Environment Protection Authority

Little Newry State Forest water quality sampling

September 2025

NSW GOVERNMENT

Acknowledgement of Country

The NSW Environment Protection Authority acknowledges the Traditional Custodians of the land on which we live and work, honours the ancestors and the Elders both past and present and extends that respect to all Aboriginal people.

We recognise Aboriginal peoples' spiritual and cultural connection and inherent right to protect the land, waters, skies and natural resources of NSW. This connection goes deep and has since the Dreaming.

We also acknowledge our Aboriginal and Torres Strait Islander employees who are an integral part of our diverse workforce and recognise the knowledge embedded forever in Aboriginal and Torres Strait Islander custodianship of Country and culture.

Aboriginal artwork by Worimi artist Gerard Black

From March to July 2025, the NSW Environment Protection Authority (EPA) sampled water quality in waterways in and around Little Newry State Forest, near Valla on the NSW Mid-North Coast, following recent timber harvesting activities.

Two small historical mineral prospecting sites are located within the state forest. Community members have raised concerns that the harvesting operations may have resulted in elevated arsenic concentrations in local streams that could impact aquatic ecosystems and pose risks for recreational users (people swimming or wading).

The sampling program assessed whether the harvesting operations impacted aquatic ecosystems or the recreational water quality of nearby waterways.

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Background

Forestry Corporation of NSW carried out timber harvesting operations in Little Newry State Forest, near Valla on the NSW Mid-North Coast, from October to December 2024. Two small historical mineral prospecting sites are located within the state forest (Figures 1, 2 and 3) and community members raised concerns that harvesting operations may have resulted in elevated arsenic concentrations in local streams that could impact aquatic ecosystems and pose risks for recreational users (people swimming or wading).

The prospecting sites are each approximately three metres wide and two metres deep and overgrown with well-established shrubs and trees and covered in leaf litter and sticks. Forestry Corporation implemented measures to mitigate any potential risk of disturbing the sites, including establishing 30-metre exclusion zones around the sites.

From March to July 2025 the NSW Environment Protection Authority (EPA) sampled waterways within and downstream of Little Newry State Forest to investigate whether harvesting operations had impacted: (1) the aquatic ecosystems of streams within the forest; or (2) recreational water quality further downstream in the Oyster Creek estuary.

Figure 1 Historical mine workings next to Fairbrothers Road in Little Newry State Forest

Figure 2 Historical mine workings next to Boundary Road in Little Newry State Forest

Sampling approach

Forest streams – Assessing potential impacts on aquatic ecosystems

Six forest stream sites were sampled, including four in Little Newry State Forest (Eco1 to Eco4) and two background sites (Eco5 and Eco6). The background sites are similar to the Little Newry State Forest sites, being located on streams in the adjacent state forest, but without recent harvesting in their catchments (Table 1; Figure 3). Sites were sampled three times during or soon after rainfall, on 5 May, 29 May and 30 June 2025.

At each site, pH, electrical conductivity, dissolved oxygen and turbidity were measured using a handheld water-quality meter. Water samples were collected and sent for laboratory analysis for alkalinity, dissolved organic carbon, and dissolved and total metals, including arsenic III and V for samples with dissolved arsenic concentrations exceeding the aquatic ecosystem health guideline values.

Sediment was also sampled at these sites during the first sampling event for total organic carbon and metals. There was a thick layer of decomposing leaves and sticks at the sites and sediment samples were collected from beneath this material.

Sampling results were compared to freshwater/lowland rivers aquatic ecosystem health water and sediment quality guideline values as provided in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000; ANZG, 2018).

For metals in water, the dissolved concentrations were compared to the 95% species protection level guideline values, reflecting the water quality objective of protecting slightly to moderately disturbed ecosystems. For metals which are known to bioaccumulate, the more conservative 99% species protection level was used. Dissolved metals were used as this is the part that is absorbed or used by aquatic organisms such as fish and invertebrates.

The sampling and analysis methods were consistent with the *Approved methods for the sampling and analysis of water pollutants in NSW* (NSW EPA, 2022).

Estuary sites – Assessing potential impacts on recreational water quality

Two estuary sites identified as potential swimming or wading locations were sampled, one downstream of Little Newry State Forest in Oyster Creek (Rec1) and one background site in Dalhousie Creek (Rec2; Table 1; Figure 3). The background site is similar to the Oyster Creek site, being located near the mouth of a similar estuary, but not downstream of Little Newry State Forest. Little Newry State Forest is a small proportion of the catchment of Rec1 so water quality at this site is also influenced by other catchment land-uses (e.g. agriculture) outside of Little Newry State Forest (Figure 3).

The estuary sites were sampled three times during dry weather, on 16 March, 17 June, and 24 July 2025. At each site, pH, electrical conductivity, dissolved oxygen, and turbidity were measured using a handheld water-quality meter. Water samples were collected and sent for laboratory analysis for dissolved and total metals, including arsenic III and V for samples with dissolved arsenic concentrations exceeding the aquatic ecosystem guideline values. To better characterise recreational water quality, samples were also analysed for enterococci (an indicator of faecal contamination).

Sampling results from the estuary sites were compared to the guideline values for recreational water quality set out in the *Guidelines for Managing Risks in Recreational Water* (NHMRC, 2008). Results were also compared to aquatic ecosystem health water quality guideline values for estuaries/marine waters, set out in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000; ANZG, 2018).

Total metal concentrations were compared to the recreational water quality guideline values. Dissolved metal concentrations were compared to the 95% species protection level, aquatic ecosystem health guideline values, and the more conservative 99% species protection level guideline values for metals which are known to bioaccumulate.

