Delta Coal

Mannering & CVC Collieries

Lake Macquarie Benthos Survey

Results No. 25

by Dr Emma Laxton

May 2025

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1. Executive Summary

J.H. & E.S. Laxton – Environmental Consultants P/L was engaged by Chain Valley Colliery to assess the potential effects of bord and pillar extraction mining beneath Lake Macquarie on benthic fauna.

The benthic survey and water quality monitoring were conducted on 5th and 6th May 2025. The survey involved the collection of benthos at 24 stations. The stations consisted of seven control, five reference and twelve impact stations. Two depth zones within the mud basin were sampled, -4.5m AHD and -5.5 to -6.0m AHD.

A total of 1207 marine benthic organisms greater than 1 mm in size were captured during the survey. These organisms represented twenty-one species. The fauna included one species of sponge; one nemertean and six polychaete worm species; eight bivalve species; one gastropod species; one chiton species, two echinoderm species and one crab species.

In May 2025, the greatest numbers of organisms were collected at benthic monitoring stations C7, IM12, R13 and IM11. The stations with the least number of organisms captured were IM4, IM6, IM9, IM10 and IM3. The number of organisms collected ranged from 24 to 307 organisms at the control monitoring stations, 26 to 87 organisms at the reference stations; and 9 to 132 organisms at the impact monitoring stations.

Polychaete worms and bivalves were the most commonly occurring organisms in the sediments off Summerland Point and in Chain Valley Bay and Bardens Bay in Autumn 2025. A total of 651 polychaetes were recorded, representing 53.9 percent of the organisms collected. *Sthenelais petitiboneae* was the most represented and widespread polychaete. A total of 295 *Sthenelais petitiboneae* were recorded, representing 24.4 percent of the organisms collected.

A total of 464 bivalves were collected during the benthic survey, representing 38.4 percent of the organisms collected. The most commonly occurring bivalve species recorded were *Theora lubrica*, *Dosinia sp*, *Corbula sp*, *Trichomya hirsuta*, *Saccostrea glomerata* and *Paphia undulata*. *Theora lubrica* was collected at 23 of the 24 monitoring stations. The majority of *Dosinia* were collected from the benthic monitoring station C7. A total of 89 *Corbula* were collected from 17 monitoring stations. *Trichomya hirsuta* was found at three monitoring stations only, with the greatest number collected from station IM11. Monitoring station IM11 also had a relatively high number of *Saccostrea glomerata*.

Other species that were recorded in the sediments were the sea star *Astropecten polyacanthus*, the brittle star *Ophionereis schayeri*, the sea slug *Philine angasi,* the sponge *Tetilla sp and* crab species.

At the time of survey sampling sites with benthos comprised predominantly of silt, were defined by relatively high numbers of the polychaete *Sthenelais petitiboneae*, and the bivalves *Theora lubrica* and *Paphia undulata.* Benthos with high portions of sand and/ or gravel were characterized by relatively higher numbers of the polychaete worms from the Chaetopteridae, Pectinariidae and Diopatra families, and the bivalve *Dosinia*. Stations that comprised predominantly of shell substrate were characterized by the presence of the mussel *Trichomya hirsuta* and the oyster *Saccostrea glomerata*. *Saccostrea glomerata* was encrusted on the large shell fragments. The dominant species were present at each depth zone indicating that water depth is not influencing the presence of these organisms in the sediments.

In Autumn 2025, the sampling stations with the greatest organism diversity were R13, IM2, IM12, C7 and IM11. Stations IM5, R12 and C3 also had relatively high organism diversity. Benthic monitoring stations R9, IM4 and IM9 had the lowest organism diversity. Species diversity ranged from 4 to 11 species at the control stations, 3 to 12 species at the reference stations, and 3 to 12 species at the impact stations. Comparisons of the average number of species collected at each monitoring station over a fourteen-year period revealed no discernable differences in diversity with water depth.

These findings support previous data collected between September 2016 and March 2020 in the Chain Valley Bay, Bardens Bay and Summerland Point regions. Despite reported changes in bed levels associated with Chain Valley Colliery underground workings, no statistical differences were found between the benthic assemblages at sites designated as Impact, Reference and Control stations (EMM, 2020).

Comparisons between the number of organisms collected during the Autumn sampling periods of March 2024 and May 2025 showed an increase in the numbers of organisms collected at seven of the 24 monitoring stations, a decrease at thirteen stations, and no change at four stations.

There was variation between the sediments collected within the study area. Three types of sediments were identified during the study. The most common sediment type comprised of a high portion of silt and shell fragments. The second sediment type consisted of silt and sand, and the third sediment or substrate type was composed largely of shell.

Rainfall in the months preceding the survey of May 2025 was 66.8 mm, 38.2 mm, 137.6 mm and 228 mm for January, February, March and April 2025 respectively (Cooranbong Lake Macquarie AWS No. 061412). By 6th May a further 30.6 mm had fallen in the catchment.

In May 2025 water temperature decreased slightly and conductivity, salinity, turbidity and pH increased with water depth due to rainfall events. Oxidation reduction potential was relatively uniform throughout the water column and dissolved oxygen either decreased with depth or was uniform throughout the water column. Testing of bottom water at each station found water temperature ranged from 20.37ºC to 21.85ºC. The average bottom water temperature was 21.23ºC. The conductivity of bottom waters ranged from 49.59 mS/cm to 51.34 mS/cm. Average bottom water conductivity was 50.78 mS/cm. Salinity of bottom waters ranged from 32.42 ppt to 33.71 ppt. Average bottom water salinity was 33.30 ppt. Average turbidity of the bottom waters ranged from 4.2 NTU to 40.3 NTU. The average bottom water turbidity was 8.95 NTU. Average pH of bottom waters ranged from pH 7.1 to pH 9.07. The average pH of bottom water was pH 8.33. The average ORP of bottom waters ranged from 440 mV to 630 mV. The average ORP of bottom waters was 494 mV . The average dissolved oxygen of bottom waters ranged from 40.7% saturation to 68% saturation. The average dissolved oxygen of bottom waters was 54.19% saturation. Average water quality did not vary significantly between control, impact and reference stations.

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3. Introduction

Lake Macquarie is the largest saline lake in New South Wales. It lies on the central coast between Sydney and Newcastle within the local government areas of Central Coast Council and Lake Macquarie Council. Lake Macquarie has a catchment of approximately 700 square kilometers and a water surface area of 110 square kilometers. The average depth of the lake is 8 metres (26 ft), with a maximum depth of 15 metres (49 ft). The lake has a permanent entrance to coastal waters at Swansea, and a shore length of approximately 174 kilometres.

The catchment of Lake Macquarie is largely rural with large areas of bushland and grazing land. The shoreline of Lake Macquarie is heavily urbanized, especially the eastern, western and northern shorelines. The region has a relatively long history of coal mining and power generation, with mining occurring since the late 1800s and the first power station at Lake Macquarie commencing operations in 1958.

Chain Valley Colliery (CVC) is an underground coal mine situated on the southern shores of Lake Macquarie about 1 kilometre south-east of the township of Mannering Park, NSW. It is located approximately 60 kilometres south of Newcastle and 80 kilometres north of Sydney. The mine has been operating since 1963. Mining is continuing within the Chain Valley Coal Lease Area using the miniwall method. Prior to mining, there were three economically viable seams in the lease area, namely the Wallarah seam (not mined since 1997); the Great Northern seam, and the Fassifern seam. In 2018 CVC went into voluntary receivership and was taken over by Great Southern Energy Pty Ltd (trading as Delta Coal) to provide coal for Vales Point Power Station.

Delta Coal is currently mining the Fassifern Seam beneath Lake Macquarie. To protect the lake foreshore, a protection zone has been established as part of the extraction plan. This zone, known as the High Water Mark (HWM) Subsidence Barrier, was calculated using a 35^{o} angle of draw from the depth of mining. The zone is approximately 130 meters wide. J.H. & E.S. Laxton – Environmental Consultants P/L was engaged by Delta Coal to assess the impact of previous miniwall mining on benthic fauna in Lake Macquarie.

In May 2025, the monitoring programme consisted of 24 stations, seven Control, five Reference and twelve Impact stations. Control stations are in areas of lakebed sufficiently remote from previous or proposed mining. Reference stations are located in areas of lakebed above subsidence areas of previous mining. Impact stations are in areas of lakebed where subsidence is expected/ experienced

from previous workings or proposed future workings. Two depth zones within the mud basin were sampled, -4.5m AHD and -5.5 to -6.0m AHD.

Over the years, as mining has progressed, reference stations have been reclassified as impact stations. Three reference stations (R7, R8, R11) were reclassified as impact stations in 2024. Due to this reclassification and in preparation for future extraction plans, two reference stations were added to the study (R12 and R13) in 2024.

The Autumn 2025 benthic communities survey and water quality testing were conducted on the 5th and 6th May.

4. Methods

Twenty-four stations were sampled in May 2025. At each station the following procedure was carried out:

- A GPS unit was used to locate the sampling station.
- A weighted line was used to measure water depth.
- A line with five sieve boxes (five replicates of 200 x 200 x 100 mm collection boxes with 1 mm mesh) and two core samplers (100 x 200 mm cylinders with 1 mm mesh) was cast overboard and secured as the boat drifted into position.
- The sieve and core samplers were filled using the forward momentum of the work boat.
- The samplers were then hauled to the surface, and the contents of each sampler placed in a clean, labeled zip-lock plastic bag.
- A 250mL jar was filled using the sediment collected from the core samplers.
- Processing of samples occurred in the laboratory.
- A water quality profile from surface to bottom or near bottom was measured using a calibrated Yeo-Kal 618 Water Quality Analyser. (The maximum reach of the Analyser is about 9 meters.) Water temperature, conductivity, salinity, pH, ORP, dissolved oxygen, turbidity and depth were measured. Each line of data was stored in the memory of the machine.

In the laboratory the marine benthic samples were treated in the following way:

- Each sample was tipped into a 1 mm mesh sieve and washed free of mud and fine sand.
- The washed material from each sample was then placed into an enamel dish and sorted for organisms.
- Organisms and parts of organisms were removed, counted, identified and the results entered into a spread sheet. This process was repeated until the debris of the entire sample had been examined.
- Sorted organisms were preserved in formaldehyde solution.

The 250mL samples of whole sediment were treated in the following way:

- Each sample was tipped into a 1L clear glass measuring cylinder and the volume made up to 800mL with freshwater.
- The cylinders were stoppered and shaken vigorously to suspend the sediment in the freshwater.
- The cylinders were then placed on the laboratory bench to allow the fractions of the sediment to settle.
- Fractions were decanted into separate measuring cylinders and allowed to settle.
- Once settled the volumes of each fraction (silt, sand, gravel and shell) were calculated and recorded. Results were displayed relative to the final volume of sediment collected.

5. Monitoring Points

Figure 5.1 shows the location of benthic monitoring stations, mine workings, and the SSD-S465 Consent boundary for May 2025. Twenty-four stations were sampled, seven control stations, five reference stations and twelve impact monitoring stations. Table 5.1 provides the depth zone, actual depth to the seabed at the time of sampling, and the location of each sampling station by eastings and northings using GDA 2020 coordinates. Two depth zones within the mud basin were sampled, -4.5m AHD and -5.5 to -6.0m AHD. Figure 5.2 shows the development consent areas for Delta Coal.

Figure 5.1 Location of benthic monitoring stations and mine workings

Table 5.1 Location, depth zone and actual depth to seabed for control (C), referenece (R) and impact (I) monitoring stations

Station	Type	Depth Zone (m) AHD	Depth (m) AHD	GDA 2020 Easting	GDA 2020 Northing
C1	C	-4.50	-4.80	364519	6330815
C2	C	-4.50	-5.20	366214	6332927
C3	C	-5.5 to -6.0m AHD	-5.10	366014	6333144
C4	C	--5.5 to -6.0m AHD	-4.50	364260	6332794
C5	C	-5.5 to -6.0m AHD	-6.30	367701	6334310
C6	C	--5.5 to -6.0m AHD	-5.50	363988	6332492
C7	C	-5.5 to -6.0m AHD	-5.00	366276	6334947
R1	R	-4.50	-6.80	364177	6331535
R9	R	-4.50	-5.00	365258	6331210
R10	R	--5.5 to -6.0m AHD	-5.90	365172	6334706
R12	R	--5.5 to -6.0m AHD	-7.00	365919	6330294
R13	R	--5.5 to -6.0m AHD	-5.90	366357	6334708
IM1	I	-4.50	-5.00	364738	6330734
IM2	I	-4.50	-4.10	364842	6332237
IM3	I	--5.5 to -6.0m AHD	-5.90	364693	6332101
IM4	I	--5.5 to -6.0m AHD	-6.90	364873	6332705
IM5 (R3)	I	-5.5 to -6.0m AHD	-7.00	364660	6332992
IM6 (R4)	I	-5.5 to -6.0m AHD	-6.30	364771	6332763
IM7 (R5)	I	--5.5 to -6.0m AHD	-6.70	364229	6333889

IM8 (R6)	I	--5.5 to -6.0m AHD	-6.00	364533	6334146
IM9 (R8)	I	--5.5 to -6.0m AHD	-6.10	364523	6332010
IM10 (R2)	I	-4.50	-4.80	365919	6330294
IM11 (R7)	I	--5.5 to -6.0m AHD	-7.00	366232	6333856
IM12 (R11)	I	--5.5 to -6.0m AHD	-5.00	367072	6333639

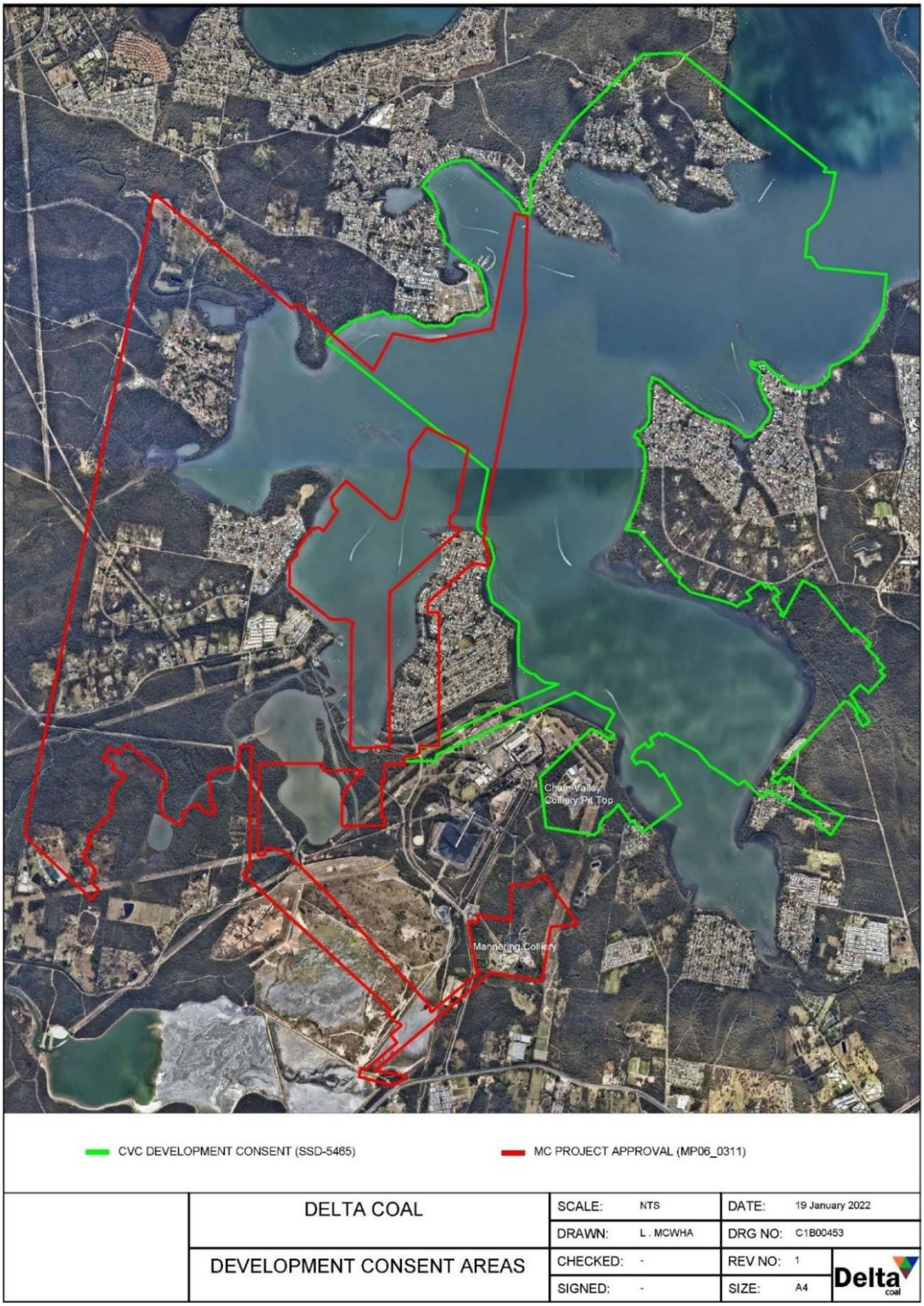


Figure 5.2 Development consent SSD-5465 and MP06_0311 areas

6. Results

a. Benthic organisms - Autumn 2025

Table 6A.1 shows the organisms found at each station sampled off Summerland Point and in Chain Valley Bay and Bardens Bay in May 2025. Benthic organisms were collected from twenty-four monitoring stations.

