Northern Territory Government

WASTE DISCHARGE LICENCE

(Pursuant to section 74 of the *Water Act 1992)*

Licensee	Lithium Developments (Grants NT) Pty Ltd
Licence Number:	**WDL248-01**
Registered Business Address:	Level 5, Flinders Street Adelaide SA 5000
ACN:	622 047 232
ABN:	70 622 047 232
Commencement Date:	25 July 2022
Amended on:	7 March 2023
Expiry Date:	24 July 2025
Licensed Action:	Controlled discharge of wastewater from Mine Water Dam 1 (MWD1) through authorised discharge point (DP1) and into an unnamed ephemeral stream that feeds into West Arm, Darwin Harbour in accordance with Table 2 and subject to the conditions of this licence.

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INFORMATION ABOUT THIS LICENCE

This waste discharge licence is granted pursuant to section 74 of the *Water Act 1992* (NT) (Water Act), which empowers the Controller of Water Resources to, in accordance with the Water Act, grant a licence to a person to carry out an action that would otherwise be an offence against this Act.

Responsibilities of Licensee

- In addition to the conditions set out in this licence, general responsibilities of licensees are set out in the *Waste Management and Pollution Control Act 1998* (NT) (**WMPC Act**), the Water Act and the *Water Regulations 1992* (NT) (**Water Regulations**).
- It is an offence under the Water Act, if the holder of a waste discharge licence contravene or cause, suffer or permit a person to contravene a term or condition to which the waste discharge licence is subject (s 76 Water Act).
- Except as expressly provided for in this licence or applicable law, it is an offence under section 16 of the Water Act to wilfully cause or cause, directly or indirectly:
    - waste to come into contact with water; or
    - water to be polluted.

Duration of licence

- This licence will remain in force until its Expiry Date, it is surrendered by the licensee, or until it is suspended or revoked by the Controller of Water Resources.
- A licensee may surrender its licence at any time (s 94 Water Act).
- If the licensee wishes to surrender its licence it should complete the notification form approved by the Controller of Water Resources and provide a copy of the completed form to the Administering Agency.
- The authority to allow waste to come into contact with water or water to be polluted ends once a licence is surrendered, and any such occurrence after a licence is surrendered is an offence pursuant to s 16 of the Water Act.

Amendment, Modification or Revocation of Licence

- As set out in section 93 of the Water Act, the Controller of Water Resources may, by notice served on the holder of the licence:
    - amend or modify the terms and conditions of a licence; or
    - where the Controller of Water Resources is satisfied that the holder of the licence has contravened or failed to comply with a term or condition of the licence or of any other licence previously held by the person for a similar purpose during the 12 months immediately preceding the grant of the first-mentioned licence, the Controller of Water Resources may:
        - revoke a licence; or
        - suspend a licence.

Transfer of Licence

- Where a waste discharge licence is granted to a person in relation to the person's use of land and, during the period of this licence, the person's interest in the land is transferred to another person, the waste discharge licence shall be deemed to have also been transferred to the other person (s 92 Water Act).

- The licensee must ensure the contact details recorded with the Administering Agency for the licence are correct at all times in accordance with condition 6. Accordingly, it is recommended the transferee complete the Controller of Water Resources approved notification of transfer of a waste discharge licence form.

Public Register

- A copy of this Licence will be placed on the Register in accordance with section 95 of the Water Act.

- A copy of plans for environmental management, reports, submissions or documents provided at Schedule 1 Item 13 will be placed on the Register.

- The Register is freely available from the Northern Territory Environment Protection Authority (**NT EPA**) website.

Water Quality Standards

- The Administrator may declare, by notice in the *Gazette*, a beneficial use, quality standard, criteria or objectives which apply in relation to any waste or class of waste, or water or class of water (s 73 Water Act).

- A water or waste beneficial use, quality standard, criteria or objectives declared under s 73 of the Act and in force is an Environment Protection Objective for the purposes of the WMPC Act (s 18 WMPC Act).

- An Environment Protection Objective is a statutory instrument to establish principles on which:

    - Environmental quality is to be maintained, enhanced, managed or protected;

    - Pollution, or environmental harm resulting from pollution, is to be assessed, prevented, reduced, controlled, rectified or cleaned up; or

    - Effective waste management is to be implemented or evaluated.

- Schedule 1 Item 1 specifies the beneficial use, quality, standard, criteria or objective relevant to this licence at the date of issue.

Environmental Interests

- Environmentally sensitive or significant areas may be captured by and protected under the *Environment Protection Act 2019* (NT) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). As such, and to best protect and regulate our waterways, waste discharge licences must identify the sensitivity of the environment surrounding the location of the Licensed Action.

- Schedule 1 Item 2 specifies the sites of conservation significance (if any) relevant to this licence at the date of issue.

- Schedule 1 Item 3 specifies the Ramsar wetlands (if any) relevant to this licence at the date of issue.

Cultural Interests

- Under Commonwealth and Northern Territory laws it can be an offence to enter or remain on or damage a sacred site.
- Sites of Aboriginal significance including registered and recorded Aboriginal sacred sites may exist in the vicinity of the Licensed Action.
- It is the licensee's responsibility to contact the Aboriginal Areas Protection Authority, appropriate land council or other governing body and ensure that any Authority Certificates required as a result of conducting the Licensed Action are obtained and complied with.
- Further specific advice on any cultural requirement or implication of the licenced activity should be sought from the relevant land council and the Aboriginal Areas Protection Authority.

END NOTES

This licence is an amendment WDL 248, issued 25 July 2022.

SCHEDULE 1 - ITEMS

1. Beneficial uses	Beneficial Uses and Objectives for the Darwin Harbour Region (Gazette No. 27, 7 July 2010).	
2. Sites of conservation significance	SOCS No. 6 Darwin Harbour.	
3. Ramsar wetlands	Not applicable.	
4. Licence Documents	(a) Water Management Plan - Appendix K, Mine Management Plan Grants Lithium Project (approved 10 June 2021). (b) Emergency Response Plan - Appendix R, Mine Management Plan Grants Lithium Project (approved 28 June 2019). (c) Stakeholder Engagement Plan - Core Lithium Grants Lithium Project Stakeholder Engagement Plan (issued 7 June 2021).	
5. Authorised Discharge Point(s)	Discharge Point 1 (DP1) from Mine Water Dam 1 (MDW1) as shown on the plan at Appendix 1.	Zone: 52 L Easting: 693153 Northing: 8598441
6. Source(s) of waste	Pit water, direct rainfall, and mine influenced water collected from Mineral Lease 31726 that is captured and stored in sediment basins and Mine Water Dam 2 (MWD2) and pumped to MWD1. Waters discharged through DP1 are pumped over the wall of MWD1 and released by a tee valve into the flow path of an adjacent unnamed ephemeral stream as shown at Appendix 1.	
7. Trigger values	The limits for parameters listed in Appendix 2.	
8. Compliance point	Grants Downstream Surface Water 5 (GDS SW5) as shown on the plan at Appendix 1.	Zone: 52 L Easting: 693374 Northing: 8600709
9. Conditions on discharge	Any authorised discharge must: (a) Not include wastewater generated outside of Mineral Lease 31726; (b) Not include wastewater treated with polyacrylamide flocculants with more than 0.05% of the neuro-toxin acrylamide monomer; (c) Occur only when the stream gauge at the compliance point GDS SW5 shows there is a sufficient amount of water to dilute discharge water to achieve trigger values; (d) In the event wastewater is treated, occurs only when the treatment process has finished, including allowing sufficient residence time for settlement of flocculants and target contaminants.	
10. Monitoring Program	The Monitoring Program includes: (a) Surface water monitoring in accordance with Appendix 3. (b) Fluvial sediment monitoring in accordance with Appendix 4. (c) Biota monitoring in accordance with Appendix 5.	
11. Critical contaminants	Aluminium (Al), Arsenic (As), Copper (Cu), Iron (Fe), Lithium (Li), Zinc (Zn), Total Phosphorus (TP), Total Nitrogen (TN), Nitrate (NO_3) and Ammonia (NH_3).	

12. Non-compliances	Non-compliances include the following exceedances: (a) An exceedance of a trigger value specified in Item 7 at the compliance point in Item 8, on three consecutive sampling occasions. (b) An exceedance of three times or more a trigger value specified in Item 7 at the compliance point in Item 8.
13. Documents placed on Register	The following documents will be placed on the Register: (a) The Licence Documents at Item 4. (b) The Monitoring Report provided in accordance with clause 45. (c) The Annual Return.

LICENCE CONDITIONS

RULES FOR INTERPRETING THE CONDITIONS OF THIS LICENCE

1. Where there is a discrepancy between the conditions of this licence and any plan, standard, guideline or other document referred to in this licence, the conditions of this licence prevail to the extent of the inconsistency.
2. Any reference to any standard, guideline or code of practice (Australian or international) in this licence means the relevant parts of the current version of that standard, guideline or code of practice.
3. In this licence, unless the contrary intention appears, words that are defined in the Water Act are intended to have the meaning given to them in that Act.
4. In this licence, unless a contrary intention appears, terms are defined in the Definitions at the end of this licence.
5. In this licence a reference to an Item is a reference to an Item in Schedule 1.

GENERAL

6. The licensee must ensure the contact details recorded with the Administering Agency for this licence are correct at all times.
7. The licensee must at all times have a 24 hour emergency contact.
8. The licensee must notify the Administering Agency prior to making any operational change that will cause, or is likely to cause, an increase in the potential for environmental harm.
9. The licensee must display clear and legible signage, in English, in a prominent location at each public entrance to the premises of the Licensed Action that includes the following details:
    - 9.1. waste discharge licence number issued under the Water Act; and
    - 9.2. 24 hour emergency contact details.
10. The licensee must cause a hard copy of this licence to be available for inspection, at the premises of the Licenced Action, by any person on request.
11. Unless otherwise specified, within 10 business days of a request, the licensee must provide to the Administering Agency a copy of any document, monitoring data or other information in relation to the Licensed Action in electronic form by emailing environmentalregulation@nt.gov.au .
12. All notices, reports, documents or other correspondence required to be provided as a condition of this licence, unless otherwise specified as a condition of this licence, must be provided in electronic form by emailing environmentalregulation@nt.gov.au.
13. The licensee must maintain, implement and comply with the current version of the documents listed in Item 4.
14. Within 10 business days of any amendment being made to a document listed in in Item 4, the licensee must provide the amended document to the Administering Agency, along with:
    - 14.1. a tabulated summary of the amendment(s) with document references;
    - 14.2. reasons for the amendment(s); and
    - 14.3. an assessment of environmental risk associated with the amendment(s).
15. The Administering Agency may require the licensee to revise or amend and resubmit any document provided in accordance with this licence. Where the Administering Agency requires any document to be revised or amended, the licensee must submit it to the Administering Agency by the date specified by the Administering Agency.
16. The licensee must operate and maintain a community feedback telephone number enabling members of the public to contact, at any time, a person or voice mail system that can accept, on behalf of the licensee, enquiries or complaints about the Licensed Action, and to which the licensee must respond. The community feedback telephone number must be displayed:

16.1. where the licensee has a website, in a prominent location on the licensee's website;

16.2. in the Stakeholder Engagement Plan; and

16.3. in other publicly available documents relating to the Licensed Action.

17. The licensee must maintain a register of complaints that records the details of each complaint received in relation to the Licensed Action and provide a copy to the Administering Agency on request. Details of the compliant must (as is reasonably practicable) include, the following information:

17.1. the person to whom the complaint was made;

17.2. the person responsible for managing the complaint;

17.3. the date and time the complaint was reported;

17.4. the date and time of the event(s) that led to the complaint;

17.5. the contact details of the complainant if known, or where no details are provided a note to that effect;

17.6. the nature of the complaint;

17.7. the nature of event(s) giving rise to the complaint;

17.8. prevailing weather conditions at the time (where relevant to the complaint);

17.9. the action taken in relation to the complaint, including any follow-up contact with the complainant; and

17.10. if no action was taken, why no action was taken.

MONITORING INFORMATION

18. If the licence expires or is otherwise surrendered, suspended or revoked and the licence contained a condition that the licensee provide a report, record or other information, including in accordance with a monitoring program pursuant to section 77 of the Water Act, the licensee must provide any report, record, information or data available to the licensee up to and including the date the licence expired or was surrendered, suspended or revoked.

OPERATIONAL

19. Without limiting the conditions of this licence, in conducting the Licensed Action, the licensee must do all things reasonable and practicable to:

19.1. prevent or minimise the likelihood of pollution occurring as a result of, or in connection with, the Licensed Action;

19.2. prevent or minimise the likelihood of environmental harm occurring as a result, or in connection with, the Licensed Action;

19.3. effectively respond to pollution and the risk of pollution occurring as a result of, or in connection with, the Licensed Action;

19.4. effectively respond to environmental harm and the risk of environmental harm occurring as a result of or in connection with the Licensed Action; and

19.5. apply the principles of ecologically sustainable development.

20. The licensee must, without limiting any other condition of this licence, in conducting the Licensed Action do all things reasonable and practicable to ensure the Licensed Action does not adversely affect any:

20.1. declared beneficial use, quality, standard or objectives declared under section 73 of the Water Act;

20.2. sites of conservation significance; or

20.3. designated Ramsar wetlands,

including, but not limited to, those listed at Items 1, 2 and 3.

21. The licensee must ensure any plant and equipment used by the licensee in conducting the Licensed Action:

    21.1. is reasonably fit for the purpose and use to which it is put;

    21.2. is maintained and operational; and

    21.3. is operated by a person trained to use the plant and equipment.

22. No change, replacement or alteration of plant and equipment is permitted if the change, replacement or alteration increases the risk of environmental harm for the Licensed Action, unless approved by the Administering Agency.

DISCHARGES

23. This licence authorises discharges of waste to water from the authorised discharge point(s) as identified in Item 5 and in accordance with the conditions of this licence.

24. Where the Administering Agency directs the licensee to cease discharge from an authorised discharge point identified in Item 5, the licensee must immediately cease the discharge.

25. A direction to cease discharge may be verbal or written, but a verbal direction from the Administering Agency will be provided in writing within 48 hours of the verbal direction. A failure to provide a written direction does not affect the requirement to comply with a verbal direction.

26. The licensee must ensure that discharge from each authorised discharge point:

    26.1. consists only of waste from the source(s) as specified in Item 6;

    26.2. does not exceed the trigger value limits at Item 7 at the compliance point at Item 8;

    26.3. meets the conditions at Item 9.

27. Following any exceedance of a trigger value limits at Item 7 at the compliance point at Item 8 the licensee must take corrective action to mitigate any environmental harm and ensure the exceedance does not reoccur.

28. The licensee must, for each authorised discharge point, install, operate and maintain a device to measure and record, for each discharge event:

    28.1. the time the discharge commenced and the duration of the discharge;

    28.2. the discharge rate of flow; and

    28.3. the discharge volume.

29. The licensee must ensure that the discharge from all discharge events at each authorised discharge point does not:

    29.1. contain any floating debris, oil, grease, petroleum hydrocarbon sheen, scum, litter or other objectionable matter;

    29.2. cause or generate odours which would adversely affect the use and amenity of surrounding waters;

    29.3. cause algal blooms in the receiving water;

    29.4. pollute groundwater;

    29.5. cause visible change in the behaviour of fish or other aquatic organisms in the receiving water;

    29.6. cause mortality of fish or other aquatic organisms;

    29.7. cause erosion or degradation to the beds and banks of a watercourse; or

    29.8. cause adverse impacts on plants or animals.

MONITORING

30. From the Commencement Date of this licence, the licensee must implement and comply with the Monitoring Program specified in Item 10.

31. The licensee must ensure that the Monitoring Program is designed, maintained and implemented in accordance with the following principles:

    31.1. the need to monitor loads upstream and downstream, including in-stream decay in loads downstream, of authorised discharge points;

    31.2. the need for event-based monitoring, in addition to routine monitoring, including revisiting sampling points as soon as practicable when samples cannot be collected at frequencies set in the Monitoring Program;

    31.3. the need for special studies to better described in-stream physical, chemical and biological processes;

    31.4. the need to target the possible critical contaminants listed at Item 11;

    31.5. the need to select sampling points that provided representative (well mixed) samples;

    31.6. the need to collect samples that are representative of discharge conditions, including taking samples from sampling points on the same day as discharge and consecutively from upstream to downstream; and

    31.7. the need to adopt a range of biological surveys to assess the health of the system.

32. The licensee must ensure that all samples and field environmental data are collected in accordance with recognised Australian Standards and guidelines (such as AS/NZS 5667.1 1998, ANZG (2018), as updated from time to time).

33. For the parameters that require analysis at a laboratory, the licensee must ensure that all samples are analysed at a laboratory with current NATA accreditation or equivalent.

34. The licensee must ensure any samples collected in accordance with the Monitoring Program or in connection with the Licensed Action or this licence, are obtained by, or under the supervision of a qualified sampler.

35. The licensee must ensure that, for each sample collected in accordance with the Monitoring Program or the Licensed Action, the following information must be recorded and retained:

    35.1. the date on which the sample was collected;

    35.2. the time at which the sample was collected;

    35.3. the location at which the sample was collected;

    35.4. the name of the person who collected the sample;

    35.5. the chain of custody forms relating to the sample;

    35.6. the field measurements (if any) and analytical results (if any) relating to the sample; and

    35.7. laboratory quality assurance and quality control documentation.

36. The licensee must for all land based monitoring points specified in the Monitoring Program:

    36.1. install and maintain appropriate identification signage so that they are reasonably identifiable at all times; and

    36.2. maintain safe access and egress, as is reasonably practicable.

37. The licensee must ensure that any proposed revisions to the Monitoring Program (other than typographical changes or revisions to formatting or referencing) are:

    37.1. reviewed by a Qualified Person, who must produce a written report about their review;

    37.2. submitted to the Administering Agency with justification for revisions; and

37.3. submitted to the Administering Agency, in both hard copy and electronic form (with a complete copy of the Qualified Person's written review), 20 business days prior to the proposed implementation date.

RECORDING AND REPORTING

38. The licensee must keep records of all exceedances of trigger values of parameters specified in Item 7, including those that are not an exceedance listed at Item 12, and provide a copy on request of the Administering Agency.

39. The licensee must keep records of all non-compliances with this licence. These records must be adequate to enable the licensee to comply with the non-compliance notification conditions of this licence.

40. A non-compliance with this licence includes the exceedances listed at Item 12.

41. The licensee must notify the Administering Agency of any non-compliance with this licence by emailing environmentalregulation@nt.gov.au, as soon as practicable after (and in any case within 24 hours after) first becoming aware of the non-compliance.

42. The licensee must include in the notification of non-compliance the following information:

    42.1. when the non-compliance was detected and by whom;

    42.2. the date and time of the non-compliance;

    42.3. whether discharge was occurring at the time of the non-compliance and the source of the discharge;

    42.4. whether non-compliant discharge is still occurring; and

    42.5. a date (within 10 business days of the non-compliance) when an investigation report will be submitted to the Administering Agency.

43. Within 10 business days of notifying the Administering Agency of any non-compliance, the licensee must provide the Administering Agency an investigation report that includes:

    43.1. when the non-compliance was detected and by whom;

    43.2. the date and time of the non-compliance;

    43.3. whether discharge was occurring at the time of the non-compliance and the source of the discharge;

    43.4. the actual and potential causes and contributing factors to the non-compliance;

    43.5. monitoring data of the discharge, and upstream and downstream water of the authorised discharge point, collected for the date the non-compliance was detected and three sampling rounds prior;

    43.6. available flow rates to demonstrate any influence streams and rivers may have had on the exceedance of trigger values;

    43.7. rainfall recorded at the site prior to the exceedance of trigger values and non-compliance;

    43.8. the risk of environmental harm arising from the non-compliance;

    43.9. the action(s) that have or will be undertaken to mitigate any environmental harm arising from the non-compliance;

    43.10. corrective actions that have or will be undertaken to ensure the non-compliance does not reoccur; and

    43.11. if no action was taken, why no action was taken.

44. The licensee must submit a completed Annual Return, by emailing environmentalregulation@nt.gov.au, within 10 business days after each Anniversary Date of this licence, which report relates to the preceding 12 month period.

45. The licensee must complete and provide to the Administering Agency a report of data and information obtained through the implementation and performance of the Monitoring Program (the Monitoring Report), as prescribed by this licence, within 10 business days after each Anniversary Date of this licence.

46. The licensee must ensure that each Monitoring Report:

    46.1. is prepared in accordance with the requirements of the Administering Agency 'Guideline for Reporting on Environmental Monitoring' (or any other guideline as adopted by the Administering Agency from time to time);

    46.2. includes a tabulation of all monitoring data required as a condition of this licence (data must be provided electronically in Microsoft® Excel® format);

    46.3. includes a tabulation of monthly and annual contaminant loads discharged from the authorised discharge point listed at Item 5. Contaminant loads must be calculated for total metals, total metalloids, total nutrients and other parameters (excluding field parameters) listed in Appendix 3. The calculations must be based on the daily discharge volume and the concentration of contaminant present in the discharge on that day. On the days when a sample was not taken then the concentration of the contaminant must be estimated using Linear Interpolation methodology;

    46.4. includes long term trend analysis of monitoring data to demonstrate any environmental impact associated with the Licensed Action over a minimum period of three years (where the data is available); and

    46.5. includes an assessment of environmental impact from the Licensed Action.

47. A copy of the documents listed at Item 13 will be placed on the Register.

PERFORMANCE IMPROVEMENT

48. Prior to discharge from the authorised discharge point listed at Item 5, the licensee must develop and provide to the Administering Agency, an operational procedure that:

    48.1. calculates the discharge dilution ratio;

    48.2. monitors compliance with condition 26; and

    48.3. adjusts the discharge rate during discharge events as flow in the catchment varies.

49. The licensee must ensure that water quality monitoring stations, including water level and flow meters, are installed and operational before 31 October 2022.

50. By 31 August 2023, the licensee must develop a plan for wastewater management and treatment that:

    50.1. provides for a reduction in total contaminant loads discharged compared to total contaminant loads discharged during the 2022/23 wet season;

    50.2. contains details of flocculants and coagulants and other treatment additives used, their breakdown products and their potential to contaminate the environment;

    50.3. provides for a reduction of total nitrogen loads compared to total nitrogen loads discharged in 2022;

    50.4. enables site-specific trigger values for total N listed at Item 7 of Schedule 1 to be met at the compliance point at Item 8 of Schedule 1, including details of all management and treatment options investigated.

51. For the 2022/23 wet season only, the following conditions apply:

    51.1. The trigger value for total nitrogen (TN) listed in Appendix 2, at the compliance point GDS SW5, is 1.5 mg/L;

    51.2. The ammonia (NH_3) concentration at the compliance point GDS SW5, must not exceed the ANZG (2018) 95% species protection acute toxicity value of 0.9 mg/L;

    51.3. The licensee must demonstrate that no environmental harm is occurring due to the increase in nitrogen load, including

51.3.1. conducting monitoring at GDS DH1 and two additional monitoring points GDS DH4 and GDS DH5 (Table 3) for the same parameters as for the compliance point GDS SW5 listed in Appendix 3. Monitoring must be conducted within 24 hours of discharge commencing **and** weekly during discharge. When no discharge is occurring monitoring will be on a monthly basis.

Table 3. Additional Monitoring Points 2022/23

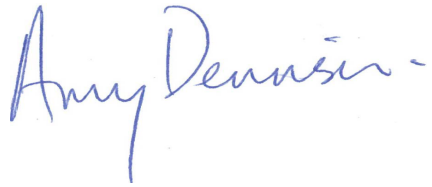
Site	Easting	Northing
GDS DH4	694352	8601994
GDS DH5	693256	8602348

51.3.2. Conducting additional water quality and biological monitoring as per Appendix 6 (Core Lithium – Waste Discharge Licence Amendment Supporting Information – Section 3.2 Environmental Risk Mitigation).

51.3.3. The licensee must provide the administering agency with a source identification report by 31 August 2023 that investigates all potential sources of high nitrogen concentrations in waste water, including an assessment of the potential of AMD from the activity impacting nitrogen loads in wastewater and in any groundwater expression to the unnamed creek at GDS SW5.

END OF LICENCE CONDITIONS

This licence is not valid unless signed below:



Amy Dennison
Delegate of the Controller of Water Resources

Date: 7 March 2023

DEFINITIONS

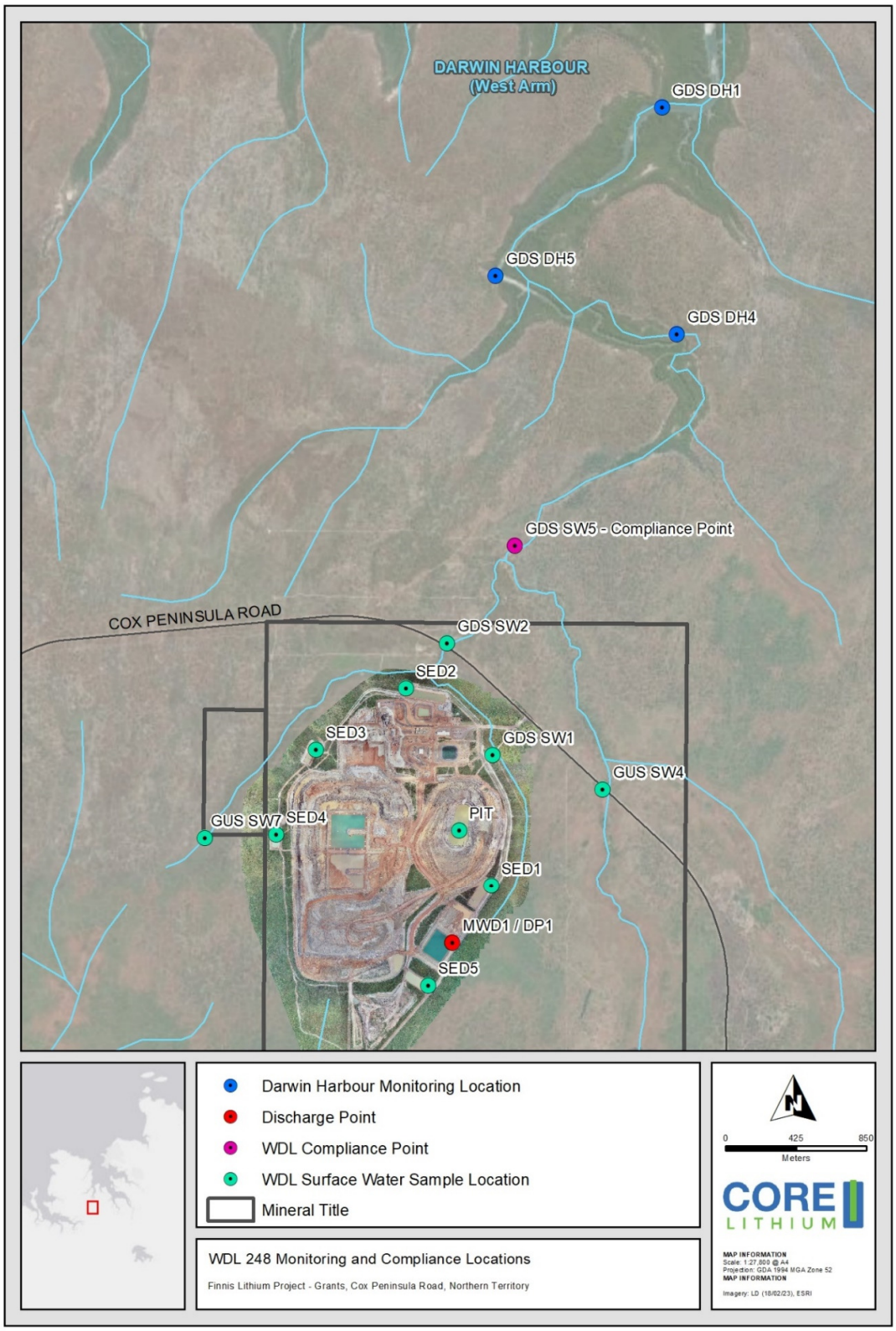
In this licence, unless a contrary intention appears:

Term	Definition
24 hour emergency contact	the phone number of a person who can be contacted at any time and be capable of responding to and providing information about any incident associated with the Licensed Action.

Term	Definition
Administering Agency	means the NT Government Department with responsibility for administering the Water Act.
AMD	acid and metalliferous drainage
Anniversary Date	annual anniversary of the Commencement Date.
Annual Return	an Administering Agency prescribed format for demonstrating and reporting compliance with the conditions of this licence.
ANZG (2018)	Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines.
Authority Certificate	a certificate issued under s 22(1) of the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT). An Authority Certificate permits a licensee to carry out work on land with or within the vicinity of a sacred site.
business days	a day not Saturday, Sunday or a public holiday, in Darwin, Northern Territory.
Consultation and Communication Plan	a written plan documenting proposed consultation and communications for the Licensed Action before, during and after the Licensed Action which includes a strategy for communicating with members of the public who are likely to have a real interest in, or be affected by, the Licensed Action.
contact details	includes the 24 hour emergency contact, and name, position title and phone number of a representative of the licensee who can be contacted about the licence and Licensed Action.
contaminant	has the meaning given in section 4 of the WMPC Act.
discharge	releasing or allowing a liquid, gas or other substance to flow out from where it has been confined.
Dry season	means 1 May to 31 October.
Emergency Response Plan	a written plan documenting the licensee's procedures for responding to emergencies caused by, resulting from or associated with the Licensed Action and that may cause environmental harm.
land	includes water and air on, above or under land.
Licensed Action	the Licensed Action as described on the covering page of this licence.
Linear Interpolation	a method to construct new data points within the range of known data points. $y = y1 + ((x - x1) * ((y2 - y1) / (x2 - x1))$ y in the unknown concentration between known concentrations y1 and y2 y1 in the first known concentration y2 is the second known concentration x is the day of the unknown concentration y x1 is the day of the first known concentration y1 x2 is the day of the second known concentration y2
litter	litter, garbage, rubbish, refuse or waste matter, and includes the body of a dead animal.
Maintain	kept in a manner that it does not present or cause a risk of environmental harm or a hazard to persons or property or, for the purposes of documents

Term	**Definition**
	including plans, a process of reviewing and amending documentation to ensure it is relevant.
NATA	National Association of Testing Authorities, Australia.
non-compliance notification	an Administering Agency prescribed format for notifying the Administering Agency of a non-compliance.
plant and equipment	all material items used in association with the Licensed Action, including (but not limited to) storage vessels and containers, pipe work and hosing, vehicles (including vessels), tools, and measuring equipment.
pollution	has the meaning given in section 4 of the WMPC Act.
public entrance	access to the licensed premises that is utilised by the public.
Qualified Person	a person registered under Section 68 of the WMPC Act.
qualified sampler	a person who has training and experience in obtaining samples from the relevant environmental medium.
Register	the register available at the website of the Northern Territory Environment Protection Authority (NT EPA).
waste	takes its meaning from the term in the WMPC Act.
wastewater	water that contains a contaminant or waste.
Water Act	*Water Act* (NT)
Wet season	means 1 November to 30 April and for the purposes of Appendix 3 includes any part of the Dry Season that discharge is occurring.
WMPC Act	*Waste Management and Pollution Control Act 1998* (NT)

APPENDIX 1: Map of Discharge Point, Compliance Point and Monitoring Sites



APPENDIX 2 : Discharge Trigger Values

			Sampling Points	Compliance Point
			Site Code	GDS SW5
			Easting	693374
			Northing	8600709
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**Trigger Values**
Environmental Field Data				
pH	pH	pH	In situ	5.2-6.6[2]
Electrical conductivity	EC	µS/cm		250[1]
Turbidity	NTU	NTU		12[3]
Dissolved oxygen	DO	% sat.		70-92[2]
Nutrients				
Total Nitrogen	TN	µg/L	Unfiltered	200[3]
Total Phosphorus	TP			10[3]
Metals and Metalloids				
Aluminium	Al	µg/L	Total and Filtered (0.45 µm)	70[3]
Arsenic	As			13[1]
Cadmium	Cd			0.2[1]
Chromium	Cr			1[1]
Copper	Cu			1.4[1]
Iron	Fe			110[3]
Lead	Pb			3.4[1]
Lithium	Li			430[4]
Mercury	Hg			0.6[1]
Nickel	Ni			11[1]
Zinc	Zn			8[1]

Key:

[1] ANGZ (2018) 95% species protection, freshwater.

[2] 20th and 80th percentile of background data for surface water quality as detailed at paragraph 6.2 of the Water Management Plan.

[3] 80th percentile of background data for surface water quality as detailed at paragraph 6.2 of the Water Management Plan.

[4] Ecotoxicity Assessment, sections 8.3 and 8.4 of the Water Management Plan.

APPENDIX 3: Surface Water Monitoring Program

			Sampling Points	Grants Downstream Surface Water 1	Grants Downstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Upstream Surface Water 7	Sediment Basins 1-5					Discharge Point	Mine Pit Sump	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GUS SW7	Sed1	Sed2	Sed3	Sed4	Sed5	MWD1[1]	Pit	GDS DH1
			Easting	693239	692989	693903	693374	691498	693167	692657	692155	691928	692775	693030	693037	694262
			Northing	8599446	8600073	8599235	8600709	8598943	6598623	8599847	8599446	8598961	8598072	8598504	8598990	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**												
Field Parameters																
Flow	-	kL/day	In situ	D	D	D	C	D	N/A	N/A	N/A	N/A	N/A	C	N/A	N/A
Water Level	-	measure		D	D	D	C	D	N/A	N/A	N/A	N/A	N/A	P, W	N/A	N/A
pH	pH	pH		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Electrical conductivity	EC	µS/cm		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Turbidity	NTU	NTU		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Temperature	Temp	°C		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Oxidation Reduction Potential	OR	mV		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Dissolved oxygen	DO	% sat.		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Nutrients																
Ammonia	NH_3	µg/L	Unfiltered (excluding FRP)	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Oxides of Nitrogen	NO_x			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Nitrate	NO_3			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Total Nitrogen	TN			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Total Phosphorus	TP			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Filterable Reactive Phosphorus	FRP			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Chlorophyll a	Chl-a			W	W	W	W	W	N/A	N/A	N/A	N/A	N/A	N/A	N/A	M[3]
Metals and Metalloids																
Aluminium	Al	µg/L	Total and Filtered (0.45 µm)	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Arsenic	As			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Cadmium	Cd			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Chromium	Cr			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Copper	Cu			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Iron	Fe			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Lead	Pb			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Lithium	Li			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Mercury	Hg			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Nickel	Ni			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]

			Sampling Points	Grants Downstream Surface Water 1	Grants Downstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Upstream Surface Water 7	Sediment Basins 1-5					Discharge Point	Mine Pit Sump	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GUS SW7	Sed1	Sed2	Sed3	Sed4	Sed5	MWD1[1]	Pit	GDS DH1
			Easting	693239	692989	693903	693374	691498	693167	692657	692155	691928	692775	693030	693037	694262
			Northing	8599446	8600073	8599235	8600709	8598943	6598623	8599847	8599446	8598961	8598072	8598504	8598990	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**												
Zinc	Zn			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Full elemental scan	-			A	A	A	A	A	A	A	A	A	A	A	A	A
Treatment regents (condition Error! Reference source not found.**)**																
Acrylamide[2]	C_3H_5NO	µg/L	Total and Filtered (0.45 µm)	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Other																
Sulphate	SO_4	mg/L	Filtered (0.45 µm)	W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Calcium	Ca			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Chloride	Cl			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Sodium	Na			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Potassium	K			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Magnesium	Mg			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Carbonate	CO_3^{2-}			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Bicarbonate	HCO3			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Total Dissolved Solids	TDS			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Total Suspended Solids	TSS		Unfiltered	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]

Key:

P = prior to discharge.

C = continuous

D = within 24 hours of commencement of discharge **and** daily during discharge. When no discharge is occurring monitoring will be on a weekly basis.

W = within 24 hours of discharge **and** weekly during discharge. When no discharge is occurring monitoring will be on a monthly basis.

F = weekly whilst discharging from sediment basins, Monthly during Wet season irrespective of discharge.

M = monthly.

A = Annually, at end of Wet season on recessional flows.

N/A = not applicable.

[1] The sampling point in MWD1 will be located close to DP1 to ensure it is representative of discharge water quality.

[2] This sampling is only required where the licensee has conducted water treatment onsite using flocculants containing Acrylamide.

[3] During Wet season only

APPENDIX 4: Fluvial Sediment Monitoring Program

			Sampling Points	Grants Downstream Surface Water 1	Grants Upstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Downstream Surface Water 7	Grants Downstream Surface Water 8	Discharge Point	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GDS SW7	GDS SW8	MWD1	GDS DH1
			Easting	693239	692989	693903	693374	691498	692465	693030	694262
			Northing	8599446	8600073	8599235	8600709	8598943	8599942	8598504	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**							
Environmental Field Data											
pH	pH	pH		A	A	A	A	A	A	A	A
Electrical conductivity	EC	µS/cm		A	A	A	A	A	A	A	A
Moisture content		%		A	A	A	A	A	A	A	A
Particle size distribution	PSD	%	<63µm >=63µm & <=2mm >2mm	A	A	A	A	A	A	A	A
Aluminium	Al	mg/kg	<63µm sediment fraction	A	A	A	A	A	A	A	A
Arsenic	As			A	A	A	A	A	A	A	A
Cadmium	Cd			A	A	A	A	A	A	A	A
Chromium	Cr			A	A	A	A	A	A	A	A
Copper	Cu			A	A	A	A	A	A	A	A
Iron	Fe			A	A	A	A	A	A	A	A
Lead	Pb			A	A	A	A	A	A	A	A
Lithium	Li			A	A	A	A	A	A	A	A
Mercury	Hg			A	A	A	A	A	A	A	A

			Sampling Points	Grants Downstream Surface Water 1	Grants Upstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Downstream Surface Water 7	Grants Downstream Surface Water 8	Discharge Point	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GDS SW7	GDS SW8	MWD1	GDS DH1
			Easting	693239	692989	693903	693374	691498	692465	693030	694262
			Northing	8599446	8600073	8599235	8600709	8598943	8599942	8598504	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**							
Nickel	Ni			A	A	A	A	A	A	A	A
Zinc	Zn			A	A	A	A	A	A	A	A
Other											
Sulphate	SO_4	mg/kg	Soluble ion extract	A	A	A	A	A	A	A	A
Calcium	Ca			A	A	A	A	A	A	A	A
Chloride	Cl			A	A	A	A	A	A	A	A
Sodium	Na			A	A	A	A	A	A	A	A
Potassium	K			A	A	A	A	A	A	A	A
Magnesium	Mg			A	A	A	A	A	A	A	A

Key:

A = Annually during recessional flow (late Wet season/early Dry season)

APPENDIX 5: Biota Monitoring Program

Project Name	Locations	Project Description	Report Frequency
Seagrass assessment	West Arm, Darwin Harbour	Seagrass monitoring to determine whether any observed change in seagrass distribution or composition has occurred in the marine waters of West Arm, Darwin Harbour. Monitoring should aim to determine whether any change identified is naturally occurring or related to mine operations.	Annually
Vegetation monitoring	Areas downstream of ML 31726	Monitoring of vegetation downstream of ML 31726 to determine if mining activities are impacting riparian vegetation communities.	Annually
Macroinvertebrate study	Darwin Harbour and Areas downstream of ML 31726	Survey of macro-invertebrate abundance and diversity in aquatic ecosystems. Data is used to monitor potential impacts from mine operations.	Annually during recessional flow (late Wet season/early Dry season)

APPENDIX 6: Environmental Risk Mitigation 2022/23

3.2 Environmental Risk Mitigation

LDGNT are committed to best practice environmental management and to minimising impacts associated with mining. LDGNT propose to undertake the following to further investigate potential impacts and provide further data on any impacts associated with a change to monitoring and compliance of TN:

- WDL 248 requires monitoring from one site in Darwin Harbour (GDS DH1) monthly during discharge. LDGNT Propose to temporarily increase the frequency of sampling at the proposed temporary mixing zone compliance point (GDS DH1) to weekly to provide additional supporting information of appropriate mixing within the harbour and to bring monitoring requirements in line with existing compliance location, GDS SW5.
- Additional sample locations within the mixing zone have been proposed (DH4 and DH5 in Figure 1) to provide additional information the appropriate dilution of TN as it moves downstream through the mixing zone.
- Monthly water quality monitoring at two additional locations (GDS DH2 and GDS DH3) in the West Arm of Darwin Harbour during the wet season (when mine site discharges will occur) will be collected in accordance with the existing EcOz (2022) WDL 248 Monitoring Program (Attachment A). LDGNT will continue to collect water quality samples at these locations to provide a better understanding of the water quality in the West Arm region, and allow for comparison of water quality across West Arm.
- LDGNT will also undertake marine macroinvertebrate sampling at those same three Darwin Harbour water quality monitoring sites once per year, to assess whether mine site discharges are impacting on benthic infauna in West Arm. Again, this is additional monitoring to that required in WDL 248.
- LDGNT are planning to undertake additional ecotoxicity assessments of mine site water, to provide additional site specific ecotox data on a range of parameters. Currently, ecotoxicity assessment has been undertaken to develop a site-specific trigger value for lithium. Additional ecotox assessment will be undertaken in 2023

  to further refine and investigate site specific trigger values, and data can be interpreted to investigate potential impacts from turbidity.
- In May 2022, LDGNT engaged consultants to undertake baseline freshwater macroinvertebrate sampling in freshwater streams downstream of GLP, as well as one reference (control) site. LDGNT now have two rounds of baseline macroinvertebrate data that can be used as a baseline for future 'impact' macroinvertebrate monitoring rounds. This data will allow assessment of potential impacts of mine site water and wastewater discharges on aquatic ecosystems downstream. LDGNT will ensure that future macroinvertebrate data analysis considers macroinvertebrate species that are susceptible to toxicity (e.g. from metals) and also turbidity.
- LDGNT will irrigate mine wastewater as much as possible, with discharge as a last resort. LDGNT are developing an Irrigation Management Plan which will include nutrient load balance and limits, salinity/sodicity assessment, management procedures for irrigation and grass/vegetation management in the irrigation area, and monitoring requirements. Irrigation of wastewater at GLP is approved under the Mining Management Plan, however, LDGNT are developing the Irrigation Management Plan as an additional strategy to ensure irrigation is undertaken with minimal potential for environmental impacts.

(Source: Core Lithium – Waste Discharge Licence Amendment - Supporting Information, February 2023. NTEPA2021/0155-005~0001)

Waste Discharge Licence 248 Monitoring Program

Lithium Developments Grants Northern Territory



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Appendices

Attachment A –Waste Discharge Licence 248 for Lithium Developments Grants Northern Territory
Attachment B –Procedure for Surface Water Sampling
Attachment C – Field Sheets from the Darwin-Daly AUSRIVAS Manual

1 INTRODUCTION

Waste Discharge Licence (WDL) 248 was granted to Lithium Developments Grants Northern Territory (LDGNT) on 25 July 2022. WDL 248 authorises discharge of mine wastewater from the Grants Lithium Project (GLP) site. Controlled discharge will occur from Water Dam 1 (MWD1), via authorised discharge point 1 (DP1), into an unnamed watercourse which ultimately discharges into West Arm, Darwin Harbour. The WDL is provided as Attachment A of this document.

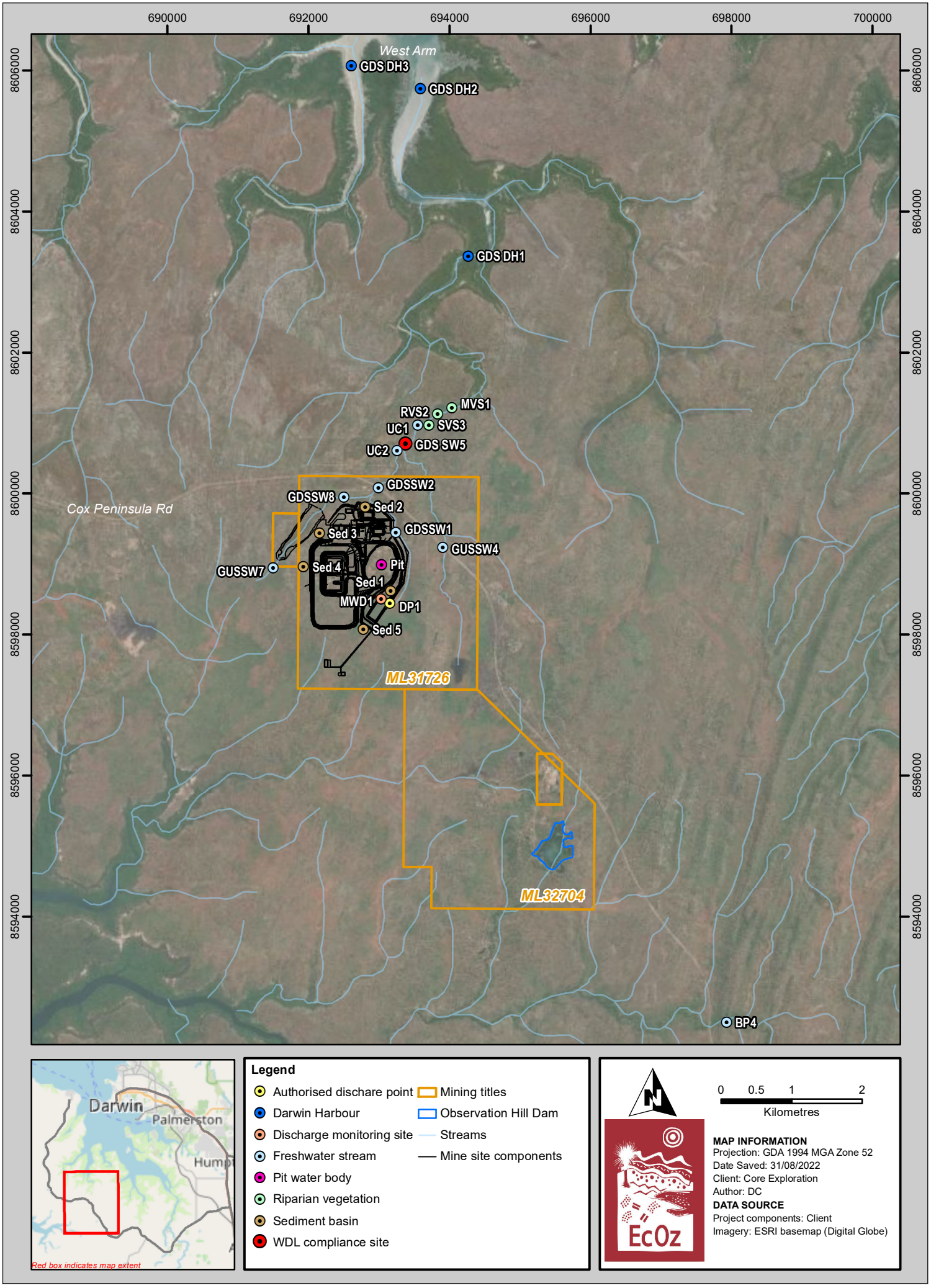
Condition 30 of WDL 248 requires implementation of the monitoring program, detailed in Appendices 3 to 5 of the WDL. Monitoring is required to be undertaken for surface water quality, fluvial sediment quality, and biota in watercourses downstream of GLP and in the West Arm of Darwin Harbour. A summary of all WDL monitoring sites, and type of monitoring that is to be undertaken at each site, is provided in Table 1-1. The locations of monitoring sites are shown on Figure 1-1.

This document details the monitoring that will be undertaken by LDGNT to satisfy the requirements of WDL 248. The monitoring program identifies monitoring locations, describes sampling methodology where appropriate, and references supporting documents which form part of LDGNT's overall Environmental Management System.

Table 1-1. Summary of all monitoring to be undertaken for WDL 248

Category	Sample Site	Easting	Northing	Surface water quality[1]	Sediment quality	Macroinvertebrate	Riparian Vegetation	Seagrass
Freshwater stream	GDS SW1	693239	8599446	Daily, weekly, monthly	Annually	-	-	-
	GDS SW2	692989	8600073	Daily, weekly, monthly	Annually	-	-	-
	GUS SW4	693903	8599235	Daily, weekly, monthly	Annually	-	-	-
	GUS SW7	691498	8598943	Daily, weekly, monthly	Annually	-	-	-
	GDS SW8	692498	8599951	Daily, weekly, monthly	Annually	-	-	-
WDL compliance site	GDS SW5	693374	8600709	Daily, weekly, monthly	Annually	Annually	-	-
Sediment basins	Sed1	693167	8598623	Weekly, monthly	-	-	-	-
	Sed2	692657	8599847	Weekly, monthly	-	-	-	-
	Sed3	692155	8599446	Weekly, monthly	-	-	-	-
	Sed4	691928	8598961	Weekly, monthly	-	-	-	-
	Sed5	692775	8598072	Weekly, monthly	-	-	-	-
WDL discharge point	MWD1	693030	8598504	Prior to discharge, daily, weekly, monthly	Annually	-	-	-
Pit water body	PIT	693037	8598990	Monthly	-	-	-	-
Darwin Harbour	GDS DH1	694262	8603365	Monthly	Annually	Annually	-	Annually
	GDS DH2	693587	8605738	Monthly	Annually	Annually	-	Annually
	GDS DH3	692608	8606060	Monthly	Annually	Annually	-	Annually
Freshwater stream	UC1	693544	8600969	Annually	Annually	Annually	-	-
	UC2	693255	8600608	Annually	Annually	Annually	-	-
	BP4	697926	8592497	Annually	Annually	Annually	-	-
Riparian vegetation	MVS1	694035	8601220	-	-	-	Annually	-
	RVS2	693834	8601132	-	-	-	Annually	-
	SVS3	693706	8600969	-	-	-	Annually	-

[1] Frequency of surface water quality monitoring depends on discharge; refer to Table 2-1 for detail. Freshwater sites will only be sampled when the watercourse is flowing, and Darwin Harbour sites will only be sampled for surface water quality during the wet season months. Refer to Table 2-1 Attachment A for the detailed surface water quality monitoring schedule.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ21190 - Grants Waste Discharge Licence - Core Lithium\01 Project Files\Report maps\All monitoring locations.mxd

Figure 1-1. All Grants WDL Monitoring Sites

2 SURFACE WATER QUALITY

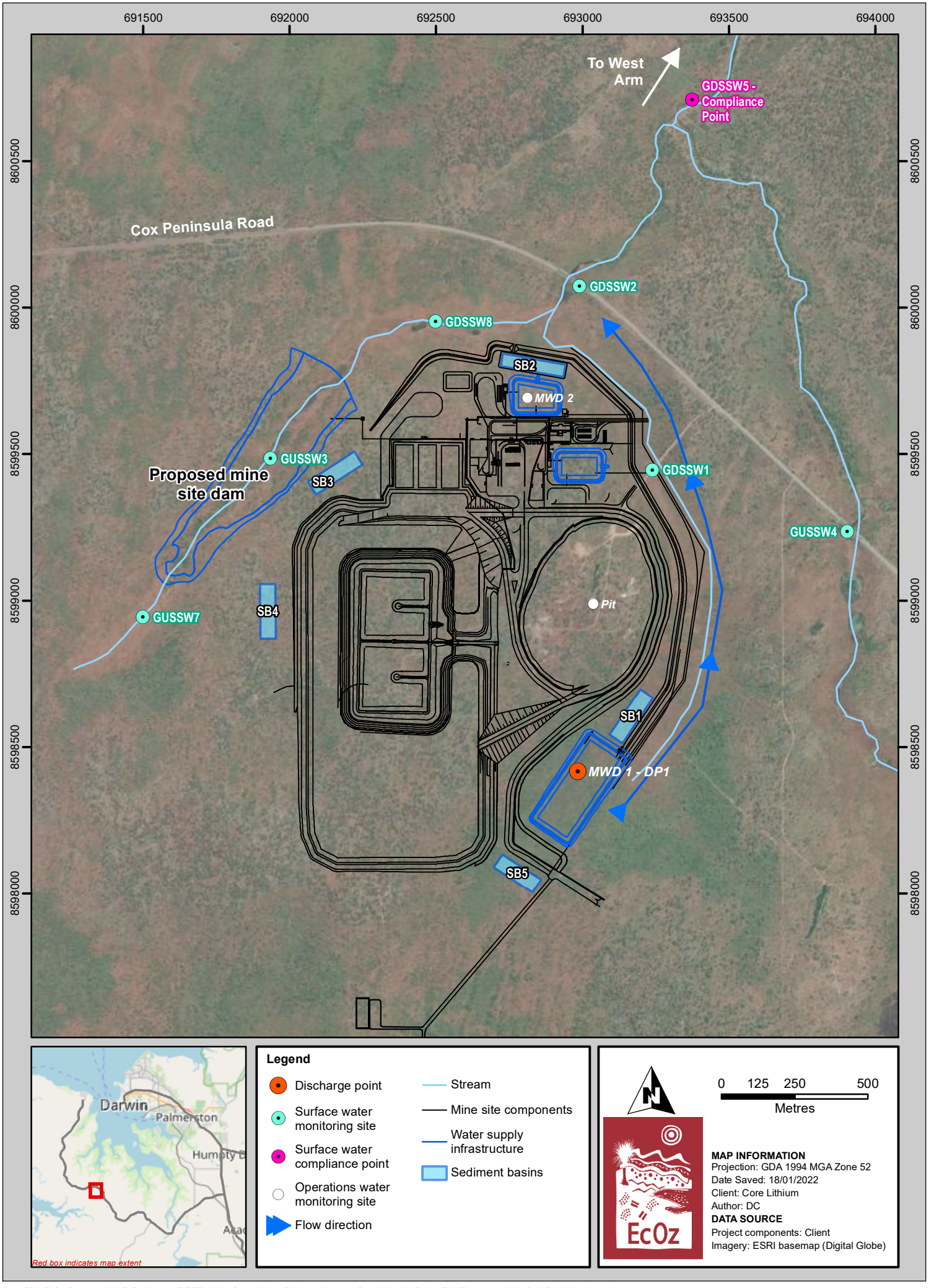
2.1 Freshwater

Surface water quality sampling will be undertaken in accordance with Appendix 3 of WDL 248 (see Attachment A). This includes regular monitoring of surface water sites upstream and downstream of the discharge point during discharge, weekly monitoring of sediment basins during discharge, and monthly monitoring of the pit water. Discharge monitoring will be undertaken at MWD1, close to DP1, the licenced discharge point, prior to discharge, and daily and weekly during discharge. The compliance point for the WDL is GDS SW5, and frequent monitoring will be undertaken during discharge. Details of water quality monitoring methodology and monitoring locations are provided in the Water Management Plan for the GLP. Locations of surface water monitoring sites which will be sampled in accordance with WDL 248 are shown on Figure 2-1. A summary of sites, analytes and monitoring frequency are provided in Table 2-1.

Table 2-1. Surface water monitoring program for WDL (freshwater sites)

Site	Description	Analytes	Frequency
GUS SW4, GUS SW7	Freshwater streams – upstream or reference	**Field parameters**: Flow, water level, pH, electrical conductivity, temperature, ORP, dissolved oxygen, turbidity. **Nutrients**: Total nitrogen, nitrate, oxides of nitrogen, ammonia, total phosphorus, filterable reactive phosphorus. **Metals and metalloids:** Total and dissolved Al, As, Cd, Cr, Cu, Fe, Pb, Li, Hg, Ni, Zn *Full elemental scan once per year **Other:** $S0_4$, Ca, Cl, Na, K, Mg, $C0_3^{2-}$, HC03, total dissolved solids, total suspended solids.	**During discharge[2]:** Daily field measurements Weekly laboratory parameters **When not discharging:** Weekly field measurements Monthly laboratory parameters
GDS SW1, GDS SW2	Freshwater stream – downstream of mine site		
GDS SW5	Compliance point		As above, and continuous flow and water level monitoring
MWD1	Discharge point		Continuous flow **During discharge:** Prior to discharge (all analytes) Daily field measurements Weekly laboratory parameters **When not discharging:** Weekly field measurements Monthly laboratory parameters
Sed 1, Sed 2, Sed 3, Sed 4, Sed 5	Sediment basins		**During discharge**: Weekly (all analytes) **When not discharging:** Monthly (all analytes) – wet season only Note flow and level are N/A
Pit	Mine site pit (discharge source water)		Monthly (all analytes) Note flow and level are N/A

[2] For all monitoring during discharge, the first monitoring event must occur within 24 hours of discharge commencing.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ21190 - Grants Waste Discharge Licence - Core Lithium\01 Project Files\Report maps\Map for WDL Application.mxd

Figure 2-1. Map of surface water sites (freshwater) to be monitored for WDL248

2.2 Marine Water

Appendix 3 of WDL 248 requires monthly monitoring of GDS DH1, located within Darwin Harbour, to be undertaken during the wet season. Two additional sites will also be sampled to provide context for comparison of data from GDS DH1 and provide water quality data for areas of Darwin Harbour downstream of the discharge point to identify any potential impacts from mine site discharges. Details of the monitoring to be undertaken in Darwin Harbour is provided in Table 2-2, and locations are shown on Figure 1-1.

Table 2-2. Darwin Harbour Monitoring Program

Monitoring Location	Description	Analytes	Frequency
GDS DH1	Marine monitoring site, ~4km downstream of WDL compliance point (GDS SW5).	**Field parameters**: Temperature, pH, electrical conductivity, salinity, ORP, dissolved oxygen, turbidity. **Nutrients**: Ultra-trace in saline waters Total nitrogen, nitrate, oxides of nitrogen, ammonia, total phosphorus, filterable reactive phosphorus. **Metals:** Total and dissolved (ultra-trace) Al, As, Cd, Cr, Cu, Fe, Pb, Li, Hg, Ni, Zn Total suspended solids	Monthly during the wet season Plus a full elemental scan of metals (total and dissolved) once per year, nominally at end of each wet season.
GDS DH2	Marine monitoring site, ~8 km downstream of compliance point, near confluence of branch of western arm of West Arm.		
GDS DH3	Marine monitoring site, reference site, on western arm of West Arm.		

2.3 Sample methods

All surface water sampling will be in accordance with relevant standards and guidelines including:

- *Australian/New Zealand Standard on Water Quality Sampling - Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples* (AS/NZS 5667.1:1998/2016), Standards Australia, New South Wales.
- *Australian Standard on Water Quality Sampling – Part 6: Guidance on sampling of rivers and streams* (AS/NZS 5667.6:1998), Standards Australia, New South Wales.
- *Australian/New Zealand Standard on Water Quality Sampling - Part 9: Sampling Guidance on sampling from marine waters* (AS/NZS 5667.9:1998/2016), Standards Australia, New South Wales.
- ANZG 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia.
- EcOz *Standard Operating Procedure Surface Water Sampling* – Update July 2020.

This will ensure representative samples are collected, and also avoid contamination of samples (of particular importance for saline waters which require ultra-trace analysis for nutrients and metals).

Freshwater sites will be accessed on foot or via ATV, and samples will be collected from the side of the watercourse. Watercourses will only be sampled when flowing.

Marine sites will be accessed via marine vessel (boat), and grab samples will be obtained from ~30 cm below the surface of the water, using sample poles. Sampling will be undertaken during neap tides, on an outgoing (ebb) tide.

Field parameters will be measured in-situ using calibrated field equipment. Laboratory samples will be collected in laboratory supplied, suitably treated containers, and stored chilled (in esky with ice bricks or portable fridge) until the samples can be dispatched to the laboratory. All samples will be submitted to a NATA accredited laboratory, within required holding times, and Chain of Custody forms will be provided to allow for tracking of samples.

All sampling equipment will be maintained and cleaned between sample sites to avoid cross contamination. Details of sample methods are provided in the standards and guidelines listed above.

A detailed description of general surface water sampling methodology is provided in the *Procedure for Surface Water Sampling*, at Appendix B.

2.4 Data management and reporting

All surface water data will be entered into the Surface Water Quality Database and compared to guideline values; site-specific trigger values, the default ANZG 2018 guideline values (for fresh or marine waters as applicable), and the Darwin Harbour Water Quality Objectives. Field data will be entered manually, while laboratory data will be provided in ESdat form, and will automatically be entered into the database. In order to ensure laboratory results are automatically issued to ESdat, ensure the following email address is listed on the COC to receive results: esdat_au+corelithium@esdatlabsync.net.

Data will be compared to guideline values and any exceedance of a guideline value will be investigated. This may include additional water quality sampling. Data will also be compared over time to identify any trends in water quality that may be attributable to waste discharges or mine site operations.

As per Condition 44 and Condition 45 of WDL 248, LDGNT will prepare an Annual Return and a Monitoring Report and submit both reports to the Administering Agency annually, within 10 business days of 25 July (the licence anniversary date).

In the event that the surface water monitoring program identifies a non-compliance with WDL 248, LDGNT will notify the Administering Agency as soon as practicable (and in any case within 24 hours) after first becoming aware of the non-compliance. If a non-compliance with WDL 248 occurs, then an investigation report will be prepared and submitted to the Administering Agency within 10 business days of the notification. As per Item 12 of Schedule 1 of WDL 248, a non-compliance with WDL 248 includes:

- An exceedance of a trigger value stipulated in the licence at the compliance point (GDS SW5) on three consecutive sampling occasions
- An exceedance of three or more times the trigger value at the compliance point (GDS SW5).

Trigger values are provided in Appendix 2 of WDL 248 (see Attachment A).

3 SEDIMENT

Fluvial sediment monitoring will be undertaken annually in accordance with Appendix 4 of WDL248 (see Attachment A).

3.1 Sample methods

Sediments will be sampled from freshwater sites GDS SW1, GDS SW2, GUS SW4, GDS SW5, GDS SW7, GDS SW8 and MWD1 – locations shown on Figure 1-1. Sediment sampling will be undertaken in accordance with relevant standards and guidelines, including:

- Australian Standard – *Guide to the investigation and sampling of sites with potentially contaminated soils, Part 1: non-volatile and semi volatile compounds* (AS 4482.1-2005)
- *Australian Standard on Water Quality Sampling – Part 19: Guidance on sampling of marine sediments* (ISO 5667.19:2004)
- *Australian Standard on Water Quality Sampling – Part 12: Guidance on sampling of bottom sediments* (ISO 5667.12:1999)
- *Recommendations for sampling and analysis of Darwin Harbour sediment* (Munksgard 2013)
- Simpson & Batley (2016): *Sediment Quality Assessment.*

Sediment samples are to be collected annually, during recessional flows (late wet season), and for efficiency will usually be collected at the same time as macroinvertebrate samples (see Section 5).

At each sample site, three grab samples will be collected from the stream. If water is present in the stream, samples will be collected from each side of the bank, or along one bank depending on access (e.g. two samples from the left bank and one from the right bank, or three samples spread along a length of the bank). Entering watercourses with flowing water or deep pools in them is not safe due to the risk of crocodile interaction. If, however, the watercourse is dry, then sediment samples can be collected across the stream; one from either bank and one from the middle of the stream. Note that, when selecting sample locations, ensure that they will be representative of sediment settling in the watercourse. The use of a shovel may be required to ensure representative samples are collected.

Samples are collected using the following methodology:

1. Clean sample equipment (trowel and/or shovel) using a 5/95 mix of Decon 90 and demineralised water.
2. Ensure sampler is wearing new nitrile powder free gloves (new gloves are to be worn for each sample).
3. Scrape away leaf litter or other debris from the ground surface. Avoid collecting pebbles and gravel as the laboratory cannot analyse large fractions.
4. Use the shovel and/or trowel to dig up sediment and transfer sample to clean, appropriately treated and laboratory supplied sample containers (250 mL sample jars and 500 mL sample bags).
5. Metals analysis is to be undertaken on the <63 µm fraction of sediment, and as such 1 kg of sample is to be provided to the laboratory for metals analysis, plus sufficient sample volume for particle size distribution and the other analytes. Samplers are to check sample volume requirements with the laboratory prior to undertaking the sampling.
6. Samples will be kept separate (i.e. collect and submit three samples per site for analysis); do not composite the samples as that will influence how the guideline values are applied.

7. Once sample containers are full, place samples in an esky with ice bricks, or vehicle fridge, until they are delivered to a NATA accredited laboratory for analysis.
8. Clean sample equipment before collecting the next sample (firstly wipe off any residual sediment with paper towel, and then wash with the Decon 90 mixture).
9. Once all sediment samples have been collected, submit the samples to a NATA accredited laboratory, with accompanying Chain of Custody forms.

In accordance with Appendix 4 of the WDL (at Attachment A), samples will be analysed for pH, EC, moisture content, particle size distribution, metals (Al, As, Cd, Cr, Cu, Fe, Pb, Li, Hg, Ni, Zn) and sulphate, calcium, chloride, sodium, potassium and magnesium. As discussed above, metals are to be analysed on the <63 µm fraction.

Sediment samples will also be collected from the three Darwin Harbour sites, as per Table 3-1 below (locations are shown on Figure 1-1) and from the macroinvertebrate sampling locations (see Section 5 below). At GDS DH1 – GDS DH3, sediment will be collected from a boat, using a Van Veen grab sampler (or similar), and then placed in suitable laboratory supplied containers, for submission to a NATA accredited laboratory for analysis. Sampling equipment will be cleaned between sites as per the above sample procedure.

Table 3-1. Darwin Harbour Sediment monitoring

Monitoring Location	Description	Analytes	Frequency
GDS DH1	Marine sediment monitoring site, ~4km downstream of compliance point.	pH, EC, moisture content Particle size distribution **Metals**: <63 µm fraction Al, As, Cd, Cr, Cu, Fe, Pb, Li, Hg, Ni, Zn **Anions/cations:** Sulphate, calcium, chloride, sodium, potassium and magnesium	Annually, at end of the wet season (nominally May)
GDS DH2	Marine monitoring site, ~8 km downstream of compliance point, near confluence of branch of western arm of West Arm.		
GDS DH3	Marine monitoring site, reference site, on western arm of West Arm.		

3.2 Data management and reporting

All sediment quality data will be entered into the Sediment Quality Database and compared to the ANZG (2018) toxicant default guidelines for sediment quality, as well as relevant baseline studies (for example, benthic sediment sampling campaign of Middle Arm and West Arm, Darwin Harbour [Radke et al. 2021]). Data will be compared over time to determine if there are detectable changes or trends in sediment quality. Changes or trends will be investigated to assess whether the change is attributable to mine site discharges

As with surface water quality data, laboratory data will be automatically entered into the database in ESdat form, and compared to guideline values. In order to ensure laboratory results are automatically issued to ESdat, ensure the following email address is listed on the COC to receive results: esdat_au+corelithium@esdatlabsync.net.

Reporting on sediment data will be within the Monitoring Report, which will be prepared and submitted annually, within 10 business days of 25 July of each year.

4 RIPARIAN VEGETATION

Riparian vegetation occurs along watercourses and surface water features and are significant vegetation communities as they are spatially restricted and provide habitat to a relatively large number of species (DENR 2019). Riparian vegetation monitoring will be undertaken in accordance with Appendix 5 of the Draft WDL, to detect any changes to riparian vegetation health or extent which could occur as a result of discharge of mine wastewater from MWD1.

Below is a Riparian Vegetation Monitoring Plan (RVMP) which includes:

- Assessment of baseline information
- Monitoring parameters, methodology and frequency
- Data analysis

4.1 Baseline surveys

A previous survey, The Mangrove and Riparian Vegetation Assessment (EcOz 2019) was undertaken to assess the riparian vegetation prior to mining activities commencing.

Three types of monitoring were undertaken; an aerial drone survey to look at the overall riparian vegetation health and assist in mapping the riparian vegetation extent, an on-ground field survey to assess vegetation structure and composition within the mapped riparian vegetation extent, and photo point monitoring. Note, the drone survey was undertaken post-wet season (March) and the vegetation site assessments and photo point monitoring was undertaken in the dry season (June).

Three riparian vegetation survey plots were established within the mangrove study site, representing riparian, swamp and mangrove communities (MVS1, RVS2 and SVS3). Table 4-1 provides a summary of baseline survey results, and Figure 4-1 shows the location of the three different riparian communities, and the monitoring sites. No reference site has been established for LDGNT (as there are no suitable sites within close proximity to the mine site), and there is no intent to add a site as part of this RVMP as the objective is to examine if there is a change in vegetation compared to baseline. The BP33 reference site, located upstream of Charlotte's creek will be used as a reference site if required – the details are within the BP33 Riparian Vegetation Monitoring Plan (EcOz 2022).

The baseline study provides a spatial dataset from which to monitor changes in riparian vegetation boundaries within the study sites. The baseline assessment indicates that vegetation communities within the study sites are in good condition, with limited pre-development disturbance. This is with the exception of the swamp community, which occurs downstream of the mine site in the West Arm catchment. Weeds and impacts from off-road racing tracks were observed within this vegetation community.

The baseline riparian vegetation site assessments and photo point monitoring was undertaken in the dry season (June). In future, the monitoring will be undertaken using the same methods as baseline, however in the post-wet season (March) when water discharge events occur.

Table 4-1. Summary of baseline riparian vegetation descriptions

Vegetation type & survey site	Vegetation Description	Other species present	NVIS code	Landform	Soil	Drainage	Fire	Weeds	Disturbance	Hydrology	Intact riparian vegetation area size (ha)
Mangrove (MVS1)	*Lumnitzera racemosa, Bruguiera exaristata, Avicennia marina* with isolated *Excoecaria ovalis* low open forest, over *Fimbristylis* sp. and *Xerochloa imberbis* mid sparse tussock grassland	None recorded	T6c	Mangrove flat near tidal creek	Brown sandy clay surface soils, some pebbles present ranging in size (2 – 6 cm)	Very poorly drained	Nil	None	None	Tidal, towards upper tide limit. Large pool located adjacent to vegetation assessment site – approximately 4 m wide.	5.18
Riparian (RVS2)	*Melaleuca viridiflora* mid woodland over *Acacia plectocarpa, Lumnitzera racemosa* (on the edge of creek) and *Avicennia marina* (in creek channel) mid open shrubland, over *Germainia grandiflora, Dapsilanthus* sp. and *Xerochloa imberbis* mid tussock grassland	**Mid stratum** *Thespesia populneoides* **Ground stratum** *Asteraceae sp., Wrightia saligna, Flagellaria indica, Acrostichum speciosum, Gymnanthera nitida, Lindernia lobelioides, Diospyros littorea*	T7i	Flat, adjacent to creek channel	Brown clay loam; rocks and pebbles common in channel adjacent to site	Poorly drained	2+ years since last fire causing minimal impact	None	Motorbike tracks nearby	Some pools nearby, inundated on large high tides and with freshwater during wet season	0.76
Swamp (SVS3)	*Melaleuca viridiflora, Erythrophleum chlorostachys* and *Corymbia polycarpa* mid woodland over *Lophostemon lactifluus, Clerodendrum floribundum* and *Denhamia obscura* mid open shrubland over *Sorghum intrans, , Aristida* sp. and *Pandanus spiralis* mid tussock grassland	**Mid stratum (M1):** *Alphitonia excelsa, Grevillea decurrens* **Ground stratum** *Germainia grandiflora, Acacia difficilis,* Fern sp., *Themeda* sp., *Wrightia saligna, Livistona humilis, Osbeckia australiana, Dianella odorata, Brachychiton megaphyllus, Fern sp.1, Antidesma ghesaembilla*	T7i	Lower slope, flat open depression	Brown sandy loam. Some quartz present near creek	Poorly drained – some wet season inundation	Last year (relatively low impact fire)	Annual mission grass scattered near site. Patches of *Hyptis suaveolens, Calopogonium mucunoides* and *Passiflora foetida* recorded nearby	None	Wet season inundation	1.5

4.1.1 Standards and guidelines

Monitoring will be in accordance with best practice guidelines and standards, including *Northern Territory guidelines and field methodology for vegetation survey and mapping* (Brocklehurst et. al. 2007) and the *NT Sampling and Processing Manual* (Llyod and Cook 1996). Details are provided below for each type of monitoring.

4.2 Methods

Drone survey

A drone survey will occur annually, post-wet season (April/May). The drone will be flown along the existing flight path corresponding to the baseline survey (EcOz 2019) to capture the riparian vegetation extent (see Figure 4-1).

- Use DJI Phantom 4pro drone to capture images at a height of 75m (75% front overlap and 65% side overlap) using the DroneDeploy app.
- Drone will be flown in the desirable conditions i.e. in the middle of the day to avoid sun light interference. Observations will also be noted i.e. timing of flight, and the weather to replicate similar conditions for future surveys.
- When importing drone data to create the orthomasoaic, the same methods as per methods in baseline report outlined in Section 3, will be applied.
- A 5cm pixel image will be exported for the survey site, a colour orthomosaic and a plant health image, displayed in red, green and blue.
- The boundary of the riparian vegetation will then be delineated using the orthomosaic imagery and remote sensing techniques.

Riparian vegetation site assessments

Monitoring will be undertaken post-wet season (April/May), after wastewater discharge events. Three riparian vegetation monitoring sites MVS1, RVS2 and SVS3 will be monitored using the same monitoring method outlined in Section 3 in the Mangrove and Riparian Vegetation Assessment (EcOz 2019). Plots will be established and vegetation species, height and % cover will be recorded within each plot. Vegetation continuity will also be monitored by traversing a 100 m long transect and estimating the canopy cover. Photo points will be established an four photographs will be taken in the same location, facing north, east, south and west, each monitoring round, to allow comparison over time.

4.3 Monitoring schedule

Table 4-2 outlines the riparian vegetation monitoring schedule that will be followed for the duration the of the WDL.

Table 4-2. Riparian vegetation monitoring schedule

Monitoring	Objective	When	Monitoring undertaken	Frequency of monitoring	Locations
Riparian vegetation site assessment survey	To capture data outlined in Table 4-1 after wet season discharges	End of Wet season (April/May)	Site assessment at all identified locations	Annual - 2023 onwards	MVS1, RVS2 and SVS3
Photo point monitoring	To capture photo points after wet season discharges	End of Wet season (April/May)	Photo monitoring at riparian vegetation assessment sites	Annual - 2023 onwards	MVS1, RVS2 and SVS3
Ongoing drone survey	To continue drone survey monitoring after wet season discharges	End of Wet season (April/May)	Drone flight	Annual - 2023 onwards	Flight path as per previous survey

4.4 Data management and reporting

4.4.1 Drone survey

The intent of analysing drone data is to determine if there is reduction in riparian vegetation extent and/or structure compared to baseline survey. If there are gaps in vegetation i.e. if there is a retraction of mapped riparian vegetation, further on-ground assessments will be undertaken. A vegetation monitoring database will be maintained which will record:

- The riparian vegetation area size (ha) based on drone mapping
- All drone images captured during the drone surveys organised in folders.
- A zip-file of all tiff files derived from drone surveys (both orthomosaic and plant health image).
- Spatial data.

4.4.2 Riparian vegetation site assessments

The data collected will be analysed using the Before After/Control Impact (BACI) approach. BACI will be applied by performing statistical analysis to test whether there is a significant difference between the baseline data and ongoing data sets collected at the same sites. Data analysis will include:

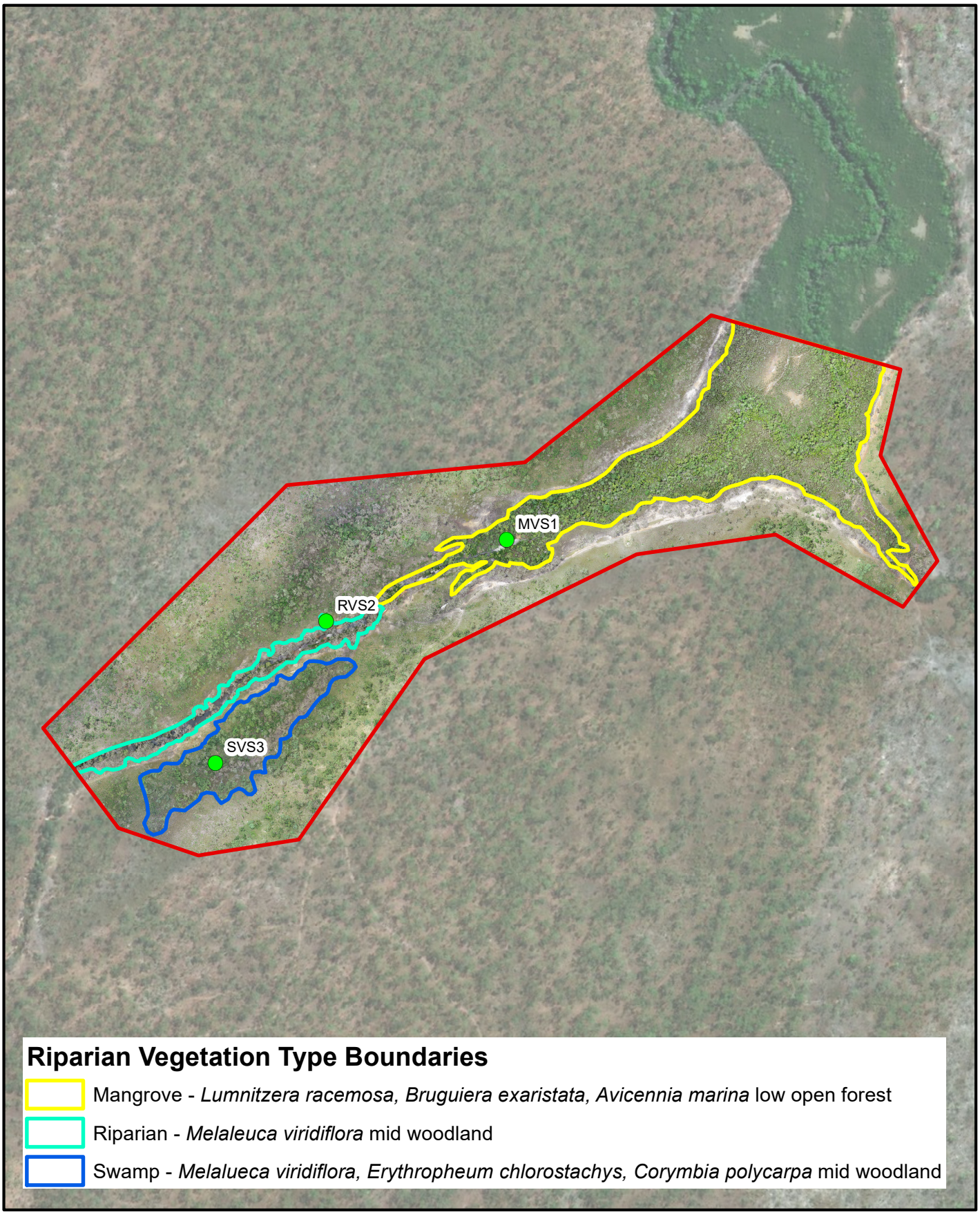
- Species composition (%) using vegetation data collected for upper, mid, ground strata data
- Average heights of plants across riparian vegetation sites.
- Canopy cover (%) for each dominant, and emergent species across riparian vegetation assessment sites compared to reference site data.
- Plants alive or dead (%) across all riparian vegetation sites.

This data will also be stored within the vegetation monitoring database.

4.4.3 Photo point monitoring

The intent of analysing photo point data is to determine if there are visual on-ground changes compared to baseline survey. All photographs will be labelled with site name, direction and date and stored in a separate zip-file.

Results of riparian vegetation monitoring will be reported on annually within the Monitoring Report, which will be prepared and submitted to the Administering Agency within 10 business days of the 25 July of each year.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ19042 - Grants Project supplementry ecology 2019\01 Project Files\Riparian veg assessment\Figure 3. Mangrove ecosystem vegetation boundaries.mxd

Figure 4-1. Map of riparian vegetation type boundaries and monitoring locations

5 MACROINVERTEBRATES

Appendix 5 of the Draft WDL requires macroinvertebrate monitoring within Darwin Harbour and areas downstream of the GLP. Macroinvertebrate sampling will be undertaken within the freshwater habitats downstream of the discharge point, and within Darwin Harbour sites which are also monitored for water quality, sediment and seagrass habitat.

Baseline macroinvertebrate sampling was undertaken in freshwater habitats downstream of the mine site in 2017, and two of these sites will be monitored ongoing to allow comparison of data over time. Sediment and water quality samples will also be collected during macroinvertebrate sampling to inform macroinvertebrate data analysis. Macroinvertebrate sampling is summarised in Table 5-1.

Table 5-1. Macroinvertebrate monitoring program

Sites	Site type	Purpose	Survey timing
UC1, UC2	Freshwater macroinvertebrates	Comparison to 2017 baseline data – downstream of mine site	Annually during recessional flows (April/May)
GDS SW5		Compliance point data	
Control (BP4)		Reference site	
GDS DH1, GDS DH2	Marine macroinvertebrates	Darwin Harbour sites downstream of mine site	Annually during recessional flows (April/May)
GDS DH3		Reference site	

5.1 Sample methods

Macroinvertebrate sampling will be undertaken annually during the recessional flows each wet season (April/May). Site locations are shown on Figure 1-1. The freshwater sites were visited and sampled in May 2022, and so are known to be accessible and appropriate for macroinvertebrate sampling. A suitable and accessible reference site near the LDGNT site could not be located, and so a reference site on an unnamed tributary of the Charlotte River, upstream of Cox Peninsula Road, has been selected as a representative reference site for both LDGNT and the adjacent BP33 mine site. The location of this site is shown on Figure 1-1 (see 'BP4'). If, during future monitoring events, the reference site UC3 (which was sampled by GHD in 2017) is found to be suitable, then it may also be sampled as a reference site. However, during sampling in 2022 there was insufficient water at site UC3 which indicates it ceases to flow soon after the wet season.

For both marine and freshwater sites, water quality samples will be collected (including measurement of field parameters and collection of surface water samples) prior to sediment and macroinvertebrate sampling to minimise contamination of water quality samples (e.g. with sediment or vegetation). Water will be analysed for the same parameters as per the surface water monitoring schedule (see Section 2). Following collection of water samples, macroinvertebrate sampling will be undertaken, and sediment samples will be collected (to be analysed for the same parameters as per Section 3).

Freshwater

Macroinvertebrate sampling will be undertaken in accordance with the *NT AUSRIVAS Sampling and Processing Manual* (Lloyd and Cook 2001) and the *Darwin-Daly Regional AUSRIVAS Models – Northern Territory* (Lamche 2007). All sampling sites are chosen from steep edge habitat with no undercut and away from any fast-flowing stream sections. Habitat descriptions of the site will be noted on the Field Sheets from the NT Darwin-Daly Region AUSRIVAS User Manual (provided at Attachment C); field notes will include site location, a sketch of the site, water quality field data, and a description of the sampled site).

At each site one person will rake along the bank and submerged root matter, and another will sweep through the water in the disturbed area with a 250 µm net to capture the removed material, which will include macroinvertebrates. Samples will be sieved on the bank through sieves of decreasing aperture to remove leaf litter and other material. This material is then thoroughly rinsed with water collected from the sample site multiple times. The remaining material is examined for any macroinvertebrates before being disposed of. All material from the finest sieve (250 µm) will be washed into a jar, which is then filled with ethanol for preservation.

Refer to the *Darwin-Daly Regional AUSRIVAS Models – Northern Territory* User Guide (Lamche 2007) for detailed sample methodology.

Samples will be labelled and stored upright in an esky, transported safely to avoid accidental damage to samples. Samples will be submitted to a suitably qualified AUSRIVAS taxonomist for identification and data analysis.

Marine water

Marine macroinvertebrate samples will be collected via a boat, using a Van Veen grab sampler. The Van Veen will be lowered over the boat and a grab sample collected. The sediment will be emptied into a clean stainless steel container for onboard processing. A number of different sized sieves will be used to remove as much sediment, sand, rock, coral and other material from the sample, using filtered marine water to carefully wash the material through the sieves. Material from the finest sieve (10 µm) will be washed into a sample jar, which is then filled with ethanol for preservation. All samples will be submitted to a suitably qualified taxonomist with experience processing and analysing marine macroinvertebrate samples.

5.2 Data management and reporting

Freshwater

Freshwater samples will be analysed in accordance with the *Darwin-Daly Regional AUSRIVAS Models – Northern Territory* (Lamche 2007). Taxa will be identified to family level where possible, except for key taxa (as per Darwin-Daly regional AUSRIVAS User Manual) which either require identification to only order level, or sub-family level. Following identification, taxa counts will be recorded in a database and samples preserved and archived.

Macroinvertebrate metrics will be generated (abundance, taxa richness, PET richness, Signal-2) and presented for each site. AUSRIVAS modelling will be completed and OE50 scores and bandings presented for each site. Multivariate analysis of macroinvertebrate community composition will be completed to understand the differences and similarities between the sites. Data will be compared between years to identify whether there is any change in macroinvertebrate diversity (species richness) or abundance.

Marine

Marine samples will be analysed and macroinvertebrates (aka benthic infauna) identified to the lowest taxonomic level possible, or morpho-species. Statistical analysis will be undertaken on the samples (e.g. PRIMER and P.A.S.T) to calculate:

- Diversity indices, to assess species richness, diversity, evenness and dominance within samples
- Multivariate analysis to assess species abundance
- Environmental correlations – to assess whether there is a correlation between environmental data (e.g. water quality data) and macroinvertebrate data.

Results of macroinvertebrate sample processing and analysis will be reported in standalone reports prepared by the taxonomist. Key findings of macroinvertebrate sampling will be reported in the annual Monitoring Report, to be prepared and submitted to the Administering Agency within 10 business days of the 25 July each year.

6 SEAGRASS

Seagrass monitoring will be undertaken in West Arm, at sites GDS DH1, GDS DH2 and GDS DH3 (see Table 2-2 and Figure 1-1 for locations), in accordance with Appendix 5 of the Draft WDL. Benthic habitat mapping, based on modelling undertaken by the Australian Institute of Marine Science (AIMS) in collaboration with the Northern Territory Government, shows low likelihood of seagrass habitat within West Arm (Galaiduk et al. 2019 and Siwabessy et al. 2020). Additionally, the extent of seagrass is known to fluctuate in the Darwin Region, due to factors such as turbidity and wind and wave action, which tends to be greater during the wet season. As such, the spatial extent and percentage cover of seagrass generally declines during the wet season and recovers and expands during the dry season (Cardno 2014). Cardno noted low seagrass cover in wet season months such as February, but greater seagrass cover in May through to October/November.

Seagrass surveys are generally undertaken in accordance with the *Monitoring and Sampling Manual: Environmental Protection (Water) Policy – Guidance on seagrass monitoring* (Qld DES 2018) and associated resources including the *Manual for Scientific Monitoring of Seagrass Habitat* (Short et. al. 2015). However, seagrass monitoring usually focusses on well-established seagrass meadows and their extent, composition and biomass over time, and many of the proposed methods in DES (2018) are designed and selected for seagrass meadows. The methods are inappropriate for application in this case as the study area is situated within mangrove lined tidal channels with no known seagrass meadows in the vicinity.

The method proposed below was selected based on the likely limited presence of seagrass, access, and safety considerations:

- Three monitoring locations will be accessed via boat (locations shown on Figure 1-1 and Table 1-1).
- At each location one 50 m transect will be established perpendicular to the channel (i.e. across the channel).
- Seagrass survey will be undertaken at three sites along the transect; one at each end and one in the middle.
- At each of the three sites along the transect, a 0.5 m x 0.5 m quadrat on a frame will be lowered to the seabed.
- A GoPro camera will be attached to the frame, which will be programmed to take photos of the quadrat within a short time frame, i.e. every 10 seconds. The frame will be moved slightly between photographs to collect four photographs per site.
- Once photographs are taken, the quadrat will be lifted to the surface again via a davit, before moving on to the next site.
- Seagrass (if present) will be identified to the genus level as per Roeleofs et al. 2005 and photographs will be used to assess percent cover using the seagrass percentage cover photo guide in *Manual for Scientific Monitoring of Seagrass Habitat* (Short et. al. 2015).
- Common species in the Darwin Harbour area include *Halophila ovalis*, *Halophila decipiens and Halodule uninervis* and it is anticipated that, if present, these will be identifiable from the imagery obtained.

The survey will be undertaken in May, at the same time as Darwin Harbour water quality, sediment and macroinvertebrate sampling. The survey will occur when seagrass is likely to be recovering, and, if present, will likely be visible. The survey will be timed for neap tides, to maximise visibility (water clarity) and ensure photographs show visible/identifiable seabed. Photographs will be reviewed, and presence/absence of seagrass noted, as well as percent cover if present.

