

**From:** [Barnes, Samuel EMPR:EX](#)  
**To:** [Craig, Andrew EMPR:EX](#)  
**Cc:** [Shaw, Sean EMPR:EX](#); [Squirrell, Colin EMPR:EX](#); [Jackson, Jolene EMPR:EX](#)  
**Subject:** FRO AWTF-S Operations - permit drafting | Confidential Cost Estimate  
**Date:** September 1, 2020 3:24:49 PM  
**Attachments:** [2020-09-01 FRO-AWTF-S Costs Confidential Detail.pdf](#)  
[image001.png](#)

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Hi Andrew,

In response to your question related to the costing estimate for FRO AWTF-S, Teck has provided a table with further cost detail (see attached).

Please let me know if you need something further from Teck. Thanks,

**Sam Barnes, RPBio**

*Senior Project Lead – Major Mines Office*

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**From:** Craig, Andrew EMPR:EX <Andrew.Craig@gov.bc.ca>  
**Sent:** August 28, 2020 3:41 PM  
**To:** Barnes, Samuel EMPR:EX <Samuel.Barnes@gov.bc.ca>  
**Cc:** Shaw, Sean EMPR:EX <Sean.Shaw@gov.bc.ca>; Marques, Victor EMPR:EX <Victor.Marques@gov.bc.ca>; Turcotte, Adrienne EMPR:EX <Adrienne.Turcotte@gov.bc.ca>; Squirrell, Colin EMPR:EX <Colin.Squirrell@gov.bc.ca>; Jackson, Jolene EMPR:EX <Jolene.Jackson@gov.bc.ca>  
**Subject:** RE: FRO AWTF-S Operations - permit drafting

Hi Sam,

There is some information missing with respect to the costing estimate provided for the FRO AWTF-S, which will be needed to finish the permit. Can you please send Teck the following information requirement:

- What inputs were used to develop the annual operating and closure costs presented in the memorandum entitled “Fording River Operations Active Water Treatment Facility South – Construction, Operation and Reclamation Cost” dated November 26, 2019? Please provide detailed rationale and the assumptions of analysis used to estimate costs.

Thanks,  
Andrew



Andrew Craig, M.Sc., P.Geo.  
**Sr. Environmental Geoscientist, Major Mines Office**  
Ministry of Energy, Mines and Petroleum Resources  
**Phone:** 778-676-5847

---

**From:** Barnes, Samuel EMPR:EX <[Samuel.Barnes@gov.bc.ca](mailto:Samuel.Barnes@gov.bc.ca)>  
**Sent:** August 25, 2020 10:05 AM  
**To:** Craig, Andrew EMPR:EX <[Andrew.Craig@gov.bc.ca](mailto:Andrew.Craig@gov.bc.ca)>  
**Cc:** Shaw, Sean EMPR:EX <[Sean.Shaw@gov.bc.ca](mailto:Sean.Shaw@gov.bc.ca)>; Marques, Victor EMPR:EX <[Victor.Marques@gov.bc.ca](mailto:Victor.Marques@gov.bc.ca)>; Turcotte, Adrienne EMPR:EX <[Adrienne.Turcotte@gov.bc.ca](mailto:Adrienne.Turcotte@gov.bc.ca)>; Squirrell, Colin EMPR:EX <[Colin.Squirrell@gov.bc.ca](mailto:Colin.Squirrell@gov.bc.ca)>; Jackson, Jolene EMPR:EX <[Jolene.Jackson@gov.bc.ca](mailto:Jolene.Jackson@gov.bc.ca)>  
**Subject:** FRO AWTF-S Operations - permit drafting

Hello Andrew,

The Review-phase for FRO AWTF-S Commissioning and Operations has ended with all reviewers (BC and KNC) closing their comments. As discussed before, this is a permit that will need to be drafted by Geoscience as the Geotech/Reclamation components of the Operations application were minimal.