A total of 1207 benthic organisms greater than 1 mm in size were captured during the Autumn survey. These organisms represented twenty-one species (Table 6A.1). The fauna included one species of sponge (Plate A1), one nemertean and six polychaete worm species (Plate A3); eight bivalve species (Plate A5); one gastropod species (Plate A4); one chiton species (Plate A5), two echinoderm species (Plate A6) and one crab species.

In May 2025, the greatest numbers of organisms were collected at benthic monitoring stations C7 (307 organisms), IM12 (132 organisms), R13 (87 organisms) and IM11 (81 organisms). The stations with the least number of organisms captured were IM4 (9 organisms), IM6 (13 organisms), IM9 (12 organisms), IM10 (16 organisms) and IM3 (20 organisms). The number of organisms collected ranged from 24 to 307 organisms at the control monitoring stations, 26 to 87 organisms at the reference stations; and 9 to 132 organisms at the impact monitoring stations (Table 6A.1).

Polychaete worms and bivalves were the most commonly occurring organisms in the sediments off Summerland Point and in Chain Valley Bay and Bardens Bay in Autumn 2025. A total of 651 polychaetes were recorded, representing 53.9 percent of the organisms collected. *Sthenelais petitiboneae* was the most represented and widespread polychaete. It was found at all 24 benthic monitoring stations. A total of 295 *Sthenelais petitiboneae* were recorded, representing 24.4 percent of the organisms collected. The polychaete designated as “mud” was also found in relatively large numbers at 17 of the 24 monitoring stations. A total of 182 were recorded during the survey, representing 15.1 percent of the organisms collected. A total of 103 *Chaetopterus* parchment tubes were collected from 6 monitoring stations (Table 6A.1).

A total of 464 bivalves were collected during the benthic survey, representing 38.4 percent of the organisms collected. The most commonly occurring bivalve species were *Theora lubrica* (143 specimens), *Dosinia sp* (136 specimens), *Corbula sp* (89 specimens), *Trichomya hirsuta* (48 specimens), *Saccostrea glomerata* (17 specimens) and *Paphia undulata* (8 specimens). *Theora lubrica* was collected at 23 of the 24 monitoring stations. *Dosinia* was collected from nine monitoring stations,

with the majority (116 specimens) collected at benthic monitoring station C7. *Corbula* was collected from 17 monitoring stations. A total of 89 were recorded, mostly from monitoring stations IM7 (13 specimens), C2 (12 specimens) and R9 (10 specimens). *Trichomya hirsuta* was found at three monitoring stations only. The station with the greatest number of *Trichomya hirsuta* was IM11 with 42 specimens. Monitoring station IM11 also had a relatively high number of *Saccostrea glomerata* or the Sydney rock oyster (12 specimens). *Paphia undulata* was recorded at six of the monitoring stations only (Table 6A.1).

Two echinoid species were sampled. The sea star *Astropecten polyacanthus* was recorded at C7 (1 specimen) only. The brittle star *Ophionereis schayeri* was found at IM11 (3 specimens), R13 (4 specimens), C5 (2 specimens), IM2 (2 specimens), IM5 (1 specimen) and IM12 (1 specimen) (Table 6A.1).

A total of 57 sea slugs were recorded during the survey. *Philine angasi* was found at seven monitoring stations. The sites with the greatest number of *Philine* were C7 (38 specimens), R13 (6 specimens), IM12 (5 specimens), C3 (4 specimens) and IM3 (2 specimens).

One specimen of the sponge *Tetilla sp* was found at IM12 (Table 6A.1), and crab species were recorded at six stations with the greatest number caught at IM11 (8 specimens).

At the time of survey sampling sites with benthos comprised predominantly of silt, were defined by relatively high numbers of the polychaete *Sthenelais petitiboneae*, and the bivalves *Theora lubrica* and *Paphia undulata.* Benthos with high portions of sand and/ or gravel were characterized by relatively higher numbers of the polychaete worms from the Chaetopteridae, Pectinariidae and Diopatra families, and the bivalve *Dosinia*. Stations that comprised predominantly of shell substrate were characterized by the presence of the mussel *Trichomya hirsuta* and the oyster *Saccostrea glomerata* (Figs 6A.1 and 6A.2, Table 6B.2). *Saccostrea glomerata* encrusted the large shell fragments.

Table 6A.1 Organisms found in the sediments during Autumn 2025 benthic communities survey.

Control Station C1		Depth zone -4.50m AHD			Depth at time of survey -4.8m AHD				56 364519	6330815		Sampled 5-6 May 2025					
Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
C1.1	0	3	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
C1.2	0	3	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
C1.3	0	2	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0
C1.4	0	4	0	0	0	0	0	0	0	2	3	0	1	0	0	0	0
C1.5	0	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
Total	**0**	**13**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**14**	**0**	**1**	**0**	**0**	**0**	**0**
Mean/station	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.8	0.0	0.2	0.0	0.0	0.0	0.0
no./m2	0	65	0	0	0	0	0	0	0	25	70	0	5	0	0	0	0
No. species		**4**												**Total Organisms at Station**			**33**

Control Station C2		Depth zone-4.50m AHD			Depth at time of survey -5.2m AHD				56 366214	6332927		Sampled 5-6 May 2025					
Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
C2.1	0	1	0	2	0	0	0	0	0	3	1	0	0	0	0	0	0
C2.2	0	0	2	2	0	0	0	0	0	5	3	0	0	0	0	0	0
C2.3	0	0	0	2	0	0	0	0	0	3	2	0	0	0	0	0	0
C2.4	0	1	0	3	0	0	0	0	0	1	2	0	0	0	0	0	0
C2.5	0	2	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0
Total	**0**	**4**	**2**	**10**	**0**	**0**	**0**	**0**	**0**	**12**	**11**	**0**	**0**	**0**	**0**	**0**	**0**
Mean/station	0.0	0.8	0.4	2.0	0.0	0.0	0.0	0.0	0.0	2.4	2.2	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	0	20	10	50	0	0	0	0	0	60	55	0	0	0	0	0	0
No. species		**5**												**Total Organisms at Station**			**39**

Control Station C3		Depth zone -5.50m AHD			Depth at time of survey -5.1m AHD				56 366014	6333144		Sampled 5-6 May 2025					
Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Philine*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
C3.1	0	4	0	2	0	0	0	2	0	0	1	0	0	0	0	0	0
C3.2	0	2	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
C3.3	0	4	0	1	0	0	0	0	0	0	4	0	0	0	0	0	1
C3.4	0	5	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0
C3.5	0	0	0	2	0	0	0	2	0	0	5	0	0	0	0	0	0
Total	**0**	**15**	**0**	**5**	**0**	**0**	**0**	**4**	**0**	**0**	**12**	**1**	**2**	**0**	**0**	**0**	**1**
Mean/station	0.0	3.0	0.0	1.0	0.0	0.0	0.0	0.8	0.0	0.0	2.4	0.2	0.4	0.0	0.0	0.0	0.2
no./m2	0	75	0	25	0	0	0	20	0	0	60	5	10	0	0	0	5
No. species		**7**												**Total Organisms at Station**			**40**

Control Station C4 Depth zone -5.50m AHD Depth at time of survey -4.5m AHD 56 364260 6332794 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
C4.1	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
C4.2	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C4.3	0	4	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0
C4.4	1	3	0	3	0	0	0	0	0	1	1	0	0	0	0	0	0
C4.5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**3**	**18**	**2**	**4**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Mean/station	0.6	3.6	0.4	0.8	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	15	90	10	20	0	0	0	0	0	10	5	0	0	0	0	0	0

No. species 6 **Total Organisms at Station** 30

Control Station C5 Depth zone -5.50m AHD Depth at time of survey -6.3m AHD 56 367701 6334510 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid *Ophionereis*	Crab
C5.1	0	5	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0
C5.2	0	3	2	2	0	0	0	0	0	0	1	0	0	0	0	1	0
C5.3	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
C5.4	0	3	0	4	7	0	0	0	0	0	0	0	0	0	0	1	0
C5.5	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**16**	**2**	**14**	**10**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**0**
Mean/station	0.0	3.2	0.4	2.8	2.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.4	0.0
no./m2	0	80	10	70	50	0	0	0	0	0	5	0	0	0	0	10	0

No. species 6 **Total Organisms at Station** 45

Control Station C6 Depth zone -5.50m AHD Depth at time of survey -5.5m AHD 56 363988 6332492 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
C6.1	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
C6.2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C6.3	0	2	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0
C6.4	0	6	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1
C6.5	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Total	**0**	**13**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**4**	**3**	**0**	**0**	**0**	**0**	**0**	**1**
Mean/station	0.0	2.6	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.8	0.6	0.0	0.0	0.0	0.0	0.0	0.2
no./m2	0	65	5	10	0	0	0	0	0	20	15	0	0	0	0	0	5

No. species 6 **Total Organisms at Station** 24

Control Station C7 Depth zone -5.50m AHD Depth at time of survey -5.0m AHD 56 364736 6334947 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Philine*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Asteroidea *Astropecten*	Crab
C7.1	1	1	4	15	5	3	0	0	13	0	2	0	24	0	0	0	1
C7.2	0	1	2	20	10	0	0	0	5	0	3	0	22	0	0	0	0
C7.3	0	3	5	15	2	8	0	0	5	0	4	0	24	0	0	0	0
C7.4	0	0	3	11	6	11	0	0	11	0	1	0	22	0	0	1	0
C7.5	0	0	0	9	3	3	0	0	4	0	0	0	24	0	0	0	0
Total	**1**	**5**	**14**	**70**	**26**	**25**	**0**	**0**	**38**	**0**	**10**	**0**	**116**	**0**	**0**	**1**	**1**
Mean/station	0.2	1.0	2.8	14.0	5.2	5.0	0.0	0.0	7.6	0.0	2.0	0.0	23.2	0.0	0.0	0.2	0.2
no./m2	5	25	70	350	130	125	0	0	190	0	50	0	580	0	0	5	5

No. species 11 **Total Organisms at Station** 307

Station R1 Depth zone -4.50m AHD Depth at time of survey -4.6m AHD 56 364177 6331535 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
R1.1	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
R1.2	0	8	0	1	0	0	0	0	0	2	1	0	0	0	0	0	0
R1.3	0	3	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0
R1.4	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
R1.5	0	6	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**18**	**0**	**2**	**3**	**1**	**0**	**0**	**0**	**6**	**5**	**0**	**0**	**0**	**0**	**0**	**0**
Mean/station	0.0	3.6	0.0	0.4	0.6	0.2	0.0	0.0	0.0	1.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	0	90	0	10	15	5	0	0	0	30	25	0	0	0	0	0	0

No. species 6 **Total Organisms at Station** 35

Station R9 Depth zone -6.00m AHD Depth at time of survey -5.0m AHD 56 366232 6331210 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
R9.1	0	1	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0
R9.2	0	2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
R9.3	0	3	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0
R9.4	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
R9.5	0	2	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0
Total	**0**	**11**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**8**	**0**	**0**	**0**	**0**	**0**	**0**
Mean/station	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	0	55	0	0	0	0	0	0	0	50	40	0	0	0	0	0	0

No. species 3 **Total Organisms at Station** 29

Station R10 Depth zone -6.00m AHD Depth at time of survey -5.9m AHD 56 365172 6334708 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Philine*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
R10.1	0	4	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
R10.2	0	3	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0
R10.3	0	6	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0
R10.4	0	3	0	2	0	0	0	0	1	2	0	0	0	0	0	0	0
R10.5	0	4	0	0	0	0	0	0	0	5	3	0	0	0	0	0	0
Total	**0**	**20**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**11**	**7**	**1**	**0**	**0**	**0**	**0**	**0**
Mean/station	0.0	4.0	0.0	0.4	0.0	0.0	0.0	0.0	0.2	2.2	1.4	0.2	0.0	0.0	0.0	0.0	0.0
no./m2	0	100	0	10	0	0	0	0	5	55	35	5	0	0	0	0	0

No. species 6 **Total Organisms at Station** 42

Station R12 Depth zone -6.00m AHD Depth at time of survey -7.0m AHD 56 365919 6330294 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Philine*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
R12.1	0	3	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
R12.2	0	3	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
R12.3	0	4	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
R12.4	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
R12.5	0	5	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0
Total	**0**	**15**	**1**	**2**	**0**	**0**	**0**	**0**	**1**	**1**	**5**	**1**	**0**	**0**	**0**	**0**	**0**
Mean/station	0.0	3.0	0.2	0.4	0.0	0.0	0.0	0.0	0.2	0.2	1.0	0.2	0.0	0.0	0.0	0.0	0.0
no./m2	0	75	5	10	0	0	0	0	5	5	25	5	0	0	0	0	0

No. species 7 **Total Organisms at Station** 26

Station R13 Depth zone -5.50m AHD Depth at time of survey -5.9m AHD 56 366357 6334708 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Philine*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid *Ophionereis*	Crab
R13.1	0	0	1	3	1	0	1	0	0	0	0	0	4	0	0	0	0
R13.2	0	3	0	5	5	0	0	0	4	0	1	0	0	0	0	0	0
R13.3	0	4	0	5	4	3	0	0	0	0	2	0	0	0	0	1	0
R13.4	1	9	0	5	9	0	0	0	1	0	0	1	0	0	0	3	0
R13.5	0	2	0	3	3	1	0	0	1	0	1	0	0	0	0	0	0
Total	**1**	**18**	**1**	**21**	**22**	**4**	**1**	**0**	**6**	**0**	**4**	**1**	**4**	**0**	**0**	**4**	**0**
Mean/station	0.2	3.6	0.2	4.2	4.4	0.8	0.2	0.0	1.2	0.0	0.8	0.2	0.8	0.0	0.0	0.8	0.0
no./m2	5	90	5	105	110	20	5	0	30	0	20	5	20	0	0	20	0

No. species 12 **Total Organisms at Station** 87

Station IM1 Depth zone -4.50m AHD Depth at time of survey -5.0m AHD 56 364738 6330734 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
IM1.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IM1.2	0	4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
IM1.3	1	6	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
IM1.4	0	5	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0
IM1.5	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Total	**1**	**20**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**3**	**0**	**0**	**0**	**0**	**0**	**0**
Mean/station	0.2	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	5	100	0	0	0	0	0	0	0	25	15	0	0	0	0	0	0

No. species 4 **Total Organisms at Station** 29

Station IM2 Depth zone -4.50m AHD Depth at time of survey -4.1m AHD 56 364842 6332237 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Bivalve *Saccostrea*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid *Ophionereis*	Crab
IM2.1	0	5	0	2	0	0	0	0	5	1	1	0	0	1	5	0	0
IM2.2	0	5	0	4	1	0	0	0	0	0	2	0	0	0	0	0	1
IM2.3	0	6	0	2	0	0	0	0	0	0	2	1	0	0	0	1	1
IM2.4	0	2	0	1	0	0	0	0	0	0	1	0	3	0	0	1	0
IM2.5	0	5	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0
Total	**0**	**23**	**0**	**9**	**1**	**0**	**0**	**0**	**5**	**7**	**6**	**1**	**3**	**1**	**5**	**2**	**2**
Mean/station	0.0	4.6	0.0	1.8	0.2	0.0	0.0	0.0	1.0	1.4	1.2	0.2	0.6	0.2	1.0	0.4	0.4
no./m2	0	115	0	45	5	0	0	0	25	35	30	5	15	5	25	10	10

No. species 12 **Total Organisms at Station** 65

Station IM3 Depth zone -5.50m AHD Depth at time of survey -5.9m AHD 56 364693 6332101 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Philine*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
IM3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IM3.2	0	2	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0
IM3.3	0	3	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
IM3.4	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
IM3.5	0	3	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Total	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**5**	**3**	**0**	**0**	**0**	**0**	**0**	**0**
Mean/station	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	0	50	0	0	0	0	0	0	10	25	15	0	0	0	0	0	0

No. species 4 **Total Organisms at Station** 20

Station IM4 Depth zone -6.00m AHD Depth at time of survey -6.9m AHD 56 364673 6332705 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
IM4.1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
IM4.2	0	1	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0
IM4.3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
IM4.4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
IM4.5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Total	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**6**	**0**	**0**	**0**	**0**	**0**	**0**
Mean/station	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	0	10	0	0	0	0	0	0	0	5	30	0	0	0	0	0	0

No. species 3 **Total Organisms at Station** 9

Station IM5 (was R3) Depth zone -5.50m AHD Depth at time of survey -7.0 m AHD 56 364660 6332992 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Mactra*	Bivalve *Trichomya*	Ophuroid *Ophionereis*	Crab
IM5.1	0	2	0	1	0	0	0	0	0	3	0	1	0	0	0	0	0
IM5.2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IM5.3	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
IM5.4		3	0	1	0	0	0	0	0	1	1	1	2	0	1	0	0
IM5.5	0	4	0	1	0	0	0	0	0	0	2	1	0	0	0	1	0
Total	**0**	**12**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**7**	**3**	**3**	**2**	**0**	**1**	**1**	**0**
Mean/station	0.0	2.4	0.0	0.6	0.0	0.0	0.0	0.0	0.0	1.4	0.6	0.6	0.4	0.0	0.2	0.2	0.0
no./m2	0	60	0	15	0	0	0	0	0	35	15	15	10	0	5	5	0

No. species 8 **Total Organisms at Station** 32

Station IM6 (was R4) Depth zone -6.00m AHD Depth at time of survey -6.3 m AHD 56 364771 6332763 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
IM6.1	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
IM6.2	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
IM6.3	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
IM6.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IM6.5	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Total	**0**	**7**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**3**	**0**	**0**	**0**	**0**	**0**	**0**
Mean/station	0.0	1.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	0	35	0	5	0	0	0	0	0	10	15	0	0	0	0	0	0

