Memo

To:	[redacted]
From:	[redacted]
Date	01/12/2025
Subject:	[redacted] – Tier I Risk Assessment against relevant guidelines
Recommendation	For Noting

Contents

Document

Drafted by	Review by	Status	Date
[redacted]	To be confirmed	Draft for comment	7/11/2025
[redacted]	[redacted]	Draft. Address comments, added lagoon removal estimated, and used PC90 from ANZG.	21/11/2025
[redacted]	[redacted]	Final	1/12/2025

File: https://inflo.mwc.melbournewater.com.au/inflo/cs.exe/properties/72047871

1 Background

[redacted]

Melbourne Water has determined that the most effective approach is to lagoon treat the solids at the Western Treatment Plant (WTP). This will involve centrifuging the solids to 20% dry weight, trucking them to WTP, and unloading them into lagoons. The solids will stabilise in lagoons for approximately six months. Then the solids can be dredged, dried, stockpiled, and reused; the same as native WTP sludge.

The chosen entry points into the lagoon systems are the 85W Cap Serpentine, and 115E Pond 1. These were selected due to a variety of operational and environmental considerations. As lagoon 115E has the shorter Hydraulic Retention Time (HRT) of the two systems. It is expected that 85W will perform better than 115E. Therefore, 115E has been assessed in this memo to represent the worst-case scenario.

This memo summaries a Tier 1 Risk Assessment related to changes in contaminant concentration in lagoon 115E at the WTP due to inclusion of the [redacted] sludge. Contaminant of concerns identified by Melbourne Water working group for the project were assessed against relevant guidelines identified. The aims were to determine if:

1. Addition of the [redacted] sludge to the lagoon would change the current risk profile significantly.

2. Significant changes were identified, further assessment may be required, or control measures considered, to manage any unacceptable risks identified.

2 Methodology for Tier I risk assessment

2.1 Sludge extraction

[redacted] sludge was extract for 1 or 6 hours in triplicate by stirring with magnetic stirrers (as slow a possible but keeping the sludge in suspension), with associated blanks, by adding 27 grams of sludge (as provide, i.e. wet) into 2L of 1000 mg/L NaCl solutions (Table 1).

Table 1 [redacted] sludge and extractant for estimating resuspended/dissolved contaminants.

Parameter	Value	Unit	Comment
Total solids (TS)	0.181	fraction	-
Sample moisture	0.819	fraction	-
Sample moist weight	27	g wet weight (ww)	-
Sample dry weight	4.887	g dry weight (dw)	Sufficient weight to improve detection limits (2.44 g/L), a higher ratio of sludge/water than proposed (0.25 g/L).
Extractant	2	L 1000 mg/L NaCl	Approximate salinity of lagoon.

2.2 Assumptions

2.2.1 WTP Lagoon flows and [redacted] sludge loads

Lagoon flow and [redacted] sludge applied:

- 100 ML/day flow into lagoon (typical flow)
- 25 t/day dw of [redacted] sludge (maximum)

Conversion of extraction to loads added per day from the [redacted] sludge:

- $Load_{SLUDGE}$ (kg/day) = $((C_{EXT}*V_{EXT})/W_{EXT})*S$
- Where:
  - C_{EXT} = Concentration in extract (mg/L)
  - V_{EXT} = Volume of extract (2 L)
  - W_{DW} = Weight of extract sample dry (4.887 g)
  - S = Sludge per d (t/day dw)

2.2.2 Current lagoon concentrations

Current lagoon contaminant concentrations were estimated from measured concentrations:

- In lagoons (Fresh water), and
- Outlet of lagoons (Marine water)

Lagoons used were Lake Borie, L115E, L145W, L85W and Walshe.

Current irrigation water quality was estimated from Class A and C recycled water concentrations.

Current concentrations in lagoon were sourced from:

- Envirosys – Melbourne Water's database for measure concentrations of substances (11/2024 to 11/2025). And if not available from:
- ESA study (Jacobs 2022).

If data was available in both data sets, an average of the two was taken.

2.3 Lagoon removal estimates of metals

Four metals were identified as a potential concern when treating [redacted] solids in WTPs lagoons. Aluminium (Al), Copper (Cu), Iron (Fe), and Zinc (Zn). It was anticipated that the concentration of metals in effluent will decrease through the lagoons, as

metals typically settle out of solution with solids. Consequently, data for these metals has been collected from effluent throughout the 115E lagoon system and analysed. [1]

All assessed metals showed a decline in concentrations throughout the lagoon system. Broadly metals in lagoons reduce by about a half (0.5) after 10 lagoons. This was achieved mostly by 5 lagoons. This varied by metal from 0.550 to 0.770.
This did not take into account the potential for a larger decrease in concentrations during the first settling phase 55E Ponds 1-3. It is likely that a faster decrease would occur with settling in the first few lagoons. However, removal coefficients (Table 2) for the lagoons available were used to estimate lagoon concentration after applying the [redacted] sludge to the WTP lagoons.

Table 2 Metal removal through Lagoon 115E

Metal	Removal coefficient (5 Lagoons) (RC5)	Removal coefficient (10 Lagoons) (RC10)
Aluminium (Al)	0.654	0.548
Copper (Cu)	0.692	0.550
Iron (Fe)	0.772	0.672
Zinc (Zn)	0.750	0.644

2.4 Assessment of extracted and current concentrations in lagoons

The hazard quotient assessment used for relevant guidance:

- pH>6.5 for Aluminium in Fresh water (extract 6.5 to 6.6).
- $CaCO_3$ was between 30 to 150 mg/L (extract measured 89 to 100 mg/L).
- Median of total measured in lagoons (C_{LAGOON}).
- Median concentration increase from [redacted] sludge extraction data (C_{SLUDGE}, mg/L) was calculated as:

  Load (mg/day)/100000000 (L/day) × Removal Coefficient in lagoons (Table 2)

- Hazard Quotient (HQ) = C_{LAGOON}/GV, or
  = $(C_{LAGOON} + C_{SLUDGE})/GV$
  = C_{SLUDGE}/GV

[1] Estimating the settling rate of metals through the 115E Lagoon System, [redacted] 14/11/2025

Guidelines values were sourced from:

- GV database – Integrated Sewage Quality Management System (ISQMS) provided guidelines for Melbourne Water licence limits (2021) and irrigation water quality (ANZG 2024).
- ANZG Aquatic default guideline values (DGV) – 2025 and NEMP 3.0 (HEPA 2025, ANZG 2025 June). The Protective concentration for 90 percent protection of species (PC90) for all except PFAS as it is bioaccumulative, in this case the PC95 was used).
- ESA study guidelines (Jacobs 2022), typically used PC95. For comparison with another guideline source for aquatic systems and use of the more protective PC95.

2.5 Impact of [redacted] sludge extraction time

Concentrations of parameters measured in the 6-hour extraction period were typically higher, except for volatiles and dissolved oxygen (Figure 1). Therefore, minimising the mixing of the [redacted] sludge entering the WTP lagoon should also minimise dissolution or resuspension of contaminants in the [redacted] sludge.

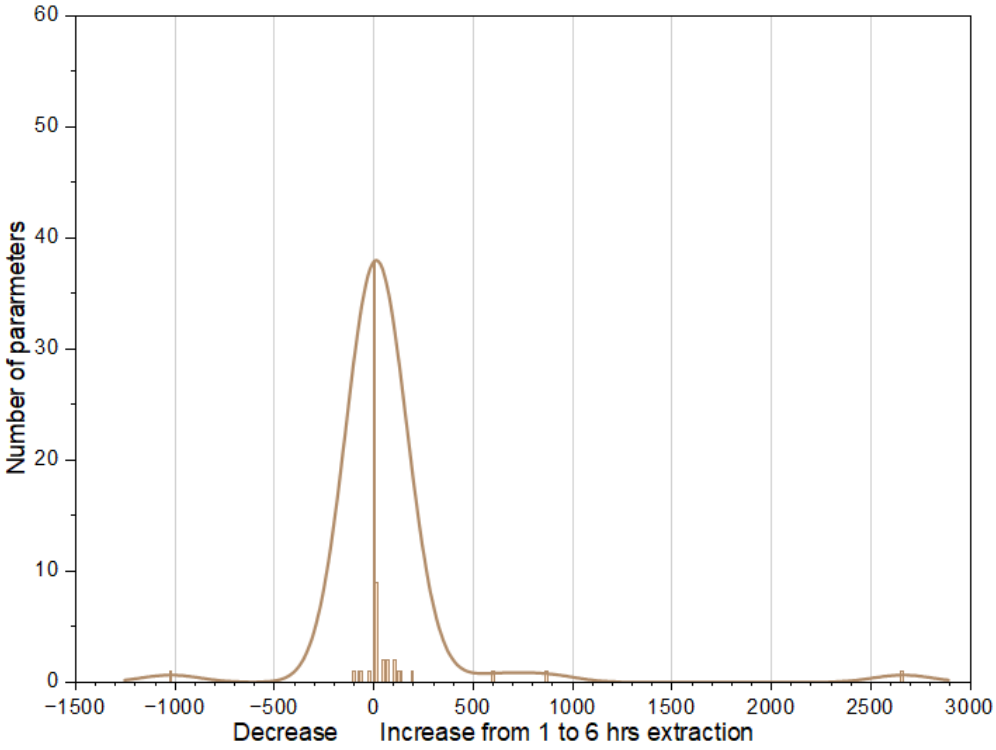

Figure 1 Frequency of parameter that increase (negative decrease) from 1 to 6-hour extraction times.