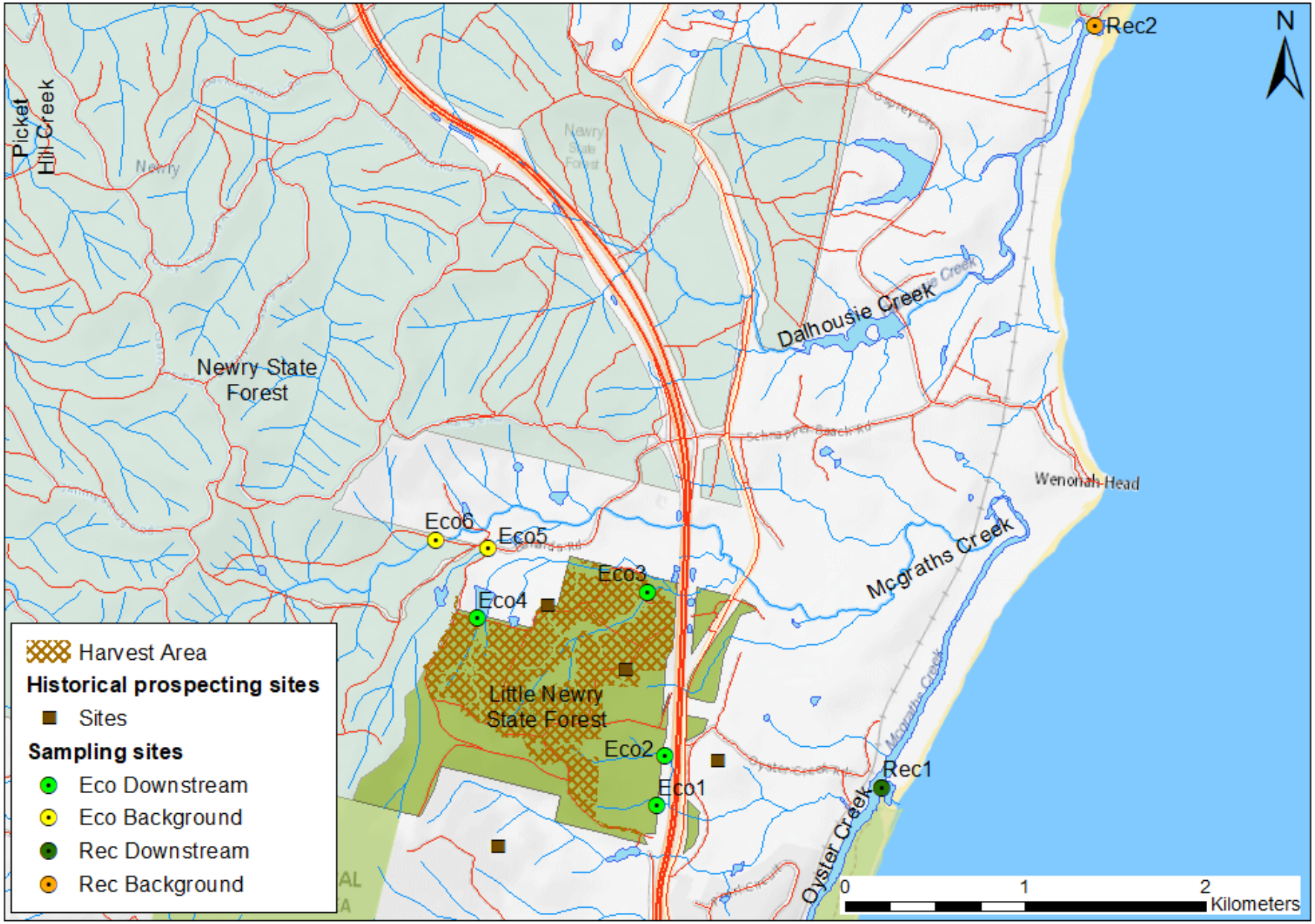

Figure 3 Map of harvest area, historical prospecting sites, and sampling sites

Table 1 Sampling sites

Sampling site	Waterway	Location description	Recent harvesting	Historical prospecting sites in catchment
Eco1	Unnamed stream	Stream site in southeastern part of Little Newry State Forest	Minimal harvesting activity within catchment	No
Eco2	Unnamed stream	Stream site in southeastern part of Little Newry State Forest with minimal harvesting activity within catchment	Minimal harvesting activity within catchment	No
Eco3	Unnamed stream	Stream site in northeastern part of Little Newry State Forest	Minimal harvesting activity within catchment	Two small prospecting holes
Eco4	Unnamed stream	Stream site in northwestern part of Little Newry State Forest	Minimal harvesting activity within catchment	No
Eco5	Unnamed stream	Stream site to the north of Little Newry State Forest	No	No
Eco6	McGraths Creek	Stream site to the northwest of Little Newry State Forest	No	No
Rec1	Oyster Creek	Site at mouth of estuary	Harvesting in a small portion of catchment	Two small historical prospecting sites within Little Newry State Forest and at least two other sites in other parts of the catchment
Rec2	Dalhousie Creek	Site at mouth of estuary	No	No

Results and discussion

Forest streams

Most analytes were below the relevant water and sediment quality guideline values in all samples.[1] Those that were above guideline values or outside of the guideline range are discussed below and summarised in Tables 1 and 2.

Physical and chemical characteristics

The pH was below the guideline range for aquatic ecosystem health (6.5 to 8.5; ANZECC & ARMCANZ, 2000) at all sites, including background sites, during the first sampling event, and the four Little Newry State Forest sites during the second sampling event (Table 2). The pH was within the guideline range at all sites during the third sampling event (Table 2). This indicates that streams in Little Newry State Forest and the surrounding area are naturally acidic at times. Waterways can be naturally acidic due to the accumulation of organic acids produced through the breakdown of organic matter. The aquatic ecosystems of these streams are adapted to these conditions.

