AGNICO EAGLE

July 12, 2024 NWB File: 2AM-WTP1830

Richard Dwyer
Nunavut Water Board
PO Box 119
Gjoa Haven, NU
X0B 1J0

Re: Response to Comments on the Whale Tail 2024 Modification under Water Licence 2AM-WTP1830

Dear Mr. Dwyer

Agnico Eagle thanks the Nunavut Water Board for the opportunity to respond to comments received from Crown-Indigenous Relations and Northern Affairs Canada and Environment and Climate Change Canada regarding the Whale Tail 2024 Modification under Water Licence 2AM-WTP1830. Our comments are provided in the enclosed.

Should you have any questions or require further information, please contact the undersigned at your convenience.

Regards,

Jamie Quesnel
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Director, Permitting & Regulatory Affairs

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CROWN-INDIGENOUS RELATIONS AND NORTHERN AFFAIRS CANADA (CIRNAC)

Interested Party:	**CIRNAC**	**Rec No.:**	**CIRNAC-R-1**
Re:	**Water Management during Closure**		

Request Made by Interested Party:
CIRNAC recommends that Agnico Eagle reintroduce table 3.8 from Version 12 and update the section based on the new information presented in Version 13 of the Water Management plan.

Agnico Eagle's Response to Request:
Agnico Eagle has reinstated Table 3.8 for key water management activities and sequencing during closure in Section 3.10 of the Water Management Plan, which is provided in Appendix A of this response package.

Interested Party:	**CIRNAC**	**Rec No.:**	**CIRNAC-R-2**
Re:	**Flooding Sequence**		

Request Made by Interested Party:

CIRNAC recommends that Agnico Eagle reintroduce "Section 3.10.1 Flooding Sequence" from Version 12 and update the section based on the new information presented in Version 13 of the Water Management plan.

Agnico Eagle's Response to Request:

Section 3.10.1 Flooding Sequence has been removed; however, the information is provided in the table reinstated back to Section 3.10, as referenced in response to CIRNAC-R-1.

ENVIRONMENT AND CLIMATE CHANGE CANADA (ECCC)

Interested Party:	**ECCC**	**Rec No.:**	**ECCC-TC-01**
Re:	**Flooded pit water quality**		

Request Made by Interested Party:
ECCC recommends that the Water Management Plan be updated to acknowledge that monitoring results must demonstrate flooded pit water quality consistently meets water quality objectives for a sufficiently long duration and that water quality has stabilized or is improving prior to reconnection.

Agnico Eagle's Response to Request:
We agree as per noted above "*…dikes will not be breached until the water quality in the flooded area meets the approved water quality objectives*" which will be addressed in the Final Closure Plan.

Interested Party:	ECCC	Rec No.:	ECCC-TC-02
Re:	Sewage Treatment		

Request Made by Interested Party:
ECCC provides the following recommendations regarding the water quality model:

- *Ongoing sewage treatment plant challenges in meeting treatment targets for nitrate and phosphorus should be reflected in the source term development.*
- *Consider the potential for attenuation pond sediments to accumulate parameters and release these parameters into the receiving environment following reconnection to surface waters. Parameters should include, but not be limited to, phosphorus and arsenic.*
- *Consider how removal of attenuation pond sediments would affect the water quality predictions during operations, closure and post-closure.*
- *Review and update the model, as appropriate, to incorporate the above recommendations.*

Agnico Eagle's Response to Request:
To address the recommendation that challenges in meeting sewage treatment targets for nitrate and phosphorus be reflected in the source terms, the measured average effluent concentrations of both parameters from 2020/2021 were used as inputs to the WBWQM (Table 2-1). This results in an 11% and 52% increase in predicted Operations average IVR Attenuation Pond (primary receiver of STP effluent) concentrations of nitrate and phosphorus, respectively (Table 2-2 and Figure 2-1), noting that predicted phosphorus concentrations remain well below the NWB Water Licence limit of 0.3 mg/L.

Table 2-1:
Average annual sewage treatment plant effluent concentrations for nitrate and phosphorus

	Average STP Effluent Concentration (mg/L)	
WTP Source Terms	**NO_3-N**	**P**
2020 and 2021	12.37	2.91
2022+	5.00	0.50

Table 2-2:
Average 2024-2028 IVR Attenuation Pond concentrations for nitrate and phosphorus

Parameter	STP Effluent Concentration (mg/L)		
	2024 ELOM	**2024 ELOM_v2**	**Increase**
NO_3-N	1.2	1.3	11%
P	0.0082	0.012	52%

