CONSTRUCTION MONITORING REPORT
NOVEMBER 2021 TO APRIL 2022

Sydney Metro City & Southwest

Package 5 & 6

Customer: Sydney Metro

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Rev 0	01/06/2022	Approved	

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Compliance Matrix

Condition	Requirement	Compliance
MCoA C14	The results of the Construction Monitoring Programs must be submitted to the Planning Secretary, and relevant regulatory agencies, for information in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program.	This Construction Monitoring Report

Introduction

This Construction Monitoring Report has been prepared in accordance with Condition C14 of Critical State Significant Infrastructure Planning Approval 8256. It contains the results of Noise and Vibration Monitoring Program and the Water Quality Monitoring Programs, conducted as part of the station upgrades and Metro Services Building (MSB) construction at:

- Dulwich Hill (Package 5)
- Hurlstone Park (Package 6)
- Campsie (Package 5)
- Belmore (Package 6)
- Wiley Park (Package 6)
- Punchbowl (Package 5)

This report details the results of the noise, vibration and surface water monitoring conducted for a period of six (6) months of construction of Package 5 and Package 6 of the Sydney Metro Southwest Project. Construction of these packages commenced on 21 April 2021 and this report details the results of the monitoring undertaken from 8 November 2021 to 7 April 2022. Monitoring results for the first six months (approximately) of the project have been covered in a separate Construction Monitoring Report[1].

Submission Requirements

In accordance with condition the Ministers Conditions of Approval (MCoA) C14, Construction Monitoring Report will be submitted to the following agencies for information:

- Inner West Council;
- City of Canterbury Bankstown; and
- DPE.

The Independent Environmental Representative for DPE will review the report prior to submission.

Surface Water Monitoring

The project sites are located within the rail corridor on the T3 Bankstown line between Dulwich Hill and Punchbowl, New South Wales (NSW). The project sites form part of the overall Cooks River catchment with water from the area discharging into the Cooks River via local stormwater drainage or overland flow. The catchment area is highly urbanised with mixed residential, commercial and industrial properties.

[1] Please refer to documents SMCSWSW5-DEW-WEC-EM-REP-001258 (Package 5) and SMCSWSW6-DEW-WEC-EM-REP-001153 (Package 6).

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The closest Project worksite to an existing watercourse is the Wiley Park Station services building, which is located approximately 100m from an unnamed concrete-lined channel, which forms the upper reaches of Coxs Creek and is identified as a first-order stream within the Cooks River Catchment. Water quality is measured on an ongoing basis for the wider Cooks River catchment by the NSW Department of Planning & Environment (DPE) as part of the Beachwatch programme. The monitoring point is at Kyeemagh Baths at the mouth of the Cooks River in Port Botany. Water quality within the Cooks River catchment is influenced by stormwater, fertilisers, industrial discharges and sewage contamination. Objectives for water quality management during construction are:

- Minimise pollution of surface water through appropriate erosion and sediment control;
- Maintain existing water quality of surrounding surface watercourses.

The water quality monitoring program, in accordance with Table 13 of the SWMP, is to be undertaken quarterly in response to wet weather events (four wet weather events - >20mm of rain per 24 hours - per year), and also including dry weather sampling. Additional surface water monitoring is undertaken during construction to monitor the effectiveness of measures for managing soil and water impacts implemented. It must be conducted for the duration of construction or unless otherwise agreed to by Downer, Sydney Metro and the Independent Environmental Representative for DPE. Details of the Water Quality Monitoring Program and the mitigation measures to reduce the impact of the construction activities are contained within the Soil and Water Management Plans listed below:

- Southwest Metro – Dulwich Hill, Campsie and Punchbowl Station Upgrades Soil and Water Management Plan. This document can be accessed via the Downer Sydney Metro Environment Documents website.

https://www.downergroup.com/Content/cms/Documents/Sydney_Metro_package_5_6/Dulwich_Hill_Campsie_and_Punchbowl_SWMP_Rev07.pdf

- Southwest Metro – Hurlstone Park, Belmore and Wiley Park Station Upgrades Soil and Water Management Plan. This document can be accessed on the Downer Sydney Metro Environment Documents website:

https://www.downergroup.com/Content/cms/Documents/Sydney_Metro_package_5_6/Hurlstone_Park__Belmore_and_Wiley_Park_SWMP_Rev07.pdf

RESULTS - SURFACE WATER MONITORING

In accordance with Table 21.4 of the EIS, Vol. 1B, the water quality trigger values relevant for the project are the following:

Indicator	Criteria (lowland rivers)
Total phosphorus	50 ug/L
Total nitrogen	500 ug/L
Chlorophyll-a	5 ug/L
Turbidity	6–50 NTU
Salinity (electrical conductivity)	125–2,200 uS/cm
Dissolved oxygen (per cent saturation)	85–110 %
pH	6.5–8.5

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A summary of the Surface Water Monitoring Results is contained within the table below. The complete Surface Water Monitoring Reports are contained within Appendixes 1-4. Bold red text indicates initial criteria exceedances.

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Parameter	12 November 2021		26 November 2021		9-10 February 2022		23 February 2022		9 March 2022	
	WP1 (upstream)	WP2 (downstream)	WP1 (upstream)	WP2 (downstream)	WP1 (upstream)	WP2 (downstream)	WP1 (upstream)	WP2 (downstream)	WP1 (upstream)	WP2 (downstream)
Monitoring Event	Wet weather event (mid-construction)		Wet weather event (mid-construction)		Dry weather (mid-construction)		Wet weather event (mid-construction)		Wet weather event (mid-construction)	
Water Depth (m)	0.15	0.20	0.15	0.20	0.05	0.1	0.3-0.4	0.2-0.3	0.15-0.2	0.15-0.2
pH	8.10	8.42	**6.07**	7.34	**8.59**	**8.78**	7.50	7.62	7.78	7.85
Electrical Conductivity (µS/cm)	514	509.2	389.2	484	680	650	230	431	622	659
Dissolved Oxygen (mg/L)	6.42	5.63	9.05	9.31	7.21	5.06	4.94	6	5.38	5.34
Dissolved Oxygen (%)	**68**	**63**	98.7	101.9	92	**62.2**	**56.7**	**72**	**58.4**	**58.1**
SHE1 Redox Potential (mV)	70.8	80.4	183.7	196.3	240.3	196	261.5	287.6	282.3	290.4
Total Suspended Solids (TSS) (mg/L)	8.4	7.6	16	7.8	<5	<5	18	9.6	17	7.8
Turbidity (NTU)	21	19	25	17	2.9	1.2	37	28	31	22
Total phosphorus (mg/L)	**0.15**	0.02	**0.13**	**0.18**	**0.14**	**0.08**	**0.23**	**0.28**	**0.16**	**0.14**
Total nitrogen (mg/L)	**2.7**	**2.8**	**1.6**	**2.4**	**1.7**	**1.6**	**1.64**	**2.6**	**1.9**	**1.8**
Chlorophyll-a (mg/L)	<0.002	<0.002	<0.002	<0.0027	**<2**	**<2**	**<2**	**<2**	<0.002	<0.002
Condition	Clear, Low Turbidity	Clear, Low Turbidity	Clear, Low Turbidity	Clear, Low Turbidity	Clear, Low Turbidity	Clear, Low Turbidity	Clear, Low Turbidity	Clear, Low Turbidity	Clear, Low Turbidity	Clear, Low Turbidity
Oil and Grease (mg/L)	<10	<10	<10	<10	<10	<10	<10	<10	10	<10

Figure 1: WP1 and WP2 location map. Please note that only WP1-DP1 and WP2-DP1 are Downer's discharge points.

For reference, the previous monitoring events at these locations yielded the results below[2]:

Parameter	10 March 2021		20 March 2021		5 May 2021		1 July 2021	
	WP1 (upstream)	WP2 (downstream)	WP1 (upstream)	WP2 (downstream)	WP1 (upstream)	WP2 (downstream)	WP1 (upstream)	WP2 (downstream)
Monitoring Event	Dry weather pre-construction baseline measurement		Wet weather event (mid-construction)		Wet weather event (mid-construction)		Quarterly sampling mid-construction event	
Water Depth (m)	0.03	0.03	0.3	0.3	0.05	0.3	0.05	0.1
pH	7.9	7.61	8.10	7.58	7.8	7.73	**9.01**	**8.83**
Electrical Conductivity (µS/cm)	54	363	246.2	133.4	**2500**	92.9	910	530.3
Dissolved Oxygen	5.64	4.09	4.79	3.92	6.35	5.95	11.21	7.92

[2] Discussion of these results are included in Construction Monitoring Report 1 (April to November 2021), SMCSWSW5-DEW-WEC-EM-REP-001258 (Package 5) and SMCSWSW6-DEW-WEC-EM-REP-001153 (Package 6).

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Parameter	10 March 2021		20 March 2021		5 May 2021		1 July 2021	
	WP1 (upstream)	WP2 (downstream)	WP1 (upstream)	WP2 (downstream)	WP1 (upstream)	WP2 (downstream)	WP1 (upstream)	WP2 (downstream)
(mg/L)								
Dissolved Oxygen (%)	**63**	**45.9**	**52.87**	**43.18**	**65.3**	**62.8**	108.8	**77.9**
SHE1 Redox Potential (mV)	140.7	181.0	122.3	135.9	164.6	109.2	53.7	122.4
Total Suspended Solids (TSS) (mg/L)	<1	<1	9.2	35	4	47	4	4.4
Turbidity (NTU)	2.9	<1	9.3	13	4.3	21	4.1	6.3
Total phosphorus (mg/L)	**0.34**	**0.12**	**<0.5**	**<0.5**	**0.21**	**0.15**	**0.18**	**0.13**
Total nitrogen (mg/L)	**2.5**	**1.68**	**2.3**	**2.3**	**5**	**1**	**1.3**	**3.1**
Chlorophyll-a (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.001
Condition	Clear Low turbidity Sheen observed	Clear Low turbidity Sheen observed	Brown Medium turbidity	Brown Medium turbidity	Clear Low to medium turbidity Sheen observed	Clear Low to medium turbidity	Clear Minor sheen observed	Clear Low turbidity
Oil and Grease (mg/L)	<10	29	<10	<10	<10	<10	<10	<10

Wet weather event (mid-construction): 12 November 2021

The sampling event was considered as a mid-construction wet-weather event based on the rainfall data recorded by two nearby weather stations:

- Canterbury Racecourse AWS station (ID: 066194): approximately 4.6 km from the site with the rainfall data recorded 19.8 mm (i.e. marginally below the 20 mm threshold) over the last 24 hours prior to the field sampling;
- Marrickville Golf Club station (ID: 066036): approximately 6.4 km from the site with the rainfall data recorded 22.0 mm (i.e. above the 20 mm threshold) over the last 24 hours prior to the field sampling.

At the time of sampling, minor flow contribution was observed on discharge point (WP1-DP1) immediately downstream / north of WP1. For the downstream of work area, the two discharge points (WP2-DP1 and WP2-DP2) within the rail corridor immediately upstream / south from WP2 were having minor flow contribution.

The results of the monitoring event indicated that:

- Concentrations of Chlorophyll-a were reported below the laboratory detection limit and adopted assessment criteria at all sample locations;
- Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations;
- Concentrations of inorganics were reported above the adopted assessment criteria with the total nitrogen concentration within both the WP1 and WP2 samples, and the total phosphorous

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concentration for WP1, but total phosphorous concentration WP2 (0.020) was below adopted assessment criteria;
- TSS concentrations were detected within both WP1 and WP2, with concentrations of 8.4 mg/L at WP1 and 7.6 mg/L at WP2
- Turbidity ranged from 21 NTU at WP1 to 19 NTU at WP2, values below adopted assessment criteria.

Results for upstream and downstream sampling on 12 November 2021 were comparable to baseline measurements, with the exception of:
- Dissolved Oxygen (DO) saturation measured at both WP1 and WP2 were outside the adopted criterion range. The downstream WP2 location had slightly lower DO (63%) compared to the upstream WP2 location (68%). Overall, this is not considered to be a significant issue, based on similar results obtained from both previous mid-construction wet-weather sampling events on 20 March 2021 and 5 May 2021. Also, the DO saturation measurements undertaken during the pre-construction dry-baseline event on 10 March 2021 returned 63.0% for WP1 and 45.9% for WP2 indicating these mid-construction wet-weather results are closer to the adopted thresholds than the baseline event;
- Phosphorous result was above the adopted threshold at upstream WP1 sample (0.15 mg/L). However, the concentration was lower at the downstream WP2 sample (0.02 mg/L) and below the adopted threshold; and
- Nitrogen levels were comparable to baseline values at WP1 (2.7 mg/L), with slightly higher levels at WP2 (2.8 mg/L).

The comparison of the wet-weather mid-construction event on 12 November 2021 with two previous wet-weather sampling events on 20 March 2021 and 5 May 2021 showed no significant difference. Based on comparison to the criteria, comparison with two previous mid-construction wet-weather events, and comparison of the upstream and downstream results, the results reported for the 12 November 2021 sampling event are not considered to reflect an adverse impact to water quality due to construction activities.

Wet weather event (mid-construction): 26 November 2021

The sampling event was considered as a mid-construction wet-weather event based on the rainfall data recorded by two nearby weather stations:
- Canterbury Racecourse AWS station (ID: 066194): approximately 4.6 km from the site with the rainfall data recorded 43.8 mm (i.e. above the 20 mm threshold) over the last 24 hours prior to the field sampling;
- Marrickville Golf Club station (ID: 066036): approximately 6.4 km from the site with the rainfall data recorded 46.0 mm (i.e. above the 20 mm threshold) over the last 24 hours prior to the field sampling.

At the time of sampling, flow contribution was observed on discharge point (WP1-DP1) immediately downstream / north of WP1 (upstream of work area). The two discharge points (WP2-DP1 and WP2-DP2) within the rail corridor immediately upstream / south from WP2 also had flow contribution at the time of sampling.

The results of the monitoring event indicated that:

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- Concentrations of Chlorophyll-a were reported below the laboratory detection limit and/or adopted assessment criteria at all sample locations;
- Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations;
- Concentrations of inorganics were reported above the adopted assessment criteria with the total nitrogen concentration within both the WP1 and WP2 samples, and the total phosphorous concentration within both the WP1 and WP2;
- TSS concentrations were detected within both WP1 and WP2, with concentrations of 16 mg/L at WP1 and 7.8 mg/L at WP2; and
- Turbidity ranged from 25 NTU at WP1 to 17 NTU at WP2.

Results for upstream and downstream sampling on 26 November 2021 were comparable, with the exception of:

- pH was outside the adopted criterion range at upstream WP1 sample (6.07); however, within the adopted criterion range at downstream WP2 sample (7.34).
- Concentrations of total phosphorous and total nitrogen were outside the adopted criterion range at upstream and downstream sampling locations and the downstream showed to have slightly higher concentrations compared to the upstream sample. However, the concentrations were generally consistent with the previous two mid-construction wet-weather events.

The comparison of the wet-weather mid-construction event on 26 November 2021 with two previous wet-weather sampling events on 20 March 2021 and 5 May 2021 showed no significant difference. Based on comparison to the criteria, comparison with two previous mid-construction wet-weather events, and comparison of the upstream and downstream results, the results reported for the 26 November 2021 sampling event are not considered to reflect an adverse impact to water quality due to construction activities.

Mid-Construction Dry-Weather Event – 9 and 10[3] February 2022

The sampling event was undertaken on 9 February 2022 during a dry-weather event with 0 mm precipitation over the last 24 hours prior to the field sampling (rainfall data was obtained from the closest Bureau of Meteorology weather station, i.e. Canterbury Racecourse AWS - station ID: 066194).

The results of the monitoring event indicate that:

- Concentrations of Chlorophyll-a were reported below the laboratory detection limit and adopted assessment criteria at all sample locations;
- Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations;
- Concentrations of inorganics were reported above the adopted assessment criteria with the total nitrogen concentration and the total phosphorous concentration within both the WP1 and WP2 samples;
- Total Suspended Solids (TSS) concentrations were reported below laboratory detection limit at all sample locations; and
- Turbidity ranged from 2.9 NTU at WP1 to 1.2 NTU at WP2.

[3] Chlorophyll-a was resampled at both WP1 and WP2 on 10 February 2022 due to damage of the sample containers during the transportation following the initial sampling work on 9 February.

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Results for the mid-construction dry-weather event sampled on 9 and 10 February 2022 generally showed monitored parameters were within the adopted threshold criteria, with the exception of dissolved oxygen, total nitrogen, total phosphorous, and pH:

- Dissolved oxygen saturation measured at WP1 (92.0%) was within the adopted criterion range whereas WP2 (62.2%) was below the adopted criterion range. This is not considered to be a significant issue, due to the pre-construction monitoring results showing saturations of 63% and 45.9% for WP1 and WP2 respectively, indicating this mid-construction results are close to the adopted thresholds than the preconstruction event;
- Total nitrogen measured at both WP1 and WP2 were above the adopted criterion range with the analytical results of 1.7 mg/L and 1.6 mg/L for WP1 and WP2 respectively. Overall, this is not considered to be a significant issue, due to the pre-construction monitoring results showing the total nitrogen concentrations of 2.5 mg/L and 1.68 mg/L for WP1 and WP2 respectively, indicating mid-construction results are closer to the adopted thresholds than the pre-construction event;
- Phosphorous measured at both WP1 and WP2 were above the adopted criterion range with the analytical results of 0.14 mg/L and 0.08 mg/L for WP1 and WP2 respectively. Overall, this is not considered to be a significant issue, due to the pre-construction monitoring results showing total phosphorus of 0.34 mg/L and 0.12 mg/L for WP1 and WP2 respectively, indicating mid-construction results are closer to the adopted thresholds than the pre-construction event;
- pH results were above the adopted criterion range in both sampling locations with the analytical results of 8.59 and 8.78 for WP1 and WP2 respectively. Overall, this is not considered to be a significant issue since the exceedance is only slightly above the adopted criteria.

Results between upstream and downstream samples collected during the mid-construction dry-weather event were comparable, with the exception of:

- pH results were slightly above the adopted threshold in both sampling locations, with similar results of 8.78 at the downstream sample and 8.59 at the upstream sample. Overall, this is not considered to be a significant issue since the difference of the upstream and downstream pH results is less than 2.5%.

Overall, conditions are similar in the pre-construction results and the mid-construction sampling event on 9 and 10 February 2022. Results between upstream and downstream samples collected during the mid-construction dry-weather event were comparable with exception of a slight increase (less than 0.2 pH unit) in pH measured at the downstream sample compared to the upstream sample. These minor exceedances are not considered to reflect an adverse impact to water quality due to construction activities.

Mid-Construction Wet-weather Event – 23 February 2022

The sampling event was considered as a mid-construction wet-weather event based on the rainfall data recorded by the nearby weather station:

- Canterbury Racecourse AWS station (ID: 066194): approximately 4.6 km from the site with the rainfall data recorded 117.8 mm over the last 24 hours prior to the field sampling.

At the time of sampling, one discharge point (WP1-DP1) was observed immediately downstream / north of WP1 with high flow contribution to the stream. During the sampling event, the two discharge points (WP2-DP1 and WP2-DP2) within the rail corridor immediately upstream / south from WP2 were observed. High

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flow contribution from both discharge points were observed at the time of sampling. It is noted that WP2-DP2 was observed to have greater flow contribution than WP2-DP1.

The results of the monitoring event indicate that:

- Concentrations of Chlorophyll-a were reported below the laboratory detection limit and adopted assessment criteria at both sample locations;
- Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations;
- Concentrations of total nitrogen and the total phosphorous were reported above the adopted assessment criteria within both WP1 and WP2 samples.
- TSS concentrations were detected within both WP1 and WP2, with concentrations of 18 mg/L at WP1 and 9.6 mg/L at WP2; and
- Turbidity was detected with concentration of 37 NTU at WP1 to 28 NTU at WP2.

Results for the mid-construction wet-weather event sampled on 23 February generally showed monitored parameters were within the adopted threshold criteria, with the exception of dissolved oxygen saturation, total nitrogen, and total phosphorous.

- Dissolved oxygen saturation measured at both WP1 (56.7%) and WP2 (72%) were below the adopted criterion range. However, this is not considered to be a significant issue because the concentration of dissolved oxygen saturation at WP2 (downstream) was closer to the adopted criterion range in comparison to WP1 (upstream);
- Total nitrogen measured at both WP1 (1.64 mg/L) and WP2 (2.6 mg/L) were above the adopted criterion range. However, the results from the previous mid-construction wet-weather sampling events show that total nitrogen at WP1 fluctuated between 1.6 mg/L and 5.0 mg/L whereas total nitrogen for WP2 fluctuated between 1.0 mg/L and 2.8 mg/L. Furthermore, the total nitrogen for both WP1 and WP2 sampled on the 23 February 2022 monitoring event were similar to the previous event ranges. As such, this increase in total nitrogen is not considered to be a significant issue.
- Total phosphorous measured at both WP1 (0.23 mg/L) and WP2 (0.28 mg/L) were above the adopted criterion range. However, the results are similar to the results from previous mid-construction wet-weather.

Results for upstream and downstream sampling on 23 February 2022 were comparable, with the exception of:

- Dissolved Oxygen (DO) saturation measured at the downstream WP2 location had higher DO saturation (72%) compared to the upstream WP1 location (56.7%). However, this is not considered to be a significant issue since the downstream result was closer to the criterion range in comparison to the upstream;
- Concentrations of total nitrogen at downstream sample was slightly higher than the upstream sample. However, this is not considered to be a significant issue, since the concentrations were generally consistent with the previous four mid-construction wet-weather events;
- Concentrations of total phosphorous results at downstream sample was slightly higher than the upstream sample. However, this is not considered to be a significant issue since the results were generally consistent with the previous four mid-construction wet-weather events;
- The pH result at downstream sample (7.62) was slightly higher than the result at upstream sample (7.50). However, this is not considered to be a significant issue since the pH measurements at

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both sample points were within the adopted criterion range and the difference of the upstream and downstream pH results is only 1.6%;
- The Electrical Conductivity (EC) result at the downstream sample (431 µS/cm) was higher than the upstream sample (230 µS/cm). However, this is not considered to be a significant issue since the EC measurements at both sample points were within the adopted criterion range and the EC values were generally consistent with the previous four mid-construction wet-weather events.

During this wet-weather monitoring event, sampling results showed monitored parameters were generally within the adopted screening criteria with the exception of dissolved oxygen saturation, total nitrogen, and total phosphorous. The comparison of the mid-construction wet-weather event conducted on 23 February 2022 to the four previous wet-weather sampling events on 20 March, 5 May, 12 November and 26 November 2021 showed no significant difference.

During this wet-weather monitoring event, the results between upstream and downstream were generally comparable with the exceptions of pH, EC, DO, total nitrogen, and total phosphorous. The pH and EC measurements at the downstream sample were slightly higher than the upstream sample, but both downstream and upstream results were within the criterion range. The DO result at the downstream sample was higher than the upstream sample, but it was closer to the adopted criterion range compared to the upstream sample. The total nitrogen and total phosphorous results at the downstream sample were slightly higher than the upstream sample, but the results at both upstream and downstream samples were generally consistent with the previous four mid-construction wet-weather events. Overall, the comparison of the upstream and downstream samples conducted on 23 February showed no significant difference.

Based on comparison to the criteria, comparison with four previous mid-construction wet-weather events, and comparison of the upstream and downstream results, the results reported for the 23 February 2022 sampling event are not considered to reflect an adverse impact to water quality due to construction activities.

Mid-Construction Wet-weather Event – 9 March 2022

The sampling event was considered as a mid-construction wet-weather event based on the rainfall data recorded by the nearby weather station:
- Canterbury Racecourse AWS station (ID: 066194): approximately 4.6 km from the site with the rainfall data recorded 68.6 mm over the last 24 hours prior to the field sampling.

At the time of sampling, WP1 (upstream of work area) contained high flowing clear water with low turbidity, as well as WP2 (downstream of work area). One discharge point (WP1-DP1) was observed immediately downstream/ north of WP1. Medium flow contribution was observed at the time of sampling. For WP2 (downstream of work area), the two discharge points (WP2-DP1 and WP2-DP2) within the rail corridor immediately upstream / south from WP2 were observed. Medium level of flow contribution was observed from discharge point WP2-DP1 and high level of flow contribution was observed from discharge point WP2-DP2.

The results of the monitoring event indicate that:
- Concentrations of Chlorophyll-a were reported below the laboratory detection limit at both sample locations;
- Concentrations of Oil and Grease were reported at 10 mg/L within the upstream sample (WP1) and below laboratory detection limit within the downstream sample (WP2);

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- Concentrations of total nitrogen and the total phosphorous were reported above the adopted criteria within both WP1 and WP2 samples;
- TSS were reported with concentration of 17 mg/L at upstream sample (WP1) and 7.8 mg/L at downstream sample WP2; and
- Turbidity was reported with concentration of 31 NTU at upstream sample (WP1) and 22 NTU at downstream sample (WP2).

One sampling event during the pre-construction period (baseline event) was undertaken on 10 March 2021 which was during dry condition. It should be noted that wet-weather and storm-event pre-construction monitoring was not able to be conducted because of the lack of rainfall. The monitoring results of baseline event (10 March 2021) has not been used for comparison with the monitoring results under this report because the conditions encountered were different (i.e. non-trigger for wet-weather event criteria). However, five previous mid-construction wet weather sampling events were used to compare and check if there is any potential adverse impact to the water quality caused by the construction activities. Overall, conditions are similar between upstream and downstream samples on 9 March 2022 and previous mid-construction wet weather events.

Results for the mid-construction wet-weather event sampled on 9 March 2022 generally showed monitored parameters were within the adopted threshold criteria, with the exception of dissolved oxygen saturation, total nitrogen, and total phosphorous:

- Dissolved oxygen saturation measured at both upstream sample (WP1: 58.4%) and downstream sample (WP2: 58.1%) were outside of the adopted criterion range (i.e., 85% to 110%). However, this is not considered to be a significant issue as the difference measured between WP1 and WP2 is minor with only 0.5% difference;
- Total nitrogen measured at both upstream sample (WP1: 1.9 mg/L) and downstream sample (WP2: 1.8 mg/L) were above the adopted criteria (i.e. 0.350 mg/L). However, the results from the previous mid-construction wet-weather sampling events show that total nitrogen at WP1 fluctuated between 1.6 mg/L and 5.0 mg/L whereas total nitrogen for WP2 fluctuated between 1.0 mg/L and 2.8 mg/L. Furthermore, the total nitrogen for both WP1 and WP2 sampled on the 9 March 2022 monitoring event were similar to the previous event ranges. As such, this elevated in total nitrogen concentrations is not considered to be a significant issue;
- Total phosphorous measured at both upstream sample (WP1: 0.16 mg/L) and downstream sample (WP2: 0.14 mg/L) were above the adopted criteria (i.e. 0.025 mg/L). However, the results from the previous mid-construction wet-weather sampling events show that total phosphorous at WP1 fluctuated between 0.13 mg/L and 0.23 mg/L whereas total phosphorous at WP2 fluctuated between 0.02 mg/L and 0.28 mg/L. Furthermore, the total phosphorous for both WP1 and WP2 sampled on the 9 March 2022 monitoring event were similar to the previous event ranges. As such, this elevated in total phosphorus concentrations is not considered to be a significant issue;
- The pH result at upstream sample (WP1: 7.78) was measured slightly lower than the result at downstream sample (WP2: 7.85). However, this is not considered to be a significant issue since the pH measurements at both sample points were within the adopted criterion range and the difference of the upstream and downstream pH results is only 0.9%.
- The EC result at the upstream sample (WP1: 622 µS/cm) was measured lower than the downstream sample (WP2: 659 µS/cm). However, this is not considered to be a significant issue since the EC measurements at both sample points were within the adopted criterion range (125

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µS/cm to 2,200 µS/cm) and the difference of the upstream and downstream pH results is only 5.6%.

During this wet-weather monitoring event, sampling results showed monitored parameters were generally within the adopted screening criteria with the exception of dissolved oxygen saturation, total nitrogen, and total phosphorous. The comparison of the mid-construction wet-weather event conducted on 9 March 2022 to the four previous wet-weather sampling events on 20 March, 5 May, 12 November, 26 November 2021 and 23 February 2022 showed no significant difference.
During this wet-weather monitoring event, the results between upstream and downstream were generally comparable with the exceptions of pH and EC. The pH and EC measurements at the downstream sample were slightly higher than the upstream sample, but both downstream and upstream results were within the criterion range. Overall, the comparison of the upstream and downstream samples conducted on 9 March 2022 showed no significant difference.

Based on comparison to the criteria, comparison with four previous mid-construction wet-weather events, and comparison of the upstream and downstream results, the results reported for the 9 March 2022 sampling event are not considered to reflect an adverse impact to water quality due to construction activities at the subject site.

Discussion - Surface Water Monitoring

The results of the surface water monitoring showed that monitored parameters were generally within the adopted screening criteria; however, some results showed parameters outside of the screening criteria. Overall, the comparison of the upstream and downstream samples conducted on 23 February showed no significant difference. Based on comparison to the criteria, comparison with four previous mid-construction wet-weather events, and comparison of the upstream and downstream results, the results reported for the 23 February 2022 sampling event are not considered to reflect an adverse impact to water quality due to construction activities. No recommendations were put forward in response to the surface water monitoring results.

Downer conducts regular inspection of the environmental controls, including sediment and erosion controls at Wiley Park to ensure that all sediments and erosion controls were in place, well maintained and functioning correctly. These inspections are conducted by the Project Team and Environmental Team. This proactive approach ensures that environmental controls are functioning properly rather than reactively inspecting the worksite following monitoring and reporting.

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Noise and vibration

The area surrounding the project sites contains a variety of land-use types and receivers, including residential, commercial, industrial and sensitive non-residential receivers. These land-uses are mixed within the identified noise catchments, although in general there are clusters of industrial and commercial areas surrounding stations, primarily residential areas between stations. The area surrounding the project sites are affected by rail noise and vibration. The majority of works will occur within the rail corridor, on the station platforms and buildings and within the Metro Services Building Areas, works will mainly occur adjacent to residential properties.

Noise and vibration monitoring must be carried out for the duration of Construction. The predominant reason for monitoring noise and vibration associated with the construction works is to ensure compliance with modelled results for noisy works and to ensure compliance with modelled results and the project's Conditions of Approval(s) and NVMP. Modelling undertaken prior to noisy construction activities assesses if Respite Offers (RO) and Alternate Accommodation (AA) are required to be provided to sensitive receivers that are impacted by noise from works conducted outside of standard working hours.
Other reasons to conduct noise and vibration monitoring include:

- In response to noise or vibration complaints;
- If requested by Sydney Metro, the ER, DPE or EPA;
- To augment baseline noise levels, if the noise environment at a receiver is considered to be different from the noise logger locations used for the EIS;
- To validate predicted noise levels associated with each works scenario assessed in the CNVIS, at the commencement of works and new construction activities or location;
- To confirm baseline vibration levels currently experienced at heritage-listed structures and at any vibration-sensitive equipment;
- Where vibration levels are predicted to exceed the vibration screening level, attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure, in accordance with Revised Environmental Mitigation Measure (REMM) NVC12; and
- As part of a plant noise audit.

The methodology and rationale for conducting noise and vibration monitoring is contained within the relevant Noise and Vibration Monitoring Plans, being:

- Southwest Metro – Dulwich Hill, Campsie and Punchbowl Station Upgrades Noise and Vibration Management Plan. This document can be accessed via the Downer Sydney Metro Environment Documents website, https://www.downergroup.com/Content/cms/Documents/Sydney_Metro_package_5_6/Dulwich_Hill__Campsie_and_Punchbowl_Station_Upgrades_NVMP_Rev06_131221_C2.pdf

- Southwest Metro – Hurlstone Park, Belmore and Wiley Park Station Upgrades Noise and Vibration Management Plan. This document can be accessed via the Downer Sydney Metro Environment Documents website, https://www.downergroup.com/Content/cms/Documents/Sydney_Metro_package_5_6/Hurlstone_Park__Belmore_and_Wiley_Park_Station_Upgrades_NVMP_Rev06_131221_C2.pdf

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RESULTS – NOISE MONITORING

The table below contains a summary of the noise monitoring results. The complete reports are provided in Appendixes 6 – 8.

Assessment Point	Measured Plant	Predicted noise level dB(A)	Measured noise level		Above predicted noise level	Comments
			LAeq(15min)	LAmax		
18th – 19th December 2021	TL927-1-19F01 WE25 NOISE AND VIBRATION MONITORING REPORT (R2) - APPENDIX 6					
105 Duntroon Street, Hurlstone Park	Two 4T excavator with bucket attachment, two hi-rail Moxy trucks and handheld cutter 18.12.2021 08:17am - 08:31am	82_T (T: Predicted LAeq, 15min for Typical activities)	69	77	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the majority of the works were occurring on the western side of the platform at a lower ground level compared to monitoring location. As a result, the works were mostly shielded at this monitoring location. Furthermore, only two 4T excavators with bucket attachments, two hi-rail Moxy trucks and a handheld cutter were operating intermittently during this measurement. In the prediction model, the distance between the work area and the receiver is approximately 3 metres. The measured works were approximately 35m away from the monitoring location. These factors contribute to the measured noise level from the works being less noisy than the predicted noise level.
3A Commons Street, Hurlstone Park	Two 4T excavator with bucket attachment, two hi-rail Moxy trucks and handheld cutter 18.12.2021 08:36am - 08:52am	80_T (T: Predicted LAeq, 15min for Typical activities)	63	83	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted level. Factors contributing to this include the intermittent nature of the works during the measurement and less noisy plant operating during this measurement compared to the prediction assumptions. Furthermore, the measured works were approximately 45m away from the monitoring location, which is further than in the prediction model, where the distance between the closest typical impact work area and the most affected facade is approximately 10 metres.
57A Ewart Lane, Dulwich Hill	Handheld drill, vacuum truck, concrete saw and 5T excavator with hammer attachment 18.12.2021 09:43am - 09:59am	77_H (H: Predicted LAeq, 15min for High impact activities)	73* (*: 5dB(A) penalty applied for hammering works)	98	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the measured construction activity was approximately 35 metres away from the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 20 metres.
59 Ewart Street, Dulwich Hill	Handheld drill, vacuum truck, concrete saw and 5T excavator with hammer attachment 18.12.2021 10:00am - 10:15am	74_H (H: Predicted LAeq, 15min for High impact activities)	68* (*: 5dB(A) penalty applied for hammering works)	89	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the rockhammering activity only occurred for approximately 2 minutes of the 15 minute measurement period. Furthermore, the measured construction activity was approximately 40 metres away from the measurement location. In the prediction model, the distance

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						between the closest high impact work area and the most affected facade is approximately 25 metres.
13-15 Anglo Road, Campsie	Vacuum truck and 7T excavator with bucket attachment 18.12.2021 11:30am - 11:45am	74_T (T: Predicted LAeq, 15min for Typical activities)	61	73	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the measured noise level is significantly lower than the predicted noise level because less noisy plant were operating during this measurement compared to the prediction assumptions. Furthermore, the measured construction activity was approximately 80 to 95 metres away from the measurement location. In the prediction model, the distance between the closest typical work area and the most affected facade is approximately 15 metres.
3 Wilfred Avenue, Campsie	Vacuum truck and 7T excavator with bucket attachment 18.12.2021 11:55am - 12:10pm	69_T (T: Predicted LAeq, 15min for Typical activities)	60	90	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the measured noise level is lower than the predicted noise level because only the vacuum truck and 7T excavator with bucket attachment were operating during this measurement, compared to noisier plant in the prediction assumptions. Furthermore, the measured construction activity was approximately 60 to 65 metres away from the measurement location. In the prediction model, the distance between the closest typical work area and the most affected facade is approximately 25 metres.
41 Urunga Parade, Punchbowl	4T excavator with hammer attachment, vacuum truck and handheld cutter 18.12.2021 02:04pm - 02:20pm	72_H (H: Predicted LAeq, 15min for High impact activities)	61* (*: 5dB(A) penalty applied for hammering works)	81	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the measured noise level is significantly lower than the predicted noise level because only the 4T excavator with hammer attachment, vacuum truck and handheld cutter were operating during this measurement, compared to noisier plant in the prediction assumptions. Furthermore, the measured construction activity was approximately 100 to 110 metres away from the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 80 metres.
228 The Boulevarde, Punchbowl	Handheld jackhammer, 4T excavator with hammer attachment and 4T excavator with bucket attachment 18.12.2021 02:37pm - 02:52pm	70_H (H: Predicted LAeq, 15min for High impact activities)	75* (*: 5dB(A) penalty applied for hammering works)	84	Yes ($L_{Aeq, 15min}$)	The measurement location is a commercial receiver. The measured $L_{Aeq, 15min}$ is higher than the predicted noise level, after applying the 5 dB(A) penalty. Note that this monitoring location was heavily affected by the constant road traffic along The Boulevarde throughout the measurement. It was not possible to measure the construction activity in the absence of traffic noise.
3 Shadforth Street, Wiley Park	Pressure washer 18.12.2021 03:09pm - 03:24pm	79_T (T: Predicted LAeq, 15min for Typical activities)	71	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted level. Note that the measured construction activity was approximately 15 metres away from the measurement location. In the prediction model, the distance

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						between the closest typical impact work area and the most affected facade is approximately 10 metres.
26th – 30th December 2021	TL927-1-20F01 SHUTDOWN 2 NOISE AND VIBRATION MONITORING REPORT (R2) - APPENDIX 7					
13-15 Anglo Road, Campsie	Two multi-crane hi-rail vehicles, handheld drills, concrete saw, hammering 26.12.2021 09:11pm – 09:26pm	74_T (T: Predicted LAeq, 15min for Typical activities)	60	83	No	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works occurring were located approximately 25m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Some plant operation and hi-rail movements were partially shielded by the station building.
	Concrete agitator and concrete pump truck 29.12.2021 09:45pm – 10:00pm	74_T (T: Predicted LAeq, 15min for Typical activities)	73	82	No ($L_{Aeq, 15min}$)	The measured LAeq, 15min is lower than the predicted noise level. Note that the concrete agitator and the concrete pump truck was located directly opposite of 13-15 Anglo Road receiver, approximately 10 metres away from the monitoring location.
	Concrete pump truck, plate compactor, hand tools including rattle gun and hammer 30.12.2021 09:00pm – 09:15pm	74_T (T: Predicted LAeq, 15min for Typical activities)	59	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 20m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the platform works were intermittent during this measurement.
35 North Parade, Campsie	3T Excavator with hammer attachment 26.12.2021 09:15pm – 09:30pm	57_T (T: Predicted LAeq, 15min for Typical activities)	67* (*: 5dB(A) penalty applied for hammering works)	77	Yes ($L_{Aeq, 15min}$)	The Gatewave model was based on typical impact activities, not high impact activities (i.e no rockhammer). The difference between typical and high impact activities sound power level is 10-12dB. The measured level is 10dB above the predicted level. This is consistent with a predicted level for high impact activities including rockhammer. The exceedance was identified immediately by the Project Noise & Vibration consultant and reported to the Construction Environmental Manager. The Environmental Manager managed the exceedance in accordance with the Project Construction Environmental Management Plan and Noise & Vibration Management Plan.
5 London Street, Campsie	Concrete truck, jumping jack	67_T	52	70	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant

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	compactor, hand tools 28.12.2021 10:25pm – 10:40pm	(T: Predicted LAeq, 15min for Typical activities)				items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 65m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that the platform works were intermittent during this measurement. The paving works at the corner of Beamish Street and North Parade were occurring during this measurement and was not audible at this monitoring location.
	Concrete agitator and concrete pump truck, hand grinder 29.12.2021 09:54pm – 10:10pm	67T (T: Predicted LAeq, 15min for Typical activities)	55	75	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 60m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that the platform works were intermittent during this measurement.
	Concrete agitator and concrete pump truck, handheld power drill, 8T excavator with bucket attachment 30.12.2021 08:56pm – 09:11pm	67T (T: Predicted LAeq, 15min for Typical activities)	53	77	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 60m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that the platform works were intermittent during this measurement.
1 Acacia Street, Belmore	Pressure washer 26.12.2021 09:56pm – 10:04pm	65T (T: Predicted LAeq, 15min for Typical activities)	N/A	N/A	N/A	Note that during this measurement, it started to rain after 8 minutes into the measurement. As a result, this measurement was adversely affected by the environmental conditions and have been deemed as an invalid measurement.
	Handheld jackhammer, light tower, concrete saw, handheld power tools 28.12.2021 09:29pm – 09:45pm	65T (T: Predicted LAeq, 15min for Typical activities)	60* (*: 5dB(A) penalty applied for hammering works)	68	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the handheld jackhammering activity was located approximately 65m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that the handheld jackhammering activity was shielded and intermittent during this measurement.

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	Hand tools including hand grinder and power drills 29.12.2021 10:30pm – 10:46pm	65T (T: Predicted LAeq, 15min for Typical activities)	50	64	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 40m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that the platform works were intermittent during this measurement.
	Handheld electric jackhammer, handheld power tools including grinder and drill, 15T excavator with bucket attachment 30.12.2021 09:41pm – 09:56pm	65T (T: Predicted LAeq, 15min for Typical activities)	58* (*: 5dB(A) penalty applied for hammering works)	73	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the handheld jackhammering activity was located approximately 65m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that the handheld jackhammering activity was shielded and intermittent during this measurement.
30 Redman Parade, Belmore	Handheld jackhammer and handheld grinder 28.12.2021 09:35pm – 09:50pm	63T (T: Predicted LAeq, 15min for Typical activities)	59* (*: 5dB(A) penalty applied for hammering works)	71	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the handheld jackhammering activity was located approximately 65m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 50 metres. Note that the handheld jackhammering activity was shielded and intermittent during this measurement.
	Excavator with quackers alarm 29.12.2021 10:24pm – 10:39pm	63T (T: Predicted LAeq, 15min for Typical activities)	54	73	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 85m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 50 metres. Note that the platform works were intermittent during this measurement.
	Plate compactor and handheld electric jackhammer 30.12.2021 09:39pm – 09:54pm	63T (T: Predicted LAeq, 15min for Typical activities)	59* (*: 5dB(A) penalty applied for hammering works)	73	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the handheld jackhammering activity was located approximately 65m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 50 metres. Note that

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						the handheld jackhammering activity was shielded and intermittent during this measurement.
41 Urunga Parade, Punchbowl	5T excavator with bucket attachment, lighting towers, Distant 8T excavator with bucket attachment, dump truck 26.12.2021 11:14pm – 11:29pm	65T (T: Predicted LAeq, 15min for Typical activities)	54	72	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. It is noted that the majority of plant operation occurred at the station building approximately 90m away from the measurement location. The background noise level at this location was dominated by generator hum from lighting towers located approximately 25m away from the measurement location. Measured excavator activity at this location occurred near the alignment approximately 50-60m away.
	Rattlegun, handheld power tools, hi-rail multi-crane vehicle, lighting towers 28.12.2021 11:44pm – 11:59pm	65T (T: Predicted LAeq, 15min for Typical activities)	53	70	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 20m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 15 metres. Some plant operation and hi-rail movements were partially shielded by the station building. Note that the platform works were intermittent during this measurement.
	Lighting towers, hi-rail 8T excavator with crane attachment 29.12.2021 08:17pm – 08:32pm	65T (T: Predicted LAeq, 15min for Typical activities)	53	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 30m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 15 metres. Some plant operation and hi-rail movements were partially shielded by the station building. Note that the platform works were intermittent during this measurement.
	Light towers, 5.5T excavator with bucket attachment, 8T excavator with bucket attachment 30.12.2021 10:54pm – 11:09pm	65T (T: Predicted LAeq, 15min for Typical activities)	54	74	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 20m away from the measurement location. The background noise level during the measurement was dominated by idle engine noise from the 5.5T excavator with bucket attachment. In the prediction model, the distance

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						between the closest work area and the most affected facade is approximately 15 metres. Note that the platform works was intermittent during this measurement.
14 Arthur Street, Punchbowl	No construction noise was audible at this monitoring location 26.12.2021 11:17pm – 11:32pm	50T (T: Predicted LAeq, 15min for Typical activities)	54 (44)1 (1: Calculated LAeq, 15min contribution from the construction activity, given that the construction noise was not audible or barely audible at the monitoring location)	70	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is higher than the predicted noise level. Note that the platform works occurring at Punchbowl Station was not audible at this monitoring location. The measured $L_{Aeq, 15min}$ of 54 dB(A) was solely caused by vehicles movement along The Boulevarde and Arthur Street. Given that the construction noise was not audible at this monitoring location, the contribution from the construction works can be assumed to be 10dB below the measured $L_{Aeq, 15min}$. As a result, the contribution from the construction works can be calculated to be 44 dB(A), which is below the predicted noise level of 50 dB(A). Note that the measured works were shielded and approximately 90 metres away from the measurement location.
	Lighting tower (which was barely audible when there was no road traffic along The Boulevarde and Arthur Street) 28.12.2021 11:48pm – 12:03am	50T (T: Predicted LAeq, 15min for Typical activities)	55 (45)1 (1: Calculated LAeq, 15min contribution from the construction activity, given that the construction noise was not audible or barely audible at the monitoring location)	76	Yes ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is higher than the predicted noise level. Note that the platform works occurring at Punchbowl Station was not audible at this monitoring location (a lighting tower was barely audible when there was no road traffic along The Boulevarde and Arthur Street). The measured LAeq, 15min of 55 dB(A) was solely caused by vehicles movement along The Boulevarde and Arthur Street. Given that the construction noise was barely audible at this monitoring location, the contribution from the construction works can be assumed to be 10dB below the measured LAeq, 15min. As a result, the contribution from the construction works can be calculated to be 45 dB(A), which is below the predicted noise level of 50 dB(A). Note that the measured works were shielded and approximately 90 metres away from the measurement location.
	Handheld grinder (which was barely audible when there was no road traffic along The Boulevarde and Arthur Street) 29.12.2021 08:10pm – 08:25pm	50T (T: Predicted LAeq, 15min for Typical activities)	56 (46)1 (1: Calculated LAeq, 15min contribution from the construction activity, given that the construction noise was not audible or barely audible at the monitoring location)	85	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is higher than the predicted noise level. Note that the platform works occurring at Punchbowl Station were not audible at this monitoring location (a handheld grinder was barely audible when there was no road traffic along The Boulevarde and Arthur Street). The measured $L_{Aeq, 15min}$ of 56 dB(A) was solely caused by vehicles movement along The Boulevarde and Arthur Street. Given that the construction noise was barely audible at this monitoring location, the contribution from the construction works can be assumed to be 10dB below the measured $L_{Aeq, 15min}$. As a result, the contribution from the construction works can be calculated

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						to be 46 dB(A), which is below the predicted noise level of 50 dB(A). Note that the measured works were shielded and approximately 90 metres away from the measurement location.
	No construction noise was audible at this monitoring location 30.12.2021 10:56pm – 11:11pm	50_T (T: Predicted LAeq, 15min for Typical activities)	57 (47)[1] (1: Calculated LAeq, 15min contribution from the construction activity, given that the construction noise was not audible or barely audible at the monitoring location)	82	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the platform works occurring at Punchbowl Station was not audible at this monitoring location. The measured $L_{Aeq, 15min}$ of 57 dB(A) was solely caused by vehicles movement along The Boulevarde and Arthur Street. Given that the construction noise was not audible at this monitoring location, the contribution from the construction works can be assumed to be 10dB below the measured $L_{Aeq, 15min}$. As a result, the contribution from the construction works can be calculated to be 47 dB(A), which is below the predicted noise level of 50 dB(A). Note that the measured works were shielded and approximately 90 metres away from the measurement location.
1-3 Shadforth Street, Wiley Park	Two 22.5T excavators with bucket attachment, handheld cutter, lighting towers 26.12.2021 11:50pm – 11:54pm	79_T (T: Predicted LAeq, 15min for Typical activities)	N/A	N/A	N/A	Note that during this measurement, it started to rain after 4 minutes into the measurement. As a result, this measurement was adversely affected by the environmental conditions and have been deemed as an invalid measurement.
	Concrete saw, hi-rail excavators and lighting tower 27.12.2021 08:03pm – 08:18pm	81_H (H: Predicted LAeq, 15min for High impact activities)	69* (*: 5dB(A) penalty applied for hammering works)	75	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the concrete sawing activity was shielded and approximately 65 metres away from the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 10 metres. Note that the concrete sawing activity was intermittent during this measurement.
	22.5T excavator with crane attachment, light towers, two 5T excavators with bucket attachment, hi-rail dump truck vehicles, bobcat, rattlegun, hand tools 28.12.2021 11:09pm – 11:25pm	79_T (T: Predicted LAeq, 15min for Typical activities)	60	72	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 20m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Some plant operation and hi-rail movements were partially shielded by the station

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						building. Note that the platform works were intermittent during this measurement.
	22.5T excavator with crane attachment, 8T excavator with auger attachment, hand grinders, hand tools, concrete saw 29.12.2021 08:55pm – 09:10pm	81_H (H: Predicted LAeq, 15min for High impact activities)	68* (*: 5dB(A) penalty applied for hammering works)	79	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the concrete sawing activity was shielded and approximately 20m metres away from the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 10 metres. Note that the concrete sawing activity was intermittent during this measurement.
	5T excavator with auger attachment, hand power tools including power drill, handheld grinder 30.12.2021 10:21pm – 10:36pm	79_T (T: Predicted LAeq, 15min for Typical activities)	57	78	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 20m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the platform works was shielded and intermittent during this measurement.
2 Shadforth Street, Wiley Park	22.5T excavator with crane attachment, shovel 28.12.2021 11:10pm – 11:25pm	81_T (T: Predicted LAeq, 15min for Typical activities)	53	65	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 40m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Some plant operation and hi-rail movements were partially shielded by the station building. Note that the platform works were intermittent during this measurement.
	22.5T excavator with crane attachment, concrete saw, rattle gun 29.12.2021 08:50pm – 09:05pm	83_H (H: Predicted LAeq, 15min for High impact activities)	65* (*: 5dB(A) penalty applied for hammering works)	73	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the concrete sawing activity was shielded and approximately 25m metres away from the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 10 metres. Note that the concrete sawing

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						activity was intermittent during this measurement.
	Hand tools including rattle gun and hammer 30.12.2021 10:19pm – 10:34pm	81T (T: Predicted LAeq, 15min for Typical activities)	55	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 30m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the platform works was shielded and intermittent during this measurement.
1 Bedford Crescent, Dulwich Hill	Handtools (grinder and hammer), hi-rail multi-crane vehicle, 13T excavator with crane attachment 28.12.2021 08:14pm – 8:29pm	75T (T: Predicted LAeq, 15min for Typical activities)	57	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works occurring were located approximately 50m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Some plant operation and hi-rail movements were partially shielded by the station building.
	Handheld jackhammer and lighting tower 29.12.2021 11:11pm – 11:26pm	76H (H: Predicted LAeq, 15min for High impact activities)	60* (*: 5dB(A) penalty applied for hammering works)	73	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the handheld jackhammering works occurring were located approximately 50m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 40 metres. Note that the jackhammering works were shielded and intermittent during this measurement.
	Concrete agitator and concrete pump truck 30.12.2021 08:03pm – 08:18pm	75T (T: Predicted LAeq, 15min for Typical activities)	59	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 80m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres.

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51 Ewart Lane, Dulwich Hill	Concrete saw, 8T excavator with crane attachment, hi-rail multi-crane vehicle, 13T excavator with crane attachment, lighting towers 28.12.2021 08:28pm – 08:43pm	74_H (H: Predicted LAeq, 15min for High impact activities)	68* (*: 5dB(A) penalty applied for hammering works)	78	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the concrete sawing activity was located approximately 30m away from the measurement location. The background noise level during this measurement was dominated by generator noise from the lighting towers. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the concrete sawing activity was intermittent during this measurement.
	Generators, lighting towers, cement mixers, 1.75T excavator with hammer attachment 29.12.2021 11:20pm – 11:36pm	72_T (T: Predicted LAeq, 15min for Typical activities)	59	74	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the rockhammering activity was located approximately 20m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the rockhammering was intermittent during this measurement.
	Cement agitator, handheld cement vibrator, light towers 30.12.2021 08:07pm – 08:22pm	72_T (T: Predicted LAeq, 15min for Typical activities)	60	77	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 20m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres.
05th February	TL927-1-21F01 2022 WE32 NOISE AND VIBRATION MONITORING REPORT (R1) – APPENDIX 8					
41 Urunga Parade, Punchbowl	Excavator with bucket attachment 05.02.2022 12:24pm – 12:39pm	73_T (T: Predicted LAeq, 15min for Typical activities)	54	74	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works were located approximately 60 metres away. In the prediction model, the distance between the closest work area and the most affected facade is approximately 15 metres. Note that the platform works were intermittent during this measurement.

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3A Commons Street, Hurlstone Park	3.5T Excavator with hammer attachment and hi-rail hydrema 05.02.2022 01:25pm – 01:40pm	82_H (H: Predicted LAeq, 15min for High impact activities)	69* (*: 5dB(A) penalty applied for hammering works)	84	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works were located approximately 15 metres away. In the prediction model, the distance between the closest work area and the most affected facade is approximately 5 metres. Note that the platform works were intermittent during this measurement.
2 Hopetoun Street, Hurlstone Park	Vacuum truck and telehandler 05.02.2022 01:55pm – 02:10pm	75_T (T: Predicted LAeq, 15min for Typical activities)	72	89	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the vacuum truck and telehandler activity were located directly opposite the monitoring location, approximately 10 metres away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 9 metres.
51 Ewart Lane, Dulwich Hill	Telehandler, hi-rail excavator with bucket attachment and handheld grinder 05.02.2022 02:58pm – 03:13pm	72_T (T: Predicted LAeq, 15min for Typical activities)	63	81	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the telehandler activity was located directly opposite the monitoring location, and repeatedly moved between 20 metres to 40 metres from the monitoring location during the measurement. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres.
1 Bedford Crescent, Dulwich Hill	Handheld grinder, hi-rail hydrema and handtools (hammer 05.02.2022 03:30pm – 03:45pm	75_T (T: Predicted LAeq, 15min for Typical activities)	56	77	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works were located approximately 60 metres away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Some plant operation and hi-rail movements were partially shielded by the station building. Note that the platform works were intermittent during this measurement.
30 Redman Parade, Belmore	Handheld grinder 05.02.2022 04:24pm – 04:39pm	63_T (T: Predicted LAeq, 15min for Typical activities)	63	87	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is the same as the predicted noise level. Note that the handheld grinder activity was located 60 metres away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 50 metres. Note that this measurement location was

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						heavily affected by road traffic noise along Redman Parade.
1 Acacia Street, Belmore	Vacuum truck, handheld grinder and hand tools (hammer) 05.02.2022 04:49pm – 05:04pm	65T (T: Predicted LAeq, 15min for Typical activities)	61	89	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the handheld grinder activity was located approximately 50 metres away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that this measurement location was heavily affected by road traffic noise along Acacia Street.
13-15 Anglo Road, Campsie	Excavator with bucket attachment, hi-rail hydrema and handtools (hammer) 05.02.2022 06:20pm – 06:35pm	74T (T: Predicted LAeq, 15min for Typical activities)	57	78	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 90 metres away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the platform works were intermittent during this measurement.
2 Wilfred Avenue, Campsie	Hi-rail hydrema, plate compactor and excavator with bucket attachment 05.02.2022 06:57pm – 07:12pm	70T (T: Predicted LAeq, 15min for Typical activities)	59	75	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 45 metres away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 25 metres. Note that the platform works were intermittent during this measurement. Note that the platform works were intermittent during this measurement.
1-3 Shadforth Street, Wiley Park	3 x EWP, excavator with bucket, rattle gun, 400T telescopic crane and handtools 05.02.2022 07:44pm – 07:59pm	79T (T: Predicted LAeq, 15min for Typical activities)	60	77	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 35 metres away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the platform works were intermittent during this measurement. Note that the platform works were intermittent during this measurement.

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7 Shadforth Street, Wiley Park	2 x EWP, rattle gun and 400T telescopic crane 05.02.2022 08:03pm – 08:18pm	65T (T: Predicted LAeq, 15min for Typical activities)	56	79	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 65 metres away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 50 metres. Note that the platform works were intermittent during this measurement. Note that the platform works were intermittent during this measurement.

RESULTS – VIBRATION MONITORING

The sections below contains a summary of the vibration monitoring results. The complete reports are provided in Appendixes 5 – 8. The established criteria for cosmetic damage in the Sydney Metro Construction Noise and Vibration Statement is as follows:

- Reinforced or framed structures: 25.0 mm/s;
- Unreinforced or light framed structures: 7.5 mm/s;
- Heritage structures (structurally sound): 7.5 mm/s; and
- Heritage structures (structurally unsound): 2.5 mm/s.

Also, in accordance with the Hurlstone Park Station Vibration Monitoring Plan developed in consultation with the Project consulting structural engineers (Appendix 9), the established vibration limits for the affected garage structure at a residential property on Commons Street are shown below:

- Greater than or equal to 4 mm/s (cosmetic damage is possible);
- Greater than or equal to 8 mm/s (cosmetic damage becoming more likely).

During the reporting period, vibration monitoring was undertaken at the following locations:

	Date	Location
1	29th November – 3rd December 2021	Residential property on Commons Street, Hurlstone Park
2	18-19th December 2021	Hurlstone Park and Campsie Stations
3	18-19th December 2021	Residential property on Commons Street, Hurlstone Park
4	26th December 2021 – 09 January 2022	Residential property on Commons Street, Hurlstone Park
5	2nd January – 9th January 2022	Platform 1 Station Building, Hurlstone Park Station
6	4th – 7th February 2022	Residential property on Commons Street, Hurlstone Park

1 – Residential property on Commons Street, Hurlstone Park (29th November - 3rd December)

The results of the unattended vibration measurements for the neighbouring garage structure at a residential property on Commons Street are presented below:

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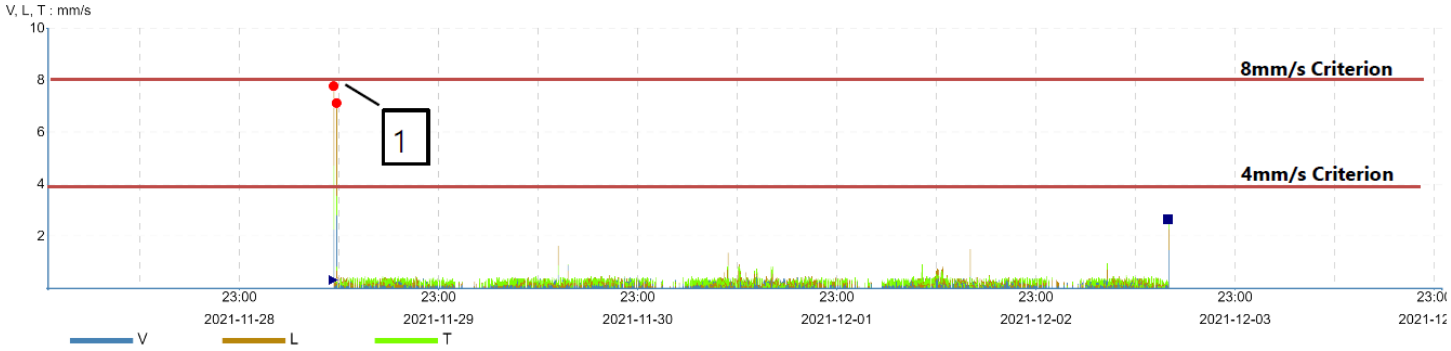

Fig. 1 – Unattended vibration monitoring location 1 results (residential property on Commons Street, 29th November – 03rd December 2021)

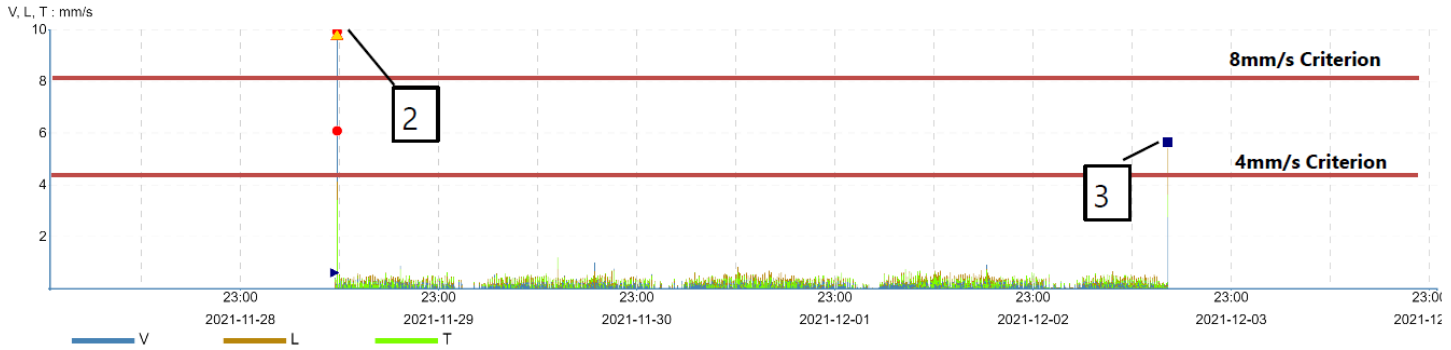

Fig. 2 – Unattended vibration monitoring location 2 results (residential property on Commons Street, 29th November – 03rd December 2021)

It can be seen in Figure 1 and Figure 2 that the vibration levels produced from the vibration intensive works in the vicinity of the affected garage structure is below 4 mm/s. Note that there were events that resulted in an instantaneous vibration level of above 4 mm/s which are justified in the table below.

Exceedance ID	Date and Time	Cause of exceedance
1	29.11.2021, 10:30am	At this time, the vibration monitor was mounted on the ground spike to commence monitoring. Exceedance was not caused by the nearby construction activities. The exceedance was the result of the monitor instillation process
2	29.11.2021, 11:00am	At this time, the vibration monitor was mounted on the ground spike to commence monitoring. Exceedance was not caused by the nearby construction activities. The exceedance was the result of the monitor instillation process.
3	03.12.2021, 03:00pm	At this time, the vibration monitor was removed from the ground spike at the completion of monitoring. Exceedance was not caused by the nearby construction activities. The exceedance was the result of the monitor instillation process

2 – Hurlstone Park Station and Campsie Station (18-19th December)

The results of the vibration monitoring at Hurlstone Park and Campsie Stations are presented in the table below. The applicable vibration criteria for cosmetic damage from the Sydney Metro Construction Noise & Vibration Statement is defined below as the screening level.

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Station	Plant	Screening Level (mm/s)	Distance from source	95th percentile PPV (mm/s)	Maximum PPV (mm/s)	Above predicted vibration level	Comments
	19th December 2021	TL927-1-19F01 WE25 NOISE AND VIBRATION MONITORING REPORT (R2) – APPENDIX 5					
Hurlstone Park Station	4T excavator with bucket attachment	2.5	1m	0.90	0.95	No	At a distance of 1 metre away, the 4T excavator with bucket attachment produced vibration levels that are below the established vibration screening criteria.
Campsie Station	7T excavator with hammer attachment	2.5	5.5m	0.60	0.58	No	At a distance of 5.5 metres away, the 7T excavator with hammer attachment produced vibration levels that are below the established vibration screening criteria. Vibration monitor was attached on the nearest affected structure.
			2.5m	1.60	1.53	No	At a distance of 2.5 metres away, the 7T excavator with hammer attachment produced vibration levels that are below the established vibration screening criteria. Vibration monitor was attached on the nearest affected structure.
	Core drilling		6m	0.13	0.16	No	At a distance of 6 metres away, the core drilling activity produced vibration levels that are below the established vibration screening criteria.

It can be seen from the table above that the measured vibration levels were below the established criteria for heritage, reinforced or unreinforced structures. As a result, the risk of cosmetic damage from the measured plant items are considered to be low.

Based on the attended vibration measurement at Hurlstone Park and Campsie Station, the measured vibration levels were below the established vibration criteria for heritage, reinforced or unreinforced structures.

3 – Residential property on Commons Street, Hurlstone Park (18-19th December)

The results of the unattended vibration measurements for the neighbouring garage structure at a residential property on Commons Street are presented below:

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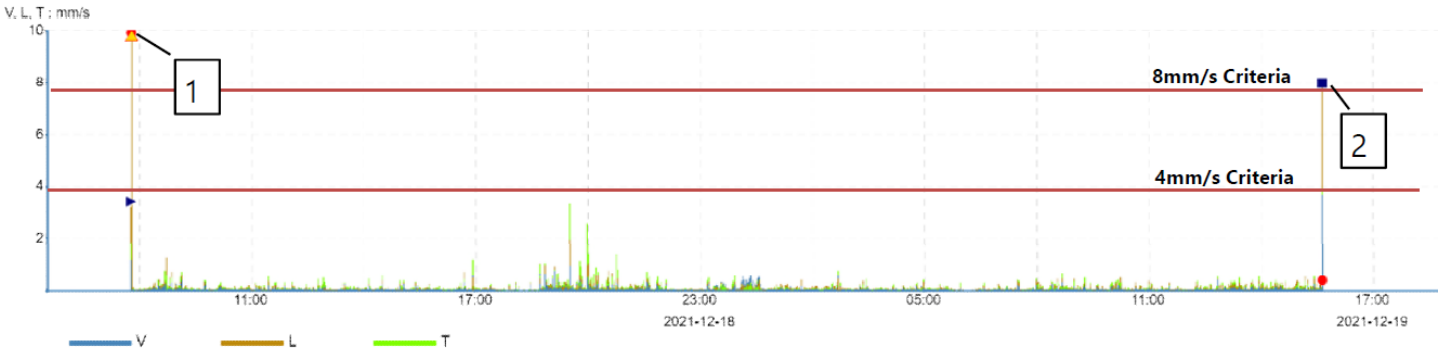

Fig. 3 – Unattended vibration monitoring location 1 results (residential property on Commons Street, 18th December – 19th December 2021)

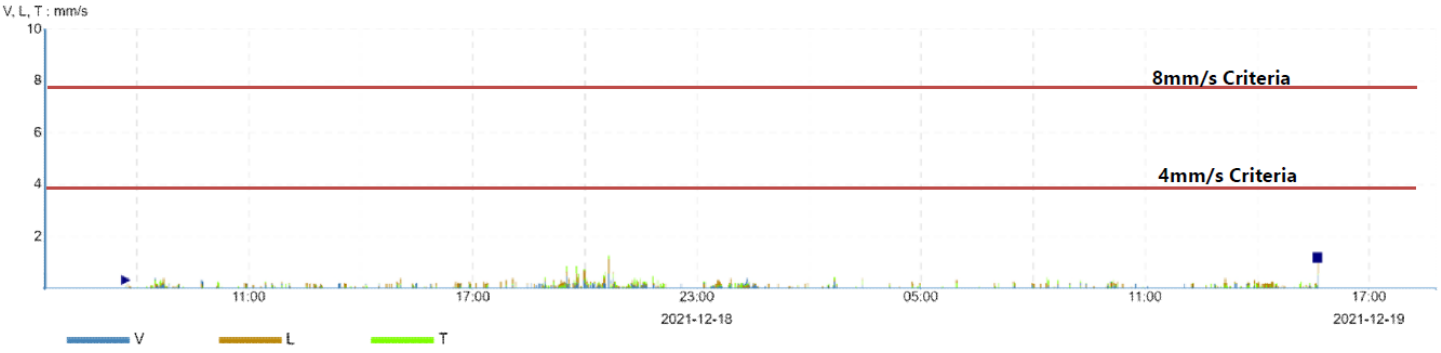

Fig. 4 – Unattended vibration monitoring location 2 results (residential property on Commons Street, 18th December – 19th December 2021)

The discussion of the unattended vibration measurements is summarised in the table below:

Exceedance ID	Date and Time	Cause of exceedance
1	18.12.2021 07:47am	At this time, the vibration monitor was mounted on the ground spike to commence monitoring. Exceedance was not caused by the nearby construction activities. The exceedance was the result of the monitor instillation process
2	19.12.2021 03:41pm	At this time, the vibration monitor was removed from the ground spike to complete the monitoring. Exceedance was not caused by the nearby construction activities. The exceedance was the result of the monitor instillation process

It can be seen in Figure 3 and Figure 4 that the vibration levels produced from the vibration intensive works in the vicinity of the affected garage structure is below 4 mm/s. Note that there were events that resulted in an instantaneous vibration level of above 4 mm/s, however these were not caused by the nearby construction activities, as justified in the table above.

