to high levels of selenium are characterized by hair loss, nail anomalies or loss, skin anomalies, garlic odour of the breath, tooth decay and, more severely, disturbances of the nervous system. Links have also been found between selenium exposure and other diseases such as diabetes and glaucoma, but results need to be confirmed before conclusions can be drawn (Health Canada, 2014).

Selenium in Groundwater

Executive Summary of the groundwater report (SNC, 2023) indicates that concentrations of dissolved selenium commonly exceeded the screening criteria in mine-affected areas, and were often increasing in concentration. This was the case for samples collected from groundwater monitoring wells completed on the mine sites as well as from monitoring wells completed as part of the regional network.

Selenium contamination has been measured in private and municipal source wells for domestic consumption. Teck (2014, PDF page 118 of 290) measured selenium concentrations in excess of the MAC in 5 of the 91 private and/or public water wells that were sampled at that time. According to Wildsight, Teck has provided alternative water supplies or treatment at 9 locations. In 2020, Sparwood had to relocate a well due to rising selenium levels, Fernie posted well water selenium concerns in 2022, had exceedances in April 2023, and began exploring for new wells in the end of 2023. There is a trend of increasing selenium contamination of alluvial aquifers in the Elk Valley, over time. According to SNC (Teck, 2014, Annex L2 page 17), "*selenium exceedances in the Elk River floodplain appear to result from recharge from the Elk River*".

Teck also monitors private drinking water wells, although it does not publish these results. In 2022, the concentrations of selenium were greater than the drinking water criterion at 11 wells; 3 of these 11 wells also contained sulphate concentrations greater than the drinking water criterion. Water quality results were provided to the respective well users.

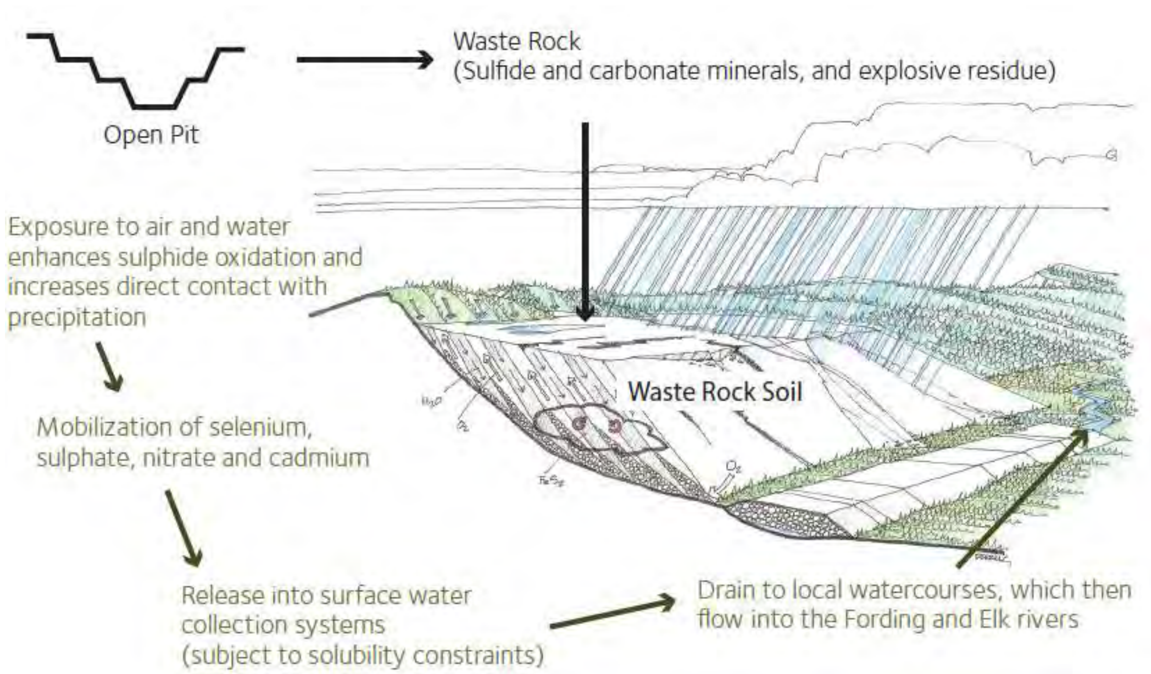
6 WATER QUALITY MODELING

General

This section provides a brief overview of the regional water quality model (titled Elk Valley Water Quality Planning Model; hereinafter referred to as the RWQM) developed by Teck to simulate existing water quality conditions, and predict future contaminant concentrations in the Elk Valley. Specifically, the model was developed as a planning and assessment tool to support the development of the Elk Valley Water Quality Plan(s) required by Ministerial Order No. M113 (Golder, 2014). Permit 107517 requires Teck to update the RWQM every 3 years, based on site-specific investigations of mine-affected water, ongoing monitoring data, and Teck's research and development program regarding selenium contamination and mitigation.

The model has undergone three iterations (documented in 2014, 2017 and 2020/2022 Elk Valley Water Quality Plans and related supporting documentation) at the time of reporting. The original 2014 RWQM was built upon previous modelling tools developed to support Teck's environmental assessment for the Line Creek Mine Phase II project. This impact assessment model was expanded to build the 2014 RWQM, which includes Teck's other mine operations in the Elk Valley.

Insert 6-1: Conceptual Model of Contaminant Release and Transport (Source: Teck, 2014)



The RWQM was developed using a commercially available, general-purpose simulation software platform called GoldSim (GoldSim Technology Group, 2010). The model includes the following four components, which are included in all three versions of the model:

1. hydrology or flow component (FC)
2. geochemical component that includes source terms that describe the release of selenium, sulphate, nitrate and other constituents from waste rock, pit walls and other mine areas (e.g. tailings and coarse coal rejects)
3. mine site data, including past, present and future conditions
4. water quality constituent transport component (WQC), that is used to estimate constitute concentrations in mine-affected watercourses in the Elk River valley

At its core, the RWQM is a water quality mass balance model. The main inputs to the model include surface water flows, geochemical source terms, and operational mine information (such as rate and placement of waste rock). Surface water flows are defined by monitoring flow data, empirical derivatives, and physically-based hydrologic models that are driven by climate-based inputs. Empirical geochemical source terms are derived from observed water quality monitoring and flow data collected downstream of representative source materials, and considered in combination with known waste rock volumes and surface water flows at the mines (SRK 2014).

The 2014 and 2017 versions of the flow component of the model were constructed using an empirical approach, which was selected as the most appropriate way of representing the current level of understanding of hydrology and geochemical processes, and conditions occurring within the waste-rock spoils and other mine features at a regional scale (Golder 2014). Due to apparent data and resource limitations, a first-principles physically-based model for the flow component was not considered feasible at those times. The 2020/2022 version of the model appears to apply physically-based principles at the local-scale (i.e. mine feature catchments) to generate flow inputs as part of the modelling process. The application of empirical-based modelling appeared to be a limitation of the 2014 and 2017 versions of the RWQM for these impacted catchments. That is, to accurately represent contaminant inputs from mining operations such as pits, rock walls and waste-rock spoils, a physically-based local-scale model was assumed to a provide an improved solution compared to the empirical method used in 2014 and 2017. The 2020/2022 RWQM upgrade was likely possible due to an increase in available climate and local flow data for mine-related areas; general advancement of modelling and site understanding; and time/resources availability considering the model has been under development for almost a decade.

A high-level summary of key FC model improvement from 2017 to 2022 include:

- inclusion of a waste rock hydrology module (as discussed above) within the overall flow control module to simulate water flow through waste rock spoils versus relying on a single surrogate watershed (i.e. Cataract Creek) as in previous model versions
- inclusion of a snowmelt runoff module to simulate water flow from undisturbed areas; and to estimate infiltration rates into waste rock spoils
- increasing the level of detail to better represent sub-catchments (increasing from 96 to 154 individual mining sub-catchments)
- accounting for groundwater-surface water partitioning at monitoring locations, and locations where intakes or other water collection systems may be required for water quality management
- extending the historical period considered in the model calibration to include data from 2004 to 2019
- improving calibration in tributaries targeted for mitigation where model performance was previously classified as poor

In terms of model calibration, the objective was to match seasonal and annual patterns in the observed data for high-priority contaminants (i.e. selenium, sulphate and nitrate). The 2014 RWQM was initially calibrated to reflect conditions from 2004 to 2010 and then refined with 2011 and 2012 data. More recent versions of the model have included additional years of data for calibration (e.g. the 2020/2022 RWQM was calibrated using 2004 to 2019).

Model outputs consist of simulated concentrations of substances including nitrate, selenium, and sulphate. The output is in the form of time series (monthly for the 2014 version, weekly or monthly for the 2017 and 2020/2022 versions) at specific monitoring and reporting nodes (Order Stations) within the watershed. Depending on model setup, the output can represent either historical or future conditions.

Measures evaluated for the planning purposes using the RWQM have included:

- active water treatment to remove dissolved substances in mine-affected water and reduce concentrations downstream of the treatment
- diversion to direct clean (i.e., not mine-affected) surface water around waste-rock spoils and reduce the amount of mine-affected water

- mine-affected water management to transfer water with relatively high concentrations to the water treatment plants
- waste-rock cover systems to reduce the infiltration of water through the waste-rock spoils

Sources considered in the mass balance equation for simulations of historical conditions included waste rock, coal rejects, pit-walls and other mine-affected areas, tailings water discharges, and drainage from natural areas. Waste rock and coal rejects included the mass transported via surface flow, and that travelling into the receiving environment through interflow or groundwater (Golder 2014).

The model excludes biological, physical, and chemical decay of substances in surface water, along with adsorption, partitioning, or absorption of substances, consistent with the conceptual model. This is believed to result in conservative estimations of substance levels in the water column (Golder 2014).

Additional 2017 Updates

The 2017 WQRM update report includes comparison of predicted selenium concentrations to water quality targets at the Order Stations, revised to account for delays to the water treatment facilities. The focal areas for the 2017 model update were to improve the calibration for nitrate, and improve tributary flow modelling and concentration projections. Water quality data current to the end of 2016 was used to calibrate the 2017 model update (Teck, 2017).

The conceptual model for waste rock hydrology was updated for the 2017 model. The change was primarily associated with the modeling of unsaturated waste rock. Catchment specific release rates were developed for selenium that included a catchment-specific lag and loading distribution, which was implemented to account for travel times from waste rock through to the receiving environment, as well as seasonality. These changes to model inputs were further refined through the calibration process (Teck, 2017).

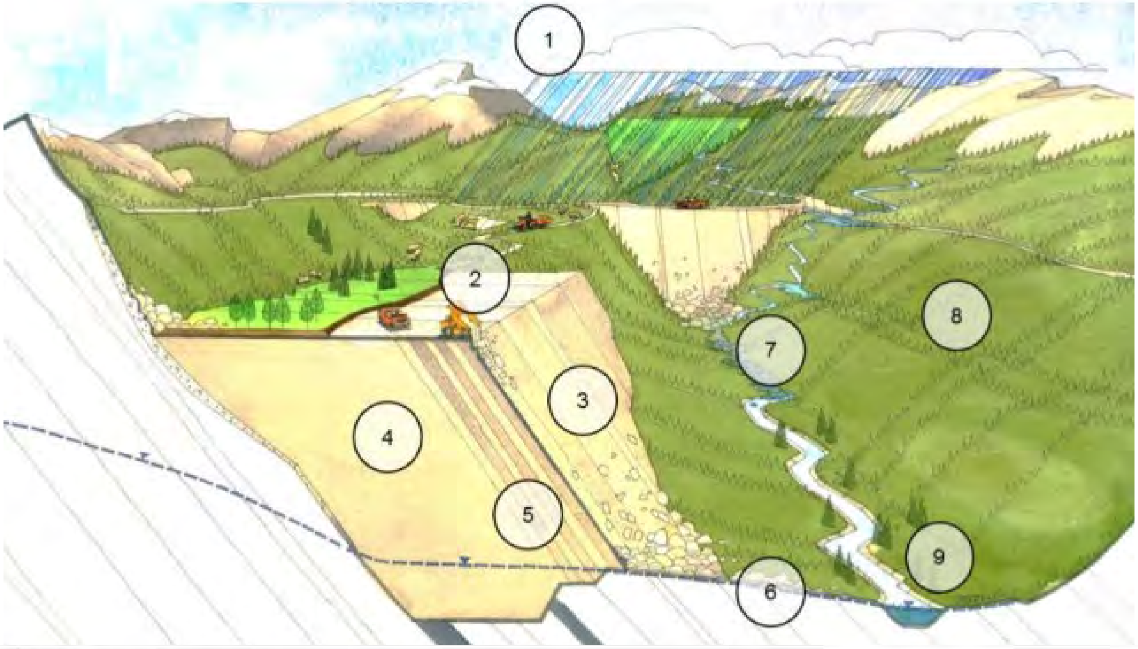
Additional 2020 Updates

The water quality component of the RWQM was updated in 2020 and the flow component in 2022. The RWQM did not incorporate the 2020 flow component model upgrades (physical-based modeling) described above due to time constraints. Therefore, the 2020 modelling used a similar modeling approach to 2017 (see **Figure 6-1**). Focus of the 2020 model update included (Teck, 2021, Section 7.1):

- updating the numerical representation of hydraulic lag to account for the quicker release of constituents from new mine spoils (as discussed above)

- applying hydraulic lag and leaching efficiency to constituents released from rehandled materials
- changing the model framework to allow for a more dynamic release of constituent mass from waste rock spoils
- calibrating the updated model with the goal of improving model performance

The 2017 and 2020/2022 RWQM performance appears to have improved, as discussed in **Section 7**.



1	**Net Percolation** • The amount of water that enters from the surface of the waste piles is a function of precipitation and snowmelt minus evaporation, transpiration and sublimation. • Run-off from the unsaturated waste rock is negligible
2	**Rock placement and physical conditions** • Waste placement is tracked as bank cubic metres (BCM) of waste placed per year and is a primary factor in source term development. • The method of construction can influence the flowpaths that constituents of interest (CIs) travel to exit the waste piles.
3	**Leaching of explosives residuals contributes inorganic nitrogen (e.g., nitrate) to contact waters** • Leaching of explosives residuals are expected to diminish with time since a finite amount of explosives are introduced during mining and nitrogen forms are not expected to be generated significantly by rock weathering. • The amount of NO_3 present is a function of placed waste rock, powder factor, management practices, wet/dry holes, blast utilization and is present dominantly as NO_3.
4	**Geochemical weathering processes under oxygenated conditions** • Oxidation of pyrite results in release of soluble components of pyrite, mainly sulphate, but also traces of elements including selenium and other metals. • Dissolution of acid-neutralizing minerals and release of soluble components of those minerals, mainly base cations (calcium, magnesium). • Throughout the unsaturated waste rock, it is assumed that pyrite oxidation is not oxygen limited. • There is a strong regional correlation of selenium to sulphate. • The interaction of reactive surfaces (e.g. iron oxides) may attenuate elements, e.g. cadmium, and precipitation of secondary minerals such as gypsum may control sulphate concentrations. • Waste rock may break down over time, exposing new surface areas as a result of compaction, physical weathering etc.
5	**Hydrological processes that may influence release of CIs from waste rock** • There are leaching inefficiencies within the waste piles that are difficult to quantify whereby not all pore spaces are leached by infiltrating waters. This can be influenced by dump height, grain size etc. • When waste rock piles are disturbed (e.g. during rehandling), pore spaces not previously leached may leach. • Travel time through the waste rock pile is believed to be largely a function of lift height and net percolation.
6	**Transport of CIs via seepage, run-off and groundwater pathways** • Water carrying CIs from the dump exit the dump as surface water and groundwater. • Negligible run-off occurs and groundwater pathways are expected to be minimal on a regional scale reporting ultimately to the Elk River. • Where groundwater pathways occur, there is a potential for load bypass at specific monitoring stations and sub-oxic reduction of Se and NO_3.
7	**In-stream precipitation processes** • As seepage with high partial pressure of CO_2 exits the waste rock pile and equilibrates with the atmosphere, calcite becomes supersaturated and precipitates within the streams. Trace metals such as cobalt and cadmium (among others) have been shown to co-precipitate with calcite when this occurs. • The precipitation of calcite is affected by seasonal changes in flow whereby during high flows and spring freshet, streams are diluted and calcite does not precipitate. During this period some trace metals concentrations (e.g. Co) tend to parallel sulphate trends in the receiving environment.
8	**Undisturbed area influences** • Dilution from undisturbed areas varies by drainage and influences the monitoring station flow and water quality. A load is associated with this undisturbed area, and the relative proportion varies by constituent.
9	**Monitoring location and data record** • Source term development requires data for flow and water chemistry. The extent of monitoring record varies across the region. Some stations have robust data sets while others are limited. Recent data (<10 years) tends to be more complete, while older data are sometimes limited.

WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Water Quality Model Concept
(Source: Teck, 2017)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:	
Project No.: WILD-01	Figure No.:	6-1

7 WATER QUALITY MEASUREMENTS VERSUS MODEL PREDICTIONS

7.1 Initial 2014 Model Predictions

The charts shown in **Figure 7-1** were developed using the 2014 water quality model. **Figure 7-1** shows measured selenium concentrations to 2014, and projected concentrations of selenium after 2014, as mitigation measures were to be implemented. The projections represent water quality at the mouth of Fording River, downstream of Line Creek, and at Elk River downstream of its confluence with Michel Creek. Review of the monthly average mean selenium concentration in each chart indicates the following:

- The predicted maximum monthly selenium concentration under average flow conditions at the mouth of Fording River was predicted to be 50 ug/L in 2014, decreasing to approximately 45 ug/L by 2015, after construction of the Line Creek Mine active water treatment facility. It was then predicted to increase gradually to slightly less than 50 ug/L in 2018, then decrease to approximately 35 ug/L in 2019, after the first Fording River Mine active water treatment facility was constructed. The predicted maximum monthly selenium concentration under average flow conditions at the mouth of Fording River was then predicted to increase gradually to approximately 40 ug/L until 2022, when a second water treatment facility was to be constructed at the Fording River Mine.
- The predicted maximum monthly selenium concentration under average flow conditions in the Elk River downstream of its confluence with Michel Creek was predicted to be approximately 14 ug/L in 2014. It was then predicted to increase gradually to approximately 16 ug/L in 2018, then decrease to approximately 13 ug/L in 2019, after the first Fording River Mine active water treatment facility was constructed. The predicted maximum monthly selenium concentration under average flow conditions in the Elk River downstream of its confluence with Michel Creek was then predicted to increase to approximately 15 g/L until 2021, when a water treatment facility was to be constructed at the Elkview Mine, then diminish to approximately 13 ug/L by 2023.