Results of seagrass monitoring will be reported on in the annual Monitoring Report, to be prepared and submitted to the Administering Agency within 10 business days of the 25 July each year.

One round of seagrass monitoring will be undertaken, following which the requirement for ongoing seagrass monitoring will be reviewed. If no seagrass is present in the tributaries of West Arm downstream of GLP then LDGNT will seek to remove the requirement for seagrass monitoring from WDL 248.

LDGNT is open to opportunities for collaboration with government and industry, or contribution to broader seagrass monitoring programs within Darwin Harbour to assess long term harbour health. Guidance from the Northern Territory Environment Protection Authority and/or Department of Environment, Parks and Water Security would be sought in this regard.

7 REFERENCES

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ATTACHMENT A –WASTE DISCHARGE LICENCE 248 FOR LITHIUM DEVELOPMENTS GRANTS NORTHERN TERRITORY

Northern Territory Government

WASTE DISCHARGE LICENCE

(Pursuant to section 74 of the *Water Act 1992)*

Licensee	Lithium Developments (Grants NT) Pty Ltd
Licence Number:	**WDL248**
Registered Business Address:	Level 5, Flinders Street Adelaide SA 5000
ACN:	622 047 232
ABN:	70 622 047 232
Commencement Date:	25 July 2022
Expiry Date:	24 July 2025
Licensed Action:	Controlled discharge of wastewater from Mine Water Dam 1 (MWD1) through authorised discharge point (DP1) and into an unnamed ephemeral stream that feeds into West Arm, Darwin Harbour in accordance with Table 2 and subject to the conditions of this licence.

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INFORMATION ABOUT THIS LICENCE

This waste discharge licence is granted pursuant to section 74 of the *Water Act 1992* (NT) (Water Act), which empowers the Controller of Water Resources to, in accordance with the Water Act, grant a licence to a person to carry out an action that would otherwise be an offence against this Act.

Responsibilities of Licensee

- In addition to the conditions set out in this licence, general responsibilities of licensees are set out in the *Waste Management and Pollution Control Act 1998* (NT) (**WMPC Act**), the Water Act and the *Water Regulations 1992* (NT) (**Water Regulations**).
- It is an offence under the Water Act, if the holder of a waste discharge licence contravene or cause, suffer or permit a person to contravene a term or condition to which the waste discharge licence is subject (s 76 Water Act).
- Except as expressly provided for in this licence or applicable law, it is an offence under section 16 of the Water Act to wilfully cause or cause, directly or indirectly:
    - waste to come into contact with water; or
    - water to be polluted.

Duration of licence

- This licence will remain in force until its Expiry Date, it is surrendered by the licensee, or until it is suspended or revoked by the Controller of Water Resources.
- A licensee may surrender its licence at any time (s 94 Water Act).
- If the licensee wishes to surrender its licence it should complete the notification form approved by the Controller of Water Resources and provide a copy of the completed form to the Administering Agency.
- The authority to allow waste to come into contact with water or water to be polluted ends once a licence is surrendered, and any such occurrence after a licence is surrendered is an offence pursuant to s 16 of the Water Act.

Amendment, Modification or Revocation of Licence

- As set out in section 93 of the Water Act, the Controller of Water Resources may, by notice served on the holder of the licence:
    - amend or modify the terms and conditions of a licence; or
    - where the Controller of Water Resources is satisfied that the holder of the licence has contravened or failed to comply with a term or condition of the licence or of any other licence previously held by the person for a similar purpose during the 12 months immediately preceding the grant of the first-mentioned licence, the Controller of Water Resources may:
        - revoke a licence; or
        - suspend a licence.

Transfer of Licence

- Where a waste discharge licence is granted to a person in relation to the person's use of land and, during the period of this licence, the person's interest in the land is transferred to another person, the waste discharge licence shall be deemed to have also been transferred to the other person (s 92 Water Act).

- The licensee must ensure the contact details recorded with the Administering Agency for the licence are correct at all times in accordance with condition 6. Accordingly, it is recommended the transferee complete the Controller of Water Resources approved notification of transfer of a waste discharge licence form.

Public Register

- A copy of this Licence will be placed on the Register in accordance with section 95 of the Water Act.

- A copy of plans for environmental management, reports, submissions or documents provided at Schedule 1 Item 13 will be placed on the Register.

- The Register is freely available from the Northern Territory Environment Protection Authority (**NT EPA**) website.

Water Quality Standards

- The Administrator may declare, by notice in the *Gazette*, a beneficial use, quality standard, criteria or objectives which apply in relation to any waste or class of waste, or water or class of water (s 73 Water Act).

- A water or waste beneficial use, quality standard, criteria or objectives declared under s 73 of the Act and in force is an Environment Protection Objective for the purposes of the WMPC Act (s 18 WMPC Act).

- An Environment Protection Objective is a statutory instrument to establish principles on which:

    - Environmental quality is to be maintained, enhanced, managed or protected;

    - Pollution, or environmental harm resulting from pollution, is to be assessed, prevented, reduced, controlled, rectified or cleaned up; or

    - Effective waste management is to be implemented or evaluated.

- Schedule 1 Item 1 specifies the beneficial use, quality, standard, criteria or objective relevant to this licence at the date of issue.

Environmental Interests

- Environmentally sensitive or significant areas may be captured by and protected under the *Environment Protection Act 2019* (NT) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). As such, and to best protect and regulate our waterways, waste discharge licences must identify the sensitivity of the environment surrounding the location of the Licensed Action.

- Schedule 1 Item 2 specifies the sites of conservation significance (if any) relevant to this licence at the date of issue.

- Schedule 1 Item 3 specifies the Ramsar wetlands (if any) relevant to this licence at the date of issue.

Cultural Interests

- Under Commonwealth and Northern Territory laws it can be an offence to enter or remain on or damage a sacred site.
- Sites of Aboriginal significance including registered and recorded Aboriginal sacred sites may exist in the vicinity of the Licensed Action.
- It is the licensee's responsibility to contact the Aboriginal Areas Protection Authority, appropriate land council or other governing body and ensure that any Authority Certificates required as a result of conducting the Licensed Action are obtained and complied with.
- Further specific advice on any cultural requirement or implication of the licenced activity should be sought from the relevant land council and the Aboriginal Areas Protection Authority.

END NOTES

This licence is a new licence, as such there are no historical records associated with the licence.

SCHEDULE 1 - ITEMS

1. Beneficial uses	Beneficial Uses and Objectives for the Darwin Harbour Region (Gazette No. 27, 7 July 2010).	
2. Sites of conservation significance	SOCS No. 6 Darwin Harbour.	
3. Ramsar wetlands	Not applicable.	
4. Licence Documents	(a) Water Management Plan - Appendix K, Mine Management Plan Grants Lithium Project (approved 10 June 2021). (b) Emergency Response Plan - Appendix R, Mine Management Plan Grants Lithium Project (approved 28 June 2019). (c) Stakeholder Engagement Plan - Core Lithium Grants Lithium Project Stakeholder Engagement Plan (issued 7 June 2021).	
5. Authorised Discharge Point(s)	Discharge Point 1 (DP1) from Mine Water Dam 1 (MDW1) as shown on the plan at Appendix 1.	Zone: 52 L Easting: 693153 Northing: 8598441
6. Source(s) of waste	Pit water, direct rainfall, and mine influenced water collected from Mineral Lease 31726 that is captured and stored in sediment basins and Mine Water Dam 2 (MWD2) and pumped to MWD1. Waters discharged through DP1 are pumped over the wall of MWD1 and released by a tee valve into the flow path of an adjacent unnamed ephemeral stream as shown at Appendix 1.	
7. Trigger values	The limits for parameters listed in Appendix 2.	
8. Compliance point	Grants Downstream Surface Water 5 (GDS SW5) as shown on the plan at Appendix 1.	Zone: 52 L Easting: 693374 Northing: 8600709
9. Conditions on discharge	Any authorised discharge must: (a) Not include wastewater generated outside of Mineral Lease 31726; (b) Not include wastewater treated with polyacrylamide flocculants with more than 0.05% of the neuro-toxin acrylamide monomer; (c) Occur only when the stream gauge at the compliance point GDS SW5 shows there is a sufficient amount of water to dilute discharge water to achieve trigger values; (d) In the event wastewater is treated, occurs only when the treatment process has finished, including allowing sufficient residence time for settlement of flocculants and target contaminants.	
10. Monitoring Program	The Monitoring Program includes: (a) Surface water monitoring in accordance with Appendix 3. (b) Fluvial sediment monitoring in accordance with Appendix 4. (c) Biota monitoring in accordance with Appendix 5.	
11. Critical contaminants	Aluminium (Al), Arsenic (As), Copper (Cu), Iron (Fe), Lithium (Li), Zinc (Zn) and Total Phosphorus (TP).	

12. Non-compliances	Non-compliances include the following exceedances: (a) An exceedance of a trigger value specified in Item 7 at the compliance point in Item 8, on three consecutive sampling occasions. (b) An exceedance of three times or more a trigger value specified in Item 7 at the compliance point in Item 8.
13. Documents placed on Register	The following documents will be placed on the Register: (a) The Licence Documents at Item 4. (b) The Monitoring Report provided in accordance with clause 45. (c) The Annual Return.

LICENCE CONDITIONS

RULES FOR INTERPRETING THE CONDITIONS OF THIS LICENCE

1. Where there is a discrepancy between the conditions of this licence and any plan, standard, guideline or other document referred to in this licence, the conditions of this licence prevail to the extent of the inconsistency.
2. Any reference to any standard, guideline or code of practice (Australian or international) in this licence means the relevant parts of the current version of that standard, guideline or code of practice.
3. In this licence, unless the contrary intention appears, words that are defined in the Water Act are intended to have the meaning given to them in that Act.
4. In this licence, unless a contrary intention appears, terms are defined in the Definitions at the end of this licence.
5. In this licence a reference to an Item is a reference to an Item in Schedule 1.

GENERAL

6. The licensee must ensure the contact details recorded with the Administering Agency for this licence are correct at all times.
7. The licensee must at all times have a 24 hour emergency contact.
8. The licensee must notify the Administering Agency prior to making any operational change that will cause, or is likely to cause, an increase in the potential for environmental harm.
9. The licensee must display clear and legible signage, in English, in a prominent location at each public entrance to the premises of the Licensed Action that includes the following details:
    - 9.1. waste discharge licence number issued under the Water Act; and
    - 9.2. 24 hour emergency contact details.
10. The licensee must cause a hard copy of this licence to be available for inspection, at the premises of the Licenced Action, by any person on request.
11. Unless otherwise specified, within 10 business days of a request, the licensee must provide to the Administering Agency a copy of any document, monitoring data or other information in relation to the Licensed Action in electronic form by emailing waste@nt.gov.au.
12. All notices, reports, documents or other correspondence required to be provided as a condition of this licence, unless otherwise specified as a condition of this licence, must be provided in electronic form by emailing waste@nt.gov.au.
13. The licensee must maintain, implement and comply with the current version of the documents listed in Item 4.
14. Within 10 business days of any amendment being made to a document listed in in Item 4, the licensee must provide the amended document to the Administering Agency, along with:
    - 14.1. a tabulated summary of the amendment(s) with document references;
    - 14.2. reasons for the amendment(s); and
    - 14.3. an assessment of environmental risk associated with the amendment(s).
15. The Administering Agency may require the licensee to revise or amend and resubmit any document provided in accordance with this licence. Where the Administering Agency requires any document to be revised or amended, the licensee must submit it to the Administering Agency by the date specified by the Administering Agency.
16. The licensee must operate and maintain a community feedback telephone number enabling members of the public to contact, at any time, a person or voice mail system that can accept, on behalf of the licensee, enquiries or complaints about the Licensed Action, and to which the licensee must respond. The community feedback telephone number must be displayed:

16.1. where the licensee has a website, in a prominent location on the licensee's website;

16.2. in the Stakeholder Engagement Plan; and

16.3. in other publicly available documents relating to the Licensed Action.

17. The licensee must maintain a register of complaints that records the details of each complaint received in relation to the Licensed Action and provide a copy to the Administering Agency on request. Details of the compliant must (as is reasonably practicable) include, the following information:

17.1. the person to whom the complaint was made;

17.2. the person responsible for managing the complaint;

17.3. the date and time the complaint was reported;

17.4. the date and time of the event(s) that led to the complaint;

17.5. the contact details of the complainant if known, or where no details are provided a note to that effect;

17.6. the nature of the complaint;

17.7. the nature of event(s) giving rise to the complaint;

17.8. prevailing weather conditions at the time (where relevant to the complaint);

17.9. the action taken in relation to the complaint, including any follow-up contact with the complainant; and

17.10. if no action was taken, why no action was taken.

MONITORING INFORMATION

18. If the licence expires or is otherwise surrendered, suspended or revoked and the licence contained a condition that the licensee provide a report, record or other information, including in accordance with a monitoring program pursuant to section 77 of the Water Act, the licensee must provide any report, record, information or data available to the licensee up to and including the date the licence expired or was surrendered, suspended or revoked.

OPERATIONAL

19. Without limiting the conditions of this licence, in conducting the Licensed Action, the licensee must do all things reasonable and practicable to:

19.1. prevent or minimise the likelihood of pollution occurring as a result of, or in connection with, the Licensed Action;

19.2. prevent or minimise the likelihood of environmental harm occurring as a result, or in connection with, the Licensed Action;

19.3. effectively respond to pollution and the risk of pollution occurring as a result of, or in connection with, the Licensed Action;

19.4. effectively respond to environmental harm and the risk of environmental harm occurring as a result of or in connection with the Licensed Action; and

19.5. apply the principles of ecologically sustainable development.

20. The licensee must, without limiting any other condition of this licence, in conducting the Licensed Action do all things reasonable and practicable to ensure the Licensed Action does not adversely affect any:

20.1. declared beneficial use, quality, standard or objectives declared under section 73 of the Water Act;

20.2. sites of conservation significance; or

20.3. designated Ramsar wetlands,

including, but not limited to, those listed at Items 1, 2 and 3.

21. The licensee must ensure any plant and equipment used by the licensee in conducting the Licensed Action:

    21.1. is reasonably fit for the purpose and use to which it is put;

    21.2. is maintained and operational; and

    21.3. is operated by a person trained to use the plant and equipment.

22. No change, replacement or alteration of plant and equipment is permitted if the change, replacement or alteration increases the risk of environmental harm for the Licensed Action, unless approved by the Administering Agency.

DISCHARGES

23. This licence authorises discharges of waste to water from the authorised discharge point(s) as identified in Item 5 and in accordance with the conditions of this licence.

24. Where the Administering Agency directs the licensee to cease discharge from an authorised discharge point identified in Item 5, the licensee must immediately cease the discharge.

25. A direction to cease discharge may be verbal or written, but a verbal direction from the Administering Agency will be provided in writing within 48 hours of the verbal direction. A failure to provide a written direction does not affect the requirement to comply with a verbal direction.

26. The licensee must ensure that discharge from each authorised discharge point:

    26.1. consists only of waste from the source(s) as specified in Item 6;

    26.2. does not exceed the trigger value limits at Item 7 at the compliance point at Item 8;

    26.3. meets the conditions at Item 9.

27. Following any exceedance of a trigger value limits at Item 7 at the compliance point at Item 8 the licensee must take corrective action to mitigate any environmental harm and ensure the exceedance does not reoccur.

28. The licensee must, for each authorised discharge point, install, operate and maintain a device to measure and record, for each discharge event:

    28.1. the time the discharge commenced and the duration of the discharge;

    28.2. the discharge rate of flow; and

    28.3. the discharge volume.

29. The licensee must ensure that the discharge from all discharge events at each authorised discharge point does not:

    29.1. contain any floating debris, oil, grease, petroleum hydrocarbon sheen, scum, litter or other objectionable matter;

    29.2. cause or generate odours which would adversely affect the use and amenity of surrounding waters;

    29.3. cause algal blooms in the receiving water;

    29.4. pollute groundwater;

    29.5. cause visible change in the behaviour of fish or other aquatic organisms in the receiving water;

    29.6. cause mortality of fish or other aquatic organisms;

    29.7. cause erosion or degradation to the beds and banks of a watercourse; or

    29.8. cause adverse impacts on plants or animals.

MONITORING

30. From the Commencement Date of this licence, the licensee must implement and comply with the Monitoring Program specified in Item 10.

31. The licensee must ensure that the Monitoring Program is designed, maintained and implemented in accordance with the following principles:

    31.1. the need to monitor loads upstream and downstream, including in-stream decay in loads downstream, of authorised discharge points;

    31.2. the need for event-based monitoring, in addition to routine monitoring, including revisiting sampling points as soon as practicable when samples cannot be collected at frequencies set in the Monitoring Program;

    31.3. the need for special studies to better described in-stream physical, chemical and biological processes;

    31.4. the need to target the possible critical contaminants listed at Item 11;

    31.5. the need to select sampling points that provided representative (well mixed) samples;

    31.6. the need to collect samples that are representative of discharge conditions, including taking samples from sampling points on the same day as discharge and consecutively from upstream to downstream; and

    31.7. the need to adopt a range of biological surveys to assess the health of the system.

32. The licensee must ensure that all samples and field environmental data are collected in accordance with recognised Australian Standards and guidelines (such as AS/NZS 5667.1 1998, ANZG (2018), as updated from time to time).

33. For the parameters that require analysis at a laboratory, the licensee must ensure that all samples are analysed at a laboratory with current NATA accreditation or equivalent.

34. The licensee must ensure any samples collected in accordance with the Monitoring Program or in connection with the Licensed Action or this licence, are obtained by, or under the supervision of a qualified sampler.

35. The licensee must ensure that, for each sample collected in accordance with the Monitoring Program or the Licensed Action, the following information must be recorded and retained:

    35.1. the date on which the sample was collected;

    35.2. the time at which the sample was collected;

    35.3. the location at which the sample was collected;

    35.4. the name of the person who collected the sample;

    35.5. the chain of custody forms relating to the sample;

    35.6. the field measurements (if any) and analytical results (if any) relating to the sample; and

    35.7. laboratory quality assurance and quality control documentation.

36. The licensee must for all land based monitoring points specified in the Monitoring Program:

    36.1. install and maintain appropriate identification signage so that they are reasonably identifiable at all times; and

    36.2. maintain safe access and egress, as is reasonably practicable.

37. The licensee must ensure that any proposed revisions to the Monitoring Program (other than typographical changes or revisions to formatting or referencing) are:

    37.1. reviewed by a Qualified Person, who must produce a written report about their review;

    37.2. submitted to the Administering Agency with justification for revisions; and

37.3. submitted to the Administering Agency, in both hard copy and electronic form (with a complete copy of the Qualified Person's written review), 20 business days prior to the proposed implementation date.

RECORDING AND REPORTING

38. The licensee must keep records of all exceedances of trigger values of parameters specified in Item 7, including those that are not an exceedance listed at Item 12, and provide a copy on request of the Administering Agency.

39. The licensee must keep records of all non-compliances with this licence. These records must be adequate to enable the licensee to comply with the non-compliance notification conditions of this licence.

40. A non-compliance with this licence includes the exceedances listed at Item 12.

41. The licensee must notify the Administering Agency of any non-compliance with this licence by emailing waste@nt.gov.au, as soon as practicable after (and in any case within 24 hours after) first becoming aware of the non-compliance.

42. The licensee must include in the notification of non-compliance the following information:

42.1. when the non-compliance was detected and by whom;

42.2. the date and time of the non-compliance;

42.3. whether discharge was occurring at the time of the non-compliance and the source of the discharge;

42.4. whether non-compliant discharge is still occurring; and

42.5. a date (within 10 business days of the non-compliance) when an investigation report will be submitted to the Administering Agency.

43. Within 10 business days of notifying the Administering Agency of any non-compliance, the licensee must provide the Administering Agency an investigation report that includes:

43.1. when the non-compliance was detected and by whom;

43.2. the date and time of the non-compliance;

43.3. whether discharge was occurring at the time of the non-compliance and the source of the discharge;

43.4. the actual and potential causes and contributing factors to the non-compliance;

43.5. monitoring data of the discharge, and upstream and downstream water of the authorised discharge point, collected for the date the non-compliance was detected and three sampling rounds prior;

43.6. available flow rates to demonstrate any influence streams and rivers may have had on the exceedance of trigger values;

43.7. rainfall recorded at the site prior to the exceedance of trigger values and non-compliance;

43.8. the risk of environmental harm arising from the non-compliance;

43.9. the action(s) that have or will be undertaken to mitigate any environmental harm arising from the non-compliance;

43.10. corrective actions that have or will be undertaken to ensure the non-compliance does not reoccur; and

43.11. if no action was taken, why no action was taken.

44. The licensee must submit a completed Annual Return, by emailing waste@nt.gov.au, within 10 business days after each Anniversary Date of this licence, which report relates to the preceding 12 month period.

45. The licensee must complete and provide to the Administering Agency a report of data and information obtained through the implementation and performance of the Monitoring Program (the Monitoring Report), as prescribed by this licence, within 10 business days after each Anniversary Date of this licence.

46. The licensee must ensure that each Monitoring Report:

    46.1. is prepared in accordance with the requirements of the Administering Agency 'Guideline for Reporting on Environmental Monitoring' (or any other guideline as adopted by the Administering Agency from time to time);

    46.2. includes a tabulation of all monitoring data required as a condition of this licence (data must be provided electronically in Microsoft® Excel® format);

    46.3. includes a tabulation of monthly and annual contaminant loads discharged from the authorised discharge point listed at Item 5. Contaminant loads must be calculated for total metals, total metalloids, total nutrients and other parameters (excluding field parameters) listed in Appendix 3. The calculations must be based on the daily discharge volume and the concentration of contaminant present in the discharge on that day. On the days when a sample was not taken then the concentration of the contaminant must be estimated using Linear Interpolation methodology;

    46.4. includes long term trend analysis of monitoring data to demonstrate any environmental impact associated with the Licensed Action over a minimum period of three years (where the data is available); and

    46.5. includes an assessment of environmental impact from the Licensed Action.

47. A copy of the documents listed at Item 13 will be placed on the Register.

PERFORMANCE IMPROVEMENT

48. Prior to discharge from the authorised discharge point listed at Item 5, the licensee must develop and provide to the Administering Agency, an operational procedure that:

    48.1. calculates the discharge dilution ratio;

    48.2. monitors compliance with condition 26; and

    48.3. adjusts the discharge rate during discharge events as flow in the catchment varies.

49. The licensee must ensure that water quality monitoring stations, including water level and flow meters, are installed and operational before 31 October 2022.

50. By 31 August 2023, the licensee must develop a plan for a wastewater management and treatment that provides for:

    50.1. a reduction in total contaminant loads discharged compared to total contaminant loads discharged during the 2022/23 wet season; and

    50.2. details of what flocculants and coagulants and other treatment additives will be used, their breakdown products and their potential to contaminate the environment.

END OF LICENCE CONDITIONS

This licence is not valid unless signed below:

JOANNE TOWNSEND
Controller of Water Resources
Dated the 25 JULY 2022

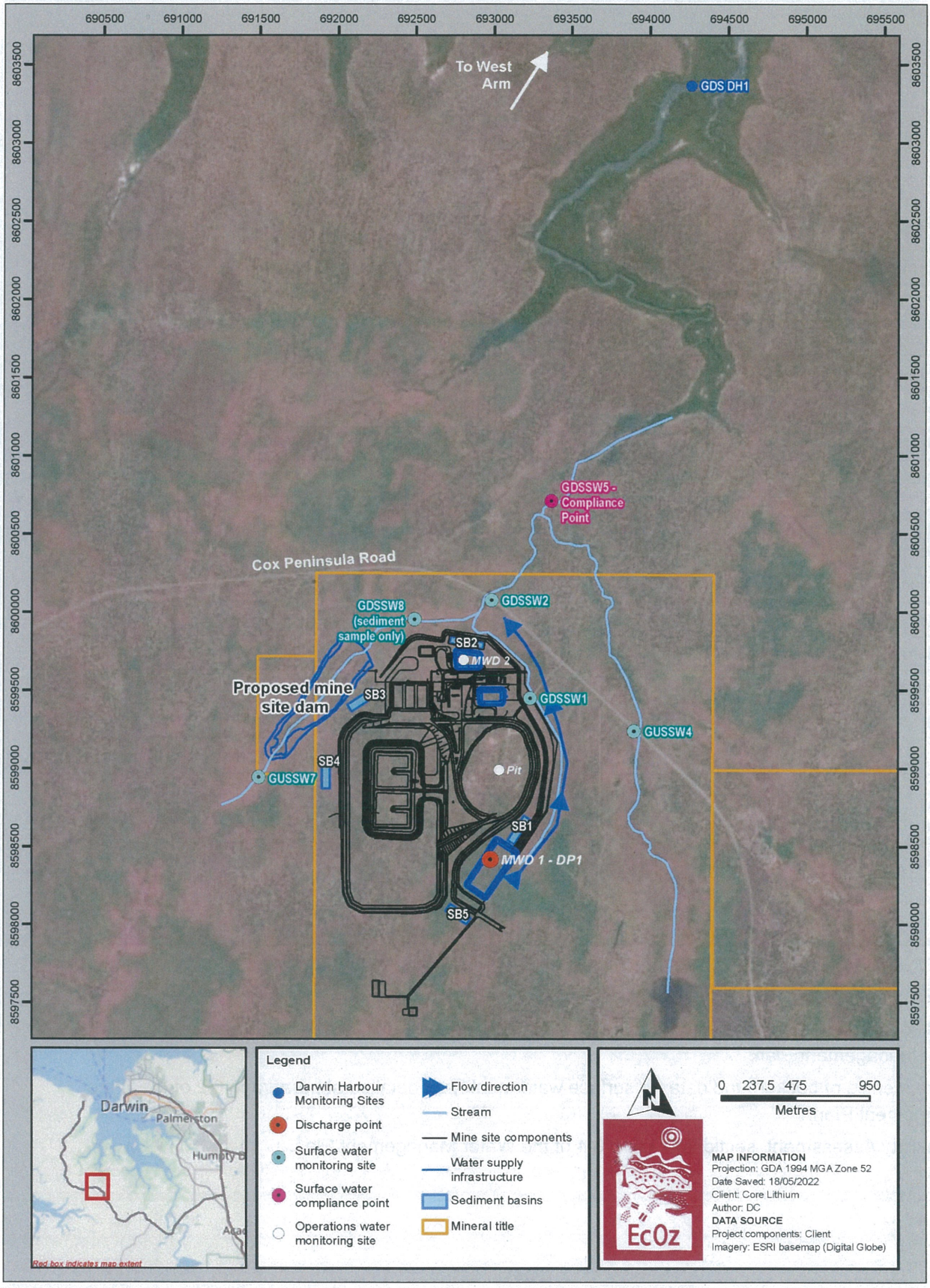
DEFINITIONS

In this licence, unless a contrary intention appears:

Term	Definition
24 hour emergency contact	the phone number of a person who can be contacted at any time and be capable of responding to and providing information about any incident associated with the Licensed Action.
Administering Agency	means the NT Government Department with responsibility for administering the Water Act.
Anniversary Date	annual anniversary of the Commencement Date.
Annual Return	an Administering Agency prescribed format for demonstrating and reporting compliance with the conditions of this licence.
ANZG (2018)	Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines.
Authority Certificate	a certificate issued under s 22(1) of the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT). An Authority Certificate permits a licensee to carry out work on land with or within the vicinity of a sacred site.
business days	a day not Saturday, Sunday or a public holiday, in Darwin, Northern Territory.
Consultation and Communication Plan	a written plan documenting proposed consultation and communications for the Licensed Action before, during and after the Licensed Action which includes a strategy for communicating with members of the public who are likely to have a real interest in, or be affected by, the Licensed Action.
contact details	includes the 24 hour emergency contact, and name, position title and phone number of a representative of the licensee who can be contacted about the licence and Licensed Action.
contaminant	has the meaning given in section 4 of the WMPC Act.
discharge	releasing or allowing a liquid, gas or other substance to flow out from where it has been confined.
Dry season	means 1 May to 31 October.
Emergency Response Plan	a written plan documenting the licensee's procedures for responding to emergencies caused by, resulting from or associated with the Licensed Action and that may cause environmental harm.
land	includes water and air on, above or under land.
Licensed Action	the Licensed Action as described on the covering page of this licence.
Linear Interpolation	a method to construct new data points within the range of known data points. $y = y1 + ((x - x1) * ((y2 - y1) / (x2 - x1))$ y in the unknown concentration between known concentrations y1 and y2 y1 in the first known concentration y2 is the second known concentration x is the day of the unknown concentration y x1 is the day of the first known concentration y1 x2 is the day of the second known concentration y2

Term	Definition
litter	litter, garbage, rubbish, refuse or waste matter, and includes the body of a dead animal.
Maintain	kept in a manner that it does not present or cause a risk of environmental harm or a hazard to persons or property or, for the purposes of documents including plans, a process of reviewing and amending documentation to ensure it is relevant.
NATA	National Association of Testing Authorities, Australia.
non-compliance notification	an Administering Agency prescribed format for notifying the Administering Agency of a non-compliance.
plant and equipment	all material items used in association with the Licensed Action, including (but not limited to) storage vessels and containers, pipe work and hosing, vehicles (including vessels), tools, and measuring equipment.
pollution	has the meaning given in section 4 of the WMPC Act.
public entrance	access to the licensed premises that is utilised by the public.
Qualified Person	a person registered under Section 68 of the WMPC Act.
qualified sampler	a person who has training and experience in obtaining samples from the relevant environmental medium.
Register	the register available at the website of the Northern Territory Environment Protection Authority (NT EPA).
waste	takes its meaning from the term in the WMPC Act.
wastewater	water that contains a contaminant or waste.
Water Act	*Water Act* (NT)
Wet season	means 1 November to 30 April and for the purposes of Appendix 3 includes any part of the Dry Season that discharge is occurring.
WMPC Act	*Waste Management and Pollution Control Act 1998* (NT)

APPENDIX 1: Map of Discharge Point, Compliance Point and Monitoring Sites



APPENDIX 2 : Discharge Trigger Values

				Sampling Points	Compliance Point
				Site Code	GDS SW5
				Easting	693374
				Northing	8600709
PARAMETER	**Abbrev.**	**Units**	**Analysis**		**Trigger Values**
Environmental Field Data					
pH	pH	pH	In situ		5.2-6.6[2]
Electrical conductivity	EC	µS/cm			250[1]
Turbidity	NTU	NTU			12[3]
Dissolved oxygen	DO	% sat.			70-92[2]
Nutrients					
Total Nitrogen	TN	µg/L	Unfiltered		200[3]
Total Phosphorus	TP				10[3]
Metals and Metalloids					
Aluminium	Al	µg/L	Total and Filtered (0.45 µm)		70[3]
Arsenic	As				13[1]
Cadmium	Cd				0.2[1]
Chromium	Cr				1[1]
Copper	Cu				1.4[1]
Iron	Fe				110[3]
Lead	Pb				3.4[1]
Lithium	Li				430[4]
Mercury	Hg				0.6[1]
Nickel	Ni				11[1]
Zinc	Zn				8[1]

Key:

[1] ANGZ (2018) 95% species protection, freshwater.

[2] 20th and 80th percentile of background data for surface water quality as detailed at paragraph 6.2 of the Water Management Plan.

[3] 80th percentile of background data for surface water quality as detailed at paragraph 6.2 of the Water Management Plan.

[4] Ecotoxicity Assessment, sections 8.3 and 8.4 of the Water Management Plan.

APPENDIX 3: Surface Water Monitoring Program

			Sampling Points	Grants Downstream Surface Water 1	Grants Downstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Upstream Surface Water 7	Sediment Basins 1-5					Discharge Point	Mine Pit Sump	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GUS SW7	Sed1	Sed2	Sed3	Sed4	Sed5	MWD1[1]	Pit	GDS DH1
			Easting	693239	692989	693903	693374	691498	693167	692657	692155	691928	692775	693030	693037	694262
			Northing	8599446	8600073	8599235	8600709	8598943	6598623	8599847	8599446	8598961	8598072	8598504	8598990	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**												
Field Parameters																
Flow	-	kL/day	In situ	D	D	D	C	D	N/A	N/A	N/A	N/A	N/A	C	N/A	N/A
Water Level	-	measure		D	D	D	C	D	N/A	N/A	N/A	N/A	N/A	P, W	N/A	N/A
pH	pH	pH		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Electrical conductivity	EC	µS/cm		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Turbidity	NTU	NTU		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Temperature	Temp	°C		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Oxidation Reduction Potential	OR	mV		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Dissolved oxygen	DO	% sat.		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Nutrients																
Ammonia	NH_4^+	µg/L	Unfiltered (excluding FRP)	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Oxides of Nitrogen	NO_x			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Nitrate	NO_3			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Total Nitrogen	TN			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Total Phosphorus	TP			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Filterable Reactive Phosphorus	FRP			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Metals and Metalloids																
Aluminium	Al	µg/L	Total and Filtered (0.45 µm)	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Arsenic	As			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Cadmium	Cd			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Chromium	Cr			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Copper	Cu			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Iron	Fe			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Lead	Pb			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Lithium	Li			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Mercury	Hg			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Nickel	Ni			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Zinc	Zn			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]

			Sampling Points	Grants Downstream Surface Water 1	Grants Downstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Upstream Surface Water 7	Sediment Basins 1-5					Discharge Point	Mine Pit Sump	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GUS SW7	Sed1	Sed2	Sed3	Sed4	Sed5	MWD1[1]	Pit	GDS DH1
			Easting	693239	692989	693903	693374	691498	693167	692657	692155	691928	692775	693030	693037	694262
			Northing	8599446	8600073	8599235	8600709	8598943	6598623	8599847	8599446	8598961	8598072	8598504	8598990	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**												
Full elemental scan	-			A	A	A	A	A	A	A	A	A	A	A	A	A
Treatment regents (condition Error! Reference source not found.)																
Acrylamide[2]	C_3H_5NO	µg/L	Total and Filtered (0.45 µm)	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Other																
Sulphate	SO_4	mg/L	Filtered (0.45 µm)	W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Calcium	Ca			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Chloride	Cl			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Sodium	Na			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Potassium	K			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Magnesium	Mg			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Carbonate	CO_3^{2-}			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Bicarbonate	HCO3			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Total Dissolved Solids	TDS			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Total Suspended Solids	TSS		Unfiltered	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]

Key:

P = prior to discharge.

C = continuous

D = within 24 hours of commencement of discharge **and** daily during discharge. When no discharge is occurring monitoring will be on a weekly basis.

W = within 24 hours of discharge **and** weekly during discharge. When no discharge is occurring monitoring will be on a monthly basis.

F = weekly whilst discharging from sediment basins, Monthly during Wet season irrespective of discharge.

M = monthly.

A = Annually, at end of Wet season on recessional flows.

N/A = not applicable.

[1] The sampling point in MWD1 will be located close to DP1 to ensure it is representative of discharge water quality.

[2] This sampling is only required where the licensee has conducted water treatment onsite using flocculants containing Acrylamide.

[3] During Wet season only

APPENDIX 4: Fluvial Sediment Monitoring Program

			Sampling Points	Grants Downstream Surface Water 1	Grants Upstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Downstream Surface Water 7	Grants Downstream Surface Water 8	Discharge Point	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GDS SW7	GDS SW8	MWD1	GDS DH1
			Easting	693239	692989	693903	693374	691498	692465	693030	694262
			Northing	8599446	8600073	8599235	8600709	8598943	8599942	8598504	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**							
Environmental Field Data											
pH	pH	pH		A	A	A	A	A	A	A	A
Electrical conductivity	EC	µS/cm		A	A	A	A	A	A	A	A
Moisture content		%		A	A	A	A	A	A	A	A
Particle size distribution	PSD	%	<63µm >=63µm & <=2mm >2mm	A	A	A	A	A	A	A	A
Aluminium	Al	mg/kg	<63µm sediment fraction	A	A	A	A	A	A	A	A
Arsenic	As			A	A	A	A	A	A	A	A
Cadmium	Cd			A	A	A	A	A	A	A	A
Chromium	Cr			A	A	A	A	A	A	A	A
Copper	Cu			A	A	A	A	A	A	A	A
Iron	Fe			A	A	A	A	A	A	A	A
Lead	Pb			A	A	A	A	A	A	A	A
Lithium	Li			A	A	A	A	A	A	A	A
Mercury	Hg			A	A	A	A	A	A	A	A

			Sampling Points	Grants Downstream Surface Water 1	Grants Upstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Downstream Surface Water 7	Grants Downstream Surface Water 8	Discharge Point	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GDS SW7	GDS SW8	MWD1	GDS DH1
			Easting	693239	692989	693903	693374	691498	692465	693030	694262
			Northing	8599446	8600073	8599235	8600709	8598943	8599942	8598504	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**							
Nickel	Ni			A	A	A	A	A	A	A	A
Zinc	Zn			A	A	A	A	A	A	A	A
Other											
Sulphate	SO_4	mg/kg	Soluble ion extract	A	A	A	A	A	A	A	A
Calcium	Ca			A	A	A	A	A	A	A	A
Chloride	Cl			A	A	A	A	A	A	A	A
Sodium	Na			A	A	A	A	A	A	A	A
Potassium	K			A	A	A	A	A	A	A	A
Magnesium	Mg			A	A	A	A	A	A	A	A

Key:

A = Annually during recessional flow (late Wet season/early Dry season)

APPENDIX 5: Biota Monitoring Program

Project Name	Locations	Project Description	Report Frequency
Seagrass assessment	West Arm, Darwin Harbour	Seagrass monitoring to determine whether any observed change in seagrass distribution or composition has occurred in the marine waters of West Arm, Darwin Harbour. Monitoring should aim to determine whether any change identified is naturally occurring or related to mine operations.	Annually
Vegetation monitoring	Areas downstream of ML 31726	Monitoring of vegetation downstream of ML 31726 to determine if mining activities are impacting riparian vegetation communities.	Annually
Macroinvertebrate study	Darwin Harbour and Areas downstream of ML 31726	Survey of macro-invertebrate abundance and diversity in aquatic ecosystems. Data is used to monitor potential impacts from mine operations.	Annually during recessional flow (late Wet season/early Dry season)

ATTACHMENT B –PROCEDURE FOR SURFACE WATER SAMPLING

Procedure
Surface Water Sampling



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DOCUMENT CONTROL RECORD

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1 INTRODUCTION

1.1 Purpose

To ensure sampling methods obtain samples representative of the surface water, and to ensure all sampling is consistent, undertaken in a safe manner and follows best-practice procedures in accordance with relevant standards.

1.2 Scope

This Procedure applies to all surface water sampling undertaken by EcOz Environmental Consultants (EcOz) personnel, noting that some sampling requirements may vary on a project-specific basis.

1.3 Standards and other requirements

To ensure the quality and accuracy of the measurements, sampling procedures have been developed in accordance with the following standards and guidelines:

- Australian Standard on Water Quality Sampling - *Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples* (AS/NZS 5667.1:1998);
- Australian Standard on Water Quality Sampling - *Part 4: Guidance on sampling from lakes, natural and man-made* (AS/NZS 5667.4:1998);
- Australian Standard on Water Quality Sampling – *Part 6: Guidance on sampling of rivers and streams* (AS/NZS 5667.6:1998);
- Australian Standard on Water Quality Sampling – *Part 10: Guidance on sampling of waste waters* (AN/NZS 5667.10:1998)
- ANZG 2018, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality,* Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia, Available: www.waterquality.gov.au/anz-guidelines
- ANZECC & ARMCANZ 2000, *Australian Guidelines for Water Quality Monitoring and Reporting*, National Water Quality Management Strategy Paper No 7, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

2 EQUIPMENT, SAFETY AND TRAINING

2.1 Equipment

The following equipment list is provided for guidance and personnel should consider project-specific sampling requirements when preparing for field sampling:

- **Map** showing monitoring sites.
- **GPS** – with coordinates uploaded for locating sample sites.
- **Site access or permit** requirements that may be required, such as keys, ID cards, contractor induction certificates, vehicle licence, Indigenous land access permit.
- **Job Safety Plan** (JSP).
- **Field Data Sheets** – enough for all sample sites plus some spares – see Appendix A – EcOz Surface Water Sampling Field Data Sheet.
- **Folder/clipboard** and waterproof notebook.
- **Stationary**: Pens / pencils, permanent markers for completing sample bottle labelling
- **Sample bottles** obtained from relevant laboratories being used (e.g. ALS, Envirolabs, etc.). Ensure that specific bottles are obtained for each parameter to be tested and appropriate pre-treatment is undertaken (e.g. preservatives). Ensure sufficient sample bottles are available for each bore, a duplicate, split and field blank sample (see definitions in Section 4.2), and spare bottles, particularly the glass bottle types.
- **Insulated cooler** with frozen ice bricks or portable Engle fridge/freezer.
- **Field meters** to measure water parameters (e.g. pH, temperature, EC, DO, ORP, turbidity); calibrated on the day of sampling.
- **Calibration solutions** and copies of the EcOz Calibration Record Sheet (if in field for >1 day) or in the event of an issue with field meters – see Appendix B - Calibration Record Sheet.
- **Camera**
- **Polypropylene sampling jug** for collecting field measurements and filling sample bottles if unable to fill bottles directly from hose.
- **Sample pole**
- **Decon 90** solution mixed with deionised water (1:20) to clean equipment between sample sites.
- **Deionised water** for collection of field blanks and rinsing equipment between sample sites.
- **Syringes and filters** (for sampling dissolved metals/ ultra-trace nutrients etc).
- **Powder-free gloves**
- **Spare batteries** for camera, GPS and field test meters
- **Chain of Custody (COC)** forms from the relevant laboratories (one for bulk of samples and one for spilt samples).
- **Plastic sleeves** (snap-lock bags) to protect COC forms inside the insulated containers.

- **Consignment (Con) Notes** for freighting samples to laboratories (either using Toll, Australian Air Express or TNT depending on the client and sampling location), pre-filled as much as possible with relevant account number, laboratory address, contacts etc.
- **Communications equipment** (e.g. mobile/satellite phone, radio).
- **PPE** – see below.
- **Garbage bag** for used filters, syringes, gloves and other general waste generated during sampling.

2.2 OH&S requirements

A JSP must be completed for each sampling event which includes all project and personnel information including emergency contacts, and an assessment of the potential hazards and required hazard control measures. Standard potential hazards and hazard control measures are listed in Table 2-1 below.

Table 2-1. Standard hazard management for surface water sampling

Task	Potential Hazards	Hazard Controls
Driving to and around site	Animals on road	• Do not swerve to avoid hitting fauna on the road, slow down and maintain line • Avoid travelling on roads early morning, late afternoon and night
	Other vehicles	• Maintain good observation when driving • Even on quiet roads, always assume the possibility of an oncoming vehicle
	Road conditions	• Stay within speed limits and drive according to conditions
	Driver fatigue	• Regularly swap drivers and take breaks
	Flat tyres	• Carry spare tyres, jack and tools • All party members must be proficient in changing a tyre on the type of vehicle being used
	Getting lost	• Use GPS, maps and radio • Ensure at least two personnel if working in remote areas. • Prepare scheduled call-in procedure prior to leaving office and abide by this procedure • Agree on procedure in the event of a missed call-in (e.g. time to wait before calling emergency services)
	Bogging	• Avoid driving in wet areas • Carry vehicle recovery equipment • At least one party member must be proficient safe use of recovery equipment • Maintain communications (e.g. radio channel 40, sat phone) • Vehicle recovery only to be undertaken by personnel who have undertaken 4WD recovery training In areas of high risk, vehicles to travel in pairs, with the second vehicle not proceeding into boggy areas until first vehicle has made it through
	Mechanical failure	• Pre-start vehicle checks • Maintain communications (e.g. radio channel 40, sat phone)
Surface water sampling	Unsafe worksite	• Upon arrival to each site, perform an assessment of potential risks/dangers unique to the area and mitigate accordingly (Take 5)
	Cuts/abrasions	• Wear full PPE when performing sampling
	Tripping/slipping/strains	• Care taken walking in rough / overgrown terrain (or seek alternative route) • Use appropriate lifting techniques (e.g. bend knees), 2 person lifts and lift within capabilities
	Dehydration/heat	• Adequate water and electrolyte replacement carried for all personnel

	exhaustion	• Competent first aid trained person within sampling group • Correct PPE • First aid is readily available
	Sunburn	• Use sunscreen and wear correct PPE (e.g. hat, long sleeves)
	Fast flowing water	• Always sample with more than one person (one person to act as a spotter) • Carry communications (e.g. radio/mobile) • Use sample pole to sample sites with fast flow • All personnel must be competent swimmers
	Snake bite	• Correct PPE (e.g. sturdy boots, long pants/gators) • All personal have first aid training • Care taken when stepping over logs • Each person to carry snake bandage at all times
	Dangerous animals (e.g. cattle, buffalo, pigs)	• Assess each site for potential dangerous animals upon arrival (Take 5) • Maintain safe distance from any animals • Shelter in vehicle if required
	Ticks	• Check body and clothing for ticks at the end of each day • Shirts to remain tucked into the trousers • Advising other personnel of the locations where ticks have been seen/recorded • Ticks to be carefully removed to avoid squeezing the tick • Seek medical advice if a tick bite is found
	Crocodiles	• Assess sample site for crocodiles and evidence of slides upon arrival • Do not enter water • Use sample pole to maintain distance from edge • Always have two people with one person acting as a spotter at any given time • Always have radio or satellite phone to ensure communication in case of emergency
	Getting lost finding sites	• Always carry a GPS and maps • Ensure all personnel are fit and capable of task prior to leaving • Make GPS waypoint of vehicle prior to leaving • Carry a radio and sat phone • Avoid travelling to unknown areas if no clear path • Prepare scheduled call-in procedure prior to leaving office and abide by this procedure • Agree on procedure in the event of a missed call-in i.e. time to wait before calling emergency services
Sampling contaminated sites	Working around contaminated water	• Assess site for safety considerations prior to commencing work • Have an evacuation plan and recovery equipment prepared • Use sampling pole to allow distance from edge • Know the location of the nearest emergency shower and whether it is in operating condition • Take care near edges and have a spotter present • Do not work near edge of if risk of falling • Always carry a radio and sat phone to ensure communication
	Acidic water in pits and drains	• Avoid coming into contact with water • Wear gloves if handling water
	Exposure	• Adequate water and electrolyte replacement carried • Correct PPE • First aid is readily available

Standard PPE should be worn, including:

- Sturdy boots (steel cap and laces if industrial/mine site).
- Hat, safety/polarised sunglasses, sunscreen.
- Protective gloves for manual handling.
- Hard hat (if required for working around machinery)

- Long pants and shirt (high-visibility if industrial/mine site).

2.3 Training and competency

All personnel conducting water sampling shall be familiar with this Procedure and have received field training from experienced personnel. This includes training in sample collection, using and calibrating field meters.

All personnel conducting water sampling shall have a current first-aid certificate.

Each field party conducting sampling in a remote area with difficult or boggy access must include a member trained in vehicle recovery who has completed the 4WD training course and has field experience in vehicle recovery.

2.4 Site access

Personnel must ensure that any required permits (e.g. Indigenous land access permit), and/or land access permissions are obtained prior to undertaking water sampling.

Personnel must also ensure that all site induction requirements are fulfilled, ID cards (e.g. Aviation Security ID Card (ASIC), Maritime Security ID Card (MSIC)), licences, contractor induction cards/certificates and keys are obtained prior to mobilising to site.

Ensure that all possible site restrictions are known, such as possession and/or use of mobile phones, cameras, flammables, particular chemicals, prior to mobilisation to site.

3 PROCEDURE

3.1 Contamination prevention precautions

3.1.1 Keep hands away from sample bottle openings and the inside of bottle lids. Be aware that sources of contamination include permanent markers, insect repellent, sunscreen, deodorant, dust and perspiration.

3.1.2 Always wear powder-free gloves and use new gloves for each sample site.

3.1.3 Do not allow the opening of sample bottles and bottle lids to touch the ground.

3.1.4 Only clean, sealed and pre-prepared preserved sample bottles obtained from a NATA accredited laboratory are to be used for laboratory samples.

3.1.5 Ensure equipment is cleaned thoroughly after each sample site with Decon 90 solution (5 %) and rinsed with deionised water.

3.1.6 Ensure sample bottles are filled to the top leaving no headspace unless otherwise specified by the laboratory.

3.1.7 Do not overfill the bottle, particularly not for sample bottles with preservative.

3.1.8 For the bottles containing preservative, after sample collection, put the lid on and shake immediately.

3.1.9 After sample collection, ensure all sample bottles are tightly sealed and stored upright in an insulated cooler (with ice-bricks) or fridge at <4°C. Do not use loose ice as this can contaminate the samples if they are left in the melted ice water.

3.2 Preparation

3.2.1 Prior to undertaking a field sampling trip, ensure that a JSP has been completed and signed by all field personnel, and by the Project Manager.

3.2.2 Gather all equipment listed in Section 2.1.

3.2.3 Bottles may need to be ordered from the laboratory. Contact the laboratory for advice on what bottles are required (certain analytes require particular bottles and preservatives).

3.2.4 Put together a package of sample bottles for each site (i.e. in a large snap-lock bag), including bottles for duplicates, split samples and blanks.

3.2.5 Label each bottle with the site name (or duplicate, split, blank) and sampler's name. Sample date and time are to be labelled in the field at the time of sample collection.

3.2.6 For metals analysis, tick the box on the bottle label for either *dissolved metals field filtered* or *total metals*, depending on whether samples for metals analysis will be filtered in the field.

3.2.7 Calibrate the field test meters (e.g. pH, temperature, EC, DO, ORP, turbidity) according to the manufacturer's instructions. Complete a Calibration Record Sheet (Appendix B).

3.2.8 Ensure camera and GPS (if required) are fully charged and have sufficient memory.

3.2.9 Depending on the number of sites being sampled, prepare a sufficient volume of Decon 90 solution (i.e. 1:20 Decon:deionised water) to use for cleaning sampling equipment in the field.

3.2.10 Print out the required number of blank Surface Water Sampling Field Data Sheets (Appendix A), laboratory COC forms, maps and bore reports.

3.2.11 Ensure that ice bricks have been put in the freezer, or the Engel fridge has been sufficiently chilled, to keep samples cool as they are collected.

3.3 Travel to sample sites

3.3.1 Review JSP prior to travel to ensure that all potential hazards have been assessed and personnel are familiar with any risks.

3.3.2 When undertaking routine surface water sampling, it is best that at least one of the field team has previous experience sampling all the sites.

3.3.3 Refer to maps, photos and marked GPS locations to confirm the correct location.

3.4 Field observations and in-situ parameters

3.4.1 Fill in the Surface Water Sampling Field Data Sheet with the sample site ID, date, time, your name, field observations such as weather conditions, water colour, clarity, water depth, flow rate, any obvious pollution (e.g. rubbish, odours, surface film, etc.), flora/fauna present, and any other issues that may affect the samples.

3.4.2 Wear powder-free gloves when collecting field samples.

3.4.3 Ideally, in-situ readings (pH, temperature, DO, EC, ORP and turbidity) are collected directly from the water body being sampled by immersing the meters in the water to be sampled. However, if safety and/or logistical issues preclude this, field readings may need to be taken from the sampling jug. In this case the DO sensor will need to be slowly swirled in the sampling jug to move water over the membrane. The sample pole can be used to collect water from water bodies that are difficult to access.

3.4.4 Record the in-situ parameters just below the water surface (between 0.2 and 0.5 m depth), depending on water depth. Alternatively, if collecting samples from various depths (e.g. depth profiling), ensure the field meter is lowered to the desired depth.

3.4.5 If collecting field readings from the sampling jug, collect a representative water sample using the jug, or sampler mounted on a sampling pole. Ensure that the jug/sampler is fully immersed and rinsed at least 3 times, tipping the rinse water away from (e.g. on the bank), or downstream of, where the sample is to be collected.

3.4.6 If sampling flowing waters, ensure that you are standing downstream of where you are sampling so as not to contaminate the sample.

3.4.7 Record all the readings on the Surface Water Sampling Field Data Sheet; one sheet to be filled out per site.

3.5 Laboratory sample collection

3.5.1 Wear powder-free gloves when collecting laboratory samples.

3.5.2 Take out the required pre-labelled sample bottles. Label bottles with sample date and time.

3.5.3 Keep hands away from sample bottle openings and the inside of bottle lids. Be aware that sources of contamination include permanent markers, insect repellent, sunscreen, deodorant, dust and perspiration.

3.5.4 If safe to do so, fill bottles directly from the water body being sampled, otherwise use the jug and/or the sample pole to collect a water sample. Be careful not to overfill bottles which contain preservatives. If the flow rate is very rapid, it may be required to fill the bottles containing preservative using a jug (pre-cleaned with Decon 90 and deionised water). Rinse the jug three times with water being sampled (disposing of rinse water away from, or downstream of, sample collection point) prior to filling laboratory bottles from jug.

3.5.5 For samples requiring field filtering (e.g. dissolved metals), draw some water from the jug into a syringe, put a filter on the end of the syringe, rinse the filter by pushing a few drops of the sample through onto the ground, then fill the bottle leaving no headspace. Depending on the size of the syringe, it may be necessary to draw several syringes-full of water to fill the sample bottle.

3.5.6 Once all bottles are filled and tightly capped with lids, place them upright into the insulated cooler and store below 4°C.

3.6 Collection of field blanks, split samples and duplicates

3.6.1 To collect a field blank, simply follow the steps outlined in Section 3.5 above using laboratory supplied rinsate water/field blank water instead of water from the site being sampled.

3.6.2 For split samples and duplicates, repeat all the above steps outlined in Section 3.5 above at the site(s) chosen for these samples (generally at least 1 in 10 sample sites). Label the sample bottle as ‘Split’ or ‘Duplicate’. Be sure to note collection of these samples on the Surface Water Sampling Field Data Sheet otherwise it will not be possible to track which site these samples were collected from because the site name is not permitted to be recorded on the bottle.

3.7 Cleaning of field equipment

3.7.1 After sampling each site, rinse all sampling equipment (e.g. jugs, field meter probes) with the pre-mixed Decon 90 solution, followed by deionised water.

3.7.2 Dispose of used filters, syringes, and gloves appropriately. Consumable sampling equipment are single use only and fresh gloves, syringes and filters are required at each site.

3.8 Sample dispatch

3.8.1 Once sampling is completed, pack the samples securely in an insulated cooler with ice bricks. Ensure that samples have sufficient contact with the ice bricks to stay as cool as possible.

3.8.2 Fill out the COC, put in a plastic sleeve (snap-lock bag) and place inside the insulated container.

3.8.3 If required, provide a copy of the COC to the client.

3.8.4 Samples must be dispatched to a NATA accredited laboratory within the required holding times, noting that:

- Samples must be dropped off at the receiving laboratory no later than 14:00 each day.
- Sample dispatch on Fridays and weekends is not acceptable for sample analysis with short holding times (e.g. microbiological, nutrients) as samples will not be transported from Darwin until the following Monday. Other parameters with longer holding times can be kept in a fridge until dispatch on Monday.

3.8.5 If sending samples direct to the laboratories:

- Tape up an insulated cooler and label with an address, consignment note and the appropriate handling stickers (e.g. fragile, keep chilled etc.).
- Deliver samples direct to freight company or organise pick-up, ensuring that samples will be dispatched in time to meet laboratory holding times (usually by 16:00 on day of sampling for overnight priority service).

3.8.6 Remember to also prepare a small insulated cooler containing the split sample for sending to a separate laboratory.

3.9 Data management

3.9.1 All Surface Water Sample Data Sheets should be saved to the project file Field and Lab Data folder on MFiles, and all photographs are to be saved to the project folder at Z:\02 EcOz Resource Materials\01 Image Bank, and labelled according to the relevant site name.

3.9.2 Correspondence and document from the laboratory should be saved to the project file Field and Lab Data folder on MFiles (e.g. results, sample receipt notices, certificate of analysis and QA/QC information).

4 ACRONYMS AND DEFINITIONS

4.1 Acronyms

COC	Chain of Custardy
DO	Dissolved Oxygen
EC	Electrical Conductivity
JSP	Job Safety Plan
mbgl	Meters below ground level
NATA	Nation Association of Testing Authorities
ORP	Oxidation-Reduction Potential
pH	Measurement of an aqueous solutions acidity or basicity. Ranges between 1 and 14.
PPE	Personal Protective Equipment
SWQ	Surface Water Quality
TOC	Top of Casing

4.2 Definitions

QA/QC Quality Assurance/Quality Control, which may include:

- Duplicate sample – collected during each sampling event (e.g. 1 duplicate for every 10 samples collected) to detect both natural environmental variation, and any errors from filed sampling methodologies.
- Split sample - collected during each sampling event (e.g. 1 split for every 10 sample sites) and sent to a different laboratory to detect any Lab-based discrepancies.
- Field blank sample – collected during each sampling event to evaluate potential contamination from personnel and/or sampling equipment.

APPENDIX A SURFACE WATER SAMPLING FIELD DATA SHEET

EcOz Environmental Services

Surface Water Field Data Sheet

PROJECT:		DATE and TIME:	
SITE NUMBER / NAME:			
SAMPLERS NAME:		PHOTO NOs:	
EASTING:		NORTHING:	
GENERAL OBSERVATIONS			
WATER COLOUR		PRESENCE OF AQUATIC FAUNA	
ODOUR		AQUATIC PLANTS	
SURFACE SCUM/ALGAE		EROSION	
RIPARIAN CONDITION		GROSS POLLUTANTS	
WATER CONDITIONS			
APPROX DEPTH OF WATER (m)		WATER FLOW (m/sec)	
WEATHER CONDITIONS			
Cloud cover/ precipitation/ wind conditions:			

FIELD SAMPLES

Parameter	Unit	Result	Meter Used	Date of calibration
pH				
Temperature				
E.C				
TDS				
Salinity				
D.O				
ORP				
Turbidity				

LABORATORY SAMPLES

Analytes Requested	Containers Used	QA/QC Samples Collected (circle)
		Duplicate Split Blank

Any other comments or special procedures (see over):

APPENDIX B FIELD METER CALIBRATION RECORD SHEET

EcOz Environmental Consultants

Probe Calibration Record Sheet

Date:				**Calibrated By:**				
Serial # of Probes Calibrated:		**pH:**		**EC:**		**DO:**		**Turbidity:**
Pre-Calibration Reading:				**Post Calibration Reading (Checking):**				
pH								
pH 7.00 Standard:		**pH 4.01 Standard:**		**pH 7.00 Standard:**		**pH 4.01 Standard:**		
pH:	mV:	pH:	mV:	pH:	mV:	pH:	mV:	
For pH 7.00: mV should be zero ± 50 mV. **For pH 4.01: mV should be +165 to +180 mV greater than the pH 7.00 mV value.**								
pH readings (circle): Good Some Problems explain here:								
EC								
Temperature at time of calibration:				**Relative calibration value:**				
EC Calibration Solution Used (circle): 447 µS/cm 1413 µS/cm 2570 µS/cm 12880 µS/cm								
EC µS/cm:	TDS g/L:	Sal ppt:		EC µS/cm:	TDS g/L:	Sal ppt:		
EC readings (circle): Good Some Problems explain here:								
Turbidity								
Turbidity 0 NTU		**Turbidity 124 NTU**			**Turbidity 1010 NTU**			
Pre cal:	Post cal:	Pre cal:	Post cal:		Pre cal:	Post cal:		
Turbidity readings (circle): Good Some Problems explain here:								
DO								
Barometric Pressure (mmHg) set for DO: (Look up local hPa on BoM usually around 1010)				**DO reading after stabilization:**				
DO readings (circle): Good Some Problems explain here:								
ORP								
240 MV standard								
ORP Pre calibration:				**ORP post calibration:**				
Probes require servicing? (e.g. DO membrane needs changing, probes need to be cleaned or sent away, batteries need replacing)								
				Actioned (tick): ☐ **Date:**				
Any other actions required? (e.g. order more calibration solutions or DO replacement membranes)								
				Actioned (tick): ☐ **Date:**				

Calibrator's Signature:

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ATTACHMENT C – FIELD SHEETS FROM THE DARWIN-DALY AUSRIVAS MANUAL

6. APPENDIX 1 – FIELD SHEETS

FIELD SHEETS

AUSRIVAS - Darwin Daly regional Models

Date **Site Code** **Site Name** **Field Team**

GPS coordinates: (*predictor variables family level model*):

Zone (UTM) **Easting** **Northing** **Datum**

Landholders and contact details

Site comments, observations

ACCESS SKETCH

SITE NAME **SITE CODE**

Indicate any features that assist locating exact sample site on subsequent trips.

WATER QUALITY

Time	**Instrument**	**Instrument Serial No.**	
pH	**units**	**E.C.**	**µS/cm**
D.O.	**mg/L**	**Water Temperature**	**°C**
Turbidity	**NTUs**	**Instrument and serial number**	

Water samples for laboratory water quality analysis

(ALKALINITY is a *predictor variable for genus level model*)

Bottle lable	**Analysis**
	Alkalinity

Observations relating to water quality (e.g. water oil, scum, foam, sediment odours)

MACROINVERTEBRATE SAMPLING

EDGE Length sampled _____m

Collected by _____

No. of containers used _____

Edge description

☐ Vertical 90°

☐ Angled 45-90°

☐ Undercut

Edge habitat mainly composed of roots from

☐ Paperbark / Melaleuca ☐ shrub

☐ other common riparian trees ☐ grass

Edge habitat

☐ roots covered by algae ☐ overhanging vegetation

Habitat velocity & depth **Flow meter serial no. _____Fan set no.____**

(*predictor variable genus level model*)

Meter Reading (Revolutions per 40s)				**Habitat depth (cm)**		
1	**2**	**3**	**Fan details**	**1**	**2**	**3**

Stream Width (at water level) (*predictor variable genus and family level models*): six measurements or estimations are taken in a 100m reach upstream of the macroinvertebrate sampling site.

Number	**1**	**2**	**3**	**4**	**5**	**6**
Width (m)						

☐ measured ☐ estimate only

Comments

DESCRIPTION OF THE REACH (reach 100 m upstream of sample site)

Habitats within 100 m reach

Sand/Silt bed	☐	Riffle	☐
Gravel/Rock bed	☐	Run	☐
Macrophytes	☐	Pool	☐
Snags	☐		

Description of stream characteristics

Width between top of levee banks (bankfull width) _____ m

Other levees ☐

Height of levee bank from water surface _____ m

Flow observable ☐

RIPARIAN ZONE (within 100 m reach)

Riparian zone width -left bank (facing downstream) _____ m

-right bank _____ m

Riparian vegetation type

Monsoon-vine forest/Rainforest	☐	Riparian shrubland	☐
Riparian forest	☐	Riparian grassland	☐
Riparian woodland	☐	Other: _____	

Weeds ☐

Evidence of fire Riparian Zone ☐

Beyond Levee Banks ☐

Cattle access ☐

Comments

SKETCH OF 100 M REACH

Indicate: ■ **water quality measurements** **macroinvertebrate sample sites** **location of vehicle access**

• **water sample collection** **width measurements**

➘ **location of Photographs** **direction of flow**

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APPROVED COMPANY ISO 9001 Quality Management Systems — QMS Certification Services

		Field					
		pH (Field)	Electrical Conductivity (field)	Turbidity (Field)	DO % Saturation (Field)	Temperature (Field)	Redox Potential (Field)
Field ID	Date						
SW4	20 Dec 2022	5.87	18.35	0.26	72.7	34.05	134.2
SW4	28 Dec 2022	5.91	8.71	7.13	79	28.66	158.2
SW4	16 Jan 2023	5.44	21	2.87	60.8	29.5	176
SW4	07 Feb 2023	8.1	11.4	1	106.5	35.3	35.6
SW4	23 Feb 2023	7.2	7.9	3.8	99.7	27.9	74.6
SW4	24 Feb 2023	7.2	4.6	17.3	87	25.7	81
SW4	25 Feb 2023	7.5	7.5	4.7	91.57	27	71.5
SW4	26 Feb 2023	6.3	9.4	2	88.64	27.1	111.2
SW4	27 Feb 2023	7.8	11.8	8	85	26.8	24.1
SW4	28 Feb 2023	6.7	12.1	1	66.9	27	80.5
SW4	01 Mar 2023	6.3	16.6	1.3	71.55	27.3	107.6
SW4	02 Mar 2023	6.2	17.3	50.9	92.2	27.7	166.6
SW4	02 Mar 2023						
SW4	03 Mar 2023	7	16.5	2.7	73.5	26.4	154
SW4	04 Mar 2023	6.4	16.1	54.8	79.2	26.2	167
SW4	05 Mar 2023	6.8	18	14.1	68.9	27.3	121
SW4	06 Mar 2023	6.4	22.4	1	67.7	27.6	134.3
SW4	07 Mar 2023	7.1	34.6	56.4	89.5		41.5
SW4	08 Mar 2023	6.2	13.6	0	64.8	28.6	119
SW4	09 Mar 2023	7.2	13.7	0.2	63.8	28.5	66.4
SW4	10 Mar 2023	7.6	12.1	1	74.1	6.9	-1.3
SW4	11 Mar 2023	6.4	50.9	18.7	110.6	35.9	113.1
SW4	12 Mar 2023	6.5	20.7	24.5	116.6	34.2	60.2
SW4	13 Mar 2023	6	20.4	1	67.9	28.4	106.8
SW4	14 Mar 2023	6.9	27	1.2	51.1	27.9	69.2
SW4	15 Mar 2023	7.1	28	6.4	95.8	29	18.6
SW4	16 Mar 2023	7.4	24.7	5.2	89	28.9	20.5
SW4	17 Mar 2023	7.1	34.6	56.4	89.5	29.8	41.5
SW4	18 Mar 2023	7	23.2	1.3	78	27.7	43.2
SW4	19 Mar 2023	7.3	28.9	37.2	78.7	27.5	42.7
SW4	20 Mar 2023	7.84	20.11	1	88.26	28.59	33.11
SW4	21 Mar 2023	5.9	17.3	19.6	87.6	27.5	119.6
SW4	22 Mar 2023	6.6	27.2	1	74.8	27.7	35

SW4	**27 Mar 2023**	6.5	16.5	1	61.9	29	71.4
SW4	**01 Apr 2023**	6.3	16.1	14.9	93.7	29.8	88.8
SW4	**04 Apr 2023**						
SW4	**04 Apr 2023**	6.2	19.6	0	87.1	28.8	103.7
SW7	**20 Dec 2022**	5.49	11.09	1.72	47	30.74	177
SW7	**16 Jan 2023**	4.89	17.1	6.11	75.8	31.7	187
SW7	**08 Feb 2023**	8	26.1	1.7	103.2	34.9	78
SW7	**23 Feb 2023**						
SW7	**24 Feb 2023**	6.7	3.3	4.5	90.9	25.9	93.4
SW7	**24 Feb 2023**	6.9	6.4	7.5	93.6	28.2	76
SW7	**25 Feb 2023**	6.2	8.3	1	91.39	27	98.5
SW7	**26 Feb 2023**	6.2	10	4.2	93.4	28.2	108.4
SW7	**27 Feb 2023**	7.8	8.1	2.7	94.6	26.6	28.9
SW7	**28 Feb 2023**	6.7	13.7	1	85.4	26.7	67.9
SW7	**01 Mar 2023**	6.5	13.4	1.4	85.94	28.7	103.9
SW7	**02 Mar 2023**						
SW7	**02 Mar 2023**	6.4	11.7	0.5	79.7	27.3	186.7
SW7	**03 Mar 2023**	6	12.2	6.4	97.1	29.7	169.8
SW7	**04 Mar 2023**	5.7	10.8	1.5	89.6	28.2	169.3
SW7	**05 Mar 2023**	6.5	12.2	0	76.2	28.3	125.5
SW7	**06 Mar 2023**	5.7	12.4	3.9	72.8	28.2	144.4
SW7	**07 Mar 2023**	5.8	13.7	2.4	97.5		84.7
SW7	**08 Mar 2023**	5.6	11.4	12.6	75.9	28.3	110.6
SW7	**09 Mar 2023**	6.2	13.7	0.7	73.8	27.6	44.8
SW7	**10 Mar 2023**	6.8	13.4	1	86.1	25.9	21.7
SW7	**11 Mar 2023**	5.6	13.8	35.1	121	37.8	152.2
SW7	**12 Mar 2023**	5.7	16.3	1	129	36.7	148.4
SW7	**13 Mar 2023**	5.5	19.8	34.3	64.6	26.5	142.1
SW7	**14 Mar 2023**	6	18.49	1	80.5	27.6	79.5
SW7	**15 Mar 2023**	6.6	13.1	1	93.9	29.5	22.1
SW7	**16 Mar 2023**	6	13.8	2.2	89.9	30	67.1
SW7	**17 Mar 2023**	5.8	13.7	2.4	97.5	30.7	84.7
SW7	**18 Mar 2023**	7.4	15.7	1	101.2	35.6	33.1
SW7	**19 Mar 2023**	7.5	12.1	1	113.9	29.8	30.6
SW7	**20 Mar 2023**	7.5	15	4.51	92.07	27.77	36.59
SW7	**21 Mar 2023**	5.2	24.3	6.8	100.1	27.3	94.9
SW7	**22 Mar 2023**	5.6	27.7	3.8	87.7	27.7	98.1
SW7	**27 Mar 2023**	5.3	18.9	1.3	56.2	27.5	104.7
SW7	**01 Apr 2023**	5.8	13.7	4.8	92	31.6	103.8
SW7	**04 Apr 2023**	6.4	12	0.5	96.2	29.4	107.2
MWD1	**30 Nov 2022**	8.85	185.4	35.4	119.6	32.4	188.1
MWD1	**09 Dec 2022**	8.37	193.08	7.71	112.47	34	140.34
MWD1	**12 Dec 2022**	6.4	208	1	105.3	33.2	198.8
MWD1	**20 Dec 2022**	7.42	213.9	410	108	32.12	131
MWD1	**28 Dec 2022**	6.24	152.69	130	59	29.35	225
MWD1	**03 Jan 2023**	7.64	131.44	37.06	100.25	27.01	51.17

MWD1	**06 Jan 2023**	6.68	145.88	24.7	100.21	27.9	
MWD1	**10 Jan 2023**	7.7	156.1	16	103.3	29.3	57.5
MWD1	**16 Jan 2023**	5.5	129.7	3.55	92.7	31.4	212
MWD1	**23 Jan 2023**	7.3	138.4	0	100.8	29.9	44.4
MWD1	**24 Jan 2023**	6.52	160.6	6.2			
MWD1	**25 Jan 2023**	7.5	143.2	0.6			
MWD1	**30 Jan 2023**	7.3	138.3	2.4	100.3	29.7	147.4
MWD1	**02 Feb 2023**	6.7	150.8	5.11			
MWD1	**03 Feb 2023**	6.7	138.3	2.8			
MWD1	**06 Feb 2023**	7	136.7	4.6	100.9	29.7	254.6
MWD1	**06 Feb 2023**						
MWD1	**09 Feb 2023**	7.6	138.2	1	101.2	30.1	106.7
MWD1	**13 Feb 2023**	7.6	135.5	1	100.9	2,901	164.9
MWD1	**17 Feb 2023**	6.08	108.4	1.2	98.61	30.55	126.7
MWD1	**19 Feb 2023**						
MWD1	**20 Feb 2023**	5.8	109.1	4.3	97.9	31.2	121.3
MWD1	**21 Feb 2023**	6.7	110.3	1	99.7	30	87.9
MWD1	**22 Feb 2023**	7.3	112.9	1	97.99	29.9	87.5
MWD1	**23 Feb 2023**	6.8	107.6	1.4	98.1	30.1	73.9
MWD1	**24 Feb 2023**	7	102.1	3.7	99	29	71.8
MWD1	**25 Feb 2023**	5.8	118.3	1.5	97.31	28.4	128.3
MWD1	**26 Feb 2023**	6.2	111.6	9.6	91.5	28.5	106.8
MWD1	**27 Feb 2023**	6.8	112.5	9.7	98.6	27.5	64.1
MWD1	**27 Feb 2023**						
MWD1	**27 Feb 2023**	6.3	113.5	7.2	98.7	28.6	73.3
MWD1	**28 Feb 2023**	6.8	111.6	5.9	99.2	28.1	73.2
MWD1	**01 Mar 2023**	6.3	110.6	5.2	97.99	28.4	104.1
MWD1	**02 Mar 2023**	6.6	99.3	4.8	100	28.9	151.6
MWD1	**03 Mar 2023**	5.8	111.63	7.1	98.9	27.6	184.3
MWD1	**04 Mar 2023**	5.5	110.5	8.1	99.4	28.3	173.4
MWD1	**05 Mar 2023**	4.2	110.4	4.2	99.6	28	122.2
MWD1	**06 Mar 2023**	5.4	103.5	11.3	100.2	29.2	152.9
MWD1	**07 Mar 2023**	6.8	87.5	28.2	100.8		89.9
MWD1	**08 Mar 2023**	5.3	111.6	9.8	100.8	28.6	166.1
MWD1	**09 Mar 2023**	7.5	110.8	88.9	102.5	31.2	66.5
MWD1	**10 Mar 2023**	8.3	107.2	116.2	101.1	29.1	22.2
MWD1	**11 Mar 2023**	5.3	110.3	217.4	100.5	28.6	179.7
MWD1	**12 Mar 2023**	5.4	103.3	121.3	97.6	29.5	165.5
MWD1	**13 Mar 2023**	5.2	88.7	29.3	101.2	31.2	207.9
MWD1	**14 Mar 2023**	5.8	85.1	39.5	100.3	29.7	134.7
MWD1	**15 Mar 2023**	5.9	11.9	67.8	102.8	30.4	85.4
MWD1	**16 Mar 2023**	6.7	80.6	10.2	101	28.9	128.3
MWD1	**17 Mar 2023**	6.8	87.5	28.2	100.8	28.9	89.9
MWD1	**18 Mar 2023**	6.5	81.4	32.7	97.7	30.1	130.5
MWD1	**19 Mar 2023**	7.4	12.1	24.7	102.9	28.7	22.7
MWD1	**20 Mar 2023**	7.42	81.21	57.26	108.18	32.4	48.9
MWD1	**21 Mar 2023**	6	72.1	69.9	101.4	30.2	143

MWD1	**22 Mar 2023**	7.2	77.5	127.5	107.3	30.5	14.6
MWD1	**25 Mar 2023**						
MWD1	**27 Mar 2023**	8.2	83.1	80.5	107.8	32	27
MWD1	**01 Apr 2023**	6.5	85.1	147	93.3	29.7	96.4
MWD1	**04 Apr 2023**	6.8	89.3	81.7	95.7	30.2	99.8
MWD1	**17 Apr 2023**	6.64	69.7	213.46	95.98	28.36	102.78
MWD1	**24 Apr 2023**	7.6	94.6	158	98.7	28.1	21
MWD1	**30 May 2023**	6.67	93.23	39.5	101.21	23.5	60.71
MWD1	**28 Jun 2023**	7.1	44.75	137.81	105.19	28.94	105.57
SW1	**21 Dec 2022**	5.78	25.24	4.4	44	26.96	165.8
SW1	**21 Dec 2022**	5.52	25.08	66.46	93.28	30.29	184.8
SW1	**28 Dec 2022**	5.98	8.59	555	88	29.1	156
SW1	**16 Jan 2023**	5.21	24.8	6.42	54.1	28.2	146
SW1	**16 Jan 2023**	4.81	29.5	45.6	83.5	31.2	200
SW1	**07 Feb 2023**	7.6	18.8	1	76.1	29.9	82.2
SW1	**07 Feb 2023**	7.9	18.2	20.7	109.4	38.1	57.1
SW1	**23 Feb 2023**	6.4	9.4	40.1	97	28.6	93.7
SW1	**24 Feb 2023**	6.9	14.5	1,007.8	86.9	25.9	71.1
SW1	**25 Feb 2023**	6.8	14.4	1,054.8	88.28	26.7	60.3
SW1	**26 Feb 2023**	6.3	13.3	5,973.5	84.1	27.5	111.8
SW1	**27 Feb 2023**	7.4	21	1,346.1	91.6	25	48.3
SW1	**28 Feb 2023**	7.2	29.2	358.7	89.2	26.2	48.7
SW1	**01 Mar 2023**	6.2	23.1	376.6	90.74	26.4	109.9
SW1	**02 Mar 2023**	6.9	22.9	381.3	89.9	27	160.9
SW1	**03 Mar 2023**	6.5	36.3	176.8	84.3	26.2	162.5
SW1	**04 Mar 2023**	5.9	38.6	96.8	85.3	26.4	175
SW1	**05 Mar 2023**	7	67.2	52.5	97.7	26.4	128.7
SW1	**06 Mar 2023**	6.8	73.1	30.3	85	26.4	131.5
SW1	**07 Mar 2023**	7.5	66.1	6.3	106.7		28.3
SW1	**08 Mar 2023**	6.3	18.7	273	87.4	27.9	93.4
SW1	**09 Mar 2023**	6.8	22.3	332	83.6	27.5	54.9
SW1	**10 Mar 2023**	7.5	44.4	220.6	85.5	26.5	11.6
SW1	**11 Mar 2023**	6	69.9	70.7	112.2	34.9	163
SW1	**12 Mar 2023**	6.4	38.6	114.3	120.4	34.1	131.1
SW1	**13 Mar 2023**						
SW1	**13 Mar 2023**	6.3	60.8	25.7	94.9	27.3	101
SW1	**14 Mar 2023**	7.4	43.6	73.8	82.8	27.5	58
SW1	**15 Mar 2023**	7.5	36.7	43.5	104.4	29.7	11
SW1	**16 Mar 2023**	7.5	54.5	6.7	100.7	29	16.2
SW1	**17 Mar 2023**	7.5	66.1	6.3	106.7	30.4	28.3
SW1	**18 Mar 2023**	7.4	62	10.1	106.8	27.7	38.3
SW1	**19 Mar 2023**	7.4	21.5	8.4	102.5	27.8	45.6
SW1	**20 Mar 2023**						
SW1	**20 Mar 2023**	7.62	58.99	18.14	106.13	28.29	23.75
SW1	**21 Mar 2023**	6.27	16.79	1	76.39	29	79.28
SW1	**21 Mar 2023**	6.6	59.4	12.4	100.15	28.1	96.2

SW1	**22 Mar 2023**	7.4	55.7	13.9	110.3	27.4	42.9
SW1	**27 Mar 2023**	7.3	33.4	68.7	114.1	28.2	35.5
SW1	**27 Mar 2023**						
SW1	**01 Apr 2023**	7.1	25.7	38.4	115	30.8	49.5
SW1	**04 Apr 2023**	7	31.8	23.9	125.7	31	75.2
SW1	**24 Apr 2023**	6.5	17.9	0	62.9	26.2	83.11
SW2	**23 Nov 2022**	6	11.53	219.7	76.13	27.9	237.77
SW2	**28 Nov 2022**	5.97	40.86	40.45	83.97	27.7	184.51
SW2	**30 Nov 2022**	6.1	46.5	125.9	112.3	32.6	228.6
SW2	**20 Dec 2022**	6.12	12.81	8.04	116	32.9	136
SW2	**21 Dec 2022**	5.9	28.46	21.1	35.73	27.37	175.7
SW2	**28 Dec 2022**	5.88	9.76	60.87	85	28.13	171
SW2	**03 Jan 2023**	6.39	16.92	102.55	91.85	28.18	124.69
SW2	**06 Jan 2023**	6.3	15.81	110	89.86	27.53	
SW2	**10 Jan 2023**	7.9	15.6	18.8	107.8	33.3	20.2
SW2	**16 Jan 2023**	5.18	28.8	8.41	56.9	28.1	139
SW2	**16 Jan 2023**	5.4	20.3	6.25	79.8	28.8	216
SW2	**23 Jan 2023**	7.6	24.4	2.8	94.6	28.3	27.9
SW2	**24 Jan 2023**	6.69	35.3	3.59			
SW2	**27 Jan 2023**	7.4	17.5	0.7			
SW2	**30 Jan 2023**						
SW2	**30 Jan 2023**	7.8	11.4	1.6	81.6	27	112.8
SW2	**02 Feb 2023**	7.3	14.7	3.2			
SW2	**03 Feb 2023**	7.2	16.7	15.4			
SW2	**06 Feb 2023**	6.8	24.4	10.9	80.1	29.1	171.4
SW2	**07 Feb 2023**	7.5	19.4	1.1	73.6	29.4	102.6
SW2	**13 Feb 2023**	7.3	14	8.8	87.9	27.9	158
SW2	**17 Feb 2023**	6.34	11.5	1.2			
SW2	**20 Feb 2023**	7.2	10.6	1	78.5	27.9	75.4
SW2	**21 Feb 2023**	7.1	10.4	1	89.9	27.3	92.9
SW2	**22 Feb 2023**	6.6	10.2	1	79.11	27.5	95.2
SW2	**23 Feb 2023**	8.1	8.2	5.7	97.8	27.7	33.5
SW2	**24 Feb 2023**	8	5.1	298	94.7	26	73.1
SW2	**25 Feb 2023**	7.2	7	54.9	89.01	27.3	63.6
SW2	**26 Feb 2023**	6.5	9.88	187.9	89.98	27.1	102.3
SW2	**27 Feb 2023**	7.7	12.8	196.5	95	26.7	37.5
SW2	**28 Feb 2023**	7	15.4	255.1	90.7	26.9	71.6
SW2	**01 Mar 2023**	6.6	16.5	72.9	93.72	26.8	86.8
SW2	**02 Mar 2023**	6.2	17.3	50.9	92.2	27.7	166.6
SW2	**03 Mar 2023**	7.2	22.6	178.6	89.4	26.2	140.2
SW2	**04 Mar 2023**	6.9	16.3	98.3	91.6	26.6	165
SW2	**05 Mar 2023**	6.2	23	26.3	86.7	27.1	124.3
SW2	**06 Mar 2023**	6.3	22	9.2	86.1	27.7	136.4
SW2	**07 Mar 2023**	7.6	24	2.9	101.5		41.5
SW2	**08 Mar 2023**	6.4	8.6	17.9	92.9	28.1	138.4
SW2	**09 Mar 2023**	7.1	15.5	39.8	89.3	28.2	47.6

SW2	**10 Mar 2023**	8.4	11.5	30.2	92.6	26.9	16.6
SW2	**11 Mar 2023**	6.6	18.8	21.5	107.1	31.6	168.7
SW2	**12 Mar 2023**	6.6	16.6	18.7	108	31.5	146.5
SW2	**13 Mar 2023**	6.4	19.1	120.3	86.8	29.2	96.9
SW2	**14 Mar 2023**	6.8	17.6	17.9	76.1	28.1	74.9
SW2	**15 Mar 2023**	7.5	20.7	7.8	101.1	28.4	12.1
SW2	**16 Mar 2023**	7.4	20.8	7.5	101.2	28.6	18.8
SW2	**18 Mar 2023**	7.3	20.7	5	91.7	27	4
SW2	**19 Mar 2023**	7.6	21.5	7.9	94.6	27.2	32.9
SW2	**20 Mar 2023**	7.69	18.87	7.84	100.5	28.69	26.86
SW2	**21 Mar 2023**	6.22	17	1	83	28.7	87.85
SW2	**21 Mar 2023**	6	21.1	9.5	93.7	27.7	114.6
SW2	**22 Mar 2023**	7	19.8	7.1	93.7	27.7	33.7
SW2	**27 Mar 2023**	7.4	16.8	3.3	89.2	28.9	30.8
SW2	**27 Mar 2023**						
SW2	**01 Apr 2023**	6.3	15.2	18.8	100.2	29	81.4
SW2	**04 Apr 2023**	6.4	16.2	0.1	98.7	28.6	93.6
SW2	**17 Apr 2023**						
SW2	**24 Apr 2023**	6.7	17.3	0	70.4	26.2	72.8
SW3	**21 Dec 2022**	6.04	8.62	0	82.93	30.98	168
SW3	**16 Jan 2023**	6.05	15	2.81	86.3	31.6	213
SW3	**07 Feb 2023**	7.6	16.8	10.4	95.7	36.7	65.8
SW3	**23 Feb 2023**	6.1	6.2	1.3	90.1	28.4	101.8
SW3	**24 Feb 2023**	7.3	5	2.9	90.4	25.9	55.8
SW3	**16 Mar 2023**	7.8	49,278	1.88	87.68	31.39	35.13
SW5	**23 Nov 2022**	5.67	362.3	680	85.05	27.48	226.19
SW5	**28 Nov 2022**	5.71	153.98	60.8	83.46	27.5	184.5
SW5	**30 Nov 2022**	6.11	35.22	143.9	84.7	29.5	204.1
SW5	**20 Dec 2022**	6.36	26.45	12.27	109	31.72	130
SW5	**28 Dec 2022**	5.82	13.27	195	87	28	171
SW5	**03 Jan 2023**	6.79	59.78	174.94	92.86	27.27	114.44
SW5	**06 Jan 2023**	7.17	18.89	110.29	89.86	27.55	
SW5	**10 Jan 2023**	7.2	16.9	16	96.6	31.3	56
SW5	**16 Jan 2023**	4.73	25.9	14.1	80.1	31.1	196
SW5	**23 Jan 2023**	7.6	24.5	2.2	94.6	29	26.7
SW5	**24 Jan 2023**	6.39	30.1	2.03			
SW5	**25 Jan 2023**	7.4	27.8	1.8			
SW5	**30 Jan 2023**	7.7	14.2	7.4	90	28	110.2
SW5	**02 Feb 2023**						
SW5	**02 Feb 2023**	7.3	15.5	5.6			
SW5	**03 Feb 2023**	7.2	18	11.8			
SW5	**06 Feb 2023**	6.9	25.9	8.7	87.1	28.5	174.4
SW5	**06 Feb 2023**						
SW5	**09 Feb 2023**	7.3	15.6	2.1	84.4	29.7	113.4
SW5	**13 Feb 2023**	7.4	13.8	82.3	90.8	28.5	134.3
SW5	**16 Feb 2023**	6.09	14.6	1.8	87.2	30.3	128.9

SW5	**17 Feb 2023**	6.45	13	9.45			
SW5	**20 Feb 2023**	6.7	13.1	1.4	85.9	29.4	75.4
SW5	**21 Feb 2023**	7.2	13.8	1	90.1	28.5	89.3
SW5	**22 Feb 2023**	7.1	12.7	7.7	86.37	27.7	95.6
SW5	**23 Feb 2023**	7.4	8.7	39.1	92.9	27.7	58.9
SW5	**24 Feb 2023**	7.7	5.5	173	92.1	26.1	67.6
SW5	**25 Feb 2023**	6.9	8.9	242.8	89.98	27.3	70.32
SW5	**26 Feb 2023**	6.1	10.3	306.2	87.42	26.9	111.3
SW5	**27 Feb 2023**	6.9	13.4	176.8	87.4	27.1	59.4
SW5	**28 Feb 2023**	6.7	14.4	113.3	88.4	27.2	82.4
SW5	**01 Mar 2023**	6.4	15.6	51.9	87.88	27.3	110.2
SW5	**02 Mar 2023**	6.7	17.1	30.2	88.7	27.8	140.4
SW5	**03 Mar 2023**	6.2	18.1	88.4	89.5	27.7	165.5
SW5	**04 Mar 2023**	6.5	14.9	52.9	89.1	27.1	150.8
SW5	**05 Mar 2023**	7.1	17	14.7	94.7	28.2	107.1
SW5	**06 Mar 2023**	6.3	21.9	7.2	86	28.3	133.4
SW5	**07 Mar 2023**	7	26.9	15.2	87.6		20
SW5	**08 Mar 2023**	6	15.8	19.8	88.7	28.8	133.6
SW5	**09 Mar 2023**	6.9	15.1	19.5	86.7	28.8	72.8
SW5	**10 Mar 2023**	8.5	14.7	46.9	90	27.4	-24.5
SW5	**11 Mar 2023**	6.1	22.6	27.4	104	30.3	182.8
SW5	**12 Mar 2023**	6.6	18	6.7	101.2	30.2	143.6
SW5	**13 Mar 2023**	6.2	19.7	15.5	86.8	29.2	103.3
SW5	**14 Mar 2023**	6.5	16.9	2.6	81.5	29.6	76.8
SW5	**15 Mar 2023**	7.3	21.3	12.4	93	27.8	2.7
SW5	**16 Mar 2023**	7.7	24.7	21.9	88	27.7	13.6
SW5	**17 Mar 2023**	7	26.9	15.2	87.6	28.9	20
SW5	**17 Mar 2023**	7.6	24	2.9	101.5	29.3	6.2
SW5	**18 Mar 2023**	7.2	25.7	7.9	88.8	27.4	32.5
SW5	**19 Mar 2023**	7	27.5	13.6	85	27.1	47.3
SW5	**20 Mar 2023**	7.36	21.56	8.65	97.09	28.61	35.11
SW5	**21 Mar 2023**	6.2	21.8	8.5	89.4	29.1	114.7
SW5	**22 Mar 2023**	6.5	24.5	4.7	91.8	28.8	60.4
SW5	**27 Mar 2023**	7.5	18.3	1	93	30.5	35.6
SW5	**27 Mar 2023**						
SW5	**30 Mar 2023**						
SW5	**01 Apr 2023**	6.5	20.3	14.7	89.6	28.4	82.2
SW5	**04 Apr 2023**	6.6	21.9	5.3	85.1	28.8	78.7
SW5	**17 Apr 2023**	6.19	14.02	58.8	90.93	25.68	101.82
DH1	**16 Mar 2023**	7.33	36,930.75	0.93	75.95	31.9	31.4
DH1	**05 Apr 2023**	7.28	41,160.2	2.62	61.53	31.34	132.37
DH2	**16 Mar 2023**	7.66	44,979.48	1	80.16	31.54	30.46
DH2	**20 Mar 2023**						
DH2	**05 Apr 2023**	7.68	43,674.6	11.33	67.75	31.19	106.77
DH3	**08 Feb 2023**	7.1	7,047.3	19.9	84.4	32	99.3
DH3	**20 Mar 2023**						