4 – Residential property on Commons Street, Hurlstone Park (26th December - 9th January)

The results of the unattended vibration measurements for the neighbouring garage structure at a residential property on Commons Street are presented below:

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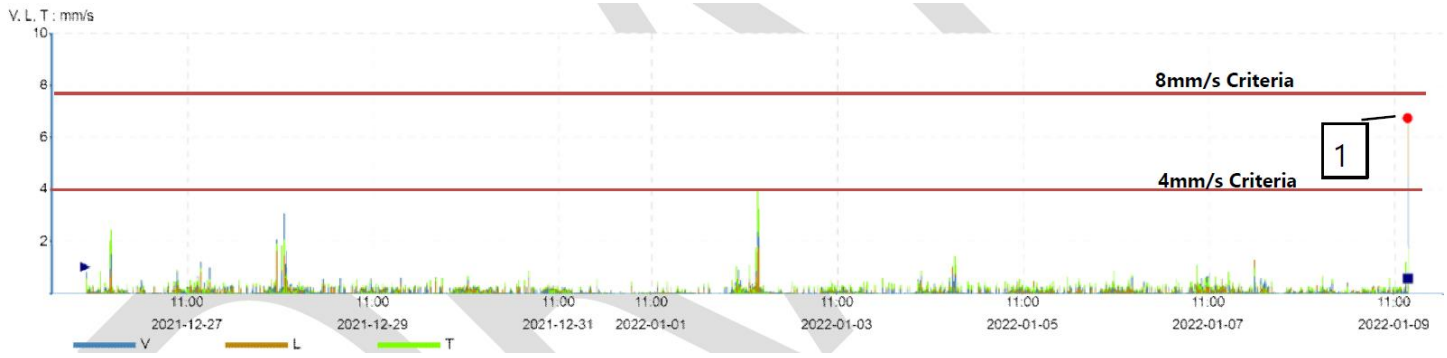

Fig. 5 – Unattended vibration monitoring location 1 results (residential property on Commons Street, 26th December 2021 – 9th January 2022)

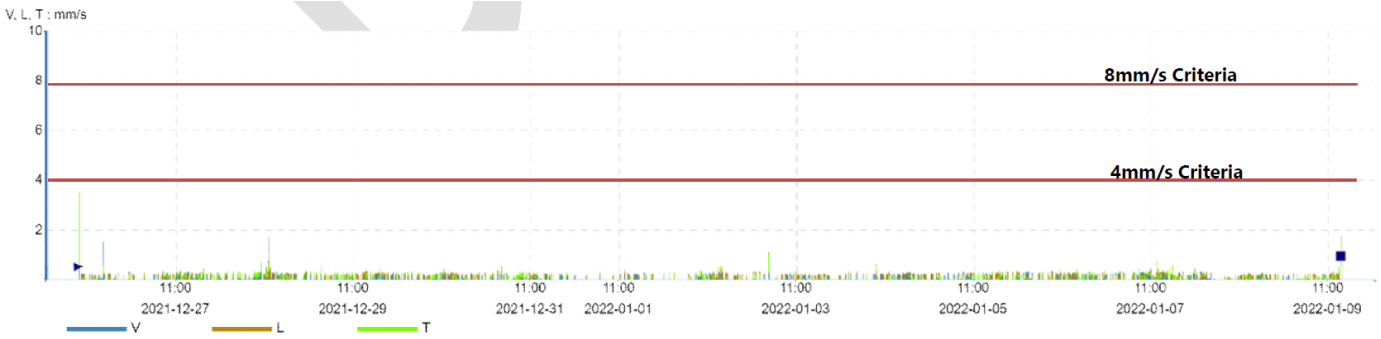

Fig. 6 – Unattended vibration monitoring location 2 results (residential property on Commons Street, 26th December 2021 – 9th January 2022)

Exceedance ID	Date and Time	Cause of exceedance
1	09.01.2022 02:25pm	At this time, the vibration monitor was removed from the ground spike to complete the monitoring. Exceedance was not caused by the nearby construction activities. The exceedance was the result of the monitor instillation process.

It can be seen in Figure 5 and 6 that the vibration levels produced from the vibration intensive works in the vicinity of the affected garage structure is below 4 mm/s. Note that there was an event that resulted in an instantaneous vibration level of above 4 mm/s, however this event was not caused by the nearby construction activities, as justified in the table above.

5 – Platform 1 station building at Hurlstone Park Station vibration monitoring (2nd – 9th January 2022)

The applicable vibration criteria for cosmetic damage from the Sydney Metro Construction Noise & Vibration Statement is as follow:

- Unreinforced or light framed structures: 7.5 mm/s
- Heritage structures (structurally sound): 7.5mm/s

The results of the unattended vibration monitoring for the station building are presented below:

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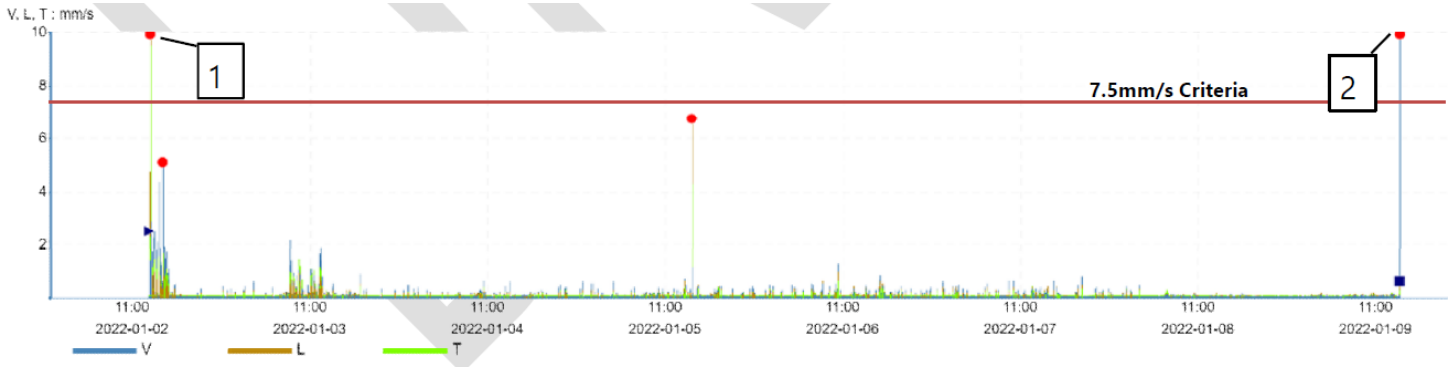

Fig. 6 – Unattended vibration monitoring at platform 1 results (2nd – 9th January 2022)

It can be seen in Figure 6 that the vibration levels produced from the jackhammering works in the vicinity of the station building on platform 1 is below 7.5 mm/s. Note that there were events that resulted in an instantaneous vibration level of above 7.5 mm/s, however these were not caused by the nearby construction activities, as justified in the table below.

Exceedance ID	Date and Time	Cause of exceedance
1	09.01.2022 02:25pm	At this time, the vibration monitor was mounted inside the station building to commence monitoring. Exceedance was not caused by the nearby construction activities. The exceedance was the result of the monitor instillation process.
2	09.01.2022 02:12pm	At this time, the vibration monitor was removed from the station building to complete the monitoring. Exceedance was not caused by the nearby construction activities. The exceedance was the result of the monitor instillation process.

The results of the unattended vibration measurements were typically below the established vibration criteria presented in the Hurlstone Park Station Vibration Monitoring Plan prepared for the works.

6 – Residential property on Commons Street, Hurlstone Park (7th February 2022)

The results of the unattended vibration measurements for the neighbouring garage structure at a residential property on Commons Street are presented below:

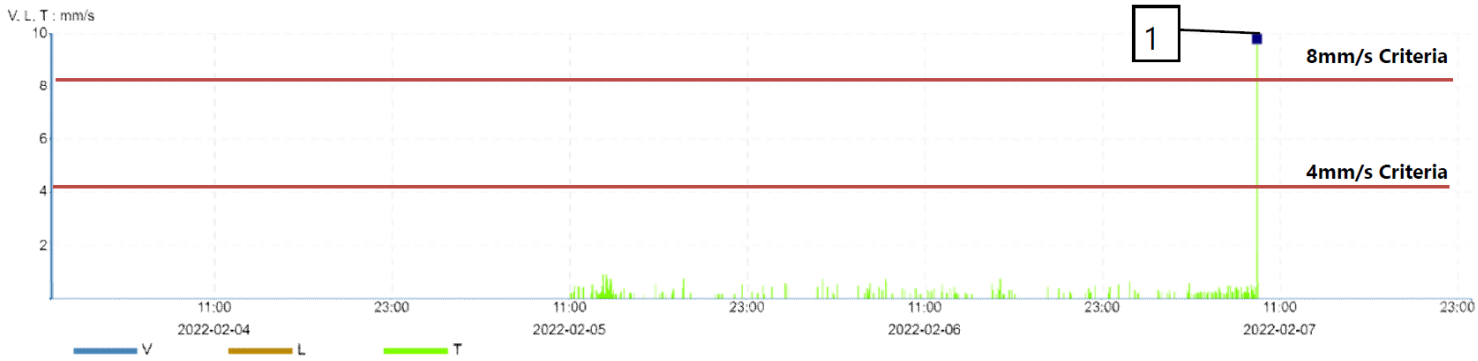

Fig. 7 – Unattended vibration monitoring location 1 results (residential property on Commons Street, 7th February 2022)

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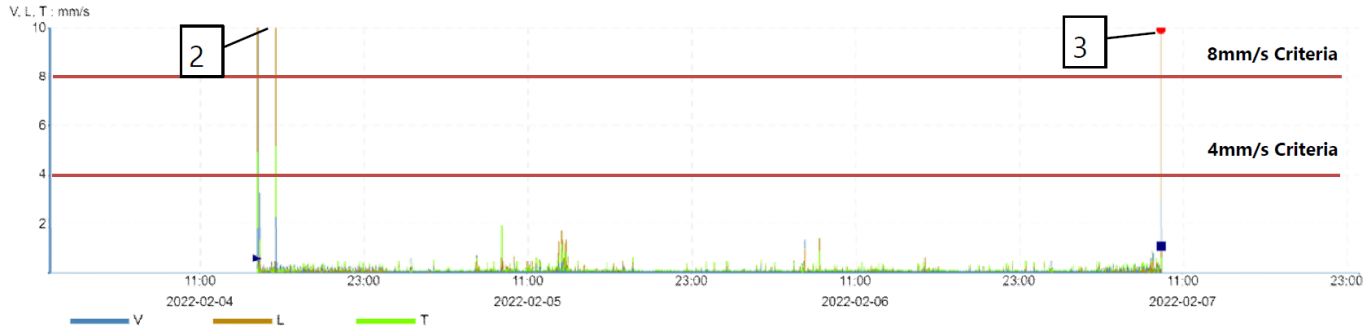

Fig. 8 – Unattended vibration monitoring location 2 results (residential property on Commons Street, 7th February 2022)

The results of the noise measurements were below the predicted $LA_{eq\ 15minutes}$ levels presented in the Gatewave model prepared for the works. The results of the unattended vibration measurements were typically below the established vibration criteria established for the location. There were events that resulted in an instantaneous vibration level of above the established vibration criteria, however, the cause of these events was not related to construction activity, as outlined in the table below.

Exceedance ID	Date and Time	Cause of exceedance
1	07.02.2022 09:24am	At this time, the vibration monitor was removed from the ground spike to complete the monitoring. Exceedance was not caused by the nearby construction activities. The exceedance was the result of the monitor instillation process.
2	04.02.2022 03:10pm	At this time, the vibration monitor was installed on the ground spike to start the monitoring. Exceedance was not caused by the nearby construction activities. The exceedance was the result of the monitor instillation process.
3	07.02.2022 09:20am	At this time, the vibration monitor was re moved from the ground spike to complete the monitoring. Exceedance was not caused by the nearby construction activities. The exceedance was the result of the monitor instillation process.

DISCUSSION – NOISE AND VIBRATION MONITORING

The noise monitoring results did not identify any exceedances of the predicted noise levels with the exception of two instances, one where traffic noise was compounding to the construction activities (making the readings less reliable) and the second one where noise levels were 10dB above predicted, which is consistent with high noise impact activities including the use of a rockhammer.

As the great majority of results did not exceed the predicted levels, the provision of construction noise mitigation measures is considered to be appropriate.

The vibration monitoring results have indicated that the construction activities have not caused vibration impacts above the screening levels.

It should also be noted that Downer conducts regular inspection of the environmental controls, including noise and vibration mitigation measures, across all work sites. These inspections are conducted by the Project Team and the Environmental Team. This proactive approach ensures that environmental controls are functioning properly rather than reactively inspecting the worksite following monitoring and reporting.

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Appendix 1 – Surface Water Monitoring Report - Wiley Park Station - NE30161_R005_SWM_WileyPark_Rev0_R

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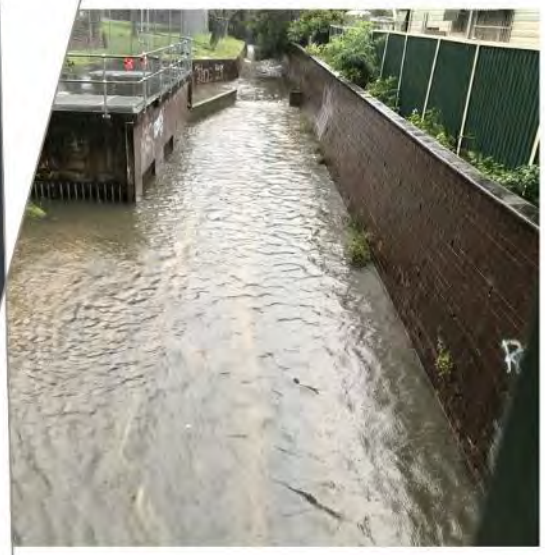
Surface Water Monitoring Report - Wiley Park Station

Wiley Park Station

NE30161



Prepared for
Downer EDI Works Pty Ltd

13 January 2022

Cardno

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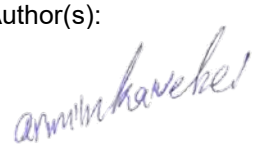

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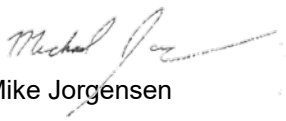

Mike Jorgensen
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Document History

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RevA	10/01/2022	Draft for Client Review	AK/CZ	MJ
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Our report is based on information made available by the client. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Cardno is both complete and accurate. Whilst, to the best of our knowledge, the information contained in this report is accurate at the date of issue, changes may occur to the site conditions, the site context or the applicable planning framework. This report should not be used after any such changes without consulting the provider of the report or a suitably qualified person.

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Appendices

Tables

1 Introduction

1.1 Background

Cardno (NSW/ACT) Pty Ltd ("Cardno") was commissioned by Downer EDI Works Pty Ltd ("Downer") to undertake monitoring and reporting of surface water quality of the unnamed channel within proximity to Wiley Park Station Upgrade Site. The proposed works includes the upgrade of the main station and installation of the Metro Services Building (MSB).

Surface water quality of the channel within proximity to Wiley Park Upgrade Site is to be monitored as per the requirements summarised in **Table 1-1**, which is taken from excerpt from the Southwest Metro – Hurlstone Park, Belmore and Wiley Park Station Upgrades Soil and Water Management Plan (SWMP). The monitoring program are prepared to meet the requirements outlined in *The Sydney Metro City and Southwest – Sydenham to Bankstown Upgrade Conditions of Approval SSi-8256*, specifically Condition 8 to Condition 10. The sampling locations (WP1 – Upstream and WP2 – Downstream) of the water quality monitoring are shown in **Appendix A**.

The closest Project worksite to an existing watercourse is Wiley Park Station services building, which is located approximately 100 m from an unnamed concrete-lined channel, which forms the upper reaches of Cox Creek and is identified as a first-order stream.

For the purpose of establishing baseline water quality data within the first-order stream at Wiley Park, water quality monitoring was intended to be undertaken for a period prior to construction of the Wiley Park services building as outlined in **Table 13** of the SWMP. At a minimum, one dry-weather sample and one wet weather sample (weather permitting) are to be collected during the pre-construction period. The frequency of pre-construction water quality monitoring within this channel was subject to water being present within the structure. However, during the baseline monitoring period no wet-weather events were able to be captured prior to commencement of construction. A dry-weather baseline monitoring event was undertaken on 10 March 2021.

This report presents the findings from the sixth and seventh surface water monitoring events, which were undertaken by Cardno on 12 and 26 November 2021. These events undertaken were wet mid-construction events.

1.2 Purpose and Objective

The purpose of the surface water monitoring works is to monitor and record surface water quality within the unnamed channel in accordance with the monitoring program as outlined in the Site's SWMP. The objective of the works is to evaluate whether construction activities are impacting water quality downstream of the project footprint in the unnamed channel.

1.3 Scope of Works

Cardno undertook the following tasks during the surface water monitoring events:

> Inspected and sampled two (2) nominated surface water sampling locations (WP1 – Upstream and WP2 – Downstream) on 12 and 26 November 2021 as part of mid-construction monitoring event.

> Recorded field parameters and noted observations of the water bodies during sampling.

> Collected two (2) primary surface water samples, one (1) intra-lab duplicate sample and one (1) inter-lab duplicate sample per sampling event for submission to a National Association of Testing Authorities, Australia (NATA) certified laboratory for analytical testing of primary and additional quality assurance/quality control (QA/QC) samples. Samples were submitted for analysis of:

- Oil & Grease;
- Total Suspended Solids (TSS);
- Nutrients (Total Phosphorous, Total Nitrogen);

- Turbidity; and
- Chlorophyll-*a*.

> Reviewed the analytical and field data and prepared this report.

Details of the monitoring program are shown below.

Table 1-1 Wiley Park Water Quality Monitoring Program

Wiley Park Water Quality Monitoring Program	
Waterway	Sydney Water Cooks River Channel (first-order stream)
Indicative monitoring points	WP1 – Upstream
	WP2 – Downstream
Interaction with Project works	Channel within proximity to Wiley Park service building site
Pre-construction works	Monthly for parameters detailed in Table 11 (including at least one dry-weather round of sampling). One wet-weather event, if possible, for the parameters detailed in Table 11, subject to event occurrence, safe conditions for monitoring and access being available to conduct monitoring. Note: A wet-weather event is when the receiving area has received greater than 20 mm of rain in 24 hours. The sampling is undertaken immediately during construction hours and if it is safe to do so.
During construction of the Wiley Park services building	Quarterly for parameters detailed in Table 11 (including during dry weather). Four wet-weather events per year for the parameters in Table 11, subject to event occurrence, safe conditions for monitoring and access being available to conduct monitoring. Note: A wet-weather event is when the receiving area has received greater than 20 mm of rain in 24 hours. The sampling was undertaken immediately during construction hours and if it is safe to do so.

2 Guidelines and Legislation

There are a range of Guidelines and Legislation and Conditions of Approval (CoA) that are applicable to the surface water monitoring program which are summarised below.

The CoA applicable to this job include:

> The Sydney Metro City and Southwest - Sydenham to Bankstown Upgrade Conditions of Approval SSI-8256, determined 12 December 2018;

The State and Federal legislation and policy and guidelines that apply to the program include:

> Environmental Planning and Assessment Act 1979 (EP&A Act);

> Contaminated Land Management Act 1997;

> Protection of the Environment Operations Act 1997 (POEO Act); and

> Water Management Act 2000 Water Management (General) Regulation 2018;

Additional guidelines and standards to the management of soil and water include:

> Landcom (2004). Managing Urban Stormwater: Soils and Construction. (Volume 1 of the 'Blue Book');

> DECC (2008). Managing Urban Stormwater: Soils and Construction. Volume 2D: Main Road Construction. (Volume 2D of the 'Blue Book');

> ANZECC (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (collectively known as the 'ANZECC Guidelines');

> ANZECC (2018). Australian and New Zealand Guidelines for Water Quality Monitoring and Reporting (collectively known as the 'ANZECC Guidelines'); and

> ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (known as 'ANZG Guidelines').

3 Monitoring Locations

Details of the sampling locations are provided in **Table 3-1**. The locations are provided in **Appendix A**. Representative photographs are presented in **Appendix B**.

3.1 Monitoring Locations

Table 3-1 Surface Water Monitoring Location Details

Sample Location	Latitude	Longitude	Description
WP1 (upstream)	-33.924014	151.065315	Immediately south of the Boulevarde and east of 118 the Boulevarde.
WP2 (downstream)	-33.923339	151.064970	Immediately north of the Urunga Parade and west of 4 Urunga Parade.

4 Quality Management

The Data Quality Objective (DQO) process is used to establish a systematic planning approach to setting the type, quantity and quality of data required for making decisions based on the environmental condition of the project area. The DQO process involves the seven steps detailed in **Table 4-1**.

Table 4-1 Data Quality Objectives

DQO	Description
Step 1 State the Problem	Construction work may adversely impact the local surface water quality within the unnamed channel near the site.
Step 2 Identify the Decisions	Are there any impacts to surface water quality from construction activities at the site?
Step 3 Identify Inputs to the Decision	The primary inputs to the decisions described above are: ▪ Assessment of surface water quality of the unnamed channel within proximity to Wiley Park service building site per the requirements outlined in the site's SWMP, with samples collected from two locations (upstream and downstream of the site); ▪ Laboratory analysis of surface water samples for relevant parameters; ▪ Assessment of the suitability of the analytical data obtained, against the Data Quality Indicators (DQIs); ▪ Assessment of the analytical results against applicable guideline criteria; and ▪ Aesthetic observations of surface water bodies, including odours, sheen and condition, if encountered.
Step 4 Define the Study Boundaries	The lateral extent of the study area is the channel near the Wiley Park service building site. The temporal boundaries of the study comprise the duration of the monitoring program, including pre-construction monitoring, construction phase, and post-construction monitoring as required.
Step 5 Develop a Decision Rule	The decision rules for the water quality monitoring sampling events included: ▪ Were primary and QA/QC samples analysed using methods endorsed by relevant regulatory guidelines at laboratories NATA-accredited for the requested analyses?

DQO	Description
	▪ Did the field and laboratory QA/QC results indicate that the data set was reliable and representative of the water quality with Relative Percentage Difference (RPD) values of 30% or less? ▪ Were the laboratory limits of reporting (LORs) below the applicable guideline criteria for the analysed parameters? ▪ Were guideline criteria sourced from endorsed guidelines? ▪ Were surface water aesthetic characteristics evaluated including odours and sheen? ▪ Were the monitoring results obtained from the downstream sample collected during construction phase greater than the upstream sample collected during the same monitoring event? If so, then the adverse impact to the quality of water in the unnamed channel is considered to have potentially occurred.
Step 6 Specify Limits on Decision Error	In accordance with the relevant guidelines as endorsed under the *Contaminated Land Management Act 1997*. Specific limits for this project are in accordance with the appropriate guidance made or endorsed by state and national regulations, appropriate indicators of data quality, and standard procedures for field sampling and handling. This step also examines the certainty of conclusive statements based on the available new Site data collected. This should include the following points to quantify tolerable limits: ▪ A decision can be made based on a certainty assumption of 95% confidence in any given data set (excluding asbestos). A limit on the decision error will be 5% that a conclusive statement may be a false positive or false negative. A decision error in the context of the decision rule presented above would lead to either underestimation or overestimation of the risk level associated with a particular sampling area. Decision errors may include: ▪ Sampling errors may occur when the sampling program does not adequately detect the variability of a contaminant from point to point across the Site. To address this, minimum numbers of samples are proposed to be collected from each media. As such, there may be limitations in the data if aspects of the sampling plan cannot be implemented. Some examples of this scenario include but not limited to: – Proposed samples are not collected due to lack of water flow or access being restricted to a given location. ▪ Limitations in ability to acquire useful and representative information from the data collected. The data are proposed to be collected from multiple locations and sample media. ▪ Measurement errors can occur during sample collection, handling, preparation, analysis and data reduction. To address this the following measures are proposed: – Field staff to follow a standard procedure when undertaking samples, including decontamination of tools, removal of adhered soil to avoid false positives in results, collection of representative samples and use of appropriate sample containers and preservation methods. – Laboratories to follow a standard procedure when preparing samples for analysis and undertaking analysis. – Laboratories to report QA/QC data for comparison with the DQIs established for the project
Step 7 Optimise the Design for Obtaining Data	To achieve the DQOs and DQIs, the following sampling procedures were implemented to optimise the design for obtaining data: ▪ Surface water samples was collected from two (2) sampling locations, as available due to access and water level; ▪ Surface water parameters were selected based on project monitoring requirements provided to Cardno; ▪ Samples were collected by suitably qualified and experienced environmental scientists;

DQO	Description
	▪ Samples were collected and preserved in accordance with relevant standards/guidelines; and ▪ Field and laboratory QA/QC procedures were adopted and reviewed to indicate the reliability of the results obtained.

4.1 Data Quality Indicators

The following DQIs have been adopted for the project. The DQIs outlined in **Table 4-2** assist with decisions regarding the usefulness of the data obtained, including the quality of the laboratory data.

Table 4-2 Summary of Data Quality Indicators

Data Quality Indicator	Frequency	Data Acceptance Criteria
Completeness		
Field documentation correct	All samples	The work was documented in accordance with Cardno SOPs
Suitably qualified and experience sampler	All samples	Person deemed competent by Cardno collecting and logging samples
Appropriate lab methods and limits of reporting (LORs)	All samples	Samples were analysed using methods endorsed by relevant regulatory guidelines at laboratories NATA-accredited for the requested analyses.
Chain of custodies (COCs) completed appropriately	All samples	The work was documented in accordance with Cardno SOPs
Sample holding times complied with	All samples	The samples were extracted and analysed within holding times specified by the project NATA-accredited laboratory
Proposed/critical locations sampled	-	Proposed/critical locations sampled
Comparability		
Consistent standard operating procedures for collection of each sample. Samples should be collected, preserved and handled in a consistent manner	All samples	All works undertaken in accordance with Cardno SOPs
Experienced sampler	All samples	Person deemed competent by Cardno collecting and logging samples
Climatic conditions (temp, rain etc) recorded and influence on samples quantified (if required)	All samples	Climatic conditions documented in field sheets
Consistent analytical methods, laboratories and units	All samples	Sample analysis to be in accordance with NATA-approved methods
Representativeness		
Sampling appropriate for media and analytes (appropriate collection, handling and storage)	All samples	Sample analysis to be in accordance with NATA-approved methods
Samples homogenous	All samples	All works undertaken in accordance with Cardno SOPs
Detection of laboratory artefacts, e.g. contamination blanks	-	Laboratory artefacts assessed and impact on results determined
Samples extracted and analysed within holding times	All samples	The samples were extracted and analysed within holding times specified by the laboratory
Precision		
Blind duplicates (intra-laboratory duplicates)	1 per 20 samples	less than or equal to 30% RPD No Limit RPD Result less than 10 × LOR
Split duplicates (inter-laboratory duplicates)	1 per 20 samples	less than or equal to 30% RPD No Limit RPD Result less than 10 × LOR

Data Quality Indicator	Frequency	Data Acceptance Criteria
Laboratory duplicates	1 per 20 samples	Results greater than 10 x LOR: less than or equal to 30% RPD Results less than 10 x LOR: No limit on RPD
Accuracy (Bias)		
Surrogate spikes	All organic samples	50-150%
Matrix spikes	1 per 20 samples	70-130%
Laboratory control samples	1 per 20 samples	70-130%
Method blanks	1 per 20 samples	<LOR

The DQOs and DQIs for the project were met during the monitoring events. Discussion of the QA/QC assessment is provided in **Appendix E**.

5 Field Investigation

The scope and method of the surface water monitoring is summarised in **Table 5-1**.

Table 5-1 Investigation Activity Summary

Activity	Details
Dates of Fieldworks	12 and 26 November 2021
Surface Water Sampling	Cardno inspected two surface water monitoring locations (WP1 – Upstream and WP2 – Downstream) on both surface water monitoring event undertaken on 12 and 26 November 2021. Primary samples were collected from the two locations during both sampling events. Cardno undertook the sampling as per the following procedures: Surface Water Body Inspection - The general site condition was observed prior to commencement of field works for signs of any site activities that may have altered the surface water contamination status or require modifications to the field or laboratory works program. Each surface water location was inspected for indicators of contamination and the presence as well as the flow of surface water. This information is recorded on the field sheets presented in **Appendix C.** Surface water flow sampling - Field parameters and visual/olfactory observations were recorded prior to sampling at each location. Physico-chemical parameters including pH, electrical conductivity (EC), dissolved oxygen (DO), reduction-oxidation potential (redox), and temperature were measured using a calibrated water quality meter. Surface water samples were collected either directly into the sampling bottle or directly from the telescopic scoop. Once field parameters were recorded, the surface water samples were transferred to appropriately preserved sample containers provided by the laboratories. Field observations, and parameters are presented in **Appendix C**. Surface water samples were placed into an Esky containing ice and maintained at or below 4°C whilst onsite and in transit to the NATA-accredited laboratories for the targeted analyses.
Surface Water Analysis	Surface water samples from the monitoring event were submitted under standard chain-of-custody (CoC) procedures to NATA-accredited Eurofins Environment Testing Australia analysis of the parameters as follows: - Oil & Grease; - TSS; - Nutrients (Total Phosphorous, Total Nitrogen); - Turbidity; and - Chlorophyll-*a*. Tabulated laboratory results are presented in **Appendix D**. The Data QA/QC program and data quality review including calibration certificates is presented in **Appendix E**. Copies of the original laboratory reports, NATA-stamped laboratory certificates, and CoC documentation are included in **Appendix F**.
Decontamination	In the event of reusable sampling or monitoring equipment (telescopic scoop, water quality meter) was used decontamination was undertaken. Decontaminated between locations using a standard bucket wash. Equipment was washed in phosphate-free detergent (Liquinox) and rinsed in laboratory-supplied rinsate water.

6 Surface Water Assessment Criteria

The assessment criteria for surface water analytical and field data were adopted from Table 11 of the site's SWMP. The criteria for selected parameters are provided in **Table 6-1** below.

Table 6-1 Water Quality Monitoring Parameters and Adopted Criteria at Wiley Park

Parameter	ANZECC Criteria – Freshwater[1]	Proposed Triger Values	Proposed Actions
Temperature (°C)	>80% ile; <20% ile	Downstream results are greater than upstream results in rainfall events up to and including the significant event threshold of greater than 20 mm in 24 hours. Downstream results are greater than upstream results during dry-weather sampling.	Environment Manager (or delegate) to re-test to confirm results and undertake an inspection of the adjacent works and propose actions where required.
DO (%Sat)	Lower limit – 85% Upper limit – 110%		
Turbidity (NTU)	6-50 NTU		
Oil and grease	-		
pH	Lower limit – 6.5 Upper limit – 8.5		
Salinity (as EC)	125 – 2,200 µS/cm		
TSS	-		
Total Phosphorus as P	25 µg/L		
Total Nitrogen as N	350 µg/L		
Chlorophyll-a	3 µg/L		

Note to Table
1 ANZECC guideline criteria are included for reference. It is noted that for dry weather events baseline testing comparison will indicate whether this existing water quality within the channel meet ANZECC guidelines, prior to construction of the services building. For wet-weather events where no baseline data is available a direct comparison to upstream and downstream results is undertaken. Sydney Metro's Principal Contractor will comply with Section 120 of the Protection of the Environment Operations Act 1997.

7 Summary of Results

7.1 Summary of Field Observations

The two (2) surface water sampling locations (WP1 – Upstream and WP2 – Downstream) were able to be accessed during both sampling events conducted on 12 and 26 November 2021. Photos of each sampling location are included in **Appendix B**. The following observations were made:

7.1.1 Mid-Construction Wet-weather Event – 12 November 2021

> The sampling event was considered as a mid-construction wet-weather event based on the rainfall data recorded by two nearby weather stations:
  - Canterbury Racecourse AWS station (ID: 066194): approximately 4.6 km from the site with the rainfall data recorded 19.8 mm (i.e. marginally below the 20 mm threshold) over the last 24 hours prior to the field sampling.
  - Marrickville Golf Club station (ID: 066036): approximately 6.4 km from the site with the rainfall data recorded 22.0 mm (i.e. above the 20 mm threshold) over the last 24 hours prior to the field sampling.

> Observation of water body:
  - WP 1 (upstream of work area) contained low to medium flowing clear water with low turbidity. The estimated depth of the water body was 0.15 m;
  - WP 2 (downstream of work area) contained low to medium flowing clear water with low turbidity. The estimated depth of the water body was 0.20 m;

> Additional observation:
  - WP1 (upstream of work area):
    - One additional discharge point (WP1-DP1) was observed immediately downstream / north of WP1, however, minor flow contribution was observed at the time of sampling. Refer to **Appendix A** for approximate location of WP1-DP1. Refer to **Appendix B** for a detailed photo.
  - WP2 (downstream of work area):
    - During the sampling event, the two discharge points (WP2-DP1 and WP2-DP2) within the rail corridor immediately upstream / south from WP2 were observed. Minor flow contribution from the discharge point WP2-DP1 was observed at the time of sampling. Also, minor flow contribution from the discharge point WP2-DP2 was observed at the time of sampling which was greater than the flow from WP2-DP1. Refer to **Appendix A** for approximate location of WP2-DP1 and WP2-DP2. Refer to **Appendix B** for detailed photos.

7.1.2 Mid-Construction Wet-weather event – 26 November 2021

> The sampling event was considered as a mid-construction wet-weather event based on the rainfall data recorded by two nearby weather stations:
  - Canterbury Racecourse AWS station (ID: 066194): approximately 4.6 km from the site with the rainfall data recorded 43.8 mm (i.e. above the 20 mm threshold) over the last 24 hours prior to the field sampling.
  - Marrickville Golf Club station (ID: 066036): approximately 6.4 km from the site with the rainfall data recorded 46.0 mm (i.e. above the 20 mm threshold) over the last 24 hours prior to the field sampling.

> Observation of water body:
  - WP 1 (upstream of work area) contained low flowing clear water with low turbidity. The estimated depth of the water body was 0.15 m;
  - WP 2 (downstream of work area) contained medium flowing clear water with low turbidity. The estimated depth of the water body was 0.20 m;

> Additional observation:
  - WP1 (upstream of work area):

- One additional discharge point (WP1-DP1) was observed immediately downstream / north of WP1 and flow contribution was observed at the time of sampling. Refer to **Appendix A** for approximate location of WP1-DP1. Refer to **Appendix B** for a detailed photo.

- WP2 (downstream of work area):
  - During the sampling event, the two discharge points (WP2-DP1 and WP2-DP2) within the rail corridor immediately upstream / south from WP2 were observed. Flow contribution from the discharge point WP2-DP1 and WP2-DP2 were observed at the time of sampling. Refer to **Appendix A** for approximate location of WP2-DP1 and WP2-DP2. Refer to **Appendix B** for detailed photos.

7.2 Field Parameters

The parameters from each location sampled are presented in **Table 7-1**.

Table 7-1 Field physico-chemical Parameters and Field Observations on 12 and 26 November 2021.

Location ID	WP1 (upstream)	WP2 (downstream)	WP1 (upstream)	WP2 (downstream)
Time of Sampling	**12 November 2021**		**26 November 2021**	
Water depth (m)	0.15	0.2	0.15	0.2
Estimated Flow Rate	Low to medium	Low to medium	Low	Medium
Temperature (°C)	19.4	19.5	19.6	19.7
pH	8.10	8.42	6.07	7.34
EC (µS/cm)	514.0	509.2	389.2	484.0
DO (mg/L)	6.42	5.63	9.05	9.31
DO (%)	68	63	98.7	101.9
Redox Potential (mV)	70.8	80.4	183.7	196.3
Condition	Clear	Clear	Clear	Clear
	Low Turbidity	Low turbidity	Low Turbidity	Low turbidity

7.3 Surface Water Analytical Results

Surface Water Analytical results are presented in **Appendix D**. Copies of the original laboratory reports, NATA-stamped laboratory certificates, and Chain of Custody documentation are included in **Appendix F**.

7.3.1 Mid-Construction Wet-weather event – 12 November 2021

The results of the monitoring event indicate that:

> Laboratory analytical results:

- Concentrations of Chlorophyll-*a* were reported below the laboratory detection limit and adopted assessment criteria at all sample locations;
- Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations;
- Concentrations of inorganics were reported above the adopted assessment criteria with the total nitrogen concentration within both the WP1 and WP2 samples, and the total phosphorous concentration for WP1 but total phosphorous concentration WP2 (0.020) was below adopted assessment criteria (0.025);
- TSS concentrations were detected within both WP1 and WP2, with concentrations of 8.4 mg/L at WP1 and 7.6 mg/L at WP2; and
- Turbidity ranged from 21 NTU at WP1 to 19 NTU at WP2.

7.3.2 Mid-Construction Wet-weather event – 26 November 2021

The results of the monitoring event indicate that:

> Laboratory analytical results:

- Concentrations of Chlorophyll-*a* were reported below the laboratory detection limit and/or adopted assessment criteria at all sample locations;
- Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations;
- Concentrations of inorganics were reported above the adopted assessment criteria with the total nitrogen concentration within both the WP1 and WP2 samples, and the total phosphorous concentration within both the WP1 and WP2;
- TSS concentrations were detected within both WP1 and WP2, with concentrations of 16 mg/L at WP1 and 7.8 mg/L at WP2; and
- Turbidity ranged from 25 NTU at WP1 to 17 NTU at WP2.

7.3.3 Baseline Results Comparison

One sampling event during the pre-construction period (baseline event) was undertaken on 10 March 2021 which was during dry condition. It should be noted that wet-weather and storm-event pre-construction monitoring was not able to be conducted because of the lack of rainfall. The monitoring results of baseline event (10 March 2021) has not been used for comparison with the monitoring results under this report because the conditions encountered were different (i.e. non-trigger for wet-weather event criteria i.e. >20 mm on 10 March 2021). However, two previous mid-construction wet weather sampling events on 20 March and 5 May 2021 were used to compare and check if there is any potential adverse impact to the water quality caused by the construction activities.

The parameters from each location sampled are presented in **Table 7-2**. Overall, conditions are similar between upstream and downstream samples on 12 and 26 November 2021 and previous wet events.

Table 7-2 Comparison of current wet condition sampling events to previous wet condition sampling events.

Time of sampling		20 March 2021		5 May 2021		12 November 2021		26 November 2021	
Location ID	Assessment Criteria	WP1	WP2	WP1	WP2	WP1	WP2	WP1	WP2
Temperature (ºC)	N/A[2]	20.2	20	18.6	18.2	19.4	19.5	19.6	19.7
pH	6.5 - 8.5	8.10	7.58	7.80	7.73	8.10	8.42	**6.07**	7.34
EC (µS/cm)	125 – 2,200	246.2	133.4	**2,500**	**92.9**	514	509	389	484
DO (mg/L)	N/A[2]	4.79	3.92	6.35	5.95	6.42	5.63	9.05	9.31
DO (%)	85% - 110%	**52.9**	**43.2**	**65.3**	**62.8**	**68**	**63**	99	102
SHE[1] Redox Potential (mV)	N/A[2]	122.3	135.9	164.6	109.2	70.8	80.4	184	196
Chlorophyll a (µg/L)	3	<5	<5	<5	<5	<2	<2	<2	2.7
Oil and Grease (mg/L)	Comparison	<10	<10	<10	<10	<10	<10	<10	<10
Kjeldahl Nitrogen Total (mg/L)	N/A[2]	0.6	0.8	NT[3]	NT[3]	NT[3]	NT[3]	NT[3]	NT[3]
Nitrate & Nitrite (as N) (mg/L)	N/A[2]	1.7	1.5	NT[3]	NT[3]	NT[3]	NT[3]	NT[3]	NT[3]
Nitrogen (Total) (mg/L)	0.35	**2.3**	**2.3**	**5.0**	**1.0**	**2.7**	**2.8**	**1.6**	**2.4**
Phosphate total (as P) (mg/L)	0.025	<0.5	<0.5	**0.21**	**0.15**	**0.15**	0.02	**0.13**	**0.18**
TSS (mg/L)	N/A[2]	9.2	35	4.0	47	8.4	7.6	16	7.8
Turbidity (NTU)	<6-50	9.3	13	4.3	21	21	19	25	17

Note to Table

1 SHE – Standard Hydrogen Electrode

2 Not Applicable

3 NT – Not Tested

7.4 Results Discussion

7.4.1 Comparison to ANZG 2018 / ANZECC 2000 Criteria

Results for the mid-construction event sampled on 12 November 2021 generally showed monitored parameters were within the adopted threshold criteria, with the exception of saturation of DO, total nitrogen, and total phosphorous.

Results for the mid-construction event sampled on 26 November 2021 generally showed monitored parameters were within the adopted threshold criteria, with the exception of pH (only at upstream WP1), total nitrogen, and total phosphorous.

7.4.2 Comparison of Upstream and Downstream Results

Results for upstream and downstream sampling on 12 November 2021 were comparable, with the exception of:

> DO saturation measured at both WP1 and WP2 were outside the adopted criterion range. The downstream WP2 location had slightly lower DO (63%) compared to the upstream WP2 location (68%). Overall, this is not considered to be a significant issue, based on:
  - Similar results obtained from both previous mid-construction wet-weather sampling events on 20 March 2021 and 5 May 2021.
  - The DO saturation measurements undertaken during the pre-construction dry-baseline event on 10 March 2021 returned 63.0% for WP1 and 45.9% for WP2 indicating these mid-construction wet-weather results are closer to the adopted thresholds than the baseline event.

> Phosphorous result was above the adopted threshold at upstream WP1 sample (0.15 mg/L). However, the concentration was lower at the downstream WP2 sample (0.02 mg/L) and below the adopted threshold.

Results for upstream and downstream sampling on 26 November 2021 were comparable, with the exception of:

> pH was outside the adopted criterion range at upstream WP1 sample (6.07), however, within the adopted criterion range at downstream WP2 sample (7.34).

> Concentrations of total phosphorous and total nitrogen were outside the adopted criterion range at upstream and downstream sampling locations and the downstream showed to have slightly higher concentrations compared to the upstream sample. However, the concentrations were generally consistent with the previous two mid-construction wet-weather events.

Refer to **Appendix D** for details. It should be noted that wet-weather and storm-event pre-construction monitoring was not able to be conducted because of the lack of rainfall.

8 Conclusion

Cardno was engaged to undertake surface water monitoring of the unnamed channel west of Wiley Park Station in accordance with the SWMP for the project. The objective of the works was to evaluate whether construction activities are impacting water quality downstream of the project footprint in the unnamed channel that receives in part stormwater from the construction area.

This report presents monitoring data from mid-construction wet-weather event on 12 and 26 November 2021. Samples were collected from two locations per event. Sampling point WP1 is located upstream from the work site while sampling point WP2 is located downstream of the work site. During this monitoring event, sampling results showed monitored parameters were generally within the adopted ANZG 2018 / ANZECC 2000 screening criteria with the exception of DO, total nitrogen, and total phosphorous on 12 November 2021 and pH (only at upstream WP1), total nitrogen, and total phosphorous on 26 November 2021.

The comparison of the wet-weather mid-construction events on 12 and 26 November 2021 with two previous wet-weather sampling events on 20 March 2021 and 5 May 2021 showed no significant difference.

Based on comparison to the criteria, comparison with two previous mid-construction wet-weather events, and comparison of the upstream and downstream results, the results reported for the 12 and 26 November 2021 sampling events are not considered to reflect an adverse impact to water quality due to construction activities.

9 References

> Southwest Metro – Hurlstone Park, Belmore and Wiley Park Station Upgrades – Soil and Water Management Plan, dated 16th February 2021;

> The Sydney Metro City and Southwest - Sydenham to Bankstown Upgrade Conditions of Approval SSI-8256, determined 12 December 2018;

> Environmental Planning and Assessment Act 1979 (EP&A Act);

> Contaminated Land Management Act 1997;

> Protection of the Environment Operations Act 1997 (POEO Act);

> Water Management Act 2000 Water Management (General) Regulation 2018;

> Landcom (2004). Managing Urban Stormwater: Soils and Construction. (Volume 1 of the 'Blue Book');

> DECC (2008). Managing Urban Stormwater: Soils and Construction. Volume 2D: Main Road Construction. (Volume 2D of the 'Blue Book');

> ANZECC (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (collectively known as the 'ANZECC Guidelines');

> ANZECC (2000). Australian and New Zealand Guidelines for Water Quality Monitoring and Reporting (collectively known as the 'ANZECC Guidelines');

> ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (known as 'ANZG Guidelines').

10 Limitations

This assessment has been undertaken in general accordance with the current industry standards for a surface water monitoring report for the purpose and objectives and scope identified in this report. The agreed scope of this assessment has been limited for the current purposes of the Client. The assessment may not identify contamination occurring in all areas of the site or occurring after sampling was conducted. Subsurface conditions may vary considerably away from the sample locations where information has been obtained. This Document has been provided by Cardno subject to the following limitations:

> This Document has been prepared for the particular purpose outlined in Cardno's proposal and Section 1 of this report and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.

> The scope and the period of Cardno's services are as described in Cardno's proposal and are subject to restrictions and limitations. Cardno did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Cardno in regards to it.

> Conditions may exist which were undetectable given the limited nature of the enquiry Cardno was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been considered in the Document. Accordingly, additional studies and actions may be required.

> In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Cardno's opinions are based upon information that existed at the time of the production of the Document. It is understood that the services provided allowed Cardno to form no more than an opinion of the actual conditions of the site at the time this Document was prepared and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

> Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.

> Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Cardno for incomplete or inaccurate data supplied by others.

> Cardno may have retained sub consultants affiliated with Cardno to provide services for the benefit of Cardno. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any direct legal recourse to, and waives any claim, demand, or cause of action against, Cardno's affiliated companies, and their employees, officers and directors.

This assessment report is not any of the following:

> A Site Audit Report or Site Audit Statement (SAR/SAS) as defined under the Contaminated Land Management Act, 1997 or an assessment sufficient for an Environmental Auditor to be able to conclude a SAR/SAS.

> A geotechnical report and the bore logs/test pit logs may not be sufficient for geotechnical advice.

> An assessment of surface water contaminants potentially arising from other sites or sources nearby.

> A total assessment of the site to determine suitability of the entire parcel of land at the site for one or more beneficial uses of land.

APPENDIX

A

FIGURES

Downer

Surface Water Monitoring

WILEY PARK STATION

Legend

- Sample Location
- Discharging Points
- Railway (NSW SS)
- Cadastre (NSW SS, 2019)

1:800 Scale at A3

m
0 10 20 30 40

N

Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (SYD)
Date: 2021-08-03 | Project: 4NE30187
Coordinate System: GDA 1994 MGA Zone 56
Map: 4NE30187-GS-002-SurfaceWater.mxd 02
Aerial imagery supplied by MetroMap (April, 2021)

APPENDIX B

PHOTOGRAPHS

Photograph 1. Upstream sampling location WP1. Date: 12 November 2021.

Photograph 2. Discharge point (WP1-DP1) and observed to have contribution to the flow at the time of sampling. Date: 12 November 2021.

Photograph 3. Downstream sampling location WP2. Date: 12 November 2021.

Photograph 4. Discharge points (WP2-DP1 and WP2-DP2) and observed to have contribution to the flow at the time of sampling. Date: 12 November 2021.

Photograph 5. Upstream sampling location WP1. Date: 26 November 2021.

Photograph 6. Downstream sampling location WP2. Date: 26 November 2021.

APPENDIX C

FIELD RECORDS

Surface Water Sampling Field Record

Site / Project: Wiley Park SWS	Sampling Point: WP1
Client:	Job No. NE30161
Person Sampling: JN	Initials: JN

Site Details

Sampling Equipment – Directly into bottle / Water Scoop / Van Dorn Sampler / Other:	Date: 12/11/21
Observations on Site: Last Rain Event / Recent Storms / Releases / Other :	

Sample Details, Observations, GPS Coordinates & Field Physiochemical Measurements
(if possible, record parameters once stable)

Sample ID	WP1	WP2			
Start Time:	12:20	12:50			
Easting					
Northing					
Sample Depth (m)	0.0-0.15	0.0-0.1			
Water Body Depth (m)	0.15	0.2			
Location – Onsite/Offsite /Inlet/Outlet/ Middle	upstream	Downstream			
Flow Rate None/ Low / Med / High	Low/Med	low/med. 5.63			
DO (mg/L) / %	6.42/68%	5.91/63%			
EC (µS/Cm)	514.0	509.2			
pH	8.1	8.42			
Eh (mV)	70.8	80.4			
Temp (°C)	19.4	19.5			
Water Colour	Clear	Clear			
Turbidity Low / Med / High	Low	Low			
Observations / Notes	GPT flow contribute to primary stream				

Sample Container & Preservation Data

Number of sample containers:	12	34			
Container Volume					
Container Type	5	5			
Preservation	ICE →				
Sample Number (for Lab ID):	WP1	WP2			
QC Dup Sample No.:		QA100 QA200			

* WP1-DP1 → minor flow at time of sampling

* WP2 - DP1 → minor flow
- DP2 → minor flow, higher than WP2-DP1

12/11/2021

Multi Parameter Water Meter

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument YSI Quatro Pro Plus
Serial No. 20M101178

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 10.00		pH 10.00		364961	pH 9.78
2. pH 7.00		pH 7.00		368081	pH 7.01
3. pH 4.00		pH 4.00		367234	pH 4.07
4. mV		231.8mV		365451/370891	231.9mV
5. EC		2.76mS		377099	2.74mS
6. D.O		0.00ppm		371864	0.03ppm
7. Temp		20.7°C		MultiTherm	19.4°C

Calibrated by: Sarah Lian

Calibration date: 12/11/2021

Next calibration due: 12/12/2021

Surface Water Sampling Field Record

Site / Project:	Wiley Park Surface Water - Wet			Sampling Point:	
Client:	Downer			Job No.	NE30161
Person Sampling:	CZ			Initials:	CZ
Site Details					
Sampling Equipment – Directly into bottle / Water Scoop / Van Dorn Sampler / Other:				Date:	26.11.2021
Observations on Site: Last Rain Event / Recent Storms / Releases / Other :					
Sample Details, Observations, GPS Coordinates & Field Physiochemical Measurements (if possible, record parameters once stable)					
Sample ID	WP1		WP2/QA100/QA200		
Start Time:	1415		1450		
Easting	/		/		
Northing	/		/		
Sample Depth (m)	0.0-0.15		0.0-0.2		
Water Body Depth (m)	0.15		0.2		
Location – Onsite/Offsite /Inlet/Outlet/ Middle	upstream		downstream		
Flow Rate None/ Low / Med / High	low		medium		
DO (mg/L) / %	9.05mg/L/98.7%		9.31mg/L/101.9%		
EC (µS/Cm) (SPC)	387.2		484		
pH	6.07		7.34		
Eh (mV)	183.7		196.3		
Temp (°C)	19.6		19.7		
Water Colour	clear		clear		
Turbidity Low / Med / High	low/25.55NTU		low/23.67NTU		
Observations / Notes	TDS (253 mg/L) WP1-DP1 flowing		TDS (315 mg/L) WP2-DP1 WP2-DP2 → flowing		
Sample Container & Preservation Data					
Number of sample containers:	5		5+4+4		
Container Volume					
Container Type					
Preservation					
Sample Number (for Lab ID):					
QC Dup Sample No.:					

Calibration & Service Report
Water Quality Meter

Company:	Active Environmental Solutions Hire	**Manufacturer:**	YSI	**Serial #:**	18H111016
Address:	Unit 16, 191 Parramatta Road AUBURN NSW 2144	**Instrument/Model:**	ProDSS Handheld Water Quality Meter	**Cable Length:**	1 M
Phone:	02 9716 5966 | **Fax**: 02 9716 5988	**Client Company:**		**Client Email:**	
Email:	hire@aesoultions.com.au	**Client Name:**		**Client Phone:**	

Item	Test	Pass	Comments
Battery	Charged	✓	
	Battery Saver	✓	Automatically turns off after 15 minutes if not used
Connections	Condition	✓	Good, clean
Cable	Condition	✓	Clean, no tears
Display	Operation	✓	
Firmware	Version	✓	1.1.8
Keypad	Operational	✓	
Display	Screen	✓	
Unit	Condition, seals and O-rings	✓	
Monitor housing	Condition	✓	
pH			
Condition		✓	Good, clean
pH millivolts for pH7 calibration range 0 mV ± 50 mV		✓	
pH 4 mV range + 165 to + 180 from 7 buffer mV value		✓	
pH slope		✓	
Response time < 90 seconds		✓	
Calibrated and conforms to manufacturer's specifications		✓	
ORP			
Condition		✓	Good, clean
Response time < 90 seconds		✓	
within ± 80mv of reference Zobell Reading		✓	
Calibrated and conforms to manufacturer's specifications		✓	Variance range ± 20mV
Conductivity			
Condition		✓	Good, clean
Calibrated and conforms to manufacturer's specifications		✓	°C
Turbidity			
Calibrated and conforms to manufacturer's specifications		✓	
Condition		✓	
Dissolved Oxygen			
Condition		✓	Good, clean
Calibrated and conforms to manufacturer's specifications		✓	

Parameter	Standards	Reference	Calibration Point	Before	After	Units
Temperature	Center 370 Thermometer	Room Temp.	22.5	N/A	22.5	°C
pH	pH 4.00	363894	4.01	4.13	4.01	pH
pH	pH 10.00	349846	10.00	10.7	10.00	pH
pH	pH 7.00	363895	7.00	7.20	7.00	pH
Conductivity	2760 µs/cm at 25°C	362912	2760	2774	2760	µs/cm
ORP (Ref. check only)	Zobell A & B	358011 & 363903	234.4	230.2	234.4	mV
Zero Dissolved Oxygen	NaSO3 in distilled water	372164; V070819	0.0	-0.2	0.0	%
100% Dissolved Oxygen	100% Air Saturation	Fresh Air	99.4	100.6	99.4	%
Zero Turbidity	0 FNU	W-54320-V070819	0.00	-0.02	0.00	FNU
Turbidity	124.00 FNU	20H20290164	124.00	124.33	124.00	FNU

Calibrated By: Milenko Sisic

Calibration Date: 26/11/2021 **Calibration Due:** 26/05/2022

APPENDIX

D

LABORATORY SUMMARY TABLE

Project Number: NE30161
Site Identification: Wiley Park Station
Report Title: Surface Water Monitoring

			Chlorophyll a	TPH	Inorganics						Physio-Chemical			
				Oil and Grease	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrogen (Total as N)	Phosphorus (Total as P)	TSS	Turbidity	pH	°C Temprature	Electrical Conductivity	Dissolved Oxygen
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	Units	°C	uS/cm	%Sat
EQL			0.002	10	0.1	0.01	0.2	0.01	1	1	0.01	0.1	0.1	0.1
ANZECC Criteria - Freshwater			0.003	-	-	-	0.35	0.025	-	<6-50	6.5-8.5	-	125-2200	85% - 110%
12 November 2021														
Lab Report Number	**Field ID**	**Date**												
841106	**WP1**	**12/11/2021**	<0.002	<10	NT	NT	**2.70**	**0.15**	8.4	21	**8.10**	19.4	514	**68**
841106	**WP2**	**12/11/2021**	<0.002	<10	NT	NT	**2.80**	0.02	7.6	19	**8.42**	19.5	509	**63**
841106	**QA100**	**12/11/2021**	NT	<10	NT	NT	**2.80**	**0.04**	11	18	-	-	-	-
ES2141599	**QA200**	**12/11/2021**	NT	<5	0.9	1.69	**2.60**	**0.16**	7	17.8	-	-	-	-
Statistics														
Maximum Concentration			**<0.002**	**<10**	**0.9**	**1.7**	**2.80**	**0.16**	**11.0**	**21.0**	**8.42**	**-**	**514.0**	**68**
26 Novemver 2021														
Lab Report Number	**Field ID**	**Date**												
845645	**WP1**	**26/11/2021**	<0.002	<10	NT	NT	**1.6**	**0.13**	16	25	**6.07**	19.6	389	**98.7**
845645	**WP2**	**26/11/2021**	0.0027	<10	NT	NT	**2.4**	**0.18**	7.8	17	**7.34**	19.7	484	**101.9**
845645	**QA100**	**26/11/2021**	NT	<10	NT	NT	**2.4**	**0.17**	12	21	-	-	-	-
ES2143963	**QA200**	**26/11/2021**	NT	<5	0.9	1.85	**2.8**	**0.19**	19	22.7	-	-	-	-
Statistics														
Maximum Concentration			**<0.002**	**<10**	**0.9**	**1.85**	**2.8**	**0.19**	**19**	**25.0**	**7.34**	**-**	**484.0**	**101.9**

* A Non Detect Multiplier of 0.5 has been applied.

APPENDIX

E

QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance/Quality Control (QA/QC) procedures were implemented to ensure the precision accuracy, representativeness, completeness and comparability of all data gathered. The QA/QC procedures included:

- Equipment calibration to ensure field measurements obtained are accurate
- Equipment decontamination to prevent cross contamination
- Use of appropriate measures (i.e. gloves) to prevent cross contamination
- Appropriate sample identification
- Correct sample preservation
- Sample transport with Chain of Custody (CoC) documentation
- Laboratory analysis in accordance with NATA accredited methods.

Table E1 details the QA/QC procedures and sample collection details undertaken through the surface water elements of the investigation. Copies of all the CoCs, along with the Sample Receipt Notifications (SRNs), Interpretive QA/QC Reports are provided in **Appendix F**.

Table E1 Field QA/QC Method Validation

Requirement	Yes / No	Comments
Equipment decontamination	Yes	In the event of involving reusable equipment. Decontamination of sampling equipment (water quality meter, telescopic water scoop etc.) was undertaken by washing with phosphate free detergent (Liquinox) followed by a rinse with potable water.
Sample collection	Yes	Samples were collected using disposable nitrile gloves via telescopic water scoop. A clean pair of gloves was used for each new sample being collected to limit the possibility of cross-contamination.
QA/QC sample collection	Yes	One (1) surface water duplicate and one (1) surface water triplicate sample were collected for intra and inter-lab QA/QC purposes to monitor the quality of the field practices for sample collection. Cardno based the investigation around a rate of one duplicate and triplicate sample per sampling event, as the requirement for duplicate and triplicate sample collection.
Sample identification	Yes	All samples were marked with a unique identifier including project number, sample location, and date.
Sample preservation	Yes	Samples were placed in a chilled ice box with ice for storage and transport to the laboratory.
CoC documentation	Yes	A CoC form was completed by Cardno detailing sample identification, collection date, sampler and laboratory analysis required. The CoC form was signed off and returned to Cardno by the laboratory staff upon receipt of all the samples. CoC forms and Sample Receipt Notification (SRN) are provided in **Appendix F**. The SRN indicates that the samples were received at the laboratory intact and chilled and within the required holding times.
NATA accredited methods	Yes	The NATA accredited Eurofins mgt and ALS Analysed the samples in accordance with NATA accredited methods. Analytical methods used are indicated in the stamped laboratory results provided in **Appendix F**.
Laboratory Internal QC	No	All Data Quality Objectives were met by the laboratories.

Table E2 Field QA/QC Collection Summary

Environmental Media	Date	Primary	Duplicate	Triplicate
Surface Water	12/11/2021	WP2	QA100	QA200
Surface Water	26/11/2021	WP2	QA100	QA200

Relative Percentage Difference Determination

Laboratory results for duplicate and triplicate samples are assessed using a determination of the Relative Percentage Difference (RPD). Where a primary sample and a duplicate sample are compared, the RPD provides an indication of the reproducibility of the results, which incorporates the sampling method. Where a primary sample and a split sample are compared, the RPD provides an indication of the accuracy of the primary laboratory results as compared to the secondary laboratory result.

The calculation used to determine the RPD is:

$$RPD = \frac{(Co - Cs)}{\left(\frac{Co + Cs}{2}\right)} x100$$

Where:

Co = Concentration of the original sample

Cs = Concentration of the duplicate sample

In calculating the RPD values the following protocols were adopted:

> Where both concentrations are above laboratory reporting limits the RPD formula is used;

> Where both concentrations are below the laboratory reporting limits, no RPD is calculated; and

> Where one or both sample concentrations are reported to be less than ten times (<10x) the laboratory reporting limit, the RPD is calculated but is not assessed against the adopted criterion.

In accordance with the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended 2013, Cardno adopts an RPD acceptance criterion up to 30% of the mean concentration of the analyte. It should be noted that variations might be higher for organic analysis, due to the volatile nature of the components, and for low concentrations of analytes.

The adopted criterion will not apply to RPDs where one of both concentrations are less than 10 times the reporting limit, as this criterion would otherwise overestimate the significance of minor variations in concentrations at or near the laboratory reporting limit. Large RPDs returned for low concentrations of analytes near the reporting limit is not as indicative of a significant difference in the results as a small RPD is for larger concentrations.

This approach is employed by NATA accredited laboratories when assessing internal duplicate sample RPDs. This approach acknowledges that concentrations at or around the reporting limit are too low for an accurate evaluation of the significance of the RPD.

This approach has been adopted when assessing the relevance (compliance) of RPDs during this investigation. RPDs will be calculated for sample sets where one or both concentrations are less than 10 times the reporting limit for discussion purposes, but will not be assessed as a pass or fail in relation to the criterion.

The RPD results for duplicate samples are presented in this appendix. Although two (2) RPD values were reported to be above the accepted 30% RPD criteria. The breaches in RPDs are not considered to alter the overall outcome of the assessment. It can be concluded that the analytical data can be relied upon for the purposes of this factual report.

Laboratory QC and QCI Report Summary

The laboratories selected for undertaking the analysis (Eurofins mgt and ALS) are NATA accredited for the analysis required and undertook certain QA/QC requirements to demonstrate the suitability of the data that is obtained. The laboratory is required to undertake and report internal laboratory QC procedures for all chemical analysis undertaken. The QC testing is required to include:

> Laboratory duplicate sample analysis at the rate of one duplicate analysis per ten samples

> Method blank at the rate of one method blank analysis per 20 samples
> Laboratory control sample at the rate of one laboratory control sample analysis per 20 samples
> Spike recovery analysis at the rate of one spike recovery analysis per 20 samples.

Compliance with the laboratory QA/QC requirements and non-conformance details are discussed in the internal Laboratory QA/QC reports included with the certificates of analysis in **Appendix F**. Laboratory QA/QC requirements were within acceptance limits.

Cardno concludes that the data reported by the NATA accredited Eurofins mgt and ALS as presented in this report is suitable for interpretative purposes and to make conclusions/recommendations regarding water quality.

Project Number: NE30161
Site Identification: Wiley Park Station
Report Title: Surface Water Monitoring

				TPH	Inorganics					
			Chlorophyll a	Oil and Grease	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrogen (Total as N)	Phosphorus (Total as P)	TSS	Turbidity
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU
EQL			0.002	10	0.1	0.01	0.2	0.01	1	1
12 November 2021										
Lab Report Number	**Field ID**	**Date**								
841106	**WP2**	**12/11/2021**	<0.002	<10	NT	NT	2.80	0.02	7.6	19
841106	**QA100**	**12/11/2021**	NT	<10	NT	NT	2.80	0.04	11	18
Statistics										
RDP (%)			**NT**	**NT**	**NT**	**NT**	**0**	**67**	**37**	**5**
841106	**WP2**	**12/11/2021**	<0.002	<10	NT	NT	2.80	0.02	7.6	19
ES2141599	**QA200**	**12/11/2021**	NT	<5	0.9	1.69	2.60	0.16	7	17.8
Statistics										
RDP (%)			**NT**	**NT**	**NT**	**NT**	**7**	**156**	**8**	**7**
26 Novemver 2021										
Lab Report Number	**Field ID**	**Date**								
845645	**WP2**	**26/11/2021**	<0.002	<10	NT	NT	2.4	0.18	7.8	17
845645	**QA100**	**26/11/2021**	NT	<10	NT	NT	2.4	0.17	12	21
Statistics										
RDP (%)			**NT**	**NT**	**NT**	**NT**	**0**	**6**	**42**	**21**
845645	**WP2**	**26/11/2021**	0.0027	<10	NT	NT	2.4	0.18	7.8	17
ES2143963	**QA200**	**26/11/2021**	NT	<5	0.9	1.85	2.8	0.19	19	22.7
Statistics										
RDP (%)			**NT**	**NT**	**NT**	**NT**	**15**	**5**	**84**	**29**

***RPDs have only been considered where a concentration is greater than 1 times the EQL.**

****Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: (1 - 10 x EQL); 30 (10 - 30 x EQL); 30 (> 30 x EQL))**

*****Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory**

APPENDIX

F

LABORATORY REPORTS

Cardno
Shaping the Future

CHAIN OF CUSTODY AND ANALYSIS REQUEST

Contact Person:	Ben Withnall	Project Name:	Downer Sydney Metro Stations - Wiley Park
Telephone Number:	0436 687 417	Project Number:	NE30161
Alternative Contact:	Chong Zheng	PO No.:	
Telephone Number:	0451 780 991	Project Specific Quote No. :	190408CDNN_1
Sampler:	JN	Turnaround Requirements:	Standard TAT
Email Address (results and invoice):	ben.withnall@cardno.com.au; chong.zeng@cardno.com.qu; ContamNSW@cardno.com.au; joshua.nito@cardno.com.au	Lab:	Eurofins | Unit F3, Building F, 16 Mars Rd, Lane Cove West NSW2066
Address: Level 9 - The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia		Attn:	Sample Receipt

Sample information						Analysis Required												Comments
Cardno Sample ID	Laboratory Sample ID	No. Containers	Preservation	Date sampled	Matrix	Chlorophyll-a	TSS	Turbidity	Oil and Grease	Total Phosphorus	Total Nitrogen							
WP1		5	ICE	12/11/2021	Water	1	1	1	1	1	1							
WP2		5	ICE		Water	1	1	1	1	1	1							
QA100		4	ICE		Water		1	1	1	1	1							
QA200		4	ICE		Water		1	1	1	1	1							Please send to ALS

Relinquished by: Joshua Nito	Received by:	Relinquished by:	Received by:	Relinquished by:
(name / company) Cardno ACT/NSW Pty Ltd	(name / company)	(name / company	(name / company)	(name / company)
Date & Time: 12/11/2021 2:40pm	Date & Time:	Date & Time:	Date & Time:	Date & Time:
Signature: JN	Signature:	Signature:	Signature:	Signature:
Received by:	Relinquished by:	Received by:	Relinquished by:	Lab use:
(name / company)	(name / company)	(name / company	(name / company)	Samples Received: Cool or Ambient (circle one)
Date & Time:	Date & Time:	Date & Time:	Date & Time:	Temperature Received at: (if applicable)
Signature:	Signature:	Signature:	Signature:	Transported by: Hand delivered / courier

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www.eurofins.com.au EnviroSales@eurofins.com

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NATA # 1261 Site # 18217

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IANZ # 1290

Sample Receipt Advice

Company name:	Cardno (NSW/ACT) Pty Ltd
Contact name:	Ben Withnall
Project name:	DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID:	NE30161
Turnaround time:	5 Day
Date/Time received	Nov 12, 2021 2:20 PM
Eurofins reference	841106

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✗	Split sample sent to requested external lab.
✓	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

QA200 to be packed for ALS. Amber will be subcontracted for Chlorophyll testing.

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Ursula Long on phone : or by email: UrsulaLong@eurofins.com

Results will be delivered electronically via email to Ben Withnall - ben.withnall@cardno.com.au.

Note: A copy of these results will also be delivered to the general Cardno (NSW/ACT) Pty Ltd email address.