2.6 Hazard quotient analysis summary

Assessment of the Hazard Quotient (HQ) and quality of the data (Appendix 6.1 and 6.2) identified (Table 3):

- 10 high risk contaminants (6 contaminants as some metals were duplicated as total and soluble),
- 3 moderate risk contaminants, and
- 72 low risk contaminants.

In total 181 contaminants were measured in the [redacted] sludge extract and 122 were below the Limit of Reporting (LOR) (Appendix 6.2). The use of higher sludge to extractant ratios for the extract to avoid these LORs was not possible as it was considered to not represent the actual mixing in the lagoon (Table 1). That is, the high LOR count was unavoidable, however, in many cases the use of the LOR was still informative as the LOR indicated a low HQ in many cases. In total 85 HQs were of use (low, moderate or high risk confirmed) and predominantly identified low risk (dot points above).

All contaminant risk for irrigation water quality or concentrations for license limits were considered low and acceptable. Loads for license limits were not considered in this report.

Table 3 Summary risk estimates from using the sludge extraction process to estimate contaminant concentration increases from addition of [redacted] sludge to the 115E lagoon at WTP

Overall Risk [A]	Count	Comment	Action
High	10	a. Al, Cu, Fe and Zn (Aluminium, Copper and Zinc) HQ for fresh water is typical 1.3 to 2.8 currently and increased at the entry point of [redacted] sludge to 1.1 to 6.7 (1 hr extraction) to 3.3 to 13.9 (6 hr extraction). b. Ammonia HQ in fresh water currently 10.1 and increases to 13.2 (1 hr, decrease slightly with 6 hr extraction) at the entry point of [redacted] sludge. c. TKN loads to Port Phillip Bay could increase from 231 to 302 t/yr (1 or 6 hrs [redacted] sludge extraction). Discussed further in Section 2.7.1.	a. Verify lagoon concentrations from the initial addition of [redacted] sludge to lagoon 115E and monitoring concentration of these contaminants in the lagoon system. Assessing soluble and total concentrations. b. As above c. Verify and confirm loads and review [redacted] sludge t/day applied as required
Mod	3	a. Cadmium – Fresh water b. Cobalt – Fresh water c. PFOS – Fresh water	a. Verify and monitor through lagoon during commissioning of program b. As above c. As above
Low	72	Low hazard no further assessment required	None
unknown	1	Chromium total analysed, guideline is Cr III and Cr IV	If a concern and extract could be analysed for these Chromium ionic species. Or include these in ongoing monitoring during the verification phase.

Overall Risk [A]	Count	Comment	Action
LOR limited	3	The limit of reporting (LOR) restricted interpretation of: a. Thallium b. Silver, metal c. Benzo(a)pyrene	If recognize by any of the working group as a concern could be analysed a lower LOR in the extract. The HQ base on the LOR was 12 to 36 (6 hr extraction). Or include these parameters at a lower LOR in ongoing monitoring during the trial
No Guideline Value	118	No guideline value was identified for 118 parameters measured	None

[A] Overall Risk considers the Guideline values, Limits of Reporting (LOR) for lagoon and extract data and HQ for marine and fresh water, and Irrigation water.

It is also important to not for verification of the risk and removal through the lagoon system at full scale, that the individual concentrations of high HQ metals that could be experienced by addition of the [redacted] sludge to the WTP lagoon systems would be in the range of current concentrations experienced across the lagoon systems (e.g. Figure 2, Appendix 6.3). As such, close monitoring of full-scale operations and verification should not significantly modify the current risk, but long-term operation may need modifications of the operation to manage any long-term risk identified from the verification data obtained from monitoring the lagoon systems.

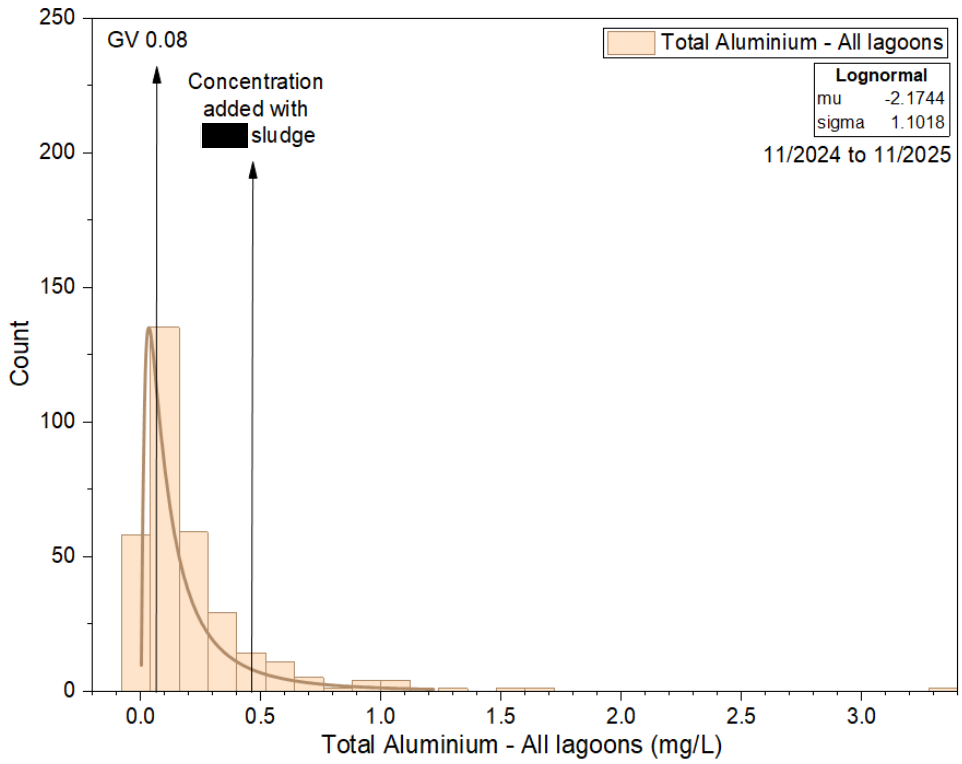

Figure 2 Variation in total aluminium concentration in Lagoon 115E ([redacted] sludge to WTP lagoon monitoring program). Appendix 6.3 includes other high Hazard Quotient metals.

2.7 Other risk identified

2.7.1 Total nitrogen loads

The TKN load increase from addition of 25 t dry weight/day of [redacted] sludge was estimated to be 231 to 302 t/yr (1 or 6 hrs extraction time). This increase is at the point of entry and missing and does consider removal through the lagoon. The current average removal of N through lagoon is approximately 22%, although this can be highly variable based several variables. Increases in N load to Port Phillip Bay will be monitored as a part of the lagoon verification program for as long as WTP is receiving [redacted] solids.

2.7.2 PFOS concentration in [redacted] biosolids

PFOS in biosolids identified from the RECON project managed by [redacted] indicated the [redacted] biosolids are higher in total PFOS concentrations (Figure 3). A shifting in higher PFOS biosolids [redacted] to WTP shifts the complication of managing the biosolids in the future. The implications from [redacted] PFOS concentrations needs to consider re impact on land application of biosolids.

PFOS was not resuspended during the extraction trial indicated that concentrations in lagoons would not be increased due to addition of the sludge to the lagoon.