DH3	**05 Apr 2023**	7.77	45,312.24	2.433	70.03	31.31	99.17
DH4	**08 Feb 2023**	7	7,562.1	10.4	72.3	30	110.1
DH4	**02 Mar 2023**	6.7	275.7	39.5	89.7	28	143.7
DH4	**09 Mar 2023**						
DH4	**09 Mar 2023**	6.8	4,326	12.5	81.5	29.1	129.4
DH4	**13 Mar 2023**	6.3	902.6	57.2	93.5	31.4	131.1
DH4	**21 Mar 2023**	7.13	8,961.21	26.2	89.49	32.2	45
DH4	**01 Apr 2023**	6.6	14,049.1	15.8	93.5	33.1	78.41
DH4	**04 Apr 2023**	6.57	6,535.59	60.7	88.16	33.5	97.72
Pit	**25 Oct 2022**	8.1	796.4	8	138	30.8	129.5
Pit	**04 Nov 2022**	9.04	636.2	138.72	315.53	35.8	160.43
Pit	**18 Nov 2022**	8	511.25	11.72	190.4	32.9	221.8
Pit	**12 Dec 2022**						
Pit	**05 Jan 2023**	7.3	73.9	112.5	113	29	96.7
Pit	**10 Jan 2023**	8.1	80.9	153.8	115.7	34.3	15.4
Pit	**16 Jan 2023**	6.54	87.4	36.9	75.6	34.5	141
Pit	**31 Jan 2023**	9.1	94.8	22.6	109.1	30.7	236.5
Pit	**07 Feb 2023**	8.7	94.7	218.6	125.1	35	65.1
Pit	**13 Feb 2023**	7.7	81.9	63	102.1	29.7	176.4
Pit	**16 Feb 2023**	6.4	78	184.3	100.7	31	160.2
Pit	**20 Feb 2023**	8.2	77.4	56.2	103.3	30.2	39.7
Pit	**27 Feb 2023**	6.7	61	462.1	91.6	27.7	72.5
Pit	**09 Mar 2023**						
Pit	**13 Mar 2023**	5.8	67.5	221.8	98.2	30.4	181.7
Pit	**20 Mar 2023**	7.32	77.53	404.76	93.63	29.55	39.38
Pit	**30 May 2023**	8	477.92	122.82	86.32	23.94	5.67
Pit	**28 Jun 2023**	7.53	759.82	162.68	56.18	13.83	35.69
SED1	**30 Nov 2022**						
SED1	**30 Nov 2022**	5.8	6	2,209	103	30.7	266.5
SED1	**08 Dec 2022**	7.08	73.59	499.9	98.12		200
SED1	**12 Dec 2022**	5.6	91.2	61.3	108.5	34.2	196.8
SED1	**13 Dec 2022**	6.14	81.56	56.99	102.8	32.39	214.65
SED1	**15 Dec 2022**	6.4	53.8	61.9	98.7	29.8	83.9
SED1	**20 Dec 2022**	6.47	80.05	214	100	30.48	155
SED1	**28 Dec 2022**	5.91	8.68	1,972	102	29.57	203
SED1	**05 Jan 2023**	7	34.2	462.5	101.5	28.2	89.1
SED1	**10 Jan 2023**	7.9	31.9	315.5	103	29.1	66.5
SED1	**16 Jan 2023**	6.02	49.2	162	86.3	32.8	213
SED1	**23 Jan 2023**	7.7	46.5	18.7	102.8	29	-6
SED1	**24 Jan 2023**	6.73	43	82			
SED1	**25 Jan 2023**	7.7	40.8	48.3	97.61	28.8	
SED1	**30 Jan 2023**	7.5	43.8	33.9	99.5	28.4	143.4
SED1	**02 Feb 2023**	7.5	40	179.1			
SED1	**03 Feb 2023**	7.5	37.9	122.4			
SED1	**06 Feb 2023**	7.2	35.2	62.4	98.6	29	191.2
SED1	**13 Feb 2023**	7.9	32.2	35.9	97	28.2	180.9

SED1	**13 Feb 2023**	7.6	34.2	32.8	98.8	28.6	178.6
SED1	**17 Feb 2023**	6.59	26.2	67			
SED1	**20 Feb 2023**	6.5	25.8	81.8	97.2	30.5	95.4
SED1	**27 Feb 2023**	7.7	11	7,088.8	100.7	25.3	24.8
SED1	**06 Mar 2023**	5.9	23.8	182.5	101.4	30.2	143
SED1	**13 Mar 2023**	4.4	52.6	19.2	103.1	34.5	217.5
SED1	**20 Mar 2023**	8.29	23	268.11	112.52	32.17	20.07
SED1	**30 Mar 2023**	6.7	24.1	77.2	97.1	28.7	133.1
SED1	**04 Apr 2023**	8.32	22.74	195.33	103.15	27.57	74.35
SED1	**12 Apr 2023**	5.56	19.66	65.79	104.12	28.78	118.29
SED1	**14 Apr 2023**	7.75	17.86	157.12	103.14	27.65	43.37
SED1	**17 Apr 2023**	5.94	17.08	822.63	97.83	25.81	121.12
SED1	**24 Apr 2023**	7.7	19.6	387.5			
SED2	**04 Nov 2022**	5.79	66.4	509.6	109.8	33.9	244.5
SED2	**23 Nov 2022**	5	61.8	151	98.23	27.6	271.6
SED2	**28 Nov 2022**	6	60.78	188.2	101.47	28.2	234.8
SED2	**29 Nov 2022**	5.3	44.23	746.16	94.7	30.9	28.19
SED2	**30 Nov 2022**	5.65	56.4	316	104.2	31.7	247.2
SED2	**06 Dec 2022**	6.6	77.6	68.6	98.9	31.1	180.7
SED2	**08 Dec 2022**	6.88	83.78	80.89	99.96		210
SED2	**12 Dec 2022**	6.4	103.3	117.6	105	32.8	199
SED2	**13 Dec 2022**	7.98	110.24	51.26	99.06	31.39	153.76
SED2	**20 Dec 2022**	6.82	60.11	136	110	31.44	87.7
SED2	**28 Dec 2022**	6	25.38	932	96.9	27.51	189
SED2	**05 Jan 2023**	6.7	32.4	1,211	98.8	27.1	106.6
SED2	**10 Jan 2023**	7.7	67.9	672.2	101.6	28.1	54.2
SED2	**16 Jan 2023**	5.37	108.5	291	90.2	30.4	179
SED2	**23 Jan 2023**	7.5	136.6	90.8	102.5	29.5	18
SED2	**24 Jan 2023**	7.54	149.5	83.5			
SED2	**25 Jan 2023**	7.5	79.5	45.5			
SED2	**30 Jan 2023**	7.5	82.5	171.3	95.4	27.7	142.3
SED2	**02 Feb 2023**	7	81.7	213.7			
SED2	**03 Feb 2023**	7.2	70.7	333.5			
SED2	**06 Feb 2023**	7.6	65.9	93.7	97.8	29.1	194.4
SED2	**13 Feb 2023**	7	58	25.8	99	28	279.9
SED2	**17 Feb 2023**	6.68	42.8	11.9			
SED2	**20 Feb 2023**	7.2	42.7	42.5	98.9	29.3	36.7
SED2	**27 Feb 2023**	7.3	14.9	1,585.1	99.2	26.1	28.9
SED2	**06 Mar 2023**	7	29	49.3	107	29.5	101.4
SED2	**13 Mar 2023**	5.6	34.3	219.6	117.7	33.4	158.7
SED2	**20 Mar 2023**	7.91	31.8	390.73	109.06	31.66	48
SED2	**30 Mar 2023**						
SED2	**04 Apr 2023**	7.07	46.56	187.59	90.44	28.59	70.71
SED2	**12 Apr 2023**	6.36	40.46	209.53	107.13	30.64	123.12
SED2	**17 Apr 2023**	6.45	23.96	1,745.56	93.95	26.96	104.56
SED2	**24 Apr 2023**	6.9	9.6	18.3			

SED2	**28 Jun 2023**	6.65	56.56	182.71	111.01	28.95	104.27
SED3	**28 Nov 2022**	5.6	3.5	2,984	94.59	27.9	258.92
SED3	**30 Nov 2022**	5.64	6.5	2,755	100.6	33.2	268
SED3	**12 Dec 2022**	5.6	164.5	34	105.3	33.8	222.2
SED3	**13 Dec 2022**	6.39	158.6	68.62	98.67	32.05	171.48
SED3	**20 Dec 2022**	6.2	64.05	53.77	98	30.92	130.1
SED3	**28 Dec 2022**	5.6	28.48	269.19	100	29.8	204
SED3	**05 Jan 2023**	6.1	18.4	1,180	99.7	27.8	110.1
SED3	**10 Jan 2023**	7.1	37.9	382.9	99.3	28.9	105
SED3	**16 Jan 2023**	5.4	47.7	141	92.4	32.1	215
SED3	**23 Jan 2023**	7.5	5.6	22.5	99.3	29.3	31.8
SED3	**24 Jan 2023**	7.62	85.2	54.2			
SED3	**25 Jan 2023**	7.7	135.6	100.2			
SED3	**30 Jan 2023**	7.4	45.6	113.7	94	27.7	130.2
SED3	**02 Feb 2023**	7.4	42.7	69.7			
SED3	**03 Feb 2023**	7	32.6	154.1			
SED3	**06 Feb 2023**	7.4	33.1	68	99.3	28.9	222.8
SED3	**13 Feb 2023**						
SED3	**17 Feb 2023**	6.87	25.9	54.2			
SED3	**20 Feb 2023**	7.2	25.6	72.1	98.6	30.2	53
SED3	**27 Feb 2023**	5.5	30	85.1	98.1	26	51.9
SED3	**06 Mar 2023**	6.7	21.2	419.8	100.2	30.3	113.6
SED3	**13 Mar 2023**	4.9	33.7	6.8	105.8	33.7	176.4
SED3	**20 Mar 2023**	7.01	26	301.8	109.82	35.09	44.94
SED3	**24 Apr 2023**	4.9	31.2	1.8			
SED4	**28 Nov 2022**	5.4	3.5	1,372	97.89	27.3	266.7
SED4	**30 Nov 2022**	5.38	5.59	1,469	106	33.5	282.8
SED4	**09 Dec 2022**	6.36	199.322	58.5	101.9	33.84	232.03
SED4	**12 Dec 2022**	5	54.5	39.9	105.9	33.6	224.1
SED4	**20 Dec 2022**	4.98	31.4	95.3	101	31.16	196.8
SED4	**28 Dec 2022**	5.53	9.23	130	102	30.6	228
SED4	**05 Jan 2023**	6.9	13.1	711	102	28	64.3
SED4	**10 Jan 2023**	7.5	21.2	307.6	98.9	29	71.2
SED4	**16 Jan 2023**	6.37	27.7	135	95.1	32.1	155
SED4	**23 Jan 2023**	6.9	33	4.1	99.5	30.2	51.8
SED4	**24 Jan 2023**	7.55	37.3	31.8			
SED4	**25 Jan 2023**	7.7	32.8	74.4			
SED4	**30 Jan 2023**	7.4	25.3	180.1	101.3	27.7	135.7
SED4	**02 Feb 2023**	7.3	24.8	154.3			
SED4	**03 Feb 2023**	6.5	22.4	138.7			
SED4	**06 Feb 2023**	7.3	18.1	119.4	97.5	28.9	227
SED4	**13 Feb 2023**	7.7	24.8	48.6	99.1	28.4	225.3
SED4	**17 Feb 2023**	6.62	18.6	42.8			
SED4	**20 Feb 2023**	7.2	18.2	26.7	97.7	30.1	56.9
SED4	**27 Feb 2023**	5.9	19.2	57	99.9	26.5	88.4
SED4	**06 Mar 2023**	7.1	15.3	87	102.3	30	107

SED4	**13 Mar 2023**	5.9	12.6	28.5	108.6	34.2	161
SED4	**20 Mar 2023**	7.8	18	67.59	108.11	34.48	5.61
SED4	**24 Apr 2023**	7.7	14	136.5			
SED5	**30 Nov 2022**	5.85	7.8	1,392	94.2	31.4	226.2
SED5	**09 Dec 2022**	6.73	31.62	574.6	105.7	36.6	141.1
SED5	**12 Dec 2022**	5.8	87.1	349.1	106.1	34.2	213
SED5	**20 Dec 2022**	6.25	36.3	585	97.4	30.48	148
SED5	**28 Dec 2022**	5.78	15.97	380	97	29	209
SED5	**05 Jan 2023**	7.1	19	352.7	99.4	29.5	99.3
SED5	**10 Jan 2023**	7.7	20.5	388.1	97.2	29.2	64.9
SED5	**16 Jan 2023**	6.34	23.3	214	95.1	33.4	178
SED5	**23 Jan 2023**	7.6	22.6	291.9	99.1	29.8	7.9
SED5	**24 Jan 2023**	6.64	27.8	176.9			
SED5	**25 Jan 2023**	7.6	25.6	199.4			
SED5	**30 Jan 2023**	7.7	19.12	344.9	93.3	27.7	137.5
SED5	**02 Feb 2023**	6.8	20.3	235.8			
SED5	**03 Feb 2023**	6.7	20.3	239.5			
SED5	**06 Feb 2023**	7.4	18.6	282.1	96.9	28.4	240.2
SED5	**13 Feb 2023**	7.6	19.6	82.3	97.6	28.3	110.9
SED5	**17 Feb 2023**	6.3	16.9	195			
SED5	**20 Feb 2023**	6.9	14.8	110.4	97.3	29.8	76.9
SED5	**27 Feb 2023**	7.2	17.7	272.2	95.7	25.9	35
SED5	**06 Mar 2023**	5.8	20.1	1,144	98.5	29.2	152.9
SED5	**13 Mar 2023**	6.3	17.3	871.9	110.8	37.8	140.3
SED5	**20 Mar 2023**	7.17	25.14	287.51	106.67	33.76	25.26
SED5	**30 Mar 2023**						
SED5	**04 Apr 2023**	6.25	23.15	136.39	91.7	29.04	119.12
SED5	**14 Apr 2023**	6.54	11.64	60.83	99.02	30.02	95.99
SED5	**17 Apr 2023**	5.99	13.53	880.52	87.04	27.49	115.88
SED5	**24 Apr 2023**	5.7	27.6	37.4			

Inorganics								
Total Phosphorus as P (Organic Phosphate as P)	Nitrite + Nitrate as N	Ammonia as N	Kjeldahl Nitrogen Total	Nitrate (as N)	Nitrite (as N)	Nitrogen (Total)	pH (Lab)	Reactive Phosphorus as P (Orthophosphate as P)
0.02	<0.01	<0.01	0.5	<0.01	<0.01	0.5	6.44	<0.01
0.02	<0.01	0.01	0.3	<0.01	<0.01	0.3	6.12	<0.01
0.01	<0.01	<0.01	0.3	<0.01	<0.01	0.3	5.74	<0.01
0.05	<0.01	0.40	0.6	<0.01	<0.01	0.6	5.96	<0.01
<0.01	<0.01	0.24	0.4	<0.01	<0.01	0.4	5.23	<0.01
<0.01	<0.01	0.03	0.2	<0.01	<0.01	0.2	6.15	<0.01
<0.01	0.03	0.11	0.3	0.03	<0.01	0.3	5.63	<0.01
<0.01	0.14	0.02	0.2	0.14	<0.01	0.3	5.56	<0.01

0.07	<0.01	0.16	0.5	<0.01	<0.01	0.5	5.65	<0.01
0.01	<0.01	0.48	0.8	<0.01	<0.01	0.8	6.25	<0.01
0.01	0.03	0.02	0.1	0.03	<0.01	0.1	5.62	<0.01
<0.01	<0.01	<0.01	0.2	<0.01	<0.01	0.2	6.49	<0.01
0.05	<0.01	<0.01	<0.1	<0.01	<0.01	<0.1	5.62	<0.01
0.02	<0.01	<0.01	0.1	<0.01	<0.01	0.1	5.99	<0.01
0.01	<0.01	0.32	0.4	<0.01	<0.01	0.4	5.24	<0.01
<0.01	<0.01	0.02	0.2	<0.01	<0.01	0.2	5.31	<0.01
<0.01	<0.01	0.10	0.2	<0.01	<0.01	0.2	6.13	<0.01
<0.01	<0.01	0.25	0.4	<0.01	<0.01	0.4	5.26	<0.01
0.01	<0.01	0.05	0.2	<0.01	<0.01	0.2	5.69	<0.01
0.13	<0.01	0.18	0.6	<0.01	<0.01	0.6	5.20	<0.01
0.01	<0.01	0.04	0.4	<0.01	<0.01	0.4	5.97	<0.01
0.01	<0.01	0.02	<0.1	<0.01	<0.01	<0.1	5.10	<0.01
0.02	17.4	0.21	1.6	16.3	1.11	19.0	6.78	0.01
0.19	28.3	8.47	15.2	27.4	0.94	43.5	7.78	0.03
0.13	15.6	1.23	2.4	13.9	1.68	18.0	6.16	<0.01
0.02	13.7	0.61	1.2	12.2	1.45	14.9	5.96	<0.01

0.02	13.3	0.41	1.8	12.1	1.24	15.1	5.82	<0.01
0.02	12.6	0.58	2.2	11.4	1.17	14.8	6.11	<0.01
0.01	12.6	0.31	3.3	11.6	1.00	15.9	6.03	<0.01
0.02	13.4	0.73	1.4	12.8	0.61	14.8	6.61	<0.01
0.01	13.6	0.95	3.3	13.2	0.41	16.9	6.67	0.01
0.01	12.9	0.35	3.6	12.5	0.37	16.5	5.87	<0.01
0.02	13.0	0.30	2.5	12.7	0.29	15.5	5.55	<0.01
0.02	14.0	0.56	7.4	13.8	0.22	21.4	5.98	<0.01
0.02	13.0	0.68	1.5	12.8	0.17	14.5	5.85	<0.01
0.02	13.0	0.39	7.8	12.8	0.15	20.8	5.54	<0.01
0.01	13.2	0.22	2.4	13.1	0.14	15.6	4.90	<0.01
0.04	11.8	0.62	2.4	11.7	0.13	14.2	5.03	<0.01
<0.01	11.5	0.22	1.2	11.4	0.09	12.7	5.32	<0.01
<0.01	12.2	0.66	1.1	12.1	0.08	13.3	5.09	<0.01
<0.01	11.9	0.14	2.9	11.8	0.06	14.8	4.58	<0.01
0.01	10.4	0.10	1.7	10.4	0.05	12.1	5.71	<0.01
<0.01	6.51	0.03	0.6	6.51	<0.01	7.1	4.52	<0.01
0.02	4.80	0.13	0.6	4.80	<0.01	5.4	4.66	<0.01

0.06	5.04	0.20	0.8	5.02	0.02	5.8	5.80	<0.01
0.09	5.16	0.31	1.2	5.16	<0.01	6.4	6.72	<0.01
0.02	6.88	0.44	1.4	6.86	0.02	8.3	5.52	<0.01
<0.10	5.48	0.10	<1.0	5.48	<0.01	5.5	5.53	<0.01
0.06	5.80	0.09	0.9	5.76	0.04	6.7	5.43	<0.01
0.03	8.65	0.06	0.8	8.44	0.21	9.4	5.72	<0.01
0.06	9.81	0.70	2.7	9.73	0.08	12.5	5.88	<0.01
0.02	<0.01	0.01	0.4	<0.01	<0.01	0.4	6.44	<0.01
0.01	0.04	0.03	0.2	0.04	<0.01	0.2	4.99	<0.01
0.11	0.06	<0.01	<1.0	0.06	<0.01	<1.0	6.10	<0.01
<0.01	<0.01	<0.01	0.3	<0.01	<0.01	0.3	5.75	<0.01
0.02	<0.01	0.05	0.4	<0.01	<0.01	0.4	5.86	<0.01
0.03	<0.01	0.02	0.2	<0.01	<0.01	0.2	6.14	<0.01
0.03	<0.01	0.04	0.1	<0.01	<0.01	0.1	5.72	<0.01
0.01	<0.01	0.56	0.7	<0.01	<0.01	0.7	4.95	<0.01
0.03	0.56	0.02	0.2	0.56	<0.01	0.8	5.42	<0.01
0.02	0.23	0.26	0.5	0.23	<0.01	0.7	6.47	<0.01
<0.01	2.07	0.22	0.7	2.05	0.02	2.8	5.96	<0.01
<0.01	2.65	0.03	0.6	2.65	<0.01	3.2	5.60	<0.01
<0.01	<0.01	0.07	0.2	<0.01	<0.01	0.2	5.45	<0.01

0.06	<0.01	0.07	0.5	<0.01	<0.01	0.5	6.49	<0.01
0.01	0.02	0.43	0.7	0.02	<0.01	0.7	6.55	<0.01
0.02	0.32	0.04	0.2	0.32	<0.01	0.5	5.70	<0.01
0.01	<0.01	<0.01	0.1	<0.01	<0.01	0.1	5.68	<0.01
0.06	0.28	0.02	0.4	0.28	<0.01	0.7	5.88	<0.01
<0.01	<0.01	<0.01	0.2	<0.01	<0.01	0.2	6.18	<0.01
0.04	<0.01	<0.01	0.5	<0.01	<0.01	0.5	6.64	<0.01
0.02	0.06	<0.01	0.3	0.06	<0.01	0.4	6.10	<0.01
0.08	0.02	0.01	<0.5	0.02	<0.01	<0.5	6.10	<0.01
<0.01	0.01	0.02	0.3	0.01	<0.01	0.3	6.06	<0.01
0.04	<0.01	<0.01	0.2	<0.01	<0.01	0.2	6.23	<0.01
0.02	<0.01	<0.01	0.4	<0.01	<0.01	0.4	5.83	<0.01
<0.01	<0.01	0.04	0.4	<0.01	<0.01	0.4	5.64	<0.01
0.02	<0.01	0.21	0.3	<0.01	<0.01	0.3	5.97	<0.01
<0.01	<0.01	0.29	0.4	<0.01	<0.01	0.4	6.21	0.01
0.02	0.06	<0.01	0.2	0.06	<0.01	0.3	5.80	<0.01
0.01	<0.01	1.41	1.7	<0.01	<0.01	1.7	7.00	<0.01
0.01	0.02	0.24	0.6	0.02	<0.01	0.6	5.37	<0.01
<0.01	<0.01	0.30	0.5	<0.01	<0.01	0.5	5.10	<0.01
0.01	<0.01	<0.01	0.4	<0.01	<0.01	0.4		<0.01
<0.01	<0.01	0.71	0.7	<0.01	<0.01	0.7	4.94	<0.01
<0.01	<0.01	0.12	0.2	<0.01	<0.01	0.2	6.21	<0.01

<0.01	<0.01	0.30	0.4	<0.01	<0.01	0.4	5.17	<0.01
<0.01	0.01	0.15	0.2	0.01	<0.01	0.2	5.49	<0.01
<0.01	<0.01	0.02	0.2	<0.01	<0.01	0.2	5.73	<0.01
0.05	<0.01	0.77	0.9	<0.01	<0.01	0.9	5.60	<0.01
<0.01	0.01	0.03	0.2	0.01	<0.01	0.2	6.01	<0.01
0.02	0.01	0.30	0.4	0.01	<0.01	0.4	5.27	<0.01
0.01	<0.01	<0.01	0.2	<0.01	<0.01	0.2		<0.01
0.01	<0.01	<0.01	0.1	<0.01	<0.01	0.1	5.85	<0.01
0.01	<0.01	0.01	0.2	<0.01	<0.01	0.2	6.07	<0.01
0.03	<0.01	0.01	0.3	<0.01	<0.01	0.3	4.93	<0.01
0.02	<0.01	0.04	0.1	<0.01	<0.01	0.1	5.66	<0.01
0.01	<0.01	0.01	0.2	<0.01	<0.01	0.2	4.82	<0.01
0.05	0.14	0.02	0.4	0.14	<0.01	0.5	6.23	<0.01
0.02	<0.01	0.01	0.3	<0.01	<0.01	0.3	6.30	<0.01
0.25	0.10	<0.01	<1.0	0.10	<0.01	<1.0	6.23	<0.01
<0.05	<0.01	<0.01	0.5	<0.01	<0.01	0.5	6.18	<0.01
0.04	0.06	<0.01	0.3	0.06	<0.01	0.4	6.82	<0.01
<0.01	0.01	<0.01	0.1	<0.01	0.01	0.1	6.41	<0.01
0.03	<0.01	0.02	0.3	<0.01	<0.01	0.3	6.61	<0.01
0.01	<0.01	0.32	0.3	<0.01	<0.01	0.3	6.03	<0.01
0.02	0.04	0.35	0.9	0.04	<0.01	0.9	6.31	<0.01
0.02	<0.01	<0.01	0.2	<0.01	<0.01	0.2	6.08	<0.01
0.01	0.02	<0.01	0.2	0.02	<0.01	0.2	6.13	<0.01
0.02	0.02	0.41	0.6	0.02	<0.01	0.6	5.74	<0.01
<0.01	<0.01	0.73	1.0	<0.01	<0.01	1.0	6.27	<0.01

0.03	<0.01	0.62	0.8	<0.01	<0.01	0.8	6.22	<0.01
<0.01	<0.01	0.04	0.4	<0.01	<0.01	0.4	5.92	<0.01
0.01	<0.01	0.08	0.2	<0.01	<0.01	0.2	5.14	<0.01
<0.01	<0.01	0.36	0.4	<0.01	<0.01	0.4	6.27	<0.01
<0.01	0.05	0.10	0.2	0.05	<0.01	0.2	5.88	<0.01
<0.01	0.17	0.28	0.4	0.17	<0.01	0.6	5.65	<0.01
0.05	<0.01	0.44	0.6	<0.01	<0.01	0.6	5.66	<0.01
0.02	<0.01	0.32	0.5	<0.01	<0.01	0.5	5.35	<0.01
0.03	<0.01	0.15	0.5	<0.01	<0.01	0.5	6.34	<0.01
<0.01	0.05	0.02	0.1	0.05	<0.01	0.2	5.54	<0.01
0.02	0.02	<0.01	0.2	0.02	<0.01	0.2	4.77	<0.01
<0.05	<0.01	<0.01	0.6	<0.01	<0.01	0.6	6.91	<0.01
0.08	<0.01	0.20	0.2	<0.01	<0.01	0.2	7.17	<0.01
<0.05	<0.01	<0.01	0.6	<0.01	0.01	0.6	7.44	0.01
0.04	<0.01	0.33	<0.1	<0.01	<0.01	<0.1	7.53	<0.01
0.08	<0.01	0.25	0.4	<0.01	<0.01	0.4	7.24	0.04
<0.05	0.02	<0.01	0.7	0.02	<0.01	0.7	7.54	<0.01

0.04	<0.01	0.07	0.3	<0.01	<0.01	0.3	7.65	<0.01
0.04	<0.01	<0.01	0.2	<0.01	<0.01	0.2	7.13	<0.01
0.01	<0.01	0.39	0.5	<0.01	<0.01	0.5	6.17	<0.01
0.01	<0.01	0.20	0.4	<0.01	<0.01	0.4	6.90	<0.01
0.02	<0.01	0.08	0.3	<0.01	<0.01	0.3	6.64	<0.01
0.05	0.07	0.29	0.9	0.07	<0.01	1.0	6.90	<0.01
0.04	<0.01	0.45	0.7	<0.01	<0.01	0.7	7.00	<0.01
0.08	0.06	0.06	0.6	0.06	<0.01	0.7	6.53	<0.01
0.20	80.8	25.3	28.3	75.5	5.32	109	7.69	0.10
0.08	5.35	0.19	1.1	4.63	0.72	6.4	5.33	<0.01
<0.10	5.89	0.14	1.1	5.35	0.54	7.0	6.24	0.01
0.04	6.06	0.34	1.6	5.76	0.30	7.7	7.35	<0.01
0.03	6.70	0.04	1.7	6.59	0.11	8.4	6.41	<0.01
0.06	6.28	0.19	1.8	6.21	0.07	8.1	6.57	<0.01
0.03	6.66	0.04	2.6	6.66	<0.01	9.3	6.06	<0.01
0.04	6.52	0.01	1.9	6.52	<0.01	8.4	6.54	<0.01
0.06	6.34	<0.01	3.4	6.34	<0.01	9.7	6.04	<0.01
0.05	4.05	0.20	1.1	4.05	<0.01	5.2	6.38	<0.01
<0.02	4.08	0.05	0.6	4.08	<0.01	4.7	4.71	<0.01
0.08	4.42	0.12	1.1	4.42	<0.01	5.5	5.92	<0.01
0.32	44.8	5.21	12.9	39.7	5.10	57.7	7.77	0.01
0.27	63.7	53.1	51.7	62.4	1.30	115	7.54	0.18
0.34	0.19	0.03	1.2	0.19	<0.01	1.4	5.75	<0.01
<0.01	0.24	0.01	0.2	0.24	<0.01	0.4	6.16	<0.01
0.02	0.45	0.02	0.4	0.45	<0.01	0.8	6.05	0.02
0.04	0.48	0.07	0.2	0.48	<0.01	0.7	6.11	<0.01
0.57	0.36	0.05	<1.0	0.35	0.01	<1.0	5.80	<0.01
<0.05	0.60	0.16	<0.5	0.59	0.01	0.6	4.91	<0.01
0.13	0.63	0.03	0.1	0.62	0.01	0.7	5.83	<0.01
0.05	0.66	0.04	0.5	0.65	0.01	1.2	5.83	<0.01
0.14	0.55	0.32	2.2	0.55	<0.01	2.8	6.70	<0.01
0.02	0.36	0.37	0.6	0.36	<0.01	1.0	5.94	<0.01
0.02	0.26	0.24	0.4	0.26	<0.01	0.7	5.47	<0.01
0.03	0.23	0.03	0.2	0.23	<0.01	0.4	5.00	<0.01

0.02	0.16	0.63	0.7	0.16	<0.01	0.9	5.06	<0.01
23.9	0.32	0.14	<2.0	0.32	<0.01	<2.0	4.91	<0.01
0.02	0.21	0.30	0.4	0.21	<0.01	0.6	4.91	<0.01
<0.01	0.19	0.03	0.1	0.19	<0.01	0.3	4.31	<0.01
<0.02	0.11	0.23	0.5	0.11	<0.01	0.6	4.61	<0.01
0.02	0.06	0.05	0.2	0.06	<0.01	0.3	5.74	<0.01
0.03	0.06	0.02	0.1	0.06	<0.01	0.2	4.61	<0.01
0.03	0.06	0.02	0.1	0.06	<0.01	0.2	5.91	<0.01
<0.05	0.07	0.02	<1.0	0.07	<0.01	<1.0	5.58	0.02
<0.50	0.07	0.02	<5.0	0.07	<0.01	<5.0	4.33	<0.01
0.03	<0.01	<0.01	0.1	<0.01	<0.01	0.1	4.98	<0.01
0.04	1.29	0.17	0.5	1.28	0.01	1.8	5.89	<0.01
0.12	1.60	0.12	0.5	1.58	0.02	2.1	6.21	<0.01
<0.01	0.67	<0.01	0.3	0.65	0.02	1.0	6.43	<0.01
0.03	0.66	<0.01	0.3	0.65	0.01	1.0	6.92	<0.01
0.03	0.67	0.01	0.3	0.65	0.02	1.0	6.14	<0.01
0.32	0.77	0.03	1.2	0.75	0.02	2.0	5.86	<0.01
0.15	0.47	0.01	<1.0	0.47	<0.01	<1.0	6.03	<0.01
0.12	0.49	<0.01	0.1	0.49	<0.01	0.6	6.58	<0.01
0.05	0.46	<0.01	0.4	0.46	<0.01	0.9	6.30	<0.01
0.02	0.28	0.33	0.5	0.28	<0.01	0.8	6.87	<0.01
0.03	0.31	0.22	0.5	0.31	<0.01	0.8	6.44	0.01
0.05	0.08	0.02	0.2	0.08	<0.01	0.3	6.92	<0.01
0.01	0.24	0.55	0.5	0.24	<0.01	0.7	5.31	<0.01
0.04	0.15	0.64	0.9	0.15	<0.01	1.0	4.11	<0.01
<0.20	0.15	0.37	<2.0	0.15	<0.01	<2.0	4.65	<0.01
0.02	0.21	0.07	0.2	0.21	<0.01	0.4	4.53	<0.01
0.03	0.06	0.34	0.5	0.06	<0.01	0.6	4.61	<0.01
0.12	<0.01	0.14	0.6	<0.01	<0.01	0.6	5.63	<0.01
0.05	<0.01	0.27	0.6	<0.01	<0.01	0.6	5.41	<0.01
0.09	0.15	0.01	1.4	0.15	<0.01	1.6	5.73	<0.01
0.15	0.13	<0.01	0.2	0.13	<0.01	0.3	6.39	<0.01
<0.50	0.30	0.06	<5.0	0.30	<0.01	<5.0	4.87	<0.01
0.02	0.22	<0.01	<0.1	0.22	<0.01	0.2	5.48	<0.01

0.22	2.32	0.03	0.9	2.30	0.02	3.2	6.01	0.01
0.71	0.20	0.07	2.1	0.19	0.01	2.3	5.75	<0.01
<0.01	0.25	<0.01	0.2	0.25	<0.01	0.4	6.37	<0.01
<0.01	0.28	0.01	0.2	0.27	0.01	0.5	5.93	<0.01
0.07	0.16	<0.01	<0.5	0.16	<0.01	<0.5	5.56	<0.01
0.12	0.14	<0.01	<0.5	0.14	<0.01	<0.5	4.59	<0.01
0.12	0.10	<0.01	0.1	0.10	<0.01	0.2	5.94	<0.01
0.04	0.04	0.11	0.4	0.04	<0.01	0.4	5.17	<0.01
0.02	0.07	0.31	0.4	0.07	<0.01	0.5	6.18	<0.01
0.02	0.11	0.09	0.2	0.11	<0.01	0.3	5.81	<0.01
0.03	0.28	<0.01	0.3	0.28	<0.01	0.6	5.79	<0.01
0.01	0.05	0.12	0.2	0.05	<0.01	0.2	5.45	<0.01
<0.01	<0.01	0.03	0.2	<0.01	<0.01	0.2	5.25	<0.01
<0.01	0.08	0.03	<0.1	0.08	<0.01	<0.1	4.54	<0.01
0.04	0.07	0.27	0.5	0.07	<0.01	0.6	4.99	<0.01
<0.01	0.03	0.03	0.1	0.03	<0.01	0.1	4.47	<0.01
0.05	<0.01	0.41	0.6	<0.01	<0.01	0.6	4.65	<0.01
0.07	0.10	0.05	1.3	0.10	<0.01	1.4	5.47	<0.01
0.01	0.16	0.02	0.2	0.16	<0.01	0.4	4.70	<0.01
0.07	0.14	0.01	<0.5	0.14	<0.01	<0.5	5.65	<0.01
0.06	0.18	0.01	<0.5	0.18	<0.01	<0.5	4.62	<0.01
0.16	0.13	<0.01	0.1	0.13	<0.01	0.2	5.88	0.01
0.03	0.03	<0.01	0.3	0.03	<0.01	0.3	4.76	<0.01
0.02	0.09	0.77	0.9	0.09	<0.01	1.0	5.81	<0.01
0.02	0.07	0.09	0.2	0.07	<0.01	0.3	5.53	<0.01
0.02	0.06	<0.01	0.2	0.06	<0.01	0.3	5.38	<0.01
0.01	0.04	0.59	0.7	0.04	<0.01	0.7	4.72	<0.01
0.09	0.01	<0.01	0.1	0.01	<0.01	0.1	4.63	<0.01
<0.01	0.13	0.32	0.4	0.13	<0.01	0.5	4.36	<0.01
<0.01	0.08	0.18	0.3	0.08	<0.01	0.4	4.69	<0.01

<0.01	0.76	0.49	0.5	0.75	0.01	1.3	4.60	<0.01
<0.01	0.03	0.02	0.1	0.03	<0.01	0.1	4.77	<0.01
0.47	0.32	0.08	2.4	0.32	<0.01	2.7	5.79	<0.01
0.05	0.44	0.02	0.5	0.44	<0.01	0.9	5.18	<0.01
0.14	0.22	0.02	<0.5	0.22	<0.01	<0.5	5.87	<0.01
0.03	0.33	<0.01	0.2	0.33	<0.01	0.5	6.05	<0.01
0.10	0.29	<0.01	<0.1	0.29	<0.01	0.3	5.96	<0.01
0.04	0.22	0.01	0.4	0.22	<0.01	0.6	4.79	<0.01
0.28	0.20	0.15	<1.0	0.20	<0.01	<1.0	6.06	<0.01
0.05	0.18	0.01	0.5	0.18	<0.01	0.7	5.80	<0.01
0.03	0.14	0.01	0.4	0.14	<0.01	0.5	5.36	<0.01
<0.01	0.14	0.74	0.9	0.14	<0.01	1.0	4.76	<0.01
0.01	0.09	<0.01	0.2	0.09	<0.01	0.3	4.88	<0.01
0.15	0.21	0.04	<1.0	0.21	<0.01	<1.0	5.28	<0.01
<0.10	0.14	0.33	1.3	0.14	<0.01	1.4	5.05	<0.01
0.09	0.12	0.23	0.7	0.12	<0.01	0.8	5.34	<0.01
<0.02	0.12	0.52	0.8	0.12	<0.01	0.9	4.63	<0.01
0.03	0.10	0.42	0.6	0.10	<0.01	0.7	4.74	<0.01
0.03	0.08	0.07	0.2	0.08	<0.01	0.3	4.69	<0.01
<0.10	0.09	0.65	<1.0	0.09	<0.01	<1.0	4.91	<0.01
<0.01	0.07	<0.01	<0.1	0.07	<0.01	<0.1	4.65	<0.01

	NA								
Reactive Phosphorus as P (Orthophosphate as P) (filtered)	Chlorophyll a	Aluminium	Aluminium (filtered)	Antimony	Antimony (filtered)	Arsenic	Arsenic (filtered)	Barium	Barium (filtered)
<0.001		0.05	0.06	<0.001	<0.001	0.002	0.001	0.008	0.006
<0.001		0.26	0.09	<0.001	<0.001	0.001	<0.001	0.006	0.003
0.004		0.09	0.02	<0.001	<0.001	0.002	0.002	0.007	0.007
<0.001		0.10	<0.01	<0.001	<0.001	<0.001	<0.001	0.014	0.001
0.004		0.08	0.01			<0.001	<0.001		
<0.001	0.001	0.08	0.01			<0.001	<0.001		
0.002	0.001	0.04	<0.01			<0.001	<0.001		
<0.001	0.001	0.08	0.03			<0.001	<0.001		

0.003	0.004	0.05	<0.01			0.001	<0.001		
<0.001	0.002	0.47	0.55			<0.001	<0.001		
<0.001	0.002	0.04	<0.01			<0.001	<0.001		
<0.001		0.12	0.06	<0.001	<0.001	<0.001	<0.001	0.006	0.005
0.001		0.23	0.08	0.003	<0.001	<0.001	<0.001	0.007	0.005
0.008		0.29	0.04	<0.001	<0.001	<0.001	<0.001	0.007	0.002
<0.001		0.42	0.08			<0.001	<0.001		
<0.001		0.13	0.05			<0.001	<0.001		
<0.001	<0.001	0.12	0.02			<0.001	<0.001		
0.003	0.001	0.04	0.01			0.003	<0.001		
<0.001	<0.001	0.23	0.03			<0.001	<0.001		
0.008	0.015	0.16	0.02			<0.001	<0.001		
<0.001	0.002	0.34	0.24			<0.001	<0.001		
<0.001	<0.001	0.04	<0.01			<0.001	<0.001		
0.005		0.14	0.02	<0.001	<0.001	0.004	0.004	0.038	0.034
0.036		3.42	0.06	<0.001	<0.001	0.006	0.006	0.040	0.023
0.009		1.24	0.74	<0.001	<0.001	0.003	0.002	0.033	0.022
0.009		0.22	<0.01	<0.001	<0.001	0.002	0.002	0.026	0.019

0.003		0.17	0.04	<0.001	<0.001	0.002	0.002	0.024	0.020
0.004		0.20	<0.01	<0.001	<0.001	0.002	0.002	0.024	0.022
0.009		0.06	0.02	<0.001	<0.001	0.002	0.002	0.025	0.021
0.002		0.06	<0.01	<0.001	<0.001	0.002	<0.001	0.026	0.023
0.004		0.08	<0.01	<0.001	<0.001	0.002	0.002	0.026	0.025
0.003		0.06	<0.01			0.002	0.002		
0.002		0.04	<0.01	<0.001	<0.001	0.002	0.002	0.029	0.023
0.006		0.04	<0.01			0.002	0.002		
<0.001		0.03	0.01			0.002	0.003		
<0.001		0.03	0.02			0.002	0.002		
0.006		0.06	0.02			0.002	0.002		
<0.001		0.08	0.02			0.001	0.001		
0.002		0.21	0.11			0.002	0.002		
0.007		0.14	0.07			0.002	0.001		
0.004		0.16	0.06			0.002	<0.001		
0.004	<0.002	0.73	0.04			0.001	<0.001		
0.003	0.002	0.84	0.18			<0.001	<0.001		
<0.001	<0.003	0.57	<0.01			0.001	0.001		

0.011	0.02	0.33	<0.01			0.002	0.001		
0.002	0.002	2.17	0.76			0.002	0.001		
0.002	0.004	1.29	<0.01			0.001	0.001		
<0.001	0.001	3.20	<0.01			0.002	<0.001		
0.008		1.84	<0.01			0.002	<0.001		
0.002		0.66	<0.01			0.002	0.001		
0.007		0.26	<0.01			0.004	0.003		
0.004		0.17	0.05	<0.001	<0.001	0.008	0.002	0.022	0.013
<0.001		0.84	0.32	<0.001	<0.001	0.001	<0.001	0.025	0.017
<0.001		7.00	0.06	<0.001	<0.001	0.002	<0.001	0.049	0.002
0.008		0.22	0.06	<0.001	<0.001	0.004	0.005	0.018	0.016
0.001		0.84	0.33	<0.001	<0.001	0.001	0.002	0.011	0.006
<0.001		0.16	0.02	<0.001	<0.001	0.003	0.001	0.030	0.009
<0.001		0.50	0.02	<0.001	<0.001	<0.001	<0.001	0.017	0.004
<0.001		0.78	0.19			<0.001	<0.001		
0.004		4.21	<0.01			0.002	<0.001		
<0.001	<0.002	2.30	<0.01			<0.001	<0.001		
0.009	0.001	0.69	0.03			<0.001	<0.001		
<0.001	<0.001	0.52	0.10			<0.001	0.001		
0.003	<0.001	0.07	<0.01			0.002	0.002		

0.001	0.008	0.84	0.05			<0.001	<0.001		
<0.001	0.001	0.78	0.84			<0.001	<0.001		
<0.001	0.001	0.47	0.02			<0.001	<0.001		
0.006		0.08	<0.01			0.002	<0.001		
<0.001		0.42	<0.01	<0.001	<0.001	<0.001	<0.001	0.030	0.022
0.001		0.15	0.09	<0.001	<0.001	<0.001	<0.001	0.006	0.004
0.003		0.54	0.07	<0.001	<0.001	0.016	0.013	0.026	0.025
<0.001		0.71	0.04	<0.001	<0.001	<0.001	<0.001	0.010	0.002
0.001		1.22	0.32	<0.001	<0.001	<0.001	<0.001	0.018	0.005
0.002		0.47	0.05	<0.001	<0.001	<0.001	<0.001	0.114	0.006
<0.001		0.29	0.03	<0.001	<0.001	<0.001	<0.001	0.006	0.005
0.002		0.26	0.06	<0.001	<0.001	0.006	0.004	0.018	0.015
0.004		0.20	0.05	<0.001	<0.001	<0.001	<0.001	0.007	0.005
<0.001		0.08	<0.01	<0.001	<0.001	<0.001	<0.001	0.009	0.005
<0.001		0.10	0.02			<0.001	<0.001		
0.004		0.24	0.04	<0.001	<0.001	<0.001	<0.001	0.014	0.009
0.001		0.17	0.02	<0.001	<0.001	0.004	0.002	0.028	0.009
0.002		0.18	0.02			<0.001	<0.001		
0.002		0.10	0.01			<0.001	<0.001		
<0.001									
0.003		0.73	0.01			<0.001	<0.001		
0.002	<0.002	0.43	0.04			<0.001	<0.001		

0.002	<0.001	0.24	0.01			<0.001	<0.001		
<0.001	<0.001	0.25	0.05			<0.001	<0.001		
0.002	<0.001	0.08	<0.01			0.002	0.001		
<0.001	0.018	0.13	<0.01			<0.001	<0.001		
<0.001	<0.001	0.31	0.02			<0.001	<0.001		
0.004	<0.001	0.09	<0.01			<0.001	<0.001		
		0.08	0.02			0.001	0.001		
0.009		0.06	<0.01			0.002	0.001		
0.001		0.09	0.05	<0.001	<0.001	<0.001	<0.001	0.004	0.003
0.001		0.06	0.02	<0.001	<0.001	<0.001	<0.001	0.005	0.003
0.002		0.42	<0.01	<0.001	<0.001	<0.001	<0.001	0.007	0.005
<0.001		0.20	0.06			<0.001	<0.001		
<0.001		0.32	<0.01	<0.001	<0.001	0.002	0.001	0.020	0.011
<0.001		0.18	0.11	<0.001	<0.001	0.001	<0.001	0.013	0.010
0.002		2.47	0.05	<0.001	<0.001	0.001	<0.001	0.018	0.004
0.003		0.93	0.21	<0.001	<0.001	<0.001	<0.001	0.017	0.008
0.001		0.74	0.45	<0.001	<0.001	<0.001	0.001	0.013	0.007
<0.001		0.32	0.02	<0.001	<0.001	0.001	<0.001	0.010	0.008
0.008		0.28	0.10	<0.001	<0.001	0.003	0.001	0.014	0.007
<0.001		0.28	0.01	<0.001	<0.001	<0.001	<0.001	0.012	0.008
0.001		0.32	0.04	<0.001	<0.001	0.001	<0.001	0.009	0.006
<0.001		0.25	0.07			<0.001	<0.001		
0.001		0.40	0.02	<0.001	<0.001	0.001	<0.001	0.012	0.010
<0.001		0.36	<0.01			<0.001	<0.001		
<0.001		0.19	<0.01			<0.001	0.001		

0.005		0.10	0.01			<0.001	<0.001		
<0.001		0.31	0.09			<0.001	<0.001		
0.003		0.31	0.02			<0.001	<0.001		
<0.001	<0.001	0.25	0.02			<0.001	<0.001		
0.004	<0.001	0.16	0.01			<0.001	<0.001		
0.001	<0.001	0.25	0.05			<0.001	<0.001		
<0.001	<0.001	<0.01	<0.01			0.001	0.001		
0.007		0.12	<0.01			<0.001	<0.001		
<0.001	<0.001	0.44	0.50			<0.001	<0.001		
<0.001	<0.001	0.21	<0.01			<0.001	<0.001		
<0.001	<0.001	0.74	0.03			<0.001	<0.001		
0.002	0.002	<0.10	<0.10			<0.010	<0.010		
<0.001	0.003	<0.10	<0.10			<0.010	<0.010		
0.003	0.001	<0.10	<0.10			<0.010	<0.010		
<0.001	0.002	<0.10	<0.10			<0.010	<0.010		
0.022		1.05	<0.01	<0.001	<0.001	0.002	0.002	0.006	0.005
0.002	<0.001	<0.10	<0.10			<0.010	<0.010		

<0.001	0.002	<0.10	<0.10			0.015	<0.010		
0.005		0.43	<0.01	<0.001	<0.001	0.001	<0.001	0.007	0.006
0.006		0.77	<0.01			0.001	<0.001		
<0.001	0.001	0.50	<0.01			<0.001	<0.001		
0.002	0.007	0.41	<0.01			<0.001	<0.001		
0.003	0.013	1.32	<0.01			0.002	0.001		
0.001	0.002	0.14	0.13			0.001	<0.001		
0.005	0.013	1.13	<0.01			0.002	<0.001		
0.063		<0.01	<0.01	<0.001	<0.001	0.029	0.026	0.005	0.003
0.007		0.96	0.02	<0.001	<0.001	0.003	0.002	0.013	0.007
0.005		1.61	0.01	<0.001	<0.001	0.004	0.003	0.014	0.005
0.017		0.68	0.11	<0.001	<0.001	0.006	0.004	0.009	0.004
0.002		0.20	0.02	<0.001	<0.001	<0.001	0.005	0.172	0.004
0.020		0.72	<0.01	<0.001	<0.001	0.005	0.004	0.009	0.004
0.002		0.56	<0.01			0.003	0.003		
0.006		1.57	<0.01			0.003	0.002		
0.006		1.00	<0.01			0.003	0.003		
0.007		4.65	<0.01			0.002	<0.001		
0.006	<0.001	5.05	0.06			0.002	<0.001		
0.007	<0.004	7.71	<0.01			0.003	0.001		
0.026		1.84	<0.01			0.053	0.050		
0.184		0.46	0.02			0.046	0.044		
0.002		25.8	0.03	<0.001	<0.001	0.006	<0.001	0.195	<0.001
0.004		0.18	<0.01	<0.001	<0.001	<0.001	<0.001	0.028	0.026
<0.001		1.40	<0.01	0.003	<0.001	<0.001	<0.001	0.022	0.020
<0.001		1.98	<0.01	<0.001	<0.001	0.001	<0.001	0.038	0.013
<0.001		20.3	0.03	<0.001	<0.001	0.002	<0.001	0.117	<0.001
0.002		5.22	0.03	<0.001	<0.001	0.002	<0.001	0.037	0.006
<0.001		3.33	<0.01	<0.001	<0.001	<0.001	<0.001	0.028	0.005
0.001		2.33	0.05	<0.001	<0.001	<0.001	<0.001	0.026	0.010
<0.001		0.93	0.01	<0.001	<0.001	<0.001	<0.001	0.018	0.012
<0.001		0.58	<0.01			<0.001	<0.001		
0.001		0.61	<0.01	<0.001	<0.001	<0.001	0.001	0.012	0.008
0.001		0.46	<0.01			<0.001	<0.001		

0.001		1.02	<0.01			<0.001	<0.001		
<0.001		8.87	0.04			0.003	<0.001		
<0.001		2.84	<0.01			<0.001	<0.001		
<0.001	<0.001	1.33	0.56			<0.001	<0.001		
<0.001	0.01	3.51	<0.01			0.002	<0.001		
0.003		0.70	<0.01			<0.001	<0.001		
<0.001	0.003	2.69	<0.01			<0.001	<0.001		
0.001	0.001	0.88	<0.01			<0.001	<0.001		
<0.001	0.001	1.89	0.14			<0.001	<0.001		
<0.001	<0.001	22.0	<0.01			0.004	<0.001		
0.002		1.92	<0.01			<0.001	<0.001		
0.002		1.71	<0.01	<0.001	<0.001	<0.001	<0.001	0.031	0.020
0.002		2.42	0.04	<0.001	<0.001	0.001	<0.001	0.034	0.009
0.002		0.43	<0.01	<0.001	<0.001	<0.001	<0.001	0.024	0.020
0.002		0.32	0.03	<0.001	<0.001	<0.001	<0.001	0.037	0.031
0.006		1.16	0.06	<0.001	<0.001	<0.001	<0.001	0.034	0.021
0.003		9.25	<0.01	<0.001	<0.001	0.002	<0.001	0.074	0.007
0.009		5.31	0.15	<0.001	<0.001	0.002	<0.001	0.060	0.009
<0.001		10.9	<0.01	<0.001	<0.001	0.003	<0.001	0.089	0.020
0.006		3.59	0.32	<0.001	<0.001	0.001	<0.001	0.072	0.037
<0.001		0.87	0.02	<0.001	<0.001	<0.001	<0.001	0.054	0.039
<0.001		1.69	<0.01			0.001	<0.001		
<0.002		0.85	<0.01	<0.001	<0.001	0.001	<0.001	0.017	0.009
<0.001		0.29	0.02			<0.001	<0.001		
0.001		0.83	<0.01			<0.001	<0.001		
<0.001		13.7	0.04			0.004	<0.001		
<0.001		1.99	0.36			<0.001	<0.001		
0.001	0.005	2.32	0.02			<0.001	<0.001		
<0.001	0.009	2.61	0.09			0.002	<0.001		
0.003		0.60	0.01			<0.001	<0.001		
<0.001	0.001	1.75	<0.01			<0.001	<0.001		
0.002	0.002	1.19	<0.01			<0.001	<0.001		
<0.001	<0.001	19.2	<0.01			0.005	<0.001		
0.001		0.35	0.01			<0.001	<0.001		

0.011		2.66	0.04			0.002	<0.001		
<0.001		11.8	0.11	<0.001	<0.001	0.001	<0.001	0.078	0.002
0.003		0.57	0.03	<0.001	<0.001	<0.001	<0.001	0.026	0.020
0.002		0.43	0.01	<0.001	<0.001	<0.001	<0.001	0.023	0.018
<0.001		3.07	<0.01	<0.001	<0.001	0.001	<0.001	0.029	0.009
0.002		6.01	0.31	<0.001	<0.001	0.002	<0.001	0.044	0.006
0.001		4.11	<0.01	<0.001	<0.001	<0.001	<0.001	0.032	0.006
0.006		1.90	0.03	0.001	<0.001	<0.001	<0.001	0.020	0.008
<0.001		0.21	<0.01	<0.001	<0.001	<0.001	<0.001	0.017	0.014
<0.001		1.13	<0.01			<0.001	<0.001		
<0.001		0.97	0.05	<0.001	<0.001	<0.001	0.001	0.031	0.023
<0.001		0.36	<0.01			0.010	<0.001		
<0.001		0.63	<0.01			<0.001	<0.001		
<0.001		1.15	0.34			<0.001	<0.001		
<0.001		4.30	<0.01			0.001	<0.001		
<0.001	0.001	0.61	0.15			<0.001	<0.001		
<0.001	0.004	1.76	<0.01			<0.001	<0.001		
0.001		10.5	0.05	<0.001	<0.001	<0.001	<0.001	0.055	0.001
<0.001		0.69	0.07	0.001	<0.001	<0.001	<0.001	0.026	0.020
<0.001		0.52	0.06	<0.001	<0.001	<0.001	0.002	0.012	0.004
0.002		4.61	0.02	<0.001	<0.001	0.001	<0.001	0.038	0.003
<0.001		3.90	<0.01	<0.001	<0.001	0.001	<0.001	0.030	0.002
0.002		2.14	0.04	<0.001	<0.001	<0.001	<0.001	0.018	0.003
<0.001		0.11	<0.01	<0.001	<0.001	<0.001	<0.001	0.010	0.007
<0.001		1.97	<0.01			<0.001	<0.001		
<0.001		1.09	<0.01	<0.001	<0.001	<0.001	<0.001	0.013	0.007
0.003		0.60	0.01			<0.001	<0.001		
0.003		0.71	<0.01			<0.001	<0.001		
<0.001		1.04	0.10			0.003	<0.001		
<0.001		0.95	<0.01			<0.001	<0.001		

0.004	0.001	0.12	<0.01			<0.001	<0.001		
<0.001	<0.002	0.62	<0.01			<0.001	<0.001		
<0.001		5.11	0.12	<0.001	<0.001	0.001	<0.001	0.055	0.003
<0.001		7.87	0.68	<0.001	<0.001	0.002	<0.001	0.074	0.035
<0.001		2.38	0.04	<0.001	<0.001	<0.001	<0.001	0.022	0.004
0.002		1.55	0.15	<0.001	<0.001	<0.001	<0.001	0.020	0.008
<0.001		12.4	0.58	<0.001	<0.001	0.002	<0.001	0.061	0.022
0.008		3.79	0.33	<0.001	<0.001	<0.001	<0.001	0.029	0.008
<0.001		2.96	0.10	<0.001	<0.001	<0.001	<0.001	0.027	0.006
<0.001		4.26	0.11			<0.001	<0.001		
<0.001		2.81	0.06	<0.001	<0.001	<0.001	<0.001	0.027	0.008
<0.001		2.49	0.03			<0.001	<0.001		
<0.001		1.23	<0.01			<0.001	<0.001		
<0.001		3.77	0.07			0.001	<0.001		
0.001		6.53	0.02			0.002	<0.001		
<0.001	0.005	12.1	0.05			0.002	<0.001		
<0.001	0.003	2.00	0.02			<0.001	<0.001		
0.007		0.36	0.02			<0.001	<0.001		
<0.001	<0.001	1.52	0.01			<0.001	<0.001		
<0.001	<0.001	9.78	0.01			0.002	<0.001		
0.003		0.32	0.04			<0.001	<0.001		

Beryllium	Beryllium (filtered)	Bismuth	Bismuth (filtered)	Boron	Boron (filtered)	Cadmium	Cadmium (filtered)	Cesium
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	

						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
						0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						0.0004	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						0.0001	<0.0001	
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	0.06	0.06	0.0001	0.0001	14
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	4
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	1

<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	1
<0.001	<0.001	<0.001	<0.001	0.06	0.06	<0.0001	<0.0001	1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						0.0002	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	

						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						0.0002	<0.0001	
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	2
0.002	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	14
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	

						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	2
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	3
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	0.0001	<0.0001	<1
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	0.06	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	

						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	3
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	2
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
						<0.0001	<0.0001	
						<0.0001	<0.0001	

						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0010	<0.0010	
						<0.0010	<0.0010	
						<0.0010	<0.0010	
						<0.0010	<0.0010	
<0.001	<0.001	<0.001	<0.001	0.63	0.55	<0.0001	<0.0001	<1
						<0.0010	<0.0010	

						<0.0010	<0.0010	
<0.001	<0.001	<0.001	<0.001	0.63	0.58	<0.0001	<0.0001	<1
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	0.0006	<0.0001	53
0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	3
0.002	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	3
<0.001	<0.001	<0.001	<0.001	<0.05	0.08	<0.0001	<0.0001	2
<0.001	<0.001	<0.001	<0.001	0.39	<0.05	<0.0001	<0.0001	2
<0.001	<0.001	<0.001	<0.001	0.12	<0.05	0.0001	<0.0001	1
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						0.0002	<0.0001	
						0.0001	<0.0001	
0.006	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	14
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	5
0.005	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	42
0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	11
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	7
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	4
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	0.0001	1
						<0.0001	<0.0001	

						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	0.0003	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	3
0.002	<0.001	<0.001	<0.001	<0.05	<0.05	0.0002	<0.0001	5
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	2
0.004	<0.001	<0.001	<0.001	<0.05	<0.05	0.0001	<0.0001	19
0.002	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	10
0.003	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	21
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	7
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	1
						<0.0001	<0.0001	
0.001	<0.001	<0.001	<0.001	<0.05	0.07	<0.0001	<0.0001	3
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						0.0002	<0.0001	
						0.0002	0.0002	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						0.0001	<0.0001	
						<0.0001	<0.0001	
						0.0002	<0.0001	
						<0.0001	<0.0001	

						0.0002	<0.0001	
0.003	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	26
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	1
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	1
0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	8
0.002	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	15
0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	11
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	5
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	2
						0.0003	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						0.0003	0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	16
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	2
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	1
0.002	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	10
0.002	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	9
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	4
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	<1
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	2
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						0.0006	<0.0001	
						0.0002	0.0002	

						<0.0001	<0.0001	
						<0.0001	<0.0001	
0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	9
0.002	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	15
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	4
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	3
0.002	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	23
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	7
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	5
						<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.0001	<0.0001	5
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						0.0002	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	
						<0.0001	<0.0001	

Cesium (filtered)	Chromium (III+VI)	Chromium (III+VI) (filtered)	Cobalt	Cobalt (filtered)	Copper	Copper (filtered)	Iron	Iron (filtered)
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.75	0.99
<1	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.48	0.10
<1	<0.001	<0.001	<0.001	<0.001	0.004	0.004	0.90	0.18
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.30	0.08
	<0.001	<0.001			<0.001	<0.001	0.15	<0.05
	<0.001	<0.001			<0.001	<0.001	0.22	<0.05
	<0.001	<0.001			<0.001	<0.001	0.33	0.08
	<0.001	<0.001			<0.001	<0.001	0.18	0.09

	<0.001	<0.001			<0.001	0.001	0.76	0.11
	<0.001	<0.001			<0.001	<0.001	0.52	0.47
	<0.001	<0.001			<0.001	<0.001	0.34	0.10
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.13	0.06
<1	<0.001	<0.001	<0.001	<0.001	0.016	0.019	0.13	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.11	<0.05
	<0.001	<0.001			<0.001	<0.001	0.10	<0.05
	<0.001	<0.001			<0.001	<0.001	<0.05	<0.05
	<0.001	<0.001			<0.001	<0.001	0.10	<0.05
	0.001	<0.001			<0.001	<0.001	0.12	<0.05
	<0.001	<0.001			<0.001	<0.001	0.42	0.08
	<0.001	<0.001			<0.001	<0.001	0.97	0.26
	<0.001	<0.001			<0.001	<0.001	0.31	0.22
	<0.001	<0.001			<0.001	<0.001	<0.05	<0.05
<1	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.07	<0.05
8	0.004	<0.001	0.003	0.002	0.003	<0.001	4.70	0.05
1	0.002	<0.001	0.002	0.001	0.002	<0.001	1.81	0.44
<1	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.24	<0.05

<1	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.16	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.16	<0.05
<1	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.05	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.06	<0.05
	<0.001	<0.001			<0.001	<0.001	<0.05	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.05	<0.05
	<0.001	<0.001			<0.001	<0.001	<0.05	<0.05
	<0.001	<0.001			<0.001	<0.001	<0.05	<0.05
	<0.001	<0.001			<0.001	<0.001	<0.05	<0.05
	<0.001	<0.001			<0.001	<0.001	<0.05	<0.05
	<0.001	<0.001			<0.001	<0.001	0.07	<0.05
	<0.001	<0.001			<0.001	<0.001	0.10	<0.05
	0.001	<0.001			<0.001	<0.001	0.08	<0.05
	<0.001	<0.001			0.002	<0.001	<0.05	<0.05
	<0.001	<0.001			<0.001	<0.001	0.96	<0.05
	<0.001	<0.001			<0.001	<0.001	0.82	<0.05
	<0.001	<0.001			0.016	0.009	0.78	<0.05

	<0.001	<0.001			0.001	<0.001	0.37	<0.05
	<0.001	<0.001			0.001	0.002	2.75	0.35
	0.002	<0.001			0.003	<0.001	2.01	<0.05
	0.004	<0.001			0.002	<0.001	5.39	<0.05
	0.003	<0.001			0.003	<0.001	2.90	<0.05
	0.001	<0.001			0.001	0.001	0.71	<0.05
	<0.001	<0.001			<0.001	<0.001	0.20	<0.05
<1	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	2.84	0.80
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.57	0.07
<1	0.008	<0.001	0.003	<0.001	0.006	<0.001	8.80	<0.05
<1	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	1.84	0.38
<1	<0.001	<0.001	<0.001	<0.001	0.002	0.003	1.14	0.18
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.36	0.25
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.38	<0.05
	<0.001	<0.001			<0.001	<0.001	0.50	0.08
	0.005	<0.001			0.004	<0.001	4.97	<0.05
	0.003	<0.001			0.002	<0.001	3.28	<0.05
	<0.001	<0.001			<0.001	<0.001	0.63	<0.05
	<0.001	<0.001			0.001	<0.001	0.35	<0.05
	<0.001	<0.001			<0.001	<0.001	0.91	0.16

	<0.001	<0.001			<0.001	<0.001	1.11	0.10
	<0.001	<0.001			<0.001	0.001	0.60	0.77
	<0.001	<0.001			<0.001	<0.001	0.45	<0.05
	<0.001	<0.001			<0.001	<0.001	1.00	0.20
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.37	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.36	0.10
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	3.34	2.81
<1	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.72	0.05
<1	0.001	<0.001	<0.001	<0.001	0.001	<0.001	1.51	0.15
<1	0.002	<0.001	0.002	<0.001	0.010	0.011	6.73	0.09
<1	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.35	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	2.30	0.39
<1	<0.001	<0.001	<0.001	<0.001	0.002	0.003	0.35	0.08
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.20	<0.05
	<0.001	<0.001			<0.001	0.008	0.26	0.06
<1	0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.33	0.07
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.49	0.27
	<0.001	<0.001			<0.001	<0.001	0.20	0.08
	<0.001	<0.001			<0.001	<0.001	0.40	0.09
	<0.001	<0.001			<0.001	<0.001	0.83	<0.05
	<0.001	<0.001			<0.001	<0.001	0.55	<0.05

	<0.001	<0.001			<0.001	<0.001	0.24	<0.05
	<0.001	<0.001			<0.001	<0.001	0.28	0.07
	<0.001	<0.001			<0.001	<0.001	0.93	0.09
	<0.001	<0.001			<0.001	<0.001	0.62	0.06
	<0.001	<0.001			<0.001	<0.001	0.26	0.05
	<0.001	<0.001			0.002	<0.001	0.32	0.07
	<0.001	<0.001			<0.001	<0.001	0.52	0.41
	<0.001	<0.001			<0.001	<0.001	0.99	0.22
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.09	<0.05
<1	<0.001	<0.001	<0.001	<0.001	0.005	0.006	0.10	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.18	<0.05
	<0.001	<0.001			<0.001	<0.001	0.06	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.09	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.78	0.20
1	0.001	<0.001	<0.001	<0.001	0.002	<0.001	1.67	0.07
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.20	0.12
<1	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	1.00	0.27
<1	<0.001	<0.001	<0.001	<0.001	<0.001	0.008	0.88	0.06
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.26	0.35
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.52	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.66	0.11
	<0.001	<0.001			<0.001	<0.001	0.53	0.11
<1	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.60	<0.05
	<0.001	<0.001			<0.001	<0.001	0.48	0.08
	<0.001	<0.001			<0.001	<0.001	0.41	0.08

	<0.001	<0.001			<0.001	<0.001	0.68	0.17
	<0.001	<0.001			<0.001	0.004	0.51	0.14
	<0.001	<0.001			<0.001	<0.001	0.48	<0.05
	<0.001	<0.001			0.002	<0.001	0.52	<0.05
	<0.001	<0.001			<0.001	<0.001	0.44	0.09
	<0.001	<0.001			<0.001	<0.001	0.42	0.10
	<0.001	<0.001			<0.001	<0.001	0.14	0.08
	0.005	<0.001			<0.001	<0.001	0.62	0.16
	<0.001	<0.001			<0.001	<0.001	0.59	0.58
	<0.001	<0.001			<0.001	<0.001	0.56	0.08
	<0.001	<0.001			<0.001	<0.001	0.89	0.09
	<0.010	<0.010			<0.010	<0.010	0.13	<0.10
	<0.010	<0.010			<0.010	<0.010	<0.10	<0.50
	<0.010	<0.010			<0.010	<0.010	0.13	<0.10
	<0.010	<0.010			<0.010	<0.010	<0.10	<0.50
<1	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	1.46	<0.05
	<0.010	<0.010			<0.010	<0.010	<0.10	<0.10

	<0.010	<0.010			<0.010	<0.010	<0.10	<0.50
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.68	<0.05
	0.001	<0.001			<0.001	<0.001	1.05	<0.05
	<0.001	<0.001			<0.001	<0.001	0.55	<0.05
	<0.001	<0.001			<0.001	<0.001	0.64	<0.05
	0.003	<0.001			<0.001	<0.001	2.09	<0.05
	<0.001	<0.001			<0.001	<0.001	0.26	0.17
	0.002	<0.001			<0.001	<0.001	2.07	<0.05
52	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.05	<0.05
<1	0.001	<0.001	0.002	<0.001	0.002	0.008	1.39	<0.05
<1	0.002	<0.001	0.002	<0.001	0.004	0.004	2.48	<0.05
<1	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.85	<0.05
<1	0.011	<0.001	0.005	<0.001	0.003	<0.001	2.93	<0.05
<1	0.001	<0.001	<0.001	<0.001	0.001	<0.001	1.04	<0.05
	<0.001	<0.001			<0.001	<0.001	0.73	<0.05
	0.002	<0.001			<0.001	<0.001	2.14	<0.05
	0.001	<0.001			<0.001	<0.001	1.42	<0.05
	0.007	<0.001			0.006	<0.001	7.71	<0.05
	0.006	<0.001			<0.001	<0.001	6.17	<0.05
	0.005	<0.001			0.010	<0.001	11.6	<0.05
	<0.001	<0.001			0.003	0.001	2.11	<0.05
	0.001	<0.001			<0.001	<0.001	0.41	<0.05
<1	0.030	<0.001	0.014	<0.001	0.016	<0.001	25.9	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	0.006	0.10	<0.05
<1	<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.09	0.15
<1	0.002	<0.001	0.002	<0.001	0.002	<0.001	2.67	<0.05
<1	0.026	<0.001	0.010	<0.001	0.018	<0.001	26.8	<0.05
<1	0.007	<0.001	0.003	<0.001	0.004	<0.001	6.60	<0.05
<1	0.004	<0.001	0.002	<0.001	0.003	0.004	4.12	<0.05
<1	0.003	<0.001	0.001	<0.001	0.002	<0.001	3.25	<0.05
<1	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.93	<0.05
	<0.001	<0.001			<0.001	0.003	0.60	<0.05
<1	0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.72	<0.05
	<0.001	<0.001			<0.001	<0.001	0.62	<0.05

	0.001	<0.001			<0.001	<0.001	1.24	<0.05
	0.011	<0.001			0.007	0.001	11.5	<0.05
	0.003	<0.001			0.003	<0.001	4.53	<0.05
	<0.001	<0.001			<0.001	<0.001	0.86	<0.05
	0.005	<0.001			0.003	<0.001	5.50	<0.05
	<0.001	<0.001			<0.001	<0.001	0.96	<0.05
	0.003	<0.001			0.002	<0.001	4.19	<0.05
	<0.001	<0.001			<0.001	<0.001	1.05	<0.05
	0.002	<0.001			<0.001	<0.001	2.64	0.09
	0.030	<0.001			0.016	<0.001	35.7	<0.05
	0.003	<0.001			0.002	<0.001	2.98	<0.05
<1	0.001	<0.001	<0.001	<0.001	0.001	0.002	1.52	<0.05
<1	0.002	<0.001	0.001	<0.001	0.004	0.038	2.62	0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.24	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	0.006	0.21	<0.05
<1	0.001	<0.001	<0.001	<0.001	0.001	<0.001	1.07	<0.05
<1	0.012	<0.001	0.004	<0.001	0.010	<0.001	12.1	<0.05
<1	0.006	<0.001	0.002	<0.001	0.005	<0.001	4.94	<0.05
<1	0.013	<0.001	0.004	<0.001	0.010	<0.001	11.9	<0.05
<1	0.004	<0.001	0.001	<0.001	0.004	<0.001	3.98	0.06
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.92	<0.05
	0.001	<0.001			<0.001	0.003	1.79	<0.05
<1	0.006	0.003	0.001	<0.001	<0.001	<0.001	1.18	0.06
	<0.001	<0.001			<0.001	<0.001	0.20	<0.05
	<0.001	<0.001			<0.001	<0.001	0.88	<0.05
	0.016	<0.001			0.013	0.005	16.0	<0.05
	0.001	<0.001			0.002	<0.001	1.58	<0.05
	0.002	<0.001			<0.001	<0.001	2.28	<0.05
	0.003	<0.001			0.003	0.008	3.10	<0.05
	<0.001	<0.001			<0.001	<0.001	0.60	<0.05
	0.002	<0.001			0.002	<0.001	2.04	<0.05
	0.001	<0.001			<0.001	<0.001	1.28	<0.05
	0.026	<0.001			0.016	<0.001	28.2	<0.05
	<0.001	<0.001			<0.001	<0.001	0.30	<0.05

	0.003	<0.001			0.002	<0.001	2.28	<0.05
<1	0.010	<0.001	0.003	<0.001	0.008	<0.001	10.6	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.47	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.40	<0.05
<1	0.004	<0.001	0.001	<0.001	0.003	<0.001	4.20	<0.05
<1	0.008	<0.001	0.003	<0.001	0.006	0.009	7.04	0.08
<1	0.006	<0.001	0.002	<0.001	0.005	0.003	5.40	<0.05
<1	0.002	<0.001	<0.001	<0.001	0.002	<0.001	2.56	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.22	<0.05
	<0.001	<0.001			<0.001	0.004	0.84	<0.05
<1	0.001	<0.001	<0.001	<0.001	<0.001	0.002	1.22	<0.05
	<0.001	<0.001			0.006	<0.001	0.31	<0.05
	<0.001	<0.001			<0.001	<0.001	0.53	<0.05
	<0.001	<0.001			<0.001	<0.001	0.68	<0.05
	0.004	<0.001			0.004	<0.001	4.89	<0.05
	<0.001	<0.001			<0.001	<0.001	0.23	<0.05
	0.002	<0.001			<0.001	<0.001	1.88	<0.05
<1	0.010	<0.001	0.002	<0.001	0.005	<0.001	7.21	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.38	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.36	<0.05
<1	0.006	<0.001	0.003	<0.001	0.005	<0.001	5.74	<0.05
<1	0.006	<0.001	0.002	<0.001	0.005	0.002	5.16	<0.05
<1	0.003	<0.001	0.001	<0.001	0.002	<0.001	3.13	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.07	<0.05
	0.002	<0.001			0.001	0.001	1.86	<0.05
<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.91	<0.05
	<0.001	<0.001			<0.001	<0.001	0.54	<0.05
	<0.001	<0.001			<0.001	<0.001	0.38	<0.05
	0.003	<0.001			0.003	<0.001	0.67	<0.05
	<0.001	<0.001			<0.001	<0.001	0.89	<0.05

	<0.001	<0.001			<0.001	<0.001	<0.05	<0.05
	<0.001	<0.001			<0.001	<0.001	0.44	<0.05
<1	0.004	<0.001	0.003	<0.001	0.002	<0.001	3.42	<0.05
<1	0.006	<0.001	0.004	0.001	0.003	<0.001	5.22	0.25
<1	0.001	<0.001	<0.001	<0.001	0.001	<0.001	1.09	<0.05
<1	0.002	<0.001	<0.001	<0.001	<0.001	0.008	1.61	<0.05
<1	0.015	<0.001	0.006	<0.001	0.011	<0.001	12.9	0.52
<1	0.004	<0.001	0.002	<0.001	0.003	<0.001	4.24	0.07
<1	0.003	<0.001	0.001	<0.001	<0.001	<0.001	2.53	<0.05
	0.004	<0.001			0.002	0.001	2.76	<0.05
<1	0.002	<0.001	<0.001	<0.001	<0.001	0.002	1.74	<0.05
	<0.001	<0.001			<0.001	<0.001	0.16	<0.05
	<0.001	<0.001			<0.001	<0.001	0.85	<0.05
	0.005	<0.001			0.004	0.008	4.38	<0.05
	0.008	<0.001			0.007	<0.001	8.52	<0.05
	0.013	<0.001			0.004	<0.001	12.1	<0.05
	0.002	<0.001			0.001	0.006	2.04	<0.05
	<0.001	<0.001			<0.001	<0.001	0.33	<0.05
	0.001	<0.001			0.001	<0.001	1.10	<0.05
	0.010	<0.001			0.005	<0.001	10.5	<0.05
	<0.001	<0.001			<0.001	<0.001	0.20	<0.05

Metals

Lead	Lead (filtered)	Lithium	Lithium (filtered)	Manganese	Manganese (filtered)	Mercury	Mercury (filtered)	Molybdenum
<0.001	<0.001	0.004	0.003	0.033	0.027	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	0.001	0.012	0.007	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	0.002	0.011	0.008	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.007	0.002	0.004	0.001	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.008	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.002	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.005	0.005			<0.0001	<0.0001	
<0.001	<0.001	0.005	0.003			<0.0001	<0.0001	

<0.001	<0.001	0.003	0.003			<0.0001	<0.0001	
<0.001	<0.001	0.004	0.004			<0.0001	<0.0001	
<0.001	<0.001	0.004	0.004			<0.0001	<0.0001	
<0.001	<0.001	0.001	<0.001	0.019	0.016	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.001	0.001	0.008	0.007	<0.0001	<0.0001	<0.001
<0.001	<0.001	<0.001	0.001	0.005	0.003	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.001	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.003	0.002			<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001			<0.0001	<0.0001	
<0.001	<0.001	<0.001	0.001			<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.004	0.003			<0.0001	<0.0001	
<0.001	<0.001	0.001	0.001			<0.0001	<0.0001	
<0.001	<0.001	0.001	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.520	0.555	0.015	<0.001	<0.0001	<0.0001	<0.001
0.002	<0.001	0.870	0.869	0.398	0.358	<0.0001	<0.0001	0.001
0.001	<0.001	0.448	0.384	0.096	0.071	<0.0001	<0.0001	0.001
<0.001	<0.001	0.376	0.320	0.069	0.056	<0.0001	<0.0001	<0.001

<0.001	<0.001	0.321	0.345	0.065	0.056	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.340	0.293	0.059	0.048	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.292	0.328	0.046	0.042	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.400	0.313	0.040	0.032	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.319	0.310	0.028	0.004	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.331	0.314			<0.0001	<0.0001	
<0.001	<0.001	0.322	0.291	0.023	0.009	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.332	0.315			<0.0001	<0.0001	
<0.001	<0.001	0.375	0.319			<0.0001	<0.0001	
<0.001	<0.001	0.384	0.316			<0.0001	<0.0001	
<0.001	<0.001	0.378	0.332			<0.0001	<0.0001	
<0.001	<0.001	0.362	0.334			<0.0001	<0.0001	
<0.001	<0.001	0.300	0.297			<0.0001	<0.0001	
<0.001	<0.001	0.254	0.301			<0.0001	<0.0001	
<0.001	<0.001	0.292	0.326			<0.0001	<0.0001	
<0.001	<0.001	0.219	0.198			<0.0001	<0.0001	
<0.001	<0.001	0.151	0.136			<0.0001	<0.0001	
<0.001	<0.001	0.098	0.103			<0.0001	<0.0001	

<0.001	<0.001	0.111	0.102			<0.0001	<0.0001	
<0.001	<0.001	0.130	0.127			<0.0001	<0.0001	
<0.001	<0.001	0.123	0.134			<0.0001	<0.0001	
0.001	<0.001	0.153	0.089			<0.0001	<0.0001	
0.001	<0.001	0.159	0.118			<0.0001	<0.0001	
<0.001	<0.001	0.332	0.212			<0.0001	<0.0001	
0.002	<0.001	0.363	0.344			<0.0001	<0.0001	
<0.001	<0.001	0.011	0.008	0.034	0.012	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.004	0.002	0.032	0.024	<0.0001	<0.0001	<0.001
0.005	<0.001	0.025	0.002	0.061	0.006	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.004	0.005	0.020	0.019	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.002	0.002	0.015	0.013	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.011	0.004	0.012	0.008	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.006	0.001	0.004	<0.001	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.002	<0.001			<0.0001	<0.0001	
0.002	<0.001	0.034	0.017			<0.0001	<0.0001	
0.001	<0.001	0.020	0.014			<0.0001	<0.0001	
<0.001	<0.001	0.072	0.059			<0.0001	<0.0001	
<0.001	<0.001	0.062	0.064			<0.0001	<0.0001	
<0.001	<0.001	0.002	<0.001			<0.0001	<0.0001	

<0.001	<0.001	0.017	0.014			<0.0001	<0.0001	
<0.001	<0.001	0.009	0.011			<0.0001	<0.0001	
<0.001	<0.001	0.023	0.024			<0.0001	<0.0001	
<0.001	<0.001	0.003	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.021	0.020	0.045	0.038	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.004	0.002	0.007	0.004	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.008	0.008	0.050	0.011	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.004	0.001	0.015	0.005	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.006	0.002	0.017	0.005	<0.0001	<0.0001	<0.001
0.003	<0.001	0.001	0.002	0.338	0.006	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	0.001	0.008	0.006	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.004	0.004	0.026	0.018	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.002	0.001	0.006	0.005	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.002	0.001	0.013	0.009	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.001	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.002	0.003	0.004	0.003	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.010	0.004	0.013	0.008	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.001	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.001	0.001			<0.0001	<0.0001	
<0.001	<0.001	0.012	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.004	0.002			<0.0001	<0.0001	

<0.001	<0.001	0.002	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.003	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.002	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.002	0.003			<0.0001	<0.0001	
<0.001	<0.001	0.003	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.002	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.002	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.004	0.003			<0.0001	<0.0001	
<0.001	<0.001	0.001	<0.001	0.004	0.002	<0.0001	<0.0001	<0.001
<0.001	<0.001	<0.001	0.001	0.005	0.003	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.001	0.002	0.006	0.004	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.001	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.009	0.007	0.032	0.022	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.006	0.005	0.013	0.009	<0.0001	<0.0001	<0.001
0.001	<0.001	0.012	0.003	0.027	0.005	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.014	0.002	0.013	0.006	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	<0.001	0.015	0.006	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.004	0.002	0.014	0.011	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.004	0.002	0.008	0.006	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	0.002	0.009	0.006	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	0.002	0.006	0.004	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.003	0.002	0.005	0.005	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	0.001			<0.0001	<0.0001	
<0.001	<0.001	0.001	0.003			<0.0001	<0.0001	

<0.001	<0.001	0.002	0.003			<0.0001	<0.0001	
<0.001	<0.001	0.003	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.008	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.003	0.003			<0.0001	<0.0001	
<0.001	<0.001	0.006	0.006			<0.0001	<0.0001	
<0.001	<0.001	0.008	0.005			<0.0001	<0.0001	
<0.001	<0.001	0.003	0.003			<0.0001	<0.0001	
<0.001	<0.001	0.004	0.005			<0.0001	<0.0001	
<0.001	<0.001	0.006	0.005			<0.0001	<0.0001	
<0.001	<0.001	0.006	0.006			<0.0001	<0.0001	
<0.001	<0.001	0.005	0.005			<0.0001	<0.0001	
<0.010	<0.010	0.090	0.084			<0.0001	<0.0001	
<0.010	<0.010	0.173	0.128			<0.0001	<0.0001	
<0.010	<0.010	0.103	0.101			<0.0001	<0.0001	
<0.010	<0.010	0.147	0.136			<0.0001	<0.0001	
<0.001	<0.001	0.023	0.023	0.076	0.059	<0.0001	<0.0001	0.002
<0.010	<0.010	0.112	0.104			<0.0001	<0.0001	

<0.010	<0.010	0.146	0.145			<0.0001	<0.0001	
<0.001	<0.001	0.024	0.025	0.056	0.045	<0.0001	<0.0001	0.001
<0.001	<0.001	0.009	0.004			<0.0001	<0.0001	
<0.001	<0.001	0.016	0.012			<0.0001	<0.0001	
<0.001	<0.001	0.025	0.022			<0.0001	<0.0001	
<0.001	<0.001	0.036	0.027			<0.0001	<0.0001	
<0.001	<0.001	0.040	0.042			<0.0001	<0.0001	
<0.001	<0.001	0.020	0.023			<0.0001	<0.0001	
<0.001	<0.001	4.09	4.01	0.290	0.129	<0.0001	<0.0001	0.009
0.001	<0.001	0.093	0.079	0.099	0.070	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.105	0.081	0.109	0.044	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.095	0.100	0.035	0.002	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.144	0.141	0.199	<0.001	<0.0001	<0.0001	0.010
<0.001	<0.001	0.101	0.118	0.015	<0.001	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.130	0.114			<0.0001	<0.0001	
<0.001	<0.001	0.163	0.133			<0.0001	<0.0001	
<0.001	<0.001	0.137	0.138			<0.0001	<0.0001	
0.002	<0.001	0.087	0.069			<0.0001	<0.0001	
<0.001	<0.001	0.106	0.077			<0.0001	<0.0001	
0.002	<0.001	0.105	0.103			<0.0001	<0.0001	
0.002	<0.001	3.27	2.47			<0.0001	<0.0001	
0.003	<0.001	1.82	1.81			<0.0001	<0.0001	
0.018	<0.001	0.067	<0.001	0.230	0.002	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.002	0.002	0.047	0.044	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	0.002	0.073	0.068	<0.0001	<0.0001	<0.001
0.002	<0.001	0.012	0.003	0.091	0.067	<0.0001	<0.0001	<0.001
0.016	<0.001	0.072	0.005	0.237	0.010	<0.0001	<0.0001	<0.001
0.003	<0.001	0.021	0.006	0.090	0.039	<0.0001	<0.0001	<0.001
0.002	<0.001	0.014	0.004	0.074	0.037	<0.0001	<0.0001	<0.001
0.001	<0.001	0.009	0.005	0.052	0.030	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.006	0.003	0.049	0.037	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.005	0.004			<0.0001	<0.0001	
<0.001	<0.001	0.002	0.003	0.070	0.057	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	0.001			<0.0001	<0.0001	

<0.001	<0.001	0.004	0.002			<0.0001	<0.0001	
0.010	<0.001	0.003	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.011	0.004			<0.0001	<0.0001	
<0.001	<0.001	0.009	0.003			<0.0001	<0.0001	
0.002	<0.001	0.012	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.007	0.004			<0.0001	<0.0001	
0.001	<0.001	0.009	0.003			<0.0001	<0.0001	
<0.001	<0.001	0.004	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.008	0.003			<0.0001	<0.0001	
0.012	<0.001	0.072	0.005			<0.0001	<0.0001	
<0.001	<0.001	0.010	0.003			<0.0001	<0.0001	
0.001	<0.001	0.056	0.062	0.154	0.128	<0.0001	<0.0001	<0.001
0.003	<0.001	0.066	0.020	0.134	0.043	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.022	0.021	0.066	0.056	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.019	0.020	0.073	0.035	<0.0001	<0.0001	<0.001
0.001	<0.001	0.025	0.015	0.106	0.080	<0.0001	<0.0001	<0.001
0.010	<0.001	0.052	0.012	0.220	0.063	<0.0001	<0.0001	<0.001
0.006	<0.001	0.024	0.009	0.125	0.043	<0.0001	<0.0001	<0.001
0.008	<0.001	0.041	0.009	0.139	0.046	<0.0001	<0.0001	<0.001
0.003	<0.001	0.013	0.008	0.060	0.031	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.011	0.006	0.047	0.026	<0.0001	<0.0001	0.001
0.001	<0.001	0.012	0.007			<0.0001	<0.0001	
<0.001	<0.001	0.010	0.006	0.071	0.052	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.006	0.002			<0.0001	<0.0001	
<0.001	0.002	0.006	0.004			<0.0001	<0.0001	
0.011	<0.001	0.050	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.021	0.017			<0.0001	<0.0001	
<0.001	<0.001	0.027	0.014			<0.0001	<0.0001	
0.003	<0.001	0.031	0.017			<0.0001	<0.0001	
<0.001	<0.001	0.020	0.014			<0.0001	<0.0001	
0.002	<0.001	0.026	0.019			<0.0001	<0.0001	
0.001	<0.001	0.019	0.015			<0.0001	<0.0001	
0.018	<0.001	0.092	0.014			<0.0001	<0.0001	
<0.001	<0.001	0.014	0.010			<0.0001	<0.0001	