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email: EnviroSales@eurofins.com

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IANZ # 1290

Company Name: Cardno (NSW/ACT) Pty Ltd
Address: Level 9, 203 Pacific Highway
St Leonards
NSW 2065

Project Name: DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID: NE30161

Order No.:
Report #: 841106
Phone: 0294967700
Fax: 02 9499 3902

Received: Nov 12, 2021 2:20 PM
Due: Nov 19, 2021
Priority: 5 Day
Contact Name: Ben Withnall

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Chlorophyll a	Chlorophyll A	Oil & Grease (HEM)	Phosphate total (as P)	Total Nitrogen (as N)	Total Suspended Solids Dried at 103–105°C	Turbidity
Melbourne Laboratory - NATA # 1261 Site # 1254						X		X		X		
Sydney Laboratory - NATA # 1261 Site # 18217									X		X	X
Brisbane Laboratory - NATA # 1261 Site # 20794												
Mayfield Laboratory - NATA # 1261 Site # 25079												
Perth Laboratory - NATA # 2377 Site # 2370												
External Laboratory							X					
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	WP1	Nov 12, 2021		Water	S21-No34284		X	X	X	X	X	X
2	WP2	Nov 12, 2021		Water	S21-No34285	X		X	X	X	X	X
3	QA100	Nov 12, 2021		Water	S21-No34286			X	X	X	X	X
Test Counts						1	1	3	3	3	3	3

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Phone : 0800 856 450
IANZ # 1290

Company Name: Cardno (NSW/ACT) Pty Ltd
Address: Level 9, 203 Pacific Highway
St Leonards
NSW 2065

Project Name: DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID: NE30161

Order No.:
Report #: 841106
Phone: 0294967700
Fax: 02 9499 3902

Received: Nov 12, 2021 2:20 PM
Due: Nov 19, 2021
Priority: 5 Day
Contact Name: Ben Withnall

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Chlorophyll a	Chlorophyll A	Oil & Grease (HEM)	Phosphate total (as P)	Total Nitrogen (as N)	Total Suspended Solids Dried at 103–105°C	Turbidity
Melbourne Laboratory - NATA # 1261 Site # 1254						X		X		X		
Sydney Laboratory - NATA # 1261 Site # 18217									X		X	X
Brisbane Laboratory - NATA # 1261 Site # 20794												
Mayfield Laboratory - NATA # 1261 Site # 25079												
Perth Laboratory - NATA # 2377 Site # 2370												
External Laboratory							X					
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	WP1	Nov 12, 2021		Water	S21-No34284		X	X	X	X	X	X
2	WP2	Nov 12, 2021		Water	S21-No34285	X		X	X	X	X	X
3	QA100	Nov 12, 2021		Water	S21-No34286			X	X	X	X	X
Test Counts						1	1	3	3	3	3	3

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Cardno (NSW/ACT) Pty Ltd
Level 9, 203 Pacific Highway
St Leonards
NSW 2065

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Ben Withnall**

Report **841106-W-V2**
Project name DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID NE30161
Received Date Nov 12, 2021

Client Sample ID			**WP1**	**WP2**	**QA100**
Sample Matrix			**Water**	**Water**	**Water**
Eurofins Sample No.			**S21-No34284**	**S21-No34285**	**S21-No34286**
Date Sampled			**Nov 12, 2021**	**Nov 12, 2021**	**Nov 12, 2021**
Test/Reference	LOR	Unit			
Chlorophyll a	2	ug/L	< 2	< 2	-
Oil & Grease (HEM)	10	mg/L	< 10	< 10	< 10
Phosphate total (as P)	0.01	mg/L	0.15	0.02	0.04
Total Nitrogen (as N)	0.2	mg/L	2.7	2.8	2.8
Total Suspended Solids Dried at 103–105°C	5	mg/L	8.4	7.6	11
Turbidity	1	NTU	21	19	18

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chlorophyll a	Melbourne	Nov 26, 2021	28 Days
- Method: LTM-INO-4340 Chlorophyll a in Waters			
Oil & Grease (HEM)	Melbourne	Nov 17, 2021	28 Days
- Method: LTM-INO-4180 Oil and Grease (APHA 5520B)			
Phosphate total (as P)	Sydney	Nov 16, 2021	28 Days
- Method: E052 Total Phosphate (as P)			
Total Nitrogen (as N)	Melbourne	Nov 17, 2021	7 Days
- Method: LTM-INO-4040 Phosphate and Nitrogen in waters			
Total Suspended Solids Dried at 103–105°C	Sydney	Nov 16, 2021	7 Days
- Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry			
Turbidity	Sydney	Nov 16, 2021	2 Days
- Method: LTM-INO-4140 Turbidity by Nephelometric Method			

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Company Name: Cardno (NSW/ACT) Pty Ltd
Address: Level 9, 203 Pacific Highway
St Leonards
NSW 2065

Project Name: DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID: NE30161

Order No.:
Report #: 841106
Phone: 0294967700
Fax: 02 9499 3902

Received: Nov 12, 2021 2:20 PM
Due: Nov 19, 2021
Priority: 5 Day
Contact Name: Ben Withnall

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Chlorophyll a	Chlorophyll A	Oil & Grease (HEM)	Phosphate total (as P)	Total Nitrogen (as N)	Total Suspended Solids Dried at 103–105°C	Turbidity
Melbourne Laboratory - NATA # 1261 Site # 1254						X		X		X		
Sydney Laboratory - NATA # 1261 Site # 18217									X		X	X
Brisbane Laboratory - NATA # 1261 Site # 20794												
Mayfield Laboratory - NATA # 1261 Site # 25079												
Perth Laboratory - NATA # 2377 Site # 2370												
External Laboratory							X					
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	WP1	Nov 12, 2021		Water	S21-No34284		X	X	X	X	X	X
2	WP2	Nov 12, 2021		Water	S21-No34285	X		X	X	X	X	X
3	QA100	Nov 12, 2021		Water	S21-No34286			X	X	X	X	X
Test Counts						1	1	3	3	3	3	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.4
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Oil & Grease (HEM)	mg/L	< 10			10	Pass	
Phosphate total (as P)	mg/L	< 0.01			0.01	Pass	
Total Nitrogen (as N)	mg/L	< 0.2			0.2	Pass	
Total Suspended Solids Dried at 103–105°C	mg/L	< 5			5	Pass	
Turbidity	NTU	< 1			1	Pass	
LCS - % Recovery							
Oil & Grease (HEM)	%	99			70-130	Pass	
Phosphate total (as P)	%	82			70-130	Pass	
Total Nitrogen (as N)	%	118			70-130	Pass	
Total Suspended Solids Dried at 103–105°C	%	101			70-130	Pass	
Turbidity	%	94			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Total Nitrogen (as N)	B21-No32406	NCP	%	103			70-130	Pass	
Total Suspended Solids Dried at 103–105°C	S21-No37201	NCP	%	106			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Chlorophyll a	S21-No34284	CP	ug/L	< 2	< 5	<1	30%	Pass	
Total Nitrogen (as N)	L21-No27938	NCP	mg/L	3.6	3.5	2.0	30%	Pass	
Total Suspended Solids Dried at 103–105°C	S21-No34284	CP	mg/L	8.4	8.8	5.0	30%	Pass	
Turbidity	S21-No34338	NCP	NTU	17	19	6.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Phosphate total (as P)	S21-No34286	CP	mg/L	0.04	0.05	16	30%	Pass	

Comments

This report has been revised (V2) to amend Chlorophyll LOR.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Ursula Long	Analytical Services Manager
Charl Du Preez	Senior Analyst-Inorganic (NSW)
Scott Beddoes	Senior Analyst-Inorganic (VIC)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Cardno
Shaping the Future

CHAIN OF CUSTODY AND ANALYSIS REQUEST

ontact Person:	Ben Withnall	Project Name:	Downer Sydney Metro Stations - Wiley Park
elephone Number:	0436 687 417	Project Number:	NE30161
lternative Contact:	Chong Zheng	PO No.:	
elephone Number:	0451 780 991	Project Specific Quote No. :	190408CDNN_1
ampler:	JN	Turnaround Requirements:	Standard TAT
mail Address (results and Invoice):	ben.withnall@cardno.com.au; chong.zeng@cardno.com.au; ContamNSW@cardno.com.au; joshua.nito@cardno.com.au	Lab:	Eurofins | Unit F3, Building F, 16 Mars Rd, Lane Cove West NSW2066
ddress: Level 9 - The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia		Attn:	Sample Receipt

Sample information						Analysis Required											Comments
Cardno Sample ID	Laboratory Sample ID	No. Containers	Preservation	Date sampled	Matrix	Chlorophyll-a	TSS	Turbidity	Oil and Grease	Total Phosphorus	Total Nitrogen						HT
WP1		5	ICE	12/11/2021	Water	1	1	1	1	1	1						
WP2		5	ICE		Water	1	1	1	1	1	1						
QA100		4	ICE		Water		1	1	1	1	1						
QA200	(1)	4	ICE		Water		1	1	1	1	1						Please send to ALS

Environmental Division Sydney
Work Order Reference
ES2141599

Telephone : +61-2-8784 8555

elinquished by:	Joshua Nito	Received by:		Relinquished by:		Received by:	Relinquished by:
ame / company)	Cardno ACT/NSW Pty Ltd	(name / company)		(name / company		(name / company)	(name / company)
ate & Time:	12/11/2021 2:40pm	Date & Time:		Date & Time:		Date & Time: 12/11/21 11:2	Date & Time:
gnature:	JN	Signature:		Signature:		Signature:	Signature:
eceived by:		Relinquished by:		Received by:		Relinquished by:	*Lab use:*
ame / company)		(name / company)		(name / company		(name / company)	Samples Received: Cool or Ambient (circle one)
ate & Time:		Date & Time:		Date & Time:		Date & Time:	Temperature Received at: (if applicable)
gnature:		Signature:		Signature:		Signature:	Transported by: Hand delivered / courier

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2141599**

Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Chong Zeng	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: chong.zeng@cardno.com.au	E-mail	: Shane.Ellis@ALSGlobal.com
Telephone	: ----	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Page	: 1 of 3
Order number	: ----	Quote number	: EP2020CARNSWACT0002 (EN/024/20)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: JOSHUA NITO		

Dates

Date Samples Received	: 17-Nov-2021 12:20	Issue Date	: 17-Nov-2021
Client Requested Due Date	: 24-Nov-2021	Scheduled Reporting Date	: **24-Nov-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 6.6' C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - EA025H Suspended Solids - Standard Level	WATER - EA045 Turbidity	WATER - EP020 Oil & Grease (O&G)	WATER - NT-11 Total Nitrogen and Total Phosphorus
ES2141599-001	12-Nov-2021 00:00	QA200	✓	✓	✓	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **WATER** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method **Client Sample ID(s)**	**Container**	**Due for extraction**	**Due for analysis**	**Samples Received**		**Instructions Received**	
				Date	**Evaluation**	**Date**	**Evaluation**
EA045: Turbidity							
QA200	Clear Plastic Bottle - Natural	----	14-Nov-2021	17-Nov-2021	✘	----	----

Requested Deliverables

BEN WITHNALL

- *AU Certificate of Analysis - NATA (COA)	Email	ben.withnall@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ben.withnall@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ben.withnall@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ben.withnall@cardno.com.au
- A4 - AU Tax Invoice (INV)	Email	ben.withnall@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	ben.withnall@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	ben.withnall@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	ben.withnall@cardno.com.au

Chong Zeng

- *AU Certificate of Analysis - NATA (COA)	Email	chong.zeng@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chong.zeng@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chong.zeng@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chong.zeng@cardno.com.au
- A4 - AU Tax Invoice (INV)	Email	chong.zeng@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	chong.zeng@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	chong.zeng@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	chong.zeng@cardno.com.au

ContamNSW

- *AU Certificate of Analysis - NATA (COA)	Email	contamnsw@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	contamnsw@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	contamnsw@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	contamnsw@cardno.com.au
- A4 - AU Tax Invoice (INV)	Email	contamnsw@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	contamnsw@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	contamnsw@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	contamnsw@cardno.com.au

INVOICES

- A4 - AU Tax Invoice (INV)	Email	apinvoices@cardno.com.au

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2141599**	Page	: 1 of 2
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Chong Zeng	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Date Samples Received	: 17-Nov-2021 12:20
Order number	: ----	Date Analysis Commenced	: 19-Nov-2021
C-O-C number	: ----	Issue Date	: 24-Nov-2021 11:04
Sampler	: JOSHUA NITO		
Site	: ----		
Quote number	: EN/024/20		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Sample ID	**QA200**	**----**	**----**	**----**	**----**
			Sampling date / time	12-Nov-2021 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2141599-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	**7**	**----**	**----**	**----**	**----**
EA045: Turbidity								
Turbidity	----	0.1	NTU	**17.8**	**----**	**----**	**----**	**----**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**1.69**	**----**	**----**	**----**	**----**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.9**	**----**	**----**	**----**	**----**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	**2.6**	**----**	**----**	**----**	**----**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.16**	**----**	**----**	**----**	**----**
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	**----**	**----**	**----**	**----**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2141599**	Page	: 1 of 3
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Chong Zeng	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Date Samples Received	: 17-Nov-2021
Order number	: ----	Date Analysis Commenced	: 19-Nov-2021
C-O-C number	: ----	Issue Date	: 24-Nov-2021
Sampler	: JOSHUA NITO		
Site	: ----		
Quote number	: EN/024/20		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 4026628)									
ES2141508-009	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.0	No Limit
ES2141599-001	QA200	EA025H: Suspended Solids (SS)	----	5	mg/L	7	7	0.0	No Limit
EA045: Turbidity (QC Lot: 4026706)									
ES2141223-007	Anonymous	EA045: Turbidity	----	0.1	NTU	15.5	15.9	2.5	0% - 20%
ES2141840-001	Anonymous	EA045: Turbidity	----	0.1	NTU	1.3	1.3	0.0	0% - 50%
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4027116)									
ES2140218-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.05	0.05	0.0	No Limit
ES2141552-018	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	2.86	2.83	1.1	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4027113)									
ES2140218-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	94.7	95.9	1.3	0% - 20%
ES2141552-017	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	4.0	4.0	0.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4027112)									
ES2140218-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	14.4	14.4	0.1	0% - 20%
ES2141552-017	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	4.74	4.79	1.2	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 4026628)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	101	83.0	129
				<5	1000 mg/L	100	82.0	110
				<5	463 mg/L	102	83.0	118
EA045: Turbidity (QCLot: 4026706)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	97.0	91.0	105
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4027116)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	101	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4027113)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	91.9	69.0	101
				<0.1	1 mg/L	98.4	70.0	118
				<0.1	5 mg/L	103	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4027112)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	96.9	71.0	101
				<0.01	0.442 mg/L	102	72.0	108
				<0.01	1 mg/L	108	70.0	130
EP020: Oil and Grease (O&G) (QCLot: 4029921)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	110	81.0	121

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4027116)							
ES2140218-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	84.8	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4027113)							
ES2140218-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	100 mg/L	106	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4027112)							
ES2140218-002	Anonymous	EK067G: Total Phosphorus as P	----	20 mg/L	112	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2141599**	Page	: 1 of 4
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Chong Zeng	Telephone	: +61 2 8784 8555
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Date Samples Received	: 17-Nov-2021
Site	: ----	Issue Date	: 24-Nov-2021
Sampler	: JOSHUA NITO	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA045: Turbidity						
Clear Plastic Bottle - Natural						
QA200	----	----	----	20-Nov-2021	14-Nov-2021	**6**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural (EA025H)							
QA200	**12-Nov-2021**	**----**	----	----	**19-Nov-2021**	19-Nov-2021	✓
EA045: Turbidity							
Clear Plastic Bottle - Natural (EA045)							
QA200	**12-Nov-2021**	**----**	----	----	**20-Nov-2021**	14-Nov-2021	×
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
QA200	**12-Nov-2021**	**----**	----	----	**22-Nov-2021**	10-Dec-2021	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
QA200	**12-Nov-2021**	**22-Nov-2021**	10-Dec-2021	✓	**22-Nov-2021**	10-Dec-2021	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
QA200	**12-Nov-2021**	**22-Nov-2021**	10-Dec-2021	✓	**22-Nov-2021**	10-Dec-2021	✓
EP020: Oil and Grease (O&G)							
Amber Glass Bottle - Sulfuric Acid (EP020)							
QA200	**12-Nov-2021**	**----**	----	----	**23-Nov-2021**	10-Dec-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Oil and Grease	EP020	WATER	In house: Referenced to APHA 5520 B. Oil & grease is a gravimetric procedure to determine the amount of oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)

Cardno
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CHAIN OF CUSTODY AND ANALYSIS REQUEST

Contact Person:	Ben Withnall	Project Name:	Downer Sydney Metro Stations - Wiley Park
Telephone Number:	0436 687 417	Project Number:	NE30161
Alternative Contact:	Chong Zheng	PO No.:	
Telephone Number:	0451 780 991	Project Specific Quote No. :	190408CDNN_1
Sampler:	CZ	Turnaround Requirements:	Standard TAT
Email Address (results and invoice):	ben.withnall@cardno.com.au; chong.zeng@cardno.com.au; ContamNSW@cardno.com.au	Lab:	Eurofins | Unit F3, Building F, 16 Mars Rd, Lane Cove West NSW2066
Address: Level 9 - The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia		Attn:	Sample Receipt

Sample information						Analysis Required												Comments
Cardno Sample ID	Laboratory Sample ID	No. Containers	Preservation	Date sampled	Matrix	Chlorophyll-a	TSS	Turbidity	Oil and Grease	Total Phosphorus	Total Nitrogen							
WP1		5	ICE	26/11/2021	Water	1	1	1	1	1	1							
WP2		5	ICE		Water	1	1	1	1	1	1							
QA100		4	ICE		Water		1	1	1	1	1							
QA200		4	ICE		Water		1	1	1	1	1							Please send to ALS

Environmental Division
Sydney
Work Order Reference
ES2143963

Telephone : +61-2-8784 8555

Relinquished by:	Chong Zeng	Received by:		Relinquished by:		Received by:		Relinquished by:	M.H
(name / company)	Cardno ACT/NSW Pty Ltd	(name / company)		(name / company		(name / company)		(name / company)	
Date & Time:	11/26/2021	Date & Time:		Date & Time:		Date & Time:	02/12/21	Date & Time:	28/11/21
Signature:	CZ	Signature:		Signature:		Signature:	1415 10	Signature:	
Received by:		Relinquished by:		Received by:		Relinquished by:		Lab use:	#845645
(name / company)		(name / company)		(name / company		(name / company)		Samples Received: Cool or Ambient (circle one)	
Date & Time:		Date & Time:		Date & Time:		Date & Time:		Temperature Received at:	(if applicable)
Signature:		Signature:		Signature:		Signature:		Transported by: Hand delivered / courier	

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2143963**

Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR BEN WITHNALL	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ben.withnall@cardno.com.au	E-mail	: Shane.Ellis@ALSGlobal.com
Telephone	: +61 2 9495 8188	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Page	: 1 of 3
Order number	: ----	Quote number	: EP2020CARNSWACT0002 (EN/024/20)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 02-Dec-2021 14:15	Issue Date	: 03-Dec-2021
Client Requested Due Date	: 09-Dec-2021	Scheduled Reporting Date	: **09-Dec-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 10.2 - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - EA025H Suspended Solids - Standard Level	WATER - EA045 Turbidity	WATER - EP020 Oil & Grease (O&G)	WATER - NT-11 Total Nitrogen and Total Phosphorus
ES2143963-001	26-Nov-2021 00:00	QA200	✓	✓	✓	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **WATER** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
EA045: Turbidity							
QA200	Clear Plastic Bottle - Natural	----	28-Nov-2021	02-Dec-2021	✘	----	----

Requested Deliverables

BEN WITHNALL

- *AU Certificate of Analysis - NATA (COA)	Email	ben.withnall@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ben.withnall@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ben.withnall@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ben.withnall@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	ben.withnall@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	ben.withnall@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	ben.withnall@cardno.com.au

Chong Zeng

- *AU Certificate of Analysis - NATA (COA)	Email	chong.zeng@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chong.zeng@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chong.zeng@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chong.zeng@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	chong.zeng@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	chong.zeng@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	chong.zeng@cardno.com.au

ContamNSW

- *AU Certificate of Analysis - NATA (COA)	Email	contamnsw@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	contamnsw@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	contamnsw@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	contamnsw@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	contamnsw@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	contamnsw@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	contamnsw@cardno.com.au

INVOICES

- A4 - AU Tax Invoice (INV)	Email	apinvoices@cardno.com.au

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2143963**	Page	: 1 of 2
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR BEN WITHNALL	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 2 9495 8188	Telephone	: +61 2 8784 8555
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Date Samples Received	: 02-Dec-2021 14:15
Order number	: ----	Date Analysis Commenced	: 03-Dec-2021
C-O-C number	: ----	Issue Date	: 09-Dec-2021 15:01
Sampler	: ----		
Site	: ----		
Quote number	: EN/024/20		
No. of samples received	: 1		
No. of samples analysed	: 1		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Sample ID	**QA200**	**----**	**----**	**----**	**----**
			Sampling date / time	26-Nov-2021 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2143963-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	**19**	**----**	**----**	**----**	**----**
EA045: Turbidity								
Turbidity	----	0.1	NTU	**22.7**	**----**	**----**	**----**	**----**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**1.85**	**----**	**----**	**----**	**----**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.9**	**----**	**----**	**----**	**----**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	**2.8**	**----**	**----**	**----**	**----**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.19**	**----**	**----**	**----**	**----**
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	**----**	**----**	**----**	**----**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2143963**	Page	: 1 of 3
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR BEN WITHNALL	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 2 9495 8188	Telephone	: +61 2 8784 8555
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Date Samples Received	: 02-Dec-2021
Order number	: ----	Date Analysis Commenced	: 03-Dec-2021
C-O-C number	: ----	Issue Date	: 09-Dec-2021
Sampler	: ----		
Site	: ----		
Quote number	: EN/024/20		
No. of samples received	: 1		
No. of samples analysed	: 1		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 4054958)									
ES2143629-002	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	11	12	0.0	No Limit
ES2143672-004	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	45	50	9.5	No Limit
EA045: Turbidity (QC Lot: 4061250)									
ES2143321-006	Anonymous	EA045: Turbidity	----	0.1	NTU	367	366	0.3	0% - 20%
ES2143918-006	Anonymous	EA045: Turbidity	----	0.1	NTU	104	104	0.0	0% - 20%
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4055680)									
ES2143931-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2143939-009	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.01	0.01	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4055678)									
ES2143929-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	3.8	4.4	13.9	No Limit
ES2143939-007	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.7	0.6	17.4	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4055679)									
ES2143929-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.02	0.03	0.0	No Limit
ES2143939-007	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.05	0.03	57.8	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 4054958)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	106	83.0	129
				<5	1000 mg/L	103	82.0	110
				<5	463 mg/L	99.4	83.0	118
EA045: Turbidity (QCLot: 4061250)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	96.2	91.0	105
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4055680)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4055678)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	86.0	69.0	101
				<0.1	1 mg/L	90.7	70.0	118
				<0.1	5 mg/L	94.6	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4055679)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	94.8	71.0	101
				<0.01	0.442 mg/L	105	72.0	108
				<0.01	1 mg/L	113	70.0	130
EP020: Oil and Grease (O&G) (QCLot: 4061857)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	110	81.0	121

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4055680)							
ES2143931-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	93.2	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4055678)							
ES2143929-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	10 mg/L	82.6	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4055679)							
ES2143929-002	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	83.0	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2143963**	Page	: 1 of 4
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR BEN WITHNALL	Telephone	: +61 2 8784 8555
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Date Samples Received	: 02-Dec-2021
Site	: ----	Issue Date	: 09-Dec-2021
Sampler	: ----	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA045: Turbidity						
Clear Plastic Bottle - Natural						
QA200	----	----	----	07-Dec-2021	28-Nov-2021	**9**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural (EA025H)							
QA200	**26-Nov-2021**	**----**	----	----	**03-Dec-2021**	03-Dec-2021	✓
EA045: Turbidity							
Clear Plastic Bottle - Natural (EA045)							
QA200	**26-Nov-2021**	**----**	----	----	**07-Dec-2021**	28-Nov-2021	×
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
QA200	**26-Nov-2021**	**----**	----	----	**06-Dec-2021**	24-Dec-2021	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
QA200	**26-Nov-2021**	**06-Dec-2021**	24-Dec-2021	✓	**06-Dec-2021**	24-Dec-2021	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
QA200	**26-Nov-2021**	**06-Dec-2021**	24-Dec-2021	✓	**06-Dec-2021**	24-Dec-2021	✓
EP020: Oil and Grease (O&G)							
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020)							
QA200	**26-Nov-2021**	**----**	----	----	**08-Dec-2021**	24-Dec-2021	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	18	**16.67**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Oil and Grease	EP020	WATER	In house: Referenced to APHA 5520 B. Oil & grease is a gravimetric procedure to determine the amount of oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)

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CHAIN OF CUSTODY AND ANALYSIS REQUEST

Contact Person:	Ben Withnall
Telephone Number:	0436 687 417
Alternative Contact:	Chong Zheng
Telephone Number:	0451 780 991
Sampler:	CZ
Email Address (results and invoice):	ben.withnall@cardno.com.au; chong.zeng@cardno.com.au; ContamNSW@cardno.com.au
Address:	Level 9 - The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia

Project Name:	Downer Sydney Metro Stations - Wiley Park
Project Number:	NE30161
PO No.:	
Project Specific Quote No. :	190408CDNN_1
Turnaround Requirements:	Standard TAT
Lab:	Eurofins | Unit F3, Building F, 16 Mars Rd, Lane Cove West NSW2066
Attn:	Sample Receipt

Sample information						Analysis Required												Comments
Cardno Sample ID	Laboratory Sample ID	No. Containers	Preservation	Date sampled	Matrix	Chlorophyll-a	TSS	Turbidity	Oil and Grease	Total Phosphorus	Total Nitrogen							
WP1		5	ICE	26/11/2021	Water	1	1	1	1	1	1							
WP2		5	ICE		Water	1	1	1	1	1	1							
QA100		4	ICE		Water		1	1	1	1	1							
QA200		4	ICE		Water		1	1	1	1	1							Please send to ALS

Relinquished by:	Chong Zeng	Received by:		Relinquished by:		Received by:		Relinquished by:	M.H
(name / company)	Cardno ACT/NSW Pty Ltd	(name / company)		(name / company)		(name / company)		(name / company)	
Date & Time:	11/26/2021	Date & Time:		Date & Time:		Date & Time:		Date & Time:	28,11,21
Signature:	CZ	Signature:		Signature:		Signature:		Signature:	
Received by:		Relinquished by:		Received by:		Relinquished by:		Lab use:	#845645
(name / company)		(name / company)		(name / company)		(name / company)		Samples Received: Cool or Ambient (circle one)	
Date & Time:		Date & Time:		Date & Time:		Date & Time:		Temperature Received at:	(if applicable)
Signature:		Signature:		Signature:		Signature:		Transported by: Hand delivered / courier	

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Rolleston, Christchurch 7675
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Sample Receipt Advice

Company name:	Cardno (NSW/ACT) Pty Ltd
Contact name:	Ben Withnall
Project name:	DOWNER SYDNEY METRO STATIONS-WILEY PARK
Project ID:	NE30161
Turnaround time:	5 Day
Date/Time received	Nov 28, 2021 7:16 PM
Eurofins reference	845645

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✓	Split sample sent to requested external lab.
✗	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

#Water sample received as (QA200)(1*plastic bottle, 1*Nutrient bottle and 2*Oil & Grease is forwarded to ALS.
Samples received by the laboratory after 5.30pm are deemed to have been received the following working day.

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Ursula Long on phone : or by email: UrsulaLong@eurofins.com

Results will be delivered electronically via email to Ben Withnall - ben.withnall@cardno.com.au.

Note: A copy of these results will also be delivered to the general Cardno (NSW/ACT) Pty Ltd email address.

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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Company Name: Cardno (NSW/ACT) Pty Ltd
Address: Level 9, 203 Pacific Highway
St Leonards
NSW 2065

Project Name: DOWNER SYDNEY METRO STATIONS-WILEY PARK
Project ID: NE30161

Order No.:
Report #: 845645
Phone: 0294967700
Fax: 02 9499 3902

Received: Nov 28, 2021 7:16 PM
Due: Dec 6, 2021
Priority: 5 Day
Contact Name: Ben Withnall

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Chlorophyll a	Oil & Grease (HEM)	Phosphate total (as P)	Total Nitrogen (as N)	Total Suspended Solids Dried at 103–105°C	Turbidity
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217											
Brisbane Laboratory - NATA # 1261 Site # 20794											
Mayfield Laboratory - NATA # 1261 Site # 25079											
Perth Laboratory - NATA # 2377 Site # 2370											
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	WP1	Nov 26, 2021		Water	S21-De00153	X	X	X	X	X	X
2	WP2	Nov 26, 2021		Water	S21-De00154	X	X	X	X	X	X
3	QA100	Nov 26, 2021		Water	S21-De00155		X	X	X	X	X
Test Counts						2	3	3	3	3	3

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Cardno (NSW/ACT) Pty Ltd
Level 9, 203 Pacific Highway
St Leonards
NSW 2065

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Ben Withnall**

Report **845645-W-V2**
Project name DOWNER SYDNEY METRO STATIONS-WILEY PARK
Project ID NE30161
Received Date Nov 28, 2021

Client Sample ID			**WP1**	**WP2**	**QA100**
Sample Matrix			**Water**	**Water**	**Water**
Eurofins Sample No.			**S21-De00153**	**S21-De00154**	**S21-De00155**
Date Sampled			**Nov 26, 2021**	**Nov 26, 2021**	**Nov 26, 2021**
Test/Reference	LOR	Unit			
Chlorophyll a	2	ug/L	< 2	2.7	-
Oil & Grease (HEM)	10	mg/L	< 10	< 10	< 10
Phosphate total (as P)	0.01	mg/L	0.13	0.18	0.17
Total Nitrogen (as N)	0.2	mg/L	1.6	2.4	2.4
Total Suspended Solids Dried at 103–105°C	5	mg/L	16	7.8	12
Turbidity	1	NTU	25	17	21

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chlorophyll a	Melbourne	Nov 29, 2021	28 Days
- Method: LTM-INO-4340 Chlorophyll a in Waters			
Oil & Grease (HEM)	Melbourne	Dec 03, 2021	28 Days
- Method: LTM-INO-4180 Oil and Grease (APHA 5520B)			
Phosphate total (as P)	Melbourne	Dec 03, 2021	28 Days
- Method: LTM-INO-4040 Phosphate by CFA			
Total Nitrogen (as N)	Melbourne	Dec 03, 2021	7 Days
- Method: LTM-INO-4040 Phosphate and Nitrogen in waters			
Total Suspended Solids Dried at 103–105°C	Melbourne	Dec 03, 2021	7 Days
- Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry			
Turbidity	Melbourne	Dec 06, 2021	28 Days
- Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)			

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NSW 2065

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Phone: 0294967700
Fax: 02 9499 3902

Received: Nov 28, 2021 7:16 PM
Due: Dec 6, 2021
Priority: 5 Day
Contact Name: Ben Withnall

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Chlorophyll a	Oil & Grease (HEM)	Phosphate total (as P)	Total Nitrogen (as N)	Total Suspended Solids Dried at 103–105°C	Turbidity
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217											
Brisbane Laboratory - NATA # 1261 Site # 20794											
Mayfield Laboratory - NATA # 1261 Site # 25079											
Perth Laboratory - NATA # 2377 Site # 2370											
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	WP1	Nov 26, 2021		Water	S21-De00153	X	X	X	X	X	X
2	WP2	Nov 26, 2021		Water	S21-De00154	X	X	X	X	X	X
3	QA100	Nov 26, 2021		Water	S21-De00155		X	X	X	X	X
Test Counts						2	3	3	3	3	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.4
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Total Nitrogen (as N)			mg/L	< 0.2			0.2	Pass	
Turbidity			NTU	< 1			1	Pass	
LCS - % Recovery									
Phosphate total (as P)			%	112			70-130	Pass	
Total Nitrogen (as N)			%	110			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Phosphate total (as P)	S21-No70290	NCP	%	66			70-130	Fail	Q08
Total Nitrogen (as N)	S21-No70290	NCP	%	65			70-130	Fail	Q08
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Phosphate total (as P)	S21-De03982	NCP	mg/L	0.04	0.03	15	30%	Pass	
Total Nitrogen (as N)	S21-De03982	NCP	mg/L	< 0.2	< 0.2	<1	30%	Pass	
Turbidity	S21-De00153	CP	NTU	25	19	27	30%	Pass	

Comments

This report has been revised (V2) to amend Chlorophyll LOR.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.

Authorised by:

Ursula Long	Analytical Services Manager
Scott Beddoes	Senior Analyst-Inorganic (VIC)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Appendix 2 – Surface Water Monitoring Report - NE30161_R006_SWM_WileyPark_Rev0

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Surface Water Monitoring Report - Wiley Park Station

Wiley Park Station

NE30161

Prepared for
Downer EDI Works Pty Ltd

4 March 2022

Cardno

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Stantec

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Version	Effective Date	Description of Revision	Prepared by	Reviewed by
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Our report is based on information made available by the client. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Cardno is both complete and accurate. Whilst, to the best of our knowledge, the information contained in this report is accurate at the date of issue, changes may occur to the site conditions, the site context or the applicable planning framework. This report should not be used after any such changes without consulting the provider of the report or a suitably qualified person.

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Appendices

Tables

1 Introduction

1.1 Background

Cardno (NSW/ACT) Pty Ltd ("Cardno") was commissioned by Downer EDI Works Pty Ltd ("Downer") to undertake monitoring and reporting of surface water quality of the unnamed channel within proximity to Wiley Park Station Upgrade Site. The proposed upgrade includes the upgrade of the main station and installation of the Metro Services Building (MSB).

Surface water quality of the channel within proximity to Wiley Park Upgrade Site is to be monitored as per the requirements summarised in the **Table 1-2**, which is excerpted from the Southwest Metro – Hurlstone Park, Belmore and Wiley Park Station Upgrades Soil and Water Management Plan (SWMP). The monitoring program are prepared to meet the requirements outlined in *The Sydney Metro City and Southwest – Sydenham to Bankstown Upgrade Conditions of Approval SSi-8256*, specifically Condition 8 to Condition 10. The sampling locations (WP1 – Upstream and WP2 – Downstream) of the water quality monitoring are shown on **Figure 1** in **Appendix** Error! Reference source not found..

The closest Project worksite to an existing watercourse is Wiley Park Station services building, which is located approximately 100 m from an unnamed concrete-lined channel, which forms the upper reaches of Coxs Creek and is identified as a first-order stream.

For the purpose of establishing baseline water quality data within the first-order stream at Wiley Park, water quality monitoring was intended to be undertaken for a period prior to construction of the Wiley Park services building as outlined in the Table 13 of the SWMP. At a minimum, one dry-weather sample and one wet weather sample (weather permitting) were intended to be collected during the pre-construction period. The frequency of pre-construction water quality monitoring within this channel was subject to water being present within the structure. However, during the baseline monitoring period no wet-weather events were able to be captured prior to commencement of construction. A dry-weather baseline monitoring event was undertaken on 10 March 2021.

This report presents the findings from the eighth surface water monitoring event, which was undertaken by Cardno on 9 and 10 February 2022. The event undertaken was a mid-construction dry-weather event. **Table 1-1** below summarised the surface water monitoring events undertaken to date by Cardno.

Table 1-1 Summary of Surface Water Monitoring Event Undertaken to Date

Date of Monitoring	Type of Event	Report Reference
10 March 2021	Pre-construction Dry Baseline	4NE30187_R001_SWM_WileyPark_RevA
20 March 2021	Mid Construction Wet Weather	4NE30187_R001_SWM_WileyPark_RevA
5 May 2021	Mid Construction Wet Weather	4NE30187_R002_SWM_WileyPark_RevA
1 July 2021	Mid Construction Dry Weather	NE30161_R003_SWM_WileyPark_Rev0
30 September 2021	Mid Construction Dry Weather	NE30161_R004_SWM_WileyPark_RevA
12 November 2021	Mid Construction Wet Weather	NE30161_R005_SWM_WileyPark_Rev0
26 November 2021	Mid Construction Wet Weather	NE30161_R005_SWM_WileyPark_Rev0
9 and 10 Februrary 2022	Mid Construction Dry Weather	NE30161_R006_SWM_WileyPark_RevA

1.2 Purpose and Objective

The purpose of the surface water monitoring works is to monitor and record surface water quality within the unnamed channel in accordance with the monitoring program as outlined in the Site's SWMP. The objective of the works is to evaluate whether construction activities are impacting water quality downstream of the project footprint in the unnamed channel.

1.3 Scope of Works

Cardno undertook the following tasks during the surface water monitoring event:

- Inspected and sampled the two (2) nominated surface water sampling locations (WP1 – Upstream and WP2 – Downstream) on 9 and 10 February 2022 as a mid-construction monitoring dry-weather event.
- Recorded field parameters and noted observations of the water bodies during sampling.
- Collected two (2) primary surface water samples, one (1) intra-lab duplicate sample and one (1) inter-lab duplicate sample per sampling event for submission to a laboratory accredited by the National Association of Testing Authorities, Australia (NATA) for analytical testing of primary and additional quality assurance/quality control (QA/QC) samples. Samples were submitted for analysis of:
  - Oil & Grease;
  - Total Suspended Solids (TSS);
  - Nutrients (Total Phosphorous, Total Nitrogen);
  - Turbidity; and
  - Chlorophyll-*a*.
- Reviewed the analytical and field data and prepared this report.

Details of the monitoring program are shown below.

Table 1-2 Wiley Park Water Quality Monitoring Program

Wiley Park Water Quality Monitoring Program	
Waterway	Sydney Water Cooks River Channel (first-order stream)
Indicative monitoring points	WP1 – Upstream
	WP2 – Downstream
Interaction with project works	Channel within proximity to Wiley Park service building site
Pre-construction works	Monthly for parameters detailed in Table 11 (including at least one dry-weather round of sampling). One wet-weather event, if possible, for the parameters detailed in Table 11, subject to event occurrence, safe conditions for monitoring and access being available to conduct monitoring. Note: A wet-weather event is when the receiving area has received greater than 20 mm of rain in 24 hours. The sampling was undertaken immediately during construction hours and if it is safe to do so.
During construction of the Wiley Park services building	Quarterly for parameters detailed in Table 11 (including during dry weather). Four wet-weather events per year for the parameters in Table 11, subject to event occurrence, safe conditions for monitoring and access being available to conduct monitoring. Note: A wet-weather event is when the receiving area has received greater than 20mm of rain in 24 hours. The sampling was undertaken immediately during construction hours and if it is safe to do so.

2 Guidelines and Legislation

There are a range of Guidelines and Legislation and Conditions of Approval (CoA) that are applicable to the surface water monitoring program which are summarised below.

The CoA applicable to this job include:

- The Sydney Metro City and Southwest - Sydenham to Bankstown Upgrade Conditions of Approval SSI-8256, determined 12 December 2018;

The State and Federal legislation and policy and guidelines that apply to the program include:

- Environmental Planning and Assessment Act 1979 (EP&A Act);
- Contaminated Land Management Act 1997;
- Protection of the Environment Operations Act 1997 (POEO Act); and
- Water Management Act 2000 Water Management (General) Regulation 2018;

Additional guidelines and standards to the management of soil and water include:

- Landcom (2004). Managing Urban Stormwater: Soils and Construction. (Volume 1 of the 'Blue Book');
- DECC (2008). Managing Urban Stormwater: Soils and Construction. Volume 2D: Main Road Construction. (Volume 2D of the 'Blue Book');
- ANZECC (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (collectively known as the 'ANZECC Guidelines');
- ANZECC (2018). Australian and New Zealand Guidelines for Water Quality Monitoring and Reporting (collectively known as the 'ANZECC Guidelines'); and
- ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (known as 'ANZG Guidelines').

3 Monitoring Locations

Details of the sampling locations are provided in **Table 3-1**. The locations are provided on **Figure 1** in **Appendix** Error! Reference source not found.. Representative photographs are presented in **Appendix REF _Ref78534754 \r \h * MERGEFORMAT** Error! Reference source not found..

3.1 Monitoring Locations

Table 3-1 Surface Water Monitoring Location Details

Sample Location	Latitude	Longitude	Description
WP1 (up-stream)	-33.924014	151.065315	Immediately south of the Boulevarde and east of 118 the Boulevarde.
WP2 (down-stream)	-33.923339	151.064970	Immediately north of the Urunga Parade and west of 4 Urunga Parade.

4 Quality Management

The Data Quality Objective (DQO) process is used to establish a systematic planning approach to setting the type, quantity and quality of data required for making decisions based on the environmental condition of the project area. The DQO process involves the seven steps detailed in **Table 4-1**.

Table 4-1 Data Quality Objectives

DQO	Description
Step 1 State the Problem	Construction work may adversely impact the local surface water quality within the unnamed channel near the site.
Step 2 Identify the Decisions	Are there any impacts to surface water quality from construction activities at the site?
Step 3 Identify Inputs to the Decision	The primary inputs to the decisions described above are: > Assessment of surface water quality of the unnamed channel within proximity to Wiley Park service building site per the requirements outlined in the site's SWMP, with samples collected from two locations (upstream and downstream of the site); > Laboratory analysis of surface water samples for relevant parameters; > Assessment of the suitability of the analytical data obtained, against the Data Quality Indicators (DQIs); > Assessment of the analytical results against applicable guideline criteria; and > Aesthetic observations of surface water bodies, including odours, sheen and condition, if encountered.
Step 4 Define the Study Boundaries	The lateral extent of the study area is the channel near the Wiley Park service building site. The temporal boundaries of the study comprises the duration of the monitoring program, including pre-construction monitoring, construction phase, and post-construction monitoring as required.
Step 5 Develop a Decision Rule	The decision rules for the water quality monitoring sampling events included: > Were primary and QA/QC samples analysed using methods endorsed by relevant regulatory guidelines at laboratories NATA-accredited for the requested analyses? > Did the field and laboratory QA/QC results indicate that the data set was reliable and representative of the water quality with Relative Percentage Difference (RPD) values of 30% or less? > Were the laboratory limits of reporting (LORs) below the applicable guideline criteria for the analysed parameters? > Were guideline criteria sourced from endorsed guidelines? > Were surface water aesthetic characteristics evaluated including odours and sheen? > Were the monitoring results obtained from the downstream sample collected during construction phase greater than the upstream sample collected during the same monitoring event? If so, then the adverse impact to the quality of water in the unnamed channel is considered to have potentially occurred.
Step 6 Specify Limits on Decision Error	In accordance with the relevant guidelines as endorsed under the *Contaminated Land Management Act 1997*. Specific limits for this project are in accordance with the appropriate guidance made or endorsed by state and national regulations, appropriate indicators of data quality, and standard procedures for field sampling and handling. This step also examines the certainty of conclusive statements based on the available new Site data collected. This should include the following points to quantify tolerable limits:

DQO	Description
	▪ A decision can be made based on a certainty assumption of 95% confidence in any given data set (excluding asbestos). A limit on the decision error will be 5% that a conclusive statement may be a false positive or false negative. A decision error in the context of the decision rule presented above would lead to either underestimation or overestimation of the risk level associated with a particular sampling area. Decision errors may include: ▪ Sampling errors may occur when the sampling program does not adequately detect the variability of a contaminant from point to point across the Site. To address this, minimum numbers of samples are proposed to be collected from each media. As such, there may be limitations in the data if aspects of the sampling plan cannot be implemented. Some examples of this scenario include but not limited to: – Proposed samples are not collected due to lack of water flow or access being restricted to a given location. ▪ Limitations in ability to acquire useful and representative information from the data collected. The data are proposed to be collected from multiple locations and sample media. ▪ Measurement errors can occur during sample collection, handling, preparation, analysis and data reduction. To address this the following measures are proposed: – Field staff to follow a standard procedure when undertaking samples, including decontamination of tools, removal of adhered soil to avoid false positives in results, collection of representative samples and use of appropriate sample containers and preservation methods. – Laboratories to follow a standard procedure when preparing samples for analysis and undertaking analysis. – Laboratories to report quality assurance/ quality control data for comparison with the DQIs established for the project
Step 7 Optimise the Design for Obtaining Data	To achieve the DQOs and DQIs, the following sampling procedures were implemented to optimise the design for obtaining data: > Surface water samples was collected from two (2) sampling locations, as available due to access and water level; > Surface water parameters were selected based on project monitoring requirements provided to Cardno; > Samples were collected by suitably qualified and experienced environmental scientists; > Samples were collected and preserved in accordance with relevant standards/guidelines; and > Field and laboratory QA/QC procedures were adopted and reviewed to indicate the reliability of the results obtained.

4.1 Data Quality Indicators

The following DQIs have been adopted for the project. The DQIs outlined in **Table 4-2** assist with decisions regarding the usefulness of the data obtained, including the quality of the laboratory data.

Table 4-2 Summary of Data Quality Indicators

Data Quality Indicator	Frequency	Data Acceptance Criteria
Completeness		
Field documentation correct	All samples	The work was documented in accordance with Cardno SOPs
Suitably qualified and experience sampler	All samples	Person deemed competent by Cardno collecting and logging samples

Data Quality Indicator	Frequency	Data Acceptance Criteria
Appropriate lab methods and limits of reporting (LORs)	All samples	Samples were analysed using methods endorsed by relevant regulatory guidelines at laboratories NATA-accredited for the requested analyses.
Chain of custodies (COCs) completed appropriately	All samples	The work was documented in accordance with Cardno SOPs
Sample holding times complied with	All samples	The samples were extracted and analysed within holding times specified by the project NATA-accredited laboratory
Proposed/critical locations sampled	-	Proposed/critical locations sampled
Comparability		
Consistent standard operating procedures for collection of each sample. Samples should be collected, preserved and handled in a consistent manner	All samples	All works undertaken in accordance with Cardno SOPs
Experienced sampler	All samples	Person deemed competent by Cardno collecting and logging samples
Climatic conditions (temp, rain etc) recorded and influence on samples quantified (if required)	All samples	Climatic conditions documented in field sheets
Consistent analytical methods, laboratories and units	All samples	Sample analysis to be in accordance with NATA-approved methods
Representativeness		
Sampling appropriate for media and analytes (appropriate collection, handling and storage)	All samples	Sample analysis to be in accordance with NATA-approved methods
Samples homogenous	All samples	All works undertaken in accordance with Cardno SOPs
Detection of laboratory artefacts, e.g. contamination blanks	-	Laboratory artefacts assessed and impact on results determined
Samples extracted and analysed within holding times	All samples	The samples were extracted and analysed within holding times specified by the laboratory
Precision		
Blind duplicates (intra-laboratory duplicates)	1 per 20 samples	Less than or equal to 30% RPD No Limit RPD result less than 10 × LOR
Split duplicates (inter-laboratory duplicates)	1 per 20 samples	Less than or equal to 30% RPD No Limit RPD result less than 10 × LOR
Laboratory duplicates	1 per 20 samples	Results greater than 10 x LOR:less than or equal to 30% RPD Results less than 10 x LOR: No limit on RPD
Accuracy (Bias)		
Surrogate spikes	All organic samples	50-150%
Matrix spikes	1 per 20 samples	70-130%
Laboratory control samples	1 per 20 samples	70-130%
Method blanks	1 per 20 samples	Less than LOR

The DQOs and DQIs for the project were met during the monitoring events. Discussion of the Quality Control / Quality Assurance assessment is provided in **Appendix E**

5 Field Investigation

The scope and method of the surface water monitoring is summarised in **Table 5-1**.

Table 5-1 Investigation Activity Summary

Activity	Details
Dates of Fieldwork	9 and 10 February 2022 (Chlorophyll-*a* was resampled at both WP1 and WP2 on 10 February 2022 due to damage of the sample containers during the transportation following the initial sampling work on 9 February).
Surface Water Sampling	Cardno inspected two surface water monitoring locations (WP1 – Upstream and WP2 – Downstream). Primary samples were collected from the two locations during the sampling event. Cardno undertook the sampling as per the following procedures: Surface Water Body Inspection - The general site condition was observed prior to commencement of field works for signs of any site activities that may have altered the surface water contamination status or require modifications to the field or laboratory works program. Each surface water location was inspected for indicators of contamination and the presence as well as the flow of surface water. This information is recorded on the field sheets presented in **Appendix C.** Surface water sampling - Field parameters and visual/olfactory observations were recorded prior to sampling at each location. Physico-chemical parameters including pH, electrical conductivity (EC), dissolved oxygen (DO), reduction-oxidation potential (redox), and temperature were measured using a calibrated water quality meter. Surface water samples were collected either directly into the sampling bottle or directly from the telescopic scoop. Once field parameters were recorded, the surface water samples were transferred to appropriately preserved sample containers provided by the laboratories. Field observations, and parameters are presented in **Appendix C**. Surface water samples were placed into an Esky containing ice and maintained at or below 4°C whilst onsite and in transit to the NATA-accredited laboratories for the targeted analyses.
Surface Water Analysis	Surface water samples from the monitoring event were submitted under standard chain-of-custody (CoC) procedures to NATA-accredited Eurofins Environment Testing Australia analysis of the parameters as follows: – Oil & Grease; – Total Suspended Solids (TSS); – Nutrients (Total Phosphorous, Total Nitrogen); – Turbidity; and – Chlorophyll-*a*. Tabulated laboratory results are presented in **Appendix D**. The Data QA /QC program and data quality review including calibration certificates is presented in **Appendix E**. Copies of the original laboratory reports, NATA-stamped laboratory certificates, and CoC documentation are included in **Appendix F**.
Decontamination	In the event of reusable sampling or monitoring equipment (telescopic scoop, water quality meter) was used decontamination was undertaken. Decontaminated between locations using a standard bucket wash. Equipment was washed in phosphate-free detergent (Liquinox) and rinsed in laboratory supplied rinsate water.

6 Surface Water Assessment Criteria

The assessment criteria for surface water analytical and field data were adopted from Table 11 of the site's SWMP. The criteria for selected parameters are provided in **Table 6-1** below. ANZECC guideline criteria are included in the table for reference.

Table 6-1 Water Quality Monitoring Parameters and Adopted Criteria at Wiley Park

Parameter	ANZECC Criteria – Freshwater[1]	Proposed Trigger Values	Proposed Actions
Temperature (°C)	>80% ile; <20% ile	Downstream results are greater than upstream results in rainfall events up to and including the significant event threshold of greater than 20 mm in 24 hours. Downstream results are greater than upstream results during dry-weather sampling.	Environment Manager (or delegate) to re-test to confirm results and undertake an inspection of the adjacent works and propose actions where required.
Dissolved Oxygen (DO)	Lower limit – 85% Upper limit -110%		
Turbidity (NTU)	6-50 NTU		
Oil and grease	-		
pH	Lower limit – 6.5 Upper limit – 8.5		
Salinity (as EC)	125 – 2200 µS/cm		
Total Suspended Solids (TSS)	-		
Total Phosphorus as P	25 µg/L		
Total Nitrogen as N	350 µg/L		
Chlorophyll-a	3 µg/L		

Note to Table
1 ANZECC guideline criteria are included for reference. It is noted that for dry weather events baseline testing comparison will indicate whether this existing water quality within the channel meet ANZECC guidelines, prior to construction of the services building. For wet weather events where no baseline data is available a direct comparison to upstream and downstream results is undertaken. Sydney Metro's Principal Contractor will comply with Section 120 of the Protection of the Environment Operations Act 1997.

7 Summary of Results

7.1 Summary of Field Observations

The two (2) surface water sampling locations (WP1 – Upstream and WP2 – Downstream) were able to be accessed during the sampling event conducted on 9 and 10 February 2022. Photos of each sampling location are included in **Appendix B**. The following observations were made:

7.1.1 Mid-Construction Dry-Weather Event – 9 and 10 February 2022

- The sampling event was initially undertaken on 9 February 2022 during a dry-weather event with 0 mm precipitation over the last 24 hours prior to the field sampling (rainfall data was obtained from the closest Bureau of Meteorology weather station, i.e. Canterbury Racecourse AWS - station ID: 066194). Refer to **Appendix C** for weather recordings;
- Observation of water body:
  - WP 1 (upstream of work area) contained low flowing clear water with low turbidity. The estimated depth of the water body was 0.05 m;
  - WP 2 (downstream of work area) contained low flowing clear water with low turbidity. The estimated depth of the water body was 0.1 m;
- Additional observation:
  - WP1 (upstream of work area):
    - One additional discharge point (WP1-DP1) was observed immediately downstream / north of WP1, however, no flow contribution was observed at the time of sampling. Refer to **Appendix A** for approximate location of WP1-DP1. Refer to **Appendix B** for a detailed photo.
  - WP2 (downstream of work area):
    - During the sampling event, the two discharge points (WP2-DP1 and WP2-DP2) within the rail corridor immediately upstream / south from WP2 were observed. Minor flow contributions from both discharge points were observed at the time of sampling. Refer to **Appendix A** for approximate location of WP2-DP1 and WP2-DP2. Refer to **Appendix B** for detailed photos.
- It is noted that Chlorophyll-a was resampled at both WP1 and WP2 on 10 February 2022 due to the damage of the sample containers during the transportation following the initial sampling work on 9 February 2022. Weather conditions (i.e. 0 mm precipitation over the last 24 hours prior to the field sampling) and water body conditions (i.e. water body depth, flow contribution from the discharging points, etc.) during this additional sampling work were similar to the original monitoring event undertaken on 9 February 2022. Thus, Chlorophyll-a results are considered to be representative of the water body condition assessed during this monitoring event.

7.2 Field Parameters

The parameters from each location sampled are presented in **Table 7-1**.

Table 7-1 Laboratory Physico-chemical Parameters and Field Observations - 9 and 10 February 2022

Location ID	WP1 (upstream of work area)	WP2 (downstream of work area)
Water Depth (m)	0.05	0.1
Estimated Flow Rate	Low	Low
Temperature (ºC)	27.7	25.9
pH	8.59	8.78
Electrical Conductivity (µS/cm)	680	650
Dissolved Oxygen (mg/L)	7.21	5.06

Location ID	WP1 (upstream of work area)	WP2 (downstream of work area)
Dissolved Oxygen (%)	92.0	62.2
Oxidation-Reduction Potential (mV)	37.7	-8.2
SHE[1] Redox Potential (mV)	240.3 [2]	196.0 [2]
Condition	Clear Low turbidity	Clear Low turbidity

Note to Table
1 SHE – Standard Hydrogen Electrode
2 Water quality meter utilised on the day of monitoring contains Ag/AgCl reference electrode with 3.5 M KCl filling solution. As such, SHE was calculated based on Table 1 of US EPA document: *SESDPROC-113-R2, Field Measurement of Oxidation-Reduction Potential (ORP)*.

7.3 Surface Water Analytical Results

Surface Water Analytical results are presented in **Appendix D**. Copies of the original laboratory reports, NATA-stamped laboratory certificates, and Chain of Custody documentation are included in **Appendix F**.

7.3.1 Mid-Construction Dry-Weather Event – 9 and 10 February 2022

The results of the monitoring event indicate that:

- Laboratory analytical results:
  - Concentrations of Chlorophyll-*a* were reported below the laboratory detection limit and adopted assessment criteria at all sample locations;
  - Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations;
  - Concentrations of inorganics were reported above the adopted assessment criteria with the total nitrogen concentration and the total phosphorous concentration within both the WP1 and WP2 samples.
  - Total Suspended Solids (TSS) concentrations were reported below laboratory detection limit at all sample locations; and
  - Turbidity ranged from 2.9 NTU at WP1 to 1.2 NTU at WP2.

7.3.2 Baseline Results Comparison

One sampling event during the pre-construction period (baseline event) was undertaken on 10 March 2021. This event has been used for comparison of mid-construction monitoring events under similar conditions (i.e. not triggering the wet-weather event criteria). It should be noted that the baseline water quality monitoring represents a single sampling event, and may not be representative of the range of water quality within the channel prior to construction starting.

The parameters from each location sampled are presented in **Table 7-2** compared with the baseline pre-construction event undertaken on 10 March 2021. Overall, conditions are similar in the pre-construction results and the mid-construction sampling event on 9 and 10 February 2022. These baseline conditions have been taken into account in interpretation in **Section 7.4** below.

Table 7-2 Comparison of current sampling results to baseline results.

Location ID	Assessment Criteria	WP1 Baseline Results	WP2 Baseline Results	WP1 9 and 10 February Results	WP2 9 and 10 February Results
Temperature (ºC)	N/A	21.3	21.1	27.7	25.9
pH	6.5 - 8.5	7.90	7.61	**8.59**	**8.78**
Electrical Conductivity (µS/cm)	125 – 2,200	543	363	680	650
Dissolved Oxygen (%)	85% - 110%	63	45.9	92.0	**62.2**
Oxidation-Reduction Potential (mV)	N/A	140.7	181.0	37.7	-8.2
SHE[1] Redox Potential (mV)	N/A	348.1[4]	388.4[4]	240.3[4]	196.0[4]
Chlorophyll a (µg/L)	3	<5	<5	<2[3]	<2[3]
Oil and Grease (mg/L)	Comparison	<10	29	<10	<10
Kjeldahl Nitrogen Total (mg/L)	N/A	1.3	0.8	NT[2]	NT[2]
Nitrate & Nitrite (as N) (mg/L)	N/A	1.2	0.88	NT[2]	NT[2]
Nitrogen (Total) (mg/L)	0.35	**2.5**	**1.68**	**1.7**	**1.6**
Phosphorus (mg/L)	0.025	**0.34**	**0.12**	**0.14**	**0.08**
TSS (mg/L)	N/A	<1	<1	<5	<5
Turbidity (NTU)	6 - 50	2.9	<1	2.9	1.2

Note to Table
1 SHE – Standard Hydrogen Electrod
2 NT- Not Tested
3 Chlorophyll-a was resampled at both WP1 and WP2 on 10 February 2022 due to damage of the sample containers during the transportation of the initial sampling work on 9 February.
4 Water quality meter utilised on the day of monitoring contains Ag/AgCl reference electrode with 3.5 M KCl filling solution. As such, SHE was calculated based on Table 1 of US EPA document: *SESDPROC-113-R2, Field Measurement of Oxidation-Reduction Potential (ORP)*.

7.4 Results Discussion

7.4.1 Comparison to ANZG 2018 / ANZECC 2000 Criteria

Results for the mid-construction dry-weather event sampled on 9 and 10 February 2022 generally showed monitored parameters were within the adopted threshold criteria, with the exception of dissolved oxygen**,** total nitrogen, total phosphorous, and pH:

- Dissolved oxygen saturation measured at WP1 (92.0%) was within the adopted criterion range whereas WP2 (62.2%) was below the adopted criterion range. This is not considered to be a significant issue, due to the pre-construction monitoring results showing saturations of 63% and 45.9% for WP1 and WP2 respectively, indicating this mid-construction results are close to the adopted thresholds than the pre-construction event.
- Total nitrogen measured at both WP1 and WP2 were above the adopted criterion range with the analytical results of 1.7 mg/L and 1.6 mg/L for WP1 and WP2 respectively. Overall, this is not considered to be a significant issue, due to the pre-construction monitoring results showing the total nitrogen concentrations of 2.5 mg/L and 1.68 mg/L for WP1 and WP2 respectively, indicating mid-construction results are closer to the adopted thresholds than the pre-construction event.
- Phosphorous measured at both WP1 and WP2 were above the adopted criterion range with the analytical results of 0.14 mg/L and 0.08 mg/L for WP1 and WP2 respectively. Overall, this is not considered to be a significant issue, due to the pre-construction monitoring results showing total phosphorus of 0.34 mg/L and 0.12 mg/L for WP1 and WP2 respectively, indicating mid-construction results are closer to the adopted thresholds than the pre-construction event.
- pH results were above the adopted criterion range in both sampling locations with the analytical results of 8.59 and 8.78 for WP1 and WP2 respectively. Overall, this is not considered to be a significant issue since the exceedance is only slightly above the adopted criteria.

7.4.2 Comparison of Upstream and Downstream Results

Results between upstream and downstream samples collected during the mid-construction dry-weather event were comparable, with the exception of:

- pH results were slightly above the adopted threshold in both sampling locations, with similar results of 8.78 at the downstream sample and 8.59 at the upstream sample. Overall, this is not considered to be a significant issue since the difference of the upstream and downstream pH results is less than 2.5%.

Refer to **Appendix D** for details.

8 Conclusion

Cardno was engaged to undertake surface water monitoring of the unnamed channel west of Wiley Park Station in accordance with the SWMP for the project. The objective of the works was to evaluate whether construction activities are impacting water quality downstream of the project footprint in the unnamed channel that receives in part stormwater from the construction area.

This report presents monitoring data of a mid-construction dry-weather event on 9 and 10 February 2022. Samples were collected from two locations. Sampling point WP1 is located up-stream from the work site while sampling point WP2 is located down-stream of the work site.

During this monitoring event, sampling results showed monitored parameters were generally within the adopted ANZG 2018 / ANZECC 2000 screening criteria with the exception of dissolved oxygen**,** total nitrogen, total phosphorous and pH. The comparison of the mid-construction dry-weather event on 9 and 10 February 2022 with the pre-construction dry-weather event on 10 March 2021 showed no significant difference.

Results between upstream and downstream samples collected during the mid-construction dry-weather event were comparable with exception of a slight increase (less than 0.2 pH unit) in pH measured at the downstream sample compared to the upstream sample.

These minor exceedances are not considered to reflect an adverse impact to water quality due to construction activities.

9 References

- Southwest Metro – Hurlstone Park, Belmore and Wiley Park Station Upgrades – Soil and Water Management Plan, dated 16th February 2021;
- The Sydney Metro City and Southwest - Sydenham to Bankstown Upgrade Conditions of Approval SSI-8256, determined 12 December 2018;
- Environmental Planning and Assessment Act 1979 (EP&A Act);
- Contaminated Land Management Act 1997;
- Protection of the Environment Operations Act 1997 (POEO Act);
- Water Management Act 2000 Water Management (General) Regulation 2018;
- Landcom (2004). Managing Urban Stormwater: Soils and Construction. (Volume 1 of the 'Blue Book');
- DECC (2008). Managing Urban Stormwater: Soils and Construction. Volume 2D: Main Road Construction. (Volume 2D of the 'Blue Book');
- ANZECC (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (collectively known as the 'ANZECC Guidelines');
- ANZECC (2000). Australian and New Zealand Guidelines for Water Quality Monitoring and Reporting (collectively known as the 'ANZECC Guidelines');
- ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (known as 'ANZG Guidelines').

10 Limitations

This assessment has been undertaken in general accordance with the current industry standards for a surface water monitoring report for the purpose and objectives and scope identified in this report. The agreed scope of this assessment has been limited for the current purposes of the Client. The assessment may not identify contamination occurring in all areas of the site, or occurring after sampling was conducted. Subsurface conditions may vary considerably away from the sample locations where information has been obtained. This Document has been provided by Cardno subject to the following limitations:

- This Document has been prepared for the particular purpose outlined in Cardno's proposal and Section 1 of this report and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.
- The scope and the period of Cardno's services are as described in Cardno's proposal, and are subject to restrictions and limitations. Cardno did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Cardno in regards to it.
- Conditions may exist which were undetectable given the limited nature of the enquiry Cardno was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.
- In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Cardno's opinions are based upon information that existed at the time of the production of the Document. It is understood that the services provided allowed Cardno to form no more than an opinion of the actual conditions of the site at the time this Document was prepared and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.
- Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.
- Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Cardno for incomplete or inaccurate data supplied by others.
- Cardno may have retained sub consultants affiliated with Cardno to provide services for the benefit of Cardno. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any direct legal recourse to, and waives any claim, demand, or cause of action against, Cardno's affiliated companies, and their employees, officers and directors.

This assessment report is not any of the following:

- A Site Audit Report or Site Audit Statement (SAR/SAS) as defined under the *Contaminated Land Management Act, 1997* or an assessment sufficient for an Environmental Auditor to be able to conclude a SAR/SAS.
- A geotechnical report and the bore logs/test pit logs may not be sufficient for geotechnical advice.
- An assessment of surface water contaminants potentially arising from other sites or sources nearby.
- A total assessment of the site to determine suitability of the entire parcel of land at the site for one or more beneficial uses of land

APPENDIX

A

FIGURES

Cardno

now

Stantec

Downer

Surface Water Monitoring

WILEY PARK STATION

Legend

- Sample Location
- Discharging Points
- Railway (NSW SS)
- Cadastre (NSW SS, 2019)

1:800 Scale at A3

m
0 10 20 30 40

N

Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (SYD)
Date: 2021-08-03 | Project: 4NE30187
Coordinate System: GDA 1994 MGA Zone 56
Map: 4NE30187-GS-002-SurfaceWater.mxd 02
Aerial imagery supplied by MetroMap (April, 2021)

APPENDIX

B

PHOTOGRAPHS

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now

Stantec

Photograph 1. Condition observed from sampling location of WP1 during the monitoring event – 09.02 2021.

Photograph 2. No stormwater in-flow observed from the discharge point WP1-DP1 which was located within the rail corridor and immediately downstream / north from WP1 during the monitoring event – 09.02.2022.

Photograph 3. Condition observed from sampling location of WP2 during the monitoring event – 09.02 2021.

Photograph 4. Minor stormwater in-flow observed from both discharge points WP2-DP1 and WP2-DP2 which were located within the rail corridor and immediately upstream / south from WP2 during the monitoring event – 09.02.2022

APPENDIX

C

FILED RECORDS

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Surface Water Sampling Field Record

Site / Project: Wiley Park Surface Water Monitoring	Sampling Point:
Client: Downer	Job No. NE30161
Person Sampling: Iraqi / Chong	Initials:

Site Details

Sampling Equipment – Directly into bottle / Water Scoop / Van Dorn Sampler / Other:	Date: 9/2/2022.
Observations on Site: Last Rain Event / Recent Storms / Releases / Other :	

Sample Details, Observations, GPS Coordinates & Field Physiochemical Measurements
(if possible, record parameters once stable)

Sample ID	WP_01	~~WP-02~~		WP_02	
Start Time:	12:47			13:53	
Easting					
Northing					
Sample Depth (m)	0-0.05m.			0 - 0.1m	
Water Body Depth (m)	0.05m.			0.1m	
Location – Onsite/Offsite /Inlet/Outlet/ Middle	upstream.			downstream.	
Flow Rate None/ Low / Med / High	low			low.	
DO (mg/L) / %	7.21 / 92.0%			5.06 / 622%	
EC (µS/Cm) - SPC	~~0.08~~	680		~~0.65~~	650
pH	8.59			8.78	
Eh (mV) - ORP	37.7			-8.32	
Temp (°C)	27.7			25.9	
Water Colour	Clear			clear	
Turbidity Low / Med / High	Low			low	
Observations / Notes	upstream discharching point is dry not contribution	to the surface water.		downstream discharching points East and west. They are all with low flow rate, contributed to the surface water.	