As a start, I have drafted the following:

- [Draft \*Mine Act\* Permit Amendment Approving Active Water Treatment Facility – South Commissioning and Operations \(Word 48 KB\)](#)
- [Draft Cover Letter \(Word 46 KB\)](#)
- [Draft SDM Checklist \(Word 26 KB\)](#)

I am working on the *MRC Summary Report* and a draft will be shared with the MRC for comment.  
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All that said, I know you are juggling a number of projects so want to better understand your current workload and the expected effort to complete this draft permit. EVO SRF Operations and Eagle 4 SRF Construction are priority but the review of these projects remains ongoing. Specific to you, we are waiting for Teck to respond to your Round 2 comments for EVO SRF and while you (and other EMPR reviewers) have completed review of Eagle 4 SRF Construction, Teck still needs to respond to KNC comments.

Happy to chat further if that is easier. Thanks,

**Sam Barnes, RPBio**

*Senior Project Lead – Major Mines Office*

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**From:** [Eykamp Lucy SPO](#)  
**To:** [Barnes, Samuel EMPR:EX](#); [Craig, Andrew EMPR:EX](#)  
**Cc:** [Fratton Glenda SPO](#); [Squirrell, Colin EMPR:EX](#); [Davidson Thomas SPO](#); [Wright Richard SPO](#)  
**Subject:** RE: Request: Info for FRO AWTF-S Mines Act permit - CONFIDENTIAL COSTS  
**Date:** November 16, 2020 8:31:09 AM  
**Attachments:** [FRO-S EMPR Costs Response Memo FINAL 13Nov2020.pdf](#)  
[FRO AWTF-S Ops Costs 2021-2023 Version2.xlsx](#)  
[FRO AWTF-S Ops Costs 2024-2026 Version2.xlsx](#)  
[FRO AWTF-S Ops Costs 2027 beyond Version2.xlsx](#)

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**[EXTERNAL] This email came from an external source. Only open attachments or links that you are expecting from a known sender.**

Good Morning Sam and Andrew,

Please find attached responses to EMPR's questions on the FRO AWTF-S cost estimates. Please note that at the time of the assessment, Teck's Water Operations have been exploring options to have the residual waste generated at all of Teck's active water treatment facilities transported and disposed of off-site. As such with the plan to transition to third party contractor for residual waste transportation and disposal, we have updated the cost estimate for FRO AWTF-S to reflect the transport and disposal of residuals off site (more details are provided in the attached memo). Revised spreadsheets have been provided (Version 2) with these revised costs (specific to FRO AWTF-S) updated in the "Contractor" tab under row "Residual Transportation and disposal".

Revised Annual Operation Cost Summary by Years:

- s.21
- 
- 

Please let me know if you have any further questions of the provided cost estimate.

Thanks

Lucy

250 425 8845

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**From:** Barnes, Samuel EMPR:EX <Samuel.Barnes@gov.bc.ca>  
**Sent:** October 20, 2020 2:10 PM  
**To:** Eykamp Lucy SPO <Lucy.Eykamp@teck.com>  
**Cc:** Fratton Glenda SPO <Glenda.Fratton@teck.com>; Squirrell, Colin EMPR:EX <colin.squirrell@gov.bc.ca>  
**Subject:** RE: Request: Info for FRO AWTF-S Mines Act permit - CONFIDENTIAL COSTS

[External email]

Hi Lucy,

In working through bonding for FRO AWTF-S further questions have come up regarding the estimated reclamation security:

- 1) EMPR understands that there is an ~~s.21~~  
s.21

- a. What assumptions or anticipated changes in the operation of the AWTF-S  
s.21
- b.
- c.

- 2) EMPR understands that costs and reagent types change over the course of the AWTF-S operation according to the estimated costs; however, changes to reagent types were not found in the *Mines Act* application for AWTF-S Operations. Please indicate where the change in reagent types is detailed in the Application. If this information is not detailed, how does the cost estimate for Chemicals during years 2024 and beyond reflect operation of the AWTF-S as detailed in the application? How are the assumptions for using less quantities and different reagents in later years of operation justified?
- 3) EMPR understands that Chemicals and Energy costs are linked to inflow rates to the AWTF-S and associated nitrate concentrations. EMPR also understands that average monthly flow rates and nitrate concentrations were applied in the cost estimate. How does the assumption to use average inflow and nitrate values represent a conservative cost estimate for operation of the facility? Why did Teck not assume that the treatment facility would reach the designed maximum nitrate removal rate of 1,400 kg/day?
- 4) EMPR understands that water treatment waste from the AWTF-S will be stored at the West Line Creek AWTF disposal location up until year 2030, which is when predicted capacity of this location is expected to be reached. How has the cost estimate for the FRO AWTF-S factored in costs associated with transporting, constructing and maintaining a new waste disposal facility for water treatment wastes generated beyond 2030?