Predictions were made for each Order Station (Teck, 2014, Sec. 8), which are discussed below.

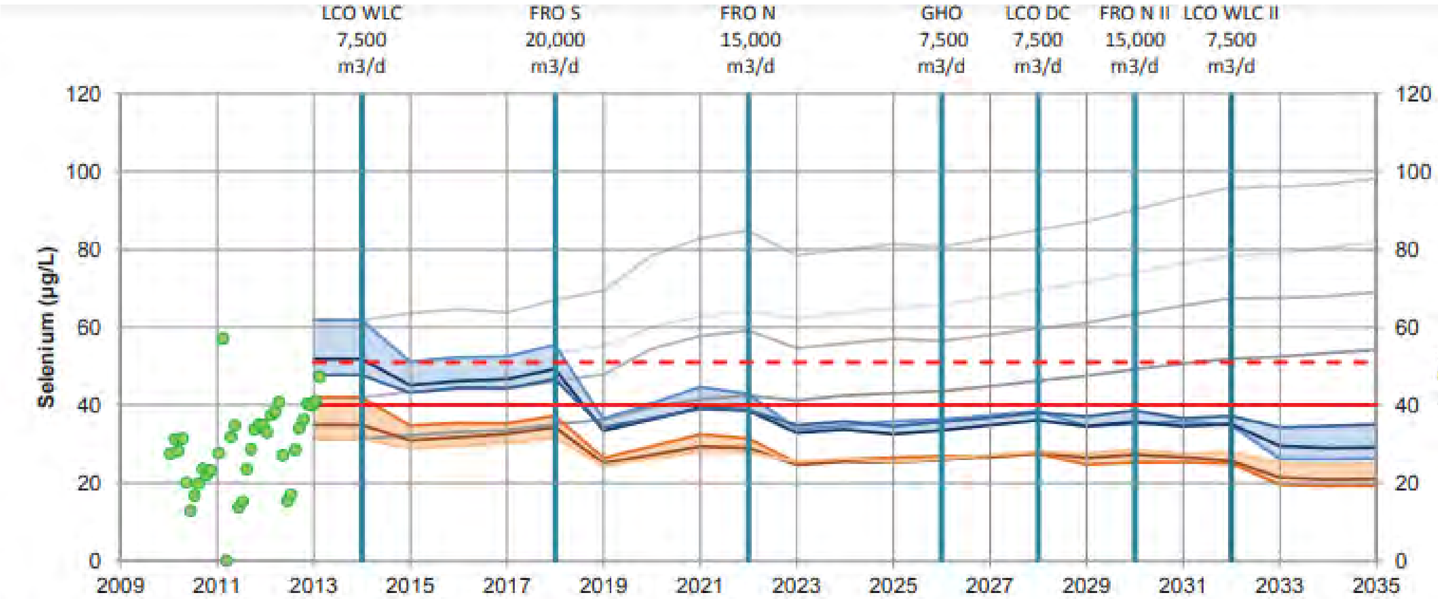


Figure 9: Predicted trend for selenium concentrations at FR5 during Plan implementation

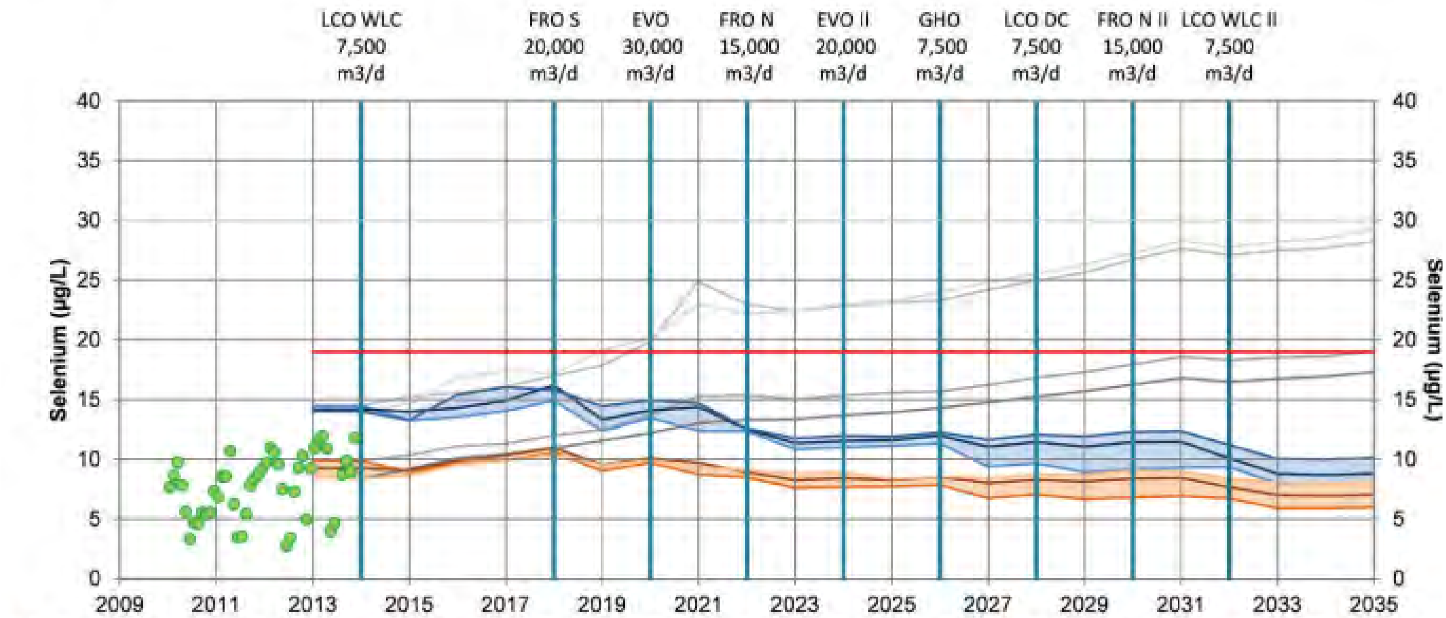


Figure 10: Predicted trend for selenium concentrations at ER3 during Plan implementation

- Predicted Maximum Monthly Concentration Under Low Flow Conditions without Mitigation
- Predicted Maximum Monthly Concentration Under High Flow Conditions without Mitigation
- Predicted Annual Average Concentration Under High Flow Conditions without Mitigation
- Predicted Annual Average Concentration Under Low Flow Conditions without Mitigation
- Predicted Maximum Monthly Concentration Under Low Flow Conditions and Initial Implementation Plan
- Predicted Maximum Monthly Concentration Under Average Flow Conditions and Initial Implementation Plan
- Predicted Maximum Monthly Concentration Under High Flow Conditions and Initial Implementation Plan
- Predicted Annual Average Concentration Under Low Flow Conditions and Initial Implementation Plan
- Predicted Annual Average Concentration Under Average Flow Conditions and Initial Implementation Plan
- Predicted Annual Average Concentration Under High Flow Conditions and Initial Implementation Plan
- Observed
- Long-term Target
- Short-term Target

- Data points prior to EVWQ Plan
- FR5: Fording River downstream of Line Creek
- ER3: Elk River downstream of Michel Creek

WILDSIGHT
SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Selenium Concentration Predictions - 2014
(Source: Teck, 2014)

BURGESS ENVIRONMENTAL

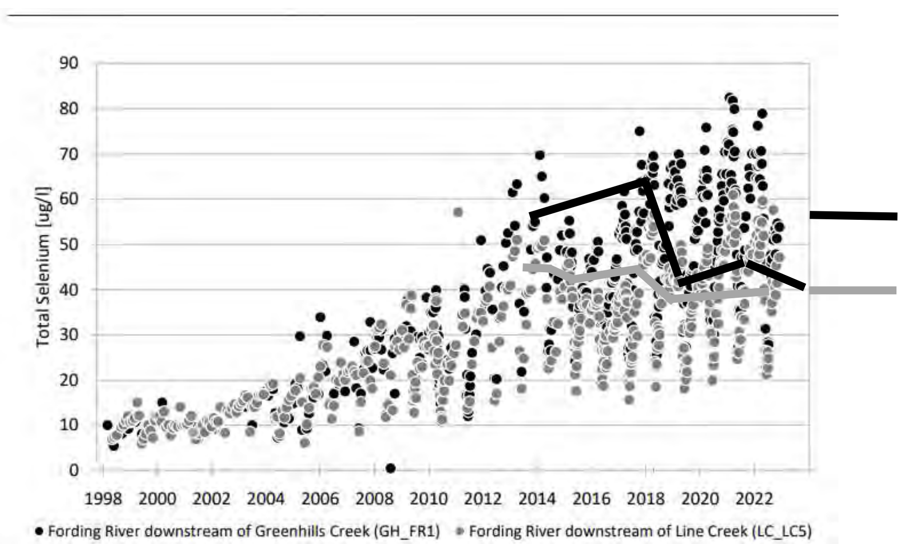
Date: 3/9/2024	Scale:
Project No.: WILD-01	Figure No.: 7-1

Fording River

Insert 7-1 overlays the predicted concentrations of selenium at the mouth of the Fording River (gray line) and downstream of Greenhills Creek (black line) to those measured by Teck through 2022 (see **Section 5**). Review of **Insert 7-1** and **Figure 7-1** indicates the following:

- The predicted diminishing concentrations of selenium in response to commissioning of the water treatment plants are not evident in the measured selenium concentrations. The measured selenium concentrations at the mouth of the Fording Fiver have been increasing steadily since 2014, with only potentially minor apparent effects resulting from the commissioning of the Line Creek Mine active water treatment plant in 2018, and the Fording River Mine active water treatment plant in 2021.
- The variabilities of the measured selenium concentrations under varying flow conditions are greater than those predicted by the model, although the modelled concentrations presented by Teck (2014) were intended to reflect average concentrations under the various flow conditions, not potential variability.
- The average selenium concentrations for all flow conditions were predicted to comply with the water quality targets of 57 ug/L and 40 ug/L in the upper and lower Fording River, respectively, by 2023. Trends in measured selenium concentrations indicate that more than half of the recently-measured concentrations exceed these water quality targets, and that the frequency of exceedances is increasing.

Insert 7-1: Predicted versus Measured Selenium Concentrations in Fording River Order Stations (Source: Teck, 2014 and 2023h)

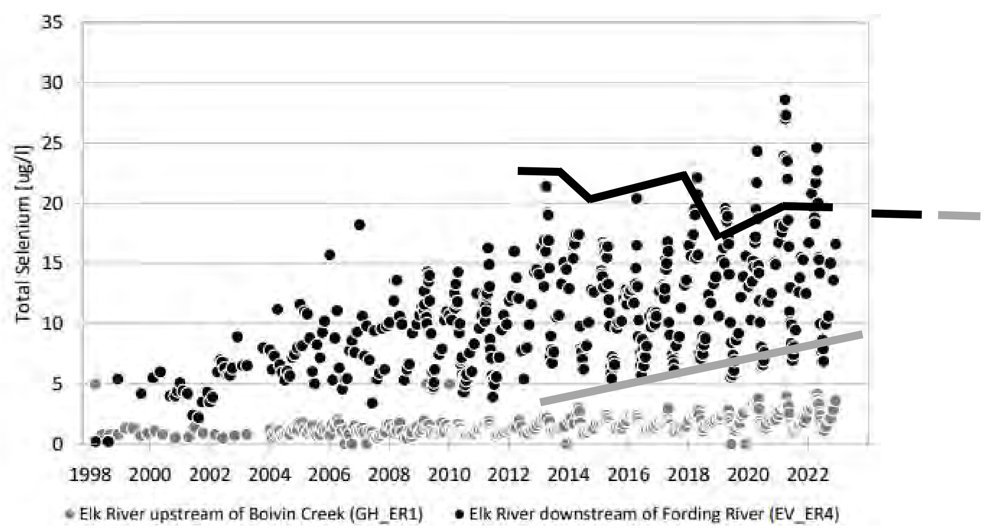


Upper Elk River

Insert 7-2 overlays the predicted concentrations of selenium in the Elk River upstream (gray line) and downstream (black line) of its confluence with Fording River to those reported by Teck through 2022 (see **Section 5**). Review of **Insert 7-2** indicates the following:

- The predicted diminishing concentrations of selenium in the Elk River downstream of Fording in response to commissioning of the Line Creek and Fording River Mines' water treatment plants are not as evident in the measured selenium concentrations. The measured selenium concentrations in this upper Elk River Order Station have been increasing steadily since 2014, with no significant reductions resulting from the commissioning of water treatment facilities in 2018 and 2021.
- The variability of the measured selenium concentrations under varying flow conditions is also greater than those predicted by the model, although the modelled concentrations presented by Teck (2014) were intended to reflect average concentrations under the various flow conditions, not potential variability.
- The measured selenium concentrations in the upper Elk River below its confluence with Fording River exceed the water quality target of 19 ug/L in most recent samples, and the frequency and degree of exceedances is on an increasing trend.
- The trend in measured selenium concentration in the upper Elk river above Fording River are lower than those predicted by the model, which indicates that the west side of the Greenhills Mine is contributing less to selenium contamination than was predicted, and that Line Creek and Fording River Mines are contributing more than predicted.

Insert 7-2: Predicted versus Measured Selenium Concentrations in Upper Elk River Order Stations (Source: Teck, 2014 and 2023h)

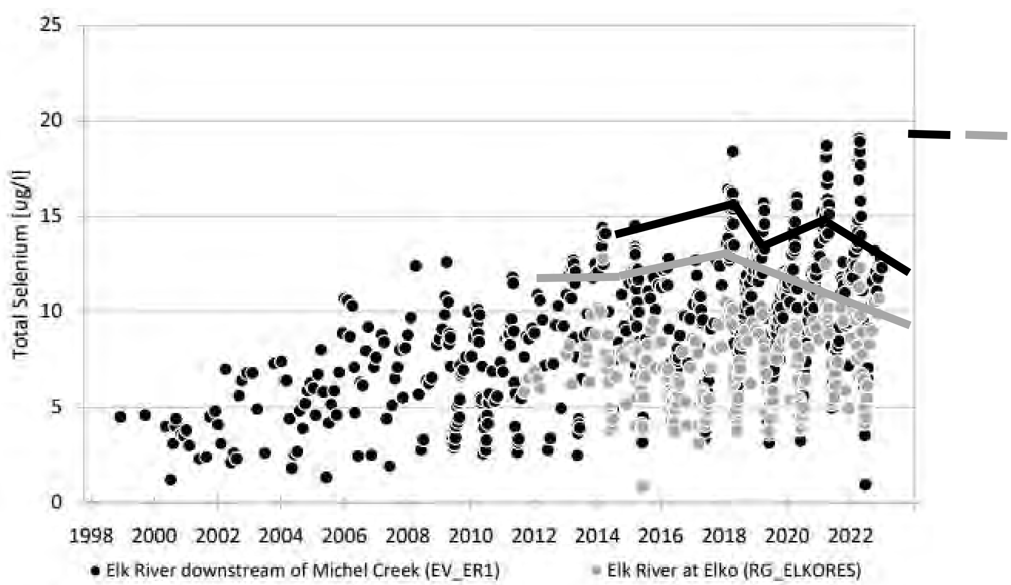


Lower Elk River

Insert 7-3 overlays the predicted concentrations of selenium in the Elk River downstream of its confluence with Michel Creek (black line) and at Elko (gray line) to those reported by Teck through 2022 (see **Section 5**). Review of **Insert 7-3** and **Figure 7-1** indicates the following:

- The predicted diminishing concentrations of selenium in the Elk River in response to commissioning of the water treatment plants are not evident in the measured selenium concentrations. The measured selenium concentrations at these Elk River Order Stations have been increasing steadily since 2014, with no significant reductions resulting from the commissioning of water treatment facilities in 2018, 2021, or 2022.
- The variability of the measured selenium concentrations under varying flow conditions is also greater than those predicted by the model, although the modelled concentrations presented by Teck (2014) were intended to reflect average concentrations under the various flow conditions, not potential variability.
- The average selenium concentrations for all flow conditions were predicted to remain below 15 ug/L after 2018 for the Order Station below Michel Creek. Trends in recent data indicate that measured concentrations occasionally exceed the water quality target of 19 ug/L, and that the frequency of exceedances was increasing by the end of 2022.