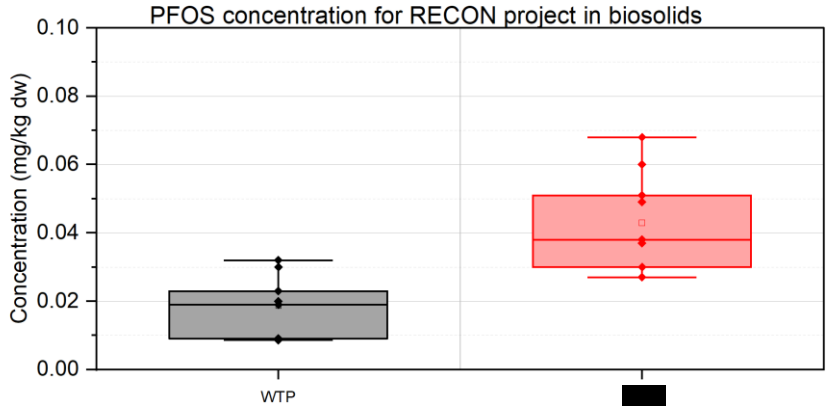

Figure 3 Variation in PFOS concentration of recently produced biosolids from the WTP and [redacted] (RECON project data, n = 9, 3 samples by 3 sampling dates ranging from 2023 to 2024)

3 Summary

The Tier 1 risk assessment of extracted [redacted] sludge in the laboratory using a method designed to represent what might happen in practice was completed. The guideline values for the contaminants indicated a low risk for 72 of the contaminants. A moderate risk for 3 and high risk for 6 contaminants (Table 3). The high risks identified are considered to be the worst case and estimated at the point of entry and mixing in the lagoon for nitrogen compounds. The associate risks are likely to be further decreased through the lagoon, and this should be verified on implementation of the program.

The concentrations of the four high risk metals have been estimated through the lagoon system; however, these estimates are compromised by the lagoon removal

rates estimates starting 4 ponds past the current sludge addition to the lagoon systems. That is, removal through the whole system is likely to be higher as the sludge is known to settle out predominantly in the first lagoon of the system. The current estimated concentrations post incorporation of sludge are also within the range currently experience in the lagoons systems. Therefore, implementation of full-scale operations can be used to verify the operational system and modify as required from the appropriate monitoring.

Our understanding of the removal of the moderate and high risk contaminants through the lagoon, from the point of added sludge, is limited and a full-scale operations is recommended to verify changes in concentrations of moderate and high risk contaminants identified in this memo. The actual risk posed through the lagoon system for these contaminants should be reassessed once concentrations are verified and modification to the sludge loads or mixing considered to minimise any risk identified.

4 Recommendations

Recommendations from this risk assessment are:

1. Verify concentration so moderate to high risk contaminants for [redacted] sludge when added to lagoon 115E at the WTP with the recommended additional monitoring throughout the lagoon system indicated in Table 3.
2. Minimising the mixing of the [redacted] sludge entering the WTP lagoon to minimise dissolution or resuspension of contaminants.
3. Modify sludge loads added, if high risk contaminants concentration levels are unacceptable for long-term operations of the sludge addition to lagoon 115E.
4. Modify sludge load based on flow rates in the lagoon systems, with a maximum of 25 t/day when flow rate a 100 ML/day or greater, and lower proportionally if flows are less than 100 ML/day.

Name of Approver **Title** Date Choose a date	Choose an item

Remember to fill in the Inflo reference below or delete prompt if not required - i.e. yellow highlight in footer below.

5 References

ANZG (2024). Draft Revised Chapter 9.2. Water Quality for Irrigation and General Water Uses: Guidelines. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Canberra.

ANZG (2025 June). Toxicant default guideline values for water quality in aquatic ecosystems. Canberra.

HEPA (2025). PFAS National Environmental Management Plan. Version 3.0, Heads of Environmental Protection Authorities Australia and New Zealand.

Jacobs (2022). Western Treatment Plant. Environmental Site Assessment. PAN 90008963, Jacobs for Melbourne Water.