Thanks,

**Sam Barnes, RPBio**

Senior Project Lead – Major Mines Office

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**From:** Eykamp Lucy SPO <[Lucy.Eykamp@teck.com](mailto:Lucy.Eykamp@teck.com)>

**Sent:** September 17, 2020 1:34 PM

**To:** Barnes, Samuel EMPR:EX <[Samuel.Barnes@gov.bc.ca](mailto:Samuel.Barnes@gov.bc.ca)>

**Cc:** Fratton Glenda SPO <[Glenda.Fratton@teck.com](mailto:Glenda.Fratton@teck.com)>; Squirrel, Colin EMPR:EX <[Colin.Squirrel@gov.bc.ca](mailto:Colin.Squirrel@gov.bc.ca)>; Andrew.Craig@gov.bc.ca'

**Subject:** RE: Request: Info for FRO AWTF-S Mines Act permit - CONFIDENTIAL COSTS

**[EXTERNAL] This email came from an external source. Only open attachments or links that you are expecting from a known sender.**

Sam,

Please find attached an updated cost estimate memo for FRO AWTF-S and excel spreadsheets providing the information requested below.

Please let me know if additional detail is needed.

Thanks  
Lucy

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**From:** Barnes, Samuel EMPR:EX <[Samuel.Barnes@gov.bc.ca](mailto:Samuel.Barnes@gov.bc.ca)>

**Sent:** September 2, 2020 10:11 AM

**To:** Eykamp Lucy SPO <[Lucy.Eykamp@teck.com](mailto:Lucy.Eykamp@teck.com)>

**Cc:** Fratton Glenda SPO <[Glenda.Fratton@teck.com](mailto:Glenda.Fratton@teck.com)>; Squirrel, Colin EMPR:EX <[colin.squirrel@gov.bc.ca](mailto:colin.squirrel@gov.bc.ca)>; Jackson, Jolene EMPR:EX <[Jolene.Jackson@gov.bc.ca](mailto:Jolene.Jackson@gov.bc.ca)>

**Subject:** RE: Request: Info for AWTF-S permit - CONFIDENTIAL COSTS

[External email]

Hi Lucy,

Thank-you for providing the table, Andrew has received it and does require more information.

*Teck should provide a detailed cost estimate breaking each of these items down into individual line items to show how the individual costs associated with 'Personnel', 'Contractor', 'Maintenance', 'Utilities', etc. are divided amongst each component.*

*This information should be provided transparently in a spreadsheet (without password protection) and should be accompanied by additional information/context to justify the*

*assumed costs. Additionally, these values should be projected out over a 100 year time span, showing the costs assumed for each of those years.*

I can arrange a call between you (and others at Teck) and Andrew to discuss if that would be helpful.

Thanks,

**Sam Barnes, RPBio**

*Senior Project Lead – Major Mines Office*

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**From:** Eykamp Lucy SPO <[Lucy.Eykamp@teck.com](mailto:Lucy.Eykamp@teck.com)>  
**Sent:** September 1, 2020 3:17 PM  
**To:** Jackson, Jolene EMPR:EX <[Jolene.Jackson@gov.bc.ca](mailto:Jolene.Jackson@gov.bc.ca)>; Barnes, Samuel EMPR:EX <[Samuel.Barnes@gov.bc.ca](mailto:Samuel.Barnes@gov.bc.ca)>  
**Cc:** Fratton Glenda SPO <[Glenda.Fratton@teck.com](mailto:Glenda.Fratton@teck.com)>; Squirrell, Colin EMPR:EX <[Colin.Squirrell@gov.bc.ca](mailto:Colin.Squirrell@gov.bc.ca)>  
**Subject:** RE: Request: Info for AWTF-S permit - CONFIDENTIAL COSTS

**[EXTERNAL] This email came from an external source. Only open attachments or links that you are expecting from a known sender.**

Sam – attached is a table to provide the info as per EMPR's request below. Please let me know if additional detail is needed.