Sample Container & Preservation Data

Number of sample containers:	PS: Due to the damage of the amber bottle (WP_01),				
Container Volume					
Container Type	2 samples for Chlorophyll-a analysis were re-collected				
Preservation	on 10/2/22 at around 12:30pm. Both WP_01 (upstream)				
Sample Number (for Lab ID):					
QC Dup Sample No.:	& WP-02 (downstream).			QA100 QA200	

SHE

Multi Parameter Water Meter

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument YSI Quatro Pro Plus
Serial No. 21B104021

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. PH 10.00		pH10.00		370064	pH 9.99
2. pH 7.00		pH 7.00		368081	pH 7.04
3. pH 4.00		pH 4.00		380327	pH 3.89
4. mV		229.6mV		365451/370891	229.4mV
5. EC		2.76mS		377099	2.76mS
6. D.O		0.00 ppm		371864	0.01ppm
7. Temp		22.3°C		MultiTherm	22.1°C

Calibrated by: Jacqualine Begman

Calibration date: 8/02/2022

Next calibration due: 10/08/2022

Australian Government
Bureau of Meteorology

Latest Weather Observations for Canterbury

IDN60801

Issued at 8:32 am EDT Thursday 10 February 2022 (issued every 10 minutes, with the page automatically refreshed every 10 minutes)

Station Details **ID:** 066194 **Name:** CANTERBURY RACECOURSE AWS **Lat:** -33.91 **Lon:** 151.11 **Height:** 3.0 m

Data from the previous 72 hours. | See also: Recent months at Canterbury

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
10/08:30am	21.8	22.1	14.9	65	4.1	WNW	7	9	4	5	-	-	0.0
10/08:00am	20.5	21.1	15.3	72	3.1	NW	6	9	3	5	-	-	0.0
10/07:30am	19.0	19.7	15.7	81	2.0	WNW	6	7	3	4	-	-	0.0
10/07:00am	16.5	17.8	15.2	92	0.8	WNW	2	7	1	4	-	-	0.0
10/06:30am	16.1	17.6	14.6	91	0.9	CALM	0	0	0	0	-	-	0.0
10/06:00am	16.0	17.5	14.7	92	0.7	CALM	0	0	0	0	-	-	0.0
10/05:30am	16.1	17.5	14.5	90	0.9	CALM	0	0	0	0	-	-	0.0
10/05:00am	16.5	17.9	14.3	87	1.3	CALM	0	6	0	3	-	-	0.0
10/04:30am	16.4	17.8	14.4	88	1.1	CALM	0	0	0	0	-	-	0.0
10/04:00am	16.4	17.9	14.6	89	1.0	CALM	0	0	0	0	-	-	0.0
10/03:30am	16.4	17.6	13.7	84	1.5	CALM	0	0	0	0	-	-	0.0
10/03:00am	16.7	18.0	14.2	85	1.4	CALM	0	0	0	0	-	-	0.0
10/02:30am	17.2	18.6	14.5	84	1.6	CALM	0	0	0	0	-	-	0.0
10/02:00am	17.3	18.8	14.6	84	1.6	CALM	0	0	0	0	-	-	0.0
10/01:30am	17.7	19.3	15.0	84	1.6	CALM	0	0	0	0	-	-	0.0
10/01:00am	17.7	19.0	14.2	80	2.0	CALM	0	0	0	0	-	-	0.0
10/12:30am	17.9	19.4	14.6	81	1.9	CALM	0	0	0	0	-	-	0.0
10/12:00am	18.6	20.0	14.5	77	2.4	CALM	0	0	0	0	-	-	0.0

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
09/11:30pm	18.8	20.3	14.7	77	2.4	CALM	0	7	0	4	-	-	0.0
09/11:00pm	19.3	21.1	15.4	78	2.3	CALM	0	0	0	0	-	-	0.0
09/10:30pm	19.9	21.4	14.7	72	3.0	CALM	0	0	0	0	-	-	0.0
09/10:00pm	21.4	22.7	14.1	63	4.2	CALM	0	0	0	0	-	-	0.0
09/09:30pm	23.7	24.1	13.6	53	5.9	NNE	4	9	2	5	-	-	0.0
09/09:00pm	24.1	24.2	14.5	55	5.7	N	7	11	4	6	-	-	0.0
09/08:30pm	24.6	24.2	14.1	52	6.2	NE	9	15	5	8	-	-	0.0

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
09/08:00pm	25.3	24.4	12.5	45	7.4	NE	9	15	5	8	-	-	0.0
09/07:30pm	26.1	24.3	12.2	42	8.0	ENE	13	20	7	11	-	-	0.0
09/07:00pm	27.2	25.5	12.4	40	8.6	ENE	13	20	7	11	-	-	0.0
09/06:30pm	27.7	25.0	11.7	37	9.2	ENE	17	24	9	13	-	-	0.0
09/06:00pm	28.3	25.5	11.4	35	9.7	ENE	17	24	9	13	-	-	0.0
09/05:30pm	28.9	25.8	11.5	34	10.0	ENE	19	26	10	14	-	-	0.0
09/05:00pm	29.2	26.1	12.2	35	9.9	ENE	20	28	11	15	-	-	0.0
09/04:30pm	29.6	26.9	11.6	33	10.4	E	17	26	9	14	-	-	0.0
09/04:00pm	29.6	26.5	11.6	33	10.4	ESE	19	26	10	14	-	-	0.0
09/03:30pm	29.7	26.6	11.7	33	10.4	E	19	28	10	15	-	-	0.0
09/03:00pm	28.4	26.0	12.7	38	9.2	ESE	17	30	9	16	-	-	0.0
09/02:30pm	29.9	27.0	8.3	26	11.9	WSW	13	20	7	11	-	-	0.0
09/02:00pm	30.3	28.7	12.7	34	10.4	S	13	30	7	16	-	-	0.0
09/01:30pm	30.0	27.5	8.4	26	11.9	W	11	22	6	12	-	-	0.0
09/01:00pm	29.6	27.6	10.2	30	11.0	WSW	11	24	6	13	-	-	0.0
09/12:30pm	29.1	27.0	11.2	33	10.3	SW	13	22	7	12	-	-	0.0
09/12:00pm	28.1	26.9	14.0	42	8.4	W	13	20	7	11	-	-	0.0
09/11:30am	27.2	25.5	13.5	42	8.1	WNW	15	20	8	11	-	-	0.0
09/11:00am	26.1	25.2	14.9	50	6.7	WNW	13	20	7	11	-	-	0.0
09/10:30am	24.7	23.8	15.9	58	5.3	WNW	15	20	8	11	-	-	0.0
09/10:00am	23.1	22.5	15.7	63	4.5	NW	13	19	7	10	-	-	0.0
09/09:30am	21.6	20.9	15.4	68	3.7	NW	13	20	7	11	-	-	0.0
09/09:00am	20.7	20.6	16.1	75	2.8	WNW	11	17	6	9	-	-	1.8
09/08:30am	19.5	19.9	16.2	81	2.0	NW	9	17	5	9	-	-	1.8
09/08:00am	18.2	18.7	16.5	90	1.0	W	9	15	5	8	-	-	1.8
09/07:30am	16.5	17.6	16.5	100	0.0	NE	6	11	3	6	-	-	1.8
09/07:00am	14.8	16.4	14.8	100	0.0	CALM	0	0	0	0	-	-	1.8
09/06:58am	14.7	16.2	14.7	100	0.0	CALM	0	0	0	0	-	-	1.8
09/06:30am	14.2	15.5	14.2	100	0.0	CALM	0	0	0	0	-	-	1.8
09/06:11am	14.3	15.7	14.3	100	0.0	CALM	0	0	0	0	-	-	1.8
09/06:10am	14.3	15.7	14.3	100	0.0	CALM	0	0	0	0	-	-	1.8
09/06:00am	14.3	15.7	14.3	100	0.0	CALM	0	0	0	0	-	-	1.8
09/05:30am	14.4	15.8	14.4	100	0.0	CALM	0	0	0	0	-	-	1.8
09/05:22am	14.6	16.1	14.6	100	0.0	CALM	0	0	0	0	-	-	1.8
09/05:19am	14.6	16.1	14.6	100	0.0	CALM	0	0	0	0	-	-	1.8
09/05:00am	14.6	16.1	14.6	100	0.0	CALM	0	0	0	0	-	-	1.8
09/04:59am	14.6	16.1	14.6	100	0.0	CALM	0	0	0	0	-	-	1.8
09/04:30am	15.1	16.8	15.1	100	0.0	CALM	0	0	0	0	-	-	1.8
09/04:00am	15.4	17.1	15.2	99	0.1	CALM	0	0	0	0	-	-	1.8
09/03:30am	15.2	16.7	14.7	97	0.3	CALM	0	0	0	0	-	-	1.8
09/03:00am	15.7	17.4	15.2	97	0.3	CALM	0	0	0	0	-	-	1.8
09/02:30am	15.7	17.4	15.1	96	0.3	CALM	0	0	0	0	-	-	1.8
09/02:00am	16.0	17.8	15.4	96	0.3	CALM	0	0	0	0	-	-	1.8
09/01:30am	16.1	17.8	15.1	94	0.6	CALM	0	0	0	0	-	-	1.8

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
09/01:00am	16.8	18.8	16.0	95	0.5	CALM	0	0	0	0	-	-	1.8
09/12:30am	16.6	18.4	15.6	94	0.6	CALM	0	0	0	0	-	-	1.8
09/12:00am	17.1	19.0	15.8	92	0.8	CALM	0	0	0	0	-	-	1.8

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
08/11:30pm	17.6	19.7	16.3	92	0.8	CALM	0	0	0	0	-	-	1.8
08/11:00pm	17.7	19.7	16.0	90	1.0	CALM	0	0	0	0	-	-	1.8
08/10:30pm	18.2	20.1	15.8	86	1.4	CALM	0	0	0	0	-	-	1.8
08/10:00pm	19.3	20.5	16.0	81	2.0	NE	4	7	2	4	-	-	1.8
08/09:30pm	19.4	21.5	16.2	82	1.9	CALM	0	0	0	0	-	-	1.8
08/09:00pm	19.7	20.5	15.8	78	2.3	NE	6	9	3	5	-	-	1.8
08/08:30pm	19.8	20.5	15.7	77	2.4	NE	6	7	3	4	-	-	1.8
08/08:00pm	20.7	21.4	15.7	73	3.0	NE	6	9	3	5	-	-	1.8
08/07:30pm	21.4	20.6	15.0	67	3.8	ENE	13	19	7	10	-	-	1.8
08/07:00pm	22.3	21.6	15.4	65	4.1	ENE	13	20	7	11	-	-	1.8
08/06:30pm	22.9	21.1	14.5	59	5.0	E	17	20	9	11	-	-	1.8
08/06:00pm	23.4	22.8	16.7	66	4.1	E	15	24	8	13	-	-	1.8
08/05:30pm	23.4	21.3	14.7	58	5.2	SE	19	28	10	15	-	-	1.8
08/05:00pm	23.6	22.2	15.6	61	4.8	ESE	17	24	9	13	-	-	1.8
08/04:30pm	23.3	22.2	16.4	65	4.2	ESE	17	28	9	15	-	-	1.8
08/04:00pm	24.3	22.7	16.0	60	5.0	SE	19	26	10	14	-	-	1.8
08/03:30pm	23.8	21.3	14.2	55	5.7	SSE	20	33	11	18	-	-	1.8
08/03:00pm	24.1	21.4	13.6	52	6.1	SE	20	28	11	15	-	-	1.8
08/02:30pm	24.5	22.6	15.1	55	5.6	SE	19	30	10	16	-	-	1.8
08/02:00pm	24.0	23.2	14.1	54	5.8	SE	11	26	6	14	-	-	1.8
08/01:30pm	23.3	24.9	15.9	63	4.5	E	2	7	1	4	-	-	1.8
08/01:00pm	22.9	23.6	16.0	65	4.2	ENE	7	13	4	7	-	-	1.8
08/12:30pm	21.6	21.2	16.3	72	3.2	NNE	13	20	7	11	-	-	1.8
08/12:00pm	21.2	21.3	15.5	70	3.4	NW	9	17	5	9	-	-	1.8
08/11:30am	21.3	21.6	17.9	81	2.1	N	13	20	7	11	-	-	1.6
08/11:00am	19.2	19.9	17.0	87	1.3	NNW	9	17	5	9	-	-	1.6
08/10:30am	17.2	16.8	16.2	94	0.6	NNE	13	19	7	10	-	-	1.6
08/10:18am	17.1	16.6	16.0	93	0.6	NNE	13	17	7	9	-	-	1.6
08/10:00am	17.1	17.3	15.8	92	0.8	N	9	15	5	8	-	-	1.6
08/09:30am	17.3	17.2	14.9	86	1.4	NE	9	13	5	7	-	-	0.0
08/09:13am	17.7	17.7	15.1	85	1.5	NNW	9	19	5	10	-	-	0.0
08/09:00am	17.9	18.0	15.5	86	1.4	NW	9	15	5	8	-	-	10.2
08/08:30am	17.5	18.1	15.7	89	1.1	NW	7	11	4	6	-	-	10.2
08/08:00am	16.8	17.9	15.7	93	0.6	NNW	4	9	2	5	-	-	10.2
08/07:30am	16.2	17.5	15.2	94	0.6	NW	2	7	1	4	-	-	10.2
08/07:15am	16.1	16.6	15.1	94	0.6	WNW	6	11	3	6	-	-	10.2
08/07:00am	16.1	16.6	15.1	94	0.6	WNW	6	11	3	6	-	-	10.0

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
08/06:59am	16.1	16.6	15.1	94	0.6	WNW	6	11	3	6	-	-	10.0
08/06:52am	16.0	17.6	15.0	94	0.6	CALM	0	2	0	1	-	-	10.0
08/06:30am	16.1	17.7	14.8	92	0.7	CALM	0	0	0	0	-	-	9.8
08/06:24am	16.2	17.8	14.9	92	0.7	CALM	0	7	0	4	-	-	9.4
08/06:00am	16.1	16.3	14.6	91	0.9	W	7	13	4	7	-	-	9.2
08/05:47am	16.1	16.2	14.5	90	0.9	W	7	13	4	7	-	-	9.2
08/05:30am	16.3	16.0	14.5	89	1.0	WSW	9	15	5	8	-	-	9.2
08/05:28am	16.3	16.0	14.5	89	1.0	WSW	9	13	5	7	-	-	9.2
08/05:00am	16.4	16.8	14.8	90	0.9	SW	6	13	3	7	-	-	9.0
08/04:30am	16.5	16.4	15.0	91	0.9	SSW	9	19	5	10	-	-	9.0
08/04:00am	16.4	16.6	14.8	90	0.9	SW	7	13	4	7	-	-	9.0
08/03:30am	16.4	16.9	15.1	92	0.8	SW	6	13	3	7	-	-	9.0
08/03:00am	16.2	16.6	15.4	95	0.5	WNW	7	11	4	6	-	-	9.0
08/02:30am	16.1	16.5	15.3	95	0.5	NNW	7	9	4	5	-	-	9.0
08/02:07am	16.1	16.1	15.3	95	0.5	NNW	9	13	5	7	-	-	9.0
08/02:00am	16.1	16.1	15.3	95	0.5	NNW	9	15	5	8	-	-	9.0
08/01:30am	16.4	17.7	15.1	92	0.8	SW	2	9	1	5	-	-	6.8
08/01:08am	17.0	18.7	15.3	90	1.0	CALM	0	0	0	0	-	-	4.8
08/01:04am	17.0	18.7	15.2	89	1.0	CALM	0	0	0	0	-	-	4.6
08/01:00am	17.0	18.7	15.2	89	1.0	CALM	0	0	0	0	-	-	4.6
08/12:38am	17.2	18.8	14.8	86	1.4	CALM	0	0	0	0	-	-	4.4
08/12:30am	17.3	18.9	14.9	86	1.4	CALM	0	0	0	0	-	-	4.2
08/12:00am	17.8	18.2	14.7	82	1.8	SSE	6	9	3	5	-	-	4.2

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
07/11:30pm	17.5	17.1	14.0	80	2.0	WSW	9	15	5	8	-	-	4.2
07/11:00pm	17.7	17.3	14.0	79	2.1	SW	9	13	5	7	-	-	4.2
07/10:30pm	18.0	16.9	14.3	79	2.1	SW	13	20	7	11	-	-	4.2
07/10:00pm	18.1	17.6	14.8	81	1.9	SW	11	19	6	10	-	-	4.2
07/09:30pm	18.7	18.9	14.6	77	2.4	SSW	7	15	4	8	-	-	4.2
07/09:00pm	17.8	18.1	14.5	81	1.9	SW	6	9	3	5	-	-	4.2
07/08:30pm	18.6	18.8	14.3	76	2.5	SSW	6	9	3	5	-	-	4.2
07/08:00pm	19.1	18.9	14.8	76	2.5	SSE	9	15	5	8	-	-	4.2
07/07:31pm	19.4	18.9	15.9	80	2.1	SSE	13	20	7	11	-	-	4.2
07/07:30pm	19.5	19.0	16.0	80	2.1	SSE	13	20	7	11	-	-	4.2
07/07:06pm	18.9	16.8	15.2	79	2.2	SE	20	32	11	17	-	-	3.2
07/07:00pm	19.3	16.5	15.4	78	2.3	SE	24	35	13	19	-	-	2.8
07/06:34pm	19.2	19.4	15.7	80	2.1	S	9	17	5	9	-	-	2.6
07/06:30pm	19.1	19.5	15.4	79	2.2	S	7	13	4	7	-	-	2.6
07/06:21pm	19.0	17.8	15.1	78	2.3	S	15	30	8	16	-	-	2.4
07/06:00pm	20.0	19.3	15.4	75	2.7	SSW	13	22	7	12	-	-	1.8
07/05:30pm	21.3	19.1	14.9	67	3.8	S	20	32	11	17	-	-	1.6

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
07/05:00pm	20.4	18.6	15.4	73	3.0	SSE	19	32	10	17	-	-	1.6
07/04:30pm	19.9	18.7	16.2	79	2.2	SSW	17	28	9	15	-	-	1.6
07/04:00pm	19.4	18.1	15.9	80	2.1	S	17	30	9	16	-	-	1.2
07/03:30pm	21.2	19.4	15.5	70	3.4	SE	19	32	10	17	-	-	1.0
07/03:03pm	19.7	20.5	17.3	86	1.5	SW	9	13	5	7	-	-	1.0
07/03:00pm	19.3	19.9	16.7	85	1.6	SW	9	13	5	7	-	-	1.0
07/02:37pm	19.3	17.8	15.4	78	2.3	S	17	28	9	15	-	-	0.2
07/02:30pm	21.0	18.4	13.2	61	4.5	SSW	19	32	10	17	-	-	0.0
07/02:00pm	21.2	19.0	14.8	67	3.8	S	20	33	11	18	-	-	0.0
07/01:51pm	20.9	18.6	14.1	65	3.9	S	19	32	10	17	-	-	0.0
07/01:30pm	20.1	13.8	13.6	66	3.7	SE	39	57	21	31	-	-	0.0
07/01:00pm	23.1	18.5	13.6	55	5.5	SSE	30	48	16	26	-	-	0.0
07/12:37pm	23.0	18.9	13.8	56	5.4	SE	28	48	15	26	-	-	0.0
07/12:30pm	22.9	20.2	14.7	60	4.8	SE	22	41	12	22	-	-	0.0
07/12:00pm	23.2	20.2	14.7	58	5.0	ESE	24	33	13	18	-	-	0.0
07/11:30am	22.0	20.7	14.9	64	4.2	SE	15	33	8	18	-	-	0.0
07/11:00am	19.7	19.5	15.8	78	2.3	S	11	17	6	9	-	-	0.0
07/10:30am	20.6	17.2	14.7	69	3.5	ESE	26	35	14	19	-	-	0.0
07/10:00am	20.9	18.4	13.6	63	4.2	SSE	19	32	10	17	-	-	0.0
07/09:30am	19.1	19.6	16.5	85	1.6	SSW	9	17	5	9	-	-	0.0
07/09:00am	18.1	19.0	16.1	88	1.2	WNW	6	9	3	5	-	-	8.0

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APPENDIX

D

LABORATORY SUMMARY TABLES

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Project Number: NE30161
Site Identification: Wiley Park Station
Report Title: Surface Water Monitoring

				TPH	Inorganics							Physio-Chemical			
			Chlorophyll a	Oil and Grease	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrogen (Total as N)	Phosphorus (Total as P)	TSS	Turbidity	pH	°C Temprature	Electrical Conductivity	Dissolved Oxygen
			mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	NTU	Units	°C	uS/cm	%Sat
EQL			0.002	10	0.1	0.01	0.2	0.01	1	1	0.01	0.1	0.1	0.1
ANZECC Criteria - Freshwater			0.003	-	-	-	0.35	25	-	<6-50	6.5-8.5	-	125-2200	85% - 110%
Lab Report Number	**Field ID**	**Date**												
861805	**WP1**	**9/02/2022**	-	<10	-	-	1.7	140	<5	2.9	**8.59**	27.7	680	**92**
			<2		-	-	-	-	-	-	-	-	-	-
861805	**WP2**	**9/02/2022**	-	<10	-	-	1.6	80	<5	1.2	**8.78**	25.9	650	**62.2**
			<2	-	-	-	-	-	-	-	-	-	-	-
861805	**QA100**	**9/02/2022**	-	<10	-	-	1.6	90	<5	1.9	-	-	-	-
ES2204592	**QA200**	**9/02/2022**	-	<5	0.6	0.85	1.4	90	<5	2.6	-	-	-	-
Statistics														
Maximum Concentration			**<2**	**<10**	0.6	0.85	1.7	**140**	**<5**	**2.9**	**8.78**	27.7	**680**	**92**
* A Non Detect Multiplier of 0.5 has been applied.														

APPENDIX

E

QUALITY ASSURANCE/QUALITY CONTRAL

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Quality Assurance/Quality Control (QA/QC) procedures were implemented to ensure the precision accuracy, representativeness, completeness and comparability of all data gathered. The QA/QC procedures included:

- Equipment calibration to ensure field measurements obtained are accurate
- Equipment decontamination to prevent cross contamination
- Use of appropriate measures (i.e. gloves) to prevent cross contamination
- Appropriate sample identification
- Correct sample preservation
- Sample transport with Chain of Custody (COC) documentation
- Laboratory analysis in accordance with NATA accredited methods.

Table E1 details the QA/QC procedures and sample collection details undertaken through the surface water elements of the investigation. Copies of all the COCs, along with the Sample Receipt Notifications (SRNs), Interpretive QA/QC Reports are provided in **Appendix F**.

Table E1 Field QA / QC Method Validation

Requirement	Yes / No	Comments
Equipment decontamination	Yes	In the event of involving reusable equipment. Decontamination of sampling equipment (water quality meter, telescopic water scoop etc.) was undertaken by washing with phosphate free detergent (Liquinox) followed by a rinse with potable water.
Sample collection	Yes	Samples were collected using disposable nitrile gloves via telescopic water scoop. A clean pair of gloves was used for each new sample being collected to limit the possibility of cross-contamination.
QA/QC sample collection	Yes	One (1) surface water duplicate and one (1) surface water triplicate sample were collected for intra and inter-lab QA/QC purposes to monitor the quality of the field practices for sample collection. Cardno based the investigation around a rate of one duplicate and triplicate sample per sampling event, as the requirement for duplicate and triplicate sample collection.
Sample identification	Yes	All samples were marked with a unique identifier including project number, sample location, and date.
Sample preservation	Yes	Samples were placed in a chilled ice box with ice for storage and transport to the laboratory.
COC documentation	Yes	A COC form was completed by Cardno detailing sample identification, collection date, sampler and laboratory analysis required. The COC form was signed off and returned to Cardno by the laboratory staff upon receipt of all the samples. COC forms and Sample Receipt Notification (SRN) are provided in **Appendix F**. The SRN indicates that the samples were received at the laboratory intact and chilled and within the required holding times.
NATA accredited methods	Yes	The NATA accredited Eurofins mgt and ALS Analysed the samples in accordance with NATA accredited methods. Analytical methods used are indicated in the stamped laboratory results provided in **Appendix F**.
Laboratory Internal QC	Yes	All Data Quality Objectives were met by the laboratories.

Table E2 Field QA/QC Collection Summary

Environmental Media	Date	Primary	Duplicate	Triplicate
Surface Water	09/02/2022	WP2	QA100	QA200
Surface Water	10/02/2022	No QA/QC samples were taken for Chlorophyll a Analysis		

Relative Percentage Difference Determination

Laboratory results for duplicate and triplicate samples are assessed using a determination of the Relative Percentage Difference (RPD). Where a primary sample and a duplicate sample are compared, the RPD provides an indication of the reproducibility of the results, which incorporates the sampling method. Where a primary sample and a split sample are compared, the RPD provides an indication of the accuracy of the primary laboratory results as compared to the secondary laboratory result.

The calculation used to determine the RPD is:

$$RPD = \frac{(Co - Cs)}{\left(\frac{Co + Cs}{2}\right)} x100$$

Where:

Co = Concentration of the original sample

Cs = Concentration of the duplicate sample

In calculating the RPD values the following protocols were adopted:

- Where both concentrations are above laboratory reporting limits the RPD formula is used;
- Where both concentrations are below the laboratory reporting limits, no RPD is calculated; and
- Where one or both sample concentrations are reported to be less than ten times (<10x) the laboratory reporting limit, the RPD is calculated but is not assessed against the adopted criterion.

In accordance with the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended 2013, Cardno adopts an RPD acceptance criterion up to 30% of the mean concentration of the analyte. It should be noted that variations might be higher for organic analysis, due to the volatile nature of the components, and for low concentrations of analytes.

The adopted criterion will not apply to RPDs where one of both concentrations are less than 10 times the reporting limit, as this criterion would otherwise overestimate the significance of minor variations in concentrations at or near the laboratory reporting limit. Large RPDs returned for low concentrations of analytes near the reporting limit is not as indicative of a significant difference in the results as a small RPD is for larger concentrations.

This approach is employed by NATA-accredited laboratories when assessing internal duplicate sample RPDs. This approach acknowledges that concentrations at or around the reporting limit are too low for an accurate evaluation of the significance of the RPD.

This approach has been adopted when assessing the relevance (compliance) of RPDs during this investigation. RPDs will be calculated for sample sets where one or both concentrations are less than 10 times the reporting limit for discussion purposes, but will not be assessed as a pass or fail in relation to the criterion.

The RPD results for duplicate samples are presented in this appendix. No RPD values were reported to be above the accepted 30% RPD criteria. It can be concluded that the analytical data can be relied upon for the purposes of this factual report.

Laboratory QC and QCI Report Summary

The laboratories selected for undertaking the analysis (Eurofins mgt and ALS) are NATA-accredited for the analysis required, and undertook certain QA/QC requirements to demonstrate the suitability of the data that is obtained. The laboratory is required to undertake and report internal laboratory Quality Control (QC) procedures for all chemical analysis undertaken. The QC testing is required to include:

- Laboratory duplicate sample analysis at the rate of one duplicate analysis per ten samples
- Method blank at the rate of one method blank analysis per 20 samples
- Laboratory control sample at the rate of one laboratory control sample analysis per 20 samples

> Spike recovery analysis at the rate of one spike recovery analysis per 20 samples.

Compliance with the laboratory QA/QC requirements and non-conformance details are discussed in the internal Laboratory QA/QC reports included with the certificates of analysis in **Appendix F**. Laboratory QA/QC requirements were within acceptance limits.

Cardno concludes that the data reported by the NATA-accredited Eurofins mgt and ALS as presented in this report is suitable for interpretative purposes and to make conclusions/recommendations regarding water quality.

DRAFT

			TPH	Inorganics					
			Oil and Grease	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrogen (Total as N)	Phosphorus (Total as P)	TSS	Turbidity
			mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	NTU
EQL			10	0.1	0.01	0.2	0.01	1	1
861805	WP1	water	<10	-	-	1.7	0.14	<5	2.9
	QA100	water	<10	-	-	1.6	0.09	<5	1.9
RPD			0	-	-	6	**43**	0	42
861805	WP1	water	<10	-	-	1.7	0.14	<5	2.9
ES2204592	QA200	water	<5	0.6	0.85	1.4	0.09	<5	2.6
RPD			0	-	-	19	**43**	0	11

APPENDIX

F

LABORATORY REPORTS

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Shaping the Future

CHAIN OF CUSTODY AND ANALYSIS REQUEST

Contact Person:	Jiaqi Zhou
Telephone Number:	0424 106 665
Alternative Contact:	Chong Zheng
Telephone Number:	0451 780 991
Sampler:	CZ
Email Address (results and invoice):	jiaqi.zhou@cardno.com.au; chong.zeng@cardno.com.au; ContamNSW@cardno.com.au
Address:	Level 9 - The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia

Project Name:	Downer Sydney Metro Stations - Wiley Park
Project Number:	NE30161
PO No.:	
Project Specific Quote No. :	190408CDNN_1
Turnaround Requirements:	Standard TAT
Lab:	Eurofins | Unit F3, Building F, 16 Mars Rd, Lane Cove West NSW2066
Attn:	Sample Receipt

#861805

Sample information						Analysis Required												Comments
Cardno Sample ID	Laboratory Sample ID	No. Containers	Preservation	Date sampled	Matrix	Chlorophyll-a	TSS	Turbidity	Oil and Grease	Total Phosphorus	Total Nitrogen							
WP1		5	ICE	9/02/2022	Water	1	1	1	1	1	1							
WP2		5	ICE		Water	1	1	1	1	1	1							
QA100		4	ICE		Water		1	1	1	1	1							
QA200		4	ICE		Water		1	1	1	1	1							Please send to ALS

Relinquished by: (name / company)	Jiaqi Zhou Cardno ACT/NSW Pty Ltd	Received by: (name / company)	MR Eurofins	Relinquished by: (name / company)		Received by: (name / company)	Relinquished by: (name / company)
Date & Time:	2/9/2022	Date & Time:	9/2/22 5:08 PM	Date & Time:		Date & Time:	Date & Time:
Signature:	JZ	Signature:		Signature:		Signature:	Signature:
Received by: (name / company)		Relinquished by: (name / company)		Received by: (name / company)		Relinquished by: (name / company)	*Lab use:*
Date & Time:		Date & Time:		Date & Time:		Date & Time:	Samples Received: Cool or Ambient (circle one)
Signature:		Signature:		Signature:		Signature:	Temperature Received at: 26.4°C (if applicable)
							Transported by: Hand delivered / courier

RE: Attention: Eurofins Sample Receipt Advice - Report 861805 : Site DOWNER SYDNEY METRO STATIONS - WILEY PARK (NE30161)

Chong Zeng <chong.zeng@cardno.com.au>

Thu 2/10/2022 11:57 AM

To: Ursula Long <UrsulaLong@eurofins.com>

Cc: #AU04_Enviro_Sample_NSW <EnviroSampleNSW@eurofins.com>; Jiaqi Zhou <jiaqi.zhou@cardno.com.au>

CAUTION: EXTERNAL EMAIL - Sent from an email domain that is not formally trusted by Eurofins.

Do not click on links or open attachments unless you recognise the sender and are certain that the content is safe.

Hi Ursula,

Due to the damage of the amber bottle (WP1), we are planning to go back to site recollect the sample for analysis of Chlorophyll-a now. Can we please request to cancel the analysis of Chlorophyll-a for WP2 and arrange an express courier to pick up the new samples – 2 amber bottles (WP1 and WP2) from 7 Thomas St, Hurstville NSW this afternoon around 2:30 pm? Contact will be myself: 0451780991.

Let me know if there is any issue.

Chong Zeng
ENVIRONMENTAL ENGINEER
CARDNO

Cardno now Stantec

Phone Direct +61294967761 Mobile 0451 780 991
Address Level 9, The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia

Email chong.zeng@cardno.com.au Web www.cardno.com
CONNECT WITH CARDNO

Cardno acknowledges the Traditional Owners of the land upon which we live and work and pay our respects to their Elders past, present and emerging - learn more.

Cardno's management systems are certified to ISO9001 (quality) and AS/NZS4801/OHSAS18001 (occupational health and safety)

This email and its attachments may contain confidential and/or privileged information for the sole use of the intended recipient(s). All electronically supplied data must be checked against an applicable hardcopy version which shall be the only document which Cardno warrants accuracy. If you are not the intended recipient, any use, distribution or copying of the information contained in this email and its attachments is strictly prohibited. If you have received this email in error, please email the sender by replying to this message and immediately delete and destroy any copies of this email and any attachments. The views or opinions expressed are the author's own and may not reflect the views or opinions of Cardno.

From: EnviroSampleNSW@eurofins.com <EnviroSampleNSW@eurofins.com>
Sent: Wednesday, 9 February 2022 10:45 PM
To: Jiaqi Zhou <jiaqi.zhou@cardno.com.au>
Cc: Chong Zeng <chong.zeng@cardno.com.au>
Subject: A en on: Eurofins Sample Receipt Advice - Report 861805 : Site DOWNER SYDNEY METRO STATIONS - WILEY PARK (NE30161)

Dear Valued Client,

Large 1L amber glass bottle received empty for sample WP1 (lid came off in the esky), Chlorophyll a analysis cancelled. Sample QA200 (1x unpreserved inorganics, 2x Oil and Grease and 1x preserved inorganics containers) forwarded to ALS for analysis.

Please find attached a Sample Receipt Advice (SRA), a Summary Sheet and a scanned copy of your Chain-of-Custody (COC). It is important that you check this documentation to ensure that the details are correct such as the Client Job Number, Turn Around Time, any comments in the Notes section and sample numbers as well as the requested analysis. If there are any irregularities then please contact your Eurofins Analytical Services Manager as soon as possible to make certain that they get changed.

Kind regards,
Mickael Ros
Sample Receipt

Eurofins | Environmental Testing
Unit F3, Parkview Building
16 Mars Road
LANE COVE WEST NSW 2066
AUSTRALIA
Phone: +61 02 9900 8421
Email: EnviroSampleNSW@eurofins.com
Website: [http://]environment.eurofins.com.au

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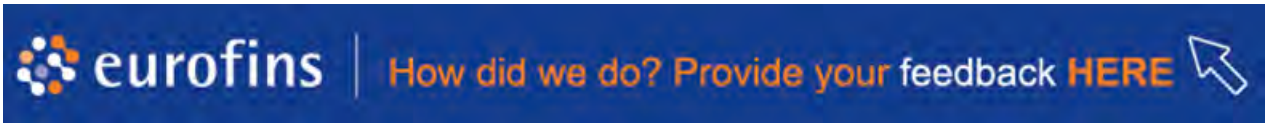
How did we do? Provide your feedback here



eurofins | Environment Testing

www.eurofins.com.au EnviroSales@eurofins.com

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IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
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IANZ # 1290

Sample Receipt Advice

Company name:	Cardno (NSW/ACT) Pty Ltd
Contact name:	Jiaqi Zhou
Project name:	DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID:	NE30161
Turnaround time:	5 Day
Date/Time received	Feb 9, 2022 5:08 PM
Eurofins reference	861805

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✓	Split sample sent to requested external lab.
✗	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Sample QA200 (1x unpreserved inorganics, 2x Oil and Grease and 1x preserved inorganics containers) forwarded to ALS for analysis.

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Ursula Long on phone : or by email: UrsulaLong@eurofins.com

Results will be delivered electronically via email to Jiaqi Zhou - jiaqi.zhou@cardno.com.au.

Note: A copy of these results will also be delivered to the general Cardno (NSW/ACT) Pty Ltd email address.

eurofins | Environment Testing

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

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Phone : +61 3 8564 5000
NATA # 1261 Site # 1254

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

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Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448
NATA # 1261 Site # 25079

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46-48 Banksia Road
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Eurofins Environment Testing NZ Limited
NZBN: 9429046024954

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Penrose, Auckland 1061
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Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Cardno (NSW/ACT) Pty Ltd
Address: Level 9, 203 Pacific Highway
St Leonards
NSW 2065

Project Name: DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID: NE30161

Order No.:
Report #: 861805
Phone: 0294967700
Fax: 02 9499 3902

Received: Feb 9, 2022 5:08 PM
Due: Feb 17, 2022
Priority: 5 Day
Contact Name: Jiaqi Zhou

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Chlorophyll a	Oil & Grease (HEM)	Phosphate total (as P)	Total Nitrogen (as N)	Total Suspended Solids Dried at 103°C–105°C	Turbidity
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217											
Brisbane Laboratory - NATA # 1261 Site # 20794											
Mayfield Laboratory - NATA # 1261 Site # 25079											
Perth Laboratory - NATA # 2377 Site # 2370											
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	WP1	Feb 09, 2022		Water	S22-Fe15861		X	X	X	X	X
2	WP2	Feb 09, 2022		Water	S22-Fe15862		X	X	X	X	X
3	QA100	Feb 09, 2022		Water	S22-Fe15863		X	X	X	X	X
4	WP1	Feb 10, 2022		Water	S22-Fe18351	X					
5	WP2	Feb 10, 2022		Water	S22-Fe18352	X					
Test Counts						2	3	3	3	3	3

Cardno (NSW/ACT) Pty Ltd
Level 9, 203 Pacific Highway
St Leonards
NSW 2065

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Jiaqi Zhou**

Report **861805-W**
Project name DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID NE30161
Received Date Feb 09, 2022

Client Sample ID			**WP1**	**WP2**	**QA100**	**WP1**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**S22-Fe15861**	**S22-Fe15862**	**S22-Fe15863**	**S22-Fe18351**
Date Sampled			**Feb 09, 2022**	**Feb 09, 2022**	**Feb 09, 2022**	**Feb 10, 2022**
Test/Reference	LOR	Unit				
Oil & Grease (HEM)	10	mg/L	< 10	< 10	< 10	-
Phosphate total (as P)	0.01	mg/L	0.14	0.08	0.09	-
Total Nitrogen (as N)	0.2	mg/L	1.7	1.6	1.6	-
Total Suspended Solids Dried at 103°C–105°C	5	mg/L	< 5	< 5	< 5	-
Turbidity	1	NTU	2.9	1.2	1.9	-
Chlorophyll a	2	ug/L	-	-	-	< 2

Client Sample ID			**WP2**
Sample Matrix			**Water**
Eurofins Sample No.			**S22-Fe18352**
Date Sampled			**Feb 10, 2022**
Test/Reference	LOR	Unit	
Chlorophyll a	2	ug/L	< 2

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Oil & Grease (HEM)	Melbourne	Feb 10, 2022	28 Days
- Method: LTM-INO-4180 Oil and Grease (APHA 5520B)			
Phosphate total (as P)	Melbourne	Feb 11, 2022	28 Days
- Method: LTM-INO-4040 Phosphate by CFA			
Total Nitrogen (as N)	Melbourne	Feb 11, 2022	7 Days
- Method: LTM-INO-4040 Phosphate and Nitrogen in waters			
Total Suspended Solids Dried at 103°C–105°C	Melbourne	Feb 10, 2022	7 Days
- Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry			
Turbidity	Melbourne	Feb 10, 2022	28 Days
- Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)			
Chlorophyll a	Melbourne	Feb 14, 2022	28 Days
- Method: LTM-INO-4340 Chlorophyll a in Waters			

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web: www.eurofins.com.au
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Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

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6 Monterey Road
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Phone : +61 8 6253 4444
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Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Cardno (NSW/ACT) Pty Ltd
Address: Level 9, 203 Pacific Highway
St Leonards
NSW 2065

Project Name: DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID: NE30161

Order No.:
Report #: 861805
Phone: 0294967700
Fax: 02 9499 3902

Received: Feb 9, 2022 5:08 PM
Due: Feb 17, 2022
Priority: 5 Day
Contact Name: Jiaqi Zhou

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Chlorophyll a	Oil & Grease (HEM)	Phosphate total (as P)	Total Nitrogen (as N)	Total Suspended Solids Dried at 103°C–105°C	Turbidity
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217											
Brisbane Laboratory - NATA # 1261 Site # 20794											
Mayfield Laboratory - NATA # 1261 Site # 25079											
Perth Laboratory - NATA # 2377 Site # 2370											
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	WP1	Feb 09, 2022		Water	S22-Fe15861		X	X	X	X	X
2	WP2	Feb 09, 2022		Water	S22-Fe15862		X	X	X	X	X
3	QA100	Feb 09, 2022		Water	S22-Fe15863		X	X	X	X	X
4	WP1	Feb 10, 2022		Water	S22-Fe18351	X					
5	WP2	Feb 10, 2022		Water	S22-Fe18352	X					
Test Counts						2	3	3	3	3	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Oil & Grease (HEM)			mg/L	< 10			10	Pass	
Phosphate total (as P)			mg/L	< 0.01			0.01	Pass	
Total Nitrogen (as N)			mg/L	< 0.2			0.2	Pass	
Total Suspended Solids Dried at 103°C–105°C			mg/L	< 5			5	Pass	
Chlorophyll a			ug/L	< 2			2	Pass	
LCS - % Recovery									
Oil & Grease (HEM)			%	120			70-130	Pass	
Phosphate total (as P)			%	107			70-130	Pass	
Total Nitrogen (as N)			%	112			70-130	Pass	
Total Suspended Solids Dried at 103°C–105°C			%	92			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Phosphate total (as P)	S22-Fe13918	NCP	%	99			70-130	Pass	
Total Suspended Solids Dried at 103°C–105°C	M22-Fe12114	NCP	%	96			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Oil & Grease (HEM)	S22-Fe18138	NCP	mg/L	< 10	< 10	<1	30%	Pass	
Phosphate total (as P)	M22-Fe15219	NCP	mg/L	2.2	dil	n/a	30%	Pass	
Total Nitrogen (as N)	M22-Fe15219	NCP	mg/L	1.5	1.6	7.0	30%	Pass	
Total Suspended Solids Dried at 103°C–105°C	M22-Fe19665	NCP	mg/L	350	350	<1	30%	Pass	
Turbidity	M22-Fe18035	NCP	NTU	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chlorophyll a	S22-Fe18351	CP	ug/L	< 2	< 2	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Ursula Long	Analytical Services Manager
Scott Beddoes	Senior Analyst-Inorganic (VIC)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Cardno
Shaping the Future

CHAIN OF CUSTODY AND ANALYSIS REQUEST

ontact Person:	Jiaqi Zhou	Project Name:	Downer Sydney Metro Stations - Wiley Park
lephone Number:	0424 106 665	Project Number:	NE30161
lternative Contact:	Chong Zheng	PO No.:	
lephone Number:	0451 780 991	Project Specific Quote No.:	190408CDNN_1
ampler:	CZ	Turnaround Requirements:	Standard TAT
mail Address (results and invoice):	jiaqi.zhou@cardno.com.au; chong.zeng@cardno.com.au; ContamNSW@cardno.com.au	Lab:	Eurofins | Unit F3, Building F, 16 Mars Rd, Lane Cove West NSW2066
ddress: Level 9 - The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia		Attn:	Sample Receipt

#861805

Sample information						Analysis Required									Comments
Cardno Sample ID	Laboratory Sample ID	No. Containers	Preservation	Date sampled	Matrix	Chlorophyll-a	TSS	Turbidity	Oil and Grease	Total Phosphorus	Total Nitrogen				
WP1		5	ICE	9/02/2022	Water	1	1	1	1	1	1				
WP2		5	ICE		Water	1	1	1	1	1	1				
QA100		4	ICE		Water		1	1	1	1	1				
QA200		4	ICE		Water		1	1	1	1	1				Please send to ALS

Environmental Division
Sydney
Work Order Reference
ES2204592

Telephone : +61-2-8784 8555

linquished by:	Jiaqi Zhou	Received by:	MR	Relinquished by:		Received by:	Relinquished by:
me / company)	Cardno ACT/NSW Pty Ltd	(name / company)	Eurof.'s	(name / company		(name / company)	(name / company)
te & Time:	2/9/2022	Date & Time:	9/2/22	Date & Time:		Date & Time: 10/2/22 1400	Date & Time:
gnature:	JZ	Signature:	5:08 PM	Signature:		Signature:	Signature:
ceived by:		Relinquished by:		Received by:		Relinquished by:	*Lab use:*
me / company)		(name / company)		(name / company		(name / company)	Samples Received: Cool or Ambient (circle one)
te & Time:		Date & Time:		Date & Time:		Date & Time:	Temperature Received at: 26.4 °C (if applicable)
gnature:		Signature:		Signature:		Signature:	Transported by: Hand delivered / courier

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2204592**

Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JIAQI ZHOU	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jiaqi.zhou@cardno.com.au	E-mail	: Shane.Ellis@ALSGlobal.com
Telephone	: ----	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Page	: 1 of 2
Order number	: ----	Quote number	: EB2017CARNSWACT0001 (EN/222 - Secondary Work)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: CZ		

Dates

Date Samples Received	: 10-Feb-2022 14:00	Issue Date	: 10-Feb-2022
Client Requested Due Date	: 16-Feb-2022	Scheduled Reporting Date	: **16-Feb-2022**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 13.9 - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- 10/02/22: This is an updated SRN which indicates the addition of an extra report recipient.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - EA025H Suspended Solids - Standard Level	WATER - EA045 Turbidity	WATER - EP020 Oil & Grease (O&G)	WATER - NT-11 Total Nitrogen and Total Phosphorus
ES2204592-001	09-Feb-2022 00:00	QA200	✓	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

Chong Zeng		
- *AU Certificate of Analysis - NATA (COA)	Email	chong.zeng@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chong.zeng@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chong.zeng@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chong.zeng@cardno.com.au
- A4 - AU Tax Invoice (INV)	Email	chong.zeng@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	chong.zeng@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	chong.zeng@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	chong.zeng@cardno.com.au
ContamNSW		
- *AU Certificate of Analysis - NATA (COA)	Email	contamnsw@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	contamnsw@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	contamnsw@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	contamnsw@cardno.com.au
- A4 - AU Tax Invoice (INV)	Email	contamnsw@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	contamnsw@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	contamnsw@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	contamnsw@cardno.com.au
INVOICES		
- A4 - AU Tax Invoice (INV)	Email	apinvoices@cardno.com.au
JIAQI ZHOU		
- *AU Certificate of Analysis - NATA (COA)	Email	jiaqi.zhou@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jiaqi.zhou@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jiaqi.zhou@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jiaqi.zhou@cardno.com.au
- A4 - AU Tax Invoice (INV)	Email	jiaqi.zhou@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	jiaqi.zhou@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	jiaqi.zhou@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	jiaqi.zhou@cardno.com.au

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2204592**	Page	: 1 of 2
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JIAQI ZHOU	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Date Samples Received	: 10-Feb-2022 14:00
Order number	: ----	Date Analysis Commenced	: 11-Feb-2022
C-O-C number	: ----	Issue Date	: 16-Feb-2022 15:29
Sampler	: CZ		
Site	: ----		
Quote number	: EN/222 - Secondary Work		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Sample ID	**QA200**	**----**	**----**	**----**	**----**
			Sampling date / time	09-Feb-2022 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2204592-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	<5	**----**	**----**	**----**	**----**
EA045: Turbidity								
Turbidity	----	0.1	NTU	**2.6**	**----**	**----**	**----**	**----**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.85**	**----**	**----**	**----**	**----**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.6**	**----**	**----**	**----**	**----**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	**1.4**	**----**	**----**	**----**	**----**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.09**	**----**	**----**	**----**	**----**
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	**----**	**----**	**----**	**----**

QUALITY CONTROL REPORT

Work Order	: **ES2204592**	Page	: 1 of 3
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JIAQI ZHOU	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Date Samples Received	: 10-Feb-2022
Order number	: ----	Date Analysis Commenced	: 11-Feb-2022
C-O-C number	: ----	Issue Date	: 16-Feb-2022
Sampler	: CZ		
Site	: ----		
Quote number	: EN/222 - Secondary Work		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 4167780)									
ES2204588-006	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	18	17	5.7	No Limit
EA045: Turbidity (QC Lot: 4168741)									
ES2204573-002	Anonymous	EA045: Turbidity	----	0.1	NTU	0.9	0.8	0.0	No Limit
EW2200593-001	Anonymous	EA045: Turbidity	----	0.1	NTU	6.2	6.2	0.0	0% - 20%
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4169740)									
ES2204585-005	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.16	0.16	0.0	0% - 50%
ES2204511-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.07	0.07	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4169743)									
ES2204511-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	38.7	40.0	3.4	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4169742)									
ES2204585-006	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.03	0.04	0.0	No Limit
ES2204511-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	4.38	4.38	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 4167780)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	102	83.0	129
				<5	1000 mg/L	97.4	82.0	110
				<5	463 mg/L	104	83.0	118
EA045: Turbidity (QCLot: 4168741)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	95.2	91.0	105
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4169740)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	97.6	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4169743)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	87.1	69.0	101
				<0.1	1 mg/L	76.3	70.0	118
				<0.1	5 mg/L	91.0	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4169742)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	96.8	71.0	101
				<0.01	0.442 mg/L	85.5	72.0	108
				<0.01	1 mg/L	96.3	70.0	130
EP020: Oil and Grease (O&G) (QCLot: 4173200)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	101	81.0	121

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4169740)							
ES2204511-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	85.8	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4169743)							
ES2204511-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	25 mg/L	84.4	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4169742)							
ES2204511-002	Anonymous	EK067G: Total Phosphorus as P	----	5 mg/L	94.1	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2204592**	Page	: 1 of 4
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JIAQI ZHOU	Telephone	: +61 2 8784 8555
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Date Samples Received	: 10-Feb-2022
Site	: ----	Issue Date	: 16-Feb-2022
Sampler	: CZ	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural (EA025H)							
QA200	**09-Feb-2022**	**----**	----	----	**11-Feb-2022**	16-Feb-2022	✓
EA045: Turbidity							
Clear Plastic Bottle - Natural (EA045)							
QA200	**09-Feb-2022**	**----**	----	----	**11-Feb-2022**	11-Feb-2022	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
QA200	**09-Feb-2022**	**----**	----	----	**14-Feb-2022**	09-Mar-2022	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
QA200	**09-Feb-2022**	**14-Feb-2022**	09-Mar-2022	✓	**14-Feb-2022**	09-Mar-2022	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
QA200	**09-Feb-2022**	**14-Feb-2022**	09-Mar-2022	✓	**14-Feb-2022**	09-Mar-2022	✓
EP020: Oil and Grease (O&G)							
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020)							
QA200	**09-Feb-2022**	**----**	----	----	**15-Feb-2022**	09-Mar-2022	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	5	**60.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	10	**30.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Oil and Grease	EP020	WATER	In house: Referenced to APHA 5520 B. Oil & grease is a gravimetric procedure to determine the amount of oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)

Appendix 3 – Surface Water Monitoring Report – Wiley Park Station NE30161_R007_SWM_WileyPark_Rev0_R

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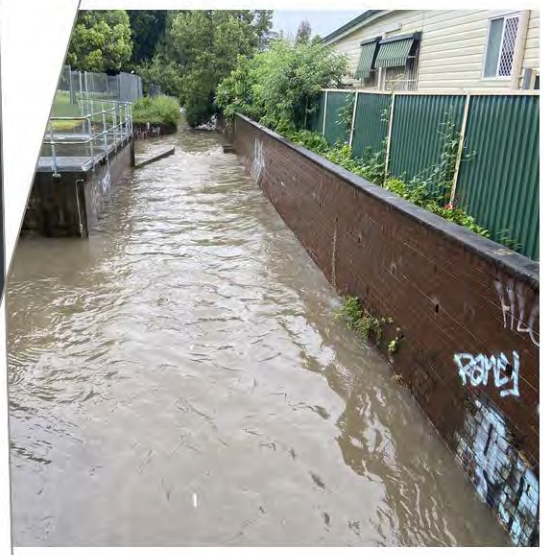
Surface Water Monitoring Report - Wiley Park Station

Wiley Park Station

NE30161



Prepared for
Downer EDI Works Pty Ltd

21 March 2022

Cardno

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Stantec

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Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
RevA	21/03/2022	Draft for Client Review	J.Zhou / C.Zeng	M.Jorgensen
Rev0	21/03/2022	First Final	J.Zhou / C.Zeng	M.Jorgensen

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Our report is based on information made available by the client. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Cardno is both complete and accurate. Whilst, to the best of our knowledge, the information contained in this report is accurate at the date of issue, changes may occur to the site conditions, the site context or the applicable planning framework. This report should not be used after any such changes without consulting the provider of the report or a suitably qualified person.

Table of Contents

Appendices

Tables

1 Introduction

1.1 Background

Cardno (NSW/ACT) Pty Ltd ("Cardno") was commissioned by Downer EDI Works Pty Ltd ("Downer") to undertake monitoring and reporting of surface water quality of the unnamed channel within proximity to Wiley Park Station Upgrade Site. The proposed works includes the upgrade of the main station and installation of the Metro Services Building (MSB).

Surface water quality of the channel within proximity to Wiley Park Upgrade Site is to be monitored as per the requirements summarised in the **Table 1-2**, which is excerpted from the Southwest Metro – Hurlstone Park, Belmore and Wiley Park Station Upgrades Soil and Water Management Plan (SWMP). The monitoring program are prepared to meet the requirements outlined in *The Sydney Metro City and Southwest – Sydenham to Bankstown Upgrade Conditions of Approval SSi-8256*, specifically Condition 8 to Condition 10. The sampling locations (WP1 – Upstream and WP2 – Downstream) of the water quality monitoring are shown on in **Appendix A.**

The closest Project worksite to an existing watercourse is Wiley Park Station services building, which is located approximately 100 m from an unnamed concrete-lined channel, which forms the upper reaches of Coxs Creek and is identified as a first-order stream.

For the purpose of establishing baseline water quality data within the first-order stream at Wiley Park, water quality monitoring was intended to be undertaken for a period prior to construction of the Wiley Park services building as outlined in the Table 13 of the SWMP. At a minimum, one dry-weather sample and one wet weather sample (weather permitting) were intended to be collected during the pre-construction period. The frequency of pre-construction water quality monitoring within this channel was subject to water being present within the structure. However, during the baseline monitoring period no wet-weather events were able to be captured prior to commencement of construction. A dry-weather baseline monitoring event was undertaken on 10 March 2021.

This report presents the findings from the ninth surface water monitoring event, which was undertaken by Cardno on 23 February 2022. The event undertaken was a mid-construction wet-weather event. **Table 1-1** below summarised the surface water monitoring events undertaken to date by Cardno.

Table 1-1 Summary of Surface Water Monitoring Event Undertaken to Date

Date of Monitoring	Type of Event	Report Reference
10 March 2021	Pre-construction Dry Baseline	4NE30187_R001_SWM_WileyPark_RevA
20 March 2021	Mid Construction Wet Weather	4NE30187_R001_SWM_WileyPark_RevA
5 May 2021	Mid Construction Wet Weather	4NE30187_R002_SWM_WileyPark_RevA
1 July 2021	Mid Construction Dry Weather	NE30161_R003_SWM_WileyPark_Rev0
30 September 2021	Mid Construction Dry Weather	NE30161_R004_SWM_WileyPark_RevA
12 November 2021	Mid Construction Wet Weather	NE30161_R005_SWM_WileyPark_Rev0
26 November 2021	Mid Construction Wet Weather	NE30161_R005_SWM_WileyPark_Rev0
9 and 10 February 2022	Mid Construction Dry Weather	NE30161_R006_SWM_WileyPark_Rev0
23 February 2022	Mid Construction Wet Weather	NE30161_R007_SWM_WileyPark_RevA

1.1 Purpose and Objective

The purpose of the surface water monitoring works is to monitor and record surface water quality within the unnamed channel in accordance with the monitoring program as outlined in the Site's SWMP. The objective of the works is to evaluate whether construction activities are impacting water quality downstream of the project footprint in the unnamed channel.

1.2 Scope of Works

Cardno undertook the following tasks during the surface water monitoring events:

- Inspected and sampled two (2) nominated surface water sampling locations (WP1 – Upstream and WP2 – Downstream) on 23 February 2022 as part of mid-construction wet-weather monitoring event.
- Recorded field parameters and noted observations of the water bodies during sampling.
- Collected two (2) primary surface water samples, one (1) intra-lab duplicate sample and one (1) inter-lab duplicate sample per sampling event for submission to a National Association of Testing Authorities, Australia (NATA) certified laboratory for analytical testing of primary and additional quality assurance/quality control (QA/QC) samples. Samples were submitted for analysis of:
  - Oil & Grease;
  - Total Suspended Solids (TSS);
  - Nutrients (Total Phosphorous, Total Nitrogen);
  - Turbidity; and
  - Chlorophyll-*a*.
- Reviewed the analytical and field data and prepared this report.

Details of the monitoring program are shown below.

Table 1-2 Wiley Park Water Quality Monitoring Program

Wiley Park Water Quality Monitoring Program	
Waterway	Sydney Water Cooks River Channel (first-order stream)
Indicative monitoring points	WP1 – Upstream
	WP2 – Downstream
Interaction with Project works	Channel within proximity to Wiley Park service building site
Pre-construction works	Monthly for parameters detailed in Table 11 (including at least one dry-weather round of sampling). One wet-weather event, if possible, for the parameters detailed in Table 11, subject to event occurrence, safe conditions for monitoring and access being available to conduct monitoring. Note: A wet-weather event is when the receiving area has received greater than 20 mm of rain in 24 hours. The sampling is undertaken immediately during construction hours and if it is safe to do so.
During construction of the Wiley Park services building	Quarterly for parameters detailed in Table 11 (including during dry weather). Four wet-weather events per year for the parameters in Table 11, subject to event occurrence, safe conditions for monitoring and access being available to conduct monitoring. Note: A wet-weather event is when the receiving area has received greater than 20 mm of rain in 24 hours. The sampling was undertaken immediately during construction hours and if it is safe to do so.

2 Guidelines and Legislation

There are a range of Guidelines and Legislation and Conditions of Approval (CoA) that are applicable to the surface water monitoring program which are summarised below.

The CoA applicable to this job include:

- The Sydney Metro City and Southwest - Sydenham to Bankstown Upgrade Conditions of Approval SSI-8256, determined 12 December 2018;

The State and Federal legislation and policy and guidelines that apply to the program include:

- Environmental Planning and Assessment Act 1979 (EP&A Act);
- Contaminated Land Management Act 1997;
- Protection of the Environment Operations Act 1997 (POEO Act); and
- Water Management Act 2000 Water Management (General) Regulation 2018;

Additional guidelines and standards to the management of soil and water include:

- Landcom (2004). Managing Urban Stormwater: Soils and Construction. (Volume 1 of the 'Blue Book');
- DECC (2008). Managing Urban Stormwater: Soils and Construction. Volume 2D: Main Road Construction. (Volume 2D of the 'Blue Book');
- ANZECC (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (collectively known as the 'ANZECC Guidelines');
- ANZECC (2018). Australian and New Zealand Guidelines for Water Quality Monitoring and Reporting (collectively known as the 'ANZECC Guidelines'); and
- ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (known as 'ANZG Guidelines').

3 Monitoring Locations

Details of the sampling locations are provided in **Table 3-1**. The locations are provided in **Appendix A.** Representative photographs are presented in **Appendix B**.

3.1 Monitoring Locations

Table 3-1 Surface Water Monitoring Location Details

Sample Location	Latitude	Longitude	Description
WP1 (up-stream)	-33.924014	151.065315	Immediately south of the Boulevarde and east of 118 the Boulevarde.
WP2 (down-stream)	-33.923339	151.064970	Immediately north of the Urunga Parade and west of 4 Urunga Parade.

4 Quality Management

The Data Quality Objective (DQO) process is used to establish a systematic planning approach to set the type, quantity and quality of data required for making decisions based on the environmental condition of the project area. The DQO process involves the seven steps detailed in **0**.

Table 4-1 Data Quality Objectives

DQO	Description
Step 1 State the Problem	Construction work may adversely impact the local surface water quality within the unnamed channel near the site.
Step 2 Identify the Decisions	Are there any impacts to surface water quality from construction activities at the site?
Step 3 Identify Inputs to the Decision	The primary inputs to the decisions described above are: ▪ Assessment of surface water quality of the unnamed channel within proximity to Wiley Park service building site per the requirements outlined in the site's SWMP, with samples collected from two locations (upstream and downstream of the site); ▪ Laboratory analysis of surface water samples for relevant parameters; ▪ Assessment of the suitability of the analytical data obtained, against the Data Quality Indicators (DQIs); ▪ Assessment of the analytical results against applicable guideline criteria; and ▪ Aesthetic observations of surface water bodies, including odours, sheen and condition, if encountered.
Step 4 Define the Study Boundaries	The lateral extent of the study area is the channel near the Wiley Park service building site. The temporal boundaries of the study comprise the duration of the monitoring program, including pre-construction monitoring, construction phase, and post-construction monitoring as required.
Step 5 Develop a Decision Rule	The decision rules for the water quality monitoring sampling events included: ▪ Were primary and QA/QC samples analysed using methods endorsed by relevant regulatory guidelines at laboratories NATA-accredited for the requested analyses? ▪ Did the field and laboratory QA/QC results indicate that the data set was reliable and representative of the water quality with Relative Percentage Difference (RPD) values of 30% or less? ▪ Were the laboratory limits of reporting (LORs) below the applicable guideline criteria for the analysed parameters? ▪ Were guideline criteria sourced from endorsed guidelines? ▪ Were surface water aesthetic characteristics evaluated including odours and sheen? ▪ Were the monitoring results obtained from the downstream sample collected during construction phase greater than the upstream sample collected during the same monitoring event? If so, then the adverse impact to the quality of water in the unnamed channel is considered to have potentially occurred.
Step 6 Specify Limits on Decision Error	In accordance with the relevant guidelines as endorsed under the *Contaminated Land Management Act 1997*. Specific limits for this project are in accordance with the appropriate guidance made or endorsed by state and national regulations, appropriate indicators of data quality, and standard procedures for field sampling and handling. This step also examines the certainty of conclusive statements based on the available new Site data collected. This should include the following points to quantify tolerable limits: ▪ A decision can be made based on a certainty assumption of 95% confidence in any given data set (excluding asbestos). A limit on the decision error will be 5% that a conclusive statement may be a false positive or false negative.

DQO	Description
	A decision error in the context of the decision rule presented above would lead to either underestimation or overestimation of the risk level associated with a particular sampling area. Decision errors may include: ▪ Sampling errors may occur when the sampling program does not adequately detect the variability of a contaminant from point to point across the Site. To address this, minimum numbers of samples are proposed to be collected from each media. As such, there may be limitations in the data if aspects of the sampling plan cannot be implemented. Some examples of this scenario include but not limited to: – Proposed samples are not collected due to lack of water flow or access being restricted to a given location. ▪ Limitations in ability to acquire useful and representative information from the data collected. The data are proposed to be collected from multiple locations and sample media. ▪ Measurement errors can occur during sample collection, handling, preparation, analysis and data reduction. To address this the following measures are proposed: – Field staff to follow a standard procedure when undertaking samples, including decontamination of tools, removal of adhered soil to avoid false positives in results, collection of representative samples and use of appropriate sample containers and preservation methods. – Laboratories to follow a standard procedure when preparing samples for analysis and undertaking analysis. – Laboratories to report QA/QC data for comparison with the DQIs established for the project
Step 7 Optimise the Design for Obtaining Data	To achieve the DQOs and DQIs, the following sampling procedures were implemented to optimise the design for obtaining data: ▪ Surface water samples was collected from two (2) sampling locations, as available due to access and water level; ▪ Surface water parameters were selected based on project monitoring requirements provided to Cardno; ▪ Samples were collected by suitably qualified and experienced environmental scientists; ▪ Samples were collected and preserved in accordance with relevant standards/guidelines; and ▪ Field and laboratory QA/QC procedures were adopted and reviewed to indicate the reliability of the results obtained.

4.1 Data Quality Indicators

The following DQIs have been adopted for the project. The DQIs outlined in **Figure 1481564985-0Table 4-2** assist with decisions regarding the usefulness of the data obtained, including the quality of the laboratory data.

Table 4-2 Summary of Data Quality Indicators

Data Quality Indicator	Frequency	Data Acceptance Criteria
Completeness		
Field documentation correct	All samples	The work was documented in accordance with Cardno SOPs
Suitably qualified and experience sampler	All samples	Person deemed competent by Cardno collecting and logging samples
Appropriate lab methods and limits of reporting (LORs)	All samples	Samples were analysed using methods endorsed by relevant regulatory guidelines at laboratories NATA-accredited for the requested analyses.
Chain of custodies (COCs) completed appropriately	All samples	The work was documented in accordance with Cardno SOPs

Data Quality Indicator	Frequency	Data Acceptance Criteria
Sample holding times complied with	All samples	The samples were extracted and analysed within holding times specified by the project NATA-accredited laboratory
Proposed/critical locations sampled	-	Proposed/critical locations sampled
Comparability		
Consistent standard operating procedures for collection of each sample. Samples should be collected, preserved and handled in a consistent manner	All samples	All works undertaken in accordance with Cardno SOPs
Experienced sampler	All samples	Person deemed competent by Cardno collecting and logging samples
Climatic conditions (temp, rain etc) recorded and influence on samples quantified (if required)	All samples	Climatic conditions documented in field sheets
Consistent analytical methods, laboratories and units	All samples	Sample analysis to be in accordance with NATA-approved methods
Representativeness		
Sampling appropriate for media and analytes (appropriate collection, handling and storage)	All samples	Sample analysis to be in accordance with NATA-approved methods
Samples homogenous	All samples	All works undertaken in accordance with Cardno SOPs
Detection of laboratory artefacts, e.g. contamination blanks	-	Laboratory artefacts assessed and impact on results determined
Samples extracted and analysed within holding times	All samples	The samples were extracted and analysed within holding times specified by the laboratory
Precision		
Blind duplicates (intra-laboratory duplicates)	1 per 20 samples	Less than or equal to 30% RPD No Limit RPD Result less than 10 × LOR
Split duplicates (inter-laboratory duplicates)	1 per 20 samples	Less than or equal to 30% RPD No Limit RPD Result less than 10 × LOR
Laboratory duplicates	1 per 20 samples	Results greater than 10 x LOR: less than or equal to 30% RPD Results less than 10 x LOR: No limit on RPD
Accuracy (Bias)		
Surrogate spikes	All organic samples	50-150%
Matrix spikes	1 per 20 samples	70-130%
Laboratory control samples	1 per 20 samples	70-130%
Method blanks	1 per 20 samples	Less than LOR

The DQOs for the project were met during the monitoring event. The DQIs for the project were met during the monitoring event with the exception of the holding time non-compliance of turbidity analysis for inter-laboratory duplicate sample QA200 due to courier delay. However, it is not considered to alter the overall outcome of the assessment. Discussion of the QA/QC assessment is provided in **Appendix E**.

5 Field Investigation

The scope and method of the surface water monitoring is summarised in **Table 5-1**.

Table 5-1 Investigation Activity Summary

Activity	Details
Dates of Fieldwork	23 February
Surface Water Sampling	Cardno inspected two surface water monitoring locations (WP1 – Upstream and WP2 – Downstream). Primary samples were collected from the two locations during the sampling event. Cardno undertook the sampling as per the following procedures: Surface Water Body Inspection - The general site condition was observed prior to commencement of field works for signs of any site activities that may have altered the surface water contamination status or require modifications to the field or laboratory works program. Each surface water location was inspected for indicators of contamination and the presence as well as the flow of surface water. This information is recorded on the field sheets presented in **Appendix C.** Surface water sampling - Field parameters and visual/olfactory observations were recorded prior to sampling at each location. Physico-chemical parameters including pH, electrical conductivity (EC), dissolved oxygen (DO), reduction-oxidation potential (redox), and temperature were measured using a calibrated water quality meter. Surface water samples were collected either directly into the sampling bottle or directly from the telescopic scoop. Once field parameters were recorded, the surface water samples were transferred to appropriately preserved sample containers provided by the laboratories. Field observations, and parameters are presented in **Appendix C**. Surface water samples were placed into an Esky containing ice and maintained at or below 4°C whilst onsite and in transit to the NATA-accredited laboratories for the targeted analyses.
Surface Water Analysis	Surface water samples from the monitoring event were submitted under standard chain-of-custody (CoC) procedures to NATA-accredited Eurofins Environment Testing Australia analysis of the parameters as follows: - Oil & Grease; - Total Suspended Solids (TSS); - Nutrients (Total Phosphorous, Total Nitrogen); - Turbidity; and - Chlorophyll-*a*. Tabulated laboratory results are presented in **Appendix D**. The Data QA /QC program and data quality review including calibration certificates is presented in **Appendix E**. Copies of the original laboratory reports, NATA-stamped laboratory certificates, and CoC documentation are included in **Appendix F**.
Decontamination	In the event of reusable sampling or monitoring equipment (telescopic scoop, water quality meter) was used decontamination was undertaken. Decontaminated between locations using a standard bucket wash. Equipment was washed in phosphate-free detergent (Liquinox) and rinsed in laboratory supplied rinsate water.

6 Surface Water Assessment Criteria

The assessment criteria for surface water analytical and field data were adopted from Table 11 of the site's SWMP. The criteria for selected parameters are provided in **Table 6-1** below. ANZECC guideline criteria are included in the table for reference.

Table 6-1 Water Quality Monitoring Parameters and Adopted Criteria at Wiley Park

Parameter	ANZECC Criteria – Freshwater[1]	Proposed Triger Values[2]	Proposed Actions
Temperature (°C)	>80% ile; <20% ile	Downstream results are greater than upstream results in rainfall events up to and including the significant event threshold of greater than 20 mm in 24 hours. Downstream results are greater than upstream results during dry-weather sampling.	Environment Manager (or delegate) to re-test to confirm results and undertake an inspection of the adjacent works and propose actions where required.
DO (%Sat)	Lower limit – 85% Upper limit – 110%		
Turbidity (NTU)	6-50 NTU		
Oil and grease	-		
pH	Lower limit – 6.5 Upper limit – 8.5		
Salinity (as EC)	125 – 2,200 µS/cm		
TSS	-		
Total Phosphorus as P	25 µg/L		
Total Nitrogen as N	350 µg/L		
Chlorophyll-a	3 µg/L		

Note to Table
1 ANZECC guideline criteria are included for reference. It is noted that for dry weather events baseline testing comparison will indicate whether this existing water quality within the channel meet ANZECC guidelines, prior to construction of the services building. For wet-weather events where no baseline data is available a direct comparison to upstream and downstream results is undertaken. Sydney Metro's Principal Contractor will comply with Section 120 of the Protection of the Environment Operations Act 1997.
2 For the ANZECC criteria given in a range (i.e. DO, pH, temperature, etc.), measured field parameters at downstream and upstream were assessed in comparison to the closeness to the criteria range.