Insert 7-3: Predicted versus Measured Selenium Concentrations in Lower Elk River Order Stations (Source: Teck, 2014 and 2023h)

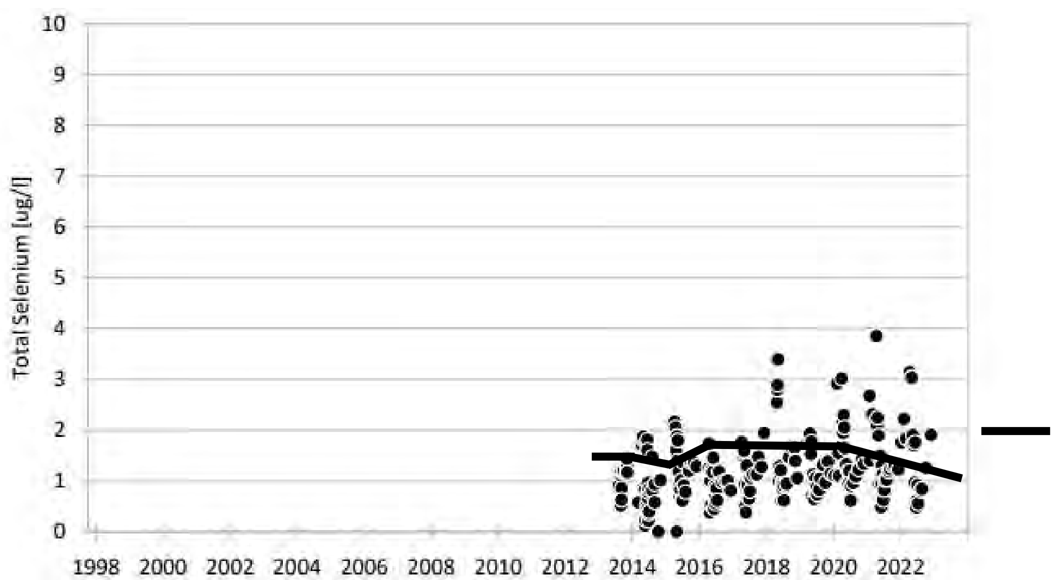


Lake Koocanusa

Insert 7-4 overlays the predicted concentrations of selenium in Lake Koocanusa to those reported by Teck through 2022 (see **Section 5**). Review of **Insert 7-2** and **Figure 7-1** indicates the following:

- The predicted, reasonably stable concentrations of selenium in Lake Koocanusa are not consistent with the measured selenium concentrations. The measured selenium concentrations at the Lake Koocanusa Order Station have been increasing steadily since 2014, with no significant reductions resulting from the commissioning of water treatment facilities in 2018, 2021, and 2022.
- The variability of the measured selenium concentrations under varying flow conditions is also greater than those predicted by the model. It is noted that the modelled concentrations presented by Teck (2014) were intended to reflect average concentrations under the various flow conditions, not potential variability.
- The average selenium concentrations for all flow conditions were predicted to remain below the 2 ug/L water quality target for Lake Koocanusa. Trends in recent data indicate that measured concentrations occasionally exceed this water quality target, and that the frequency of exceedances was increasing at the end of 2022.

Insert 7-4: Predicted versus Measured Selenium Concentrations in Lake Koocanusa Order Station (Source: Teck, 2014 and 2023h)



Summary

The direct comparison of predicted versus measured concentrations of selenium at the Order Stations is made more complicated because the water treatment facilities planned in 2014 were commissioned later than was assumed by the model. As a result, improvements in water quality that were predicted as a result of commissioning the Line Creek, Fording River, and Elkview Mines water treatment facilities were delayed. Additionally, the model predictions were for average monthly concentrations predicted for average, high and low flow conditions, without a corresponding assessment of potential variability. Notwithstanding these complicating factors, the predicted reductions in selenium concentrations do not appear to have occurred after the treatment facilities came on-line.

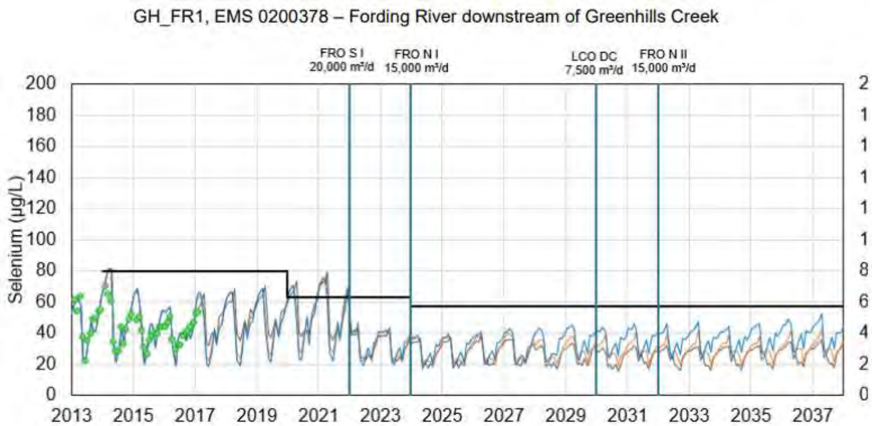
The modeling also predicted that, by 2023, concentrations of selenium would generally comply with the water quality targets at each of the Order Stations. By the end of 2022, this had not occurred. At most order stations, the recently measured concentrations of selenium have regularly exceeded the water quality targets for those stations, and the frequency and degree of exceedance appears to be worsening.

7.2 2017 Model Predictions

Fording River Downstream of Greenhills Creek

Insert 7-5 shows the concentrations of selenium in Fording River downstream of Greenhills Creek that were predicted by the 2017 model update. Review of **Insert 7-5** indicates that the selenium concentrations were predicted to vary seasonally and gradually increase to a maximum of approximately 80 ug/L in 2021, then diminish in 2022 and 2023 to approximately 40 ug/L in response to the commissioning of the Fording River active water treatment facility. Review of **Insert 7-1** indicates that the selenium concentrations at this location varied seasonally, and increased gradually and consistently to a maximum of approximately 85 ug/L in 2021, then diminished to a maximum of approximately 80 ug/L in 2022. There is insufficient data available to assess the longer term effect of the Fording River water treatment facilities on selenium concentrations at this location.

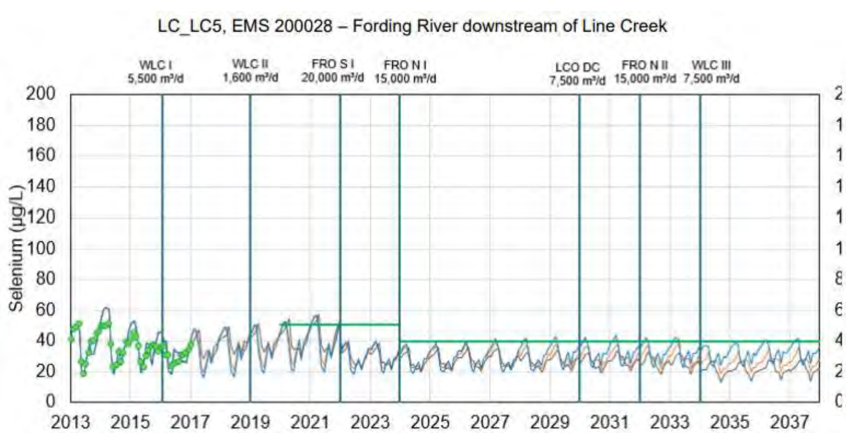
Insert 7-5: Predicted Selenium Concentrations in Fording River downstream of Greenhills Creek (Source: Teck, 2017)



Fording River Downstream of Line Creek

Insert 7-6 shows the concentrations of selenium in Fording River downstream of Line Creek that were predicted by the 2017 model update. Review of **Insert 7-6** indicates that the selenium concentrations were predicted to vary seasonally and gradually increase to a maximum of approximately 58 ug/L in 2021, then diminish in 2022 and 2023 to approximately 40 ug/L in response to the commissioning of the Fording River active water treatment facility. Review of **Insert 7-1** indicates that the selenium concentrations at this location varied seasonally, and increased gradually and consistently to a maximum of approximately 62 ug/L in 2021, then diminished to a maximum of approximately 60 ug/L in 2022. There was insufficient data available to assess the effect of the Fording River water treatment facilities on selenium concentrations at this location.

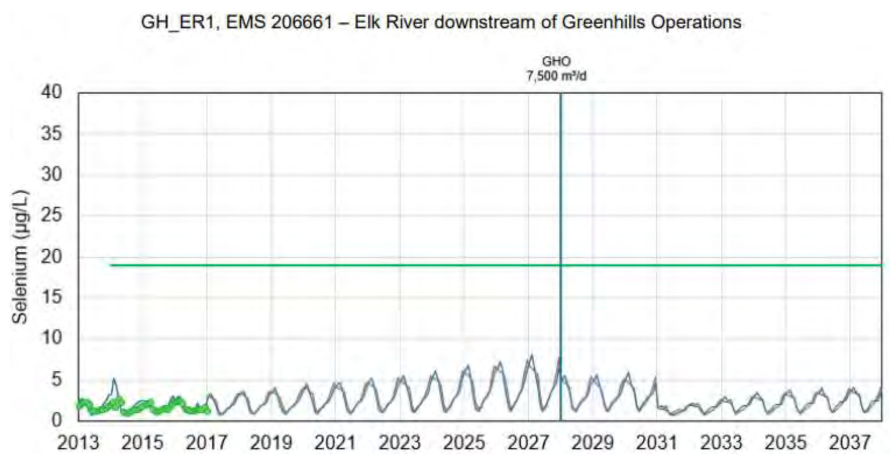
Insert 7-6: Predicted Selenium Concentrations in Fording River downstream of Line Creek (Source: Teck, 2017)



Elk River Downstream of Greenhills Mine

Insert 7-7 shows the concentrations of selenium in Elk River downstream of the Greenhills Mine that were predicted by the 2017 model update. Review of **Insert 7-7** indicates that the selenium concentrations were predicted to vary seasonally and gradually increase to a maximum of approximately 5 ug/L in 2022. Review of **Insert 7-2** indicates that the selenium concentrations at this location varied seasonally, and increased consistently to a maximum of approximately 4.5 ug/L in 2022, which is consistent with the modeled predictions.

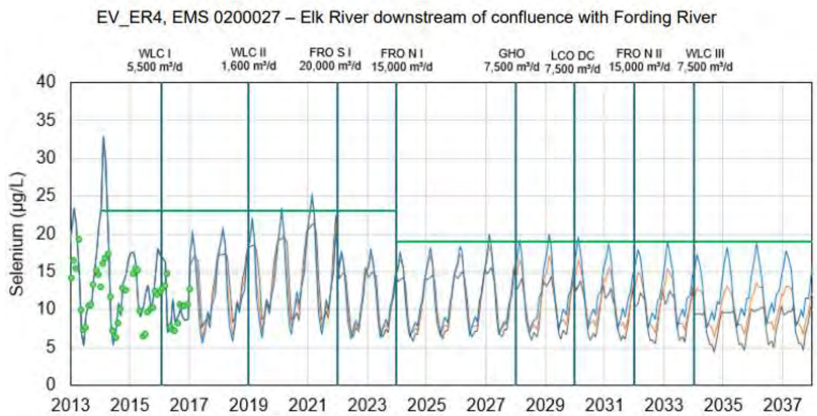
Insert 7-7: Predicted Selenium Concentrations in Elk River downstream of Greenhills Mine (Source: Teck, 2017)



Elk River Downstream of Fording River

Insert 7-8 shows the concentrations of selenium in Elk River downstream of Fording River that were predicted by the 2017 model update. Review of **Insert 7-8** indicates that the selenium concentrations were predicted to vary seasonally and gradually increase to a maximum of approximately 25 ug/L in 2021, then diminish in 2022 in response to the commissioning of the Fording River active water treatment facility. The water quality target of 19 ug/L at this location was delayed until 2024. Review of **Insert 7-2** indicates that the selenium concentrations at this location varied seasonally, and increased consistently to a maximum of approximately 29 ug/L in 2021, then diminished to a maximum of approximately 25 ug/L in 2022. There was insufficient data available to determine whether this is a short term effect, or whether the Fording River water treatment facilities will have longer term positive effects.

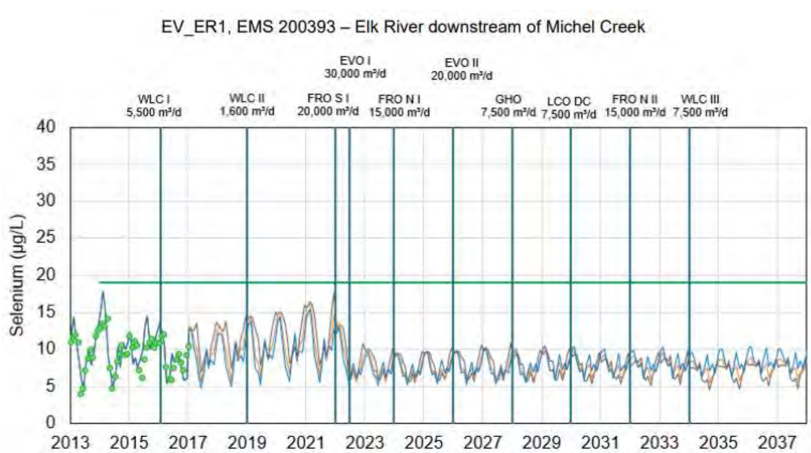
Insert 7-8: Predicted Selenium Concentrations in Elk River downstream of Fording River (Source: Teck, 2017)



Elk River Downstream of Michel Creek

Insert 7-9 shows the concentrations of selenium in Elk River downstream of Michel Creek that were predicted by the 2017 model update. Review of **Insert 7-9** indicates that the selenium concentrations were predicted to vary seasonally and gradually increase to a maximum of approximately 16 ug/L in 2021, then diminish dramatically in 2022 and 2023 to approximately 10 ug/L in response to the commissioning of the Fording River active water treatment facility, and the Elkview saturated rock fill treatment facility. Review of **Insert 7-9** indicates that the selenium concentrations at this location varied seasonally, and increased consistently to a maximum of approximately 19 ug/L in 2022. There was no evident, significant reduction in measured selenium concentrations resulting from the commissioning of the Fording River active water treatment facility and/or the Elkview saturated rock fill treatment facility (see **Insert 7-3**).

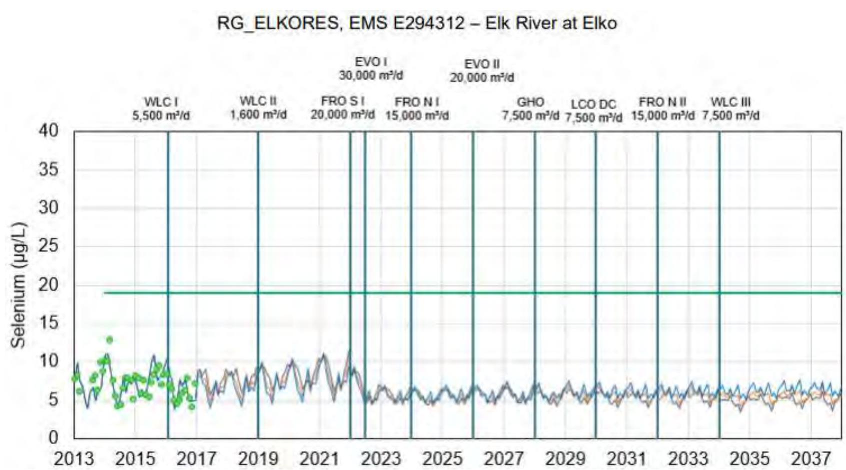
Insert 7-9: Predicted Selenium Concentrations in Elk River downstream of Michel Creek (Source: Teck, 2017)



Elk River at Elko Reservoir

Insert 7-10 shows the concentrations of selenium in Elk River at Elko that were predicted by the 2017 model update. Review of **Insert 7-10** indicates that the selenium concentrations were predicted to vary seasonally and gradually increase to a maximum of approximately 11 ug/L in 2021, then diminish in 2022 and 2023 in response to the commissioning of the Fording River and Elkview water treatment facilities. Review of **Insert 7-10** indicates that the selenium concentrations at this location varied seasonally, and increased consistently to a maximum of between approximately 12 and 13 ug/L by 2022. There was no evident, significant reduction in measured selenium concentrations resulting from the commissioning of the Fording River and Elkview water treatment facilities (see **Insert 7-3**).

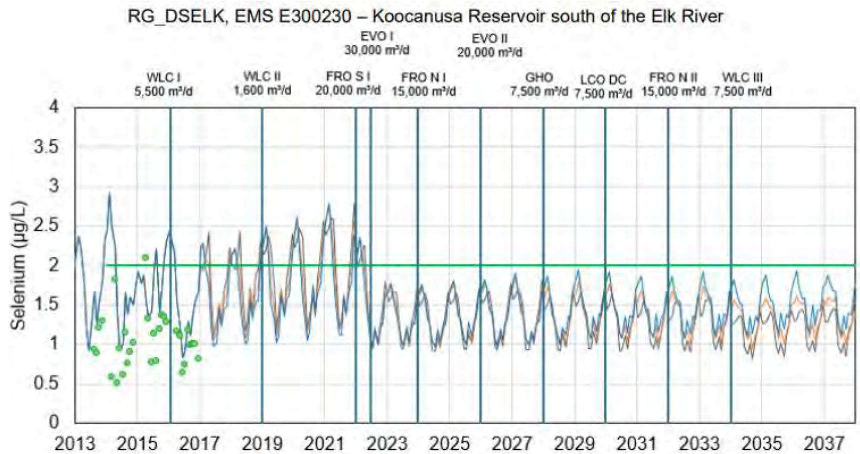
Insert 7-10: Predicted Selenium Concentrations in Elk River at Elko (Source: Teck, 2017)



Lake Koocanusa

Insert 7-11 shows the concentrations of selenium in Lake Koocanusa that were predicted by the 2017 model update. Review of **Insert 7-11** indicates that the selenium concentrations were predicted to vary seasonally and gradually increase to a maximum of approximately 2.6 ug/L in 2021, then diminish in 2022 and 2023 in response to the commissioning of the Fording River and Elkview water treatment facilities. Review of **Insert 7-11** indicates that the selenium concentrations at this location varied seasonally, and the maximum concentrations varied between approximately 3 and 4 ug/L from 2018 to 2022. There was no evident reduction in measured selenium concentrations resulting from the commissioning of the Fording River and Elkview water treatment facilities.

Insert 7-11: Predicted Selenium Concentrations in Lake Koocanusa (Source: Teck, 2017)



Summary

The water quality predictions in the 2017 model update account for the seasonal variance in selenium concentrations, which is generally consistent with the measured concentrations. The selenium concentrations predicted by the 2017 model update are generally closer to the measured concentrations than the 2014 model, which is expected from a more recent update. The reductions in the predicted selenium concentrations at the Order Stations located closer to the mines appear to be borne out by the measured concentrations, although additional data is required to verify these trends. Conversely, the measured selenium concentrations in lower Elk River and Lake Koocanusa are not consistent with these predicted improvements. Again, additional data is required over a longer term to verify reliable trends. In general, the model predicts lower selenium concentrations than those measured in water samples collected from the Order Stations through 2022. The 2017 model update also predicted significant improvements to water quality at all significantly impacted Order Stations between 2021 and 2023. This has not proven to be the case, although this is likely due to treatment systems being commissioned later than the timelines assumed in the model predictions.