Thanks  
Lucy  
250 425 8845

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**From:** Jackson, Jolene EMPR:EX <[Jolene.Jackson@gov.bc.ca](mailto:Jolene.Jackson@gov.bc.ca)>  
**Sent:** August 28, 2020 5:07 PM  
**To:** Eykamp Lucy SPO <[Lucy.Eykamp@teck.com](mailto:Lucy.Eykamp@teck.com)>  
**Cc:** Barnes, Samuel EMPR:EX <[Samuel.Barnes@gov.bc.ca](mailto:Samuel.Barnes@gov.bc.ca)>; Fratton Glenda SPO <[Glenda.Fratton@teck.com](mailto:Glenda.Fratton@teck.com)>; Squirrell, Colin EMPR:EX <[colin.squirrell@gov.bc.ca](mailto:colin.squirrell@gov.bc.ca)>  
**Subject:** Request: Info for AWTF-S permit

[External email]

Hi Lucy,

Andrew requested the following information in order to complete the AWTF-S *Mines Act* permit:

- What inputs were used to develop the annual operating and closure costs presented in the

memorandum entitled “Fording River Operations Active Water Treatment Facility South – Construction, Operation and Reclamation Cost” dated November 26, 2019? Please provide detailed rationale and the assumptions of analysis used to estimate costs.

s.22

Thanks,  
Jolene

Jolene Jackson MA BA  
Senior Project Lead, Major Mines Office  
BC Ministry of Energy, Mines and Petroleum Resources  
office 778-698-4365 | cell 250-886-5453  
[jolene.jackson@gov.bc.ca](mailto:jolene.jackson@gov.bc.ca)



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s.21

**From:** [Craig, Andrew EMPR:EX](#)  
**To:** [Cadeau, Tara EMPR:EX](#)  
**Cc:** [Jackson, Kira EMPR:EX](#); [Medig, Kirsti EMPR:EX](#); [Senger, Natalie EMPR:EX](#); [Norlund, Kelsey EMPR:EX](#)  
**Subject:** NPV Calculation  
**Date:** January 7, 2021 8:59:36 AM  
**Attachments:** [2020 12 02 FRO AWTF-S EMPR Costing Combined.xlsx](#)  
[image001.png](#)

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FYI – see the attached spreadsheet for NPV calculation example (and located [here](#)).



Andrew Craig, M.Sc., P.Geo.

**Sr. Environmental Geoscientist, Major Mines Office**

Ministry of Energy, Mines and Low Carbon Innovation

**Phone:** 778-676-5847

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s.21

## Yuzik, Naomi EMLI:EX

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**From:** Craig, Andrew EMPR:EX  
**Sent:** January 7, 2021 9:00 AM  
**To:** Cadeau, Tara EMPR:EX  
**Cc:** Jackson, Kira EMPR:EX; Medig, Kirsti EMPR:EX; Senger, Natalie EMPR:EX; Norlund, Kelsey EMPR:EX  
**Subject:** NPV Calculation  
**Attachments:** 2020 12 02 FRO AWTF-S EMPR Costing\_Combined.xlsx

FYI – see the attached spreadsheet for NPV calculation example (and located [here](#)).



Andrew Craig, M.Sc., P.Geo.  
**Sr. Environmental Geoscientist, Major Mines Office**  
Ministry of Energy, Mines and Low Carbon Innovation  
**Phone:** 778-676-5847

**From:** [Norlund, Kelsey EMLI:EX](#)  
**To:** [Craig, Andrew EMLI:EX](#)  
**Subject:** RE: FRO AWTF-S Reclamation Security - EMLI Review  
**Date:** March 31, 2021 3:57:00 PM  
**Attachments:** [image001.jpg](#)  
[image002.png](#)

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Please file as is...