No. species 4 **Total Organisms at Station** 13

Station IM7 (was R5) Depth zone -6.00m AHD Depth at time of survey -6.7 m AHD 56 364229 6333889 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
IM7.1	0	1	0	1	0	0	0	0	0	1	3	0	0	0	0	0	0
IM7.2	0	7	0	0	0	0	0	0	0	6	3	0	1	0	0	0	0
IM7.3	0	4	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0
IM7.4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
IM7.5	0	5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Total	**0**	**17**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**13**	**8**	**0**	**1**	**0**	**0**	**0**	**0**
Mean/station	0.0	3.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0	2.6	1.6	0.0	0.2	0.0	0.0	0.0	0.0
no./m2	0	85	0	5	0	0	0	0	0	65	40	0	5	0	0	0	0

No. species 5 **Total Organisms at Station** 40

Station IM8 (was R6) Depth zone -6.00m AHD Depth at time of survey -6.8 m AHD 56 364533 6334146 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
IM8.1	0	3	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0
IM8.2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
IM8.3	0	2	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0
IM8.4	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
IM8.5	0	3	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Total	**0**	**8**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**6**	**5**	**0**	**0**	**0**	**0**	**0**	**0**
Mean/station	0.0	1.6	0.0	0.4	0.0	0.0	0.0	0.0	0.0	1.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	0	40	0	10	0	0	0	0	0	30	25	0	0	0	0	0	0

No. species 4 **Total Organisms at Station** 21

Station IM9 (was R8) Depth zone -6.00m AHD Depth at time of survey -6.1 m AHD 56 364323 63322010 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
IM9.1	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
IM9.2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
IM9.3	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
IM9.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IM9.5	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Total	**0**	**7**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**
Mean/station	0.0	1.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	0	35	0	5	0	0	0	0	0	0	20	0	0	0	0	0	0

No. species 3 **Total Organisms at Station** 12

Station IM10 (was R2) Depth zone -4.50m AHD Depth at time of survey -4.8 m AHD 56 365919 6330294 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Gastropod *Nassarius*	Gastropod *Bedeva*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve *Anadara*	Bivalve *Trichomya*	Ophuroid	Crab
IM10.1	0	2	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0
IM10.2	0	1	0	0	0	0	0	0	0	4	0	0	0	1	0	0	0
IM10.3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IM10.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IM10.5	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**3**	**0**	**0**	**1**	**0**	**0**	**0**
Mean/station	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.6	0.0	0.0	0.2	0.0	0.0	0.0
no./m2	0	30	0	0	0	0	0	0	0	30	15	0	0	5	0	0	0

No. species 4 **Total Organisms at Station** 16

Station IM11 (was R7) Depth zone -6.00m AHD Depth at time of survey -7.0 m AHD 56 366232 6333856 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Mollusca Polyplacophora	Ophuroid *Ophionereis*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve juvenile	Bivalve *Trichomya*	Bivalve *Saccostrea*	Crab
IM11.1	0	3	1	0	0	0	0	0	0	0	0	0	0	0	5	0	4
IM11.2	0	2	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0
IM11.3	0	2	0	0	0	0	0	0	2	0	0	0	0	0	13	2	1
IM11.4	0	1	0	0	0	0	0	0	0	0	0	0	1	0	18	7	0
IM11.5	0	1	1	0	0	0	0	1	1	0	0	0	0	0	6	3	3
Total	**0**	**9**	**3**	**0**	**0**	**0**	**0**	**1**	**3**	**0**	**0**	**0**	**1**	**2**	**42**	**12**	**8**
Mean/station	0.0	1.8	0.6	0.0	0.0	0.0	0.0	0.2	0.6	0.0	0.0	0.0	0.2	0.4	8.4	2.4	1.6
no./m2	0	45	15	0	0	0	0	5	15	0	0	0	5	10	210	60	40

No. species 9 **Total Organisms at Station** 81

Station IM12 (was R11) Depth zone -6.00m AHD Depth at time of survey -5.0 m AHD 56 367072 6333638 Sampled 5-6 May 2025

Replicates	Nemertea *Gorgonorhynchus*	Polychaete *Sthenelais*	Polychaete thin	Polychaete mud	Polychaete *Chaetopterus*	Polychaete *Onuphidae*	Polychaete Pectinariidae	Porifera *Tetilla*	Gastropod *Philine*	Bivalve *Corbula*	Bivalve *Theora*	Bivalve *Paphia*	Bivalve *Dosinia*	Bivalve juvenile	Bivalve *Trichomya*	Ophuroid *Ophionereis*	Crab
R11.1	0	0	2	11	12	3	0	0	1	0	8	0	0	0	0	1	0
R11.2	0	5	1	1	7	1	0	0	0	0	0	0	2	0	0	1	1
R11.3	0	2	1	9	8	0	0	0	0	0	1	0	0	0	0	0	0
R11.4	0	0	0	10	9	3	0	0	0	0	5	0	2	0	0	1	0
R11.5	1	1	0	2	5	3	0	1	4	0	3	0	2	2	0	0	0
Total	**1**	**8**	**4**	**33**	**41**	**10**	**0**	**1**	**5**	**0**	**17**	**0**	**6**	**2**	**0**	**3**	**1**
Mean/station	0.2	1.6	0.8	6.6	8.2	2.0	0.0	0.2	1.0	0.0	3.4	0.0	1.2	0.4	0.0	0.6	0.2
no./m2	5	40	20	165	205	50	0	5	25	0	85	0	30	10	0	15	5

No. species 12 **Total Organisms at Station** 132

Total Organisms Collected 1207
Total number of species recorded 20

The dominant species such as the polychaetes *Sthenelais* and *Chaetopterus* and the bivalves *Theora*, *Corbula* and *Dosinia* were present at each depth zone. This indicates that at the time of the survey, water depth was not influencing the presence of these organisms in the sediments (Figures 6A.1 and 6A.2).

In Autumn 2025, the sampling stations with the greatest organism diversity were R13, IM2, IM12, C7 and IM11 with 12, 12, 12, 11 and 9 species recorded respectively. Stations IM5 (8), R12 (7) and C3 (7) also had relatively high organism diversity. Benthic monitoring stations R9, IM4 and IM9 had the lowest organism diversity with 3 species recorded at each station (Table 6A.2). Species diversity ranged from 4 to 11 species at the control stations, 3 to 12 species at the impact stations, and 3 to 12 species at the reference stations. Comparisons of the number of species collected at each monitoring station over a fourteen-year period revealed no discernable differences in diversity with water depth (Table 6A.2).

These findings support previous data collected between September 2016 and March 2020 in the Chain Valley Bay, Bardens Bay and Summerland Point regions. Despite reported changes in bed levels associated with Chain Valley Colliery underground workings, no statistical differences were found between the benthic assemblages at sites designated as Impact, Reference and Control stations (EMM, 2020).

P1 *Sthenelais pettiboneae* P2 Polychaete mud P3 Chaetopteridae P4 *Gorgonorhynchus repens*

Figure 6A.1 Number of worms found at each control, reference and impact Station, May 2025

B1 *Theora* B2 *Corbula* B3 *Paphia* B4 *Dosinia* B5 *Trichomya* B6 *Saccostrea*

Figure 6A.2 Number of bivalves found at each control, reference and impact Station, May 2025

Table 6A.2 Number of species found at each monitoring station with depth – years 2012 to 2025

-4.5m AHD. Overall mean: 5.18

Station	C1	C2	IM1	IM2	IM10 (R2)	R1	R9	R12
Feb 2012	10	5	7	4	8	8		
Sep 2012	3	6	4	4	3	6		
Mar 2013	4	5	7	5	5	6		
Sep 2013	6	6	4	3	6	5		
Mar 2014	4	3	5	9	4	6		
Sep 2014	3	4	5	6	5	6		
Mar 2015	3	3	5	4	3	5		
Sep 2015	5	4	5	5	3	5		
Mar 2016	6	4	6	6	5	6		
Sep 2016	7	3	6	4	4	8	8	
Mar 2017	2	4	3	4	5	4	5	
Sep 2017	4	4	5	5	3	4	4	
Mar 2018	4	4	5	7	8	7	4	
Sep 2018	3	4	4	8	4	4	5	
Mar 2019	6	3	5	5	5	4	4	
Sep 2019	5	6	6	5	3	4	4	
Mar 2020	5	6	7	7	6	6	4	
Aug 2020	6	5	5	6	5	4	5	
Mar 2021	5	6	7	7	4	5	6	
Sep 2021	4	4	3	7	4	5	4	
Mar 2022	5	6	5	6	4	6	5	
Sep 2022	5	5	6	8	5	6	7	
Mar 2023	6	6	8	9	4	6	6	
Mar 2024	6	6	9	8	3	7	4	5
May 2025	4	5	4	12	4	6	3	7
Mean	**4.84**	**4.68**	**5.44**	**6.16**	**4.52**	**5.56**	**4.88**	**6.00**
STD	**1.65**	**1.11**	**1.47**	**2.08**	**1.39**	**1.19**	**1.31**	**1.41**
Min	**2**	**3**	**3**	**3**	**3**	**4**	**3**	**5**
Max	**10**	**6**	**9**	**12**	**8**	**8**	**8**	**7**

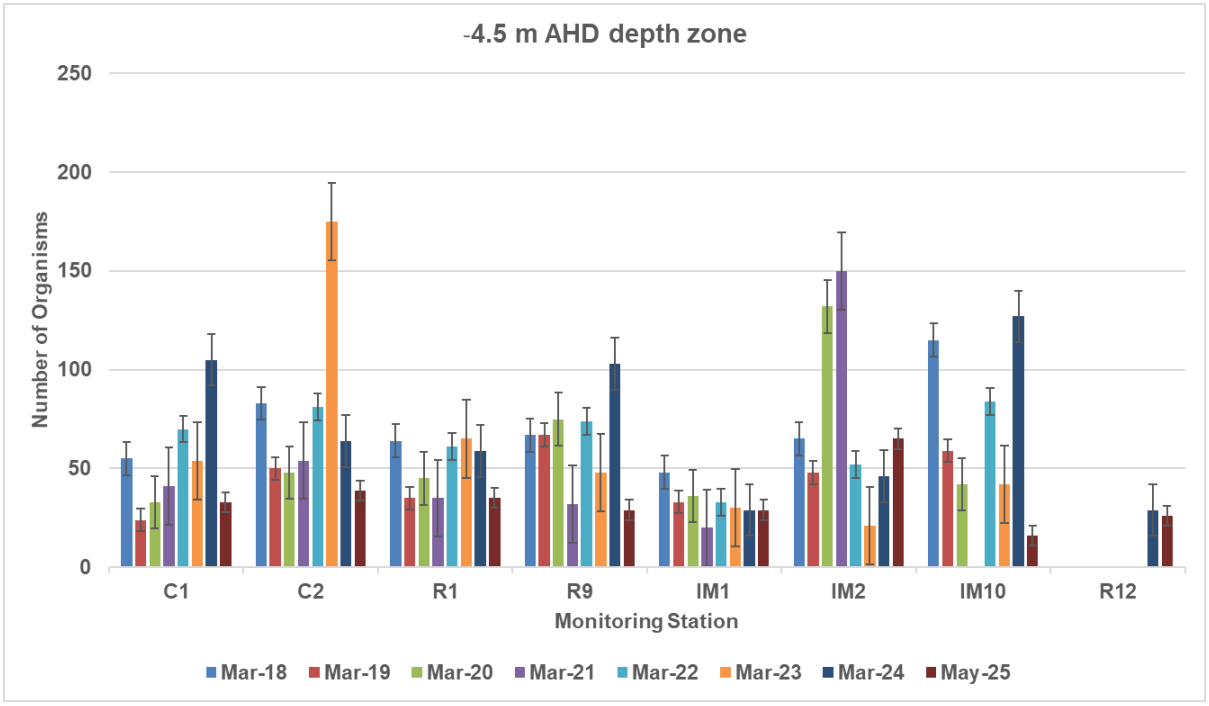
-5.5m AHD. Overall mean: 5.01

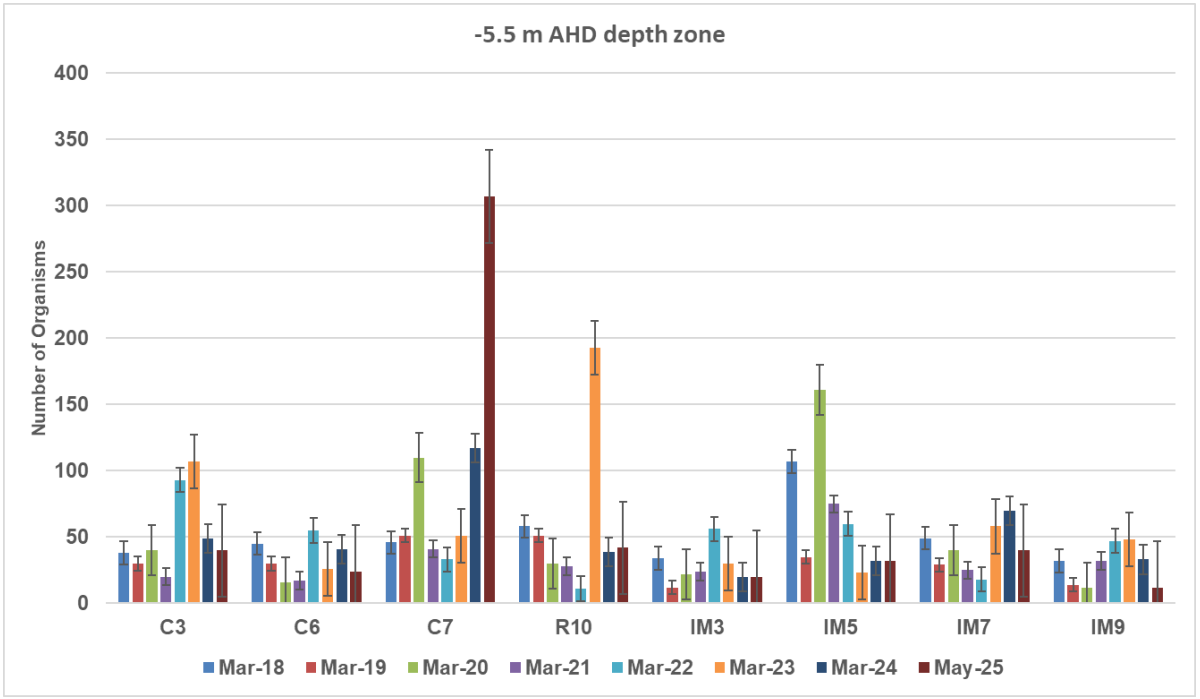
Station	C3	C6	C7	IM3	IM5 (R3)	IM7 (R5)	IM9 (R8)	R10
Feb 2012	5			4	5			
Sep 2012	4			3	4			
Mar 2013	7			5	6			
Sep 2013	3			4	5			
Mar 2014	5			4	5	4		
Sep 2014	4			3	6	3		
Mar 2015	5			4	6	3		
Sep 2015	4			4	4	5		
Mar 2016	5			3	6	4		
Sep 2016	6	8		6	5	6	5	
Mar 2017	5	5		3	4	4	3	
Sep 2017	4	5		5	6	4	5	
Mar 2018	8	3	5	3	5	6	3	4
Sep 2018	4	5	5	4	5	5	4	4
Mar 2019	4	5	3	2	7	5	4	6
Sep 2019	5	5	6	7	7	4	4	4
Mar 2020	6	3	6	4	7	4	3	4
Aug 2020	4	5	5	4	7	7	4	5
Mar 2021	3	2	2	5	7	5	4	5
Sep 2021	7	7	6	4	8	4	3	6
Mar 2022	4	7	4	5	9	4	3	6
Sep 2022	7	5	6	6	7	5	6	6
Mar 2023	5	4	6	4	4	4	6	5
Mar 2024	9	6	8	6	12	5	4	5
May 2025	7	6	11	4	8	5	3	6
Mean	**5.20**	**5.06**	**5.62**	**4.24**	**6.20**	**4.57**	**4.00**	**5.08**
STD	**1.55**	**1.57**	**2.22**	**1.16**	**1.83**	**0.98**	**1.03**	**0.86**
Min	**3**	**2**	**2**	**2**	**4**	**3**	**3**	**4**
Max	**9**	**8**	**11**	**7**	**12**	**7**	**6**	**6**

-6m AHD. Overall mean: 5.12

Station	C4	C5	IM4	IM6 (R4)	IM8 (R6)	IM11 (R7)	IM12 (R11)	R13
Feb 2012	7		5	5				
Sep 2012	4		5	5				
Mar 2013	7		5	5				
Sep 2013	7		5	4				
Mar 2014	5		5	3	3			
Sep 2014	8		6	6	3			
Mar 2015	3		5	5	3			
Sep 2015	3		4	6	4			
Mar 2016	5	5	4	4	4	8		
Sep 2016	5	4	3	6	7	7		
Mar 2017	3	5	4	5	4	4		
Sep 2017	4	4	5	5	4	4		
Mar 2018	4	4	4	4	3	4	4	
Sep 2018	6	5	4	5	4	6	4	
Mar 2019	4	6	4	3	4	4	6	
Sep 2019	5	4	5	4	4	5	3	
Mar 2020	4	7	4	4	4	8	4	
Aug 2020	4	3	6	4	5	8	4	
Mar 2021	4	5	7	4	5	5	8	
Sep 2021	6	7	4	3	4	7	7	
Mar 2022	7	6	6	7	4	8	6	
Sep 2022	7	6	3	6	4	4	5	
Mar 2023	6	6	7	4	5	5	4	
Mar 2024	6	8	4	4	4	13	7	9
May 2025	6	6	3	4	4	9	12	12
Mean	**5.20**	**5.35**	**4.68**	**4.60**	**4.10**	**6.41**	**5.69**	**10.50**
STD	**1.47**	**1.32**	**1.11**	**1.04**	**0.89**	**2.45**	**2.43**	**2.12**
Min	**3**	**3**	**3**	**3**	**3**	**4**	**3**	**9**
Max	**8**	**8**	**7**	**7**	**7**	**13**	**12**	**12**

Figure 6A.3 shows the number of organisms collected at each station from 2018 to 2025. Comparisons between the number of organisms collected during the Autumn sampling periods of March 2024 and May 2025 showed an increase in the numbers of organisms collected at seven of the 24 monitoring stations, a decrease at thirteen stations, and no change at four stations.