The dissolved oxygen concentrations were within the guideline range for aquatic ecosystem health at the two background sites during the first sampling event (Table 2). Dissolved oxygen concentrations were below the guideline range in all other samples from the three sampling events (Table 2). The lower dissolved oxygen concentrations are probably caused by natural breakdown of leaves and other organic matter, noting that a thick layer of organic matter was observed at sites.

The turbidity was above the aquatic ecosystem health guideline value at one Little Newry State Forest site and one background site during the third sampling event (Table 2). These higher turbidity levels were likely the result of sediment laden runoff associated with recent rainfall. Turbidity was below the guideline value in all other samples from all three sampling events.

The electrical conductivity was below the guideline value in most samples but above the aquatic ecosystem health guideline value (300µS/cm) at some Little Newry State Forest and background sites during all three sampling events (Table 2). This indicates that electrical conductivity is naturally elevated at times in streams in the area and is probably related to the local geology, with the aquatic ecosystems adapted to these conditions.

Metals

The dissolved aluminium concentrations of samples were generally above the aquatic ecosystem health guideline value, apart from one Little Newry State Forest and one background site sample during the third sampling event (Table 2).

Dissolved copper concentrations were above the aquatic ecosystem health guideline value at three of the Little Newry State Forest sites and both background sites during the first sampling event, and at one of the background sites during the second sampling event (Table 2). Dissolved copper concentrations were below the aquatic ecosystem health guideline value in all other samples from both Little Newry State Forest and background sites (Table 2).

[1] An analyte is a chemical or physical property being measured in a water sample.

Dissolved iron concentrations exceeded the aquatic ecosystem health, interim working level (IWL), guideline value at all sites during all three sampling events (Table 2).

Given that dissolved aluminium, copper and iron concentrations were elevated both at Little Newry State Forest sites and background sites, it is likely that the concentrations of these metals relate to local geology rather than the recent harvest operations.

The dissolved chromium concentration of one sample was above the hexavalent chromium (CrVI) guideline value at one Little Newry State Forest site during the first sampling event (Table 2). Dissolved chromium can be composed of different forms of chromium including hexavalent chromium. Samples were not analysed for hexavalent chromium specifically; however, given that the dissolved concentration of this sample was only slightly above the hexavalent chromium guideline value, it is likely that the hexavalent chromium concentration was at or below the guideline value. Noting that the dissolved chromium concentration of all other samples was below the hexavalent chromium guideline value, it is unlikely that the harvest operations have increased dissolved chromium concentrations in the streams.

The dissolved cobalt concentration of one sample was above aquatic ecosystem health, interim working level (IWL), guideline value at one Little Newry State Forest site during the third sampling event (Table 2). Interim working levels are based on limited biological effects data (ANZG, 2018). ANZG (2018) therefore categorises these as low-reliability guideline values, to be used until more reliable guideline values are available (ANZG, 2018). Given that the concentrations of all other samples were below the interim working level, it is unlikely that the harvest operations have increased dissolved cobalt concentrations in the streams.

Arsenic III and arsenic V concentrations did not exceed the aquatic ecosystem health guideline values in any water samples (Table 2). On 29 May, the dissolved arsenic concentration at Eco2 (0.026 mg/L) was higher than the arsenic III and arsenic V aquatic ecosystem health guideline values (0.024 mg/L and 0.013 mg/L respectively; Table 2). However, the arsenic III and arsenic V concentrations of this sample were below the respective aquatic ecosystem health guideline values (Table 2). Dissolved arsenic concentrations of all other samples were below the arsenic III and arsenic V aquatic ecosystem health guideline values (Table 2). This indicates that the arsenic concentrations in the Little Newry State Forest streams are unlikely to pose risks to aquatic organisms.

The sediment sample from one of the Little Newry State Forest sites had an arsenic concentration of 24 mg/kg, exceeding the default guideline value for aquatic ecosystems (20 mg/kg) but below the high guideline value (70 mg/kg; Table 3). The arsenic concentrations of all other samples were below the default guideline value (Table 3). Noting that sediment was covered by a thick layer of decomposing leaves and sticks, and that sediment arsenic concentrations were low at the other Little Newry State Forest sites, the higher sediment arsenic concentration at this site is unlikely to relate to recent harvest activities.

Conclusions

The results indicate that the harvest operations have not impacted the aquatic ecosystems of forest streams in Little Newry State Forest.

Analytes were generally below the relevant water quality guideline value in all samples, and arsenic III and arsenic V concentrations did not exceed the guideline values in any water samples. Some physical and chemical stressors and metals exceeded the guideline value or were outside the

guideline range in samples both from Little Newry State Forest and background sites. This suggests that water quality is affected by local factors other than the harvest operations, including decomposition of organic matter and natural geology.

The sediment arsenic concentration was above the default sediment quality guideline value at one of the Little Newry State Forest sites. However, the higher sediment arsenic concentration at this site is unlikely to relate to recent harvest activities given that the sediment was sampled from beneath a thick layer of decomposing leaves and sticks, indicating that it represented longer-term rather than recent deposition. Additionally, sediment arsenic concentrations were low at the other three Little Newry State Forest sites.

Table 2 Summary of water quality exceedences of aquatic ecosystem health guideline values (ANZG 2018 and ANZECC/ARMCANZ 2000) at Little Newry State Forest (Eco1 to Eco4) and background (Eco5 and 6) forest stream sites

Bolded values indicate exceedences of guideline values. Refer to Appendix A, Table 6 for the full sampling results.