0.003	<0.001	0.512	0.437			<0.0001	<0.0001	
0.009	<0.001	0.031	<0.001	0.084	0.003	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.002	0.003	0.025	0.018	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	0.002	0.052	0.043	<0.0001	<0.0001	<0.001
0.002	<0.001	0.012	0.001	0.069	0.034	<0.0001	<0.0001	<0.001
0.004	<0.001	0.023	0.003	0.100	0.021	<0.0001	<0.0001	<0.001
0.002	<0.001	0.016	0.002	0.079	0.033	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.007	0.003	0.052	0.031	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	0.002	0.040	0.034	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.007	0.004			<0.0001	<0.0001	
<0.001	<0.001	0.006	0.005	0.118	0.094	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.707	0.004			<0.0001	<0.0001	
<0.001	<0.001	0.008	0.006			<0.0001	<0.0001	
<0.001	<0.001	<0.001	<0.001			<0.0001	<0.0001	
0.002	<0.001	0.017	0.001			<0.0001	<0.0001	
<0.001	<0.001	0.002	0.001			<0.0001	<0.0001	
<0.001	<0.001	0.007	<0.001			<0.0001	<0.0001	
0.011	<0.001	0.014	<0.001	0.016	<0.001	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.004	0.002	0.010	0.009	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.003	0.001	0.006	0.003	<0.0001	<0.0001	<0.001
0.004	<0.001	0.020	0.002	0.076	0.006	<0.0001	<0.0001	<0.001
0.002	<0.001	0.020	0.002	0.065	0.015	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.009	0.003	0.036	0.016	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.004	0.002	0.022	0.019	<0.0001	<0.0001	<0.001
0.001	<0.001	0.007	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.003	0.003	0.014	0.012	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.019	0.002			<0.0001	<0.0001	
<0.001	<0.001	0.004	0.003			<0.0001	<0.0001	
0.003	<0.001	<0.001	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.003	<0.001			<0.0001	<0.0001	

<0.001	<0.001	0.001	0.001			<0.0001	<0.0001	
<0.001	<0.001	0.002	<0.001			<0.0001	<0.0001	
0.004	<0.001	0.033	<0.001	0.042	0.005	<0.0001	<0.0001	<0.001
0.005	0.002	0.018	<0.001	0.068	0.041	<0.0001	<0.0001	<0.001
0.002	<0.001	0.005	<0.001	0.015	0.006	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.005	0.001	0.025	0.012	<0.0001	<0.0001	<0.001
0.006	0.001	0.039	0.004	0.095	0.035	<0.0001	<0.0001	<0.001
0.002	<0.001	0.010	0.002	0.038	0.012	<0.0001	<0.0001	<0.001
0.002	<0.001	0.011	0.001	0.036	0.010	<0.0001	<0.0001	<0.001
0.002	<0.001	0.011	<0.001			<0.0001	<0.0001	
0.001	<0.001	0.005	0.001	0.031	0.016	<0.0001	<0.0001	<0.001
<0.001	<0.001	0.002	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.004	0.002			<0.0001	<0.0001	
0.002	<0.001	<0.001	<0.001			<0.0001	<0.0001	
0.003	<0.001	0.021	0.001			<0.0001	<0.0001	
0.004	<0.001	0.038	0.002			<0.0001	<0.0001	
0.001	<0.001	0.006	<0.001			<0.0001	<0.0001	
<0.001	<0.001	0.003	0.003			<0.0001	<0.0001	
<0.001	<0.001	0.005	0.004			<0.0001	<0.0001	
0.006	<0.001	0.028	0.004			<0.0001	<0.0001	
<0.001	<0.001	0.002	0.001			<0.0001	<0.0001	

Molybdenum (filtered)	Nickel	Nickel (filtered)	Selenium	Selenium (filtered)	Silver	Silver (filtered)	Strontium	Strontium (filtered)
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.002	0.002
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.002	0.001
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.002	0.002
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.009	0.004
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						

	<0.001	0.005						
	<0.001	<0.001						
	<0.001	<0.001						
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.002	0.002
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.001	0.001
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.001	0.004
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	0.002						
	<0.001	<0.001						
	<0.001	<0.001						
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.046	0.042
0.002	0.005	0.002	<0.01	<0.01	<0.001	<0.001	0.090	0.090
<0.001	0.003	0.001	<0.01	<0.01	<0.001	<0.001	0.049	0.043
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.061	0.037

<0.001	0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.039	0.033
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.038	0.037
<0.001	0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.041	0.039
<0.001	0.004	<0.001	<0.01	<0.01	<0.001	<0.001	0.042	0.038
<0.001	0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.039	0.038
	0.001	<0.001						
<0.001	<0.001	0.001	<0.01	<0.01	<0.001	<0.001	0.040	0.032
	0.001	<0.001						
	0.001	<0.001						
	0.001	<0.001						
	0.001	<0.001						
	0.001	0.001						
	<0.001	<0.001						
	0.002	0.001						
	0.001	<0.001						
	0.003	0.001						
	<0.001	0.001						
	0.001	0.001						

	<0.001	<0.001						
	0.002	0.001						
	0.002	<0.001						
	0.004	<0.001						
	0.003	<0.001						
	0.002	<0.001						
	0.001	<0.001						
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.004	0.003
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.012	0.009
<0.001	0.005	<0.001	<0.01	<0.01	<0.001	<0.001	0.009	0.002
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.003	0.003
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.008	0.007
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.013	0.007
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.011	0.007
	0.001	<0.001						
	0.004	<0.001						
	0.002	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						

	<0.001	0.002						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
0.003	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.027	0.023
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.006	0.004
<0.001	0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.008	0.007
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.007	0.005
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.006	0.004
<0.001	0.009	<0.001	<0.01	<0.01	<0.001	<0.001	0.044	0.002
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.005	0.006
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.003	0.003
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.005	0.004
<0.001	0.003	<0.001	<0.01	<0.01	<0.001	<0.001	0.004	0.003
	<0.001	<0.001						
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.033	0.026
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.012	0.006
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						

	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	0.003	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.001	<0.001
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.002	0.002
	<0.001	<0.001						
0.002	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.010	0.007
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.013	0.011
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.013	0.006
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.009	0.006
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.007	0.006
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.004	0.004
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.006	0.005
<0.001	0.003	<0.001	<0.01	<0.01	<0.001	<0.001	0.008	0.007
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.003	0.003
	<0.001	<0.001						
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.014	0.013
	<0.001	<0.001						
	<0.001	<0.001						

	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	<0.010	<0.010						
	<0.010	<0.010						
	<0.010	<0.010						
	<0.010	<0.010						
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.757	0.784
	<0.010	<0.010						

	<0.010	<0.010						
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.836	0.862
	<0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
	0.001	<0.001						
	<0.001	<0.001						
	<0.001	<0.001						
0.008	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.231	0.233
<0.001	0.003	<0.001	<0.01	<0.01	<0.001	<0.001	0.020	0.017
<0.001	0.003	<0.001	<0.01	<0.01	<0.001	<0.001	0.022	0.018
<0.001	0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.024	0.021
0.002	0.009	<0.001	<0.01	<0.01	<0.001	<0.001	2.65	0.022
<0.001	0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.024	0.021
	0.001	<0.001						
	0.003	<0.001						
	0.002	<0.001						
	0.006	<0.001						
	0.004	<0.001						
	0.005	<0.001						
	0.001	<0.001						
	0.004	0.001						
<0.001	0.024	<0.001	<0.01	<0.01	<0.001	<0.001	0.003	<0.001
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.020	0.020
<0.001	0.001	0.001	<0.01	<0.01	<0.001	<0.001	0.022	0.021
<0.001	0.003	0.002	<0.01	<0.01	<0.001	<0.001	0.032	0.026
<0.001	0.019	<0.001	<0.01	<0.01	<0.001	<0.001	0.017	0.002
<0.001	0.006	<0.001	<0.01	<0.01	<0.001	<0.001	0.012	0.008
<0.001	0.004	<0.001	<0.01	<0.01	<0.001	<0.001	0.011	0.009
<0.001	0.002	<0.001	<0.01	<0.01	<0.001	<0.001	0.018	0.014
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.015	0.013
	<0.001	<0.001						
<0.001	0.001	0.002	<0.01	<0.01	<0.001	<0.001	0.012	0.010
	<0.001	<0.001						

	<0.001	<0.001						
	0.006	<0.001						
	0.003	<0.001						
	<0.001	0.001						
	0.003	<0.001						
	<0.001	<0.001						
	0.002	<0.001						
	0.001	<0.001						
	0.002	<0.001						
	0.020	<0.001						
	0.002	<0.001						
<0.001	0.002	<0.001	<0.01	<0.01	<0.001	<0.001	0.034	0.029
<0.001	0.002	0.002	<0.01	<0.01	<0.001	<0.001	0.040	0.019
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.043	0.043
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.051	0.048
<0.001	0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.077	0.063
<0.001	0.008	<0.001	<0.01	<0.01	<0.001	<0.001	0.079	0.047
0.001	0.004	<0.001	<0.01	<0.01	<0.001	<0.001	0.054	0.033
<0.001	0.010	<0.001	<0.01	<0.01	<0.001	<0.001	0.065	0.054
<0.001	0.002	<0.001	<0.01	<0.01	<0.001	<0.001	0.075	0.063
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.099	0.083
	0.001	<0.001						
<0.001	0.004	0.002	<0.01	<0.01	<0.001	<0.001	0.016	0.006
	<0.001	<0.001						
	<0.001	0.002						
	0.010	<0.001						
	0.001	<0.001						
	<0.001	<0.001						
	0.002	<0.001						
	<0.001	<0.001						
	0.001	<0.001						
	0.001	<0.001						
	0.017	<0.001						
	<0.001	<0.001						

	0.002	<0.001						
0.004	0.008	<0.001	<0.01	<0.01	<0.001	<0.001	0.005	<0.001
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.040	0.037
<0.001	0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.020	0.018
<0.001	0.003	<0.001	<0.01	<0.01	<0.001	<0.001	0.010	0.007
<0.001	0.007	<0.001	<0.01	<0.01	<0.001	<0.001	0.004	0.001
<0.001	0.006	<0.001	<0.01	<0.01	<0.001	<0.001	0.008	0.006
<0.001	0.002	<0.001	<0.01	<0.01	<0.001	<0.001	0.010	0.008
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.015	0.013
	0.001	<0.001						
<0.001	0.001	0.001	<0.01	<0.01	<0.001	<0.001	0.079	0.070
	0.022	<0.001						
	0.002	<0.001						
	<0.001	<0.001						
	0.004	<0.001						
	<0.001	<0.001						
	0.001	<0.001						
0.002	0.005	<0.001	<0.01	<0.01	<0.001	<0.001	0.001	<0.001
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.007	0.006
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.002	<0.001
<0.001	0.006	<0.001	<0.01	<0.01	<0.001	<0.001	0.004	<0.001
<0.001	0.005	<0.001	<0.01	<0.01	<0.001	<0.001	0.004	0.002
<0.001	0.003	<0.001	<0.01	<0.01	<0.001	<0.001	0.005	0.003
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.005	0.004
	0.002	<0.001						
<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.004	0.004
	<0.001	<0.001						
	<0.001	<0.001						
	0.001	<0.001						
	<0.001	<0.001						

	<0.001	<0.001						
	<0.001	<0.001						
0.004	0.004	<0.001	<0.01	<0.01	<0.001	<0.001	0.003	<0.001
<0.001	0.008	<0.001	<0.01	<0.01	<0.001	<0.001	0.046	0.010
<0.001	0.001	<0.001	<0.01	<0.01	<0.001	<0.001	0.003	0.002
<0.001	0.002	<0.001	<0.01	<0.01	<0.001	<0.001	0.003	0.002
<0.001	0.013	<0.001	<0.01	<0.01	<0.001	<0.001	0.005	0.004
<0.001	0.003	<0.001	<0.01	<0.01	<0.001	<0.001	0.004	0.002
<0.001	0.003	<0.001	<0.01	<0.01	<0.001	<0.001	0.004	0.003
	0.003	<0.001						
<0.001	0.002	<0.001	<0.01	<0.01	<0.001	<0.001	0.003	0.003
	<0.001	<0.001						
	0.002	<0.001						
	0.003	<0.001						
	0.007	<0.001						
	0.009	<0.001						
	0.002	<0.001						
	<0.001	0.001						
	<0.001	<0.001						
	0.007	<0.001						
	<0.001	<0.001						

Thallium	Thallium (filtered)	Thorium	Thorium (filtered)	Tin	Tin (filtered)	Titanium	Titanium (filtered)	Uranium
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1

<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.18	<0.01	<1
<0.001	<0.001	3	<1	<0.001	<0.001	0.07	0.02	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.01	<0.01	<1

<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1

<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.01	0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.25	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.02	0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.01	<0.01	<1

<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	0.03	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.02	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.05	0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1

<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.04	0.07	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.03	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.02	0.02	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.01	<0.01	<1

<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.05	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.09	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.03	<0.01	<1
<0.001	<0.001	2	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.04	<0.01	<1
<0.001	<0.001	3	<1	<0.001	<0.001	0.15	<0.01	1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	2	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.08	<0.01	<1
<0.001	<0.001	8	<1	<0.001	<0.001	0.74	<0.01	3
<0.001	<0.001	2	<1	<0.001	<0.001	0.27	<0.01	<1
<0.001	<0.001	1	<1	<0.001	<0.001	0.16	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.10	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.04	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.03	<0.01	<1

<0.001	<0.001	<1	<1	<0.001	<0.001	0.04	<0.01	<1
<0.001	<0.001	2	<1	<0.001	<0.001	0.06	<0.01	1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.02	<0.01	<1
<0.001	<0.001	2	<1	<0.001	<0.001	0.29	<0.01	4
<0.001	<0.001	3	<1	<0.001	<0.001	0.14	<0.01	2
<0.001	<0.001	6	<1	<0.001	<0.001	0.32	<0.01	2
<0.001	<0.001	<1	<1	<0.001	<0.001	0.09	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.02	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.05	<0.01	<1

<0.001	<0.001	5	<1	<0.001	<0.001	0.18	<0.01	2
<0.001	<0.001	<1	<1	<0.001	<0.001	0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.14	<0.01	<1
<0.001	<0.001	2	<1	<0.001	<0.001	0.30	<0.01	<1
<0.001	<0.001	2	<1	<0.001	<0.001	0.22	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.10	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.03	<0.01	<1
<0.001	<0.001	4	<1	<0.001	<0.001	0.05	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	2	<1	<0.001	<0.001	0.24	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.21	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.11	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	<0.01	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.03	<0.01	<1

<0.001	<0.001	1	<1	<0.001	<0.001	0.07	<0.01	<1
<0.001	<0.001	2	<1	<0.001	<0.001	0.09	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.02	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.06	<0.01	<1
<0.001	<0.001	4	<1	<0.001	<0.001	0.46	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.13	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.08	<0.01	<1
<0.001	<0.001	<1	<1	<0.001	<0.001	0.05	<0.01	<1

					Organics Other			
Uranium (filtered)	Vanadium	Vanadium (filtered)	Zinc	Zinc (filtered)	Sulfate as SO4 - Turbidimetric (filtered)	Chloride	Calcium (filtered)	Magnesium (filtered)
<1	<0.01	<0.01	<0.005	<0.005	<1	3	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	1	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	3	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	2	<1	<1
			0.005	<0.005	<1	4	<1	<1
			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	1	3	<1	<1

			0.027	0.007	<1	3	<1	<1
			<0.005	<0.005	<1	4	<1	<1
			<0.005	<0.005	<1	4	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	1	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	2	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	2	<1	<1
			0.011	<0.005	<1	2	<1	<1
			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	<1	5	1	<1
			<0.005	<0.005	<1	4	<1	<1
			<0.005	<0.005	<1	2	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	6	2	4	6
<1	<0.01	<0.01	0.092	<0.005	6	3	8	11
<1	<0.01	<0.01	0.011	<0.005	5	2	4	6
<1	<0.01	<0.01	<0.005	<0.005	4	2	3	5

<1	<0.01	<0.01	<0.005	0.007	4	3	3	4
<1	<0.01	<0.01	<0.005	<0.005	5	2	3	5
<1	<0.01	<0.01	0.008	<0.005	4	3	4	5
<1	<0.01	<0.01	0.007	<0.005	4	2	3	5
<1	<0.01	<0.01	<0.005	<0.005	4	2	3	5
					4	2	3	4
<1	<0.01	<0.01	<0.005	<0.005	4	2	3	4
			<0.005	<0.005	4	2	3	5
			<0.005	<0.005	4	2	3	5
			<0.005	<0.005	4	3	3	5
			<0.005	<0.005	4	2	3	5
			<0.005	<0.005	4	3	3	5
			<0.005	<0.005	4	2	3	4
			0.006	<0.005	4	3	3	5
			0.008	<0.005	4	2	3	4
			0.007	<0.005	4	2	2	3
			<0.005	<0.005	9	3	2	3
			<0.005	<0.005	9	3	1	2

			<0.005	<0.005	12	3	1	2
			<0.005	<0.005	9	3	1	2
			0.007	0.010	11	3	1	2
			0.014	<0.005	12	3	2	3
			0.009	<0.005	13	3	2	3
			<0.005	<0.005	12	3	3	4
			<0.005	<0.005	12	4	4	4
<1	<0.01	<0.01	0.006	<0.005	<1	6	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	7	1	<1	<1
<1	<0.01	<0.01	0.025	<0.005	<1	<1	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	4	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	2	4	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	3	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	2	3	<1	<1
			<0.005	<0.005	<1	2	<1	<1
			0.018	<0.005	2	4	<1	<1
			0.008	<0.005	1	3	<1	<1
			<0.005	<0.005	5	3	<1	1
			<0.005	<0.005	7	3	<1	1
			<0.005	<0.005	<1	4	<1	<1

			<0.005	<0.005	<1	4	1	<1
			<0.005	<0.005	2	4	<1	<1
			<0.005	<0.005	4	3	<1	<1
			<0.005	<0.005	<1	4	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	14	<1	4	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	1	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	5	<1	1
<1	<0.01	<0.01	<0.005	<0.005	<1	1	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	4	<1	<1
<1	<0.01	<0.01	0.751	0.018	<1	4	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	1	3	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	4	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	1	3	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	3	2	<1	<1
					<1	2	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	7	3	2	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	2	2	<1	<1
			<0.005	<0.005	<1	2	<1	<1
			0.006	<0.005	3	3	<1	<1
			<0.005	<0.005	1	2	<1	<1

			<0.005	<0.005	1	3	<1	<1
			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	<1	4	<1	<1
			<0.005	<0.005	1	4	<1	<1
			<0.005	<0.005	1	3	<1	<1
			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	1	3	<1	<1
			<0.005	<0.005	<1	4	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	1	<1	<1
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<1	<0.01	<0.01	<0.005	<0.005	2	2	<1	<1
			<0.005	<0.005	<1	2	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	4	5	1	<1
<1	<0.01	<0.01	<0.005	<0.005	4	4	1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	1	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	2	4	1	<1
<1	<0.01	<0.01	<0.005	0.012	1	4	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	3	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	1	3	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	3	3	1	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	3	<1	<1
					<1	3	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	3	11	1	<1
			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	2	3	<1	<1

			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	2	4	<1	<1
			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	<1	3	<1	<1
			<0.005	<0.005	1	3	<1	<1
			<0.005	<0.005	<1	4	<1	<1
			<0.005	<0.005	<1	4	<1	<1
			<0.005	<0.005	<1	4	<1	<1
			<0.005	<0.005	<1	4	<1	<1
			<0.005	<0.005	<1	2	<1	<1
			<0.052	<0.050	994	11,100	228	686
			<0.052	<0.050	2,080	14,800	342	998
			<0.052	<0.050	2,110	13,600	293	857
			<0.052	<0.050	2,240	16,000	382	1,120
<1	<0.01	<0.01	<0.005	<0.005	285	2,060	45	129
			<0.052	<0.050	2,260	15,600	347	1,020

			<0.052	<0.050	2,300	16,300	401	1,170
<1	<0.01	<0.01	0.005	<0.005	308	2,400	50	141
			0.006	<0.005	9	81	2	4
			<0.005	<0.005	233	1,530	32	90
			<0.005	<0.005	283	2,280	47	134
			<0.005	<0.005	420	3,230	74	207
			<0.005	<0.005	598	4,920	108	303
			0.008	<0.005	208	1,570	33	99
5	<0.01	<0.01	<0.005	<0.005	6	10	26	27
<1	<0.01	<0.01	0.007	0.010	4	3	1	2
<1	<0.01	<0.01	0.011	<0.005	5	4	1	3
<1	<0.01	<0.01	<0.005	<0.005	5	4	2	3
<1	<0.01	<0.01	0.058	<0.005	5	4	2	3
<1	<0.01	<0.01	<0.005	<0.005	5	4	2	3
			<0.005	<0.005	6	4	2	3
			0.010	<0.005	5	4	2	3
			0.006	<0.005	6	4	2	3
			0.031	<0.005	6	2	<1	1
			0.016	<0.005	8	3	<1	2
			0.018	<0.005	6	3	<1	2
			0.006	<0.005	9	8	23	18
			0.007	<0.005	6	6	18	12
<1	0.02	<0.01	0.096	<0.005	<1	<1	<1	<1
<1	<0.01	<0.01	<0.005	0.007	25	2	9	1
<1	<0.01	<0.01	<0.005	<0.005	16	1	5	1
<1	<0.01	<0.01	0.012	<0.005	25	1	7	<1
<1	0.02	<0.01	0.105	<0.005	<1	2	<1	<1
<1	<0.01	<0.01	0.023	<0.005	5	4	1	<1
<1	<0.01	<0.01	0.013	<0.005	4	5	1	<1
<1	<0.01	<0.01	0.009	<0.005	10	4	3	<1
<1	<0.01	<0.01	<0.005	<0.005	9	4	3	<1
					9	4	2	1
<1	<0.01	<0.01	0.007	<0.005	8	3	1	<1
			<0.005	<0.005	7	3	<1	<1

			<0.005	<0.005	7	3	<1	<1
			0.029	<0.005	<1	3	<1	<1
			0.014	<0.005	5	3	<1	<1
			0.015	0.022	12	3	<1	1
			0.023	<0.005	4	3	<1	<1
			0.006	<0.005	5	2	<1	<1
			0.010	<0.005	4	2	<1	<1
			0.005	<0.005	5	2	<1	<1
			0.007	<0.005	5	3	<1	<1
			0.077	<0.005	4	<1	<1	<1
			0.009	<0.005	8	3	<1	<1
<1	<0.01	<0.01	0.008	0.008	25	<1	8	1
<1	<0.01	<0.01	0.013	0.037	12	<1	4	1
<1	<0.01	<0.01	<0.005	<0.005	24	1	8	<1
<1	<0.01	<0.01	<0.005	0.008	31	2	14	1
<1	<0.01	<0.01	0.008	<0.005	20	1	6	1
<1	0.01	<0.01	0.046	<0.005	6	6	2	<1
<1	<0.01	<0.01	0.027	<0.005	4	5	1	<1
<1	0.01	<0.01	0.047	<0.005	18	5	7	1
<1	<0.01	<0.01	0.020	<0.005	33	5	13	1
<1	<0.01	<0.01	<0.005	<0.005	40	5	19	2
					23	4	8	2
<1	<0.01	<0.01	0.007	<0.005	9	2	2	1
			<0.005	<0.005	14	2	4	2
			0.006	<0.005	19	3	6	2
			0.066	0.006	6	2	<1	<1
			0.017	0.009	12	3	2	<1
			0.008	<0.005	8	3	1	<1
			0.016	<0.005	7	3	2	<1
			0.006	0.010	9	3	3	1
			0.013	0.006	11	3	3	<1
			0.012	0.005	12	3	4	<1
			0.065	<0.005	6	<1	2	<1
			<0.005	<0.005	9	2	2	<1

			0.024	<0.005	10	5	2	2
<1	<0.01	<0.01	0.020	<0.005	<1	<1	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	60	<1	21	<1
<1	<0.01	<0.01	0.006	<0.005	25	<1	8	1
<1	<0.01	<0.01	0.011	<0.005	10	<1	2	<1
<1	<0.01	<0.01	0.032	0.012	2	4	<1	<1
<1	<0.01	<0.01	0.025	<0.005	9	4	2	<1
<1	<0.01	<0.01	0.010	<0.005	13	4	4	<1
<1	<0.01	<0.01	<0.005	<0.005	21	4	7	1
					12	2	3	1
<1	<0.01	<0.01	0.006	0.010	19	3	6	2
			0.011	<0.005	8	2	2	1
			0.007	0.034	8	3	6	2
			0.008	0.006	8	2	<1	<1
			0.021	<0.005	4	3	<1	<1
			<0.005	<0.005	8	3	1	<1
			<0.005	<0.005	5	2	<1	<1
<1	<0.01	<0.01	0.012	<0.005	<1	<1	<1	<1
<1	<0.01	<0.01	0.009	0.008	10	<1	3	<1
<1	<0.01	<0.01	<0.005	<0.005	<1	1	<1	<1
<1	<0.01	<0.01	0.024	<0.005	<1	3	<1	<1
<1	<0.01	<0.01	0.020	<0.005	3	4	<1	<1
<1	<0.01	<0.01	0.011	<0.005	6	3	1	<1
<1	<0.01	<0.01	<0.005	<0.005	8	3	2	<1
					5	3	1	<1
<1	<0.01	<0.01	<0.005	<0.005	6	3	2	<1
			<0.005	<0.005	6	3	2	<1
			<0.005	<0.005	4	4	1	<1
			0.008	<0.005	4	2	<1	<1
			0.008	<0.005	2	2	<1	<1

			<0.005	<0.005	2	3	<1	<1
			<0.005	<0.005	3	2	<1	<1
<1	<0.01	<0.01	0.008	<0.005	<1	<1	<1	<1
<1	<0.01	<0.01	0.008	<0.005	12	1	4	1
<1	<0.01	<0.01	<0.005	<0.005	<1	1	<1	<1
<1	<0.01	<0.01	0.006	0.010	<1	4	<1	<1
<1	0.01	<0.01	0.044	<0.005	<1	5	<1	<1
<1	<0.01	<0.01	0.011	<0.005	<1	4	<1	<1
<1	<0.01	<0.01	0.007	<0.005	<1	5	<1	<1
					1	4	<1	<1
<1	<0.01	<0.01	<0.005	<0.005	2	3	<1	<1
			<0.005	<0.005	4	3	<1	<1
			<0.005	<0.005	3	3	<1	<1
			0.016	<0.005	<1	4	<1	<1
			0.031	<0.005	2	3	<1	<1
			0.031	<0.005	<1	4	<1	<1
			0.006	<0.005	4	3	<1	<1
			0.008	0.008	4	4	<1	<1
			<0.005	<0.005	4	3	<1	<1
			0.024	<0.005	3	14	<1	1
			<0.005	<0.005	5	4	<1	<1

		Alkalinity						
Potassium (filtered)	Sodium (filtered)	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Carbonate as CaCO3)	Alkalinity (Hydroxide) as CaCO3	Alkalinity (total) as CaCO3	Anions Total	Cations Total	Hardness as CaCO3 (filtered)
<1	4	5	<1	<1	5	0.18	0.17	
<1	2	2	<1	<1	2	0.07	0.09	
<1	2	3	<1	<1	3	0.14	0.09	
<1	2	7	<1	<1	7	0.20	0.09	
<1	3	2	<1	<1	2	0.15	0.13	
<1	2	3	<1	<1	3	0.14	0.09	
<1	3	<1	<1	<1	<1	0.08	0.13	
<1	3	2	<1	<1	2	0.14	0.13	

<1	2	4	<1	<1	4	0.16	0.09	
<1	3	3	<1	<1	3	0.17	0.13	
<1	3	3	<1	<1	3	0.17	0.13	
<1	2	4	<1	<1	4	0.11	0.09	
<1	2	<1	<1	<1	<1	0.06	0.09	
<1	7	3	<1	<1	3	0.12	0.30	
<1	1	2	<1	<1	2	0.10	0.04	
<1	3	3	<1	<1	3	0.14	0.13	
<1	2	2	<1	<1	2	0.12	0.09	
<1	3	1	<1	<1	1	0.10	0.13	
<1	2	4	<1	<1	4	0.16	0.09	
<1	5	2	<1	<1	2	0.18	0.27	
<1	2	2	<1	<1	2	0.15	0.09	
<1	2	<1	<1	<1	<1	0.06	0.09	
4	12	5	<1	<1	5	1.52	1.32	
9	17	48	<1	<1	48	3.19	3.36	
5	12	3	<1	<1	3	1.33	1.34	
4	11	1	<1	<1	1	1.14	1.14	

3	8	4	<1	<1	4	1.20	0.90	
4	10	7	<1	<1	7	1.20	1.10	
5	11	4	<1	<1	4	1.15	1.22	
4	10	6	<1	<1	6	1.22	1.10	
4	10	7	<1	<1	7	1.25	1.10	
4	9	3	<1	<1	3	1.12	0.97	
3	8	9	<1	<1	9	1.25	1.08	
4	10	1	<1	<1	1	1.16	1.10	
4	10	4	<1	<1	4	1.15	1.10	
4	10	3	<1	<1	3	1.16	1.10	
4	10	1	<1	<1	1	1.10	1.10	
4	9	1	<1	<1	1	1.03	1.05	
4	10	1	<1	<1	1	0.98	1.02	
4	10	<1	<1	<1	<1	1.04	1.10	
4	9	<1	<1	<1	<1	0.99	0.97	
3	9	1	<1	<1	1	0.90	0.81	
4	8	<1	<1	<1	<1	0.74	0.80	
3	7	1	<1	<1	1	0.63	0.60	

4	8	4	<1	<1	4	0.41	0.66	
4	8	4	<1	<1	4	0.35	0.66	
3	8	3	<1	<1	3	0.37	0.64	
5	11	4	<1	<1	4	0.81	0.95	
4	8	<1	<1	<1	<1	0.77	0.80	
4	8	<1	<1	<1	<1	0.95	0.93	
4	10	8	<1	<1	8	1.22	1.07	
1	5	7	<1	<1	7	0.31	0.24	
<1	2	<1	<1	<1	<1	0.17	0.09	
<1	2	2	<1	<1	2	0.04	0.09	
<1	2	4	<1	<1	4	0.19	0.09	
<1	3	3	<1	<1	3	0.21	0.13	
<1	3	8	<1	<1	8	0.24	0.13	
<1	3	3	<1	<1	3	0.19	0.13	
<1	2	2	<1	<1	2	0.10	0.09	
<1	4	2	<1	<1	2	0.19	0.17	
<1	3	5	<1	<1	5	0.20	0.13	
2	6	1	<1	<1	1	0.21	0.39	
2	6	2	<1	<1	2	0.27	0.39	
<1	2	3	<1	<1	3	0.17	0.09	

1	6	13	<1	<1	13	0.37	0.34	
1	3	4	<1	<1	4	0.23	0.16	
1	4	10	<1	<1	10	0.37	0.20	
<1	3	2	<1	<1	2	0.15	0.13	
<1	<1	3	<1	<1	3	0.35	0.20	
<1	2	4	<1	<1	4	0.11	0.09	
2	4	7	<1	<1	7	0.28	0.31	
<1	2	2	<1	<1	2	0.07	0.09	
<1	3	2	<1	<1	2	0.15	0.13	
<1	2	4	<1	<1	4	0.19	0.09	
<1	2	4	<1	<1	4	0.18	0.09	
<1	2	5	<1	<1	5	0.21	0.09	
<1	2	<1	<1	<1	<1	0.10	0.09	
<1	2	4	<1	<1	4	0.20	0.09	
<1	1	3	<1	<1	3	0.12	0.04	
1	2	5	<1	<1	5	0.33	0.21	
<1	3	15	<1	<1	15	0.38	0.13	
<1	2	2	<1	<1	2	0.14	0.09	
<1	2	3	<1	<1	3	0.12	0.09	
<1	2	<1	<1	<1	<1	0.15	0.09	
<1	2	2	<1	<1	2	0.12	0.09	

<1	3	<1	<1	<1	<1	0.10	0.13	
<1	2	<1	<1	<1	<1	0.08	0.09	
<1	2	2	<1	<1	2	0.15	0.09	
<1	2	3	<1	<1	3	0.19	0.09	
<1	2	5	<1	<1	5			
<1	2	<1	<1	<1	<1	0.08	0.09	
<1	3	3	<1	<1	3	0.16	0.13	
<1	3	14	<1	<1	14	0.39	0.13	
<1	2	3	<1	<1	3	0.09	0.09	
<1	1	<1	<1	<1	<1	0.06	0.04	
<1	2	3	<1	<1	3	0.16	0.09	
<1	1	<1	<1	<1	<1	0.06	0.04	
1	3	7	<1	<1	7	0.36	0.20	
<1	3	4	<1	<1	4	0.28	0.18	
<1	3	2	<1	<1	2	0.07	0.13	
<1	4	2	<1	<1	2	0.19	0.22	
<1	3	9	<1	<1	9	0.31	0.13	
<1	3	5	<1	<1	5	0.18	0.13	
<1	3	4	<1	<1	4	0.18	0.13	
<1	3	5	<1	<1	5	0.25	0.18	
<1	2	7	<1	<1	7	0.22	0.09	
<1	2	6	<1	<1	6	0.20	0.09	
<1	5	9	<1	<1	9	0.55	0.27	
<1	3	3	<1	<1	3	0.14	0.13	
<1	3	4	<1	<1	4	0.21	0.13	

<1	3	5	<1	<1	5	0.18	0.13	
<1	5	3	<1	<1	3	0.14	0.22	
<1	2	1	<1	<1	1	0.17	0.09	
<1	2	3	<1	<1	3	0.14	0.09	
<1	3	2	<1	<1	2	0.12	0.13	
<1	3	2	<1	<1	2	0.14	0.13	
<1	3	3	<1	<1	3	0.17	0.13	
<1	4	3	<1	<1	3	0.17	0.17	
<1	3	3	<1	<1	3	0.17	0.13	
<1	3	3	<1	<1	3	0.17	0.13	
<1	4	1	<1	<1	1	0.08	0.17	
216	5,750	83	<1	<1	83	335	323	
312	8,480	111	<1	<1	111	463	476	
274	7,260	99	<1	<1	99	430	408	
346	9,330	113	<1	<1	113	500	526	
46	1,170	34	<1	<1	34	64.7	64.9	
322	8,680	104	<1	<1	104	489	487	

364	9,800	114	<1	<1	114	510	552	
48	1,270	31	<1	<1	31	74.7	70.6	
2	48	5	<1	<1	5	2.57	2.57	
30	775	21	<1	<1	21	48.4	43.5	
44	1,190	26	<1	<1	26	70.7	66.3	
68	1,820	42	<1	<1	42	101	102	
91	2,560	44	<1	<1	44	152	144	
36	902	39	<1	<1	39	49.4	50.0	
16	42	85	<1	<1	85	7.56	7.56	
2	5	<1	<1	<1	<1	0.55	0.50	
3	7	7	<1	<1	7	0.71	0.68	
4	9	13	<1	<1	13	0.88	0.84	
4	8	8	<1	<1	8	0.86	0.80	
3	8	14	<1	<1	14	0.50	0.77	
4	9	6	<1	<1	6	0.83	0.84	
4	9	7	<1	<1	7	0.82	0.84	
4	9	6	<1	<1	6	0.81	0.84	
3	6	3	<1	<1	3	0.24	0.42	
4	7	<1	<1	<1	<1	0.25	0.57	
4	8	4	<1	<1	4	0.61	0.61	
12	40	92	<1	<1	92	5.45	5.60	
9	38	119	<1	<1	119	7.13	7.56	
<1	1	2	<1	<1	2	0.04	0.04	
<1	2	15	<1	<1	15	0.88	0.62	
<1	1	2	<1	<1	2	0.40	0.38	
1	1	5	<1	<1	5	0.65	0.42	
<1	2	<1	<1	<1	<1	0.06	0.09	
<1	2	<1	<1	<1	<1	0.22	0.14	
1	3	1	<1	<1	1	0.24	0.20	
<1	2	4	<1	<1	4	0.40	0.24	
1	3	3	<1	<1	3	0.36	0.30	
2	5	2	<1	<1	2	0.34	0.45	
2	3	2	<1	<1	2	0.29	0.23	
2	3	<1	<1	<1	<1	0.23	0.18	

1	3	<1	<1	<1	<1	0.23	0.16	
<1	3	<1	<1	<1	<1	0.08	0.13	
2	3	<1	<1	<1	<1	0.19	0.18	
2	3	<1	<1	<1	<1	0.33	0.26	
1	2	<1	<1	<1	<1	0.17	0.11	
1	3	2	<1	<1	2	0.20	0.16	
1	3	<1	<1	<1	<1	0.14	0.16	
1	2	3	<1	<1	3	0.22	0.11	
1	2	3	<1	<1	3	0.25	0.11	
2	4	<1	<1	<1	<1	0.08	0.22	
2	2	<1	<1	<1	<1	0.25	0.14	
1	1	5	<1	<1	5	0.62	0.55	
<1	2	7	<1	<1	7	0.39	0.37	
1	2	4	<1	<1	4	0.61	0.51	
1	2	9	<1	<1	9	0.88	0.89	
1	2	5	<1	<1	5	0.54	0.49	
1	2	<1	<1	<1	<1	0.29	0.21	
<1	3	2	<1	<1	2	0.26	0.18	
<1	3	5	<1	<1	5	0.62	0.56	
<1	3	12	<1	<1	12	1.07	0.86	
1	4	12	<1	<1	12	1.21	1.31	
2	3	16	<1	<1	16	0.91	0.74	
5	4	11	<1	<1	11	0.46	0.48	
1	2	1	<1	<1	1	0.37	0.48	
2	8	<1	<1	<1	<1	0.48	0.86	
<1	2	<1	<1	<1	<1	0.18	0.09	
1	3	<1	<1	<1	<1	0.33	0.26	
1	3	<1	<1	<1	<1	0.25	0.20	
1	3	<1	<1	<1	<1	0.23	0.26	
1	7	4	<1	<1	4	0.35	0.56	
2	3	4	<1	<1	4	0.39	0.33	
1	3	9	<1	<1	9	0.51	0.36	
1	3	2	<1	<1	2	0.16	0.26	
1	2	2	<1	<1	2	0.28	0.21	

3	6	6	<1	<1	6	0.47	0.60	
<1	<1	4	<1	<1	4	0.08	<0.01	
<1	<1	3	<1	<1	3	1.31	1.05	
<1	<1	4	<1	<1	4	0.60	0.48	
<1	2	<1	<1	<1	<1	0.21	0.19	
<1	2	<1	<1	<1	<1	0.15	0.09	
<1	2	1	<1	<1	1	0.32	0.19	
<1	2	4	<1	<1	4	0.46	0.29	
<1	2	3	<1	<1	3	0.61	0.52	
<1	1	8	<1	<1	8	0.47	0.28	
2	3	5	<1	<1	5	0.58	0.64	
<1	2	2	<1	<1	2	0.26	0.27	
1	4	1	<1	<1	1	0.27	0.66	
<1	2	<1	<1	<1	<1	0.22	0.09	
<1	2	<1	<1	<1	<1	0.17	0.09	
<1	2	<1	<1	<1	<1	0.25	0.14	
<1	2	1	<1	<1	1	0.18	0.09	
<1	<1	2	<1	<1	2	0.04	<0.01	
<1	<1	3	<1	<1	3	0.27	0.15	
<1	2	<1	<1	<1	<1	0.03	0.09	
<1	2	<1	<1	<1	<1	0.08	0.09	
<1	2	1	<1	<1	1	0.20	0.09	
<1	2	<1	<1	<1	<1	0.21	0.14	
<1	2	2	<1	<1	2	0.29	0.19	
<1	2	2	<1	<1	2	0.23	0.14	
<1	2	1	<1	<1	1	0.23	0.19	
<1	2	<1	<1	<1	<1	0.21	0.19	
<1	2	<1	<1	<1	<1	0.20	0.14	
<1	2	<1	<1	<1	<1	0.14	0.09	
<1	2	2	<1	<1	2	0.14	0.09	

<1	2	<1	<1	<1	<1	0.13	0.09	
<1	2	<1	<1	<1	<1	0.12	0.09	
<1	<1	3	<1	<1	3	0.06	<0.01	
1	1	2	<1	<1	2	0.32	0.35	
<1	2	<1	<1	<1	<1	0.03	0.09	
<1	3	5	<1	<1	5	0.21	0.13	
<1	3	2	<1	<1	2	0.18	0.13	
<1	2	<1	<1	<1	<1	0.11	0.09	
<1	3	2	<1	<1	2	0.18	0.13	
<1	2	5	<1	<1	5	0.23	0.09	
<1	2	<1	<1	<1	<1	0.13	0.09	
<1	2	<1	<1	<1	<1	0.17	0.09	
<1	2	<1	<1	<1	<1	0.15	0.09	
<1	3	2	<1	<1	2	0.15	0.13	
<1	3	1	<1	<1	1	0.15	0.13	
<1	3	<1	<1	<1	<1	0.11	0.13	
<1	3	1	<1	<1	1	0.19	0.13	
<1	3	<1	<1	<1	<1	0.20	0.13	
<1	3	2	<1	<1	2	0.21	0.13	
1	9	2	<1	<1	2	0.50	0.50	
<1	2	1	<1	<1	1	0.24	0.09	

TDS	TSS	Lab Other						
Total Dissolved Solids (Lab)	Total Suspended Solids (Lab)	Dissolved Oxygen (Lab)	Electrical Conductivity (Lab)	Ionic Balance	Salinity	Turbidity (Lab)	Naphthalene (VOC)	Benzene
		9.2	20			2.2	<0.005	<1
		9.2	10			9.1	<0.005	<1
19	<5	8.6	19			1.6	<0.005	<1
31	<5	9.2	14			1.6	<0.005	<1
22	<5	7.5	17			1.4	<0.005	<1
11	<5	7.7	16			1.7	<0.005	<1
15	<5	9.9	16			1.8	<0.005	<1
22	<5	9.6	15			1.6	<0.005	<1

25	<5	9.2	19			1.3	<0.005	<1
34	7	8.5	20			13.8		
20	<5	8.8	20			0.9		
		9.1	11			4.0	<0.005	<1
11	<5	9.3	14			3.6	<0.005	<1
26	<5	9.2	10			3.4	<0.005	<1
<10	<5	9.3	9			6.7	<0.005	<1
25	<5	8.6	14			1.9	<0.005	<1
<10	<5	9.5	14			2.1	<0.005	<1
20	12	9.6	13			7.4	<0.005	<1
28	<5	9.5	13			4.9	<0.005	<1
34	17	9.1	21			4.8	<0.005	<1
26	<5	8.6	15			10.9		
17	<5	9.6	13			1.7		
		10.9	172			7.3	<0.005	<1
		9.0	358	2.58		114	<0.005	<1
		8.5	154			103	<0.005	<1
		9.1	133			21.2	<0.005	<1

138	18	10.5	141			8.3	<0.005	<1
123	<5	9.7	145			10.2	<0.005	<1
129	<5	8.8	143			1.6	<0.005	<1
140	6	9.3	144			1.2	<0.005	<1
122	<5	10.0	145			3.2	<0.005	<1
112	<5	10.2	136			1.9	<0.005	<1
123	<5	9.2	142			1.0	<0.005	<1
142	<5	9.7	165			1.6	<0.005	<1
88	<5	9.3	130			1.0	<0.005	<1
95	<5	9.4	131			1.2	<0.005	<1
123	<5	9.4	131			2.4	<0.005	<1
88	<5	8.8	132			3.4	<0.005	<1
145	<5	9.7	126			6.0	<0.005	<1
126	<5	8.9	126			3.3	<0.005	<1
114	<5	9.2	120			3.3	<0.005	<1
119	20	9.8	107			33.7	<0.005	<1
86	7	9.0	88			19.5	<0.005	<1
103	14	10.3	72			33.3	<0.005	<1

72	22	10.3	85			31.7	<0.005	<1
94	46	8.4	86			81.6		
91	24	9.5	87			51.1		
102	60	9.5	94			146	<0.005	<1
102	43	10.5	93			127	<0.005	<1
98	14	10.5	115			18.2	<0.005	<1
110	32	11.3	133			55.8	<0.005	<1
		9.1	28			7.8	<0.005	<1
		9.2	28			43.6	<0.005	<1
		9.2	10			466	<0.005	<1
31	<5	8.6	24			4.6	<0.005	<1
38	<5	9.4	28			37.5	<0.005	<1
24	<5	9.0	20			3.1	<0.005	<1
37	<5	9.2	19			19.5	<0.005	<1
17	12	9.5	13			29.5	<0.005	<1
99	93	8.8	25			256	<0.005	<1
69	44	9.1	24			164	<0.005	<1
48	5	9.9	45			35.9	<0.005	<1
67	<5	10.0	51			14.2	<0.005	<1
42	<5	8.5	18			2.4	<0.005	<1

49	12	10.1	35			42.2	<0.005	<1
42	8	9.7	27			28.6		
36	<5	10.5	32			21.0		
49	<5	9.9	19			3.4	<0.005	<1
		10.9	47			73.0	<0.005	<1
		9.2	14			8.1	<0.005	<1
		9.2	32			18.4	<0.005	<1
		9.2	13			48.8	<0.005	<1
		9.2	20			75.5	<0.005	<1
30	<5	10.3	16			2.3	<0.005	<1
30	<5	9.7	18			16.6	<0.005	<1
31	<5	8.7	24			5.6	<0.005	<1
16	<5	9.1	19			4.2	<0.005	<1
23	<5	9.6	19			1.1	<0.005	<1
20	<5	9.4	11			1.6	<0.005	<1
24	8	9.0	33			13.8	<0.005	<1
29	<5	9.1	24			3.4	<0.005	<1
10	<5	9.3	18			5.3	<0.005	<1
<10	<5	9.2	13			2.6	<0.005	<1
34	12	8.9	19			35.8	<0.005	<1
16	9	9.5	17			29.0	<0.005	<1

24	<5	9.7	17			9.8	<0.005	<1
30	<5	9.6	14			5.3	<0.005	<1
40	<5	9.6	19			2.3	<0.005	<1
34	17	9.8	18			7.4	<0.005	<1
<10	<5	10.8	16			<0.1		
20	<5	9.6	16			2.5		
	<5							
50	<5	9.2	20			4.0	<0.005	<1
		9.3	11			1.2	<0.005	<1
14	<5	9.8	13			0.7	<0.005	<1
28	<5	9.1	17			8.7	<0.005	<1
<10	<5	8.5	9			4.1	<0.005	<1
					28.85			
		10.5	38			78.8	<0.005	<1
		9.3	30			12.3	<0.005	<1
		9.1	14			93.6	<0.005	<1
		9.1	31			64.3	<0.005	<1
42	31	10.3	20			59.7	<0.005	<1
26	<5	9.3	20			11.2	<0.005	<1
31	<5	10.3	24			9.6	<0.005	<1
30	5	9.8	24			4.2	<0.005	<1
20	<5	9.6	15			7.9	<0.005	<1
44	6	10.3	15			10.0	<0.005	<1
40	<5	9.2	64			6.0	<0.005	<1
15	<5	9.8	17			6.1	<0.005	<1
<10	<5	9.2	18			4.2	<0.005	<1

23	<5	9.3	18			2.7	<0.005	<1
22	<5	9.9	13			10.9	<0.005	<1
28	9	9.0	19			23.8	<0.005	<1
<10	<5	9.5	16			15.2	<0.005	<1
15	<5	10.2	18			7.9	<0.005	<1
30	<5	9.8	19			8.0	<0.005	<1
35	<5	9.2	20			3.3	<0.005	<1
41	8	8.3	22			4.6	<0.005	<1
32	6	8.4	21			12.7		
29	<5	9.0	23			9.3		
34	17	9.6	20			34.7	<0.005	<1
22,800	10	9.1	34,100	1.82		2.9	<0.005	<1
31,900	<5	8.3	42,700	1.39		5.4		
					25.98			
27,200	<5	9.2	39,700	2.58		3.0	<0.005	<1
34,100	8	8.5	45,000	2.50		4.7		
4,100	34	9.1	6,890	0.16		21.2	<0.005	<1
30,100	<5	9.4	41,600	0.22		2.6	<0.005	<1

34,500	5	8.0	45,500	3.95		4.4		
4,550	11	9.1	7,500	2.86		5.4	<0.005	<1
186	16	9.1	299			26.2	<0.005	<1
2,780	13	9.0	5,180	5.38		7.6	<0.005	<1
4,220	10	10.1	6,920	3.26		11.8	<0.005	<1
6,500	51	9.1	9,310	0.46		37.2	<0.005	<1
9,740	18	9.4	14,600	2.74		12.8		
3,090	69	10.4	5,270	0.56		46.2		
		11.0	875	2.05		7.3	<0.005	<1
					0.26			
86	60	10.8	80			44.4	<0.005	<1
93	56	9.7	88			73.4	<0.005	<1
89	24	10.0	93			26.4	<0.005	<1
80	10	9.9	94			17.6	<0.005	<1
88	13	9.2	98			27.8	<0.005	<1
91	15	9.7	93			30.8	<0.005	<1
102	48	9.2	93			74.8	<0.005	<1
91	19	9.3	94			33.3	<0.005	<1
86	116	9.2	64			226	<0.005	<1
141	54	10.0	69			149	<0.005	<1
135	104	9.5	68			267	<0.005	<1
464	79	10.2	622	1.30		85.7	<0.005	<1
517	559	9.1	932	2.97		26.5	<0.005	<1
		10.8	7			1,810	<0.005	<1
		11.9	72			29.0	<0.005	<1
		11.7	50			27.6	<0.005	<1
		9.2	66			86.0	<0.005	<1
		9.2	11			1,770	<0.005	<1
87	145	10.3	38			333	<0.005	<1
54	88	9.7	34			203	<0.005	<1
93	34	9.8	51			118	<0.005	<1
49	16	9.3	45			13.1	<0.005	<1
40	6	9.3	40			17.5	<0.005	<1
45	12	9.1	36			33.9	<0.005	<1
23	8	9.7	36			26.2	<0.005	<1

28	24	9.2	32			37.9	<0.005	<1
89	288	9.6	18			565	<0.005	<1
		9.1	28			125	<0.005	<1
21	9	9.0	52			23.5	<0.005	<1
67	44	10.3	22			181	<0.005	<1
41	30	8.7	25			52.0	<0.005	<1
33	46	9.4	22			140	<0.005	<1
28	14	9.4	23			43.8	<0.005	<1
39	23	10.0	25			89.5	<0.005	<1
108	608	9.9	23			1,060	<0.005	<1
59	40	10.3	26			105	<0.005	<1
					0.03			
		10.9	79			115	<0.005	<1
		10.6	53			204	<0.005	<1
		9.9	74			50.5	<0.005	<1
		11.8	101			15.6	<0.005	<1
		9.2	70			69.6	<0.005	<1
		9.2	27			818	<0.005	<1
118	382	10.5	36			656	<0.005	<1
132	209	9.3	73			507	<0.005	<1
142	65	9.5	118			211	<0.005	<1
100	33	9.3	134			40.6	<0.005	<1
79	32	9.0	76			96.3	<0.005	<1
27	18	9.0	36			40.2	<0.005	<1
34	10	9.5	59			19.3	<0.005	<1
52	12	9.3	71			28.4	<0.005	<1
82	460	10.0	25			877	<0.005	<1
39	59	9.2	51			67.5	<0.005	<1
34	63	10.1	33			179	<0.005	<1
101	57	9.5	32			217	<0.005	<1
56	28	8.4	40			69.2	<0.005	<1
54	30	9.9	45			105	<0.005	<1
60	35	9.6	49			116	<0.005	<1
159	551	9.5	30			1,240	<0.005	<1
88	6	10.8	35			23.9	<0.005	<1

101	38	11.4	73			119	<0.005	<1
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		11.9	133			43.2	<0.005	<1
		9.2	67			24.6	<0.005	<1
		9.2	30			233	<0.005	<1
91	326	10.8	22			562	<0.005	<1
49	112	9.3	40			265	<0.005	<1
54	37	9.5	50			110	<0.005	<1
52	8	9.1	65			6.1	<0.005	<1
42	17	9.2	40			55.3	<0.005	<1
60	16	9.2	67			55.6	<0.005	<1
18	14	9.4	33			23.0	<0.005	<1
34	<5	9.3	34			27.2	<0.005	<1
39	16	10.2	34			25.8	<0.005	<1
48	151	9.0	22			228	<0.005	<1
21	8	9.6	32			16.0	<0.005	<1
50	33	9.5	22			106	<0.005	<1
		11.1	5			942	<0.005	<1
		9.3	32			17.3	<0.005	<1
		9.2	12			80.0	<0.005	<1
76	232	11.0	16			434	<0.005	<1
49	119	9.1	24			250	<0.005	<1
46	46	9.5	28			106	<0.005	<1
32	<5	9.1	34			4.3	<0.005	<1
44	52	9.4	24			95.6	<0.005	<1
54	21	9.2	26			60.5	<0.005	<1
17	14	9.2	28			27.0	<0.005	<1
31	10	9.3	23			16.9	<0.005	<1
40	15	9.7	21			29.8	<0.005	<1
		9.0	17			40.3	<0.005	<1

11	<5	9.7	17			20.2	<0.005	<1
20	6	9.8	16			29.7	<0.005	<1
		10.3	9			928	<0.005	<1
		9.1	41			327	<0.005	<1
		9.2	12			143	<0.005	<1
46	100	10.5	21			90.4	<0.005	<1
75	106	9.7	24			246	<0.005	<1
60	58	1.6	23			161	<0.005	<1
73	60	8.9	24			137	<0.005	<1
73	82	9.4	18			179	<0.005	<1
70	35	9.1	18			124	<0.005	<1
13	26	9.4	23			54.1	<0.005	<1
18	22	9.3	20			38.9	<0.005	<1
72	90	9.4	19			234	<0.005	<1
		9.1	22			603	<0.005	<1
91	252	9.6	18			661	<0.005	<1
61	70	10.2	23			160	<0.005	<1
44	12	8.7	27			29.3	<0.005	<1
42	26	9.1	23			85.4	<0.005	<1
101	225	9.3	32			476	<0.005	<1
38	<5	10.9	28			11.5	<0.005	<1

BTEX								
Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (F2)
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TRH				TPH				
>C10-C16 Fraction (F2 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 Fraction (Sum)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)
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VOCs	Other	
Acrylamide	Rubidium	Rubidium (filtered)
	<0.001	<0.001
	0.001	<0.001
<0.2	<0.001	<0.001
	<0.001	<0.001

	<0.001	<0.001
<0.2	<0.001	<0.001
	<0.001	<0.001

<0.2	0.013	0.010
<0.2	0.013	0.012
<0.2	0.015	0.012
<0.2	0.014	0.012
<0.2	0.012	0.011
	0.011	0.009

	0.005	0.005
	0.005	0.002
	0.044	<0.001
<0.2	0.002	0.002
<0.2	0.004	0.001
	0.002	0.001
	0.002	<0.001

	0.004	0.003
	<0.001	<0.001
	0.008	0.007
	0.004	<0.001
	0.008	0.001
<0.2	0.014	<0.001
<0.2	<0.001	<0.001
<0.2	0.003	0.002
<0.2	<0.001	<0.001
<0.2	<0.001	<0.001
<0.2		
	0.006	0.002
	0.002	0.001

	<0.001	<0.001
<0.2	<0.001	<0.001
	<0.001	<0.001
	0.006	0.003
	0.002	<0.001
	0.010	0.005
	0.007	<0.001
<0.2	0.004	<0.001
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<0.2	0.001	<0.001
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<0.2	0.001	<0.001
	0.002	<0.001

	0.014	0.014
	0.173	0.183
<0.2	0.014	0.005
<0.2	0.018	0.005
<0.2	0.012	0.006
<0.2	0.075	0.005
	0.011	0.005
	0.036	<0.001
	0.002	0.001
	0.003	0.003
	0.020	0.003
	0.131	0.002
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<0.2	0.028	0.002
<0.2	0.018	0.002
<0.2	0.006	0.002
	0.008	0.002

	0.012	0.004
	0.016	0.002
	0.006	0.004
	0.005	0.004
	0.010	0.004
	0.057	0.002
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<0.2	0.007	0.003
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	0.031	0.008

	0.045	0.002
	0.002	0.001
	0.005	0.002
	0.024	0.002
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	0.010	0.004
	0.018	<0.001
	0.004	0.001
	0.003	<0.001
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	0.007	<0.001

	0.021	0.002
	0.026	0.003
	0.007	<0.001
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<0.2	0.023	0.001
<0.2	0.016	<0.001
<0.2		
	0.012	<0.001

		Moisture Content	Chloride		Electrical Conductivity (Lab)
	EQL	%	mg/kg	mg/L	µS/cm
		0.1	10	1	1
Field ID	**Date**				
SW4 1 of 3	**27 Apr 2023**	29.0	<10		16
SW4 1 of 3 B	**27 Apr 2023**				
SW4 2 of 3	**27 Apr 2023**	31.7	<10		15
SW4 2 of 3 B	**27 Apr 2023**				
SW4 3 of 3	**27 Apr 2023**	37.6	<10		18
SW4 3 of 3 B	**27 Apr 2023**				
SW7 1 of 3	**27 Apr 2023**	60.8	<10		13
SW7 1 of 3 B	**27 Apr 2023**				
SW7 2 of 3	**27 Apr 2023**	40.5	<10		14
SW7 2 of 3 B	**27 Apr 2023**				
SW7 3 of 3	**27 Apr 2023**	45.8	<10		14
SW7 3 of 3 B	**27 Apr 2023**				
SW8 1 of 3	**27 Apr 2023**	45.4	<10		16
SW8 1 of 3 B	**27 Apr 2023**				
SW8 2 of 3	**27 Apr 2023**	41.2	<10		14
SW8 2 of 3 B	**27 Apr 2023**				
SW8 3 of 3	**27 Apr 2023**	53.2	10		15
SW8 3 of 3 B	**27 Apr 2023**				
MWD1	**27 Apr 2023**	40.0	<10		14
MWD1 1 of 3 B	**27 Apr 2023**				
MWD1 2 of 3	**27 Apr 2023**	50.8	<10		14
MWD1 2 of 3 B	**27 Apr 2023**				
MWD1 3 of 3	**27 Apr 2023**	44.4	<10		13
MWD1 3 of 3 B	**27 Apr 2023**				
SW1 1 of 3	**17 Apr 2023**	37.5	<10		12
SW1 1 of 3	**27 Apr 2023**	47.2	<10		9
SW1 1 of 3 B	**17 Apr 2023**				
SW1 1 of 3 B	**27 Apr 2023**				
SW1 2 of 3	**17 Apr 2023**	60.3	30		19
SW1 2 of 3	**27 Apr 2023**	55.9	<10		9
SW1 2 of 3 B	**17 Apr 2023**				
SW1 2 of 3 B	**27 Apr 2023**				
SW1 3 of 3	**17 Apr 2023**	51.0	20		16
SW1 3 of 3	**27 Apr 2023**	43.4	<10		40
SW1 3 of 3 B	**17 Apr 2023**				

SW1 3 of 3 B	**27 Apr 2023**				
SW2 1 of 3	**17 Apr 2023**	22.6	<10		6
SW2 1 of 3	**27 Apr 2023**	94.6	260		44
SW2 1 of 3 B	**17 Apr 2023**				
SW2 1 of 3 B	**27 Apr 2023**				
SW2 2 of 3	**17 Apr 2023**	24.4	<10		10
SW2 2 of 3	**27 Apr 2023**	36.2	10		18
SW2 2 of 3 B	**17 Apr 2023**				
SW2 2 of 3 B	**27 Apr 2023**				
SW2 3 of 3	**17 Apr 2023**	31.7	<10		9
SW2 3 of 3	**27 Apr 2023**	53.1	10		21
SW2 3 of 3 B	**17 Apr 2023**				
SW2 3 of 3 B	**27 Apr 2023**				
SW5 1 of 3	**19 Apr 2023**	22.3	<10		6
SW5 1 of 3 B	**19 Apr 2023**				
SW5 2 of 3	**19 Apr 2023**	20.3	<10		6
SW5 2 of 3 B	**19 Apr 2023**				
SW5 3 of 3	**19 Apr 2023**	20.5	<10		8
SW5 3 of 3 B	**19 Apr 2023**				
DH1 - 1 of 3	**03 May 2023**	58.2	19,300		5,520
DH1 - 1 of 3 B	**03 May 2023**				
DH1 - 2 of 3	**03 May 2023**	64.6	23,900		5,650
DH1 - 2 of 3 B	**03 May 2023**				
DH1 - 3 of 3	**03 May 2023**	74.4	36,600		6,130
DH1 - 3 of 3 B	**03 May 2023**				

pH (Lab)	Sodium (filtered)	Sulphate (filtered)	Aluminium	Arsenic	Cadmium	Calcium (filtered)	Chromium (III+VI)
-	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.1	10	10	1	0.1	0.1	10	0.1
6.2	<10	<10				<10	
			5,210	8.37	<0.1		8.7
6.2	<10	<10				<10	
			5,120	16.2	<0.1		7.8
6.2	<10	<10				<10	
			6,580	14.3	<0.1		11.8
6.3	10	<10				<10	
			8,870	<1.00	<0.1		6.3
5.7	<10	<10				<10	
			10,400	<1.00	<0.1		7.0
5.6	10	<10				<10	
			12,200	<1.00	<0.1		7.2
6.0	10	<10				<10	
			15,000	1.33	<0.1		10.1
5.9	<10	<10				<10	
			17,000	1.50	<0.1		10.7
6.0	10	<10				<10	
			16,000	1.28	<0.1		10.0
6.4	<10	<10				<10	
			9,480	5.60	<0.1		19.6
6.5	10	10				<10	
			10,500	6.09	<0.1		21.0
6.5	<10	<10				<10	
			11,400	6.48	<0.1		22.5
5.5	<10	<10				<10	
6.0	<10	<10				<10	
			4,010	8.88	<0.1		9.2
			9,760	21.3	<0.1		17.6
5.5	20	<10				<10	
5.9	10	<10				<10	
			6,220	31.5	<0.1		9.8
			11,600	14.8	<0.1		17.8
5.6	20	<10				<10	
5.7	<10	<10				<10	
			4,170	3.91	<0.1		6.8

			10,400	16.2	<0.1		16.1
5.7	<10	<10				<10	
5.6	210	140				40	
			6,130	25.1	<0.1		12.5
			10,700	8.58	<0.1		16.6
5.4	<10	<10				<10	
6.1	<10	<10				<10	
			4,070	14.3	<0.1		10.9
			9,340	5.99	<0.1		17.8
5.7	<10	<10				<10	
6.1	20	<10				<10	
			4,510	20.8	<0.1		10.3
			9,590	6.82	<0.1		25.3
5.8	<10	<10				<10	
			5,920	74.7	<0.1		15.5
6.0	<10	<10				<10	
			7,140	28.4	<0.1		21.8
6.0	<10	<10				<10	
			6,440	26.7	<0.1		19.4
8.2	12,800	3,080				290	
			13,900	22.7	<0.1		32.4
7.5	15,800	3,730				310	
			12,700	23.7	<0.1		36.0
7.9	23,200	5,410				520	
			13,200	24.0	<0.1		33.9

Copper	Iron	Lead	Lithium	Magnesium (filtered)	Mercury	Nickel	Potassium (filtered)
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.1	1	0.1	0.01	10	0.0005	0.1	10
				<10			<10
3.8	10,000	9.2	10.0		0.01	3.3	
				<10			<10
3.8	16,500	9.8	8.6		0.01	2.5	
				<10			<10
5.3	21,800	11.2	11.0		0.02	3.7	
				<10			<10
4.3	2,480	12.3	11.2		0.01	2.8	
				<10			<10
4.4	2,720	14.0	14.3		0.01	3.0	
				<10			<10
4.7	2,410	16.2	13.6		0.01	3.2	
				<10			<10
7.7	4,620	17.4	19.3		0.02	5.3	
				<10			<10
11.2	3,890	18.9	19.8		0.03	5.9	
				<10			<10
8.8	4,440	16.6	18.8		0.03	6.0	
				<10			<10
8.3	35,800	10.3	24.6		<0.01	8.8	
				<10			<10
9.4	37,100	10.3	27.2		<0.01	10.6	
				<10			<10
10.3	39,800	10.8	26.9		<0.01	11.0	
				<10			<10
				<10			<10
6.2	7,640	14.4	8.2		0.02	2.3	
7.4	27,200	16.4	15.7		0.02	6.2	
				<10			20
				<10			<10
8.2	22,900	12.7	8.5		0.02	6.2	
8.9	23,500	17.2	20.6		0.03	7.5	
				<10			<10
				<10			<10
5.9	5,000	9.3	7.9		0.01	2.4	

7.6	23,200	16.1	16.8		0.02	6.0	
				<10			<10
				70			220
9.2	18,300	14.8	10.1		0.01	2.7	
9.8	34,900	16.4	12.3		0.02	6.9	
				<10			<10
				<10			<10
7.7	12,000	12.1	5.9		0.01	2.3	
7.5	27,400	13.0	12.4		0.02	6.6	
				<10			<10
				<10			<10
5.2	14,600	11.7	8.5		0.02	2.7	
6.7	28,300	13.8	12.7		0.02	5.7	
				<10			<10
16.2	40,000	21.0	9.5		0.02	5.9	
				<10			<10
19.4	35,200	25.8	12.3		0.01	7.1	
				<10			<10
15.6	29,800	15.7	10.4		0.01	6.4	
				870			1,020
10.0	33,600	12.1	15.3		0.02	10.4	
				1,070			1,170
8.7	31,900	12.7	15.9		0.03	10.8	
				1,770			1,690
7.9	31,500	11.9	15.1		0.01	10.6	

Zinc	Total Organic Carbon	+1180µm	+150µm	+19.0mm	+2.36mm	+300µm	+37.5mm
mg/kg	%	%	%	%	%	%	%
0.1		1	1	1	1	1	1
	0.81	50	73	<1	44	62	<1
4.9							
	0.40	41	71	<1	35	56	<1
4.0							
	1.01	44	72	5	40	56	<1
6.4							
	2.85	5	25	<1	2	16	<1
1.4							
	2.30	11	28	<1	4	24	<1
1.7							
	3.40	7	23	<1	2	19	<1
1.6							
	3.10	1	28	<1	<1	9	<1
4.6							
	6.38	21	61	<1	8	44	<1
5.3							
	6.11	5	34	<1	<1	17	<1
4.2							
	0.33	2	9	<1	1	4	<1
30.7							
	0.35	<1	4	<1	<1	1	<1
36.6							
	0.26	<1	5	<1	<1	2	<1
38.0							
	2.02	1	52	<1	<1	17	<1
	2.17	3	18	<1	2	8	<1
5.8							
13.9							
	5.16	1	39	<1	<1	9	<1
	3.47	3	28	<1	<1	16	<1
13.2							
16.4							
	7.14	3	24	<1	1	10	<1
	3.13	16	29	<1	16	20	<1
5.3							

11.9							
	0.29	8	69	<1	1	35	<1
	2.34	14	38	<1	11	24	<1
7.3							
21.1							
	0.99	6	49	<1	3	19	<1
	1.76	40	55	<1	34	44	<1
6.9							
13.2							
	1.14	1	47	<1	<1	11	<1
	2.39	78	90	<1	68	87	<1
7.7							
11.2							
	0.13	<1	93	<1	<1	47	<1
44.7							
	0.23	37	94	<1	2	79	<1
23.5							
	0.17	20	91	<1	<1	67	<1
33.4							
	3.42	5	36	<1	2	11	<1
29.0							
	4.97	12	22	<1	7	15	<1
29.5							
	5.45	11	23	<1	6	16	<1
28.2							

+4.75mm	+425µm	+600µm	+75.0mm	+75µm	+9.5mm	Cobbles (>6cm)	Fines (<75 µm)
%	%	%	%	%	%	%	%
1	1	1	1	1	1	1	1
34	57	54	<1	88	21	<1	12
27	50	46	<1	88	9	<1	12
38	51	47	<1	90	34	<1	10
<1	12	9	<1	35	<1	<1	65
<1	21	18	<1	35	<1	<1	65
<1	17	14	<1	27	<1	<1	73
<1	6	3	<1	52	<1	<1	48
<1	39	34	<1	75	<1	<1	25
<1	13	10	<1	48	<1	<1	52
<1	3	2	<1	28	<1	<1	72
<1	<1	<1	<1	17	<1	<1	83
<1	<1	<1	<1	22	<1	<1	78
<1	7	4	<1	83	<1	<1	17
<1	6	5	<1	42	<1	<1	58
<1	5	3	<1	70	<1	<1	30
<1	12	9	<1	50	<1	<1	50
<1	7	6	<1	55	<1	<1	45
15	18	18	<1	50	14	<1	50

<1	23	16	<1	91	<1	<1	9
6	20	18	<1	59	<1	<1	41
<1	12	9	<1	83	<1	<1	17
20	42	41	<1	84	4	<1	16
<1	4	3	<1	81	<1	<1	19
54	85	83	<1	93	39	<1	7
<1	20	7	<1	100	<1	<1	<1
<1	70	61	<1	98	<1	<1	2
<1	55	45	<1	98	<1	<1	2
<1	8	7	<1	47	<1	<1	53
<1	14	14	<1	26	<1	<1	74
<1	14	13	<1	27	<1	<1	73

Gravel (>2mm)	Sand (>75 µm)	Passing 63µm
%	%	%
1	1	0.01

46	42	
		13.3
37	51	
		14.0
41	49	
		12.4
3	32	
		47.3
6	29	
		44.9
4	23	
		38.8
<1	52	
		29.2
12	63	
		13.8
2	46	
		23.2
<1	28	
		39.6
<1	17	
		58.0
<1	22	
		56.2
1	82	
2	40	
		11.7
		40.6
1	69	
1	49	
		16.0
		53.7
2	53	
16	34	
		35.3

		49.6
3	88	
12	47	
		7.56
		11.5
4	79	
36	48	
		17.5
		15.4
1	80	
71	22	
		17.0
		16.0
<1	100	
		1.07
13	85	
		1.00
6	92	
		1.14
3	44	
		12.8
9	17	
		17.4
8	19	
		14.4

Grants Open Cut Mine

Biological and Sediment Monitoring 2023

Final Report



Aquatic Ecology Services

This report has been prepared for Ecoz as a technical document. The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. As a result, not all relevant site features and conditions may have been identified in this report.

Field data and macroinvertebrate samples were obtained from Ecoz. Aquatic Ecology Services has made the assumption that all data has been validated and is correct, and that standard protocols were followed during sampling.

Version	Prepared by	Reviewed by	Review Date
Draft 1.0	T Steele	C. Pietsch	15/07/2023
Draft 1.1	T Steele	C. Jones	20/07/2023
Final 2.0	T Steele		

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1. Background

1.1 Project Description

The Finniss Lithium Project is the flagship mining project for Core Lithium Limited (Core), located on the Cox Peninsula approximately 25km from Darwin. Lithium Developments (Grants NT) Pty Ltd (LDGNT) is a 100% owned subsidiary of Core and is the operator of the Grants Lithium Project, situated on mineral titles ML31726, ML32074, ML32278 and EMP28651. A Mining Authorisation was granted on 1 April 2020 under the *Mining Management Act 2001* for the Grants open cut mine. – A mining operation and processing facility has been developed on ML31726 and the key physical components comprise an open cut pit, integrated waste rock dump and tailings storage facility, run-of mine pad, water management infrastructure and processing plant.

The Northern Territory Environment Protection Agency (NT EPA) has completed its impact assessment for the Finniss Lithium Project BP33 underground mine, and preliminary works including land clearing are anticipated to commence in July 2023. BP33 is located approximately 7.5 km by road, southeast of the Grants site. Exploration activities continue within the tenement areas.

1.2 Catchment

The Grants open cut mine is located within the wider Darwin Harbour catchment. The catchment consists of several low order streams that are predominately unnamed tidal creek systems that flow to the West Arm of Darwin Harbour. The mine intersects, two stream catchments. The freshwater sections of both catchments are short, and the mine is located at the headwaters of these catchments. The combined area of these two catchments is 13.6 km^2. Pre-mining, there was one existing water body (Observation Hill Dam) that was established in the 1980's, and which is used by LDGNT as a water source for mining operations. Observation Hill Dam is situated in the headwaters of a drainage line that discharges to the Charlotte River, approximately 3 km downstream.

1.3 Monitoring Program

In 2017, GHD conducted aquatic ecology surveys as part of the approvals process for the Finnis Lithium Project. This represented the first aquatic ecology surveys completed in the freshwater section of the Darwin Harbour catchment. The surveys included collection of data on fish, macroinvertebrate and *in situ* water quality. The sampling design for monitoring in 2023 has adopted the sampling design for Grants, with an additional site included in a reference waterway in the Charlotte River catchment.

The Waste Discharge Licence (WDL248) for Grants authorises controlled discharge of wastewater from Mine Water Dam 1 through authorised discharge point (DP1) and into an unnamed ephemeral stream that feeds into West Arm, Darwin Harbour. The WDL stipulates the monitoring requirements for surface water, fluvial sediment and biota. A biological and sediment monitoring program was implemented to gather data before active discharge occurred from Grants. This follows the BACI design (Before, After, Control, Impact), allowing

for temporal comparison of aquatic ecosystem health that includes a period prior to mining commencing in 2022.

1.4 Scope

Aquatic Ecology Services was engaged by Ecoz to complete sample processing, data analysis and reporting for the freshwater biological and sediment components of the monitoring program. This report details the outcome of sampling completed in the early dry season of 2023.

2. Study Design

2.1 Sampling sites

Five sites were visited during macroinvertebrate and sediment sampling in 2023 (Table 1). This included four downstream sites in the Darwin Harbour catchment, and one Reference site located upstream of all mining activity in the Charlotte River Catchment. Sites UC1, UC2 and UC3 were previously sampled by GHD in 2017. Site UC3 was not sampled in 2022 but was added to the monitoring program in 2023. Site UC3 is located on an unnamed tributary, east of the Grants site as shown in Figure 1. Site UC3is considered to be an Upstream site, as it is located within a different hydrological sub-catchment (2b) as shown on Figure 1.

Table 1 – Sampling sites for the Grants Project Area. All coordinates in Zone 52L

Site Code	Site type	Description	Easting	Northing
BP4	Reference	Unnamed Creek upstream of Cox Peninsula Road	697786	8592522
UC3	Upstream	Tributary entering the unnamed creek between UC2 and GDS SW5	693645	8600380
UC2	Downstream	Unnamed Creek directly downstream of Grants, upstream of compliance point	693137	8600170
GDS SW5	Downstream	Unnamed Creek at WDL compliance point	693365	8600709
UC1	Downstream	Unnamed Creek furthest downstream, directly upstream of estuary	693549	8600956

2.2 Timing

To meet the protocols outlined in the Darwin-Daly AUSRIVAS sampling manual (Lamche 2007), sampling was conducted in the post-wet season. Sampling was undertaken in mid- April.



Aquatic Ecology Services

Grants Open Cut Mine Biological and Sediment Monitoring 2023

Figure 1 - Macroinvertebrate sampling locations

Imagery: Google satellite Hybrid: https://mt1.google.com/vt/lyrs=y&x={x}&y={y}&z={z}

0 0.5 1 km

3. Methods

3.1 Habitat assessment

At each site, descriptions of habitat characteristics were recorded following the criteria listed in the Northern Territory AUSRIVAS "Darwin-Daly Region Model" field sheets (Lamche, 2007). Habitat assessments were undertaken in consideration of the whole reach sampled, including:

- Site description
- Water quality
- Instream physical characteristics (flow velocity and depth, instream habitat characteristics, bank height, riparian zone width)
- Riparian vegetation characteristics (types, %cover, exotic species, erosion, land use)
- Water quality observations (clarity, odour, oils, foam/scum, plumes etc.)
- Sketches of the site, including a cross - section of the reach.

The information recorded was used to assist interpretation of biological data. Data recorded was also used in conjunction with the biological community information as the basis of the overall health assessment.

Photos were taken of upstream and downstream portions of the reach sampled, as well as bank habitat and other key habitat features. This further characterises the habitat conditions at each site, serving as a pictorial record of site conditions that can be tracked over time using photos taken from the same photo points.

3.2 Water and sediment quality

3.2.1 In situ water quality

The physico-chemical parameters of the water at each site were measured using a calibrated multi-parameter water quality meter. The following parameters were recorded:

- Water temperature (°C)
- Dissolved oxygen (DO) concentrations (mg/L and % saturation)
- pH
- Electrical conductivity (EC) (µS/cm)
- Turbidity

The results were compared against the WDL Discharge Trigger Values (Appendix 2 of WDL248). The WDL Discharge Trigger Values (DTVs) are applicable at the downstream compliance site, GDS SW5.

3.2.2 Water and sediment grab sampling

Water and sediment sampling methods utilised at each site were in accordance with those outlined in ANZECC (2000) and Simpson and Batley (2016) and involved:

- Collection of water samples from below the water surface in the centre of the creek where possible
- The collection of multiple sediment samples (3 in total) from random sides of the bank and sieved to 2mm
- Placing water and sediments into a laboratory-supplied container, labelled with site and sample details
- Keeping samples in chilled eskies for onward delivery to a NATA accredited laboratory for testing.

Analyses performed on surface waters are detailed in Table 2. Total metals were analysed for the parameters shown in Table 3.

Table 2 - Testing parameters for water collected at Grants

Lab Analyses	Analytes
Physico-chemical	Total suspended solids (TSS)
Major anions	Alkalinity, chloride, sulfate
Major cations	Calcium, magnesium, sodium, potassium
Metals (dissolved and total)	Aluminium, arsenic, cadmium, chromium, copper, iron, lead, lithium, mercury, nickel, zinc
Nutrients	Total nitrogen, ammonia as N, nitrite, nitrate, NOx, total kjeldahl nitrogen, phosphorus, reactive phosphorus

Table 3 – Testing parameters for sediments collected at Grants

Lab Analyses	Analytes
Total recoverable metals	Aluminium, arsenic, cadmium, chromium, copper, iron, lead, lithium, mercury, nickel, zinc
Other parameters	Particle size distribution (PSD), total organic carbon (TOC), moisture content

Water quality results were compared against the WDL DTVs and sediments against the toxicant default guidelines values (DGVs) for sediment quality (ANZECC & ARMCANZ 2000). The sediment DGVs indicate the concentrations below which there is a low risk of unacceptable effects occurring, and should be used, with other lines of evidence, to protect aquatic ecosystems. In contrast, the 'upper' guideline values (GV-High), provide an indication of concentrations at which you might already expect to observe toxicity-related adverse effects.

3.3 Macroinvertebrates

3.3.1 Field sampling

Macroinvertebrate sampling and field processing was completed by Ecoz, and followed procedures outlined in the Northern Territory AUSRIVAS Manual for the Darwin-Daly Region (Lamche, 2007). Sampling involved one field team member scraping submerged root matter associated with the lower bank to agitate and remove macroinvertebrates into the water column, while the other field team member swept a dip net through the water column downstream of the edge habitat, to collect the dislodged animals. Areas of riffle or fast flowing habitat, Pandanus roots and severe bank undercuts were avoided when collecting edge habitat samples.

Once collected, the samples were washed through 10mm and 250µm mesh sieves. The course mesh sieve was examined for large, conspicuous taxa, and these were placed in a labelled sample container. The sample collected in the fine mesh sieve was also placed in the labelled sample container and filled with 70% ethanol. All samples were sent to the macroinvertebrate laboratory for further processing and identification.

3.3.2 Laboratory processing

Samples were washed through a series of sieves (10mm, 500µm and 250µm mesh sizes). Any large, conspicuous taxa identified in the 10 mm mesh sieve were added to the contents of the large mesh fraction retained in the field. The contents of the 500µm mesh sieve were retained for macroinvertebrate identification and enumeration, while the 250µm fraction was retained as sample residue for quality assurance purposes. The contents of the 500µm mesh fraction was poured into a Marchant sub-sampler (Marchant, 1989) and extractions made randomly from cells (aliquots) in this apparatus.

These extractions were placed under a microscope and the taxa identified and counted. This process continued until either all aliquots were examined, or a total of 200 individuals had been counted and identified. The number of aliquots required to be processed to obtain a minimum 200 individual sub-sample was recorded in order to be able to calculate relative abundance. A Leica stereo-dissection microscope was used to examine specimens.

Taxa were identified to family level where possible, with the exception of key taxa identified in Lamche (2007), requiring identification to order level (e.g., Conchostraca, Oligochaeta etc.). Quality assurance processes were followed as per Lamche (2007). Five percent of samples were sent to an external laboratory and checked for correct identification by an AUSRIVAS accredited Senior Taxonomist.

3.4 Data analysis

A number of indices can be used to assess and/or quantify the influence of anthropogenic activities on macroinvertebrate communities. Responses to contaminants or changes in flow can result in anything from changes in abundance and diversity, through to changes in community composition through the loss or reduction of sensitive taxa. Macroinvertebrate community indices were calculated for each sample at each site. The time lapsed and change in samplers between original baseline sampling in 2017 and current monitoring makes the data less comparable from a statistical context, and so is not considered relevant to the current monitoring. For these reasons, the data has not been considered in statistical analyses.

A one-way ANOVA was performed for each macroinvertebrate index to understand if significant differences are present between baseline (2022) and operations (2023) data. A summary of the univariate macroinvertebrate indices assessed as part of this study is provided below:

- Relative abundance – Total number of individual taxa collected at a site. This information is calculated based on processing requirements in the laboratory (% of sample processed).
- Taxa richness (Family) – Total number of taxa present at the site used as a measure of diversity of families (used for long-term data analysis).
- PET richness – total number of families from orders Plecoptera, Ephemeroptera and Trichoptera. PET taxa are generally more sensitive to disturbance.
- SIGNAL-2 – a biotic index that allocates a value to each macroinvertebrate family based on their sensitivity to pollution. The metric is calculated by averaging the index of all families collected. Lamche (2007) cautions against the use of the SIGNAL-2 index for assessing the status of Northern Territory macroinvertebrate communities. This measure is however, considered appropriate for this study as the number of pollution-sensitive versus pollution-tolerant families does provide some insight to the level of stress that the macroinvertebrate community is experiencing.
- To further interrogate SIGNAL-2 results, the tolerant taxa index was calculated from SIGNAL grade numbers. Taxa with SIGNAL grade numbers of 3 or less are designated as tolerant (Marshall *et al.* 2001), and the number of these tolerant taxa are compared to the overall taxa count and expressed as a percentage. This approach allows for a more nuanced assessment of any impacts associated with active discharge from Mine Water Dam 1 in the future and provides background data on the overall tolerance of taxa in the catchments.

Prior to 2021, biological monitoring programs commonly utilised the NT AUSRIVAS Darwin-Daly Early (dry season) Family level Edge habitat model. New guidance on the use of these models in the NT to understand impacts of point source pollution have since been published (ANZG 2023a). The updated guidance states that the models are not useful in understanding aquatic ecosystem health outside of the large rivers where macroinvertebrates have been collected, and therefore AUSRIVAS modelling has not been undertaken on the data collected in 2023.

In addition to univariate analysis of metrics, an assessment of differences in the macroinvertebrate community composition was undertaken. Statistical analysis was undertaken comparing sample groups

from baseline (2022) and operations (2023). Sample data was fourth-root transformed prior to multivariate analysis and was completed using PRIMER Version 7.0.21. Non-metric Multidimensional Scaling (NMDS) Ordination provides a representation of the relative similarity of entities (i.e., samples) based on their attributes (i.e., macroinvertebrate community composition) within a reduced dimensional space. The more similar sites are to each other, the closer they are located in the NMDS ordination space.

In this study, a NMDS plot was used for data to display the similarity between site types (Reference and Downstream). A similarity matrix for all pairs of samples based on the Bray-Curtis similarity coefficient was calculated. Stress, which is a measure of the distortion produced by compressing multi-dimensional data into a reduced set of dimensions, was used to gauge how reliable the patterns presented in two-dimensional NMDS plots are. Stress levels above 0.20 indicate a poor representation of inter-sample similarity and, as such, the NMDS results with stress values of this order require interpretation with caution (Clarke *et al.* 2014).

The ANOSIM (ANalysis Of SIMilarity) routine was applied on the similarity matrix for each ordination analysis to determine if the differences between sites observed within the ordination plots were significantly different. This analysis provides a measure of the dissimilarity of groups of samples (years) in the form of an R-statistic that typically lies between 0 and 1; values close to 1 imply that these groups are very dissimilar and those approaching 0 are very similar. A p-value is calculated to determine the statistical significance of the sites groupings. The interpretation of group separation is not wholly based upon the p-value, but rather the R-statistic, as the numbers of replicates within the groups being compared does not unduly affect the R value.

4. Site Conditions

Rainfall, recorded at the closest available Bureau of Meteorology weather station (Darwin River Dam Station no. 14183) is presented in Figure 2. A total of 1887.9 mm of rain was recorded in the 2022/2023 wet season, which was above than the long-term average for the area (1630.96 mm). Rainfall was above average in the months of September to December, and slightly below average for the remainder of the wet season. A total of 343 mm of rainfall was recorded in the six weeks prior to sampling.

It is acknowledged that rainfall in the NT can be patchy, and rainfall recorded at Darwin River Dam is indicative of climate, but may not accurately represent conditions on site.

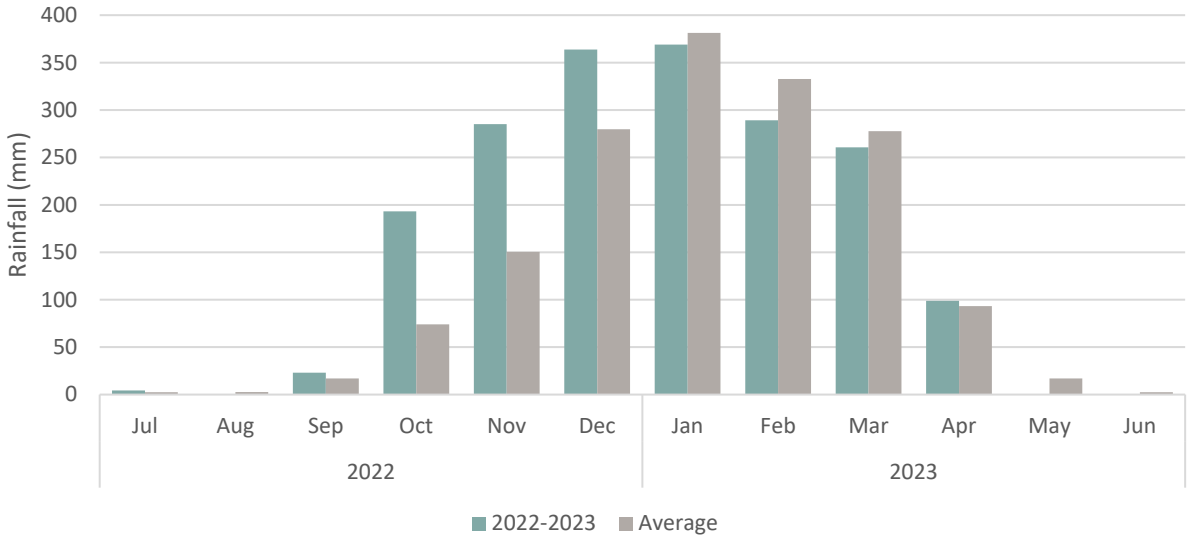


Figure 2 – Monthly Rainfall recorded at Darwin River Dam July 2022-June 2023 (BOM 2023)

5. Results

5.1 Habitat characteristics

Habitat characteristics of each site are detailed below in Table 4. All sites downstream of Grants were flowing at between 1-1.5m/second, whilst BP4 was flowing around 0.5m/second. A copy of scanned fieldsheets are available in 0.