-4.5 m AHD depth zone
250
200
150
100
50
0
Number of Organisms
C1
C2
R1
R9
IM1
IM2
IM10
R12
Monitoring Station
Mar-18
Mar-19
Mar-20
Mar-21
Mar-22
Mar-23
Mar-24
May-25


-5.5 m AHD depth zone
400
350
300
250
200
150
100
50
0
Number of Organisms
C3
C6
C7
R10
IM3
IM5
IM7
IM9
Mar-18
Mar-19
Mar-20
Mar-21
Mar-22
Mar-23
Mar-24
May-25

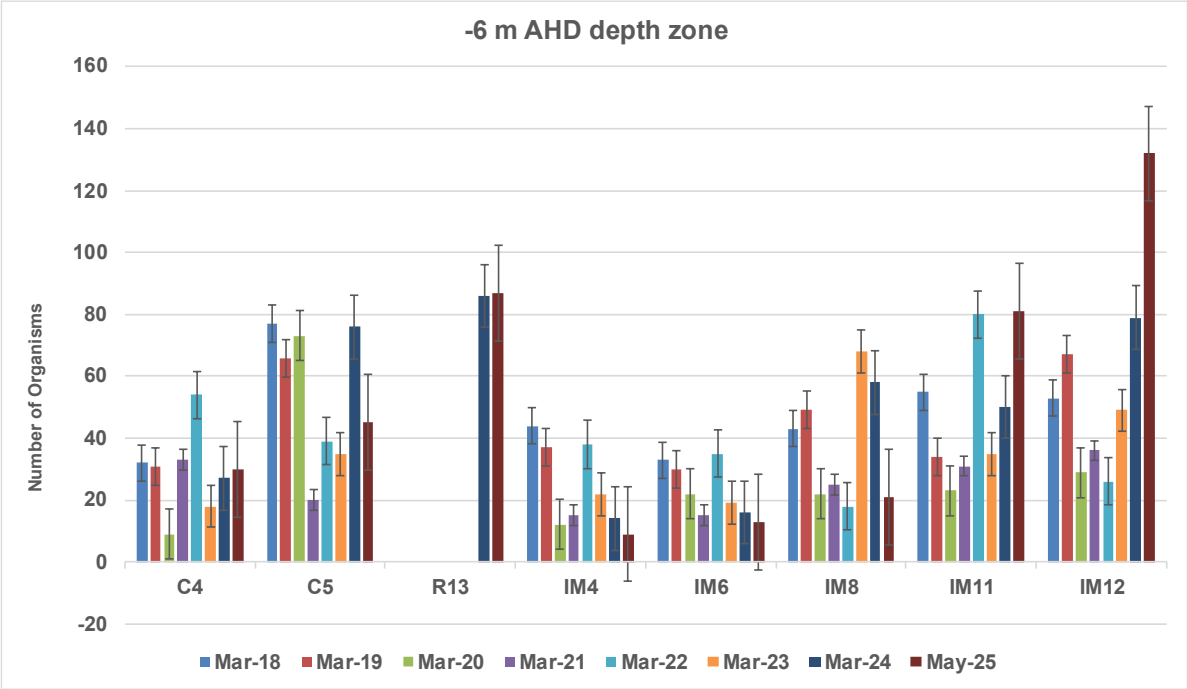


Figure 6A.4 Number of organisms at each benthic monitoring station from 2018-2025

b. Sediment Analysis

In May 2025, the sediment in the mud basin of Lake Macquarie off Summerland Point, Chain Valley Bay and Bardens Bay was largely composed of fine grey silt and small to large shell fragments (Table 6B.1). Benthic monitoring stations that had a high portion of both silt and shell were C4 (50% shell), IM5 (50% shell), IM10 (45% shell), IM1 (45% shell), C6 (40% shell) and IM2 (35% shell). Three monitoring stations had sediments with high portions of silt and sand. These benthic monitoring stations were IM12 with 49% sand, C7 with 45% sand and R13 with 20% sand. Benthic monitoring station IM11 was comprised of 98 percent small to large sized shell fragments (Table 6B.2).

Table 6B.1 Description of sediment collected from benthic sampling stations, May 2025

Station	Description
C1	Dark grey silt with small to large sized shell fragments.
C2	Dark grey silt with small to medium sized shell fragments.
C3	Dark grey silt with some small to medium sized shell fragments.
C4	Dark grey silt and small to medium sized shell fragments.
C5	Dark grey silt with small to large shell fragments. Some fine to medium grained grey sand.
C6	Dark grey silt with small to large shell fragments. Mud plastic in nature.
C7	Dark grey silt with fine to medium grained grey sand. Some gravel.
R1	Dark grey silt and some small sized shell fragments. Small percentage of fine grey sand.
R9	Dark grey silt with some small to medium sized shell fragments.
R10	Dark grey silt with some small to large shell fragments.
R12	Dark grey silt with some small to large shell fragments.
R13	Dark grey silt with fine grained dark grey sand and gravel.
IM1	Dark grey silt and small to large sized shell fragments and some medium to coarse grained sand.
IM2	Dark grey silt and small to large shell fragments. Some sand.
IM3	Dark grey silt with some small to medium sized shell fragments.
IM4	Dark grey silt and small to medium sized shell fragments.
IM5 (R3)	Dark grey silt and small to large sized shell fragments.
IM6 (R4)	Dark grey silt with some small to large sized shell fragments.
IM7 (R5)	Dark grey silt with some small to large sized shell fragments.

IM8 (R6)	Dark grey silt with small to medium sized shell fragments.
IM9 (R8)	Dark grey silt with some small to medium sized shell fragments.
IM10 (R2)	Dark grey silt and small to large sized shell fragments.
IM11 (R7)	Small to large shell fragments with some sand.
IM12 (R11)	Dark grey silt and fine to medium grained sand. Some gravel.

Table 6B.2 Percentage of silt, sand, gravel and shell in sediment collected at each station

	% Silt	% Sand	% Gravel	% Shell
C1	80	0	0	20
C2	75	0	0	15
C3	94	1	0	5
C4	50	0	0	50
C5	80	5	0	15
C6	60	0	0	40
C7	55	45	1	0
R1	93	2	0	5
R9	95	0	0	5
R10	90	0	0	10
R12	90	0	0	10
R13	74	20	5	1
IM1	50	5	0	45
IM2	60	5	0	35
IM3	74	1	0	25
IM4	85	0	0	15

IM5 (R3)	50	0	0	50
IM6 (R4)	80	0	0	20
IM7 (R5)	80	0	0	20
IM8 (R6)	90	0	0	10
IM9 (R8)	90	0	0	10
IM10 (R2)	65	0	0	45
IM11 (R7)	0	2	0	98
IM12 (R11)	50	49	1	0

c. Physical characteristics of water in Lake Macquarie – May 2025

Rainfall in the months preceding the survey of May 2025 was 66.8 mm, 38.2 mm, 137.6 mm and 228 mm for January, February, March and April 2025 respectively (Cooranbong Lake Macquarie AWS No. 061412). By 6th May a further 30.6 mm had fallen in the catchment.

At each station, a water quality profile was taken using a calibrated Yeo-Kal 618RU Analyser. The physical characteristics were measured on 5th and 6th May 2025**.** Units of measurement were Temperature (Temp) - degrees Celsius; Conductivity (Cond) - mS/cm; Salinity (Sal) - parts per thousand; pH; Dissolved Oxygen - % saturation and mg/L; Oxidation Reduction Potential (ORP) - mV and Turbidity (Turb) - NTU.

Throughout the study area, water temperature declined slightly with water depth (Appendix B). Water temperature at C2, for instance, was 21.93ºC at the surface and was 21.56ºC at -4.5m AHD. The water temperature throughout the water column ranged from 20.37ºC at IM10 (-4.8m AHD) to 24.16ºC at C6 (-0.3m AHD). The average water temperature throughout the water column was 21.44ºC and the standard deviation was 0.58ºC. There was no significant difference in water temperature throughout the water column between Control, Impact or Reference sites. The temperature of bottom water ranged from 20.37ºC at IM10 (-4.8m AHD) to 21.85ºC at IM7 (-6.7m AHD). Average bottom water temperature was 21.23ºC and the standard deviation was 0.39ºC (Table C6.1).

Conductivity increased slightly with water depth throughout the study area (Appendix B). At the time of survey water conductivity at C5 was 48.51 mS/cm at the surface increasing to 50.31 mS/cm at -6.3m

AHD. The increase in conductivity with water depth was due to the recent rainfall events with the influx of freshwater at the surface of the water profile. Conductivity throughout the water column ranged from 48.30 mS/cm at C2 (-0.5m AHD) to 51.39 mS/cm at R9 (-5.0m AHD). Average conductivity throughout the water column was 49.91 mS/cm and the standard deviation was 0.90 mS/cm. Average conductivity throughout the water column did not vary significantly between Control, Impact or Reference sites. The conductivity of bottom waters ranged from 49.59 mS/cm at C2 (-5.2m AHD) to 51.34 mS/cm at IM11 (-7.0m AHD). Average bottom water conductivity was 50.78 mS/cm and the standard deviation was 0.51 mS/cm (Table C6.1).

The influx of freshwater from rainfall events decreased salinity of surface waters throughout the study area and resulted in an increase of salinity with water depth throughout the water column (Appendix B). At the time of the survey, water salinity at monitoring station R12 was 32.06 ppt at the surface and 33.67 ppt at -7.0m AHD. Salinity throughout the water column ranged from 31.48 ppt at C2 to 33.55 ppt at C1. Average salinity throughout the water column was 32.66 ppt and the standard deviation was 0.66 ppt. Average salinity did not vary significantly between Control, Impact or Reference sites. Average salinity of bottom waters ranged from 32.42 ppt at C2 (-5.2m AHD) to 33.71 ppt at IM11 (-7.0m AHD). Average bottom water salinity was 33.30 ppt and the standard deviation was 0.37 ppt (Table C6.1).

The combination of rainfall and wind, wave and current action resulted in an increase of water turbidity with water depth throughout the study area (Appendix B). At the time of the survey, turbidity at monitoring station IM3 was 3.3 NTU at the surface increasing to 9.1 NTU at -5.9m AHD. Throughout the water column turbidity ranged from 1.9 NTU at R9 (-0.3m AHD) to 40.30 NTU at C1 (-4.8m AHD). Average turbidity throughout the water column was 4.46 NTU and the standard deviation was 2.62 NTU. Average turbidity did not vary significantly between Control, Impact or Reference sites. Average turbidity of bottom waters ranged from 4.2 NTU at IM7 (-6.7m AHD) to 40.3 NTU at C1 (-4.8m AHD). The average bottom water turbidity was 8.95 NTU and the standard deviation was 7.02 NTU (Table C6.1).

Throughout the study area, pH increased slightly with water depth (Appendix B). At C3, for instance, pH was 7.65 at the surface and increased to 8.58 at -5.1m AHD. Throughout the water column pH ranged from 5.93 at R13 (-0.3m AHD) to 9.16 at IM7 (-4.0m AHD). Average pH throughout the water column was 8.19 and the standard deviation was 0.56. Average pH did not vary significantly between Control, Impact or Reference sites. Average pH of bottom waters ranged from pH 7.1 at R12 (-7.0m

AHD) to pH 9.07 at IM8 (-6.8m AHD). The average pH of bottom water was pH 8.33 and the standard deviation was 0.53 (Table C6.1).

Oxidation reduction potential (ORP) was relatively uniform throughout the water column (Appendix B). At the time of survey, ORP at monitoring station R9 was 566 mV at the surface and was 562 mV at -5.0m AHD. Throughout the water column, ORP ranged from 440 mV at C2 (-4.5m AHD) to 647 mV at C1 (-0.3m AHD). The average ORP throughout the water column was 493 mV and the standard deviation was 55 mV. Average ORP did not vary significantly between Control, Impact or Reference sites. The average ORP of bottom waters ranged from 440 mV at C2 (-5.2m AHD) to 630 mV at C1 (-4.8m AHD). The average ORP of bottom waters was 494 mV and the standard deviation was 56 mV (Table C6.1).

Dissolved oxygen decreased with depth or was uniform throughout the water column and the study area. At IM6, for instance, dissolved oxygen decreased from 67.3% saturation at the surface to 62.8% saturation at -6.3m AHD. At monitoring station R10 dissolved oxygen decreased from 64.7% saturation at the surface to 41.4 % saturation at -5.9m AHD (Appendix B). Throughout the water column, dissolved oxygen concentrations ranged from 40.7% saturation at R12 (-7.0m AHD) to 82.2% saturation at IM12 (-2.5m AHD). The average dissolved oxygen throughout the water column was 64.87% saturation and the standard deviation was 8.01% saturation. Average dissolved oxygen did not differ significantly between Control, Impact or Reference sites. The average dissolved oxygen of bottom waters ranged from 40.7% saturation at R12 (-7.0m AHD) to 68% saturation at R1 (-4.6m AHD). The average dissolved oxygen of bottom waters was 54.19% saturation and the standard deviation was 8.3% saturation. (Table C6.1).

Table 6C.2 compares the average water quality variables of bottom water over a ten-year period from March 2016 to May 2025. Water temperature ranged from 21.23^{o}C to 27.54^{o}C, with an average of 25.15^{o}C and a standard deviation of 1.68^{o}C. Conductivity ranged from 50.52 mS/cm to 58.47 mS/cm, with an average of 54.49 mS/cm and a standard deviation of 3.11 mS/cm. Salinity had a range of 33.3 ppt to 39.0 ppt, with an average of 35.78 ppt and standard deviation of 2.18 ppt. Dissolved oxygen had a range of 54.2% saturation to 109.5% saturation, with an average of 84.7% saturation. pH ranged from pH 7.73 to pH 9.74, with an average of pH 8.44 and a standard deviation of pH 0.56. The water quality variables over the ten-year period did not vary significantly, and any variation was largely due to rainfall and other weather conditions such as wind and wave action.

Table 6C.1 Physical characteristics of bottom waters at benthic stations – May 2025

Station	Depth m	Temperature °C	Conductivity mS/cm	Salinity ppt	pH	ORP mV	Turbidity NTU	DO % sat	DO mg/L
Control Stations									
C1	4.8	20.83	51.12	33.55	8.38	630	40.3	60.6	4.45
C2	5.2	21.56	49.59	32.42	9.00	440	7.3	53.4	3.89
C3	5.1	21.41	50.04	32.75	8.58	442	9.2	49.8	3.64
C4	4.5	21.14	51.06	33.50	7.24	494	8.7	58.5	4.27
C5	6.3	21.25	50.31	32.95	8.59	442	7.2	62.7	4.59
C6	5.5	20.54	50.55	33.12	8.70	486	6.8	64.1	4.74
C7	5.0	21.40	50.12	32.81	8.63	444	5.8	57.9	4.23
Mean		**21.16**	**50.40**	**33.01**	**8.45**	**483**	**12.19**	**58.14**	**4.26**
Stdev		**0.36**	**0.56**	**0.41**	**0.56**	**69**	**12.45**	**5.08**	**0.39**
Min		**20.54**	**49.59**	**32.42**	**7.24**	**440**	**5.8**	**49.8**	**3.64**
Max		**21.56**	**51.12**	**33.55**	**9.00**	**630**	**40.30**	**64.10**	**4.74**
Reference Stations									
R1	4.6	20.85	50.63	33.18	7.77	481	7.0	68.0	5.00
R9	5	21.04	51.11	33.54	8.44	559	15.3	50.9	3.73
R10	5.9	21.70	51.30	33.68	8.26	452	7.8	41.4	2.99
R12	7	21.82	51.29	33.67	7.10	444	7.0	40.7	2.93
R13	5.9	21.44	50.89	33.38	7.83	451	5.1	47.9	3.49
Mean		**21.37**	**51.04**	**33.49**	**7.88**	**477**	**8.44**	**49.78**	**3.63**
Stdev		**0.42**	**0.29**	**0.21**	**0.52**	**48**	**3.96**	**11.06**	**0.84**
Min		**20.85**	**50.63**	**33.18**	**7.10**	**444**	**5.10**	**40.70**	**2.93**
Max		**21.82**	**51.30**	**33.68**	**8.44**	**559**	**15.30**	**68.00**	**5.00**
Impact Stations									
IM1	5	20.57	50.83	33.34	7.60	599	7.0	64.8	4.79
IM2	4.1	21.29	50.47	33.07	8.23	522	6.4	66.3	4.85
IM3	5.9	21.15	51.19	33.60	8.58	532	9.1	48.7	3.55
IM4	6.9	21.23	51.24	33.64	8.28	513	9.1	46.3	3.37
IM5 (R3)	7	21.29	51.24	33.64	8.65	501	8.5	49.8	3.63
IM6 (R4)	6.3	21.20	50.38	33.00	7.66	506	5.4	62.8	4.6
IM7 (R5)	6.7	21.85	51.27	33.66	9.00	459	4.2	54.2	3.91
IM8 (R6)	6.8	21.62	51.12	33.54	9.07	457	6.9	43.7	3.16
IM9 (R8)	6.1	20.98	51.13	33.56	8.41	543	8.7	54.3	3.98
IM10 (R2)	4.8	20.37	50.63	33.19	8.52	578	5.4	56.8	4.22
IM11 (R7)	7	21.59	51.34	33.71	8.64	444	9.6	41.2	2.98
IM12 (R11)	5	21.44	49.93	32.67	8.67	442	6.9	55.8	4.08
Mean		**21.22**	**50.90**	**33.39**	**8.44**	**508**	**7.27**	**53.73**	**3.93**
Stdev		**0.42**	**0.45**	**0.33**	**0.45**	**51**	**1.74**	**8.15**	**0.62**
Min		**20.37**	**49.93**	**32.67**	**7.6**	**442**	**4.2**	**41.2**	**2.98**
Max		**21.85**	**51.34**	**33.71**	**9.07**	**599**	**9.60**	**66.30**	**4.85**
Bottom Water Quality - all stations									
Mean		**21.23**	**50.78**	**33.30**	**8.33**	**494**	**8.95**	**54.19**	**3.96**
STDev		**0.39**	**0.51**	**0.37**	**0.53**	**56**	**7.02**	**8.30**	**0.63**
Min		**20.37**	**49.59**	**32.42**	**7.1**	**440**	**4.2**	**40.7**	**2.93**
Max		**21.85**	**51.34**	**33.71**	**9.07**	**630**	**40.3**	**68**	**5**