7.3 2020 Model Update

In general, projected selenium concentrations made using the 2020 model were higher than those predicted using the 2017 model. The reductions in predicted selenium concentrations resulting from the water treatment facilities were also delayed until 2023; hence, this model should more accurately reflect this period. Differences in the selenium projections were attributable to the following three changes to the model (Teck, 2021, Section 8.3.2):

- surface water – groundwater partitioning at tributary monitoring stations

- incorporation of variable hydraulic lag as it applies to new waste rock spoils, along with the presence of the immediately available initial soluble load
- updated methods to simulate waste rock flow

A detailed review of individual predictions made using the 2020/2022 Model update has not been completed because there was insufficient data to evaluate trends. In general, the predicted selenium concentrations correlate more closely with the measured concentrations of selenium at the Order Stations, which is expected given the recency of the model update. Significant reductions in selenium concentrations were predicted to occur at the Order Station between 2022 and 2024. There are early indications of reductions in the measured concentrations of selenium in samples collected from the Order Stations through the first half of 2023; however, there are insufficient data available to verify these trends. Reductions in measured selenium concentrations are anticipated to occur in 2024 as a result of the increased treatment capacity that was brought on-line in 2023 and early 2024.

The flow component of the model was modified (Teck, 2022a) as part of the 2020 update. The primary change involved switching from an analogue-based model to a climate driven model for some of the flow components of the model domain. Other modifications included simulating flow through waste rock, simulating snow-melt on unaffected areas, and including groundwater.

7.4 Summary

It is difficult to evaluate the reliability of the model predictions because the timing of the commissioning of the water treatment facilities has not been consistent with the timing assumed in the models. In general, the predictions made by the 2020 model update more closely correlate to measured concentrations than the two prior versions of the model. Given the recency of the 2020 model update, this is to be expected. This model update, and the 2017 model update, predict significant reductions in selenium concentrations at the Order Stations, through 2024. There was insufficient data available to evaluate these predicted improvements.

The measured concentrations of selenium in samples collected from the lowest Order Stations (Elk River downstream of Michel Creek, Elk River at Elko. and Lake Koocanusa) exceed the modeled predictions in all three cases.

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Teck, 2023g. Elk Valley Water Quality Plan Progress Update Fall 2023.

Teck, 2023h. Permit 107517 Surface Water Quality Monitoring 2022 Annual Report. March 31, 2023.

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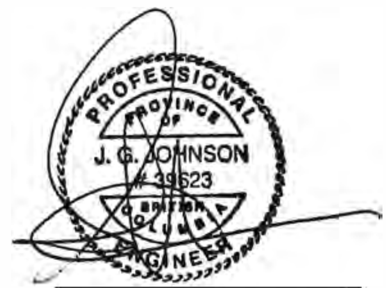
USGS, 2022. Selenium in the Kootenai River Basin, Montana and Idaho, United States, and British Columbia, Canada.

9 CLOSURE

This report has been prepared for Wildsight. The text contained herein presents documentation of the assessment of the selenium contamination emanating from Teck Coal's mine operations in the Elk Valley, B.C. This represents the opinion of Burgess Environmental Ltd. that is based on this work as well as information provided by Wildsight, reports made publicly available by Teck, and publicly available information.

All data contained herein has been reviewed and interpreted by, or under the direct supervision of Gordon J. Johnson, P.Eng.



Gordon J. Johnson, M.Sc., P. Eng.
President
Burgess Environmental Ltd.

APPENDIX A
RECLAMATION SECURITY ESTIMATE

Appendix A: Estimate of Reclamation Security for Selenium Contamination Teck Coal's Elk Valley Mines

Submitted to:
Wildsight

Date:
March 18, 2024

Burgess Environmental Ltd.
24 Strathlorne Crescent SW
Calgary, Alberta, T3H 1M8
Telephone: (403) 466 9482
Email: burgessenv@shaw.ca

Author:
Gordon J. Johnson, M.Sc., P.Eng.

Burgess Environmental

Table of Contents

List of Tables

List of Figures

1 INTRODUCTION

1.1 Background

Teck Coal has initiated a process to sell its metallurgical coal mining and processing business (Elk Valley Resources) to Glencore PLC, with a minority stake being sold to Nippon Steel Corporation. Wildsight is concerned that appropriate Reclamation Security, which is required by the Major Mines Reclamation Security Policy (B.C, 2022a), is in place to cover all of the costs for reclamation of these mines. By 2023, Teck Coal had set aside $1.5 billion of Reclamation Security to cover the unplanned closure of its British Columbia (B.C.) coal mines (B.C., 2023a, Appendix C), and this amount is scheduled to increase.

Wildsight is specifically concerned that the Reclamation Security is adequate to cover the cost of remediating selenium, which is leaching out of Teck Coal's active and closed mines (**Figure A1**), and is expected to leach out of these mines for many decades (Teck, 2014, PDF page 4 of 290), and potentially centuries. Through 2022, Teck has reportedly spent over $1.4 billion trying to reduce selenium contamination, and will spend an additional $550 million in 2023 and 2024 (Teck, 2023). However, the concentrations of selenium in the Elk River watershed continued to worsen through 2022 (USGS, 2022, PDF page 2 of 4; **Section 5**). Wildsight has retained Burgess Environmental Ltd. (Burgess) to assess this issue, and provide an independent, third-party estimate of the costs to remediate the selenium contamination emanating from Teck Coal's mines.

1.2 Objective and Scope

This Appendix estimates the financial liabilities to Teck Coal that are associated with the selenium contamination emanating from its coal mine operations in southeast B.C. The B.C. (2022a, PDF page 8 of 24) Policy states, "*reclamation security is intended to cover the cost of reclaiming a site in the event that a mining company defaults on their obligation to do so or becomes insolvent. Costs that must be considered include those necessary to: close and maintain infrastructure such as tailing dams and waste rock dumps; construct, operate and maintain water treatment plants, waste cover systems and other required mitigations; re-contour the site, prepare the surface, place a suitable growth medium, revegetate the site, and implement on-going monitoring and surveillance programs*". As such, the cost of remediating selenium contamination emanating from Teck Coal's mine operations accounts for only a portion of Teck's reclamation liabilities; surface reclamation of the mines and the remediation of other water pollutants (Teck, 2014, PDF page 4 of 290) are also required but are not included in this estimate.

This Appendix estimates the Reclamation Security required to remediate selenium contamination emanating from Teck Coal's Elk Valley mines. The main report includes a review of the relevant background information, which provides the supporting basis for this Reclamation Security estimate and includes the following:

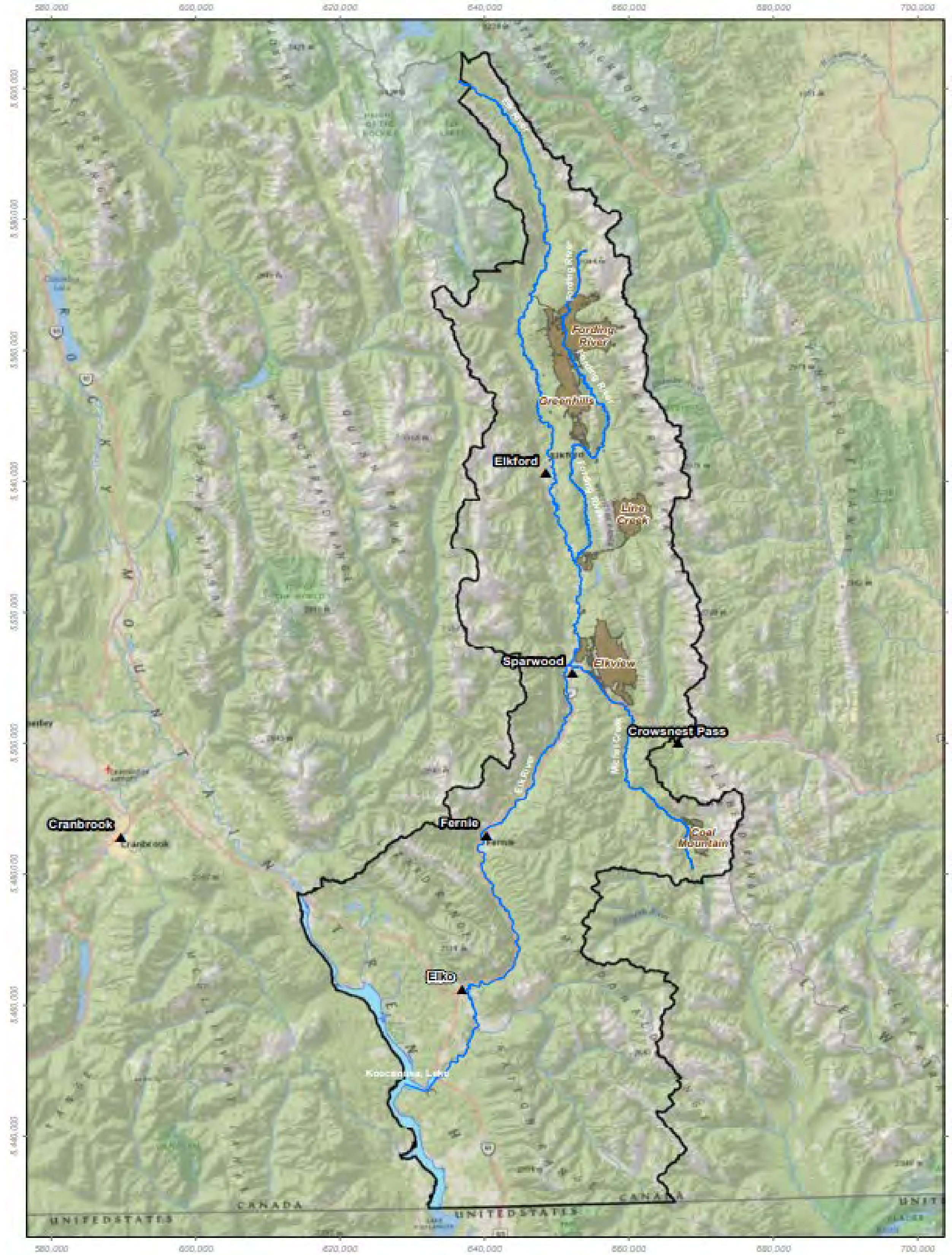
- background information
- a description of the Elk Valley watershed
- a summary of the regulatory basis related to selenium contamination
- descriptions of Teck Coal's mine operations in the Elk Valley, including information relevant to the selenium contamination for each operation
- detailed analyses of the selenium concentrations in surface water and groundwater of the Elk Valley watershed
- assessment of Teck's predictive models

1.3 Reliance Materials

This assessment is based on the following:

- data, information, reports, and plans made available to the public by Teck Coal
- data, information, reports, and plans made available to the public by the B.C. government
- publicly available information, including technical analyses completed by others
- the experience and judgment of the authors

A large body of information has been developed by Teck Coal, some of which has been submitted to B.C. regulators, which has not been made available publicly. Examples would include, but are not necessarily limited to, regulatory reporting, internal studies and research, and detailed cost information submitted to support its current Reclamation Security estimates. This Reclamation Security estimate would benefit from being provided access to this information.



WILDSIGHT

SELENIUM RELATED RECLAMATION LIABILITIES
TECK COAL MINES IN SOIUTHEAST BRITISH COLUMBIA

Teck Coal Mines in Elk River Watershed

(Source: Teck, 2014)

BURGESS ENVIRONMENTAL

Date: 3/9/2024	Scale:	
Project No.: SULP-01	Figure No.:	A1

2 RELEVANT LEGISLATION AND GUIDANCE

A summary of relevant legislation and guidance documents published by the Province of British Columbia is provided for context to this Reclamation Security estimate. This summary is not intended to represent an exhaustive review of legislation and guidance, or a legal opinion.

2.1 Mines Act

Review of the provisions of Section 10: Permitting of the Mines Act (B.C., 2023b) indicates that the B.C. regulator has the authority to set and change the Reclamation Security required by Teck to address liabilities associated with selenium pollution, as follows.

- Subsection (4) provides the chief permitting officer the legal authority to determine the amount and form of financial security required of Teck for (a) mine reclamation, and (b) protection of, and mitigation of damages to, watercourses.
- Subsection (5) gives the chief permitting officer the ability to require annual changes to the security so that funds are available over the life of mine to cover the costs to reclaim and close the mine, to mitigate impacts to the environment, and to fulfill the conditions of the permit and any orders relating to reclamation and the protection of watercourses.
- Subsection (7) provides the chief permitting officer with the ability to change the reclamation security requirements for a mine at any time if it is deemed necessary.

2.2 Environmental Management Act

The Environmental Management Act (B.C., 2023c) is relevant to the calculation of Reclamation Security for three primary reasons, as follows:

- Section 14(1)(b) allows a director that is issuing a permit authorizing the introduction of waste into the environment to require the permittee to give security in the amount and form and subject to conditions the director specifies.
- In April 2013, the B.C. Minister of Environment's Order M113, issued under Section 89 of the Environmental Management Act, directed Teck to develop an area-based water-quality management plan for the Elk Valley.
- The Environmental Management Act gives the Director the authority to prepare and publish environmental management plans for specific areas of British Columbia, including plans for the protection of water courses. It is understood that this authority was used to approve Teck's (2014) Elk Valley Water Quality Plan.

2.3 Major Mines Reclamation Security Policy (Interim)

This section summarizes the Major Mines Reclamation Security Policy (B.C., 2022a), and provides guidance to major mine permit holders regarding B.C.'s approach to managing Reclamation Security.

Objectives and Scope

The B.C. (2022a, PDF page 4 of 24) Policy Statement reads, "*this policy seeks to ensure that permittees for major mines pay the full cost of environmental cleanup and reclamation for their mine. New mines and any existing mines (whether in operation, in care & maintenance or closed) having less than five years of remaining mineral reserves will be required to post full reclamation security equal to the company's reclamation liability on the mine site. A partial exploration incentive security will be available to mines that have invested in sufficient exploration to demonstrate at least five years of remaining reserves. The policy seeks . . . to reduce the differential between reclamation liabilities and reclamation securities for existing mines*".

It is understood that Teck is eligible for a partial (25%) reduction in Reclamation Security because its major mines have been operating for more than 5 years and will operate for more than an additional 5 years.

"*The objective of mine reclamation is to return disturbed land to a state that will achieve desired end land use goals, and to reduce risks to the public and to the environment. This requires that land and watercourses are left in a state of physical and geochemical stability and that disturbed land is revegetated to a self-sustaining state that satisfies the end land use*" (B.C., 2022, PDF page 8 of 24). "*Reclamation security is intended to cover the cost . . . to: close and maintain infrastructure such as tailing dams and waste rock dumps; construct, operate and maintain water treatment plants, waste cover systems and other required mitigations; re-contour the site, prepare the surface, place a suitable growth medium, revegetate the site, and implement on-going monitoring and surveillance programs*" (B.C., 2022a, PDF page 8 of 24). Based on these statements, the Reclamation Security for Teck is required to cover the cost of mitigating selenium contamination, as well as all other costs that would be incurred to physically secure and reclaim its mine sites and address other water contamination.

Calculating Reclamation Security

In short, Reclamation Security is intended to cover the costs of unplanned closure/bankruptcy of the mine. Reclamation Security is calculated every five years and is based on the mine's 5-Year Mine Plan and Reclamation and Closure Plan. Reclamation Security is based on the Net Present Value (NPV) of the estimated liability during the next 5 years (i.e. the peak liability before the next updates to the Reclamation and Closure Plan are due), and covers a 100-year post closure period.

The progress must be indicated for each task on an annual basis, and a cost estimate provided for each year of the post-closure period. For large mines, the annual discount rate for calculating the NPV of the Reclamation Security is 4%.

The Reclamation Security estimate must be completed by a qualified person and is subject to verification and acceptance by Ministry of Energy, Mines and Low-Carbon Initiatives (EMLI) (B.C., 2022a, PDF page 12 of 24).

The calculation is based on third-party contractor and consulting rates, and follows a spreadsheet format developed by EMLI. Guidance is provided for the following:

- labour and material rates
- mobilization and demobilization
- engineering
- project management
- administration
- conventional reclamation
- dismantling and demolition
- monitoring
- capital and operating costs for water treatment
- site maintenance
- contingency

For water treatment, "*capital costs should be based on a recent cost estimate provided by a supplier or on the actual cost of a similar system used elsewhere. Capital costs for water treatment facilities that are planned for construction after mine closure, or in the last 10 years of the mine life, must be included*" in the cost estimate (B.C., 2022a, PDF page 14 of 24). Table 1 of this Policy allows the Chief Permitting Officer to exclude the capital cost for water treatment under certain conditions.

Progressive Reclamation and Source Control

Progressive reclamation and source control are encouraged as opportunities to reduce Reclamation Security in general, and potential liability to taxpayers in particular. The Policy states, "*progressive reclamation serves to reduce the potential reclamation liability faced by the province and reduces the corresponding reclamation security required of mining companies*"; and "*prioritizing up-front planning and source control during the early stages of mine design can significantly reduce a mining company's environmental liability and the amount of the required reclamation security*".

These policy positions are relevant to the calculation and management of Reclamation Security because they allow for Teck to apply for reductions in Reclamation Security as key mitigating measures, such as the construction of water treatment facilities, are implemented.

2.4 Code for Mines in British Columbia

Portions of the Health, Safety and Reclamation Code for Mines in British Columbia (B.C., 2022b) are also relevant to Reclamation Security, as follows:

- Part 10.1.3 (i) requires Teck to provide a detailed reclamation liability cost estimate of all outstanding reclamation and closure liabilities over the planned life of mine, including any long-term monitoring and maintenance obligations.
- Part 10.6.15 allows for the chief inspector to return all or part of a reclamation security when satisfactory work has been done.
- Part 10.6.16 allows Teck the opportunity to apply to the chief inspector for a release or partial release of reclamation security requirements based on work completed.

2.5 Ministerial Order 113

Ministerial Order 113 (B.C., 2013) describes additional regulatory requirements of Teck that are specific to the contamination of the Elk River by Teck's operations in the Elk Valley. Amongst other requirements, Ministerial Order 113 (Schedule C) requires the following:

1. "*immediately begin to stabilize water quality concentrations of selenium, cadmium, nitrate, and sulphate, and the rate of formation of calcite in the designated area;*
2. *in the medium-term, reduce the rate of formation of calcite and set targets to demonstrate progressive reduction in water quality concentrations of selenium, cadmium, nitrate and sulphate in the designated area; and*
3. *in the longer term, further reduce:*
    a. *concentrations of selenium, cadmium, nitrate, and sulphate in the designated area to acceptable contaminant levels as identified in section B below, and*
    b. *control the rate of calcite formation to acceptable levels as identified in section B below*."