Kelsey Norlund, Ph.D., P.Geo.  
**Manager, Environmental Geoscience, Major Mines Office**  
Ministry of Energy, Mines and Low Carbon Innovation  
**Phone:** 236-478-3740

---

**From:** Craig, Andrew EMLI:EX <[Andrew.Craig@gov.bc.ca](mailto:Andrew.Craig@gov.bc.ca)>  
**Sent:** March 31, 2021 12:23 PM  
**To:** Norlund, Kelsey EMLI:EX <[Kelsey.Norlund@gov.bc.ca](mailto:Kelsey.Norlund@gov.bc.ca)>  
**Subject:** RE: FRO AWTF-S Reclamation Security - EMLI Review

Hi Kelsey,

Please find attached the FRO AWTF-S costing review note to file, for your review. I tried to keep this succinct, but let me know if you have any comments.

Thanks,  
Andrew

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**From:** Norlund, Kelsey EMLI:EX <[Kelsey.Norlund@gov.bc.ca](mailto:Kelsey.Norlund@gov.bc.ca)>  
**Sent:** March 31, 2021 8:02 AM  
**To:** Craig, Andrew EMLI:EX <[Andrew.Craig@gov.bc.ca](mailto:Andrew.Craig@gov.bc.ca)>  
**Subject:** RE: FRO AWTF-S Reclamation Security - EMLI Review

Hi Andrew,

I spoke with Sean yesterday about the expectations regarding FRO AWTF-S costs.

At this point, Sean is requesting that you review Teck's response, and then write a note to file with the EMLI geoscience assessed operational costs. Please write a few sentences summarizing your assessment, recognition that Teck disagrees, and then your final recommendation. This recommendation can then go to the SDM for consideration.

At this point, no further back and forth with Teck is required but Sean is looking for a record of the review and the final EMLI assessed liability.

Appreciate you sticking with it!

Thanks,



Kelsey Norlund, Ph.D., P.Geo.  
**Manager, Environmental Geoscience, Major Mines Office**  
Ministry of Energy, Mines and Low Carbon Innovation  
**Phone: 236-478-3740**

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**From:** Lucy Eykamp <[Lucy.Eykamp@teck.com](mailto:Lucy.Eykamp@teck.com)>

**Sent:** March 26, 2021 6:24 AM

**To:** Craig, Andrew EMLI:EX <[Andrew.Craig@gov.bc.ca](mailto:Andrew.Craig@gov.bc.ca)>

**Cc:** Constable, Lowell EMLI:EX <[Lowell.Constable@gov.bc.ca](mailto:Lowell.Constable@gov.bc.ca)>; Shaw, Sean EMLI:EX <[Sean.Shaw@gov.bc.ca](mailto:Sean.Shaw@gov.bc.ca)>; Norlund, Kelsey EMLI:EX <[Kelsey.Norlund@gov.bc.ca](mailto:Kelsey.Norlund@gov.bc.ca)>; Medig, Kirsti EMLI:EX <[Kirsti.Medig@gov.bc.ca](mailto:Kirsti.Medig@gov.bc.ca)>; Antill, Timothy EMLI:EX <[Timothy.Antill@gov.bc.ca](mailto:Timothy.Antill@gov.bc.ca)>; Marques, Victor EMLI:EX <[Victor.Marques@gov.bc.ca](mailto:Victor.Marques@gov.bc.ca)>; Squirrell, Colin EMLI:EX <[Colin.Squirrell@gov.bc.ca](mailto:Colin.Squirrell@gov.bc.ca)>; Barnes, Samuel EMLI:EX <[Samuel.Barnes@gov.bc.ca](mailto:Samuel.Barnes@gov.bc.ca)>; Glenda Fratton <[Glenda.Fratton@teck.com](mailto:Glenda.Fratton@teck.com)>; Thomas Davidson <[Thomas.Davidson@teck.com](mailto:Thomas.Davidson@teck.com)>; Richard Wright <[Richard.Wright@teck.com](mailto:Richard.Wright@teck.com)>; Dean Runzer <[Dean.Runzer@teck.com](mailto:Dean.Runzer@teck.com)>

**Subject:** RE: FRO AWTF-S Reclamation Security - EMLI Review

**[EXTERNAL] This email came from an external source. Only open attachments or links that you are expecting from a known sender.**

Good Morning Andrew,

Please find attached our response to your comment on the review of FRO AWTF-S operational costs.