Table 6C.2 Average water quality of bottom waters - 2016 to 2025

	Temperature °C	Conductivity mS/cm	Salinity ppt	Dissolved Oxygen % sat	Dissolved Oxygen mg/L	pH	Turbidity NTU
Mar-16	27.54	51.00	33.40	99.2	6.50	8.20	4.0
Mar-17	23.90	57.10	38.00	109.5	7.42	8.30	7.5
Mar-18	25.73	58.47	39.04	87.7	5.73	8.96	46.5
Mar-19	26.20	58.39	38.97	83.3	5.39	9.74	1.6
Mar-20	24.86	50.52	33.33	63.6	4.36	8.69	6.88
Mar-21	24.93	51.88	34.11	88.9	6.05	7.98	5.02
Mar-22	24.36	53.77	35.55	90.0	6.12	8.58	11.39
Mar-23	26.90	57.48	35.28	88.35	5.68	7.73	27.46
Mar-24	25.80	55.53	36.82	81.89	5.41	7.91	10.45
May-25	21.23	50.78	33.30	54.19	3.96	8.33	8.95
Average	25.15	54.49	35.78	84.66	5.66	8.44	12.98
Std	1.68	3.11	2.18	15.10	0.94	0.56	13.04
Min	21.23	50.52	33.3	54.19	3.96	7.73	1.6
Max	27.54	58.47	39.04	109.5	7.42	9.74	46.5

7. Discussion

In May 2025, 24 benthic stations were sampled in the study area. A total of 1207 organisms greater than 1mm in size were found, comprising 21 species. Polychaete worms and bivalve molluscs were the most frequently encountered organisms. Stations were distinguished by the relative abundance of the dominant species.

During this survey, the presence of species in the benthos were not determined by water depth. The dominant species occupied sediments at each depth zone, from – 4.5m AHD to -6.0m AHD. These findings support the data collected by J.H. & E.S. Laxton - Environmental Consultants P/L from September 2016 to March 2020 in the Chain Valley Bay, Bardens Bay and Summerland Point regions, analysed independently by EMM in April 2020. It was found that despite reported changes in bed levels associated with Chain Valley Colliery underground working, no significant differences were identified

between the benthic assemblages at control, reference and impact sites (EMM, 2020).

Sediment composition appears to be a major parameter influencing the presence of organisms in the benthos. At the time of survey sampling sites with benthos comprised predominantly of silt, were defined by relatively high numbers of the polychaete *Sthenelais petitiboneae*, and the bivalves *Theora lubrica* and *Paphia undulata.* Benthos with high portions of sand and/ or gravel were characterized by relatively higher numbers of the polychaete worms from the Chaetopteridae, Pectinariidae and Diopatra families, and the bivalve *Dosinia*. Stations that comprised predominantly of shell substrate were characterized by the presence of the mussel *Trichomya hirsuta* and the oyster *Saccostrea glomerata*. *Saccostrea glomerata* was encrusted to the large shell fragments.

Physical variables such as salinity, conductivity and turbidity of the bottom water had little influence on the species composition of the benthos. Dissolved oxygen concentration, however, can have a major effect on abundance. Major extinction events have occurred in the mud basin of Lake Macquarie. The evidence for this lies in the presence of large numbers of intact but dead bivalve shells entombed in the mud in Chain Valley Bay. The cause of extinction events appeared to be prolonged dissolved oxygen depletion of bottom water.

8. Conclusion and Compliance Table

The results from the May 2025 benthic communities monitoring survey show compliance to Schedule 4 Environmental Conditions – underground mining performance measures – natural environment biodiversity – benthic communities table with respect to effects of subsidence on Benthic communities which display nil to minor environmental consequences due to underground mining.

The Environmental Subsidence Impact Performance Measures for benthic communities are listed in the table below:

Conditions from SSD-5465 – Mod 4	Compliance Status and Comments
Schedule 4 Environmental Conditions – underground mining Performance Measures – Natural Environment Biodiversity – Benthic Communities	**Compliant – See section 16 - Conclusions**

Subsidence Impact Performance Measure – Minor environmental consequences, including minor changes composition and/or distribution.	
Measurements undertaken by generally accepted methods. **Measures Methods fully described.**	**Compliant – See section 4 and 5** **Compliant – See section 4 and 5**

9. References

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Appendices

A. Background Information

i. Factors Affecting Depth of Water in Lake Macquarie

The bathymetric chart (**Figure A1**) of Lake Macquarie shows water depths relative to AHD throughout the year 1997. The actual water depth above the lakebed varied greatly, between 0 and 1.3m above AHD over the year.

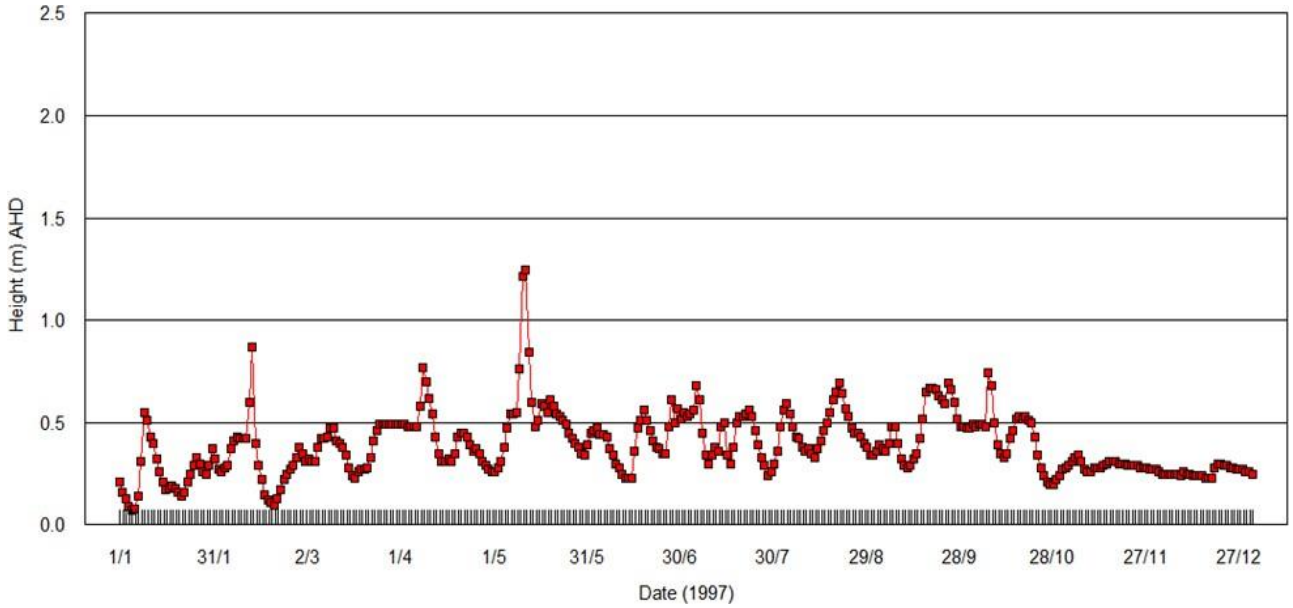


Figure A1 Water level changes in a coastal lagoon with an entrance open to coastal waters.

Water depths in coastal saline lakes with an open entrance to coastal waters vary due to combinations of the following factors:

- The body of Lake Macquarie is subject to tidal influence. The height of the tidal prism at Swansea Head may reach almost 2m (during spring tides) but by the time the body of the lake is reached, the tidal prism has been reduced to around 0.05m.
- The height of coastal waters and coastal lakes are influenced by changes in atmospheric pressure. The Tasman Sea acts as a huge barometer. When the atmospheric pressure is high

the sea surface is depressed. This causes water to drain from Lake Macquarie causing the depth of water in the body of the lake to decrease. When the atmospheric pressure over the Tasman Sea is low, the surface of the sea bulges upwards. This raising of sea level causes water to flow into Lake Macquarie, increasing the water depth.

- Low pressure systems in the Tasman Sea almost always generate strong winds and coastal rainfall. The strong winds cause large swells to form that impact the coast. Wave setup at the entrance to Lake Macquarie causes the water level in the lake to rise as large volumes of seawater enter the system.

- Rainfall during a period of low atmospheric pressure causes runoff into catchment rivers and streams to increase. When this extra water reaches the body of Lake Macquarie, the water level rises in proportion to the runoff volume. This water is prevented from exiting the lake by wave setup at the entrance and the state of the tide. Under these circumstances, the level of the lake may rise to heights of a meter or more above AHD.

ii. Benthic Organisms in Lake Macquarie

Previous studies (Laxton, 2022) conducted off Summerland Point and in Chain Valley Bay, Lake Macquarie between February 2012 and September 2024 found the following organisms were present in the benthos (**Table A1**):

Table A1 Organisms found in Benthos of Lake Macquarie (2012-2024)

Designated name	Family or Species	Comments
Foraminifera	*Spiroloculina* *Trochammina*	Single-celled heterotrophic organisms that live predominantly in marine environments.
Anemone	Coelenterata	Found associated with mussel shells.
Planaria (Flat worm)	Platyhelminthes	Two specimens found in 2017.
Polychaete thin	*Sthenelais pettiboneae*	Most common polychaete present.
Polychaete	*Gorgonorhynchus repens*	Common.
Polychaete (mud tube)	Not yet identified	Present in small numbers.
Polychaete	*Chaetopterus sp*	Common.
Polychaete	*Diopatra sp*	Common.

Polychaete	*Pectinaria sp*	First found in March 2019
Gastropod	*Nassarius jonasii*	Present in small numbers.
Gastropod	*Lepsiella* (*Bedeva*) *hanleyi*	Present in small numbers.
Gastropod	*Philine angasi*	First recorded in August 2014.
Bivalve	*Corbula truncata*	Common as live animals and dead shells.
Bivalve	*Theora lubrica*	Common
Bivalve	*Paphia undulata*	Uncommon as live animals. Common as dead shells.
Bivalve	*Cyamiomactra mactroides*	Uncommon as live animals.
Bivalve	*Mactra sp*	First collected in December 2022 off Pulbah Island.
Bivalve	*Anadara trapezia*	Uncommon.
Bivalve	*Dosinia sculpta*	Found in sandy sediments.
Bivalve	*Trichomya hirsuta*	Common as dead shells. Found in large clumps.
Bivalve	*Saccostrea glomerata*	Occasionally found on mussel shells.
Ophuroid	*Ophionereis schayeri*	Found amongst mussel clumps and on mud.
Echinoid	*Astropecten polyacanthus*	Found in sandy sediments.
Echinoid	Sea urchins	Encountered in sandy sediments.
Echinoid	*Echinocardium cordatum*	Encountered in sandy sediments.
Sponge	*Tetilla sp*	Collected occasionally.
Sponge	*Dysidea sp*	Collected occasionally.
Sponge	Red sponge	Several specimens found in 2019.
Crabs	Small	Captured occasionally.
Prawn	Small	Captured occasionally.

Plates A1 to A8 provide information about the benthic organisms present in the basin muds and sands of Lake Macquarie, NSW.

Plate A1 Sponge species found on the benthos of Lake Macquarie

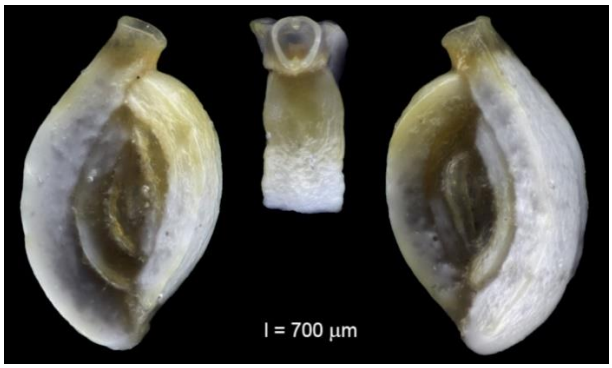
Phylum: Porifera
Class: Demospongiae
Subclass: Errantia
Order: Tetractinellida
Family: Tellidae
Species: *Tetilla sp*

Remarks: Tetillids are ovoid to spherical sponges which are found commonly in all marine habitats at all depths. They are especially common in sedimented habitats.

Phylum: Porifera
Class: Demospongiae
Family: Dysideidae
Species: Dysidea *sp*

Remarks: Typically mauve in colour, irregularly shaped with varying numbers of oscula and a coarse, hard and bumpy surface texture.

Plate A2 Foraminifera greater than 1mm in size found in the benthos of Lake Macquarie



Phylum: Foraminifera
Class: Miliolata
Family: Spiroloculinidae
Species: *Spiroloculina communis*

Remarks: Genus of porcelaneous Foraminifera known from the Upper Cretaceous to the present. Planispiral throughout development.

Phylum: Foraminifera
Class: Miliolata
Family: Spiroloculinidae
Species: *Trochammina sp*

Remarks: Test trochospiral, free or attached. Wall agglutinated, single layered imperforate. Chambers subglobular or axially strongly compressed.

Plate A3 Annelid and Nemertean species found in the benthos of Lake Macquarie

Phylum: Annelida
Class: Polychaeta
Subclass: Errantia
Order: Phyllodocida
Family: Sigalionidae
Species: *Sthenelais petitiboneae*

Remarks: Found in marine environments

Phylum: Annelida
Class: Polychaeta
Subclass: Canalipalpata
Order: Terebellida
Family: Chaetopteridae
Genus: *Chaetopterus*

Remarks: *Chaetopterus* or the parchment worm or parchment tube worm is a genus of marine polychaete worm that lives in a tube it constructs in sediments or attaches to a rocky or coral reef substrate. The common name arises from the parchment-like appearance of the tubes that house these worms.

Phylum: Annelida
Class: Polychaeta
Subclass: Canalipalpata
Order: Terebellida
Family: Pectinariidae

Remarks: Pectinariidae live vertically, head-down in sandy sediments, with the narrow tip of the conical tube at about the sediment surface. They feed on buried organic matter within the sediments. *Pectinaria anitpoda* is one of the most common and widespread of this family. Found in inshore waters and off the continental shelf to a depth of about 90 m.

Phylum: Annelida
Class: Polychaeta
Subclass: Errantia
Order: Eunicida
Family: Onuphidae
Genus: *Diopatra*

Remarks: Members of this genus live in thick, parchment-like tubes that project from the sediment on the seabed. The tubes comprise of fragments of shell, algae, fibers and other small objects collected by the worm and stuck in place by mucus.

Phylum: Nemertea

Class: Anopla

Order: Heteronemertea

Family: Gorgonorhynchidae

Species: *Gorgonorhynchus repens*

Remarks: *G. repens* is orange in colour and grows to an unstretched length of about 50 mm. It is cylindrical in shape with bluntly tapering ends. The proboscis is a densely branching structure giving the impression of a cloud of mucus secretion. Proboscis worms are predatory, snaring or spearing their prey.

Plate A4 Gastropod species found in the benthos of Lake Macquarie

Phylum: Mollusca

Class: Gastropoda

Superfamily: Buccinoidea

Family: Nassariidae

Species: *Nassarius jonasii*

Remarks: Endemic to Australia; Noosa Heads, Qld, to SA. Inhabit sand and mud flats in estuaries and lagoons, intertidal down to 100 m. Most *Nassarius* species are very active scavengers. They often burrow into marine substrates and then wait with only their siphon protruding, until they smell nearby food.

Phylum: Mollusca

Class: Gastropoda

Order: Neogastropoda

Family: Muricidae

Species: *Lepsiella (Bedeva) hanleyi*

Remarks: Common name mussel drill. Shell up to 32 mm, with angulated whorls, a high spire and moderately long anterior canal and with both spiral threads and axial ribs. Endemic to Australia. Found in temperate and southern parts of tropical Australia. Lives mainly on sheltered shores, including estuaries and often in association with mangroves. Feeds by drilling holes in bivalves. Lays lens-shaped capsules and development is direct.