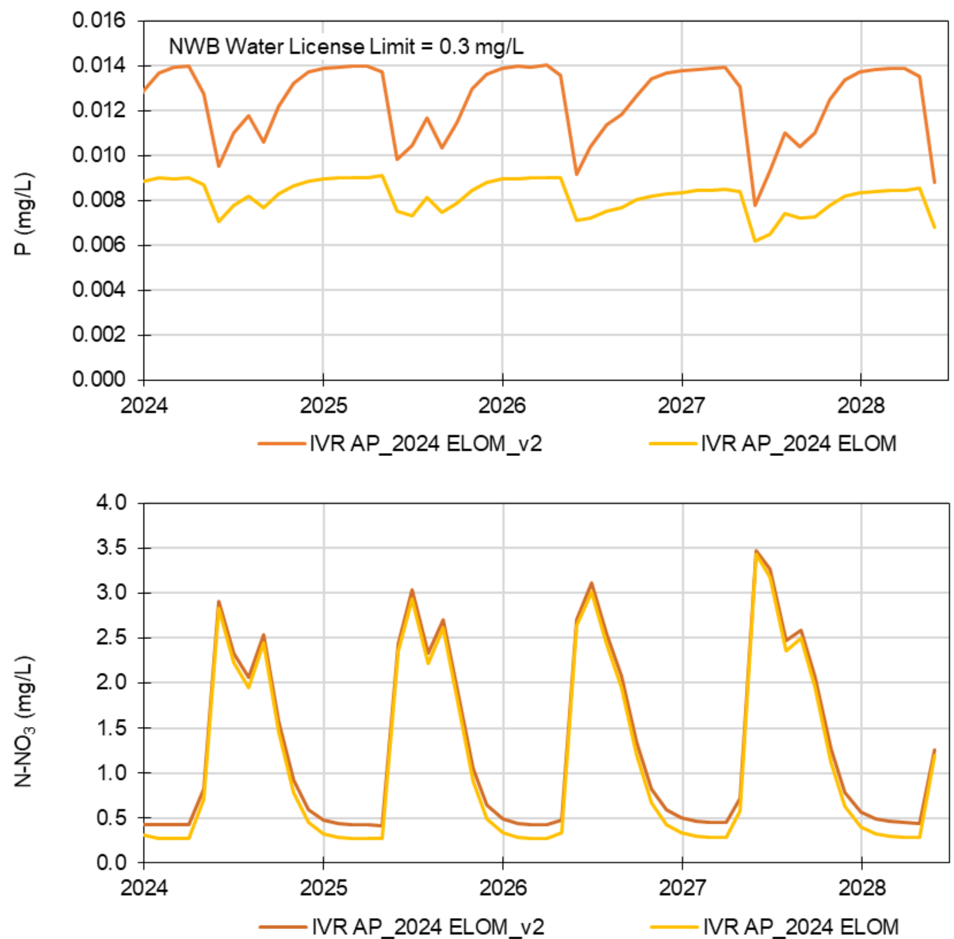


Figure 2-1: **Predicted phosphorous (P) and nitrate (N-NO_3) concentrations in the IVR Attenuation Pond during Operations in the Whale Tail ELOM model as submitted (orange line), and with the updated nitrate and phosphorus sewage treatment plant source terms (v2; red line).**

Attenuation pond sediments may accumulate parameters during operations that are then released into the receiving environment following reconnection to surface waters. To address this potential pathway for contaminant release, a diffusive flux model was completed for WT AP in closure (note that IVR AP is backfilled during active closure). The calculations used operations results shown in Figure 2-1, which assumed elevated WTP effluent concentrations throughout operations (Table 2-1).

In the absence of significant advective flux, parameter transport from sediments into the attenuation pond will be dominated by diffusion created by a concentration gradient. If concentrations in sediment pore water exceed those of the overlying pond, an efflux of metals from pore water into the overlying pond can be expected. Conversely, if metal concentrations are lower in sediment pore water than in the overlying pond, a diffusive influx of metals from the pond into the sediments may occur.

The calculation of fluxes of dissolved species across the sediment-water interface are based on Fick's First Law of diffusion, as described in Martin et al., (2003a, b). This law defines the diffusive flux of solutes, describing their transfer along a concentration gradient from zones of high concentration to zones of low concentration. Fick's First Law describes the diffusive flux of solutes in mg/m^2/yr according to the equation:

$$J_z = D°_J / F\phi * (dc/dz)$$

where J_z = flux (mass/area/time); $D°_J$ = temperature-dependent diffusion coefficient; F= formation factor (Manheim, 1970); ϕ = porosity; and dc/dz = the concentration gradient across the sediment-water interface, which is defined as the change in concentration (dc) over the gradient distance at the sediment-water interface (dz). The $D°_J$ is an element specific *in situ* coefficient, with estimates provided at 0°C by Li and Gregory (1974).