Table 4 – Grants site descriptions, April, 2023

Site description	Site photo
BP4 – Reference The site is located on an unnamed creek upstream of Cox Peninsula Road. The riparian zone was intact and consisted of paperbarks and pandanus, with little understorey. The riparian zone provided high shading, exposed roots and detritus in the creek bed. Sediments were made up of sand and silt, and some algae was present. Floating macrophytes were observed in deeper pools.	
UC2 – Downstream The site was made up of pool habitat connected by shallow riffle/runs. Floating macrophytes were present in deeper pools. Large woody debris, detritus and exposed roots were common. The riparian zone consisted of large paperbark trees, providing moderate shade. Native grasses and herbs were present in the understorey and were trailing in the water.	
GDS SW5 - Downstream The site is located at the WDL compliance point. There was less riparian vegetation present at the site compared with other sites, which resulted in more exposed banks and little shade. Despite a lack of vegetation, there was little erosion, and the substrate was made up of a mix of pebbles and gravel along with sand and silt. There were no deep pools present, and runs were connected by shallow riffles.	

Site description	Site photo
UC1 – Downstream The site was a series of slow-flowing pools connected by shallow runs. The substrate was made up of gravel, sand and silt. Large woody debris and undercut banks were common, with leaf packs and algae present in backwaters. Riparian vegetation was sparse, mainly being made up of large overhanging Melaleucas.	

5.2 Water quality

5.2.1 In situ

In situ water quality data collected at sampling sites is presented in Table 5. The following observations can be made about water parameters at sites associated with Grants:

- Water temperatures were similar at most sites, and warmest furthest downstream at UC1.
- Dissolved oxygen was variable and did not appear to have a relationship to catchment position. DO was lowest at the Refence site, BP4.
- Conductivity was below the WDL DTV at all sites, and water was considered fresh.
- pH readings were above the upper WDL DTV at all sites including the Reference and upstream sites (BP4 and UC3 respectively). pH was highest at GDS SW5.
- Turbidity was below the WDL discharge trigger value at all sites besides UC2.

Table 5 – In situ water quality results from Grants sites visited in April 2023. Exceedances highlighted in grey

Site Code	Time	Temp (°C)	DO (%)	EC (µS/cm)	pH	Turbidity (NTU)
WDL Discharge Trigger Values[1]			70-92	250	5.2-6.6	12
BP4	11:15	25.76	61.9	23	7.56	7.10
UC3	8:10	26.00	86.8	24	6.64	4.18
UC2	11:00	26.10	97.2	18	7.74	31.00
GDS SW5	7:30	25.87	74.0	22	8.30	6.07
UC1	10:20	29.00	100.5	29	7.80	7.70

[1] Applicable at WDL248 Compliance Point GDS SW5.

5.2.2 Laboratory analysed water quality

Water quality results for sites associated with Grants are presented in Table 6, and a complete set of results are available in Appendix B. The following observations can be made based on these results:

- Except for sodium, all dissolved major cations were below the laboratory limit of reporting (LOR). Sodium concentrations across the sites were comparable.
- No exceedances of respective WDL DTVs were reported for dissolved metals.
- Total aluminium concentrations at BP4, UC2 and GDS SW5 were above the WDL DTV of 70 µg/L (0.07 mg/L).
- Except at site UC1, all total iron concentrations were above the WDL DTV of 110 µg/L (0.11 mg/L).
- All total and dissolved arsenic, cadmium, chromium, copper, lead, and nickel concentrations were below the LOR.
- Except for total zinc at BP4, all total and dissolved zinc concentrations were below the LOR.
- Total and dissolved lithium concentrations at all sites were below the WDL DTV.
- Total nitrogen and phosphorus WDL DTVs were exceeded at BP4, and UC1 and UC2 respectively.

Table 6 – Laboratory analysed water quality results from sites associated with Grants

Analyte	Units	LOR	BP4	UC3	UC2	GDS SW5	UC1	WDL TV[1]
Physicochemical parameters								
TSS	mg/L	5	<5	<5	<5	<5	<5	NA
Alkalinity and major anions								
Bicarbonate alkalinity	mg/L	5	<1	3	2	3	4	NA
Carbonate alkalinity	mg/L	1	<1	<1	<1	<1	<1	NA
Total alkalinity as $CaCO_3$	mg/L	1	<1	3	2	3	4	NA
Sulfate as SO_4	mg/L	1	<1	<1	<1	<1	<1	N/A
Chloride	mg/L	1	4	4	3	3	6	NA
Major cations								
Calcium	mg/L	1	<1	<1	<1	<1	<1	NA
Magnesium	mg/L	1	<1	<1	<1	<1	<1	NA
Potassium	mg/L	1	<1	<1	<1	<1	<1	NA
Sodium	mg/L	1	3	3	2	3	5	NA
Dissolved metals								
Aluminium	mg/L	0.01	0.03	<0.01	0.03	0.02	0.02	0.07
Arsenic	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.013
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
Copper	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0014
Iron	mg/L	0.05	0.11	0.1	0.06	0.07	0.07	0.11
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0034
Lithium	mg/L	0.001	0.002	0.002	<0.001	0.002	0.002	0.43
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0006
Nickel	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.011
Zinc	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008
Nutrients								
Total nitrogen	mg/L	0.1	0.4	0.1	0.2	0.1	0.1	0.2
Total phosphorus	mg/L	0.01	<0.01	0.01	0.02	0.01	0.02	0.01

[1] Applicable at Compliance Point GDS SW5

5.3 Sediment quality

Sediment particle size analysis and sediment quality results, for samples collected at sites associated with Grants are presented in **Error! Reference source not found.** and Table 7. Data are compared against the ARMCANZ & ANZECC 2000 default guidelines for toxicants in sediment. Results are presented as total metals. The following observations are made based on the results:

- Sediments were dominated by sand, except for samples collected at reference site BP4, which were dominated by fine material. As samples were sieved to 2mm in the field, it was unlikely that cobbles and gravel would make up a significant portion of each sample.
- Total arsenic was above the DGV at GDS SW5 and UC1. One of three replicate arsenic concentrations were above the DGV-high guideline value at each site. The concentration of arsenic at GDS SW5 and UC1 were elevated, despite a lower fraction of sediments compared with UC2.
- Total nickel was above the SGV-low in one sample collected at UC1.
- The most consistent results for all metals were found at BP4, which contained a very high proportion of finer sediments and lower metal concentrations. The result suggests that arsenic and other metals may not be inherently high in sediments. It is noted that BP4 is in a separate catchment, and are not directly comparable.
- Results from UC3 demonstrated little accumulation of metals in sediments at the site.

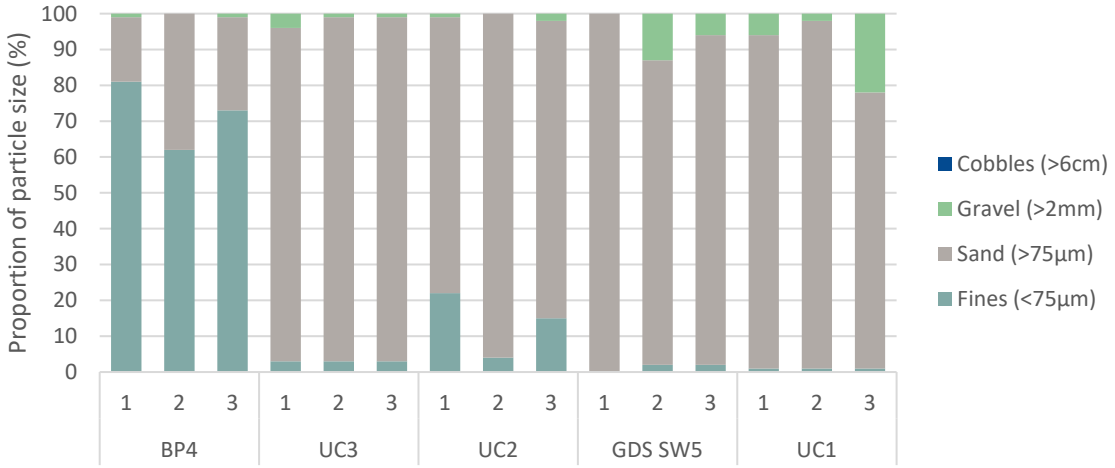


Figure 3 - Sediment particle size distribution of samples collected at Grants

Table 7 - Sediment quality results for samples collected at Grants. All results are presented in mg/kg

Analyte	LOR*	BP4			UC3			UC2			GDS SW5			UC1			DGV	GV-high
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
Aluminium	50	3910	2660	3930	8280	9810	12200	14400	9930	4120	5920	7140	6440	11500	6040	6860	-	-
Arsenic	1	<1.00	<1.00	<1.00	<1.00	<1.00	1.52	<1.00	<1.00	1.63	74.7	28.4	26.7	35.4	37.1	253	20	70
Cadmium	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.5	10
Chromium	2	4.5	3	4.4	<1.0	1.1	1.4	<1.0	1.1	2.8	15.5	21.8	19.4	48.8	21.3	37.6	80	370
Copper	5	14.7	7.4	8.8	<1.0	2.3	1.6	<1.0	<1.0	5.5	16.2	19.4	15.6	20.8	17.5	20	65	270
Iron	50	3040	2220	2170	22300	13300	12000	6760	18600	7720	40000	35200	29800	20600	30000	49600	-	-
Lead	5	7.7	5.4	8	<1.0	2.8	5.2	1.6	2.6	8.5	21	25.8	15.7	14.7	14.3	20.5	50	220
Lithium		3.6	3.7	4.1	11.6	15.1	22.8	19.2	19.6	6.5	9.5	12.3	10.4	49.8	14.4	14.8	-	-
Mercury	0.01	0.03	0.02	0.03	0.02	0.02	0.02	0.01	0.01	<0.01	0.02	0.01	0.01	0.02	0.01	0.02	0.15	1.00
Nickel	2	2.6	2.8	3	<1.0	<1.0	1.7	<1.0	<1.0	2.7	5.9	7.1	6.4	32.5	7	7.2	21	52
Zinc	5	6.5	7	7.6	26.5	13.3	14	9	17.3	3.8	44.7	23.5	33.4	30.7	27.8	28.8	200	410

**LORs were higher for some metals at site BP4*

5.4 Macroinvertebrates

5.4.1 Relative abundance

The relative abundance of all samples collected in 2023 are presented in Figure 4. Relative abundance increased with distance downstream of Grants, and samples collected at the tributary site UC3 showed similar results to the site furthest upstream at UC2. Relative abundance was greatest furthest downstream at UC1.

When reviewing historical data (Figure 5), the results in 2022 and 2023 varied at each site, and no significant difference between years was found (p=>0.05. 0). A decrease in abundance was observed at reference site BP4, whilst an increase was seen furthest downstream at UC1. The trend of increasing abundance with distance downstream was more pronounced in 2023, compared with previous data which was relatively similar at all sites.

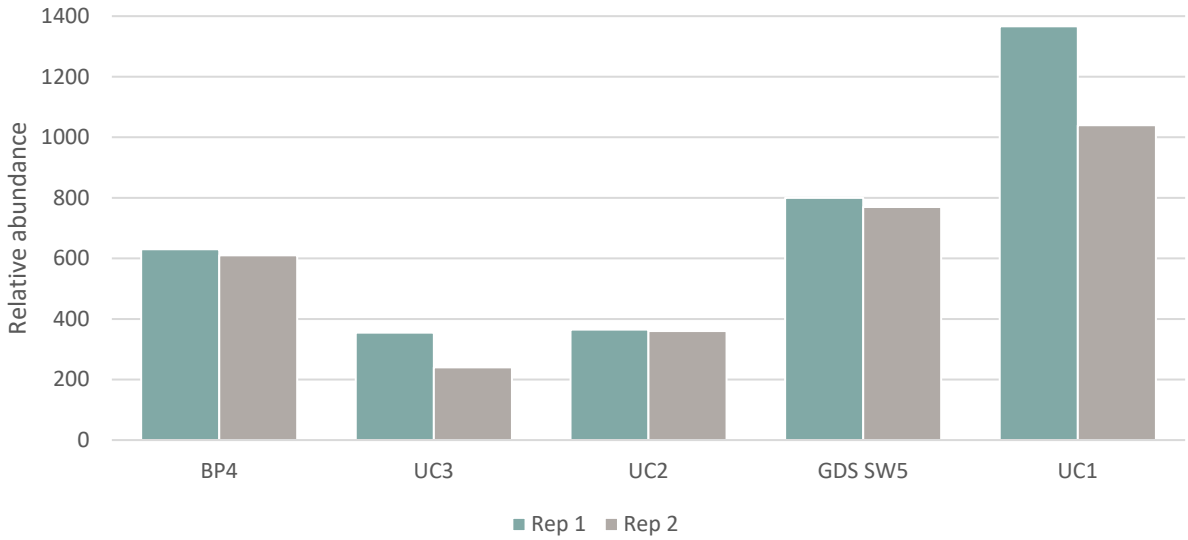


Figure 4 - Relative abundance of samples collected at Grants, April 2023

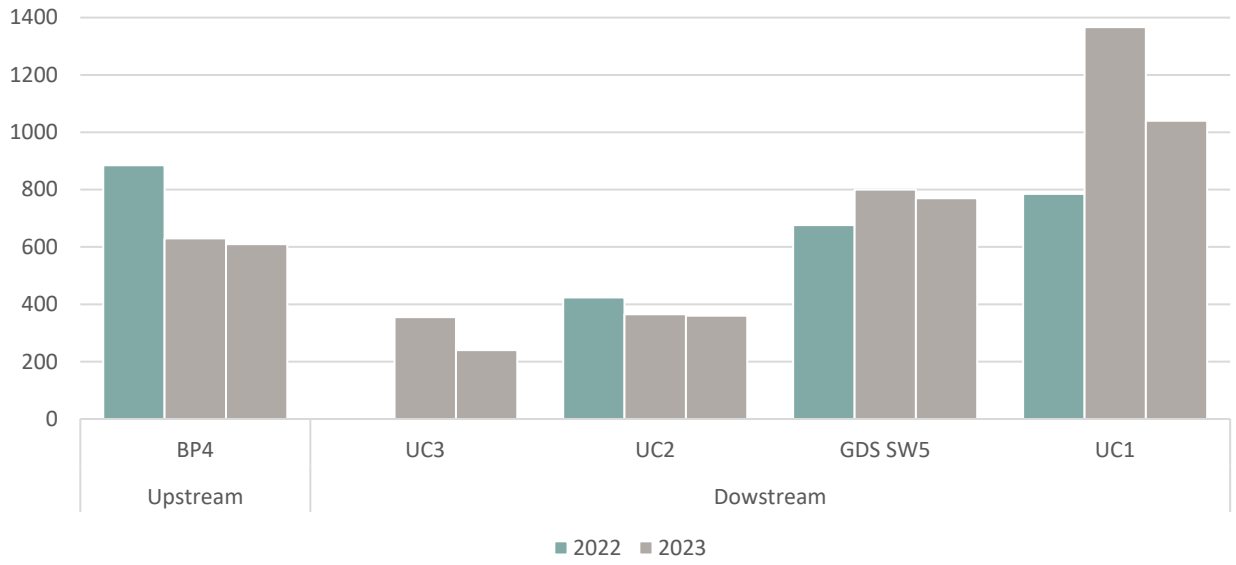


Figure 5 - Relative abundance of samples collected at Grants 2022 - 2023

5.4.2 Taxa richness

The taxa richness of samples collected in 2023 are presented in Figure 6. Macroinvertebrate diversity was lowest directly downstream of Grants at UC2, and increased with distance downstream. There was very little variability in taxa richness within each site, including at the reference site BP4.

Data collected in both 2022 and 2023 is presented in Figure 7. There was a marked difference in taxa richness between 2022 and 2023 at UC2, with the number of taxa almost halved in 2023 from 17 to 9. More taxa were collected in 2023 at UC1, and sites BP4 and GDS SW5 contained a similar taxa richness in both years. Despite the notable differences in taxa richness, there was no significant difference (p=>0.05) between years (0).

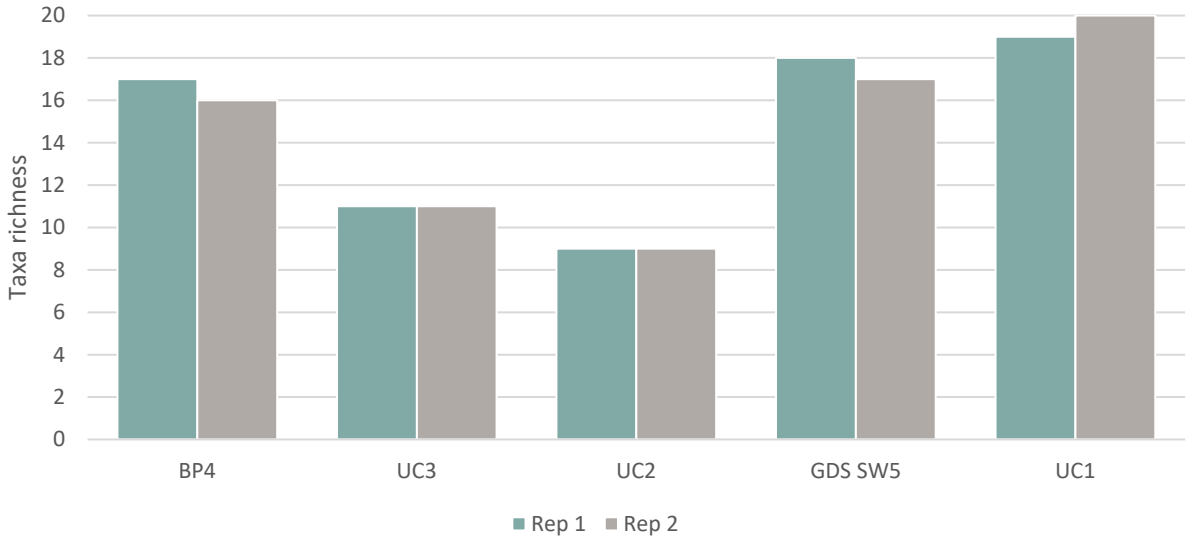


Figure 6 – Taxa richness of samples collected at Grants, April 2023

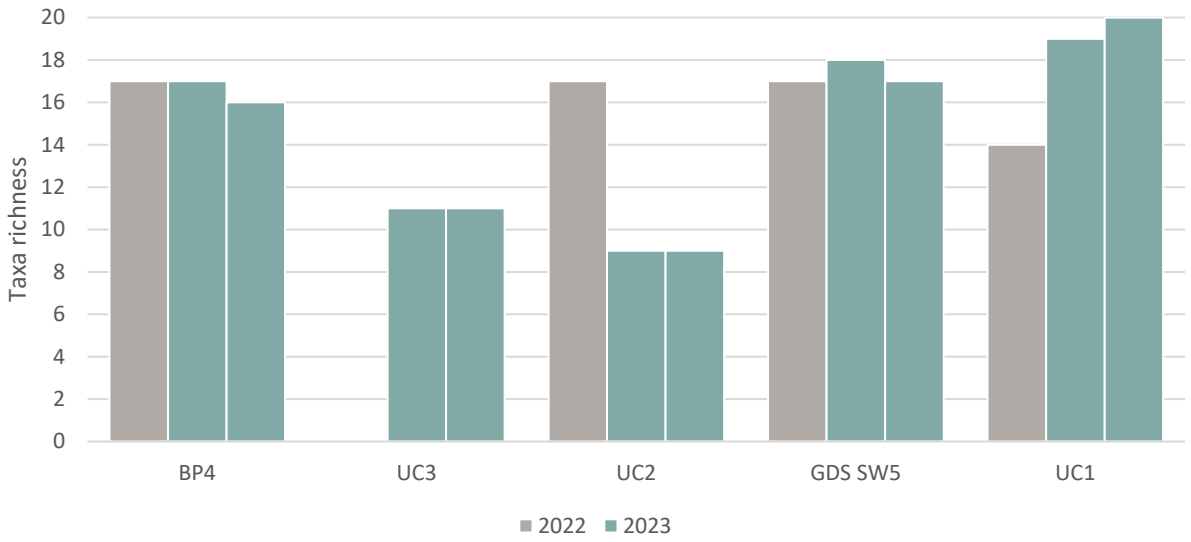


Figure 7 - Taxa richness of samples collected at Grants 2022 - 2023

5.4.3 PET richness

The PET richness of samples collected in 2023 are presented in Figure 8. As for other metrics, site UC2 had the lowest number of PET taxa, and richness increased with distance downstream. The highest number of PET taxa were collected at the reference site.

When reviewing historical results, PET richness varied between years. Lower numbers of PET taxa were found at both UC2 and GDS SW5 in 2023 compared with 2022, whereas the same or higher PET richness was recorded downstream at UC1. There was at least twice the number of PET taxa collected at the reference site in 2023 compared with the result from 2022. There was no significant difference found between years (p=>0.05, 0).

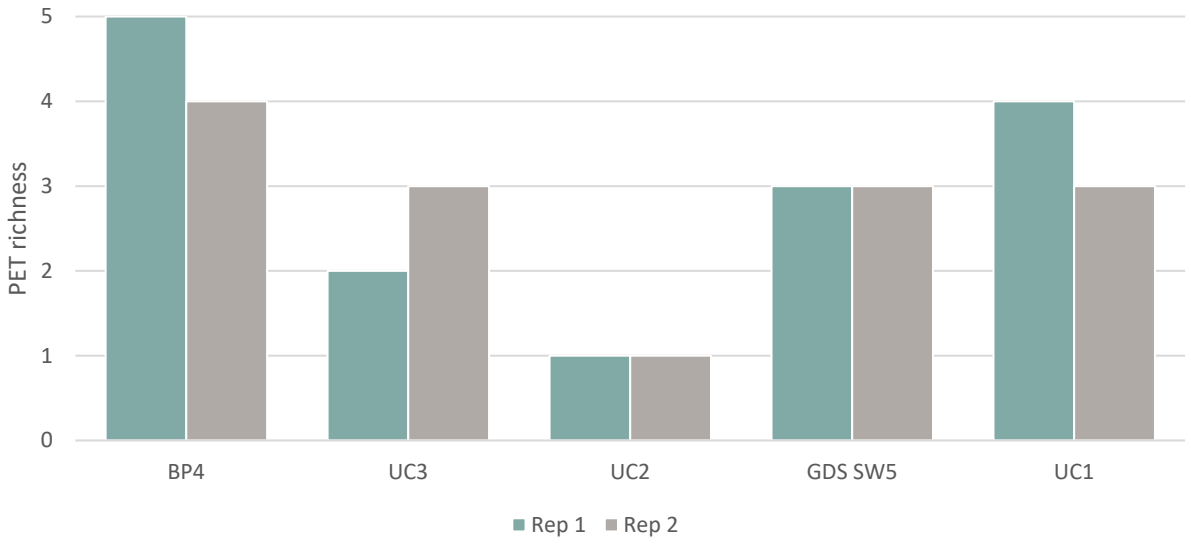


Figure 8 – PET richness of samples collected at Grants, April 2023

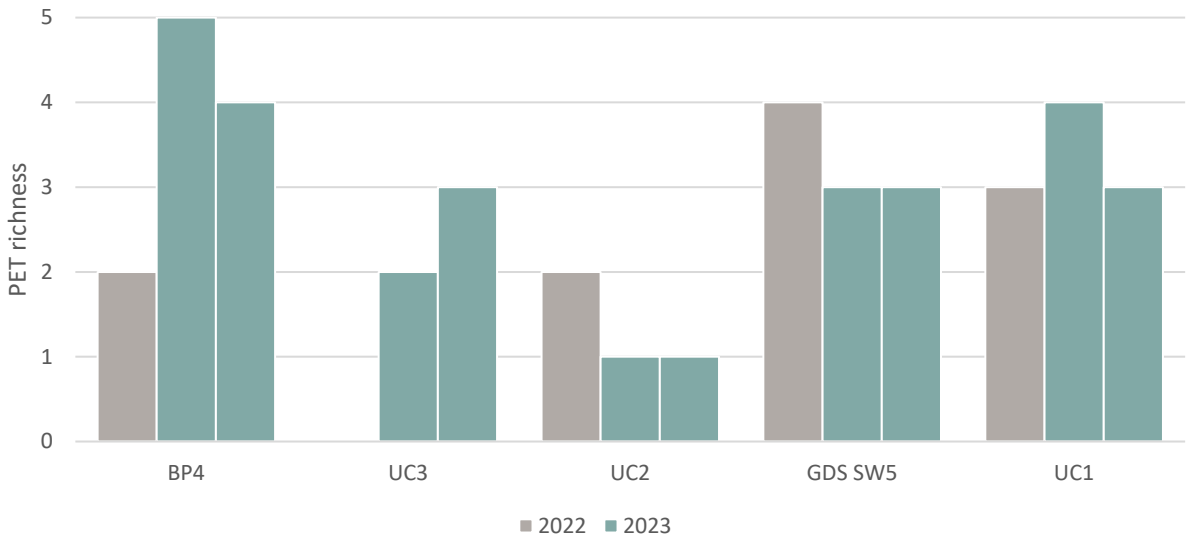


Figure 9 – PET richness of samples collected at Grants 2022 - 2023

5.4.4 SIGNAL-2

SIGNAL-2 results are presented in Figure 10. Results were slightly variable at most sites, with the lowest SIGNAL-2 scores found at UC2. When comparing baseline sampling in 2022 with 2023 results, similar SIGNAL-2 scores were recorded at BP4 and UC2, and varied most at UC1, which returned lower SIGNAL 2 scores in 2023. There was no significant difference found between years (p=>0.05, 0). SIGNAL-2 scores are indicative of a pollution tolerant community at all sites.

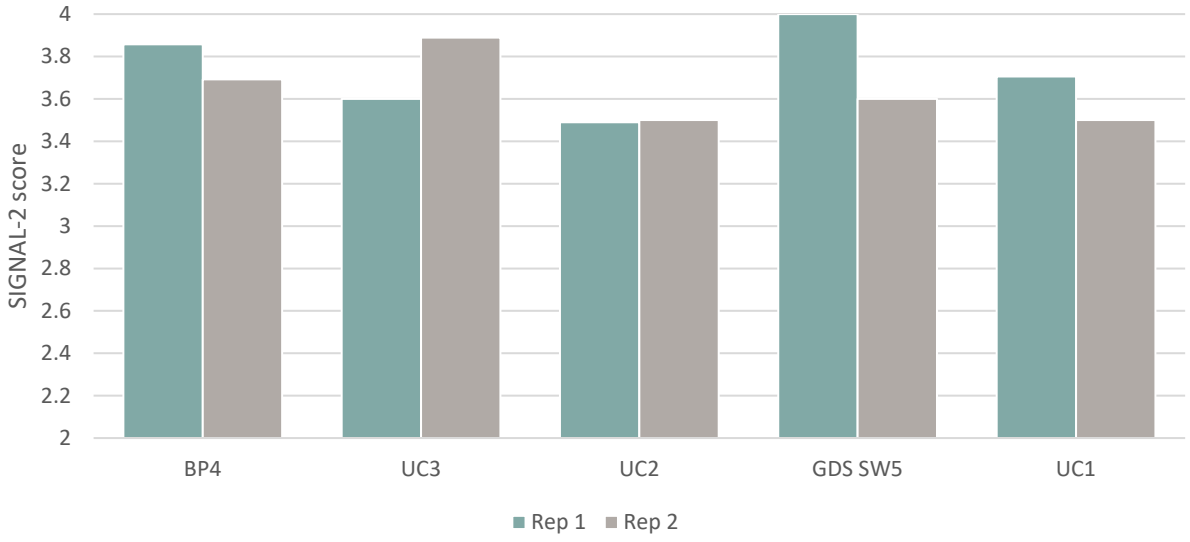


Figure 10 - SIGNAL-2 scores for samples collected at Grants, April 2023

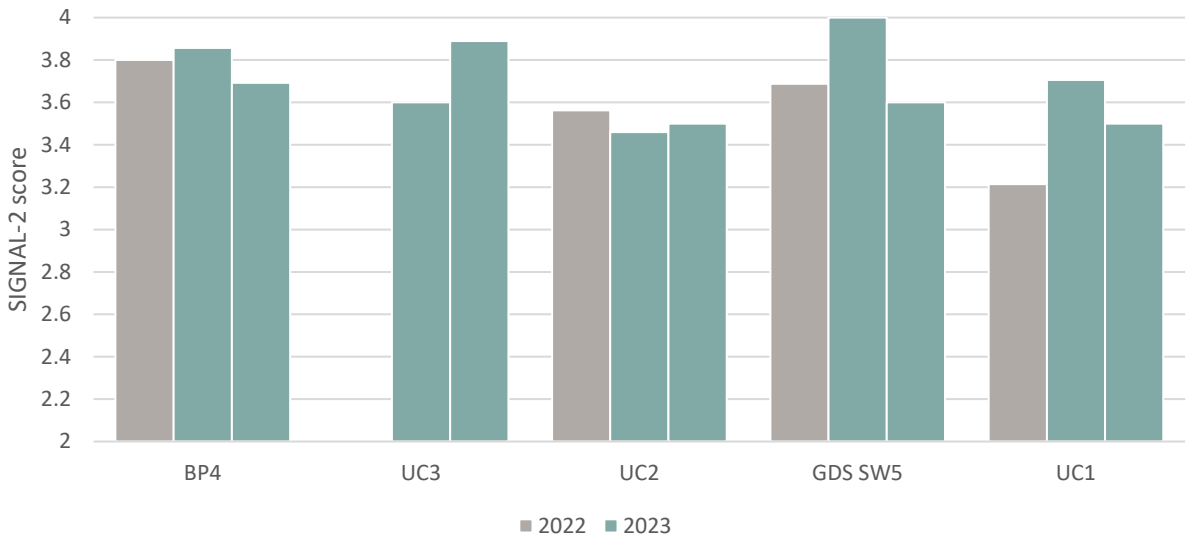


Figure 11 – SIGNAL-2 scores for samples collected at Grants 2022 – 2023

5.4.5 Community composition

Approximately 6516 individuals were collected across the Grants sites, comprising of 30 families from 12 orders. The proportion of each macroinvertebrate order in each sample is presented in Figure 12. Samples were dominated by True Flies (Diptera) and freshwater shrimp and prawns (Decapoda). There was a clear inverse relationship in abundance of Diptera present at UC3 and UC2, and Decapoda (namely Atyidae) at GDS SW5 and UC1. Similar proportional trends were present in baseline data (AES 2022), yet the proportion of Diptera at UC2 is much more pronounced than was previously observed. The lowest diversity of orders was found at UC3 and UC2.

The NMDS plot (Figure 13) demonstrates the similarity of the community at UC2 and UC3, when compared to other sites. Variability in community composition between samples at UC1 was evident, with one sample showing greater similarity to samples collected at GDS SW5. Samples collected at sites BP4 and UC2 demonstrated that composition of macroinvertebrate taxa was at least 80% similar within the site, denoting that habitat was more likely to be uniform at these sites.

When comparing baseline data to 2023 results (Figure 14), the compliance point (GDS SW5) shows the highest similarity in community composition across both years. Even though the year of sampling appeared to play a role in the similarity of samples collected, the results of the ANOSIM analysis showed no significant difference in community composition between baseline and operations years (Global R = 0.125, p = 0.205).

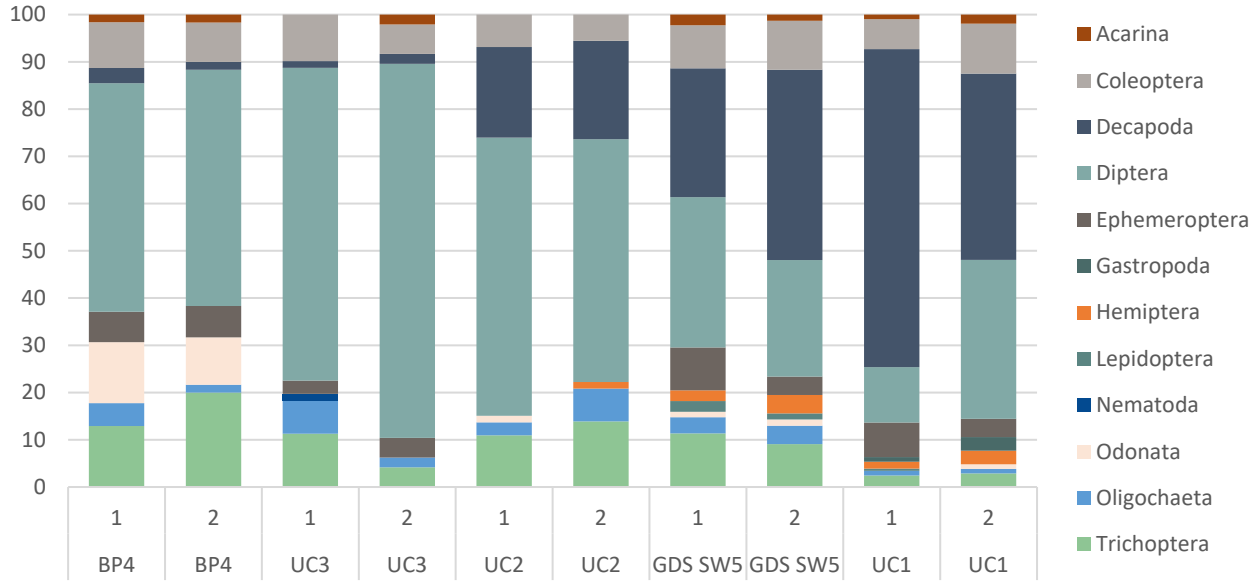


Figure 12 - Proportional abundance of macroinvertebrate orders collected in 2023

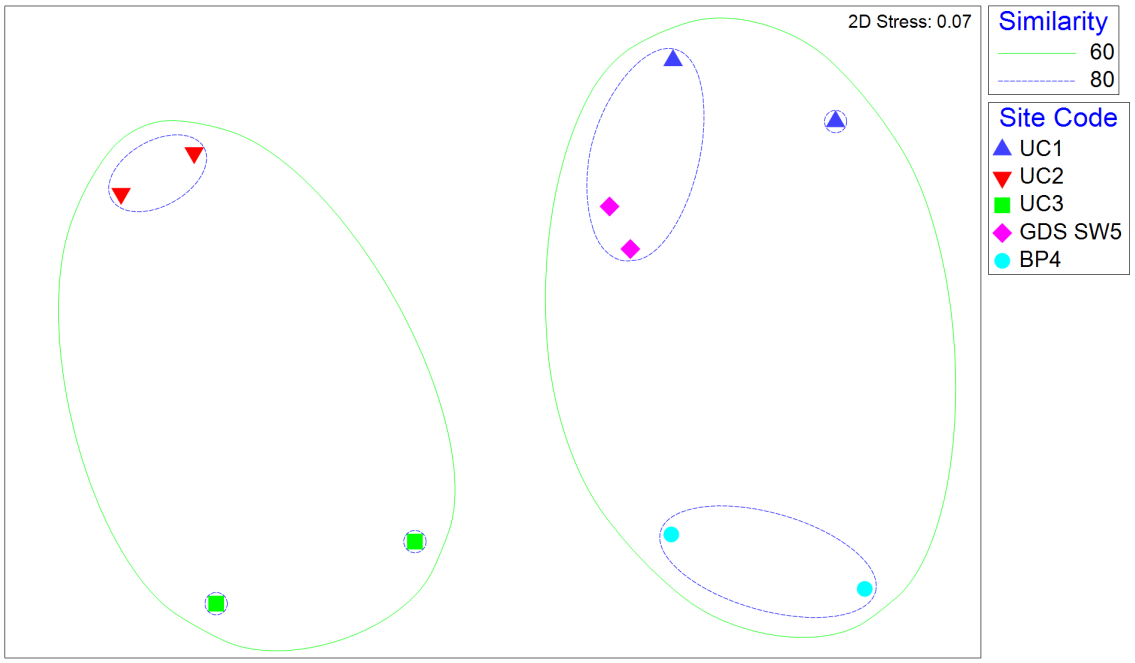


Figure 13 - NMDS plot showing variation in community composition between Grants sites

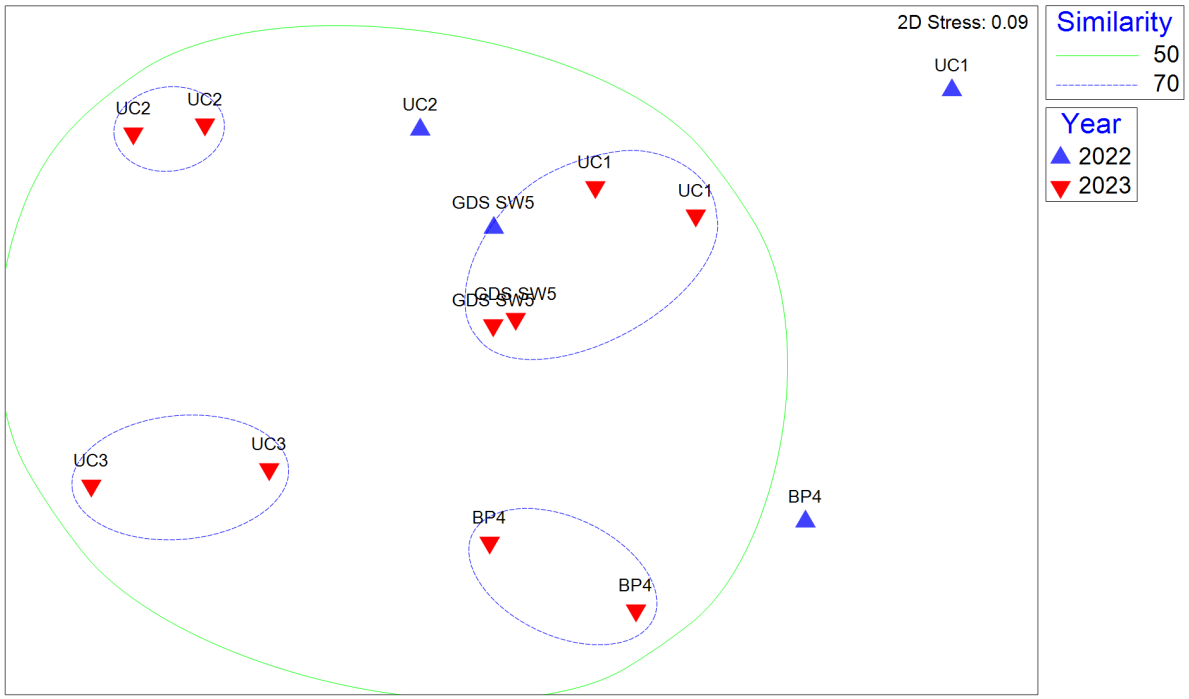


Figure 14 - NMDS plot showing variation in community composition between Grants sites 2022-2023

6. Discussion

The sampling design for this monitoring program follows the before, after, control impact (BACI) design, with two baseline monitoring events occurring prior to the commencement of mine water discharge from Grants (GHD 2017, AES 2022). Differences in samplers and the time elapsed between sampling events meant that data collected in 2017 was not directly relevant to data collected in 2022 and 2023 and so was not used in analysing impact of discharge. The removal of this data from ongoing monitoring allows for "before" data to be used from 2022. The inclusion of site UC3 in 2023, along with replicate macroinvertebrate sampling has improved the overall sampling design to allow for all influences on downstream environment to be understood.

Macroinvertebrate and sediment sampling at Grants in 2023 was completed after an above-average wet season, and site conditions reflected those conditions. Habitat characteristics of each site appeared to influence the differences in microhabitat availability across sites, with sites GWS SW5 and UC1 containing a lot of similarities in habitat availability. One of the main differences in habitat was lower riparian vegetation coverage at GDS SW5, which meant lower frequency of exposed roots and undercut banks, less provision of detritus to the substrate, and low shading. Despite these differences, taxa richness and pollution tolerance were similar across GDS SW5 and UC1. The site furthest upstream and closest to Grants (UC2) contained more shaded and deep-water habitat, and returned poorer aquatic ecosystem health results. Turbidity was above the WDL DTV at UC2.

Lower turbidity downstream at GDS SW5 and UC1 indicates that turbidity mat be spatially limited, and water entering the unnamed creek, via a tributary downstream of site UC2, may be ameliorating turbid waters found upstream.

There were no exceedances of the WDL DTVs for water samples collected downstream of Grants, and where metals were recorded above the LOR, there was no spatial pattern to the results. The circumneutral or slightly alkaline waters recorded at each of the sites was a marked change from results recorded in 2022, which were highly acidic (AES 2022). The change in results may be related to flow present at all sites, which was not the case in previous sampling.

Sediment results downstream of Grants suggest that arsenic is either naturally present in sediments in the catchment or bound in fine sediments that are being transported from the Grants site. The two sites furthest downstream returned arsenic values above the sediment DGVs, with one replicate result from UC1 and GDS SW5 being particularly high. Water and sediment results from a tributary entering the unnamed creek downstream of UC2, did not report elevated arsenic and are therefore not expected to be contributing to the results found downstream. The results of sediment monitoring were analysed as total metals, which does not allow for an accurate characterisation of bioavailability. Where future analysis can incorporate acid-extractible values, a comparison can be made and bioavailability (and therefore environmental risk) can be more accurately understood.

Arsenic results indicate a potential risk to aquatic ecosystems, should it become bioavailable. It should be noted however, that a low proportion of fine sediments were present in these samples, and thus reflect a

lower risk of significant concentrations of arsenic dissolving in solution. Arsenic concentrations should continue to be monitored closely to understand trends associated with active discharge, annual rainfall and erosion and sedimentation. The lack of dissolved arsenic in the waters collected confirms that there was little bioavailability at the time of sampling.

In 2023, macroinvertebrate sampling results showed a clear impairment of the community at UC2 directly downstream of Grants, and improvements in aquatic ecosystem health with distance downstream. Community health and differences in community composition at UC2 were not consistent with poor water or sediment quality results, besides elevated turbidity. Although different to downstream sites, habitat at UC2 did not appear to contain a low diversity of microhabitats. Increased turbidity at the site may be playing a role in the diversity and sensitivity of taxa present. Changes in macroinvertebrate metrics from those collected prior to dewatering in 2022 indicate a decline in aquatic ecosystem health at the site. The cause of the decline cannot be directly attributed to the discharge from MWD1, as environmental factors, such as above average rainfall, and flow at the site need to be considered. The decline in health was spatially limited to UC2, and improvement in ecosystem health was apparent downstream. There were similarities in macroinvertebrate community composition at GDS SW5 and UC1, which is largely related to analogous habitat availability at the sites in 2023.

The compliance point, GDS SW5 showed very little change in metrics and composition between years, whereas other sites monitored (UC2 and UC1) did show variability. The lower complexity of habitat at GDS SW5 is likely to result in less variability in macroinvertebrate metrics over time, whereas other sites that are subject to changes in habitat availability with creek height, will likely contain more variable invertebrate communities. Although there were some observable differences between years, there was no significant difference found across sites sampled in both years for any macroinvertebrate metric or community composition.

The results of sampling in 2023 demonstrate that active discharge from Grants has had no significant impact on the aquatic ecosystems of waterways draining to Darwin Harbour, although turbidity appears to be impacting macroinvertebrate health directly downstream of the mine. Ongoing sampling to monitor turbidity, sediment metal loads and ecosystem health is needed to understand the long-term impacts of active discharge on the receiving environment.

7. Recommendations

Replicate macroinvertebrate sampling has shown an increase in statistical power. Replicated sampling should continue in future sampling events. The addition of site UC3 allows for a better understanding of catchment dynamics and should continue to be sampled in future monitoring.

Sediment samples returned variable results in sediment size and metal concentrations between replicates at sites. Future sampling should consider collecting a single composite sample across the site, with a duplicate sample for quality assurance taken from one site each sampling round. Any metal accumulation in sediments is likely to include a proportion that is not bioavailable. Laboratory analysis was completed on the 63µm fraction of samples, this should be altered to include all material under 2mm as recommended by ANZG (ANZG 2023b). Total and acid-extractible metals analysis should be performed to assist with understanding the bioavailability of elevated metals found in sediments downstream of Grants.

One of the most obvious differences in site conditions between 2022 and 2023 is flow. Sites were reduced to isolated pools in 2022, whereas flow was present at all sites in 2023, often resulting in riffles and runs, which can produce inflated macroinvertebrate metrics such as abundance and taxa richness. Conditions suggest that sampling may have been completed earlier than stipulated by the NT Darwin-Daly Protocols, which state that sampling should take place 4-6 weeks after a flushing event in the catchment. Rainfall was above average in the early wet season, and more than 360mm of rain fell in the six weeks prior to sampling taking place. These conditions would have likely resulted in flows and flushing in the catchment. Flows of this magnitude would have likely been followed by declining, but not stable flows which were still present during sampling in mid-April 2023. Sampling should be carried out when optimum conditions for stabilised populations throughout the catchment are occurring so that accurate assessments of long-term aquatic ecosystem health can be made. It is acknowledged that predicting optimum conditions and the logistics of mobilising sampling teams can be problematic in the Northern Territory and it is not always possible to sample at optimal times.

8. References

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Appendix A. Fieldsheets

6. APPENDIX 1 – FIELD SHEETS

FIELD SHEETS

AUSRIVAS - Darwin Daly regional Models

Date	Site Code	Site Name	Field Team
18.4.23	BP4 33	~~BP33~~ BP4	MO BJ

GPS coordinates: (*predictor variables family level model*):

Zone (UTM)	Easting	Northing	Datum

Landholders and contact details

Site comments, observations

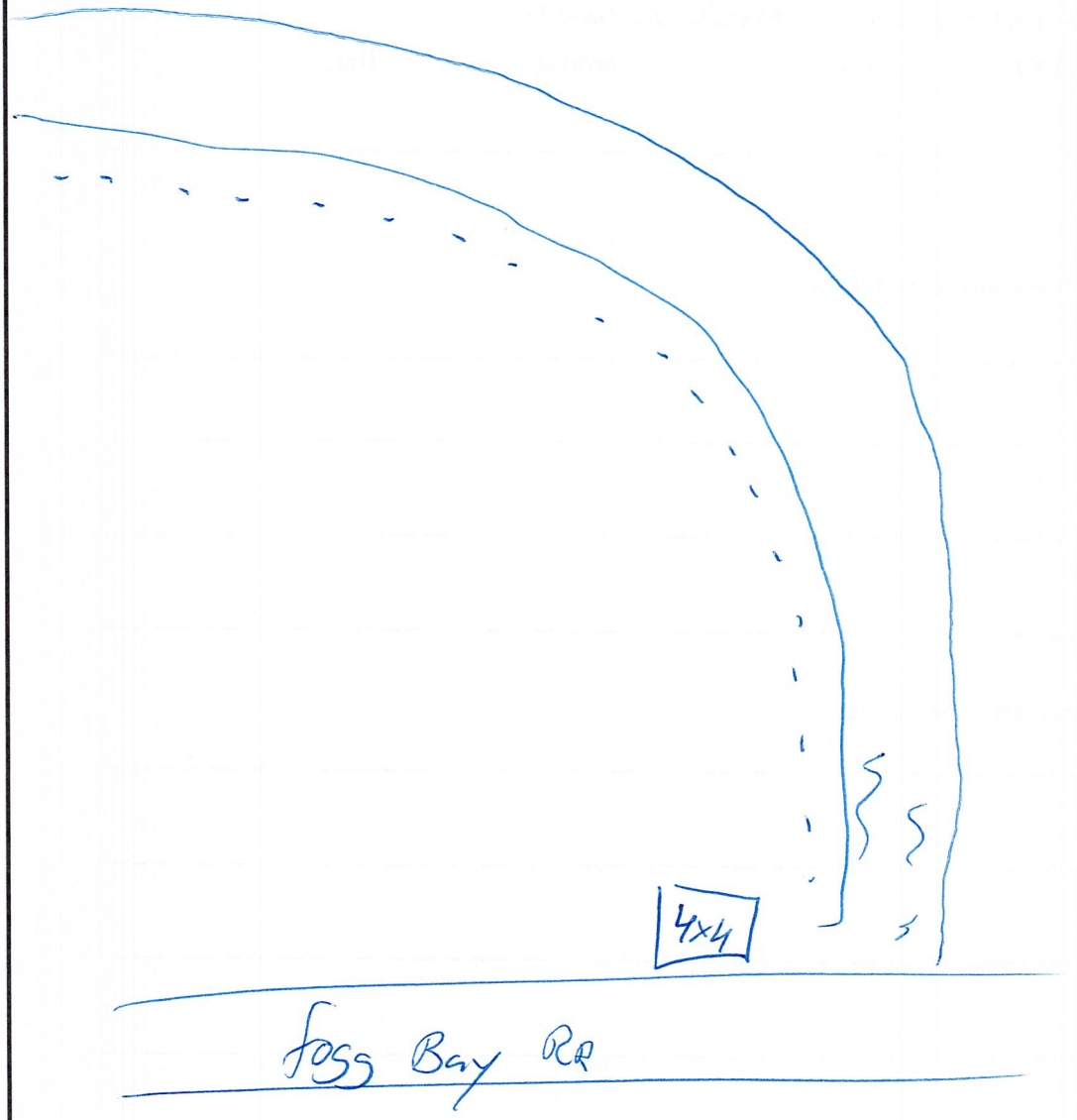
ACCESS SKETCH

SITE NAME

~~BP4~~ BP33

SITE CODE

BP4



Indicate any features that assist locating exact sample site on subsequent trips.

WATER QUALITY

Time 11:15 **Instrument** Hannah **Instrument Serial No.**

pH 7.56 **units** **E.C.** 23 **µS/cm**

D.O. 61.9 **mg/L** **Water Temperature** 25.76 **°C**

Turbidity 7.10 **NTUs** **Instrument and serial number**

Water samples for laboratory water quality analysis

(ALKALINITY is a *predictor variable for genus level model*)

Bottle lable	Analysis
	Alkalinity

Observations relating to water quality (e.g. water oil, scum, foam, sediment odours)

Clear, no odour

MACROINVERTEBRATE SAMPLING

EDGE

Length sampled 10 m

Collected by BD HO

No. of containers used 2

Edge description

☐ Vertical 90°

☑ Angled 45-90°

☐ Undercut

Edge habitat mainly composed of roots from

☑ Paperbark / Melaleuca

☐ other common riparian trees

☑ shrub

☑ grass

Edge habitat

☐ roots covered by algae

☑ overhanging vegetation

Habitat velocity & depth **Flow meter serial no.** _____ **Fan set no.**____

(*predictor variable genus level model*)

Meter Reading (Revolutions per 40s)				Habitat depth (cm)		
1	2	3	Fan details	1	2	3

0.5m/s

Stream Width (at water level) (*predictor variable genus and family level models*): six measurements or estimations are taken in a 100m reach upstream of the macroinvertebrate sampling site.

Number	1	2	3	4	5	6
Width (m)					X	

☐ measured ☑ estimate only

Comments

DESCRIPTION OF THE REACH (reach 100 m upstream of sample site)

Habitats within 100 m reach

Sand/Silt bed	☑	Riffle	☑
Gravel/Rock bed	☑	Run	☐
Macrophytes	☑	Pool	☑
Snags	☑		

Description of stream characteristics

Width between top of levee banks (bankfull width) 7 m

Other levees ☐

Height of levee bank from water surface 1.5 m

Flow observable ☑

RIPARIAN ZONE (within 100 m reach)

Riparian zone width -left bank (facing downstream) 20 m

-right bank 20 m

Riparian vegetation type

Monsoon-vine forest/Rainforest	☐	Riparian shrubland	☑
Riparian forest	☑	Riparian grassland	☑
Riparian woodland	☑	Other:	

Weeds ☐

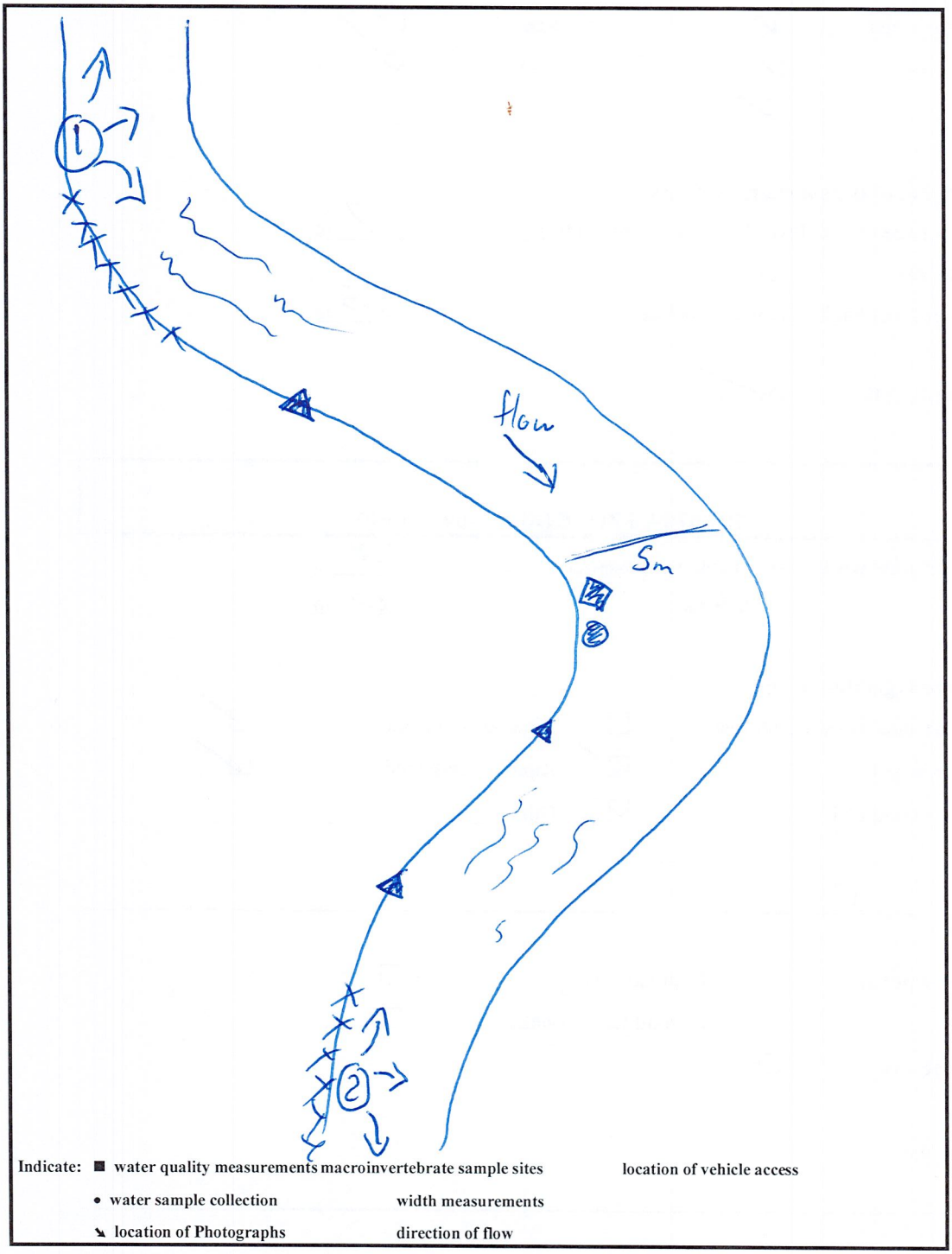
Evidence of fire Riparian Zone ☐

Beyond Levee Banks ☐

Cattle access ☐

Comments

SKETCH OF 100 M REACH



6. APPENDIX 1 – FIELD SHEETS

FIELD SHEETS

AUSRIVAS - Darwin Daly regional Models

Date	Site Code	Site Name	Field Team
20/09/23	Grants	VC3	BD, LL

GPS coordinates: (*predictor variables family level model*):

Zone (UTM)	Easting	Northing	Datum

Landholders and contact details

Core Lithium

Site comments, observations

lots of washout Gullies lead to Creek

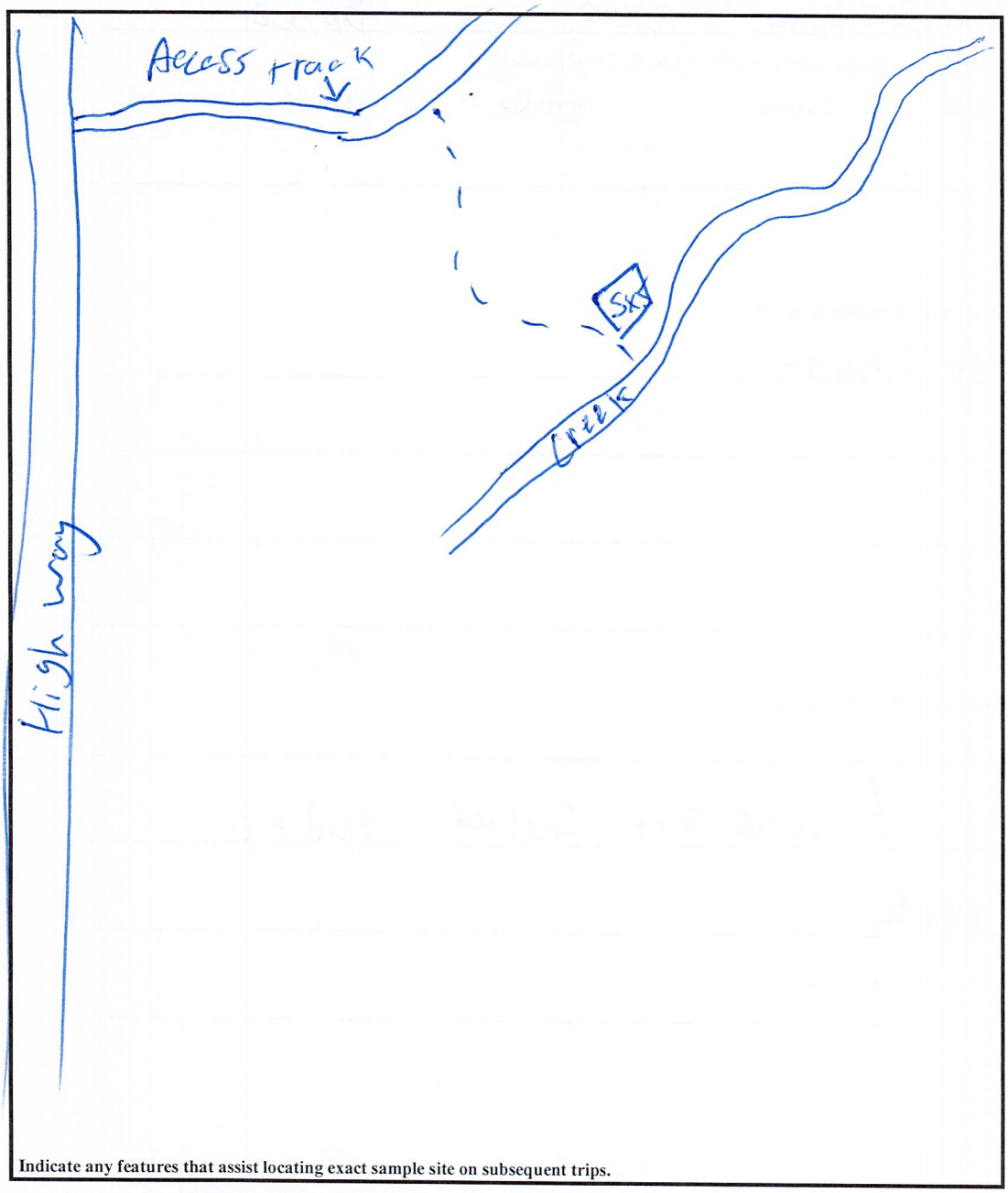
ACCESS SKETCH

SITE NAME

VC3

SITE CODE

Grants



Indicate any features that assist locating exact sample site on subsequent trips.

WATER QUALITY

Time 0810	**Instrument**	**Instrument Serial No.**		
pH 6.64	**units**	**E.C.** 24		**µS/cm**
D.O. 86.8	**mg/L**	**Water Temperature** 26		**°C**
Turbidity 4.18	**NTUs**	**Instrument and serial number**		

Water samples for laboratory water quality analysis

(ALKALINITY is a *predictor variable for genus level model*)

Bottle lable	Analysis
	Alkalinity

Observations relating to water quality (e.g. water oil, scum, foam, sediment odours)

Clear, Flowing, Small bubbles on surface, flora

MACROINVERTEBRATE SAMPLING

EDGE

Length sampled 10 m

Collected by EC03

No. of containers used _____

Edge description

- ☑ Vertical 90°
- ☐ Angled 45-90°
- ☐ Undercut

Edge habitat mainly composed of roots from

- ☑ Paperbark / Melaleuca
- ☑ other common riparian trees
- ☐ shrub
- ☑ grass

Edge habitat

- ☑ roots covered by algae
- ☑ overhanging vegetation

Habitat velocity & depth **Flow meter serial no.** _____ **Fan set no.**____

(*predictor variable genus level model*)

Meter Reading (Revolutions per 40s)			1.5 m/s	Habitat depth (cm)		
1	2	3	Fan details	1	2	3

Stream Width (at water level) (*predictor variable genus and family level models*): six measurements or estimations are taken in a 100m reach upstream of the macroinvertebrate sampling site.

Number	1	2	3	4	5	6
Width (m)			✓			

☐ measured ☑ estimate only

Comments

Dense macrophyte cover, narrow, clear, lots of overhang

DESCRIPTION OF THE REACH (reach 100 m upstream of sample site)

Habitats within 100 m reach

Sand/Silt bed	☑	Riffle	☑
Gravel/Rock bed	☑	Run	☑
Macrophytes	☑	Pool	☑
Snags	☑		

Description of stream characteristics

Width between top of levee banks (bankfull width) 6 m

Other levees ☐

Height of levee bank from water surface 0.5 m

Flow observable ☑

RIPARIAN ZONE (within 100 m reach)

Riparian zone width -left bank (facing downstream) 5 m

-right bank 3 m

Riparian vegetation type

Monsoon-vine forest/Rainforest	☐	Riparian shrubland	☐
Riparian forest	☐	Riparian grassland	☐
Riparian woodland	☑	Other: _____	

Weeds ☐

Evidence of fire N/A

Riparian Zone ☐

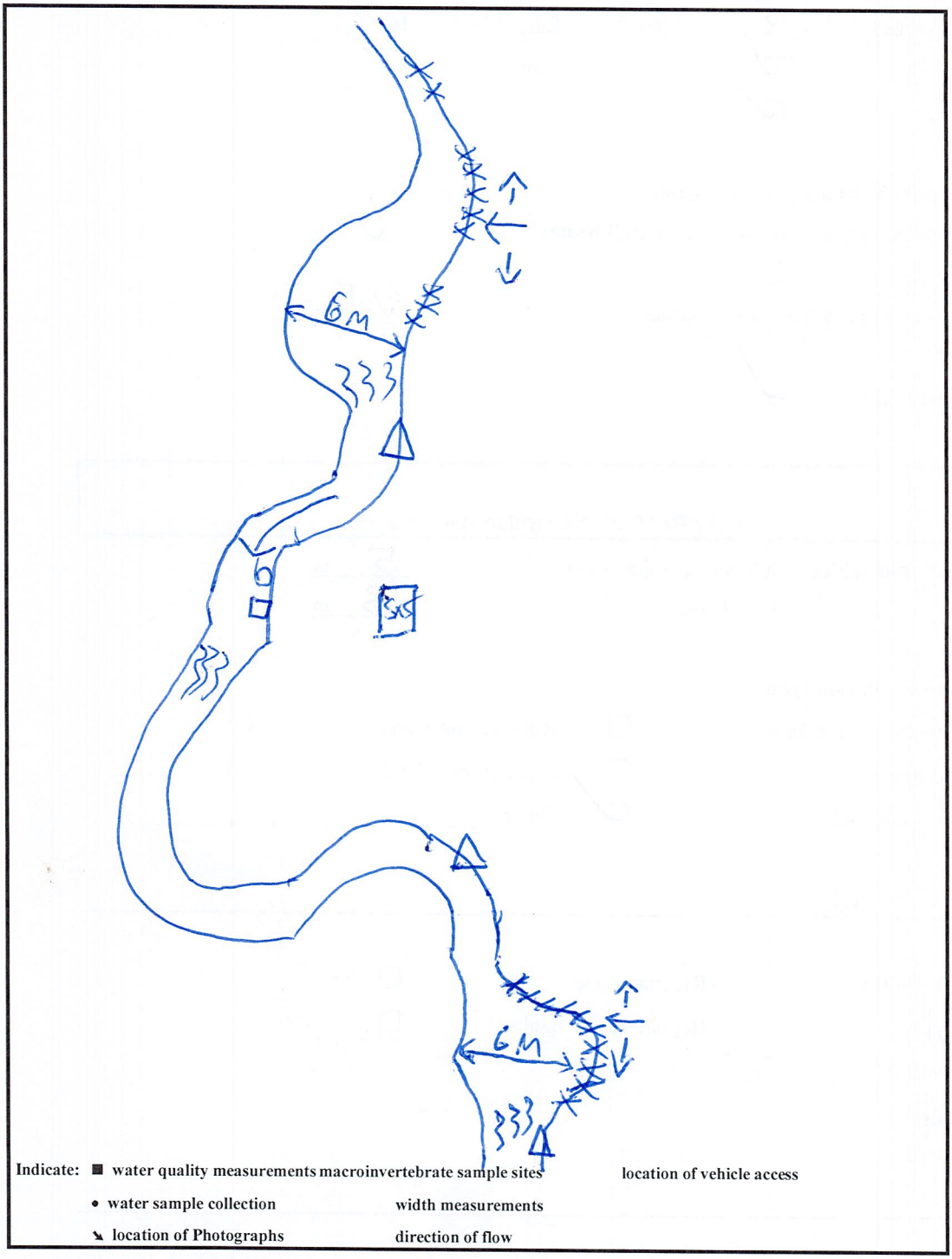
Beyond Levee Banks ☐

Cattle access ☐

N/A

Comments

SKETCH OF 100 M REACH



6. APPENDIX 1 – FIELD SHEETS

FIELD SHEETS

AUSRIVAS - Darwin Daly regional Models

Date	Site Code	Site Name	Field Team
20/04/23	Grant5	UC2	BD, HL

GPS coordinates: (*predictor variables family level model*):

Zone (UTM)	Easting	Northing	Datum

Landholders and contact details

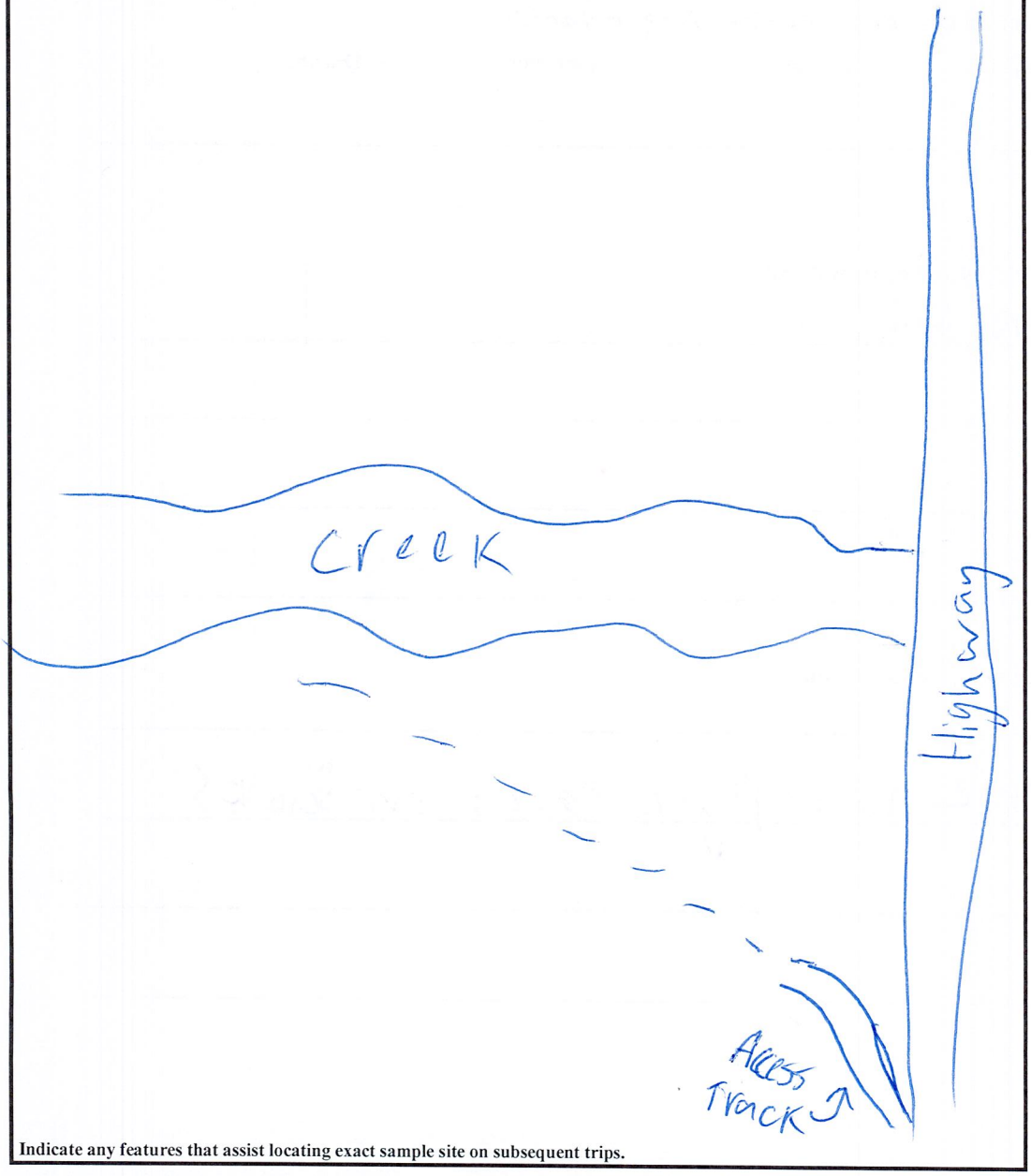
Core Lithium

Site comments, observations

Dense macrophyte cover on Banks

ACCESS SKETCH

SITE NAME **SITE CODE**



Indicate any features that assist locating exact sample site on subsequent trips.

WATER QUALITY

Time	1100	**Instrument**	**Instrument Serial No.**	
pH	7.74	**units**	**E.C.** 18	**µS/cm**
D.O.	97.2	**mg/L**	**Water Temperature** 26.1	**°C**
Turbidity	31	**NTUs**	**Instrument and serial number**	

Water samples for laboratory water quality analysis

(ALKALINITY is a *predictor variable for genus level model*)

Bottle lable	**Analysis**
	Alkalinity

Observations relating to water quality (e.g. water oil, scum, foam, sediment odours)

Turbid, lillies

MACROINVERTEBRATE SAMPLING

EDGE

Length sampled 10 m

Collected by EC03

No. of containers used _____

Edge description

- ☑ Vertical 90°
- ☐ Angled 45-90°
- ☐ Undercut

Edge habitat mainly composed of roots from

- ☑ Paperbark / Melaleuca
- ☐ shrub
- ☑ other common riparian trees
- ☑ grass

Edge habitat

- ☑ roots covered by algae
- ☑ overhanging vegetation

Habitat velocity & depth **Flow meter serial no.** _____ **Fan set no.**____

(*predictor variable genus level model*)

Meter Reading (Revolutions per 40s)			71 M/S	Habitat depth (cm)		
1	2	3	Fan details	1	2	3

Stream Width (at water level) (*predictor variable genus and family level models*): six measurements or estimations are taken in a 100m reach upstream of the macroinvertebrate sampling site.

Number	1	2	3	4	5	6
Width (m)					✓	

☐ measured ☑ estimate only

Comments

Stream is uneven. wider in some areas, narrower in others

DESCRIPTION OF THE REACH (reach 100 m upstream of sample site)

Habitats within 100 m reach

Sand/Silt bed	☑	Riffle	☑
Gravel/Rock bed	☑	Run	☐
Macrophytes	☑	Pool	☑
Snags	☑		

Description of stream characteristics

Width between top of levee banks (bankfull width) 10 m

Other levees ☐

Height of levee bank from water surface 0.8 m

Flow observable ☑

RIPARIAN ZONE (within 100 m reach)

Riparian zone width -left bank (facing downstream) 4 m

-right bank 5 m

Riparian vegetation type

Monsoon-vine forest/Rainforest	☐	Riparian shrubland	☐
Riparian forest	☐	Riparian grassland	☐
Riparian woodland	☑	Other: _____	

Weeds ☐

Evidence of fire

N/A

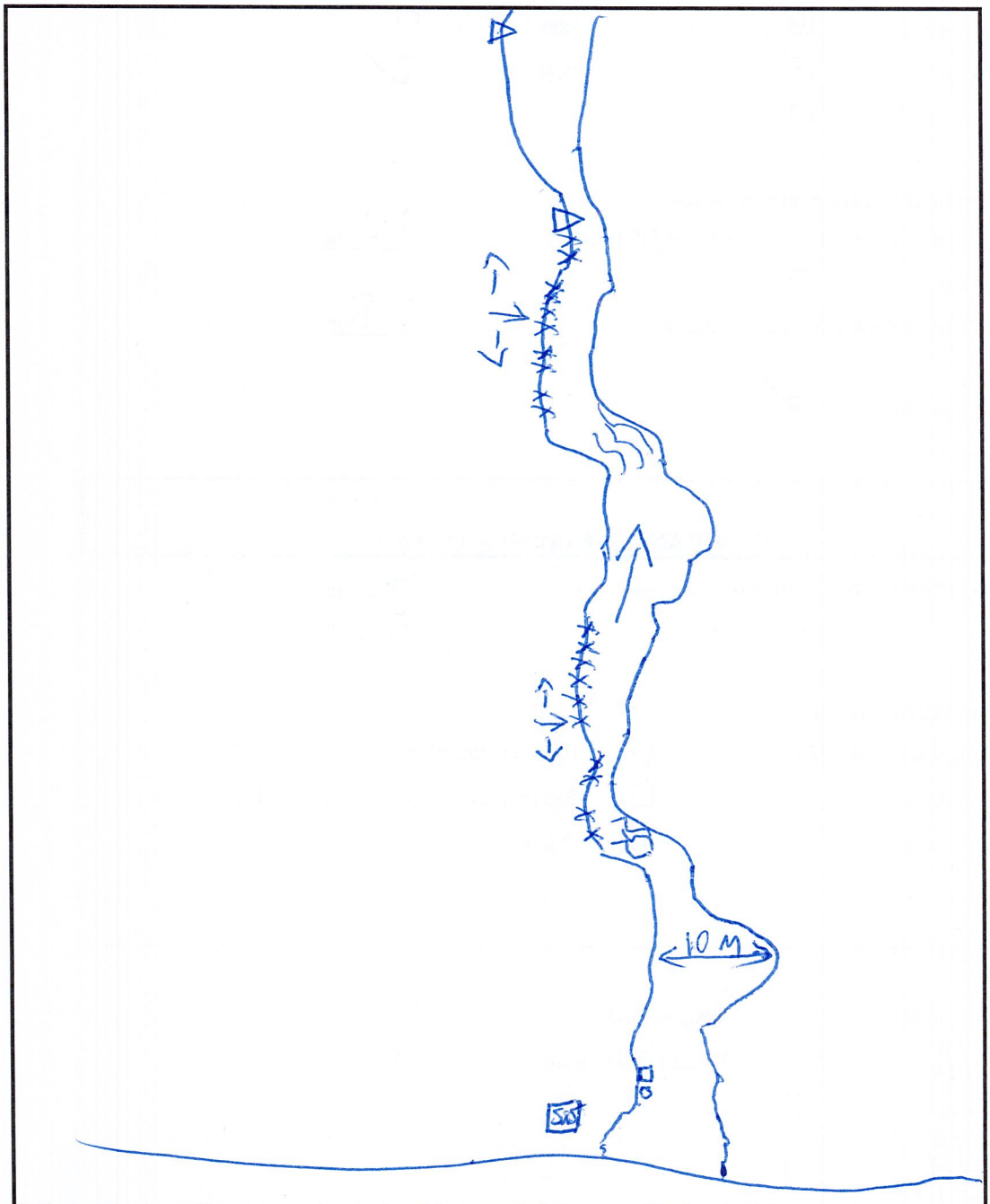
Riparian Zone	☐
Beyond Levee Banks	☐

Cattle access ☐

N/A

Comments

SKETCH OF 100 M REACH



Indicate: ■ water quality measurements macroinvertebrate sample sites location of vehicle access
• water sample collection width measurements
↘ location of Photographs direction of flow

6. APPENDIX 1 – FIELD SHEETS

FIELD SHEETS

AUSRIVAS - Darwin Daly regional Models

Date 19/04/23 **Site Code** Grants Gd55w5 ~~Gd55w~~ 5 **Site Name** Gd55w5 **Field Team** BD, LL

GPS coordinates: (*predictor variables family level model*):

Zone (UTM)	Easting	Northing	Datum

Landholders and contact details

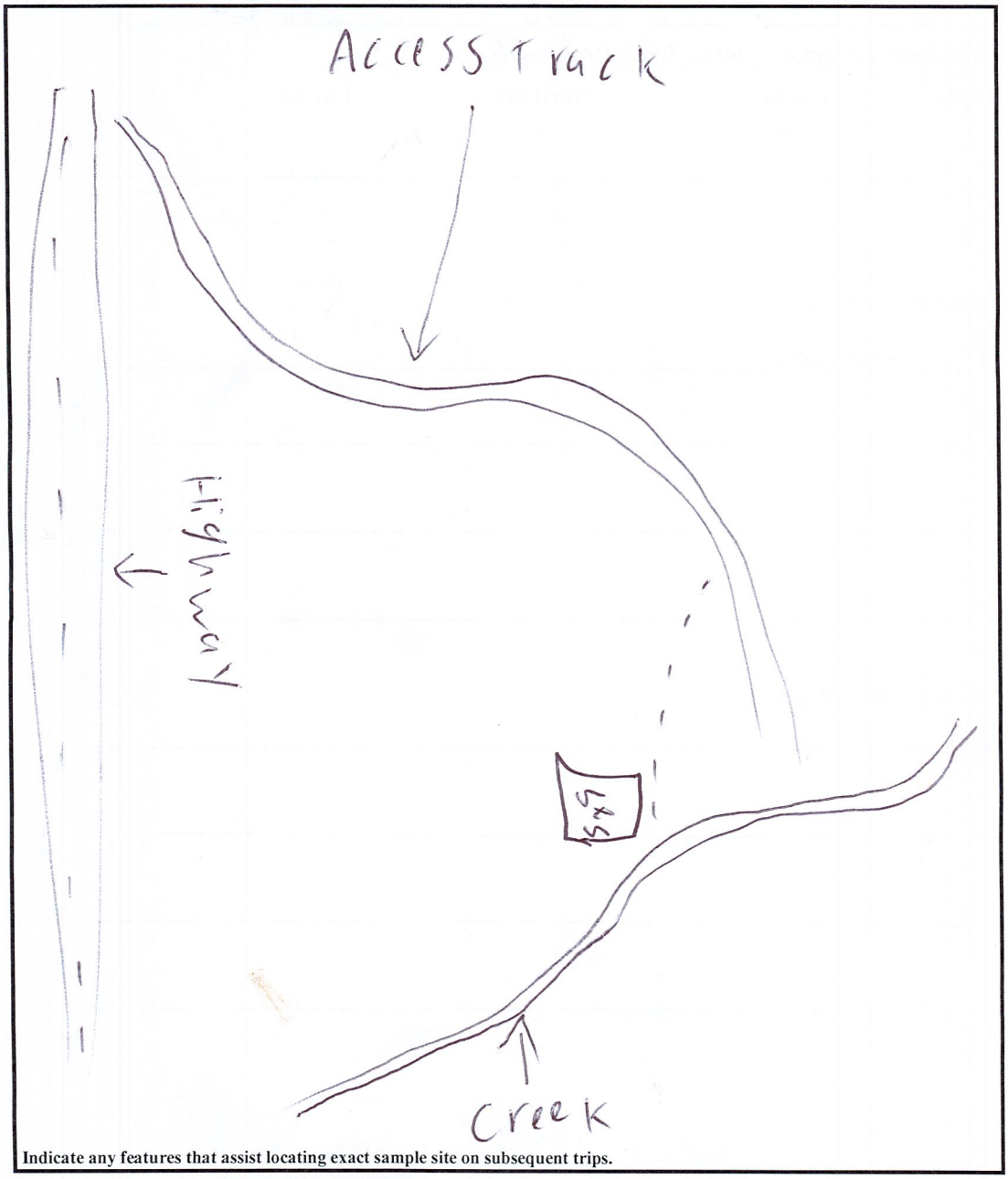
Core lithium

Site comments, observations

ACCESS SKETCH

SITE NAME GDSSW5

SITE CODE Grant5



Indicate any features that assist locating exact sample site on subsequent trips.

WATER QUALITY

Time 0730 **Instrument** **Instrument Serial No.**

pH 8.3 **units** **E.C.** 22 **µS/cm**

D.O. 74 **mg/L** **Water Temperature** 25.87 **°C**

Turbidity 6.07 **NTUs** **Instrument and serial number**

Water samples for laboratory water quality analysis

(ALKALINITY is a *predictor variable for genus level model*)

Bottle lable	Analysis
	Alkalinity

Observations relating to water quality (e.g. water oil, scum, foam, sediment odours)

Foam, No Odour, Aquatic Flora, Detritus

MACROINVERTEBRATE SAMPLING

EDGE Length sampled 10 m

Collected by RK

No. of containers used _____

Edge description

☑ Vertical 90°

☐ Angled 45-90°

☐ Undercut

Edge habitat mainly composed of roots from

☑ Paperbark / Melaleuca ☐ shrub

☐ other common riparian trees ☑ grass

Edge habitat

☑ roots covered by algae ☑ overhanging vegetation

Habitat velocity & depth **Flow meter serial no.** _____ **Fan set no.**____

(*predictor variable genus level model*)

Meter Reading (Revolutions per 40s)			1.5 M/S	Habitat depth (cm)		
1	2	3	Fan details	1	2	3

Stream Width (at water level) (*predictor variable genus and family level models*): six measurements or estimations are taken in a 100m reach upstream of the macroinvertebrate sampling site.

Number	1	2	3	4	5	6
Width (m)					✓	

☐ measured ☑ estimate only

Comments

2 x samples taken (macro replicate)

DESCRIPTION OF THE REACH (reach 100 m upstream of sample site)

Habitats within 100 m reach

Sand/Silt bed	☑	Riffle	☑
Gravel/Rock bed	☑	Run	☑
Macrophytes	☑	Pool	☐
Snags	☑		

Description of stream characteristics

Width between top of levee banks (bankfull width) 8 m

Other levees ☐

Height of levee bank from water surface 0.5 m

Flow observable ☑

RIPARIAN ZONE (within 100 m reach)

Riparian zone width -left bank (facing downstream) 5 m

-right bank 7 m

Riparian vegetation type

Monsoon-vine forest/Rainforest	☐	Riparian shrubland	☐
Riparian forest	☐	Riparian grassland	☑
Riparian woodland	☑	Other: _____	

Weeds ☐

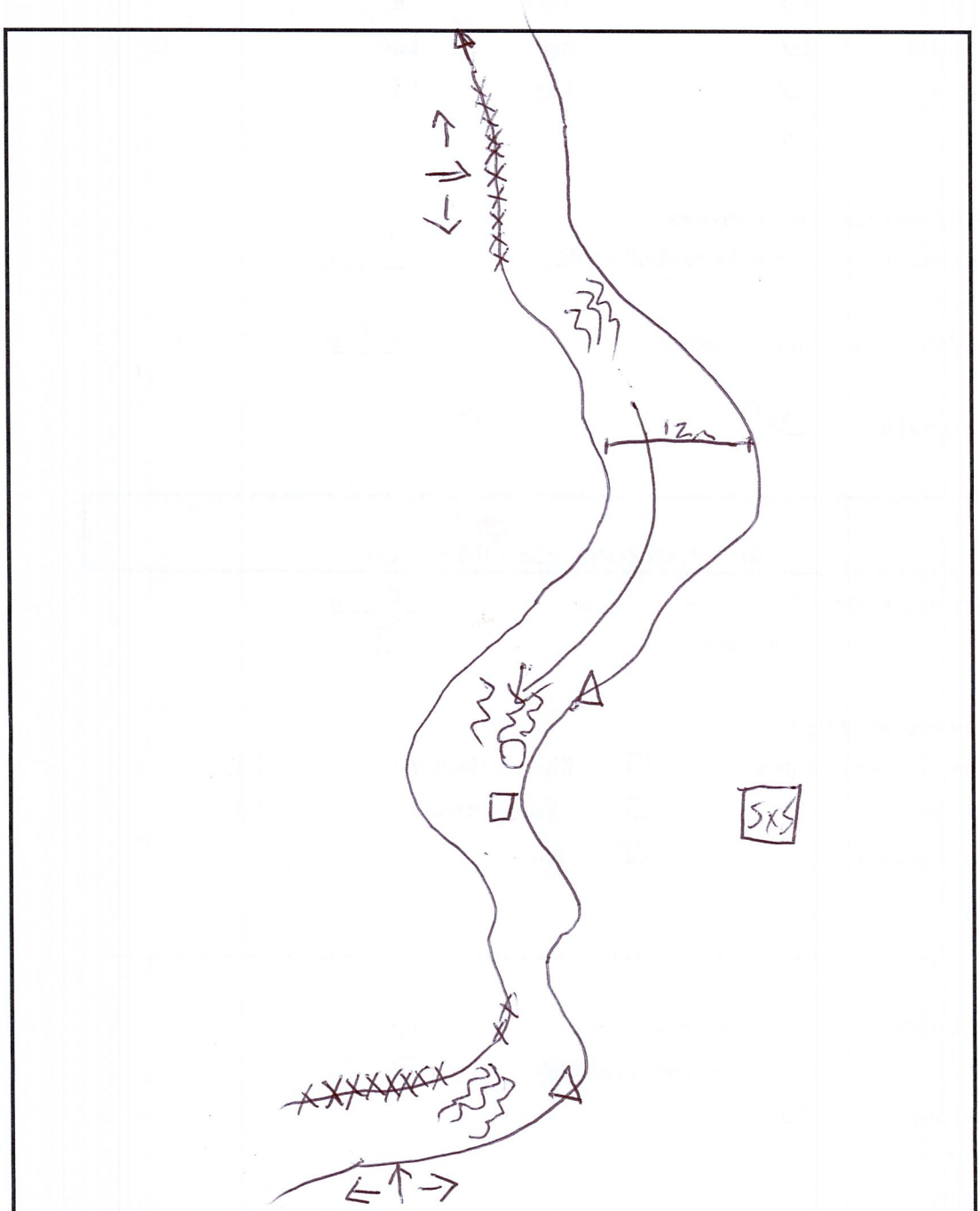
Evidence of fire N/A

Riparian Zone	☐
Beyond Levee Banks	☐

Cattle access ☐ N/A

Comments

SKETCH OF 100 M REACH



Indicate: ■ water quality measurements macroinvertebrate sample sites location of vehicle access
• water sample collection width measurements
↘ location of Photographs direction of flow

6. APPENDIX 1 – FIELD SHEETS

FIELD SHEETS

AUSRIVAS - Darwin Daly regional Models

Date	Site Code	Site Name	Field Team
19/04/23	Grants	VC1	BD, RR

GPS coordinates: (*predictor variables family level model*):

Zone (UTM)	Easting	Northing	Datum

Landholders and contact details

Core lithium

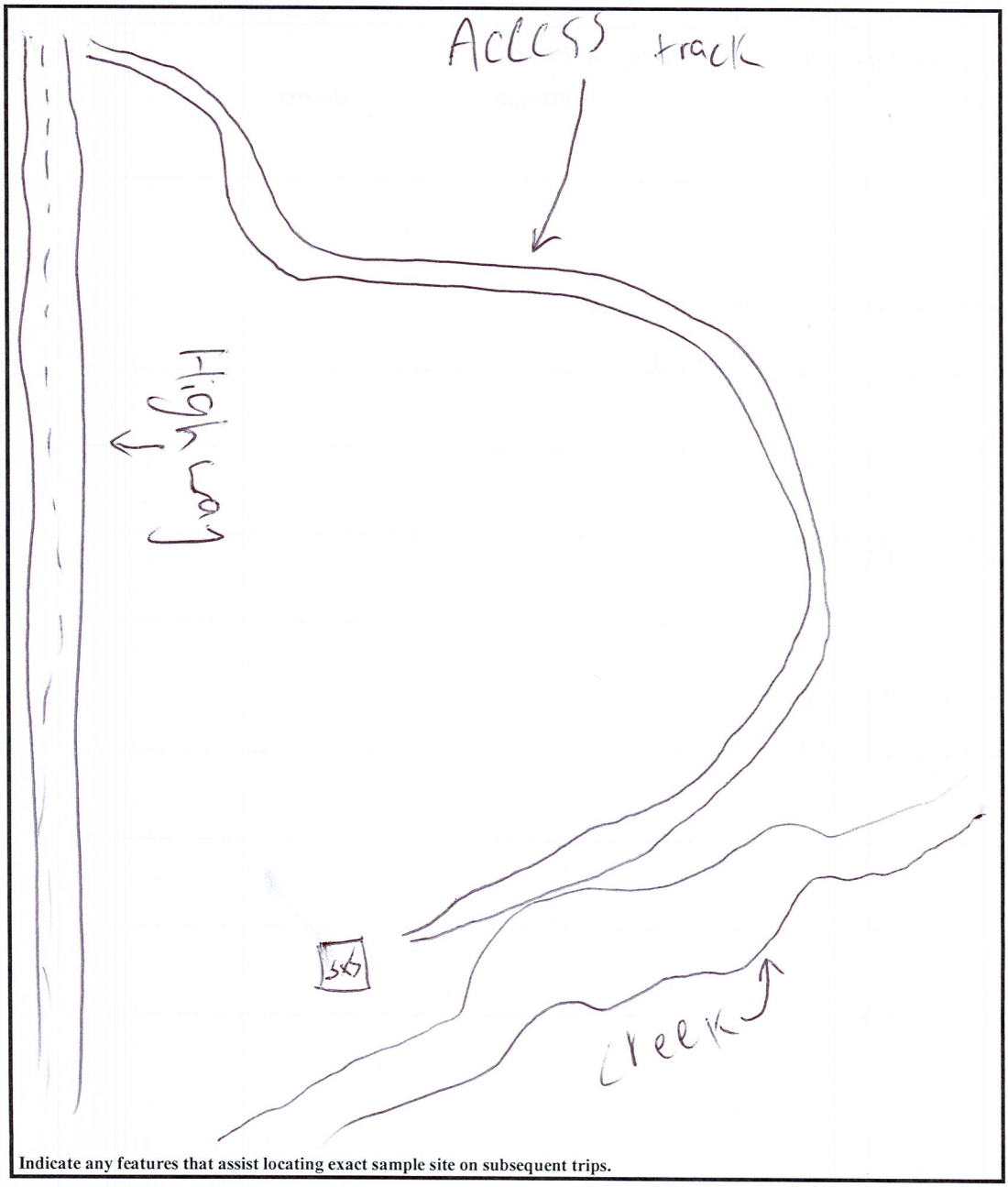
Site comments, observations

Rocky, Detritus

ACCESS SKETCH

SITE NAME VC1

SITE CODE Grants



Indicate any features that assist locating exact sample site on subsequent trips.