3 SELENIUM MITIGATION REQUIREMENTS

3.1 General Approach

The requirements related to remediating the selenium contamination emanating from each of Teck's Elk Valley coal mines are divided into the following categories:

- operation and maintenance of existing facilities
- construction, operation, and maintenance of additional facilities identified in Teck's 2023 update
- monitoring and reporting specific to selenium contamination of surface water and groundwater

It is assumed that the current water quality targets would continue to be used as appropriate standards throughout the term of remediation. Based on the analysis of water quality testing as part of the Order (B.C., 2013), it is evident that additional water treatment is required to comply with these targets (see **Section 5, Main Report**).

Teck (2023) has identified additional water treatment facilities that it plans to build and begin operating between now and 2027, which are included in this Reclamation Security cost estimate. Teck is commissioning saturated rock fills to treat selenium contaminated water, which Burgess considers an evolving technology that still needs to demonstrate capacity and effectiveness over the longer term. It is possible that the saturated rock fills will need to be replaced by active water treatment in the future, which would significantly increase the Reclamation Security requirements associated with the selenium contamination. This possibility is not included in this Reclamation Security estimate.

In addition to Teck's mine-specific obligations, Teck is required to complete regional monitoring and reporting, as well as maintaining stakeholder engagement and outreach programs. For cost estimating purposes, it is assumed that all non-mine specific sampling (e.g. groundwater, fish tissue, benthic, etc.) is implemented as part of the Elk Valley Water Quality Plan (Teck, 2014).

3.2 Elkview Mine

Existing Treatment Facilities

Elkview is required to continue to operate and maintain its saturated rock fill treatment facility with a capacity of 20,000 m^3/day.

New Treatment Facilities

Based on the review of water quality and quantity data, additional water treatment is required for the Harmer Creek watershed, and Erickson Creek watershed. Teck has identified an additional 15,000 m^3/day saturated rock fill water treatment requirement for its Elkview Mine.

Monitoring and Reporting

Water quality monitoring is implemented for the following water courses and water bodies within the footprint area of the mine: Michel Creek, Erickson Creek, Dry Creek, Harmer Creek, Aquaduct Creek, Cosssarini Creek, Otto Creek, unnamed creeks (7), and in-pit lakes and lagoons (7). This amounts to 21 sampling locations.

3.3 Line Creek Mine

Existing Treatment Facilities

Line Creek Mine is required to continue to operate its existing 7,500 m^3/day active water treatment facility.

New Treatment Facilities

Based on the review of water quality and quantity data, additional active water treatment is required for the Dry Creek watershed, and North Line Creek watershed. Teck has identified an additional 20,000 m^3/day active water treatment requirement for its Line Creek Mine.

Monitoring and Reporting

Review of the hydrology of the Line Creek Mine (**Main Report, Section 3.2**) indicates that there are 12 surface water catchments that warrant monitoring.

3.4 Fording River Mine

Existing Treatment Facilities

Teck has constructed and commissioned a 20,000 m^3/day active water treatment facility. It is commissioning a 30,000 m^3/day saturated rock fill treatment facility, which for the purpose of this estimate is assumed to be 90% complete.

New Treatment Facilities

Two additional saturated rock fill treatment facilities with a combined capacity of 30,000 m^3/day are planned for the north Fording River Mine area.

Monitoring and Reporting

The hydrology of Fording River is complicated by the large number of creeks and ephemeral drainages in the mine area. For cost estimating purposes, it is assumed that there are 30 surface water monitoring points in the Fording Mine area.

3.5 Greenhills Mine

Existing Treatment Facilities

There are no existing selenium water treatment facilities at the Greenhills Mine.

New Treatment Facilities

A 7,500 m^3/day active water treatment facility is planned for Greenhills Creek.

Monitoring and Reporting

The hydrology of the Greenhill Mines is also complicated by the large number of creeks and ephemeral drainages in the mine area. For cost estimating purposes, it is assumed that there are 14 surface water monitoring points in the Greenhills Mine area.

3.6 Coal Mountain Mine

No selenium-specific treatment is planned for the Coal Mountain Mine; therefore, the cost for environmental monitoring of selenium contamination from this mine has been rolled into the cost estimates for the Elk Valley Water Quality Plan.

3.7 Elk Valley Water Quality Plan

For the purpose of establishing the Reclamation Security cost estimates, it is assumed that all compliance, groundwater, benthic organisms, and tissue monitoring is included in the regional program, within the requirements of the Elk Valley Water Quality Plan. The combined program would therefore include the following tasks:

- Order point monitoring: 5 surface water order points monitored weekly
- Compliance point monitoring: 6 surface water compliance points monitored weekly
- Groundwater monitoring: a total of 176 well sample locations (21 background, 29 Fording River, 26 Greenhills, 35 Line Creek, 46 Elkview, 19 Coal Mountain) sampled quarterly
- Benthic monitoring: estimated
- Tissue sampling: estimated

4 RECLAMATION LIABILITY ESTIMATES

4.1 Cost Basis

New Water Treatment Facility

The cost for a new water treatment facility is based on the reported cost for the 7,500 m^3/day active water treatment facility. This facility is reported to have cost $105 million in 2013 (Teck, 2014, PDF page 36 of 290). Based on 2.5% annual inflation since that time, a new active water treatment facility of similar size is estimated to cost $140 million today, or $18,400 per m^3/day of treatment capacity.

Saturate rock fill treatment is reportedly less expensive. Mackie, et al. (2022) states, "*costs of the* (saturated rock fill) *trial system were compared to those from the nearby West Line Creek treatment plant which treats a flow rate of 7,500 m*^{3}*/d, at nitrate and selenium concentrations similar to those in the* (saturated rock fill) *influent. The* (saturated rock fill) *was constructed at a capital cost of approximately one third of that of the West Line Creek facility and operates at approximately one half the operating cost for a similar flow rate*". Based on this statement, a new saturated rock fill treatment facility is estimated to cost $6,200 per m^3/day of capacity.

Treatment Facility Maintenance and Operation

For active water treatment, the cost estimate is based on an annual maintenance cost of 6% of the capital cost for active water treatment ($1,100 per m^3/day), and an annual operation cost of 4% of the capital cost for active water treatment ($740 per m^3/day). For a saturation, the maintenance and operating costs are estimated to be $550 per m^3/day and $370 per m^3/day, which are half of the maintenance and operating costs for active water treatment.

Monitoring and Reporting

Water monitoring costs are based on weekly sampling and a crew of two collecting 4 samples per day. This is considered reasonable given the expanses of the sampling areas. The annual cost of analysis and reporting is estimated to be $180,000, based on experience and professional judgment.

Elk Valley Water Quality Plan

Teck's obligations for reclamation extend to maintaining the existing Elk Valley Water Quality Plan. The following assumptions were made as the bases for these cost estimates:

- Surface water monitoring costs are based on weekly sampling and a crew of two collecting 4 samples per day. The annual cost of analysis and reporting is estimated to be $260,000.
- Groundwater monitoring costs are based on quarterly sampling and a crew of two collecting 3 samples per day. The annual cost of analysis and reporting is estimated to be $300,000.

- Tissue sampling costs are based on annual sampling and a crew of two collecting 3 samples per day. The annual cost of analysis and reporting is estimated to be $50,000.
- Benthic survey costs are based on annual surveys requiring a crew of completing one survey every 2 days. The annual cost of analysis and reporting is estimated to be $50,000.
- The stakeholder engagement program is estimated to cost $100,000 per year.

Other Cost Items

The following cost estimating assumption were made based on the Major Mines Reclamation Security Policy (B.C., 2022a):

- Project Management: 10% of project costs
- Contingency: 15% of project costs
- NPV discount factor: 4% per annum
- Estimate Term: 60 years (maximum term as per Policy is 100 years)

4.2 Reclamation Security Estimate

The Reclamation Security estimate (**Table A1**) to remediate the selenium contamination emanating from Teck's mines is $6.4 billion, of which $4.8 billion requires financial security as specified in the the Major Mines Reclamation Security Policy (B.C., 2022a). Note that these values have been extracted from the detailed Reclamation Security estimate that is presented in Attachment A and have been rounded. It is noted that this estimate addresses only the selenium pollution caused by Teck's coal mines in the Elk Valley and does not include surface reclamation of the mines, remediation of water supplies in the Valley, or mitigation of other pollution.

Table A1

Reclamation Security Cost Estimate for Selenium Contamination

Reclamation Requirement	Cost	
Elkview	$	1.03 billion
Line Creek	$	1.86 billion
Fording River	$	2,88 billion
Greenhills	$	0.56 billion
Elk Valley Monitoring	$	0.06 billion
Total Reclamation Security	$	6.40 billion
Net Reclamation Security	$	4.80 billion

It is further noted that the Mines Act provides the Chief Permitting Officer with discretion regarding the amount and type of Reclamation Security that is required of a major mine operator, and that the Policy guidelines (B.C., 2022a, Table 1) allows the Chief Permitting Officer to exclude the capital costs of water treatment facilities under certain circumstances. The capital costs for water treatment included in this estimate amount to approximately $800 million. Excluding these costs would further decrease the Reclamation Security by $600 million, to approximately $4.2 billion.

5 REFERENCES

B.C., 2013. Province of British Columbia Order of the Minister of Environment Section 89, Environmental Management Act. Ministerial Order No. M113.

B.C., 2022a. Major Mines Reclamation Security Policy (Interim). Ministry of Energy, Mines and Low Carbon Innovation. April 5, 2022.

B.C., 2022b. Health, Safety and Reclamation Code for Mines in British Columbia. Revised November 2022.

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B.C., 2023c. Environmental Management Act. SBC 2003, Chapter 53. Last modified in 2023 by regulation.

Teck, 2014. Elk Valley Water Quality Plan. Submitted July 22, 2014.

Teck, 2023g. Elk Valley Water Quality Plan Progress Update Fall 2023.

USGS, 2022. Selenium in the Kootenai River Basin, Montana and Idaho, United States, and British Columbia, Canada.

ATTACHMENT A
RECLAMATION SECURITY ESTIMATE

Total Cost

Reclamation Requirement	Cost	
Elkview	$	1,033,413,922
Line Creek	$	1,858,856,440
Fording River	$	2,877,166,052
Greenhills	$	560,537,213
Elk Valley Monitoring	$	66,101,033
Total Reclamation Security	$	6,396,074,660
Net Reclamation Security	$	4,797,055,995

Cost Basis for Estimate

Water Treatment

Item	Value	Comment
Capital Cost Reference	$ 105,000,000.00	Line Creek
Capacity (m3/day)	7,500	Teck 2023b
Years Ago	11	Teck 2023b
Current Cost	$ 137,769,099	2.5% escalation
Unit Cost - Capital	$ 18,369.21	per m3
Unit Cost - Maintenance	$ 1,102.15	6% of capital
Unit Cost - Operation	$ 734.77	4% of capital

Surface Water Sampling

Item	Number	Units	Unit Cost	Total Cost
Personnel (2)	2.5	Hours	$ 250.00	$ 625.00
Vehicle and Instruments	2.5	Hours	$ 40.00	$ 100.00
Analysis	1	Sample	$ 300.00	$ 300.00
Per Sample Cost				$ 1,025.00

Groundwater Sampling

Item	Number	Units	Unit Cost	Total Cost
Personnel (2)	3.3	Hours	$ 250.00	$ 825.00
Vehicle and Instruments	3.3	Hours	$ 40.00	$ 132.00
Analysis	1	Sample	$ 300.00	$ 300.00
Per Sample Cost				$ 1,257.00

Benthic Surveys

Item	Number	Units	Unit Cost	Total Cost
Personnel (2)	20	Hours	$ 250.00	$ 5,000.00
Vehicle and Instruments	20	Hours	$ 40.00	$ 800.00
Analysis	1	Sample	$ 1,000.00	$ 1,000.00
Per Sample Cost				$ 6,800.00

Tissue Sampling

Item	Number	Units	Unit Cost	Total Cost
Personnel (2)	3.3	Hours	$ 250.00	$ 825.00
Vehicle and Instruments	3.3	Hours	$ 40.00	$ 132.00
Analysis	1	Sample	$ 300.00	$ 300.00
Per Sample Cost				$ 1,257.00

Elk Valley Water Quality Plan **Total Cost** **$ 66,101,033**

Cost Item	Number	Cost	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
Surface Water Samples	572	$ 1,025	$ 586,300	$ 562,848	$ 540,334	$ 518,721	$ 497,972	$ 478,053	$ 458,931	$ 440,574	$ 422,951	$ 406,033	$ 389,791	$ 374,200	$ 359,232	$ 344,862
Surface Water Annual Reporting	1	$ 260,000	$ 260,000	$ 249,600	$ 239,616	$ 230,031	$ 220,830	$ 211,997	$ 203,517	$ 195,376	$ 187,561	$ 180,059	$ 172,856	$ 165,942	$ 159,305	$ 152,932
Groundwater Samples	704	$ 884,928	$ 884,928	$ 849,531	$ 815,550	$ 782,928	$ 751,611	$ 721,546	$ 692,684	$ 664,977	$ 638,378	$ 612,843	$ 588,329	$ 564,796	$ 542,204	$ 520,516
Groundwater Annual Reporting	1	$ 300,000	$ 300,000	$ 288,000	$ 276,480	$ 265,421	$ 254,804	$ 244,612	$ 234,827	$ 225,434	$ 216,417	$ 207,760	$ 199,450	$ 191,472	$ 183,813	$ 176,460
Tissue Sampling	100	$ 1,257	$ 125,700	$ 120,672	$ 115,845	$ 111,211	$ 106,763	$ 102,492	$ 98,393	$ 94,457	$ 90,679	$ 87,052	$ 83,569	$ 80,227	$ 77,018	$ 73,937
Tissue Annual Reporting	1	$ 50,000	$ 50,000	$ 48,000	$ 46,080	$ 44,237	$ 42,467	$ 40,769	$ 39,138	$ 37,572	$ 36,069	$ 34,627	$ 33,242	$ 31,912	$ 30,635	$ 29,410
Benthic Surveys	10	$ 6,800	$ 68,000	$ 65,280	$ 62,669	$ 60,162	$ 57,756	$ 55,445	$ 53,228	$ 51,098	$ 49,054	$ 47,092	$ 45,209	$ 43,400	$ 41,664	$ 39,998
Benthic Reporting	1	$ 50,000	$ 50,000	$ 48,000	$ 46,080	$ 44,237	$ 42,467	$ 40,769	$ 39,138	$ 37,572	$ 36,069	$ 34,627	$ 33,242	$ 31,912	$ 30,635	$ 29,410
Stakeholder Engagement	1	$ 100,000	$ 100,000	$ 96,000	$ 92,160	$ 88,474	$ 84,935	$ 81,537	$ 78,276	$ 75,145	$ 72,139	$ 69,253	$ 66,483	$ 63,824	$ 61,271	$ 58,820
Project Management	10%		$ 242,493	$ 81,245	$ 77,995	$ 74,875	$ 71,880	$ 69,005	$ 66,245	$ 63,595	$ 61,051	$ 58,609	$ 56,265	$ 54,014	$ 51,854	$ 49,779
Contingency	15%		$ 400,113	$ 361,376	$ 346,921	$ 333,044	$ 319,723	$ 306,934	$ 294,656	$ 282,870	$ 271,555	$ 260,693	$ 250,265	$ 240,255	$ 230,645	$ 221,419
Annual Total			$ 3,067,534	$ 2,770,552	$ 2,659,730	$ 2,553,341	$ 2,451,207	$ 2,353,159	$ 2,259,032	$ 2,168,671	$ 2,081,924	$ 1,998,647	$ 1,918,701	$ 1,841,953	$ 1,768,275	$ 1,697,544
Discount Multiplier	96%															

Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33
$ 331,068	$ 317,825	$ 305,112	$ 292,908	$ 281,191	$ 269,944	$ 259,146	$ 248,780	$ 238,829	$ 229,276	$ 220,105	$ 211,301	$ 202,849	$ 194,735	$ 186,945	$ 179,467	$ 172,289	$ 165,397	$ 158,781
$ 146,815	$ 140,942	$ 135,305	$ 129,893	$ 124,697	$ 119,709	$ 114,921	$ 110,324	$ 105,911	$ 101,674	$ 97,607	$ 93,703	$ 89,955	$ 86,357	$ 82,903	$ 79,586	$ 76,403	$ 73,347	$ 70,413
$ 499,695	$ 479,707	$ 460,519	$ 442,098	$ 424,414	$ 407,438	$ 391,140	$ 375,495	$ 360,475	$ 346,056	$ 332,214	$ 318,925	$ 306,168	$ 293,921	$ 282,165	$ 270,878	$ 260,043	$ 249,641	$ 239,655
$ 169,402	$ 162,626	$ 156,121	$ 149,876	$ 143,881	$ 138,126	$ 132,601	$ 127,297	$ 122,205	$ 117,317	$ 112,624	$ 108,119	$ 103,794	$ 99,642	$ 95,657	$ 91,831	$ 88,157	$ 84,631	$ 81,246
$ 70,979	$ 68,140	$ 65,415	$ 62,798	$ 60,286	$ 57,875	$ 55,560	$ 53,337	$ 51,204	$ 49,156	$ 47,189	$ 45,302	$ 43,490	$ 41,750	$ 40,080	$ 38,477	$ 36,938	$ 35,460	$ 34,042
$ 28,234	$ 27,104	$ 26,020	$ 24,979	$ 23,980	$ 23,021	$ 22,100	$ 21,216	$ 20,367	$ 19,553	$ 18,771	$ 18,020	$ 17,299	$ 16,607	$ 15,943	$ 15,305	$ 14,693	$ 14,105	$ 13,541
$ 38,398	$ 36,862	$ 35,387	$ 33,972	$ 32,613	$ 31,309	$ 30,056	$ 28,854	$ 27,700	$ 26,592	$ 25,528	$ 24,507	$ 23,527	$ 22,586	$ 21,682	$ 20,815	$ 19,982	$ 19,183	$ 18,416
$ 28,234	$ 27,104	$ 26,020	$ 24,979	$ 23,980	$ 23,021	$ 22,100	$ 21,216	$ 20,367	$ 19,553	$ 18,771	$ 18,020	$ 17,299	$ 16,607	$ 15,943	$ 15,305	$ 14,693	$ 14,105	$ 13,541
$ 56,467	$ 54,209	$ 52,040	$ 49,959	$ 47,960	$ 46,042	$ 44,200	$ 42,432	$ 40,735	$ 39,106	$ 37,541	$ 36,040	$ 34,598	$ 33,214	$ 31,886	$ 30,610	$ 29,386	$ 28,210	$ 27,082
$ 47,788	$ 45,877	$ 44,042	$ 42,280	$ 40,589	$ 38,965	$ 37,407	$ 35,910	$ 34,474	$ 33,095	$ 31,771	$ 30,500	$ 29,280	$ 28,109	$ 26,985	$ 25,905	$ 24,869	$ 23,874	$ 22,919
$ 212,562	$ 204,060	$ 195,897	$ 188,061	$ 180,539	$ 173,317	$ 166,385	$ 159,729	$ 153,340	$ 147,206	$ 141,318	$ 135,665	$ 130,239	$ 125,029	$ 120,028	$ 115,227	$ 110,618	$ 106,193	$ 101,945
$ 1,629,642	$ 1,564,457	$ 1,501,879	$ 1,441,803	$ 1,384,131	$ 1,328,766	$ 1,275,615	$ 1,224,591	$ 1,175,607	$ 1,128,583	$ 1,083,440	$ 1,040,102	$ 998,498	$ 958,558	$ 920,216	$ 883,407	$ 848,071	$ 814,148	$ 781,582