WT AP sediment porosity is assumed to be 0.3, and a gradient distance of 5 cm throughout active closure, reflecting the progression of the concentration gradient into the sediments during active closure (2043-2050). The formation factor is a measure of tortuosity which describes the convoluted (or "tortuous") path ions and molecules must follow to circumvent solid sediment particles (Boudreau, 1997), and can be calculated as follows:

$$F = \phi^{-m}$$

Where m is the exponent of porosity, estimated to range from 1.5 when porosity is <0.6, and to 2 when porosity is > 0.6 by Taylor-Smith (1971), resulting in an F value of 8.0 for pond sediments.

The diffusive gradient (dc) was calculated for As, P and NH_3 by assuming average operations water quality represents pore water, while average post-closure water quality represents the overlying pond. This approach lead to a negative (e.g., downward) diffusive gradient for As, and therefore no diffusive flux was assumed. The resulting diffusive flux loading rates where then applied in the GoldSim WQ model to produce concentration predictions for the WT AP during active closure. The results are shown in Table 2-3 in comparison to the base case model. Overall, the additional loadings result in minimal change to predicted water quality. The largest increase occurs for P, which increases by 8% but remains below site water quality objectives. This shows that removal of AP sediments at the end of operations would have a minimal influence on closure water quality.

Table 2-3:
Whale Tail Attenuation Pond Concentrations during active closure. Concentrations predictions are compared for scnearios with and without diffusive flux from WT AP sediments.

Parameter		Min	Average	Max
As	Base Case	0.000505	0.00704	0.128
	Diffusive Flux	0.000505	0.00704	0.128
	% Diff	0%	0%	0%
P	Base Case	0.00312	0.00494	0.00757
	Diffusive Flux	0.00401	0.00557	0.00821
	% Diff	29%	13%	8%
Total Ammonia	Base Case	0.000241	0.0288	0.479
	Diffusive Flux	0.000159	0.0298	0.479
	% Diff	-34%	3%	0%

Interested Party:	**ECCC**	**Rec No.:**	**ECCC-TC-03**
Re:	**Water quality predictions**		

Request Made by Interested Party:
ECCC recommends that Appendix C (Whale Tail Water Balance and Water Quality Report), Section 6 (Water Quality Model Results) provide comparison figures depicting concentrations in pit lakes, attenuation ponds and treated effluent for the ELOM model as compared to the 2018 FEIS model.

Agnico Eagle's Response to Request:
The requested comparisons between the ELOM model predictions presented in Appendix C and 2018 FEIS model predictions are provided in Figure 2-2 through Figure 2-4. These comparisons are provided for 2024-2025, which defines the overlapping period with the 2018 FEIS mine plan, for arsenic and phosphorus.

In the Whale Tail Pit, predicted phosphorus concentrations are substantially higher in all seasons in the 2018 FEIS model predictions, relative to the 2024 ELOM model (Figure 2-2). Winter arsenic concentrations are generally comparable between the two models; however, the predicted arsenic concentrations are elevated in the open water season in the 2018 FEIS model relative to the 2024 ELOM model, with the exception of May and June.

Winter concentrations of phosphorus are generally comparable between the 2024 ELOM and 2018 FEIS model predictions in the IVR Pit, while summer concentrations are substantially higher in the 2018 FEIS predictions (Figure 2-3). Predicted arsenic concentrations in the IVR Pit are higher in the 2024 ELOM model relative to the 2018 FEIS, with relatively lower seasonal variability.

The 2018 FEIS model predicted significantly higher phosphorus concentrations in both Attenuation Ponds relative to the 2024 ELOM predictions (Figure 2-4). Similarly, predicted arsenic concentrations were higher in the 2018 FEIS model in both Attenuation Ponds and the treated effluent, relative to the 2024 ELOM predictions (Figure 2-5).