Phylum: Mollusca

Class: Gastropoda

Subclass: Heterobranchia

Family: Philinoidae

Species: *Philine angasi*

Remarks: Species of sea snail, marine opisthobranch gastropod mollusc. Commonly called headshield slugs. The foot of this family has developed into fleshy rounded lobes that surround and obscure the shell.

Plate A5 Bivalve species and other molluscs found in the benthos of Lake Macquarie

Phylum: Mollusca

Class: Bivalvia

Order: Myoida

Family: Corbulidae

Species: *Corbula sp*

Remarks: Marine bivalve mollusc.

Phylum: Mollusca

Class: Bivalvia

Order: Veneroida

Family: Semelidae

Species: *Theora lubrica*

Remarks: Small infaunal bivalve native to the Northwest Pacific. It has been introduced to California, Australia, New Zealand, the Mediterranean Sea, and the Atlantic coast of Spain. It typically occurs in soft, muddy subtidal or lower intertidal sediments, rich in organic matter. It is considered a pollution-indicator species, because of its frequent dominance in highly polluted sediments. No ecological or economic impacts have been reported for this species.

Phylum: Mollusca

Class: Bivalvia

Order: Veneroida

Family: Veneridae

Species: *Paphia undulata*

Remarks: Saltwater clam, marine bivalve mollusc. Inhabits inshore shallow sandy seabeds.

Phylum: Mollusca

Class: Bivalvia

Order: Veneroida

Family: Veneridae

Species: *Dosinia sculpta*

Remarks: *Dosinia* is a genus of saltwater clams, marine bivalve molluscs in the family Veneridae, (subfamily Dosiniinae). The shell of *Dosinia* species is disc-like in shape, usually white, and therefore is reminiscent of the shells of Lucinid bivalves.

Typically found in the intertidal zone at the water's edge at a mean distance from sea level of -15 meters (-50 feet).

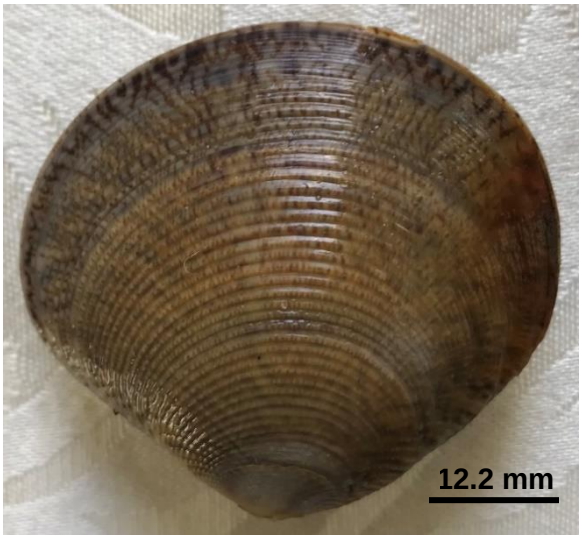
Phylum: Mollusca

Class: Bivalvia

Order: Veneroida

Family: Cyamiidae

Species: *Cyamiomactra mactroides*



Phylum: Mollusca

Class: Bivalvia

Order: Veneroida

Family: Mactridae

Species: *Mactra*

Remarks: Large genus of medium-sized marine bivalve mollusc or clam, commonly known as trough shells or duck clams. The word "trough" refers to the large ligamental pit at the hinge line, which contains a large internal ligament. Most bivalves in other families have an external ligament.

Phylum: Mollusca

Class: Bivalvia

Order: Arcoida

Family: Arcidae

Species: *Anadara trapezia*

Remarks: Sydney cockle, or ark cockle is an estuarine filter-feeding bivalve. Its calcareous, heavily-ribbed, shell can grow to approximately 7 to 8 cm across. Its current range is along the east coast of Australia, from Queensland to Victoria. It has been used as an indicator species to study levels of the metals selenium, copper and cadmium.

Phylum: Mollusca

Class: Bivalvia

Order: Mytiloida

Family: Mytilidae

Species: *Trichomya hirsuta*

Remarks: The hairy mussel is a major part of the megafauna of Lake Macquarie. It is tolerant of low oxygen levels in the water and its temperature tolerance range has been researched in connection with using the waters of the lake for cooling power stations.

Hairy mussels have been used as bioindicators to monitor concentrations of heavy metals (namely Pb, Cd, Cu, Zn, Co, Ni, and Ag) in marine environments.

Phylum: Mollusca

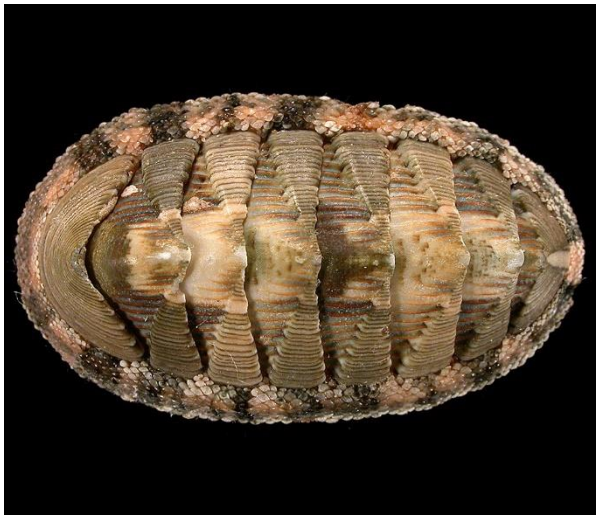
Class: Bivalvia

Order: Ostreoida

Family: Pectinidae

Species: *Saccostrea glomerata*

Remarks: Sydney rock oysters are endemic to Australia and New Zealand. In Australia it is found in bays, inlets and sheltered estuaries from Wingan Inlet in eastern Victoria, along the east coast of NSW and up to Hervey Bay QLD, around northern Australia and down the west coast to Shark Bay in WA. Sydney rock oysters are capable of tolerating a wide range of salinities. They are usually found in the intertidal zone to 3 metres below the low water mark.



Phylum: Mollusca

Class: Polyplacophora

Remarks: Chitons have a shell composed of eight separate shell plates or valves. These plates overlap slightly at the front and back edges, enabling articulation. These plates protect the mollusc; and enable the animal to flex upward when manoeuvering over uneven surfaces. It also makes it possible for chitons to curl up into a ball when dislodged from rocks. The shell plates are encircled by a skirt known as a girdle.

Chitons live worldwide, from cold to tropic waters. They live on hard surfaces such as under rocks or in crevices. They are fully marine.

Plate A6 Sea stars found in Lake Macquarie, NSW

Phylum: Echinodermata

Class: Ophiuroidea

Order: Ophiurida

Family: Ophionereididae

Species: *Ophionereis schayeri*

Remarks: Largest and most common brittle star found in Sydney waters. Brittle stars have five long, slender arms which radiate out from a central disc. The mouth is located in the centre of the underside of the disc. There is no anus. Offshore, brittle stars form dense aggregations. In intertidal zones, they are typically found as single individuals in crevices, under stones and amongst seaweed. They feed by raising their arms above the substrate; extending tube-feet; and removing particles from the water. They pass food along the arms to the mouth. They also scavenge on decaying matter.

Phylum: Echinodermata

Class: Asteroidea

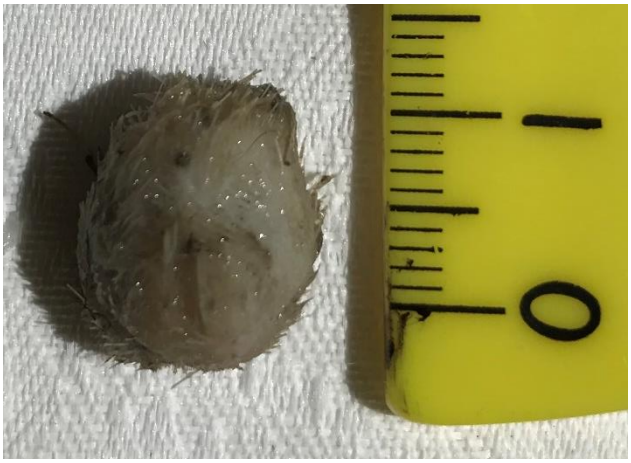
Order: Paxillosida

Family: Astropectinidae

Species: *Astropecten polyacanthus*

Remarks: Sand sifting starfish or comb sea star is a widespread species found throughout the Indo-Pacific region. The armspread is up to 20 cm. Spends much of its time buried in the silty seabed. Feeds on detritus, bivalves and gastropods. Also digests biofilm and small invertebrates. Mostly nocturnal.

Plate A7 Sea urchins found in Lake Macquarie, NSW



Phylum: Echinodermata

Class: Echinoidea

Order: Spatangoida

Family: Loveniidae

Species: *Echinocardium cordatum*

Remarks: Sand dollars are small in size. They possess a rigid skeleton called a test. The test consists of calcium carbonate plates arranged in a fivefold symmetric pattern.

Phylum: Echinodermata
Class: Echinoidea
Order: Cidaroida

Plate A8 Crab species found in Lake Macquarie, NSW

Phylum: Arthropoda
Class: Malacostraca
Order: Decapoda

B. Water Quality Data

Control monitoring stations

C1

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	7:57:12	0.3	21.34	49.93	32.67	2.8	7.75	647	72.0	5.27
5/05/2025	7:57:30	0.5	21.19	50.49	33.08	2.8	8.21	645	72.4	5.30
5/05/2025	7:57:50	1	21.04	50.70	33.24	2.7	8.61	644	72.9	5.34
5/05/2025	7:58:03	1.5	20.98	50.72	33.25	2.7	8.79	643	73.5	5.4
5/05/2025	7:59:03	2	20.84	50.73	33.26	3.4	8.48	640	74.8	5.51
5/05/2025	7:59:16	2.5	20.52	50.82	33.33	3.5	8.35	639	74.9	5.54
5/05/2025	7:59:28	3	20.52	50.91	33.39	3.6	8.26	638	73.3	5.42
5/05/2025	7:59:31	3.5	20.52	50.91	33.39	3.5	8.26	638	73.0	5.40
5/05/2025	7:59:40	4	20.53	50.92	33.40	3.5	8.24	637	70.8	5.24
5/05/2025	7:59:53	4.5	20.66	51.00	33.46	3.9	8.28	636	68.6	5.06
5/05/2025	8:00:49	4.8	20.83	51.12	33.55	40.3	8.38	630	60.6	4.45
Average			**20.82**	**50.75**	**33.27**	**6.61**	**8.33**	**639.73**	**71.53**	**5.27**
Stdev			**0.29**	**0.32**	**0.24**	**11.18**	**0.26**	**4.82**	**4.03**	**0.30**
Min			**20.52**	**49.93**	**32.67**	**2.70**	**7.75**	**630.00**	**60.60**	**4.45**
Max			**21.34**	**51.12**	**33.55**	**40.30**	**8.79**	**647.00**	**74.90**	**5.54**

C2

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
6/05/2025	14:12:36	0.3	21.93	48.36	31.52	4.8	7.65	444	61.5	4.48
6/05/2025	14:12:47	0.5	21.81	48.30	31.48	4.7	7.69	443	60.8	4.44
6/05/2025	14:13:21	1	21.74	48.36	31.52	4.6	8.07	443	59.3	4.33
6/05/2025	14:13:45	1.5	21.57	48.38	31.54	4.5	8.21	443	58.0	4.25
6/05/2025	14:14:01	2	21.60	48.64	31.73	4.5	8.50	443	57.3	4.19
6/05/2025	14:14:19	2.5	21.74	49.08	32.05	4.5	8.67	443	56.5	4.12
6/05/2025	14:14:36	3	21.50	49.27	32.19	4.8	8.69	443	56.2	4.11
6/05/2025	14:14:56	3.5	21.57	49.56	32.4	5.0	8.78	443	55.7	4.06
6/05/2025	14:15:17	4	21.49	49.73	32.52	5.6	8.80	443	54.4	3.98
6/05/2025	14:17:02	4.5	21.56	49.59	32.42	7.3	9.00	440	53.4	3.89
Average			**21.65**	**48.93**	**31.94**	**5.03**	**8.41**	**443**	**57.31**	**4.19**
Stdev			**0.15**	**0.58**	**0.42**	**0.86**	**0.48**	**1**	**2.63**	**0.19**
Min			**21.49**	**48.30**	**31.48**	**4.50**	**7.65**	**440**	**53.40**	**3.89**
Max			**21.93**	**49.73**	**32.52**	**7.30**	**9.00**	**444**	**61.50**	**4.48**

C3

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
6/05/2025	13:51:06	0.3	22.24	48.41	31.56	4.7	7.65	443	71.0	5.15
6/05/2025	13:51:25	0.5	22.14	48.39	31.54	4.4	7.74	443	68.1	4.94
6/05/2025	13:51:44	1	21.86	48.40	31.55	4.6	7.92	443	65.0	4.74
6/05/2025	13:52:02	1.5	21.70	48.48	31.61	4.6	8.20	442	63.7	4.66
6/05/2025	13:52:20	2	21.78	48.67	31.75	4.3	8.42	442	63.0	4.60
6/05/2025	13:52:46	2.5	21.59	49.23	32.16	4.5	8.53	443	62.1	4.54
6/05/2025	13:53:08	3	21.39	49.27	32.19	4.6	8.54	442	61.2	4.49
6/05/2025	13:53:25	3.5	21.45	49.70	32.51	4.9	8.53	442	60.3	4.40
6/05/2025	13:53:28	4	21.45	49.74	32.53	4.9	8.53	442	60.1	4.40
6/05/2025	13:53:44	4.5	21.42	50.08	32.78	6.2	8.50	442	57.6	4.20
6/05/2025	13:54:07	5	21.34	50.48	33.07	6.3	8.49	442	53.3	3.89
6/05/2025	13:55:34	5.1	21.41	50.04	32.75	9.2	8.58	442	49.8	3.64
Average			**21.65**	**49.24**	**32.17**	**5.27**	**8.30**	**442**	**61.27**	**4.47**
Stdev			**0.30**	**0.76**	**0.56**	**1.40**	**0.34**	**0**	**5.84**	**0.42**
Min			**21.34**	**48.39**	**31.54**	**4.30**	**7.65**	**442**	**49.80**	**3.64**
Max			**22.24**	**50.48**	**33.07**	**9.20**	**8.58**	**443**	**71.00**	**5.15**

C4

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	12:44:09	0.3	22.60	49.11	32.07	3.6	7.69	497	71.1	5.11
5/05/2025	12:44:37	0.5	22.60	49.24	32.17	3.8	8.2	496	70.2	5.04
5/05/2025	12:44:52	1	21.33	48.78	31.83	3.7	8.22	496	71.8	5.28
5/05/2025	12:45:08	1.5	21.26	49.00	31.99	3.7	8.12	496	72.9	5.36
5/05/2025	12:45:22	2	21.22	49.58	32.41	3.6	7.70	496	72.8	5.34
5/05/2025	12:45:37	2.5	21.31	50.46	33.06	3.5	7.81	496	70.8	5.17
5/05/2025	12:45:54	3	21.20	50.52	33.10	3.7	7.47	496	69.5	5.08
5/05/2025	12:46:13	3.5	20.88	50.80	33.31	4.1	6.53	496	68.6	5.04
5/05/2025	12:46:27	4	20.99	51.02	33.47	5.1	6.72	495	65.7	4.81
5/05/2025	12:46:44	4.5	21.14	51.06	33.50	6.4	6.68	495	62.4	4.56
Average			**21.45**	**49.96**	**32.69**	**4.12**	**7.51**	**496**	**69.58**	**5.08**
Stdev			**0.62**	**0.90**	**0.66**	**0.93**	**0.65**	**1**	**3.30**	**0.25**
Min			**20.88**	**48.78**	**31.83**	**3.50**	**6.53**	**495**	**62.40**	**4.56**
Max			**22.60**	**51.06**	**33.50**	**6.40**	**8.22**	**497**	**72.90**	**5.36**

C5

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
6/05/2025	12:38:44	0.5	22.16	48.51	31.63	3.6	7.58	443	74.8	5.42
6/05/2025	12:39:08	1	21.84	48.44	31.58	3.5	7.83	444	75.2	5.49
6/05/2025	12:39:28	1.5	21.49	48.42	31.57	3.6	8.23	444	74.9	5.50
6/05/2025	12:39:51	2	21.33	48.39	31.55	3.7	8.34	444	73.1	5.39
6/05/2025	12:40:07	2.5	21.37	48.50	31.62	3.7	8.39	444	72.6	5.34
6/05/2025	12:40:32	3	21.46	48.70	31.77	4.0	8.33	444	68.2	5.00
6/05/2025	12:40:48	3.5	21.42	49.75	32.54	4.4	8.35	444	66.3	4.85
6/05/2025	12:41:06	4	21.27	49.99	32.72	4.6	8.13	444	66.3	4.86
6/05/2025	12:41:28	4.5	21.24	50.16	32.84	4.9	8.35	444	65.2	4.77
6/05/2025	12:41:45	5	21.26	50.26	32.91	5.3	8.32	443	63.5	4.64
6/05/2025	12:41:59	5.5	21.24	50.33	32.97	5.5	8.31	443	64.7	4.73
6/05/2025	12:42:14	6	21.34	50.57	33.14	5.9	8.36	443	64.0	4.67
6/05/2025	12:43:45	6.3	21.25	50.31	32.95	7.2	8.59	442	62.7	4.59
Average			**21.44**	**49.41**	**32.29**	**4.61**	**8.24**	**444**	**68.58**	**5.02**
Stdev			**0.27**	**0.91**	**0.66**	**1.12**	**0.26**	**1**	**4.81**	**0.35**
Min			**21.24**	**48.39**	**31.55**	**3.50**	**7.58**	**442**	**62.70**	**4.59**
Max			**22.16**	**50.57**	**33.14**	**7.20**	**8.59**	**444**	**75.20**	**5.50**