6 Appendix

6.1 Hazard quotients

Contaminant	ISQMS Guideline Data base (GVQ)				ANZG - DGV				ESA study guidance					
					PC95mg.		PC90mg.L		PC95		PC95			
	License Limit		Irrigation		Marine		Fresh water		Marine		Fresh water		Irrigation	
	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge
Aluminium	--	--	0.0	0.1	0.2	0.5	1.5	6.4	12.6	35.1	2.2	9.3	0.0	0.1
Antimony	--	--	--	--	--	--	0.1	0.2	0.0	0.0	0.1	0.2	--	--
Arsenic	--	--	0.0	0.0	--	--	--	--	0.0	0.0	0.2	0.2	0.0	0.0
Barium	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	--	--	0.0	0.0	--	--	--	--	0.0	0.0	0.4	0.4	0.0	0.0
Boron	--	--	0.4	0.4	--	--	0.1	0.1	0.0	0.0	0.2	0.2	0.4	0.4
Cadmium	0.0	0.0	0.0	0.1	0.0	0.0	0.5	0.7	0.0	0.0	1.0	1.4	0.0	0.0
Cobalt	--	--	0.0	0.0	0.0	0.0	0.7	1.0	0.0	0.0	0.7	1.0	0.0	0.0
Copper	0.0	0.0	0.0	0.1	0.2	0.7	2.8	15.0	0.2	0.7	3.6	19.3	0.0	0.1
Iron	--	--	0.5	4.5	--	--	--	--	0.0	0.1	1.0	3.7	0.5	4.5
Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.3	0.6	0.0	0.0
Manganese	--	--	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.4
Mercury	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	1.7	2.3	0.1	0.1
Molybdenum	--	--	0.1	0.2	--	--	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.2
Nickel, metal	0.0	0.0	0.0	0.1	0.0	0.0	0.5	0.9	0.0	0.1	0.6	1.0	0.0	0.1
Selenium	--	--	0.1	0.1	--	--	0.1	0.1	0.0	0.0	0.2	0.3	0.1	0.1
Silver, metal	--	--	--	--	0.0	0.0	10.0	12.0	0.0	0.0	20.0	24.1	--	--
Strontium	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	--	--	--	--	0.0	0.0	33.3	36.7	--	--	--	--	--	--
Tin, metal	--	--	--	--	--	--	--	--	0.0	0.0	0.0	0.1	--	--
Titanium	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	--	--	0.0	0.0	0.0	0.0	0.8	1.0	0.0	0.0	0.8	1.0	0.0	0.0
Zinc	0.0	0.0	0.0	0.1	0.1	0.2	1.1	3.3	0.1	0.2	2.1	6.2	0.0	0.0
Aluminum;Soluble	--	--	0.0	0.1	0.0	0.3	0.4	5.3	2.6	25.1	0.5	7.7	0.0	0.1
Antimony;Soluble	--	--	--	--	--	--	0.1	0.2	0.0	0.0	0.1	0.2	--	--
Arsenic;Soluble	--	--	0.0	0.0	--	--	--	--	0.0	0.0	0.2	0.2	0.0	0.0
Barium;Soluble	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Contaminant	ISQMS Guideline Data base (GVQ)				ANZG - DGV				ESA study guidance					
					PC95mg.		PC90mg.L		PC95		PC95			
	License Limit		Irrigation		Marine		Fresh water		Marine		Fresh water		Irrigation	
	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge
Beryllium;Soluble	--	--	0.0	0.0	--	--	--	--	0.0	0.0	0.4	0.4	0.0	0.0
Boron;Soluble	--	--	0.4	0.4	--	--	0.1	0.1	0.0	0.0	0.2	0.2	0.4	0.4
Cadmium;Soluble	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.0	0.0	0.5	0.9	0.0	0.0
Chromium;Soluble	0.0	0.0	--	--	--	--	--	--	--	--	--	--	--	--
Cobalt;Soluble	--	--	0.0	0.0	0.0	0.0	0.7	1.0	0.0	0.0	0.7	1.0	0.0	0.0
Copper;Soluble	0.0	0.0	0.0	0.1	0.1	0.5	1.7	13.9	0.1	0.5	2.1	17.9	0.0	0.1
Iron;Soluble	--	--	1.0	5.1	--	--	--	--	0.0	0.1	0.8	3.5	1.0	5.1
Lead;Soluble	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.3	0.6	0.0	0.0
Manganese;Soluble	--	--	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3
Mercury;Soluble	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	1.7	2.3	0.1	0.1
Molybdenum, insoluble compounds (as Mo);Soluble	--	--	0.1	0.2	--	--	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.2
Nickel, metal;Soluble	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	0.0	0.1	0.5	0.8	0.0	0.0
Selenium;Soluble	--	--	0.5	0.5	--	--	0.6	0.6	0.1	0.1	2.0	2.1	0.5	0.5
Silver, metal;Soluble	--	--	--	--	0.0	0.0	10.0	12.0	0.0	0.0	20.0	24.1	--	--
Strontium;Soluble	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium;Soluble	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tin, metal;Soluble	--	--	--	--	--	--	--	--	0.0	0.0	0.0	0.1	--	--
Titanium;Soluble	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium;Soluble	--	--	0.1	0.1	0.0	0.0	1.7	1.9	0.0	0.0	1.7	1.9	0.1	0.1
Zinc;Soluble	0.0	0.0	0.0	0.1	0.0	0.2	0.7	2.9	0.0	0.2	1.3	5.4	0.0	0.0
Lanthanum;Soluble	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Kjeldahl Nitrogen as N	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hardness	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silicon	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulphur	--	--	--	--	--	--	--	--	--	--	--	--	--	--
INFORMATION	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PFBS	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluoropentanesulfonic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluorohexanesulfonic acid	--	--	0.8	1.0	--	--	--	--	--	--	--	--	--	--
PFHpS	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PFOS	--	--	0.87	0.91	0.1	0.1	0.21	0.22	5.3	5.4	120.9	125.3	--	--
PFNS	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PFDS	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluoropropanesulfonic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Contaminant	ISQMS Guideline Data base (GVQ)				ANZG - DGV				ESA study guidance					
					PC95mg.		PC90mg.L		PC95		PC95			
	License Limit		Irrigation		Marine		Fresh water		Marine		Fresh water		Irrigation	
	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge
Perfluorobutanoic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluoropentanoic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluorohexanoic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluoroheptanoic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluorooctanoic acid	--	--	0.1	0.1	--	--	--	--	0.0	0.0	0.0	0.0	--	--
Perfluorononanoic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluorodecanoic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluoroundecanoic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
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Perfluorotridecanoic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PFTeDA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PFHxDA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluorooctanesulfonamide	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-methyl perfluorooctanesulfonamide	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-ethyl perfluorooctanesulfonamide	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-MeFOSE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-EtFOSE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-methylperfluoro-1-octanesulfonamidoacetic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-ethyl perfluorooctanesulfonamidoacetic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4:2 FLUOROTELOMER SULFONIC ACID	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6:2FTS	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1H,1H,2H,2H-perfluorododecane sulfonic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Per and poly-fluoroalkyl substances (PFAS)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PFOS / PFHxS	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sum of WA DWER PFAS (n=10)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DO	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrate + Nitrite	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ammonia	0.0	0.0	--	--	0.1	0.2	10.7	12.8	0.2	0.3	20.6	24.7	--	--
Benzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
Toluene	--	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
Ethylbenzene	--	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
Xylenes	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene, monomer	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Contaminant	ISQMS Guideline Data base (GVQ)				ANZG - DGV				ESA study guidance					
					PC95mg.		PC90mg.L		PC95		PC95			
	License Limit		Irrigation		Marine		Fresh water		Marine		Fresh water		Irrigation	
	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge
Isopropylbenzene	--	--	--	--	0.0	0.0	0.1	0.1	--	--	--	--	--	--
1,2,4-trichlorobenzene	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
1,1,1,2-Tetrachloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-tetrachlorethane	--	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
1,1-Dichloroethane (1,1-DCE)	--	--	--	--	--	--	--	--	0.0	0.0	0.0	0.0	--	--
1,1-Dichloroethylene	--	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
1,1-dichloropropylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane (TCP)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloropropane	--	--	33.1	33.8	--	--	--	--	--	--	--	--	--	--
Ethylene Dibromide	--	--	12.9	13.1	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethene (cis)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-trans-dicloroethylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylene dichloride (EDC)	--	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
Propylene dichloride	--	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
1,3-dichloropropane	--	--	--	--	0.0	0.0	0.0	0.0	--	--	--	--	--	--
1,3-Dichloropropene(cis-)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-dichloropropene(trans-)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2-dichloropropane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1-Chloro-2-methylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-chlorotoluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobromomethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorobromomethane	--	--	--	--	--	--	--	--	0.0	0.0	0.0	0.0	--	--
Bromobenzene (phenyl bromide; bromobenzol)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	--	--	--	--	--	--	--	--	0.0	0.0	0.0	0.0	--	--
Tetrachloromethane	--	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
Chloroform	--	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	--	--
Monochlorobenzene	--	--	--	--	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	--	--
Dibromochloromethane	--	--	--	--	--	--	--	--	0.0	0.0	0.0	0.0	--	--
Dibromomethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-(Dicyanomethylene)-2-methyl-6-(4-(dimethylamino)styryl)-4H-pyran	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane (freon 11)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perchloroethylene	--	--	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	--	--
Vinyl chloride, monomer	--	--	--	--	0.0	0.0	0.4	0.4	0.0	0.0	0.5	0.5	--	--
Methyl chloroform	--	--	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--

Contaminant	ISQMS Guideline Data base (GVQ)				ANZG - DGV				ESA study guidance					
					PC95mg.		PC90mg.L		PC95		PC95			
	License Limit		Irrigation		Marine		Fresh water		Marine		Fresh water		Irrigation	
	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge
1,1,2-Trichlorethane	--	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
1,1,2-Trichloroethene	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
2-propanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acrylonitrile	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylhexyl acrylate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ISOPROPANOL (ISOPROPYL-ALCOHOL)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MEK	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MIBK	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH_C6-C9	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TRH_C6-C10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TRH_C6-C10 minus BTEX	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphtalene	--	--	--	--	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.2	--	--
Acenaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9H-Fluorene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	--	0.0	0.0	0.0	0.0	0.5	0.6	0.0	0.1	3.3	4.0	--	--
Anthracene	--	--	0.0	0.0	0.1	0.1	1.3	1.6	--	--	--	--	--	--
Fluoranthene	--	--	0.4	0.5	0.0	0.0	1.2	1.4	0.1	0.1	2.0	2.4	--	--
Pyrene	--	--	0.2	0.2	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo[k]fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	0.0	0.0	0.1	0.2	5.0	6.0	0.3	0.4	20.0	24.1	--	--
1,2,5,6-Dibenzanthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(ghi)perylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3,cd)pyrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sum of PAHs	0.0	0.0	--	--	--	--	--	--	--	--	--	--	--	--
Sum of selected BDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrobenzene	--	--	--	--	--	--	0.0	0.0	--	--	--	--	--	--
Phenol	0.0	0.0	0.8	13.6	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	--	--
Orthocresol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-methylphenol (m-cresol)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Para-cresol	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Contaminant	ISQMS Guideline Data base (GVQ)				ANZG - DGV				ESA study guidance					
					PC95mg.		PC90mg.L		PC95		PC95			
	License Limit		Irrigation		Marine		Fresh water		Marine		Fresh water		Irrigation	
	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge
2,4-dimethylphenol	--	--	--	--	--	--	1.0	1.1	0.0	0.0	1.0	1.1	--	--
2-nitrophenol	--	--	--	--	--	--	--	--	0.0	0.0	0.0	0.0	--	--
4-nitrophenol	--	--	0.0	0.0	--	--	0.0	0.0	--	--	--	--	--	--
Non Halogenated Phenols	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Parachlorometacresol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-chlorophenol	--	--	--	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0	--	--
2,4-DCP	--	--	0.0	0.0	--	--	0.0	0.0	0.0	0.0	0.0	0.0	--	--
2,6-dichlorophenol	--	--	--	--	--	--	0.1	0.1	0.0	0.0	0.1	0.1	--	--
Pentachlorophenate	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	--	--
2,3,4,5-Tetrachlorophenol (2,3,4,5-TeCP)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6-tetrachlorophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,5,6-tetrachlorophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol (2,4,5-TCP)	--	--	--	--	--	--	--	--	0.0	0.0	0.7	0.7	--	--
2,4,6-trichlorophenol	--	--	0.0	0.0	--	--	0.0	0.0	0.0	0.0	0.1	0.1	--	--
Phenols (Halogenated total)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sum of phenol, monochlorophenol, dichlorophenol and their isomers	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TRH>C10-C16 minus NAP	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH C10-C14	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH C15-C28	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH C15 - C28	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TRH>C10-C16	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TRH>C16-C34	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TRH>C34-C40	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sum of TRH>C10-C40	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oxidation-Reduction Potential	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TDS (Total Dissolved Solids)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH	--	--	--	--	--	--	--	--	--	--	--	--	--	--
EC_SED	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bicarbonate Alkalinity (as CaCO3)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbonate Alkalinity (as CaCO3)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OH AS CACO3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Alkalinity as CaCO3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoride	--	--	2.2	2.2	--	--	--	--	--	--	--	--	--	--
Cyanide (free)	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Contaminant	ISQMS Guideline Data base (GVQ)				ANZG - DGV				ESA study guidance					
					PC95mg.		PC90mg.L		PC95		PC95			
	License Limit		Irrigation		Marine		Fresh water		Marine		Fresh water		Irrigation	
	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge	Now	Sludge
TCN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrate ion	--	--	--	--	--	--	2.2	--	0.0	--	3.9	--	--	--
Sodium	--	--	2.3	--	--	--	--	--	--	--	--	--	--	--
Suspended Solids	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--
Phosphorus (yellow)	0.0	--	15.5	--	--	--	--	--	2.0	--	133.5	--	154.7	--
Phosphate ion	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lanthanum	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrite (NO2)	--	--	--	--	--	--	--	--	0.1	--	6.4	--	--	--
Lithium	--	--	0.0	--	--	--	--	--	--	--	--	--	--	--
Total Organic Nitrogen	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TDS - Inorganic	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SUM OF USEPA PFAS	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SUM OF ENHEALTH PFAS	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH C10-C36	--	--	--	--	--	--	--	--	--	--	--	--	--	--