Also in checking the Version 2 cost estimate provided to EMLI on November 16, 2020, Teck noted an error in the flow value used for April in the Chemicals tab. Teck has corrected this error and is providing updated spreadsheets to EMLI (Version 3) (flow rate for April in the Chemicals tab corrected to reflect the flow rate shown in the INTRO tab). Below is revised Annual Operation Cost Summary by Years for FRO AWTF-S:

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We would be happy to discuss this further with EMLI if desired.

Thanks  
Lucy  
250 425 8845

**From:** Craig, Andrew EMLI:EX <[Andrew.Craig@gov.bc.ca](mailto:Andrew.Craig@gov.bc.ca)>

**Sent:** March 10, 2021 12:33 PM

**To:** Eykamp Lucy SPO <[Lucy.Eykamp@teck.com](mailto:Lucy.Eykamp@teck.com)>

**Cc:** Constable, Lowell EMLI:EX <[Lowell.Constable@gov.bc.ca](mailto:Lowell.Constable@gov.bc.ca)>; Shaw, Sean EMLI:EX <[Sean.Shaw@gov.bc.ca](mailto:Sean.Shaw@gov.bc.ca)>; Norlund, Kelsey EMLI:EX <[Kelsey.Norlund@gov.bc.ca](mailto:Kelsey.Norlund@gov.bc.ca)>; Medig, Kirsti EMLI:EX <[Kirsti.Medig@gov.bc.ca](mailto:Kirsti.Medig@gov.bc.ca)>; Antill, Timothy EMPR:EX <[Timothy.Antill@gov.bc.ca](mailto:Timothy.Antill@gov.bc.ca)>; Marques, Victor EMPR:EX <[victor.marques@gov.bc.ca](mailto:victor.marques@gov.bc.ca)>; Squirrell, Colin EMPR:EX <[colin.squirrell@gov.bc.ca](mailto:colin.squirrell@gov.bc.ca)>; Barnes, Samuel EMPR:EX <[Samuel.Barnes@gov.bc.ca](mailto:Samuel.Barnes@gov.bc.ca)>; Fratton Glenda SPO <[Glenda.Fratton@teck.com](mailto:Glenda.Fratton@teck.com)>; Davidson Thomas SPO <[Thomas.Davidson@teck.com](mailto:Thomas.Davidson@teck.com)>; Wright Richard SPO <[Richard.Wright@teck.com](mailto:Richard.Wright@teck.com)>; Runzer Dean SPO <[Dean.Runzer@teck.com](mailto:Dean.Runzer@teck.com)>

**Subject:** FRO AWTF-S Reclamation Security - EMLI Review

[External email]

Hi Lucy,

Please find attached EMLI's review memorandum of the Fording River AWTF-S reclamation security estimate, which includes one comment. The purpose of this memorandum is to bring to conclusion the technical review of the reclamation security costs associated with the FRO AWTF-S authorization.

Additionally, it is understood that Teck is engaged with Chief Permitting Officer in determining the amount and payment schedule associated with the C-3 *Mines Act* permit. EMLI recognizes that this memorandum does not pre-empt any on-going conversations on the reclamation security amount between Teck and the Chief Permitting Officer, however, it is EMLI's expectation that Teck submits a detailed response to the comment provided within a reasonable time frame.

Please do not hesitate to contact me if you have any further questions.