C6

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	13:10:19	0.5	24.16	49.89	32.64	4.3	7.93	488	64.9	4.52
5/05/2025	13:10:43	1	23.25	49.68	32.49	3.9	8.29	488	66.0	4.67
5/05/2025	13:11:07	1.5	21.86	49.45	32.32	4.2	8.41	488	67.9	4.93
5/05/2025	13:11:27	2	22.02	50.27	32.92	3.9	8.40	488	67.0	4.84
5/05/2025	13:11:54	2.5	21.34	50.41	33.03	3.9	8.50	488	65.9	4.81
5/05/2025	13:12:13	3	21.25	50.51	33.09	3.9	8.62	488	65.6	4.79
5/05/2025	13:12:33	3.5	21.17	50.50	33.09	4.2	8.39	488	65.0	4.76
5/05/2025	13:12:55	4	20.60	50.53	33.11	4.5	8.20	488	65.4	4.84
5/05/2025	13:13:11	4.5	20.58	50.69	33.23	5.4	8.30	487	64.8	4.79
5/05/2025	13:14:29	5.5	20.54	50.55	33.12	6.8	8.70	486	64.1	4.74
Average			**21.68**	**50.25**	**32.90**	**4.50**	**8.37**	**487.70**	**65.66**	**4.77**
Stdev			**1.20**	**0.42**	**0.31**	**0.93**	**0.22**	**0.67**	**1.12**	**0.11**
Min			**20.54**	**49.45**	**32.32**	**3.90**	**7.93**	**486.00**	**64.10**	**4.52**
Max			**24.16**	**50.69**	**33.23**	**6.80**	**8.70**	**488.00**	**67.90**	**4.93**

C7

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
6/05/2025	12:12:22	0.3	21.85	49.03	32.02	4.1	7.43	446	71.3	5.19
6/05/2025	12:12:36	0.5	21.72	49.03	32.01	3.6	7.50	445	70.1	5.12
6/05/2025	12:13:33	1	21.47	49.03	32.01	3.5	8.33	445	67.7	4.96
6/05/2025	12:13:54	1.5	21.37	49.07	32.04	3.6	8.54	445	68.9	5.06
6/05/2025	12:13:57	2	21.37	49.07	32.04	3.6	8.54	445	68.7	5.05
6/05/2025	12:14:08	2.5	21.29	49.04	32.02	3.6	8.55	445	68.0	5.00
6/05/2025	12:14:22	3	21.21	49.07	32.05	3.8	8.55	445	68.2	5.02
6/05/2025	12:14:37	3.5	21.19	49.60	32.43	4.1	8.59	445	66.9	4.91
6/05/2025	12:14:52	4	21.32	49.87	32.63	4.1	8.61	445	65.4	4.79
6/05/2025	12:15:07	4.5	21.37	49.99	32.71	4.2	8.63	445	63.7	4.65
6/05/2025	12:16:34	5	21.40	50.12	32.81	5.8	8.63	444	57.9	4.23
Average			**21.41**	**49.36**	**32.25**	**4.00**	**8.35**	**445.00**	**66.98**	**4.91**
Stdev			**0.20**	**0.44**	**0.32**	**0.65**	**0.45**	**0.45**	**3.66**	**0.27**
Min			**21.19**	**49.03**	**32.01**	**3.50**	**7.43**	**444.00**	**57.90**	**4.23**
Max			**21.85**	**50.12**	**32.81**	**5.80**	**8.63**	**446.00**	**71.30**	**5.19**

Reference monitoring stations

R1

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	13:35:54	0.3	22.45	49.08	32.05	3.8	7.33	484	79.4	5.71
5/05/2025	13:36:20	0.5	22.09	49.47	32.34	3.8	7.38	483	77.8	5.62
5/05/2025	13:36:36	1	21.64	49.79	32.57	3.8	7.57	484	77.3	5.63
5/05/2025	13:36:39	1.5	21.63	49.79	32.57	3.8	7.60	484	77.5	5.65
5/05/2025	13:37:04	2	21.54	49.93	32.67	4.0	7.88	483	75.4	5.50
5/05/2025	13:37:21	2.5	21.34	50.52	33.10	3.8	7.94	483	76.1	5.55
5/05/2025	13:37:39	3	21.11	50.57	33.14	3.9	8.04	483	75.4	5.53
5/05/2025	13:37:57	3.5	20.87	50.60	33.16	4.3	8.08	483	72.9	5.36
5/05/2025	13:38:19	4	20.83	50.65	33.20	5.3	8.10	483	69.7	5.13
5/05/2025	13:39:23	4.5	20.85	50.63	33.19	6.9	7.76	481	68.1	5.01
5/05/2025	13:39:26	4.6	20.85	50.63	33.18	7.0	7.77	481	68.0	5.00
Average			**21.38**	**50.15**	**32.83**	**4.58**	**7.77**	**483**	**74.33**	**5.43**
Stdev			**0.55**	**0.56**	**0.41**	**1.25**	**0.27**	**1**	**4.05**	**0.26**
Min			**20.83**	**49.08**	**32.05**	**3.80**	**7.33**	**481**	**68.00**	**5.00**
Max			**22.45**	**50.65**	**33.20**	**7.00**	**8.10**	**484**	**79.40**	**5.71**

R9

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	9:19:53	0.3	21.08	49.33	32.23	1.9	7.79	566	67.9	5.00
5/05/2025	9:20:19	0.5	20.84	49.72	32.52	2.0	8.04	566	67.5	4.99
5/05/2025	9:20:33	1	20.73	49.69	32.50	2.1	7.99	565	67.4	4.99
5/05/2025	9:20:49	1.5	20.84	50.10	32.80	2.2	8.56	565	66.1	4.88
5/05/2025	9:21:07	2	20.96	50.36	32.98	2.4	8.50	564	66.7	4.91
5/05/2025	9:21:27	2.5	20.79	50.52	33.11	2.6	8.61	564	67.5	4.98
5/05/2025	9:21:30	3	20.80	50.52	33.10	2.6	8.61	564	67.4	4.97
5/05/2025	9:21:46	3.5	20.54	50.47	33.07	2.9	8.64	564	66.1	4.90
5/05/2025	9:22:08	4	20.57	50.55	33.12	3.1	8.61	563	63.6	4.71
5/05/2025	9:22:45	4.5	20.94	51.14	33.56	4.0	8.66	563	57.8	4.23
5/05/2025	9:23:16	5	21.19	51.39	33.75	7.3	8.69	562	50.3	3.67
Average			**20.84**	**50.34**	**32.98**	**3.01**	**8.43**	**564**	**64.39**	**4.75**
Stdev			**0.20**	**0.61**	**0.45**	**1.54**	**0.32**	**1**	**5.51**	**0.42**
Min			**20.54**	**49.33**	**32.23**	**1.90**	**7.79**	**562**	**50.30**	**3.67**
Max			**21.19**	**51.39**	**33.75**	**7.30**	**8.69**	**566**	**67.90**	**5.00**

R10

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
6/05/2025	8:36:31	0.3	21.25	49.21	32.15	3.5	7.23	452	64.7	4.76
6/05/2025	8:36:51	0.5	21.25	49.21	32.14	3.7	7.85	453	64.2	4.72
6/05/2025	8:37:27	1	21.24	49.20	32.13	3.8	8.45	453	63.4	4.66
6/05/2025	8:37:51	1.5	21.24	49.22	32.15	4.0	8.49	453	62.7	4.61
6/05/2025	8:38:13	2	21.24	49.43	32.30	5.0	8.52	453	60.1	4.41
6/05/2025	8:38:32	2.5	21.22	49.50	32.35	4.4	8.5	453	59.8	4.39
6/05/2025	8:38:51	3	21.32	49.76	32.54	4.6	8.57	453	59.6	4.37
6/05/2025	8:39:05	3.5	21.35	50.05	32.76	4.9	8.54	453	58.7	4.29
6/05/2025	8:39:21	4	21.52	50.81	33.32	5.4	8.55	453	55.9	4.06
6/05/2025	8:39:24	4.5	21.52	50.84	33.34	5.4	8.55	453	55.5	4.03
6/05/2025	8:39:35	5	21.64	51.20	33.61	5.8	8.5	453	50.7	3.67
6/05/2025	8:39:53	5.5	21.69	51.27	33.66	8.3	8.56	453	45.1	3.26
6/05/2025	8:41:07	5.9	21.70	51.30	33.68	7.8	8.26	452	41.4	2.99
Average			**21.40**	**50.08**	**32.78**	**5.12**	**8.35**	**453**	**57.06**	**4.17**
Stdev			**0.19**	**0.87**	**0.64**	**1.48**	**0.39**	**0**	**7.30**	**0.56**
Min			**21.22**	**49.20**	**32.13**	**3.50**	**7.23**	**452**	**41.40**	**2.99**
Max			**21.70**	**51.30**	**33.68**	**8.30**	**8.57**	**453**	**64.70**	**4.76**

R12

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
6/05/2025	11:44:49	0.3	21.53	49.09	32.06	2.0	6.80	443	74.9	5.48
6/05/2025	11:45:10	0.5	21.47	49.08	32.05	2.0	6.43	443	71.4	5.23
6/05/2025	11:45:30	1	21.37	49.11	32.07	2.0	6.67	443	69.8	5.12
6/05/2025	11:45:42	1.5	21.42	49.17	32.12	2.1	6.93	443	69.4	5.09
6/05/2025	11:45:57	2	21.30	49.23	32.16	2.1	7.14	443	69.6	5.11
6/05/2025	11:46:12	2.5	21.46	49.33	32.23	2.2	7.26	443	65.6	4.80
6/05/2025	11:46:26	3	21.41	49.50	32.36	2.4	7.35	443	65.4	4.79
6/05/2025	11:46:41	3.5	21.39	49.61	32.44	2.6	7.01	443	61.9	4.53
6/05/2025	11:46:56	4	21.43	49.96	32.69	2.7	7.05	443	60.0	4.38
6/05/2025	11:47:16	4.5	21.74	50.99	33.45	3.2	7.22	444	56.7	4.10
6/05/2025	11:47:32	5	21.7	51.05	33.50	3.6	7.14	444	53.4	3.86
6/05/2025	11:47:52	5.5	21.71	51.07	33.51	4.1	7.19	444	49.9	3.61
6/05/2025	11:48:15	6	21.72	51.10	33.53	4.9	7.15	444	46.9	3.39
6/05/2025	11:48:18	6.5	21.71	51.10	33.53	4.9	7.10	444	46.6	3.37
6/05/2025	11:48:47	7	21.82	51.29	33.67	7.0	7.10	444	40.7	2.93
Average			**21.55**	**50.05**	**32.76**	**3.19**	**7.04**	**443**	**60.15**	**4.39**
Stdev			**0.17**	**0.92**	**0.68**	**1.47**	**0.24**	**1**	**10.60**	**0.80**
Min			**21.30**	**49.08**	**32.05**	**2.00**	**6.43**	**443**	**40.70**	**2.93**
Max			**21.82**	**51.29**	**33.67**	**7.00**	**7.35**	**444**	**74.90**	**5.48**

R13

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
6/05/2025	9:04:22	0.5	21.57	48.98	31.98	2.0	5.93	450	70.0	5.12
6/05/2025	9:04:50	1	21.57	49.06	32.04	2.4	6.65	450	68.7	5.02
6/05/2025	9:05:04	1.5	21.53	49.12	32.08	2.5	7.10	450	69.3	5.07
6/05/2025	9:05:17	2	21.53	49.11	32.07	2.5	7.73	450	67.7	4.95
6/05/2025	9:05:31	2.5	21.51	49.17	32.11	2.7	8.07	451	68.1	4.99
6/05/2025	9:05:46	3	21.36	49.17	32.12	2.7	8.32	451	67.4	4.95
6/05/2025	9:06:00	3.5	21.18	49.14	32.09	2.8	8.35	451	65.6	4.83
6/05/2025	9:06:16	4	21.06	49.20	32.14	3.0	8.39	451	64.4	4.75
6/05/2025	9:06:32	4.5	21.36	50.03	32.75	3.3	8.40	452	62.4	4.56
6/05/2025	9:06:46	5	21.35	50.89	33.38	3.6	8.42	452	60.9	4.44
6/05/2025	9:06:59	5.5	21.43	51.07	33.51	4.3	8.47	452	56.9	4.13
6/05/2025	9:08:07	5.9	21.44	50.89	33.38	5.1	7.83	451	47.9	3.49
Average			**21.41**	**49.65**	**32.47**	**3.08**	**7.81**	**451**	**64.11**	**4.69**
Stdev			**0.16**	**0.83**	**0.61**	**0.88**	**0.83**	**1**	**6.41**	**0.48**
Min			**21.06**	**48.98**	**31.98**	**2.00**	**5.93**	**450**	**47.90**	**3.49**
Max			**21.57**	**51.07**	**33.51**	**5.10**	**8.47**	**452**	**70.00**	**5.12**

IM1

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	8:22:55	0.5	21.45	50.26	32.91	2.7	7.19	608	75.8	5.53
5/05/2025	8:23:14	1	21.53	50.16	32.84	2.9	7.39	607	75.8	5.52
5/05/2025	8:23:34	1.5	21.25	50.57	33.14	3.0	7.72	606	76.4	5.58
5/05/2025	8:23:59	2	21.02	50.63	33.19	3.4	8.03	605	77.2	5.67
5/05/2025	8:24:15	2.5	21.00	50.66	33.21	3.5	8.07	604	77.5	5.69
5/05/2025	8:24:29	3	20.72	50.62	33.18	3.6	8.07	604	78.0	5.76
5/05/2025	8:24:43	3.5	20.49	50.67	33.22	3.8	8.16	604	77.5	5.74
5/05/2025	8:24:58	4	20.55	50.81	33.32	4.3	7.78	603	75.4	5.57
5/05/2025	8:25:12	4.5	20.56	50.83	33.33	4.9	7.60	603	72.7	5.38
5/05/2025	8:26:44	5	20.57	50.83	33.34	7.0	7.60	599	64.8	4.79
Average			**20.91**	**50.60**	**33.17**	**3.91**	**7.76**	**604**	**75.11**	**5.52**
Stdev			**0.39**	**0.23**	**0.17**	**1.27**	**0.32**	**2**	**3.93**	**0.28**
Min			**20.49**	**50.16**	**32.84**	**2.70**	**7.19**	**599**	**64.80**	**4.79**
Max			**21.53**	**50.83**	**33.34**	**7.00**	**8.16**	**608**	**78.00**	**5.76**

IM2

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	10:45:14	0.5	21.17	48.76	31.81	3.5	7.76	526	69.4	5.12
5/05/2025	10:45:39	1	21.01	48.76	31.82	3.5	8.02	525	71.5	5.29
5/05/2025	10:46:03	1.5	20.86	48.76	31.82	3.4	8.19	525	71.5	5.30
5/05/2025	10:46:06	2	20.86	48.76	31.81	3.4	8.22	525	71.5	5.30
5/05/2025	10:46:30	2.5	20.93	48.91	31.93	3.5	8.30	524	71.0	5.26
5/05/2025	10:46:53	3	21.25	49.76	32.55	3.7	8.50	524	67.9	4.98
5/05/2025	10:47:09	3.5	21.4	50.06	32.77	4.0	8.48	524	67.5	4.93
5/05/2025	10:47:29	4	21.32	50.32	32.95	4.3	8.54	523	67.9	4.96
5/05/2025	10:48:43	4.1	21.29	50.47	33.07	6.4	8.23	522	66.3	4.85
Average			**21.12**	**49.40**	**32.28**	**3.97**	**8.25**	**524**	**69.39**	**5.11**
Stdev			**0.21**	**0.74**	**0.54**	**0.96**	**0.25**	**1**	**2.05**	**0.18**
Min			**20.86**	**48.76**	**31.81**	**3.40**	**7.76**	**522**	**66.30**	**4.85**
Max			**21.40**	**50.47**	**33.07**	**6.40**	**8.54**	**526**	**71.50**	**5.30**

IM3

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	10:19:12	0.5	21.06	48.84	31.87	3.3	7.10	537	65.7	4.86
5/05/2025	10:19:39	1	21.01	48.86	31.88	3.4	7.42	537	66.5	4.92
5/05/2025	10:20:03	1.5	20.87	48.91	31.92	3.4	7.68	536	66.2	4.91
5/05/2025	10:20:41	2	21.13	49.70	32.50	3.5	8.11	536	65.3	4.80
5/05/2025	10:21:02	2.5	21.36	50.01	32.73	3.9	8.28	535	64.9	4.74
5/05/2025	10:21:18	3	21.31	50.19	32.86	3.9	8.37	535	65.5	4.79
5/05/2025	10:21:42	3.5	21.25	50.44	33.05	4.3	8.45	534	65.5	4.79
5/05/2025	10:22:02	4	21.20	50.50	33.09	4.6	8.44	534	65.0	4.76
5/05/2025	10:22:20	4.5	21.08	51.17	33.58	5.6	8.43	535	62.5	4.57
5/05/2025	10:22:38	5	21.09	51.18	33.59	6.2	8.41	534	55.8	4.08
5/05/2025	10:22:53	5.5	21.11	51.19	33.60	7.2	8.43	534	53.3	3.90
5/05/2025	10:24:14	5.9	21.15	51.19	33.60	9.1	8.58	532	48.7	3.55
Average			**21.14**	**50.18**	**32.86**	**4.87**	**8.14**	**535**	**62.08**	**4.56**
Stdev			**0.13**	**0.93**	**0.69**	**1.82**	**0.48**	**1**	**6.00**	**0.45**
Min			**20.87**	**48.84**	**31.87**	**3.30**	**7.10**	**532**	**48.70**	**3.55**
Max			**21.36**	**51.19**	**33.60**	**9.10**	**8.58**	**537**	**66.50**	**4.92**