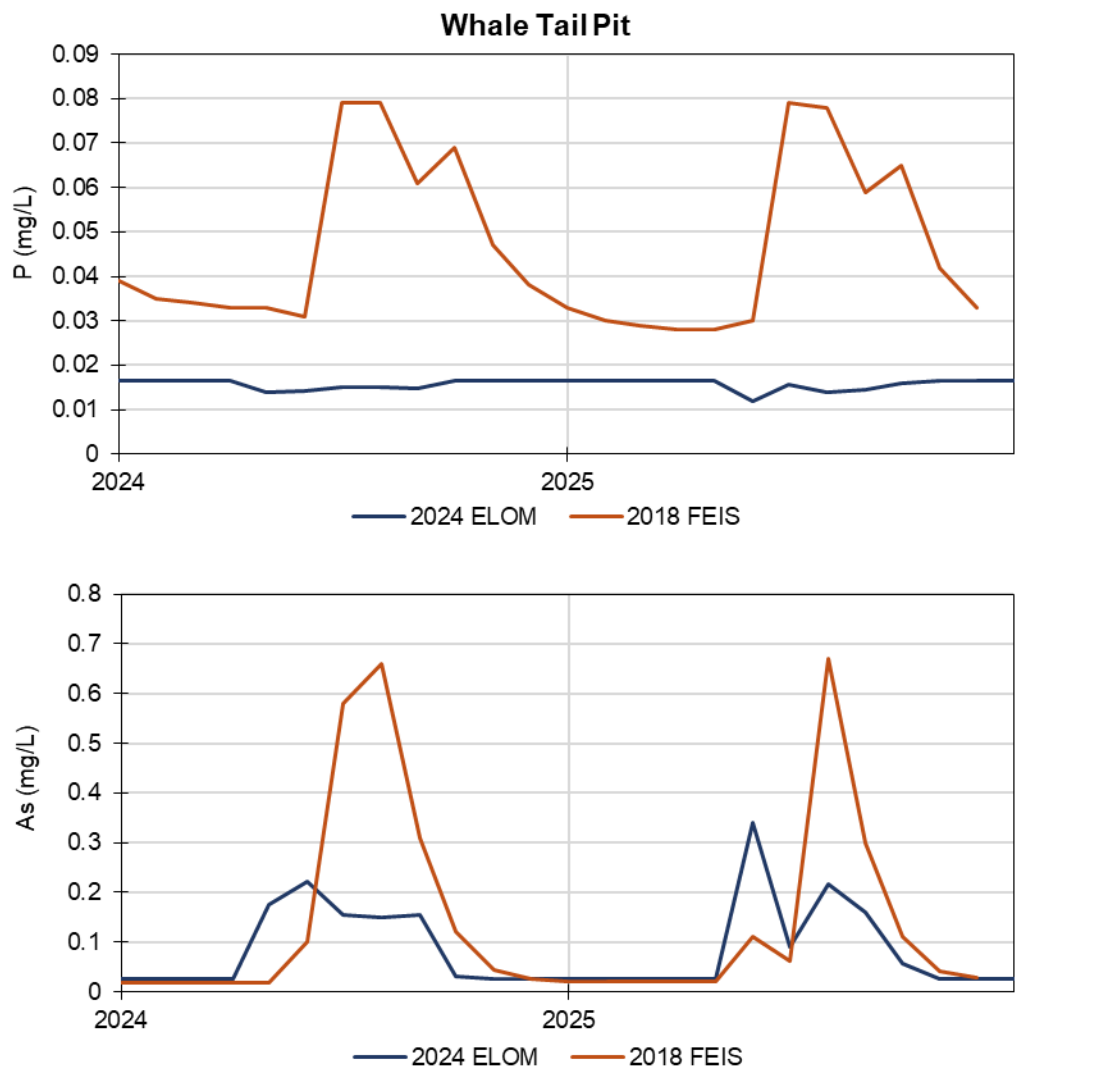


Figure 2-2: **Predicted phosphorous (P) and arsenic (As) concentrations for the Whale Tail Pit during Operations in the Whale Tail ELOM model, as compared to the 2018 FEIS model.**