Thank you,



Andrew Craig, M.Sc., P.Geo.  
**Sr. Environmental Geoscientist, Major Mines Office**  
Ministry of Energy, Mines and Low Carbon Innovation  
**Phone:** 778-676-5847

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March 10, 2021

To: Lucy Eykamp, Senior Specialist Regulatory Approvals, Teck Coal Limited

Re: **EMLI Geoscience Review – Fording River Operations Active Water Treatment Facility South, Reclamation Security Estimate**

The Ministry of Energy, Mines and Low Carbon Innovation (EMLI) has reviewed the reclamation security estimate provided for the *Mines Act* amendment application entitled "Operations Application Fording River Operations Active Water Treatment Facility South", dated November 2019, prepared by Teck Coal Limited (Teck) for Fording River Operations (FRO). As part of this review, EMLI has also reviewed the following documents as they relate to reclamation security estimates for the FRO Active Water Treatment Facility South (AWTF-S):

- Memorandum entitled "Fording River Operations Active Water Treatment Facility South – Construction, Operation and Reclamation Cost: September 2020 Update CONFIDENTIAL", dated September 17, 2020, prepared by Teck (Document 1);
- Memorandum entitled "FRO AWTF-S: Clarification on long term operational costs", dated November 13, 2020, prepared by Teck (Document 2);
- Memorandum entitled "Fording River Operations Active Water Treatment Facility South – Construction, Operation and Reclamation Cost", dated November 26, 2019, prepared by Teck (Document 3);
- Spreadsheets entitled "FRO AWTF-S Ops Costs 2021-2023"; "FRO AWTF-S Ops Costs 2024-2026"; "FRO Ops Costs 2027 beyond", undated (received by EMLI on September 17, 2020), prepared by Teck (Document 4); and,
- Spreadsheets entitled "FRO AWTF-S Ops Costs 2021-2023\_Version2"; "FRO AWTF-S Ops Costs 2024-2026\_Version2"; "FRO Ops Costs 2027 beyond\_Version2", undated (received by EMLI on November 16, 2020), prepared by Teck (Document 5).

The purpose of this review is to outline EMLI's conclusions from the AWTF-S costing information provided and to identify if reasonably conservative assumptions were used to estimate costs required to treat elevated concentrations of selenium and nitrate at FRO in perpetuity.

A summary of EMLI's understanding of the costing information is provided in the following section, followed by a geoscience comment. EMLI recognizes that this memorandum does not pre-empt any on-going conversations on the reclamation security amount between Teck and the Chief Permitting Officer (CPO), however, it is EMLI's expectation that Teck submits a detailed response to the comment provided.

### **EMLI's Understanding**

Following submission of the FRO AWTF-S Commissioning and Operations application, EMLI understands that Teck provided initial (Documents 1, 4) and updated (Documents 2, 3, 5) reclamation security estimate

packages, which outline the anticipated costs associated with the Construction, Operations and Closure phases for the FRO AWTF-S. The reclamation security estimate for Operations has been subdivided into three time periods: 2021-2023, 2024-2026 and 2027 and beyond, with annual costs associated with subcategories including: Administration; Contractors and Consultants; Maintenance; Energy; Chemicals and Media; and Lab Supplies and Other. Unit costs for specific materials, reagents and resources have been assigned under each of the subcategories with corresponding assumptions. In addition, EMLI understands that overall costs of the Energy and Chemicals and Media subcategories are closely dependent on the influent flow rate and nitrate concentration received by the AWTF-S due to the power and reagent demands tied to selenium and nitrate removal.

Generally, the proposed operational unit costs for individual items listed in Document 4 and 5, Teck's responses to previous EMLI comments in Document 2, and Closure estimates provided by Teck in Document 3 were reasonable for the purpose of calculating and estimating total costs of each subcategory. However, it is EMLI's position that the assumed monthly/daily average treatment flow rates and nitrate concentrations, which subsequently affect the annual costs associated with the Energy and Chemical and Media subcategories, are insufficiently conservative based on information provided in the Application, including:

1. Documents 4 and 5 indicate that average monthly/daily flowrates were used for Swift-Cataract and Kilmarnock Creek intakes, which range between 6,667 to 10,887 m<sup>3</sup>/day during November to March. However, according to Section 5.3.1.1 and Figure 5.3-1 of the Application, high monthly/daily flowrates during the same months are greater than approximately 14,000 m<sup>3</sup>/day from years 2020 to 2026, which leaves a potential discrepancy of up to 7,000 m<sup>3</sup>/day of influent requiring treatment from the cost estimate.
2. Documents 4 and 5 indicate that average monthly/daily nitrate concentrations were applied to the costing spreadsheet. Average case flow rates and average nitrate concentrations were calculated to have a nitrate removal rate ranging from approximately 600 to 1,200 kg/day (average of 821 kg/day), which is below the maximum nitrate removal limit of 1,400 kg/day. However, Section 5.3 of the Application indicates that the upper bound nitrate concentrations from Swift-Cataract and Kilmarnock creeks were adopted in the water quality model to provide conservative but realistic values.