		02/05/2025						29/05/2025						30/06/2025					
		Little Newry State Forest sites				Background sites		Little Newry State Forest sites				Background sites		Little Newry State Forest sites				Background sites	
	Aquatic ecosystem health guideline value/range	**Eco1**	**Eco2**	**Eco3**	**Eco4**	**Eco5**	**Eco6**	**Eco1**	**Eco2**	**Eco3**	**Eco4**	**Eco5**	**Eco6**	**Eco1**	**Eco2**	**Eco3**	**Eco4**	**Eco5**	**Eco6**
Physiochemistry																			
pH	6.5 to 8.5	**5.57**	**5.34**	**5.84**	**5.83**	**6.22**	**6.26**	**5.94**	**5.42**	**6.17**	**6.09**	6.72	6.71	6.88	8.24	8.49	7.54	6.81	7.28
Dissolved oxygen (% sat)	85 to 110	**54**	**45.2**	**71.1**	**70.9**	90	85.5	**31.3**	**5.1**	**38.6**	**49.8**	**57**	**64.5**	**49.1**	**29.7**	**50.6**	**70.7**	**57.2**	**63.1**
Turbidity (NTU)	50	4.2	7.6	8.2	6.6	5.9	5.3	5.6	5.7	9.4	6.9	7.1	5.4	27.7	18	43.1	**75.8**	**88.3**	**14.8**
Electrical conductivity (µS/cm)	300	**339**	289	**349**	217	131	185	**309**	257	291	224	149	184	**354**	**368**	**420**	**423**	169	**336**
Dissolved metals (mg/L)																			
Aluminium	0.0008 (IWL pH<6.5) 0.055 (pH>6.5)	**0.09**	**0.26**	**0.46**	**0.58**	**0.35**	**0.15**	**0.1**	**0.17**	**0.33**	**0.23**	**0.11**	**0.09**	**0.05**	**0.12**	**0.17**	**0.15**	**0.23**	<0.04
Arsenic	0.013 (AsV guideline)	0.0062	0.0098	0.0018	0.0016	0.0012	0.0013	0.0076	**0.026**	0.0018	0.0013	0.0013	0.0012	0.0046	0.0098	0.0012	0.0009	0.0017	0.0009
Arsenic III	0.024	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	n/a	n/a	n/a	n/a	<0.001	<0.001	n/a	n/a	n/a	n/a
Arsenic V	0.013	0.005	0.008	0.002	<0.001	<0.001	<0.001	0.002	0.004	n/a	n/a	n/a	n/a	0.001	0.004	n/a	n/a	n/a	n/a
Chromium	0.001 (CrVI guideline)	<0.0005	0.0009	0.001	**0.0012**	<0.0005	<0.0005	<0.0005	0.0006	0.0007	0.0006	<0.0005	<0.0005	<0.0005	0.0006	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	0.0014 (IWL)	0.00075	0.00053	0.00072	0.0011	0.00024	0.00034	0.00066	0.00056	0.00046	0.00094	0.00028	0.00036	0.00091	0.00081	0.0011	**0.0026**	0.0008	0.00056
Copper	0.0014	0.0004	**0.0019**	**0.0033**	**0.0037**	**0.0020**	**0.0020**	0.0003	0.0003	0.0006	0.0002	0.0004	**0.0023**	0.0002	0.0009	0.0008	0.001	0.0009	0.0005
Iron	0.3 (IWL)	**2.9**	**3.3**	**1.8**	**1.6**	**0.8**	**0.6**	**2.5**	**5.9**	**1.5**	**1.5**	**0.8**	**0.5**	**2.7**	**4**	**1.2**	**2.7**	**1.7**	**0.4**

IWL = Interim working level guideline value based on limited biological effects data

Table 3 Summary of water quality exceedences of the sediment quality guideline values (ANZG 2018) at Little Newry State Forest (Eco1 to Eco4) and background (Eco5 and 6) forest stream sites on 02/05/2025

Bolded values indicate exceedences of guideline values. Refer to Appendix A, Table 7 for the full sampling results.

	Sediment quality guideline value		Little Newry State Forest sites				Background sites	
	Default	**High**	**Eco1**	**Eco2**	**Eco3**	**Eco4**	**Eco5**	**Eco6**
Arsenic (mg/kg)	**20**	**70**	**24**	10	4	6	4	<4

Estuary sites

Most analytes were below the relevant water quality guideline values or laboratory limit of reporting in all samples. Those that were above guideline values or outside of the guideline range are discussed below and summarised in Tables 3 and 4.

Recreational water quality

The total arsenic concentrations of all samples were below the recreational water quality guideline value (Table 4), indicating thar arsenic levels are unlikely to pose risks to people swimming or bathing in the estuaries.

The dissolved oxygen concentrations of some samples from both sites were below the recreational water quality guideline value (Table 4). The lower dissolved oxygen concentrations at times likely relate to natural breakdown of leaves and other organic matter.

Enterococci concentrations were above the microbial assessment category A threshold (≤40 colony forming units per 100mL; NHMRC, 2008) at Dalhousie Creek during the first two sampling events (Table 4). All other samples were below this threshold. Enterococci concentrations below the microbial assessment category A threshold indicate a low risk of gastroenteritis illness, with an average probability of less than one case per 100 exposures (NHMRC, 2008). This increases to one case in 20 exposures for concentrations within the microbial assessment category B range (41 to 200 cfu/100mL; NHMRC, 2008).

There were no other exceedences of recreational water quality guidelines at either site (Table 4).

The results did not indicate any water quality risks for people swimming or bathing in the Oyster Creek estuary.