7 Summary of Results

7.1 Summary of Field Observations

The two (2) surface water sampling locations (WP1 – Upstream and WP2 – Downstream) were able to be accessed during the sampling event conducted on 23 February 2022. Photos of each sampling location are included in **Appendix A**. The following observations were made:

7.1.1 Mid-Construction Wet-weather Event – 23 February 2022

- The sampling event was considered as a mid-construction wet-weather event based on the rainfall data recorded by the nearby weather station:
  - Canterbury Racecourse AWS station (ID: 066194): approximately 4.6 km from the site with the rainfall data recorded 117.8 mm over the last 24 hours prior to the field sampling. Refer to **Appendix C** for weather recordings.
- Observation of water body:
  - WP 1 (upstream of work area) contained high flowing clear water with low turbidity. The estimated depth of the water body was 0.3 m to 0.4 m;
  - WP 2 (downstream of work area) contained high flowing clear water with low turbidity. The estimated depth of the water body was 0.2 m to 0.3 m;
- Additional observation:
  - WP1 (upstream of work area):
    - One discharge point (WP1-DP1) was observed immediately downstream / north of WP1. High flow contribution was observed at the time of sampling. Refer to **Appendix A** for approximate location of WP1-DP1. Refer to **Appendix B** for a detailed photo.
  - WP2 (downstream of work area):
    - During the sampling event, the two discharge points (WP2-DP1 and WP2-DP2) within the rail corridor immediately upstream / south from WP2 were observed. High flow contribution from both discharge points were observed at the time of sampling. It is noted that WP2-DP2 was observed to have greater flow contribution than WP2-DP1. Refer to **Appendix A** for approximate location of WP2-DP1 and WP2-DP2. Refer to **Appendix B** for detailed photos.

7.2 Field Parameters

The parameters from each location sampled are presented in **Table 7-1**.

Table 7-1 Field Physico-chemical Parameters and Field Observations on 23 February 2022

Location ID	WP1 (upstream)	WP2 (downstream)
Water depth (m)	0.3-0.4	0.2-0.3
Estimated Flow Rate	high	high
Temperature (°C)	22.6	23.4
pH	7.50	7.62
Electrical Conductivity (µS/cm)	230	431
Dissolved Oxygen (mg/L)	4.94	6.00
Dissolved Oxygen (%)	56.7	72.0
Oxidation-Reduction Potential (mV)	55.3	81.4
SHE[1] Redox Potential (mV)[2]	261.5	287.6

Location ID	WP1 (upstream)	WP2 (downstream)
Condition	Clear Low Turbidity	Clear Low Turbidity

Note to Table
1 SHE – Standard Hydrogen Electrode
2 Water quality meter utilised on the day of monitoring contains Ag/AgCl reference electrode with 3.5 M KCl filling solution. As such, SHE was calculated based on Table 1 of US EPA document: *SESDPROC-113-R2, Field Measurement of Oxidation-Reduction Potential (ORP)*.

7.3 Surface Water Analytical Results

Surface Water Analytical results are presented in **Appendix D**. Copies of the original laboratory reports, NATA-stamped laboratory certificates, and Chain of Custody documentation are included in **Appendix F**.

7.3.1 Mid-Construction Wet-weather Event – 23 February 2022

The results of the monitoring event indicate that:

> Laboratory analytical results:

- Concentrations of Chlorophyll-*a* were reported below the laboratory detection limit and adopted ANZG 2018 / ANZECC 2000 criteria at both sample locations;
- Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations;
- Concentrations of total nitrogen and the total phosphorous were reported above the adopted ANZG 2018 / ANZEEC 2000 criteria within both WP1 and WP2 samples.
- TSS concentrations were detected within both WP1 and WP2, with concentrations of 18 mg/L at WP1 and 9.6 mg/L at WP2; and
- Turbidity was detected with concentration of 37 NTU at WP1 to 28 NTU at WP2.

7.3.2 Baseline Results Comparison

One sampling event during the pre-construction period (baseline event) was undertaken on 10 March 2021 which was during dry condition. It should be noted that wet-weather and storm-event pre-construction monitoring was not able to be conducted because of the lack of rainfall. The monitoring results of baseline event (10 March 2021) has not been used for comparison with the monitoring results under this report because the conditions encountered were different (i.e. non-trigger for wet-weather event criteria). However, four previous mid-construction wet weather sampling events were used to compare and check if there is any potential adverse impact to the water quality caused by the construction activities.

The parameters from each location sampled are presented in **Table 7-2**. Overall, conditions are similar between upstream and downstream samples on 23 February 2022 and previous mid-construction wet weather events.

Table 7-2 Comparison of current wet condition sampling event to previous wet condition sampling events

Time of sampling		20 March 2021		5 May 2021		12 November 2021		26 November 2021		23 February 2022	
Location ID	Assessment Criteria	WP1	WP2	WP1	WP2	WP1	WP2	WP1	WP2	WP1	WP2
Temperature (°C)	N/A[2]	20.2	20	18.6	18.2	19.4	19.5	19.6	19.7	22.6	23.4
pH	6.5 - 8.5	8.10	7.58	7.80	7.73	8.10	8.42	**6.07**	7.34	7.50	7.62
EC (µS/cm)	125 – 2,200	246.2	133.4	**2,500**	**92.9**	514	509	389	484	230	431
DO (mg/L)	N/A[2]	4.79	3.92	6.35	5.95	6.42	5.63	9.05	9.31	4.94	6.0
DO (%)	85% - 110%	**52.9**	**43.2**	**65.3**	**62.8**	**68**	**63**	99	102	**56.7**	**72**
SHE[1] Redox Potential (mV)[4]	N/A[2]	122.3	135.9	164.6	109.2	70.8	80.4	184	196	261.5	287.6
Chlorophyll a (µg/L)	3	<5	<5	<5	<5	<2	<2	<2	2.7	<2	<2
Oil and Grease (mg/L)	Comparison	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Kjeldahl Nitrogen Total (mg/L)	N/A[2]	0.6	0.8	NT[3]	NT[3]	NT[3]	NT[3]	NT[3]	NT[3]	0.8	0.8
Nitrate & Nitrite (as N) (mg/L)	N/A[2]	1.7	1.5	NT[3]	NT[3]	NT[3]	NT[3]	NT[3]	NT[3]	0.84	1.8
Nitrogen (Total) (mg/L)	0.35	**2.3**	**2.3**	**5.0**	**1.0**	**2.7**	**2.8**	**1.6**	**2.4**	**1.64**	**2.6**
Phosphate total (as P) (mg/L)	0.025	<0.5	<0.5	**0.21**	**0.15**	**0.15**	0.02	**0.13**	**0.18**	**0.23**	**0.28**
TSS (mg/L)	N/A[2]	9.2	35	4.0	47	8.4	7.6	16	7.8	18	9.6
Turbidity (NTU)	6-50	9.3	13	4.3	21	21	19	25	17	37	28

Note to Table
1 SHE – Standard Hydrogen Electrode
2 Not Applicable
3 NT – Not Tested
4 Water quality meter utilised on the day of monitoring contains Ag/AgCl reference electrode with 3.5 M KCl filling solution. As such, SHE was calculated based on Table 1 of US EPA document: *SESDPROC-113-R2, Field Measurement of Oxidation-Reduction Potential (ORP)*.

7.4 Results Discussion

7.4.1 Comparison to ANZG 2018 / ANZECC 2000 Criteria

Results for the mid-construction wet-weather event sampled on 23 February generally showed monitored parameters were within the adopted threshold criteria, with the exception of dissolved oxygen saturation, total nitrogen, and total phosphorous.

- Dissolved oxygen saturation measured at both WP1 (56.7%) and WP2 (72%) were below the adopted criterion range. However, this is not considered to be a significant issue because the concentration of dissolved oxygen saturation at WP2 (downstream) was closer to the adopted criterion range in comparison to WP1 (upstream).
- Total nitrogen measured at both WP1 (1.64 mg/L) and WP2 (2.6 mg/L) were above the adopted criterion range. However, the results from the previous mid-construction wet-weather sampling events show that total nitrogen at WP1 fluctuated between 1.6 mg/L and 5.0 mg/L whereas total nitrogen for WP2 fluctuated between 1.0 mg/L and 2.8 mg/L. Furthermore, the total nitrogen for both WP1 and WP2 sampled on the 23 February 2022 monitoring event were similar to the previous event ranges. As such, this increase in total nitrogen is not considered to be a significant issue.
- Total phosphorous measured at both WP1 (0.23 mg/L) and WP2 (0.28 mg/L) were above the adopted criterion range. However, the results are similar to the results from previous mid-construction wet-weather events. As such, this is not considered to be a significant issue.

7.4.2 Comparison of Upstream and Downstream Results

Results for upstream and downstream sampling on 23 February 2022 were comparable, with the exception of:

- DO saturation measured at the downstream WP2 location had higher DO saturation (72%) compared to the upstream WP1 location (56.7%). However, this is not considered to be a significant issue since the downstream result was closer to the ANZG 2018/ANZECC 2000 criterion range in comparison to the upstream.
- Concentrations of total nitrogen at downstream sample was slightly higher than the upstream sample. However, this is not considered to be a significant issue, since the concentrations were generally consistent with the previous four mid-construction wet-weather events. Refer to **Section 7.4.1.**
- Concentrations of total phosphorous results at downstream sample was slightly higher than the upstream sample. However, this is not considered to be a significant issue since the results were generally consistent with the previous four mid-construction wet-weather events. Refer to **Section 7.4.1.**
- The pH result at downstream sample (7.62) was slightly higher than the result at upstream sample (7.50). However, this is not considered to be a significant issue since the pH measurements at both sample points were within the adopted ANZG 2018/ANZECC 2000 criterion range and the difference of the upstream and downstream pH results is only 1.6%.
- The EC result at the downstream sample (431 µS/cm) was higher than the upstream sample (230 µS/cm). However, this is not considered to be a significant issue since the EC measurements at both sample points were within the adopted ANZG 2018/ANZECC 2000 criterion range and the EC values were generally consistent with the previous four mid-construction wet-weather events.

Refer to **Appendix D** for details. It should be noted that wet-weather and storm-event pre-construction monitoring was not able to be conducted because of the lack of rainfall.

8 Conclusion

Cardno was engaged to undertake surface water monitoring of the unnamed channel west of Wiley Park Station in accordance with the SWMP for the project. The objective of the works was to evaluate whether construction activities are impacting water quality downstream of the project footprint in the unnamed channel that receives in part stormwater from the construction area.

This report presents monitoring data from mid-construction wet-weather event on 23 February 2022. Samples were collected from two locations. Sampling point WP1 is located upstream from the work site while sampling point WP2 is located downstream of the work site.

During this wet-weather monitoring event, sampling results showed monitored parameters were generally within the adopted ANZG 2018 / ANZECC 2000 screening criteria with the exception of dissolved oxygen saturation, total nitrogen, and total phosphorous. The comparison of the mid-construction wet-weather event conducted on 23 February 2022 to the four previous wet-weather sampling events on 20 March, 5 May, 12 November and 26 November 2021 showed no significant difference.

During this wet-weather monitoring event, the results between upstream and downstream were generally comparable with the exceptions of pH, EC, DO, total nitrogen, and total phosphorous. The pH and EC measurements at the downstream sample were slightly higher than the upstream sample, but both downstream and upstream results were within the ANZG 2018/ANZECC 2000 criterion range. The DO result at the downstream sample was higher than the upstream sample, but it was closer to the adopted criterion range compared to the upstream sample. The total nitrogen and total phosphorous results at the downstream sample were slightly higher than the upstream sample, but the results at both upstream and downstream samples were generally consistent with the previous four mid-construction wet-weather events. Overall, the comparison of the upstream and downstream samples conducted on 23 February showed no significant difference.

Based on comparison to the criteria, comparison with four previous mid-construction wet-weather events, and comparison of the upstream and downstream results, the results reported for the 23 February 2022 sampling event are not considered to reflect an adverse impact to water quality due to construction activities.

9 References

- Southwest Metro – Hurlstone Park, Belmore and Wiley Park Station Upgrades – Soil and Water Management Plan, dated 16th February 2021;
- The Sydney Metro City and Southwest - Sydenham to Bankstown Upgrade Conditions of Approval SSI-8256, determined 12 December 2018;
- Environmental Planning and Assessment Act 1979 (EP&A Act);
- Contaminated Land Management Act 1997;
- Protection of the Environment Operations Act 1997 (POEO Act);
- Water Management Act 2000 Water Management (General) Regulation 2018;
- Landcom (2004). Managing Urban Stormwater: Soils and Construction. (Volume 1 of the 'Blue Book');
- DECC (2008). Managing Urban Stormwater: Soils and Construction. Volume 2D: Main Road Construction. (Volume 2D of the 'Blue Book');
- ANZECC (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (collectively known as the 'ANZECC Guidelines');
- ANZECC (2000). Australian and New Zealand Guidelines for Water Quality Monitoring and Reporting (collectively known as the 'ANZECC Guidelines');
- ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (known as 'ANZG Guidelines').

10 Limitations

This assessment has been undertaken in general accordance with the current industry standards for a surface water monitoring report for the purpose and objectives and scope identified in this report. The agreed scope of this assessment has been limited for the current purposes of the Client. The assessment may not identify contamination occurring in all areas of the site, or occurring after sampling was conducted. Subsurface conditions may vary considerably away from the sample locations where information has been obtained. This Document has been provided by Cardno subject to the following limitations:

- This Document has been prepared for the particular purpose outlined in Cardno's proposal and Section 1 of this report and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.
- The scope and the period of Cardno's services are as described in Cardno's proposal, and are subject to restrictions and limitations. Cardno did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Cardno in regards to it.
- Conditions may exist which were undetectable given the limited nature of the enquiry Cardno was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.
- In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Cardno's opinions are based upon information that existed at the time of the production of the Document. It is understood that the services provided allowed Cardno to form no more than an opinion of the actual conditions of the site at the time this Document was prepared and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.
- Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.
- Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Cardno for incomplete or inaccurate data supplied by others.
- Cardno may have retained sub consultants affiliated with Cardno to provide services for the benefit of Cardno. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any direct legal recourse to, and waives any claim, demand, or cause of action against, Cardno's affiliated companies, and their employees, officers and directors.

This assessment report is not any of the following:

- A Site Audit Report or Site Audit Statement (SAR/SAS) as defined under the *Contaminated Land Management Act, 1997* or an assessment sufficient for an Environmental Auditor to be able to conclude a SAR/SAS.
- A geotechnical report and the bore logs/test pit logs may not be sufficient for geotechnical advice.
- An assessment of surface water contaminants potentially arising from other sites or sources nearby.
- A total assessment of the site to determine suitability of the entire parcel of land at the site for one or more beneficial uses of land

APPENDIX

A

FIGURES

Cardno

now

Stantec

Downer

Surface Water Monitoring

WILEY PARK STATION

Legend

- Sample Location
- Discharging Points
- Railway (NSW SS)
- Cadastre (NSW SS, 2019)

1:800 Scale at A3

m
0 10 20 30 40

N

Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (SYD)
Date: 2021-08-03 | Project: 4NE30187
Coordinate System: GDA 1994 MGA Zone 56
Map: 4NE30187-GS-002-SurfaceWater.mxd 02
Aerial imagery supplied by MetroMap (April, 2021)

APPENDIX

B

PHOTOGRAPHS

Cardno

now

Stantec

Photograph 1. Upstream sampling location WP1. Date: 23 February 2022.

Photograph 2. High stormwater in-flow observed from the discharge point WP1-DP1 which was located within the rail corridor and immediately downstream/north from WP1. Date: 23 February 2022.

Photograph 3. Downstream sampling location WP2. Date: 23 February 2022.

Photograph 4. High stormwater in-flow observed from both discharge points WP2-DP1 and WP2-DP2 which were located within the rail corridor and immediately upstream/south from WP2. Date: 23 February 2022.

APPENDIX

C

FILED RECORDS

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Surface Water Sampling Field Record

Site / Project: Wiley Park Surface Water Monitoring				**Sampling Point:**	
Client: Downer				Job No. NE30161	
Person Sampling: JZ				Initials:	
Site Details					
Sampling Equipment – Directly into bottle / Water Scoop / Van Dorn Sampler / Other:				Date: 23/02/2022	
Observations on Site: Last Rain Event / Recent Storms / Releases / Other :					
Sample Details, Observations, GPS Coordinates & Field Physiochemical Measurements (if possible, record parameters once stable)					
Sample ID	WP_01			WP_02	
Start Time:	10:20 am			11:10am	
Easting					
Northing					
Sample Depth (m)	0.3 -0.35			0.2-0.25	
Water Body Depth (m)	0.3-0.4			0.2-0.3	
Location – Onsite/Offsite /Inlet/Outlet/ Middle	upstream			downstream	
Flow Rate None/ Low / Med / High	High			High	
DO (mg/L)	4.94			6.0	
DO (%)	56.7			72	
EC (µS/Cm) -SPC	230			431	
pH	7.50			7.62	
Eh (mV) -ORP	55.3			81.4	
Temp (^{O}C)	22.6			23.4	
Water Colour	clear			clear	
Turbidity Low / Med / High	low			low	
Observations / Notes	Upstream DP with high flow rate, contributed to the surface water			Downstream DPs both with high flow rate, contributed to the surface water	
Sample Container & Preservation Data					
Number of sample containers:					
Container Volume					
Container Type					
Preservation					
Sample Number (for Lab ID):					
QC Dup Sample No.:				QA100 QA200	

Multi Parameter Water Meter

Instrument: YSI Quatro Pro Plus
Serial No.: 11C100764

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper	✓	
	Settings	✓	
Software	Version	✓	
Data logger	Operation	✓	
Download	Operation	✓	
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 10.00		pH 10.00		378646	pH 10.01
2. pH 7.00		pH 7.00		377339	pH 7.02
3. pH 4.00		pH 4.00		380327	pH 3.98
4. mV		234.0mV		365451/374424	223.0mV
5. EC		2.76mS		377099	2.74mS
6. D.O		0.00 ppm		371864	0.04ppm
7. Temp		20.6°C		MultiTherm	20.2°C

Calibrated by: Michelle Wagner

Calibration date: 21/02/2022

Next calibration due: 20/08/2022

Australian Government
Bureau of Meteorology

Latest Weather Observations for Canterbury

IDN60801

Issued at 7:32 am EDT Wednesday 23 February 2022 (issued every 10 minutes, with the page automatically refreshed every 10 minutes)

Station Details **ID:** 066194 **Name:** CANTERBURY RACECOURSE AWS **Lat:** -33.91 **Lon:** 151.11 **Height:** 3.0 m

Data from the previous 72 hours. | See also: Recent months at Canterbury

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
23/07:30am	20.7	24.8	20.7	100	0.0	CALM	0	0	0	0	-	-	119.2
23/07:24am	20.5	24.5	20.5	100	0.0	CALM	0	0	0	0	-	-	119.2
23/07:00am	20.2	22.7	20.2	100	0.0	NE	7	15	4	8	-	-	117.6
23/06:56am	20.1	23.1	20.1	100	0.0	ENE	4	15	2	8	-	-	116.4
23/06:30am	19.9	23.6	19.9	100	0.0	CALM	0	6	0	3	-	-	114.8
23/06:29am	19.9	23.6	19.9	100	0.0	CALM	0	6	0	3	-	-	114.8
23/06:09am	19.8	23.4	19.8	100	0.0	CALM	0	0	0	0	-	-	114.8
23/06:00am	19.9	23.6	19.9	100	0.0	CALM	0	0	0	0	-	-	114.8
23/05:42am	19.8	23.4	19.8	100	0.0	CALM	0	0	0	0	-	-	114.8
23/05:30am	20.0	23.7	20.0	100	0.0	CALM	0	0	0	0	-	-	114.8
23/05:00am	20.2	24.0	20.2	100	0.0	CALM	0	0	0	0	-	-	114.8
23/04:30am	20.3	22.8	20.3	100	0.0	E	7	11	4	6	-	-	114.6
23/04:19am	20.4	22.6	20.4	100	0.0	E	9	15	5	8	-	-	114.4
23/04:00am	20.5	22.7	20.5	100	0.0	ENE	9	17	5	9	-	-	113.8
23/03:59am	20.5	22.7	20.5	100	0.0	ENE	9	17	5	9	-	-	113.8
23/03:55am	20.4	23.0	20.4	100	0.0	NE	7	13	4	7	-	-	112.8
23/03:30am	20.2	23.6	20.2	100	0.0	NE	2	7	1	4	-	-	111.0
23/03:03am	20.1	22.5	20.1	100	0.0	NE	7	9	4	5	-	-	108.8
23/03:00am	20.1	22.5	20.1	100	0.0	NE	7	7	4	4	-	-	108.6
23/02:57am	20.1	22.7	20.1	100	0.0	NE	6	7	3	4	-	-	108.6
23/02:39am	20.0	23.3	20.0	100	0.0	NE	2	7	1	4	-	-	107.8
23/02:36am	20.0	23.3	20.0	100	0.0	NE	2	7	1	4	-	-	107.8
23/02:30am	20.0	23.3	20.0	100	0.0	NE	2	7	1	4	-	-	107.6
23/02:00am	20.0	22.0	20.0	100	0.0	E	9	13	5	7	-	-	104.8
23/01:30am	20.2	21.9	20.2	100	0.0	N	11	22	6	12	-	-	101.6
23/01:18am	20.3	23.0	20.3	100	0.0	WNW	6	13	3	7	-	-	95.2
23/01:12am	20.3	23.8	20.3	100	0.0	W	2	7	1	4	-	-	94.6
23/01:00am	20.2	22.3	20.2	100	0.0	W	9	13	5	7	-	-	94.6
23/12:54am	20.2	22.3	20.2	100	0.0	W	9	13	5	7	-	-	94.4

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
23/12:30am	20.1	23.5	20.1	100	0.0	WSW	2	9	1	5	-	-	93.6
23/12:00am	20.1	23.9	20.1	100	0.0	CALM	0	0	0	0	-	-	93.6

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
22/11:42pm	20.2	23.6	20.2	100	0.0	W	2	7	1	4	-	-	93.6
22/11:30pm	20.2	23.3	20.2	100	0.0	W	4	7	2	4	-	-	93.2
22/11:13pm	20.2	23.3	20.2	100	0.0	SSW	4	9	2	5	-	-	91.8
22/11:00pm	20.0	23.7	20.0	100	0.0	CALM	0	0	0	0	-	-	90.6
22/10:30pm	20.1	22.7	20.1	100	0.0	SSW	6	7	3	4	-	-	90.6
22/10:29pm	20.1	23.1	20.1	100	0.0	SSW	4	7	2	4	-	-	90.6
22/10:00pm	20.2	22.7	20.2	100	0.0	SSE	7	13	4	7	-	-	88.6
22/09:30pm	19.9	22.8	19.9	100	0.0	WSW	4	7	2	4	-	-	86.2
22/09:00pm	19.8	21.7	19.8	100	0.0	NNW	9	17	5	9	-	-	83.2
22/08:44pm	20.0	21.2	19.8	99	0.1	NW	13	28	7	15	-	-	76.8
22/08:30pm	19.9	22.3	19.7	99	0.1	SSW	6	11	3	6	-	-	75.6
22/08:23pm	19.9	22.1	19.7	99	0.1	SSW	7	11	4	6	-	-	75.6
22/08:00pm	20.1	22.0	19.8	98	0.2	SE	9	17	5	9	-	-	74.4
22/07:46pm	20.3	22.1	19.5	95	0.5	SSE	9	13	5	7	-	-	71.6
22/07:30pm	20.6	22.9	19.4	93	0.8	SSE	6	11	3	6	-	-	71.0
22/07:00pm	20.7	22.9	19.5	93	0.8	SSE	7	11	4	6	-	-	70.4
22/06:30pm	20.9	22.8	19.7	93	0.8	SE	9	13	5	7	-	-	70.4
22/06:00pm	20.7	22.3	20.0	96	0.4	SSE	11	19	6	10	-	-	70.4
22/05:30pm	20.6	22.1	20.6	100	0.0	SE	13	17	7	9	-	-	70.4
22/05:00pm	20.6	22.9	20.6	100	0.0	SE	9	15	5	8	-	-	70.4
22/04:30pm	20.8	22.8	20.8	100	0.0	SSE	11	19	6	10	-	-	70.2
22/04:00pm	20.3	24.2	20.3	100	0.0	CALM	0	4	0	2	-	-	69.6
22/03:49pm	20.2	24.0	20.2	100	0.0	CALM	0	0	0	0	-	-	69.4
22/03:30pm	19.9	22.8	19.9	100	0.0	S	4	7	2	4	-	-	68.4
22/03:00pm	19.9	21.9	19.9	100	0.0	ENE	9	13	5	7	-	-	65.8
22/02:30pm	19.4	20.7	19.4	100	0.0	ESE	11	19	6	10	-	-	61.4
22/02:00pm	20.3	22.1	20.3	100	0.0	SSE	11	19	6	10	-	-	48.4
22/01:30pm	20.2	21.9	20.2	100	0.0	S	11	20	6	11	-	-	28.2
22/01:00pm	20.0	21.9	19.8	99	0.1	SW	9	22	5	12	-	-	8.6
22/12:49pm	20.0	21.2	19.8	99	0.1	SW	13	20	7	11	-	-	7.4
22/12:30pm	20.2	22.2	20.0	99	0.1	SW	9	17	5	9	-	-	6.0
22/12:00pm	20.9	22.5	20.7	99	0.1	S	13	22	7	12	-	-	5.2
22/11:44am	20.6	22.0	20.4	99	0.1	S	13	20	7	11	-	-	5.2
22/11:30am	20.4	21.7	20.1	98	0.2	S	13	19	7	10	-	-	5.2
22/11:24am	20.5	21.8	20.2	98	0.2	S	13	19	7	10	-	-	4.6
22/11:05am	20.8	22.6	20.3	97	0.3	S	11	17	6	9	-	-	3.6
22/11:00am	20.8	22.6	20.3	97	0.3	S	11	17	6	9	-	-	3.6
22/10:42am	21.4	23.0	21.4	100	0.0	SSW	15	37	8	20	-	-	2.8

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
22/10:30am	20.4	21.8	19.6	95	0.5	SSW	11	17	6	9	-	-	1.8
22/10:16am	20.5	21.9	19.5	94	0.6	S	11	20	6	11	-	-	1.8
22/10:00am	20.7	22.5	19.5	93	0.8	S	9	15	5	8	-	-	1.4
22/09:57am	20.7	22.3	19.2	91	0.9	SSE	9	17	5	9	-	-	1.4
22/09:30am	22.1	22.7	19.5	85	1.7	SSE	15	26	8	14	-	-	0.0
22/09:00am	22.3	22.9	20.2	88	1.4	SE	17	28	9	15	-	-	5.0
22/08:33am	20.7	22.4	20.2	97	0.3	S	11	20	6	11	-	-	5.0
22/08:30am	20.4	21.6	19.9	97	0.3	SSW	13	20	7	11	-	-	5.0
22/08:00am	20.2	20.7	19.2	94	0.6	S	15	22	8	12	-	-	3.6
22/07:59am	20.2	21.1	19.2	94	0.6	S	13	20	7	11	-	-	3.4
22/07:30am	20.0	20.0	19.0	94	0.6	S	17	28	9	15	-	-	2.2
22/07:16am	20.0	20.0	19.0	94	0.6	SSE	17	26	9	14	-	-	2.2
22/07:00am	19.9	19.7	18.6	92	0.8	SSE	17	32	9	17	-	-	2.0
22/06:59am	20.0	19.4	18.5	91	0.9	SSE	19	32	10	17	-	-	2.0
22/06:30am	20.7	20.8	18.3	86	1.5	S	15	28	8	15	-	-	1.6
22/06:00am	21.3	21.9	18.7	85	1.6	S	13	22	7	12	-	-	1.6
22/05:30am	21.7	22.4	18.9	84	1.8	S	13	20	7	11	-	-	1.6
22/05:00am	22.9	23.9	19.5	81	2.2	SE	13	20	7	11	-	-	1.6
22/04:30am	22.8	23.4	19.4	81	2.2	SE	15	24	8	13	-	-	1.6
22/04:00am	22.7	23.2	19.3	81	2.2	ESE	15	22	8	12	-	-	1.6
22/03:30am	22.9	23.1	19.3	80	2.3	ESE	17	22	9	12	-	-	1.6
22/03:00am	22.9	23.9	19.5	81	2.2	ESE	13	22	7	12	-	-	1.6
22/02:30am	22.8	24.0	19.8	83	1.9	ESE	13	17	7	9	-	-	1.6
22/02:00am	22.6	24.9	19.9	85	1.7	ESE	7	13	4	7	-	-	1.6
22/01:30am	22.5	24.7	19.7	84	1.8	ESE	7	11	4	6	-	-	1.6
22/01:00am	22.8	24.8	20.0	84	1.8	ESE	9	15	5	8	-	-	1.6
22/12:30am	23.0	24.7	20.1	84	1.9	SE	11	15	6	8	-	-	1.6
22/12:00am	23.0	24.4	20.3	85	1.7	ESE	13	17	7	9	-	-	1.6

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
21/11:30pm	22.6	26.4	20.9	90	1.1	ESE	2	11	1	6	-	-	1.6
21/11:00pm	22.6	26.9	21.1	91	1.0	CALM	0	0	0	0	-	-	1.6
21/10:30pm	22.8	26.8	20.5	87	1.5	CALM	0	0	0	0	-	-	1.6
21/10:00pm	23.0	25.9	20.7	87	1.5	ENE	6	11	3	6	-	-	1.6
21/09:30pm	22.9	26.7	21.0	89	1.2	NE	2	7	1	4	-	-	1.6
21/09:00pm	22.9	25.9	20.8	88	1.4	E	6	11	3	6	-	-	1.6
21/08:30pm	22.6	25.0	20.9	90	1.1	SE	9	15	5	8	-	-	1.6
21/08:00pm	22.7	24.0	20.8	89	1.2	ESE	15	20	8	11	-	-	1.2
21/07:30pm	22.9	23.8	20.1	84	1.8	E	15	24	8	13	-	-	0.6
21/07:00pm	23.7	23.4	19.2	76	2.9	ESE	19	26	10	14	-	-	0.0
21/06:30pm	24.0	22.8	19.3	75	3.0	SE	24	35	13	19	-	-	0.0
21/06:00pm	24.4	22.9	19.5	74	3.1	SE	26	35	14	19	-	-	0.0

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
21/05:30pm	24.8	23.6	19.2	71	3.6	SE	24	37	13	20	-	-	0.0
21/05:00pm	26.1	24.1	20.0	69	4.0	SE	30	39	16	21	-	-	0.0
21/04:30pm	26.8	25.1	19.9	66	4.5	SSE	28	44	15	24	-	-	0.0
21/04:00pm	26.4	24.6	19.5	66	4.5	SE	28	43	15	23	-	-	0.0
21/03:30pm	26.6	24.6	19.2	64	4.8	SE	28	39	15	21	-	-	0.0
21/03:00pm	26.9	25.8	19.5	64	4.8	SE	24	35	13	19	-	-	0.0
21/02:30pm	26.5	25.1	19.6	66	4.5	SE	26	41	14	22	-	-	0.0
21/02:00pm	26.9	26.0	19.8	65	4.6	SE	24	39	13	21	-	-	0.0
21/01:30pm	27.7	26.0	16.3	49	7.0	SE	20	28	11	15	-	-	0.0
21/01:00pm	28.4	25.5	15.0	44	8.1	SSE	24	32	13	17	-	-	0.0
21/12:30pm	28.9	26.5	14.3	40	8.8	SE	20	32	11	17	-	-	0.0
21/12:00pm	30.9	33.0	17.2	43	8.7	NNW	2	7	1	4	-	-	0.0
21/11:30am	29.9	30.7	13.6	36	9.7	NE	2	9	1	5	-	-	0.0
21/11:00am	28.1	28.4	15.1	45	7.9	E	7	17	4	9	-	-	0.0
21/10:30am	26.9	26.2	14.3	46	7.5	SE	11	15	6	8	-	-	0.0
21/10:00am	25.1	24.6	13.9	49	6.6	WNW	9	13	5	7	-	-	0.0
21/09:30am	24.2	23.7	13.7	52	6.1	NNW	9	15	5	8	-	-	0.0
21/09:00am	23.8	23.3	13.9	54	5.8	NNW	9	17	5	9	-	-	0.0
21/08:30am	23.7	20.9	12.7	50	6.3	WNW	19	32	10	17	-	-	0.0
21/08:00am	23.7	22.0	12.4	49	6.5	WNW	13	24	7	13	-	-	0.0
21/07:30am	25.3	22.6	10.4	39	8.3	W	15	26	8	14	-	-	0.0
21/07:00am	25.1	21.6	10.9	41	8.0	WNW	20	32	11	17	-	-	0.0
21/06:37am	25.6	20.9	10.6	39	8.4	NW	26	48	14	26	-	-	0.0
21/06:30am	25.7	21.8	10.7	39	8.4	NNW	22	48	12	26	-	-	0.0
21/06:00am	23.7	21.1	13.3	52	6.0	WSW	19	32	10	17	-	-	0.0
21/05:30am	24.3	21.8	14.1	53	6.0	NW	20	33	11	18	-	-	0.0
21/05:00am	23.8	22.8	16.6	64	4.4	NNW	17	28	9	15	-	-	0.0
21/04:30am	23.0	24.2	19.0	78	2.5	NNW	11	20	6	11	-	-	0.0
21/04:00am	22.6	24.2	19.2	81	2.2	NNW	9	13	5	7	-	-	0.0
21/03:30am	22.7	24.8	19.3	81	2.2	NNE	7	11	4	6	-	-	0.0
21/03:00am	22.6	24.5	19.8	84	1.8	NE	9	19	5	10	-	-	0.0
21/02:30am	21.3	23.6	19.9	92	0.9	ENE	7	15	4	8	-	-	0.0
21/02:00am	20.5	23.8	19.0	91	0.9	CALM	0	0	0	0	-	-	0.0
21/01:30am	20.5	23.6	18.6	89	1.2	CALM	0	0	0	0	-	-	0.0
21/01:00am	20.8	23.9	18.6	87	1.4	CALM	0	0	0	0	-	-	0.0
21/12:30am	21.7	24.8	18.7	83	1.9	CALM	0	0	0	0	-	-	0.0
21/12:00am	22.7	25.9	18.9	79	2.4	CALM	0	6	0	3	-	-	0.0

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
20/11:30pm	23.5	25.5	19.2	77	2.7	NNW	7	11	4	6	-	-	0.0
20/11:00pm	24.1	25.8	19.4	75	3.0	NNE	9	17	5	9	-	-	0.0
20/10:30pm	23.9	25.5	19.2	75	3.0	NE	9	17	5	9	-	-	0.0

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
20/10:00pm	24.1	25.0	19.2	74	3.1	NNE	13	22	7	12	-	-	0.0
20/09:30pm	24.0	24.8	19.1	74	3.1	NNE	13	19	7	10	-	-	0.0
20/09:00pm	24.3	24.4	19.1	73	3.3	NE	17	26	9	14	-	-	0.0
20/08:30pm	24.1	24.1	19.0	73	3.2	NE	17	28	9	15	-	-	0.0
20/08:00pm	24.4	23.9	18.6	70	3.7	NNE	19	30	10	16	-	-	0.0
20/07:30pm	24.8	24.1	18.3	67	4.1	NE	19	35	10	19	-	-	0.0
20/07:00pm	25.5	24.0	17.7	62	4.9	NE	22	37	12	20	-	-	0.0
20/06:30pm	26.2	25.1	17.8	60	5.3	NE	20	35	11	19	-	-	0.0
20/06:00pm	26.9	25.9	17.9	57	5.7	NE	20	30	11	16	-	-	0.0
20/05:30pm	26.9	25.1	17.9	57	5.7	ENE	24	39	13	21	-	-	0.0
20/05:00pm	27.6	25.9	18.0	55	6.1	ENE	24	33	13	18	-	-	0.0
20/04:30pm	28.3	27.1	18.4	55	6.3	ENE	22	33	12	18	-	-	0.0
20/04:00pm	28.3	26.3	17.5	52	6.8	ENE	24	33	13	18	-	-	0.0
20/03:30pm	28.3	27.2	17.8	53	6.7	ENE	20	32	11	17	-	-	0.0
20/03:00pm	27.9	26.9	18.0	55	6.3	ENE	20	32	11	17	-	-	0.0
20/02:30pm	28.1	28.0	18.8	57	6.0	ENE	17	28	9	15	-	-	0.0
20/02:00pm	28.5	29.0	19.2	57	6.0	ENE	15	26	8	14	-	-	0.0
20/01:30pm	27.8	28.2	19.1	59	5.6	NE	15	22	8	12	-	-	0.0
20/01:00pm	27.6	27.4	16.6	51	6.8	NNE	13	24	7	13	-	-	0.0
20/12:30pm	27.0	26.3	16.3	52	6.6	NNE	15	22	8	12	-	-	0.0
20/12:00pm	25.9	25.2	15.3	52	6.4	NNW	13	22	7	12	-	-	0.0
20/11:30am	26.4	24.8	15.1	49	6.8	NNE	17	26	9	14	-	-	0.0
20/11:00am	26.1	24.8	15.8	53	6.3	N	17	26	9	14	-	-	0.0
20/10:30am	25.1	26.0	17.6	63	4.7	N	9	15	5	8	-	-	0.0
20/10:00am	24.1	24.2	17.4	66	4.2	N	13	20	7	11	-	-	0.0
20/09:30am	23.1	23.7	16.9	68	3.8	WNW	9	15	5	8	-	-	0.0
20/09:00am	22.3	22.9	16.8	71	3.4	WNW	9	13	5	7	-	-	0.2
20/08:30am	21.1	22.2	17.1	78	2.4	NW	7	11	4	6	-	-	0.2
20/08:00am	19.8	20.9	17.0	84	1.7	WNW	7	9	4	5	-	-	0.2

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APPENDIX

D

LABORATORY SUMMARY TABLES

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Results Table 1

Project Number: NE30161
Site Identification: Wiley Park Station
Report Title: Surface Water Monitoring

				TPH	Inorganics							Physio-Chemical			
			Chlorophyll a	Oil and Grease	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrogen (Total as N)	Phosphorus (Total as P)	TSS	Turbidity	pH	°Temprature	Electrical Conductivity	Dissolved Oxygen
			mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	NTU	Units	°C	uS/cm	%Sat
EQL			0.002	10	0.1	0.01	0.2	0.01	1	1	0.01	0.1	0.1	0.1
ANZECC Criteria - Freshwater			0.003	-	-	-	0.35	25	-	<6-50	6.5-8.5	-	125-2200	85% - 110%
Lab Report Number	**Field ID**	**Date**												
861805	**WP1**	**9/02/2022**	<2	<10	0.8	0.84	**1.64**	**230**	18	37	7.50	22.6	230	**56.7**
861805	**WP2**	**9/02/2022**	<2	<10	0.8	1.8	**2.6**	**280**	9.6	28	7.62	23.4	431	**72**
861805	**QA100**	**9/02/2022**	-	<10	1.4	1.8	**3.2**	**290**	29	29	-	-	-	-
ES2204592	**QA200**	**9/02/2022**	-	<5	0.5	1.52	**2**	**290**	13	35.1	-	-	-	-
Statistics														
Maximum Concentration			<2	<10	1.4	1.8	**3.2**	**290**	29	37.0	7.62	23.4	431	**72**
* A Non Detect Multiplier of 0.5 has been applied.														

APPENDIX

E

QUALITY ASSURANCE/QUALITY CONTRAL

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Quality Assurance/Quality Control (QA/QC) procedures were implemented to ensure the precision accuracy, representativeness, completeness and comparability of all data gathered. The QA/QC procedures included:

- Equipment calibration to ensure field measurements obtained are accurate
- Equipment decontamination to prevent cross contamination
- Use of appropriate measures (i.e. gloves) to prevent cross contamination
- Appropriate sample identification
- Correct sample preservation
- Sample transport with Chain of Custody (CoC) documentation
- Laboratory analysis in accordance with NATA accredited methods.

Table E1 details the QA/QC procedures and sample collection details undertaken through the surface water elements of the investigation. Copies of all the CoCs, along with the Sample Receipt Notifications (SRNs), Interpretive QA/QC Reports are provided in **Appendix F**.

Table E1 Field QA/QC Method Validation

Requirement	Yes / No	Comments
Equipment decontamination	Yes	In the event of involving reusable equipment. Decontamination of sampling equipment (water quality meter, telescopic water scoop etc.) was undertaken by washing with phosphate free detergent (Liquinox) followed by a rinse with potable water.
Sample collection	Yes	Samples were collected using disposable nitrile gloves via telescopic water scoop. A clean pair of gloves was used for each new sample being collected to limit the possibility of cross-contamination.
QA/QC sample collection*	Yes	One (1) surface water duplicate and one (1) surface water triplicate sample were collected for intra and inter-lab QA/QC purposes to monitor the quality of the field practices for sample collection. Cardno based the investigation around a rate of one duplicate and triplicate sample per sampling event, as the requirement for duplicate and triplicate sample collection.
Sample identification	Yes	All samples were marked with a unique identifier including project number, sample location, and date.
Sample preservation	Yes	Samples were placed in a chilled ice box with ice for storage and transport to the laboratory.
CoC documentation	Yes	A CoC form was completed by Cardno detailing sample identification, collection date, sampler and laboratory analysis required. The CoC form was signed off and returned to Cardno by the laboratory staff upon receipt of all the samples. CoC forms and Sample Receipt Notification (SRN) are provided in **Appendix F**. The SRN indicates that the samples were received at the laboratory intact and chilled and within the required holding times.
NATA accredited methods	Yes	The NATA accredited Eurofins mgt and ALS Analysed the samples in accordance with NATA accredited methods. Analytical methods used are indicated in the stamped laboratory results provided in **Appendix F**.
Laboratory Internal QC	Yes	All Data Quality Objectives were met by the laboratories.

Note of Table
*It is noted that the inter-laboratory duplicate sample QA200 for turbidity analysis did not meet the compliance time due to the extended sampling holding time by the laboratory. This is not considered to alter the overall outcome of the assessment.

Table E2 Field QA/QC Collection Summary

Environmental Media	Date	Primary	Duplicate	Triplicate
Surface Water	23/02/2022	WP2	QA100	QA200

Relative Percentage Difference Determination

Laboratory results for duplicate and triplicate samples are assessed using a determination of the Relative Percentage Difference (RPD). Where a primary sample and a duplicate sample are compared, the RPD provides an indication of the reproducibility of the results, which incorporates the sampling method. Where a primary sample and a split sample are compared, the RPD provides an indication of the accuracy of the primary laboratory results as compared to the secondary laboratory result.

The calculation used to determine the RPD is:

$$RPD = \frac{(Co - Cs)}{\left(\frac{Co + Cs}{2}\right)} x100$$

Where:

Co = Concentration of the original sample

Cs = Concentration of the duplicate sample

In calculating the RPD values the following protocols were adopted:

- Where both concentrations are above laboratory reporting limits the RPD formula is used;
- Where both concentrations are below the laboratory reporting limits, no RPD is calculated; and
- Where one or both sample concentrations are reported to be less than ten times (<10x) the laboratory reporting limit, the RPD is calculated but is not assessed against the adopted criterion.

In accordance with the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended 2013, Cardno adopts an RPD acceptance criterion up to 30% of the mean concentration of the analyte. It should be noted that variations might be higher for organic analysis, due to the volatile nature of the components, and for low concentrations of analytes.

The adopted criterion will not apply to RPDs where one of both concentrations are less than 10 times the reporting limit, as this criterion would otherwise overestimate the significance of minor variations in concentrations at or near the laboratory reporting limit. Large RPDs returned for low concentrations of analytes near the reporting limit is not as indicative of a significant difference in the results as a small RPD is for larger concentrations.

This approach is employed by NATA-accredited laboratories when assessing internal duplicate sample RPDs. This approach acknowledges that concentrations at or around the reporting limit are too low for an accurate evaluation of the significance of the RPD.

This approach has been adopted when assessing the relevance (compliance) of RPDs during this investigation. RPDs will be calculated for sample sets where one or both concentrations are less than 10 times the reporting limit for discussion purposes, but will not be assessed as a pass or fail in relation to the criterion.

The RPD results for duplicate samples are presented in this appendix. Although one (1) RPD value was reported to be above the accepted 30% RPD criteria. The breaches in RPDs are not considered to alter the overall outcome of the assessment. It can be concluded that the analytical data can be relied upon for the purposes of this factual report.

Laboratory QC and QCI Report Summary

The laboratories selected for undertaking the analysis (Eurofins mgt and ALS) are NATA-accredited for the analysis required, and undertook certain QA/QC requirements to demonstrate the suitability of the data that is obtained. The laboratory is required to undertake and report internal laboratory Quality Control (QC) procedures for all chemical analysis undertaken. The QC testing is required to include:

- Laboratory duplicate sample analysis at the rate of one duplicate analysis per ten samples
- Method blank at the rate of one method blank analysis per 20 samples

DRAFT

- Laboratory control sample at the rate of one laboratory control sample analysis per 20 samples
- Spike recovery analysis at the rate of one spike recovery analysis per 20 samples.

Compliance with the laboratory QA/QC requirements and non-conformance details are discussed in the internal Laboratory QA/QC reports included with the certificates of analysis in **Appendix F**. Laboratory QA/QC requirements were within acceptance limits.

Cardno concludes that the data reported by the NATA-accredited Eurofins mgt and ALS as presented in this report is suitable for interpretative purposes and to make conclusions/recommendations regarding water quality.

DRAFT

Project Number: NE30161
Site Identification: Wiley Park Station
Report Title: Surface Water Monitoring

				TPH	Inorganics					
				Oil and Grease	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrogen (Total)	Phosphorus	TSS	Turbidity
				mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	NTU
EQL				5	0.1	0.01	0.1	10	5	0.1
Lab Report Number	**Field ID**	**Matrix Type**	**Date**							
866292	**WP2**	**water**	**23/02/2022**	<10	0.8	1.8	2.6	280	9.6	28
	QA100	**water**	**23/02/2022**	<10	1.4	1.8	3.2	290	29	29
RPD				0	55	0	21	4	101	4
866292	**WP2**	**water**	**23/02/2022**	<10	0.8	1.8	2.6	280	9.6	28
ES2207026	**QA200**	**water**	**23/02/2022**	<5	0.5	1.52	2.0	290	13	35.1
RPD				0	46	17	26	4	30	23

***RPDs have only been considered where a concentration is greater than 1 times the EQL.**
****Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: (1 - 10 x EQL); 30 (10 - 30 x EQL); 30 (> 30 x EQL))**
*****Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory**

APPENDIX

F

LABORATORY REPORTS

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CHAIN OF CUSTODY AND ANALYSIS REQUEST

Contact Person:	Jiaqi Zhou	Project Name:	Downer Sydney Metro Stations - Wiley Park
Telephone Number:	0424 106 665	Project Number:	NE30161
Alternative Contact:	Chong Zheng	PO No.:	
Telephone Number:	0451 780 991	Project Specific Quote No. :	190408CDNN_1
Sampler:	JZ	Turnaround Requirements:	5 Days TAT
Email Address (results and invoice):	jiaqi.zhou@cardno.com.au; chong.zeng@cardno.com.au; ContamNSW@cardno.com.au	Lab:	Eurofins | Unit F3, Building F, 16 Mars Rd, Lane Cove West NSW2066
Address: Level 9 - The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia		Attn:	Sample Receipt

#866292

Sample information						Analysis Required												Comments
Cardno Sample ID	Laboratory Sample ID	No. Containers	Preservation	Date sampled	Matrix	Chlorophyll-a	TSS	Turbidity	Oil and Grease	Total Phosphorus	Total Nitrogen							
WP1		5	ICE	23/02/2022	Water	1	1	1	1	1	1							Please reduce the detection limit of Chlorophyll a from 5 ug/L to 2 ug/L
WP2		5	ICE		Water	1	1	1	1	1	1							
QA100		4	ICE		Water		1	1	1	1	1							Please send to ALS
QA200		4	ICE		Water		1	1	1	1	1							

Relinquished by:	Jiaqi Zhou	Received by:	MR	Relinquished by:	Received by:	Relinquished by:
(name / company)	Cardno ACT/NSW Pty Ltd	(name / company)	Eurofins	(name / company)	(name / company)	(name / company)
Date & Time:	2/23/2022	Date & Time:	24/2/22 10:49AM	Date & Time:	Date & Time:	Date & Time:
Signature:	JZ	Signature:		Signature:	Signature:	Signature:
Received by:		Relinquished by:		Received by:	Relinquished by:	*Lab use:*
(name / company)		(name / company)		(name / company)	(name / company)	Samples Received: Cool or Ambient (circle one)
Date & Time:		Date & Time:		Date & Time:	Date & Time:	Temperature Received at: 8.2°C (if applicable)
Signature:		Signature:		Signature:	Signature:	Transported by: Hand delivered / courier

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IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Sample Receipt Advice

Company name:	Cardno (NSW/ACT) Pty Ltd
Contact name:	Jiaqi Zhou
Project name:	DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID:	NE30161
Turnaround time:	5 Day
Date/Time received	Feb 24, 2022 10:49 AM
Eurofins reference	866292

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✓	Split sample sent to requested external lab.
✗	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Sample QA200 (1x unpreserved inorganics, 2x Oil and Grease and 1x preserved inorganics containers) forwarded to ALS for analysis.

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Ursula Long on phone : or by email: UrsulaLong@eurofins.com

Results will be delivered electronically via email to Jiaqi Zhou - jiaqi.zhou@cardno.com.au.

Note: A copy of these results will also be delivered to the general Cardno (NSW/ACT) Pty Ltd email address.

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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NATA # 1261 Site # 20794

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Company Name: Cardno (NSW/ACT) Pty Ltd
Address: Level 9, 203 Pacific Highway
St Leonards
NSW 2065

Project Name: DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID: NE30161

Order No.:
Report #: 866292
Phone: 0294967700
Fax: 02 9499 3902

Received: Feb 24, 2022 10:49 AM
Due: Mar 3, 2022
Priority: 5 Day
Contact Name: Jiaqi Zhou

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Chlorophyll a	Oil & Grease (HEM)	Phosphate total (as P)	Total Suspended Solids Dried at 103°C–105°C	Turbidity	Total Nitrogen Set (as N)
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X				X
Sydney Laboratory - NATA # 1261 Site # 18217								X	X	X	
Brisbane Laboratory - NATA # 1261 Site # 20794											
Mayfield Laboratory - NATA # 1261 Site # 25079											
Perth Laboratory - NATA # 2377 Site # 2370											
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	WP1	Feb 23, 2022		Water	S22-Fe51030	X	X	X	X	X	X
2	WP2	Feb 23, 2022		Water	S22-Fe51031	X	X	X	X	X	X
3	QA100	Feb 23, 2022		Water	S22-Fe51032		X	X	X	X	X
Test Counts						2	3	3	3	3	3

Cardno (NSW/ACT) Pty Ltd
Level 9, 203 Pacific Highway
St Leonards
NSW 2065

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Jiaqi Zhou**

Report **866292-W**
Project name DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID NE30161
Received Date Feb 24, 2022

Client Sample ID			**WP1**	**WP2**	**QA100**
Sample Matrix			**Water**	**Water**	**Water**
Eurofins Sample No.			**S22-Fe51030**	**S22-Fe51031**	**S22-Fe51032**
Date Sampled			**Feb 23, 2022**	**Feb 23, 2022**	**Feb 23, 2022**
Test/Reference	LOR	Unit			
Chlorophyll a	2	ug/L	< 2	< 2	-
Nitrate & Nitrite (as N)	0.05	mg/L	0.84	1.8	1.8
Oil & Grease (HEM)	10	mg/L	< 10	< 10	< 10
Phosphate total (as P)	0.01	mg/L	0.23	0.28	0.29
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	0.8	0.8	1.4
Total Nitrogen (as N)*	0.2	mg/L	1.64	2.6	3.2
Total Suspended Solids Dried at 103°C–105°C	5	mg/L	18	9.6	29
Turbidity	1	NTU	37	28	29

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chlorophyll a	Melbourne	Mar 01, 2022	28 Days
- Method: LTM-INO-4340 Chlorophyll a in Waters			
Oil & Grease (HEM)	Melbourne	Feb 28, 2022	28 Days
- Method: LTM-INO-4180 Oil and Grease (APHA 5520B)			
Phosphate total (as P)	Sydney	Feb 25, 2022	28 Days
- Method: E052 Total Phosphate (as P)			
Total Suspended Solids Dried at 103°C–105°C	Sydney	Feb 25, 2022	7 Days
- Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry			
Turbidity	Sydney	Feb 25, 2022	2 Days
- Method: LTM-INO-4140 Turbidity by Nephelometric Method			
Total Nitrogen Set (as N)			
Nitrate & Nitrite (as N)	Melbourne	Feb 28, 2022	28 Days
- Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA			
Total Kjeldahl Nitrogen (as N)	Melbourne	Feb 28, 2022	28 Days
- Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA			

eurofins | Environment Testing

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43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Cardno (NSW/ACT) Pty Ltd
Address: Level 9, 203 Pacific Highway
St Leonards
NSW 2065

Project Name: DOWNER SYDNEY METRO STATIONS - WILEY PARK
Project ID: NE30161

Order No.:
Report #: 866292
Phone: 0294967700
Fax: 02 9499 3902

Received: Feb 24, 2022 10:49 AM
Due: Mar 3, 2022
Priority: 5 Day
Contact Name: Jiaqi Zhou

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Chlorophyll a	Oil & Grease (HEM)	Phosphate total (as P)	Total Suspended Solids Dried at 103°C–105°C	Turbidity	Total Nitrogen Set (as N)
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X				X
Sydney Laboratory - NATA # 1261 Site # 18217								X	X	X	
Brisbane Laboratory - NATA # 1261 Site # 20794											
Mayfield Laboratory - NATA # 1261 Site # 25079											
Perth Laboratory - NATA # 2377 Site # 2370											
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	WP1	Feb 23, 2022		Water	S22-Fe51030	X	X	X	X	X	X
2	WP2	Feb 23, 2022		Water	S22-Fe51031	X	X	X	X	X	X
3	QA100	Feb 23, 2022		Water	S22-Fe51032		X	X	X	X	X
Test Counts						2	3	3	3	3	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Chlorophyll a			ug/L	< 2			2	Pass	
Oil & Grease (HEM)			mg/L	< 10			10	Pass	
Phosphate total (as P)			mg/L	< 0.01			0.01	Pass	
Total Kjeldahl Nitrogen (as N)			mg/L	< 0.2			0.2	Pass	
Turbidity			NTU	< 1			1	Pass	
LCS - % Recovery									
Oil & Grease (HEM)			%	110			70-130	Pass	
Phosphate total (as P)			%	106			70-130	Pass	
Total Kjeldahl Nitrogen (as N)			%	73			70-130	Pass	
Turbidity			%	93			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Phosphate total (as P)	S22-Fe57560	NCP	%	103			70-130	Pass	
Total Kjeldahl Nitrogen (as N)	S22-Fe51065	NCP	%	94			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Chlorophyll a	S22-Fe51030	CP	ug/L	< 2	< 2	<1	30%	Pass	
Total Kjeldahl Nitrogen (as N)	L22-Fe53184	NCP	mg/L	1.3	1.3	4.6	30%	Pass	
Turbidity	S22-Fe50864	NCP	NTU	2.3	2.4	1.0	30%	Pass	

Comments

Eurofins | Environment Testing accreditation number 1261, site 18217 is currently in progress of a controlled transition to a new custom built location at 179 Magowar Road, Girraween, NSW 2145. All results on this report denoted as being performed by Eurofins | Environment Testing Unit F3, Building F, 16 Mars road, Lane Cove West, NSW 2066, corporate site 18217, will have been performed on either Lane Cove or new Girraween site

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Ursula Long	Analytical Services Manager
Charl Du Preez	Senior Analyst-Inorganic (NSW)
Scott Beddoes	Senior Analyst-Inorganic (VIC)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

Cardno
Shaping the Future

CHAIN OF CUSTODY AND ANALYSIS REQUEST

Contact Person:	Jiaqi Zhou
Telephone Number:	0424 106 665
Alternative Contact:	Chong Zhong
Telephone Number:	0451 780 991
Sampler:	JZ
Email Address (results and invoice):	jiaqi.zhou@cardno.com.au; chong.zeng@cardno.com.au; ContamNSW@cardno.com.au
Address:	Level 9 - The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia

Project Name:	Downer Sydney Metro Stations - Wiley Park
Project Number:	NE30161
PO No.:	
Project Specific Quote No.:	190408CDNN_1
Turnaround Requirements:	5 Days TAT
Lab:	Eurofins | Unit F3, Building F, 16 Mars Rd, Lane Cove West NSW2066
Attn:	Sample Receipt

#866292

HT

Cardno Sample ID	Laboratory Sample ID	No. Containers	Preservation	Date sampled	Matrix	Chlorophyll-a	TSS	Turbidity	Oil and Grease	Total Phosphorus	Total Nitrogen	Comments
WP1		5	ICE	23/02/2022	Water	1	1	1	1	1	1	Please reduce the detection limit of Chlorophyll a from 5 ug/L to 2 ug/L
WP2		5	ICE		Water	1	1	1	1	1	1	
QA100		4	ICE		Water		1	1	1	1	1	
QA200		4	ICE		Water		1	1	1	1	1	Please send to ALS

Environmental Division
Sydney
Work Order Reference
ES2207026
Telephone : +61-2-8784 8555

Relinquished by: Jiaqi Zhou	Received by: MR	Relinquished by:	Received by: SOPHIA 1260	Relinquished by:
(name / company) Cardno ACT/NSW Pty Ltd	(name / company) Eurofins	(name / company)	(name / company)	(name / company)
Date & Time: 2/23/2022	Date & Time: 24/2/22 10:49AM	Date & Time:	Date & Time: 1/3/22 1500	Date & Time:
Signature: JZ	Signature:	Signature:	Signature:	Signature:
Received by:	Relinquished by:	Received by:	Relinquished by:	Lab use:
(name / company)	(name / company)	(name / company)	(name / company)	Samples Received: Cool or Ambient (circle one)
Date & Time:	Date & Time:	Date & Time:	Date & Time:	Temperature Received at: 8.2°C (if applicable)
Signature:	Signature:	Signature:	Signature:	Transported by: Hand delivered / courier

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2207026**

Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JIAQI ZHOU	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jiaqi.zhou@cardno.com.au	E-mail	: Shane.Ellis@ALSGlobal.com
Telephone	: ----	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Page	: 1 of 3
Order number	: NE30161	Quote number	: EP2020CARNSWACT0002 (EN/024/20)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: JZ		

Dates

Date Samples Received	: 01-Mar-2022 15:00	Issue Date	: 02-Mar-2022
Client Requested Due Date	: 07-Mar-2022	Scheduled Reporting Date	: **07-Mar-2022**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 12.1'C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - EA025H Suspended Solids - Standard Level	WATER - EA045 Turbidity	WATER - EK062G Total Nitrogen as N (TKN + NOx reported) By	WATER - EK067G Total Phosphorus as P By Discrete Analyser	WATER - EP020 Oil & Grease (O&G)
ES2207026-001	23-Feb-2022 00:00	QA200	✓	✓	✓	✓	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **WATER** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
EA045: Turbidity							
QA200	Clear Plastic Bottle - Natural	----	25-Feb-2022	01-Mar-2022	✘	----	----

Requested Deliverables

Chong Zeng

- *AU Certificate of Analysis - NATA (COA)	Email	chong.zeng@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chong.zeng@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chong.zeng@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chong.zeng@cardno.com.au
- A4 - AU Tax Invoice (INV)	Email	chong.zeng@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	chong.zeng@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	chong.zeng@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	chong.zeng@cardno.com.au

ContamNSW

- *AU Certificate of Analysis - NATA (COA)	Email	contamnsw@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	contamnsw@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	contamnsw@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	contamnsw@cardno.com.au
- A4 - AU Tax Invoice (INV)	Email	contamnsw@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	contamnsw@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	contamnsw@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	contamnsw@cardno.com.au

INVOICES

- A4 - AU Tax Invoice (INV)	Email	apinvoices@cardno.com.au

JIAQI ZHOU

- *AU Certificate of Analysis - NATA (COA)	Email	jiaqi.zhou@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jiaqi.zhou@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jiaqi.zhou@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jiaqi.zhou@cardno.com.au
- A4 - AU Tax Invoice (INV)	Email	jiaqi.zhou@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	jiaqi.zhou@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	jiaqi.zhou@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	jiaqi.zhou@cardno.com.au

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2207026**	Page	: 1 of 2
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JIAQI ZHOU	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Date Samples Received	: 01-Mar-2022 15:00
Order number	: NE30161	Date Analysis Commenced	: 02-Mar-2022
C-O-C number	: ----	Issue Date	: 07-Mar-2022 12:31
Sampler	: JZ		
Site	: ----		
Quote number	: EN/024/20		
No. of samples received	: 1		
No. of samples analysed	: 1		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Sample ID	**QA200**	**----**	**----**	**----**	**----**
			Sampling date / time	23-Feb-2022 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2207026-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	**13**	**----**	**----**	**----**	**----**
EA045: Turbidity								
Turbidity	----	0.1	NTU	**35.1**	**----**	**----**	**----**	**----**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**1.52**	**----**	**----**	**----**	**----**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.5**	**----**	**----**	**----**	**----**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	**2.0**	**----**	**----**	**----**	**----**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.29**	**----**	**----**	**----**	**----**
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	**----**	**----**	**----**	**----**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2207026**	Page	: 1 of 3
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JIAQI ZHOU	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Date Samples Received	: 01-Mar-2022
Order number	: NE30161	Date Analysis Commenced	: 02-Mar-2022
C-O-C number	: ----	Issue Date	: 07-Mar-2022
Sampler	: JZ		
Site	: ----		
Quote number	: EN/024/20		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 4205302)									
ES2206493-017	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	6	10	44.8	No Limit
EW2200832-018	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	7	9	24.2	No Limit
EA045: Turbidity (QC Lot: 4204893)									
ES2207026-001	QA200	EA045: Turbidity	----	0.1	NTU	35.1	36.2	3.1	0% - 20%
ES2207107-002	Anonymous	EA045: Turbidity	----	0.1	NTU	44.2	44.6	0.9	0% - 20%
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4205371)									
ES2206948-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	1.83	1.84	0.0	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4205366)									
ES2206462-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.0	1.9	0.0	No Limit
ES2206874-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.6	1.5	0.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4205367)									
ME2200343-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.22	0.22	0.0	No Limit
EW2200956-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.02	0.02	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 4205302)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	95.0	83.0	129
				<5	1000 mg/L	97.9	82.0	110
				<5	463 mg/L	103	83.0	118
EA045: Turbidity (QCLot: 4204893)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	98.0	91.0	105
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4205371)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	104	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4205366)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	88.0	69.0	101
				<0.1	1 mg/L	88.2	70.0	118
				<0.1	5 mg/L	97.0	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4205367)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	96.3	71.3	126
				<0.01	0.442 mg/L	97.7	71.3	126
				<0.01	1 mg/L	106	71.3	126
EP020: Oil and Grease (O&G) (QCLot: 4208052)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	108	81.0	121

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4205371)							
ES2206948-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	79.2	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4205366)							
ES2206462-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	10 mg/L	96.5	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4205367)							
ME2200342-001	Anonymous	EK067G: Total Phosphorus as P	----	5 mg/L	104	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2207026**	Page	: 1 of 4
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JIAQI ZHOU	Telephone	: +61 2 8784 8555
Project	: NE30161 DOWNER SYDNEY METRO STATIONS - WILEY PARK	Date Samples Received	: 01-Mar-2022
Site	: ----	Issue Date	: 07-Mar-2022
Sampler	: JZ	No. of samples received	: 1
Order number	: NE30161	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA045: Turbidity						
Clear Plastic Bottle - Natural						
QA200	----	----	----	02-Mar-2022	25-Feb-2022	**5**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural (EA025H)							
QA200	**23-Feb-2022**	**----**	----	----	**02-Mar-2022**	02-Mar-2022	✓
EA045: Turbidity							
Clear Plastic Bottle - Natural (EA045)							
QA200	**23-Feb-2022**	**----**	----	----	**02-Mar-2022**	25-Feb-2022	×
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
QA200	**23-Feb-2022**	**----**	----	----	**03-Mar-2022**	23-Mar-2022	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
QA200	**23-Feb-2022**	**03-Mar-2022**	23-Mar-2022	✓	**03-Mar-2022**	23-Mar-2022	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
QA200	**23-Feb-2022**	**03-Mar-2022**	23-Mar-2022	✓	**03-Mar-2022**	23-Mar-2022	✓
EP020: Oil and Grease (O&G)							
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020)							
QA200	**23-Feb-2022**	**----**	----	----	**04-Mar-2022**	23-Mar-2022	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	12	**25.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Oil and Grease	EP020	WATER	In house: Referenced to APHA 5520 B. Oil & grease is a gravimetric procedure to determine the amount of dissolved or emulsified oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)

Appendix 4 – Surface Water Monitoring Report – Wiley Park Station
NE30161_R008_SWM_WileyPark_Rev0

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Surface Water Monitoring Report - Wiley Park Station

Wiley Park Station

NE30161

Prepared for
Downer EDI Works Pty Ltd

28 March 2022

Cardno

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Stantec

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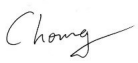
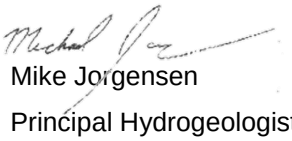


Chong Zeng

Environmental Engineer

Approved By:



Mike Jorgensen
Principal Hydrogeologist

Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
RevA	28/03/2022	Draft for Client Review	C.Zeng	M.Jorgensen
Rev0	28/03/2022	First Final	C.Zeng	M.Jorgensen

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Our report is based on information made available by the client. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Cardno is both complete and accurate. Whilst, to the best of our knowledge, the information contained in this report is accurate at the date of issue, changes may occur to the site conditions, the site context or the applicable planning framework. This report should not be used after any such changes without consulting the provider of the report or a suitably qualified person.

Table of Contents

Appendices

Tables

1 Introduction

1.1 Background

Cardno (NSW/ACT) Pty Ltd ("Cardno") was commissioned by Downer EDI Works Pty Ltd ("Downer") to undertake monitoring and reporting of surface water quality of the unnamed channel within proximity to Wiley Park Station Upgrade Site. The proposed works includes the upgrade of the main station and installation of the Metro Services Building (MSB).

Surface water quality of the channel within proximity to Wiley Park Upgrade Site is to be monitored as per the requirements summarised in the **Table 1-2**, which is excerpted from the Southwest Metro – Hurlstone Park, Belmore and Wiley Park Station Upgrades Soil and Water Management Plan (SWMP). The monitoring program are prepared to meet the requirements outlined in *The Sydney Metro City and Southwest – Sydenham to Bankstown Upgrade Conditions of Approval SSi-8256*, specifically Condition 8 to Condition 10. The sampling locations (WP1 – Upstream and WP2 – Downstream) of the water quality monitoring are shown on in **Appendix A.**

The closest Project worksite to an existing watercourse is Wiley Park Station services building, which is located approximately 100 m from an unnamed concrete-lined channel, which forms the upper reaches of Coxs Creek and is identified as a first-order stream.

For the purpose of establishing baseline water quality data within the first-order stream at Wiley Park, water quality monitoring was intended to be undertaken for a period prior to construction of the Wiley Park services building as outlined in the Table 13 of the SWMP. At a minimum, one dry-weather sample and one wet weather sample (weather permitting) were intended to be collected during the pre-construction period. The frequency of pre-construction water quality monitoring within this channel was subject to water being present within the structure. However, during the baseline monitoring period no wet-weather events were able to be captured prior to commencement of construction. A dry-weather baseline monitoring event was undertaken on 10 March 2021.

This report presents the findings from the tenth surface water monitoring event, which was undertaken by Cardno on 9 March 2022. The event undertaken was a mid-construction wet-weather event. **Table 1-1** below summarised the surface water monitoring events undertaken to date by Cardno.

Table 1-1 Summary of Surface Water Monitoring Event Undertaken to Date

Date of Monitoring	Type of Event	Report Reference
10 March 2021	Pre-construction Dry Baseline	4NE30187_R001_SWM_WileyPark_Rev0
20 March 2021	Mid Construction Wet Weather	4NE30187_R001_SWM_WileyPark_Rev0
5 May 2021	Mid Construction Wet Weather	4NE30187_R002_SWM_WileyPark_Rev0
1 July 2021	Mid Construction Dry Weather	NE30161_R003_SWM_WileyPark_Rev0
30 September 2021	Mid Construction Dry Weather	NE30161_R004_SWM_WileyPark_Rev0
12 November 2021	Mid Construction Wet Weather	NE30161_R005_SWM_WileyPark_Rev0
26 November 2021	Mid Construction Wet Weather	NE30161_R005_SWM_WileyPark_Rev0
9 and 10 February 2022	Mid Construction Dry Weather	NE30161_R006_SWM_WileyPark_Rev0
23 February 2022	Mid Construction Wet Weather	NE30161_R007_SWM_WileyPark_Rev0

1.1 Purpose and Objective

The purpose of the surface water monitoring works is to monitor and record surface water quality within the unnamed channel in accordance with the monitoring program as outlined in the Site's SWMP. The objective of the works is to evaluate whether construction activities are impacting water quality downstream of the project footprint in the unnamed channel.