6.2 Data quality (DQ) overall risk characterisation

Table 4. Contaminant DQ scores, comments from assessment of concentration and DQ and final Overall Risk identified

Contaminant	Envirosys Marine	Envirosys Fresh	Envirosys Irrigation	ESA study Marine	ESA study Fresh	ESA study Irrigation	Extr. DQ	Comment	GV check	Overall Risk
Aluminium	1.00	4.00	1.94	--	--	--	1.00	Significant changes in total aluminium at sludge point of entry, total should settle through lagoon		High
Antimony	0.80	3.52	1.19	--	--	--	1.00	Minimal shift in HQ now and at sludge entry point		Low
Arsenic	2.00	3.99	1.38	--	--	--	1.00	Minimal shift in HQ now and at sludge entry point		Low
Barium	1.00	4.00	2.00	--	--	--	1.00	NoGV	NoGV	NoGV
Beryllium	2.01	3.01	1.01	--	--	--	0.01	Minimal shift in HQ now and at sludge entry point		Low
Boron	3.00	4.00	3.00	--	--	--	1.00	Minimal shift in HQ now and at sludge entry point		Low
Cadmium	3.49	3.11	2.01	--	--	--	1.00	18% increase in HQ for total cadmium in fresh water sludge entry point, dissolved HQ <= 0.7, total LORlimited for fresh water with 0.11 baseline samples above LOR. i.e. HQ would be lower if the LOR was lower.		Mod
Chromium	3.95	3.88	1.44	--	--	--	1.00	Minimal shift in HQ now to added sludge at start of lagoon, GV is Cr II and Cr VI		unknown
Cobalt	0.80	3.79	1.25	--	--	--	1.00	Minimal shift in HQ now to added sludge at start of lagoon, HQ<=1		Mod
Copper	3.96	3.92	2.96	--	--	--	1.00	Significant increase freshwater at sludge entry point, HQ 3.6 to 12.7, need to check if GV is total or soluble		High
Iron	1.00	4.00	1.94	--	--	--	1.00	Significant increase freshwater at sludge entry point, need to check if GV is total or soluble		High
Lead	3.78	3.49	2.01	--	--	--	1.00	Minimal shift in HQ now to added sludge at start of lagoon		Low
Manganese	3.00	4.00	3.00	--	--	--	1.00	Minimal shift in HQ now to added sludge at start of lagoon		Low
Mercury	3.21	3.03	2.04	--	--	--	1.00	Minimal shift in HQ now to added sludge at start of lagoon		Low
Molybdenum	1.00	3.97	1.69	--	--	--	1.00	Minimal shift in HQ now to added sludge at start of lagoon		Low
Nickel, metal	4.00	4.00	0.89	--	--	--	1.00	Minimal shift in HQ now to added sludge at start of lagoon		Low
Selenium	0.80	3.32	1.01	--	--	--	1.00	Minimal shift in HQ now to added sludge at start of lagoon		Low
Silver, metal	0.01	0.01	1.01	--	--	--	1.00	Minimal shift in HQ now to added sludge at start of lagoon		Low
Strontium	1.00	1.00	1.00	--	--	--	1.00	No GV	NoGV	NoGV
Thallium	0.01	0.01	0.01	--	--	--	0.01	LORlimited		LORlimited
Tin, metal	0.01	3.26	1.06	--	--	--	1.00	Minimal shift in HQ now to added sludge at start of lagoon		Low
Titanium	1.00	1.00	0.01	--	--	--	1.00	No GV	NoGV	NoGV
Vanadium	0.80	1.00	1.31	--	--	--	1.00	Minimal shift in HQ now to added sludge at start of lagoon		Low
Zinc	4.00	4.00	3.00	--	--	--	1.00	Significant changes in soluble Zinc at sludge point of entry, check changes through lagoon		High
Aluminum;Soluble	0.01	--	--	1.00	1.00	0.50	1.00	Significant changes in soluble aluminium at sludge point of entry, total should settle through lagoon		High
Antimony;Soluble	0.50	--	--	0.60	0.01	0.50	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Arsenic;Soluble	1.00	--	--	1.00	1.00	1.00	1.00	Low HQ minimal change in HQ from addition of sludge		Low
Barium;Soluble	1.00	--	--	--	--	--	0.67	Low HQ minimal change in HQ from addition of sludge	NoGV	NoGV

Contaminant	Envirosys Marine	Envirosys Fresh	Envirosys Irrigation	ESA study Marine	ESA study Fresh	ESA study Irrigation	Extr. DQ	Comment	GV check	Overall Risk
Beryllium;Soluble	0.01	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Boron;Soluble	1.00	--	--	1.00	1.00	1.00	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Cadmium;Soluble	0.01	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Chromium;Soluble	0.01	--	--	--	--	--	0.01	Guidelines are Cr III and IV		Low
Cobalt;Soluble	0.01	--	--	0.40	0.01	0.01	0.01	LORlimited, HQ relatively low, so low risk		Low
Copper;Soluble	1.00	--	--	1.00	1.00	1.00	1.00	Significant increase freshwater at sludge entry point, HQ 2.1to 11.3, need to check if GV is total or soluble		High
Iron;Soluble	0.50	--	--	0.80	1.00	0.50	1.00	Irrigation water manageable, Fe for fresh water HQ>1 and significant increase from sludge		High
Lead;Soluble	0.01	--	--	0.20	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Manganese;Soluble	1.00	--	--	1.00	1.00	1.00	1.00	Low HQ minimal change in HQ from addition of sludge		Low
Mercury;Soluble	0.01	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Molybdenum, insoluble compounds (as Mo);Soluble	--	--	--	1.00	0.80	1.00	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Nickel, metal;Soluble	1.00	--	--	1.00	1.00	1.00	1.00	Low HQ minimal change in HQ from addition of sludge		Low
Selenium;Soluble	0.25	--	--	0.01	0.01	0.01	1.00	Low HQ minimal change in HQ from addition of sludge		Low
Silver, metal;Soluble	0.25	--	--	0.20	0.01	0.01	0.01	LOR limited, LOR of sludge extracted, and lagoon needs to be lower to access.		LORlimited
Strontium;Soluble	1.00	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
Thallium;Soluble	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
Tin, metal;Soluble	0.01	--	--	0.01	0.40	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Titanium;Soluble	0.01	--	--	--	--	--	1.00	No data	NoGV	NoGV
Vanadium;Soluble	1.00	--	--	0.01	0.01	0.01	0.01	LORlimited, HQ relatively low, so low risk		Low
Zinc;Soluble	1.00	--	--	1.00	0.60	1.00	1.00	Significant changes in soluble Zinc at sludge point of entry, check changes through lagoon		High
Lanthanum;Soluble	--	--	--	--	--	--	0.01	No data	NoGV	NoGV
Total Kjeldahl Nitrogen as N	4.00	4.00	4.00	1.00	1.00	1.00	1.00	TKN load added at start is 232 to 302 t/year - 22% see worksheet: edata Stats	NoGV	High
Hardness	--	--	--	--	--	--	1.00	No data	NoGV	NoGV
Silicon	4.00	--	--	--	--	--	1.00	No data	NoGV	NoGV
sulphur	--	--	--	--	--	--	1.00	No data	NoGV	NoGV
INFORMATION	--	--	--	--	--	--	1.00	No data	NoGV	NoGV
PFBS	3.55	2.01	3.46	0.20	0.20	0.01	0.01	NoGV	NoGV	NoGV
Perfluoropentanesulfonic acid	3.39	2.01	3.26	1.00	1.00	1.00	0.01	NoGV	NoGV	NoGV
Perfluorohexanesulfonic acid	4.00	2.04	3.99	1.00	1.00	1.00	0.01	LOR limited and HQ < 1		Low
PFHpS	3.15	2.01	3.03	1.00	1.00	0.50	0.01	NoGV	NoGV	NoGV
PFOS	3.99	3.00	3.99	1.00	1.00	1.00	1.00	ESA assessed on 99th percentile protective concentration (PC99), ANZG uses PC95		Mod
PFNS	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
PFDS	3.01	2.01	3.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Perfluoropropanesulfonic acid	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
Perfluorobutanoic acid	3.22	2.01	3.04	0.40	0.40	0.50	0.01	NoGV	NoGV	NoGV