Aquatic ecosystem health

The dissolved oxygen concentrations of the Oyster Creek (Rec1) samples were slightly higher than those of the Dalhousie Creek (Rec2) samples and some samples from both sites were below the guideline range for aquatic ecosystem health of estuaries (Table 5). The lower dissolved oxygen concentrations at times likely relate to natural breakdown of leaves and other organic matter.

Dissolved aluminium concentrations were above the aquatic ecosystem health guideline value at Dalhousie Creek during two of the three sampling events (Table 5). The dissolved aluminium concentrations of all other samples from both sites were below the laboratory limit of reporting, noting that this limit was marginally above the guideline value.

Dissolved iron concentrations were above the aquatic ecosystem health interim working level at Dalhousie Creek during two of the three sampling events (Table 5). The dissolved iron concentrations of all other samples from both sites were below the interim working level.

The aquatic ecosystem health guideline values for arsenic III and V in marine water, set out in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, are based on limited biological effects data (ANZG, 2018). ANZG (2018) therefore categorises these as low reliability guideline values, to be used as interim working levels until more reliable guideline values are available (ANZG, 2018).

Arsenic V concentrations were above the aquatic ecosystem health interim working level in all three samples from Oyster Creek (Rec1), while concentrations were below the interim working level in all three samples from Dalhousie Creek (Rec2; Table 5). The arsenic III concentrations of all samples

from Rec1 and Rec2 were below the aquatic ecosystem health interim working level (Table 5). Little Newry State Forest is unlikely to be the source of the elevated arsenic V concentrations in Oyster Creek given that the concentrations were much lower at the Little Newry State Forest sites.

Conclusions

The results did not indicate any water quality risks for people swimming or bathing in the Oyster Creek estuary. Arsenic concentrations were below the recreational guideline value, indicating that the levels are not a risk to people swimming or wading.

Arsenic V concentrations exceeded the aquatic ecosystem health interim working level. These elevated arsenic V concentrations are unlikely to be related to recent harvest activities given that concentrations were much lower at the Little Newry State Forest sites. Instead, these likely arise from the natural geology and/or other catchment influences outside of Little Newry State Forest.

Table 4 Summary of water quality exceedences of recreational water quality guideline values (NHMRC, 2008) at Oyster Creek (Rec1) and Dalhousie Creek (Rec2).

Bolded values indicate exceedences of guideline values. Refer to Appendix A, Table 8 for the full sampling results.

		16/04/2025		17/06/2025		29/07/2025	
		Rec1	Rec2	Rec1	Rec2	Rec1	Rec2
	Recreational water quality guideline value	Oyster Creek	Dalhousie Creek	Oyster Creek	Dalhousie Creek	Oyster Creek	Dalhousie Creek
Physiochemistry and faecal indicators							
Dissolved oxygen (% sat)	>80	87.7	**67.2**	**74.4**	**72.6**	101.6	95.4
Enterococcus (cfu/100mL)	<40 (Category A)	20	**110**	8	**104**	10	8

Enterococcus Category A – Enterococci concentrations below the microbial assessment category A threshold indicate a low risk of gastroenteritis illness, with an average probability of less than one case per 100 exposures (NHMRC, 2008). This increases to one case in 20 exposures for concentrations within the microbial assessment category B range (41 to 200 cfu/100mL; NHMRC, 2008).

Table 5 Summary of water quality exceedences of aquatic ecosystem health guideline values (ANZG 2018 and ANZECC/ARMCANZ 2000) at Oyster Creek (Rec1) and Dalhousie Creek (Rec2).

Bolded values indicate exceedences of guideline values. Refer to Appendix A, Table 9 for the full sampling results.

		16/04/2025		17/06/2025		29/07/2025	
		Rec1	Rec2	Rec1	Rec2	Rec1	Rec2
	Aquatic ecosystem health guideline value	Oyster Creek	Dalhousie Creek	Oyster Creek	Dalhousie Creek	Oyster Creek	Dalhousie Creek
Physiochemistry							
Dissolved oxygen (% sat)	80 to 110	87.7	**67.2**	**74.4**	**72.6**	101.6	95.4
Dissolved metals (mg/L)							
Aluminium	0.037	**<0.04**	**0.05**	**<0.04**	**0.09**	**<0.04**	**<0.04**
Arsenic	0.0023 (IWL AsIII)	**0.017**	0.002	**0.01**	0.001	**0.007**	<0.001
Arsenic III	0.0023 (IWL)	<0.001	0.002	<0.001	-	<0.001	-
Arsenic V	0.0045 (IWL)	**0.014**	<0.001	**0.006**	-	**0.005**	-
Iron	0.3 (IWL)	<0.1	**0.4**	<0.1	**0.5**	<0.1	<0.1

IWL = Interim working level guideline value based on limited biological effects data
99% SPL = 99% species protection level guideline value for toxicants that bioaccumulate

References

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Appendix A: Forest streams sampling results tables

Table 6 Little Newry State Forest (Eco1 to Eco4) and background (Eco5 and 6) forest stream water sampling results compared to the aquatic ecosystem health guideline values (ANZG 2018 and ANZECC/ARMCANZ 2000)