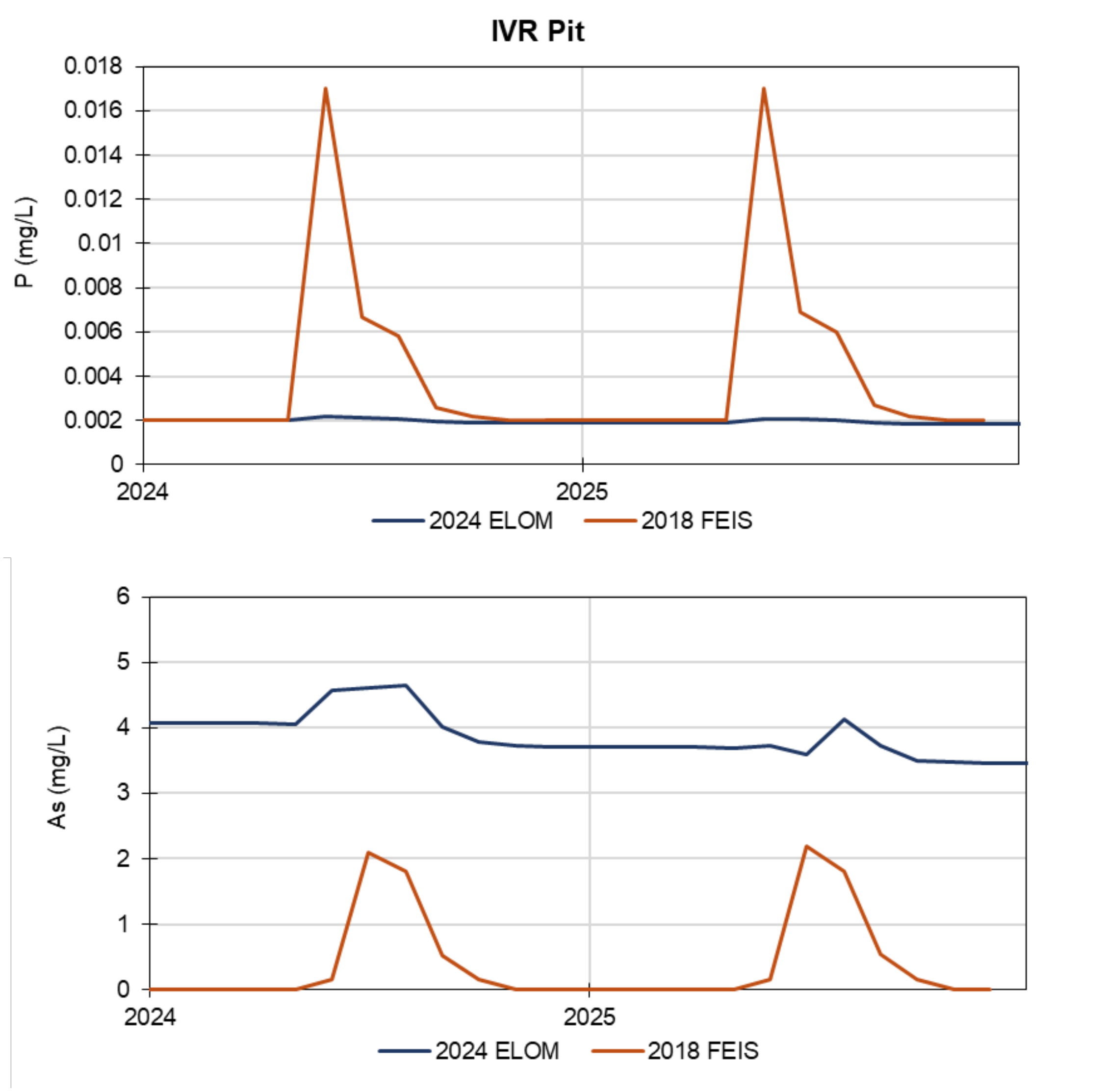


Figure 2-3: **Predicted phosphorous (P) and arsenic (As) concentrations for the IVR Pit during Operations in the Whale Tail ELOM model, as compared to the 2018 FEIS model.**