Year 34	Year 35	Year 36	Year 37	Year 38	Year 39	Year 40	Year 41	Year 42	Year 43	Year 44	Year 45	Year 46	Year 47	Year 48	Year 49	Year 50	Year 51	Year 52
$ 152,430	$ 146,333	$ 140,480	$ 134,860	$ 129,466	$ 124,287	$ 119,316	$ 114,543	$ 109,961	$ 105,563	$ 101,340	$ 97,287	$ 93,395	$ 89,660	$ 86,073	$ 82,630	$ 79,325	$ 76,152	$ 73,106
$ 67,596	$ 64,893	$ 62,297	$ 59,805	$ 57,413	$ 55,116	$ 52,912	$ 50,795	$ 48,763	$ 46,813	$ 44,940	$ 43,143	$ 41,417	$ 39,760	$ 38,170	$ 36,643	$ 35,177	$ 33,770	$ 32,419
$ 230,069	$ 220,867	$ 212,032	$ 203,551	$ 195,409	$ 187,592	$ 180,089	$ 172,885	$ 165,970	$ 159,331	$ 152,958	$ 146,839	$ 140,966	$ 135,327	$ 129,914	$ 124,717	$ 119,729	$ 114,940	$ 110,342
$ 77,996	$ 74,876	$ 71,881	$ 69,006	$ 66,246	$ 63,596	$ 61,052	$ 58,610	$ 56,265	$ 54,015	$ 51,854	$ 49,780	$ 47,789	$ 45,877	$ 44,042	$ 42,281	$ 40,589	$ 38,966	$ 37,407
$ 32,680	$ 31,373	$ 30,118	$ 28,913	$ 27,757	$ 26,647	$ 25,581	$ 24,558	$ 23,575	$ 22,632	$ 21,727	$ 20,858	$ 20,024	$ 19,223	$ 18,454	$ 17,716	$ 17,007	$ 16,327	$ 15,674
$ 12,999	$ 12,479	$ 11,980	$ 11,501	$ 11,041	$ 10,599	$ 10,175	$ 9,768	$ 9,378	$ 9,002	$ 8,642	$ 8,297	$ 7,965	$ 7,646	$ 7,340	$ 7,047	$ 6,765	$ 6,494	$ 6,235
$ 17,679	$ 16,972	$ 16,293	$ 15,641	$ 15,016	$ 14,415	$ 13,838	$ 13,285	$ 12,754	$ 12,243	$ 11,754	$ 11,283	$ 10,832	$ 10,399	$ 9,983	$ 9,584	$ 9,200	$ 8,832	$ 8,479
$ 12,999	$ 12,479	$ 11,980	$ 11,501	$ 11,041	$ 10,599	$ 10,175	$ 9,768	$ 9,378	$ 9,002	$ 8,642	$ 8,297	$ 7,965	$ 7,646	$ 7,340	$ 7,047	$ 6,765	$ 6,494	$ 6,235
$ 25,999	$ 24,959	$ 23,960	$ 23,002	$ 22,082	$ 21,199	$ 20,351	$ 19,537	$ 18,755	$ 18,005	$ 17,285	$ 16,593	$ 15,930	$ 15,292	$ 14,681	$ 14,094	$ 13,530	$ 12,989	$ 12,469
$ 22,003	$ 21,123	$ 20,278	$ 19,467	$ 18,688	$ 17,940	$ 17,223	$ 16,534	$ 15,872	$ 15,238	$ 14,628	$ 14,043	$ 13,481	$ 12,942	$ 12,424	$ 11,927	$ 11,450	$ 10,992	$ 10,553
$ 97,868	$ 93,953	$ 90,195	$ 86,587	$ 83,124	$ 79,799	$ 76,607	$ 73,542	$ 70,601	$ 67,777	$ 65,066	$ 62,463	$ 59,964	$ 57,566	$ 55,263	$ 53,053	$ 50,931	$ 48,893	$ 46,938
$ 750,319	$ 720,306	$ 691,494	$ 663,834	$ 637,281	$ 611,789	$ 587,318	$ 563,825	$ 541,272	$ 519,621	$ 498,836	$ 478,883	$ 459,728	$ 441,338	$ 423,685	$ 406,738	$ 390,468	$ 374,849	$ 359,855

Year 53	Year 54	Year 55	Year 56	Year 57	Year 58	Year 59	Year 60
$ 70,182	$ 67,374	$ 64,679	$ 62,092	$ 59,609	$ 57,224	$ 54,935	$ 52,738
$ 31,123	$ 29,878	$ 28,683	$ 27,535	$ 26,434	$ 25,377	$ 24,362	$ 23,387
$ 105,928	$ 101,691	$ 97,624	$ 93,719	$ 89,970	$ 86,371	$ 82,916	$ 79,600
$ 35,911	$ 34,474	$ 33,095	$ 31,772	$ 30,501	$ 29,281	$ 28,109	$ 26,985
$ 15,047	$ 14,445	$ 13,867	$ 13,312	$ 12,780	$ 12,269	$ 11,778	$ 11,307
$ 5,985	$ 5,746	$ 5,516	$ 5,295	$ 5,083	$ 4,880	$ 4,685	$ 4,498
$ 8,140	$ 7,814	$ 7,502	$ 7,202	$ 6,913	$ 6,637	$ 6,371	$ 6,117
$ 5,985	$ 5,746	$ 5,516	$ 5,295	$ 5,083	$ 4,880	$ 4,685	$ 4,498
$ 11,970	$ 11,491	$ 11,032	$ 10,591	$ 10,167	$ 9,760	$ 9,370	$ 8,995
$ 10,130	$ 9,725	$ 9,336	$ 8,963	$ 8,604	$ 8,260	$ 7,930	$ 7,612
$ 45,060	$ 43,258	$ 41,527	$ 39,866	$ 38,272	$ 36,741	$ 35,271	$ 33,860
$ 345,461	$ 331,643	$ 318,377	$ 305,642	$ 293,416	$ 281,680	$ 270,412	$ 259,596

Elkview Mine **Total Estimated Cost** **$ 1,033,413,922**

Cost Item	**Number**	**Unit Cost**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**
Existing Treatment Maintenance	20,000	$ 551	$ 11,021,528	$ 10,580,667	$ 10,157,440	$ 9,751,143	$ 9,361,097	$ 8,986,653	$ 8,627,187	$ 8,282,099	$ 7,950,815	$ 7,632,783	$ 7,327,471	$ 7,034,373	$ 6,752,998	$ 6,482,878
Existing Treatment Operation	20,000	$ 367	$ 7,347,685	$ 7,053,778	$ 6,771,627	$ 6,500,762	$ 6,240,731	$ 5,991,102	$ 5,751,458	$ 5,521,400	$ 5,300,544	$ 5,088,522	$ 4,884,981	$ 4,689,582	$ 4,501,998	$ 4,321,919
New Treatment System	15,000	$ 6,123	$ 91,846,066	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
New Treatment Maintenance	15,000	$ 551	$ -	$ 7,935,500	$ 7,618,080	$ 7,313,357	$ 7,020,823	$ 6,739,990	$ 6,470,390	$ 6,211,575	$ 5,963,112	$ 5,724,587	$ 5,495,604	$ 5,275,779	$ 5,064,748	$ 4,862,158
New Treatment Operation	15,000	$ 367	$ -	$ 5,290,333	$ 5,078,720	$ 4,875,571	$ 4,680,548	$ 4,493,326	$ 4,313,593	$ 4,141,050	$ 3,975,408	$ 3,816,391	$ 3,663,736	$ 3,517,186	$ 3,376,499	$ 3,241,439
Water Sampling	21	$ 1,025	$ 21,525	$ 20,664	$ 19,837	$ 19,044	$ 18,282	$ 17,551	$ 16,849	$ 16,175	$ 15,528	$ 14,907	$ 14,311	$ 13,738	$ 13,189	$ 12,661
Annual Reporting	1	$ 180,000	$ 180,000	$ 172,800	$ 165,888	$ 159,252	$ 152,882	$ 146,767	$ 140,896	$ 135,261	$ 129,850	$ 124,656	$ 119,670	$ 114,883	$ 110,288	$ 105,876
Project Management	10%		$ 11,041,680	$ 3,105,374	$ 2,981,159	$ 2,861,913	$ 2,747,436	$ 2,637,539	$ 2,532,037	$ 2,430,756	$ 2,333,526	$ 2,240,185	$ 2,150,577	$ 2,064,554	$ 1,981,972	$ 1,902,693
Contingency	15%		$ 18,218,773	$ 5,123,867	$ 4,918,913	$ 4,722,156	$ 4,533,270	$ 4,351,939	$ 4,177,862	$ 4,010,747	$ 3,850,317	$ 3,696,305	$ 3,548,452	$ 3,406,514	$ 3,270,254	$ 3,139,444
Annual Total			$ 139,677,257	$ 39,282,984	$ 37,711,665	$ 36,203,198	$ 34,755,070	$ 33,364,867	$ 32,030,273	$ 30,749,062	$ 29,519,099	$ 28,338,335	$ 27,204,802	$ 26,116,610	$ 25,071,945	$ 24,069,068
Discount Multiplier	96%															

Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33
$ 6,223,563	$ 5,974,620	$ 5,735,635	$ 5,506,210	$ 5,285,962	$ 5,074,523	$ 4,871,542	$ 4,676,680	$ 4,489,613	$ 4,310,029	$ 4,137,628	$ 3,972,122	$ 3,813,238	$ 3,660,708	$ 3,514,280	$ 3,373,709	$ 3,238,760	$ 3,109,210	$ 2,984,841
$ 4,149,042	$ 3,983,080	$ 3,823,757	$ 3,670,807	$ 3,523,974	$ 3,383,015	$ 3,247,695	$ 3,117,787	$ 2,993,076	$ 2,873,352	$ 2,758,418	$ 2,648,082	$ 2,542,158	$ 2,440,472	$ 2,342,853	$ 2,249,139	$ 2,159,173	$ 2,072,807	$ 1,989,894
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 4,667,672	$ 4,480,965	$ 4,301,727	$ 4,129,657	$ 3,964,471	$ 3,805,892	$ 3,653,657	$ 3,507,510	$ 3,367,210	$ 3,232,522	$ 3,103,221	$ 2,979,092	$ 2,859,928	$ 2,745,531	$ 2,635,710	$ 2,530,281	$ 2,429,070	$ 2,331,907	$ 2,238,631
$ 3,111,781	$ 2,987,310	$ 2,867,818	$ 2,753,105	$ 2,642,981	$ 2,537,262	$ 2,435,771	$ 2,338,340	$ 2,244,807	$ 2,155,014	$ 2,068,814	$ 1,986,061	$ 1,906,619	$ 1,830,354	$ 1,757,140	$ 1,686,854	$ 1,619,380	$ 1,554,605	$ 1,492,421
$ 12,155	$ 11,668	$ 11,202	$ 10,754	$ 10,323	$ 9,911	$ 9,514	$ 9,134	$ 8,768	$ 8,417	$ 8,081	$ 7,758	$ 7,447	$ 7,149	$ 6,863	$ 6,589	$ 6,325	$ 6,072	$ 5,829
$ 101,641	$ 97,576	$ 93,673	$ 89,926	$ 86,329	$ 82,875	$ 79,560	$ 76,378	$ 73,323	$ 70,390	$ 67,574	$ 64,871	$ 62,277	$ 59,785	$ 57,394	$ 55,098	$ 52,894	$ 50,779	$ 48,747
$ 1,826,585	$ 1,753,522	$ 1,683,381	$ 1,616,046	$ 1,551,404	$ 1,489,348	$ 1,429,774	$ 1,372,583	$ 1,317,680	$ 1,264,972	$ 1,214,374	$ 1,165,799	$ 1,119,167	$ 1,074,400	$ 1,031,424	$ 990,167	$ 950,560	$ 912,538	$ 876,036
$ 3,013,866	$ 2,893,311	$ 2,777,579	$ 2,666,476	$ 2,559,817	$ 2,457,424	$ 2,359,127	$ 2,264,762	$ 2,174,171	$ 2,087,205	$ 2,003,716	$ 1,923,568	$ 1,846,625	$ 1,772,760	$ 1,701,850	$ 1,633,776	$ 1,568,425	$ 1,505,688	$ 1,445,460
$ 23,106,305	$ 22,182,053	$ 21,294,771	$ 20,442,980	$ 19,625,261	$ 18,840,250	$ 18,086,640	$ 17,363,174	$ 16,668,648	$ 16,001,902	$ 15,361,826	$ 14,747,353	$ 14,157,458	$ 13,591,160	$ 13,047,514	$ 12,525,613	$ 12,024,589	$ 11,543,605	$ 11,081,861

Year 34	Year 35	Year 36	Year 37	Year 38	Year 39	Year 40	Year 41	Year 42	Year 43	Year 44	Year 45	Year 46	Year 47	Year 48	Year 49	Year 50	Year 51	Year 52
$ 2,865,448	$ 2,750,830	$ 2,640,797	$ 2,535,165	$ 2,433,758	$ 2,336,408	$ 2,242,952	$ 2,153,233	$ 2,067,104	$ 1,984,420	$ 1,905,043	$ 1,828,841	$ 1,755,688	$ 1,685,460	$ 1,618,042	$ 1,553,320	$ 1,491,187	$ 1,431,540	$ 1,374,278
$ 1,910,299	$ 1,833,887	$ 1,760,531	$ 1,690,110	$ 1,622,505	$ 1,557,605	$ 1,495,301	$ 1,435,489	$ 1,378,069	$ 1,322,947	$ 1,270,029	$ 1,219,228	$ 1,170,459	$ 1,123,640	$ 1,078,695	$ 1,035,547	$ 994,125	$ 954,360	$ 916,186
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 2,149,086	$ 2,063,122	$ 1,980,597	$ 1,901,374	$ 1,825,319	$ 1,752,306	$ 1,682,214	$ 1,614,925	$ 1,550,328	$ 1,488,315	$ 1,428,782	$ 1,371,631	$ 1,316,766	$ 1,264,095	$ 1,213,531	$ 1,164,990	$ 1,118,391	$ 1,073,655	$ 1,030,709
$ 1,432,724	$ 1,375,415	$ 1,320,398	$ 1,267,582	$ 1,216,879	$ 1,168,204	$ 1,121,476	$ 1,076,617	$ 1,033,552	$ 992,210	$ 952,522	$ 914,421	$ 877,844	$ 842,730	$ 809,021	$ 776,660	$ 745,594	$ 715,770	$ 687,139
$ 5,596	$ 5,372	$ 5,157	$ 4,951	$ 4,753	$ 4,563	$ 4,380	$ 4,205	$ 4,037	$ 3,876	$ 3,721	$ 3,572	$ 3,429	$ 3,292	$ 3,160	$ 3,034	$ 2,912	$ 2,796	$ 2,684
$ 46,798	$ 44,926	$ 43,129	$ 41,403	$ 39,747	$ 38,157	$ 36,631	$ 35,166	$ 33,759	$ 32,409	$ 31,113	$ 29,868	$ 28,673	$ 27,526	$ 26,425	$ 25,368	$ 24,354	$ 23,379	$ 22,444
$ 840,995	$ 807,355	$ 775,061	$ 744,059	$ 714,296	$ 685,724	$ 658,295	$ 631,964	$ 606,685	$ 582,418	$ 559,121	$ 536,756	$ 515,286	$ 494,674	$ 474,887	$ 455,892	$ 437,656	$ 420,150	$ 403,344
$ 1,387,642	$ 1,332,136	$ 1,278,851	$ 1,227,697	$ 1,178,589	$ 1,131,445	$ 1,086,187	$ 1,042,740	$ 1,001,030	$ 960,989	$ 922,549	$ 885,648	$ 850,222	$ 816,213	$ 783,564	$ 752,222	$ 722,133	$ 693,247	$ 665,518
$ 10,638,586	$ 10,213,043	$ 9,804,521	$ 9,412,340	$ 9,035,847	$ 8,674,413	$ 8,327,436	$ 7,994,339	$ 7,674,565	$ 7,367,583	$ 7,072,879	$ 6,789,964	$ 6,518,366	$ 6,257,631	$ 6,007,326	$ 5,767,033	$ 5,536,351	$ 5,314,897	$ 5,102,302