1.2 Scope of Works

Cardno undertook the following tasks during the surface water monitoring events:

- Inspected and sampled two (2) nominated surface water sampling locations (WP1 – Upstream and WP2 – Downstream) on 9 March 2022 as part of mid-construction wet-weather monitoring event.
- Recorded field parameters and noted observations of the water bodies during sampling.
- Collected two (2) primary surface water samples, one (1) intra-lab duplicate sample and one (1) inter-lab duplicate sample per sampling event for submission to a National Association of Testing Authorities, Australia (NATA) certified laboratory for analytical testing of primary and additional quality assurance/quality control (QA/QC) samples. Samples were submitted for analysis of:
  - Oil & Grease;
  - Total Suspended Solids (TSS);
  - Nutrients (Total Phosphorous, Total Nitrogen);
  - Turbidity; and
  - Chlorophyll-*a*.
- Reviewed the analytical and field data and prepared this report.

Details of the monitoring program are shown below.

Table 1-2 Wiley Park Water Quality Monitoring Program

Wiley Park Water Quality Monitoring Program	
Waterway	Sydney Water Cooks River Channel (first-order stream)
Indicative monitoring points	WP1 – Upstream
	WP2 – Downstream
Interaction with Project works	Channel within proximity to Wiley Park service building site
Pre-construction works	Monthly for parameters detailed in Table 11 (including at least one dry-weather round of sampling). One wet-weather event, if possible, for the parameters detailed in Table 11, subject to event occurrence, safe conditions for monitoring and access being available to conduct monitoring. Note: A wet-weather event is when the receiving area has received greater than 20 mm of rain in 24 hours. The sampling is undertaken immediately during construction hours and if it is safe to do so.
During construction of the Wiley Park services building	Quarterly for parameters detailed in Table 11 (including during dry weather). Four wet-weather events per year for the parameters in Table 11, subject to event occurrence, safe conditions for monitoring and access being available to conduct monitoring. Note: A wet-weather event is when the receiving area has received greater than 20 mm of rain in 24 hours. The sampling was undertaken immediately during construction hours and if it is safe to do so.

2 Guidelines and Legislation

There are a range of Guidelines and Legislation and Conditions of Approval (CoA) that are applicable to the surface water monitoring program which are summarised below.

The CoA applicable to this job include:

- The Sydney Metro City and Southwest - Sydenham to Bankstown Upgrade Conditions of Approval SSI-8256, determined 12 December 2018;

The State and Federal legislation and policy and guidelines that apply to the program include:

- Environmental Planning and Assessment Act 1979 (EP&A Act);
- Contaminated Land Management Act 1997;
- Protection of the Environment Operations Act 1997 (POEO Act); and
- Water Management Act 2000 Water Management (General) Regulation 2018;

Additional guidelines and standards to the management of soil and water include:

- Landcom (2004). Managing Urban Stormwater: Soils and Construction. (Volume 1 of the 'Blue Book');
- DECC (2008). Managing Urban Stormwater: Soils and Construction. Volume 2D: Main Road Construction. (Volume 2D of the 'Blue Book');
- ANZECC (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (collectively known as the 'ANZECC Guidelines');
- ANZECC (2018). Australian and New Zealand Guidelines for Water Quality Monitoring and Reporting (collectively known as the 'ANZECC Guidelines'); and
- ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (known as 'ANZG Guidelines').

3 Monitoring Locations

Details of the sampling locations are provided in **Table 3-1**. The locations are provided in **Appendix A.** Representative photographs are presented in **Appendix B**.

3.1 Monitoring Locations

Table 3-1 Surface Water Monitoring Location Details

Sample Location	Latitude	Longitude	Description
WP1 (up-stream)	-33.924014	151.065315	Immediately south of the Boulevarde and east of 118 the Boulevarde.
WP2 (down-stream)	-33.923339	151.064970	Immediately north of the Urunga Parade and west of 4 Urunga Parade.

4 Quality Management

The Data Quality Objective (DQO) process is used to establish a systematic planning approach to set the type, quantity and quality of data required for making decisions based on the environmental condition of the project area. The DQO process involves the seven steps detailed in **0**.

Table 4-1 Data Quality Objectives

DQO	Description
Step 1 State the Problem	Construction work may adversely impact the local surface water quality within the unnamed channel near the site.
Step 2 Identify the Decisions	Are there any impacts to surface water quality from construction activities at the site?
Step 3 Identify Inputs to the Decision	The primary inputs to the decisions described above are: ▪ Assessment of surface water quality of the unnamed channel within proximity to Wiley Park service building site per the requirements outlined in the site's SWMP, with samples collected from two locations (upstream and downstream of the site); ▪ Laboratory analysis of surface water samples for relevant parameters; ▪ Assessment of the suitability of the analytical data obtained, against the Data Quality Indicators (DQIs); ▪ Assessment of the analytical results against applicable guideline criteria; and ▪ Aesthetic observations of surface water bodies, including odours, sheen and condition, if encountered.
Step 4 Define the Study Boundaries	The lateral extent of the study area is the channel near the Wiley Park service building site. The temporal boundaries of the study comprise the duration of the monitoring program, including pre-construction monitoring, construction phase, and post-construction monitoring as required.
Step 5 Develop a Decision Rule	The decision rules for the water quality monitoring sampling events included: ▪ Were primary and QA/QC samples analysed using methods endorsed by relevant regulatory guidelines at laboratories NATA-accredited for the requested analyses? ▪ Did the field and laboratory QA/QC results indicate that the data set was reliable and representative of the water quality with Relative Percentage Difference (RPD) values of 30% or less? ▪ Were the laboratory limits of reporting (LORs) below the applicable guideline criteria for the analysed parameters? ▪ Were guideline criteria sourced from endorsed guidelines? ▪ Were surface water aesthetic characteristics evaluated including odours and sheen? ▪ Were the monitoring results obtained from the downstream sample collected during construction phase greater than the upstream sample collected during the same monitoring event? If so, then the adverse impact to the quality of water in the unnamed channel is considered to have potentially occurred.
Step 6 Specify Limits on Decision Error	In accordance with the relevant guidelines as endorsed under the *Contaminated Land Management Act 1997*. Specific limits for this project are in accordance with the appropriate guidance made or endorsed by state and national regulations, appropriate indicators of data quality, and standard procedures for field sampling and handling. This step also examines the certainty of conclusive statements based on the available new Site data collected. This should include the following points to quantify tolerable limits: ▪ A decision can be made based on a certainty assumption of 95% confidence in any given data set (excluding asbestos). A limit on the decision error will be 5% that a conclusive statement may be a false positive or false negative.

DQO	Description
	A decision error in the context of the decision rule presented above would lead to either underestimation or overestimation of the risk level associated with a particular sampling area. Decision errors may include: ▪ Sampling errors may occur when the sampling program does not adequately detect the variability of a contaminant from point to point across the Site. To address this, minimum numbers of samples are proposed to be collected from each media. As such, there may be limitations in the data if aspects of the sampling plan cannot be implemented. Some examples of this scenario include but not limited to: – Proposed samples are not collected due to lack of water flow or access being restricted to a given location. ▪ Limitations in ability to acquire useful and representative information from the data collected. The data are proposed to be collected from multiple locations and sample media. ▪ Measurement errors can occur during sample collection, handling, preparation, analysis and data reduction. To address this the following measures are proposed: – Field staff to follow a standard procedure when undertaking samples, including decontamination of tools, removal of adhered soil to avoid false positives in results, collection of representative samples and use of appropriate sample containers and preservation methods. – Laboratories to follow a standard procedure when preparing samples for analysis and undertaking analysis. – Laboratories to report QA/QC data for comparison with the DQIs established for the project
Step 7 Optimise the Design for Obtaining Data	To achieve the DQOs and DQIs, the following sampling procedures were implemented to optimise the design for obtaining data: ▪ Surface water samples was collected from two (2) sampling locations, as available due to access and water level; ▪ Surface water parameters were selected based on project monitoring requirements provided to Cardno; ▪ Samples were collected by suitably qualified and experienced environmental scientists; ▪ Samples were collected and preserved in accordance with relevant standards/guidelines; and ▪ Field and laboratory QA/QC procedures were adopted and reviewed to indicate the reliability of the results obtained.

4.1 Data Quality Indicators

The following DQIs have been adopted for the project. The DQIs outlined in **Figure 1352327993-0Table 4-2** assist with decisions regarding the usefulness of the data obtained, including the quality of the laboratory data.

Table 4-2 Summary of Data Quality Indicators

Data Quality Indicator	Frequency	Data Acceptance Criteria
Completeness		
Field documentation correct	All samples	The work was documented in accordance with Cardno SOPs
Suitably qualified and experience sampler	All samples	Person deemed competent by Cardno collecting and logging samples
Appropriate lab methods and limits of reporting (LORs)	All samples	Samples were analysed using methods endorsed by relevant regulatory guidelines at laboratories NATA-accredited for the requested analyses.
Chain of custodies (COCs) completed appropriately	All samples	The work was documented in accordance with Cardno SOPs

Data Quality Indicator	Frequency	Data Acceptance Criteria
Sample holding times complied with	All samples	The samples were extracted and analysed within holding times specified by the project NATA-accredited laboratory
Proposed/critical locations sampled	-	Proposed/critical locations sampled
Comparability		
Consistent standard operating procedures for collection of each sample. Samples should be collected, preserved and handled in a consistent manner	All samples	All works undertaken in accordance with Cardno SOPs
Experienced sampler	All samples	Person deemed competent by Cardno collecting and logging samples
Climatic conditions (temp, rain etc) recorded and influence on samples quantified (if required)	All samples	Climatic conditions documented in field sheets
Consistent analytical methods, laboratories and units	All samples	Sample analysis to be in accordance with NATA-approved methods
Representativeness		
Sampling appropriate for media and analytes (appropriate collection, handling and storage)	All samples	Sample analysis to be in accordance with NATA-approved methods
Samples homogenous	All samples	All works undertaken in accordance with Cardno SOPs
Detection of laboratory artefacts, e.g. contamination blanks	-	Laboratory artefacts assessed and impact on results determined
Samples extracted and analysed within holding times	All samples	The samples were extracted and analysed within holding times specified by the laboratory
Precision		
Blind duplicates (intra-laboratory duplicates)	1 per 20 samples	Less than or equal to 30% RPD No Limit RPD Result less than 10 × LOR
Split duplicates (inter-laboratory duplicates)	1 per 20 samples	Less than or equal to 30% RPD No Limit RPD Result less than 10 × LOR
Laboratory duplicates	1 per 20 samples	Results greater than 10 x LOR: less than or equal to 30% RPD Results less than 10 x LOR: No limit on RPD
Accuracy (Bias)		
Surrogate spikes	All organic samples	50-150%
Matrix spikes	1 per 20 samples	70-130%
Laboratory control samples	1 per 20 samples	70-130%
Method blanks	1 per 20 samples	Less than LOR

The DQOs for the project were met during the monitoring event. Discussion of the QA/QC assessment is provided in **Appendix E**.

5 Field Investigation

The scope and method of the surface water monitoring is summarised in **Table 5-1**.

Table 5-1 Investigation Activity Summary

Activity	Details
Dates of Fieldwork	9 March 2022
Surface Water Sampling	Cardno inspected two surface water monitoring locations (WP1 – Upstream and WP2 – Downstream). Primary samples were collected from the two locations during the sampling event. Cardno undertook the sampling as per the following procedures: Surface Water Body Inspection - The general site condition was observed prior to commencement of field works for signs of any site activities that may have altered the surface water contamination status or require modifications to the field or laboratory works program. Each surface water location was inspected for indicators of contamination and the presence as well as the flow of surface water. This information is recorded on the field sheets presented in **Appendix C.** Surface water sampling - Field parameters and visual/olfactory observations were recorded prior to sampling at each location. Physico-chemical parameters including pH, electrical conductivity (EC), dissolved oxygen (DO), reduction-oxidation potential (redox), and temperature were measured using a calibrated water quality meter. Surface water samples were collected either directly into the sampling bottle or directly from the telescopic scoop. Once field parameters were recorded, the surface water samples were transferred to appropriately preserved sample containers provided by the laboratories. Field observations, and parameters are presented in **Appendix C**. Surface water samples were placed into an Esky containing ice and maintained at or below 4°C whilst onsite and in transit to the NATA-accredited laboratories for the targeted analyses.
Surface Water Analysis	Surface water samples from the monitoring event were submitted under standard chain-of-custody (CoC) procedures to NATA-accredited Eurofins Environment Testing Australia analysis of the parameters as follows: – Oil & Grease; – Total Suspended Solids (TSS); – Nutrients (Total Phosphorous, Total Nitrogen); – Turbidity; and – Chlorophyll-*a*. Tabulated laboratory results are presented in **Appendix D**. The Data QA /QC program and data quality review including calibration certificates is presented in **Appendix E**. Copies of the original laboratory reports, NATA-stamped laboratory certificates, and CoC documentation are included in **Appendix F**.
Decontamination	In the event of reusable sampling or monitoring equipment (telescopic scoop, water quality meter) was used decontamination was undertaken. Decontaminated between locations using a standard bucket wash. Equipment was washed in phosphate-free detergent (Liquinox) and rinsed in laboratory supplied rinsate water.

6 Surface Water Assessment Criteria

The assessment criteria for surface water analytical and field data were adopted from Table 11 of the site's SWMP. The criteria for selected parameters are provided in **Table 6-1** below. ANZECC guideline criteria are included in the table for reference.

Table 6-1 Water Quality Monitoring Parameters and Adopted Criteria at Wiley Park

Parameter	ANZECC Criteria – Freshwater[1]	Proposed Triger Values[2]	Proposed Actions
Temperature (°C)	>80% ile; <20% ile	Downstream results are greater than upstream results in rainfall events up to and including the significant event threshold of greater than 20 mm in 24 hours. Downstream results are greater than upstream results during dry-weather sampling.	Environment Manager (or delegate) to re-test to confirm results and undertake an inspection of the adjacent works and propose actions where required.
DO (%Sat)	Lower limit – 85% Upper limit – 110%		
Turbidity (NTU)	6-50 NTU		
Oil and grease	-		
pH	Lower limit – 6.5 Upper limit – 8.5		
Salinity (as EC)	125 – 2,200 µS/cm		
TSS	-		
Total Phosphorus as P	25 µg/L		
Total Nitrogen as N	350 µg/L		
Chlorophyll-a	3 µg/L		

Note to Table
1 ANZECC guideline criteria are included for reference. It is noted that for dry weather events baseline testing comparison will indicate whether this existing water quality within the channel meet ANZECC guidelines, prior to construction of the services building. For wet-weather events where no baseline data is available a direct comparison to upstream and downstream results is undertaken. Sydney Metro's Principal Contractor will comply with Section 120 of the Protection of the Environment Operations Act 1997.
2 For the ANZECC criteria given in a range (i.e. DO, pH, temperature, etc.), measured field parameters at downstream and upstream were assessed in comparison to the closeness to the criteria range.

7 Summary of Results

7.1 Summary of Field Observations

The two (2) surface water sampling locations (WP1 – Upstream and WP2 – Downstream) were able to be accessed during the sampling event conducted on 9 March 2022. Photos of each sampling location are included in **Appendix A**. The following observations were made:

7.1.1 Mid-Construction Wet-weather Event – 9 March 2022

- The sampling event was considered as a mid-construction wet-weather event based on the rainfall data recorded by the nearby weather station:
  - Canterbury Racecourse AWS station (ID: 066194): approximately 4.6 km from the site with the rainfall data recorded 68.6 mm over the last 24 hours prior to the field sampling. Refer to **Appendix C** for weather recordings.
- Observation of water body:
  - WP 1 (upstream of work area) contained high flowing clear water with low turbidity. The estimated depth of the water body was 0.15 to 0.2 m;
  - WP 2 (downstream of work area) contained high flowing clear water with low turbidity. The estimated depth of the water body was 0.15 to 0.2 m;
- Additional observation:
  - WP1 (upstream of work area):
    - One discharge point (WP1-DP1) was observed immediately downstream / north of WP1. Medium flow contribution was observed at the time of sampling. Refer to **Appendix A** for approximate location of WP1-DP1. Refer to **Appendix B** for a detailed photo.
  - WP2 (downstream of work area):
    - During the sampling event, the two discharge points (WP2-DP1 and WP2-DP2) within the rail corridor immediately upstream / south from WP2 were observed. Medium level of flow contribution was observed from discharge point WP2-DP1 and high level of flow contribution was observed from discharge point WP2-DP2. Refer to **Appendix A** for approximate location of WP2-DP1 and WP2-DP2. Refer to **Appendix B** for detailed photos.

7.2 Field Parameters

The parameters from each location sampled are presented in **Table 7-1**.

Table 7-1 Field Physico-chemical Parameters and Field Observations on 9 March 2022

Location ID	WP1 (upstream)	WP2 (downstream)
Water depth (m)	0.15-0.2	0.15-0.2
Estimated Flow Rate	high	high
Temperature (°C)	19.4	19.4
pH	7.78	7.85
Electrical Conductivity (µS/cm)	622	659
Dissolved Oxygen (mg/L)	5.38	5.34
Dissolved Oxygen (%)	58.4	58.1
Oxidation-Reduction Potential (mV)	73.5	81.6
SHE[1] Redox Potential (mV)[2]	282.3	290.4

Location ID	WP1 (upstream)	WP2 (downstream)
Condition	Clear Low Turbidity	Clear Low Turbidity

Note to Table
1 SHE – Standard Hydrogen Electrode
2 Water quality meter utilised on the day of monitoring contains Ag/AgCl reference electrode with 3.5 M KCl filling solution. As such, SHE was calculated based on Table 1 of US EPA document: *SESDPROC-113-R2, Field Measurement of Oxidation-Reduction Potential (ORP)*.

7.3 Surface Water Analytical Results

Surface Water Analytical results are presented in **Appendix D**. Copies of the original laboratory reports, NATA-stamped laboratory certificates, and Chain of Custody documentation are included in **Appendix F**.

7.3.1 Mid-Construction Wet-weather Event – 23 February 2022

The results of the monitoring event indicate that:

- Laboratory analytical results:
  - Concentrations of Chlorophyll-*a* were reported below the laboratory detection limit at both sample locations;
  - Concentrations of Oil and Grease were reported at 10 mg/L within the upstream sample (WP1) and below laboratory detection limit within the downstream sample (WP2);
  - Concentrations of inorganics (total nitrogen and the total phosphorous) were reported:
    - Total nitrogen:
      - Upstream (WP1): 1.9 mg/L
      - Downstream (WP2): 1.8 mg/L
    - Total phosphorous:
      - Upstream (WP1): 0.16 mg/L
      - Downstream (WP2): 0.14 mg/L
  - TSS were reported with concentration of 17 mg/L at upstream sample (WP1) and 7.8 mg/L at downstream sample WP2; and
  - Turbidity was reported with concentration of 31 NTU at upstream sample (WP1) and 22 NTU at downstream sample (WP2).

7.3.2 Baseline Results Comparison

One sampling event during the pre-construction period (baseline event) was undertaken on 10 March 2021 which was during dry condition. It should be noted that wet-weather and storm-event pre-construction monitoring was not able to be conducted because of the lack of rainfall. The monitoring results of baseline event (10 March 2021) has not been used for comparison with the monitoring results under this report because the conditions encountered were different (i.e. non-trigger for wet-weather event criteria). However, five previous mid-construction wet weather sampling events were used to compare and check if there is any potential adverse impact to the water quality caused by the construction activities.

The parameters from each location sampled are presented in **Table 7-2**. Overall, conditions are similar between upstream and downstream samples on 9 March 2022 and previous mid-construction wet weather events.

Table 7-2 Comparison of current wet condition sampling event to previous wet condition sampling events

Time of sampling		20 March 2021		5 May 2021		12 November 2021		26 November 2021		23 February 2022		9 March 2022	
Location ID	Assessment Criteria	WP1	WP2	WP1	WP2	WP1	WP2	WP1	WP2	WP1	WP2	WP1	WP2
Temperature (°C)	N/A[2]	20.2	20	18.6	18.2	19.4	19.5	19.6	19.7	22.6	23.4	19.4	19.4
pH	6.5 - 8.5	8.10	7.58	7.80	7.73	8.10	8.42	**6.07**	7.34	7.50	7.62	7.78	7.85
EC (µS/cm)	125 – 2,200	246.2	133.4	**2,500**	**92.9**	514	509	389	484	230	431	622	659
DO (mg/L)	N/A[2]	4.79	3.92	6.35	5.95	6.42	5.63	9.05	9.31	4.94	6.0	5.38	5.34
DO (%)	85% - 110%	**52.9**	**43.2**	**65.3**	**62.8**	**68**	**63**	99	102	**56.7**	**72**	**58.4**	**58.1**
SHE[1] Redox Potential (mV)[4]	N/A[2]	122.3	135.9	164.6	109.2	70.8	80.4	184	196	261.5	287.6	282.3	290.4
Chlorophyll a (µg/L)	3	<5	<5	<5	<5	<2	<2	<2	2.7	<2	<2	<2	<2
Oil and Grease (mg/L)	Comparison	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	<10
Kjeldahl Nitrogen Total (mg/L)	N/A[2]	0.6	0.8	NT[3]	NT[3]	NT[3]	NT[3]	NT[3]	NT[3]	0.8	0.8	NT[3]	NT[3]
Nitrate & Nitrite (as N) (mg/L)	N/A[2]	1.7	1.5	NT[3]	NT[3]	NT[3]	NT[3]	NT[3]	NT[3]	0.84	1.8	NT[3]	NT[3]
Nitrogen (Total) (mg/L)	0.35	**2.3**	**2.3**	**5.0**	**1.0**	**2.7**	**2.8**	**1.6**	**2.4**	**1.64**	**2.6**	**1.9**	**1.8**
Phosphate total (as P) (mg/L)	0.025	<0.5	<0.5	**0.21**	**0.15**	**0.15**	0.02	**0.13**	**0.18**	**0.23**	**0.28**	**0.16**	**0.14**
TSS (mg/L)	N/A[2]	9.2	35	4.0	47	8.4	7.6	16	7.8	18	9.6	17	7.8
Turbidity (NTU)	6-50	9.3	13	4.3	21	21	19	25	17	37	28	31	22

Note to Table
1 SHE – Standard Hydrogen Electrode
2 Not Applicable
3 NT – Not Tested
4 Water quality meter utilised on the day of monitoring contains Ag/AgCl reference electrode with 3.5 M KCl filling solution. As such, SHE was calculated based on Table 1 of US EPA document: *SESDPROC-113-R2, Field Measurement of Oxidation-Reduction Potential (ORP)*.

7.4 Results Discussion

7.4.1 Comparison to ANZG 2018 / ANZECC 2000 Criteria

Results for the mid-construction wet-weather event sampled on 9 March 2022 generally showed monitored parameters were within the adopted threshold criteria, with the exception of dissolved oxygen saturation, total nitrogen, and total phosphorous.

- Dissolved oxygen saturation measured at both upstream sample (WP1: 58.4%) and downstream sample (WP2: 58.1%) were outside of the adopted criterion range (i.e., 85% to 110%). However, this is not considered to be a significant issue as the difference measured between WP1 and WP2 is minor with only 0.5% difference.
- Total nitrogen measured at both upstream sample (WP1: 1.9 mg/L) and downstream sample (WP2: 1.8 mg/L) were above the adopted criteria (i.e. 0.350 mg/L). However, the results from the previous mid-construction wet-weather sampling events show that total nitrogen at WP1 fluctuated between 1.6 mg/L and 5.0 mg/L whereas total nitrogen for WP2 fluctuated between 1.0 mg/L and 2.8 mg/L. Furthermore, the total nitrogen for both WP1 and WP2 sampled on the 9 March 2022 monitoring event were similar to the previous event ranges. As such, this elevated in total nitrogen concentrations is not considered to be a significant issue.
- Total phosphorous measured at both upstream sample (WP1: 0.16 mg/L) and downstream sample (WP2: 0.14 mg/L) were above the adopted criteria (i.e. 0.025 mg/L). However, the results from the previous mid-construction wet-weather sampling events show that total phosphorous at WP1 fluctuated between 0.13 mg/L and 0.23 mg/L whereas total phosphorous at WP2 fluctuated between 0.02 mg/L and 0.28 mg/L. Furthermore, the total phosphorous for both WP1 and WP2 sampled on the 9 March 2022 monitoring event were similar to the previous event ranges. As such, this elevated in total phosphorus concentrations is not considered to be a significant issue.

7.4.2 Comparison of Upstream and Downstream Results

Results for upstream and downstream sampling on 9 March 2022 were comparable, with the exception of:

- The pH result at upstream sample (WP1: 7.78) was measured slightly lower than the result at downstream sample (WP2: 7.85). However, this is not considered to be a significant issue since the pH measurements at both sample points were within the adopted ANZG 2018/ANZECC 2000 criterion range (i.e., 6.5 to 8.5) and the difference of the upstream and downstream pH results is only 0.9%.
- The EC result at the upstream sample (WP1: 622 µS/cm) was measured lower than the downstream sample (WP2: 659 µS/cm). However, this is not considered to be a significant issue since the EC measurements at both sample points were within the adopted ANZG 2018/ANZECC 2000 criterion range (125 µS/cm to 2,200 µS/cm) and the difference of the upstream and downstream pH results is only 5.6%.

Refer to **Appendix D** for details. It should be noted that wet-weather and storm-event pre-construction monitoring was not able to be conducted because of the lack of rainfall.

8 Conclusion

Cardno was engaged to undertake surface water monitoring of the unnamed channel west of Wiley Park Station in accordance with the SWMP for the project. The objective of the works was to evaluate whether construction activities are impacting water quality downstream of the project footprint in the unnamed channel that receives in part stormwater from the construction area.

This report presents monitoring data from mid-construction wet-weather event on 9 March 2022. Samples were collected from two locations. Sampling point WP1 is located upstream from the work site while sampling point WP2 is located downstream of the work site.

During this wet-weather monitoring event, sampling results showed monitored parameters were generally within the adopted ANZG 2018 / ANZECC 2000 screening criteria with the exception of dissolved oxygen saturation, total nitrogen, and total phosphorous. The comparison of the mid-construction wet-weather event conducted on 9 March 2022 to the four previous wet-weather sampling events on 20 March, 5 May, 12 November, 26 November 2021 and 23 February 2022 showed no significant difference.

During this wet-weather monitoring event, the results between upstream and downstream were generally comparable with the exceptions of pH and EC. The pH and EC measurements at the downstream sample were slightly higher than the upstream sample, but both downstream and upstream results were within the ANZG 2018/ANZECC 2000 criterion range. Overall, the comparison of the upstream and downstream samples conducted on 9 March 2022 showed no significant difference.

Based on comparison to the criteria, comparison with four previous mid-construction wet-weather events, and comparison of the upstream and downstream results, the results reported for the 9 March 2022 sampling event are not considered to reflect an adverse impact to water quality due to construction activities at the subject site.

9 References

- Southwest Metro – Hurlstone Park, Belmore and Wiley Park Station Upgrades – Soil and Water Management Plan, dated 16th February 2021;
- The Sydney Metro City and Southwest - Sydenham to Bankstown Upgrade Conditions of Approval SSI-8256, determined 12 December 2018;
- Environmental Planning and Assessment Act 1979 (EP&A Act);
- Contaminated Land Management Act 1997;
- Protection of the Environment Operations Act 1997 (POEO Act);
- Water Management Act 2000 Water Management (General) Regulation 2018;
- Landcom (2004). Managing Urban Stormwater: Soils and Construction. (Volume 1 of the 'Blue Book');
- DECC (2008). Managing Urban Stormwater: Soils and Construction. Volume 2D: Main Road Construction. (Volume 2D of the 'Blue Book');
- ANZECC (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (collectively known as the 'ANZECC Guidelines');
- ANZECC (2000). Australian and New Zealand Guidelines for Water Quality Monitoring and Reporting (collectively known as the 'ANZECC Guidelines');
- ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (known as 'ANZG Guidelines').

10 Limitations

This assessment has been undertaken in general accordance with the current industry standards for a surface water monitoring report for the purpose and objectives and scope identified in this report. The agreed scope of this assessment has been limited for the current purposes of the Client. The assessment may not identify contamination occurring in all areas of the site, or occurring after sampling was conducted. Subsurface conditions may vary considerably away from the sample locations where information has been obtained. This Document has been provided by Cardno subject to the following limitations:

- This Document has been prepared for the particular purpose outlined in Cardno's proposal and Section 1 of this report and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.
- The scope and the period of Cardno's services are as described in Cardno's proposal, and are subject to restrictions and limitations. Cardno did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Cardno in regards to it.
- Conditions may exist which were undetectable given the limited nature of the enquiry Cardno was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.
- In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Cardno's opinions are based upon information that existed at the time of the production of the Document. It is understood that the services provided allowed Cardno to form no more than an opinion of the actual conditions of the site at the time this Document was prepared and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.
- Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.
- Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Cardno for incomplete or inaccurate data supplied by others.
- Cardno may have retained sub consultants affiliated with Cardno to provide services for the benefit of Cardno. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any direct legal recourse to, and waives any claim, demand, or cause of action against, Cardno's affiliated companies, and their employees, officers and directors.

This assessment report is not any of the following:

- A Site Audit Report or Site Audit Statement (SAR/SAS) as defined under the *Contaminated Land Management Act, 1997* or an assessment sufficient for an Environmental Auditor to be able to conclude a SAR/SAS.
- A geotechnical report and the bore logs/test pit logs may not be sufficient for geotechnical advice.
- An assessment of surface water contaminants potentially arising from other sites or sources nearby.
- A total assessment of the site to determine suitability of the entire parcel of land at the site for one or more beneficial uses of land

APPENDIX

A

FIGURES

Cardno

now

Stantec

Downer

Surface Water Monitoring

WILEY PARK STATION

Legend

- Sample Location
- Discharging Points
- Railway (NSW SS)
- Cadastre (NSW SS, 2019)

1:800 Scale at A3

m
0 10 20 30 40

N

Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (SYD)
Date: 2021-08-03 | Project: 4NE30187
Coordinate System: GDA 1994 MGA Zone 56
Map: 4NE30187-GS-002-SurfaceWater.mxd 02
Aerial imagery supplied by MetroMap (April, 2021)

APPENDIX

B

PHOTOGRAPHS

Cardno

now

Stantec

Photograph 1. Upstream sampling location WP1. Date: 9 March 2022.

Photograph 2. Medium stormwater in-flow observed from the discharge point WP1-DP1 which was located within the rail corridor and immediately downstream/north from WP1. Date: 9 March 2022.

Photograph 3. Downstream sampling location WP2. Date: 9 March 2022.

Photograph 4. Medium level of flow contribution was observed from discharge point WP2-DP1 and high level of flow contribution was observed from discharge point WP2-DP2. Date: 9 March 2022.

APPENDIX

C

FILED RECORDS

Cardno

now

Stantec

Surface Water Sampling Field Record

Site / Project: Wiley Park Surface Water Monitoring				**Sampling Point:**	
Client: Downer				Job No. NE30161	
Person Sampling: Jiaqi				Initials: JZ	
Site Details					
Sampling Equipment – Directly into bottle / **Water Scoop** / Van Dorn Sampler / Other:				Date: 09/03/22	
Observations on Site: Last Rain Event / **Recent Storms** / Releases / Other :					
Sample Details, Observations, GPS Coordinates & Field Physiochemical Measurements (if possible, record parameters once stable)					
Sample ID	WP01			WP02	
Start Time:	7:50am			9:00am	
Easting					
Northing					
Sample Depth (m)	0.1-0.15			0.1-0.15	
Water Body Depth (m)	0.15-0.2			0.15-0.2	
Location – Onsite/Offsite /Inlet/Outlet/ Middle	Upstream			Downstream	
Flow Rate None/ Low / Med / High	High			High	
DO (mg/L)	5.38			5.34	
DO (%)	58.4			58.1	
EC (µS/Cm)	622			659	
pH	7.78			7.85	
Eh (mV)	73.5			81.6	
Temp (^{O}C)	19.4			19.4	
Water Colour	Clear			Clear	
Turbidity Low / Med / High	Low			Low	
Observations / Notes	Upstream DP with medium flow rate, contributed to the water body			Downstream DPs contributed to the water body, east DP with medium flow rate, west DP with high flow rate	
Sample Container & Preservation Data					
Number of sample containers:					
Container Volume					
Container Type					
Preservation					
Sample Number (for Lab ID):					
QC Dup Sample No.:				QA100/QA200	

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 20M101183

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 10.00		pH 10.00		378646	pH 9.87
2. pH 7.00		pH 7.00		377339	pH 6.99
3. pH 4.00		pH 4.00		380327	pH 4.02
4. mV		229.6mV		365451/374424	229.5mV
5. EC		2.76mS/cm		377099	2.74mS/cm
6. D.O		0.00ppm		371864	0.00ppm
7. Temp		22.3°C		MultiTherm	21.4°C

Calibrated by: **Sarah Lian**

Calibration date: **4/03/2022**

Next calibration due: **3/04/2022**

Latest Weather Observations for Canterbury

IDN60801

Issued at 12:53 pm EDT Wednesday 9 March 2022 (issued every 10 minutes, with the page automatically refreshed every 10 minutes)

About weather observations | Map of weather stations | Latest weather observations for NSW | Other Formats

Station Details ID: 066194 Name: CANTERBURY RACECOURSE AWS Lat: -33.91 Lon: 151.11 Height: 3.0 m

Data from the previous 72 hours. | See also: Recent months at Canterbury

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
09/12:33pm	23.0	19.2	14.6	59	5.0	SSW	28	46	15	25	-	-	0.0
09/12:30pm	23.2	19.7	14.5	58	5.1	SSW	26	46	14	25	-	-	0.0
09/12:00pm	22.9	18.8	15.0	61	4.7	SSW	30	54	16	29	-	-	0.0
09/11:56am	22.6	18.4	14.7	61	4.7	SSW	30	54	16	29	-	-	0.0
09/11:54am	22.5	18.8	14.9	62	4.5	SSW	28	54	15	29	-	-	0.0
09/11:30am	22.7	20.7	15.0	61	4.6	SSW	19	35	10	19	-	-	0.0
09/11:00am	22.6	19.8	15.4	64	4.3	SSW	24	39	13	21	-	-	0.0
09/10:30am	22.4	21.4	15.7	66	4.0	SW	15	24	8	13	-	-	0.0
09/10:00am	21.9	21.1	16.0	69	3.6	WSW	15	28	8	15	-	-	0.0
09/09:30am	21.4	20.9	15.9	71	3.3	WSW	13	24	7	13	-	-	0.0
09/09:00am	21.3	21.3	16.3	73	3.0	WSW	11	17	6	9	-	-	52.2
09/08:30am	20.7	20.2	15.9	74	2.9	WSW	13	28	7	15	-	-	52.2
09/08:00am	20.6	19.1	15.4	72	3.1	WSW	17	35	9	19	-	-	52.2
09/07:30am	20.2	20.1	16.0	77	2.5	WSW	11	26	6	14	-	-	52.2
09/07:00am	19.9	19.9	16.3	80	2.2	W	11	17	6	9	-	-	52.2
09/06:30am	19.9	20.4	16.5	81	2.0	WSW	9	15	5	8	-	-	52.2
09/06:00am	19.8	19.9	16.4	81	2.0	WSW	11	19	6	10	-	-	52.2
09/05:30am	19.6	19.7	16.4	82	1.9	WSW	11	19	6	10	-	-	52.2
09/05:00am	19.7	19.4	16.5	82	1.9	W	13	20	7	11	-	-	52.2
09/04:30am	19.7	19.4	16.5	82	1.9	WSW	13	22	7	12	-	-	52.2
09/04:00am	19.5	19.1	16.3	82	1.9	WSW	13	26	7	14	-	-	52.2
09/03:30am	19.6	19.4	16.6	83	1.8	SW	13	30	7	16	-	-	52.2
09/03:00am	18.9	19.0	16.5	86	1.4	WSW	11	19	6	10	-	-	52.2
09/02:30am	19.3	18.3	16.5	84	1.7	WSW	17	28	9	15	-	-	52.2
09/02:00am	19.0	19.1	16.6	86	1.4	SW	11	20	6	11	-	-	52.2
09/01:30am	19.2	17.5	16.2	83	1.8	SSW	20	39	11	21	-	-	51.8
09/01:00am	19.9	17.6	15.7	77	2.5	SSW	22	35	12	19	-	-	51.4
09/12:30am	19.7	17.4	15.8	78	2.3	SSW	22	46	12	25	-	-	51.4
09/12:00am	19.5	16.9	15.8	79	2.2	SSW	24	46	13	25	-	-	51.4

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
08/11:34pm	19.6	16.3	16.1	80	2.1	SSW	28	52	15	28	-	-	51.4
08/11:30pm	19.4	16.9	16.1	81	2.0	SSW	24	50	13	27	-	-	51.4
08/11:15pm	19.3	16.1	16.3	83	1.8	SSW	28	57	15	31	-	-	51.4
08/11:00pm	18.9	16.2	16.7	87	1.3	SSW	26	46	14	25	-	-	51.4
08/10:30pm	18.7	17.1	17.4	92	0.8	SSW	22	50	12	27	-	-	50.4
08/10:18pm	18.5	15.7	17.2	92	0.8	SSW	28	50	15	27	-	-	49.6
08/10:00pm	18.9	16.0	17.9	94	0.6	SSW	30	54	16	29	-	-	48.2
08/09:30pm	18.8	16.2	17.8	94	0.6	SSW	28	59	15	32	-	-	41.6
08/09:22pm	19.0	16.4	17.7	92	0.8	SSW	28	59	15	32	-	-	38.8
08/09:13pm	19.3	16.6	17.6	90	1.0	SSW	28	48	15	26	-	-	38.4
08/09:00pm	19.3	16.6	17.6	90	1.0	SSW	28	44	15	24	-	-	38.2
08/08:33pm	19.3	16.7	17.8	91	0.9	SSW	28	46	15	25	-	-	38.0
08/08:30pm	19.3	15.9	17.6	90	1.0	SSW	32	48	17	26	-	-	37.8

08/08:00pm	20.4	17.6	17.2	82	2.0	SW	28	50	15	27	-	-	37.2
08/07:53pm	20.6	17.8	17.4	82	2.0	SSW	28	50	15	27	-	-	37.2
08/07:30pm	20.6	18.3	17.6	83	1.8	SSW	26	39	14	21	-	-	37.2
08/07:00pm	20.2	19.4	18.0	87	1.4	SW	19	35	10	19	-	-	37.0
08/06:30pm	20.1	19.2	18.2	89	1.2	SW	20	41	11	22	-	-	36.8
08/06:00pm	20.0	19.4	18.5	91	0.9	SW	19	32	10	17	-	-	36.8
08/05:30pm	20.0	18.9	18.7	92	0.8	SSW	22	35	12	19	-	-	36.8
08/05:05pm	19.5	19.1	18.8	96	0.4	SSW	19	35	10	19	-	-	36.8
08/05:00pm	19.5	18.5	18.8	96	0.4	SSW	22	41	12	22	-	-	36.8
08/04:54pm	19.5	17.3	18.8	96	0.4	SSW	28	48	15	26	-	-	36.6
08/04:30pm	19.9	18.3	19.1	95	0.5	SSW	26	41	14	22	-	-	35.6
08/04:16pm	20.3	18.4	19.3	94	0.6	SSW	28	52	15	28	-	-	34.4
08/04:14pm	20.3	19.6	19.5	95	0.5	SSW	22	43	12	23	-	-	34.2
08/04:12pm	20.4	19.7	19.6	95	0.5	SSW	22	39	12	21	-	-	33.8
08/04:00pm	20.3	20.5	20.1	99	0.1	SSW	19	32	10	17	-	-	33.2
08/03:30pm	20.3	19.9	20.1	99	0.1	SSW	22	44	12	24	-	-	31.6
08/03:00pm	20.3	19.8	20.0	98	0.2	SSW	22	44	12	24	-	-	27.4
08/02:34pm	20.6	20.7	19.9	96	0.4	SSW	19	32	10	17	-	-	21.8
08/02:30pm	20.6	21.1	20.1	97	0.3	SSW	17	30	9	16	-	-	21.4
08/02:26pm	20.7	21.3	20.2	97	0.3	SSW	17	30	9	16	-	-	21.2
08/02:04pm	20.8	20.9	20.0	95	0.5	SSW	19	30	10	16	-	-	19.8
08/02:00pm	20.8	20.6	19.8	94	0.6	SSW	20	35	11	19	-	-	19.4
08/01:30pm	20.8	20.8	20.1	96	0.4	S	20	35	11	19	-	-	18.2
08/01:00pm	21.0	21.3	20.3	96	0.4	S	19	35	10	19	-	-	16.6
08/12:30pm	21.5	21.8	20.8	96	0.5	S	20	43	11	23	-	-	14.8
08/12:00pm	21.6	23.2	21.4	99	0.1	SSW	15	26	8	14	-	-	13.4
08/11:46am	21.6	22.8	21.4	99	0.1	S	17	30	9	16	-	-	13.0
08/11:30am	21.5	22.2	21.5	100	0.0	SSW	20	35	11	19	-	-	12.6
08/11:06am	21.8	23.2	21.8	100	0.0	SSW	17	28	9	15	-	-	9.8
08/11:00am	22.0	23.5	22.0	100	0.0	SSW	17	26	9	14	-	-	9.4
08/10:35am	21.8	23.6	21.8	100	0.0	SSW	15	22	8	12	-	-	9.2
08/10:30am	21.8	23.6	21.8	100	0.0	SSW	15	22	8	12	-	-	9.0
08/10:04am	21.8	24.0	21.8	100	0.0	S	13	22	7	12	-	-	4.8
08/10:00am	21.8	24.3	21.8	100	0.0	S	11	19	6	10	-	-	4.0
08/09:58am	21.7	24.2	21.7	100	0.0	S	11	19	6	10	-	-	4.0
08/09:38am	21.4	23.7	21.4	100	0.0	S	11	17	6	9	-	-	3.0
08/09:30am	21.4	24.1	21.4	100	0.0	SW	9	13	5	7	-	-	2.2
08/09:29am	21.4	24.1	21.4	100	0.0	SW	9	13	5	7	-	-	2.2
08/09:00am	21.4	24.1	21.4	100	0.0	W	9	17	5	9	-	-	125.2
08/08:30am	21.5	23.9	21.5	100	0.0	SSE	11	17	6	9	-	-	115.4
08/08:00am	21.6	23.6	21.6	100	0.0	SSE	13	24	7	13	-	-	108.8
08/07:30am	21.5	24.3	21.5	100	0.0	S	9	19	5	10	-	-	104.6
08/07:13am	21.5	23.9	21.5	100	0.0	SSE	11	17	6	9	-	-	104.0
08/07:00am	21.4	23.3	21.4	100	0.0	SSE	13	19	7	10	-	-	103.6
08/06:30am	21.4	23.7	21.4	100	0.0	SE	11	17	6	9	-	-	102.6
08/06:00am	21.4	23.7	21.4	100	0.0	SSE	11	15	6	8	-	-	102.6
08/05:30am	21.2	23.8	21.2	100	0.0	SSE	9	13	5	7	-	-	102.6
08/05:00am	21.3	24.0	21.3	100	0.0	S	9	19	5	10	-	-	102.6
08/04:30am	21.3	24.0	21.3	100	0.0	S	9	17	5	9	-	-	102.2
08/04:09am	21.4	23.7	21.4	100	0.0	SE	11	19	6	10	-	-	101.6
08/04:00am	21.4	24.1	21.4	100	0.0	SSE	9	17	5	9	-	-	101.0
08/03:30am	21.3	24.3	21.3	100	0.0	ESE	7	9	4	5	-	-	97.6
08/03:00am	21.1	25.4	21.1	100	0.0	CALM	0	0	0	0	-	-	94.4
08/02:30am	21.0	25.2	21.0	100	0.0	CALM	0	0	0	0	-	-	90.2
08/02:25am	21.0	25.2	21.0	100	0.0	CALM	0	0	0	0	-	-	89.6
08/02:06am	21.2	24.2	21.2	100	0.0	SE	7	9	4	5	-	-	88.6
08/02:00am	21.2	25.1	21.2	100	0.0	SSE	2	9	1	5	-	-	88.4
08/01:30am	21.1	24.6	21.1	100	0.0	SSW	4	9	2	5	-	-	85.4
08/01:29am	21.2	24.8	21.2	100	0.0	SSW	4	9	2	5	-	-	85.4
08/01:00am	21.1	25.4	21.1	100	0.0	CALM	0	4	0	2	-	-	84.4
08/12:55am	21.1	24.6	21.1	100	0.0	S	4	9	2	5	-	-	84.4
08/12:30am	21.1	23.6	21.1	100	0.0	S	9	11	5	6	-	-	83.0

08/12:29am	21.1	23.6	21.1	100	0.0	S	9	11	5	6	-	-	82.8
08/12:27am	21.1	23.6	21.1	100	0.0	S	9	11	5	6	-	-	82.6
08/12:00am	21.4	25.8	21.4	100	0.0	CALM	0	0	0	0	-	-	80.6

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
07/11:53pm	21.3	25.7	21.3	100	0.0	CALM	0	0	0	0	-	-	80.2
07/11:44pm	21.3	25.7	21.3	100	0.0	CALM	0	0	0	0	-	-	79.6
07/11:30pm	21.5	24.3	21.5	100	0.0	SSE	9	11	5	6	-	-	79.4
07/11:00pm	21.4	25.1	21.4	100	0.0	SSE	4	11	2	6	-	-	76.6
07/10:30pm	21.7	24.9	21.7	100	0.0	S	7	11	4	6	-	-	54.2
07/10:00pm	22.2	24.6	22.2	100	0.0	ESE	13	28	7	15	-	-	46.8
07/09:31pm	22.3	27.2	22.3	100	0.0	CALM	0	0	0	0	-	-	37.0
07/09:30pm	22.4	27.3	22.4	100	0.0	CALM	0	0	0	0	-	-	36.2
07/09:29pm	22.4	27.3	22.4	100	0.0	CALM	0	0	0	0	-	-	35.6
07/09:00pm	22.4	26.2	22.4	100	0.0	NW	6	7	3	4	-	-	33.6
07/08:59pm	22.4	26.2	22.4	100	0.0	NW	6	7	3	4	-	-	33.4
07/08:30pm	22.3	26.0	22.3	100	0.0	WNW	6	9	3	5	-	-	32.2
07/08:00pm	22.4	26.0	22.4	100	0.0	SW	7	11	4	6	-	-	31.8
07/07:42pm	22.3	25.9	22.3	100	0.0	SW	7	11	4	6	-	-	31.8
07/07:30pm	22.3	25.9	22.3	100	0.0	SSW	7	11	4	6	-	-	31.8
07/07:00pm	22.3	24.3	21.6	96	0.5	NE	13	17	7	9	-	-	18.8
07/06:44pm	23.7	26.5	23.0	96	0.5	ESE	13	24	7	13	-	-	6.0
07/06:30pm	23.8	26.6	23.0	95	0.5	SE	13	19	7	10	-	-	5.2
07/06:00pm	24.3	25.1	22.4	89	1.3	SE	22	32	12	17	-	-	4.6
07/05:30pm	24.7	25.1	22.4	87	1.5	SE	24	33	13	18	-	-	4.6
07/05:00pm	25.2	27.6	22.9	87	1.6	SE	15	28	8	15	-	-	4.6
07/04:30pm	25.6	26.5	21.9	80	2.5	ESE	20	30	11	16	-	-	4.6
07/04:00pm	25.9	27.8	22.8	83	2.1	ESE	17	28	9	15	-	-	4.6
07/03:30pm	26.1	27.9	23.2	84	2.0	ESE	19	30	10	16	-	-	4.6
07/03:20pm	25.6	28.7	24.2	92	1.0	ESE	15	24	8	13	-	-	4.6
07/03:03pm	24.9	27.2	23.5	92	1.0	ESE	17	26	9	14	-	-	4.6
07/03:00pm	25.0	26.9	23.4	91	1.1	ESE	19	26	10	14	-	-	4.4
07/02:44pm	25.1	29.9	23.5	91	1.1	ENE	4	13	2	7	-	-	4.2
07/02:30pm	24.5	28.6	22.9	91	1.1	ENE	6	11	3	6	-	-	4.2
07/02:24pm	24.7	28.2	22.8	89	1.3	ESE	9	17	5	9	-	-	4.2
07/02:00pm	25.0	27.5	23.2	90	1.2	ESE	15	22	8	12	-	-	3.0
07/01:30pm	24.4	27.6	23.0	92	0.9	SE	11	15	6	8	-	-	3.0
07/01:00pm	24.0	28.5	23.7	98	0.2	SE	6	9	3	5	-	-	3.0
07/12:30pm	23.1	25.8	22.8	98	0.2	E	13	19	7	10	-	-	2.8
07/12:00pm	23.3	25.1	22.6	96	0.5	E	17	22	9	12	-	-	2.2
07/11:30am	23.5	25.8	22.8	96	0.5	E	15	20	8	11	-	-	1.2
07/11:11am	23.8	25.8	23.0	95	0.5	ESE	17	26	9	14	-	-	0.6
07/11:00am	23.8	25.1	22.6	93	0.8	E	20	28	11	15	-	-	0.6
07/10:56am	24.0	25.3	22.6	92	0.9	ESE	20	28	11	15	-	-	0.4
07/10:30am	24.6	26.3	22.3	87	1.5	ESE	17	28	9	15	-	-	0.0
07/10:00am	24.8	26.4	22.1	85	1.8	ESE	17	22	9	12	-	-	0.0
07/09:30am	24.1	26.7	22.7	92	0.9	ESE	13	24	7	13	-	-	0.0
07/09:00am	23.6	27.0	23.3	98	0.2	SE	11	15	6	8	-	-	50.8
07/08:30am	23.3	25.8	22.5	95	0.5	ESE	13	22	7	12	-	-	50.8
07/08:00am	23.5	25.3	22.5	94	0.7	ESE	17	26	9	14	-	-	50.6
07/07:30am	23.6	25.2	22.9	96	0.5	ESE	19	26	10	14	-	-	50.6
07/07:00am	23.5	25.1	23.3	99	0.1	ESE	20	32	11	17	-	-	50.6
07/06:30am	23.4	25.1	23.4	100	0.0	ESE	20	32	11	17	-	-	50.6
07/06:11am	23.4	24.7	23.4	100	0.0	ESE	22	33	12	18	-	-	50.4
07/06:00am	23.4	24.7	23.4	100	0.0	ESE	22	46	12	25	-	-	50.4
07/05:54am	23.4	24.7	23.4	100	0.0	SE	22	35	12	19	-	-	50.2
07/05:34am	23.3	24.2	23.3	100	0.0	SE	24	37	13	20	-	-	50.0
07/05:30am	23.2	24.4	23.2	100	0.0	SE	22	30	12	16	-	-	50.0
07/05:09am	23.1	24.8	23.1	100	0.0	SE	19	28	10	15	-	-	47.8
07/05:00am	23.1	24.8	23.1	100	0.0	SE	19	24	10	13	-	-	46.6

07/04:42am	22.4	23.7	22.4	100	0.0	SE	19	28	10	15	-	-	46.6
07/04:30am	22.2	22.5	22.2	100	0.0	SE	24	35	13	19	-	-	46.6
07/04:15am	22.9	23.9	22.9	100	0.0	SSE	22	33	12	18	-	-	44.6
07/04:14am	22.9	24.3	22.9	100	0.0	SSE	20	33	11	18	-	-	44.4
07/04:00am	22.8	23.4	22.8	100	0.0	SSE	24	37	13	20	-	-	43.2
07/03:46am	22.9	23.9	22.9	100	0.0	SSE	22	37	12	20	-	-	42.0
07/03:43am	23.0	24.7	23.0	100	0.0	SSE	19	37	10	20	-	-	41.6
07/03:30am	22.7	23.6	22.7	100	0.0	SE	22	35	12	19	-	-	41.4
07/03:18am	23.1	24.8	23.1	100	0.0	SSE	19	30	10	16	-	-	40.8
07/03:00am	23.2	24.0	23.2	100	0.0	SSE	24	35	13	19	-	-	40.6
07/02:47am	23.0	24.5	23.0	100	0.0	SSE	20	30	11	16	-	-	40.6
07/02:30am	22.8	24.7	22.8	100	0.0	SSE	17	33	9	18	-	-	40.0
07/02:09am	23.0	25.8	23.0	100	0.0	SSE	13	22	7	12	-	-	35.6
07/02:00am	23.0	25.4	23.0	100	0.0	SSE	15	22	8	12	-	-	34.8
07/01:30am	22.8	25.3	22.5	98	0.2	S	13	24	7	13	-	-	34.6
07/01:00am	22.9	25.3	22.9	100	0.0	SSE	15	22	8	12	-	-	34.6
07/12:30am	23.0	25.0	23.0	100	0.0	SSE	17	32	9	17	-	-	34.6
07/12:00am	22.9	24.9	22.9	100	0.0	SSE	17	22	9	12	-	-	34.4

Date/Time EDT	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
06/11:36pm	22.9	24.9	22.9	100	0.0	SSE	17	28	9	15	-	-	34.4
06/11:30pm	22.7	24.6	22.7	100	0.0	SSE	17	28	9	15	-	-	34.4
06/11:00pm	22.9	24.2	22.6	98	0.2	SE	20	33	11	18	-	-	25.8
06/10:41pm	23.3	25.7	22.3	94	0.7	SSE	13	20	7	11	-	-	23.0
06/10:30pm	23.5	25.1	22.1	92	0.9	SSE	17	28	9	15	-	-	22.6
06/10:00pm	23.3	25.4	22.5	95	0.5	SSE	15	30	8	16	-	-	22.6
06/09:30pm	22.9	25.5	22.6	98	0.2	SSE	13	22	7	12	-	-	22.6
06/09:00pm	22.7	25.0	22.7	100	0.0	SSE	15	26	8	14	-	-	22.6
06/08:30pm	22.9	24.9	22.9	100	0.0	SSE	17	26	9	14	-	-	22.6
06/08:02pm	22.9	24.9	22.9	100	0.0	SSE	17	30	9	16	-	-	22.6
06/08:00pm	22.9	24.9	22.9	100	0.0	SSE	17	30	9	16	-	-	22.6
06/07:30pm	22.9	25.3	22.9	100	0.0	SSE	15	28	8	15	-	-	19.2
06/07:16pm	23.0	25.3	22.0	94	0.7	SSE	13	22	7	12	-	-	15.0
06/07:00pm	23.1	25.8	21.4	90	1.1	S	9	17	5	9	-	-	12.8
06/06:30pm	23.1	25.3	21.2	89	1.2	S	11	20	6	11	-	-	12.8
06/06:00pm	23.1	24.9	21.2	89	1.2	SSW	13	20	7	11	-	-	12.8
06/05:30pm	23.0	24.7	21.6	92	0.9	S	15	22	8	12	-	-	12.8
06/05:00pm	22.8	24.6	21.8	94	0.7	S	15	30	8	16	-	-	12.8
06/04:30pm	22.2	23.7	22.0	99	0.1	S	17	30	9	16	-	-	12.8
06/04:00pm	21.5	22.1	21.3	99	0.1	S	20	32	11	17	-	-	12.8
06/03:55pm	21.5	22.1	21.3	99	0.1	S	20	32	11	17	-	-	12.6
06/03:30pm	21.4	21.7	20.7	96	0.5	S	20	35	11	19	-	-	9.4
06/03:19pm	22.2	21.6	20.5	90	1.1	S	24	41	13	22	-	-	2.4
06/03:00pm	23.3	22.0	20.6	85	1.8	S	28	48	15	26	-	-	1.0
06/02:49pm	22.8	22.8	20.9	89	1.2	S	22	39	12	21	-	-	1.0
06/02:31pm	22.2	21.5	20.3	89	1.2	S	24	41	13	22	-	-	1.0
06/02:30pm	22.4	21.8	20.5	89	1.2	S	24	41	13	22	-	-	0.8
06/02:00pm	23.7	22.0	19.8	79	2.5	S	28	52	15	28	-	-	0.2
06/01:33pm	24.1	22.0	19.8	77	2.8	S	30	48	16	26	-	-	0.2
06/01:30pm	24.1	21.5	19.6	76	2.9	S	32	48	17	26	-	-	0.2
06/01:25pm	24.6	22.7	20.1	76	2.9	S	30	48	16	26	-	-	0.2
06/01:00pm	24.3	23.5	20.0	77	2.8	S	24	41	13	22	-	-	0.2

Other formats

Comma delimited format used in spreadsheet applications
http://www.bom.gov.au/fwo/IDN60801/IDN60801.94766.axf

JavaScript Object Notation format (JSON) in row-major order
http://www.bom.gov.au/fwo/IDN60801/IDN60801.94766.json

Data quality

Most of these data are generated automatically and are frequently updated. Quality checks on data are not normally performed. It is possible for incorrect values to appear. Refer to information at About Latest Weather Observations and please check the disclaimer before using these data.

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APPENDIX D

LABORATORY SUMMARY TABLES

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Results Table 1

Project Number: NE30161
Site Identification: Wiley Park Station
Report Title: Surface Water Monitoring

				TPH	Inorganics							Physio-Chemical			
			Chlorophyll a	Oil and Grease	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrogen (Total as N)	Phosphorus (Total as P)	TSS	Turbidity	pH	°C Temprature	Electrical Conductivity	Dissolved Oxygen
			mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	NTU	Units	°C	uS/cm	%Sat
EQL			0.002	10	0.1	0.01	0.2	0.01	1	1	0.01	0.1	0.1	0.1
ANZECC Criteria - Freshwater			0.003	-	-	-	0.35	25	-	<6-50	6.5-8.5	-	125-2200	85% - 110%
Lab Report Number	**Field ID**	**Date**												
869657	**WP1**	**9/03/2022**	<0.002	10	NT	NT	**1.9**	**160**	17	31	7.78	19.4	622	**58.4**
869657	**WP2**	**9/03/2022**	<0.002	<10	NT	NT	**1.8**	**140**	7.8	22	7.85	19.4	659	**58.1**
869657	**QA100**	**9/03/2022**	-	<10	NT	NT	**1.8**	**140**	6.2	20	-	-	-	-
ES2208343	**QA200**	**9/03/2022**	-	<5	1	1.69	**2.7**	**190**	7	14.7	-	-	-	-
Maximum Concentration			<0.002	<10	1	1.69	**2.7**	**190**	17	31	7.85	19.4	659	**58.4**

* A Non Detect Multiplier of 0.5 has been applied.

NT - Not Test

APPENDIX

E

QUALITY ASSURANCE/QUALITY CONTRAL

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Quality Assurance/Quality Control (QA/QC) procedures were implemented to ensure the precision accuracy, representativeness, completeness and comparability of all data gathered. The QA/QC procedures included:

- Equipment calibration to ensure field measurements obtained are accurate
- Equipment decontamination to prevent cross contamination
- Use of appropriate measures (i.e. gloves) to prevent cross contamination
- Appropriate sample identification
- Correct sample preservation
- Sample transport with Chain of Custody (CoC) documentation
- Laboratory analysis in accordance with NATA accredited methods.

Table E1 details the QA/QC procedures and sample collection details undertaken through the surface water elements of the investigation. Copies of all the CoCs, along with the Sample Receipt Notifications (SRNs), Interpretive QA/QC Reports are provided in **Appendix F**.

Table E1 Field QA/QC Method Validation

Requirement	Yes / No	Comments
Equipment decontamination	Yes	In the event of involving reusable equipment. Decontamination of sampling equipment (water quality meter, telescopic water scoop etc.) was undertaken by washing with phosphate free detergent (Liquinox) followed by a rinse with potable water.
Sample collection	Yes	Samples were collected using disposable nitrile gloves via telescopic water scoop. A clean pair of gloves was used for each new sample being collected to limit the possibility of cross-contamination.
QA/QC sample collection*	Yes	One (1) surface water duplicate and one (1) surface water triplicate sample were collected for intra and inter-lab QA/QC purposes to monitor the quality of the field practices for sample collection. Cardno based the investigation around a rate of one duplicate and triplicate sample per sampling event, as the requirement for duplicate and triplicate sample collection.
Sample identification	Yes	All samples were marked with a unique identifier including project number, sample location, and date.
Sample preservation	Yes	Samples were placed in a chilled ice box with ice for storage and transport to the laboratory.
CoC documentation	Yes	A CoC form was completed by Cardno detailing sample identification, collection date, sampler and laboratory analysis required. The CoC form was signed off and returned to Cardno by the laboratory staff upon receipt of all the samples. CoC forms and Sample Receipt Notification (SRN) are provided in **Appendix F**. The SRN indicates that the samples were received at the laboratory intact and chilled and within the required holding times.
NATA accredited methods	Yes	The NATA accredited Eurofins mgt and ALS Analysed the samples in accordance with NATA accredited methods. Analytical methods used are indicated in the stamped laboratory results provided in **Appendix F**.
Laboratory Internal QC	Yes	All Data Quality Objectives were met by the laboratories.

Note of Table
*It is noted that the inter-laboratory duplicate sample QA200 for turbidity analysis did not meet the compliance time due to the extended sampling holding time by the laboratory. This is not considered to alter the overall outcome of the assessment.

Table E2 Field QA/QC Collection Summary

Environmental Media	Date	Primary	Duplicate	Triplicate
Surface Water	09/03/2022	WP2	QA100	QA200

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Relative Percentage Difference Determination

Laboratory results for duplicate and triplicate samples are assessed using a determination of the Relative Percentage Difference (RPD). Where a primary sample and a duplicate sample are compared, the RPD provides an indication of the reproducibility of the results, which incorporates the sampling method. Where a primary sample and a split sample are compared, the RPD provides an indication of the accuracy of the primary laboratory results as compared to the secondary laboratory result.

The calculation used to determine the RPD is:

$$RPD = \frac{(Co - Cs)}{\left(\frac{Co + Cs}{2}\right)} x100$$

Where:

Co = Concentration of the original sample

Cs = Concentration of the duplicate sample

In calculating the RPD values the following protocols were adopted:

- Where both concentrations are above laboratory reporting limits the RPD formula is used;
- Where both concentrations are below the laboratory reporting limits, no RPD is calculated; and
- Where one or both sample concentrations are reported to be less than ten times (<10x) the laboratory reporting limit, the RPD is calculated but is not assessed against the adopted criterion.

In accordance with the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended 2013, Cardno adopts an RPD acceptance criterion up to 30% of the mean concentration of the analyte. It should be noted that variations might be higher for organic analysis, due to the volatile nature of the components, and for low concentrations of analytes.

The adopted criterion will not apply to RPDs where one of both concentrations are less than 10 times the reporting limit, as this criterion would otherwise overestimate the significance of minor variations in concentrations at or near the laboratory reporting limit. Large RPDs returned for low concentrations of analytes near the reporting limit is not as indicative of a significant difference in the results as a small RPD is for larger concentrations.

This approach is employed by NATA-accredited laboratories when assessing internal duplicate sample RPDs. This approach acknowledges that concentrations at or around the reporting limit are too low for an accurate evaluation of the significance of the RPD.

This approach has been adopted when assessing the relevance (compliance) of RPDs during this investigation. RPDs will be calculated for sample sets where one or both concentrations are less than 10 times the reporting limit for discussion purposes, but will not be assessed as a pass or fail in relation to the criterion.

The RPD results for duplicate samples are presented in this appendix. Although two (2) RPD values were reported to be above the accepted 30% RPD criteria. The breaches in RPDs are not considered to alter the overall outcome of the assessment. It can be concluded that the analytical data can be relied upon for the purposes of this factual report.

Laboratory QC and QCI Report Summary

The laboratories selected for undertaking the analysis (Eurofins mgt and ALS) are NATA-accredited for the analysis required, and undertook certain QA/QC requirements to demonstrate the suitability of the data that is obtained. The laboratory is required to undertake and report internal laboratory Quality Control (QC) procedures for all chemical analysis undertaken. The QC testing is required to include:

- Laboratory duplicate sample analysis at the rate of one duplicate analysis per ten samples
- Method blank at the rate of one method blank analysis per 20 samples

- Laboratory control sample at the rate of one laboratory control sample analysis per 20 samples
- Spike recovery analysis at the rate of one spike recovery analysis per 20 samples.

Compliance with the laboratory QA/QC requirements and non-conformance details are discussed in the internal Laboratory QA/QC reports included with the certificates of analysis in **Appendix F**. Laboratory QA/QC requirements were within acceptance limits.

Cardno concludes that the data reported by the NATA-accredited Eurofins mgt and ALS as presented in this report is suitable for interpretative purposes and to make conclusions/recommendations regarding water quality.

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				TPH	Inorganics			
				Oil and Grease	Nitrogen (Total)	Phosphorus	TSS	Turbidity
				mg/L	mg/L	µg/L	mg/L	NTU
EQL				5	0.1	10	5	0.1
Field ID	**Lab Report Number**	**Matrix Type**	**Date**					
WP2	**869657**	**water**	**9/03/2022**	<10	1.8	140	7.8	22
QA100	**869657**	**water**	**9/03/2022**	<10	1.8	140	6.2	20
RPD				0	0	0	23	10
WP2	**869657**	**water**	**9/03/2022**	<10	1.8	140	7.8	22
QA200	**ES2208343**	**water**	**9/03/2022**	<5	2.7	190	7	14.7
RPD				0	**40**	30	11	**40**

***RPDs have only been considered where a concentration is greater than 1 times the EQL.**

****Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: (1 - 10 x EQL); 30 (10 - 30 x EQL); 30 (> 30 x EQL))**

*****Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory**

APPENDIX

F

LABORATORY REPORTS

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CHAIN OF CUSTODY AND ANALYSIS REQUEST

ontact Person:	Jiaqi Zhou	Project Name:	Downer Sydney Metro Stations - Wiley Park
elephone Number:	0424 106 665	Project Number:	NE30161
lternative Contact:	Chong Zheng	PO No.:	
elephone Number:	0451 780 991	Project Specific Quote No. :	190408CDNN_1
ampler:	JZ	Turnaround Requirements:	5 Days TAT
mail Address (results and Invoice):	jiaqi.zhou@cardno.com.au; chong.zeng@cardno.com.au; ContamNSW@cardno.com.au	Lab:	Eurofins | Unit F3, Building F, 16 Mars Rd, Lane Cove West NSW2066
ddress: Level 9 - The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia		Attn:	Sample Receipt

Sample Information						Analysis Required												Comments
Cardno Sample ID	Laboratory Sample ID	No. Containers	Preservation	Date sampled	Matrix	Chlorophyll-a	TSS	Turbidity	Oil and Grease	Total Phosphorus	Total Nitrogen							
WP1		5	ICE	9/03/2022	Water	1	1	1	1	1	1							Please reduce the detection limit of Chlorophyll a from 5 ug/L to 2 ug/L
WP2		5	ICE		Water	1	1	1	1	1	1							
QA100		4	ICE		Water		1	1	1	1	1							Please send to ALS
QA200		4	ICE		Water		1	1	1	1	1							

Environmental Division
Sydney
Work Order Reference
ES2208343

Telephone : +61-2-8784 8555

elinquished by:	Jiaqi Zhou	Received by:	G.L	Relinquished by:	#869657	Received by:	Relinquished by:
ame / company)	Cardno ACT/NSW Pty Ltd	(name / company)		(name / company		(name / company)	(name / company)
ate & Time:	3/9/2022	Date & Time:	9/3/22 1:20pm	Date & Time:		Date & Time:	Date & Time:
gnature:	JZ	Signature:	G.L	Signature:	12.1°C	Signature:	Signature:
eceived by:		Relinquished by:		Received by:	SOOSH 9/3/22 1730	Relinquished by:	*Lab use:*
ame / company)		(name / company)		(name / company	9/3/22 1730	(name / company)	Samples Received: Cool or Ambient (circle one)
ate & Time:		Date & Time:		Date & Time:	9/3/22 1730	Date & Time:	Temperature Received at: (if applicable)
gnature:		Signature:		Signature:	8.9°	Signature:	

Cardno sample submission- NE30161

Jiaqi Zhou <jiaqi.zhou@cardno.com.au>

Wed 3/9/2022 1:09 PM

To: #AU04_Enviro_Sample_NSW <EnviroSampleNSW@eurofins.com>

Cc: Ursula Long <UrsulaLong@eurofins.com>; Chong Zeng <chong.zeng@cardno.com.au>

1 attachments (23 KB)

WP_SWM_COC_09032022.xlsx;

CAUTION: EXTERNAL EMAIL - Sent from an email domain that is not formally trusted by Eurofins.