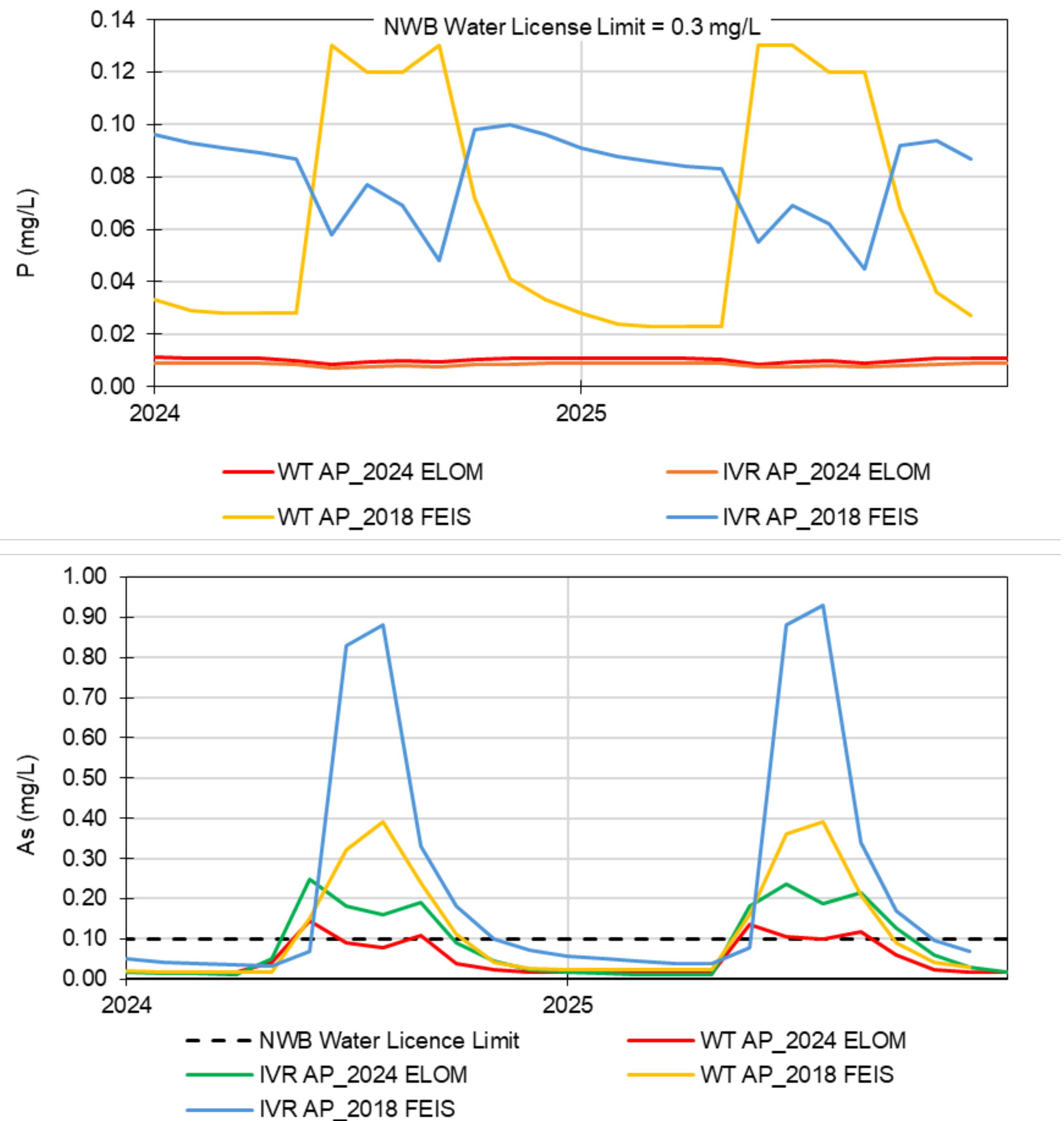
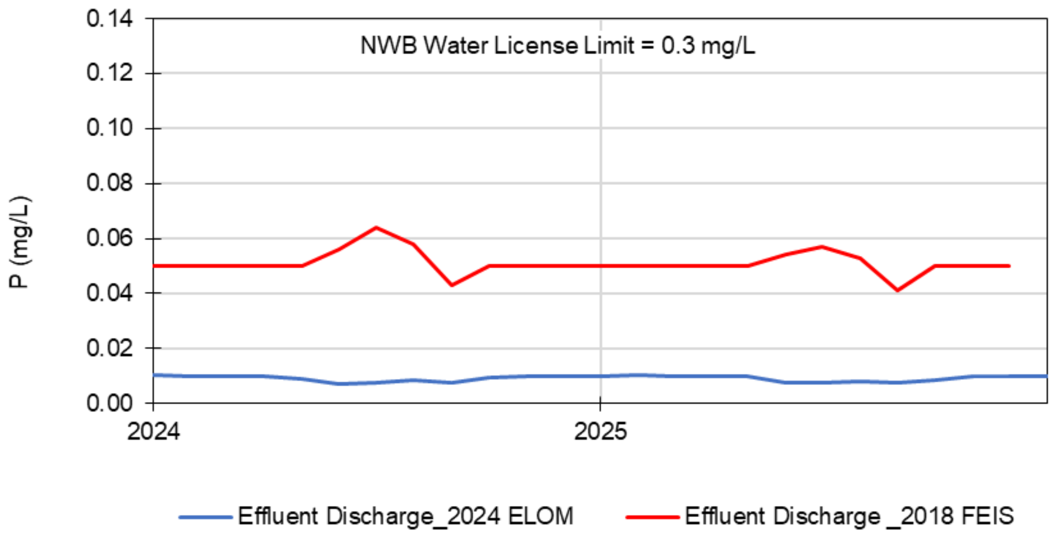


Figure 2-4: **Predicted phosphorous (P) and arsenic (As) concentrations in the Whale Tail Attenuation Pond and IVR Attenuation Pond during Operations in the Whale Tail ELOM model, as compared to the 2018 FEIS model.**



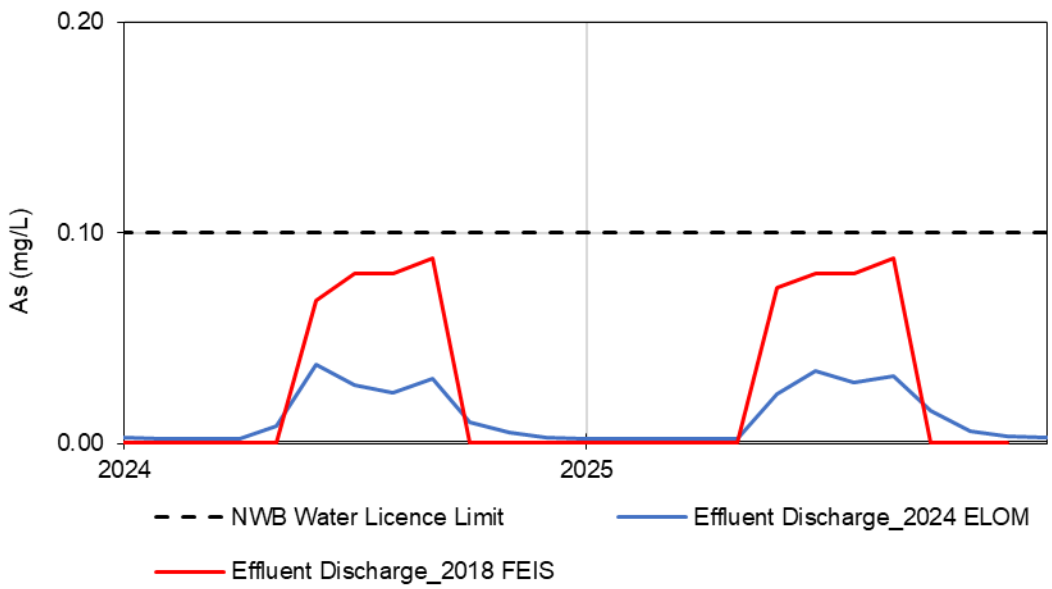


Figure 2-5: **Predicted phosphorous (P) and arsenic (As) concentrations in the treated O-WTP effluent during Operations in the Whale Tail ELOM model, as compared to the 2018 FEIS model.**

Following the model updates to address the comments from ECCC regarding sewage treatment plant performance, Figure 2-6 presents the updated phosphorus and nitrate predictions from the ELOM model for the IVR Attenuation Pond and treated O-WTP effluent, compared to the corresponding predictions from the 2018 FEIS model.

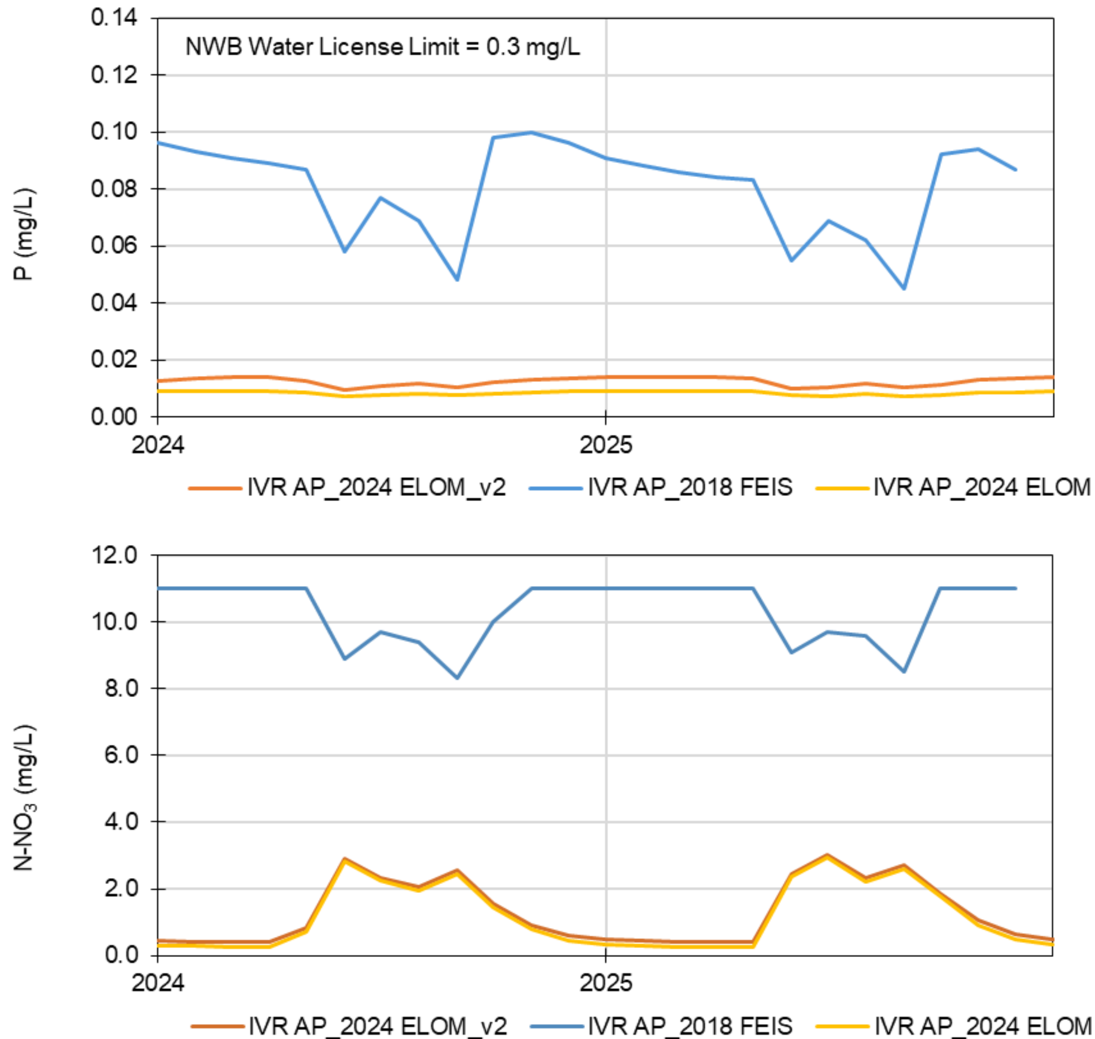


Figure 2-6: **Predicted phosphorous (P) and nitrate (N-NO_3) concentrations in the IVR Attenuation Pond during Operations in the Whale Tail ELOM model as submitted (orange line), and with the updated nitrate and phosphorus sewage treatment plant source terms (v2; red line), as compared to the 2018 FEIS model (blue line).**

Interested Party:	**ECCC**	**Rec No.:**	**ECCC-TC-04**
Re:	**Figure 6-2**		

Request Made by Interested Party:

ECCC recommends that the Proponent review the title of Figure 6-2 in Appendix C (Whale Tail Water Balance and Water Quality Report) and correct as needed.

Agnico Eagle's Response to Request:

ECCC is correct, Figure 6-2 was mislabelled in Appendix C. Figure 6-2 is replicated below with the correct label.

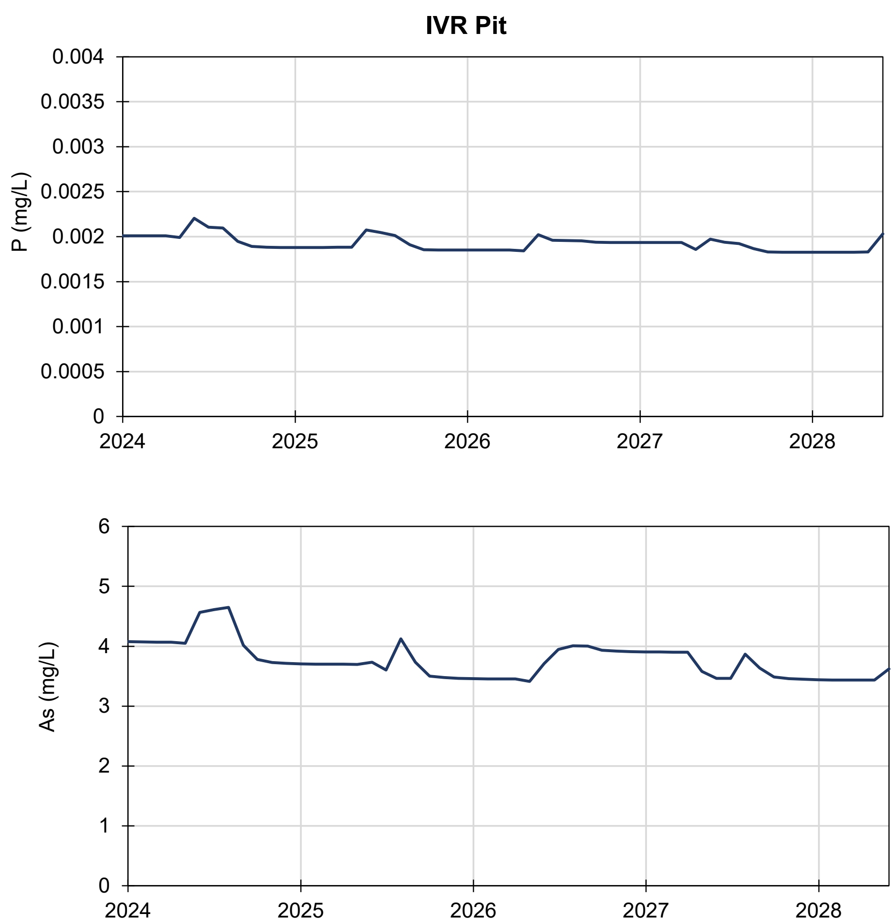


Figure 6-7: Predicted phosphorous (P) and arsenic (As) concentrations for the IVR Pit during Operations in the Whale Tail ELOM model.

APPENDIX A: Whale Tail Water Management Plan-v13

refer to standalone pdf