Year 53	Year 54	Year 55	Year 56	Year 57	Year 58	Year 59	Year 60
$ 1,319,307	$ 1,266,535	$ 1,215,873	$ 1,167,239	$ 1,120,549	$ 1,075,727	$ 1,032,698	$ 991,390
$ 879,538	$ 844,357	$ 810,582	$ 778,159	$ 747,033	$ 717,151	$ 688,465	$ 660,927
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 989,480	$ 949,901	$ 911,905	$ 875,429	$ 840,412	$ 806,795	$ 774,523	$ 743,543
$ 659,654	$ 633,267	$ 607,937	$ 583,619	$ 560,275	$ 537,864	$ 516,349	$ 495,695
$ 2,577	$ 2,474	$ 2,375	$ 2,280	$ 2,188	$ 2,101	$ 2,017	$ 1,936
$ 21,546	$ 20,685	$ 19,857	$ 19,063	$ 18,300	$ 17,568	$ 16,866	$ 16,191
$ 387,210	$ 371,722	$ 356,853	$ 342,579	$ 328,876	$ 315,721	$ 303,092	$ 290,968
$ 638,897	$ 613,341	$ 588,807	$ 565,255	$ 542,645	$ 520,939	$ 500,102	$ 480,097
$ 4,898,209	$ 4,702,281	$ 4,514,190	$ 4,333,622	$ 4,160,277	$ 3,993,866	$ 3,834,112	$ 3,680,747

Greenhills Mine **Total Estimated Cost** **$ 560,537,213**

Cost Item	Number	Unit Cost	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Existing Treatment Maintenance	-	$ 1,102	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Existing Treatment Operation	-	$ 735	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
New Treatment System	7,500	$ 18,369	$ 137,769,099	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
New Treatment Maintenance	7,500	$ 1,102	$ -	$ 7,935,500	$ 7,618,080	$ 7,313,357	$ 7,020,823	$ 6,739,990	$ 6,470,390	$ 6,211,575	$ 5,963,112	$ 5,724,587	$ 5,495,604	$ 5,275,779	$ 5,064,748
New Treatment Operation	7,500	$ 735	$ -	$ 5,290,333	$ 5,078,720	$ 4,875,571	$ 4,680,548	$ 4,493,326	$ 4,313,593	$ 4,141,050	$ 3,975,408	$ 3,816,391	$ 3,663,736	$ 3,517,186	$ 3,376,499
Water Sampling	14	$ 1,025	$ 14,350	$ 13,776	$ 13,225	$ 12,696	$ 12,188	$ 11,701	$ 11,233	$ 10,783	$ 10,352	$ 9,938	$ 9,540	$ 9,159	$ 8,792
Annual Reporting	1	$ 180,000	$ 180,000	$ 172,800	$ 165,888	$ 159,252	$ 152,882	$ 146,767	$ 140,896	$ 135,261	$ 129,850	$ 124,656	$ 119,670	$ 114,883	$ 110,288
Project Management	10%		$ 13,796,345	$ 1,341,241	$ 1,287,591	$ 1,236,088	$ 1,186,644	$ 1,139,178	$ 1,093,611	$ 1,049,867	$ 1,007,872	$ 967,557	$ 928,855	$ 891,701	$ 856,033
Contingency	15%		$ 22,763,969	$ 2,213,048	$ 2,124,526	$ 2,039,545	$ 1,957,963	$ 1,879,644	$ 1,804,459	$ 1,732,280	$ 1,662,989	$ 1,596,469	$ 1,532,611	$ 1,471,306	$ 1,412,454
Annual Total			$ 174,523,763	$ 16,966,698	$ 16,288,030	$ 15,636,509	$ 15,011,049	$ 14,410,607	$ 13,834,182	$ 13,280,815	$ 12,749,582	$ 12,239,599	$ 11,750,015	$ 11,280,015	$ 10,828,814
Discount Multiplier	96%														

Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 4,862,158	$ 4,667,672	$ 4,480,965	$ 4,301,727	$ 4,129,657	$ 3,964,471	$ 3,805,892	$ 3,653,657	$ 3,507,510	$ 3,367,210	$ 3,232,522	$ 3,103,221	$ 2,979,092	$ 2,859,928	$ 2,745,531	$ 2,635,710	$ 2,530,281	$ 2,429,070
$ 3,241,439	$ 3,111,781	$ 2,987,310	$ 2,867,818	$ 2,753,105	$ 2,642,981	$ 2,537,262	$ 2,435,771	$ 2,338,340	$ 2,244,807	$ 2,155,014	$ 2,068,814	$ 1,986,061	$ 1,906,619	$ 1,830,354	$ 1,757,140	$ 1,686,854	$ 1,619,380
$ 8,441	$ 8,103	$ 7,779	$ 7,468	$ 7,169	$ 6,882	$ 6,607	$ 6,343	$ 6,089	$ 5,845	$ 5,612	$ 5,387	$ 5,172	$ 4,965	$ 4,766	$ 4,576	$ 4,393	$ 4,217
$ 105,876	$ 101,641	$ 97,576	$ 93,673	$ 89,926	$ 86,329	$ 82,875	$ 79,560	$ 76,378	$ 73,323	$ 70,390	$ 67,574	$ 64,871	$ 62,277	$ 59,785	$ 57,394	$ 55,098	$ 52,894
$ 821,791	$ 788,920	$ 757,363	$ 727,068	$ 697,986	$ 670,066	$ 643,264	$ 617,533	$ 592,832	$ 569,118	$ 546,354	$ 524,500	$ 503,520	$ 483,379	$ 464,044	$ 445,482	$ 427,663	$ 410,556
$ 1,355,956	$ 1,301,718	$ 1,249,649	$ 1,199,663	$ 1,151,676	$ 1,105,609	$ 1,061,385	$ 1,018,930	$ 978,172	$ 939,046	$ 901,484	$ 865,424	$ 830,807	$ 797,575	$ 765,672	$ 735,045	$ 705,643	$ 677,418
$ 10,395,661	$ 9,979,835	$ 9,580,642	$ 9,197,416	$ 8,829,519	$ 8,476,339	$ 8,137,285	$ 7,811,794	$ 7,499,322	$ 7,199,349	$ 6,911,375	$ 6,634,920	$ 6,369,523	$ 6,114,742	$ 5,870,153	$ 5,635,346	$ 5,409,933	$ 5,193,535

Year 32	Year 33	Year 34	Year 35	Year 36	Year 37	Year 38	Year 39	Year 40	Year 41	Year 42	Year 43	Year 44	Year 45	Year 46	Year 47	Year 48	Year 49
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 2,331,907	$ 2,238,631	$ 2,149,086	$ 2,063,122	$ 1,980,597	$ 1,901,374	$ 1,825,319	$ 1,752,306	$ 1,682,214	$ 1,614,925	$ 1,550,328	$ 1,488,315	$ 1,428,782	$ 1,371,631	$ 1,316,766	$ 1,264,095	$ 1,213,531	$ 1,164,990
$ 1,554,605	$ 1,492,421	$ 1,432,724	$ 1,375,415	$ 1,320,398	$ 1,267,582	$ 1,216,879	$ 1,168,204	$ 1,121,476	$ 1,076,617	$ 1,033,552	$ 992,210	$ 952,522	$ 914,421	$ 877,844	$ 842,730	$ 809,021	$ 776,660
$ 4,048	$ 3,886	$ 3,731	$ 3,582	$ 3,438	$ 3,301	$ 3,169	$ 3,042	$ 2,920	$ 2,804	$ 2,691	$ 2,584	$ 2,480	$ 2,381	$ 2,286	$ 2,194	$ 2,107	$ 2,022
$ 50,779	$ 48,747	$ 46,798	$ 44,926	$ 43,129	$ 41,403	$ 39,747	$ 38,157	$ 36,631	$ 35,166	$ 33,759	$ 32,409	$ 31,113	$ 29,868	$ 28,673	$ 27,526	$ 26,425	$ 25,368
$ 394,134	$ 378,369	$ 363,234	$ 348,704	$ 334,756	$ 321,366	$ 308,511	$ 296,171	$ 284,324	$ 272,951	$ 262,033	$ 251,552	$ 241,490	$ 231,830	$ 222,557	$ 213,655	$ 205,108	$ 196,904
$ 650,321	$ 624,308	$ 599,336	$ 575,362	$ 552,348	$ 530,254	$ 509,044	$ 488,682	$ 469,135	$ 450,369	$ 432,355	$ 415,060	$ 398,458	$ 382,520	$ 367,219	$ 352,530	$ 338,429	$ 324,892
$ 4,985,794	$ 4,786,362	$ 4,594,908	$ 4,411,111	$ 4,234,667	$ 4,065,280	$ 3,902,669	$ 3,746,562	$ 3,596,700	$ 3,452,832	$ 3,314,718	$ 3,182,130	$ 3,054,845	$ 2,932,651	$ 2,815,345	$ 2,702,731	$ 2,594,622	$ 2,490,837

Year 50	Year 51	Year 52	Year 53	Year 54	Year 55	Year 56	Year 57	Year 58	Year 59	Year 60
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 1,118,391	$ 1,073,655	$ 1,030,709	$ 989,480	$ 949,901	$ 911,905	$ 875,429	$ 840,412	$ 806,795	$ 774,523	$ 743,543
$ 745,594	$ 715,770	$ 687,139	$ 659,654	$ 633,267	$ 607,937	$ 583,619	$ 560,275	$ 537,864	$ 516,349	$ 495,695
$ 1,942	$ 1,864	$ 1,789	$ 1,718	$ 1,649	$ 1,583	$ 1,520	$ 1,459	$ 1,401	$ 1,345	$ 1,291
$ 24,354	$ 23,379	$ 22,444	$ 21,546	$ 20,685	$ 19,857	$ 19,063	$ 18,300	$ 17,568	$ 16,866	$ 16,191
$ 189,028	$ 181,467	$ 174,208	$ 167,240	$ 160,550	$ 154,128	$ 147,963	$ 142,045	$ 136,363	$ 130,908	$ 125,672
$ 311,896	$ 299,420	$ 287,443	$ 275,946	$ 264,908	$ 254,312	$ 244,139	$ 234,374	$ 224,999	$ 215,999	$ 207,359
$ 2,391,203	$ 2,295,555	$ 2,203,733	$ 2,115,584	$ 2,030,960	$ 1,949,722	$ 1,871,733	$ 1,796,864	$ 1,724,989	$ 1,655,990	$ 1,589,750

Fording River Mine **Total Estimated Cost** **$ 2,877,166,052**

Cost Item	**Number**	**Unit Cost**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**
Existing Active Treatment Maintenance	20,000	$ 1,102	$ 22,043,056	$ 21,161,334	$ 20,314,880	$ 19,502,285	$ 18,722,194	$ 17,973,306	$ 17,254,374	$ 16,564,199	$ 15,901,631	$ 15,265,566	$ 14,654,943	$ 14,068,745	$ 13,505,995
Existing Active Treatment Operation	20,000	$ 735	$ 14,695,371	$ 14,107,556	$ 13,543,254	$ 13,001,523	$ 12,481,462	$ 11,982,204	$ 11,502,916	$ 11,042,799	$ 10,601,087	$ 10,177,044	$ 9,769,962	$ 9,379,163	$ 9,003,997
Existing SRF Treatment Maintenance	27,000	$ 551	$ 14,879,063	$ 14,283,900	$ 13,712,544	$ 13,164,042	$ 12,637,481	$ 12,131,981	$ 11,646,702	$ 11,180,834	$ 10,733,601	$ 10,304,257	$ 9,892,086	$ 9,496,403	$ 9,116,547
Existing SRF Treatment Operation	27,000	$ 367	$ 9,919,375	$ 9,522,600	$ 9,141,696	$ 8,776,028	$ 8,424,987	$ 8,087,988	$ 7,764,468	$ 7,453,889	$ 7,155,734	$ 6,869,504	$ 6,594,724	$ 6,330,935	$ 6,077,698
New SRF Treatment System	33,000	$ 6,123	$ 202,061,345	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
New SRF Treatment Maintenance	33,000	$ 551	$ -	$ 17,458,100	$ 16,759,776	$ 16,089,385	$ 15,445,810	$ 14,827,977	$ 14,234,858	$ 13,665,464	$ 13,118,845	$ 12,594,092	$ 12,090,328	$ 11,606,715	$ 11,142,446
New SRF Treatment Operation	33,000	$ 367	$ -	$ 11,638,733	$ 11,173,184	$ 10,726,257	$ 10,297,207	$ 9,885,318	$ 9,489,906	$ 9,110,309	$ 8,745,897	$ 8,396,061	$ 8,060,219	$ 7,737,810	$ 7,428,297
Water Sampling	30	$ 1,025	$ 30,750	$ 29,520	$ 28,339	$ 27,206	$ 26,117	$ 25,073	$ 24,070	$ 23,107	$ 22,183	$ 21,295	$ 20,444	$ 19,626	$ 18,841
Annual Reporting	1	$ 180,000	$ 180,000	$ 172,800	$ 165,888	$ 159,252	$ 152,882	$ 146,767	$ 140,896	$ 135,261	$ 129,850	$ 124,656	$ 119,670	$ 114,883	$ 110,288
Project Management	10%		$ 26,380,896	$ 8,837,454	$ 8,483,956	$ 8,144,598	$ 7,818,814	$ 7,506,061	$ 7,205,819	$ 6,917,586	$ 6,640,883	$ 6,375,247	$ 6,120,238	$ 5,875,428	$ 5,640,411
Contingency	15%		$ 43,528,478	$ 14,581,800	$ 13,998,528	$ 13,438,587	$ 12,901,043	$ 12,385,001	$ 11,889,601	$ 11,414,017	$ 10,957,457	$ 10,519,158	$ 10,098,392	$ 9,694,456	$ 9,306,678
Annual Total			$ 333,718,334	$111,793,797	$107,322,046	$103,029,164	$ 98,907,997	$ 94,951,677	$ 91,153,610	$ 87,507,466	$ 84,007,167	$ 80,646,880	$ 77,421,005	$ 74,324,165	$ 71,351,198
Discount Multiplier	96%														

Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32
$ 12,965,756	$ 12,447,125	$ 11,949,240	$ 11,471,271	$ 11,012,420	$ 10,571,923	$ 10,149,046	$ 9,743,084	$ 9,353,361	$ 8,979,227	$ 8,620,057	$ 8,275,255	$ 7,944,245	$ 7,626,475	$ 7,321,416	$ 7,028,560	$ 6,747,417	$ 6,477,520	$ 6,218,420
$ 8,643,837	$ 8,298,084	$ 7,966,160	$ 7,647,514	$ 7,341,613	$ 7,047,949	$ 6,766,031	$ 6,495,390	$ 6,235,574	$ 5,986,151	$ 5,746,705	$ 5,516,837	$ 5,296,163	$ 5,084,317	$ 4,880,944	$ 4,685,706	$ 4,498,278	$ 4,318,347	$ 4,145,613
$ 8,751,885	$ 8,401,810	$ 8,065,737	$ 7,743,108	$ 7,433,383	$ 7,136,048	$ 6,850,606	$ 6,576,582	$ 6,313,519	$ 6,060,978	$ 5,818,539	$ 5,585,797	$ 5,362,365	$ 5,147,871	$ 4,941,956	$ 4,744,278	$ 4,554,507	$ 4,372,326	$ 4,197,433
$ 5,834,590	$ 5,601,206	$ 5,377,158	$ 5,162,072	$ 4,955,589	$ 4,757,365	$ 4,567,071	$ 4,384,388	$ 4,209,012	$ 4,040,652	$ 3,879,026	$ 3,723,865	$ 3,574,910	$ 3,431,914	$ 3,294,637	$ 3,162,852	$ 3,036,338	$ 2,914,884	$ 2,798,289
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 10,696,748	$ 10,268,878	$ 9,858,123	$ 9,463,798	$ 9,085,246	$ 8,721,837	$ 8,372,963	$ 8,038,045	$ 7,716,523	$ 7,407,862	$ 7,111,547	$ 6,827,086	$ 6,554,002	$ 6,291,842	$ 6,040,168	$ 5,798,562	$ 5,566,619	$ 5,343,954	$ 5,130,196
$ 7,131,166	$ 6,845,919	$ 6,572,082	$ 6,309,199	$ 6,056,831	$ 5,814,558	$ 5,581,975	$ 5,358,696	$ 5,144,349	$ 4,938,575	$ 4,741,032	$ 4,551,390	$ 4,369,335	$ 4,194,561	$ 4,026,779	$ 3,865,708	$ 3,711,079	$ 3,562,636	$ 3,420,131
$ 18,087	$ 17,364	$ 16,669	$ 16,002	$ 15,362	$ 14,748	$ 14,158	$ 13,592	$ 13,048	$ 12,526	$ 12,025	$ 11,544	$ 11,082	$ 10,639	$ 10,213	$ 9,805	$ 9,413	$ 9,036	$ 8,675
$ 105,876	$ 101,641	$ 97,576	$ 93,673	$ 89,926	$ 86,329	$ 82,875	$ 79,560	$ 76,378	$ 73,323	$ 70,390	$ 67,574	$ 64,871	$ 62,277	$ 59,785	$ 57,394	$ 55,098	$ 52,894	$ 50,779
$ 5,414,795	$ 5,198,203	$ 4,990,275	$ 4,790,664	$ 4,599,037	$ 4,415,076	$ 4,238,473	$ 4,068,934	$ 3,906,176	$ 3,749,929	$ 3,599,932	$ 3,455,935	$ 3,317,697	$ 3,184,990	$ 3,057,590	$ 2,935,286	$ 2,817,875	$ 2,705,160	$ 2,596,954
$ 8,934,411	$ 8,577,034	$ 8,233,953	$ 7,904,595	$ 7,588,411	$ 7,284,875	$ 6,993,480	$ 6,713,741	$ 6,445,191	$ 6,187,383	$ 5,939,888	$ 5,702,292	$ 5,474,201	$ 5,255,233	$ 5,045,023	$ 4,843,222	$ 4,649,494	$ 4,463,514	$ 4,284,973
$ 68,497,150	$ 65,757,264	$ 63,126,974	$ 60,601,895	$ 58,177,819	$ 55,850,706	$ 53,616,678	$ 51,472,011	$ 49,413,131	$ 47,436,605	$ 45,539,141	$ 43,717,575	$ 41,968,872	$ 40,290,118	$ 38,678,513	$ 37,131,372	$ 35,646,117	$ 34,220,273	$ 32,851,462