		02/05/2025						29/05/2025						30/06/2025					
		Little Newry State Forest sites				Background sites		Little Newry State Forest sites				Background sites		Little Newry State Forest sites				Background sites	
	Aquatic ecosystem health guideline value/range	**Eco1**	**Eco2**	**Eco3**	**Eco4**	**Eco5**	**Eco6**	**Eco1**	**Eco2**	**Eco3**	**Eco4**	**Eco5**	**Eco6**	**Eco1**	**Eco2**	**Eco3**	**Eco4**	**Eco5**	**Eco6**
Physiochemistry																			
pH	6.5 to 8.5	**5.57**	**5.34**	**5.84**	**5.83**	**6.22**	**6.26**	**5.94**	**5.42**	**6.17**	**6.09**	6.72	6.71	6.88	8.24	8.49	7.54	6.81	7.28
Dissolved oxygen (% sat)	85 to 110	**54**	**45.2**	**71.1**	**70.9**	90	85.5	**31.3**	**5.1**	**38.6**	**49.8**	**57**	**64.5**	**49.1**	**29.7**	**50.6**	**70.7**	**57.2**	**63.1**
Turbidity (NTU)	50	4.2	7.6	8.2	6.6	5.9	5.3	5.6	5.7	9.4	6.9	7.1	5.4	27.7	18	43.1	**75.8**	**88.3**	**14.8**
Electrical conductivity (µS/cm)	300	**339**	289	**349**	217	131	185	**309**	257	291	224	149	184	**354**	**368**	**420**	**423**	169	**336**
Total alkalinity (mg CaCO3/L)	-	9	6	13	9	13	15	7	<6	10	7	15	14	8	9	8	6	17	17
Dissolved organic carbon (mg/L)	-	8	13	24	16	7	7	5	6	18	11	6	5	4	8	12	8	8	4
Dissolved metals (mg/L)																			
Aluminium	0.0008 (IWL pH<6.5) 0.055 (pH>6.5)	**0.09**	**0.26**	**0.46**	**0.58**	**0.35**	**0.15**	**0.1**	**0.17**	**0.33**	**0.23**	**0.11**	**0.09**	**0.05**	**0.12**	**0.17**	**0.15**	**0.23**	<0.04
Antimony	0.009 (IWL)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	0.013 (AsV guideline)	0.0062	0.0098	0.0018	0.0016	0.0012	0.0013	0.0076	**0.026**	0.0018	0.0013	0.0013	0.0012	0.0046	0.0098	0.0012	0.0009	0.0017	0.0009
Arsenic III	0.024	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	n/a	n/a	n/a	n/a	<0.001	<0.001	n/a	n/a	n/a	n/a
Arsenic V	0.013	0.005	0.008	0.002	<0.001	<0.001	<0.001	0.002	0.004	n/a	n/a	n/a	n/a	0.001	0.004	n/a	n/a	n/a	n/a
Barium	-	0.029	0.018	0.03	0.025	0.014	0.014	0.026	0.017	0.024	0.023	0.013	0.013	0.027	0.019	0.032	0.046	0.018	0.022
Beryllium	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005

		02/05/2025						29/05/2025						30/06/2025					
		Little Newry State Forest sites			Background sites			Little Newry State Forest sites			Background sites			Little Newry State Forest sites			Background sites		
	Aquatic ecosystem health guideline value/range	Eco1	Eco2	Eco3	Eco4	Eco5	Eco6	Eco1	Eco2	Eco3	Eco4	Eco5	Eco6	Eco1	Eco2	Eco3	Eco4	Eco5	Eco6
Boron	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	0.0002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Calcium	-	3	2	3.4	2.3	2.7	3.4	2.8	1.6	3	2.3	2.6	3.4	2.5	2.2	3.9	3.7	3.2	6.9
Chromium	0.001 (CrVI guideline)	<0.0005	0.0009	0.001	**0.0012**	<0.0005	<0.0005	<0.0005	0.0006	0.0007	0.0006	<0.0005	<0.0005	<0.0005	0.0006	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	0.0014 (IWL)	0.00075	0.00053	0.00072	0.0011	0.00024	0.00034	0.00066	0.00056	0.00046	0.00094	0.00028	0.00036	0.00091	0.00081	0.0011	**0.0026**	0.0008	0.00056
Copper	0.0014	0.0004	**0.0019**	**0.0033**	**0.0037**	**0.0020**	**0.0020**	0.0003	0.0003	0.0006	0.0002	0.0004	**0.0023**	0.0002	0.0009	0.0008	0.001	0.0009	0.0005
Iron	0.3 (IWL)	**2.9**	**3.3**	**1.8**	**1.6**	**0.8**	**0.6**	**2.5**	**5.9**	**1.5**	**1.5**	**0.8**	**0.5**	**2.7**	**4**	**1.2**	**2.7**	**1.7**	**0.4**
Lead	0.0034	<0.0001	0.0001	0.0002	0.0003	0.0001	0.0001	<0.0001	<0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001
Lithium	-	0.0003	0.0003	0.0006	0.0002	0.0005	0.0024	0.0003	0.0003	0.0006	0.0002	0.0004	0.0023	0.0008	0.0006	0.0011	0.0004	0.0007	0.0055
Magnesium	-	7.8	5	7.3	4.7	3.1	4	7.3	5.6	5.9	5	2.8	4	7.3	6.5	9.5	9.5	3.8	8.1
Manganese	1.9	0.06	0.04	0.06	0.13	0.03	0.03	0.047	0.032	0.033	0.12	0.036	0.032	0.06	0.07	0.12	0.38	0.11	0.07
Mercury	0.00006 (99% SPL)	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004
Molybdenum	0.034	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0007	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Nickel	0.011	<0.0005	0.0008	0.0012	0.001	<0.0005	0.0008	<0.0005	0.0008	0.0009	0.0006	<0.0005	0.0005	0.0005	0.0007	0.0008	0.001	<0.0005	<0.0005
Potassium	-	1.4	1.4	1.4	1.3	1.1	1	1.3	1.4	1.3	1.7	1	1	1	1.2	1.7	1.9	1.4	1.5
Selenium	0.005 (99% SPL)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Silver	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Sodium	-	49	39	50	30	23	26	44	45	43	31	23	24	44	46	61	53	24	42
Strontium	-	0.044	0.037	0.059	0.041	0.036	0.048	0.046	0.028	0.047	0.042	0.039	0.047	0.045	0.04	0.077	0.081	0.055	0.099
Sulfur	-	1.8	2.1	2.5	1.3	2.1	2.2	1.8	2.4	2.3	1.2	1.7	2.2	2	2.5	2.2	1.2	1.4	3.4
Thallium	0.00003 (IWL)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

		02/05/2025						29/05/2025						30/06/2025					
		Little Newry State Forest sites			Background sites			Little Newry State Forest sites			Background sites			Little Newry State Forest sites			Background sites		
	Aquatic ecosystem health guideline value/range	Eco1	Eco2	Eco3	Eco4	Eco5	Eco6	Eco1	Eco2	Eco3	Eco4	Eco5	Eco6	Eco1	Eco2	Eco3	Eco4	Eco5	Eco6
Tin	-	<0.0002	<0.0002	<0.0002	0.0015	<0.0002	<0.0002	0.011	0.017	0.0042	0.0011	0.0005	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Titanium	-	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	0.006 (IWL)	0.0004	0.001	0.0017	0.0019	0.0011	0.001	0.0005	0.0008	0.0015	0.0011	0.0006	0.0008	0.0003	0.0006	0.0009	0.0006	0.0012	0.0004
Zinc	0.008	0.001	0.002	0.002	0.008	<0.001	0.001	0.002	0.006	0.004	0.005	0.004	0.001	0.002	0.004	0.003	0.003	0.002	0.001

IWL = Interim working level guideline value based on limited biological effects data
99% SPL = 99% species protection level guideline value for toxicants that bioaccumulate

Table 7 Little Newry State Forest (Eco1 to Eco4) and background (Eco5 and 6) forest stream sediment sampling results for 02/05/2025 compared to the sediment quality guideline values (ANZG 2018).

	Sediment quality guideline value		Little Newry State Forest sites				Background sites	
Concentration (mg/kg)	**Default**	**High**	**Eco1**	**Eco2**	**Eco3**	**Eco4**	**Eco5**	**Eco6**
Total organic carbon	-	-	45,000	140,000	31,000	45,000	33,000	21,000
Aluminium	-	-	8,000	4,800	6,600	9,200	12,000	8,200
Arsenic	20	70	**24**	10	4	6	4	<4
Barium	-	-	21	29	32	62	50	56
Beryllium	-	-	<1	<1	<1	<1	<1	<1
Boron	-	-	<10	<10	<10	<10	<10	<12
Cadmium	1.5	10	<1	<1	<1	<1	<1	<1
Calcium	-	-	160	300	440	630	350	920
Chromium	80	370	12	5	7	12	9	8
Cobalt	-	-	<1	<1	<1	2	2	2
Copper	65	270	4	7	7	13	15	10
Iron	-	-	8,900	5,700	4,500	9,300	8,700	5,700
Lead	50	220	5	5	4	6	4	6
Lithium	-	-	3	2	4	3	5	13
Magnesium	-	-	360	550	810	950	1,200	1,200
Manganese	-	-	20	16	38	98	47	53
Mercury	0.15	1	0.05	0.11	0.029	0.032	0.038	0.024
Molybdenum	-	-	1	2	<1	3	3	<1
Nickel	21	52	2	2	3	4	4	5
Phosphorus	-	-	120	190	100	170	160	110
Potassium	-	-	190	240	340	560	520	460
Selenium	-	-	<4	<4	<4	<4	<4	<5
Silver	1	4	<0.6	<0.6	<0.6	<0.6	<0.6	<0.7

	Sediment quality guideline value		Little Newry State Forest sites				Background sites	
Concentration (mg/kg)	**Default**	**High**	**Eco1**	**Eco2**	**Eco3**	**Eco4**	**Eco5**	**Eco6**
Sodium	-	-	210	330	120	130	130	110
Strontium	-	-	5	9	10	15	10	14
Sulfur	-	-	550	1,100	270	480	360	160
Thallium	-	-	<2	<2	<2	<2	<2	<2
Tin	-	-	<2	<2	<2	<2	<2	<2
Titanium	-	-	81	63	110	130	290	200
Vanadium	-	-	30	15	15	26	27	20
Zinc	200	410	6	9	11	13	16	18

Appendix B: Estuary sampling results tables

Table 8 Oyster Creek (Rec1) and Dalhousie Creek (Rec2) sampling results compared to the recreational water quality guideline values (NHMRC, 2008)

		16/04/2025		17/06/2025		29/07/2025	
		Rec1	Rec2	Rec1	Rec2	Rec1	Rec2
	Recreational water quality guideline value	Oyster Creek	Dalhousie Creek	Oyster Creek	Dalhousie Creek	Oyster Creek	Dalhousie Creek
Physiochemistry and faecal indicators							
pH	6.5 to 8.5	8.47	7.79	8.05	8.17	8	8.23
Dissolved oxygen (% sat)	>80	87.7	**67.2**	**74.4**	**72.6**	101.6	95.4
Turbidity (NTU)	-	2.5	8.8	5.6	2.3	<3	<3
Electrical conductivity (µS/cm)	-	36,600	16,800	39,300	12,700	22,400	22,200
Total alkalinity (mg CaCO3/L)	-	99	63	95	71	66	81
Dissolved organic carbon (mg/L)	-	5	8.4	3	13	3	6
Enterococcus (cfu/100mL)	<40 (Category A)	20	**110**	8	**104**	10	8
Total metals (mg/L)							
Aluminium	-	0.13	0.29	0.13	0.18	0.14	<0.04
Antimony	0.03	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	0.1	0.021	0.003	0.017	0.002	0.018	0.001
Barium	20	0.00096	0.016	0.01	0.012	0.014	0.014
Beryllium	0.6	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Boron	40	3	1.2	2.3	0.9	1.2	1.7
Cadmium	0.02	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Calcium	-	260	120	210	97	110	160
Chromium	0.5 (CrVI guideline)	<0.0005	0.0011	0.0006	0.0009	<0.0005	<0.0005
Cobalt	-	0.0004	0.0003	0.0005	0.0003	0.0005	0.0003

		16/04/2025		17/06/2025		29/07/2025	
		Rec1	Rec2	Rec1	Rec2	Rec1	Rec2
	Recreational water quality guideline value	Oyster Creek	Dalhousie Creek	Oyster Creek	Dalhousie Creek	Oyster Creek	Dalhousie Creek
Copper	20	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	-	0.2	1.1	0.8	0.9	0.8	0.2
Lead	0.05	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Lithium	-	0.11	0.047	0.08	0.04	0.04	0.06
Magnesium	-	880	400	700	270	370	470
Manganese	1	0.027	0.06	0.022	0.045	0.05	0.045
Mercury	0.01	<0.00005	<0.00005	<0.0004	<0.0004	<0.0004	<0.0004
Molybdenum	0.5	0.008	0.003	0.005	0.002	0.003	0.003
Nickel	0.2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Potassium	-	280	120	260	99	120	160
Selenium	0.04	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Silver	1	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Sodium	-	7400	3000	5900	2300	3000	4100
Strontium	-	5.1	2.2	4	1.8	2.3	3.2
Sulfur	-	650	280	480	180	230	300
Thallium	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Tin	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	-	0.0014	0.0012	0.0014	0.0011	0.0006	<0.0005
Zinc	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Enterococcus Category A – Enterococci concentrations below the microbial assessment category A threshold indicate a low risk of gastroenteritis illness, with an average probability of less than one case per 100 exposures (NHMRC, 2008). This increases to one case in 20 exposures for concentrations within the microbial assessment category B range (41 to 200 cfu/100mL; NHMRC, 2008).

Table 9 Oyster Creek (Rec1) and Dalhousie Creek (Rec2) sampling results compared to the aquatic ecosystem health guideline values (ANZG 2018 and ANZECC/ARMCANZ 2000).

		16/04/2025		17/06/2025		29/07/2025	
		Rec1	Rec2	Rec1	Rec2	Rec1	Rec2
	Aquatic ecosystem health guideline value	Oyster Creek	Dalhousie Creek	Oyster Creek	Dalhousie Creek	Oyster Creek	Dalhousie Creek
Physiochemistry							
pH	7.0 to 8.5	8.47	7.79	8.05	8.17	8	8.23
Dissolved oxygen (% sat)	80 to 110	87.7	67.2	74.4	72.6	101.6	95.4
Turbidity (NTU)	10	2.5	8.8	5.6	2.3	<3	<3
Electrical conductivity (µS/cm)	-	36,600	16,800	39,300	12,700	22,400	22,200
Total alkalinity (mg CaCO3/L)	-	99	63	95	71	66	81
Dissolved organic carbon (mg/L)	-	5	8.4	3	13	3	6
Dissolved metals (mg/L)							
Aluminium	0.037	**<0.04**	**0.05**	**<0.04**	**0.09**	**<0.04**	**<0.04**
Antimony	0.27 (IWL SnIII)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	0.0023 (IWL AsIII)	**0.017**	0.002	**0.01**	0.001	**0.007**	<0.001
Arsenic III	0.0023 (IWL)	<0.001	0.002	<0.001	-	<0.001	-
Arsenic V	0.0045 (IWL)	**0.014**	<0.001	**0.006**	-	**0.005**	-
Barium	-	0.0094	0.015	0.0099	0.011	0.013	0.015
Beryllium	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Boron	-	3.1	1.2	2.2	1	1.2	1.6
Cadmium	0.0007 (99% SPL)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Calcium	-	260	120	220	100	110	150
Chromium	0.0044	0.0008	0.0006	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	0.001	0.0003	0.0002	<0.001	<0.001	0.0004	0.0002
Copper	0.0013	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

		16/04/2025		17/06/2025		29/07/2025	
		Rec1	Rec2	Rec1	Rec2	Rec1	Rec2
	Aquatic ecosystem health guideline value	Oyster Creek	Dalhousie Creek	Oyster Creek	Dalhousie Creek	Oyster Creek	Dalhousie Creek
Iron	0.3 (IWL)	<0.1	**0.4**	<0.1	**0.5**	<0.1	<0.1
Lead	0.0044	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Lithium	-	0.11	0.048	0.08	0.04	0.04	0.05
Magnesium	-	880	380	0.08	0.04	390	490
Manganese	0.08 (IWL)	0.024	0.058	0.021	0.04	0.044	0.043
Mercury	0.0001 (99% SPL)	0.00005	0.00005	**<0.0004**	**<0.0004**	**<0.0004**	**<0.0004**
Molybdenum	0.023 (IWL)	0.008	0.003	0.005	0.002	0.003	0.003
Nickel	0.007 (99% SPL)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Potassium	-	330	120	230	100	130	160
Selenium	0.003 (IWL)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Silver	0.0014	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Sodium	-	7300	3000	6000	2500	3000	3700
Strontium	-	5	2.2	4.1	1.9	2	3.1
Sulfur	-	650	270	480	190	240	310
Thallium	0.017 (IWL)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Tin	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	0.1	0.0009	0.0006	0.001	0.0006	<0.0005	<0.0005
Zinc	0.008	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

IWL = Interim working level guideline value based on limited biological effects data
99% SPL = 99% species protection level guideline value for toxicants that bioaccumulate

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