### **EMLI's Revisions to the Security Estimate**

Operational unit costs for individual items listed in Document 5, and Closure estimates provided in Document 3 were not modified from the proposed values based on responses in Document 2. However, revisions were applied to the assumed daily/monthly average treatment flow rates and nitrate concentrations on the following basis:

- Section 5.3.1.1 indicates that flows from Swift-Cataract and Kilmarnock Creek exceed 20,000 m<sup>3</sup>/day during all months of the year, yet less influent will be sent the AWTF-S due to water availability and intake efficiency. EMLI assumes that groundwater capture and intake efficiency at Kilmarnock Creek will increase as operation of the AWTF-S continues past 2024 based on learnings from the groundwater bypass investigation and out of necessity to treat mine affected discharge at FRO. Further, this conservative assumption better aligns with the high inflow rate scenario shown in Figure 5.3-1 and Figure 5.3-3 of the Application. Accordingly, EMLI assumes the following daily/monthly treatment flow rate at AWTF-S:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Flowrate (m <sup>3</sup> /day)	14,000	12,000	13,000	19,500	20,000	20,000	20,000	20,000	20,000	20,000	18,500	16,000

- Section 5.3 of the Application describes the upper bound nitrate concentrations to be realistic. Therefore, EMLI assumes that the following values provide a conservative approach for calculating nitrate dependent variables, including energy, reagents, and treatment media:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Nitrate (mg/L)	100	105	105	70	70	70	70	70	70	70	75	85

- Section 5.3.3 of the Application indicates that the design basis of the AWTF-S for nitrate removal rate limits of 1,400 kg/day. Based on EMLI's assumption to apply higher treatment flow rates and nitrate concentrations above, EMLI's revisions were still shown to have daily nitrate removal rates within the AWTF-S design limit.

After applying EMLI's assumptions to the updated reclamation security estimate over a 100-year period, including yearly discount rates, a 20% contingency, and the proposed Closure cost of \$21 the revised reclamation security totals \$21. This amount was found to differ from Teck's original and updated security cost estimates of \$21.

### **Comment**

- If Teck disagrees with EMLI's assumptions and assessment, please provide rationale and supporting information to demonstrate that conservative treatment flow rates and nitrate concentrations have been incorporated into the cost estimate and address any discrepancies with the information presented in the FRO AWTF-S Operations Application. Otherwise, please acknowledge EMLI's estimate.

## **Closure**

It is understood that Teck is engaged with CPO in determining the amount and payment schedule associated with the C-3 *Mines Act* permit. The purpose of this memorandum is to bring to conclusion the technical review of the reclamation security costs associated with the AWTF-S authorization. The conclusions of EMLI technical staff are provided as recommendations to the CPO.

EMLI recognizes the efforts by Teck to provide costing information for the FRO AWTF-S. However, assumptions within the initial and revised cost estimates, particularly around the assumed average influent flowrates and nitrate concentrations, do not demonstrate that a reasonable degree of conservatism had been considered which suggests there is potential for the estimate to contain significant discrepancies relative to the liability. It is EMLI's expectation that Teck submits a detailed response to the comment provided.

Please do not hesitate to contact me with any questions.

Sincerely,

Andrew Craig, M.Sc., P.Geo.  
Sr. Environmental Geoscientist, EMLI

cc. Lowell Constable, Executive Director / Deputy Chief Permitting Officer, EMLI  
Sean Shaw, Director of Technical Operations, EMLI  
Kelsey Norlund, Manager Environmental Geoscience and Permitting, EMLI  
Colin Squirrell, Project Director, EMLI  
Victor Marques, A/Manager Geotechnical Engineering, EMLI  
Tim Antill, Manager Reclamation, EMLI

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Withheld pursuant to/removed as

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