Do not click on links or open attachments unless you recognise the sender and are certain that the content is safe.

Hi Ursula,

Please find the attached COC for the water samples I dropped off this morning (Please note that QA200 sample need to be sent to ALS ASAP). Could you please reduce the detection limit of Chlorophyll a from 5 ug/L to 2 ug/L? Please feel free to contact me if there is any issue. Thank you for your help.

Jiaqi Zhou
ENVIRONMENTAL ENGINEER
CARDNO

Cardno now Stantec

Phone Direct +61 2 9024 7073
Address Level 9, The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia

Email jiaqi.zhou@cardno.com.au Web www.cardno.com
CONNECT WITH CARDNO

Cardno acknowledges the Traditional Owners of the land upon which we live and work and pay our respects to their Elders past, present and emerging - learn more.

Cardno's management systems are certified to ISO9001 (quality) and AS/NZS4801/OHSAS18001 (occupational health and safety)

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SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2208343**

Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JIAQI ZHOU	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jiaqi.zhou@cardno.com.au	E-mail	: Shane.Ellis@ALSGlobal.com
Telephone	: ----	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: Downer Sydney Metro Stations - Wiley Park	Page	: 1 of 3
Order number	: NE30161	Quote number	: EP2020CARNSWACT0002 (EN/024/20)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: JIAQI ZHOU		

Dates

Date Samples Received	: 09-Mar-2022 18:21	Issue Date	: 14-Mar-2022
Client Requested Due Date	: 17-Mar-2022	Scheduled Reporting Date	: **17-Mar-2022**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 3.9'C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

Method Sample ID	Sample Container Received	Preferred Sample Container for Analysis
Suspended Solids (High Level) : EA025H		
QA200	- Amber Jar - Sulfuric Acid or Sodium Bisulfate	- Clear Plastic Bottle - Natural
Turbidity : EA045		
QA200	- Amber Jar - Sulfuric Acid or Sodium Bisulfate	- Clear Plastic Bottle - Natural

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA025H Suspended Solids - Standard Level	WATER - EA045 Turbidity	WATER - EP020 Oil & Grease (O&G)	WATER - NT-11 Total Nitrogen and Total Phosphorus
ES2208343-001	09-Mar-2022 00:00	QA200	✓	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

Chong Zeng

- *AU Certificate of Analysis - NATA (COA)	Email	chong.zeng@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chong.zeng@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chong.zeng@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chong.zeng@cardno.com.au
- A4 - AU Tax Invoice (INV)	Email	chong.zeng@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	chong.zeng@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	chong.zeng@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	chong.zeng@cardno.com.au

ContamNSW

- *AU Certificate of Analysis - NATA (COA)	Email	contamnsw@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	contamnsw@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	contamnsw@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	contamnsw@cardno.com.au
- A4 - AU Tax Invoice (INV)	Email	contamnsw@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	contamnsw@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	contamnsw@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	contamnsw@cardno.com.au

INVOICES

- A4 - AU Tax Invoice (INV)	Email	apinvoices@cardno.com.au

JIAQI ZHOU

- *AU Certificate of Analysis - NATA (COA)	Email	jiaqi.zhou@cardno.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jiaqi.zhou@cardno.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jiaqi.zhou@cardno.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jiaqi.zhou@cardno.com.au
- A4 - AU Tax Invoice (INV)	Email	jiaqi.zhou@cardno.com.au
- Chain of Custody (CoC) (COC)	Email	jiaqi.zhou@cardno.com.au
- EDI Format - ENMRG (ENMRG)	Email	jiaqi.zhou@cardno.com.au
- EDI Format - ESDAT (ESDAT)	Email	jiaqi.zhou@cardno.com.au

QUALITY CONTROL REPORT

Work Order	: **ES2208343**	Page	: 1 of 3
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JIAQI ZHOU	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: Downer Sydney Metro Stations - Wiley Park	Date Samples Received	: 09-Mar-2022
Order number	: NE30161	Date Analysis Commenced	: 15-Mar-2022
C-O-C number	: ----	Issue Date	: 17-Mar-2022
Sampler	: JIAQI ZHOU		
Site	: ----		
Quote number	: EN/024/20		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 4229099)									
ES2208233-002	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	3560	3810	6.8	0% - 20%
ES2208510-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	267	282	5.3	0% - 20%
EA045: Turbidity (QC Lot: 4231366)									
ES2208343-001	QA200	EA045: Turbidity	----	0.1	NTU	14.7	14.6	0.7	0% - 20%
ES2209265-001	Anonymous	EA045: Turbidity	----	0.1	NTU	121	121	0.0	0% - 20%
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4228449)									
ES2208233-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	16.7	16.7	0.2	0% - 20%
ES2208278-015	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.01	0.02	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4228456)									
ES2208233-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	3.5	3.4	0.0	No Limit
ES2208278-017	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	79.4	78.6	1.1	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4228455)									
ES2208233-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	10.4	10.1	2.7	0% - 20%
ES2208278-017	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	2.41	2.30	4.3	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 4229099)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	99.7	83.0	129
				<5	1000 mg/L	100	82.0	110
				<5	463 mg/L	101	83.0	118
EA045: Turbidity (QCLot: 4231366)								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	98.2	91.0	105
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4228449)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4228456)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	88.5	69.0	101
				<0.1	1 mg/L	80.1	70.0	118
				<0.1	5 mg/L	101	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4228455)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	94.9	71.3	126
				<0.01	0.442 mg/L	109	71.3	126
				<0.01	1 mg/L	112	71.3	126
EP020: Oil and Grease (O&G) (QCLot: 4229287)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	112	81.0	121

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4228449)							
ES2208233-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4228456)							
ES2208247-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	101	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4228455)							
ES2208247-001	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	111	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2208343**	Page	: 1 of 5
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JIAQI ZHOU	Telephone	: +61 2 8784 8555
Project	: Downer Sydney Metro Stations - Wiley Park	Date Samples Received	: 09-Mar-2022
Site	: ----	Issue Date	: 17-Mar-2022
Sampler	: JIAQI ZHOU	No. of samples received	: 1
Order number	: NE30161	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ar	ES2208233--001	Anonymous	**Nitrite + Nitrate as N**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EA045: Turbidity						
Amber Jar - Sulfuric Acid or Sodium Bisulfate						
QA200	----	----	----	16-Mar-2022	11-Mar-2022	**5**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EA025: Total Suspended Solids dried at 104 ± 2°C							
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EA025H)							
QA200	**09-Mar-2022**	**----**	----	----	**16-Mar-2022**	16-Mar-2022	✓
EA045: Turbidity							
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EA045)							
QA200	**09-Mar-2022**	**----**	----	----	**16-Mar-2022**	11-Mar-2022	×
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
QA200	**09-Mar-2022**	**----**	----	----	**15-Mar-2022**	06-Apr-2022	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
QA200	**09-Mar-2022**	**15-Mar-2022**	06-Apr-2022	✓	**15-Mar-2022**	06-Apr-2022	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
QA200	**09-Mar-2022**	**15-Mar-2022**	06-Apr-2022	✓	**15-Mar-2022**	06-Apr-2022	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP020: Oil and Grease (O&G)							
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020)							
QA200	**09-Mar-2022**	**----**	----	----	**16-Mar-2022**	06-Apr-2022	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Oil and Grease	EP020	WATER	In house: Referenced to APHA 5520 B. Oil & grease is a gravimetric procedure to determine the amount of dissolved or emulsified oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2208343**	Page	: 1 of 2
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JIAQI ZHOU	Contact	: Shane Ellis
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: Downer Sydney Metro Stations - Wiley Park	Date Samples Received	: 09-Mar-2022 18:21
Order number	: NE30161	Date Analysis Commenced	: 15-Mar-2022
C-O-C number	: ----	Issue Date	: 17-Mar-2022 15:34
Sampler	: JIAQI ZHOU		
Site	: ----		
Quote number	: EN/024/20		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Sample ID	**QA200**	**----**	**----**	**----**	**----**
			Sampling date / time	09-Mar-2022 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2208343-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	**7**	**----**	**----**	**----**	**----**
EA045: Turbidity								
Turbidity	----	0.1	NTU	**14.7**	**----**	**----**	**----**	**----**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**1.69**	**----**	**----**	**----**	**----**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**1.0**	**----**	**----**	**----**	**----**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	**2.7**	**----**	**----**	**----**	**----**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.19**	**----**	**----**	**----**	**----**
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	**----**	**----**	**----**	**----**

CHAIN OF CUSTODY AND ANALYSIS REQUEST

Cardno — Shaping the Future

Contact Person:	Jiaqi Zhou	Project Name:	Downer Sydney Metro Stations - Wiley Park
Telephone Number:	0424 106 665	Project Number:	NE30161
Alternative Contact:	Chong Zheng	PO No.:	
Telephone Number:	0451 780 991	Project Specific Quote No. :	190408CDNN_1
Sampler:	JZ	Turnaround Requirements:	5 Days TAT
Email Address (results and invoice):	jiaqi.zhou@cardno.com.au; chong.zeng@cardno.com.au; ContamNSW@cardno.com.au	Lab:	Eurofins | Unit F3, Building F, 16 Mars Rd, Lane Cove West NSW2066
Address: Level 9 - The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia		Attn:	Sample Receipt

Sample information						Analysis Required												Comments
Cardno Sample ID	Laboratory Sample ID	No. Containers	Preservation	Date sampled	Matrix	Chlorophyll-a	TSS	Turbidity	Oil and Grease	Total Phosphorus	Total Nitrogen							
WP1		5	ICE	9/03/2022	Water	1	1	1	1	1	1							Please reduce the detection limit of Chlorophyll a from 5 ug/L to 2 ug/L
WP2		5	ICE		Water	1	1	1	1	1	1							
QA100		4	ICE		Water		1	1	1	1	1							Please send to ALS
QA200		4	ICE		Water		1	1	1	1	1							

Relinquished by:	Jiaqi Zhou	Received by:	G.L	Relinquished by:	#869657	Received by:	Relinquished by:
(name / company)	Cardno ACT/NSW Pty Ltd	(name / company)		(name / company)		(name / company)	(name / company)
Date & Time:	3/9/2022	Date & Time:	9/3/22 1:10 PM	Date & Time:		Date & Time:	Date & Time:
Signature:	JZ	Signature:	G.L	Signature:	12.1°C	Signature:	Signature:
Received by:		Relinquished by:		Received by:		Relinquished by:	*Lab use:*
(name / company)		(name / company)		(name / company)		(name / company)	Samples Received: Cool or Ambient (circle one)
Date & Time:		Date & Time:		Date & Time:		Date & Time:	Temperature Received at: (if applicable)
Signature:		Signature:		Signature:		Signature:	Transported by: Hand delivered / courier

Cardno sample submission- NE30161

Jiaqi Zhou <jiaqi.zhou@cardno.com.au>

Wed 3/9/2022 1:09 PM

To: #AU04_Enviro_Sample_NSW <EnviroSampleNSW@eurofins.com>

Cc: Ursula Long <UrsulaLong@eurofins.com>; Chong Zeng <chong.zeng@cardno.com.au>

1 attachments (23 KB)

WP_SWM_COC_09032022.xlsx;

CAUTION: EXTERNAL EMAIL - Sent from an email domain that is not formally trusted by Eurofins.

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Hi Ursula,

Please find the attached COC for the water samples I dropped off this morning (Please note that QA200 sample need to be sent to ALS ASAP). Could you please reduce the detection limit of Chlorophyll a from 5 ug/L to 2 ug/L? Please feel free to contact me if there is any issue. Thank you for your help.

Jiaqi Zhou
ENVIRONMENTAL ENGINEER
CARDNO

Cardno now Stantec

Phone Direct +61 2 9024 7073
Address Level 9, The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia

Email jiaqi.zhou@cardno.com.au Web www.cardno.com
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Cardno's management systems are certified to ISO9001 (quality) and AS/NZS4801/OHSAS18001 (occupational health and safety)

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43 Detroit Drive
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Phone : 0800 856 450
IANZ # 1290

Sample Receipt Advice

Company name:	Cardno (NSW/ACT) Pty Ltd
Contact name:	Jiaqi Zhou
Project name:	DOWNER SYDNEY METRO STATIONS- WILEY PARK
Project ID:	NE30161
Turnaround time:	5 Day
Date/Time received	Mar 9, 2022 1:10 PM
Eurofins reference	869657

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✓	Split sample sent to requested external lab.
✗	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

QA200 TO BE SENT FOR ALS ANALYSIS 9/3/22

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Ursula Long on phone : or by email: UrsulaLong@eurofins.com

Results will be delivered electronically via email to Jiaqi Zhou - jiaqi.zhou@cardno.com.au.

Note: A copy of these results will also be delivered to the general Cardno (NSW/ACT) Pty Ltd email address.

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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Company Name: Cardno (NSW/ACT) Pty Ltd
Address: Level 9, 203 Pacific Highway
St Leonards
NSW 2065

Project Name: DOWNER SYDNEY METRO STATIONS- WILEY PARK
Project ID: NE30161

Order No.:
Report #: 869657
Phone: 0294967700
Fax: 02 9499 3902

Received: Mar 9, 2022 1:10 PM
Due: Mar 16, 2022
Priority: 5 Day
Contact Name: Jiaqi Zhou

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Chlorophyll a	Oil & Grease (HEM)	Phosphate total (as P)	Total Nitrogen (as N)	Total Suspended Solids Dried at 103°C–105°C	Turbidity
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X		X		
Sydney Laboratory - NATA # 1261 Site # 18217								X		X	X
Brisbane Laboratory - NATA # 1261 Site # 20794											
Mayfield Laboratory - NATA # 1261 Site # 25079											
Perth Laboratory - NATA # 2377 Site # 2370											
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	WP1	Mar 09, 2022		Water	S22-Ma17605	X	X	X	X	X	X
2	WP2	Mar 09, 2022		Water	S22-Ma17606	X	X	X	X	X	X
3	QA100	Mar 09, 2022		Water	S22-Ma17607		X	X	X	X	X
Test Counts						2	3	3	3	3	3

Cardno (NSW/ACT) Pty Ltd
Level 9, 203 Pacific Highway
St Leonards
NSW 2065

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Jiaqi Zhou**

Report **869657-W**
Project name DOWNER SYDNEY METRO STATIONS- WILEY PARK
Project ID NE30161
Received Date Mar 09, 2022

Client Sample ID			**WP1**	**WP2**	**QA100**
Sample Matrix			**Water**	**Water**	**Water**
Eurofins Sample No.			**S22-Ma17605**	**S22-Ma17606**	**S22-Ma17607**
Date Sampled			**Mar 09, 2022**	**Mar 09, 2022**	**Mar 09, 2022**
Test/Reference	LOR	Unit			
Chlorophyll a	2	ug/L	< 2	< 2	-
Oil & Grease (HEM)	10	mg/L	10	< 10	< 10
Phosphate total (as P)	0.01	mg/L	0.16	0.14	0.14
Total Nitrogen (as N)	0.2	mg/L	1.9	1.8	1.8
Total Suspended Solids Dried at 103°C–105°C	5	mg/L	17	7.8	6.2
Turbidity	1	NTU	31	22	20

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chlorophyll a	Melbourne	Mar 11, 2022	28 Days
- Method: LTM-INO-4340 Chlorophyll a in Waters			
Oil & Grease (HEM)	Melbourne	Mar 10, 2022	28 Days
- Method: LTM-INO-4180 Oil and Grease (APHA 5520B)			
Phosphate total (as P)	Sydney	Mar 09, 2022	28 Days
- Method: E052 Total Phosphate (as P)			
Total Nitrogen (as N)	Melbourne	Mar 17, 2022	7 Days
- Method: LTM-INO-4040 Phosphate and Nitrogen in waters			
Total Suspended Solids Dried at 103°C–105°C	Sydney	Mar 09, 2022	7 Days
- Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry			
Turbidity	Sydney	Mar 09, 2022	2 Days
- Method: LTM-INO-4140 Turbidity by Nephelometric Method			

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Company Name: Cardno (NSW/ACT) Pty Ltd
Address: Level 9, 203 Pacific Highway
St Leonards
NSW 2065

Project Name: DOWNER SYDNEY METRO STATIONS- WILEY PARK
Project ID: NE30161

Order No.:
Report #: 869657
Phone: 0294967700
Fax: 02 9499 3902

Received: Mar 9, 2022 1:10 PM
Due: Mar 16, 2022
Priority: 5 Day
Contact Name: Jiaqi Zhou

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Chlorophyll a	Oil & Grease (HEM)	Phosphate total (as P)	Total Nitrogen (as N)	Total Suspended Solids Dried at 103°C–105°C	Turbidity
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X		X		
Sydney Laboratory - NATA # 1261 Site # 18217								X		X	X
Brisbane Laboratory - NATA # 1261 Site # 20794											
Mayfield Laboratory - NATA # 1261 Site # 25079											
Perth Laboratory - NATA # 2377 Site # 2370											
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	WP1	Mar 09, 2022		Water	S22-Ma17605	X	X	X	X	X	X
2	WP2	Mar 09, 2022		Water	S22-Ma17606	X	X	X	X	X	X
3	QA100	Mar 09, 2022		Water	S22-Ma17607		X	X	X	X	X
Test Counts						2	3	3	3	3	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Chlorophyll a	ug/L	< 2			2	Pass	
Oil & Grease (HEM)	mg/L	< 10			10	Pass	
Total Suspended Solids Dried at 103°C–105°C	mg/L	< 5			5	Pass	
Turbidity	NTU	< 1			1	Pass	
LCS - % Recovery							
Oil & Grease (HEM)	%	83			70-130	Pass	
Total Suspended Solids Dried at 103°C–105°C	%	102			70-130	Pass	
Turbidity	%	93			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Total Suspended Solids Dried at 103°C–105°C	S22-Ma24731	NCP	%	116			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Chlorophyll a	S22-Ma17605	CP	ug/L	< 2	< 2	<1	30%	Pass	
Oil & Grease (HEM)	S22-Ma17262	NCP	mg/L	< 10	< 10	<1	30%	Pass	
Total Suspended Solids Dried at 103°C–105°C	S22-Ma24731	NCP	mg/L	140	140	3.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Turbidity	S22-Ma17607	CP	NTU	20	20	3.0	30%	Pass	

Comments

Eurofins | Environment Testing accreditation number 1261, site 18217 is currently in progress of a controlled transition to a new custom built location at 179 Magowar Road, Girraween, NSW 2145. All results on this report denoted as being performed by Eurofins | Environment Testing Unit F3, Building F, 16 Mars road, Lane Cove West, NSW 2066, corporate site 18217, will have been performed on either Lane Cove or new Girraween site

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Ursula Long	Analytical Services Manager
Charl Du Preez	Senior Analyst-Inorganic (NSW)
Scott Beddoes	Senior Analyst-Inorganic (VIC)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Appendix 5 – TL927-1-18F01 Hurlstone Park Station Vibration Monitoring Report (r1)

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8 December 2021

TL927-1-18F01 Hurlstone Park Station Vibration Monitoring Report (r1)

Downer EDI Works Pty Ltd
76 Berry Street
Nth Sydney NSW 2060

Sydney Metro Southwest - Station Upgrades - Hurlstone Park Station Vibration Monitoring

1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct vibration monitoring during the Station Upgrades works for Sydney Metro Southwest. The vibration monitoring was undertaken to monitor potentially affected structures. This report provides a summary of the monitoring results.

2 Details of monitoring

Two unattended vibration monitors were installed at the neighbouring garage structure at 3A Commons Street, Hurlstone Park between 10:30am 29th November and 03:00pm 3rd December 2021.

2.1 Measurement location

The measurement locations are listed in Table 2-1. Figures depicting the monitoring locations are included in APPENDIX A.

Table 2-1: Measurement locations

Measurement ID	Assessment Point	Date and time	Measured plant	Monitoring type	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
M1	Neighbouring garage structure at 3A Commons Street, Hurlstone Park (Appendix A.1)	29.11.2021 – 03.12.2021 10:30am – 03:00pm	Excavator with hammer attachment	Vibration	5m	N/A

2.2 Measurement equipment

The instrumentation used for the vibration measurement are summarised in Table 2-2. The accelerometers used in the measurements have current calibration certificates.

Table 2-2: Summary of vibration instrumentation

Type	Make / Model
Triaxial Transducers	Sigicom C12 (SN: 66830)
Triaxial Transducers	Sigicom C12 (SN: 70250)

3 Vibration Monitoring results

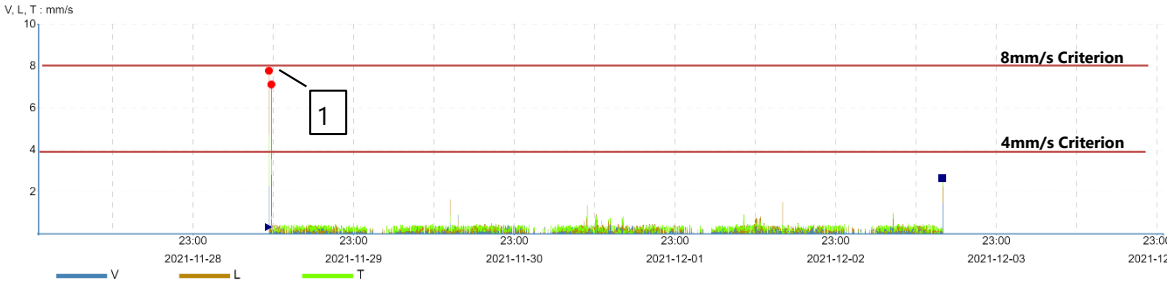
3.1 Neighbouring garage structure at 3A Commons Street Vibration Monitoring

In accordance with the Hurlstone Park Station Vibration Monitoring Plan[1], the established vibration limits for the affected garage structure are shown below:

- Greater than or equal to 4 mm/s (cosmetic damage is possible);
- Greater than or equal to 8 mm/s (cosmetic damage becoming more likely).

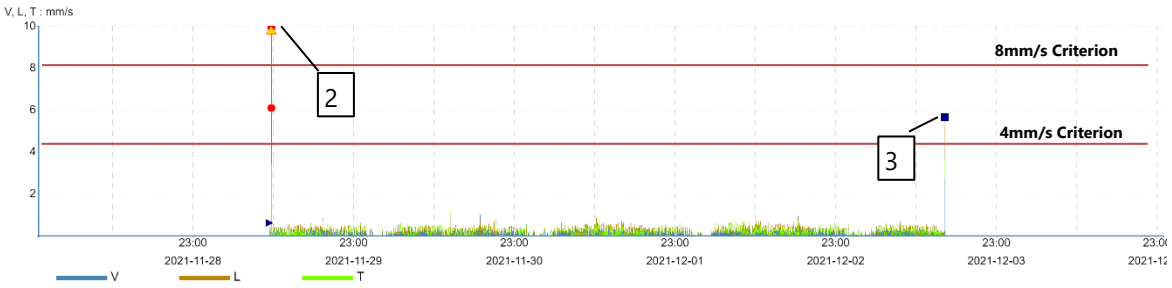
The results of the unattended vibration measurements for the neighbouring garage structure at 3A Commons Street are presented in Figure 3-1 and Figure 3-2.

Figure 3-1: Unattended vibration monitoring location 1 results (refer to Appendix A.1)



[1] Sydney Metro Southwest – Station Upgrades – Hurlstone Park Station Vibration Monitoring Plan (ref: TL927-1-14F01 Hurlstone Park Stn VIB MON PLAN (r2)), dated 14 October 2021

Figure 3-2: Unattended vibration monitoring location 2 results (refer to Appendix A.1)



The discussion of the unattended vibration measurements is summarised in Table 3-1 below.

Table 3-1: Unattended vibration monitoring summary

Exceedance ID	Date and Time	Cause of exceedance
1	29.11.2021 10:30am	At this time, the vibration monitor was mounted on the ground spike to commence monitoring. Exceedance was not caused by the nearby construction activities.
2	29.11.2021 11:00am	At this time, the vibration monitor was mounted on the ground spike to commence monitoring. Exceedance was not caused by the nearby construction activities.
3	03.12.2021 03:00pm	At this time, the vibration monitor was removed from the ground spike at the completion of monitoring. Exceedance was not caused by the nearby construction activities.

It can be seen in Figure 3-1 and Figure 3-2 that the vibration levels produced from the vibration intensive works in the vicinity of the affected garage structure is below 4 mm/s. Note that there were events that resulted in an instantaneous vibration level of above 4 mm/s which are justified in Table 3-1.

4 Conclusion

Renzo Tonin & Associates completed vibration monitoring for the Station Upgrades works. The results of the unattended vibration measurements were typically below the established vibration criteria presented in the Hurlstone Park Station Vibration Monitoring Plan prepared for the works. There were events that resulted in an instantaneous vibration level of above 4 mm/s. The cause of each event is outlined in Table 3-1.

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
08.12.2021	First Issue	0	1	R. Zhafranata	T. Gowen	T. Gowen

File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\18 November Hurlstone Park Stn Vibration Monitoring\TL927-1-18F01 Hurlstone Park Station Vibration Monitoring Report (r1).docx

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

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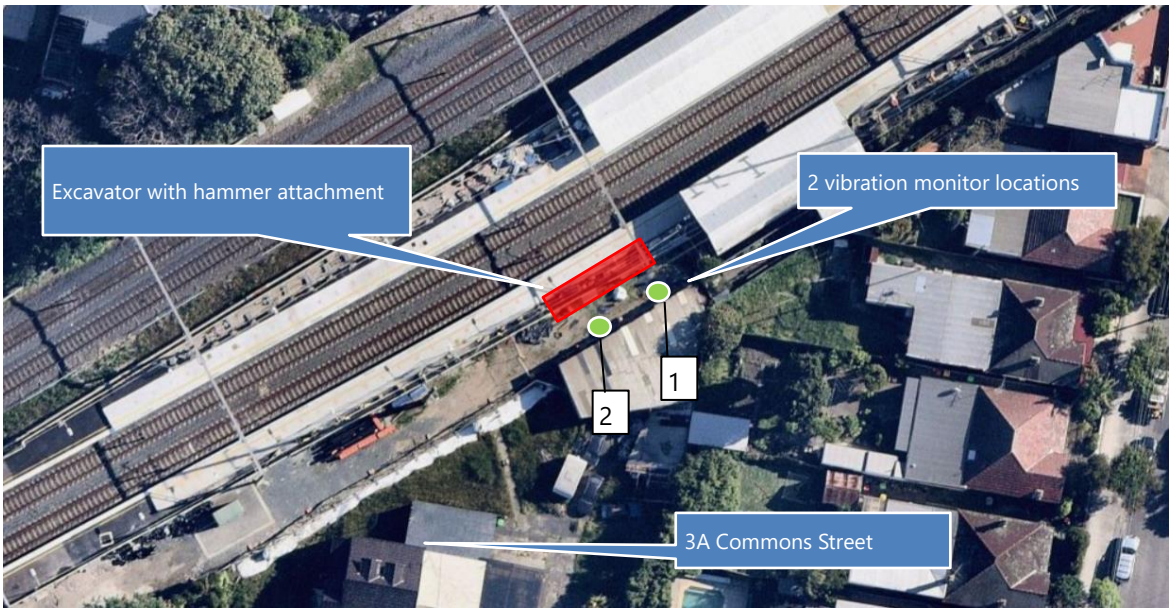
APPENDIX A Measurement locations

A.1 Hurlstone Park Station (Vibration)



Appendix 6 – TL927-1-19F01 WE25 Noise and Vibration Monitoring Report (r2)

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23 December 2021
TL927-1-19F01 WE25 Noise and Vibration Monitoring Report (r2)

Downer EDI Works Pty Ltd
76 Berry Street
Nth Sydney NSW 2060

Sydney Metro Southwest - Station Upgrades - WE25 Possession Works

1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct noise and vibration monitoring during the Station Upgrades WE25 possession works for Sydney Metro Southwest. The noise monitoring was undertaken to verify predicted noise levels in the corresponding Gatewave model (Gatewave scenario ID: 2973 for high impact activities and Gatewave scenario ID: 2971 for typical activities). The vibration monitoring was undertaken to establish site specific minimum working distances for vibration intensive plant and monitor potentially affected structures. This report provides a summary of the monitoring results.

2 Details of monitoring

Noise monitoring was undertaken at Hurlstone Park, Dulwich Hill, Campsie, Punchbowl and Wiley Park Station on 18th December 2021. Attended vibration monitoring was undertaken at Hurlstone Park and Campsie Station on 18th December 2021. Two unattended vibration monitors were installed at the neighbouring garage structure at 3A Commons Street, Hurlstone Park between 7:30am 18th December and 4:00pm 19th December 2021.

2.1 Measurement location

The noise measurements were conducted at the worst affected residential receiver, relative to the measured works. The attended vibration monitoring was conducted at Campsie Station during rockhammering and core drilling works. The attended vibration monitoring was also conducted at Hurlstone Park Station during asphalt excavation activity on the station platform. The measurement locations are listed in Table 2-1. Figures depicting the monitoring locations are included in APPENDIX A.

Table 2-1: Measurement locations

Measurement ID	Assessment Point	Date and time	Measured plant	Monitoring type	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
M1	105 Duntroon Street, Hurlstone Park (Appendix A.1)	18.12.2021 08:17am - 08:31am	Two 4T excavator with bucket attachment and two hi-rail Moxy trucks, handheld cutter	Noise	35m	No
M2	3A Commons Street, Hurlstone Park (Appendix A.2)	18.12.2021 08:36am - 08:52am	Two 4T excavator with bucket attachment and two hi-rail Moxy trucks, handheld cutter	Noise	45m	No
M3	57A Ewart Lane, Dulwich Hill (Appendix A.3)	18.12.2021 09:43am - 09:59am	Handheld drill, vacuum truck, concrete saw and 5T excavator with hammer attachment	Noise	35m	No
M4	59 Ewart Street, Dulwich Hill (Appendix A.3)	18.12.2021 10:00am - 10:15am	Handheld drill, vacuum truck, concrete saw and 5T excavator with hammer attachment	Noise	40m	No
M5	13-15 Anglo Road, Campsie (Appendix A.4)	18.12.2021 11:30am - 11:45am	Vacuum truck and 7T excavator with bucket attachment	Noise	80-95m	No
M6	3 Wilfred Avenue, Campsie (Appendix A.4)	18.12.2021 11:55am - 12:10pm	Vacuum truck and 7T excavator with bucket attachment	Noise	60-65m	No
M7	41 Urunga Parade, Punchbowl (Appendix A.5)	18.12.2021 02:04pm - 02:20pm	4T excavator with hammer attachment, vacuum truck and handheld cutter	Noise	100-110m	No
M8	228 The Boulevarde, Punchbowl (Appendix A.5)	18.12.2021 02:37pm - 02:52pm	Handheld jackhammer, 4T excavator with hammer attachment and 4T excavator with bucket attachment	Noise	45-50m	No
M9	3 Shadforth Street, Wiley Park (Appendix A.6)	18.12.2021 03:09pm - 03:24pm	Pressure washer	Noise	15m	No
M10	Hurlstone Park Station (Appendix A.8)	18.12.2021 09:04am - 09:10am	4T Excavator with bucket attachment	Vibration	1m	N/A
M11	Campsie Station (Appendix A.7)	18.12.2021 01:08pm - 01:20pm	7T Excavator with hammer attachment	Vibration	2.5m and 5.5m	N/A

Measurement ID	Assessment Point	Date and time	Measured plant	Monitoring type	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
M12	Campsie Station (Appendix A.7)	18.12.2021 03:54pm - 04:10pm	Core drill	Vibration	6m	N/A
M13	Neighbouring garage structure at 3A Commons Street, Hurlstone Park (Appendix A.8)	18.12.2021 - 19.12.2021 07:30am - 04:00pm	Excavator with bucket attachment and excavator with hammer attachment	Vibration	5m	N/A

2.2 Measurement equipment

Noise measurement equipment consisted of one NTi Audio XL2 Type 1 sound level meter and microphone calibrator. The microphone was checked prior and after measurements using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed. All instrumentation complies with AS IEC 61672.1 2004 '*Electroacoustics - Sound Level Meters*' and carries current NATA certification (or if less than 2 years old, manufacturers certification).

Table 2-2 summarises the details of noise measurement equipment.

Table 2-2: Summary of noise measurement equipment

Instrument	Make	Model	Serial Number	Last Calibrated
Type 1 Sound Level Meter (XL2-B)	NTi	XL2	A2A-16217-E0	13 August 2021
Type 1 Sound Level Meter Calibrator	B&K	Type 4231	3009707	2 December 2020

The instrumentation used for the vibration measurement are summarised in Table 2-3. The accelerometers used in the measurements have current calibration certificates.

Table 2-3: Summary of vibration instrumentation

Type	Make / Model
Triaxial Transducers	Sigicom C12 (SN: 70250)
Triaxial Transducers	Sigicom C22 (SN: 102479)
Accelerometer	Endevco 61C13
Type 1 Signal Analyser	Soundbook-1

2.3 Environmental conditions

Environmental conditions recorded during the measurements are provided in Table 2-4. Environmental conditions did not have an adverse effect on the measured noise and vibration levels.

Table 2-4: Environmental conditions

Measurement ID	Assessment Point	Date and Start Time	Environmental Conditions
M1	103 Duntroon Street, Hurlstone Park	18.12.2021 08:17am	Clear sky; air temperature 19°C, wind speed <5 m/s; relative humidity 51%.
M2	3A Commons Street, Hurlstone Park	18.12.2021 08:36am	Clear sky; air temperature 20°C, wind speed <5 m/s; relative humidity 51%.
M3	57a Ewart Lane, Dulwich Hill	18.12.2021 09:43am	Clear sky; air temperature 24°C, wind speed <5 m/s; relative humidity 51%.
M4	59 Ewart Street, Dulwich Hill	18.12.2021 10:00am	Clear sky; air temperature 25°C, wind speed <5 m/s; relative humidity 51%.
M5	11 Anglo Road, Campsie	18.12.2021 11:30am	Clear sky; air temperature 27°C, wind speed <5 m/s; relative humidity 48%.
M6	3 Wilfred Avenue, Campsie	18.12.2021 11:55am	Clear sky; air temperature 27°C, wind speed <5 m/s; relative humidity 48%.
M7	41 Urunga Parade, Punchbowl	18.12.2021 02:04pm	Clear sky; air temperature 30°C, wind speed <5 m/s; relative humidity 48%.
M8	228 The Boulevarde, Punchbowl	18.12.2021 02:37pm	Clear sky; air temperature 31°C, wind speed <5 m/s; relative humidity 48%.
M9	3 Shadforth Street, Wiley Park	18.12.2021 03:09pm	Clear sky; air temperature 32°C, wind speed <5 m/s; relative humidity 48%.

3 Noise Monitoring results

The results of the noise monitoring are presented in Table 3-1 below.

Table 3-1: Measured noise levels $L_{Aeq(15min)}$

Measurement ID	Assessment Point	Prediction assumption (plant and equipment)	Predicted noise level dB(A)	Measured plant	Measured noise level dB(A)		Above predicted noise level?	Comments
					$L_{Aeq(15min)}$	L_{Amax}		
M1	105 Duntroon Street, Hurlstone Park	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	82[T]	Two 4T excavator with bucket attachment, two hi-rail Moxy trucks and handheld cutter	69	77	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the majority of the works were occurring on the western side of the platform at a lower ground level compared to monitoring location. As a result, the works were mostly shielded at this monitoring location. Furthermore, only two 4T excavator with bucket attachment, two hi-rail Moxy trucks and a handheld cutter were operating intermittently during this measurement. In the prediction model, the distance between the work area and the receiver is approximately 3 metres. The measured works were approximately 35m away from the monitoring location. These factors contribute to the measured noise level from the works being less noisy than the predicted noise level.
M2	3A Commons Street, Hurlstone Park	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	80[T]	Two 4T excavator with bucket attachment, two hi-rail Moxy trucks and handheld cutter	63	83	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted level. Factors contributing to this include the intermittent nature of the works during the measurement and less noisy plant operating during this measurement compared to the prediction assumptions. Furthermore, the measured works were approximately 45m away from the monitoring location, which is further than in the prediction model, where the distance between the closest typical impact work area and the most affected facade is approximately 10 metres.
M3	57A Ewart Lane, Dulwich Hill	Concrete saw, 5T excavators with hammer attachment, jackhammer, excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	77[H]	Handheld drill, vacuum truck, concrete saw and 5T excavator with hammer attachment	73*	98	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the measured construction activity was approximately 35 metres away from the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 20 metres.
M4	59 Ewart Street, Dulwich Hill	Concrete saw, 5T excavators with hammer attachment, jackhammer, excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	74[H]	Handheld drill, vacuum truck, concrete saw and 5T excavator with hammer attachment	68*	89	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the rockhammering activity only occurred for approximately 2 minutes of the 15 minute measurement period. Furthermore, the measured construction activity was approximately 40 metres away from the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 25 metres.
M5	13-15 Anglo Road, Campsie	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	74[T]	Vacuum truck and 7T excavator with bucket attachment	61	73	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the measured noise level is significantly lower than the predicted noise level because less noisy plant were operating during this measurement compared to the prediction assumptions. Furthermore, the measured construction activity was approximately 80 to 95 metres away from the measurement location. In the prediction model, the distance between the closest typical work area and the most affected facade is approximately 15 metres.
M6	3 Wilfred Avenue, Campsie	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	69[T]	Vacuum truck and 7T excavator with bucket attachment	60	90	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the measured noise level is lower than the predicted noise level because only the vacuum truck and 7T excavator with bucket attachment were operating during this measurement, compared to noisier plant in the prediction assumptions. Furthermore, the measured construction activity was approximately 60 to 65 metres away from the measurement location. In the prediction model, the distance between the closest typical work area and the most affected facade is approximately 25 metres.
M7	41 Urunga Parade, Punchbowl	Concrete saw, 5T excavators with hammer attachment, jackhammer, excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	72[H]	4T excavator with hammer attachment, vacuum truck and handheld cutter	61*	81	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the measured noise level is significantly lower than the predicted noise level because only the 4T excavator with hammer attachment, vacuum truck and handheld cutter were operating during this measurement, compared to noisier plant in the prediction assumptions. Furthermore, the measured construction activity was approximately 100 to 110 metres away from the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 80 metres.
M8	228 The Boulevarde, Punchbowl	Concrete saw, 5T excavators with hammer attachment, jackhammer, excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	70[H]	Handheld jackhammer, 4T excavator with hammer attachment and 4T excavator with bucket attachment	75*	84	Yes ($L_{Aeq, 15min}$)	The measurement location is a commercial receiver. The measured $L_{Aeq, 15min}$ is higher than the predicted noise level, after applying the 5 dB(A) penalty. Note that this monitoring location was heavily affected by the constant road traffic along The Boulevarde throughout the measurement. It was not possible to measure the construction activity in the absence of traffic noise.
M9	3 Shadforth Street, Wiley Park	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	79[T]	Pressure washer	71	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted level. Note that the measured construction activity was approximately 15 metres away from the measurement location. In the prediction model, the distance between the closest typical impact work area and the most affected facade is approximately 10 metres.

Notes:
*: 5dB(A) penalty applied for hammering works.
T: Predicted $L_{Aeq, 15min}$ for Typical activities
H: Predicted $L_{Aeq, 15min}$ for High impact activities

4 Vibration Monitoring results

4.1 Attended vibration monitoring and minimum working distance

The established vibration criteria for cosmetic damage in the Construction Noise & Vibration – OOHW Assessment Stage 2 Possession Works (CNV-OOHWA)[1] is as follows:

- Reinforced or frame structures: 25.0 mm/s
- Unreinforced or light framed structures: 7.5 mm/s
- Heritage structures: 2.5 mm/s

The results of the vibration monitoring are presented in Table 4-1.

Table 4-1: Measured vibration levels

Measurement ID	Assessment point	Plant	Distance from source	95th percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
M10	Hurlstone Park Station	4T excavator with bucket attachment	1m	0.90	0.95	At a distance of 1 metre away, the 4T excavator with bucket attachment produced vibration levels that are below the established vibration screening criteria.
M11	Campsie Station	7T excavator with hammer attachment	5.5m	0.60	0.58	At a distance of 5.5 metres away, the 7T excavator with hammer attachment produced vibration levels that are below the established vibration screening criteria. Vibration monitor was attached on the nearest affected structure.
		7T excavator with hammer attachment	2.5m	1.60	1.53	At a distance of 2.5 metres away, the 7T excavator with hammer attachment produced vibration levels that are below the established vibration screening criteria. Vibration monitor was attached on the nearest affected structure.
M12	Campsie Station	Core drilling	6m	0.13	0.16	At a distance of 6 metres away, the core drilling activity produced vibration levels that are below the established vibration screening criteria.

It can be seen from Table 4-1 that the measured vibration levels were below the established criteria for heritage, reinforced or unreinforced structures. As a result, the risk of cosmetic damage from the measured plant items are considered to be low.

[1] TL927-1-02F01 CNV_OOHWA WE42 Possession April 2021 (r4), dated: 06 April 2021

4.2 Neighbouring garage structure at 3A Commons Street Vibration Monitoring

In accordance with the Hurlstone Park Station Vibration Monitoring Plan[2], the established vibration limits for the affected garage structure are shown below:

- Greater than or equal to 4 mm/s (cosmetic damage is possible);
- Greater than or equal to 8 mm/s (cosmetic damage becoming more likely).

The results of the unattended vibration measurements for the neighbouring garage structure at 3A Commons Street are presented in Figure 4-1 and Figure 4-2.

Figure 4-1: Unattended vibration monitoring location 1 results (refer to Appendix A.8)

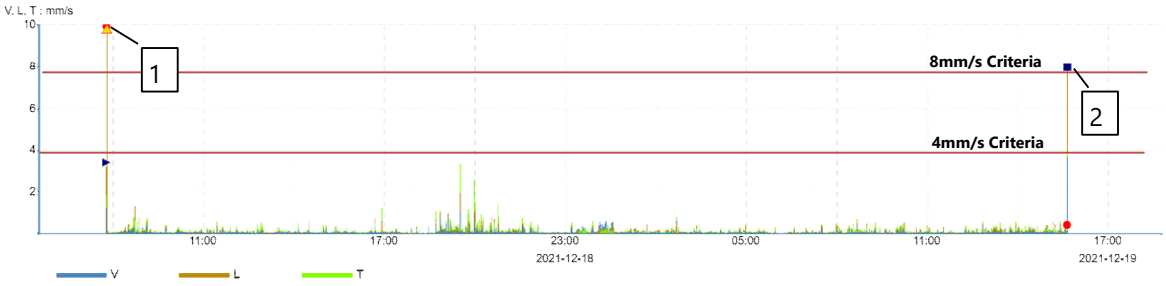
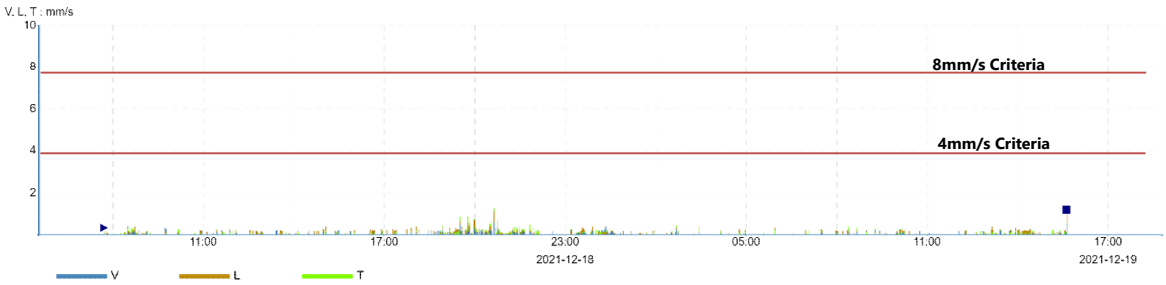


Figure 4-2: Unattended vibration monitoring location 2 results (refer to Appendix A.8)



[2] Sydney Metro Southwest – Station Upgrades – Hurlstone Park Station Vibration Monitoring Plan (ref: TL927-1-14F01 Hurlstone Park Stn VIB MON PLAN (r2)), dated 14 October 2021

The discussion of the unattended vibration measurements is summarised in Table 4-2 below.

Table 4-2: Unattended vibration monitoring summary

Exceedance ID	Date and Time	Cause of exceedance
1	18.12.2021 07:47am	At this time, the vibration monitor was mounted on the ground spike to commence monitoring. Exceedance was not caused by the nearby construction activities.
2	19.12.2021 03:41pm	At this time, the vibration monitor was removed from the ground spike to complete the monitoring. Exceedance was not caused by the nearby construction activities.

It can be seen in Figure 4-1 and Figure 4-2 that the vibration levels produced from the vibration intensive works in the vicinity of the affected garage structure is below 4 mm/s. Note that there were events that resulted in an instantaneous vibration level of above 4 mm/s, however these were not caused by the nearby construction activities, as justified in Table 4-2.

5 Conclusion

Renzo Tonin & Associates completed noise and vibration monitoring for the WE25 possession works. The results of the noise measurements were below the predicted $L_{Aeq\ 15minutes}$ levels presented in the Gatewave model prepared for the works.

Based on the attended vibration measurement at Hurlstone Park and Campsie Station, the measured vibration levels were below the established vibration criteria for heritage, reinforced or unreinforced structures.

The results of the unattended vibration measurements were typically below the established vibration criteria presented in the Hurlstone Park Station Vibration Monitoring Plan prepared for the works. There were events that resulted in an instantaneous vibration level of above 4 mm/s. The cause of each event was not related to construction activity, as outlined in Table 4-2.

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
23.12.2021	First Issue	0, 1	2	J. Liang/ R. Zhafranata	M. Tabacchi/ T. Gowen	T. Gowen

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We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

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APPENDIX A Measurement locations

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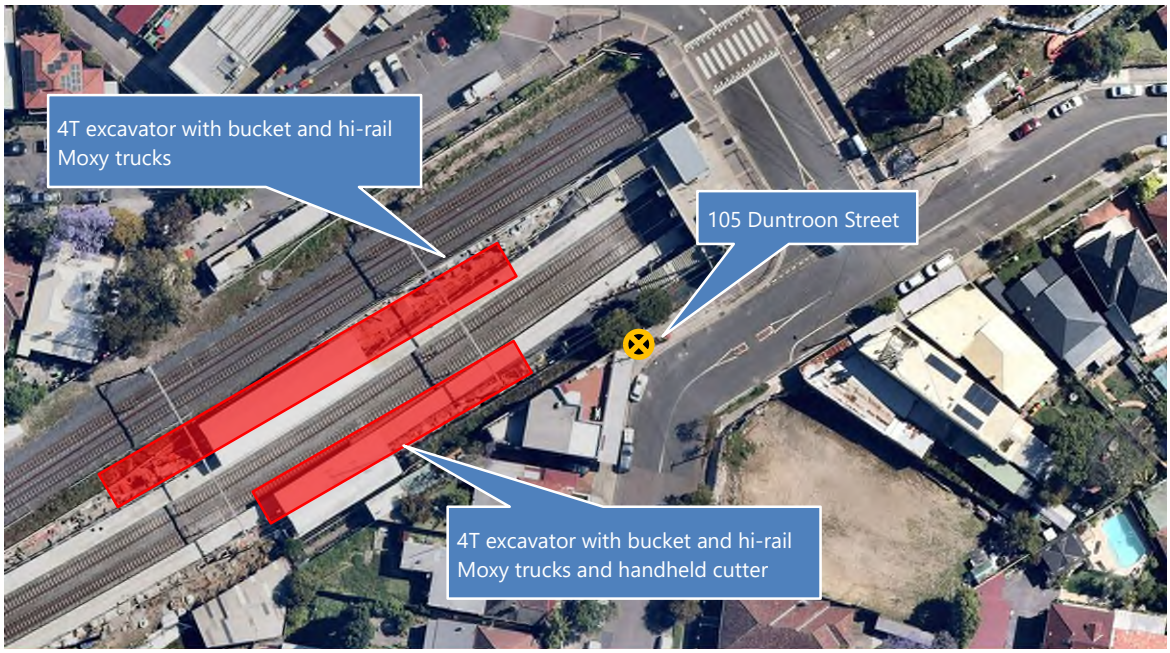
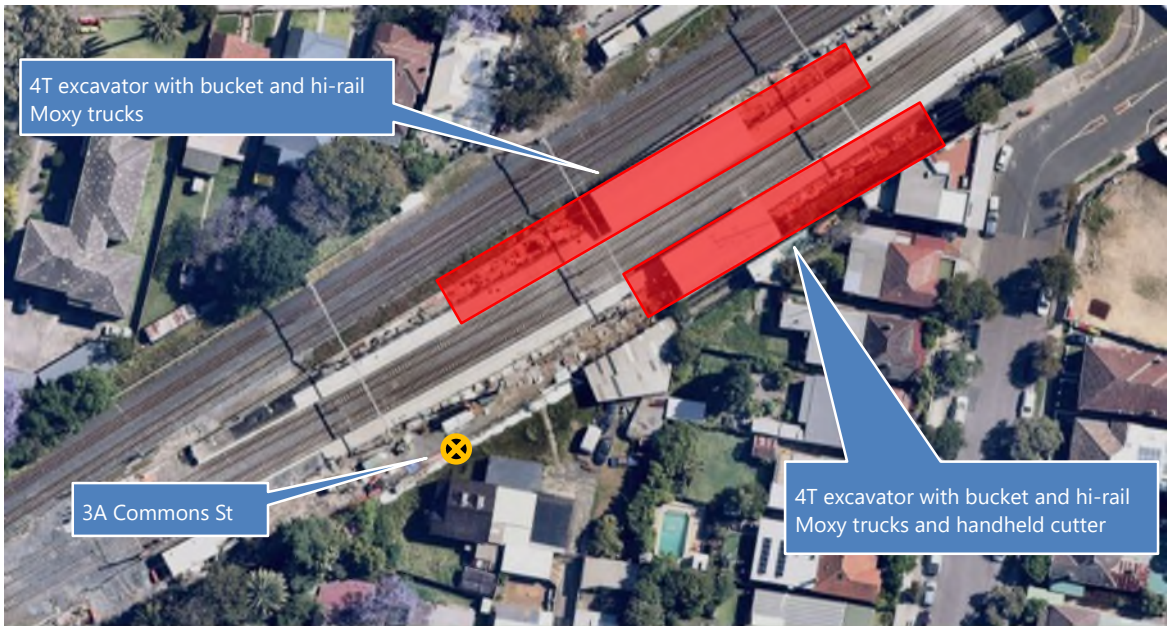
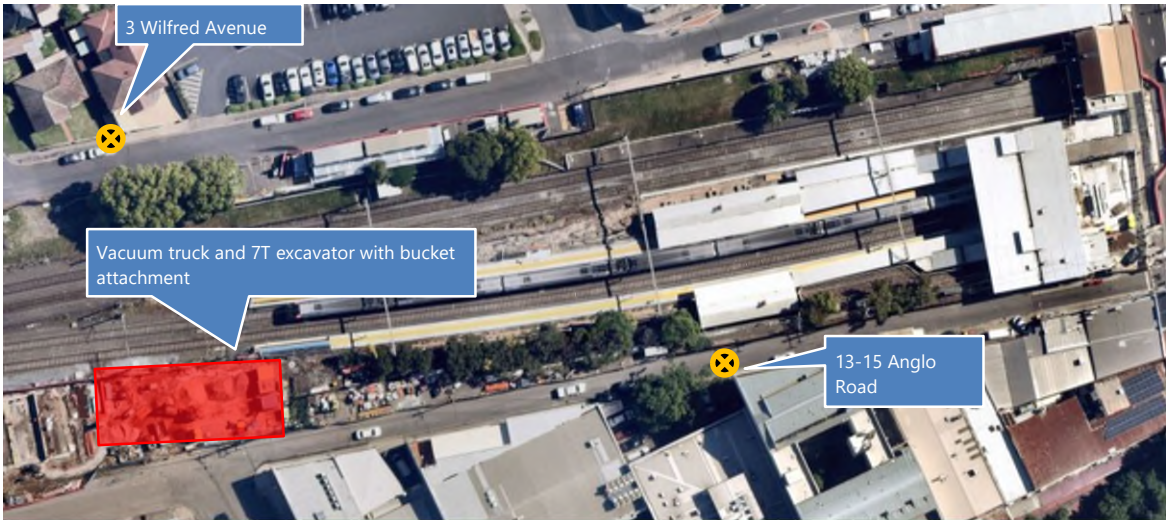


A.2 3A Commons Street, Hurlstone Park



A.3 57A Ewart Lane and 59 Ewart Street, Dulwich Hill

A.4 13-15 Anglo Road and 3 Wilfred Avenue, Campise

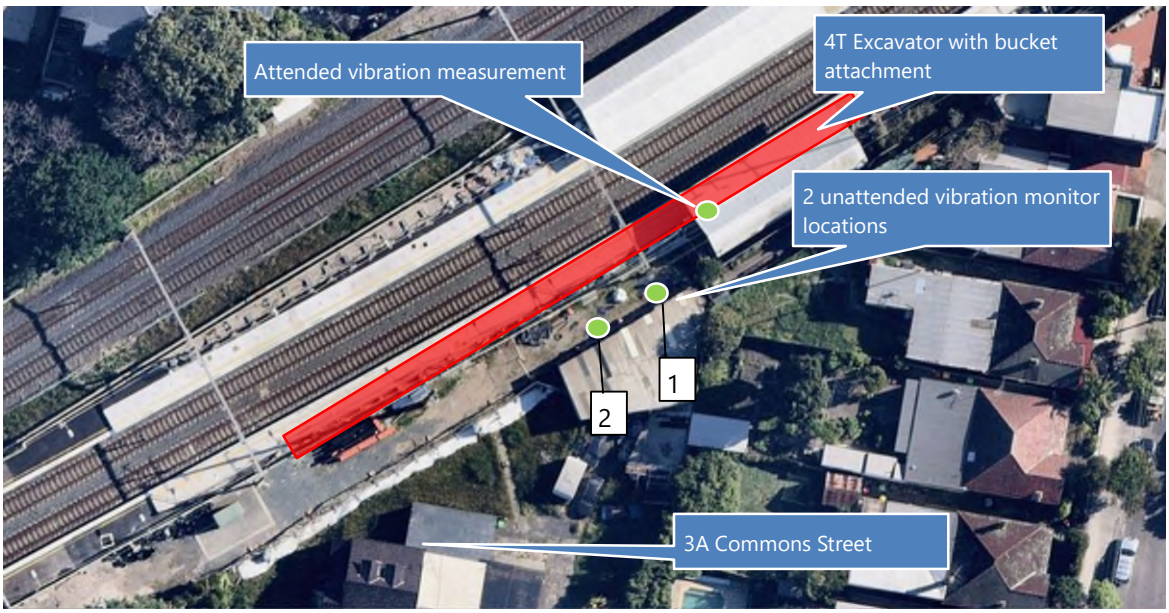


A.5 41 Urunga Parade and 228 The Boulevarde, Punchbowl

A.6 3 Shadforth Street, Wiley Park

A.7 Campsie Station (Vibration)

A.8 Hurlstone Park Station (Vibration)



Appendix 7 – TL927-1-20F01 Shutdown 2 Noise and Vibration Monitoring Report (r2)

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18 May 2022
TL927-1-20F01 Shutdown 2 Noise and Vibration Monitoring Report (r2)

Downer EDI Works Pty Ltd
76 Berry Street
Nth Sydney NSW 2060

Sydney Metro Southwest - Station Upgrades - Shutdown 2 Possession Works

1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct noise and vibration monitoring during the Station Upgrades Shutdown 2 possession works for Sydney Metro Southwest. The noise monitoring was undertaken to verify predicted noise levels in the corresponding Gatewave model (Gatewave scenario ID: 2973 for high impact activities and Gatewave scenario ID: 2971 and 3008 for typical activities). The vibration monitoring was undertaken to monitor potentially affected structures. This report provides a summary of the monitoring results.

2 Details of monitoring

Noise monitoring was undertaken at Belmore, Campsie, Dulwich Hill, Punchbowl and Wiley Park Station between 26th December 2021 and 30th December 2021. Note that no construction works were occurring at Hurlstone Park Station during the evening ang night period between 26th December 2021 and 30th December 2021.

Two unattended vibration monitors were installed at the neighbouring garage structure at 3A Commons Street, Hurlstone Park between 08:00am 26th December and 03:00pm 9th January 2022. One unattended vibration monitor was installed inside the station building on platform 1 at Hurlstone Park Station between 01:00pm 2nd January 2022 and 03:00pm 9th January 2022.

2.1 Measurement location

The noise measurements were conducted at the worst affected residential receiver, relative to the measured works. The measurement locations are listed in Table 2-1. Figures depicting the monitoring locations are included in APPENDIX A.

Table 2-1: Measurement locations

Measurement ID	Assessment Point	Date and time	Measured plant	Monitoring type	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
M1	13-15 Anglo Road, Campsie (Appendix A.2)	26.12.2021 09:11pm – 09:26pm	Two multi-crane hi-rail vehicles, hand tools including cutters and hammering	Noise	25m	No
M2	35 North Parade, Campsie (Appendix A.2)	26.12.2021 09:15pm – 09:30pm	3T excavator with hammer attachment	Noise	90m	No
M3	1 Acacia Street, Belmore (Appendix A.3)	26.12.2021 09:56pm – 10:04pm	Pressure washer	Noise	40m	No
M4	41 Urunga Parade, Punchbowl (Appendix A.4)	26.12.2021 11:14pm – 11:29pm	5T excavator with bucket attachment, lighting towers. Distant 8t excavator with bucket attachment and dump truck	Noise	25m	No
M5	14 Arthur Street, Punchbowl (Appendix A.4)	26.12.2021 11:17pm – 11:32pm	No construction noise was audible at this monitoring location	Noise	90m	No
M6	1-3 Shadforth Street, Wiley Park (Appendix A.5)	26.12.2021 11:50pm – 11:54pm	2 x 22.5t excavator with bucket attachment, lighting towers, hand tools	Noise	22m	No
M7	1-3 Shadforth Street, Wiley Park (Appendix A.5)	27.12.2021 08:03pm – 08:18pm	Concrete saw, hi-rail excavators and lighting tower	Noise	20m-65m	No
M8	1 Bedford Crescent, Dulwich Hill (Appendix A.1)	28.12.2021 08:14pm – 8:29pm	Handtools (grinder and hammer), hi-rail multi-crane vehicle, 13T excavator with crane attachment	Noise	50m	Some lighting towers were fitted with noise blankets
M9	51 Ewart Lane, Dulwich Hill (Appendix A.1)	28.12.2021 08:28pm – 08:43pm	Concrete saw, 8T excavator with crane attachment, hi-rail multi-crane vehicle, 13T excavator with crane attachment, lighting towers	Noise	30m	Some lighting towers were fitted with noise blankets
M10	1 Acacia Street, Belmore (Appendix A.3)	28.12.2021 09:29pm – 09:45pm	Handheld jackhammer, light tower, concrete saw, handheld power tools	Noise	65m	No

Measurement ID	Assessment Point	Date and time	Measured plant	Monitoring type	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
M11	30 Redman Parade, Belmore (Appendix A.3)	28.12.2021 09:35pm – 09:50pm	Handheld jackhammer and handheld grinder	Noise	65m	No
M12	5 London Street, Campsie (Appendix A.2)	28.12.2021 10:25pm – 10:40pm	Concrete truck, jumping jack compactor, hand tools	Noise	65m	No
M13	1-3 Shadforth Street, Wiley Park (Appendix A.5)	28.12.2021 11:09pm – 11:25pm	22.5T excavator with crane attachment, light towers, two 5T excavators with bucket attachment, hi-rail dump truck vehicles, bobcat, rattlegun, hand tools	Noise	20m	No
M14	2 Shadforth Street, Wiley Park (Appendix A.5)	28.12.2021 11:10pm – 11:25pm	22.5T excavator with crane attachment, shovel	Noise	40m	No
M15	41 Urunga Parade, Punchbowl (Appendix A.4)	28.12.2021 11:44pm – 11:59pm	Rattlegun, handheld power tools, hi-rail multi-crane vehicle, light towers	Noise	20m	No
M16	14 Arthur Street, Punchbowl (Appendix A.4)	28.12.2021 11:48pm – 12:03am	Lighting tower	Noise	90m	No
M17	14 Arthur Street, Punchbowl (Appendix A.4)	29.12.2021 08:10pm – 08:25pm	Handheld grinder	Noise	90m	No
M18	41 Urunga Parade, Punchbowl (Appendix A.4)	29.12.2021 08:17pm – 08:32pm	Lighting towers, hi-rail 8T excavator with crane attachment	Noise	30m	No
M19	2 Shadforth Street, Wiley Park (Appendix A.5)	29.12.2021 08:50pm – 09:05pm	22.5T excavator with crane attachment, concrete saw, rattle gun	Noise	25m	No
M20	1-3 Shadforth Street, Wiley Park (Appendix A.5)	29.12.2021 08:55pm – 09:10pm	22.5T excavator with crane attachment, 8T excavator with auger attachment, hand grinders, hand tools	Noise	20m	No
M21	13-15 Anglo Road, Campsie (Appendix A.2)	29.12.2021 09:45pm – 10:00pm	Concrete agitator, and concrete pump truck	Noise	10m	No

Measurement ID	Assessment Point	Date and time	Measured plant	Monitoring type	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
M22	5 London Street, Campsie (Appendix A.2)	29.12.2021 09:54pm – 10:10pm	Concrete agitator and concrete pump truck, hand grinder	Noise	60m	No
M23	30 Redman Parade, Belmore (Appendix A.3)	29.12.2021 10:24pm – 10:39pm	Excavator with quackers alarm	Noise	85m	No
M24	1 Acacia Street, Belmore (Appendix A.3)	29.12.2021 10:30pm – 10:46pm	Hand tools including hand grinder and power drills	Noise	40m	No
M25	1 Bedford Crescent, Dulwich Hill (Appendix A.1)	29.12.2021 11:11pm – 11:26pm	Handheld jackhammer and lighting tower	Noise	50m	Yes
M26	51 Ewart Lane, Dulwich Hill (Appendix A.1)	29.12.2021 11:20pm – 11:36pm	Generators, lighting towers, cement mixers, 1.75T excavator with hammer attachment	Noise	20m	Some lighting towers were surrounded by noise blankets
M27	1 Bedford Crescent, Dulwich Hill (Appendix A.1)	30.12.2021 08:03pm – 08:18pm	Concrete agitator and concrete pump truck	Noise	80m	Some lighting towers were fitted with noise blankets
M28	51 Ewart Lane, Dulwich Hill (Appendix A.1)	30.12.2021 08:07pm – 08:22pm	Cement agitator, handheld cement vibrator, light towers	Noise	20m	Some lighting towers were fitted with noise blankets
M29	5 London Street, Campsie (Appendix A.2)	30.12.2021 08:56pm – 09:11pm	Concrete agitator and concrete pump truck, handheld power drill, 8T excavator with bucket attachment	Noise	60m	No
M30	13-15 Anglo Road, Campsie (Appendix A.2)	30.12.2021 09:00pm – 09:15pm	Concrete pump truck, plate compactor, hand tools including rattle gun and hammer	Noise	20m	No
M31	30 Redman Parade, Belmore (Appendix A.3)	30.12.2021 09:39pm – 09:54pm	Plate compactor and handheld electric jackhammer	Noise	65m	No
M32	1 Acacia Street, Belmore (Appendix A.3)	30.12.2021 09:41pm – 09:56pm	Handheld electric jackhammer, handheld power tools including grinder and drill, 15T excavator with bucket attachment	Noise	40m	No

Measurement ID	Assessment Point	Date and time	Measured plant	Monitoring type	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
M33	2 Shadforth Street, Wiley Park (Appendix A.5)	30.12.2021 10:19pm – 10:34pm	Hand tools including rattle gun and hammer	Noise	30m	No
M34	1-3 Shadforth Street, Wiley Park (Appendix A.5)	30.12.2021 10:21pm – 10:36pm	5T excavator with auger attachment, hand power tools including power drill, handheld grinder	Noise	20m	No
M35	41 Urunga Parade, Punchbowl (Appendix A.4)	30.12.2021 10:54pm – 11:09pm	Light towers, 5.5T excavator with bucket attachment, 8T excavator with bucket attachment	Noise	20m	No
M36	14 Arthur Street, Punchbowl (Appendix A.4)	30.12.2021 10:56pm – 11:11pm	No construction noise was audible at this monitoring location	Noise	90m	No
M37	Neighbouring garage structure at 3A Commons Street, Hurlstone Park (Appendix A.6)	26.12.2021 – 09.01.2021 08:00am – 03:00pm	Jackhammer	Vibration	5m	N/A
M38	Station building on platform 1, Hurlstone Park Station (Appendix A.6)	02.01.2022 – 09.01.2022 01:00pm – 03:00pm	Jackhammer	Vibration	1-5m	N/A

2.2 Measurement equipment

Noise measurement equipment consisted of one Nti Audio XL2 Type 1 sound level meter and microphone calibrator. The microphone was checked prior and after measurements using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed. All instrumentation complies with AS IEC 61672.1 2004 '*Electroacoustics – Sound Level Meters*' and carries current NATA certification (or if less than 2 years old, manufacturers certification).

Table 2-2 summarises the details of noise measurement equipment.

Table 2-2: Summary of noise measurement equipment

Instrument	Make	Model	Serial Number	Last Calibrated
Type 1 Sound Level Meter (XL2-B)	Nti	XL2	A2A-16217-E0	13 August 2021
Type 1 Sound Level Meter (XL2-B)	Nti	XL2	A2A-02386-D2	7 July 2021
Type 1 Sound Level Meter Calibrator	B&K	Type 4231	3009707	2 December 2020

The instrumentation used for the vibration measurement are summarised in Table 2-3. The accelerometers used in the measurements have current calibration certificates.

Table 2-3: Summary of vibration instrumentation

Type	Make / Model
Triaxial Transducers	Sigicom C12 (SN: 66830)
Triaxial Transducers	Sigicom C22 (SN: 70250)

2.3 Environmental conditions

Environmental conditions recorded during the measurements are provided in Table 2-4. Environmental conditions did have an adverse effect on some of the measured noise levels. Noise measurements that have been adversely affected by the environmental conditions have been deemed as an invalid measurement (identified in the table below).

Table 2-4: Environmental conditions

Measurement ID	Assessment Point	Date and Start Time	Environmental Conditions
M1	11 Lilian Lane, Campsie	26.12.2021 09:11pm	Overcast; air temperature 21°C, wind speed <5 m/s; relative humidity 81%.
M2	35 North Parade, Campsie	26.12.2021 09:15pm	Overcast; air temperature 21°C, wind speed <5 m/s; relative humidity 81%.
M3	1 Acacia Street, Belmore*	26.12.2021 09:56pm	Overcast; air temperature 20°C, wind speed <5 m/s; relative humidity 80%. Note that it started to rain during this measurement. As a result, the measurement was stopped.
M4	41 Urunga Parade, Punchbowl	26.12.2021 11:14pm	Overcast; air temperature 19°C, wind speed <5 m/s; relative humidity 84%.
M5	14 Arthur Street, Punchbowl	26.12.2021 11:17pm	Overcast; air temperature 21°C, wind speed <5 m/s; relative humidity 84%.
M6	1A Shadforth Street, Wiley Park*	26.12.2021 11:50pm	Overcast; air temperature 19°C, wind speed <5 m/s; relative humidity 84%. Note that it started to rain during this measurement. As a result, the measurement was stopped.
M7	1A Shadforth Street, Wiley Park	27.12.2021 08:03pm	Overcast; air temperature 20°C, wind speed <5 m/s; relative humidity 83%.
M8	1 Bedford Crescent, Dulwich Hill	28.12.2021 08:14pm	Overcast; air temperature 18°C, wind speed <5 m/s; relative humidity 66%.
M9	1 Ewart Lane, Dulwich Hill	28.12.2021 08:28pm	Overcast; air temperature 18°C, wind speed <5 m/s; relative humidity 66%.
M10	30 Redman Parade, Belmore	28.12.2021 09:35pm	Partly cloudy; air temperature 18°C, wind speed <5 m/s; relative humidity 63%.
M11	1 Acacia Street, Belmore	28.12.2021 09:29pm	Partly cloudy; air temperature 18°C, wind speed <5 m/s; relative humidity 63%.
M12	5 London Street, Campsie	28.12.2021 10:25pm	Clear sky; air temperature 18°C, wind speed <5 m/s; relative humidity 65%.
M13	1-3 Shadforth Street, Wiley Park	28.12.2021 11:09pm	Clear sky; air temperature 17°C, wind speed <5 m/s; relative humidity 73%.