IM4

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	11:08:38	0.5	21.04	48.67	31.75	3.4	7.33	518	70.3	5.20
5/05/2025	11:09:09	1	20.91	48.68	31.76	3.2	7.74	517	69.2	5.13
5/05/2025	11:09:12	1.5	20.80	48.65	31.73	3.3	7.64	517	69.0	5.13
5/05/2025	11:09:31	2	20.75	48.68	31.76	3.3	7.64	516	68.4	5.09
5/05/2025	11:09:50	2.5	21.06	50.03	32.74	3.6	7.58	517	66.4	4.88
5/05/2025	11:10:08	3	21.06	50.02	32.74	3.6	7.60	516	66.2	4.87
5/05/2025	11:10:11	3.5	21.18	50.30	32.94	4.0	7.61	516	63.7	4.66
5/05/2025	11:10:39	4	21.13	50.37	33.00	4.5	7.35	515	63.5	4.66
5/05/2025	11:11:03	4.5	21.21	50.59	33.16	4.9	7.45	515	63.4	4.64
5/05/2025	11:11:17	5	21.17	50.59	33.15	5.5	7.45	515	62.2	4.55
5/05/2025	11:11:40	5.5	21.26	51.24	33.64	6.5	7.48	515	58.1	4.23
5/05/2025	11:12:00	6	21.33	51.29	33.67	7.1	7.61	515	51.5	3.75
5/05/2025	11:12:18	6.5	21.40	51.35	33.72	8.8	7.83	515	46.8	3.40
5/05/2025	11:12:44	6.9	21.23	51.24	33.64	9.1	8.28	513	46.3	3.37
Average			**21.11**	**50.12**	**32.81**	**5.06**	**7.61**	**516**	**61.79**	**4.54**
Stdev			**0.19**	**1.05**	**0.77**	**2.05**	**0.24**	**1**	**8.12**	**0.63**
Min			**20.75**	**48.65**	**31.73**	**3.20**	**7.33**	**513**	**46.30**	**3.37**
Max			**21.40**	**51.35**	**33.72**	**9.10**	**8.28**	**518**	**70.30**	**5.20**

IM5

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	12:10:01	0.5	21.06	48.53	31.65	3.2	7.35	504	67.7	5.01
5/05/2025	12:10:22	1	20.78	48.53	31.65	3.1	7.94	503	67.2	5.00
5/05/2025	12:10:57	1.5	20.84	48.75	31.81	3.2	8.43	502	66.4	4.93
5/05/2025	12:11:17	2	21.05	49.42	32.30	3.4	8.56	502	64.5	4.75
5/05/2025	12:11:35	2.5	21.14	50.26	32.91	3.8	8.59	503	62.7	4.6
5/05/2025	12:11:53	3	21.20	50.46	33.06	4.2	8.61	502	61.3	4.49
5/05/2025	12:12:08	3.5	21.22	50.53	33.11	4.7	8.61	502	61.0	4.46
5/05/2025	12:12:11	4	21.22	50.53	33.11	4.7	8.62	502	61.0	4.46
5/05/2025	12:12:30	4.5	21.19	50.59	33.15	5.4	8.65	501	60.6	4.43
5/05/2025	12:12:33	5	21.19	50.60	33.17	5.4	8.67	501	60.6	4.43
5/05/2025	12:12:47	5.5	21.22	51.13	33.56	6.9	8.66	502	58.8	4.29
5/05/2025	12:13:01	6	21.23	51.17	33.58	7.2	8.68	502	54.3	3.96
5/05/2025	12:13:13	6.5	21.25	51.18	33.59	7.9	8.69	501	51.8	3.78
5/05/2025	12:13:29	7	21.29	51.24	33.64	8.5	8.65	501	49.8	3.63
Average			**21.13**	**50.21**	**32.88**	**5.11**	**8.48**	**502**	**60.55**	**4.44**
Stdev			**0.15**	**0.99**	**0.73**	**1.84**	**0.38**	**1**	**5.44**	**0.43**
Min			**20.78**	**48.53**	**31.65**	**3.10**	**7.35**	**501**	**49.80**	**3.63**
Max			**21.29**	**51.24**	**33.64**	**8.50**	**8.69**	**504**	**67.70**	**5.01**

IM6

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	11:37:52	0.5	21.12	48.66	31.74	2.9	8.06	510	67.3	4.97
5/05/2025	11:38:25	1	21.01	48.72	31.79	3.0	8.36	510	67.5	4.99
5/05/2025	11:38:42	1.5	20.84	48.64	31.73	3.0	8.46	510	67.4	5.00
5/05/2025	11:39:05	2	20.72	48.66	31.74	3.1	8.45	509	66.5	4.95
5/05/2025	11:39:22	2.5	21.05	49.94	32.68	3.4	8.31	509	64.8	4.76
5/05/2025	11:39:36	3	21.13	50.18	32.85	3.6	8.42	509	63.0	4.62
5/05/2025	11:39:52	4.5	21.19	50.37	33.00	3.8	8.33	508	62.9	4.61
5/05/2025	11:40:59	6.3	21.20	50.38	33.00	5.4	7.66	506	62.8	4.60
Average			**21.03**	**49.44**	**32.32**	**3.53**	**8.26**	**509**	**65.28**	**4.81**
Stdev			**0.17**	**0.84**	**0.61**	**0.82**	**0.27**	**1**	**2.15**	**0.18**
Min			**20.72**	**48.64**	**31.73**	**2.90**	**7.66**	**506**	**62.80**	**4.60**
Max			**21.20**	**50.38**	**33.00**	**5.40**	**8.46**	**510**	**67.50**	**5.00**

IM7

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
6/05/2025	7:46:36	0.5	22.9	48.93	31.94	2.9	8.55	461	69.2	4.95
6/05/2025	7:47:02	1	21.77	48.95	31.96	2.7	8.81	461	71.3	5.20
6/05/2025	7:47:24	1.5	21.53	49.07	32.04	2.6	8.97	461	72.7	5.32
6/05/2025	7:47:40	2	21.53	49.11	32.07	2.7	9.00	461	71.6	5.24
6/05/2025	7:48:02	2.5	21.61	49.17	32.11	2.7	9.06	461	71.4	5.22
6/05/2025	7:48:21	3	21.63	49.19	32.13	3.0	9.05	460	71.1	5.19
6/05/2025	7:48:37	3.5	21.67	49.41	32.29	3.1	9.12	460	71.1	5.18
6/05/2025	7:48:53	4	21.75	49.70	32.5	3.3	9.16	460	69.8	5.08
6/05/2025	7:49:06	4.5	21.81	49.91	32.65	3.5	9.10	460	68.3	4.95
6/05/2025	7:49:23	5	21.44	49.84	32.61	3.6	9.09	460	67.3	4.92
6/05/2025	7:49:30	5.5	21.61	51.22	33.62	3.9	9.06	460	66.7	4.83
6/05/2025	7:49:45	6	22.05	51.27	33.66	4.1	9.00	460	62.9	4.52
6/05/2025	7:50:02	6.5	21.86	51.28	33.66	4.5	8.99	460	57.7	4.16
6/05/2025	7:51:09	6.7	21.85	51.27	33.66	4.2	9.00	459	54.2	3.91
Average			**21.79**	**49.88**	**32.64**	**3.34**	**9.00**	**460**	**67.52**	**4.91**
Stdev			**0.36**	**0.96**	**0.70**	**0.63**	**0.15**	**1**	**5.57**	**0.43**
Min			**21.44**	**48.93**	**31.94**	**2.60**	**8.55**	**459**	**54.20**	**3.91**
Max			**22.90**	**51.28**	**33.66**	**4.50**	**9.16**	**461**	**72.70**	**5.32**

IM8

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
6/05/2025	8:10:29	0.5	22.87	48.90	31.92	3.8	7.76	457	65.2	4.66
6/05/2025	8:10:47	1	22.29	49.12	32.08	3.9	7.84	456	62.5	4.51
6/05/2025	8:10:59	1.5	21.63	49.04	32.02	3.8	8.21	457	63.3	4.62
6/05/2025	8:11:12	2	21.44	49.16	32.11	4.8	8.39	457	61.6	4.52
6/05/2025	8:11:30	2.5	21.42	49.24	32.16	4.6	8.42	457	61.2	4.49
6/05/2025	8:11:48	3	21.47	49.31	32.22	4.9	8.63	457	60.3	4.42
6/05/2025	8:12:04	3.5	21.36	49.27	32.19	4.8	8.76	457	58.9	4.32
6/05/2025	8:12:21	4	21.34	49.47	32.34	4.7	8.92	457	57.8	4.24
6/05/2025	8:12:35	4.5	21.52	50.19	32.86	4.7	9.04	457	57.3	4.17
6/05/2025	8:12:48	5	21.66	50.25	32.91	4.9	9.08	457	55.0	4.00
6/05/2025	8:13:01	5.5	21.56	50.61	33.17	5.4	8.95	457	53.8	3.91
6/05/2025	8:13:13	6	21.58	50.98	33.44	5.5	8.91	457	51.5	3.73
6/05/2025	8:13:25	6.5	21.64	51.13	33.56	6.8	8.98	458	49.1	3.55
6/05/2025	8:14:33	6.8	21.62	51.12	33.54	6.9	9.07	457	43.7	3.16
Average			**21.67**	**49.84**	**32.61**	**4.96**	**8.64**	**457**	**57.23**	**4.16**
Stdev			**0.41**	**0.84**	**0.61**	**0.95**	**0.45**	**0**	**6.04**	**0.44**
Min			**21.34**	**48.90**	**31.92**	**3.80**	**7.76**	**456**	**43.70**	**3.16**
Max			**22.87**	**51.13**	**33.56**	**6.90**	**9.08**	**458**	**65.20**	**4.66**

IM9 (was R8)

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	9:50:22	0.5	21.62	49.21	32.14	3.3	7.69	551	67.8	4.95
5/05/2025	9:50:50	1	21.64	49.16	32.11	3.4	7.75	549	67.2	4.91
5/05/2025	9:51:20	1.5	21.55	49.13	32.08	3.5	7.85	548	67.9	4.96
5/05/2025	9:51:52	2	21.02	49.66	32.47	3.5	8.25	547	67.4	4.96
5/05/2025	9:52:14	2.5	21.24	50.13	32.82	3.7	8.36	547	66.1	4.84
5/05/2025	9:52:36	3	21.18	50.48	33.08	3.9	8.34	546	66.4	4.86
5/05/2025	9:53:03	3.5	21.21	50.51	33.10	4.3	8.46	546	66.1	4.83
5/05/2025	9:53:25	4	21.18	50.52	33.11	4.7	8.48	545	65.2	4.78
5/05/2025	9:53:41	4.5	21.00	51.14	33.56	6.0	8.46	546	63.5	4.65
5/05/2025	9:53:58	5	20.99	51.14	33.56	6.7	8.27	546	57.8	4.23
5/05/2025	9:54:09	5.5	20.99	51.14	33.56	6.3	8.24	546	56.2	4.12
5/05/2025	9:54:25	6	20.99	51.13	33.56	7.1	8.27	545	55.1	4.04
5/05/2025	9:55:58	6.1	20.98	51.13	33.56	8.7	8.41	543	54.3	3.98
Average			**21.20**	**50.34**	**32.98**	**5.01**	**8.22**	**547**	**63.15**	**4.62**
Stdev			**0.25**	**0.81**	**0.60**	**1.76**	**0.27**	**2**	**5.25**	**0.38**
Min			**20.98**	**49.13**	**32.08**	**3.30**	**7.69**	**543**	**54.30**	**3.98**
Max			**21.64**	**51.14**	**33.56**	**8.70**	**8.48**	**551**	**67.90**	**4.96**

IM10 (was R2)

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
5/05/2025	8:51:16	0.5	21.17	50.06	32.77	2.2	7.85	587	75.4	5.53
5/05/2025	8:51:38	1	21.07	50.22	32.88	2.6	8.06	586	69.6	5.11
5/05/2025	8:51:58	1.5	20.90	50.31	32.95	2.7	8.19	585	65.9	4.85
5/05/2025	8:52:19	2	20.71	50.33	32.97	3.3	8.37	584	64.4	4.76
5/05/2025	8:52:35	2.5	20.72	50.36	32.99	4.3	8.44	583	64.9	4.80
5/05/2025	8:52:47	3	20.71	50.36	32.99	3.1	8.41	582	64.1	4.73
5/05/2025	8:53:04	3.5	20.69	50.41	33.03	3.4	8.44	582	63.4	4.69
5/05/2025	8:53:26	4	20.44	50.56	33.13	3.7	8.58	581	62.2	4.62
5/05/2025	8:53:41	4.5	20.38	50.74	33.27	5.0	8.62	581	59.9	4.45
5/05/2025	8:55:15	4.8	20.37	50.63	33.19	5.4	8.52	578	56.8	4.22
Average			**20.72**	**50.40**	**33.02**	**3.57**	**8.35**	**583**	**64.66**	**4.78**
Stdev			**0.27**	**0.20**	**0.15**	**1.05**	**0.24**	**3**	**5.10**	**0.36**
Min			**20.37**	**50.06**	**32.77**	**2.20**	**7.85**	**578**	**56.80**	**4.22**
Max			**21.17**	**50.74**	**33.27**	**5.40**	**8.62**	**587**	**75.40**	**5.53**

IM11 (was R7)

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
6/05/2025	13:29:53	0.3	22.08	48.39	31.54	3.6	8.03	445	74.1	5.38
6/05/2025	13:30:17	0.5	21.75	48.43	31.57	3.8	8.31	445	73.7	5.39
6/05/2025	13:30:35	1	21.72	48.45	31.59	3.8	8.51	445	73.6	5.38
6/05/2025	13:30:51	1.5	21.63	48.56	31.67	3.7	8.58	445	73.8	5.40
6/05/2025	13:31:07	2	21.66	48.62	31.71	3.7	8.61	444	73.6	5.39
6/05/2025	13:31:25	2.5	21.50	48.77	31.82	3.9	8.60	444	72.4	5.31
6/05/2025	13:31:43	3	21.35	49.20	32.14	4.2	8.63	445	70.2	5.15
6/05/2025	13:31:59	3.5	21.37	49.58	32.41	4.6	8.67	445	68.5	5.01
6/05/2025	13:32:19	4	21.58	50.27	32.92	6.7	8.58	445	63.2	4.60
6/05/2025	13:32:43	4.5	21.49	50.74	33.26	5.8	8.49	445	59.3	4.31
6/05/2025	13:33:08	5	21.69	51.13	33.56	6.6	8.50	445	53.1	3.84
6/05/2025	13:33:27	5.5	21.81	51.29	33.68	7.1	8.57	445	50.0	3.61
6/05/2025	13:33:40	6	21.71	51.27	33.66	7.6	8.56	445	49.0	3.54
6/05/2025	13:33:53	6.5	21.61	51.29	33.68	8.1	8.57	445	47.1	3.41
6/05/2025	13:35:15	7	21.59	51.34	33.71	9.6	8.64	444	41.2	2.98
Average			**21.64**	**49.82**	**32.59**	**5.52**	**8.52**	**445**	**62.85**	**4.58**
Stdev			**0.18**	**1.25**	**0.92**	**1.97**	**0.16**	**0**	**11.81**	**0.88**
Min			**21.35**	**48.39**	**31.54**	**3.60**	**8.03**	**444**	**41.20**	**2.98**
Max			**22.08**	**51.34**	**33.71**	**9.60**	**8.67**	**445**	**74.10**	**5.40**

IM12 (was R11)

Date	Time	Depth	Temp (C)	Cond (ms/cm)	Sal (ppt)	Turb (ntu)	pH	ORP (mv)	DO (%sat)	D.O. (mg/L)
6/05/2025	13:01:50	0.5	22.09	48.55	31.66	3.2	7.62	445	79.2	5.75
6/05/2025	13:02:08	1	21.97	48.54	31.65	3.4	7.79	445	81.8	5.96
6/05/2025	13:02:39	1.5	21.97	48.53	31.65	3.5	8.37	445	79.7	5.80
6/05/2025	13:03:01	2	21.79	48.52	31.64	3.5	8.57	445	81.7	5.97
6/05/2025	13:03:21	2.5	21.81	48.60	31.69	3.3	8.62	444	82.2	6.00
6/05/2025	13:03:44	3	21.55	48.52	31.64	3.5	8.64	444	81.4	5.97
6/05/2025	13:04:10	3.5	21.61	49.51	32.37	3.8	8.64	444	78.8	5.75
6/05/2025	13:04:26	4	21.46	49.91	32.66	4.2	8.59	444	76.3	5.57
6/05/2025	13:04:46	4.5	21.54	50.18	32.86	6.4	8.51	444	70.4	5.13
6/05/2025	13:06:39	5	21.44	49.93	32.67	6.9	8.67	442	55.8	4.08
Average			**21.72**	**49.08**	**32.05**	**4.17**	**8.40**	**444**	**76.73**	**5.60**
Stdev			**0.23**	**0.71**	**0.52**	**1.34**	**0.38**	**1**	**8.16**	**0.59**
Min			**21.44**	**48.52**	**31.64**	**3.20**	**7.62**	**442**	**55.80**	**4.08**
Max			**22.09**	**50.18**	**32.86**	**6.90**	**8.67**	**445**	**82.20**	**6.00**