WATER QUALITY

Time 1020	**Instrument**	**Instrument Serial No.**		
pH 7.8	**units**	**E.C.** 29		**µS/cm**
D.O. 100.5	**mg/L**	**Water Temperature** 26,12		**°C**
Turbidity 7.70	**NTUs**	**Instrument and serial number**		

Water samples for laboratory water quality analysis

(ALKALINITY is a *predictor variable for genus level model*)

Bottle lable	Analysis
	Alkalinity

Observations relating to water quality (e.g. water oil, scum, foam, sediment odours)

No odour, fauna present, Flora present

MACROINVERTEBRATE SAMPLING

EDGE Length sampled 10 m

Collected by EC03

No. of containers used _____

Edge description

- ☑ Vertical 90°
- ☐ Angled 45-90°
- ☐ Undercut

Edge habitat mainly composed of roots from

- ☑ Paperbark / Melaleuca
- ☐ shrub
- ☐ other common riparian trees
- ☑ grass

Edge habitat

- ☑ roots covered by algae
- ☑ overhanging vegetation

Habitat velocity & depth **Flow meter serial no.** _____ **Fan set no.**____

(*predictor variable genus level model*)

Meter Reading (Revolutions per 40s)			1.5 M/S	Habitat depth (cm)		
1	2	3	Fan details	1	2	3

Stream Width (at water level) (*predictor variable genus and family level models*): six measurements or estimations are taken in a 100m reach upstream of the macroinvertebrate sampling site.

Number	1	2	3	4	5	6
Width (m)			✓			

☐ measured ☑ estimate only

Comments

Macro Replicate taken

DESCRIPTION OF THE REACH (reach 100 m upstream of sample site)

Habitats within 100 m reach

Sand/Silt bed	☑	Riffle	☑
Gravel/Rock bed	☑	Run	☑
Macrophytes	☑	Pool	☑
Snags	☑		

Description of stream characteristics

Width between top of levee banks (bankfull width) 64 m

Other levees ☐

Height of levee bank from water surface 0.4 m

Flow observable ☑

RIPARIAN ZONE (within 100 m reach)

Riparian zone width -left bank (facing downstream) 3 m

-right bank 4 m

Riparian vegetation type

Monsoon-vine forest/Rainforest	☐	Riparian shrubland	☐
Riparian forest	☐	Riparian grassland	☐
Riparian woodland	☑	Other: _____	

Weeds ☐

Evidence of fire N/A

Riparian Zone ☐

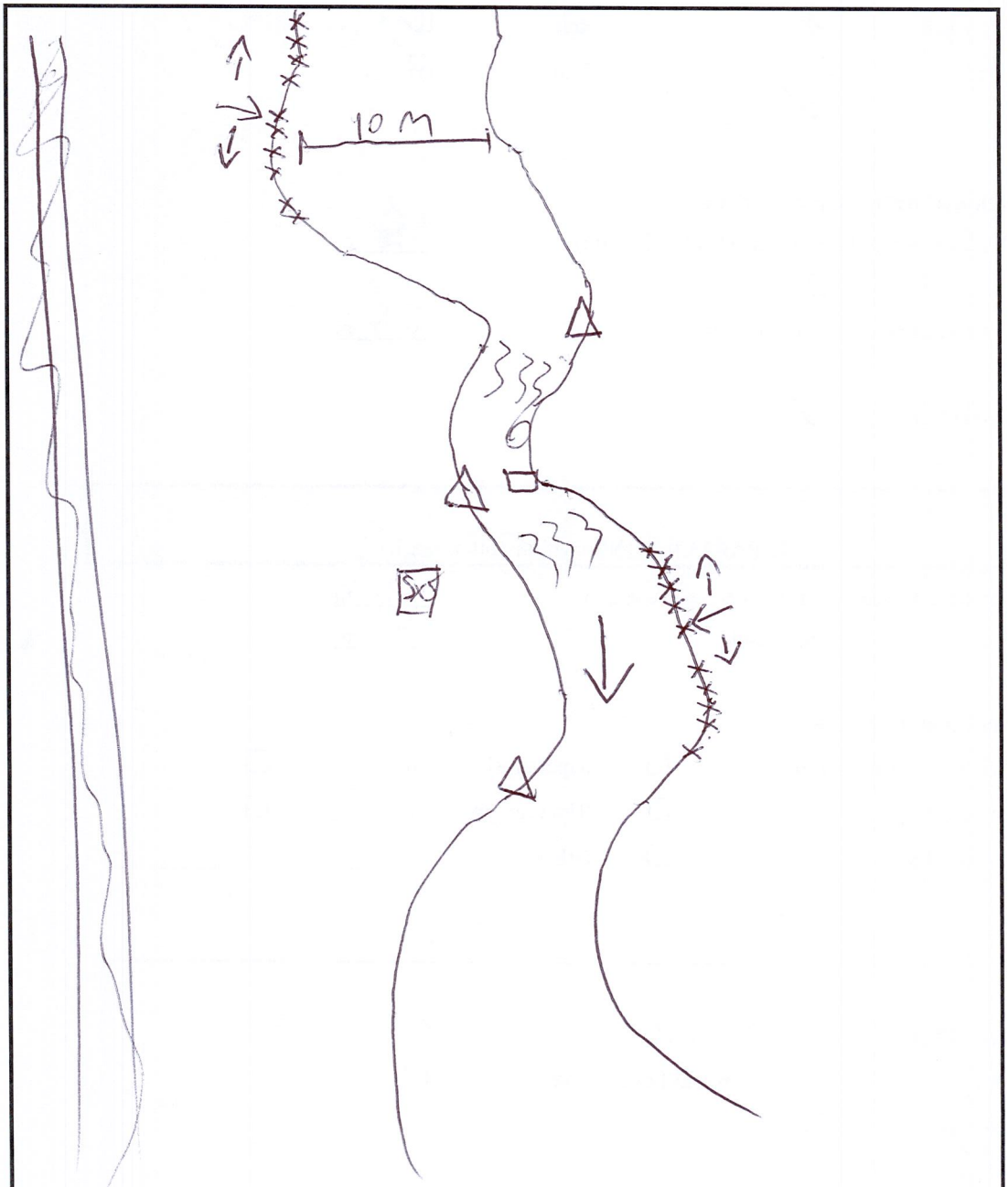
Beyond Levee Banks ☐

Cattle access ☐

N/A

Comments

SKETCH OF 100 M REACH



Indicate: ■ water quality measurements macroinvertebrate sample sites location of vehicle access

• water sample collection width measurements

↘ location of Photographs direction of flow

Appendix B. Water quality data

Grants Surface Water

Analyte	Unit	LOR	BP4	UC1	GDSSW5	UC2	UC3
Hydroxide Alkalinity as CaCO3	mg/L	1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	1	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	mg/L	1	<1	4	3	2	3
Total Alkalinity as CaCO3	mg/L	1	<1	4	3	2	3
Sulfate as SO4 - Turbidimetric	mg/L	1	<1	<1	<1	<1	<1
Chloride	mg/L	1	4	6	3	3	4
Calcium	mg/L	1	<1	<1	<1	<1	<1
Magnesium	mg/L	1	<1	<1	<1	<1	<1
Sodium	mg/L	1	3	5	3	2	3
Potassium	mg/L	1	<1	<1	<1	<1	<1
Dissolved Aluminium	mg/L	0.01	0.03	0.02	0.02	0.03	<0.01
Dissolved Arsenic	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Copper	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Lithium	mg/L	0.001	0.002	0.002	0.002	<0.001	0.002
Dissolved Nickel	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Zinc	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Iron	mg/L	0.05	0.11	0.07	0.07	0.06	0.1
Dissolved Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Total Aluminium	mg/L	0.01	0.12	<0.01	0.08	0.09	0.02
Total Arsenic	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Total Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Copper	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Lithium	mg/L	0.001	<0.001	0.003	0.003	0.001	0.003
Total Nickel	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Zinc	mg/L	0.005	0.01	<0.005	<0.005	<0.005	<0.005
Total Iron	mg/L	0.05	0.61	<0.05	0.43	0.27	0.4
Total Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Ammonia as N	mg/L	0.01	0.02	0.01	0.04	0.01	<0.01
Nitrite as N	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite + Nitrate as N	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Kjeldahl Nitrogen as N	mg/L	0.1	0.4	0.1	0.1	0.2	0.1
Total Nitrogen as N	mg/L	0.1	0.4	0.1	0.1	0.2	0.1

Analyte	Unit	LOR	BP4	UC1	GDSSW5	UC2	UC3
Total Phosphorus as P	mg/L	0.01	<0.01	0.02	0.01	0.02	0.01
Reactive Phosphorus as P	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Grants Sediment

Analyte	Unit	LOR	BP4			UC3			UC2			GDS SW5			UC1		
Replicate			1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
pH Value	Unit	0.1	5.2	5.2	5	5.4	5.1	5.1	5.5	5.6	5.7	5.8	6	6	6.3	6.1	6.7
Sulfate as SO4 2-	mg/kg	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	<10	<10
Chloride	mg/kg	10	20	20	20	<10	<10	<10	<10	<10	<10	<10	<10	<10	30	<10	40
Calcium	mg/kg	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Magnesium	mg/kg	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Sodium	mg/kg	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Potassium	mg/kg	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aluminium	mg/kg	50	3910	2660	3930	14400	9930	4120	8280	9810	12200	5920	7140	6440	11500	6040	6860
Iron	mg/kg	50	3040	2220	2170	6760	18600	7720	22300	13300	12000	40000	35200	29800	20600	30000	49600
Arsenic	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00	1.63	<1.00	<1.00	1.52	74.7	28.4	26.7	35.4	37.1	253	<1.00
Cadmium	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/kg	4.5	3	4.4	<1.0	1.1	2.8	<1.0	1.1	1.4	15.5	21.8	19.4	48.8	21.3	37.6	4.5
Copper	mg/kg	14.7	7.4	8.8	<1.0	<1.0	5.5	<1.0	2.3	1.6	16.2	19.4	15.6	20.8	17.5	20	14.7
Lead	mg/kg	7.7	5.4	8	1.6	2.6	8.5	<1.0	2.8	5.2	21	25.8	15.7	14.7	14.3	20.5	7.7
Nickel	mg/kg	2.6	2.8	3	<1.0	<1.0	2.7	<1.0	<1.0	1.7	5.9	7.1	6.4	32.5	7	7.2	2.6
Zinc	mg/kg	6.5	7	7.6	9	17.3	3.8	26.5	13.3	14	44.7	23.5	33.4	30.7	27.8	28.8	6.5
Lithium	mg/kg	3.6	3.7	4.1	19.2	19.6	6.5	11.6	15.1	22.8	9.5	12.3	10.4	49.8	14.4	14.8	3.6
Mercury	mg/kg	0.03	0.02	0.03	0.01	0.01	<0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.02	0.03

Appendix C. Raw Macroinvertebrate Data

Order	Family/Sub-family	BP4	BP4	UC3	UC3	UC2	UC2	GDS SW5	GDS SW5	UC1	UC1
		1	2	1	2	1	2	1	2	1	2
Acarina	Acarina	10	10	0	5	0	0	18	10	13	20
Coleoptera	Dytiscidae	10	10	0	0	0	0	0	10	0	30
Coleoptera	Elmidae	0	0	0	0	0	0	9	0	0	0
Coleoptera	Hydraenidae	0	0	0	0	0	0	0	0	7	0
Coleoptera	Hydrochidae	20	30	0	5	10	10	45	40	60	60
Coleoptera	Hydrophilidae	0	10	25	10	15	10	18	30	20	10
Coleoptera	Noteridae	30	0	0	0	0	0	0	0	0	10
Coleoptera	Scirtidae	0	0	10	0	0	0	0	0	0	0
Decapoda	Atyidae	20	10	5	5	35	50	182	220	900	390
Decapoda	Palaemonidae	10	10	0	0	35	25	36	90	20	20
Diptera	Ceratopogonidae	30	10	25	20	0	0	18	10	20	50
Diptera	Chironominae	210	250	175	145	150	125	182	150	113	230
Diptera	Orthocladiinae	0	0	5	0	0	0	9	20	7	0
Diptera	Tanypodinae	60	40	30	25	65	60	36	10	13	60
Diptera	Tipulidae	0	0	0	0	0	0	9	0	7	10
Ephemeroptera	Baetidae	10	20	0	5	0	0	55	20	67	40
Ephemeroptera	Caenidae	30	20	10	5	0	0	18	10	33	0
Gastropoda	Bithyniidae	0	0	0	0	0	0	0	0	13	20
Gastropoda	Planorbidae	0	0	0	0	0	0	0	0	0	10
Hemiptera	Corixidae	0	0	0	0	0	0	0	0	0	10
Hemiptera	Mesoveliidae	0	0	0	0	0	5	18	30	20	20
Lepidoptera	Crambidae	0	0	0	0	0	0	18	10	7	0
Nematoda	Nematoda	0	0	5	0	0	0	0	0	0	0
Odonata	Corduliidae	0	0	0	0	5	0	0	0	0	0
Odonata	Isostictidae	30	20	0	0	0	0	0	0	0	0
Odonata	Libellulidae	50	40	0	0	0	0	9	10	0	10
Oligochaeta	Oligochaeta	30	10	25	5	10	25	27	30	13	10
Trichoptera	Ecnomidae	10	10	0	0	0	0	0	0	0	0
Trichoptera	Hydroptilidae	10	0	0	0	0	0	0	0	7	10
Trichoptera	Leptoceridae	60	110	40	10	40	50	91	70	27	20

Appendix D. ANOVA Results

Relative abundance

Source	DF	Sum of Square	Mean Square	F Statistic	P-value
Groups (between groups)	1	4323.4571	4323.4571	0.04177	0.8415
Error (within groups)	12	1241953.401	103496.1168		
Total	13	1246276.859	95867.4507		

Taxa richness

Source	DF	Sum of Square	Mean Square	F Statistic	P-value
Groups (between groups)	1	6.8643	6.8643	0.4878	0.4982
Error (within groups)	12	168.85	14.0708		
Total	13	175.7143	13.5165		

PET richness

Source	DF	Sum of Square	Mean Square	F Statistic	P-value
Groups (between groups)	1	0.1667	0.1667	0.0995	0.7589
Error (within groups)	12	16.75	1.675		
Total	13	16.9167	1.5379		

SIGNAL-2

Source	DF	Sum of Square	Mean Square	F Statistic	P-value
Groups (between groups)	1	0.03736	0.03736	0.9012	0.3612
Error (within groups)	12	0.4975	0.04146		
Total	13	0.5348	0.04114		

Appendix E. Macroinvertebrate QA

Aquatic Ecology Services

Macroinvertebrate Identification Quality Assurance Certificate

Site Code: UC1
Identification Date: 29/06/2023
QA Date: 10/07/2023
Percentage Correct: 100%

Replicate: 2 of 2
Identifier: T Steele
Senior Taxonomist: S Jones
QA Result: Pass

Habitat: Edge
Identification Level: Family

Taxonomy	Original Count	QA Count	Comment
Acarina	2	1	
Dytiscidae	3	3	
Hydrochidae	6	6	
Hydrophilidae	1	1	
Noteridae	1	1	
Atyidae	39	39	
Palaemonidae	2	2	
Ceratopogonidae	5	5	
Chironominae	23	22	
Tanypodinae	6	6	
Tipulidae	1	1	
Baetidae	4	4	
Bithyniidae	2	2	
Planorbidae	1	1	
Corixidae	1	1	
Mesoveliidae	2	2	
Libellulidae	1	1	
Oligochaeta	1	1	
Hydroptilidae	1	1	
Leptoceridae	2	2	



Good science at a fair price

WDL 2023 Seagrass Monitoring Report

Lithium Developments Grants

Northern Territory



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1 INTRODUCTION

Lithium Developments Grants Northern Territory (LDGNT) are required to survey the waterway into which their wastewater will flow as part of their Waste Discharge License (WDL). Controlled discharge will occur from Water Dam 1 (MWD1) via an authorised discharge point DP1, into an un-named stream which discharges into West Arm, Darwin Harbour. Part of the WDL248 monitoring program includes a survey of biota within Darwin Harbour downstream of the discharge, to assess potential harmful impacts on the ecology of the surrounding area.

LDGNT engaged EcOz Environmental Consultants (EcOz) to conduct monitoring of the discharge location within Darwin Harbour in compliance with their WDL. Seagrass surveys were conducted along 3 sites downstream of the Grants discharge point from 2 May 2023 to 3 May 2023. These sites are referred to as Grants Downstream Darwin Harbour (GDS DH) 1, 2 and 3.

Seagrass is an important feature of marine ecosystems providing habitat and food for a wide variety of species. Three species of seagrass have been described from the area: *Halophila ovalis, Haludule uninervis* and *Enhalus acoroides*, which were to be identified utilising existing knowledge of morphology along with identification images. Smit et al. 2018. This report seeks to document the work conducted by EcOz, including their methodology and results of the conducted surveys.

2 METHODOLOGY

2.1 Survey locations

Seagrass monitoring generally focusses on well-established seagrass meadows and their extent, composition and biomass over time. The study area is situated within mangrove lined tidal channels with no known seagrass meadows in the vicinity (Radke et al. 2018). The sites selected to survey encompass the Southeastern portion of West Arm relative to the discharge point along the unnamed stream. Each site was assessed to have the potential to include seagrass habitat as well as be relevant to the study of the impact on Grants wastewater discharge (refer to Figure 2-1). GDS DH1 was selected because of its close proximity to the actual discharge point, which would allow for an assessment on habitat health in response to close waste water discharge. GDS DH2 was selected as it would be able to show habitat which is further from the point of pollution. GDS DH3 was selected as a control to show what an unimpacted seagrass habitat may look like.

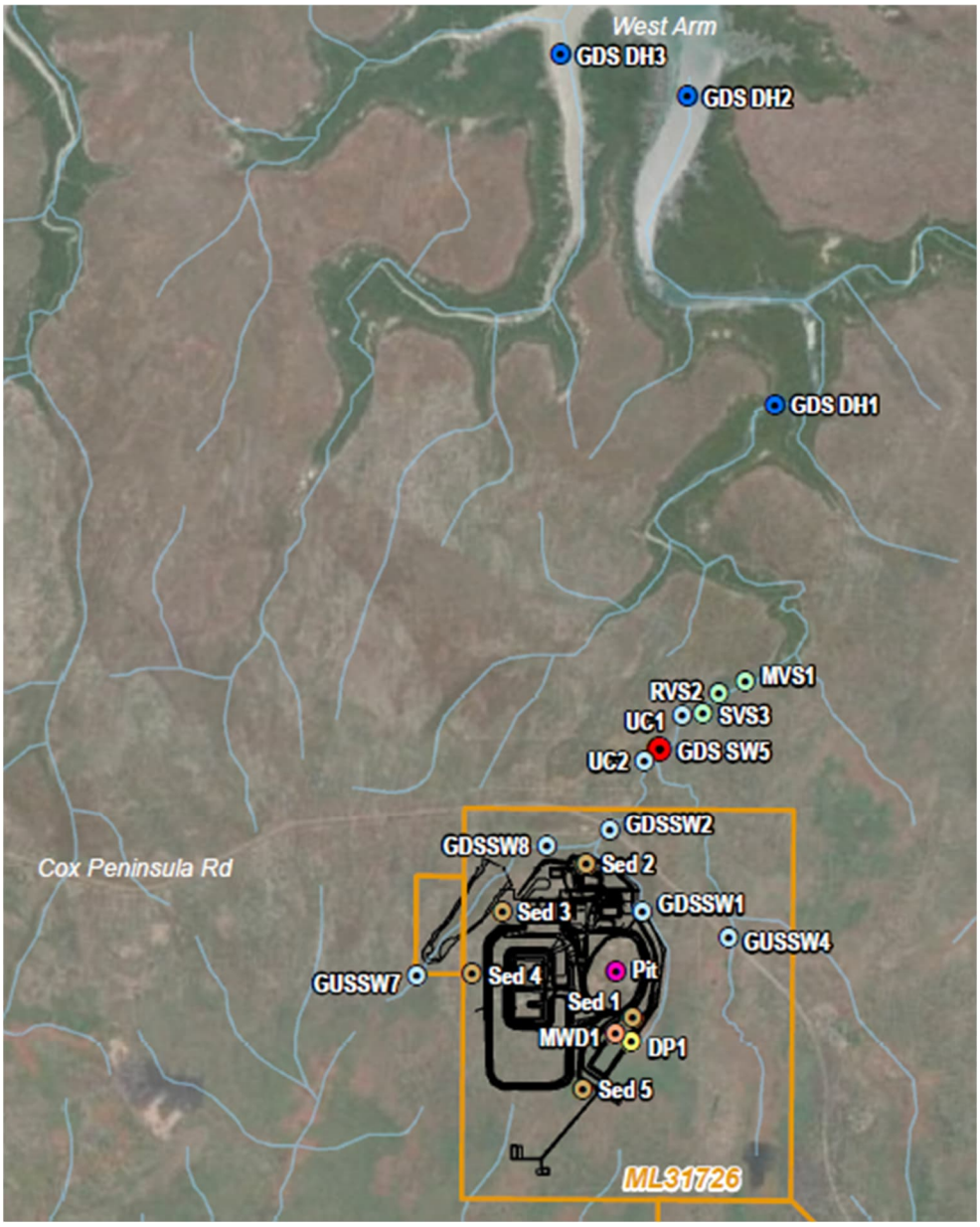


Figure 2-1. Map of survey locations

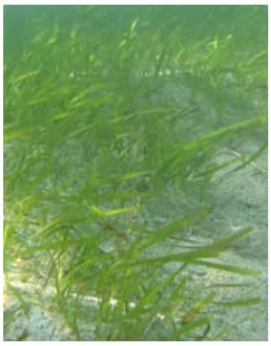
2.2 Data collection

Survey methods were adapted from Department of Environment and Science Queensland (DES, 2018). A submersible camera frame (SCF) was constructed to observe sediment floor and seagrass. A light was fitted to the SCF to increase visibility in turbid conditions. The method involved suspending the SCF until it reached the bottom. Following this the SCF was towed across a transect line from bank to bank in order to collect footage for analysis of potential seagrass occurrence. Seagrass images were to be identified against database images of target seagrass species. An example of target seagrass images may be found in Figure 2-2. Video footage was reviewed and still images extracted of the benthic environment, focussing on all significant features in each video.

Halodule uninervis:



- Usually larger than *Halodule pinifolia*
- Trident leaf tip
- 1 central longitudinal vein
- Rhizome usually pale ivory, with clean black leaf scars
- Dugong preferred food
- Found on shallow/intertidal sand or mud banks



Halophila ovalis:



- Oval shaped leaves in pairs
- 8 or more cross veins
- No hairs on leaf surface
- Preferred dugong food
- Common early colonising species
- Found from intertidal to subtidal depths



Enhalus acoroides:



- Very long ribbon-like leaves 30-150 cm long
- Leaves with inrolled leaf margins
- Thick rhizome with long black bristles and cord-like roots
- Found on shallow/intertidal sand/mud banks (often adjacent to mangrove forests)

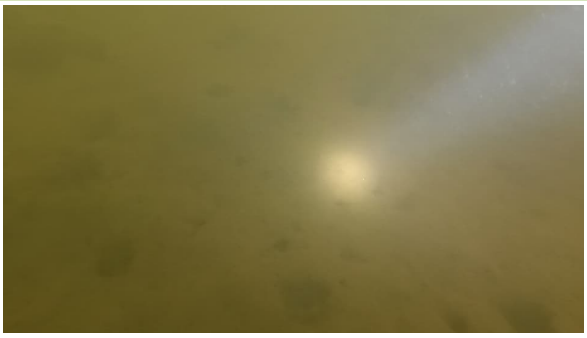
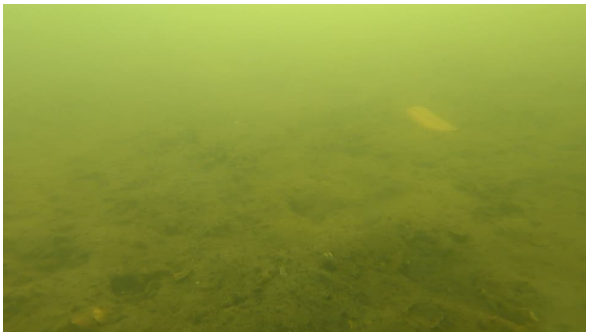


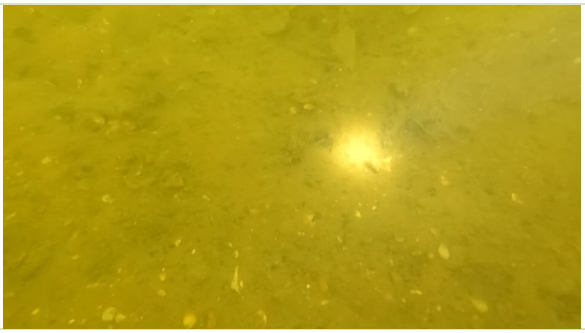
Figure 2-2. Identification images of the three seagrass species known to occur in Darwin Harbour

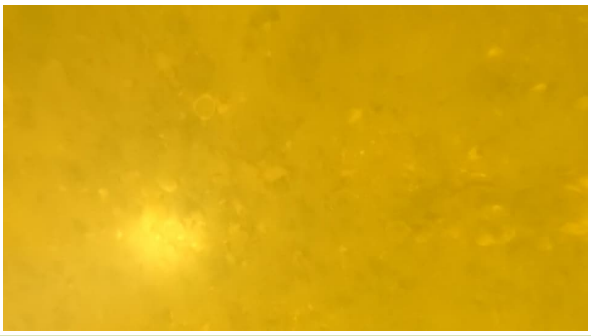
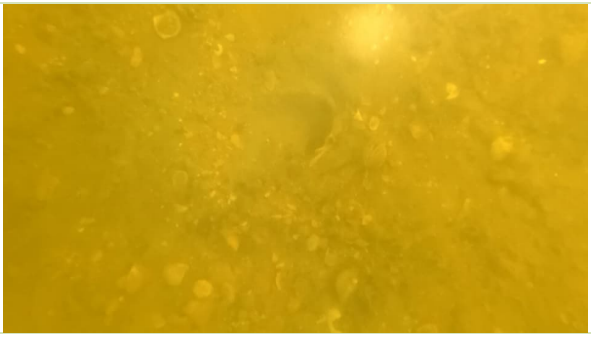
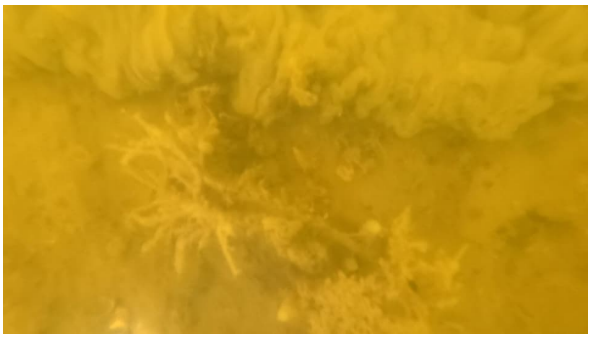
3 RESULTS

No seagrass was detected at any of the sites surveyed during the 2023 round of seagrass monitoring. Imagery taken from footage collected was in many cases impeded by high turbidity. All sites had a sandy substrate with heavy sedimentation. Environmental conditions have a large impact on the suitability of habitat for seagrass growth.

Table 3-1– Still images taken during seagrass surveys with descriptions.

Site ID	Video reference and Time stamp (minutes-seconds)	Site Description	Image
GDS DH1	- GH010178 - 00-58	Heavy sedimentation. Substrate is sand dispersed with large rocks. No seagrass detected	
GDS DH1	- GH010178 - 02-55	Heavy sedimentation. Substrate is sand dispersed with large rocks. No seagrass detected	
GDS DH1	- GH010178 - 05-03	Heavy sedimentation. Substrate is sand dispersed with small rocks. No seagrass detected	
GDS DH2	- GH010176 - 02-10	Heavy sedimentation, detritus present, terrestrial plant leaf. Substrate is sand. no seagrass	

GDS DH2	- GH010176 - 10-05	Heavy sedimentation. Substrate is sand with detritus and shells. No seagrass detected	
GDS DH2	- GH010179 - 03:44	Heavy sedimentation. Substrate is sand with detritus and shells. No seagrass detected	
GDS DH2	- GH010181 - 01:04	Water is highly turbid, sedimentation visible, substrate not visible. Detritus visible as well as sponge coral. No seagrass detected.	
GDS DH2	- GH010181 - 01:21	Heavy sedimentation. Substrate is sand with dispersed shells. No seagrass detected	
GDS DH2	- GH20176 - 01:36	Heavy sedimentation. Substrate is sand and detritus. Sponge coral present. No seagrass detected.	

GDS DH3	- GH10183 - 00:46	Heavy sedimentation. Substrate is sand with detritus and shells. No seagrass detected	
GDS DH3	- GH10185 - 00:53	Heavy sedimentation. Substrate is sand with detritus and shells. No seagrass detected	
GDS DH3	- GH010185 - 01:18	Heavy sedimentation. Substrate is sand and detritus. Sponge coral present. No seagrass detected.	

4 CONCLUSION

In conclusion, the survey conducted to assess the presence and distribution of seagrass in the study area yielded no evidence of seagrass beds. Several factors could contribute to the absence of seagrass in the surveyed areas. Environmental conditions, such as water quality, light availability and sediment composition, play a crucial role in seagrass growth and survival.

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Riparian Vegetation Assessment Report 2023

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1 INTRODUCTION

Lithium Developments (Grants NT) Pty Ltd (LDGNT) operate the Grants Lithium Project (GLP) located on Cox Peninsula Road approximately 90 km southwest of Darwin by road (Figure 1-1). LDGNT were granted Waste Discharge Licence (WDL248) which licences the controlled discharge of mine wastewater from Mine Water Dam 1 into an unnamed watercourse which flows north of the GLP and ultimately discharges into the West Arm of Darwin Harbour. Schedule 10 of WDL248 requires LDGNT to undertake a monitoring program in accordance with the licence conditions, which (as per Appendix 5 of the WDL) includes annual monitoring of vegetation downstream of ML31726 to determine if mining activities are impacting riparian vegetation communities.

EcOz developed the WDL248 Monitoring Program (Appendix A) which details the monitoring to be undertaken to comply with the conditions of WDL248 and describes the methodology for riparian vegetation monitoring. Riparian vegetation monitoring is to be undertaken once annually at the end of each wet season, at three survey sites, and results compared against baseline data to determine if there are changes to riparian vegetation over time.

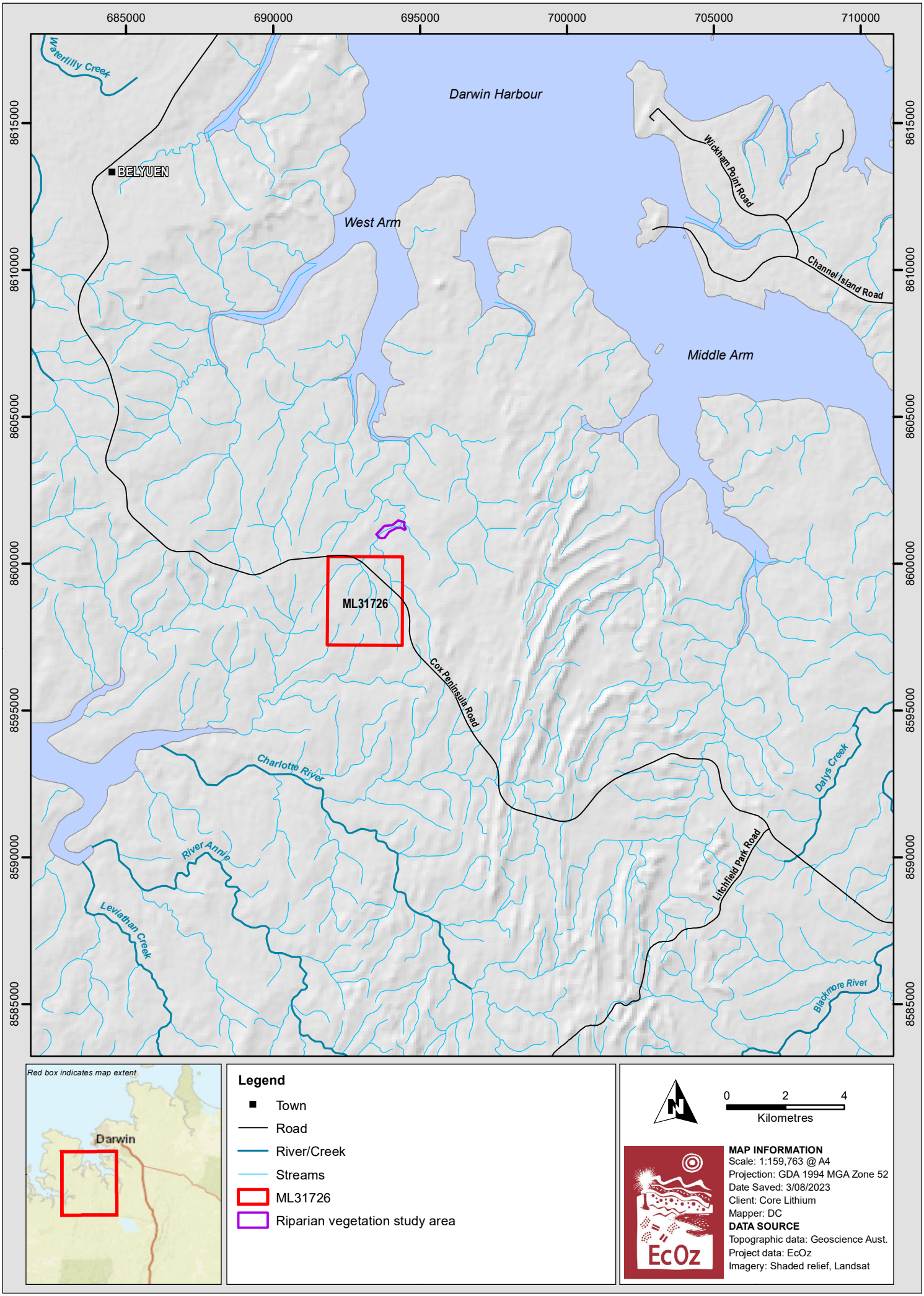
This document presents the methodology and results of the post-wet season riparian vegetation survey undertaken in April and May 2023, and compares results to baseline conditions.

1.1 Background

Riparian communities are essential for maintaining healthy ecosystems and economic productivity along rivers (DENR 2019). When maintaining a riparian vegetation system, it is vital to retain a diverse vegetation cover to assist in maintaining the functions that a riparian vegetation community provides i.e. supporting aquatic habitats, shading the river and regulating the temperature, bank stabilisation, filtering of sediments and improving water quality by reducing contaminants (Dixon & Douglas 2015).

Monitoring changes in riparian vegetation over time (i.e. vegetation structure, species composition, or extent of vegetation) can be an indicator of a change in water quality. Riparian vegetation monitoring is one of the multiple lines of evidence within the monitoring program, which also includes water and sediment quality monitoring, macroinvertebrate sampling and seagrass monitoring in Darwin Harbour.

A baseline survey was undertaken in 2019 which presents a reference condition against which the 2023 monitoring data can be compared (EcOz 2019). It should be noted the baseline drone survey was undertaken on 13 March 2023, towards the end of the annual wet-season, and the vegetation site assessment was undertaken in early June, 2019. Monitoring undertaken as part of the WDL248 Monitoring Program will be undertaken at the end of each wet season (April/May each year) for consistency and to assist with comparison between years.



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Figure 1-1. Location map including riparian vegetatoin study area

2 METHODS

The post wet-season riparian vegetation assessments were undertaken at GLP by two experienced botanists on 13 April 2023. A separate site visit was undertaken on 4 May 2023 to conduct the drone survey.

Monitoring was undertaken in accordance with the methods detailed in the WDL248 Monitoring Program (see Appendix A). There were two components: a drone survey and riparian vegetation site assessment survey (which included photo-point monitoring).

A drone survey was undertaken along a predefined flight path to map riparian vegetation extent and density and detect any changes in riparian vegetation condition since the baseline survey in 2019. The drone survey was designed to survey the three different riparian vegetation communities captured in the previous study (EcOz 2019) – mangrove, riparian, and swamp. Drone images were imported to create an orthomosaic image, and analysis was undertaken to assess vegetation extent and density (health) over time. The intent of analysing drone data over time is to determine if there is a reduction in riparian vegetation biomass (ha). If there is a 'retraction' of mapped riparian vegetation i.e. 10% or greater loss of vegetation biomass, further on-ground assessments need to be undertaken. A 'stable' overall status indicates there is no greater than 10% loss of the vegetation biomass, comparable to baseline mapping. An 'increase' in the overall status indicates 10% or greater vegetation biomass, compared to baseline mapping.

Riparian vegetation site assessments (on-ground) were undertaken at three established potential impact sites (MVS1, RVS2, SVS3; see Figure 3-1) to record riparian vegetation species diversity and composition. Vegetation and photo monitoring data was compiled into a database that can be added to over time as monitoring data is collected annually. The vegetation data was analysed by comparing 2019 baseline data with the 2023 survey results to assess if there were any changes in vegetation health i.e. no tree mortality, or physical changes to health of plants through the use of on-ground assessment and photo monitoring points (See Appendix A; section 4.4).

3 RESULTS

3.1 Drone survey

The conditions were suitable for flying on the day, with minimal wind and cloud cover. The vegetation type map is presented in Figure 3-1. There were relatively minor changes to the area size (ha) and extent of each riparian vegetation patch size compared to the 2019 baseline survey (Table 3-1). There was an overall increase of 1.31 ha of riparian vegetation compared to 2019. This may be attributed to a below average wet season in 2018/2019 and an above average wet in 2022/2023, which may have resulted in an overall increase in riparian vegetation. The largest increase was observed in the mangrove riparian vegetation community, of 1.22 ha. The riparian vegetation community and swamp riparian vegetation remained stable (Table 3-1).

Table 3-1. Area size (ha) of each vegetation type and overall status

Vegetation type	Area (ha) 2019 survey	Area (ha) 2023 survey	Difference	Overall status
Mangrove	5.18	6.40	1.22 ha	Increase
Riparian	0.76	1.10	0.34 ha	Stable
Swamp	1.50	1.25	0.25 ha	Stable
Total	**7.44**	**8.75**	**1.31 ha**	**Increase**

3.2 Riparian vegetation site assessment

The majority of the star pickets at the three established monitoring sites (MVS1, RVS2, SVS3) were visible during field investigations. There was only one absent (north west picket) at the MVS1, however this did not change photo monitoring points. A summary of each riparian site assessment is provided below in Table 3-2.

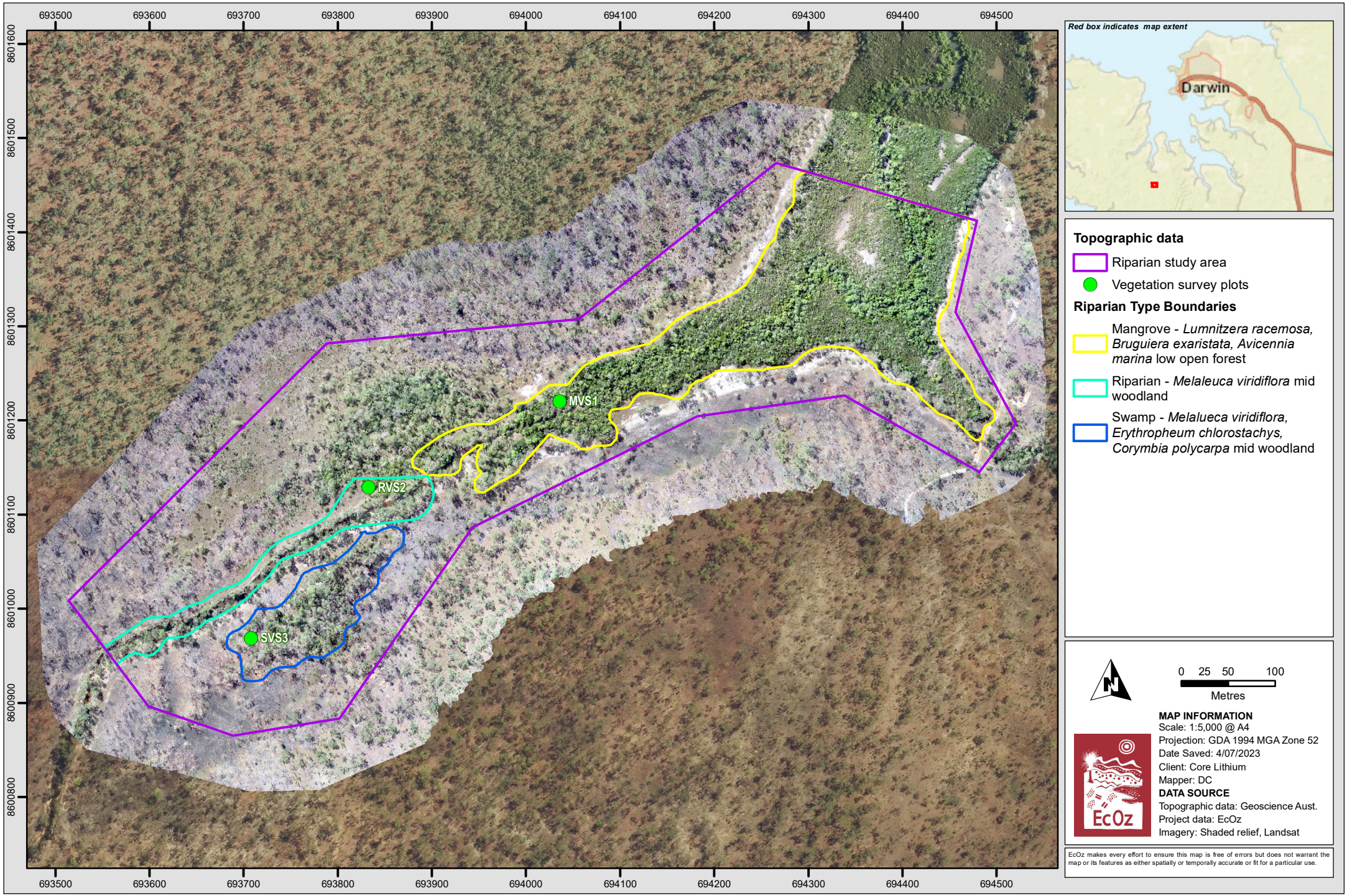
The vegetation map showing riparian vegetation assessment sites is presented in Figure 3-1, and a table showing the results of field data collected at each survey site is present in Appendix B. Overall, the vegetation composition and structure at all monitoring sites was mostly consistent with 2019 results. There were a few minor changes noted (see Table 3-2).

Incidental observations recorded during the survey noted that mangrove vegetation communities were generally in good condition. No major weed populations or fire impacts were observed. Similar disturbance results were recorded within the landward swamp riparian community, compared to the baseline survey in 2019. A number of the same weed species recorded within the swamp community in the 2019 baseline survey were also recorded as part of the 2023 survey, these included:

- Hyptis (*Hyptis suaveolens*), declared under the NT *Weeds Management Act 2001* - Class B (spread to be controlled)
- Environmental weeds (not declared) Annual mission grass (*Cenchrus pedicellatus*), Calopo (Calopogonium mucunoides) and Stinking passionfruit (*Passiflora foetida*).

Table 3-2. Summary of riparian vegetation site assessment descriptions

Survey site	Vegetation Description	Vegetation type	Comparison to baseline survey (EcOz 2019)
MVS1	The upper stratum comprised of *Lumnitzera racemose* and *Avicennia marina* mid open forest with a sub-stratum of *Bruguiera exaristata*, with isolated *Excoecaria ovalis* and occasional *Ceriops tagal*. Height ranging from 1 – 3 m tall. The ground stratum comprised of sparse tussock grasslands, dominated by *Fimbristylis* sp., and *Xerochloa imberbis* and *Acrostichum* sp. (restricted to the creek bank only).	Mangrove	Minor variation in species composition. One additional mid-stratum species (*Ceriops tagal*) was recorded in 2023, and one additional ground stratum sp (*Acrostichum* sp.) was recorded. Structurally, the vegetation was consistent.
RVS2	The upper stratum comprised of *Melaleuca viridiflora* mid woodland with a sub-stratum (mid shrubland) of *Acacia plectocarpa, Lumnitzera racemosa*, *Avicennia marina* and occasional *Hibiscus tiliaceus* (restricted to creek bank). The ground stratum comprised of sparse tussock grasslands, dominated by *Fimbristylis* sp. and *Xerochloa imberbis* and *Acrostichum sp*. (restricted to the creek bank only).	Riparian	Some variation in species composition. One additional mid-stratum species *(Hibiscus tiliaceus)* was recorded in 2023, and two additional ground stratum species (*Acrostichum* sp. and *Eriachne triseta*). No *Dapsilanthus spathaceus* was recorded in the 2023 survey, compared to 2019. Structurally, the vegetation was consistent.
SVS3	The upper stratum comprised of *Melaleuca viridiflora, Erythrophleum chlorostachys* and *Corymbia polycarpa* mid woodland with a sub-stratum of *Lophostemon lactifluus*, *Clerodendrum floribundum* and *Erythrophleum chlorostachys*. The ground stratum comprised of mid tussock grasslands, dominated by *Sorghum intrans, Eriachne triseta* and *Pandanus spiralis.*	Swamp	Minor variation in species composition. *Denhamia obscura* was replaced with *Erythrophleum chlorostachys* as one of the dominant mid-stratum plants present in the 2023 survey. The mid-stratum plant (*Denhamia obscura)* continues to persist within the midstory.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ23048 - Finniss Lithium Project Riparian Vegetation Monitoring 2023\1. Project Files\2. Report Maps\Riparian vegetation map.mxd

Figure 3-1. Map of riparian vegetation boundaries and assessment sites

4 CONCLUSION

This report provides a summary of the 2023 riparian vegetation survey results, compared to the baseline collected in 2019.

Mine impacted wastewater was discharged over the 2022/2023 wet season. The drone survey results indicate an overall increase in riparian vegetation of 1.31 ha, compared to the 2019 baseline survey. The swamp and riparian vegetation communities were in a stable condition, with no significant change in the extent of the vegetation communities identified in the 2023 drone survey.

Based on the riparian vegetation site assessment, some minor vegetation composition changes were noted – mostly occurring in the mid-strum and ground stratum. The slight variations in the ground stratum could be attributed to the timing of monitoring (i.e. seasonal variations); baseline monitoring was not undertaken until the middle of the dry season, compared to the end of the wet season in 2023.

Overall, the riparian vegetation monitoring undertaken in 2023 did not identify any significant changes in the extent or species composition of riparian vegetation communities downstream of GLP that could be attributed to discharge of mine impacted wastewater.

The next round of riparian vegetation monitoring is scheduled to be undertaken at the end of the wet season in 2024 (nominally April/May). It is recommended to establish a reference site as part of the next monitoring event, to assist with data interpretation.

APPENDIX A WDL248-01 MONITORING PROGRAM

Waste Discharge Licence 248 Monitoring Program

Lithium Developments Grants Northern Territory



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Attachment B –Procedure for Surface Water Sampling
Attachment C – Field Sheets from the Darwin-Daly AUSRIVAS Manual

1 INTRODUCTION

Waste Discharge Licence (WDL) 248 was granted to Lithium Developments Grants Northern Territory (LDGNT) on 25 July 2022. WDL 248 authorises discharge of mine wastewater from the Grants Lithium Project (GLP) site. Controlled discharge will occur from Water Dam 1 (MWD1), via authorised discharge point 1 (DP1), into an unnamed watercourse which ultimately discharges into West Arm, Darwin Harbour. The WDL is provided as Attachment A of this document.

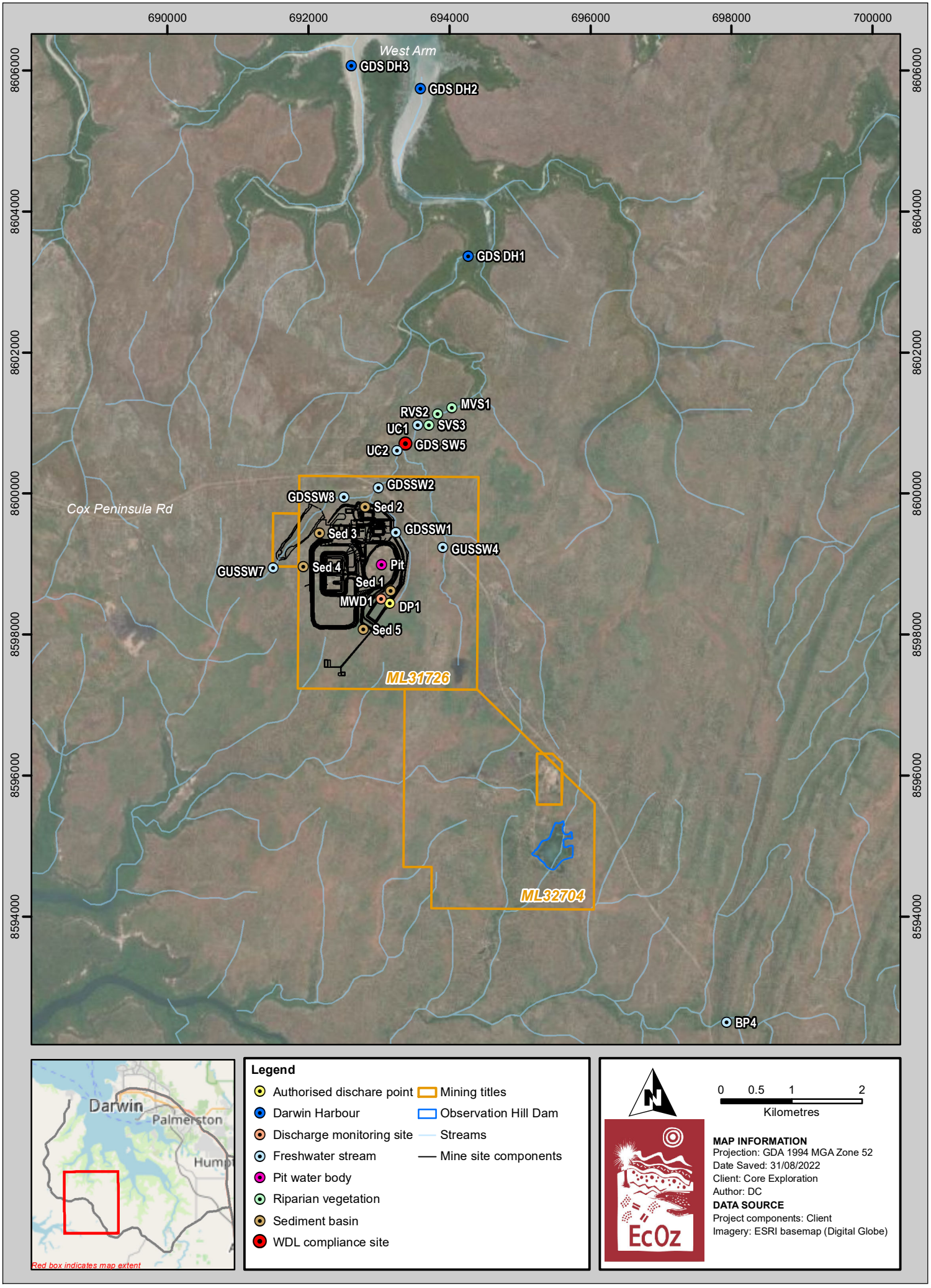
Condition 30 of WDL 248 requires implementation of the monitoring program, detailed in Appendices 3 to 5 of the WDL. Monitoring is required to be undertaken for surface water quality, fluvial sediment quality, and biota in watercourses downstream of GLP and in the West Arm of Darwin Harbour. A summary of all WDL monitoring sites, and type of monitoring that is to be undertaken at each site, is provided in Table 1-1. The locations of monitoring sites are shown on Figure 1-1.

This document details the monitoring that will be undertaken by LDGNT to satisfy the requirements of WDL 248. The monitoring program identifies monitoring locations, describes sampling methodology where appropriate, and references supporting documents which form part of LDGNT's overall Environmental Management System.

Table 1-1. Summary of all monitoring to be undertaken for WDL 248

Category	Sample Site	Easting	Northing	Surface water quality[1]	Sediment quality	Macroinvertebrate	Riparian Vegetation	Seagrass
Freshwater stream	GDS SW1	693239	8599446	Daily, weekly, monthly	Annually	-	-	-
	GDS SW2	692989	8600073	Daily, weekly, monthly	Annually	-	-	-
	GUS SW4	693903	8599235	Daily, weekly, monthly	Annually	-	-	-
	GUS SW7	691498	8598943	Daily, weekly, monthly	Annually	-	-	-
	GDS SW8	692498	8599951	Daily, weekly, monthly	Annually	-	-	-
WDL compliance site	GDS SW5	693374	8600709	Daily, weekly, monthly	Annually	Annually	-	-
Sediment basins	Sed1	693167	8598623	Weekly, monthly	-	-	-	-
	Sed2	692657	8599847	Weekly, monthly	-	-	-	-
	Sed3	692155	8599446	Weekly, monthly	-	-	-	-
	Sed4	691928	8598961	Weekly, monthly	-	-	-	-
	Sed5	692775	8598072	Weekly, monthly	-	-	-	-
WDL discharge point	MWD1	693030	8598504	Prior to discharge, daily, weekly, monthly	Annually	-	-	-
Pit water body	PIT	693037	8598990	Monthly	-	-	-	-
Darwin Harbour	GDS DH1	694262	8603365	Monthly	Annually	Annually	-	Annually
	GDS DH2	693587	8605738	Monthly	Annually	Annually	-	Annually
	GDS DH3	692608	8606060	Monthly	Annually	Annually	-	Annually
Freshwater stream	UC1	693544	8600969	Annually	Annually	Annually	-	-
	UC2	693255	8600608	Annually	Annually	Annually	-	-
	BP4	697926	8592497	Annually	Annually	Annually	-	-
Riparian vegetation	MVS1	694035	8601220	-	-	-	Annually	-
	RVS2	693834	8601132	-	-	-	Annually	-
	SVS3	693706	8600969	-	-	-	Annually	-

[1] Frequency of surface water quality monitoring depends on discharge; refer to Table 2-1 for detail. Freshwater sites will only be sampled when the watercourse is flowing, and Darwin Harbour sites will only be sampled for surface water quality during the wet season months. Refer to Table 2-1 Attachment A for the detailed surface water quality monitoring schedule.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ21190 - Grants Waste Discharge Licence - Core Lithium\01 Project Files\Report maps\All monitoring locations.mxd

Figure 1-1. All Grants WDL Monitoring Sites

2 SURFACE WATER QUALITY

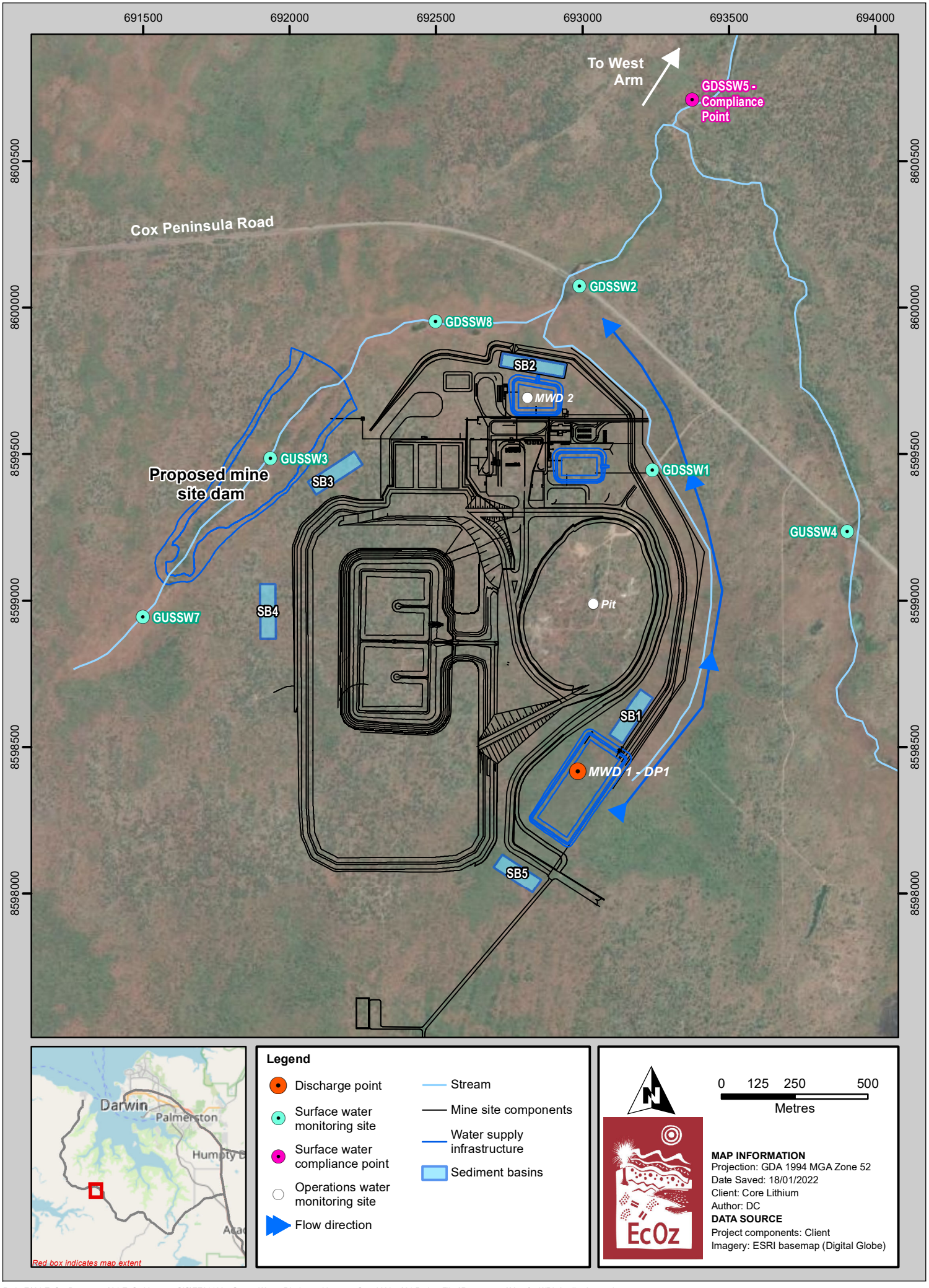
2.1 Freshwater

Surface water quality sampling will be undertaken in accordance with Appendix 3 of WDL 248 (see Attachment A). This includes regular monitoring of surface water sites upstream and downstream of the discharge point during discharge, weekly monitoring of sediment basins during discharge, and monthly monitoring of the pit water. Discharge monitoring will be undertaken at MWD1, close to DP1, the licenced discharge point, prior to discharge, and daily and weekly during discharge. The compliance point for the WDL is GDS SW5, and frequent monitoring will be undertaken during discharge. Details of water quality monitoring methodology and monitoring locations are provided in the Water Management Plan for the GLP. Locations of surface water monitoring sites which will be sampled in accordance with WDL 248 are shown on Figure 2-1. A summary of sites, analytes and monitoring frequency are provided in Table 2-1.

Table 2-1. Surface water monitoring program for WDL (freshwater sites)

Site	Description	Analytes	Frequency
GUS SW4, GUS SW7	Freshwater streams – upstream or reference	**Field parameters**: Flow, water level, pH, electrical conductivity, temperature, ORP, dissolved oxygen, turbidity. **Nutrients**: Total nitrogen, nitrate, oxides of nitrogen, ammonia, total phosphorus, filterable reactive phosphorus. **Metals and metalloids:** Total and dissolved Al, As, Cd, Cr, Cu, Fe, Pb, Li, Hg, Ni, Zn *Full elemental scan once per year **Other:** $S0_4$, Ca, Cl, Na, K, Mg, $C0_3^{2-}$, HC03, total dissolved solids, total suspended solids.	**During discharge[2]:** Daily field measurements Weekly laboratory parameters **When not discharging:** Weekly field measurements Monthly laboratory parameters
GDS SW1, GDS SW2	Freshwater stream – downstream of mine site		
GDS SW5	Compliance point		As above, and continuous flow and water level monitoring
MWD1	Discharge point		Continuous flow **During discharge:** Prior to discharge (all analytes) Daily field measurements Weekly laboratory parameters **When not discharging:** Weekly field measurements Monthly laboratory parameters
Sed 1, Sed 2, Sed 3, Sed 4, Sed 5	Sediment basins		**During discharge**: Weekly (all analytes) **When not discharging:** Monthly (all analytes) – wet season only Note flow and level are N/A
Pit	Mine site pit (discharge source water)		Monthly (all analytes) Note flow and level are N/A

[2] For all monitoring during discharge, the first monitoring event must occur within 24 hours of discharge commencing.



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Figure 2-1. Map of surface water sites (freshwater) to be monitored for WDL248

2.2 Marine Water

Appendix 3 of WDL 248 requires monthly monitoring of GDS DH1, located within Darwin Harbour, to be undertaken during the wet season. Two additional sites will also be sampled to provide context for comparison of data from GDS DH1 and provide water quality data for areas of Darwin Harbour downstream of the discharge point to identify any potential impacts from mine site discharges. Details of the monitoring to be undertaken in Darwin Harbour is provided in Table 2-2, and locations are shown on Figure 1-1.

Table 2-2. Darwin Harbour Monitoring Program

Monitoring Location	Description	Analytes	Frequency
GDS DH1	Marine monitoring site, ~4km downstream of WDL compliance point (GDS SW5).	**Field parameters**: Temperature, pH, electrical conductivity, salinity, ORP, dissolved oxygen, turbidity. **Nutrients**: Ultra-trace in saline waters Total nitrogen, nitrate, oxides of nitrogen, ammonia, total phosphorus, filterable reactive phosphorus. **Metals:** Total and dissolved (ultra-trace) Al, As, Cd, Cr, Cu, Fe, Pb, Li, Hg, Ni, Zn Total suspended solids	Monthly during the wet season Plus a full elemental scan of metals (total and dissolved) once per year, nominally at end of each wet season.
GDS DH2	Marine monitoring site, ~8 km downstream of compliance point, near confluence of branch of western arm of West Arm.		
GDS DH3	Marine monitoring site, reference site, on western arm of West Arm.		

2.3 Sample methods

All surface water sampling will be in accordance with relevant standards and guidelines including:

- *Australian/New Zealand Standard on Water Quality Sampling - Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples* (AS/NZS 5667.1:1998/2016), Standards Australia, New South Wales.
- *Australian Standard on Water Quality Sampling – Part 6: Guidance on sampling of rivers and streams* (AS/NZS 5667.6:1998), Standards Australia, New South Wales.
- *Australian/New Zealand Standard on Water Quality Sampling - Part 9: Sampling Guidance on sampling from marine waters* (AS/NZS 5667.9:1998/2016), Standards Australia, New South Wales.
- ANZG 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia.
- EcOz *Standard Operating Procedure Surface Water Sampling* – Update July 2020.

This will ensure representative samples are collected, and also avoid contamination of samples (of particular importance for saline waters which require ultra-trace analysis for nutrients and metals).

Freshwater sites will be accessed on foot or via ATV, and samples will be collected from the side of the watercourse. Watercourses will only be sampled when flowing.

Marine sites will be accessed via marine vessel (boat), and grab samples will be obtained from ~30 cm below the surface of the water, using sample poles. Sampling will be undertaken during neap tides, on an outgoing (ebb) tide.

Field parameters will be measured in-situ using calibrated field equipment. Laboratory samples will be collected in laboratory supplied, suitably treated containers, and stored chilled (in esky with ice bricks or portable fridge) until the samples can be dispatched to the laboratory. All samples will be submitted to a NATA accredited laboratory, within required holding times, and Chain of Custody forms will be provided to allow for tracking of samples.

All sampling equipment will be maintained and cleaned between sample sites to avoid cross contamination. Details of sample methods are provided in the standards and guidelines listed above.

A detailed description of general surface water sampling methodology is provided in the *Procedure for Surface Water Sampling*, at Appendix B.

2.4 Data management and reporting

All surface water data will be entered into the Surface Water Quality Database and compared to guideline values; site-specific trigger values, the default ANZG 2018 guideline values (for fresh or marine waters as applicable), and the Darwin Harbour Water Quality Objectives. Field data will be entered manually, while laboratory data will be provided in ESdat form, and will automatically be entered into the database. In order to ensure laboratory results are automatically issued to ESdat, ensure the following email address is listed on the COC to receive results: esdat_au+corelithium@esdatlabsync.net.

Data will be compared to guideline values and any exceedance of a guideline value will be investigated. This may include additional water quality sampling. Data will also be compared over time to identify any trends in water quality that may be attributable to waste discharges or mine site operations.

As per Condition 44 and Condition 45 of WDL 248, LDGNT will prepare an Annual Return and a Monitoring Report and submit both reports to the Administering Agency annually, within 10 business days of 25 July (the licence anniversary date).

In the event that the surface water monitoring program identifies a non-compliance with WDL 248, LDGNT will notify the Administering Agency as soon as practicable (and in any case within 24 hours) after first becoming aware of the non-compliance. If a non-compliance with WDL 248 occurs, then an investigation report will be prepared and submitted to the Administering Agency within 10 business days of the notification. As per Item 12 of Schedule 1 of WDL 248, a non-compliance with WDL 248 includes:

- An exceedance of a trigger value stipulated in the licence at the compliance point (GDS SW5) on three consecutive sampling occasions
- An exceedance of three or more times the trigger value at the compliance point (GDS SW5).

Trigger values are provided in Appendix 2 of WDL 248 (see Attachment A).

3 SEDIMENT

Fluvial sediment monitoring will be undertaken annually in accordance with Appendix 4 of WDL248 (see Attachment A).

3.1 Sample methods

Sediments will be sampled from freshwater sites GDS SW1, GDS SW2, GUS SW4, GDS SW5, GDS SW7, GDS SW8 and MWD1 – locations shown on Figure 1-1. Sediment sampling will be undertaken in accordance with relevant standards and guidelines, including:

- Australian Standard – *Guide to the investigation and sampling of sites with potentially contaminated soils, Part 1: non-volatile and semi volatile compounds* (AS 4482.1-2005)
- *Australian Standard on Water Quality Sampling – Part 19: Guidance on sampling of marine sediments* (ISO 5667.19:2004)
- *Australian Standard on Water Quality Sampling – Part 12: Guidance on sampling of bottom sediments* (ISO 5667.12:1999)
- *Recommendations for sampling and analysis of Darwin Harbour sediment* (Munksgard 2013)
- Simpson & Batley (2016): *Sediment Quality Assessment.*

Sediment samples are to be collected annually, during recessional flows (late wet season), and for efficiency will usually be collected at the same time as macroinvertebrate samples (see Section 5).

At each sample site, three grab samples will be collected from the stream. If water is present in the stream, samples will be collected from each side of the bank, or along one bank depending on access (e.g. two samples from the left bank and one from the right bank, or three samples spread along a length of the bank). Entering watercourses with flowing water or deep pools in them is not safe due to the risk of crocodile interaction. If, however, the watercourse is dry, then sediment samples can be collected across the stream; one from either bank and one from the middle of the stream. Note that, when selecting sample locations, ensure that they will be representative of sediment settling in the watercourse. The use of a shovel may be required to ensure representative samples are collected.

Samples are collected using the following methodology:

1. Clean sample equipment (trowel and/or shovel) using a 5/95 mix of Decon 90 and demineralised water.
2. Ensure sampler is wearing new nitrile powder free gloves (new gloves are to be worn for each sample).
3. Scrape away leaf litter or other debris from the ground surface. Avoid collecting pebbles and gravel as the laboratory cannot analyse large fractions.
4. Use the shovel and/or trowel to dig up sediment and transfer sample to clean, appropriately treated and laboratory supplied sample containers (250 mL sample jars and 500 mL sample bags).
5. Metals analysis is to be undertaken on the <63 µm fraction of sediment, and as such 1 kg of sample is to be provided to the laboratory for metals analysis, plus sufficient sample volume for particle size distribution and the other analytes. Samplers are to check sample volume requirements with the laboratory prior to undertaking the sampling.
6. Samples will be kept separate (i.e. collect and submit three samples per site for analysis); do not composite the samples as that will influence how the guideline values are applied.

7. Once sample containers are full, place samples in an esky with ice bricks, or vehicle fridge, until they are delivered to a NATA accredited laboratory for analysis.
8. Clean sample equipment before collecting the next sample (firstly wipe off any residual sediment with paper towel, and then wash with the Decon 90 mixture).
9. Once all sediment samples have been collected, submit the samples to a NATA accredited laboratory, with accompanying Chain of Custody forms.

In accordance with Appendix 4 of the WDL (at Attachment A), samples will be analysed for pH, EC, moisture content, particle size distribution, metals (Al, As, Cd, Cr, Cu, Fe, Pb, Li, Hg, Ni, Zn) and sulphate, calcium, chloride, sodium, potassium and magnesium. As discussed above, metals are to be analysed on the <63 µm fraction.

Sediment samples will also be collected from the three Darwin Harbour sites, as per Table 3-1 below (locations are shown on Figure 1-1) and from the macroinvertebrate sampling locations (see Section 5 below). At GDS DH1 – GDS DH3, sediment will be collected from a boat, using a Van Veen grab sampler (or similar), and then placed in suitable laboratory supplied containers, for submission to a NATA accredited laboratory for analysis. Sampling equipment will be cleaned between sites as per the above sample procedure.

Table 3-1. Darwin Harbour Sediment monitoring

Monitoring Location	Description	Analytes	Frequency
GDS DH1	Marine sediment monitoring site, ~4km downstream of compliance point.	pH, EC, moisture content Particle size distribution **Metals**: <63 µm fraction Al, As, Cd, Cr, Cu, Fe, Pb, Li, Hg, Ni, Zn **Anions/cations:** Sulphate, calcium, chloride, sodium, potassium and magnesium	Annually, at end of the wet season (nominally May)
GDS DH2	Marine monitoring site, ~8 km downstream of compliance point, near confluence of branch of western arm of West Arm.		
GDS DH3	Marine monitoring site, reference site, on western arm of West Arm.		

3.2 Data management and reporting

All sediment quality data will be entered into the Sediment Quality Database and compared to the ANZG (2018) toxicant default guidelines for sediment quality, as well as relevant baseline studies (for example, benthic sediment sampling campaign of Middle Arm and West Arm, Darwin Harbour [Radke et al. 2021]). Data will be compared over time to determine if there are detectable changes or trends in sediment quality. Changes or trends will be investigated to assess whether the change is attributable to mine site discharges

As with surface water quality data, laboratory data will be automatically entered into the database in ESdat form, and compared to guideline values. In order to ensure laboratory results are automatically issued to ESdat, ensure the following email address is listed on the COC to receive results: esdat_au+corelithium@esdatlabsync.net.

Reporting on sediment data will be within the Monitoring Report, which will be prepared and submitted annually, within 10 business days of 25 July of each year.

4 RIPARIAN VEGETATION

Riparian vegetation occurs along watercourses and surface water features and are significant vegetation communities as they are spatially restricted and provide habitat to a relatively large number of species (DENR 2019). Riparian vegetation monitoring will be undertaken in accordance with Appendix 5 of the Draft WDL, to detect any changes to riparian vegetation health or extent which could occur as a result of discharge of mine wastewater from MWD1.

Below is a Riparian Vegetation Monitoring Plan (RVMP) which includes:

- Assessment of baseline information
- Monitoring parameters, methodology and frequency
- Data analysis

4.1 Baseline surveys

A previous survey, The Mangrove and Riparian Vegetation Assessment (EcOz 2019) was undertaken to assess the riparian vegetation prior to mining activities commencing.

Three types of monitoring were undertaken; an aerial drone survey to look at the overall riparian vegetation health and assist in mapping the riparian vegetation extent, an on-ground field survey to assess vegetation structure and composition within the mapped riparian vegetation extent, and photo point monitoring. Note, the drone survey was undertaken post-wet season (March) and the vegetation site assessments and photo point monitoring was undertaken in the dry season (June).

Three riparian vegetation survey plots were established within the mangrove study site, representing riparian, swamp and mangrove communities (MVS1, RVS2 and SVS3). Table 4-1 provides a summary of baseline survey results, and Figure 4-1 shows the location of the three different riparian communities, and the monitoring sites. No reference site has been established for LDGNT (as there are no suitable sites within close proximity to the mine site), and there is no intent to add a site as part of this RVMP as the objective is to examine if there is a change in vegetation compared to baseline. The BP33 reference site, located upstream of Charlotte's creek will be used as a reference site if required – the details are within the BP33 Riparian Vegetation Monitoring Plan (EcOz 2022).

The baseline study provides a spatial dataset from which to monitor changes in riparian vegetation boundaries within the study sites. The baseline assessment indicates that vegetation communities within the study sites are in good condition, with limited pre-development disturbance. This is with the exception of the swamp community, which occurs downstream of the mine site in the West Arm catchment. Weeds and impacts from off-road racing tracks were observed within this vegetation community.

The baseline riparian vegetation site assessments and photo point monitoring was undertaken in the dry season (June). In future, the monitoring will be undertaken using the same methods as baseline, however in the post-wet season (March) when water discharge events occur.

Table 4-1. Summary of baseline riparian vegetation descriptions

Vegetation type & survey site	Vegetation Description	Other species present	NVIS code	Landform	Soil	Drainage	Fire	Weeds	Disturbance	Hydrology	Intact riparian vegetation area size (ha)
Mangrove (MVS1)	*Lumnitzera racemosa, Bruguiera exaristata, Avicennia marina* with isolated *Excoecaria ovalis* low open forest, over *Fimbristylis* sp. and *Xerochloa imberbis* mid sparse tussock grassland	None recorded	T6c	Mangrove flat near tidal creek	Brown sandy clay surface soils, some pebbles present ranging in size (2 – 6 cm)	Very poorly drained	Nil	None	None	Tidal, towards upper tide limit. Large pool located adjacent to vegetation assessment site – approximately 4 m wide.	5.18
Riparian (RVS2)	*Melaleuca viridiflora* mid woodland over *Acacia plectocarpa, Lumnitzera racemosa* (on the edge of creek) and *Avicennia marina* (in creek channel) mid open shrubland, over *Germainia grandiflora, Dapsilanthus* sp. and *Xerochloa imberbis* mid tussock grassland	**Mid stratum** *Thespesia populneoides* **Ground stratum** *Asteraceae sp., Wrightia saligna, Flagellaria indica, Acrostichum speciosum, Gymnanthera nitida, Lindernia lobelioides, Diospyros littorea*	T7i	Flat, adjacent to creek channel	Brown clay loam; rocks and pebbles common in channel adjacent to site	Poorly drained	2+ years since last fire causing minimal impact	None	Motorbike tracks nearby	Some pools nearby, inundated on large high tides and with freshwater during wet season	0.76
Swamp (SVS3)	*Melaleuca viridiflora, Erythrophleum chlorostachys* and *Corymbia polycarpa* mid woodland over *Lophostemon lactifluus, Clerodendrum floribundum* and *Denhamia obscura* mid open shrubland over *Sorghum intrans, , Aristida* sp. and *Pandanus spiralis* mid tussock grassland	**Mid stratum (M1):** *Alphitonia excelsa, Grevillea decurrens* **Ground stratum** *Germainia grandiflora, Acacia difficilis,* Fern sp., *Themeda* sp., *Wrightia saligna, Livistona humilis, Osbeckia australiana, Dianella odorata, Brachychiton megaphyllus, Fern sp.1, Antidesma ghesaembilla*	T7i	Lower slope, flat open depression	Brown sandy loam. Some quartz present near creek	Poorly drained – some wet season inundation	Last year (relatively low impact fire)	Annual mission grass scattered near site. Patches of *Hyptis suaveolens, Calopogonium mucunoides* and *Passiflora foetida* recorded nearby	None	Wet season inundation	1.5

4.1.1 Standards and guidelines

Monitoring will be in accordance with best practice guidelines and standards, including *Northern Territory guidelines and field methodology for vegetation survey and mapping* (Brocklehurst et. al. 2007) and the *NT Sampling and Processing Manual* (Llyod and Cook 1996). Details are provided below for each type of monitoring.

4.2 Methods

Drone survey

A drone survey will occur annually, post-wet season (April/May). The drone will be flown along the existing flight path corresponding to the baseline survey (EcOz 2019) to capture the riparian vegetation extent (see Figure 4-1).

- Use DJI Phantom 4pro drone to capture images at a height of 75m (75% front overlap and 65% side overlap) using the DroneDeploy app.
- Drone will be flown in the desirable conditions i.e. in the middle of the day to avoid sun light interference. Observations will also be noted i.e. timing of flight, and the weather to replicate similar conditions for future surveys.
- When importing drone data to create the orthomasoaic, the same methods as per methods in baseline report outlined in Section 3, will be applied.
- A 5cm pixel image will be exported for the survey site, a colour orthomosaic and a plant health image, displayed in red, green and blue.
- The boundary of the riparian vegetation will then be delineated using the orthomosaic imagery and remote sensing techniques.

Riparian vegetation site assessments

Monitoring will be undertaken post-wet season (April/May), after wastewater discharge events. Three riparian vegetation monitoring sites MVS1, RVS2 and SVS3 will be monitored using the same monitoring method outlined in Section 3 in the Mangrove and Riparian Vegetation Assessment (EcOz 2019). Plots will be established and vegetation species, height and % cover will be recorded within each plot. Vegetation continuity will also be monitored by traversing a 100 m long transect and estimating the canopy cover. Photo points will be established an four photographs will be taken in the same location, facing north, east, south and west, each monitoring round, to allow comparison over time.

4.3 Monitoring schedule

Table 4-2 outlines the riparian vegetation monitoring schedule that will be followed for the duration the of the WDL.

Table 4-2. Riparian vegetation monitoring schedule

Monitoring	Objective	When	Monitoring undertaken	Frequency of monitoring	Locations
Riparian vegetation site assessment survey	To capture data outlined in Table 4-1 after wet season discharges	End of Wet season (April/May)	Site assessment at all identified locations	Annual - 2023 onwards	MVS1, RVS2 and SVS3
Photo point monitoring	To capture photo points after wet season discharges	End of Wet season (April/May)	Photo monitoring at riparian vegetation assessment sites	Annual - 2023 onwards	MVS1, RVS2 and SVS3
Ongoing drone survey	To continue drone survey monitoring after wet season discharges	End of Wet season (April/May)	Drone flight	Annual - 2023 onwards	Flight path as per previous survey

4.4 Data management and reporting

4.4.1 Drone survey

The intent of analysing drone data is to determine if there is reduction in riparian vegetation extent and/or structure compared to baseline survey. If there are gaps in vegetation i.e. if there is a retraction of mapped riparian vegetation, further on-ground assessments will be undertaken. A vegetation monitoring database will be maintained which will record:

- The riparian vegetation area size (ha) based on drone mapping
- All drone images captured during the drone surveys organised in folders.
- A zip-file of all tiff files derived from drone surveys (both orthomosaic and plant health image).
- Spatial data.

4.4.2 Riparian vegetation site assessments

The data collected will be analysed using the Before After/Control Impact (BACI) approach. BACI will be applied by performing statistical analysis to test whether there is a significant difference between the baseline data and ongoing data sets collected at the same sites. Data analysis will include:

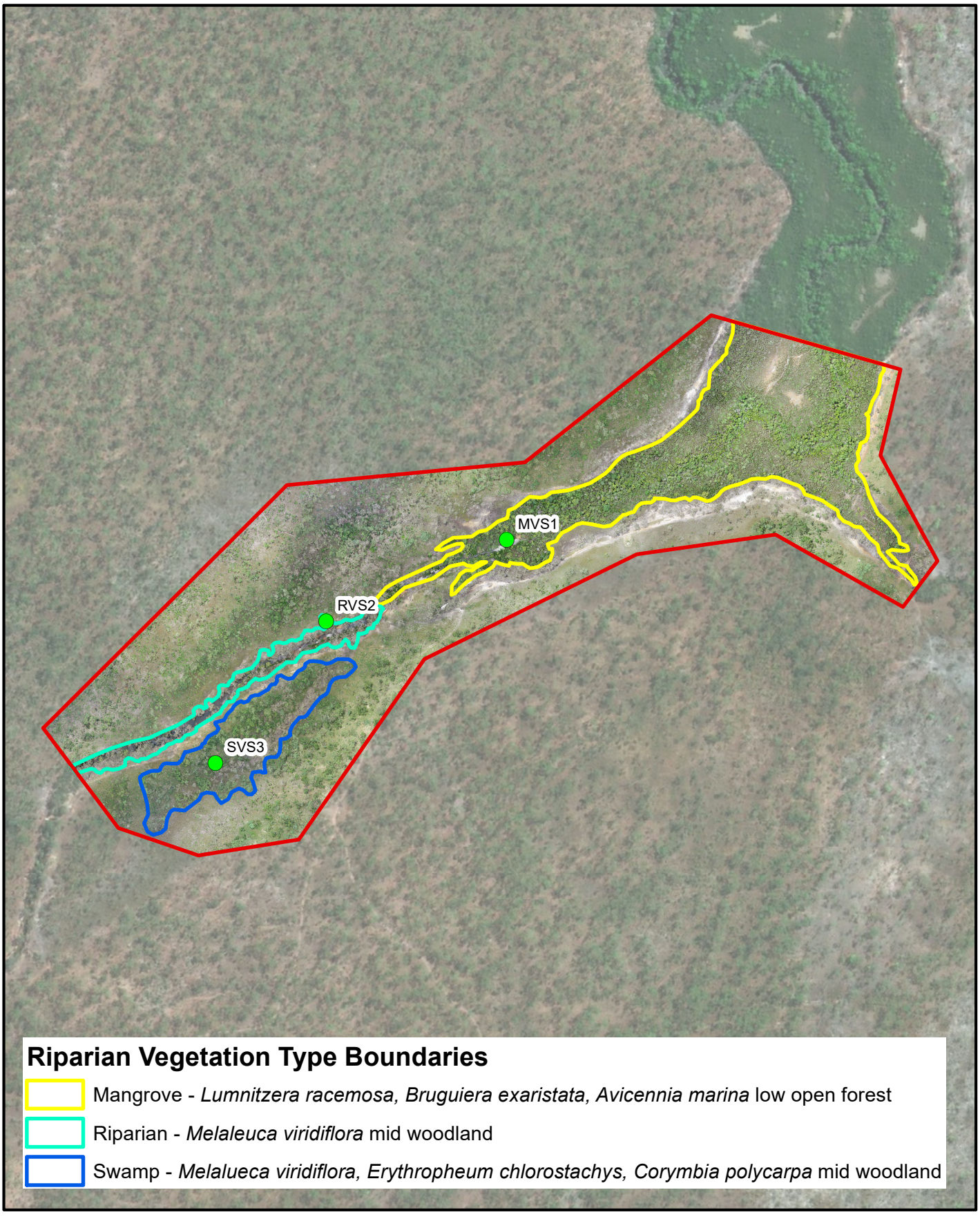
- Species composition (%) using vegetation data collected for upper, mid, ground strata data
- Average heights of plants across riparian vegetation sites.
- Canopy cover (%) for each dominant, and emergent species across riparian vegetation assessment sites compared to reference site data.
- Plants alive or dead (%) across all riparian vegetation sites.

This data will also be stored within the vegetation monitoring database.

4.4.3 Photo point monitoring

The intent of analysing photo point data is to determine if there are visual on-ground changes compared to baseline survey. All photographs will be labelled with site name, direction and date and stored in a separate zip-file.

Results of riparian vegetation monitoring will be reported on annually within the Monitoring Report, which will be prepared and submitted to the Administering Agency within 10 business days of the 25 July of each year.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ19042 - Grants Project supplementry ecology 2019\01 Project Files\Riparian veg assessment\Figure 3. Mangrove ecosystem vegetation boundaries.mxd

Figure 4-1. Map of riparian vegetation type boundaries and monitoring locations

5 MACROINVERTEBRATES

Appendix 5 of the Draft WDL requires macroinvertebrate monitoring within Darwin Harbour and areas downstream of the GLP. Macroinvertebrate sampling will be undertaken within the freshwater habitats downstream of the discharge point, and within Darwin Harbour sites which are also monitored for water quality, sediment and seagrass habitat.

Baseline macroinvertebrate sampling was undertaken in freshwater habitats downstream of the mine site in 2017, and two of these sites will be monitored ongoing to allow comparison of data over time. Sediment and water quality samples will also be collected during macroinvertebrate sampling to inform macroinvertebrate data analysis. Macroinvertebrate sampling is summarised in Table 5-1.