Year 33	Year 34	Year 35	Year 36	Year 37	Year 38	Year 39	Year 40	Year 41	Year 42	Year 43	Year 44	Year 45	Year 46	Year 47	Year 48	Year 49	Year 50	Year 51
$ 5,969,683	$ 5,730,896	$ 5,501,660	$ 5,281,593	$ 5,070,330	$ 4,867,516	$ 4,672,816	$ 4,485,903	$ 4,306,467	$ 4,134,208	$ 3,968,840	$ 3,810,086	$ 3,657,683	$ 3,511,376	$ 3,370,921	$ 3,236,084	$ 3,106,640	$ 2,982,375	$ 2,863,080
$ 3,979,789	$ 3,820,597	$ 3,667,773	$ 3,521,062	$ 3,380,220	$ 3,245,011	$ 3,115,210	$ 2,990,602	$ 2,870,978	$ 2,756,139	$ 2,645,893	$ 2,540,058	$ 2,438,455	$ 2,340,917	$ 2,247,280	$ 2,157,389	$ 2,071,094	$ 1,988,250	$ 1,908,720
$ 4,029,536	$ 3,868,354	$ 3,713,620	$ 3,565,075	$ 3,422,472	$ 3,285,574	$ 3,154,151	$ 3,027,985	$ 2,906,865	$ 2,790,591	$ 2,678,967	$ 2,571,808	$ 2,468,936	$ 2,370,179	$ 2,275,371	$ 2,184,357	$ 2,096,982	$ 2,013,103	$ 1,932,579
$ 2,686,357	$ 2,578,903	$ 2,475,747	$ 2,376,717	$ 2,281,648	$ 2,190,382	$ 2,102,767	$ 2,018,656	$ 1,937,910	$ 1,860,394	$ 1,785,978	$ 1,714,539	$ 1,645,957	$ 1,580,119	$ 1,516,914	$ 1,456,238	$ 1,397,988	$ 1,342,069	$ 1,288,386
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 4,924,988	$ 4,727,989	$ 4,538,869	$ 4,357,314	$ 4,183,022	$ 4,015,701	$ 3,855,073	$ 3,700,870	$ 3,552,835	$ 3,410,722	$ 3,274,293	$ 3,143,321	$ 3,017,588	$ 2,896,885	$ 2,781,009	$ 2,669,769	$ 2,562,978	$ 2,460,459	$ 2,362,041
$ 3,283,326	$ 3,151,993	$ 3,025,913	$ 2,904,876	$ 2,788,681	$ 2,677,134	$ 2,570,049	$ 2,467,247	$ 2,368,557	$ 2,273,815	$ 2,182,862	$ 2,095,548	$ 2,011,726	$ 1,931,257	$ 1,854,006	$ 1,779,846	$ 1,708,652	$ 1,640,306	$ 1,574,694
$ 8,328	$ 7,995	$ 7,675	$ 7,368	$ 7,073	$ 6,790	$ 6,519	$ 6,258	$ 6,008	$ 5,767	$ 5,537	$ 5,315	$ 5,102	$ 4,898	$ 4,702	$ 4,514	$ 4,334	$ 4,160	$ 3,994
$ 48,747	$ 46,798	$ 44,926	$ 43,129	$ 41,403	$ 39,747	$ 38,157	$ 36,631	$ 35,166	$ 33,759	$ 32,409	$ 31,113	$ 29,868	$ 28,673	$ 27,526	$ 26,425	$ 25,368	$ 24,354	$ 23,379
$ 2,493,075	$ 2,393,352	$ 2,297,618	$ 2,205,714	$ 2,117,485	$ 2,032,786	$ 1,951,474	$ 1,873,415	$ 1,798,479	$ 1,726,539	$ 1,657,478	$ 1,591,179	$ 1,527,532	$ 1,466,430	$ 1,407,773	$ 1,351,462	$ 1,297,404	$ 1,245,508	$ 1,195,687
$ 4,113,574	$ 3,949,031	$ 3,791,070	$ 3,639,427	$ 3,493,850	$ 3,354,096	$ 3,219,932	$ 3,091,135	$ 2,967,490	$ 2,848,790	$ 2,734,838	$ 2,625,445	$ 2,520,427	$ 2,419,610	$ 2,322,826	$ 2,229,913	$ 2,140,716	$ 2,055,087	$ 1,972,884
$ 31,537,403	$ 30,275,907	$ 29,064,871	$ 27,902,276	$ 26,786,185	$ 25,714,738	$ 24,686,148	$ 23,698,702	$ 22,750,754	$ 21,840,724	$ 20,967,095	$ 20,128,411	$ 19,323,275	$ 18,550,344	$ 17,808,330	$ 17,095,997	$ 16,412,157	$ 15,755,671	$ 15,125,444

Year 52	Year 53	Year 54	Year 55	Year 56	Year 57	Year 58	Year 59	Year 60
$ 2,748,557	$ 2,638,614	$ 2,533,070	$ 2,431,747	$ 2,334,477	$ 2,241,098	$ 2,151,454	$ 2,065,396	$ 1,982,780
$ 1,832,371	$ 1,759,076	$ 1,688,713	$ 1,621,165	$ 1,556,318	$ 1,494,065	$ 1,434,303	$ 1,376,931	$ 1,321,853
$ 1,855,276	$ 1,781,065	$ 1,709,822	$ 1,641,429	$ 1,575,772	$ 1,512,741	$ 1,452,232	$ 1,394,142	$ 1,338,377
$ 1,236,850	$ 1,187,376	$ 1,139,881	$ 1,094,286	$ 1,050,515	$ 1,008,494	$ 968,154	$ 929,428	$ 892,251
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 2,267,559	$ 2,176,857	$ 2,089,783	$ 2,006,191	$ 1,925,944	$ 1,848,906	$ 1,774,950	$ 1,703,952	$ 1,635,794
$ 1,511,706	$ 1,451,238	$ 1,393,188	$ 1,337,461	$ 1,283,962	$ 1,232,604	$ 1,183,300	$ 1,135,968	$ 1,090,529
$ 3,834	$ 3,681	$ 3,534	$ 3,392	$ 3,257	$ 3,126	$ 3,001	$ 2,881	$ 2,766
$ 22,444	$ 21,546	$ 20,685	$ 19,857	$ 19,063	$ 18,300	$ 17,568	$ 16,866	$ 16,191
$ 1,147,860	$ 1,101,945	$ 1,057,868	$ 1,015,553	$ 974,931	$ 935,934	$ 898,496	$ 862,556	$ 828,054
$ 1,893,969	$ 1,818,210	$ 1,745,481	$ 1,675,662	$ 1,608,636	$ 1,544,290	$ 1,482,519	$ 1,423,218	$ 1,366,289
$ 14,520,426	$ 13,939,609	$ 13,382,025	$ 12,846,744	$ 12,332,874	$ 11,839,559	$ 11,365,977	$ 10,911,338	$ 10,474,884

Line Creek Mine **Total Estimated Cost** **$ 1,858,856,440**

Cost Item	**Number**	**Unit Cost**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**
Existing Treatment Maintenance	7,500	$ 1,102	$ 8,266,146	$ 7,935,500	$ 7,618,080	$ 7,313,357	$ 7,020,823	$ 6,739,990	$ 6,470,390	$ 6,211,575	$ 5,963,112	$ 5,724,587	$ 5,495,604	$ 5,275,779	$ 5,064,748	$ 4,862,158
Existing Treatment Operation	7,500	$ 735	$ 5,510,764	$ 5,290,333	$ 5,078,720	$ 4,875,571	$ 4,680,548	$ 4,493,326	$ 4,313,593	$ 4,141,050	$ 3,975,408	$ 3,816,391	$ 3,663,736	$ 3,517,186	$ 3,376,499	$ 3,241,439
New Treatment System	20,000	$ 18,369	$ 367,384,264	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
New Treatment Maintenance	20,000	$ 1,102	$ -	$ 21,161,334	$ 20,314,880	$ 19,502,285	$ 18,722,194	$ 17,973,306	$ 17,254,374	$ 16,564,199	$ 15,901,631	$ 15,265,566	$ 14,654,943	$ 14,068,745	$ 13,505,995	$ 12,965,756
New Treatment Operation	20,000	$ 735	$ -	$ 14,107,556	$ 13,543,254	$ 13,001,523	$ 12,481,462	$ 11,982,204	$ 11,502,916	$ 11,042,799	$ 10,601,087	$ 10,177,044	$ 9,769,962	$ 9,379,163	$ 9,003,997	$ 8,643,837
Water Sampling	12	$ 1,025	$ 12,300	$ 11,808	$ 11,336	$ 10,882	$ 10,447	$ 10,029	$ 9,628	$ 9,243	$ 8,873	$ 8,518	$ 8,177	$ 7,850	$ 7,536	$ 7,235
Annual Reporting	1	$ 180,000	$ 180,000	$ 172,800	$ 165,888	$ 159,252	$ 152,882	$ 146,767	$ 140,896	$ 135,261	$ 129,850	$ 124,656	$ 119,670	$ 114,883	$ 110,288	$ 105,876
Project Management	10%		$ 38,135,347	$ 4,867,933	$ 4,673,216	$ 4,486,287	$ 4,306,836	$ 4,134,562	$ 3,969,180	$ 3,810,413	$ 3,657,996	$ 3,511,676	$ 3,371,209	$ 3,236,361	$ 3,106,906	$ 2,982,630
Contingency	15%		$ 62,923,323	$ 8,032,090	$ 7,710,806	$ 7,402,374	$ 7,106,279	$ 6,822,028	$ 6,549,147	$ 6,287,181	$ 6,035,693	$ 5,794,266	$ 5,562,495	$ 5,339,995	$ 5,126,395	$ 4,921,340
Annual Total			$ 482,412,145	$ 61,579,354	$ 59,116,179	$ 56,751,532	$ 54,481,471	$ 52,302,212	$ 50,210,124	$ 48,201,719	$ 46,273,650	$ 44,422,704	$ 42,645,796	$ 40,939,964	$ 39,302,365	$ 37,730,271
Discount Multiplier	96%															

Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33
$ 4,667,672	$ 4,480,965	$ 4,301,727	$ 4,129,657	$ 3,964,471	$ 3,805,892	$ 3,653,657	$ 3,507,510	$ 3,367,210	$ 3,232,522	$ 3,103,221	$ 2,979,092	$ 2,859,928	$ 2,745,531	$ 2,635,710	$ 2,530,281	$ 2,429,070	$ 2,331,907	$ 2,238,631
$ 3,111,781	$ 2,987,310	$ 2,867,818	$ 2,753,105	$ 2,642,981	$ 2,537,262	$ 2,435,771	$ 2,338,340	$ 2,244,807	$ 2,155,014	$ 2,068,814	$ 1,986,061	$ 1,906,619	$ 1,830,354	$ 1,757,140	$ 1,686,854	$ 1,619,380	$ 1,554,605	$ 1,492,421
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 12,447,125	$ 11,949,240	$ 11,471,271	$ 11,012,420	$ 10,571,923	$ 10,149,046	$ 9,743,084	$ 9,353,361	$ 8,979,227	$ 8,620,057	$ 8,275,255	$ 7,944,245	$ 7,626,475	$ 7,321,416	$ 7,028,560	$ 6,747,417	$ 6,477,520	$ 6,218,420	$ 5,969,683
$ 8,298,084	$ 7,966,160	$ 7,647,514	$ 7,341,613	$ 7,047,949	$ 6,766,031	$ 6,495,390	$ 6,235,574	$ 5,986,151	$ 5,746,705	$ 5,516,837	$ 5,296,163	$ 5,084,317	$ 4,880,944	$ 4,685,706	$ 4,498,278	$ 4,318,347	$ 4,145,613	$ 3,979,789
$ 6,945	$ 6,668	$ 6,401	$ 6,145	$ 5,899	$ 5,663	$ 5,437	$ 5,219	$ 5,010	$ 4,810	$ 4,618	$ 4,433	$ 4,256	$ 4,085	$ 3,922	$ 3,765	$ 3,614	$ 3,470	$ 3,331
$ 101,641	$ 97,576	$ 93,673	$ 89,926	$ 86,329	$ 82,875	$ 79,560	$ 76,378	$ 73,323	$ 70,390	$ 67,574	$ 64,871	$ 62,277	$ 59,785	$ 57,394	$ 55,098	$ 52,894	$ 50,779	$ 48,747
$ 2,863,325	$ 2,748,792	$ 2,638,840	$ 2,533,287	$ 2,431,955	$ 2,334,677	$ 2,241,290	$ 2,151,638	$ 2,065,573	$ 1,982,950	$ 1,903,632	$ 1,827,487	$ 1,754,387	$ 1,684,212	$ 1,616,843	$ 1,552,169	$ 1,490,083	$ 1,430,479	$ 1,373,260
$ 4,724,486	$ 4,535,507	$ 4,354,086	$ 4,179,923	$ 4,012,726	$ 3,852,217	$ 3,698,128	$ 3,550,203	$ 3,408,195	$ 3,271,867	$ 3,140,993	$ 3,015,353	$ 2,894,739	$ 2,778,949	$ 2,667,791	$ 2,561,080	$ 2,458,636	$ 2,360,291	$ 2,265,879
$ 36,221,060	$ 34,772,218	$ 33,381,329	$ 32,046,076	$ 30,764,233	$ 29,533,663	$ 28,352,317	$ 27,218,224	$ 26,129,495	$ 25,084,315	$ 24,080,943	$ 23,117,705	$ 22,192,997	$ 21,305,277	$ 20,453,066	$ 19,634,943	$ 18,849,546	$ 18,095,564	$ 17,371,741

Year 34	Year 35	Year 36	Year 37	Year 38	Year 39	Year 40	Year 41	Year 42	Year 43	Year 44	Year 45	Year 50	Year 51	Year 52	Year 53	Year 54	Year 55	Year 56
$ 2,149,086	$ 2,063,122	$ 1,980,597	$ 1,901,374	$ 1,825,319	$ 1,752,306	$ 1,682,214	$ 1,614,925	$ 1,550,328	$ 1,488,315	$ 1,428,782	$ 1,371,631	$ 1,316,766	$ 1,264,095	$ 1,213,531	$ 1,164,990	$ 1,118,391	$ 1,073,655	$ 1,030,709
$ 1,432,724	$ 1,375,415	$ 1,320,398	$ 1,267,582	$ 1,216,879	$ 1,168,204	$ 1,121,476	$ 1,076,617	$ 1,033,552	$ 992,210	$ 952,522	$ 914,421	$ 877,844	$ 842,730	$ 809,021	$ 776,660	$ 745,594	$ 715,770	$ 687,139
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 5,730,896	$ 5,501,660	$ 5,281,593	$ 5,070,330	$ 4,867,516	$ 4,672,816	$ 4,485,903	$ 4,306,467	$ 4,134,208	$ 3,968,840	$ 3,810,086	$ 3,657,683	$ 3,511,376	$ 3,370,921	$ 3,236,084	$ 3,106,640	$ 2,982,375	$ 2,863,080	$ 2,748,557
$ 3,820,597	$ 3,667,773	$ 3,521,062	$ 3,380,220	$ 3,245,011	$ 3,115,210	$ 2,990,602	$ 2,870,978	$ 2,756,139	$ 2,645,893	$ 2,540,058	$ 2,438,455	$ 2,340,917	$ 2,247,280	$ 2,157,389	$ 2,071,094	$ 1,988,250	$ 1,908,720	$ 1,832,371
$ 3,198	$ 3,070	$ 2,947	$ 2,829	$ 2,716	$ 2,607	$ 2,503	$ 2,403	$ 2,307	$ 2,215	$ 2,126	$ 2,041	$ 1,959	$ 1,881	$ 1,806	$ 1,734	$ 1,664	$ 1,598	$ 1,534
$ 46,798	$ 44,926	$ 43,129	$ 41,403	$ 39,747	$ 38,157	$ 36,631	$ 35,166	$ 33,759	$ 32,409	$ 31,113	$ 29,868	$ 28,673	$ 27,526	$ 26,425	$ 25,368	$ 24,354	$ 23,379	$ 22,444
$ 1,318,330	$ 1,265,597	$ 1,214,973	$ 1,166,374	$ 1,119,719	$ 1,074,930	$ 1,031,933	$ 990,656	$ 951,029	$ 912,988	$ 876,469	$ 841,410	$ 807,754	$ 775,443	$ 744,426	$ 714,649	$ 686,063	$ 658,620	$ 632,275
$ 2,175,244	$ 2,088,234	$ 2,004,705	$ 1,924,517	$ 1,847,536	$ 1,773,635	$ 1,702,689	$ 1,634,582	$ 1,569,198	$ 1,506,430	$ 1,446,173	$ 1,388,326	$ 1,332,793	$ 1,279,482	$ 1,228,302	$ 1,179,170	$ 1,132,003	$ 1,086,723	$ 1,043,254
$ 16,676,872	$ 16,009,797	$ 15,369,405	$ 14,754,629	$ 14,164,443	$ 13,597,866	$ 13,053,951	$ 12,531,793	$ 12,030,521	$ 11,549,300	$ 11,087,328	$ 10,643,835	$ 10,218,082	$ 9,809,359	$ 9,416,984	$ 9,040,305	$ 8,678,693	$ 8,331,545	$ 7,998,283

Year 57	Year 58	Year 59	Year 60
$ 989,480	$ 949,901	$ 911,905	$ 875,429
$ 659,654	$ 633,267	$ 607,937	$ 583,619
$ -	$ -	$ -	$ -
$ 2,638,614	$ 2,533,070	$ 2,431,747	$ 2,334,477
$ 1,759,076	$ 1,688,713	$ 1,621,165	$ 1,556,318
$ 1,472	$ 1,413	$ 1,357	$ 1,303
$ 21,546	$ 20,685	$ 19,857	$ 19,063
$ 606,984	$ 582,705	$ 559,397	$ 537,021
$ 1,001,524	$ 961,463	$ 923,005	$ 886,084
$ 7,678,352	$ 7,371,218	$ 7,076,369	$ 6,793,314