Contaminant	Envirosys Marine	Envirosys Fresh	Envirosys Irrigation	ESA study Marine	ESA study Fresh	ESA study Irrigation	Extr. DQ	Comment	GV check	Overall Risk
Perfluoropentanoic acid	3.98	2.01	3.88	--	--	--	0.01	NoGV	NoGV	NoGV
Perfluorohexanoic acid	3.99	2.23	3.99	1.00	1.00	1.00	0.01	NoGV	NoGV	NoGV
Perfluoroheptanoic acid	3.99	2.01	3.97	1.00	1.00	1.00	0.01	NoGV	NoGV	NoGV
Perfluorooctanoic acid	4.00	2.27	4.00	1.00	1.00	1.00	0.01	Low HQs		Low
Perfluorononanoic acid	3.55	2.01	3.58	1.00	1.00	1.00	0.01	NoGV	NoGV	NoGV
Perfluorodecanoic acid	3.40	2.01	3.62	1.00	1.00	1.00	0.01	NoGV	NoGV	NoGV
Perfluoroundecanoic acid	3.01	2.01	3.01	0.40	0.60	0.01	0.01	NoGV	NoGV	NoGV
Perfluorododecanoic acid	3.01	2.01	3.01	0.40	0.40	0.01	0.01	NoGV	NoGV	NoGV
Perfluorotridecanoic acid	3.01	2.01	3.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
PFTeDA	3.01	2.01	3.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
PFHxDA	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
Perfluorooctanesulfonamide	3.23	2.01	3.06	1.00	0.40	0.01	0.01	NoGV	NoGV	NoGV
N-methyl perfluorooctanesulfonamide	3.01	2.01	3.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
N-ethyl perfluorooctanesulfonamide	3.01	2.01	3.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
N-MeFOSE	3.01	2.01	3.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
N-EtFOSE	3.01	2.01	3.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
N-methylperfluoro-1-octanesulfonamidoacetic acid	3.26	2.04	3.27	1.00	0.80	0.50	0.01	NoGV	NoGV	NoGV
N-ethyl perfluorooctanesulfonamidoacetic acid	3.40	2.08	3.27	1.00	0.80	0.01	0.01	NoGV	NoGV	NoGV
4:2 FLUOROTELOMER SULFONIC ACID	3.01	2.01	3.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
6:2FTS	3.28	2.01	3.50	0.80	0.80	1.00	0.01	NoGV	NoGV	NoGV
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	3.01	2.01	3.01	0.01	0.20	0.01	0.01	NoGV	NoGV	NoGV
1H,1H,2H,2H-perfluorododecane sulfonic acid	3.01	2.01	3.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Per and poly-fluoroalkyl substances (PFAS)	4.00	--	4.00	1.00	1.00	1.00	1.00	NoGV	NoGV	NoGV
PFOS / PFHxS	4.00	3.00	3.99	1.00	1.00	1.00	1.00	NoGV	NoGV	NoGV
Sum of WA DWER PFAS (n=10)	4.00	3.00	4.00	1.00	1.00	1.00	1.00	NoGV	NoGV	NoGV
PFOS SURROGATE	--	--	--	--	--	--	1.00	QA	NoGV	QA
PFOA SURROGATE	--	--	--	--	--	--	1.00	QA	NoGV	QA
DO	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
Nitrate + Nitrite	--	--	--	--	--	--	0.67	NoGV	NoGV	NoGV
Ammonia	3.87	3.95	3.69	1.00	1.00	1.00	1.00	S24% increase in HQ for freshwater from sludge at point of entry		High

Contaminant	Envirosys Marine	Envirosys Fresh	Envirosys Irrigation	ESA study Marine	ESA study Fresh	ESA study Irrigation	Extr. DQ	Comment	GV check	Overall Risk
Benzene	3.01	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Toluene	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Ethylbenzene	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Xylenes	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Styrene, monomer	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Isopropylbenzene	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
1,2,4-trichlorobenzene	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
1,1,1,2-Tetrachloroethane	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
1,1,2,2-tetrachlorethane	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
1,1-Dichloroethane (1,1-DCE)	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
1,1-Dichloroethylene	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
1,1-dichloropropylene	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
1,2,3-Trichloropropane (TCP)	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Dibromochloropropane	--	--	--	0.01	0.01	0.01	0.01	LORlimited, HQ shift low and for irrigation water TPI, so risk low		Low
Ethylene Dibromide	--	--	--	0.01	0.01	0.01	0.01	LORlimited, HQ shift low and for irrigation water TPI, so risk low		Low
1,2-Dichloroethene (cis)	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
1,2-trans-dicloroethylene	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Ethylene dichloride (EDC)	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Propylene dichloride	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
1,3-dichloropropane	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
1,3-Dichloropropene(cis-)	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
1,3-dichloropropene(trans-)	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
2,2-dichloropropane	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
1-Chloro-2-methylbenzene	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
4-chlorotoluene	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Chlorobromomethane	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
Dichlorobromomethane	--	--	--	0.01	1.00	0.50	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Bromobenzene (phenyl bromide; bromobenzol)	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Bromoform	--	--	--	0.01	0.01	0.50	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Tetrachloromethane	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Chloroform	--	--	--	0.01	1.00	0.50	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Monochlorobenzene	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Dibromochloromethane	--	--	--	0.01	0.01	0.50	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Dibromomethane	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
4-(Dicyanomethylene)-2-methyl-6-(4-(dimethylamino)styryl)-4H-pyran	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV

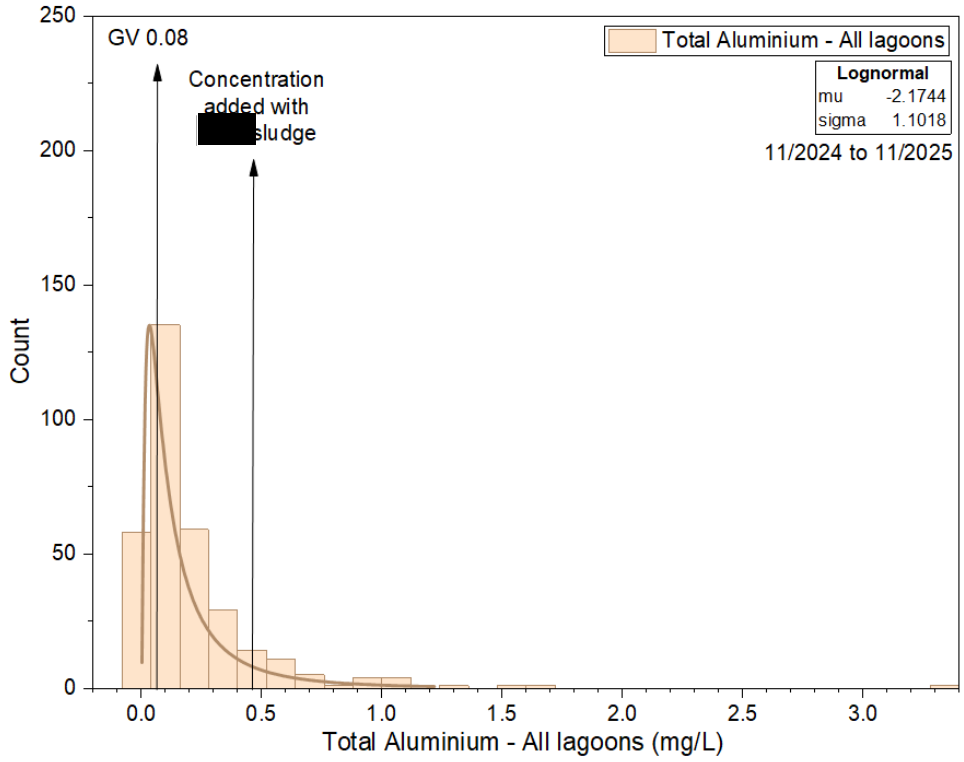
Contaminant	Envirosys Marine	Envirosys Fresh	Envirosys Irrigation	ESA study Marine	ESA study Fresh	ESA study Irrigation	Extr. DQ	Comment	GV check	Overall Risk
Trichlorofluoromethane (freon 11)	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Perchloroethylene	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Vinyl chloride, monomer	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Methyl chloroform	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
1,1,2-Trichlorethane	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
1,1,2-Trichloroethene	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
2-propanone	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
Acrylonitrile	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
Ethylhexyl acrylate	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
ISOPROPANOL (ISOPROPYL-ALCOHOL)	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
MEK	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
MIBK	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
TPH_C6-C9	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
TRH_C6-C10	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
TRH_C6-C10 minus BTEX	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
Naphtalene	--	--	--	0.01	0.01	0.01	0.01	Low HQ minimal change in HQ from addition of sludge		Low
Acenaphthalene	3.01	--	0.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Acenaphthene	3.01	--	0.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
9H-Fluorene	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Phenanthrene	3.04	--	0.01	0.01	0.01	0.01	0.01	Limited by LOR, HQ relatively low so probably low risk		Low
Anthracene	3.01	--	0.01	0.01	0.01	0.01	0.01	Limited by LOR, HQ relatively low so probably low risk		Low
Fluoranthene	--	--	--	0.01	0.01	0.01	0.01	Limited by LOR, HQ relatively low so probably low risk		Low
Pyrene	3.01	--	0.01	0.01	0.01	0.01	0.01	Limited by LOR, HQ relatively low so probably low risk		Low
Benzo(a)anthracene	3.01	--	0.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Chrysene	3.01	--	0.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Benzo(b)fluoranthene	3.01	--	0.01	--	--	--	0.01	NoGV	NoGV	NoGV
Benzo[k]fluoranthene	3.01	--	0.01	--	--	--	0.01	NoGV	NoGV	NoGV
Benzo(a)pyrene	3.01	--	0.01	0.01	0.01	0.01	0.01	LORlimited		LORlimited
1,2,5,6-Dibenzanthracene	3.01	--	0.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Benzo(ghi)perylene	3.01	--	0.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Indeno(1,2,3,cd)pyrene	3.01	--	0.01	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
Sum of PAHs	3.04	--	0.01	--	--	--	0.01	Low HQs		Low
Sum of selected BDE	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
Nitrobenzene	--	--	--	0.01	0.01	0.01	0.01	Low HQ		Low
Phenol	--	--	--	0.01	0.01	0.01	1.00	Operational TPI for irrigation, 115 E not used for irrigation		Low

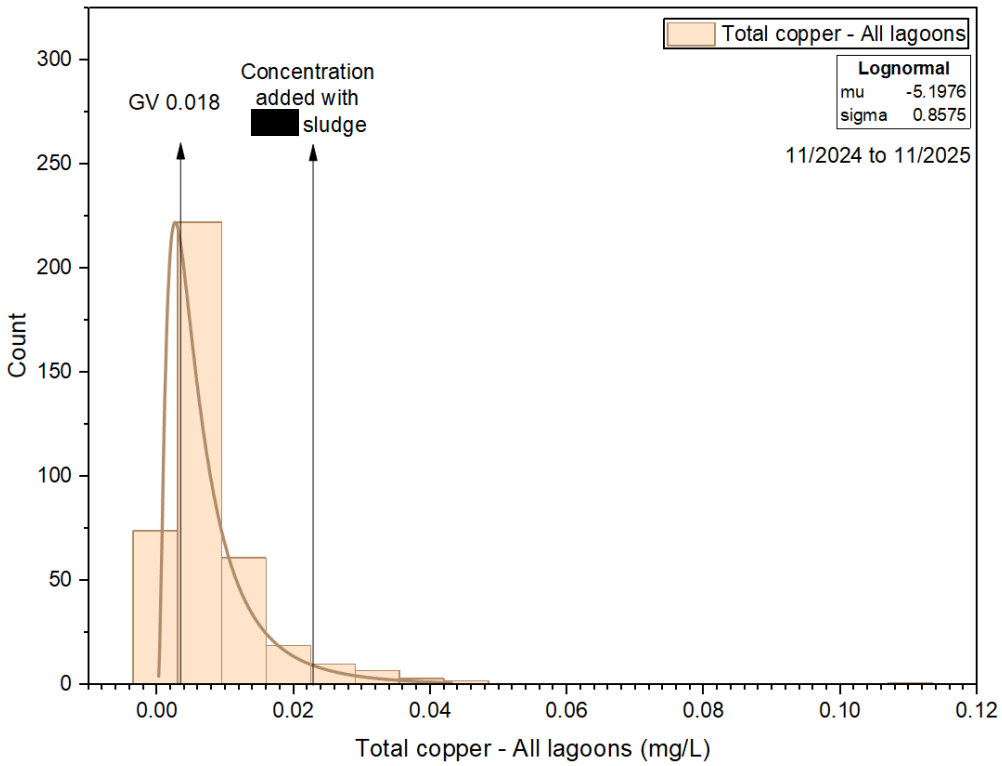
Contaminant	Envirosys Marine	Envirosys Fresh	Envirosys Irrigation	ESA study Marine	ESA study Fresh	ESA study Irrigation	Extr. DQ	Comment	GV check	Overall Risk
Orthocresol	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
3-methylphenol (m-cresol)	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
Para-cresol	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
2,4-dimethylphenol	--	--	--	0.01	0.01	0.01	0.01	LORlimited, HQ relatively low, so low risk		Low
2-nitrophenol	--	--	--	0.01	0.01	0.01	0.01	LowHQs		Low
4-nitrophenol	--	--	--	0.01	0.01	0.01	0.01	LowHQs		Low
Non Halogenated Phenols	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
Parachlorometacresol	--	--	--	0.01	0.01	0.01	0.01	NoGV	NoGV	NoGV
2-chlorophenol	--	--	--	0.01	0.01	0.01	0.01	LowHQs		Low
2,4-DCP	--	--	--	0.01	0.01	0.01	0.01	LowHQs		Low
2,6-dichlorophenol	--	--	--	0.01	0.01	0.01	0.01	LowHQs		Low
Pentachlorophenate	--	--	--	0.01	0.01	0.01	0.01	LowHQs		Low
2,3,4,5-Tetrachlorophenol (2,3,4,5-TeCP)	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
2,3,4,6-tetrachlorophenol	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
2,3,5,6-tetrachlorophenol	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
2,4,5-Trichlorophenol (2,4,5-TCP)	--	--	--	0.01	0.01	0.01	0.01	LowHQs, LORlimited		Low
2,4,6-trichlorophenol	--	--	--	0.01	0.01	0.01	0.01	LowHQs		Low
Phenols (Halogenated total)	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
Sum of phenol, monochlorophenol, dichlorophenol and their isomers	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
TRH>C10-C16 minus NAP	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
TPH C10-C14	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
TPH C15-C28	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
TPH C15 - C28	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
TRH>C10-C16	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
TRH>C16-C34	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
TRH>C34-C40	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
Sum of TRH>C10-C40	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
Oxidation-Reduction Potential	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
TDS (Total Dissolved Solids)	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
pH	4.00	4.00	2.00	--	--	--	1.00	NoGV	NoGV	NoGV
EC_SED	1.00	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
Bicarbonate Alkalinity (as CaCO3)	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV
Carbonate Alkalinity (as CaCO3)	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
OH AS CACO3	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
Alkalinity as CaCO3	--	--	--	--	--	--	1.00	NoGV	NoGV	NoGV

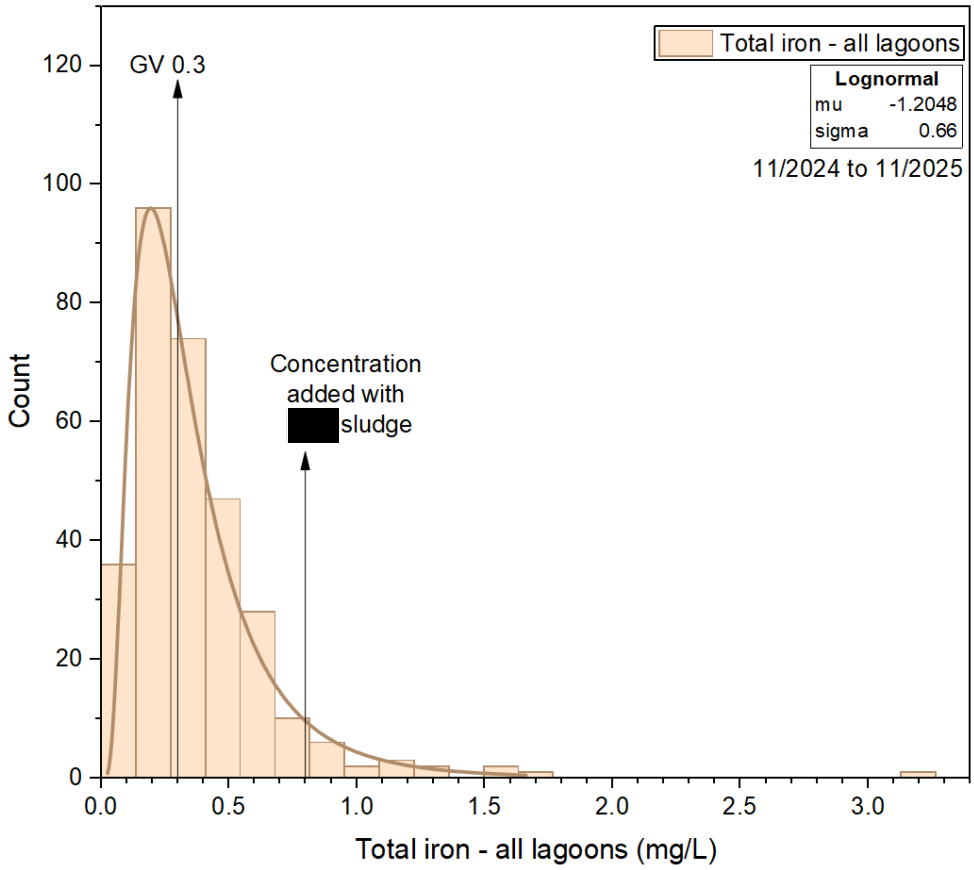
Contaminant	Envirosys Marine	Envirosys Fresh	Envirosys Irrigation	ESA study Marine	ESA study Fresh	ESA study Irrigation	Extr. DQ	Comment	GV check	Overall Risk
Fluoride	3.00	--	1.00	--	--	--	1.00	No HQ increase, and irrigation water risk has been identified and being monitored		Low
Cyanide (free)	--	--	--	--	--	--	0.01	NoGV	NoGV	NoGV
TCN	4.00	4.00	4.00	--	--	--	1.00	NoGV	NoGV	NoGV
Nitrate ion	3.92	3.95	4.00	1.00	1.00	1.00	--	No sludge data		NoSludgeData
Sodium	--	--	4.00	--	--	--	--	No sludge data		NoSludgeData
Suspended Solids	4.00	3.99	3.79	--	--	--	--	No sludge data		NoSludgeData
Phosphorus (yellow)	4.00	4.00	4.00	1.00	1.00	1.00	--	No sludge data		NoSludgeData
Phosphate ion	--	--	4.00	--	--	--	--	No sludge data	NoGV	NoGV
Lanthanum	--	--	0.01	--	--	--	--	No sludge data	NoGV	NoGV
TOC	1.00	4.00	4.00	--	--	--	--	No sludge data	NoGV	NoGV
Nitrite (NO2)	3.91	3.97	3.48	1.00	1.00	0.50	--	No sludge data		NoSludgeData
Lithium	--	--	1.01	--	--	--	--	No sludge data		NoSludgeData
Total Organic Nitrogen	--	--	2.00	--	--	--	--	No sludge data	NoGV	NoGV
TDS - Inorganic	--	--	2.00	--	--	--	--	No sludge data	NoGV	NoGV
SUM OF USEPA PFAS	--	--	4.00	--	--	--	--	No sludge data	NoGV	NoGV
SUM OF ENHEALTH PFAS	--			--	--	--		No sludge data	NoGV	NoGV
TPH C10-C36	--			--	--	--		NoGV	NoGV	NoGV

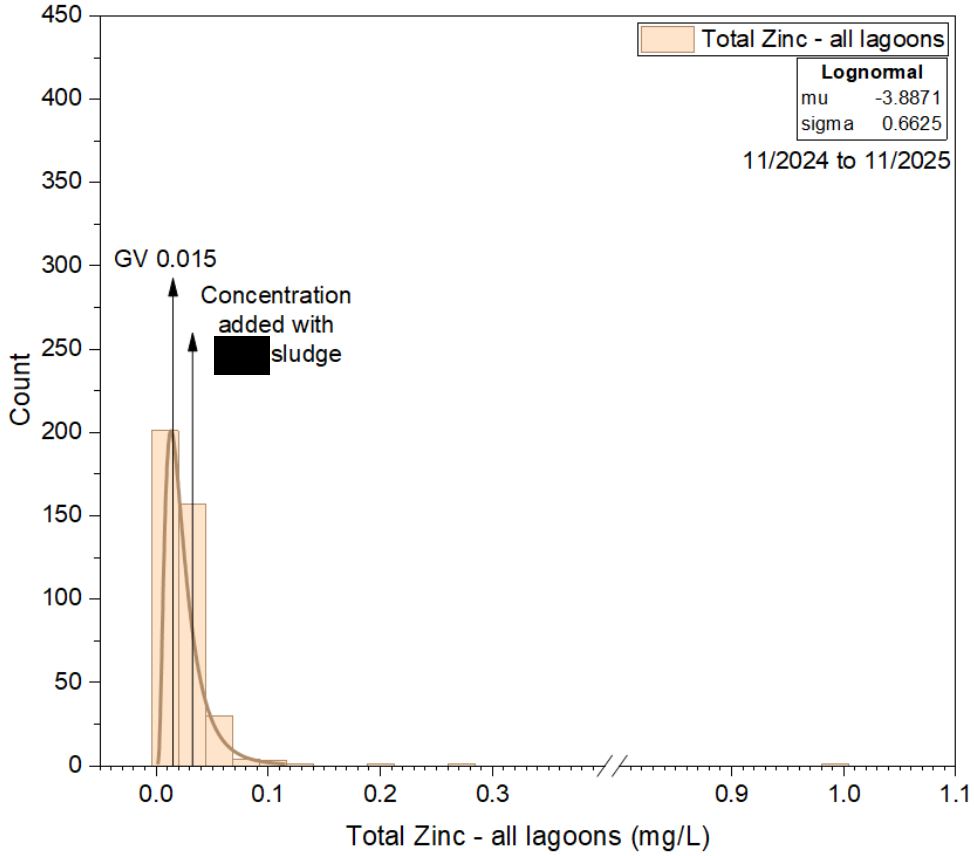
Data quality scores are based on 0=<10, 1=10 to <20, 2=20 to <50, 3>50 data points and the fraction of LOR/total count is the fraction. Where 0.01 indicate most if not all are <LOR, 4.0 = greater tan 50 data points and they are all above the LOR. LOR = Limit of Reporting, NoGV= No Guideline Value, HQ=Hazard Quotient, Ext. = Extract. Risks were assessed as Low = HQ <0.5, Mod HQ = 0.5 to <1.0, High HQ ≥1.0.

6.3 Distribution of high HQ metal concentration in lagoons compared with Guideline Values (GV) and concentations added from [redacted] sludge






Total iron - all lagoons
Lognormal
mu -1.2048
sigma 0.66
11/2024 to 11/2025
GV 0.3
Concentration added with [redacted] sludge
Count
Total iron - all lagoons (mg/L)


Total Zinc - all lagoons
Lognormal
mu -3.8871
sigma 0.6625
11/2024 to 11/2025
GV 0.015
Concentration added with [redacted] sludge
Count
Total Zinc - all lagoons (mg/L)