Table 5-1. Macroinvertebrate monitoring program

Sites	Site type	Purpose	Survey timing
UC1, UC2	Freshwater macroinvertebrates	Comparison to 2017 baseline data – downstream of mine site	Annually during recessional flows (April/May)
GDS SW5		Compliance point data	
Control (BP4)		Reference site	
GDS DH1, GDS DH2	Marine macroinvertebrates	Darwin Harbour sites downstream of mine site	Annually during recessional flows (April/May)
GDS DH3		Reference site	

5.1 Sample methods

Macroinvertebrate sampling will be undertaken annually during the recessional flows each wet season (April/May). Site locations are shown on Figure 1-1. The freshwater sites were visited and sampled in May 2022, and so are known to be accessible and appropriate for macroinvertebrate sampling. A suitable and accessible reference site near the LDGNT site could not be located, and so a reference site on an unnamed tributary of the Charlotte River, upstream of Cox Peninsula Road, has been selected as a representative reference site for both LDGNT and the adjacent BP33 mine site. The location of this site is shown on Figure 1-1 (see 'BP4'). If, during future monitoring events, the reference site UC3 (which was sampled by GHD in 2017) is found to be suitable, then it may also be sampled as a reference site. However, during sampling in 2022 there was insufficient water at site UC3 which indicates it ceases to flow soon after the wet season.

For both marine and freshwater sites, water quality samples will be collected (including measurement of field parameters and collection of surface water samples) prior to sediment and macroinvertebrate sampling to minimise contamination of water quality samples (e.g. with sediment or vegetation). Water will be analysed for the same parameters as per the surface water monitoring schedule (see Section 2). Following collection of water samples, macroinvertebrate sampling will be undertaken, and sediment samples will be collected (to be analysed for the same parameters as per Section 3).

Freshwater

Macroinvertebrate sampling will be undertaken in accordance with the *NT AUSRIVAS Sampling and Processing Manual* (Lloyd and Cook 2001) and the *Darwin-Daly Regional AUSRIVAS Models – Northern Territory* (Lamche 2007). All sampling sites are chosen from steep edge habitat with no undercut and away from any fast-flowing stream sections. Habitat descriptions of the site will be noted on the Field Sheets from the NT Darwin-Daly Region AUSRIVAS User Manual (provided at Attachment C); field notes will include site location, a sketch of the site, water quality field data, and a description of the sampled site).

At each site one person will rake along the bank and submerged root matter, and another will sweep through the water in the disturbed area with a 250 µm net to capture the removed material, which will include macroinvertebrates. Samples will be sieved on the bank through sieves of decreasing aperture to remove leaf litter and other material. This material is then thoroughly rinsed with water collected from the sample site multiple times. The remaining material is examined for any macroinvertebrates before being disposed of. All material from the finest sieve (250 µm) will be washed into a jar, which is then filled with ethanol for preservation.

Refer to the *Darwin-Daly Regional AUSRIVAS Models – Northern Territory* User Guide (Lamche 2007) for detailed sample methodology.

Samples will be labelled and stored upright in an esky, transported safely to avoid accidental damage to samples. Samples will be submitted to a suitably qualified AUSRIVAS taxonomist for identification and data analysis.

Marine water

Marine macroinvertebrate samples will be collected via a boat, using a Van Veen grab sampler. The Van Veen will be lowered over the boat and a grab sample collected. The sediment will be emptied into a clean stainless steel container for onboard processing. A number of different sized sieves will be used to remove as much sediment, sand, rock, coral and other material from the sample, using filtered marine water to carefully wash the material through the sieves. Material from the finest sieve (10 µm) will be washed into a sample jar, which is then filled with ethanol for preservation. All samples will be submitted to a suitably qualified taxonomist with experience processing and analysing marine macroinvertebrate samples.

5.2 Data management and reporting

Freshwater

Freshwater samples will be analysed in accordance with the *Darwin-Daly Regional AUSRIVAS Models – Northern Territory* (Lamche 2007). Taxa will be identified to family level where possible, except for key taxa (as per Darwin-Daly regional AUSRIVAS User Manual) which either require identification to only order level, or sub-family level. Following identification, taxa counts will be recorded in a database and samples preserved and archived.

Macroinvertebrate metrics will be generated (abundance, taxa richness, PET richness, Signal-2) and presented for each site. AUSRIVAS modelling will be completed and OE50 scores and bandings presented for each site. Multivariate analysis of macroinvertebrate community composition will be completed to understand the differences and similarities between the sites. Data will be compared between years to identify whether there is any change in macroinvertebrate diversity (species richness) or abundance.

Marine

Marine samples will be analysed and macroinvertebrates (aka benthic infauna) identified to the lowest taxonomic level possible, or morpho-species. Statistical analysis will be undertaken on the samples (e.g. PRIMER and P.A.S.T) to calculate:

- Diversity indices, to assess species richness, diversity, evenness and dominance within samples
- Multivariate analysis to assess species abundance
- Environmental correlations – to assess whether there is a correlation between environmental data (e.g. water quality data) and macroinvertebrate data.

Results of macroinvertebrate sample processing and analysis will be reported in standalone reports prepared by the taxonomist. Key findings of macroinvertebrate sampling will be reported in the annual Monitoring Report, to be prepared and submitted to the Administering Agency within 10 business days of the 25 July each year.

6 SEAGRASS

Seagrass monitoring will be undertaken in West Arm, at sites GDS DH1, GDS DH2 and GDS DH3 (see Table 2-2 and Figure 1-1 for locations), in accordance with Appendix 5 of the Draft WDL. Benthic habitat mapping, based on modelling undertaken by the Australian Institute of Marine Science (AIMS) in collaboration with the Northern Territory Government, shows low likelihood of seagrass habitat within West Arm (Galaiduk et al. 2019 and Siwabessy et al. 2020). Additionally, the extent of seagrass is known to fluctuate in the Darwin Region, due to factors such as turbidity and wind and wave action, which tends to be greater during the wet season. As such, the spatial extent and percentage cover of seagrass generally declines during the wet season and recovers and expands during the dry season (Cardno 2014). Cardno noted low seagrass cover in wet season months such as February, but greater seagrass cover in May through to October/November.

Seagrass surveys are generally undertaken in accordance with the *Monitoring and Sampling Manual: Environmental Protection (Water) Policy – Guidance on seagrass monitoring* (Qld DES 2018) and associated resources including the *Manual for Scientific Monitoring of Seagrass Habitat* (Short et. al. 2015). However, seagrass monitoring usually focusses on well-established seagrass meadows and their extent, composition and biomass over time, and many of the proposed methods in DES (2018) are designed and selected for seagrass meadows. The methods are inappropriate for application in this case as the study area is situated within mangrove lined tidal channels with no known seagrass meadows in the vicinity.

The method proposed below was selected based on the likely limited presence of seagrass, access, and safety considerations:

- Three monitoring locations will be accessed via boat (locations shown on Figure 1-1 and Table 1-1).
- At each location one 50 m transect will be established perpendicular to the channel (i.e. across the channel).
- Seagrass survey will be undertaken at three sites along the transect; one at each end and one in the middle.
- At each of the three sites along the transect, a 0.5 m x 0.5 m quadrat on a frame will be lowered to the seabed.
- A GoPro camera will be attached to the frame, which will be programmed to take photos of the quadrat within a short time frame, i.e. every 10 seconds. The frame will be moved slightly between photographs to collect four photographs per site.
- Once photographs are taken, the quadrat will be lifted to the surface again via a davit, before moving on to the next site.
- Seagrass (if present) will be identified to the genus level as per Roeleofs et al. 2005 and photographs will be used to assess percent cover using the seagrass percentage cover photo guide in *Manual for Scientific Monitoring of Seagrass Habitat* (Short et. al. 2015).
- Common species in the Darwin Harbour area include *Halophila ovalis*, *Halophila decipiens and Halodule uninervis* and it is anticipated that, if present, these will be identifiable from the imagery obtained.

The survey will be undertaken in May, at the same time as Darwin Harbour water quality, sediment and macroinvertebrate sampling. The survey will occur when seagrass is likely to be recovering, and, if present, will likely be visible. The survey will be timed for neap tides, to maximise visibility (water clarity) and ensure photographs show visible/identifiable seabed. Photographs will be reviewed, and presence/absence of seagrass noted, as well as percent cover if present.

Results of seagrass monitoring will be reported on in the annual Monitoring Report, to be prepared and submitted to the Administering Agency within 10 business days of the 25 July each year.

One round of seagrass monitoring will be undertaken, following which the requirement for ongoing seagrass monitoring will be reviewed. If no seagrass is present in the tributaries of West Arm downstream of GLP then LDGNT will seek to remove the requirement for seagrass monitoring from WDL 248.

LDGNT is open to opportunities for collaboration with government and industry, or contribution to broader seagrass monitoring programs within Darwin Harbour to assess long term harbour health. Guidance from the Northern Territory Environment Protection Authority and/or Department of Environment, Parks and Water Security would be sought in this regard.

7 REFERENCES

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ATTACHMENT A –WASTE DISCHARGE LICENCE 248 FOR LITHIUM DEVELOPMENTS GRANTS NORTHERN TERRITORY

Northern Territory Government

WASTE DISCHARGE LICENCE

(Pursuant to section 74 of the *Water Act 1992)*

Licensee	Lithium Developments (Grants NT) Pty Ltd
Licence Number:	**WDL248**
Registered Business Address:	Level 5, Flinders Street Adelaide SA 5000
ACN:	622 047 232
ABN:	70 622 047 232
Commencement Date:	25 July 2022
Expiry Date:	24 July 2025
Licensed Action:	Controlled discharge of wastewater from Mine Water Dam 1 (MWD1) through authorised discharge point (DP1) and into an unnamed ephemeral stream that feeds into West Arm, Darwin Harbour in accordance with Table 2 and subject to the conditions of this licence.

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INFORMATION ABOUT THIS LICENCE

This waste discharge licence is granted pursuant to section 74 of the *Water Act 1992* (NT) (Water Act), which empowers the Controller of Water Resources to, in accordance with the Water Act, grant a licence to a person to carry out an action that would otherwise be an offence against this Act.

Responsibilities of Licensee

- In addition to the conditions set out in this licence, general responsibilities of licensees are set out in the *Waste Management and Pollution Control Act 1998* (NT) (**WMPC Act**), the Water Act and the *Water Regulations 1992* (NT) (**Water Regulations**).
- It is an offence under the Water Act, if the holder of a waste discharge licence contravene or cause, suffer or permit a person to contravene a term or condition to which the waste discharge licence is subject (s 76 Water Act).
- Except as expressly provided for in this licence or applicable law, it is an offence under section 16 of the Water Act to wilfully cause or cause, directly or indirectly:
    - waste to come into contact with water; or
    - water to be polluted.

Duration of licence

- This licence will remain in force until its Expiry Date, it is surrendered by the licensee, or until it is suspended or revoked by the Controller of Water Resources.
- A licensee may surrender its licence at any time (s 94 Water Act).
- If the licensee wishes to surrender its licence it should complete the notification form approved by the Controller of Water Resources and provide a copy of the completed form to the Administering Agency.
- The authority to allow waste to come into contact with water or water to be polluted ends once a licence is surrendered, and any such occurrence after a licence is surrendered is an offence pursuant to s 16 of the Water Act.

Amendment, Modification or Revocation of Licence

- As set out in section 93 of the Water Act, the Controller of Water Resources may, by notice served on the holder of the licence:
    - amend or modify the terms and conditions of a licence; or
    - where the Controller of Water Resources is satisfied that the holder of the licence has contravened or failed to comply with a term or condition of the licence or of any other licence previously held by the person for a similar purpose during the 12 months immediately preceding the grant of the first-mentioned licence, the Controller of Water Resources may:
        - revoke a licence; or
        - suspend a licence.

Transfer of Licence

- Where a waste discharge licence is granted to a person in relation to the person's use of land and, during the period of this licence, the person's interest in the land is transferred to another person, the waste discharge licence shall be deemed to have also been transferred to the other person (s 92 Water Act).

- The licensee must ensure the contact details recorded with the Administering Agency for the licence are correct at all times in accordance with condition 6. Accordingly, it is recommended the transferee complete the Controller of Water Resources approved notification of transfer of a waste discharge licence form.

Public Register

- A copy of this Licence will be placed on the Register in accordance with section 95 of the Water Act.

- A copy of plans for environmental management, reports, submissions or documents provided at Schedule 1 Item 13 will be placed on the Register.

- The Register is freely available from the Northern Territory Environment Protection Authority (**NT EPA**) website.

Water Quality Standards

- The Administrator may declare, by notice in the *Gazette*, a beneficial use, quality standard, criteria or objectives which apply in relation to any waste or class of waste, or water or class of water (s 73 Water Act).

- A water or waste beneficial use, quality standard, criteria or objectives declared under s 73 of the Act and in force is an Environment Protection Objective for the purposes of the WMPC Act (s 18 WMPC Act).

- An Environment Protection Objective is a statutory instrument to establish principles on which:

    - Environmental quality is to be maintained, enhanced, managed or protected;

    - Pollution, or environmental harm resulting from pollution, is to be assessed, prevented, reduced, controlled, rectified or cleaned up; or

    - Effective waste management is to be implemented or evaluated.

- Schedule 1 Item 1 specifies the beneficial use, quality, standard, criteria or objective relevant to this licence at the date of issue.

Environmental Interests

- Environmentally sensitive or significant areas may be captured by and protected under the *Environment Protection Act 2019* (NT) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). As such, and to best protect and regulate our waterways, waste discharge licences must identify the sensitivity of the environment surrounding the location of the Licensed Action.

- Schedule 1 Item 2 specifies the sites of conservation significance (if any) relevant to this licence at the date of issue.

- Schedule 1 Item 3 specifies the Ramsar wetlands (if any) relevant to this licence at the date of issue.

Cultural Interests

- Under Commonwealth and Northern Territory laws it can be an offence to enter or remain on or damage a sacred site.
- Sites of Aboriginal significance including registered and recorded Aboriginal sacred sites may exist in the vicinity of the Licensed Action.
- It is the licensee's responsibility to contact the Aboriginal Areas Protection Authority, appropriate land council or other governing body and ensure that any Authority Certificates required as a result of conducting the Licensed Action are obtained and complied with.
- Further specific advice on any cultural requirement or implication of the licenced activity should be sought from the relevant land council and the Aboriginal Areas Protection Authority.

END NOTES

This licence is a new licence, as such there are no historical records associated with the licence.

SCHEDULE 1 - ITEMS

1. Beneficial uses	Beneficial Uses and Objectives for the Darwin Harbour Region (Gazette No. 27, 7 July 2010).	
2. Sites of conservation significance	SOCS No. 6 Darwin Harbour.	
3. Ramsar wetlands	Not applicable.	
4. Licence Documents	(a) Water Management Plan - Appendix K, Mine Management Plan Grants Lithium Project (approved 10 June 2021). (b) Emergency Response Plan - Appendix R, Mine Management Plan Grants Lithium Project (approved 28 June 2019). (c) Stakeholder Engagement Plan - Core Lithium Grants Lithium Project Stakeholder Engagement Plan (issued 7 June 2021).	
5. Authorised Discharge Point(s)	Discharge Point 1 (DP1) from Mine Water Dam 1 (MDW1) as shown on the plan at Appendix 1.	Zone: 52 L Easting: 693153 Northing: 8598441
6. Source(s) of waste	Pit water, direct rainfall, and mine influenced water collected from Mineral Lease 31726 that is captured and stored in sediment basins and Mine Water Dam 2 (MWD2) and pumped to MWD1. Waters discharged through DP1 are pumped over the wall of MWD1 and released by a tee valve into the flow path of an adjacent unnamed ephemeral stream as shown at Appendix 1.	
7. Trigger values	The limits for parameters listed in Appendix 2.	
8. Compliance point	Grants Downstream Surface Water 5 (GDS SW5) as shown on the plan at Appendix 1.	Zone: 52 L Easting: 693374 Northing: 8600709
9. Conditions on discharge	Any authorised discharge must: (a) Not include wastewater generated outside of Mineral Lease 31726; (b) Not include wastewater treated with polyacrylamide flocculants with more than 0.05% of the neuro-toxin acrylamide monomer; (c) Occur only when the stream gauge at the compliance point GDS SW5 shows there is a sufficient amount of water to dilute discharge water to achieve trigger values; (d) In the event wastewater is treated, occurs only when the treatment process has finished, including allowing sufficient residence time for settlement of flocculants and target contaminants.	
10. Monitoring Program	The Monitoring Program includes: (a) Surface water monitoring in accordance with Appendix 3. (b) Fluvial sediment monitoring in accordance with Appendix 4. (c) Biota monitoring in accordance with Appendix 5.	
11. Critical contaminants	Aluminium (Al), Arsenic (As), Copper (Cu), Iron (Fe), Lithium (Li), Zinc (Zn) and Total Phosphorus (TP).	

12. Non-compliances	Non-compliances include the following exceedances: (a) An exceedance of a trigger value specified in Item 7 at the compliance point in Item 8, on three consecutive sampling occasions. (b) An exceedance of three times or more a trigger value specified in Item 7 at the compliance point in Item 8.
13. Documents placed on Register	The following documents will be placed on the Register: (a) The Licence Documents at Item 4. (b) The Monitoring Report provided in accordance with clause 45. (c) The Annual Return.

LICENCE CONDITIONS

RULES FOR INTERPRETING THE CONDITIONS OF THIS LICENCE

1. Where there is a discrepancy between the conditions of this licence and any plan, standard, guideline or other document referred to in this licence, the conditions of this licence prevail to the extent of the inconsistency.
2. Any reference to any standard, guideline or code of practice (Australian or international) in this licence means the relevant parts of the current version of that standard, guideline or code of practice.
3. In this licence, unless the contrary intention appears, words that are defined in the Water Act are intended to have the meaning given to them in that Act.
4. In this licence, unless a contrary intention appears, terms are defined in the Definitions at the end of this licence.
5. In this licence a reference to an Item is a reference to an Item in Schedule 1.

GENERAL

6. The licensee must ensure the contact details recorded with the Administering Agency for this licence are correct at all times.
7. The licensee must at all times have a 24 hour emergency contact.
8. The licensee must notify the Administering Agency prior to making any operational change that will cause, or is likely to cause, an increase in the potential for environmental harm.
9. The licensee must display clear and legible signage, in English, in a prominent location at each public entrance to the premises of the Licensed Action that includes the following details:
    - 9.1. waste discharge licence number issued under the Water Act; and
    - 9.2. 24 hour emergency contact details.
10. The licensee must cause a hard copy of this licence to be available for inspection, at the premises of the Licenced Action, by any person on request.
11. Unless otherwise specified, within 10 business days of a request, the licensee must provide to the Administering Agency a copy of any document, monitoring data or other information in relation to the Licensed Action in electronic form by emailing waste@nt.gov.au.
12. All notices, reports, documents or other correspondence required to be provided as a condition of this licence, unless otherwise specified as a condition of this licence, must be provided in electronic form by emailing waste@nt.gov.au.
13. The licensee must maintain, implement and comply with the current version of the documents listed in Item 4.
14. Within 10 business days of any amendment being made to a document listed in in Item 4, the licensee must provide the amended document to the Administering Agency, along with:
    - 14.1. a tabulated summary of the amendment(s) with document references;
    - 14.2. reasons for the amendment(s); and
    - 14.3. an assessment of environmental risk associated with the amendment(s).
15. The Administering Agency may require the licensee to revise or amend and resubmit any document provided in accordance with this licence. Where the Administering Agency requires any document to be revised or amended, the licensee must submit it to the Administering Agency by the date specified by the Administering Agency.
16. The licensee must operate and maintain a community feedback telephone number enabling members of the public to contact, at any time, a person or voice mail system that can accept, on behalf of the licensee, enquiries or complaints about the Licensed Action, and to which the licensee must respond. The community feedback telephone number must be displayed:

16.1. where the licensee has a website, in a prominent location on the licensee's website;

16.2. in the Stakeholder Engagement Plan; and

16.3. in other publicly available documents relating to the Licensed Action.

17. The licensee must maintain a register of complaints that records the details of each complaint received in relation to the Licensed Action and provide a copy to the Administering Agency on request. Details of the compliant must (as is reasonably practicable) include, the following information:

17.1. the person to whom the complaint was made;

17.2. the person responsible for managing the complaint;

17.3. the date and time the complaint was reported;

17.4. the date and time of the event(s) that led to the complaint;

17.5. the contact details of the complainant if known, or where no details are provided a note to that effect;

17.6. the nature of the complaint;

17.7. the nature of event(s) giving rise to the complaint;

17.8. prevailing weather conditions at the time (where relevant to the complaint);

17.9. the action taken in relation to the complaint, including any follow-up contact with the complainant; and

17.10. if no action was taken, why no action was taken.

MONITORING INFORMATION

18. If the licence expires or is otherwise surrendered, suspended or revoked and the licence contained a condition that the licensee provide a report, record or other information, including in accordance with a monitoring program pursuant to section 77 of the Water Act, the licensee must provide any report, record, information or data available to the licensee up to and including the date the licence expired or was surrendered, suspended or revoked.

OPERATIONAL

19. Without limiting the conditions of this licence, in conducting the Licensed Action, the licensee must do all things reasonable and practicable to:

19.1. prevent or minimise the likelihood of pollution occurring as a result of, or in connection with, the Licensed Action;

19.2. prevent or minimise the likelihood of environmental harm occurring as a result, or in connection with, the Licensed Action;

19.3. effectively respond to pollution and the risk of pollution occurring as a result of, or in connection with, the Licensed Action;

19.4. effectively respond to environmental harm and the risk of environmental harm occurring as a result of or in connection with the Licensed Action; and

19.5. apply the principles of ecologically sustainable development.

20. The licensee must, without limiting any other condition of this licence, in conducting the Licensed Action do all things reasonable and practicable to ensure the Licensed Action does not adversely affect any:

20.1. declared beneficial use, quality, standard or objectives declared under section 73 of the Water Act;

20.2. sites of conservation significance; or

20.3. designated Ramsar wetlands,

including, but not limited to, those listed at Items 1, 2 and 3.

21. The licensee must ensure any plant and equipment used by the licensee in conducting the Licensed Action:

    21.1. is reasonably fit for the purpose and use to which it is put;

    21.2. is maintained and operational; and

    21.3. is operated by a person trained to use the plant and equipment.

22. No change, replacement or alteration of plant and equipment is permitted if the change, replacement or alteration increases the risk of environmental harm for the Licensed Action, unless approved by the Administering Agency.

DISCHARGES

23. This licence authorises discharges of waste to water from the authorised discharge point(s) as identified in Item 5 and in accordance with the conditions of this licence.

24. Where the Administering Agency directs the licensee to cease discharge from an authorised discharge point identified in Item 5, the licensee must immediately cease the discharge.

25. A direction to cease discharge may be verbal or written, but a verbal direction from the Administering Agency will be provided in writing within 48 hours of the verbal direction. A failure to provide a written direction does not affect the requirement to comply with a verbal direction.

26. The licensee must ensure that discharge from each authorised discharge point:

    26.1. consists only of waste from the source(s) as specified in Item 6;

    26.2. does not exceed the trigger value limits at Item 7 at the compliance point at Item 8;

    26.3. meets the conditions at Item 9.

27. Following any exceedance of a trigger value limits at Item 7 at the compliance point at Item 8 the licensee must take corrective action to mitigate any environmental harm and ensure the exceedance does not reoccur.

28. The licensee must, for each authorised discharge point, install, operate and maintain a device to measure and record, for each discharge event:

    28.1. the time the discharge commenced and the duration of the discharge;

    28.2. the discharge rate of flow; and

    28.3. the discharge volume.

29. The licensee must ensure that the discharge from all discharge events at each authorised discharge point does not:

    29.1. contain any floating debris, oil, grease, petroleum hydrocarbon sheen, scum, litter or other objectionable matter;

    29.2. cause or generate odours which would adversely affect the use and amenity of surrounding waters;

    29.3. cause algal blooms in the receiving water;

    29.4. pollute groundwater;

    29.5. cause visible change in the behaviour of fish or other aquatic organisms in the receiving water;

    29.6. cause mortality of fish or other aquatic organisms;

    29.7. cause erosion or degradation to the beds and banks of a watercourse; or

    29.8. cause adverse impacts on plants or animals.

MONITORING

30. From the Commencement Date of this licence, the licensee must implement and comply with the Monitoring Program specified in Item 10.

31. The licensee must ensure that the Monitoring Program is designed, maintained and implemented in accordance with the following principles:

    31.1. the need to monitor loads upstream and downstream, including in-stream decay in loads downstream, of authorised discharge points;

    31.2. the need for event-based monitoring, in addition to routine monitoring, including revisiting sampling points as soon as practicable when samples cannot be collected at frequencies set in the Monitoring Program;

    31.3. the need for special studies to better described in-stream physical, chemical and biological processes;

    31.4. the need to target the possible critical contaminants listed at Item 11;

    31.5. the need to select sampling points that provided representative (well mixed) samples;

    31.6. the need to collect samples that are representative of discharge conditions, including taking samples from sampling points on the same day as discharge and consecutively from upstream to downstream; and

    31.7. the need to adopt a range of biological surveys to assess the health of the system.

32. The licensee must ensure that all samples and field environmental data are collected in accordance with recognised Australian Standards and guidelines (such as AS/NZS 5667.1 1998, ANZG (2018), as updated from time to time).

33. For the parameters that require analysis at a laboratory, the licensee must ensure that all samples are analysed at a laboratory with current NATA accreditation or equivalent.

34. The licensee must ensure any samples collected in accordance with the Monitoring Program or in connection with the Licensed Action or this licence, are obtained by, or under the supervision of a qualified sampler.

35. The licensee must ensure that, for each sample collected in accordance with the Monitoring Program or the Licensed Action, the following information must be recorded and retained:

    35.1. the date on which the sample was collected;

    35.2. the time at which the sample was collected;

    35.3. the location at which the sample was collected;

    35.4. the name of the person who collected the sample;

    35.5. the chain of custody forms relating to the sample;

    35.6. the field measurements (if any) and analytical results (if any) relating to the sample; and

    35.7. laboratory quality assurance and quality control documentation.

36. The licensee must for all land based monitoring points specified in the Monitoring Program:

    36.1. install and maintain appropriate identification signage so that they are reasonably identifiable at all times; and

    36.2. maintain safe access and egress, as is reasonably practicable.

37. The licensee must ensure that any proposed revisions to the Monitoring Program (other than typographical changes or revisions to formatting or referencing) are:

    37.1. reviewed by a Qualified Person, who must produce a written report about their review;

    37.2. submitted to the Administering Agency with justification for revisions; and

37.3. submitted to the Administering Agency, in both hard copy and electronic form (with a complete copy of the Qualified Person's written review), 20 business days prior to the proposed implementation date.

RECORDING AND REPORTING

38. The licensee must keep records of all exceedances of trigger values of parameters specified in Item 7, including those that are not an exceedance listed at Item 12, and provide a copy on request of the Administering Agency.

39. The licensee must keep records of all non-compliances with this licence. These records must be adequate to enable the licensee to comply with the non-compliance notification conditions of this licence.

40. A non-compliance with this licence includes the exceedances listed at Item 12.

41. The licensee must notify the Administering Agency of any non-compliance with this licence by emailing waste@nt.gov.au, as soon as practicable after (and in any case within 24 hours after) first becoming aware of the non-compliance.

42. The licensee must include in the notification of non-compliance the following information:

42.1. when the non-compliance was detected and by whom;

42.2. the date and time of the non-compliance;

42.3. whether discharge was occurring at the time of the non-compliance and the source of the discharge;

42.4. whether non-compliant discharge is still occurring; and

42.5. a date (within 10 business days of the non-compliance) when an investigation report will be submitted to the Administering Agency.

43. Within 10 business days of notifying the Administering Agency of any non-compliance, the licensee must provide the Administering Agency an investigation report that includes:

43.1. when the non-compliance was detected and by whom;

43.2. the date and time of the non-compliance;

43.3. whether discharge was occurring at the time of the non-compliance and the source of the discharge;

43.4. the actual and potential causes and contributing factors to the non-compliance;

43.5. monitoring data of the discharge, and upstream and downstream water of the authorised discharge point, collected for the date the non-compliance was detected and three sampling rounds prior;

43.6. available flow rates to demonstrate any influence streams and rivers may have had on the exceedance of trigger values;

43.7. rainfall recorded at the site prior to the exceedance of trigger values and non-compliance;

43.8. the risk of environmental harm arising from the non-compliance;

43.9. the action(s) that have or will be undertaken to mitigate any environmental harm arising from the non-compliance;

43.10. corrective actions that have or will be undertaken to ensure the non-compliance does not reoccur; and

43.11. if no action was taken, why no action was taken.

44. The licensee must submit a completed Annual Return, by emailing waste@nt.gov.au, within 10 business days after each Anniversary Date of this licence, which report relates to the preceding 12 month period.

45. The licensee must complete and provide to the Administering Agency a report of data and information obtained through the implementation and performance of the Monitoring Program (the Monitoring Report), as prescribed by this licence, within 10 business days after each Anniversary Date of this licence.

46. The licensee must ensure that each Monitoring Report:

    46.1. is prepared in accordance with the requirements of the Administering Agency 'Guideline for Reporting on Environmental Monitoring' (or any other guideline as adopted by the Administering Agency from time to time);

    46.2. includes a tabulation of all monitoring data required as a condition of this licence (data must be provided electronically in Microsoft® Excel® format);

    46.3. includes a tabulation of monthly and annual contaminant loads discharged from the authorised discharge point listed at Item 5. Contaminant loads must be calculated for total metals, total metalloids, total nutrients and other parameters (excluding field parameters) listed in Appendix 3. The calculations must be based on the daily discharge volume and the concentration of contaminant present in the discharge on that day. On the days when a sample was not taken then the concentration of the contaminant must be estimated using Linear Interpolation methodology;

    46.4. includes long term trend analysis of monitoring data to demonstrate any environmental impact associated with the Licensed Action over a minimum period of three years (where the data is available); and

    46.5. includes an assessment of environmental impact from the Licensed Action.

47. A copy of the documents listed at Item 13 will be placed on the Register.

PERFORMANCE IMPROVEMENT

48. Prior to discharge from the authorised discharge point listed at Item 5, the licensee must develop and provide to the Administering Agency, an operational procedure that:

    48.1. calculates the discharge dilution ratio;

    48.2. monitors compliance with condition 26; and

    48.3. adjusts the discharge rate during discharge events as flow in the catchment varies.

49. The licensee must ensure that water quality monitoring stations, including water level and flow meters, are installed and operational before 31 October 2022.

50. By 31 August 2023, the licensee must develop a plan for a wastewater management and treatment that provides for:

    50.1. a reduction in total contaminant loads discharged compared to total contaminant loads discharged during the 2022/23 wet season; and

    50.2. details of what flocculants and coagulants and other treatment additives will be used, their breakdown products and their potential to contaminate the environment.

END OF LICENCE CONDITIONS

This licence is not valid unless signed below:

JOANNE TOWNSEND
Controller of Water Resources
Dated the 25 JULY 2022

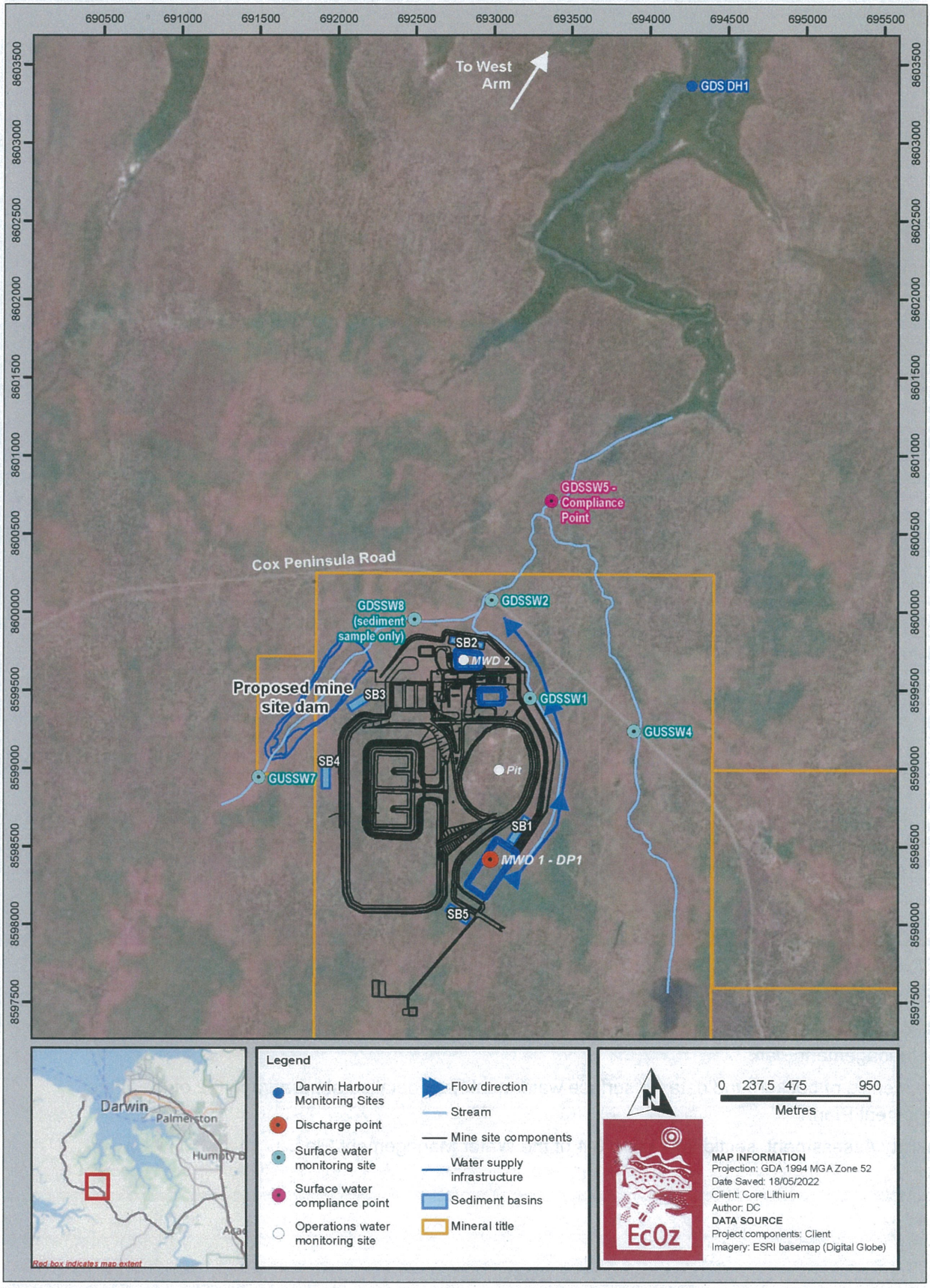
DEFINITIONS

In this licence, unless a contrary intention appears:

Term	Definition
24 hour emergency contact	the phone number of a person who can be contacted at any time and be capable of responding to and providing information about any incident associated with the Licensed Action.
Administering Agency	means the NT Government Department with responsibility for administering the Water Act.
Anniversary Date	annual anniversary of the Commencement Date.
Annual Return	an Administering Agency prescribed format for demonstrating and reporting compliance with the conditions of this licence.
ANZG (2018)	Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines.
Authority Certificate	a certificate issued under s 22(1) of the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT). An Authority Certificate permits a licensee to carry out work on land with or within the vicinity of a sacred site.
business days	a day not Saturday, Sunday or a public holiday, in Darwin, Northern Territory.
Consultation and Communication Plan	a written plan documenting proposed consultation and communications for the Licensed Action before, during and after the Licensed Action which includes a strategy for communicating with members of the public who are likely to have a real interest in, or be affected by, the Licensed Action.
contact details	includes the 24 hour emergency contact, and name, position title and phone number of a representative of the licensee who can be contacted about the licence and Licensed Action.
contaminant	has the meaning given in section 4 of the WMPC Act.
discharge	releasing or allowing a liquid, gas or other substance to flow out from where it has been confined.
Dry season	means 1 May to 31 October.
Emergency Response Plan	a written plan documenting the licensee's procedures for responding to emergencies caused by, resulting from or associated with the Licensed Action and that may cause environmental harm.
land	includes water and air on, above or under land.
Licensed Action	the Licensed Action as described on the covering page of this licence.
Linear Interpolation	a method to construct new data points within the range of known data points. $y = y1 + ((x - x1) * ((y2 - y1) / (x2 - x1))$ y in the unknown concentration between known concentrations y1 and y2 y1 in the first known concentration y2 is the second known concentration x is the day of the unknown concentration y x1 is the day of the first known concentration y1 x2 is the day of the second known concentration y2

Term	Definition
litter	litter, garbage, rubbish, refuse or waste matter, and includes the body of a dead animal.
Maintain	kept in a manner that it does not present or cause a risk of environmental harm or a hazard to persons or property or, for the purposes of documents including plans, a process of reviewing and amending documentation to ensure it is relevant.
NATA	National Association of Testing Authorities, Australia.
non-compliance notification	an Administering Agency prescribed format for notifying the Administering Agency of a non-compliance.
plant and equipment	all material items used in association with the Licensed Action, including (but not limited to) storage vessels and containers, pipe work and hosing, vehicles (including vessels), tools, and measuring equipment.
pollution	has the meaning given in section 4 of the WMPC Act.
public entrance	access to the licensed premises that is utilised by the public.
Qualified Person	a person registered under Section 68 of the WMPC Act.
qualified sampler	a person who has training and experience in obtaining samples from the relevant environmental medium.
Register	the register available at the website of the Northern Territory Environment Protection Authority (NT EPA).
waste	takes its meaning from the term in the WMPC Act.
wastewater	water that contains a contaminant or waste.
Water Act	*Water Act* (NT)
Wet season	means 1 November to 30 April and for the purposes of Appendix 3 includes any part of the Dry Season that discharge is occurring.
WMPC Act	*Waste Management and Pollution Control Act 1998* (NT)

APPENDIX 1: Map of Discharge Point, Compliance Point and Monitoring Sites



APPENDIX 2 : Discharge Trigger Values

			Sampling Points	Compliance Point
			Site Code	GDS SW5
			Easting	693374
			Northing	8600709
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**Trigger Values**
Environmental Field Data				
pH	pH	pH	In situ	5.2-6.6[2]
Electrical conductivity	EC	µS/cm		250[1]
Turbidity	NTU	NTU		12[3]
Dissolved oxygen	DO	% sat.		70-92[2]
Nutrients				
Total Nitrogen	TN	µg/L	Unfiltered	200[3]
Total Phosphorus	TP			10[3]
Metals and Metalloids				
Aluminium	Al	µg/L	Total and Filtered (0.45 µm)	70[3]
Arsenic	As			13[1]
Cadmium	Cd			0.2[1]
Chromium	Cr			1[1]
Copper	Cu			1.4[1]
Iron	Fe			110[3]
Lead	Pb			3.4[1]
Lithium	Li			430[4]
Mercury	Hg			0.6[1]
Nickel	Ni			11[1]
Zinc	Zn			8[1]

Key:

[1] ANGZ (2018) 95% species protection, freshwater.

[2] 20th and 80th percentile of background data for surface water quality as detailed at paragraph 6.2 of the Water Management Plan.

[3] 80th percentile of background data for surface water quality as detailed at paragraph 6.2 of the Water Management Plan.

[4] Ecotoxicity Assessment, sections 8.3 and 8.4 of the Water Management Plan.

APPENDIX 3: Surface Water Monitoring Program

			Sampling Points	Grants Downstream Surface Water 1	Grants Downstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Upstream Surface Water 7	Sediment Basins 1-5					Discharge Point	Mine Pit Sump	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GUS SW7	Sed1	Sed2	Sed3	Sed4	Sed5	MWD1[1]	Pit	GDS DH1
			Easting	693239	692989	693903	693374	691498	693167	692657	692155	691928	692775	693030	693037	694262
			Northing	8599446	8600073	8599235	8600709	8598943	6598623	8599847	8599446	8598961	8598072	8598504	8598990	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**												
Field Parameters																
Flow	-	kL/day	In situ	D	D	D	C	D	N/A	N/A	N/A	N/A	N/A	C	N/A	N/A
Water Level	-	measure		D	D	D	C	D	N/A	N/A	N/A	N/A	N/A	P, W	N/A	N/A
pH	pH	pH		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Electrical conductivity	EC	µS/cm		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Turbidity	NTU	NTU		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Temperature	Temp	°C		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Oxidation Reduction Potential	OR	mV		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Dissolved oxygen	DO	% sat.		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Nutrients																
Ammonia	NH_4^+	µg/L	Unfiltered (excluding FRP)	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Oxides of Nitrogen	NO_x			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Nitrate	NO_3			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Total Nitrogen	TN			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Total Phosphorus	TP			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Filterable Reactive Phosphorus	FRP			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Metals and Metalloids																
Aluminium	Al	µg/L	Total and Filtered (0.45 µm)	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Arsenic	As			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Cadmium	Cd			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Chromium	Cr			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Copper	Cu			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Iron	Fe			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Lead	Pb			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Lithium	Li			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Mercury	Hg			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Nickel	Ni			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Zinc	Zn			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]

			Sampling Points	Grants Downstream Surface Water 1	Grants Downstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Upstream Surface Water 7	Sediment Basins 1-5					Discharge Point	Mine Pit Sump	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GUS SW7	Sed1	Sed2	Sed3	Sed4	Sed5	MWD1[1]	Pit	GDS DH1
			Easting	693239	692989	693903	693374	691498	693167	692657	692155	691928	692775	693030	693037	694262
			Northing	8599446	8600073	8599235	8600709	8598943	6598623	8599847	8599446	8598961	8598072	8598504	8598990	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**												
Full elemental scan	-			A	A	A	A	A	A	A	A	A	A	A	A	A
Treatment regents (condition Error! Reference source not found.)																
Acrylamide[2]	C_3H_5NO	µg/L	Total and Filtered (0.45 µm)	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Other																
Sulphate	SO_4	mg/L	Filtered (0.45 µm)	W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Calcium	Ca			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Chloride	Cl			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Sodium	Na			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Potassium	K			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Magnesium	Mg			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Carbonate	CO_3^{2-}			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Bicarbonate	HCO3			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Total Dissolved Solids	TDS			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Total Suspended Solids	TSS		Unfiltered	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]

Key:

P = prior to discharge.

C = continuous

D = within 24 hours of commencement of discharge **and** daily during discharge. When no discharge is occurring monitoring will be on a weekly basis.

W = within 24 hours of discharge **and** weekly during discharge. When no discharge is occurring monitoring will be on a monthly basis.

F = weekly whilst discharging from sediment basins, Monthly during Wet season irrespective of discharge.

M = monthly.

A = Annually, at end of Wet season on recessional flows.

N/A = not applicable.

[1] The sampling point in MWD1 will be located close to DP1 to ensure it is representative of discharge water quality.

[2] This sampling is only required where the licensee has conducted water treatment onsite using flocculants containing Acrylamide.

[3] During Wet season only

APPENDIX 4: Fluvial Sediment Monitoring Program

			Sampling Points	Grants Downstream Surface Water 1	Grants Upstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Downstream Surface Water 7	Grants Downstream Surface Water 8	Discharge Point	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GDS SW7	GDS SW8	MWD1	GDS DH1
			Easting	693239	692989	693903	693374	691498	692465	693030	694262
			Northing	8599446	8600073	8599235	8600709	8598943	8599942	8598504	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**							
Environmental Field Data											
pH	pH	pH		A	A	A	A	A	A	A	A
Electrical conductivity	EC	µS/cm		A	A	A	A	A	A	A	A
Moisture content		%		A	A	A	A	A	A	A	A
Particle size distribution	PSD	%	<63µm >=63µm & <=2mm >2mm	A	A	A	A	A	A	A	A
Aluminium	Al	mg/kg	<63µm sediment fraction	A	A	A	A	A	A	A	A
Arsenic	As			A	A	A	A	A	A	A	A
Cadmium	Cd			A	A	A	A	A	A	A	A
Chromium	Cr			A	A	A	A	A	A	A	A
Copper	Cu			A	A	A	A	A	A	A	A
Iron	Fe			A	A	A	A	A	A	A	A
Lead	Pb			A	A	A	A	A	A	A	A
Lithium	Li			A	A	A	A	A	A	A	A
Mercury	Hg			A	A	A	A	A	A	A	A

			Sampling Points	Grants Downstream Surface Water 1	Grants Upstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Downstream Surface Water 7	Grants Downstream Surface Water 8	Discharge Point	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GDS SW7	GDS SW8	MWD1	GDS DH1
			Easting	693239	692989	693903	693374	691498	692465	693030	694262
			Northing	8599446	8600073	8599235	8600709	8598943	8599942	8598504	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**							
Nickel	Ni			A	A	A	A	A	A	A	A
Zinc	Zn			A	A	A	A	A	A	A	A
Other											
Sulphate	SO_4	mg/kg	Soluble ion extract	A	A	A	A	A	A	A	A
Calcium	Ca			A	A	A	A	A	A	A	A
Chloride	Cl			A	A	A	A	A	A	A	A
Sodium	Na			A	A	A	A	A	A	A	A
Potassium	K			A	A	A	A	A	A	A	A
Magnesium	Mg			A	A	A	A	A	A	A	A

Key:

A = Annually during recessional flow (late Wet season/early Dry season)

APPENDIX 5: Biota Monitoring Program

Project Name	Locations	Project Description	Report Frequency
Seagrass assessment	West Arm, Darwin Harbour	Seagrass monitoring to determine whether any observed change in seagrass distribution or composition has occurred in the marine waters of West Arm, Darwin Harbour. Monitoring should aim to determine whether any change identified is naturally occurring or related to mine operations.	Annually
Vegetation monitoring	Areas downstream of ML 31726	Monitoring of vegetation downstream of ML 31726 to determine if mining activities are impacting riparian vegetation communities.	Annually
Macroinvertebrate study	Darwin Harbour and Areas downstream of ML 31726	Survey of macro-invertebrate abundance and diversity in aquatic ecosystems. Data is used to monitor potential impacts from mine operations.	Annually during recessional flow (late Wet season/early Dry season)

ATTACHMENT B –PROCEDURE FOR SURFACE WATER SAMPLING

Not included

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APPROVED COMPANY AS/NZS 4801 Occupational Health & Safety Management Systems — QMS Certification Services
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APPENDIX B FIELD VEGETATION DESCRIPTIONS

Site MVS1 – *Lumnitzera racemosa, Bruguiera exaristata, Avicennia marina* low open forest over *Fimbristylis* sp. and *Xerochloa imberbis* mid sparse tussock grassland
NVIS Code: T6c
Location (GDSA94, z52): 694035E, 8601220N
Upper 1: Mid (ranging from 3 – 6 m) open forest dominated by *Lumnitzera racemose* and *Avicennia marina*
Mid 1: *Bruguiera exaristata,* with isolated *Excoecaria ovalis* and some *Ceriops tagal.* Height ranging from 1 – 3 m tall.
Ground 1: Sparse tussock grassland (25% cover) dominated by *Fimbristylis* sp. and *Xerochloa imberbis* and *Acrostichum sp.*
 
 
Land unit (Greater Darwin 25K) – 9b Marine
Landform: Mangrove flat near tidal creek
Soils: Brown sandy clay surface soils, some pebbles present ranging in size (2 – 6 cm)
Drainage: Very poorly drained
Fire history: No fire impact
Weeds: Absent
Other disturbances: Some horse tracks and scats evident along the edge of the mangrove community
Hydrology: Creek flowing at time of survey, some aquatic fish present at time of survey

Site RVS2 – *Melaleuca viridiflora* mid woodland over *Acacia plectocarpa* mid open shrubland over *Germainia grandiflora* mid tussock grassland
NVIS Code: T7i
Location (GDA94, z52): 693834E 8601132N
Upper 1: Mid (10 – 14 m) woodland dominated by *Melaleuca viridiflora*
Mid 1: Mid (40%) shrubland dominated by *Acacia plectocarpa, Lumnitzera racemosa* (on the edge of creek) and *Avicennia marina* (in creek channel) and minor *Hibiscus tiliaceus* scattered through mangroves
Ground 1: Mid tussock grassland (40 % cover) dominated by *Germainia grandiflora, Eriachne triseta* and *Xerochloa imberbis.* Other species present include *Acrostichum sp*
   
Land unit (Greater Darwin 25K) – 6b Drainage system
Landform: Upper creek bank , adjacent to creek channel
Soils: Brown clay loam; rocks and pebbles common in channel adjacent to site
Drainage: Poorly drained
Fire history: 2+ years since last fire causing minimal impact
Weeds: None
Disturbance: Pig tracks observed, and motorbike tracks
Hydrology: Some pools nearby, inundated on large high tides and with freshwater during wet season. Creek flowing at time of survey, some aquatic fish present at time of survey

Site SVS3 – *Melaleuca viridiflora, Erythrophleum chlorostachys* and *Corymbia polycarpa* mid woodland over *Lophostemon lactifluus* mid open shrubland over *Sorghum intrans* mid tussock grassland
NVIS Code: T7i
Location (GDA94, z52): 693708E, 8600969N
Upper 1: Mid (8 – 12 m tall) woodland dominated by *Melaleuca viridiflora, Erythrophleum chlorostachys* and *Corymbia polycarpa*
Mid 1: Mid (2 – 7 m tall) shrubland dominated by *Lophostemon lactifluus, Clerodendrum floribundum* and *Erythrophleum chlorostachys.* Other species noted include *Denhamia obscura, Alphitonia excelsa, Grevillea decurrens, Grevillea pteridifolia, Terminalia ferdinandiana, Banksia dentata* and *Brachychiton paradoxus, Livistona humilis* and *Wrightia saligna*
Ground 1: Mid tussock grassland (60% cover) dominated by *Sorghum intrans, Eriachne triseta* and *Pandanus spiralis.* Other species include *Themeda* sp., *Osbeckia australiana, Dianella odorata, Brachychiton megaphyllus, Acrostichum sp, Antidesma ghesaembilla*
   
Land unit (Greater Darwin 25K) – 6b: Drainage system
Landform: Lower slope, flat open depression
Soils: Brown sandy loam. Some quartz present near creek
Drainage: Poorly drained – some wet season inundation
Fire history: Last year (relatively low impact fire)
Weeds: Annual mission grass scattered near site. Patches of *Hyptis suaveolens*, *Calopogonium mucunoides* and *Passiflora foetida* recorded nearby
Disturbance: Weeds

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Waste Discharge Licence 248: Monitoring Report 2023 Grants Lithium Project

Project details	
Waste Discharge Licence (WDL) number:	WDL248
Licence holder	Lithium Developments (Grants NT) Pty Ltd
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EXECUTIVE SUMMARY

Lithium Developments (Grants NT) Pty Ltd (LDGNT) operates the Grants Lithium Project on Mineral Lease 31726. LDGNT was granted Waste Discharge Licence (WDL248) on 25 July 2022, pursuant to Section 74 of the *Water Act 1992*. WDL248 licences the controlled discharge of mine wastewater from Mine Water Dam 1 (MWD1), via authorised Discharge Point 1 (DP1) subject to meeting licence conditions. Monitoring is required to be undertaken in accordance with Appendix 3 - 5 of the WDL, and Appendix 2 provides assessment criteria for the licence compliance point (GDS SW5).

The purpose of this WDL Monitoring Report is to fulfil the reporting requirements of WDL248 Condition 45, which stipulates that LDGNT must provide a Monitoring Report within 10 business days after each Anniversary Date of the licence (i.e., within 10 business days of 25 July). The report period is 25 July 2022 to 25 July 2023.

An amendment to the WDL (WDL248-01) was granted on 7 March 2023. The amendment was made to allow the controlled discharge of nutrient mine affected water from MWD1 and included a revised total nitrogen (TN) trigger value (TV) and an additional TV for ammonium. The amendment also required the monitoring of two additional marine sites in the West Arm of Darwin Harbour.

Controlled discharge via the authorised discharge point DP1, occurred between 23 February 2023 and 5 April 2023. A total of 214.4 ML of mine wastewater was discharged over this period. The TN and ammonium TVs were not exceeded at any time at GDS SW5 over this period.

Monitoring was undertaken consistent with the WDL248 Monitoring Program (EcOz, 2022) and comprised:

- Surface water - flow, water level and field parameters, nutrients, metals and metalloids, major ions and alkalinity, and total solids.
- Fluvial sediment particle size distribution and chemistry
- Biota monitoring including macroinvertebrates, riparian vegetation, and seagrass.

This report presents the data collected and provides interpretation and recommendations to address the TV exceedances, and incidents of non-compliance with the WDL. The load of key contaminants for the reporting period have been calculated and are presented in section 5.

The mine pit sump and MWD1 had elevated nitrogen concentrations, dominated by nitrate that data suggest was quickly bound by organic matter in the receiving environment. The remaining contaminants, specifically total suspended solids, aluminium, and iron were elevated at the sediment basins relative to MWD1. pH, whilst elevated when compared to the WDL248 TV, was consistent across all sites except the upstream site GUS SW7. The total phosphorus TV (10 µg/L) at GDS SW5 was exceeded on 50 percent of all sampling occasions over the reporting period.

The freshwater macroinvertebrate data demonstrate that active discharge from MWD1 has had no significant impact on the aquatic ecosystems of waterways draining to Darwin Harbour, although turbidity appears to be impacting macroinvertebrate health directly downstream of the mine, at monitoring location UC2.

No algal blooms or similar indicators of nutrient enrichment were observed over the reporting period. All chl-a concentrations are comparable between sites, with the highest concentrations observed at the marine sampling locations.

No impacts on downstream riparian vegetation were observed for the reporting period, and no seagrass was detected at the Darwin Harbour monitoring sites GDS DH1, GDS DH2 and GDS DH3.

In conclusion, data collected over the reporting period and its subsequent analysis has been used to inform the development and implementation of several measures to improve water management.

Sediment basins

The sediment basins were demonstrated to be the primary source of suspended solids, aluminium and iron. To address this, LDGNT have sought and received approval for the relocation of sediment basins 1 and 5, the

conversion of basins 1 and 3 to High Efficiency Basins, the establishment of internal baffles to create a settling fore-bay in basins 2, 4 and 5, and the development of water management strategy documentation to guide the operation of basins, pumps and dams.

Mine Water Dam

LDGNT have received regulatory approval to construct additional mine affected water storage capacity at MWD1 cell 3. The construction of the second cell of MWD1 in line with initial approvals, in addition to the third cell will triple the storage capacity on site and enabled greater control of water treatment and optimum conditions for discharge.

Source control

Analysis of water quality data completed for the preparation of this report has refined the understanding of different water qualities on site and informed the development of management strategies to segregate and tailor treatment methods appropriately.

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Appendix H Riparian vegetation Monitoring Report

1 INTRODUCTION

1.1 Background

Lithium Developments (Grants NT) Pty Ltd (LDGNT) operates the Grants Lithium Project (GLP) on Mineral Lease (ML) 31726. GLP commenced construction during quarter 4 of 2021, in accordance with Authorisation 1021-01. The approved Mining Management Plan, and supporting Water Management Plan, document the mining activities and water and wastewater management strategies to be implemented at GLP. One water management strategy is to discharge excess mine water and mine wastewater to an unnamed tributary which runs east of GLP, and then flows north, ultimately discharging to the West Arm of Darwin Harbour.

Lithium Developments (Grants NT) Pty Ltd was granted Waste Discharge Licence (WDL) 248 on 25 July 2022, pursuant to Section 74 of the *Water Act 1992* (NT). WDL248 licences the controlled discharge of mine wastewater from Mine Water Dam 1 (MWD1), via authorised Discharge Point 1 (DP1), subject to meeting licence conditions (see Appendix A).

Monitoring is required to be undertaken in accordance with Appendix 3 - 5 of WDL248, as detailed in Appendix B.

1.2 Scope and purpose

The purpose of this WDL Monitoring Report is to fulfil the reporting requirements of WDL248 Condition 45, which stipulates that LDGNT must provide a Monitoring Report within 10 business days after each Anniversary Date of the licence (i.e., within 10 business days of 25 July). Condition 46 states:

The licensee must ensure that each Monitoring Report:

> *(46.1) is prepared in accordance with the requirements of the Administering Agency 'Guideline for Reporting on Environmental Monitoring' (or any other guideline as adopted by the Administering Agency from time to time);*
>
> *(46.2) includes a tabulation of all monitoring data required as a condition of this licence (data must be provided electronically in Microsoft Excel format);*
>
> *(46.3) includes a tabulation of monthly and annual contaminant loads discharged form the authorised discharge point listed at Item 5. Contaminant loads must be calculated for total metals, total metalloids, total nutrients and other parameters (excluding field parameters) listed in Appendix 3. The calculations must be based on the daily discharge volume and the concentration of contaminant present in the discharge on that day. On the days when a sample was not taken then the concentration of the contaminant must be estimate using Linear Interpolation methodology;*
>
> *(46.4) includes long term trend analysis of monitoring data to demonstrate any environmental impact associated with the Licenced Action over a minimum period of three years (where the data is available); and*
>
> *(46.5) includes an assessment of environmental impact from the Licenced Action.*

The monitoring required to be undertaken is detailed in Table 1-1 below.

Table 1-1. Summary of all monitoring to be undertaken for WDL248

Category	Sample Site	Easting	Northing	Surface water quality[1]	Sediment quality	Macroinvertebrate	Riparian Vegetation	Seagrass
Freshwater stream	GDS SW1	693239	8599446	Daily, weekly, monthly	Annually	-	-	-
	GDS SW2	692989	8600073	Daily, weekly, monthly	Annually	-	-	-
	GUS SW4	693903	8599235	Daily, weekly, monthly	Annually	-	-	-
	GUS SW7	691498	8598943	Daily, weekly, monthly	Annually	-	-	-
	GDS SW8	692498	8599951	Daily, weekly, monthly	Annually	-	-	-
WDL compliance site	GDS SW5	693374	8600709	Daily, weekly, monthly	Annually	Annually	-	-
Sediment basins	Sed1	693167	8598623	Weekly, monthly	-	-	-	-
	Sed2	692657	8599847	Weekly, monthly	-	-	-	-
	Sed3	692155	8599446	Weekly, monthly	-	-	-	-
	Sed4	691928	8598961	Weekly, monthly	-	-	-	-
	Sed5	692775	8598072	Weekly, monthly	-	-	-	-
WDL discharge point	MWD1	693030	8598504	Prior to discharge, daily, weekly, monthly	Annually	-	-	-
Pit water body	PIT	693037	8598990	Monthly	-	-	-	-
Darwin Harbour	GDS DH1	694262	8603365	Monthly	Annually	Annually	-	Annually
	GDS DH2	693587	8605738	Monthly	-	Annually	-	Annually
	GDS DH3	692608	8606060	Monthly	-	Annually	-	Annually
Riparian vegetation	MVS1	694035	8601220	-	-	-	Annually	-
	RVS2	693834	8601132	-	-	-	Annually	-
	SVS3	693706	8600969	-	-	-	Annually	-

[1] Frequency of surface water quality monitoring depends on discharge. Freshwater sites will only be sampled when the watercourse is flowing, and Darwin Harbour sites will only be sampled for surface water quality during the wet season months. Refer to **Error! Reference source not found.** Attachment A for the detailed surface water quality monitoring schedule.

1.3 Reporting period

The monitoring report period is 25 July 2022 to 25 July 2023. Controlled discharge via the authorised discharge point DP1, occurred between 23 February 2023 and 5 April 2023 within the reporting period.

1.4 Certification

I Mike Stone, Chief Operations Officer, have reviewed this report and I confirm that to the best of my knowledge and ability all the information provided in the report is true and accurate.

2 ACTIVITIES WITHIN REPORTING PERIOD

2.1 Mining activities

Mining activities within the reporting period included:

- Conventional open cut mining of approximately 5.6M bcm of waste rock and ore using drill and blast, hydraulic excavation, and haulage by rear dump trucks.
- Crushing of pegmatite ore and processing via dense media separation.
- Road haulage of concentrate product to Darwin Port.

Additional civil construction activities undertaken during the reporting period included:

- Haul and access road construction.
- Installation and commissioning of non-production infrastructure including potable and fire water, sewage, and electrical connections.
- Construction of water management infrastructure.

A Mining Management Plan (MMP) amendment has been accepted by the Department of Industry, Tourism and Trade (DITT) to relocate sediment basin (Sed) 1 and Sed 5 and construct an additional cell (Cell 3) at MWD1. The objective of the work is to increase the available capacity to store and manage mine affected water and reduce sediment loads. Sed 1 and 5 structures will be constructed as High Efficiency Sediment (HES) Type B basins. Sediment Basin 1 will then be dewatered and backfilled. Sediment Basin 5 will be consumed by the construction of the second cell of the Mine Water Dam 1. It is anticipated that these works will improve the quality of water discharged from the GLP.

2.2 Wastewater discharges

Table 2-1 provides the daily and cumulative discharge volumes for the months of February, March and April 2023.

Table 2-1. DP1 discharge volumes

February			March			April		
Date	**Daily (ML)**	**Cumulative (ML)**	**Date**	**Daily (ML)**	**Cumulative (ML)**	**Date**	**Daily (ML)**	**Cumulative (ML)**
			1/03/2023	0.6	12.0	1/04/2023	3.5	200.4
			2/03/2023	1.2	13.2	2/04/2023	3.5	203.9
			3/03/2023	4.3	17.5	3/04/2023	3.5	207.4
			4/03/2023	13.2	30.7	4/04/2023	3.5	210.9
			5/03/2023	0.0	30.7	5/04/2023	3.5	214.4
			6/03/2023	0.0	30.7			
			7/03/2023	0.0	30.7			
			8/03/2023	0.2	30.9			
			9/03/2023	0.0	30.9			
			10/03/2023	10.0	41.0			
			11/03/2023	8.1	49.1			
			12/03/2023	3.3	52.4			
			13/03/2023	6.9	59.3			
			14/03/2023	2.1	61.4			
			15/03/2023	9.8	71.2			
			16/03/2023	14.2	85.4			
			17/03/2023	19.0	104.4			
			18/03/2023	19.0	123.4			
			19/03/2023	5.0	128.4			
			20/03/2023	5.0	133.4			
			21/03/2023	15.0	148.4			
			22/03/2023	15.0	163.4			
23/02/2023	0.7	-	23/03/2023	15.0	178.4			
24/02/2023	2.6	3.4	24/03/2023	15.0	193.4			
25/02/2023	4.4	7.8	25/03/2023	0.0	193.4			
26/02/2023	1.6	9.4	26/03/2023	0.0	193.4			
27/02/2023	1.4	10.8	27/03/2023	0.0	193.4			
28/02/2023	0.6	11.4	28/03/2023	0.0	193.4			
			29/03/2023	0.0	193.4			
			30/03/2023	0.0	193.4			
			31/03/2023	3.5	196.9			

Daily and cumulative volumes discharged for the reporting period are shown in Figure 2-1. A total of 214.4 ML of water was discharged from DP1.

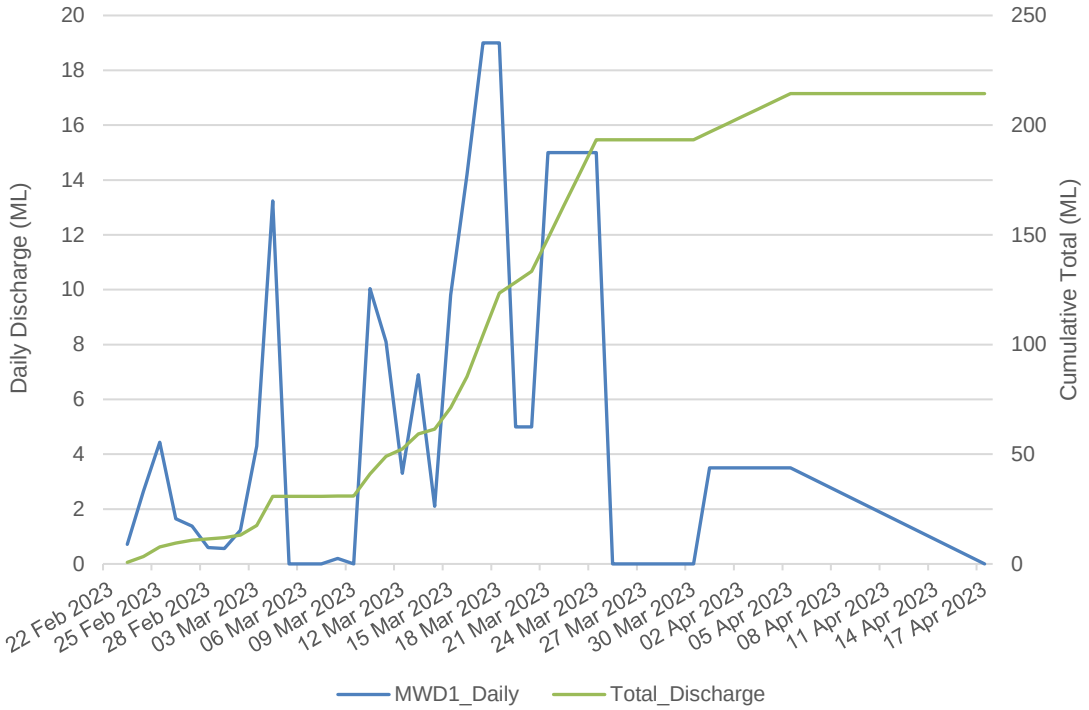


Figure 2-1. DP1 daily and cumulative discharge volumes

3 MONITORING PROGRAM

This section provides a summary of the WDL248 Monitoring Program (EcOz, 2022 attached as Appendix B) for the GLP, consistent with:

- Appendix 3 of WDL248: Surface water monitoring program
- Appendix 4 of WDL248: Fluvial sediment monitoring program, and
- Appendix 5 of WDL248: Biota monitoring program.

3.1 Surface water monitoring

The surface water monitoring program involves the regular monitoring of surface water sites upstream and downstream of the discharge point during discharge, the weekly monitoring of sediment basins during discharge, and monthly monitoring of the pit water. Discharge monitoring was undertaken at MWD1, close to DP1, the licenced discharge point, prior to discharge, and daily and weekly during discharge.

The compliance point for WDL248 is GDS SW5. The locations of surface water monitoring sites, sampled in accordance with WDL248 are shown on Figure 3-1. A summary of sites, analytes and monitoring frequency are provided in Table 3-1.

WDL248-01 amendment dated 7 March 2023, required the monitoring of two additional marine sites in the West Arm of Darwin Harbour. These sites, GDS DH4 and GDS DH5 are shown on Figure 3-2. Condition 51.3 states that *the licensee must demonstrate that no environmental harm is occurring due to the increase in nitrogen load, including conducting monitoring at GDS DH1 and two additional monitoring points GDS DH4 and GDS DH5 for the same parameters as for the compliance point GDS SW5 listed in Appendix 3*.

All surface water sampling will be in accordance with relevant standards and guidelines including:

- Australian/New Zealand Standard on Water Quality Sampling - Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (AS/NZS 5667.1:1998/2016), Standards Australia, New South Wales.
- Australian Standard on Water Quality Sampling - Part 6: Guidance on sampling of rivers and streams (AS/NZS 5667.6:1998), Standards Australia, New South Wales.
- Australian/New Zealand Standard on Water Quality Sampling - Part 9: Sampling Guidance on sampling from marine waters (AS/NZS 5667.9:1998/2016), Standards Australia, New South Wales.
- ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia.
- EcOz Standard Operating Procedure Surface Water Sampling - update July 2020.

Freshwater sites were accessed on foot or via ATV, and samples collected from the side of the watercourse. Watercourses were only be sampled when flowing.

Marine sites were accessed via marine vessel (boat), and grab samples obtained from ~30 cm below the surface of the water, using sample poles.

Field parameters were measured in-situ using calibrated field equipment. Laboratory samples were collected in laboratory supplied, suitably treated containers, and stored chilled (in esky with ice bricks or portable fridge) until the samples can be dispatched to the laboratory. All samples were submitted to a NATA accredited laboratory, with Chain of Custody forms provided to allow for the tracking of samples.

All sampling equipment was maintained and cleaned between sample sites to avoid cross contamination. Further details of sample methods are provided in the WDL248 Monitoring Program (Appendix B).

The names of all monitoring locations have been abbreviated for the purpose of preparing this report. For example, GDS SW1 is referred to as SW1. This has been done to avoid confusing between sites. For all parameter values less than the laboratory limit of detection (LOR), half of the LOR was used for statistical analysis.

3.2 Fluvial sediment monitoring

Sediment samples were collected at eight sites as described in Table 3-2. The sediment sampling locations are shown on Figure 3-1. Sediment samples are collected annually, during recessional flows (late wet season). Sediment sampling and analysis was undertaken in accordance with relevant standards and guidelines, including:

- Australian Standard on Water Quality Sampling - Part 19: Guidance on sampling of marine sediments (ISO 5667.19:2004)
- Australian Standard on Water Quality Sampling - Part 12: Guidance on sampling of bottom sediments (ISO 5667.12:1999)
- Recommendations for sampling and analysis of Darwin Harbour sediment (Munksgard 2013) and
- Simpson & Batley (2016): Sediment Quality Assessment.

The mine and freshwater sites were sampled in April 2023 using a trowel. 1 kg of sample at each location was collected to permit particle size distribution analysis. Marine sediments were collected at GDS DH1, DH2 and DH3 in May 2023. Marine sediment samples were collected from a boat using a Van Veen grab sampler. At each sample site, three grab samples were collected.

In accordance with Appendix 4 of WDL248 samples were analysed for:

- Particle size distribution
- pH
- Electrical Conductivity (EC)
- Moisture content
- Metals:
    - Aluminium (Al)
    - Arsenic (As)
    - Cadmium (Cd)
    - Chromium (Cr)
    - Copper (Cu)
    - Iron (Fe)
    - Lead (Pb)
    - Lithium (Li)
    - Mercury (Hg)
    - Nickel (Ni)
    - Zinc (Zn) and
- Sulphate (SO_4), chloride (Cl), calcium (Ca), sodium (Na), potassium (K) and magnesium (Mg).

Metal analysis was completed on the <63µm fraction. For all parameter values less than the laboratory limit of detection (LOR), half of the LOR was used for statistical analysis.

3.3 Biota monitoring

A summary of the biota monitoring program is provided in Table 3-3. A short description of each program is provided below. Technical reports, providing detailed methodology, results and interpretation of data collected during this reporting period are provided as appendices to this report.

Freshwater macroinvertebrates

Five monitoring locations, including a reference site (BP4 located on an unnamed creek upstream of Cox Peninsula Road), an upstream site (UC3 located on a tributary entering the unnamed creek between UC2 and GDS SW5) and three downstream sites (UC2, GDS SW5 and UC1) were sampled in mid-April 2023. The sampling locations are shown on Figure 3-1.

Sampling was consistent with the protocols outlined in the Darwin-Daly AUSRIVAS sampling manual (Lamche, 2007). Surface water and sediment samples were collected concurrently to facilitate the interpretation of data. Sediment samples were bank sieved to 2 mm and analysed for total metal and metalloid concentrations. Metal and metalloids (total and filtered), major ions and alkalinity, and nutrient concentrations were determined in water.

The univariate macroinvertebrate indices assessed at each site included:

- Relative abundance
- Taxa richness (family)
- PET richness,
- SIGNAL-2 and
- Community composition.

A detailed description of the biota monitoring program can be found in Section 5 of the WDL248 Monitoring Program (Appendix B) and the 2023 technical report (Appendix E).

Macroinvertebrate samples were also collected from the marine environment, specificallly GDS DH1, GDS DH2 and GDS DH3. Surface water and sediment samples were collected concurrently to facilitate the interpretation of data. Sediment samples sieved to 2 mm and analysed for total metal and metalloid concentrations. Metal and metalloids (total and filtered), major ions and alkalinity, and nutrient concentrations were determined in water.

At the time of preparing this 2023 WDL248 Monitoring Report, the marine technical report was incomplete. This report will be provided separately to NT EPA upon receipt.

Riparian vegeation

Riparian vegetation occurs along watercourses and surface water features and are significant vegetation communities as they are spatially restricted and provide habitat to a relatively large number of species (DENR, 2019). Riparian vegetation monitoring was undertaken in accordance with WDL248 and WDL248 Monitoring Program to detect any changes to riparian vegetation health or extent which could occur from the discharge of mine wastewater from MWD1. There are two components of the survey:

- a drone survey and
- riparian vegetation site assessment survey (which included photo-point monitoring).

The post wet-season riparian vegetation assessments were undertaken by two experienced botanists on 13 April 2023. A separate site visit was undertaken on 4 May 2023 to conduct the drone survey. The drone survey was undertaken along a predefined flight path to map riparian vegetation extent and density and detect any changes in riparian vegetation condition since the baseline survey in 2019. The drone survey was designed to survey the three different riparian vegetation communities captured in the previous study (EcOz 2019) –

mangrove, riparian and swamp. Drone images were imported to create an orthomosaic image, and analysis was undertaken to assess vegetation extent and density (health) over time.

Riparian vegetation site assessments (on-ground) were undertaken at three established potential impact sites (MVS1, RVS2, SVS3) to record riparian vegetation species diversity and composition. The site locations are shown on Figure 3-1. Vegetation and photo monitoring data was compiled into a database that can be added to over time as monitoring data is collected annually. The vegetation data was analysed by comparing 2019 baseline data with the 2023 survey results to assess if there were any changes in vegetation health or the extent of the riparian vegetation.

A detailed description of the biota monitoring program can be found in Section 4 of the WDL248 Monitoring Program (Appendix B) and the 2023 technical report (Appendix H).

Seagrass

Seagrass monitoring was undertaken at sites GDS DH1, GDS DH2 and GDS DH3 from 2 May 2023 to 3 May 2023 in accordance with WDL248 and WDL248 Monitoring Program. The study area is situated within mangrove lined tidal channels with no known seagrass meadows in the vicinity (Radke et al., 2018). The sites selected to survey encompass the south-eastern portion of West Arm relative to the discharge point along the unnamed stream.

Survey methods were adapted from Department of Environment and Science Queensland (DES, 2018). A submersible camera frame (SCF) was constructed to observe sediment floor and seagrass. A light was fitted to the SCF to increase visibility in turbid conditions. The method involved suspending the SCF until it reached the bottom. Following this the SCF was towed across a transect line from bank to bank in order to collect footage for analysis of potential seagrass occurrence. Seagrass images were to be identified against database images of target seagrass species. Video footage was reviewed and still images extracted of the benthic environment.

A detailed description of the biota monitoring program can be found in Section 6 of the WDL248 Monitoring Program (Appendix B) and the 2023 technical report (Appendix G).

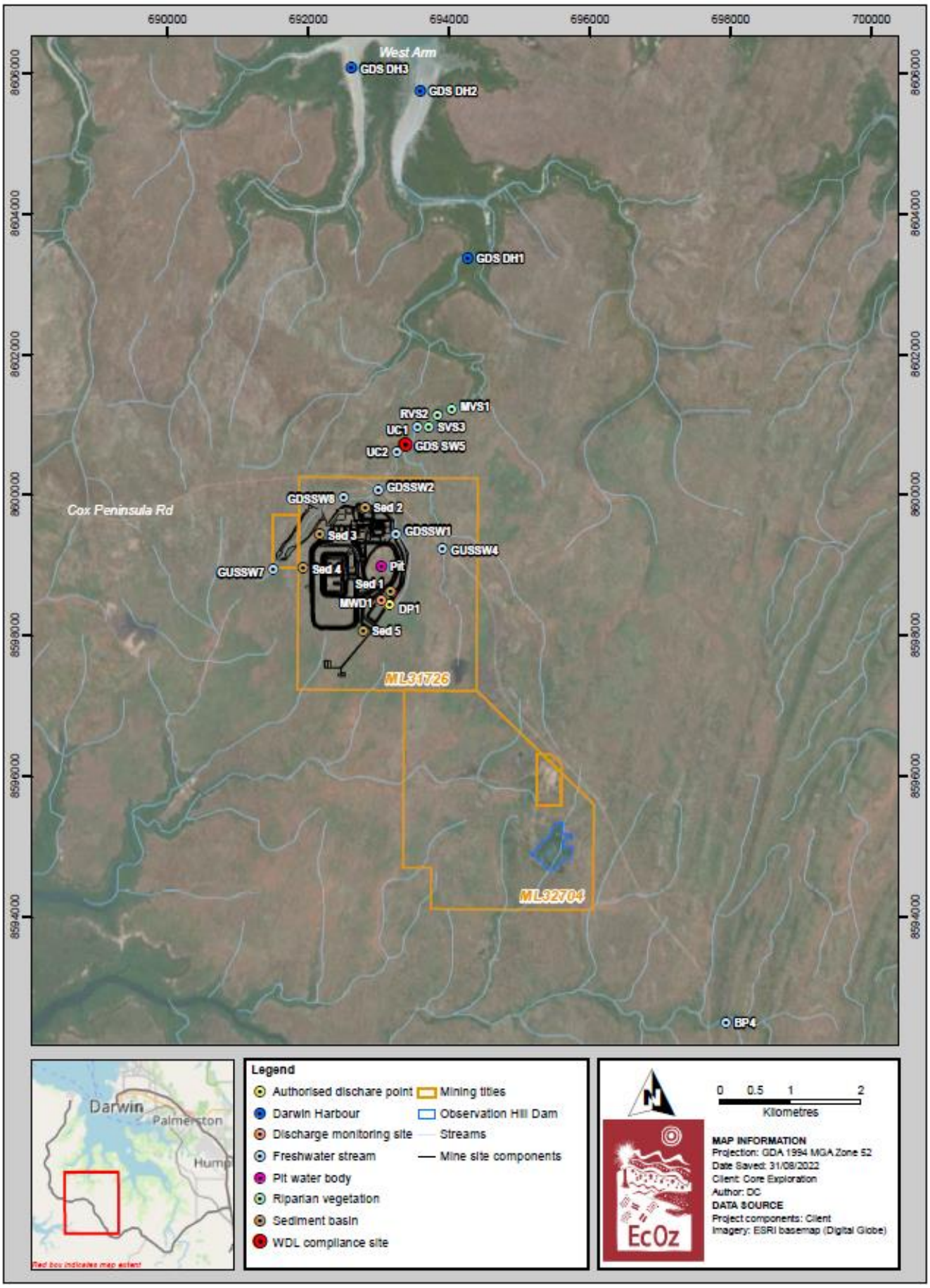


Figure 3-1. All WDL248 Monitoring Locations

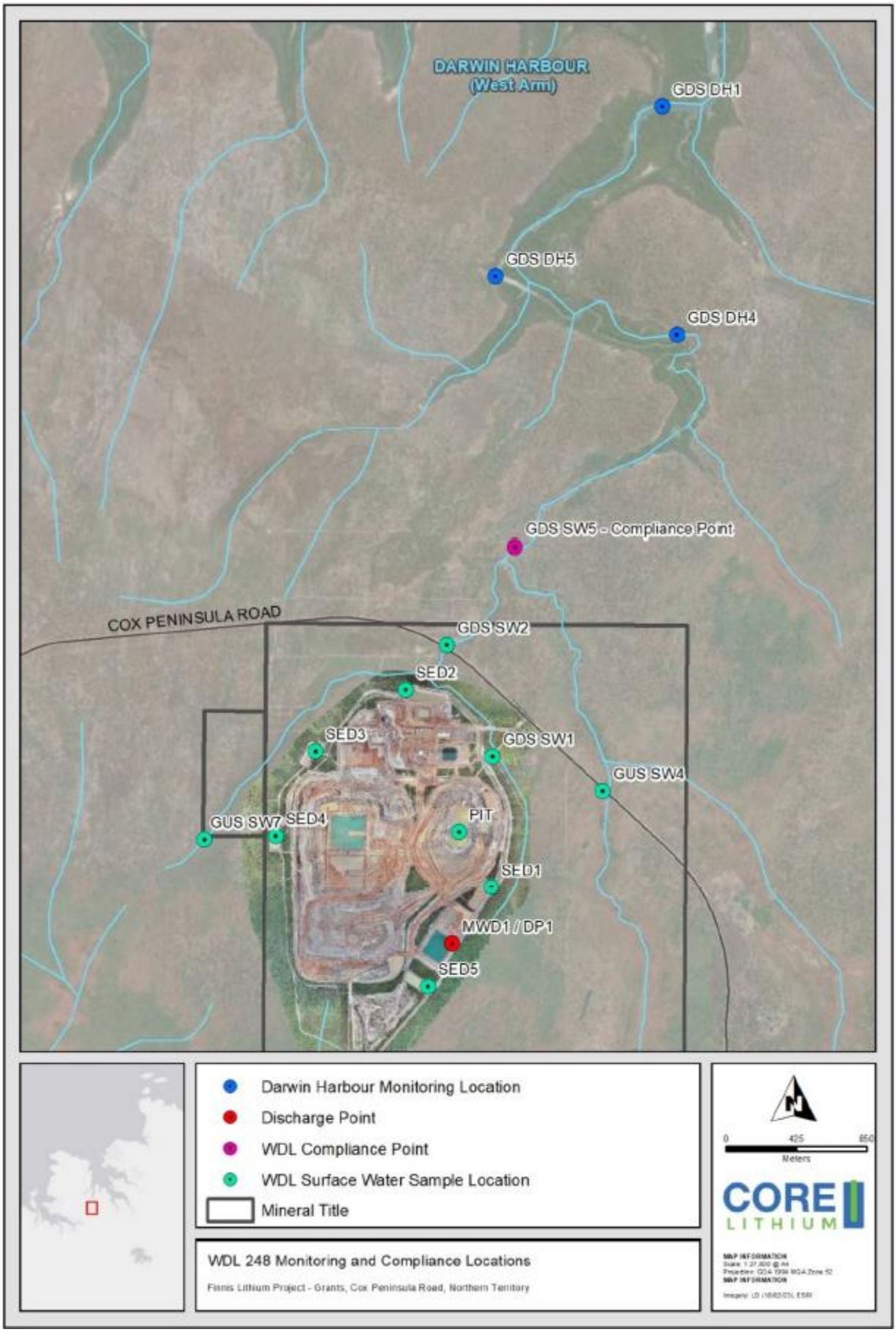


Figure 3-2. WDL248-01 monitoring and compliance locations

Table 3-1. Surface water monitoring program

			Sampling Points	Grants Downstream Surface Water 1	Grants Downstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Upstream Surface Water 7	Sediment Basins 1-5					Discharge Point	Mine Pit Sump	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GUS SW7	Sed1	Sed2	Sed3	Sed4	Sed5	MWD1[1]	Pit	GDS DH1
			Easting	693239	692989	693903	693374	691498	693167	692657	692155	691928	692775	693030	693037	694262
			Northing	8599446	8600073	8599235	8600709	8598943	6598623	8599847	8599446	8598961	8598072	8598504	8598990	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**												
Field Parameters																
Flow	-	kL/day	In situ	D	D	D	C	D	N/A	N/A	N/A	N/A	N/A	C	N/A	N/A
Water Level	-	measure		D	D	D	C	D	N/A	N/A	N/A	N/A	N/A	P, W	N/A	N/A
pH	pH	pH		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Electrical conductivity	EC	µS/cm		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Turbidity	NTU	NTU		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Temperature	Temp	°C		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Oxidation Reduction Potential	OR	mV		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Dissolved oxygen	DO	% sat.		D	D	D	D	D	F	F	F	F	F	P, D	M	M[3]
Nutrients																
Ammonia	NH_3	µg/L	Unfiltered (excluding FRP)	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Oxides of Nitrogen	NO_x			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Nitrate	NO_3			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Total Nitrogen	TN			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Total Phosphorus	TP			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Filterable Reactive Phosphorus	FRP			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Chlorophyll a	Chl-a			W	W	W	W	W	N/A	N/A	N/A	N/A	N/A	N/A	N/A	M[3]
Metals and Metalloids																
Aluminium	Al	µg/L	Total and Filtered (0.45 µm)	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Arsenic	As			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Cadmium	Cd			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Chromium	Cr			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Copper	Cu			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Iron	Fe			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Lead	Pb			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Lithium	Li			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Mercury	Hg			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Nickel	Ni			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]

			Sampling Points	Grants Downstream Surface Water 1	Grants Downstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Upstream Surface Water 7	Sediment Basins 1-5					Discharge Point	Mine Pit Sump	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GUS SW7	Sed1	Sed2	Sed3	Sed4	Sed5	MWD1[1]	Pit	GDS DH1
			Easting	693239	692989	693903	693374	691498	693167	692657	692155	691928	692775	693030	693037	694262
			Northing	8599446	8600073	8599235	8600709	8598943	6598623	8599847	8599446	8598961	8598072	8598504	8598990	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**												
Zinc	Zn			W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Full elemental scan	-			A	A	A	A	A	A	A	A	A	A	A	A	A
Treatment regents (condition Error! Reference source not found.)																
Acrylamide[2]	C_3H_5NO	µg/L	Total and Filtered (0.45 µm)	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]
Other																
Sulphate	SO_4	mg/L	Filtered (0.45 µm)	W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Calcium	Ca			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Chloride	Cl			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Sodium	Na			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Potassium	K			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Magnesium	Mg			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Carbonate	CO_3^{2-}			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Bicarbonate	HCO3			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Total Dissolved Solids	TDS			W	W	W	W	W	F	F	F	F	F	P, W	M	N/A
Total Suspended Solids	TSS		Unfiltered	W	W	W	W	W	F	F	F	F	F	P, W	M	M[3]

Key:

P = prior to discharge.

C = continuous

D = within 24 hours of commencement of discharge **and** daily during discharge. When no discharge is occurring monitoring will be on a weekly basis.

W = within 24 hours of discharge **and** weekly during discharge. When no discharge is occurring monitoring will be on a monthly basis.

F = weekly whilst discharging from sediment basins, Monthly during Wet season irrespective of discharge.

M = monthly.

A = Annually, at end of Wet season on recessional flows.

N/A = not applicable.

[1] The sampling point in MWD1 will be located close to DP1 to ensure it is representative of discharge water quality.

[2] This sampling is only required where the licensee has conducted water treatment onsite using flocculants containing Acrylamide.

[3] During Wet season only

Table 3-2. Fluvial sediment monitoring program

			Sampling Points	Grants Downstream Surface Water 1	Grants Upstream Surface Water 2	Grants Upstream Surface Water 4	Grants Downstream Surface Water 5	Grants Downstream Surface Water 7	Grants Downstream Surface Water 8	Discharge Point	Grants Downstream Darwin Harbour 1
			Site Code	GDS SW1	GDS SW2	GUS SW4	GDS SW5	GDS SW7	GDS SW8	MWD1	GDS DH1
			Easting	693239	692989	693903	693374	691498	692465	693030	694262
			Northing	8599446	8600073	8599235	8600709	8598943	8599942	8598504	8603365
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**FREQUENCY**							
Environmental Field Data											
pH	pH	pH		A	A	A	A	A	A	A	A
Electrical conductivity	EC	µS/cm		A	A	A	A	A	A	A	A
Moisture content		%		A	A	A	A	A	A	A	A
Particle size distribution	PSD	%	<63µm >=63µm & <=2mm >2mm	A	A	A	A	A	A	A	A
Aluminium	Al	mg/kg	<63µm sediment fraction	A	A	A	A	A	A	A	A
Arsenic	As			A	A	A	A	A	A	A	A
Cadmium	Cd			A	A	A	A	A	A	A	A
Chromium	Cr			A	A	A	A	A	A	A	A
Copper	Cu			A	A	A	A	A	A	A	A
Iron	Fe			A	A	A	A	A	A	A	A
Lead	Pb			A	A	A	A	A	A	A	A
Lithium	Li			A	A	A	A	A	A	A	A
Mercury	Hg			A	A	A	A	A	A	A	A

Nickel	Ni			A	A	A	A	A	A	A	A
Zinc	Zn			A	A	A	A	A	A	A	A
Other											
Sulphate	SO_4	mg/kg	Soluble ion extract	A	A	A	A	A	A	A	A
Calcium	Ca			A	A	A	A	A	A	A	A
Chloride	Cl			A	A	A	A	A	A	A	A
Sodium	Na			A	A	A	A	A	A	A	A
Potassium	K			A	A	A	A	A	A	A	A
Magnesium	Mg			A	A	A	A	A	A	A	A

Key:

A = Annually during recessional flow (late Wet season/early Dry season)

Table 3-3. Biota monitoring program

Project Name	Locations	Project Description	Report Frequency
Seagrass assessment	West Arm, Darwin Harbour	Seagrass monitoring to determine whether any observed change in seagrass distribution or composition has occurred in the marine waters of West Arm, Darwin Harbour. Monitoring should aim to determine whether any change identified is naturally occurring or related to mine operations.	Annually
Vegetation monitoring	Areas downstream of ML 31726	Monitoring of vegetation downstream of ML 31726 to determine if mining activities are impacting riparian vegetation communities.	Annually
Macroinvertebrate study	Darwin Harbour and Areas downstream of ML 31726	Survey of macro-invertebrate abundance and diversity in aquatic ecosystems. Data is used to monitor potential impacts from mine operations.	Annually during recessional flow (late Wet season/early Dry season)

3.4 Assessment criteria and non-compliance reporting

A summary of the assessment criteria, as per WDL248, is provided in Table 3-4.

Table 3-4. WDL248 Discharge trigger values

			Sampling Points	Compliance Point
			Site Code	GDS SW5
			Easting	693374
			Northing	8600709
PARAMETER	**Abbrev.**	**Units**	**Analysis**	**Trigger Values**
Environmental Field Data				
pH	pH	pH	In situ	5.2-6.6[2]
Electrical conductivity	EC	µS/cm		250[1]
Turbidity	NTU	NTU		12[3]
Dissolved oxygen	DO	% sat.		70-92[2]
Nutrients				
Total Nitrogen	TN	µg/L	Unfiltered	200[3]
Total Phosphorus	TP			10[3]
Metals and Metalloids				
Aluminium	Al	µg/L	Total and Filtered (0.45 µm)	70[3]
Arsenic	As			13[1]
Cadmium	Cd			0.2[1]
Chromium	Cr			1[1]
Copper	Cu			1.4[1]
Iron	Fe			110[3]
Lead	Pb			3.4[1]
Lithium	Li			430[4]
Mercury	Hg			0.6[1]
Nickel	Ni			11[1]
Zinc	Zn			8[1]

Key:

[1] ANGZ (2018) 95% species protection, freshwater.

[2] 20th and 80th percentile of background data for surface water quality as detailed at paragraph 6.2 of the Water Management Plan.

[3] 80th percentile of background data for surface water quality as detailed at paragraph 6.2 of the Water Management Plan.

[4] Ecotoxicity Assessment, sections 8.3 and 8.4 of the Water Management Plan.

The table is soured from WDL248 (Appendix 2). The amended WDL (WDL248-01) includes the following revised trigger values, against which the empirical data has been compared:

51. For the 2022/23 wet season only, the following conditions apply:

51.1. The trigger value for total nitrogen (TN) listed in Appendix 2, at the compliance point GDS SW5, is 1.5 mg/L.

51.2. The ammonia (NH_3) concentration at the compliance point GDS SW5, must not exceed the ANZG (2018) 95% species protection acute toxicity value of 0.9 mg/L.

In relation to metals, the filtered (<0.45 µm) and not total fraction is considered to reflect the bioavailability of the metal more accurately. Whilst the total concentration provides an initial screening tool, the filtered

concentration is more typically used to assess potential impacts to aquatic health. This approach is consistent with national guidance (ANGZ, 2018).

3.5 Monitoring undertaken during reporting period

Monitoring over the reporting period was undertaken in line with the intent of the WDL and monitoring program. Some gaps in monitoring were noted, typically relating to faulty in-situ probes, which will be addressed prior to the commencement of the 2023/2024 wet season. There were 14 reportable incidents over the reporting period, a summary of which is provided in Table 3-5. All incidents relate to the monitoring compliance point, GDS SW5.

Table 3-5. Summary of WDL248 non-conformances

Date	Description	Actions
23/02/2023	Turbidity three times the trigger value	Reported to NT EPA 26/02/23
24/02/2023	Turbidity three times the trigger value,	Reported to NT EPA 26/02/23
25/02/2023	Turbidity three times the trigger value, turbidity and pH above the trigger on three consecutive occasions pH 7.0	Turbidity reported to NT EPA 26/02/23 pH reported to NT EPA 27/02/23
26/02/2023	Turbidity three times the trigger value	Reported to NT EPA 26/02/23
27/02/2023	Turbidity three times the trigger value	Reported to NT EPA 27/02/23
28/02/2023	Turbidity three times the trigger value, Turbidity above the trigger on three consecutive occasions	Reported to NT EPA 01/03/23
1/03/2023	Turbidity three times the trigger value	Reported to NT EPA 01/03/23
3/03/2023	Turbidity three times the trigger value, Turbidity above the trigger on three consecutive occasions	Reported to NT EPA 03/03/23
4/03/2023	Turbidity three times the trigger value	Reported to NT EPA 04/03/23
7/03/2023	Turbidity three times the trigger value	Reported to NT EPA 08/03/23
9/03/2023	Turbidity above the trigger on three consecutive occasions.	Reported to NT EPA 10/03/23
10/03/2023	pH outside of trigger range	Reported to NT EPA 10/03/23
17/03/2023	pH outside of trigger range on three consecutive occasions	Reported to NT EPA 17/03/23
20/03/2023	pH outside of trigger range on three consecutive occasions	Reported to NT EPA 28/03/24

4 RESULTS AND DISCUSSION

4.1 Surface water

4.1.1 Field parameters

Flow and water level

The flow and water levels at the WDL248 compliance location, GDS SW5, are presented in Figure 4-1 and Figure 4-2 respectively.

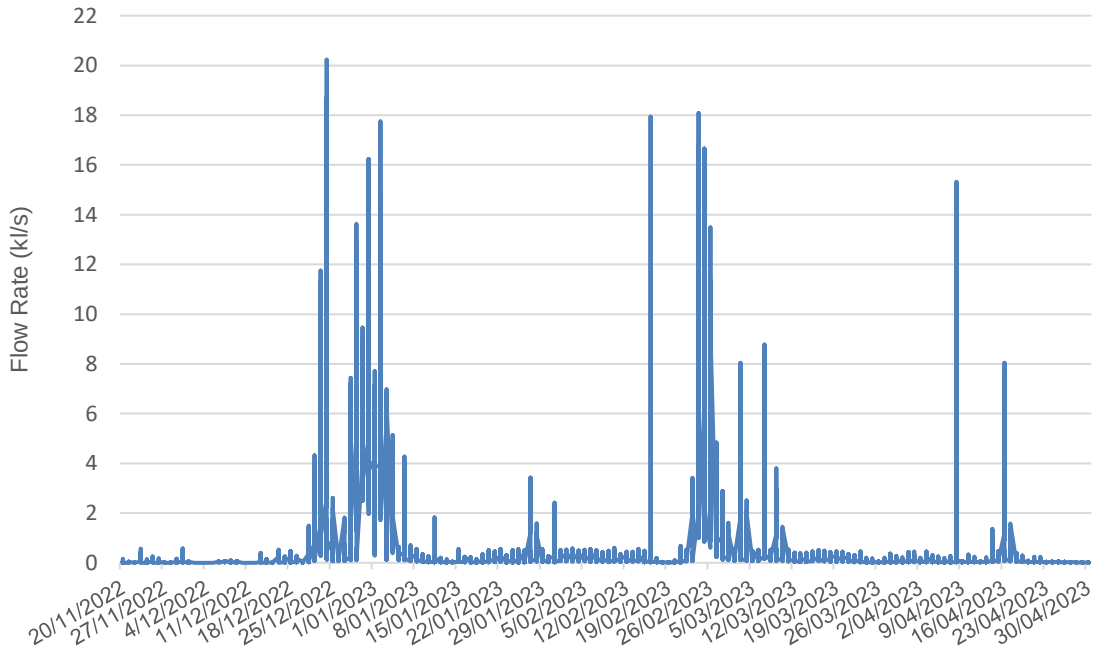


Figure 4-1. Flow at WDL248 compliance point (GDS SW5)

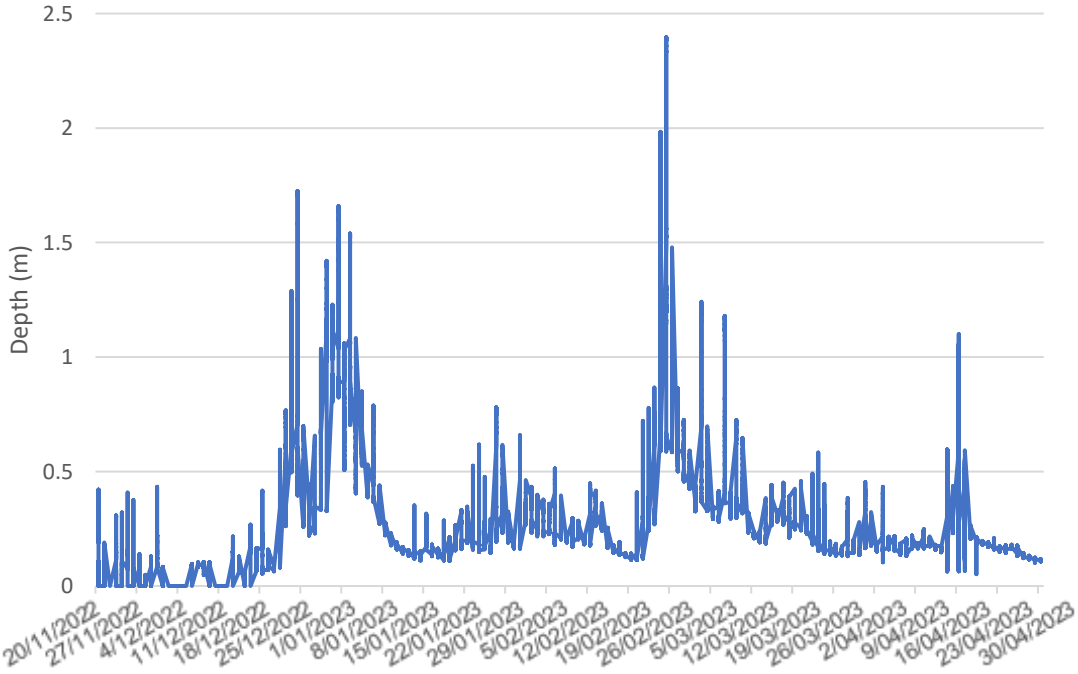


Figure 4-2. Water depth at WDL248 compliance point (GDS SW5)

Intermittent flow commenced at GDS SW5 in approximately mid-November 2022 as shown in Figure 4-1. Short duration peaks in depth of up to 2.4 m were reported as illustrated in Figure 4-2.

In-situ water quality

A summary of the field data is provided in Table 4-1. The numbers in bold are above the respective WDL248 Trigger Value (TV) and any exceedance at the compliance point (GDS SW5) is shaded green.

Table 4-1. Field parameter summary data

Site/Parameter		pH -	EC µS/cm	Turbidity NTU	DO % Saturation	Temperature °C	ORP mV
SW4	Median	**6.75**	19.11	**12.7**	81.5	28.1	85.4
	80th P	**7.22**	25.16	**19.2**	91.7	29.2	124
SW7	Median	6.1	13.55	1.96	91.2	28.2	98.3
	80th P	**6.74**	16.62	5.32	**97.5**	30.7	146
MWD1	Median	**6.7**	111	10	**100**	29.5	107
	80th P	**7.42**	138	**81.2**	**103**	30.9	165
SW1	Median	**6.9**	33.4	**66.5**	**94.9**	27.8	71.1
	80th P	**7.42**	59.7	**362**	**107**	30.3	136
SW2	Median	**6.9**	16.6	**15.4**	91.8	27.9	93.6
	80th P	**7.5**	21.1	**98**	**100**	28.8	159
SW5	Median	**6.9**	18.1	**14.7**	88.8	28.4	95.6
	80th P	**7.35**	25.9	**78**	**92.9**	29.5	140
DH4	Median	**6.7**	6536	**26.2**	89.5	31.4	110
	80th P	**6.96**	8681	**53.7**	**92.7**	32.9	131
DH5	Median	**6.65**	14054	**19.1**	91.5	31.6	102
	80th P	**7**	19900	**26.1**	**102.5**	33.5	129
DH1	Median	**7.31**	39045	1.78	**68.7**	31.6	82
	80th P	**7.32**	40314	2.28	73.1	31.8	112
DH2	Median	**7.67**	44327	6.17	74	31.4	68.6
	80th P	**7.68**	44719	9.26	77.7	31.5	91.5
DH3	Median	**7.44**	26180	11.2	77.2	31.7	99.2
	80th P	**7.64**	37659	**16.4**	81.5	31.9	99.3
Pit	Median	**7.85**	84.65	**131**	**103**	30.6	113
	80th P	**8.2**	**511**	**219**	**125**	34.3	176
Sed 1	Median	**7**	34.2	**122**	**101**	29.0	143
	80th P	**7.7**	49.2	**388**	**103**	31.0	200
Sed 2	Median	**6.89**	60.4	**185**	**99.6**	29.3	133
	80th P	**7.5**	82	**438**	**107**	31.4	206
Sed 3	Median	**6.7**	32.6	**85.1**	**99.3**	30.2	130
	80th P	**7.4**	57.5	**351**	**101**	33.0	221
Sed 4	Median	**6.9**	20.2	**91.2**	**101**	30.2	158
	80th P	**7.52**	32	**165**	**105**	33.6	228

Site/Parameter		pH -	EC µS/cm	Turbidity NTU	DO % Saturation	Temperature °C	ORP mV
Sed 5	Median	**6.67**	20.2	**285**	**97.4**	29.7	128
	80th P	**7.4**	25.6	**575**	**101**	33.5	184
WDL Trigger Value		**5.2-6.6**	**250**	**12**	**70-92**	-	-

pH

The upper pH limit of 6.6 was commonly exceeded at all monitoring locations. Except for SW7, all median pH values were above the TV. The 80th percentile exceeded the TV at all sites (including SW7). The spread in data is illustrated in Figure 4-3.

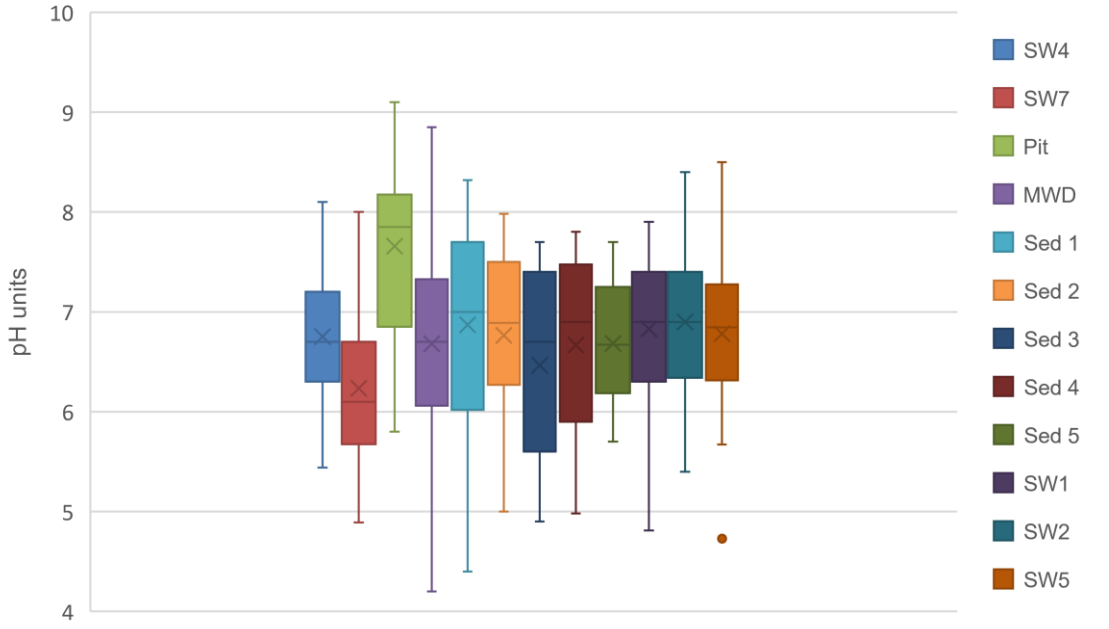


Figure 4-3. pH

Electrical Conductivity

All freshwater EC values remained below the WDL248 TV of 250 µS/cm. The highest EC values were reported for MWD1 as shown in Table 4-1.

Turbidity

Turbidity, measured as NTU, was elevated at all freshwater sites except for SW7. At SW4, the second upstream site, the median and 80th percentile NTU values exceeded the WDL248 TV of 12 NTU. The spread in data is illustrated in Figure 4-4. Turbidity was highest in the sediment basins, and the first downstream sampling location SW1.

Turbidity at GDS SW5 exceeded the WDL248 TV of 12 NTU on 34 of 56 sampling occasions (61% of sampling occasions). Turbidity is temporally presented in Figure 4-5.

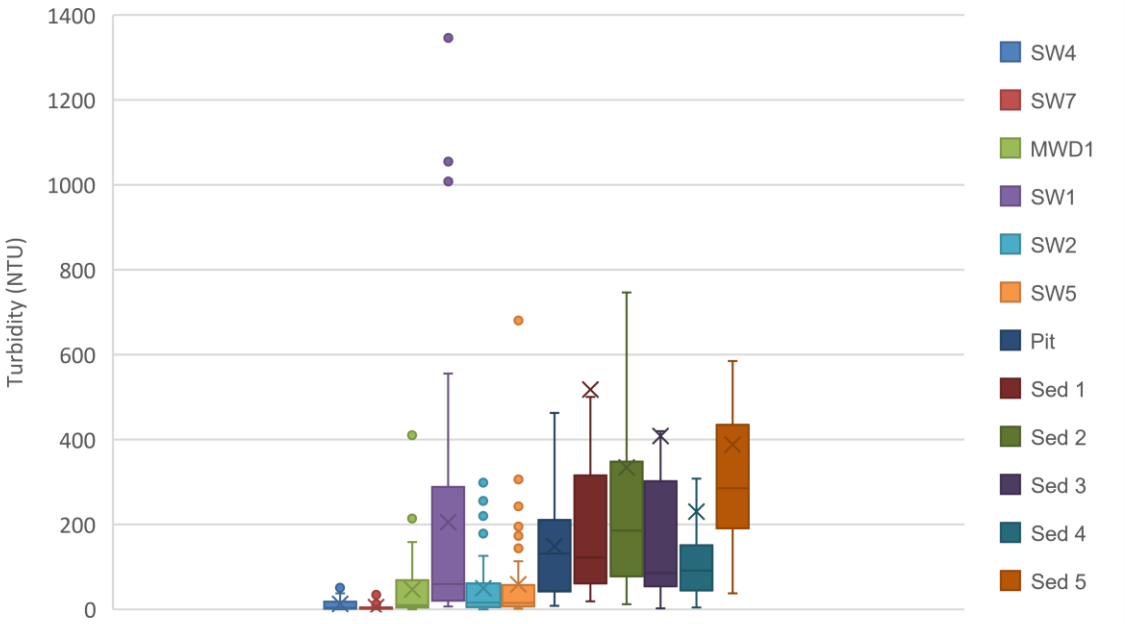


Figure 4-4. Turbidity

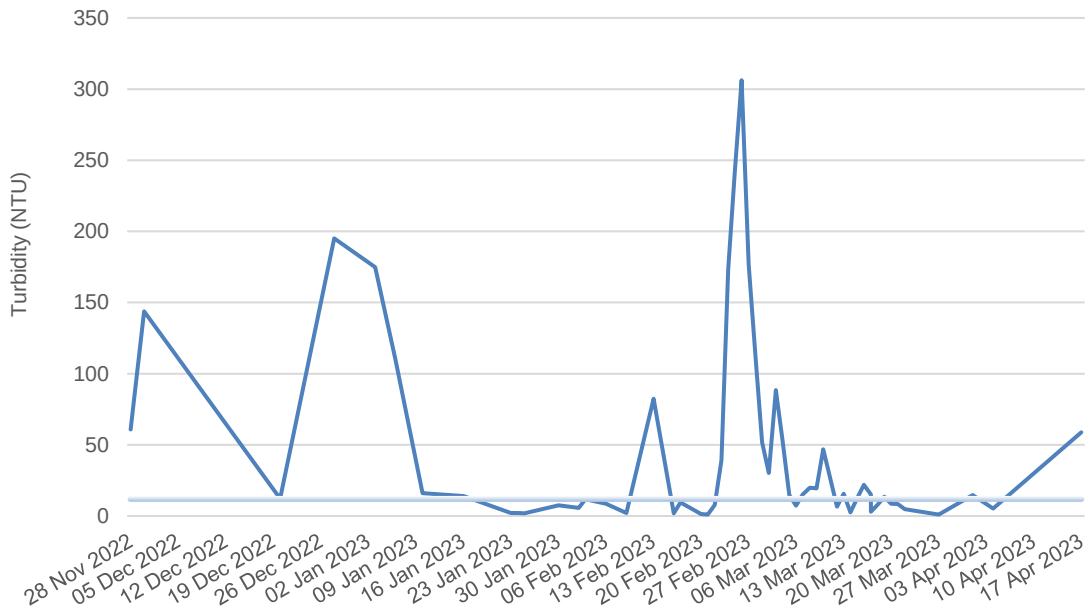


Figure 4-5. Compliance Point (GDS SW5) turbidity

Temperature

Water temperature was consistent across all sites, with median values ranging between 27.8 °C and 28.2 °C in the freshwater environment. Water temperatures were higher in the marine environment and at the water storages.

Dissolved oxygen

Dissolved oxygen (DO) concentrations were consistently above the lower WDL248 GV of 70%. The highest median concentration was 94.9 % saturation at SW1 (Figure 4-6Figure 4-1). No correlation between DO and chlorophyll-a was observed.

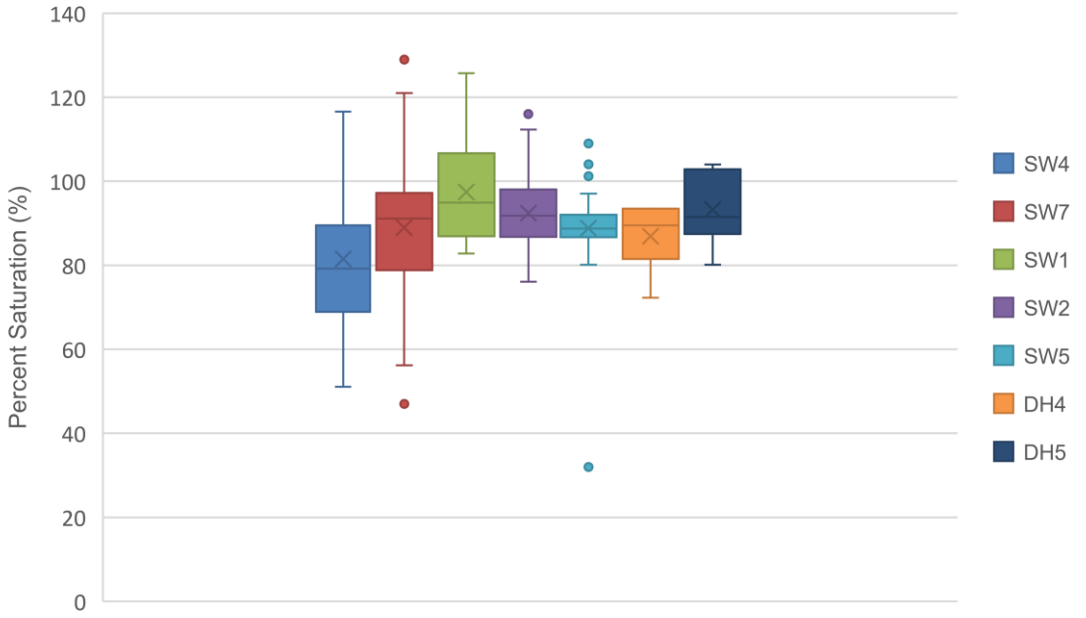


Figure 4-6. Dissolved oxygen percent saturation

4.1.2 Nutrients

The median and 80th percentile values for nutrients are provided in Table 4-2. Those numbers in bold are above the respective WDL248 Trigger Value (TV) and any exceedance at the compliance point (GDS SW5) is shaded green.

Table 4-2. Nutrient concentrations (mg/L)

		NH_3	**NO_x**	**NO_3**	**T_N**	**T_P**	**FRP**	**Chl-a**
Limit of Reporting		0.01	0.01	0.01	0.1	0.01	#	0.001
SW4	Median	0.030	0.005	0.005	0.300	0.01	0.0005	0.0015
	80th P	0.240	0.030	0.030	0.500	**0.02**	0.0020	0.0020
SW7	Median	0.040	0.005	0.005	0.200	0.01	0.0005	0.0008
	80th P	0.180	0.005	0.005	0.400	**0.02**	0.0030	0.0020
MWD1	Median	0.350	12.6	11.8	**14.8**	**0.02**	0.0040	0.0020
	80th P	0.668	13.5	12.9	**16.7**	**0.048**	0.0074	0.0036
SW1	Median	0.045	0.050	0.050	0.600	**0.02**	0.0005	0.001
	80th P	0.252	0.512	0.512	0.780	**0.03**	0.0010	0.001
SW2	Median	0.080	0.005	0.005	0.400	0.008	0.0010	0.0005
	80th P	0.300	0.020	0.020	0.520	**0.024**	0.0022	0.0010
SW5	Median	0.060	0.005	0.005	0.400	**0.02**	0.0005	0.0005
	80th P	0.354	0.050	0.050	0.600	**0.03**	0.0030	0.0005
DH4	Median	0.200	0.005	0.005	0.500	**0.04**	0.0030	0.0070
	80th P	0.370	0.049	0.049	0.700	**0.048**	0.0050	0.0130

Limit of Reporting		NH_3 0.01	NO_x 0.01	NO_3 0.01	T_N 0.1	T_P 0.01	FRP #	Chl-a 0.001
DH5	Median	0.305	0.005	0.005	0.550	**0.035**	0.0025	0.0060
	80th P	0.380	0.020	0.020	0.600	**0.04**	0.0040	0.0098
DH1	Median	0.103	<LOR	<LOR	0.400	**0.043**	0.0013	0.0025
	80th P	0.161	<LOR	<LOR	0.520	**0.065**	0.0017	0.0028
DH2	Median	0.168	<LOR	<LOR	0.303	**0.033**	0.0018	0.0015
	80th P	0.265	<LOR	<LOR	0.481	**0.037**	0.0025	0.0018
DH3	Median	0.070	0.005	0.005	0.400	**0.04**	0.0020	0.0013
	80th P	0.178	0.014	0.014	0.580	**0.064**	0.0140	0.0017
Pit	Median	0.165	6.31	6.28	**8.25**	**0.055**	0.0070	0.0013
	80th P	2.288	21.9	19.9	**28.9**	**0.128**	0.0224	0.0017
Sed 1	Median	0.040	0.230	0.230	0.600	**0.03**	0.0005	0.001
	80th P	0.236	0.468	0.468	1.000	**0.136**	0.0016	0.0030
Sed 2	Median	0.045	0.290	0.290	0.850	**0.05**	0.0010	0.0020
	80th P	0.294	0.670	0.650	1.680	**0.132**	0.0030	0.0058
Sed 3	Median	0.030	0.090	0.090	0.350	**0.025**	0.0005	0.0025
	80th P	0.120	0.200	0.190	0.600	**0.07**	0.0020	0.0034
Sed 4	Median	0.020	0.090	0.090	0.300	**0.02**	0.0005	0.001
	80th P	0.354	0.144	0.144	0.760	**0.07**	0.0022	0.001
Sed 5	Median	0.040	0.140	0.140	0.500	**0.05**	0.0005	0.0018
	80th P	0.366	0.248	0.248	0.900	**0.116**	0.0014	0.0038
WDL Trigger Value		-	-	-	**1.5**	**0.01**	-	-

Variable LOR due to matrix interference.

Ammonia

All ammonia (NH_3) concentration at the compliance point GDS SW5, were below the ANZG (2018) 95% species protection acute toxicity value of 0.9 mg/L.

Nitrogen

No exceedances of the WDL248 Total Nitrogen (TN) TV of 1.5 mg/L were reported at the compliance point GDS SW5 over the reporting period. Figure 4-7 shows the median nitrogen concentrations at the upstream and downstream monitoring locations.

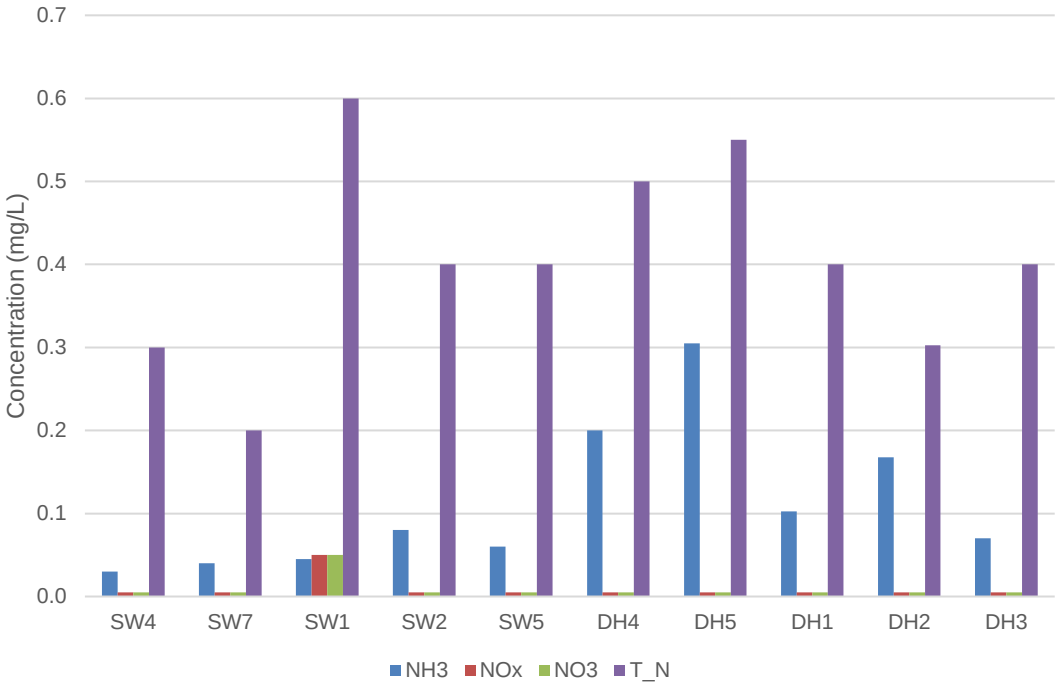


Figure 4-7. Median nitrogen concentrations upstream and downstream of DP1

The highest concentrations of TN were observed at MWD1 and the mine pit sump (Figure 4-8). TN concentrations were variable as shown in Figure 4-9.

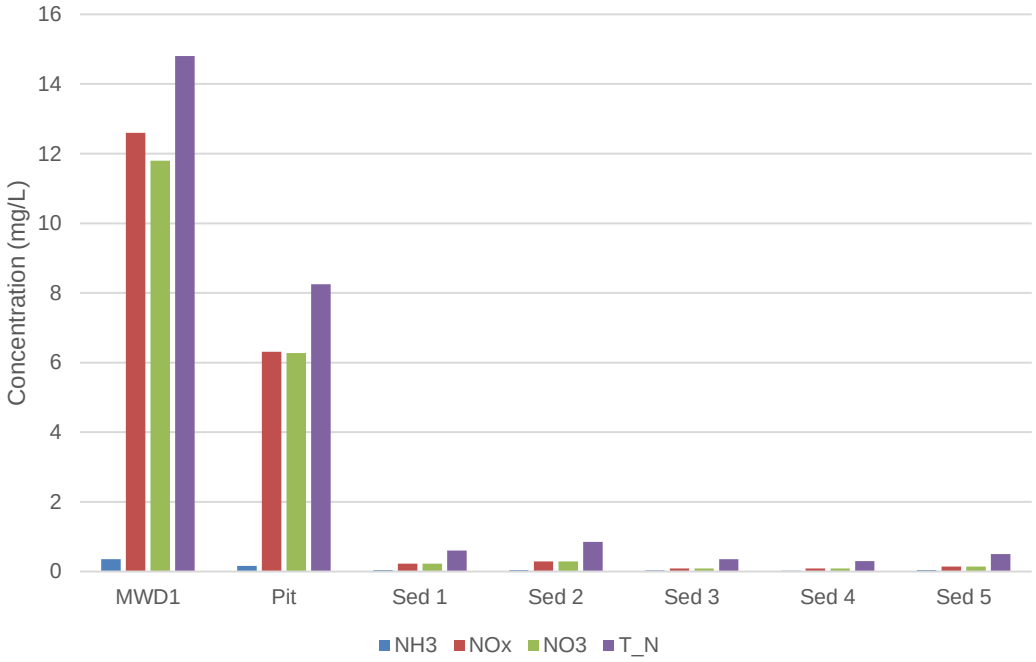


Figure 4-8. Median nitrogen concentrations at Grants water management storages

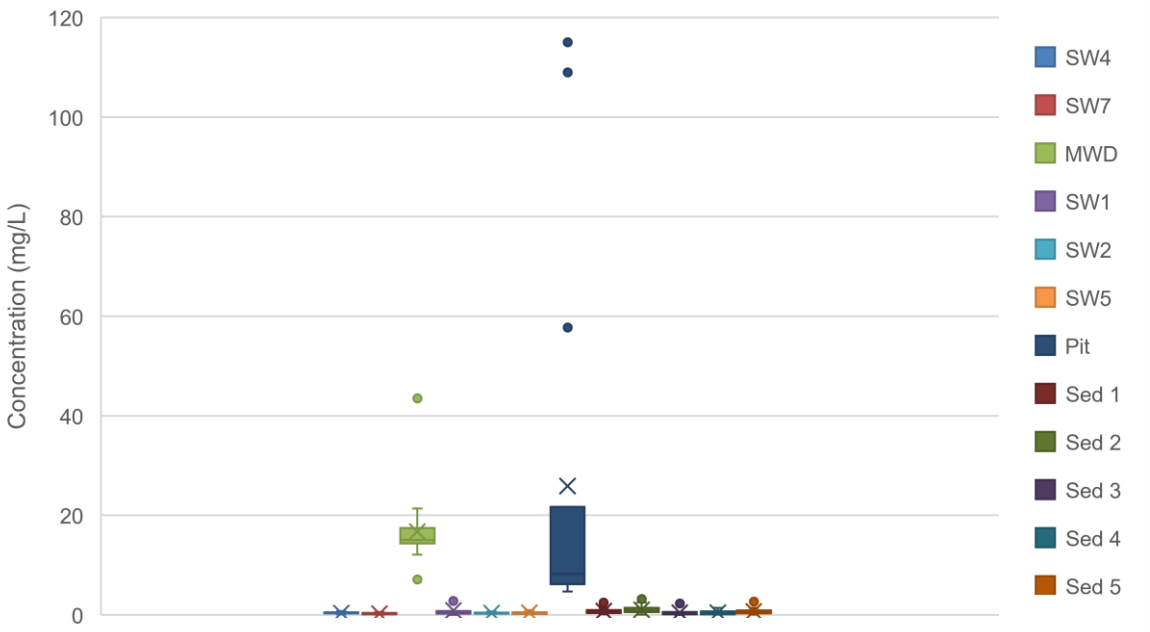


Figure 4-9. Total Nitrogen concentrations

As shown in Figure 4-10, TN at MWD1 largely comprised of nitrate, in contrast to the upstream sites and GDS SW5, which were dominated by Total Kjeldahl Nitrogen (TKN). TKN is the sum of nitrogen bound in organic substances and ammonium.

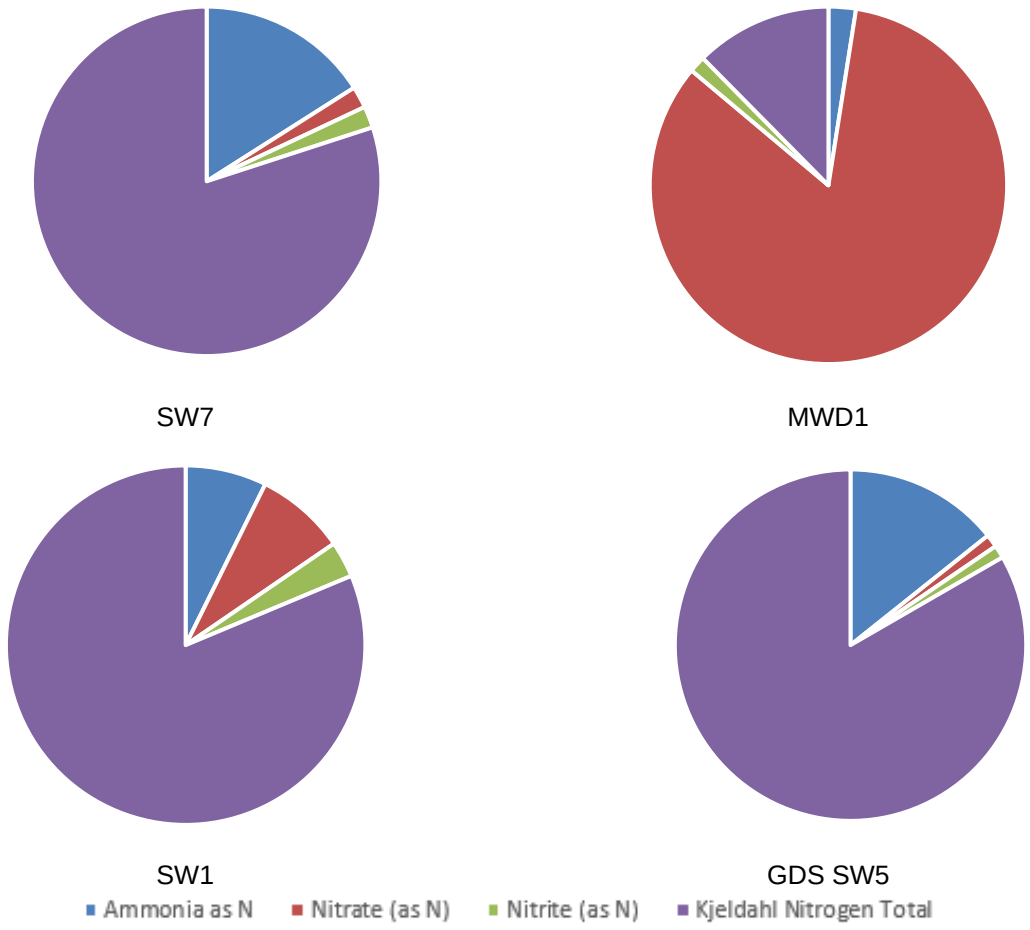


Figure 4-10. Nitrogen by form

Nitrate

The box and whisker plots below demonstrate the spread of nitrate concentrations, for the upstream and downstream environment (Figure 4-11) and mine water management infrastructure (Figure 4-12).

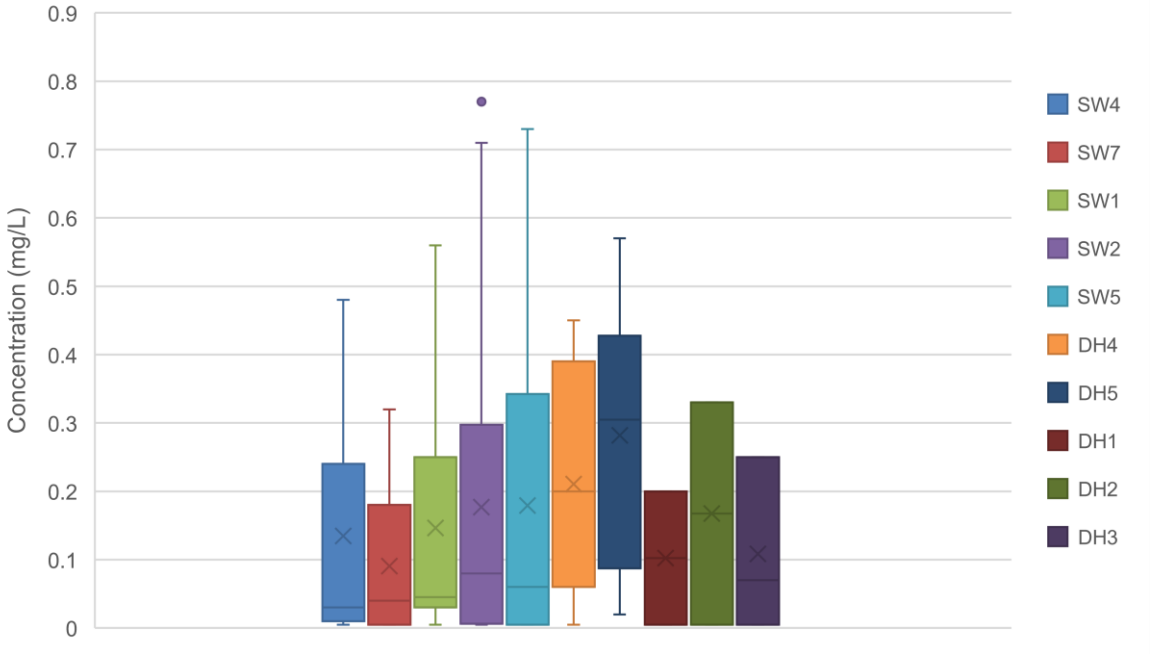


Figure 4-11. Nitrate concentrations upstream and downstream of DP1

Nitrate concentrations were an order of magnitude higher at the mine, when compared to the upstream monitoring locations and GDS SW5.

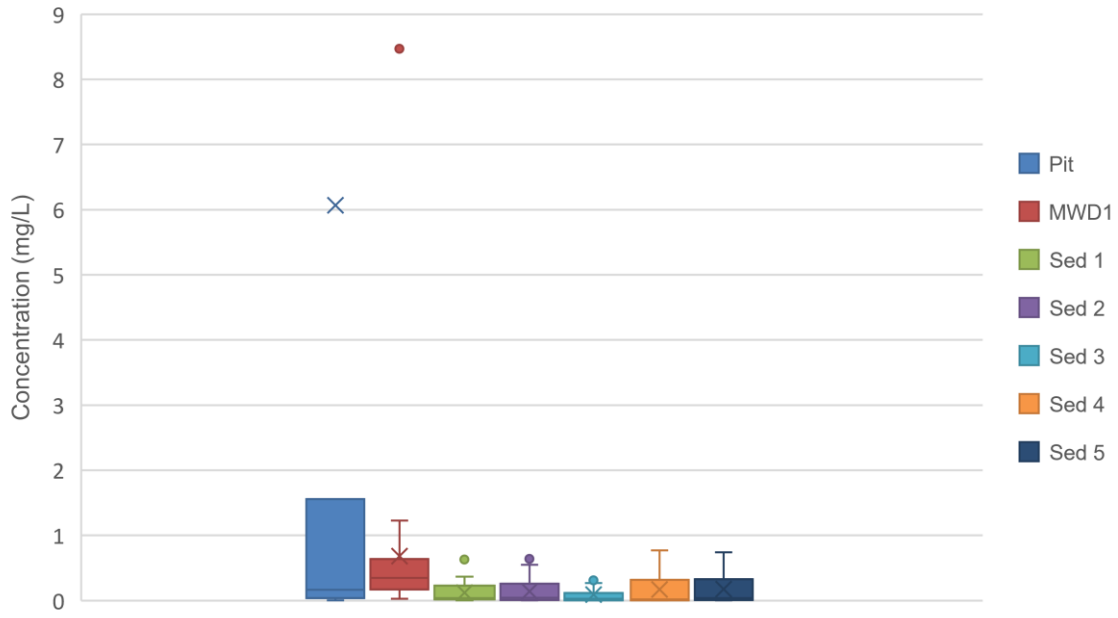


Figure 4-12. Nitrate concentrations at Grants water management storages

Phosphorus

Median Total Phosphorus (TP) concentrations for the reporting period are shown in Figure 4-13Figure 4-13. Median phosphorus and chlorophyl-a concentrations. TP at GDS SW5 exceeded the WDL248 TV of 0.01 mg/L (10 µg/L) on 12 of 24 sampling occasions (50% of sampling occasions).

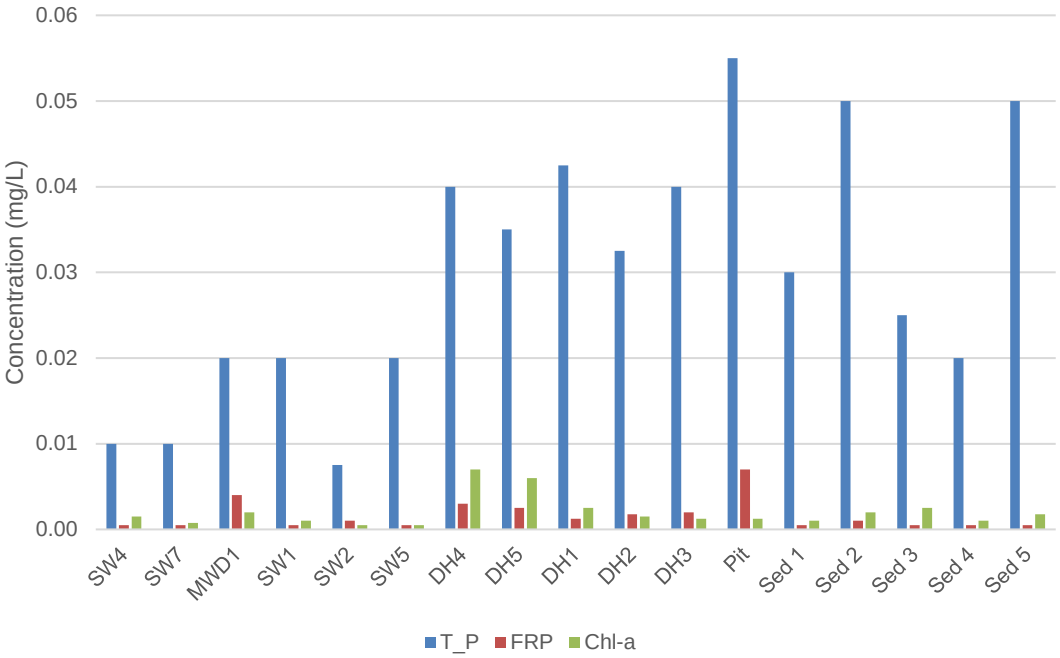


Figure 4-13. Median phosphorus and chlorophyl-a concentrations

Temporally TP was variable, as shown in Figure 4-14.

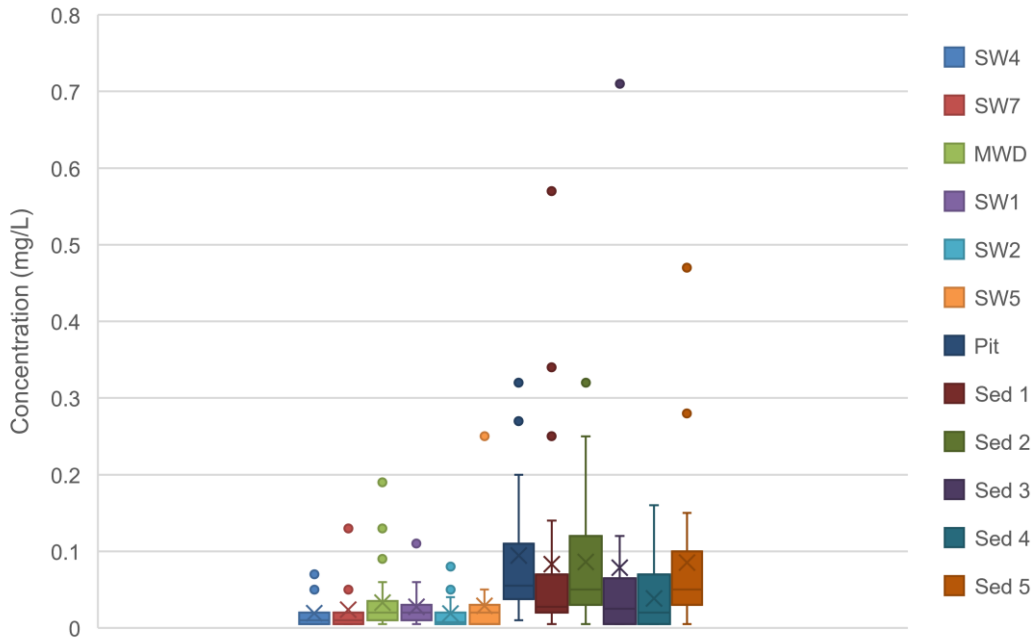


Figure 4-14. Total Phosphorus concentrations

Chlorophyl-a

Monitoring of chlorophyl-a (chl-a) commenced on 9 March 2023, consistent with the amended WDL dated 7 March 2023. Chl-a concentrations are reported in Table 4-2 and shown in Figure 4-13. Chl-a concentrations were generally low with no clear correlation to nutrient concentrations.

4.1.3 Metals and metalloids

The median and 80th percentile values for metal and metalloids are provided in Table 4-3 and Table 4-4. Each table provides data for the total and filtered fraction. Those numbers in bold are above the respective WDL248 Trigger Value (TV) and any exceedance at the compliance point (GDS SW5) is shaded green.

All mercury concentrations were less than the LOR and are not presented in the tables.

Table 4-3. Metal and metalloid concentrations (mg/L)

		Al_T	Al_F	As_T	As_F	Fe_T	Fe_F	Li_T	Li_F
Limit of reporting		0.01	0.01	0.001	0.001	0.05	0.05	0.001	0.001
SW4	Median	**0.08**	0.01	0.0005	0.0005	**0.34**	0.1	0.004	0.003
	80th P	**0.1**	0.06	0.001	0.0005	**0.76**	**0.18**	0.005	0.004
SW7	Median	**0.16**	0.04	0.0005	<LOR	**0.12**	0.025	0.001	0.001
	80th P	**0.29**	0.08	0.0005	<LOR	**0.31**	0.08	0.001	0.002
MWD1	Median	**0.2**	0.01	0.002	0.002	**0.16**	0.025	0.322	0.313
	80th P	**1**	0.06	0.002	0.002	**1.3**	0.025	0.3768	0.3328
SW1	Median	**0.81**	0.055	0.0005	0.0005	**0.615**	0.025	0.0185	0.0125
	80th P	**2.008**	0.294	0.001	0.0005	**2.852**	0.096	0.0322	0.0226
SW2	Median	**0.24**	0.02	<LOR	<LOR	**0.35**	0.06	0.002	0.002
	80th P	**0.446**	0.05	<LOR	<LOR	**0.66**	0.084	0.004	0.002
SW5	Median	**0.295**	0.02	0.0005	0.0005	**0.595**	0.09	0.004	0.003
	80th P	**0.416**	0.094	0.001	0.0007	**0.934**	0.164	0.0068	0.005
DH4	Median	**0.5**	0.005	0.001	<LOR	**0.68**	0.025	0.024	0.023
	80th P	**1.058**	0.005	0.0018	<LOR	**1.866**	0.025	0.0338	0.0266
DH5	Median	**0.537**	0.035	0.001	0.0005	**0.82**	0.025	0.04	0.022
	80th P	**0.72**	0.05	0.002	0.0005	**1.1**	0.06	0.056	0.036
DH1	Median	<LOR	<LOR	<LOR	<LOR	0.09	**0.15**	0.1315	0.106
	80th P	<LOR	<LOR	<LOR	<LOR	**0.114**	**0.21**	0.1564	0.1192
DH2	Median	<LOR	<LOR	<LOR	<LOR	0.09	**0.15**	0.125	0.1185
	80th P	<LOR	<LOR	<LOR	<LOR	**0.114**	**0.21**	0.1382	0.129
DH3	Median	0.05	0.05	0.005	0.005	0.05	0.05	0.112	0.104
	80th P	**0.65**	0.05	0.011	0.005	**0.896**	**0.17**	0.1324	0.1286
Pit	Median	**0.98**	0.005	0.003	0.003	**1.765**	<LOR	0.118	0.116
	80th P	**2.964**	0.02	**0.0152**	**0.0134**	**4.226**	<LOR	0.8258	0.8086
Sed 1	Median	**1.92**	0.005	0.0005	0.0005	**2.67**	0.025	0.009	0.003
	80th P	**4.536**	0.03	0.002	0.0005	**6.16**	0.025	0.0132	0.004
Sed 2	Median	**1.73**	0.015	0.0005	<LOR	**1.685**	0.025	0.023	0.014
	80th P	**4.278**	0.048	0.002	<LOR	**4.364**	0.025	0.0508	0.0194
Sed 3	Median	**1.14**	0.0075	0.0005	0.0005	**1.03**	0.025	0.007	0.002
	80th P	**4.11**	0.11	0.001	0.0005	**4.89**	0.025	0.017	0.004
Sed 4	Median	**0.95**	0.005	0.0005	0.0005	**0.67**	0.025	0.004	0.002
	80th P	**2.492**	0.052	0.0006	0.0005	**3.536**	0.025	0.015	0.0022
Sed 5	Median	**2.96**	0.05	0.0005	<LOR	**2.53**	0.025	0.006	0.001
	80th P	**7.066**	0.132	0.0014	<LOR	**6.54**	0.025	0.0238	0.0024
WDL Trigger Value		**0.07**	**0.07**	**0.013**	**0.013**	**0.11**	**0.11**	**0.43**	**0.43**

Table 4-4. Metal and metalloid concentrations continued (mg/L)

		Cd_T	Cd_F	Cr_T	Cr_F	Cu_T	Cu_F	Pb_T	Pb_F	Ni_T	Ni_F	Zn_T	Zn_F
Limit of reporting		0.0001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.005
SW4	Median	<LOR	<LOR	<LOR	<LOR	0.0005	0.0005	<LOR	<LOR	<LOR	<LOR	0.0025	0.0025
	80th P	<LOR	<LOR	<LOR	<LOR	0.0005	0.0005	<LOR	<LOR	<LOR	<LOR	0.0025	0.0025
SW7	Median	0.00005	<LOR	<LOR	<LOR	0.0005	0.0005	<LOR	<LOR	<LOR	0.0005	0.0025	<LOR
	80th P	0.0001	<LOR	<LOR	<LOR	0.0005	0.0005	<LOR	<LOR	<LOR	0.0005	0.0025	<LOR
MWD1	Median	0.00005	0.00005	0.0005	<LOR	0.0005	0.0005	0.0005	<LOR	0.001	0.0005	0.0025	0.0025
	80th P	0.00005	0.00005	0.001	<LOR	**0.002**	0.0007	0.0005	<LOR	0.0024	0.001	0.0076	0.0025
SW1	Median	<LOR	<LOR	0.0005	<LOR	0.0005	0.0005	0.0005	<LOR	0.0005	0.0005	0.0025	<LOR
	80th P	<LOR	<LOR	**0.0025**	<LOR	**0.002**	0.0005	0.0008	<LOR	0.0018	0.0005	0.0069	<LOR
SW2	Median	0.00005	<LOR	0.0005	0.0005	0.0005	0.0005	0.0005	<LOR	0.0005	<LOR	0.0025	0.0025
	80th P	0.00005	<LOR	0.0005	0.0005	0.001	0.0015	0.0005	<LOR	0.0005	<LOR	0.0025	0.0025
SW5	Median	<LOR	<LOR	0.0005	<LOR	0.0005	0.0005	0.0005	<LOR	0.0005	<LOR	0.0025	0.0025
	80th P	<LOR	<LOR	0.0005	<LOR	0.0005	0.0011	0.0005	<LOR	0.0005	<LOR	0.0025	0.0025
DH4	Median	<LOR	<LOR	0.0005	<LOR	<LOR	<LOR	<LOR	<LOR	0.0005	<LOR	0.0025	<LOR
	80th P	<LOR	<LOR	**0.0018**	<LOR	<LOR	<LOR	<LOR	<LOR	0.0005	<LOR	0.0058	<LOR
DH5	Median	<LOR	<LOR	0.0005	<LOR	0.00075	0.0005	<LOR	<LOR	<LOR	<LOR	0.0025	0.00475
	80th P	<LOR	<LOR	0.001	<LOR	**0.002**	**0.002**	<LOR	<LOR	<LOR	<LOR	0.007	0.007
DH1	Median	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.025	0.025
	80th P	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.025	0.025
DH2	Median	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.025	0.025
	80th P	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.025	0.025
DH3	Median	<LOR	<LOR	**0.005**	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.025	0.025
	80th P	<LOR	<LOR	**0.005**	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.025	0.025
Pit	Median	0.00005	<LOR	0.001	<LOR	**0.0015**	0.0005	0.0005	<LOR	0.003	0.0005	0.007	0.0025
	80th P	0.0001	<LOR	**0.0054**	<LOR	**0.0034**	0.0007	0.002	<LOR	0.0044	0.0005	0.0168	0.0025
Sed 1	Median	<LOR	0.00005	**0.002**	0.0005	0.002	0.0005	0.0005	<LOR	0.002	0.0005	0.0095	0.0025
	80th P	<LOR	0.00005	**0.0062**	0.0005	**0.0036**	0.0008	0.0026	<LOR	0.0052	0.0005	0.023	0.0025
Sed 2	Median	0.00005	0.00005	**0.0015**	0.0005	0.001	0.0005	0.001	0.0005	0.001	0.0005	0.012	0.0025
	80th P	0.00014	0.00005	**0.006**	0.0005	**0.0044**	**0.0024**	0.0042	0.0005	0.004	0.0005	0.0258	0.0072
Sed 3	Median	0.00005	0.00005	0.00075	0.0005	0.0005	0.0005	0.0005	0.0005	0.0015	0.0005	0.008	0.0025
	80th P	0.00005	0.00005	**0.004**	0.0005	**0.005**	**0.002**	0.002	0.0005	0.006	0.0005	0.0202	0.0068
Sed 4	Median	0.00005	0.00005	0.0005	0.0005	0.0005	0.0005	0.0005	<LOR	0.0005	<LOR	0.00525	0.0025
	80th P	0.00005	0.00005	**0.0036**	0.0005	**0.0034**	0.0005	0.0022	<LOR	0.0034	<LOR	0.0114	0.0025
Sed 5	Median	0.00005	<LOR	**0.003**	<LOR	0.001	0.0005	0.002	0.0005	0.003	0.0005	0.0075	0.0025
	80th P	0.00005	<LOR	**0.0068**	<LOR	**0.004**	0.0014	0.004	0.0005	0.007	0.0005	0.0208	0.0025
WDL Trigger Value		**0.0002**	**0.0002**	**0.001**	**0.001**	**0.0014**	**0.0014**	**0.0034**	**0.0034**	**0.011**	**0.011**	**0.008**	**0.008**

As indicated in Table 4-3, the median and 80th percentile concentrations for total aluminium and iron were above respective WDL248 TVs. Additionally, the 80th percentile concentrations for filtered aluminium and iron exceeded the respective TVs. Data, as illustrated in Figure 4-15 and Figure 4-16, suggest the source of these metals is primarily the sediment basins and not MWD1.

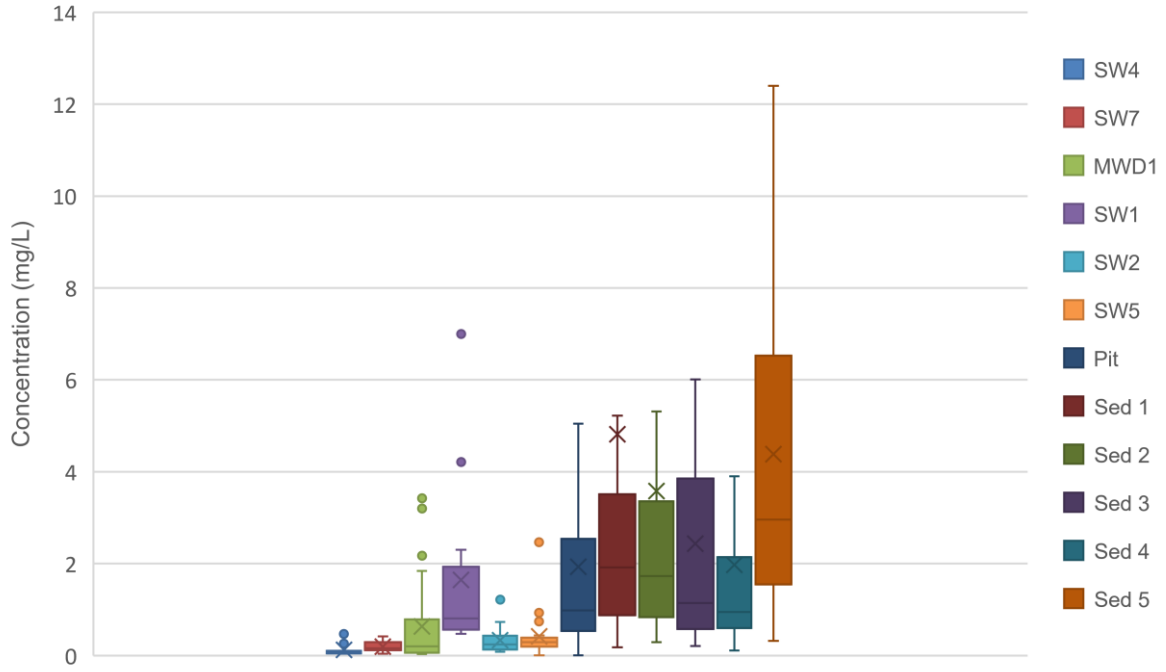


Figure 4-15. Total aluminium concentrations

Total and filtered aluminium at GDS SW5 exceeded the WDL248 TV of 0.07 mg/L (70 µg/L) on 23 of 24 sampling occasions (96%) and 5 of 24 sampling occasions (21%) respectively.

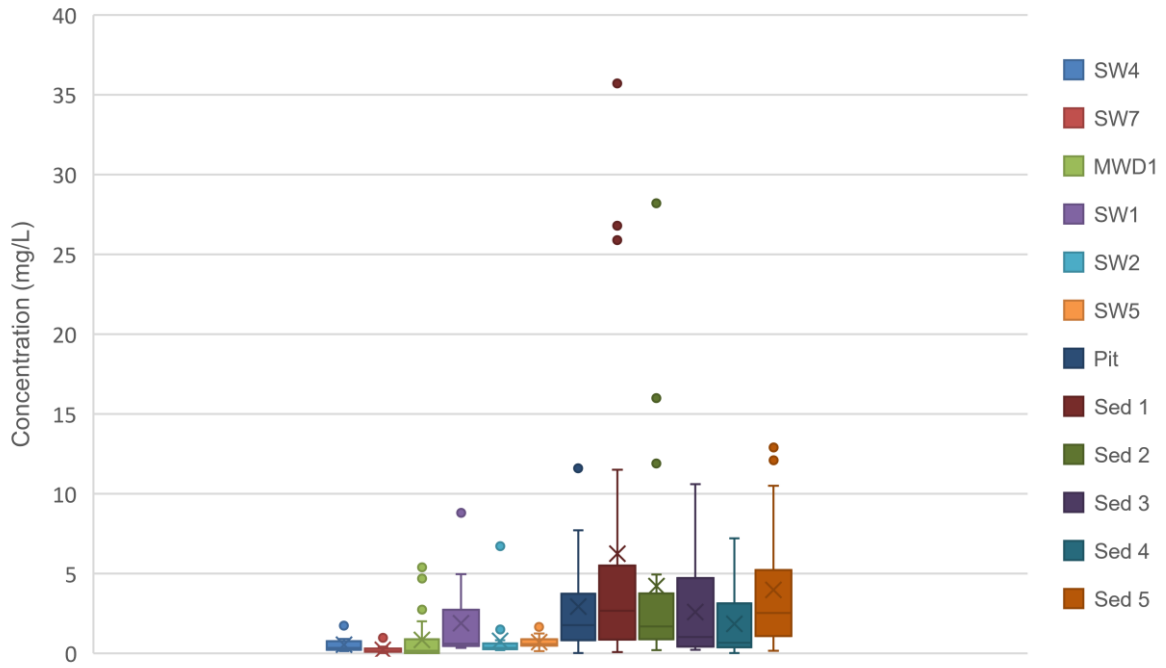


Figure 4-16. Total iron concentrations

Total iron at GDS SW5 exceeded the WDL248 TV of 0.11 mg/L (110 µg/L) on all sampling occasions. Filtered concentrations of iron exceeded the TV on eight occasions (33%) over the reporting period.

4.1.4 Treatment reagents

Acrylamide concentrations were measured on 21 occasions across the reporting period. All concentrations at all sites were less than the LOR (0.2 µg/L).

4.1.5 Other

The median and 80th percentile values for major ions, alkalinity and solids are provided in Table 4-5. There are no TV identified in WDL248 for these parameters. All carbonate concentrations were less than the LOR and are not presented in the table.

Table 4-5. Major ions, alkalinity and solids

		SO_4	Cl	Ca	Mg	K	Na	HCO_3	TDS	TSS
Limit of reporting		1	1	1	1	1	1	1	10	5
SW4	Median	0.5	3	0.5	0.5	0.5	3	3	22	2.5
	80th P	0.5	4	0.5	0.5	0.5	3	4	27.4	2.5
SW7	Median	0.5	3	0.5	0.5	0.5	2	2	22.5	2.5
	80th P	0.5	3	0.5	0.5	0.5	3	3	26.4	4.4
MWD1	Median	4	3	3	4	4	10	3	112	2.5
	80th P	9.8	3	3	5	4	10.4	5.4	127	22.4
SW1	Median	2	3	0.5	0.5	0.5	3	2.5	45	6.5
	80th P	4.8	4	0.5	0.5	1	5.6	4.8	67.4	18.4
SW2	Median	1	3	0.5	0.5	0.5	2	3	23	2.5
	80th P	2.4	3	0.5	0.5	0.5	2	4	30	8.2
SW5	Median	0.5	3	0.5	0.5	0.5	3	3	29	2.5
	80th P	2.2	4	1	0.5	0.5	4	6.2	35	8
DH4	Median	283	2280	47	134	44	1190	31	4220	16
	80th P	398	3064	69	194	64	1710	41.4	6110	44.4
DH5	Median	613	4905	102	290	95	2485	47.5	9595	18.5
	80th P	862	6520	163	459	140	3950	60	13700	45
DH1	Median	1537	12950	285	842	264	7115	97	27350	6.25
	80th P	1863	14060	319	936	293	7934	105	30080	8.5
DH2	Median	2175	14800	338	989	310	8295	106	30650	5.25
	80th P	2214	15520	364	1067	332	8916	110	32720	6.9
DH3	Median	2260	15600	347	1020	322	8680	104	30100	5
	80th P	2284	16020	379	1110	347	9352	110	32740	22.4
Pit	Median	6	4	2	3	4	8.5	7	91	54
	80th P	6	4.8	8.4	6.6	6	20.6	42.4	139	94
Sed 1	Median	5	3	0.5	0.5	1	3	1	45	30
	80th P	9.6	3.6	2.6	0.5	2	3	3	83	79.6
Sed 2	Median	12	3	3.5	1	1	3	4	80.5	36.5
	80th P	23.4	5	8	1.4	1.4	3.4	9	111	151
Sed 3	Median	8.5	2.5	2	0.5	0.5	2	1.5	48.5	16.5
	80th P	19	4	6	1	0.5	2	4	53.6	97
Sed 4	Median	4	3	0.5	0.5	0.5	2	0.5	40	18
	80th P	6	3	2	0.5	0.5	2	2	49	65.4
Sed 5	Median	2	4	0.5	0.5	0.5	3	1	61	60
	80th P	4	4	0.5	0.5	0.5	3	2	73.4	101

With the exception of the marine monitoring locations, water is soft with low concentrations of major anions and cations.

Total suspended solids (TSS) concentrations were higher in the mine pit sump and sediment basins as shown in Figure 4-17.

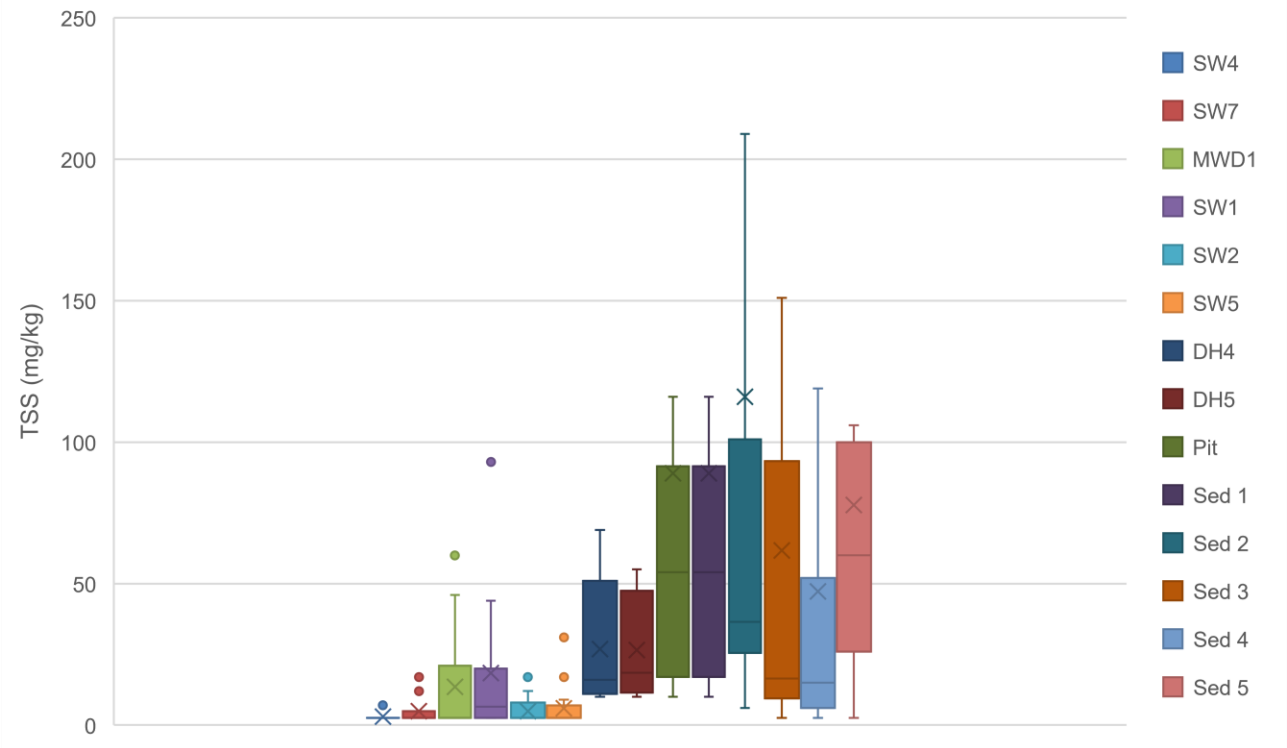


Figure 4-17. Total Suspended Solids concentrations

4.2 Fluvial sediment

4.2.1 Particle size distribution

The portion of fines, sand and gravel was spatially variable as shown in Figure 4-18. At MWD1, fines i.e., < 75 µm represented almost 80% of the sediment sampled, whilst at GDS SW5, sand (> 75 µm but less than 2 mm) dominated. As shown in Table 4-6, only 1% of the sediment sampled at GDS SW5 had a diameter of less than 63 µm.

4.2.1 Chemistry

Whilst there are no compliance trigger values for sediment, data have been compared against the guideline values for sediment quality (ANZG, 2018). Table 4-6 provides the average sediment pH, EC and toxicant concentrations at each site. The default and GV-high values are shown, and any exceedances are shaded green.

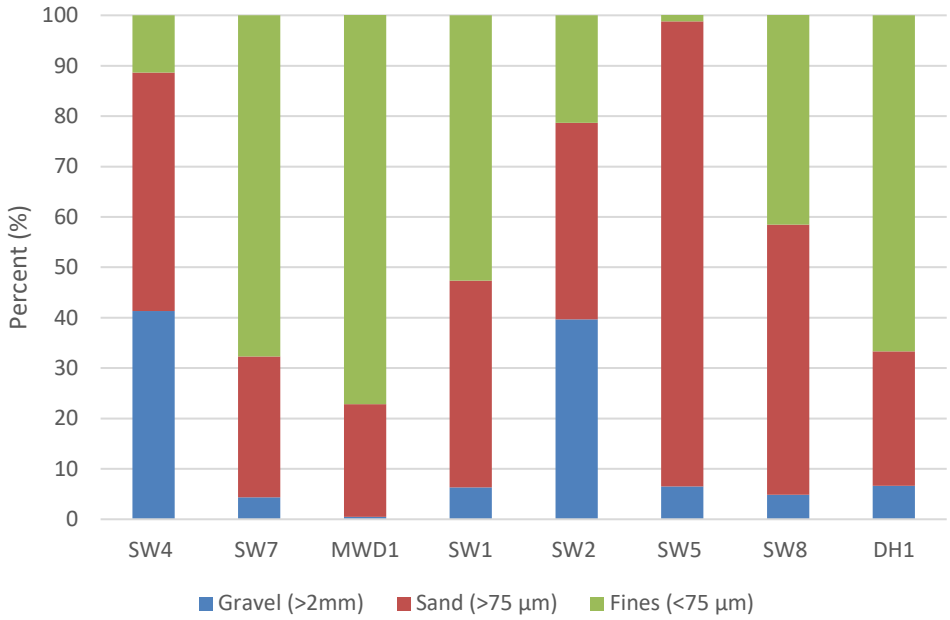


Figure 4-18. Fluvial sediment particle size distribution

Table 4-6. Average sediment total metal and metalloid concentrations (mg/kg)

LOR	pH -	EC 1	Al 1	As #	Cr 0.1	Cu 0.1	Fe 1	Pb 0.1	Li 0.01	Hg #	Ni 0.1	Zn 0.1	% passing 63 µm
SW4	6.20	16.3	5637	12.96	9.43	4.30	16100	10.07	9.87	0.013	3.17	5.1	13.2
SW7	5.87	13.7	10490	0.5	6.83	4.47	2537	14.2	13.03	0.010	3	1.57	43.7
SW8	5.97	15	16000	1.37	10.3	9.23	4317	17.6	19.3	0.027	5.73	4.7	22.1
MWD1	6.47	13.7	10460	6.06	21	9.33	37567	10.5	26.2	<LOR	10.1	35.1	51.3
SW1	5.87	19.3	10587	17.4	17.2	7.97	24633	16.6	17.7	0.023	6.57	14.1	48
SW2	5.93	27.7	9877	7.13	19.9	8	30200	14.4	12.5	0.020	6.4	15.2	14.3
SW5	5.93	6.7	6500	43.3	18.9	17.1	35000	20.9	10.7	0.013	6.47	33.9	1.07
DH1	7.87	5767	13267	23.5	34.1	8.87	32333	12.2	15.4	0.020	10.6	28.9	14.9
DGV	-	-	-	20	80	65	-	50	-	0.15	21	200	-
GV-high	-	-	-	70	370	270	-	220	-	1	52	410	-

Variable LOR due to matrix interference.

Arsenic was the only metal that was detected in concentrations which exceeded the ANZG 2018 default guideline values for sediment. The concentration of arsenic in sediment sampled at SW5 and DH1 exceeded the DGV of 20 mg/kg. Three sediment samples were collected at each site. Of the three samples collected at SW5, one exceeded the GV-high value of 70 mg/kg.

Arsenic is known to be naturally high in Darwin Harbour sediments. Fortune concluded that the observed levels of arsenic in Darwin Harbour most likely reflect natural weathering of arsenic rich coastal substrata (Fortune, 2006) and Munksgaard et al., (2013) similarly that given the spatial extent of elevated arsenic levels throughout the study area (Darwin Harbour), it is likely to be indicative of local geology.

Select sediment metal concentrations are shown in Figure 4-19.

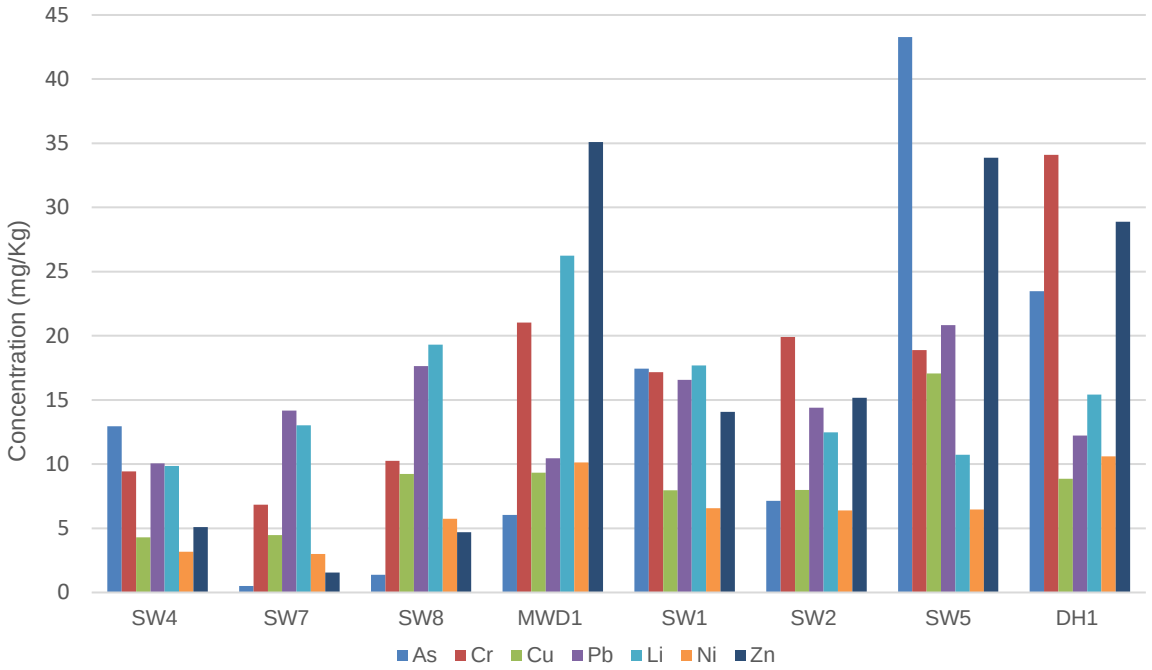


Figure 4-19. Average sediment metal and metalloid concentrations

4.3 Biota

4.3.1 Freshwater macroinvertebrates

A copy of the technical report (deliverable) is provided as Appendix E. In summary, in 2023, macroinvertebrate sampling results showed a clear impairment of the community at UC2 directly downstream of the GLP, and improvements in aquatic ecosystem health with distance downstream. There was no correlation between poor water quality or sediment quality and community health and differences in community composition at UC2, except for elevated turbidity, which may be impacting macroinvertebrate health directly downstream of GLP. Changes in macroinvertebrate metrics from those collected prior to discharge in 2022 indicate a decline in aquatic ecosystem health at the site.

The cause of the decline cannot be directly attributed to the discharge from MWD1, as environmental factors, such as above average rainfall, and flow at the site need to be considered. The decline in health was spatially limited to UC2, and improvement in ecosystem health was apparent downstream.

The compliance point, GDS SW5 showed very little change in metrics and composition between years, whereas other sites monitored (UC2 and UC1) did show variability. The lower complexity of habitat at GDS SW5 is likely to result in less variability in macroinvertebrate metrics over time, whereas other sites that are subject to changes in habitat availability with creek height, will likely contain more variable invertebrate communities. Although there were some observable differences between years, there was no significant difference found across sites sampled in both years for any macroinvertebrate metric or community composition.

The results of sampling in 2023 demonstrate that active discharge from the GLP has had no significant impact on the aquatic ecosystems of waterways draining to Darwin Harbour, although turbidity appears to be impacting macroinvertebrate health directly downstream of the mine. Ongoing sampling to monitor turbidity, sediment metal loads and ecosystem health is needed to understand the long-term impacts of active discharge on the receiving environment.

4.3.2 Riparian vegetation

A copy of the technical report (deliverable) is provided as Appendix H. In summary, the monitoring did not identify any significant changes in the extent or species composition of riparian vegetation communities downstream of the GLP that could be attributed to the discharge of mine impacted wastewater.

The drone survey results indicated an overall increase in riparian vegetation of 1.31 ha, compared to the 2019 baseline survey, with the main increase observed in the mangrove community. The swamp and riparian vegetation communities were in a stable condition, with no significant change in the extent of the vegetation communities identified in the 2023 drone survey.

Based on the riparian vegetation site assessment, some minor vegetation composition changes were noted, mostly occurring in the mid-stratum and ground stratum. The slight variations in the ground stratum could be attributed to the timing of monitoring (i.e., seasonal variations).

4.3.3 Seagrass

The seagrass survey was completed in May 2023. A copy of the technical report (deliverable) is provided as Appendix G. Seagrass surveys were conducted along 3 sites downstream of DP1 being, Grants Downstream Darwin Harbour (GDS DH) 1, 2 and 3. No seagrass was detected at any of the sites surveyed. All sites had a sandy substrate with heavy sedimentation.

This finding is consistent with the predictive benthic habitat mapping, based on modelling undertaken by the Australian Institute of Marine Science (AIMS) in collaboration with the Northern Territory Government, which showed low likelihood of seagrass habitat within the West Arm (Galaiduk et al. 2019 and Siwabessy et al. 2020).

5 CONTAMINANT LOADS

Contaminant loads were calculated for DP1 (MWD1) over the reporting period. As tabulated in section 2.2, discharge from DP1 commenced on 23 February 2023 and ceased 5 April 2023. The calculations were based on the daily discharge volume and concentration of contaminant present in the discharge on that day. On the days when a sample was not taken, the concentration of the contaminant was estimated using linear interpolation methodology.

The contaminant loads for the reporting period are shown in Table 5-1. The contaminants are listed in order of load (highest to lowest).

Table 5-1. Monthly and annual contaminant loads

Parameter	Feb (kg)	Mar (kg)	Apr (kg)	Total (kg)
Total Suspended Solids	28.57	2,310	574	2,912
Sulphate	45.71	1,568	178.5	1,792
Total Nitrogen	153.2	1323	132	1,609
Oxides of Nitrogen	133.1	1172	108.4	1,414
Nitrate	132	1170	108.2	1,410
Chloride	28.38	525.4	52.5	606
Iron	0.98	119.8	40.36	161
Aluminium	1.69	103.1	28.74	134
Ammonia	4.73	26.82	6.79	38.4
Lithium	3.75	25.57	2.20	31.5
Total Phosphorus	0.244	3.716	0.840	4.80
Nitrite	1.19	3.22	0.25	4.71
Copper	0.006	1.248	0.039	1.29
Filterable Reactive Phosphorus	0.016	0.670	0.035	0.72
Zinc	0.03	0.59	0.09	0.714
Arsenic	0.018	0.208	0.025	0.250
Nickel	0.01	0.18	0.04	0.223
Chromium	0.006	0.097	0.025	0.127
Cadmium	0.001	0.010	0.001	0.012

6 LONG TERM TREND ANALYSIS

Operations at GLP commenced in October 2022. This report is the first WDL monitoring report since commencing operations, and previous data are limited to baseline data from which the site-specific trigger values were developed. The data do not permit an assessment of long-term temporal trends.

7 IMPACTS OF WASTEWATER DISCHARGE

The macroinvertebrate data showed an impairment of the community at UC2, directly downstream of DP1, and improvements in aquatic ecosystem health with distance downstream. Whilst the decline cannot be directly attributed to the discharge from MWD1, turbidity was identified as impacting macroinvertebrate health directly downstream at this site. Short duration peaks in turbidity are common in the head waters of ephemeral creeks.

pH, whilst elevated when compared to the WDL248 TV, was consistent across all sites except for GUS SW7. Following the collection of an additional 12 months of data, it may be timely to revisit the baseline and upstream site data and amend the TV as appropriate.

No algal blooms or similar indicators of nutrient enrichment were observed over the reporting period. All chl-a concentrations are comparable between sites, with the highest concentrations observed at the marine sampling locations.

Following discharge, the data indicate that nitrate is quickly bound to organic matter. TN at MWD1 and the mine pit sump is dominated by nitrate. All remaining monitoring locations, including at SW1 immediately downstream of DP1 are dominated by TKN, indicating at these sites the nitrogen is organically bound and less bioavailable (Figure 4-10). LDGNT intend to review the baseline and upstream site data and seek an amendment to the WDL248 TV for TN, to better reflect potential downstream impact and initiate appropriate response to prevent that impact.

Arsenic concentrations in surface water downstream of DP1 do not indicate an impact relating to discharge. Fluvial sediment data, however, suggest that arsenic is either naturally present in sediments in the catchment or bound in sediments that are being transported from the site. The particle size distribution data indicate that the bioavailability of arsenic at GDS SW5 is likely limited given the coarseness of the sediment. The data indicate a potential risk to aquatic ecosystems, should arsenic become bioavailable, via resuspension under differing pH conditions for example.

No impacts on downstream riparian vegetation were observed for the reporting period.

No seagrass was detected at the Darwin Harbour monitoring sites GDSDH1, GDSDH2 and GDSDH3. This is consistent with the benthic habitat mapping for Darwin Harbour, which shows low likelihood of seagrass habitat within West Arm. As per the WDL Monitoring Program (Appendix B), LDGNT intend to seek an amendment to WDL248 to remove the requirement to monitor seagrass in West Arm.

8 CONCLUSION

The data collected over the reporting period indicate that the sediment basins are the primary source of suspended solids, aluminium, and iron. To address this and the exceedances identified during this reporting period, LDGNT has commenced construction of High Efficiency Sediment Basins at basin 1 and 4, implementation of improved baffles at basins 3 and 5, and improved water treatment methodologies for Sediment Basin 2. These works will, respectively, reduce the requirement for active management of turbid stormwater runoff, improve efficacy of flocculants, and improve treatment response times. These works will be completed and stabilised prior to commencement of the 2023/24 wet season. A description of this work is provided in section 2.1 of this report.

The exception to this is nitrogen (nitrate) which was higher in the mine pit sump and MWD1. A total of 214.4 ML of wastewater was discharged from MWD1 over the reporting period, significantly reducing the inventory of TN impacted water. This discharge was permitted under an amendment to WDL 248, for the 2022/23 wet season only. An internal contaminant source assessment identified flooding of a loaded blast pattern following a series of short duration high intensity rain events, as the principal source of dissolved nitrate. LDGNT have undertaken an audit of blast management practices and will implement an improvement plan to monitor and reduce the potential for products of blasting to impact water quality. The revised TN TV of 1.5 mg/L, or ammonia of 0.9 mg/L was not exceeded at GDS SW5.

LDGNT will review and update the WDL248 Monitoring Program considering the first 12 months of operations and the data analysis undertaken to compile this monitoring report. Also, LDGNT will seek an amendment to WDL conditions and guideline values to reflect this improved understanding of background water quality and flow conditions.

The following actions are proposed to improve the WDL 248 Monitoring Program:

- Addition of total organic carbon (TOC) and dissolved organic carbon (DOC) to the list of parameters for surface water.
- Monitoring of sediment quality in the GLP sediment basins.
- Undertaking total and weak acid extractable metal analysis for sediments.
- Arsenic concentrations will continue to be monitored closely to understand trends associated with active discharge, annual rainfall and erosion and sedimentation.

The following actions are proposed to improve water management in accordance with conditions of WDL248:

- Drone application of water treatment chemicals to reduce reagent use, improve treatment efficacy, and speed of reaction.
- Install high efficiency sediment basins equipped with rainfall triggered automatic dosing units to reduce workload and improve efficiency.
- Complete construction of water piping infrastructure to enable water to be managed on site between infrastructure to maximise storage capacity and onsite water usage.
- Complete construction of additional water storage capacity to enable retention of mine affected water on site and therefore reduce licence water extraction of raw water during the dry season.

9 REFERENCES

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APPENDIX A WDL248

APPENDIX B WDL248 MONITORING PROGRAM

APPENDIX C TABULATED WATER QUALITY MONITORING DATA

APPENDIX D TABULATED SEDIMENT QUALITY MONITORING DATA

APPENDIX E MACROINVERTEBRATE SAMPLING REPORT: FRESHWATER

APPENDIX F MACROINVERTEBRATE SAMPLING REPORT: MARINE

To be provided separately

APPENDIX G SEAGRASS MONITORING REPORT

APPENDIX H RIPARIAN VEGETATION MONITORING REPORT