Measurement ID	Assessment Point	Date and Start Time	Environmental Conditions
M14	2 Shadforth Street, Wiley Park	28.12.2021 11:10pm	Clear sky; air temperature 17°C, wind speed <5 m/s; relative humidity 73%.
M15	41 Urunga Parade, Punchbowl	28.12.2021 11:44pm	Clear sky; air temperature 17°C, wind speed <5 m/s; relative humidity 70%.
M16	14 Arthur Street, Punchbowl	28.12.2021 11:48pm	Clear sky; air temperature 17°C, wind speed <5 m/s; relative humidity 70%.
M17	14 Arthur Street, Punchbowl	29.12.2021 08:10pm	Clear sky; air temperature 21°C, wind speed <5 m/s; relative humidity 65%.
M18	41 Urunga Parade, Punchbowl	29.12.2021 08:17pm	Clear sky; air temperature 21°C, wind speed <5 m/s; relative humidity 65%.
M19	2 Shadforth Street, Wiley Park	29.12.2021 08:50pm	Clear sky; air temperature 20°C, wind speed <5 m/s; relative humidity 66%.
M20	1-3 Shadforth Street, Wiley Park	29.12.2021 08:55pm	Clear sky; air temperature 20°C, wind speed <5 m/s; relative humidity 66%.
M21	13-15 Anglo Road, Campsie	29.12.2021 09:45pm	Clear sky; air temperature 18°C, wind speed <5 m/s; relative humidity 73%.
M22	5 London Street, Campsie	29.12.2021 09:54pm	Clear sky; air temperature 18°C, wind speed <5 m/s; relative humidity 73%.
M23	30 Redman Parade, Belmore	29.12.2021 10:24pm	Clear sky; air temperature 17°C, wind speed <5 m/s; relative humidity 77%.
M24	1 Acacia Street, Belmore	29.12.2021 10:30pm	Clear sky; air temperature 17°C, wind speed <5 m/s; relative humidity 77%.
M25	1 Bedford Crescent, Dulwich Hill	29.12.2021 11:11pm	Clear sky; air temperature 18°C, wind speed <5 m/s; relative humidity 80%.
M26	51 Ewart Lane, Dulwich Hill	29.12.2021 11:20pm	Clear sky; air temperature 18°C, wind speed <5 m/s; relative humidity 80%.
M27	1 Bedford Crescent, Dulwich Hill	30.12.2021 08:03pm	Clear sky; air temperature 23°C, wind speed <5 m/s; relative humidity 65%.
M28	51 Ewart Lane, Dulwich Hill	30.12.2021 08:07pm	Clear sky; air temperature 23°C, wind speed <5 m/s; relative humidity 65%.
M29	5 London Street, Campsie	30.12.2021 08:56pm	Clear sky; air temperature 22°C, wind speed <5 m/s; relative humidity 69%.
M30	13-15 Anglo Road, Campsie	30.12.2021 09:00pm	Clear sky; air temperature 22°C, wind speed <5 m/s; relative humidity 69%.
M31	30 Redman Parade, Belmore	30.12.2021 09:39pm	Clear sky; air temperature 22°C, wind speed <5 m/s; relative humidity 69%.
M32	1 Acacia Street, Belmore	30.12.2021 09:41pm	Clear sky; air temperature 22°C, wind speed <5 m/s; relative humidity 69%.
M33	2 Shadforth Street, Wiley Park	30.12.2021 10:19pm	Clear sky; air temperature 22°C, wind speed <5 m/s; relative humidity 70%.
M34	1-3 Shadforth Street, Wiley Park	30.12.2021 10:21pm	Clear sky; air temperature 22°C, wind speed <5 m/s; relative humidity 70%.

Measurement ID	Assessment Point	Date and Start Time	Environmental Conditions
M35	41 Urunga Parade, Punchbowl	30.12.2021 10:54pm	Clear sky; air temperature 21°C, wind speed <5 m/s; relative humidity 70%.
M36	14 Arthur Street, Punchbowl	30.12.2021 10:56pm	Clear sky; air temperature 21°C, wind speed <5 m/s; relative humidity 70%.

Notes: * This measurement was adversely affected by the environmental conditions and have been deemed as an invalid measurement.

3 Noise Monitoring results

The results of the noise monitoring are presented in Table 3-1 below.

Table 3-1: Measured noise levels $L_{Aeq(15min)}$

Measurement ID	Assessment Point	Prediction assumption (plant and equipment)	Predicted noise level dB(A)	Measured plant	Measured noise level dB(A)		Above predicted noise level?	Comments
					$L_{Aeq(15min)}$	L_{Amax}		
M1	13-15 Anglo Road, Campsie	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	74[T]	Two multi-crane hi-rail vehicles, handheld drills, concrete saw, hammering	60	83	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works occurring were located approximately 25m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Some plant operation and hi-rail movements were partially shielded by the station building.
M2	35 North Parade, Campsie	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	57[T]	3T excavator with hammer attachment	67*	77	Yes ($L_{Aeq, 15min}$)	The Gatewave model was based on typical impact activities, not high impact activities (i.e no rockhammer). The difference between typical and high impact activities sound power level is 10-12dB. The measured level is 10dB above the predicted level. This is consistent with a predicted level for high impact activities including rockhammer.
M3	1 Acacia Street, Belmore	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	65[T]	Pressure washer	N/A	N/A	N/A	Note that during this measurement, it started to rain after 8 minutes into the measurement. As a result, this measurement was adversely affected by the environmental conditions and have been deemed as an invalid measurement.
M4	41 Urunga Parade, Punchbowl	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	65[T]	5T excavator with bucket attachment, lighting towers, Distant 8T excavator with bucket attachment, dump truck	54	72	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. It is noted that the majority of plant operation occurred at the station building approximately 90m away from the measurement location. The background noise level at this location was dominated by generator hum from lighting towers located approximately 25m away from the measurement location. Measured excavator activity at this location occurred near the alignment approximately 50-60m away.
M5	14 Arthur Street, Punchbowl	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	50[T]	No construction noise was audible at this monitoring location	54 (44)[1]	70	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is higher than the predicted noise level. Note that the platform works occurring at Punchbowl Station was not audible at this monitoring location. The measured $L_{Aeq, 15min}$ of 54 dB(A) was solely caused by vehicles movement along The Boulevarde and Arthur Street. Given that the construction noise was not audible at this monitoring location, the contribution from the construction works can be assumed to be 10dB below the measured $L_{Aeq, 15min}$. As a result, the contribution from the construction works can be calculated to be 44 dB(A), which is below the predicted noise level of 50 dB(A). Note that the measured works were shielded and approximately 90 metres away from the measurement location.
M6	1-3 Shadforth Street, Wiley Park	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	79[T]	Two 22.5T excavators with bucket attachment, handheld cutter, lighting towers	N/A	N/A	N/A	Note that during this measurement, it started to rain after 4 minutes into the measurement. As a result, this measurement was adversely affected by the environmental conditions and have been deemed as an invalid measurement.
M7	1-3 Shadforth Street, Wiley Park	Concrete saw, 5T excavators with hammer attachment, jackhammer, excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	81[H]	Concrete saw, hi-rail excavators and lighting tower	69*	75	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the concrete sawing activity was shielded and approximately 65 metres away from the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 10 metres. Note that the concrete sawing activity was intermittent during this measurement.
M8	1 Bedford Crescent, Dulwich Hill	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	75[T]	Handtools (grinder and hammer), hi-rail multi-crane vehicle, 13T excavator with crane attachment	57	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works occurring were located approximately 50m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Some plant operation and hi-rail movements were partially shielded by the station building.
M9	51 Ewart Lane, Dulwich Hill	Concrete saw, 5T excavators with hammer attachment, jackhammer, excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	74[H]	Concrete saw, 8T excavator with crane attachment, hi-rail multi-crane vehicle, 13T excavator with crane attachment, lighting towers	68*	78	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the concrete sawing activity was located approximately 30m away from the measurement location. The background noise level during this measurement was dominated by generator noise from the lighting towers. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the concrete sawing activity was intermittent during this measurement.
M10	1 Acacia Street, Belmore	Concrete saw, 5T excavators with hammer attachment, jackhammer, excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	65[T]	Handheld jackhammer, light tower, concrete saw, handheld power tools	60*	68	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the handheld jackhammering activity was located approximately 65m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that the handheld jackhammering activity was shielded and intermittent during this measurement.

Measurement ID	Assessment Point	Prediction assumption (plant and equipment)	Predicted noise level dB(A)	Measured plant	Measured noise level dB(A)		Above predicted noise level?	Comments
					$L_{Aeq(15min)}$	L_{Amax}		
M11	30 Redman Parade, Belmore	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	63^{T}	Handheld jackhammer and handheld grinder	59*	71	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the handheld jackhammering activity was located approximately 65m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 50 metres. Note that the handheld jackhammering activity was shielded and intermittent during this measurement.
M12	5 London Street, Campsie	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	67^{T}	Concrete truck, jumping jack compactor, hand tools	52	70	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 65m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that the platform works were intermittent during this measurement. The paving works at the corner of Beamish Street and North Parade were occurring during this measurement and was not audible at this monitoring location.
M13	1-3 Shadforth Street, Wiley Park	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	79^{T}	22.5T excavator with crane attachment, light towers, two 5T excavators with bucket attachment, hi-rail dump truck vehicles, bobcat, rattlegun, hand tools	60	72	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 20m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Some plant operation and hi-rail movements were partially shielded by the station building. Note that the platform works were intermittent during this measurement.
M14	2 Shadforth Street, Wiley Park	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	81^{T}	22.5T excavator with crane attachment, shovel	53	65	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 40m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Some plant operation and hi-rail movements were partially shielded by the station building. Note that the platform works were intermittent during this measurement.
M15	41 Urunga Parade, Punchbowl	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	65^{T}	Rattlegun, handheld power tools, hi-rail multi-crane vehicle, lighting towers	53	70	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 20m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 15 metres. Some plant operation and hi-rail movements were partially shielded by the station building. Note that the platform works were intermittent during this measurement.
M16	14 Arthur Street, Punchbowl	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	50^{T}	Lighting tower was barely audible when there was no road traffic along The Boulevarde and Arthur Street	55 (45)[1]	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is higher than the predicted noise level. Note that the platform works occurring at Punchbowl Station was not audible at this monitoring location (a lighting tower was barely audible when there was no road traffic along The Boulevarde and Arthur Street). The measured LAeq, 15min of 55 dB(A) was solely caused by vehicles movement along The Boulevarde and Arthur Street. Given that the construction noise was barely audible at this monitoring location, the contribution from the construction works can be assumed to be 10dB below the measured LAeq, 15min. As a result, the contribution from the construction works can be calculated to be 45 dB(A), which is below the predicted noise level of 50 dB(A). Note that the measured works were shielded and approximately 90 metres away from the measurement location.
M17	14 Arthur Street, Punchbowl	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	50^{T}	Handheld grinder was barely audible when there was no road traffic along The Boulevarde and Arthur Street	56 (46)[1]	85	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is higher than the predicted noise level. Note that the platform works occurring at Punchbowl Station were not audible at this monitoring location (a handheld grinder was barely audible when there was no road traffic along The Boulevarde and Arthur Street). The measured $L_{Aeq, 15min}$ of 56 dB(A) was solely caused by vehicles movement along The Boulevarde and Arthur Street. Given that the construction noise was barely audible at this monitoring location, the contribution from the construction works can be assumed to be 10dB below the measured $L_{Aeq, 15min}$. As a result, the contribution from the construction works can be calculated to be 46 dB(A), which is below the predicted noise level of 50 dB(A). Note that the measured works were shielded and approximately 90 metres away from the measurement location.
M18	41 Urunga Parade, Punchbowl	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	65^{T}	Lighting towers, hi-rail 8T excavator with crane attachment	53	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 30m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 15 metres. Some plant operation and hi-rail movements were partially shielded by the station building. Note that the platform works were intermittent during this measurement.

Measurement ID	Assessment Point	Prediction assumption (plant and equipment)	Predicted noise level dB(A)	Measured plant	Measured noise level dB(A)		Above predicted noise level?	Comments
					$L_{Aeq(15min)}$	L_{Amax}		
M19	2 Shadforth Street, Wiley Park	Concrete saw, 5T excavators with hammer attachment, jackhammer, excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	83[H]	22.5T excavator with crane attachment, concrete saw, rattle gun	65*	73	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the concrete sawing activity was shielded and approximately 25m metres away from the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 10 metres. Note that the concrete sawing activity was intermittent during this measurement.
M20	1-3 Shadforth Street, Wiley Park	Concrete saw, 5T excavators with hammer attachment, jackhammer, excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	81[H]	22.5T excavator with crane attachment, 8T excavator with auger attachment, hand grinders, hand tools, concrete saw	68*	79	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the concrete sawing activity was shielded and approximately 20m metres away from the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 10 metres. Note that the concrete sawing activity was intermittent during this measurement.
M21	13-15 Anglo Road, Campsie	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	74[T]	Concrete agitator and concrete pump truck	73	82	No ($L_{Aeq, 15min}$)	The measured LAeq, 15min is lower than the predicted noise level. Note that the concrete agitator and the concrete pump truck was located directly opposite of 13-15 Anglo Road receiver, approximately 10 metres away from the monitoring location.
M22	5 London Street, Campsie	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	67[T]	Concrete agitator and concrete pump truck, hand grinder	55	75	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 60m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that the platform works were intermittent during this measurement.
M23	30 Redman Parade, Belmore	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	63[T]	Excavator with quackers alarm	54	73	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 85m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 50 metres. Note that the platform works were intermittent during this measurement.
M24	1 Acacia Street, Belmore	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	65[T]	Hand tools including hand grinder and power drills	50	64	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 40m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that the platform works were intermittent during this measurement.
M25	1 Bedford Crescent, Dulwich Hill	Concrete saw, 5T excavators with hammer attachment, jackhammer, excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	76[H]	Handheld jackhammer and lighting tower	60*	73	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the handheld jackhammering works occurring were located approximately 50m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 40 metres. Note that the jackhammering works were shielded and intermittent during this measurement.
M26	51 Ewart Lane, Dulwich Hill	Concrete saw, 5T excavators with hammer attachment, jackhammer, excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	72[T]	Generators, lighting towers, cement mixers, 1.75T excavator with hammer attachment	59	74	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the rockhammering activity was located approximately 20m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the rockhammering was intermittent during this measurement.
M27	1 Bedford Crescent, Dulwich Hill	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	75[T]	Concrete agitator and concrete pump truck	59	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 80m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres.
M28	51 Ewart Lane, Dulwich Hill	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	72[T]	Cement agitator, handheld cement vibrator, light towers	60	77	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 20m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres.

Measurement ID	Assessment Point	Prediction assumption (plant and equipment)	Predicted noise level dB(A)	Measured plant	Measured noise level dB(A)		Above predicted noise level?	Comments
					$L_{Aeq(15min)}$	L_{Amax}		
M29	5 London Street, Campsie	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	67[T]	Concrete agitator and concrete pump truck, handheld power drill, 8T excavator with bucket attachment	53	77	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 60m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that the platform works were intermittent during this measurement.
M30	13-15 Anglo Road, Campsie	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	74[T]	Concrete pump truck, plate compactor, hand tools including rattle gun and hammer	59	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 20m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the platform works were intermittent during this measurement.
M31	30 Redman Parade, Belmore	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	63[T]	Plate compactor and handheld electric jackhammer	59*	73	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the handheld jackhammering activity was located approximately 65m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 50 metres. Note that the handheld jackhammering activity was shielded and intermittent during this measurement.
M32	1 Acacia Street, Belmore	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	65[T]	Handheld electric jackhammer, handheld power tools including grinder and drill, 15T excavator with bucket attachment	58*	73	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the handheld jackhammering activity was located approximately 65m away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that the handheld jackhammering activity was shielded and intermittent during this measurement.
M33	2 Shadforth Street, Wiley Park	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	81[T]	Hand tools including rattle gun and hammer	55	76	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 30m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the platform works was shielded and intermittent during this measurement.
M34	1-3 Shadforth Street, Wiley Park	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	79[T]	5T excavator with auger attachment, hand power tools including power drill, handheld grinder	57	78	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 20m away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the platform works was shielded and intermittent during this measurement.
M35	41 Urunga Parade, Punchbowl	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	65[T]	Light towers, 5.5T excavator with bucket attachment, 8T excavator with bucket attachment	54	74	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 20m away from the measurement location. The background noise level during the measurement was dominated by idle engine noise from the 5.5T excavator with bucket attachment. In the prediction model, the distance between the closest work area and the most affected facade is approximately 15 metres. Note that the platform works was intermittent during this measurement.
M36	14 Arthur Street, Punchbowl	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	50[T]	No construction noise was audible at this monitoring location	57 (47)[1]	82	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the platform works occurring at Punchbowl Station was not audible at this monitoring location. The measured $L_{Aeq, 15min}$ of 57 dB(A) was solely caused by vehicles movement along The Boulevarde and Arthur Street. Given that the construction noise was not audible at this monitoring location, the contribution from the construction works can be assumed to be 10dB below the measured $L_{Aeq, 15min}$. As a result, the contribution from the construction works can be calculated to be 47 dB(A), which is below the predicted noise level of 50 dB(A). Note that the measured works were shielded and approximately 90 metres away from the measurement location.

Notes:

*: 5dB(A) penalty applied for high impact activities.

T: Predicted $L_{Aeq, 15min}$ for Typical activities.

H: Predicted $L_{Aeq, 15min}$ for High impact activities.

1: Calculated $L_{Aeq, 15min}$ contribution from the construction activity, given that the construction noise was not audible or barely audible at the monitoring location.

4 Vibration Monitoring results

4.1 Neighbouring garage structure at 3A Commons Street Vibration Monitoring

In accordance with the Hurlstone Park Station Vibration Monitoring Plan[1], the established vibration limits for the affected garage structure are shown below:

- Greater than or equal to 4 mm/s (cosmetic damage is possible);
- Greater than or equal to 8 mm/s (cosmetic damage becoming more likely).

The results of the unattended vibration measurements for the neighbouring garage structure at 3A Commons Street are presented in Figure 4-1 and Figure 4-2.

Figure 4-1: Unattended vibration monitoring location 1 results (refer to Appendix A.6)

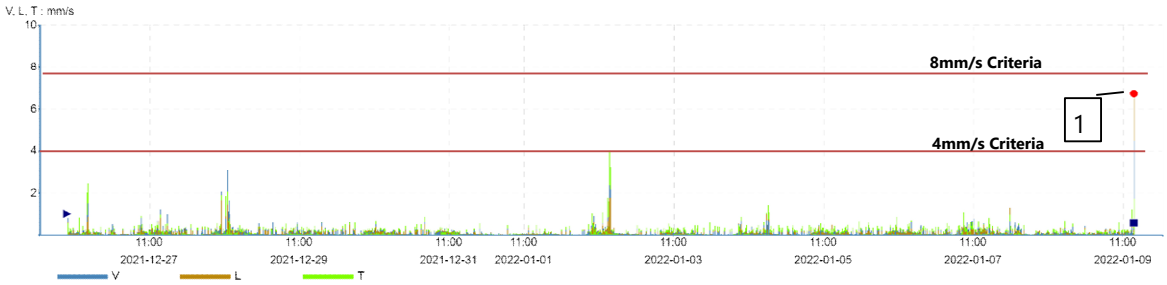
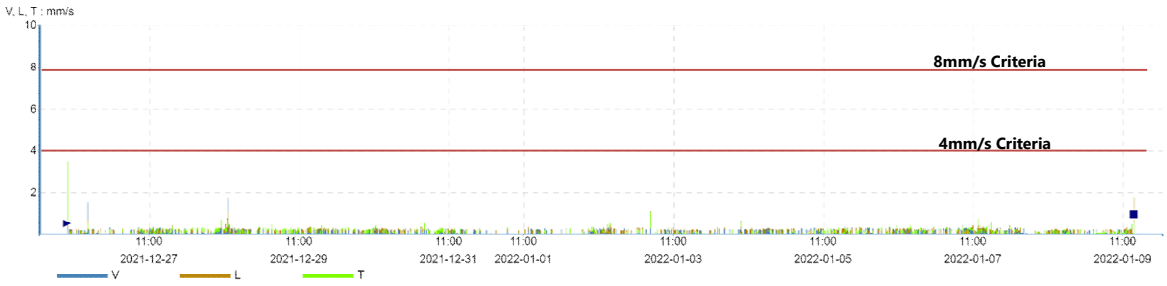


Figure 4-2: Unattended vibration monitoring location 2 results (refer to Appendix A.6)



[1] Sydney Metro Southwest – Station Upgrades – Hurlstone Park Station Vibration Monitoring Plan (ref: TL927-1-14F01 Hurlstone Park Stn VIB MON PLAN (r2)), dated 14 October 2021

The discussion of the unattended vibration measurements is summarised in Table 4-1 below.

Table 4-1: Unattended vibration monitoring summary

Exceedance ID	Date and Time	Cause of exceedance
1	09.01.2022 02:25pm	At this time, the vibration monitor was removed from the ground spike to complete the monitoring. Exceedance was not caused by the nearby construction activities.

It can be seen in Figure 4-1 and Figure 4-2 that the vibration levels produced from the vibration intensive works in the vicinity of the affected garage structure is below 4 mm/s. Note that there was an event that resulted in an instantaneous vibration level of above 4 mm/s, however this event was not caused by the nearby construction activities, as justified in Table 4-1.

4.2 Platform 1 station building at Hurlstone Park Station vibration monitoring

The applicable vibration criteria for cosmetic damage from the Construction Noise & Vibration – OOHW Assessment Stage 2 Possession Works (CNV-OOHWA)[2] is as follow:

- Unreinforced or light framed structures: 7.5 mm/s
- Heritage structures (structurally sound): 7.5mm/s

The results of the unattended vibration monitoring for the station building are presented in Figure 4-3.

Figure 4-3: Unattended vibration monitoring at platform 1 results (refer to Appendix A.6)

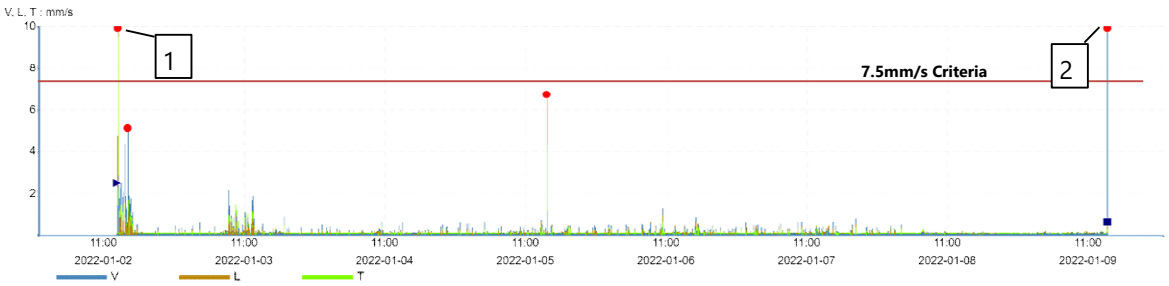


Table 4-2: Unattended vibration monitoring summary

Exceedance ID	Date and Time	Cause of exceedance
1	02.01.2022 01:19pm	At this time, the vibration monitor was mounted inside the station building to commence monitoring. Exceedance was not caused by the nearby construction activities.

[2] TL927-1-02F01 CNV_OOHWA WE42 Possession April 2021 (r4), dated: 06 April 2021

Exceedance ID	Date and Time	Cause of exceedance
2	09.01.2022 02:12pm	At this time, the vibration monitor was removed from the station building to complete the monitoring. Exceedance was not caused by the nearby construction activities.

It can be seen in Figure 4-3 that the vibration levels produced from the jackhammering works in the vicinity of the station building on platform 1 is below 7.5 mm/s. Note that there were events that resulted in an instantaneous vibration level of above 7.5 mm/s, however these were not caused by the nearby construction activities, as justified in Table 4-2.

5 Conclusion

Renzo Tonin & Associates completed noise and vibration monitoring for the Shutdown 2 possession works. The results of the noise measurements were below the predicted $L_{Aeq\ 15minutes}$ levels presented in the Gatewave model prepared for the works, with the exception of the M2 noise measurement. The cause of exceedance has been explained in Table 3-1.

The results of the unattended vibration measurements were typically below the established vibration criteria presented in the Hurlstone Park Station Vibration Monitoring Plan prepared for the works. There were events that resulted in an instantaneous vibration level of above the established vibration criteria. The cause of each event was not related to construction activity, as outlined in Table 4-1 and Table 4-2.

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
10.01.2022	First Issue	0	1	L. Woolf/ R. Zhafranata	M. Tabacchi/ T. Gowen	T. Gowen
18.05.2022	Additional comments added, in relation to temporary noise barrier observations and rectified the prediction assumptions for M2 measurement.	-	2	L. Woolf/ R. Zhafranata	M. Tabacchi/ T. Gowen	T. Gowen

File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\20 December Shutdown 2 possession\TL927-1-20F01 Shutdown 2 Noise and Vibration Monitoring Report (r2).docx

Important Disclaimers:

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This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

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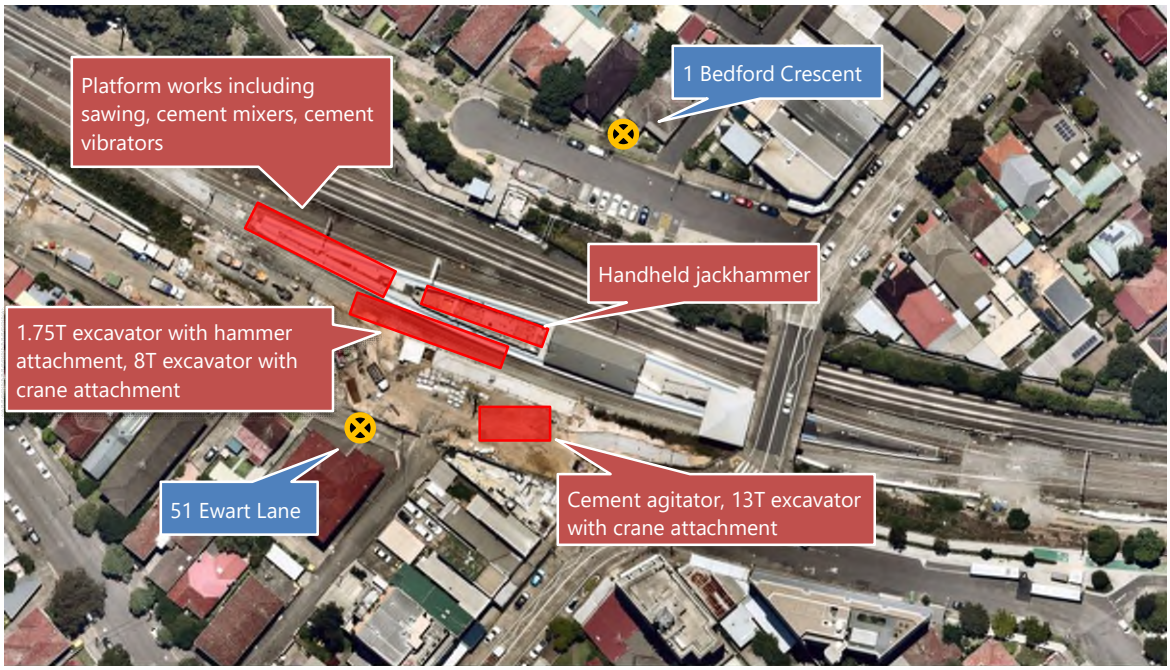
We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

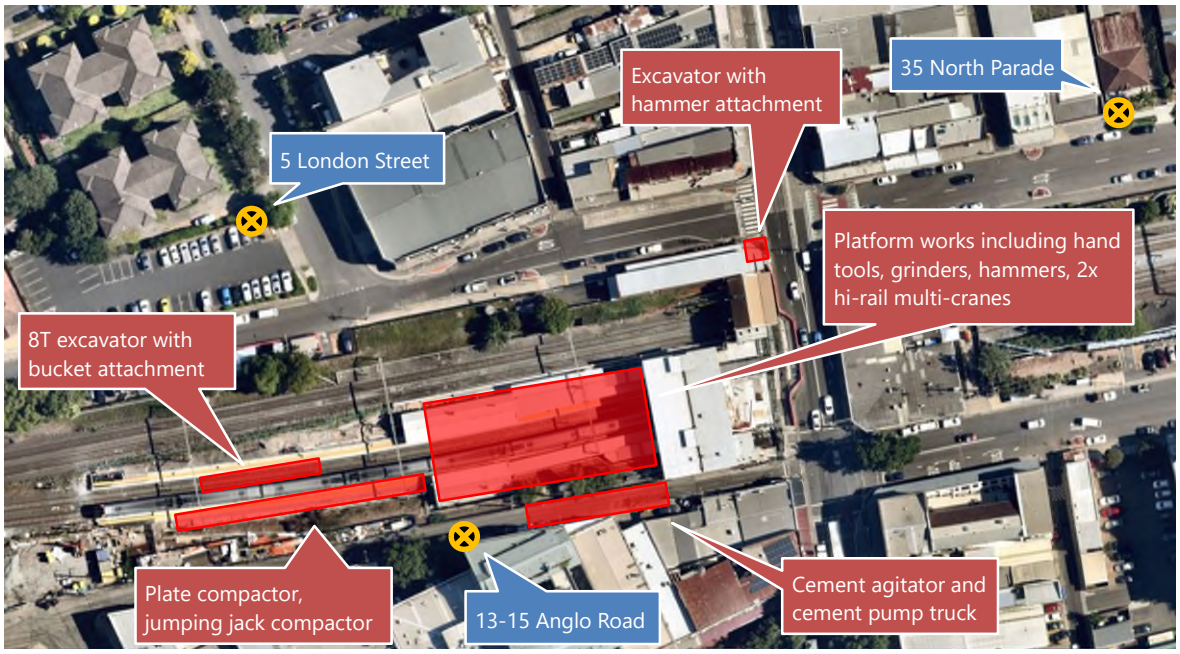
External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systemfaçadefacade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

APPENDIX A Measurement locations

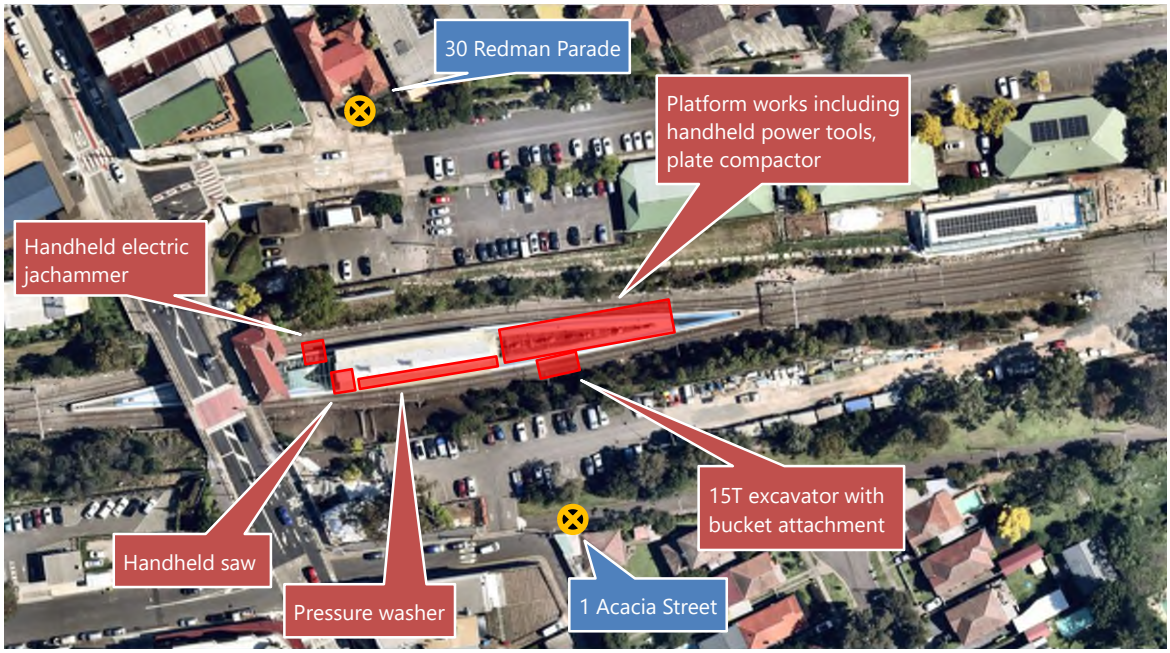
A.1 Dulwich Hill Station: 51 Ewart Lane, 1 Bedford Crescent



A.2 Campsie Station: 13-15 Anglo Road, 35 North Parade, 5 London Street

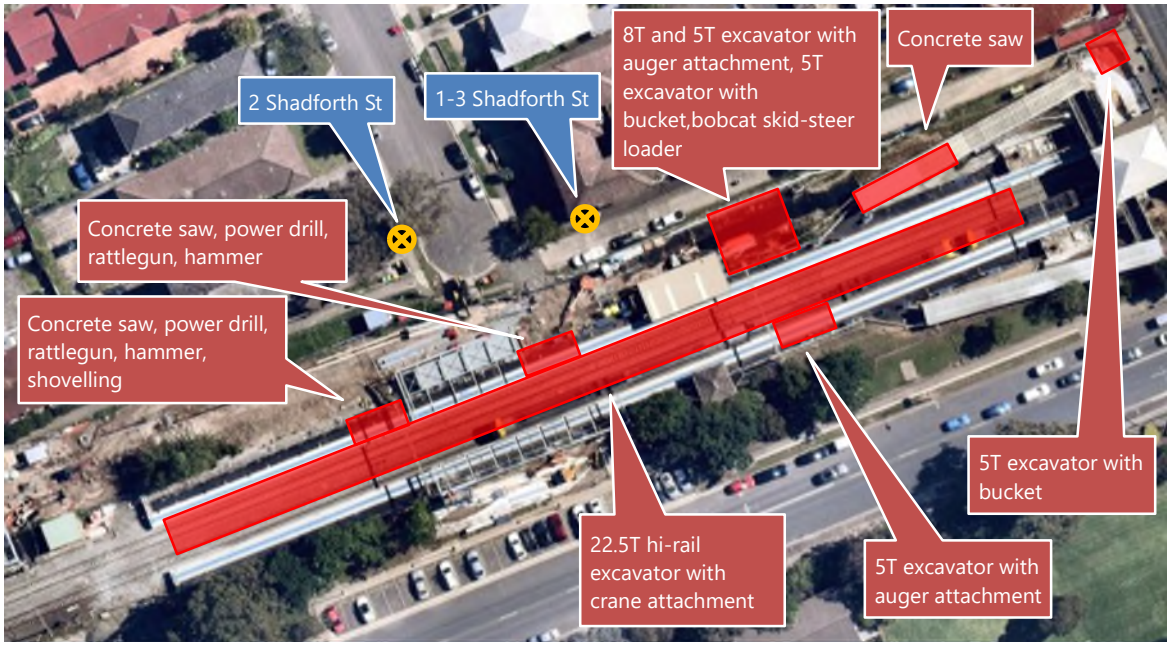


A.3 Belmore Station: 30 Redman Parade, 1 Acacia Street

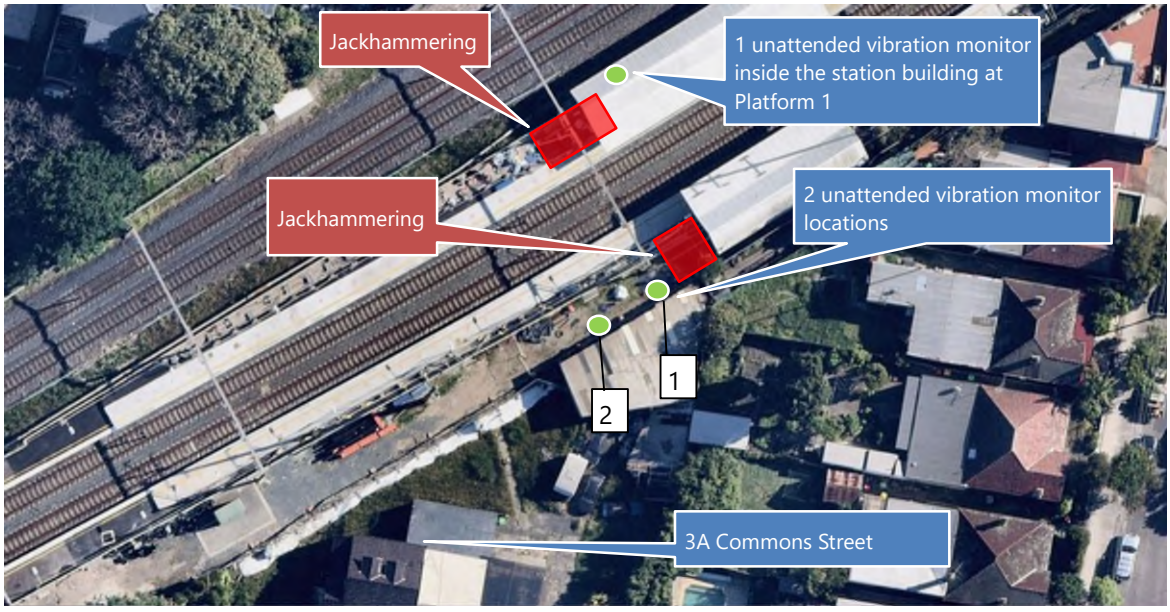


A.4 Punchbowl Station: 41 Urunga Street, 14 Arthur Street

A.5 Wiley Park Station: 1-3 Shadforth Street, 2 Shadforth Street



A.6 Hurlstone Park Station (Vibration)



Appendix 8 – TL927-1-21F01 2022 WE32 Noise and Vibration Monitoring Report (r1)

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10 February 2022
TL927-1-21F01 2022 WE32 Noise and Vibration Monitoring Report (r1)

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Sydney Metro Southwest - Station Upgrades - WE32 Possession Works

1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct noise and vibration monitoring during the Station Upgrades WE32 possession works for Sydney Metro Southwest. The noise monitoring was undertaken to verify predicted noise levels in the corresponding Gatewave model (Gatewave scenario ID: 2973 for high impact activities and Gatewave scenario ID: 2971 for typical activities). The vibration monitoring was undertaken to monitor potentially affected structures. This report provides a summary of the monitoring results.

Plant noise auditing was also conducted during the Station Upgrades WE32 possession works. The plant noise auditing was undertaken to ensure that the plant and equipment being used for the works are operating as expected.

2 Details of monitoring

Noise monitoring was undertaken at Hurlstone Park, Belmore, Campsie, Dulwich Hill, Punchbowl and Wiley Park Station on 5th February 2022.

Two unattended vibration monitors were installed at the neighbouring garage structure at 3A Commons Street, Hurlstone Park between 03:00pm 4th February and 09:00am 7th February 2022.

2.1 Measurement location

The noise measurements were conducted at the worst affected residential receivers, relative to the measured works. The measurement locations are listed in Table 2-1. Figures depicting the monitoring locations are included in APPENDIX A.

Table 2-1: Measurement locations

Measurement ID	Assessment Point	Date and time	Measured plant	Monitoring type	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
M1	41 Urunga Parade, Punchbowl (Appendix A.1)	05.02.2022 12:24pm – 12:39pm	Excavator with bucket attachment	Noise	60m	No
M2	3A Commons Street, Hurlstone Park (Appendix A.2)	05.02.2022 01:25pm – 01:40pm	3.5T Excavator with hammer attachment and hi-rail hydrema	Noise	15m	No
M3	2 Hopetoun Street, Hurlstone Park (Appendix A.2)	05.02.2022 01:55pm – 02:10pm	Vacuum truck and telehandler	Noise	2m - 10m	No
M4	51 Ewart Lane, Dulwich Hill (Appendix A.3)	05.02.2022 02:58pm – 03:13pm	Telehandler, hi-rail excavator with bucket attachment and handheld grinder	Noise	20m	Yes, noise blankets were installed on the gate facing Ewart Lane.
M5	1 Bedford Crescent, Dulwich Hill (Appendix A.3)	05.02.2022 03:30pm – 03:45pm	Handheld grinder, hi-rail hydrema and handtools (hammer)	Noise	60m	No
M6	30 Redman Parade, Belmore (Appendix A.4)	05.02.2022 04:24pm – 04:39pm	Handheld grinder	Noise	60m	No
M7	1 Acacia Street, Belmore (Appendix A.4)	05.02.2022 04:49pm – 05:04pm	Vacuum truck, handheld grinder and hand tools (hammer)	Noise	50m	No
M8	13-15 Anglo Road, Campsie (Appendix A.5)	05.02.2022 06:20pm – 06:35pm	6T excavator with bucket attachment, hi-rail hydrema and handtools (hammer)	Noise	90m	No
M9	2 Wilfred Avenue, Campsie (Appendix A.5)	05.02.2022 06:57pm – 07:12pm	Hi-rail hydrema, plate compactor and excavator with bucket attachment	Noise	45m	No. During this measurement, a lighting tower on Anglo Road was spotted being installed with noise blankets.
M10	1-3 Shadforth Street, Wiley Park (Appendix A.6)	05.02.2022 07:44pm – 07:59pm	3 x EWP, excavator with bucket, rattle gun, crane and handtools	Noise	35m	No
M11	7 Shadforth Street, Wiley Park (Appendix A.6)	05.02.2022 08:03pm – 08:18pm	2 x EWP, rattle gun and crane	Noise	65m	No

Measurement ID	Assessment Point	Date and time	Measured plant	Monitoring type	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
M12	Neighbouring garage structure at 3A Commons Street, Hurlstone Park (Appendix A.2)	04.02.2022 – 07.02.2022 03:00pm – 09:00am	3.5T excavator with hammer attachment	Vibration	5m	N/A

2.2 Measurement equipment

Noise measurement equipment consisted of one Nti Audio XL2 Type 1 sound level meter and microphone calibrator. The microphone was checked prior and after measurements using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed. All instrumentation complies with AS IEC 61672.1 2004 '*Electroacoustics – Sound Level Meters*' and carries current NATA certification (or if less than 2 years old, manufacturers certification).

Table 2-2 summarises the details of noise measurement equipment.

Table 2-2: Summary of noise measurement equipment

Instrument	Make	Model	Serial Number	Last Calibrated
Type 1 Sound Level Meter (XL2-A)	NTI	XL2	A2A-02386-D2	7 July 2021
Type 1 Sound Level Meter (XL2-B)	NTI	XL2	A2A-16217-E0	13 August 2021
Type 1 Sound Level Meter Calibrator	B&K	Type 4231	3009707	2 December 2020

The instrumentation used for the vibration measurement are summarised in Table 2-3. The accelerometers used in the measurements have current calibration certificates.

Table 2-3: Summary of vibration instrumentation

Type	Make / Model
Triaxial Transducers	Sigicom C12 (SN: 66900)
Triaxial Transducers	Sigicom C22 (SN: 102479)

2.3 Environmental conditions

Environmental conditions recorded during the measurements are provided in Table 2-4. Environmental conditions did have an adverse effect on some of the measured noise levels. Noise measurements that have been adversely affected by the environmental conditions have been deemed as an invalid measurement (identified in the table below).

Table 2-4: Environmental conditions

Measurement ID	Assessment Point	Date and Start Time	Environmental Conditions
M1	41 Urunga Parade, Punchbowl	05.02.2022 12:24pm	Partly cloudy; air temperature 25°C, wind speed <5 m/s; relative humidity 58%.
M2	3A Commons Street, Hurlstone Park	05.02.2022 01:25pm	Partly cloudy; air temperature 27°C, wind speed <5 m/s; relative humidity 46%.
M3	2 Hopetoun Street, Hurlstone Park	05.02.2022 01:55pm	Partly cloudy; air temperature 27°C, wind speed <5 m/s; relative humidity 47%.
M4	51 Ewart Lane, Dulwich Hill	05.02.2022 02:58pm	Partly cloudy; air temperature 28°C, wind speed <5 m/s; relative humidity 53%.
M5	1 Bedford Crescent, Dulwich Hill	05.02.2022 03:30pm	Overcast; air temperature 23°C, wind speed <5 m/s; relative humidity 53%.
M6	30 Redman Parade, Belmore	05.02.2022 04:24pm	Partly cloudy; air temperature 28°C, wind speed <5 m/s; relative humidity 50.2%.
M7	1 Acacia street, Belmore	05.02.2022 04:49pm	Overcast; air temperature 27°C, wind speed <5 m/s; relative humidity 48%.
M8	13-15 Anglo Road, Campsie	05.02.2022 06:20pm	Overcast; air temperature 26°C, wind speed <5 m/s; relative humidity 49%.
M9	2 Wilfred Avenue, Campsie	05.02.2022 06:57pm	Overcast; air temperature 23°C, wind speed <5 m/s; relative humidity 54%.
M10	1-3 Shadforth Street, Wiley Park	05.02.2022 07:44pm	Partly cloudy; air temperature 22°C, wind speed <5 m/s; relative humidity 60%.
M11	7 Shadforth Street, Wiley Park	05.02.2022 08:03pm	Overcast; air temperature 21°C, wind speed <5 m/s; relative humidity 61%.

Notes: * This measurement was adversely affected by the environmental conditions and have been deemed as an invalid measurement.

3 Noise monitoring results

The results of the noise monitoring are presented in Table 3-1 below.

Table 3-1: Measured noise levels $L_{Aeq(15min)}$

Measurement ID	Assessment Point	Prediction assumption (plant and equipment)	Predicted noise level dB(A)	Measured plant	Measured noise level dB(A)		Above predicted noise level?	Comments
					$L_{Aeq(15min)}$	L_{Amax}		
M1	41 Urunga Parade, Punchbowl	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	73[T]	Excavator with bucket attachment	54	74	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works were located approximately 60 metres away. In the prediction model, the distance between the closest work area and the most affected facade is approximately 15 metres. Note that the platform works were intermittent during this measurement.
M2	3A Commons Street, Hurlstone Park	Concrete saw, 5T excavators with hammer attachment, jackhammer, excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	82[H]	3.5T Excavator with hammer attachment and hi-rail hydrema	69*	84	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works were located approximately 15 metres away. In the prediction model, the distance between the closest work area and the most affected facade is approximately 5 metres. Note that the platform works were intermittent during this measurement.
M3	2 Hopetoun Street, Hurlstone Park	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	75[T]	Vacuum truck and telehandler	72	89	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the vacuum truck and telehandler activity were located directly opposite the monitoring location, approximately 10 metres away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 9 metres.
M4	51 Ewart Lane, Dulwich Hill	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	72[T]	Telehandler, hi-rail excavator with bucket attachment and handheld grinder	63	81	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the telehandler activity was located directly opposite the monitoring location, and repeatedly moved between 20 metres to 40 metres from the monitoring location during the measurement. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres.
M5	1 Bedford Crescent, Dulwich Hill	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	75[T]	Handheld grinder, hi-rail hydrema and handtools (hammer)	56	77	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works were located approximately 60 metres away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Some plant operation and hi-rail movements were partially shielded by the station building. Note that the platform works were intermittent during this measurement.
M6	30 Redman Parade, Belmore	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	63[T]	Handheld grinder	63	87	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is the same as the predicted noise level. Note that the handheld grinder activity was located 60 metres away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 50 metres. Note that this measurement location was heavily affected by road traffic noise along Redman Parade.
M7	1 Acacia Street, Belmore	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	65[T]	Vacuum truck, handheld grinder and hand tools (hammer)	61	89	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Note that the handheld grinder activity was located approximately 50 metres away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 35 metres. Note that this measurement location was heavily affected by road traffic noise along Acacia Street.
M8	13-15 Anglo Road, Campsie	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	74[T]	Excavator with bucket attachment, hi-rail hydrema and handtools (hammer)	57	78	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 90 metres away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the platform works were intermittent during this measurement.
M9	2 Wilfred Avenue, Campsie	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	70[T]	Hi-rail hydrema, plate compactor and excavator with bucket attachment	59	75	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 45 metres away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 25 metres. Note that the platform works were intermittent during this measurement. Note that the platform works were intermittent during this measurement.
M10	1-3 Shadforth Street, Wiley Park	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	79[T]	3 x EWP, excavator with bucket, rattle gun, 400T telescopic crane and handtools	60	77	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 35 metres away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 10 metres. Note that the platform works were intermittent during this measurement. Note that the platform works were intermittent during this measurement.

Measurement ID	Assessment Point	Prediction assumption (plant and equipment)	Predicted noise level dB(A)	Measured plant	Measured noise level dB(A)		Above predicted noise level?	Comments
					$L_{Aeq(15min)}$	L_{Amax}		
M11	7 Shadforth Street, Wiley Park	Excavator with bucket attachment, hand tools, skid street/bobcat, plate compactor, compressor, concrete agitator, drill rig, concrete pump, excavator with pulveriser and pressure washer	65^{T}	2 x EWP, rattle gun and 400T telescopic crane	56	79	No ($L_{Aeq, 15min}$)	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. This can be attributed to lesser quantity of plant items operating during the measurement compared to the predicted noisier plant in the prediction assumptions. Furthermore, the platform works was located approximately 65 metres away and at a lower ground level than the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 50 metres. Note that the platform works were intermittent during this measurement. Note that the platform works were intermittent during this measurement.

Notes:

*: 5dB(A) penalty applied for high impact activities.

T: Predicted $L_{Aeq, 15min}$ for Typical activities.

H: Predicted $L_{Aeq, 15min}$ for High impact activities.

4 Plant noise auditing results

The plant noise auditing was conducted on site, in order to better assess how it operates in the field. The plant noise auditing locations are listed in Table 4-1. Figures depicting the plant noise auditing locations are included in APPENDIX A.

Table 4-1: Plant noise auditing locations

Measurement ID	Assessment Point	Date	Time	Measured plant	Measured distance
M13 (Appendix A.2)	Hurlstone Park Station	05.02.2022	01:25pm – 01:43pm	3.5T excavator with hammer attachment	3m and 5m
M14 (Appendix A.2)	Hurlstone Park Station	05.02.2022	01:48pm – 02:10pm	Vacuum truck (idling)	4m and 10m
M15 (Appendix A.2)	Hurlstone Park Station	05.02.2022	01:48pm – 02:10pm	Vacuum truck (operating)	4m and 10m
M16 (Appendix A.3)	Dulwich Hill Station	05.02.2022	03:31pm – 03:38pm	EWP (idling)	2m and 3m
M17 (Appendix A.4)	Belmore Station	05.02.2022	04:23pm – 04:33pm	Handheld grinder	3m and 7m
M18 (Appendix A.5)	Campsie Station	05.02.2022	06:32pm – 06:40pm	6T excavator with bucket attachment moving with alarms	3m, 4m and 6m
M19 (Appendix A.5)	Campsie Station	05.02.2022	06:32pm – 06:40pm	6T excavator with bucket attachment moving without alarms	3m, 4m and 6m
M20 (Appendix A.6)	Wiley Park Station	05.02.2022	07:50pm – 08:05pm	400T telescopic crane (idling)	4m, 5.5m, 7m, and 10m
M21 (Appendix A.6)	Wiley Park Station	05.02.2022	07:50pm – 08:05pm	400T telescopic crane (lifting)	4m and 10m

Based on the conducted plant noise auditing, the calculated sound power level for each measured plant and corresponding comments are shown in Table 4-2.

Table 4-2: Plant noise auditing results

Measurement ID	Measured plant	Calculated overall sound power level, dB(A)	Gatewave plant	Gatewave sound power level, dB(A)	Comments
M13	3.5T excavator with hammer attachment	113	Excavators with hammers (5T)	115	The calculated overall sound power level of the 3.5T excavator with hammer attachment was deemed representative and operating as expected.
M14	Vacuum truck (idling)	90	-	-	It was noted on site that the vacuum truck had an enclosure around the suction noise source. Furthermore, the exhaust side of the vacuum truck could not be measured safely as the work area is on the same side as the exhaust side. Additional plant auditing for the vacuum truck is required before including this item in the Gatewave database
M15	Vacuum truck (operating)	100	Vacuum truck	107	It was noted on site that the vacuum truck had an enclosure around the suction noise source. Furthermore, the exhaust side of the vacuum truck could not be measured safely as the work area is on the same side as the exhaust side. Additional plant auditing for the vacuum truck is required before including this item in the Gatewave database
M16	EWP (idling)	83	-	-	The calculated overall sound power level of the idling EWP will be added to the Gatewave database.
M17	Handheld grinder	107	Handtool – grinder	107	The calculated overall sound power level of the handheld grinder is consistent with the Gatwave sound power level of 'Handtool – grinder'.
M18	6T excavator with bucket attachment moving with alarms	98	Excavator w bucket (5t)	103	The Gatewave sound power level of 103 dB(A) for the 'Excavator w bucket (5t)' includes spoil handling and tracking. During this measurement, the 6T excavator was only tracking with alarms. This item will be included in the Gatewave database.

Measurement ID	Measured plant	Calculated overall sound power level, dB(A)	Gatewave plant	Gatewave sound power level, dB(A)	Comments
M19	6T excavator with bucket attachment moving without alarm	95	Excavator w bucket (5t)	103	The Gatewave sound power level of 103 dB(A) for the 'Excavator w bucket (5t)' includes spoil handling and tracking. During this measurement, the 6T excavator was only tracking without alarms. This item will be included in the Gatewave database.
M20	400T telescopic crane (idling)	96	-	-	Currently, Gatewave does not have a specific sound power level for a 400T telescopic crane idling. The calculated overall sound power level of the idling 400T telescopic crane will be added to the Gatewave database. Note that due to safety requirements, measurement locations around the 400T telescopic crane were very limited.
M21	400T telescopic crane (lifting)	101	-	-	Currently, Gatewave does not have a specific sound power level for a 400T telescopic crane lifting. The calculated overall sound power level of the 400T telescopic crane lifting will be added to the Gatewave database. Note that due to safety requirements, measurement locations around the 400T telescopic crane were very limited.

5 Vibration monitoring results

5.1 Neighbouring garage structure at 3A Commons Street Vibration Monitoring

In accordance with the Hurlstone Park Station Vibration Monitoring Plan[1], the established vibration limits for the affected garage structure are shown below:

- Greater than or equal to 4 mm/s (cosmetic damage is possible);
- Greater than or equal to 8 mm/s (cosmetic damage becoming more likely).

The results of the unattended vibration measurements for the neighbouring garage structure at 3A Commons Street are presented in Figure 5-1 and Figure 5-2.

Figure 5-1: Unattended vibration monitoring location 1 results (refer to Appendix A.2)

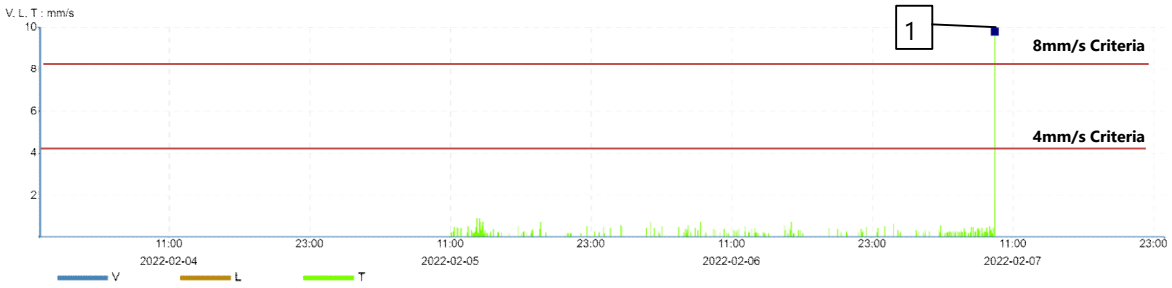
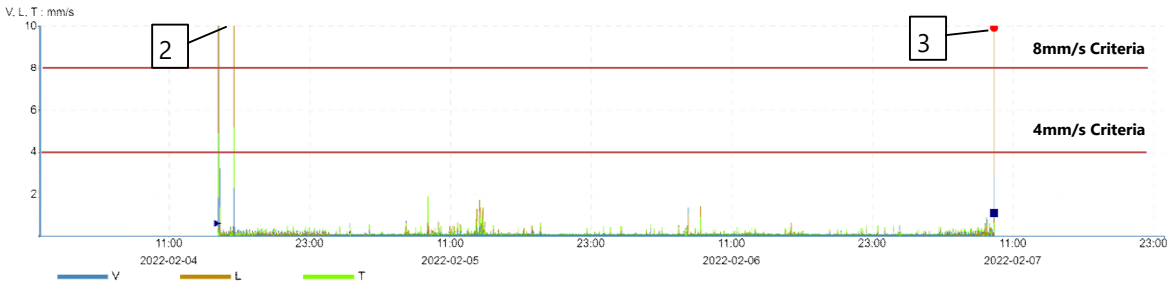


Figure 5-2: Unattended vibration monitoring location 2 results (refer to Appendix A.2)



4mm/s Criteria

[1] Sydney Metro Southwest – Station Upgrades – Hurlstone Park Station Vibration Monitoring Plan (ref: TL927-1-14F01 Hurlstone Park Stn VIB MON PLAN (r2)), dated 14 October 2021

The discussion of the unattended vibration measurements is summarised in Table 5-1 below.

Table 5-1: Unattended vibration monitoring summary

Exceedance ID	Date and Time	Cause of exceedance
1	07.02.2022 09:24am	At this time, the vibration monitor was removed from the ground spike to complete the monitoring. Exceedance was not caused by the nearby construction activities.
2	04.02.2022 03:10pm	At this time, the vibration monitor was install on the ground spike to start the monitoring. Exceedance was not caused by the nearby construction activities.
3	07.02.2022 09:20am	At this time, the vibration monitor was removed from the ground spike to complete the monitoring. Exceedance was not caused by the nearby construction activities.

It can be seen in Figure 5-1 and Figure 5-2 that the vibration levels produced from the vibration intensive works in the vicinity of the affected garage structure is below 4 mm/s. Note that there were events that resulted in an instantaneous vibration level of above 4 mm/s, however this event was not caused by the nearby construction activities, as justified in Table 5-1.

6 Conclusion

Renzo Tonin & Associates completed noise and vibration monitoring for the WE32 possession works. The results of the noise measurements were below the predicted $L_{Aeq\ 15minutes}$ levels presented in the Gatewave model prepared for the works.

The results of the unattended vibration measurements were typically below the established vibration criteria presented in the Hurlstone Park Station Vibration Monitoring Plan prepared for the works. There were events that resulted in an instantaneous vibration level of above the established vibration criteria, however, the cause of these events was not related to construction activity, as outlined in Table 5-1.

The results of the conducted plant noise auditing in Table 4-2 have shown that the measured plant are operating as expected. Gatewave database will be updated accordingly.

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
10.02.2022	First Issue	0	1	D. Auld/ R. Zhafranata	M. Tabacchi/ T. Gowen	M. Tabacchi

File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\21 February 2022 WE32 possession\TL927-1-21F01 2022 WE32 Noise and Vibration Monitoring Report (r1).docx

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

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In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

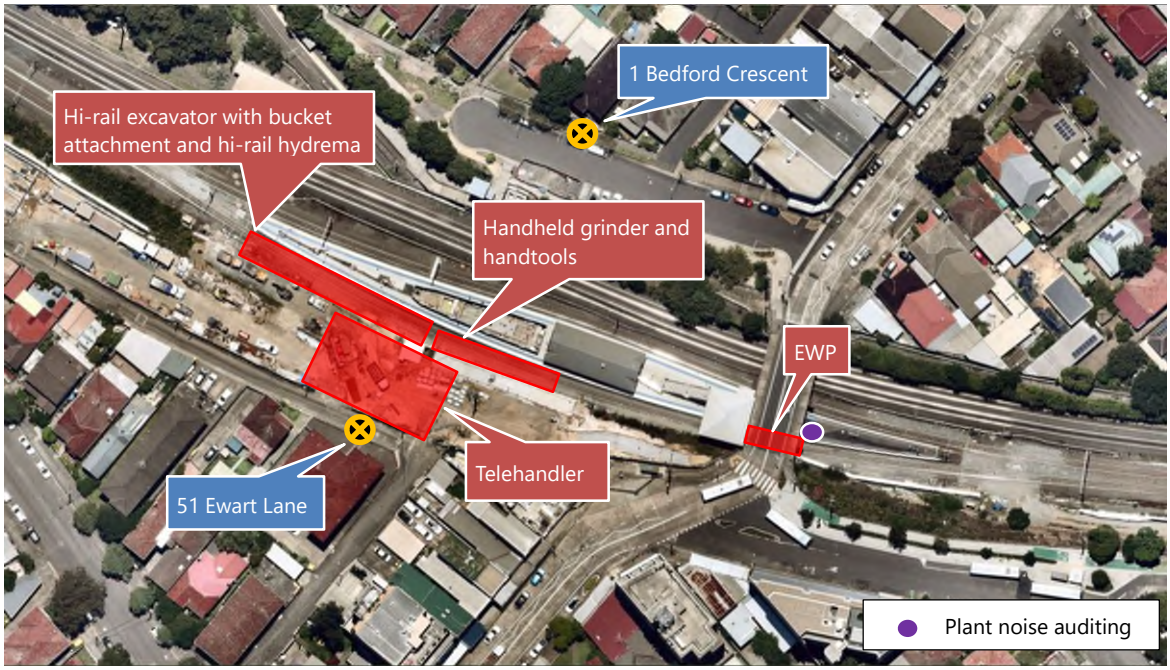
External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systemfaçadefacade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

APPENDIX A Measurement locations

A.1 Punchbowl Station: 41 Urunga Street

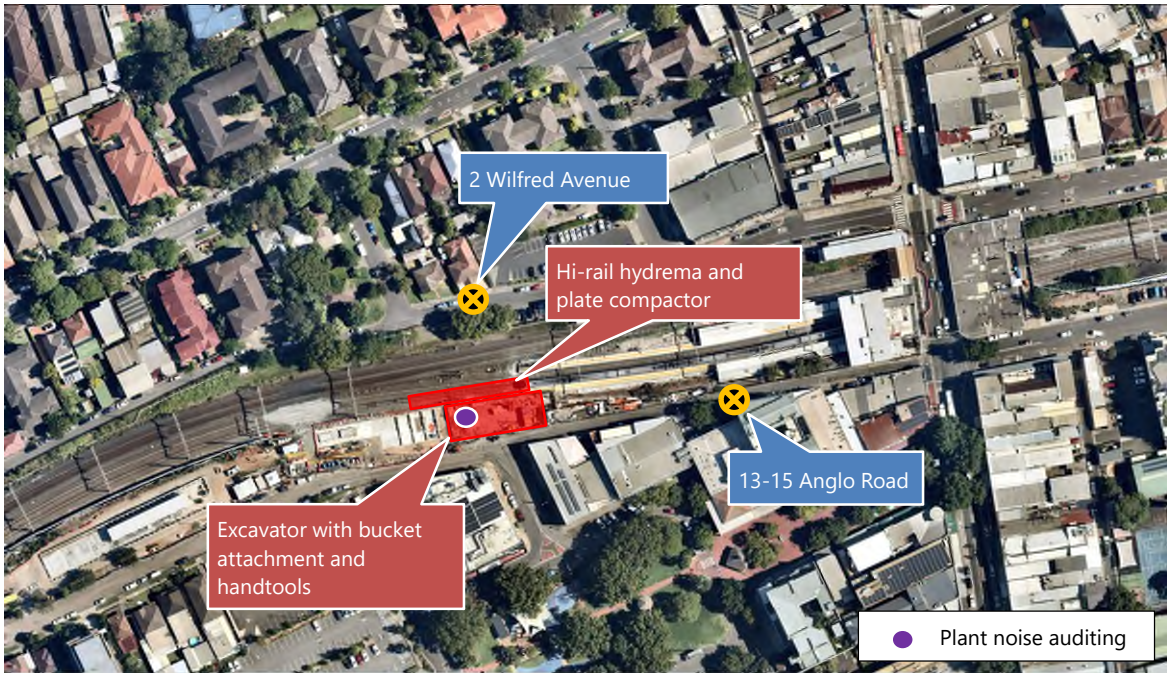
A.2 Hurlstone Park Station: 3A Commons Street and 2 Hopetoun Street

A.3 Dulwich Hill Station: 51 Ewart Lane and 1 Bedford Crescent



A.4 Belmore Station: 30 Redman Parade and 1 Acacia Street

A.5 Campsie Station: 13-15 Anglo Road and 2 Wilfred Avenue



A.6 Wiley Park Station: 1-3 Shadforth Street and 7 Shadforth Street

Appendix 9 – EDS-16589-HPS-18_0: Sydney Metro Package 5 and 6 – Hurlstone Park Station Monitoring of Garage Wall

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Tuesday, 31 August 2021 Project No. 00016589

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ATTENTION: Robel Chowdhury
Robel.Chowdhury@Downergroup.com

EDS-16589-HPS-18_0: SYDNEY METRO PACKAGE 5 AND PACKAGE 6 – HURLSTONE PARK STATION MONTIORING OF GARAGE WALL

Introduction

Lindsay Dynan Consulting Engineers have been requested to provide advice on the extent of survey and vibration monitoring recommended for proposed construction activities in the vicinity of the neighbouring garage and the collapsed boundary wall. We understand that proposed construction activities will include rock breakers that could cause ground vibrations.

Recommendation

GARAGE WALL – STABILITY AND CRACK MONITORING

Survey monitoring and crack gauge monitoring is recommended for the following:

- Crack width growth
- Wall out of plane displacement (tilts or leans)

Methodology:

- Visually monitor the condition of the garage wall during construction activities on a daily basis
- Inspect and record results of the survey and crack gauge position on a daily basis during rock breaking activities otherwise weekly
- Should any vertical or translation movement exceed 3mm refer to Lindsay Dynan for review
- Should any crack width increase by 1mm or greater refer to Lindsay Dynan for review (Note: 1mm limit is based on a Very Slight damage category in accordance with AS 2870. Refer appendix A for further details)

Figure 1: Survey Locations – Garage Wall

VIBRATION MONITORING

PPV or PVS is typically used to represent damage potential to buildings and structures and is subject to the type of construction, condition of the structure, ground conditions and distance from source. The garage building appears to in poor condition and includes unreinforced block construction. Damage associated with ground vibrations is also highly dependent on the fundamental frequency of the structure.

We recommend vibration monitoring be install at 2 locations along garage (say ¼ points). We further recommend that the following triggers be consider:

- Greater than or equal to 4mm/s (damage is possible)
  - Stop work and re-assess how to limit vibration
  - Progress with full time visual monitor of the wall

- Greater than or equal to 8mm/s (damage becoming more likely)
  - Stop work and refer to Lindsay Dynan

DILAPIDATION RECORD

We recommend that a photographic record of the existing garage is recorded prior to further works and include evidence of existing crack widths.

WALL TEMPORARY STABILTY

Lindsay Dynan inspected the garage wall on 26 August 2021 and observed that the wall is hollow unreinforced block. We also observed that the top of the wall is unrestrained at the roof level. On this basis we recommend that temporary propping is provided to the wall to provide lateral support and eliminate risk of collapse. Refer to separate correspondence on temporary propping.

LIMITATIONS

This assessment does not consider the following:

- Noise or vibration limits for compliance with EPA or other guidelines
- Comfort limits for neighbours
- Stability of the already damaged and partly demolished boundary wall
- We have not considered monitoring requirements for excavations adjacent to the garage or boundary wall

Please note that this letter does not relieve any party of their responsibility to comply with relevant documentation such as drawings, specifications and standards. This certificate shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations, and does not constitute an inspection certificate.

Should you require any further advice or clarification of any of the above, please do not hesitate to contact us.

Yours faithfully
LINDSAY DYNAN
CONSULTING ENGINEERS PTY LIMITED

Peter Forder
Principal Engineer
BEng(Civil), CPEng, NER

Appendix A

Extract AS2870 – Residential Slabs and Footings

Classification of Damage due to Foundation Movement

TABLE C1

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 1)	Damage category
Hairline cracks	<0.1 mm	0 Negligible
Fine cracks that do not need repair	<1 mm	1 Very slight
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2 Slight
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weather tightness often impaired	5 mm to 15 mm (or a number of cracks 3 mm or more in one group)	3 Moderate
Extensive repair work involving breaking out and replacing sections of walls, especially over doors and windows. Window frames and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15 mm to 25 mm but also depends on number of cracks	4 Severe

NOTES: