

---

# CONSTRUCTION MONITORING REPORT

## Sydney Metro City & Southwest

### Package 5 & 6

Customer: Sydney Metro

Document Preparation and Control	Document Review
Geraldine Figueira	James Allsop – Environment Manager
Document Approval	Signature

Project Documents Code			
Downer		Sydney Metro	
TBC	Rev. C	TBC	

Project Document Code	Latest Version Number	Latest Version Date
Package 5 <b>SMCSWSW5-DEW-WEC-EM-REP-001258</b>	Rev. C	18/03/2022
Package 6 <b>SMCSWSW6-DEW-WEC-EM-REP-001153</b>		

Document Version History			
Version No.	Date	Document Status	Brief Description of Change(s) from Previous Version
Rev A	07/02/2022	For review	Issued for comment
Rev B	11/03/2022	For approval	Document reviewed in response to ER and Metro comments
Rev C	18/03/2022	For approval	Document reviewed in response to additional ER comments

## Table of Contents

Compliance Matrix.....	3
Introduction.....	3
Surface Water Monitoring.....	3
Noise and vibration.....	10
Appendix 1 – Surface Water Monitoring Report -Wiley Park Station - 4NE30187_R001_SWM_WileyPark_RevA.....	27
Appendix 2 – Surface Water Monitoring Report - 4NE30187_R002_SWM_WileyPark_RevA.....	28
Appendix 3 – Surface Water Monitoring Report – Wiley Park Station NE30161_R003_SWM_Wile yPark_Rev0_R1 .....	29
Appendix 4 – TL927-1-02F02 WE42 NOISE AND VIBRATION MONITORING REPORT (R1).....	30
Appendix 5 – TL927-1-07F01 WE48 NOISE AND VIBRATION MONITORING REPORT (R1).....	31
Appendix 6 – TL927-1-08F01 WE49 NOISE AND VIBRATION MONITORING REPORT (R2).....	32
Appendix 7 – TL927-1-09F01 WE52 WK1 NOISE AND VIBRATION MONITORING REPORT (R3) .....	33
Appendix 8 – TL927-1-10F01 WK52-WE2 NOISE AND VIBRATION MONITORING REPORT (R1).....	34
Appendix 9 – TL927-1-15F01 WK16 NOISE AND VIBRATION MONITORING REPORT (R6).....	35
Appendix 10 – TL927-1-16F01 WK17 NOISE AND VIBRATION MONITORING REPORT (R3).....	36
Appendix 11 – TL927-1-17F01 WK19 NOISE AND VIBRATION MONITORING REPORT (R2).....	37
Appendix 12 – TL927-1-03F01 HURLSTONE PARK STN VIB MON REPORT (R1) .....	38
Appendix 13 – TL927-1-04F01 WILEY PARK STN VIB MON REPORT (R1) .....	39
Appendix 14 – TL927-1-05F01 PUNCHBOWL STN VIB MON REPORT (R1).....	40
Appendix 15 – TL927-1-06F01 BELMORE METRO BUILDING SITE VIB MON REPORT (R1) .....	41
Appendix 16 – TL927-1-12F01 HURLSTONE PARK STN VIB MON REPORT (R1) .....	42
Appendix 17 – TL927-1-13F01 DULWICH HILL STN VIB MON REPORT (R1).....	43

## 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 conducted during the first 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 21 April 2021 to 7 November 2021 (being approximately six months). The extension to November captured a run of possessions which included monitoring results and has been included for completeness.

### 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
- DPIE

The Independent Environmental Representative for DPIE 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, 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.

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 Cocks 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 Office of Environment and Heritage 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 DPIE. 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\\_Station\\_Upgrades\\_SWMP\\_Rev06.pdf](https://www.downergroup.com/Content/cms/Documents/Sydney_Metro_package_5_6/Dulwich_Hill_Campsie_and_Punchbowl_Station_Upgrades_SWMP_Rev06.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\\_Station\\_Upgrades\\_SWMP\\_Rev06.pdf](https://www.downergroup.com/Content/cms/Documents/Sydney_Metro_package_5_6/Hurlstone_Park_Belmore_and_Wiley_Park_Station_Upgrades_SWMP_Rev06.pdf)

## RESULTS - SURFACE WATER MONITORING

In accordance with Table 21.4 of the EIS, Vol. 1B, the water quality triggers 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) <sup>1</sup>	125-2,200 uS/cm
Dissolved oxygen (per cent saturation)	85-110 %
pH	6.5-8.5

A summary of the Surface Water Monitoring Results is contained within the table below. The complete Surface Water Monitoring Reports are contained within Appendixes 1-3. Bold red text indicates initial criteria exceedances.

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)
<b>Monitoring Event</b>	Dry weather pre-construction baseline measurement		Wet weather event (mid-construction)		Wet weather event (mid-construction)		Quarterly sampling mid-construction event	
<b>Water Depth (m)</b>	0.03	0.03	0.3	0.3	0.05	0.3	0.05	0.1
<b>pH</b>	7.9	7.61	8.10	7.58	7.8	7.73	<b>9.01</b>	<b>8.83</b>
<b>Electrical Conductivity (µS/cm)</b>	54	363	246.2	133.4	<b>2500</b>	92.9	910	530.3
<b>Dissolved Oxygen (mg/L)</b>	5.64	4.09	4.79	3.92	6.35	5.95	11.21	7.92
<b>Dissolved Oxygen (%)</b>	<b>63</b>	<b>45.9</b>	<b>52.87</b>	<b>43.18</b>	<b>65.3</b>	<b>62.8</b>	108.8	<b>77.9</b>
<b>SHE1 Redox Potential (mV)</b>	140.7	181.0	122.3	135.9	164.6	109.2	53.7	122.4
<b>Total Suspended Solids (TSS) (mg/L)</b>	<1	<1	9.2	35	4	47	4	4.4
<b>Turbidity (NTU)</b>	2.9	<1	9.3	13	4.3	21	4.1	6.3
<b>Total phosphorus (mg/L)</b>	<b>0.34</b>	<b>0.12</b>	<b>&lt;0.5</b>	<b>&lt;0.5</b>	<b>0.21</b>	<b>0.15</b>	<b>0.18</b>	<b>0.13</b>
<b>Total nitrogen (mg/L)</b>	<b>2.5</b>	<b>1.68</b>	<b>2.3</b>	<b>2.3</b>	<b>5</b>	<b>1</b>	<b>1.3</b>	<b>3.1</b>
<b>Chlorophyll-a (mg/L)</b>	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.001
<b>Condition</b>	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
<b>Oil and Grease (mg/L)</b>	<10	29	<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.

### Baseline Dry Weather Event: 10 March 2021

The results of the monitoring event indicates that:

- Electrical Conductivity ( $\mu\text{S}/\text{cm}$ ) was within the adopted assessment criteria at all sample locations;
- Dissolved Oxygen (%Sat) was reported outside of the target range (85%-110%) with results ranging from 63% saturation upstream at WP1 and 45.9% saturation downstream at WP2;
- Concentrations of tested inorganics (phosphorous and nitrogen) were reported below the adopted assessment criteria, with the exception of nitrogen and phosphorous which exceeded the ANZECC criteria at both sample locations. Upstream concentrations at WP1 were higher than concentrations downstream at WP2;
- Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations, with the exception of the downstream sample WP2;
- Concentrations of Chlorophyll-a were reported below the laboratory detection limit and adopted assessment criteria at all sample locations;
- Total Suspended Solids (TSS) was not detected above the laboratory limit of reporting in both sample locations; and
- Turbidity ranged from 2.9 NTU at WP1 and <1 NTU at WP2.

---

These results reflect the status of the waterline during dry weather prior to construction commencement, when works had not yet started. Therefore, documented values are not related to any Downer activity.

#### **Mid Construction Wet Weather Event: 20 March 2021**

Rainfall recorded at this wet-weather event was of 56.8 mm. The results of the monitoring event indicated that:

- Electrical Conductivity ( $\mu\text{S}/\text{cm}$ ) was within the adopted assessment criteria at all sample locations;
- Dissolved Oxygen (%Sat) was reported outside of the target range (85%-110%) with results ranging from 52.9% saturation upstream at WP1 and 43.2% saturation downstream at WP2. Results are consistent with the baseline measurement;
- Concentrations of analysed inorganics were reported below the adopted assessment criteria, with the exception of nitrogen within both the WP1 and WP2 samples, and phosphorous within a triplicate quality assurance sample from WP2 which exceed the ANZECC criteria. Results are consistent with the baseline measurement;
- Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations;
- Concentrations of Chlorophyll-a were reported below the laboratory detection limit and adopted assessment criteria at all sample locations;
- Total Suspended Solids (TSS) concentrations were detected within both WP1 and WP2, with concentrations of 9.2 mg/L at WP1 and 35 mg/L at WP2; and
- Turbidity ranged from 9.3 NTU at WP1 to 13.2 NTU at WP2.

#### **Mid Construction Wet-weather Event: 5 May 2021**

Rainfall recorded at this wet-weather event was of 22.6 mm. The results of the monitoring event indicate that:

- Electrical Conductivity ( $\mu\text{S}/\text{cm}$ ) was reported outside of the target range (125-2,200  $\mu\text{S}/\text{cm}$ ) with results ranging from 2,500  $\mu\text{S}/\text{cm}$  upstream at WP1 and 92.9  $\mu\text{S}/\text{cm}$  downstream at WP2. Readings were re-checked in the field using the WQM from the water collected as a bulk sample and consistent results were observed when re-checking both the WP1 and WP2 sampled water. No point source was observed at WP1;
- Dissolved Oxygen (%Sat) was reported outside of the target range (85%-110%) with results ranging from 65.3% saturation upstream at WP1 and 62.8% saturation downstream at WP2;
- Concentrations of analysed 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 samples. Results are generally consistent with baseline measurement;
- Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations;
- Concentrations of Chlorophyll-a were reported below the laboratory detection limit and adopted assessment criteria at all sample locations;
- Total Suspended Solids (TSS) concentrations were detected within both WP1 and WP2, with concentrations of 4 mg/L at WP1 and 21 mg/L at WP2; and
- Turbidity ranged from 4.3 NTU at WP1 to 21 NTU at WP2.

During the wet-weather sampling event the two discharge points (including the one connecting the construction site and the unnamed channel) within the rail corridor immediately upstream / south from WP2 were observed to be not flowing and not contributing to the channel. Therefore, exceedances are not related to Downer's construction activities.

---

## Quarterly Mid-Construction Event – 1 July 2021

The results of the monitoring event indicate that:

- Field measurements – physio-chemical parameters:
  - pH was reported outside of the target range (6.5-8.5) with results ranging from 9.01 upstream at WP1 and 8.83 downstream at WP2. The PH is higher upstream and gets closer to target closer to downstream, so pH values are not a result of Downer's works;
  - Electrical Conductivity ( $\mu\text{S}/\text{cm}$ ) was reported within of the target range (125-2,200  $\mu\text{S}/\text{cm}$ ) at both sampling locations with results ranging from 910  $\mu\text{S}/\text{cm}$  upstream at WP1 and 530.3  $\mu\text{S}/\text{cm}$  downstream at WP2; and
  - Dissolved Oxygen (%Sat) was reported outside of the target range (85%-110%) at downstream sampling point WP2. The results are ranging from 108.8% saturation upstream at WP1 and 77.9% saturation downstream at WP2. Dissolved oxygen saturation was below the adopted threshold at WP2 but within range at WP1. 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 mid-construction results are closer to the adopted thresholds than the pre-construction event.
  
- 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 analysed 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 samples. Concentration of inorganics is lower downstream, so results cannot be attributed to Downer's works.
  - Total Suspended Solids (TSS) concentrations were detected within both WP1 and WP2, with concentrations of 4 mg/L at WP1 and 4.4 mg/L at WP2; and
  - Turbidity ranged from 4.1 NTU at WP1 to 6.3 NTU at WP2.

Nitrogen and turbidity results within the samples were observed to be higher in the downstream WP2 sampling point. In addition, dissolved oxygen saturation was below the adopted range within WP2. Based on comparison to the criteria, and pre-construction monitoring event, these results are not considered to reflect an adverse impact to water quality due to Downer's construction activities.

### DISCUSSION - SURFACE WATER MONITORING

The results of the surface water monitoring showed that monitored parameters were generally within the adopted ANZECC screening criteria; however, some results showed parameters outside of the screening criteria. In these instances, the recommended actions were:

- Undertake an inspection of the adjacent works and controls within the current worksite area and propose actions where required in accordance with the SMWP; and
- Assess the area downstream of sampling point WP1 to confirm whether there are additional discharge points downstream of WP1 which may contribute the stormwater in-flow to the unnamed channel during the rainfall events.

In response to these recommendations inspections of the site were conducted to ensure that all sediments and erosion controls were in place, well maintained and functioning correctly. The stormwater system was also inspected, and it was noted that there were stormwater intake points and most likely other stormwater connections between WP1 and WP2, this being the case there are other sources of potential pollution between the two sampling locations.



It should also be noted that Downer conducts regular inspection of the environmental controls, including sediment and erosion controls at Wiley Park. 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.

---

## 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, DPIE 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\\_Rev02\\_210302\\_W\\_.pdf](https://www.downergroup.com/Content/cms/Documents/Sydney_Metro_package_5_6/Dulwich_Hill_Campsie_and_Punchbowl_Station_Upgrades_NVMP_Rev02_210302_W_.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/Southwest\\_Metro\\_-\\_Hurlstone\\_Park\\_Belmore\\_Wiley\\_Park\\_Station\\_Upgrades\\_-\\_Noise\\_and\\_Vibration\\_Management\\_Plan.pdf](https://www.downergroup.com/Content/cms/Documents/Sydney_Metro_package_5_6/Southwest_Metro_-_Hurlstone_Park_Belmore_Wiley_Park_Station_Upgrades_-_Noise_and_Vibration_Management_Plan.pdf)

## RESULTS – NOISE MONITORING

The table below contains a summary of the noise monitoring results. The complete reports are provided in Appendixes 4 - 17

Assessment Point	Measured Plant	Predicted noise level dB(A)	Measured noise level		Above predicted noise level	Comments
			LAeq(15min)	LAmx		
19 <sup>th</sup> – 20 <sup>th</sup> April 2021	TL927-1-02F02 WE42 NOISE AND VIBRATION MONITORING REPORT (R2) - APPENDIXES 4					
1 Ewart Lane, Dulwich Hill	Demo Saw	72	61	66	No	Temporary noise barriers were setup correctly during the measurement. The measured LAeq, 15min is lower than the predicted noise level.
	Lighting tower	68	61	61	No	Lighting tower setup on 19.04.2021. The measured LAeq, 15min is lower than the predicted noise level.
	Lighting tower	68	55	55	No	Lighting tower setup on 20.04.2021. Note that a different lighting tower was setup on the Tuesday night, which produced lower noise levels. The measured LAeq, 15min is lower than the predicted noise level.
107 Duntroon Street, Hurlstone Park	Demo saw	67	52	57	No	Temporary noise barriers were setup correctly during the measurement. The measured LAeq, 15min is lower than the predicted noise level.
	Hand tools	56	46	53	No	Temporary noise barriers were setup correctly during the measurement. The measured LAeq, 15min is lower than the predicted noise level.
13-15 Anglo Rd, Campsie	Lighting tower	68	49	61	No	The lighting tower was not audible at this monitoring location. As a result, the noise contribution from the lighting tower can be assumed to be at least 10dB less than the measured LAeq, 15min.
	Excavator with clamp attachment	68	61	78	No	The measured LAeq, 15min is lower than the predicted noise level during the demolition of shed works.
1-3 Shadforth Street, Wiley Park	Hand tools	72	54	61	No	The measured LAeq, 15min is lower than the predicted noise level.
	Hand tools	72	70	85	No	The measured LAeq, 15min is lower than the predicted noise levels. Note that this measurement included the activity of hammering which produced higher noise levels.
14 Arthur Street, Punchbowl	Vacuum truck	46	52	64	No	The vacuum truck was not audible at this monitoring location. As a result, the noise contribution from the lighting tower can be assumed to be at least 10dB less than the measured LAeq, 15min.
28 <sup>th</sup> May – 29 <sup>th</sup> May 2021	TL927-1-07F01 WE48 NOISE AND VIBRATION MONITORING REPORT (R1) - APPENDIXES 5					
1A Shadforth Street, Wiley Park	Concrete saw (south platform), vacuum truck, lighting tower	73	71	83	No	The measured LAeq, 15min is lower than the predicted noise level.
	Concrete (north)	73	67	72	No	The measured LAeq, 15min is

	platform), vacuum truck, lighting tower					lower than the predicted noise level.
	Jackhammering	73	66	83	No	The measured LAeq, 15min is lower than the predicted noise level.
2 Shadforth Street, Wiley Park	Concrete saw	80	63	78	No	The measured LAeq, 15min is lower than the predicted noise level. During this measurement, the station platform building was in between the measured plant and the receiver. As a result, the measured noise level is significantly lower than the predicted noise level.
	Chainsaw, wood chipper	82	70	80	No	The measured LAeq, 15min is lower than the predicted noise level.
1 Cornelia Street, Wiley Park	Crane mounted truck	78	72	100	No	The measured LAeq, 15min is lower than the predicted noise level. The measured L <sub>Amax</sub> of 100 dB(A) was caused by dropping chocks.
2A Cornelia Street, Wiley Park	Crane mounted truck	69	60	74	No	The measured LAeq, 15min is lower than the predicted noise level.
1 Ewart Lane, Dulwich Hill	Excavator	77	65	80	No	The measured LAeq, 15min is lower than the predicted noise level.
	Excavator with bucket, lighting tower, truck and dogs	78	67	82	No	The measured LAeq, 15min is lower than the predicted noise level.
41 Uranga Parade, Punchbowl	5T Excavator with auger attachment	68	63	77	No	The measured LAeq, 15min is lower than the predicted noise level.
13-15 Anglo Road, Campsie	Excavator with bucket, generator	79	60	62	No	The measured LAeq, 15min is lower than the predicted noise level. During this measurement, only the generator was audible at the closest residential receiver. Furthermore, noise barriers were installed around the generator. As a result, the measured noise level is significantly lower than the predicted noise level.
103 Duntroon Street, Hurlstone Park	Excavator with hammer attachment	93	66	74	No	The measured LAeq, 15min is lower than the predicted noise level. The predicted noise level was calculated for the most affected facade. Note that there was no access to the most affected facade. The property building provided shielding from the measured plant. As a result, the measured noise level is significantly lower than the predicted noise level.
1 Acacia Street, Belmore	Vac truck	71	71	78	No	The measured LAeq, 15min is consistent with the predicted noise level.
2 Hopetoun Street, Hurlstone Park	Excavator with hammer, lighting tower, moxy trucks, boring and trenching activities	69	57	62	No	The measured LAeq, 15min is lower than the predicted noise level. Note that the boring and trenching activities were not audible at this monitoring location.
5th June 2021	TL927-1-08F01 WE49 NOISE AND VIBRATION MONITORING REPORT (R2) - APPENDIX 6					
7 Bedford Crescent,	Flatbed truck, excavator, generator	67	54	66	No	The measured LAeq, 15min is lower than the predicted noise level. The

Dulwich Hill						hoardings on the station platform provided partial shielding for this monitoring location.
3A Commons Street, Hurlstone Park	Generator, excavator, hi-rail loading vehicles	73	69	77	No	The measured LAeq, 15min is lower than the predicted noise level.
12 Railway Street, Hurlstone Park	Telescopic crane, flatbed truck and van	72	59	90	No	The measured LAeq, 15min is lower than the predicted noise level. Explain about the distance of the measured plant.
5-9 London Street, Campsie	Chainsaw	74	61	80	No	The measured LAeq, 15min is lower than the predicted noise level.
1A Shadforth Street, Wiley Park	Excavator with hammer attachment	80	66	87	No	The measured LAeq, 15min is lower than the predicted noise level.
41 Uranga Parade, Punchbowl	Hiab truck, excavator	68	53	79	No	The measured LAeq, 15min is lower than the predicted noise level. Occasional distant noise impacts from the excavator was audible at this monitoring location.
1 Acacia Street, Belmore	Vacuum truck, excavator with bucket and auger attachment	68	57	80	No	The measured LAeq, 15min is lower than the predicted noise level.
28 <sup>th</sup> June – 1 <sup>st</sup> July 2021	TL927-1-09F01 WE52 WK1 NOISE AND VIBRATION MONITORING REPORT (R3) - APPENDIXES 7					
2 Shadforth Street, Wiley Park	Excavators with bucket attachment, handheld grinder, truck deliveries	81	64	84	No	The measured LAeq, 15min is lower than the predicted noise level.
30 Redman Parade, Belmore	3.5T excavator with rockhammer attachment, excavators with bucket attachment	65	63	76	No	The measured LAeq, 15min is lower than the predicted noise level.
103/105 Duntroon Street, Hurlstone Park	Excavators with bucket attachment, Moxy trucks	82	65	85	No	The measured LAeq, 15min is lower than the predicted noise level
	Excavator with rockhammer attachment, excavator with bucket attachment, generator	84	66	76	No	Note that there was no access to the most affected facade. The property building provided shielding between the rockhammering activity and the measurement location. As a result, the measured LAeq, 15min noise level is significantly lower than the predicted noise level.
1 Ewart Lane, Dulwich Hill	Generator, truck deliveries, excavator with rockdrill attachment	74	73	86	No	The measured LAeq, 15min is lower than the predicted noise level.
71 Ewart Street, Dulwich Hill	Excavator with rockdrill attachment	84	64	75	No	The measured LAeq, 15min is lower than the predicted noise level. During this measurement, only the rockdrilling activity is audible from the works. There were no concurrent works in the work area directly across from the monitoring location. As a result, the measured noise level is significantly lower than the predicted noise level.
5 Bedford Crescent, Dulwich Hill	Excavator with rockdrill attachment and generator	74	69	78	No	The measured LAeq, 15min is lower than the predicted noise level.
199 Beamish Street, Campsie	Two 5T excavators with bucket and gripper attachment, truck deliveries	70	75	92	Not applicable	le These measurements were deemed invalid as the environmental conditions caused adverse effect on the measured

	(construction bin)					noise levels.
	Two 5T excavators with gripper attachment	70	75	91	Not applicable	
8 -10 Shadforth Street, Wiley Park	15T excavator with bucket attachment and Moxy truck	64	55	73	No	The measured LAeq, 15min is lower than the predicted noise level.
115 Duntroon Street, Hurlstone Park	Excavator with rockhammer attachment	67	63	83	No	The measured LAeq, 15min is lower than the predicted noise level.
5 Commons Street, Hurlstone Park	Excavator with bucket attachment, Moxy trucks, lighting tower, concrete agitator	68	54	75	No	The measured LAeq, 15min is lower than the predicted noise level
41 Urunga Parade, Punchbowl	Excavator with bucket attachment, stockpile management, Moxy truck	73	58	72	No	The measured LAeq, 15min is lower than the predicted noise level.
50 Floss Street, Hurlstone Park	Two excavators with rockhammer attachment, concrete saw	73	68	74	No	The measured LAeq, 15min is lower than the predicted noise level.
107 Duntroon Street, Hurlstone Park	Concrete saw, excavator with rockhammer attachment, generator, electric rotary cutter	79	66	87	No	The measured LAeq, 15min is lower than the predicted noise level.
5 Railway Street, Hurlstone Park	15T Excavator with bucket attachment, truck delivery, fuel truck, 8T roller	83	63	82	No	The measured LAeq, 15min is lower than the predicted noise level.
	35T Pilling rig with auger, concrete truck	83	65	72	No	The measured LAeq, 15min is lower than the predicted noise level.
7 Commons Street, Hurlstone Park	5T Excavator with bucket attachment, concrete truck, jackhammer	75	59	74	No	The measured LAeq, 15min is lower than the predicted noise level. Jackhammering was not the dominant noise source, as it was just audible at this monitoring location. As a result, the measured noise level is compared to the predicted noise level for a typical activity.
7 <sup>th</sup> July – 11 <sup>th</sup> July 2021	TL927-1-10F01 WK52-WE2 NOISE AND VIBRATION MONITORING REPORT (R3) - APPENDIXES 8					
5 Railway Street, Hurlstone Park	35T piling rig, generator, delivery truck	82	56 (58)*	80	No	Note that there was no access to the most affected facade. As a result, the measured LAeq, 15min noise level in the bracket was the estimated noise level at the nearest residential facade, based on distance correction.
5A Foord Ave, Hurlstone Park	Concrete pumping, cleaning	82-84	60 (67)*	73	No	Note that there was no access to the most affected facade. As a result, the measured LAeq, 15min noise level in the bracket was the estimated noise level at the nearest residential facade, based on distance correction. Plant in use different to predicted plant.
5 Foord Ave, Hurlstone Park	Excavator 15T with bucket	82-84	56 (59)*	81	No	Measurement was performed at 7m from the worst effected facade. The measured LAeq, 15min is

			represents estimated noise level at the nearest residential façade, based on distance correction			lower than the predicted noise level.
5 Railway Street, Hurlstone Park	35T pilling rig with auger, Excavator 15T (2)	82	67 (69)*  *Bracketed value represents estimated noise level at the nearest residential façade, based on distance correction	89	No	Note that there was no access to the most affected façade. As a result, the measured LAeq, 15min noise level in bracket was the estimated noise level at the nearest residential façade, based on distance correction.
5 Foord Ave, Hurlstone Park	Crane Truck delivery	73-75	55	68	No	Measurement was performed at 7m from the worst effected façade. The measured LAeq, 15min is lower than the predicted noise level.
5 Railway st. Hurlstone Park	35T pilling rig with auger, 15T excavator with bucket, Crane Truck delivery	82	60 (62)*  *Bracketed value represents estimated noise level at the nearest residential façade, based on distance correction	77	No	Note that there was no access to the most affected façade. As a result, the measured LAeq, 15min noise level in bracket was the estimated noise level at the nearest residential façade, based on distance correction.
	35T pilling rig with auger, 15T excavator with bucket	82	63 (65)*  *Bracketed value represents estimated noise level at the nearest residential façade, based on distance correction	78	No	Note that there was no access to the most affected facade. As a result, the measured LAeq, 15min noise level in bracket was the estimated noise level at the nearest residential façade, based on distance correction.
254 Wardell Rd, Dulwich Hill	Concrete pumping, Crane truck idling, 13T excavator with Moxy truck	58	50	61	No	Measurement performed on the Wardell Rd. facing Dullwich Hill station. The measured LAeq, 15min is lower than the predicted noise level.
5 Foord Ave, Hurlstone Park	Crane Truck delivery	73-75	48	45	No	Measurement was performed at 7m from the worst effected façade. The measured LAeq, 15min is lower than the predicted noise level.
17 Burnett St, Hurlstone Park	Crane Truck delivery	64	51	70	No	The measured LAeq, 15min is lower than the predicted noise level.
5 Railway St. Hurlstone Park	35T pilling with auger, 15T excavator with bucket. Electric rotary cutter	82	61 (63)*  *Bracketed value represents estimated noise level at the nearest residential façade, based on distance correction	79	No	Note that there was no access to the most affected facade. As a result, the measured LAeq, 15min noise level in bracket was the estimated noise level at the nearest residential façade, based on distance correction.
7 Bedford Cresnet, Dulwich Hill	Concrete truck, excavators with bucket, hand tools	73	60	78	No	The measured LAeq, 15min is lower than the predicted noise level.
1 Ewart Lane,	Concrete truck,	72	69	86	No	The measured LAeq, 15min is

Dulwich Hill	delivery trucks					lower than the predicted noise level.
1 Acacia Street, Belmore	Lighting tower	62	57	77	No	The measured LAeq, 15min is lower than the predicted noise level.
30 Redman Parade, Belmore	Excavator with bucket, power tools	63	59	85	No	The measured LAeq, 15min is lower than the predicted noise level.
3 Wilfred Avenue, Campsie	Excavator with bucket, dump trucks	69	57	72	No	The measured LAeq, 15min is lower than the predicted noise level.
13 Angelo Road, Campsie	Excavator with bucket, wackerpacker	74	62	79	No	The measured LAeq, 15min is lower than the predicted noise level. Measurement location is on the corridor boundary fence. Sensitive receivers are on upper floors only.
279 The Boulevard, Punchbowl	Excavator with auger, hand tools, concrete pump	76	68	85	No	The measured LAeq, 15min is lower than the predicted noise level. Measurement location is affected by road traffic. Sensitive receivers are on upper floors only.
709 Punchbowl Road, Punchbowl	Pressure washer, hand tools	73	71	84	No	Dominated by road traffic. Sensitive receivers are on upper floors only
103 Duntroon Street, Hurlstone Park	Concrete truck and pump	82	72	90	No	The measured LAeq, 15min is lower than the predicted noise level.
5 Foord Ave, Hurlstone Park	Excavator with bucket, skip bin truck	84	61 (64)*	79	No	The measured LAeq, 15min is lower than the predicted noise level.
			*Bracketed value represents estimated noise level at the nearest residential façade, based on distance correction			
12 Railway Street, Hurlstone Park	Concrete truck, excavator with bucket, street sweeper	71	70	88	No	The measured LAeq, 15min is lower than the predicted noise level.
107 Duntroon St, Hurlstone Park	Electric jackhammer, Generator	73	58	63	No	The measured LAeq, 15min is lower than the predicted noise level.
16 <sup>th</sup> October 2021	TL927-1-15F01 WE16 NOISE AND VIBRATION MONITORING REPORT (R6) - APPENDIXES 9					
2 Hopetoun Street, Hurlstone Park	Two 15T excavator with bucket attachment	73	64	89	No	The measured LAeq, 15min is lower than the predicted noise level. Note that the measured noise level is lower than the predicted noise level because only the two 15T excavator with bucket attachment were operating during this measurement.
103-105 Duntroon Street, Hurlstone Park	Two 5T excavator with bucket attachment	84	65	78	No	The measured LAeq, 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 two 5T excavator with bucket attachment were operating during this measurement. Furthermore, access to the most affected facade for this receiver was not provided. As a result, the measurement was



						taken on the facade facing Duntroon Street. In the prediction model, the distance between the closest work area and the most affected facade is approximately 4 metres. However, it was noted on site that the two 5T excavators with bucket attachment were approximately 12 to 25 metres away from the measurement location.
24 Floss Street, Hurlstone Park	Electrical chainsaw and BC1800 shredder	Not Applicable	85	98	Not Applicable	This activity was undertaken during standard construction hours, from 08:00 to 18:00 - for confirmation of this refer to the timing of the noise verification monitoring contained within the report, being 10:28 to 10:43. This being the case the OoHWA is not applicable to this activity. However, the activity was scheduled between 06:00 and 18:00 in the endorsed OoHWA, and as such has a modelled noise level. It has been noted that the recorded noise level is above the modelled noise level.
41 Urunga Parade, Punchbowl	Electrical chainsaw and BC1800 shredder	78	58	71	No	The measured LAeq, 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 electrical chainsaw and the BC1800 shredder were operating during this measurement. Furthermore, it was noted on site that the electrical chainsaw and the BC1800 shredder were approximately 150 metres away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 30 metres.
7 Common Street, Hurlstone Park	Two 15T excavator with bucket attachment, plate compactor	77	62	80	No	The measured LAeq, 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 two 5T excavator with bucket attachment and a plate compactor were operating during this measurement. Furthermore, it was noted on site that the two 15T excavator with bucket attachment and the plate compactor were approximately 20 to 40 metres 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.
23 <sup>rd</sup> October 2021	TL927-1-16F01 WK17 NOISE AND VIBRATION MONITORING REPORT (R3) - APPENDIXES 10					
7 Commons Street, Hurlstone Park	2T excavator unloading with delivery truck, 7T hi-rail excavator transporting materials,	77	63	86	No	The measured LAeq, 15min is lower than the predicted noise level. Note that the measured noise level is significantly lower than the predicted noise level

	concrete saw					because only the 2T excavator unloading with delivery truck, 7T hi-rail excavator transporting materials and concrete saw were operating during this measurement. Furthermore, it was noted on site that the measured concrete sawing activity was approximately 100 metres away from the measured location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 15 metres.
3A Commons Street, Hurlstone Park	7T excavator with bucket attachment, 5T excavator idling, fencing removal	82	65	96	No	The measured LAeq, 15min is lower than the predicted noise level. LMax caused by nearby steel fence dropping. Note that the measured noise level is significantly lower than the predicted noise level because only the 7T excavator with bucket attachment and 5T excavator were operating during this measurement. Furthermore, it was noted on site that there were no high impact activities occurring during this measurement. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 10 metres.
20 Redman Parade, Belmore	Hi-rail dump truck, stockpile management, 5T excavator with bucket attachment	66	58	75	No	The measured LAeq, 15min is lower than the predicted noise level. Note that the measured noise level is lower than the predicted noise level because only the hi-rail dump truck, stockpile management and 5T excavator with bucket attachment were operating during this measurement. Furthermore, it was noted on site that the measured construction activity was approximately 40 metres away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 30 metres.
17 Redman Parade, Belmore	Hi-rail dump truck, stockpile management, 5T Excavator with bucket	60	60	82	No	The measured LAeq, 15min is consistent with the predicted noise level.
1A Shadforth Street, Wiley Park	5T Excavator with hammer attachment, handheld jackhammer	83	62	74	No	The measured LAeq, 15min is lower than the predicted noise level. It was noted on site that the hammering works were occurring underneath the station concourse. As a result, the noise source was shielded by the station structure. Furthermore, only the 5T Excavator with hammer attachment and the handheld jackhammer were operating during this measurement. It was also noted on site that the measured construction activity was approximately 50 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 15 metres. Therefore, the measured noise level is significantly below the predicted noise level.
	5T excavator with hammer attachment, handheld jackhammer	83	63	82	No	The measured LAeq, 15min is lower than the predicted noise level. It was noted on site that the hammering works were occurring underneath the station concourse. As a result, the noise source was shielded by the station structure. Furthermore, only the 5T Excavator with hammer attachment and the handheld jackhammer were operating during this measurement. It was also noted on site that the measured construction activity was approximately 50 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 15 metres. Therefore, the measured noise level is significantly below the predicted noise level.
51 Ewart Lane, Dulwich Hill	8T excavator with hammer attachment, concrete truck	74	69	81	No	The measured LAeq, 15min is lower than the predicted noise level. Note that the measured noise level is lower than the predicted noise level because only the 8T excavator with hammer attachment and concrete truck were operating during this measurement.
57 Ewart Lane, Dulwich Hill	8T excavator with hammer attachment, concrete truck	77	70	82	No	The measured LAeq, 15min is lower than the predicted noise level. Note that the measured noise level is lower than the predicted noise level because only the 8T excavator with hammer attachment and concrete truck were operating during this measurement.
2 Hopetoun Street, Hurlstone Park	Vacuum truck, hi-rail dump truck	73	69	76	No	The measured LAeq, 15min is lower than the predicted noise level.
3A Commons Street, Hurlstone Park	Power hand tools, 5T excavator with bucket attachment, 5T excavator with hammer attachment, hi-rail dump truck	82	62	78	No	The measured LAeq, 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 power hand tools, 5T excavator with bucket attachment, 5T excavator with hammer attachment and a hi-rail dump truck were operating during this measurement. Furthermore, it was noted that the measured construction activity was approximately 7 to 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 10 metres.
	Power hand tools, 5T excavator with bucket attachment, 5T excavator with hammer attachment, hi-rail dump truck	82	63	78	No	The measured LAeq, 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 power hand tools, 5T excavator with bucket attachment, 5T excavator with hammer attachment and a hi-rail dump truck were operating during this measurement. Furthermore, it was noted that the measured construction activity was approximately 7 to 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 10 metres.
105 Duntroon Street, Hurlstone Park	Two 5T Excavator with bucket attachment, two hi-rail dump truck, handheld power drill	84	67	86	No	The measured LAeq, 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 two 5T Excavator with bucket attachment, two hi-rail dump truck and a handheld power drill were operating during this measurement. Furthermore, access to the most affected facade for this receiver was not provided. As a result, the measurement was taken on the facade facing Duntroon Street. In the prediction model, the distance between the closest work area and the most affected facade is approximately 4 metres. However, it was noted on site that the measured construction activity were approximately 23 metres away from the measurement location.
48 Floss Street, Hurlstone Park	Concrete saw, two 5T excavator with bucket attachment, two hirail dump truck	76	52	69	No	The measured LAeq, 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 concrete saw, two 5T excavator with bucket attachment and two hi-rail dump truck were operating during this measurement. Furthermore, access to the most affected facade for this receiver was not provided. As a result, the measurement was taken on the facade facing Floss Street. In the prediction model, the distance between the closest work area and the most affected facade is approximately 20 metres. However, it was noted on site that the measured construction activity were approximately 47 to 50 metres away from the measurement location.

6 <sup>th</sup> November 2021		TL927-1-17F01 WK19 NOISE AND VIBRATION MONITORING REPORT (R2) - APPENDIXES 11				
51A Ewart Lane, Dulwich Hill	5T excavator with hammer attachment, delivery truck and vacuum truck	74	74	82	No	The measured LAeq, 15min is consistent with the predicted noise level.
57A Ewart Lane, Dulwich Hill	5T excavator with hammer attachment, 3T excavator moving materials	77	70	86	No	The measured LAeq, 15min is lower than the predicted noise level. The measured LMax was caused by a construction worker dropping materials. Note that the measured noise level is lower than the predicted noise level because the rockhammering activity is intermittent during the measurement. Furthermore, the rockhammering work area is at a lower ground level compared to the measurement location. Therefore, the rockhammering activity was partially shielded at this monitoring location.
59 Ewart Steet, Dulwich Hill	5T excavator with hammer attachment, rotary cutter, reversing beeper and vacuum truck	74	63	78	No	The measured LAeq, 15min is lower than the predicted noise level. Note that the measured noise level is significantly lower than the predicted noise level because the rockhammering activity is intermittent during the measurement. The rockhammering work area is at a lower ground level compared to the measurement location. Therefore, the rockhammering activity was partially shielded at this monitoring location. Furthermore, it was noted on site that the measured construction activity was approximately 50 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.

## RESULTS – VIBRATION MONITORING

The table below contains a summary of the vibration monitoring results. The complete reports are provided in Appendixes 4 – 17. The established criteria for cosmetic damage in the Construction Noise & Vibration OOHV Assessments 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

Station	Plant	Distance from source	95th percentile PPV (mm/s)	Maximum PPV (mm/s)	Above predicted vibration level	Comments
19 <sup>th</sup> – 20 <sup>th</sup> April 2021		TL927-1-02F02 WE42 NOISE AND VIBRATION MONITORING REPORT (R1) - APPENDIXES 4				
Hurlstone Park Station	Demo saw	0.2m	2.38	2.72	Yes (for heritage structures) No (for reinforced,	At 0.2 metres away, the concrete saw produced a maximum PPV value of 2.72 mm/s. This maximum PPV value exceeds the screening level for Heritage structures (2.5

					unreinforced or light framed structures)	mm/s). New site specific minimum working distances for using a demo saw established for heritage structures (minimum 0.5m).
		0.5m	1.46	1.78	No	At 0.5 metres away, the concrete saw produced vibration levels that are below the established vibration criteria.
	<b>12<sup>th</sup> May 2021</b>	<b>TL927-1-03F01 HURLSTONE PARK STN VIB MON REPORT (R1) - APPENDIXES 12</b>				
Hurlstone Park Station	96-pound handheld jackhammer	0.5m	1.17	1.35	No	At 0.5 metres away, the 96 pounds handheld jackhammer produced vibration levels that are below the established vibration criteria.
		1m	0.97	1.11	No	At 1 metre away, the 96 pounds handheld jackhammer produced vibration levels that are below the established vibration criteria.
		2m	0.85	1.11	No	At 2 metres away, the 96 pounds handheld jackhammer produced vibration levels that are below the established vibration criteria.
		3m	0.30	0.32	No	At 3 metres away, the 96 pounds handheld jackhammer produced vibration levels that are below the established vibration criteria.
	<b>14<sup>th</sup> May 2021</b>	<b>TL927-1-04F01 WILEY PARK STN VIB MON REPORT (R1) - APPENDIXES 13</b>				
Wiley Park Station	1.7T Kubota excavator with hammer attachment	3m	0.73	1.24	No	At a slant distance of 3 metres away, the 1.7T Kubota excavator with hammer attachment produced vibration levels that are below the established vibration criteria.
		4m	0.23	0.56	No	At a slant distance of 4 metres away, the 1.7T Kubota excavator with hammer attachment produced vibration levels that are below the established vibration criteria.
		5m	0.20	0.24	No	At a slant distance of 5 metres away, the 1.7T Kubota excavator with hammer attachment produced vibration levels that are below the established vibration criteria.
	<b>18<sup>th</sup> May 2021</b>	<b>TL927-1-05F01 PUNCHBOWL STN VIB MON REPORT (R1) - APPENDIXES 14</b>				
Punchbowl Station	80kg plate compactor	1m	2.26	2.38	No	At a distance of 1 metre away, the 80kg plate compactor produced vibration levels that are below the established vibration screening criteria.
		2m	0.85	1.22	No	At a distance of 2 metres away, the 80kg plate compactor produced vibration levels that are below the established vibration screening criteria.
		3m	0.75	0.86	No	At a distance of 3 metres away, the 80kg plate compactor produced vibration levels that are below the established vibration screening criteria.
	<b>20<sup>th</sup> May 2021</b>	<b>TL927-1-06F01 BELMORE METRO BUILDING SITE VIB MON REPORT (R1) - APPENDIXES 15</b>				
Belmore Station	10T smooth drum roller	3m - static	<0.5	<0.5	No	During this measurement, vibration signals from the source could not be detected.
		3m - vibratory	1.74	1.87	No	At a distance of 3 metres away with vibratory mode, the 10T smooth drum roller produced vibration levels that are below the established vibration screening criteria.
		4m - static	<0.5	<0.5	No	During this measurement, vibration signals from the source could not be detected.
		4m - vibratory	1.26	1.39	No	At a distance of 4 metres away with vibratory mode, the 10T smooth drum roller produced vibration levels that are below the established vibration screening criteria.
		5m - static	<0.5	<0.5	No	During this measurement, vibration signals from the source could not be detected.
		5m - vibratory	0.76	0.85	No	At a distance of 5 metres away with vibratory mode, the 10T smooth drum roller produced vibration levels that are below the established vibration screening criteria.
	<b>28<sup>th</sup> May – 29<sup>th</sup> May 2021</b>	<b>TL927-1-07F01 WE48 NOISE AND VIBRATION MONITORING REPORT (R1) - APPENDIXES 6</b>				
Wiley Park	Concrete saw	3m, measured at	<0.5	<0.5	No	The vibration monitor was mounted on the North platform building. During the concrete sawing activity, the vibration signals from the

		the affected heritage structure				concrete saw could not be detected. As a result, the concrete saw was allowed to be operated.
	Handheld jackhammer	3m	0.95	1.05	No	At 3m the jackhammer produced vibration levels that are below the established vibration criteria
		7m	0.13	0.26	No	At 7m the jackhammer produced vibration levels that are below the established vibration criteria
	90-pound handheld jackhammer	1m, Measured at the affected heritage structure	0.97	1.12	No	The vibration monitor was mounted on the North platform building. During the jackhammering activity, the 90-pound handheld jackhammer produced vibration levels that are below the established vibration criteria. As a result, the 90-pound handheld jackhammer was allowed to be operated.
Punchbowl Station	5T excavator with auger attachment	1m	0.35	1.15	No	The 5T excavator with auger attachment produced vibration levels that are below the established vibration criteria at 2 m, 1.5 m and 1 m away. Since the bored piling works are greater than 1 metre away from the platform building, the 5T excavator with auger attachment was allowed to be operated
		1.5m	0.29	0.96	No	
		2m	0.26	0.81	No	
Hurlstone Park	10T excavator with hammer attachment	2m	3.69	6.06	Yes	At 2 metres away, the 10T excavator with hammer attachment produced a 95th percentile PPV value of 3.69 mm/s. As a result, a new site specific minimum working distance for using a 10T excavator with hammer attachment was established for heritage structures (minimum working distance is 3m from heritage structures).
		3m	1.55	2.40	No	At 4 metres and 3 metres away, the 10T excavator with hammer attachment produced vibration levels that are below the established vibration criteria. As a result, the 10T excavator with hammer attachment can be operated with a minimum working distance of 3 metres for heritage structures.
		4m	0.90	1.20	No	
	2.5T excavator with hammer attachment (hp)	2m, Measured at the affected heritage structure	1.39	1.82	No	The vibration monitor was mounted on the South platform building. During the rockhammering activity, the 2.5T excavator with hammer attachment produced vibration levels that are below the established vibration criteria. As a result, the 2.5T excavator with hammer attachment was allowed to be operated.
	5 <sup>th</sup> June 2021	TL927-1-08F01 WE49 NOISE AND VIBRATION MONITORING REPORT (R2) - APPENDIXES 6				
Belmore Station	XD9-1 excavator (piling works)	4m, measured at the affected heritage structure	0.12	0.29	No	The vibration monitor was mounted on the external platform building. During the piling activity, the vibration signals from the XD9-1 excavator produced vibration levels that are below the established vibration criteria. As a result, the XD9-1 excavator was allowed to be operated.
	28 <sup>th</sup> June – 1 <sup>st</sup> July 2021	TL927-1-09F01 WE52-WK1 NOISE AND VIBRATION MONITORING REPORT (R3) - APPENDIXES 7				
Wiley Park Station	14T excavator with bucket attachment	3m, measured at the affected heritage structure	0.55	1.00	No	The vibration monitor was mounted on the platform building. During the excavating activity, the vibration signals from the 14T excavator with bucket attachment produced vibration levels that are below the established vibration criteria. As a result, the 14T excavator with bucket attachment was allowed to be operated.
Belmore Station	3.5T excavator with rockhammer attachment	10m, measured at the affected heritage	0.25	0.45	No	The vibration monitor was mounted on the platform building. During the rockhammering activity, the vibration signals from the 3.5T excavator with rockhammer attachment produced vibration levels that are below the

		structure				established vibration criteria. As a result, the 3.5T excavator with rockhammer attachment was allowed to be operated.
Dulwich Hill Station	6T excavator with rockdrill attachment	15m, measured at the affected heritage structure	< 0.5	1.15	No	The vibration monitor was mounted on the platform building. During the rockdrilling activity, the vibration signals from the 6T excavator with rockdrill attachment produced vibration levels that are below the established vibration criteria. As a result, the 6T excavator with rockdrill attachment was allowed to be operated.
Punchbowl Station	Station (refer to figure A.10) Handheld electric jackhammer	1m	0.90	1.65	No	The vibration monitor was mounted on the platform building. It was understood that the affected wall of the platform building is not heritage. As a result, the screening criterion for unreinforced structures (7.5 mm/s) was used for this measurement. During the jackhammering activity, the vibration signals from the handheld electric jackhammer produced vibration levels that are below the established screening criterion for unreinforced structures (7.5 mm/s). As a result, the handheld electric jackhammer was allowed to be operated.
Hurlstone Park Station	3T roller – static mode	10m, measured at the closest residential structure	< 0.5	< 0.5	No	During the rolling activity, the vibration signals from the 3T roller on static mode produced vibration levels that are below the established screening criterion for unreinforced structures (7.5 mm/s). As a result, the 3T roller on static mode was allowed to be operated.
	8T roller – static mode	5m	0.90	1.50	No	During the rolling activity, the vibration signals from the 8T roller on static mode produced vibration levels that are below the established screening criterion for unreinforced structures (7.5 mm/s). As a result, the 8T roller on static mode can be operated at a minimum distance of 5 metres from unreinforced structures.
	35T piling rig with auger	20m, measured at the closest residential structure	< 0.5	< 0.5	No	During the piling activity, the vibration signals from the 35T piling rig with auger produced vibration levels that are below the established screening criterion for unreinforced structures (7.5 mm/s). As a result, the 35T piling rig with auger was allowed to be operated.
<b>8<sup>th</sup> July 2021 TL927-1-10F01 WK52-WE2 NOISE AND VIBRATION MONITORING REPORT (R3) - APPENDIXES 8</b>						
Hurlstone Park Station	Vibratory plate compactor	1m, measured at the affected Station building	3.0	3.8	No	The vibration monitor was mounted on the platform building. During the asphalt compacting activity, the vibration signals from the vibratory plate produced vibration levels that are below the established vibration criteria. As a result, the Vibratory plate compactor was allowed to be operated.
Wily Park Station	5T Asphalt Roller (nonvibratory)	1m	<0.5	<0.5	No	The vibration monitor was mounted on the platform. During the asphalt compacting activity, the vibration signals from the 5T non-vibratory roller produced vibration levels that are below the established vibration criteria. As a result, the 5T nonvibratory roller was allowed to be operated.
Wily Park Station	Vibratory plate compactor	1m	3.0	3.2	No	The vibration monitor was mounted on the platform. During the asphalt compacting activity, the vibration signals from the vibratory plate produced vibration levels that are below the established vibration criteria. As a result, the Vibratory plate compactor was allowed to



						be operated.
7 <sup>th</sup> October 2021		TL927-1-12F01 HURLSTONE PARK STN VIB MON REPORT (R1) - APPENDIXES 16				
Hurlstone Park Station	96 pound handheld jackhammer	1m	3.93	4.05	No	At 1 metre away, the 96 pound handheld jackhammer produced vibration levels that are below the established vibration screening level for unreinforced or light framed structures (including sound heritage structures).
		2m	1.99	2.02	No	At 2 metres away, the 96 pound handheld jackhammer produced vibration levels that are below the establish- APPENDIXES 5ed vibration screening levels.
7 <sup>th</sup> October 2021		TL927-1-13F01 DULWICH HILL STN VIB MON REPORT (R1) - APPENDIXES 17				
Dulwich Hill Station	5T excavator with hammer attachment	7m	1.74	1.78	No	At the affected property boundary, the 5T excavator with hammer attachment produced vibration levels that are below the established vibration screening levels.
16 <sup>th</sup> October 2021		TL927-1-15F01 W16 NOISE AND VIBRATION MONITORING REPORT (R6) - APPENDIXES 9				
Hurlstone Park Station	Two 5T excavator with bucket attachment	12m	0.03	0.04	No	The accelerometer was mounted on the residential building at 103-105 Duntroon Street, Hurlstone Park. The measured results show that the baseline value did not change during the excavation work. Therefore, the vibration signals from the two 5T excavators with bucket attachment could not be detected at this measurement location. As a result, the 5T excavators with bucket attachment was allowed to be operated.
	5T excavator with hammer attachment	12m	0.04	0.09	No	The accelerometer was mounted on the residential building at 103-105 Duntroon Street, Hurlstone Park. The measured results show that the baseline value did not change during the excavation work. Therefore, the vibration signals from the 5T excavator with hammer attachment could not be detected at this measurement location. As a result, the 5T excavator with hammer attachment was allowed to be operated.
Punchbowl Station	2T Excavator with hammer	1m	1.09	2.28	No	The accelerometer was mounted on the station structure at the station building. During the hammering activity, the vibration signals from the hammer produced vibration levels that are below the established vibration criteria. As a result, the 2T excavator with hammer attachment was allowed to be operated.
23 <sup>rd</sup> October 2021		TL927-1-16F01 W17 NOISE AND VIBRATION MONITORING REPORT (R3) - APPENDIXES 10				
Wiley Park Station, location 1	Handheld jackhammer	10m	0.64	0.88	No	The accelerometer was mounted on the concourse station structure at Wiley Park Station. During the hammering activity, the handheld jackhammer produced vibration levels that were below the established vibration criteria. As a result, the handheld jackhammer was allowed to be operated.
Wiley Park Station, location 2	5T excavator with hammer attachment	10m	0.25	0.56	No	The accelerometer was mounted on the concourse station structure at Wiley Park Station. During the hammering activity, the handheld jackhammer produced vibration levels that were below the established vibration criteria. As a result, the 5T excavator with hammer attachment was allowed to be

						operated.
6 <sup>th</sup> November 2021						TL927-1-17F01 WK19 NOISE AND VIBRATION MONITORING REPORT (R2) - APPENDIXES 11
Dulwich Hill Station	5T excavator with hammer attachment	6m	0.90	0.95	No	At a distance of 6 metres away, the 5T excavator with hammer attachment produced vibration levels that are below the established vibration screening criteria
	5T excavator with hammer attachment	5m	1.08	1.13	No	At a distance of 5 metres away, the 5T excavator with hammer attachment produced vibration levels that are below the established vibration screening criteria.
	5T excavator with hammer attachment	3m	1.60	1.66	No	At a distance of 3 metres away, the 5T excavator with hammer attachment produced vibration levels that are below the established vibration screening criteria.

## DISCUSSION – NOISE AND VIBRATION MONITORING

The noise monitoring results did not identify any exceedances of the predicted noise levels. This shows that the provision of construction noise mitigation measures has been appropriate.

The vibration monitoring results have indicated that a majority of the construction activities that have occurred have not caused vibration impacts above the screening levels, however it was noted in TL927-1-07F01 WE48 NOISE AND VIBRATION MONITORING REPORT (R1) that at 2 metres away, a 10T excavator with hammer attachment produced a 95th percentile PPV value of 3.69 mm/s. As a result, 10T excavators with hammer attachment have a minimum working distance of 3m from heritage structures. Also, as noted in report TL927-1-02F02 WE42 Noise and Vibration Monitoring Report (r1), monitoring the use of a demo saw at 0.2m showed maximum PPV parameters were exceed for heritage structures, establishing the use of this equipment to 0.5m, where maximum PPV demonstrated to be within the established parameters.

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.

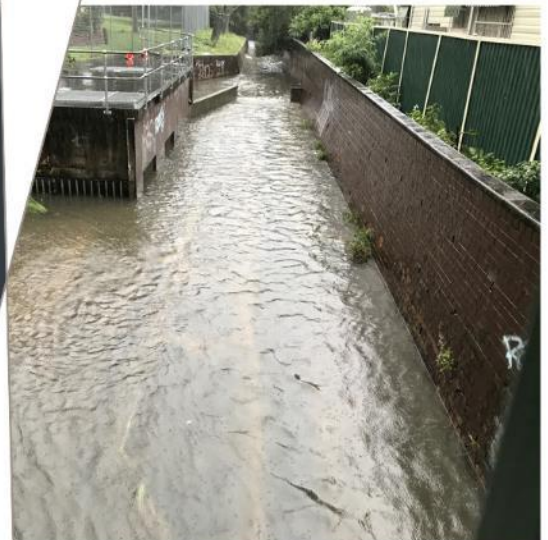
---

## Appendix 1 – Surface Water Monitoring Report - Wiley Park Station - 4NE30187\_R001\_SWM\_WileyPark\_RevA

# Surface Water Monitoring Report - Wiley Park Station

Wiley Park Station

4NE30187



Prepared for  
Downer EDI Works Pty Ltd

20 April 2021

## Contact Information

### Cardno (NSW/ACT) Pty Ltd

ABN 95 001 145 035

Level 9 - The Forum  
203 Pacific Highway  
St Leonards NSW 2065  
PO Box 19

www.cardno.com

Phone +61 2 9496 7700

Fax +61 2 9439 5170

Author(s):

Chong Zeng  
Environmental Engineer

Approved By:

Mike Jorgensen  
Principal Hydrogeologist

## Document Information

Prepared for	Downer EDI Works Pty Ltd
Project Name	Wiley Park Station
File Reference	4NE30187_R001_SWM_WileyPark_RevA.docm
Job Reference	4NE30187
Date	20 April 2021
Version Number	RevA

Effective Date	20/04/2021
----------------	------------

Date Approved	20/04/2021
---------------	------------

## Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
V1	19/04/2021	Draft for Internal Review	CZ	MJ
RevA	20/04/2021	Draft for Client Review	CZ	MJ

© Cardno. Copyright in the whole and every part of this document belongs to Cardno and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person other than by agreement with Cardno.

This document is produced by Cardno solely for the benefit and use by the client in accordance with the terms of the engagement. Cardno does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by any third party on the content of this document.

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

---

1	Introduction	1
	1.1 Background	1
	1.2 Objectives	1
	1.3 Scope of Works	1
2	Guidelines and Legislation	2
3	Monitoring Locations	2
	3.1 Monitoring Locations	2
4	Quality Management	2
	4.2 Data Quality Indicators	4
5	Field Investigation	6
6	Surface Water Assessment Criteria	7
7	Summary of Results	8
	7.1 Summary of Field Observations	8
	7.2 Field Parameters	9
	7.3 Surface Water Analytical Results	10
	7.4 Results Discussion	10
8	Conclusion	1
9	References	2
10	Limitations	3

## Appendices

---

<b>Appendix A</b>	Figures
<b>Appendix B</b>	Photographs
<b>Appendix C</b>	Field Records
<b>Appendix D</b>	Laboratory Summary tables
<b>Appendix E</b>	Quality Assurance/Quality control
<b>Appendix F</b>	Laboratory reports

## Tables

---

Table 1-1	Wiley Park Water Quality Monitoring Program	1
Table 3-1	Surface Water Monitoring Location Details	2
Table 4-1	Data Quality Objectives	3
Table 4-2	Summary of Data Quality Indicators	4
Table 5-1	Investigation Activity Summary	6
Table 6-1	Water Quality Monitoring Parameters and Adopted Criteria at Wiley Park	7
Table 7-1	Laboratory Physico-chemical Parameters and Field Observations	9

# 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 1-1**, 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 A**.

This report represents the surface water monitoring events undertaken by Cardno on 10<sup>th</sup> March 2021 and 20<sup>th</sup> March 2021.

The closest Project worksite to an existing watercourse is 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.

For the purpose of establishing baseline water quality data within the first order stream at Wiley Park, water quality monitoring was 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 is subject to water being present within the structure.

The monitoring event undertaken on the 10<sup>th</sup> of March was a pre-construction baseline round during dry weather. Note that during the baseline monitoring period no wet weather events were able to be captured prior to commencement of construction. The event undertaken on the 20<sup>th</sup> of March was a wet weather event, during possession whilst construction had commenced. This report includes the data obtained from one baseline dry weather round and one mid-construction wet weather round. Data was not obtained from a pre-construction baseline wet weather event due to the lack of rainfall.

Table 1-1 Wiley Park Water Quality Monitoring Program

<b>Waterway</b>	Sydney Water Cooks River Channel (first order stream)
<b>Indicative monitoring points</b>	WP1 – Upstream
<b>Indicative monitoring points</b>	WP2 – Downstream
<b>Interaction with Project works</b>	Channel within proximity to Wiley Park service building site
<b>Pre-construction works</b>	<p>Monthly for parameters detailed in Table 11 (including at least one dry weather round of sampling).</p> <p>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.</p> <p>Note: A wet weather event is when the receiving area has received greater than 20mm of rain in 24 hours. The sampling will be undertaken immediately during construction hours and if it is safe to do so.</p>
<b>During construction of the Wiley Park services building</b>	<p>Quarterly for parameters detailed in Table 11 (including during dry weather).</p> <p>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.</p> <p>Note: A wet weather event is when the receiving area has received &gt;20mm of rain in 24 hours. The sampling will be undertaken immediately during construction hours and if it is safe to do so.</p>

## 1.2 Objectives

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 March 2021 surface water monitoring event:

- > Inspected and sampled the two (2) nominated surface water sampling locations on the 10<sup>th</sup> March as a dry weather baseline monitoring event;
- > Inspected and sampled the two (2) nominated surface water sampling locations on the 20<sup>th</sup> March as a wet weather mid-construction monitoring event;
- > Recorded field parameters and noted observations of the water bodies during sampling;
- > Collected two (2) primary surface water samples, one field duplicate sample and one field triplicate 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.



- > Review of analytical and field data and preparation of this report.

## 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);
- > 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');
- > 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 **Figure 1** 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	-33.924014	151.065315	Immediately south of the Boulevard and east of 118 the Boulevard.
WP2	-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	Ongoing surface water monitoring is required to determine if the construction work is impacting the local surface water quality within the unnamed channel.
Step 2 Identify the Decisions	The decisions that need to be made are: <ul style="list-style-type: none"> <li>&gt; Are there any impacts to surface water quality from the construction of the site?</li> </ul>
Step 3 Identify Inputs to the Decision	The primary inputs to the decisions described above are: <ul style="list-style-type: none"> <li>&gt; 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);</li> <li>&gt; Laboratory analysis of surface water samples for relevant parameters;</li> <li>&gt; Assessment of the suitability of the analytical data obtained, against the Data Quality Indicators (DQIs);</li> <li>&gt; Assessment of the analytical results against applicable guideline criteria; and</li> <li>&gt; Aesthetic observations of surface water bodies, including odours, sheen and condition, if encountered.</li> </ul>
Step 4 Define the Study Boundaries	The lateral extent of the study area is the channel within proximity to Wiley Park service building site.  The temporal boundaries of the study will 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: <ul style="list-style-type: none"> <li>&gt; Were primary and QA/QC samples analysed using methods endorsed by relevant regulatory guidelines at laboratories NATA-accredited for the requested analyses?</li> <li>&gt; 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?</li> <li>&gt; Were the laboratory limits of reporting (LORs) below the applicable guideline criteria for the analysed parameters?</li> <li>&gt; Were guideline criteria sourced from endorsed guidelines?</li> <li>&gt; Were surface water aesthetic characteristics evaluated including odours and sheen?</li> </ul>
Step 6 Specify Limits on Decision Errors	To ensure the results obtained are reproducible and accurate, a QA/QC plan was incorporated into the sampling and analytical program. DQIs were used to assess the reliability of field procedures and analytical results. In particular, the DQIs within NSW EPA 2017 were used to document and quantify compliance. DQIs are described as follows: <ul style="list-style-type: none"> <li>&gt; Completeness – A measure of the amount of useable data from a data collection activity;</li> <li>&gt; Comparability – The confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event;</li> <li>&gt; Representativeness – The confidence (expressed qualitatively) that data are representative of each media present in the project area;</li> <li>&gt; Precision – A quantitative measure of the variability (or reproducibility) of data; and</li> <li>&gt; Accuracy (bias) – A quantitative measure of the closeness of reported data to the true value.</li> </ul>
Step 7	To achieve the DQOs and DQIs, the following sampling procedures were implemented to optimise the design for obtaining data:

DQO	Description
Optimise the Design for Obtaining Data	<ul style="list-style-type: none"> <li>&gt; Surface water samples was collected from two (2) sampling locations, as available due to access and water level;</li> <li>&gt; Surface water parameters were selected based on project monitoring requirements provided to Cardno;</li> <li>&gt; Samples were collected by suitably qualified and experienced environmental scientists;</li> <li>&gt; Samples were collected and preserved in accordance with relevant standards/guidelines; and</li> <li>&gt; Field and laboratory QA/QC procedures were adopted and reviewed to indicate the reliability of the results obtained.</li> </ul>

## 4.2 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
<b>Completeness</b>		
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
<b>Comparability</b>		
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
<b>Representativeness</b>		
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

Data Quality Indicator	Frequency	Data Acceptance Criteria
Samples extracted and analysed within holding times	All samples	The samples were extracted and analysed within holding times specified by the laboratory
<b>Precision</b>		
Blind duplicates (intra-laboratory duplicates)	1 per 20 samples	<30% RPD No Limit RPD Result <10 x LOR
Split duplicates (inter-laboratory duplicates)	1 per 20 samples	<30% RPD No Limit RPD Result <10 x LOR
Laboratory duplicates	1 per 20 samples	Results greater than 10 x LOR: <30% RPD Results less than 10 x LOR: No limit on RPD
<b>Accuracy (Bias)</b>		
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 on 10 and 20 March 2021. 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	10 March 2021 and 20 March 2021
Surface Water Sampling	<p>Cardno inspected two surface water monitoring locations. Primary samples were collected from each of the two locations per sampling event. Cardno undertook the sampling as per the following procedures:</p> <p><u>Surface Water Body Inspection</u> - 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.</p> <p>Each surface water location was inspected for indicators of contamination and the presence of surface water. This information is recorded on the field sheets presented in <b>Appendix C</b>.</p> <p><u>Surface water sampling</u> - Field parameters and visual/olfactory observations were recorded prior to sampling at each location. Physio-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 <b>Appendix C</b>.</p> <p>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.</p>
Surface Water Analysis	<p>Surface water samples from each monitoring event were submitted under standard chain-of-custody (CoC) procedures to NATA-accredited Eurofins Environment Testing Australia analysis of the parameters as follows:</p> <ul style="list-style-type: none"> <li>- Oil &amp; Grease;</li> <li>- Total Suspended Solids (TSS);</li> <li>- Nutrients (Total Phosphorous, Total Nitrogen);</li> <li>- Turbidity; and</li> <li>- Chlorophyll-a.</li> </ul> <p>Tabulated laboratory results are presented in <b>Appendix D</b>. The Data QA /QC program and data quality review including calibration certificates is presented in <b>Appendix E</b>.</p> <p>Copies of the original laboratory reports, NATA-stamped laboratory certificates, and CoC documentation are included in <b>Appendix F</b>.</p>
Decontamination	<p>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.</p>

## 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 <sup>1</sup>	Proposed Trigger Values	Proposed Actions
Temperature (°C)	>80% ile; <20% ile		
Dissolved Oxygen (DO)	Lower limit – 85% Upper limit -110%		
Turbidity (NTU)	6-50 NTU	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.	Environment Manager (or delegate) to re-test to confirm results and undertake an inspection of the adjacent works and propose actions where required.
Oil and grease	-		
pH	Lower limit – 6.5 Upper limit – 8.5		
Salinity (as EC)	125 – 2200 µS/cm	Downstream results are > than upstream results during dry weather sampling.	
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 baseline testing will indicate whether this existing water quality within the channel meet ANZECC guidelines, prior to construction of the services building. 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 surface water sampling locations were able to be accessed during both sampling events conducted on 10 March 2021 and 20 March 2021. Photos of each sampling location are included in **Appendix B**. The following observations were made:

#### 7.1.1 Dry Weather Baseline Event – 10 March 2021

> Sampling Event on 10 March 2021:

- The sampling event was undertaken in cloudy weather with 0 mm precipitation over the last 24 hours;
- WP 1 contained low flowing clear water with low turbidity. The estimated depth of the water body was 0.03 m. Visible oil sheen observed at the time of sampling work (refer Photograph 1 in Appendix B); and
- WP 2 contained low flowing clear water with low turbidity. The estimated depth of the water body was 0.03 m. Visible oil sheen observed at the time of sampling work (refer Photograph 2 in Appendix B);

#### 7.1.2 Wet Weather Mid-Construction Event – 20 March 2021

> Sampling Event on 20 March 2021:

- The sampling event was undertaken during a storm event with heavy rain with 92.0 mm precipitation over the last 24 hours;
- WP 1 contained high flowing brown water with medium turbidity. The estimated depth of the water body was 0.3 m;
- WP 2 contained high flowing brown water with medium turbidity. The estimated depth of the water body was 0.3 m;

## 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

Location ID	Water Depth (m)	Temperature (°C)	pH	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Redox Potential (mV)	Condition
<b>10 March 2021</b>								
WP1	0.03	21.3	7.90	543	5.64	63	140.7	Clear Low turbidity Sheen observed
WP2	0.03	21.1	7.61	363	4.09	45.9	181.0	Clear Low turbidity Sheen observed
<b>20 March 2021</b>								
WP1	0.3	20.2	8.10	246.2	4.79	52.87	122.3	Brown Medium turbidity
WP2	0.3	20.0	7.58	133.4	3.92	43.18	135.9	Brown Medium 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 Baseline Dry Weather Event: 10 March 2021

The results of the monitoring event indicates that:

- > Electrical Conductivity ( $\mu\text{S}/\text{cm}$ ) was within the adopted assessment criteria at all sample locations;
- > Dissolved Oxygen (%Sat) was reported outside of the target range (85%-110%) with results ranging from 63% saturation upstream at WP1 and 45.9% saturation downstream at WP2;
- > Concentrations of inorganics were reported below the adopted assessment criteria with the exception of nitrogen and phosphorous which exceeded the ANZECC criteria at both sample locations. Upstream concentrations at WP1 were higher than concentrations downstream at WP2;
- > Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations with the exception of the downstream sample WP2;
- > Concentrations of Chlorophyll-a were reported below the laboratory detection limit and adopted assessment criteria at all sample locations; and
- > Total Suspended Solids (TSS) was not detected above the laboratory limit of reporting in both sample locations; and
- > Turbidity ranged from 2.9 NTU at WP1 and <1 NTU at WP2.

### 7.3.2 Mid Construction Wet Weather Event: 20 March 2021

The results of the monitoring event indicates that:

- > Electrical Conductivity ( $\mu\text{S}/\text{cm}$ ) was within the adopted assessment criteria at all sample locations;
- > Dissolved Oxygen (%Sat) was reported outside of the target range (85%-110%) with results ranging from 52.9% saturation upstream at WP1 and 43.2% saturation downstream at WP2;
- > Concentrations of inorganics were reported below the adopted assessment criteria with the exception of nitrogen within both the WP1 and WP2 samples, and phosphorous within a triplicate quality assurance sample from WP2 which exceed the ANZECC criteria.
- > Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations;
- > Concentrations of Chlorophyll-a were reported below the laboratory detection limit and adopted assessment criteria at all sample locations;
- > Total Suspended Solids (TSS) concentrations were detected within both WP1 and WP2, with concentrations of 9.2 mg/L at WP1 and 35 mg/L at WP2; and
- > Turbidity ranged from 9.3 NTU at WP1 to 13.2 NTU at WP2.

## 7.4 Results Discussion

### 7.4.1 Baseline Monitoring Results

As described above, the baseline dry weather monitoring undertaken shows that generally monitored parameters are within the adopted threshold criteria with the exception of nitrogen, phosphorous, and dissolved oxygen saturation. Generally, downstream results for inorganic analytes were lower than upstream results. Hydrocarbon sheen was observed on at both locations, however oil and grease was only detected above the limit of reporting at the WP1 downstream location.

During the dry weather event, the two inlet points from the rail corridor (eastern and western) slightly upstream from the WP2 downstream sampling point were not observed to be flowing. The eastern inlet point is assumed to collect flow from towards to the construction footprint, and the western inlet from away from the opposite side of the channel. Results are likely representative of natural variability in water quality sampled.

#### 7.4.2 Mid-Construction Wet Weather Event – 20 March

Results for the mid-construction wet weather event sampled on 20 March generally showed monitored parameters were within the adopted threshold criteria, with the exception of nitrogen, phosphorous, and dissolved oxygen saturation consistent with the pre-construction monitoring.

Results for upstream and downstream sampling were comparable, with the exception of TSS and turbidity which were higher in the WP2 downstream location.

It should be noted that wet weather and storm event pre-construction monitoring was not able to be conducted, and therefore baseline data for comparison is not available. During the wet weather sampling event the two inlet points within the rail corridor mentioned above immediately upstream from WP2 were observed to be flowing and contributing to the channel.

## 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.

This report presents monitoring data from one pre-construction baseline dry weather event on 10 March 2021, and one mid-construction wet weather event on 20 March 2021.

Baseline dry weather sampling results showed monitored parameters were generally within the adopted ANZECC screening criteria with the exception of nitrogen, phosphorous and dissolved oxygen saturation.

During the wet weather event sampled on 20 March, TSS and turbidity results were observed to be higher in the downstream WP2 sampling point. Although baseline conditions for wet weather are unknown, Cardno recommends the Environment Manager (or delegate) to re-test to confirm results and undertake an inspection of the adjacent works and propose actions where required in accordance with the SMWP.

## 9 References

---

- > Southwest Metro – Hurlstone Park, Belmore and Wiley Park Station Upgrades – Soil and Water Management Plan, dated 16<sup>th</sup> 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 (2018). 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



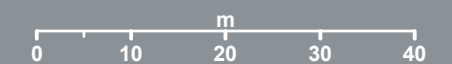
## Surface Water Monitoring

WILEY PARK STATION

### Legend

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

1:800 Scale at A3



APPENDIX

# B

PHOTOGRAPHS





**Photograph 1.** Condition observed from sampling location of WP1 during the monitoring event – 10 March.



**Photograph 2.** Condition observed from sampling location of WP2 during the monitoring event – 10 March.



**Photograph 3.** Condition observed from sampling location of WP1 during the monitoring event – 20 March.



**Photograph 4.** Condition observed from sampling location of WP2 during the monitoring event – 20 March.

APPENDIX

C

FIELD RECORDS



**Surface Water Sampling Field Record**

Site / Project: <i>Downer bridge lake</i>		Sampling Point: <i>WPI</i>	
Client: <i>Downer</i>		Job No. <i>ANE30187</i>	
Person Sampling:		Initials: <i>kw</i>	
Site Details			
Sampling Equipment – Directly into bottle / Water Scoop / Van Dorn Sampler / Other:		Date: <i>20.3.21</i>	
Observations on Site: Last Rain Event / Recent Storms / Releases / Other : <i>Storm during sampling</i>			
Sample Details, Observations, GPS Coordinates & Field Physiochemical Measurements (if possible, record parameters once stable)			
Sample ID	<i>WPI</i>		
Start Time:	<i>11:45</i>		
Easting			
Northing			
Sample Depth (m)	<i>0.1</i>		
Water Body Depth (m)	<i>0.3</i>		
Location – Onsite/Offsite /Inlet/Outlet/ Middle	<i>upstream channel</i>		
Flow Rate None/ Low / Med / High	<i>High</i>		
DO (mg/L)	<i>4.79</i>		
EC (µS/Cm)	<i>246.2</i>		
pH	<i>8.10</i>		
Eh (mV)	<i>122.3</i>		
Temp (°C)	<i>20.2</i>		
Water Colour	<i>brown</i>		
Turbidity Low / Med / High	<i>med</i>		
Observations / Notes	<i>no sheen</i>		
Sample Container & Preservation Data			
Number of sample containers:	<i>4</i>		
Container Volume			
Container Type			
Preservation			
Sample Number (for Lab ID):	<i>WPI</i>		
QC Dup Sample No.:	<i>—</i>		

name.

**Surface Water Sampling Field Record**

Site / Project:	Downer Wiley Park			Sampling Point:	WPZ
Client:	Downer			Job No.:	4NE301P7
Person Sampling:	BW			Initials:	BW
Site Details					
Sampling Equipment – Directly into bottle / Water Scoop / Van Dorn Sampler / Other:	Water Scoop			Date:	20-3-21
Observations on Site: Last Rain Event / Recent Storms / Releases / Other:	Storm dry samples				
Sample Details, Observations, GPS Coordinates & Field Physiochemical Measurements (if possible, record parameters once stable)					
Sample ID					
Start Time:	12:00				
Easting					
Northing					
Sample Depth (m)	0.1				
Water Body Depth (m)	0.3				
Location – Onsite/Offsite /Inlet/Outlet/ Middle	Down stream channel				
Flow Rate None/ Low / Med / High	High				
DO (mg/L)	3.92				
EC (µS/Cm)	133.4				
pH	7.58				
Eh (mV)	135.9				
Temp (°C)	20.0				
Water Colour	brown				
Turbidity Low / Med / High	med				
Observations / Notes	no sheen				
Sample Container & Preservation Data					
Number of sample containers:	A				
Container Volume					
Container Type					
Preservation					
Sample Number (for Lab ID):	WPZ				
QC Dup Sample No.:	QA100	QA200			

name.

**Surface Water Sampling Field Record**

Site / Project: <i>Dawson Lake Park</i>	Sampling Point: <i>WP2A</i>
Client: <i>Bowen</i>	Job No. <i>4NE30/82</i>
Person Sampling: <i>BW</i>	Initials: <i>BW</i>

**Site Details**

Sampling Equipment – Directly into bottle / Water Scoop / Van Dorn Sampler / Other: <i>Water Scoop</i>	Date: <i>20.3.21</i>
Observations on Site: Last Rain Event / Recent Storms / Releases / Other: <i>Storm during sampling</i>	

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

Sample ID	<i>WP2A</i>			
Start Time:	<i>12:00</i>			
Easting				
Northing				
Sample Depth (m)	<i>0.1</i>			
Water Body Depth (m)	<i>0.3</i>			
Location – Onsite/Offsite /Inlet/Outlet/ Middle	<i>Outlet, offsite side</i>	<i>Station Side</i>		
Flow Rate None/ Low / Med / High	<i>High</i>			
DO (mg/L)	<i>4.80</i>			
EC (µS/Cm)	<i>214.1</i>			
pH	<i>9.05</i>			
Eh (mV)	<i>93.5</i>			
Temp (°C)	<i>20.1</i>			
Water Colour	<i>Brown</i>			
Turbidity Low / Med / High	<i>med</i>			
Observations / Notes	<i>no sheen</i>			

**Sample Container & Preservation Data**

Number of sample containers:	<i>4</i>			
Container Volume				
Container Type				
Preservation				
Sample Number (for Lab ID):	<i>WP2A</i>			
QC Dup Sample No.:	<i>—</i>			

**Surface Water Sampling Field Record**

Site / Project:	Downer Wiley Park			Sampling Point:	WP2B
Client:	Downer			Job No.	4NE30187
Person Sampling:	BW			Initials:	BW
Site Details					
Sampling Equipment – Directly into bottle / Water Scoop / Van Dorn Sampler / Other:				Date:	20-3-21
Observations on Site: Last Rain Event / Recent Storms / Releases / Other:	Storm during sampling				
Sample Details, Observations, GPS Coordinates & Field Physiochemical Measurements (if possible, record parameters once stable)					
<b>Sample ID</b>					
Start Time:	12:05				
Easting					
Northing					
Sample Depth (m)	0.1				
Water Body Depth (m)	0.3				
Location – Onsite/Offsite /Inlet/Outlet/ Middle	Outlet Downer Side	Track Side			
Flow Rate None/ Low / Med / High	High				
DO (mg/L)	5.19				
EC (µS/Cm)	193.1				
pH	7.73				
Eh (mV)	142.3				
Temp (°C)	20.1				
Water Colour	brown				
Turbidity Low / Med / High	red				
Observations / Notes	No sheen				
Sample Container & Preservation Data					
Number of sample containers:	4				
Container Volume					
Container Type					
Preservation					
Sample Number (for Lab ID):	WP2B				
QC Dup Sample No.:					



APPENDIX

# D

LABORATORY SUMMARY TABLES

	Chlorophyll a	TPH	Inorganics					Physio-Chemical				
		Oil and Grease	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrogen (Total)	Phosphorus	TSS	Turbidity	pH	Temperature	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	0.005	5	0.1	0.01	0.1	0.01	1	0.1	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%

Lab Report Number	Field ID	Date	Chlorophyll a	TPH	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrogen (Total)	Phosphorus	TSS	Turbidity	pH	Temperature	Electrical Conductivity	Dissolved Oxygen
779437	WP1	10/03/2021	<0.005	<10	1.3	1.2	2.5	0.34	<1	2.9	7.9	21.3	543	63
779437	WP2	10/03/2021	<0.005	29	0.8	0.88	1.68	0.12	<1	<1	7.61	21.1	363	45.9
782225	WP1	20/03/2021	<0.005	<10	0.6	1.7	2.3	<0.5	9.2	9.3	8.1	20	246.2	52.87
782225	WP2	20/03/2021	<0.005	<10	0.8	1.5	2.3	<0.5	35	13	7.58	20.1	133.4	43.18
779437	QA100	10/03/2021	-	28	2.7	0.86	3.56	0.12	4	1.2	-	-	-	-
782225	QA100	20/03/2021	-	<10	0.9	1.8	2.7	<0.5	25	17	-	-	-	-
ES2108619	QA200	10/03/2021	-	8	0.6	0.74	1.3	0.09	6	1	-	-	-	-
ES2110601	QA200	20/03/2021	-	<5	1	1.33	2.3	0.29	31	13.4	-	-	-	-

Statistics

Maximum Concentration	<0.005	29.00	2.70	1.80	3.56	0.34	35.00	17.00	8.10	-	-	543.00	63
-----------------------	--------	-------	------	------	------	------	-------	-------	------	---	---	--------	----

\* 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 collection	sample 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 <b>Appendix F</b> . 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 <b>Appendix F</b> .
Laboratory QC	Internal 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	10/03/2020	WP2	QA100	QA200
Surface Water	20/03/2020	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:

$$RPD = \frac{(C_o - C_s)}{\left(\frac{C_o + C_s}{2}\right)} \times 100$$

Where:

$C_o$  = Concentration of the original sample

$C_s$  = 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 six (6) 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.

			Lab Report Number		779437		779437		779437		ES2108619		782225		782225		782225		ES2110601			
			Field ID		WP2		QA100		WP2		QA200		WP2		QA100		WP2		QA200			
			Matrix Type		water		water		water		water		water		water		water		water			
			Date		10/03/2021		10/03/2021		RPD		10/03/2021		10/03/2021		RPD		20/03/2021		20/03/2021		RPD	
	Unit	EQL																				
NA																						
Chlorophyll a	mg/L	0.005	<0.005				<0.005						<0.005					<0.005				
TPH																						
Oil and Grease	mg/L	5	29	28	4	29	8	114	<10	<10	0	<10	<5	0								
Inorganics																						
Kjeldahl Nitrogen Total	mg/L	0.1	0.8	2.7	109	0.8	0.6	29	0.8	0.9	12	0.8	1.0	22								
Nitrate & Nitrite (as N)	mg/L	0.01	0.88	0.86	2	0.88	0.74	17	1.5	1.8	18	1.5	1.33	12								
Nitrogen (Total)	mg/L	0.1	1.68	3.56	72	1.68	1.3	26	2.3	2.7	16	2.3	2.3	0								
Phosphorus	mg/L	0.01	0.12	0.12	0	0.12	0.09	29	<0.5	<0.5	0	<0.5	0.29	0								
TSS	mg/L	1	<1	4.0	120	<1	6	143	35	25	33	35	31	12								
Turbidity	NTU	0.1	<1	1.2	18	<1	1.0	0	13	17	27	13	13.4	3								

\*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: 81 (1 - 10 x EQL); 50 (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





## CHAIN OF CUSTODY AND ANALYSIS REQUEST

Contact Person: Ben Withnall	Project Name: Downer Sydney Metro Stations
Telephone Number: 0436 687 417	Project Number: Downer WP
Alternative Contact: Chong Zheng	PO No.:
Telephone Number:	Project Specific Quote No. : 190408CDNN_1
Sampler: BW	Turnaround Requirements: Standard TAT
Email Address (results and invoice): <a href="mailto:ben.withnall@cardno.com.au">ben.withnall@cardno.com.au</a> ; <a href="mailto:ContamNSW@cardno.com.au">ContamNSW@cardno.com.au</a>	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		4	ICE	10/03/2021	Water	1	1	1	1	1	1																													
WP2		4	ICE	10/03/2021	Water	1	1	1	1	1	1																													
QA100		3	ICE	10/03/2021	Water		1	1	1	1	1																													
QA200		3	ICE	10/03/2021	Water		1	1	1	1	1																											Please send to ALS		

Relinquished by: Ben Withnall <small>(name / company)</small> Cardno ACT/NSW Pty Ltd	Received by: <i>M BIRKETT</i> <small>(name / company)</small> EUROFINNS	Relinquished by: _____ <small>(name / company)</small>	Received by: _____ <small>(name / company)</small>	Relinquished by: _____ <small>(name / company)</small>
Date & Time: 10/03/2021	Date & Time: <i>10/03/21 3:55pm</i>	Date & Time: _____	Date & Time: _____	Date & Time: _____
Signature: BW	Signature: <i>up</i>	Signature: _____	Signature: _____	Signature: _____
Received by: _____ <small>(name / company)</small>	Relinquished by: _____ <small>(name / company)</small>	Received by: _____ <small>(name / company)</small>	Relinquished by: _____ <small>(name / company)</small>	<i>Lab use:</i>
Date & Time: _____	Date & Time: _____	Date & Time: _____	Date & Time: _____	Samples Received: Cool or Ambient (circle one)
Signature: _____	Signature: _____	Signature: _____	Signature: _____	Temperature Received at: <i>10.5</i> (if applicable)
				Transported by: Hand delivered / courier

779437

## Australia

**Melbourne**

6 Monterey Road  
Dandenong South VIC 3175  
Phone : +61 3 8564 5000  
NATA # 1261  
Site # 1254 & 14271

**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

**Perth**

2/91 Leach Highway  
Kewdale WA 6105  
Phone : +61 8 9251 9600  
NATA # 1261  
Site # 23736

**Newcastle**

4/52 Industrial Drive  
Mayfield East NSW 2304  
PO Box 60 Wickham 2293  
Phone : +61 2 4968 8448

## New Zealand

**Auckland**

35 O'Rorke Road  
Penrose, Auckland 1061  
Phone : +64 9 526 45 51  
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:** Ben Kortlever  
**Project name:** DOWNER SYDNEY METRO STATIONS  
**Project ID:** DOWNER WP  
**Turnaround time:** 5 Day  
**Date/Time received:** Mar 10, 2021 3:55 PM  
**Eurofins reference:** 779437

## 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(oil and grease jar, unpreserved 500ml bottle and nutrients bottle) forwarded to ALS.

## 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](mailto:UrsulaLong@eurofins.com)**

Results will be delivered electronically via email to Ben Kortlever - [benjamin.kortlever@cardno.com](mailto:benjamin.kortlever@cardno.com).

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

**Australia**

**Melbourne**  
6 Monterey Road  
Dandenong South VIC 3175  
Phone : +61 3 8564 5000  
NATA # 1261  
Site # 1254 & 14271

**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

**Perth**  
2/91 Leach Highway  
Kewdale WA 6105  
Phone : +61 8 9251 9600  
NATA # 1261  
Site # 23736

**Newcastle**  
4/52 Industrial Drive  
Mayfield East NSW 2304  
PO Box 60 Wickham 2293  
Phone : +61 2 4968 8448

**New Zealand**

**Auckland**  
35 O'Rorke Road  
Penrose, Auckland 1061  
Phone : +64 9 526 45 51  
IANZ # 1327

**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  
**Project ID:** DOWNER WP

**Order No.:**  
**Report #:** 779437  
**Phone:** 0294967700  
**Fax:** 02 9499 3902

**Received:** Mar 10, 2021 3:55 PM  
**Due:** Mar 17, 2021  
**Priority:** 5 Day  
**Contact Name:** Ben Kortlever

**Eurofins Analytical Services Manager : Ursula Long**

Sample Detail						Chlorophyll a	Oil & Grease (HEM)	Phosphate total (as P)	Total Suspended Solids Dried at 103-105°C	Turbidity	Total Nitrogen Set (as N)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
Mayfield Laboratory											
External Laboratory											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
1	WP1	Mar 10, 2021		Water	S21-Ma20129	X	X	X	X	X	X
2	WP2	Mar 10, 2021		Water	S21-Ma20130	X	X	X	X	X	X
3	QA100	Mar 10, 2021		Water	S21-Ma20131		X	X	X	X	X
<b>Test Counts</b>						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 and proficiency testing scheme providers  
 reports.

**Attention:** **Ben Withnall**

**Report** **779437-W**  
 Project name **DOWNER SYDNEY METRO STATIONS**  
 Project ID **DOWNER WP**  
 Received Date **Mar 10, 2021**

Client Sample ID			WP1	WP2	QA100
Sample Matrix			Water	Water	Water
Eurofins Sample No.			S21-Ma20129	S21-Ma20130	S21-Ma20131
Date Sampled			Mar 10, 2021	Mar 10, 2021	Mar 10, 2021
Test/Reference	LOR	Unit			
Chlorophyll a	5	ug/L	< 5	< 5	-
Nitrate & Nitrite (as N)	0.05	mg/L	1.2	0.88	0.86
Oil & Grease (HEM)	10	mg/L	< 10	29	28
Phosphate total (as P)	0.01	mg/L	0.34	0.12	0.12
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	1.3	0.8	2.7
Total Nitrogen (as N)*	0.2	mg/L	2.5	1.68	3.56
Total Suspended Solids Dried at 103–105°C	1	mg/L	< 1	< 1	4.0
Turbidity	1	NTU	2.9	< 1	1.2

**Sample History**

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported. A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

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.

<b>Description</b>	<b>Testing Site</b>	<b>Extracted</b>	<b>Holding Time</b>
Chlorophyll a - Method: LTM-INO-4340 Chlorophyll a in Waters	Melbourne	Mar 13, 2021	2 Days
Oil & Grease (HEM) - Method: LTM-INO-4180 Oil and Grease (APHA 5520B)	Melbourne	Mar 13, 2021	28 Days
Phosphate total (as P) - Method: LTM-INO-4040 Phosphate by CFA	Melbourne	Mar 13, 2021	28 Days
Total Suspended Solids Dried at 103–105°C - Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry	Melbourne	Mar 13, 2021	7 Days
Turbidity - Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)	Melbourne	Mar 15, 2021	2 Days
Total Nitrogen Set (as N) Nitrate & Nitrite (as N) - Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA	Melbourne	Mar 13, 2021	28 Days
Total Kjeldahl Nitrogen (as N) - Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA	Melbourne	Mar 13, 2021	7 Days

**Australia**

**Melbourne**  
6 Monterey Road  
Dandenong South VIC 3175  
Phone : +61 3 8564 5000  
NATA # 1261  
Site # 1254 & 14271

**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

**Perth**  
2/91 Leach Highway  
Kewdale WA 6105  
Phone : +61 8 9251 9600  
NATA # 1261  
Site # 23736

**Newcastle**  
4/52 Industrial Drive  
Mayfield East NSW 2304  
PO Box 60 Wickham 2293  
Phone : +61 2 4968 8448

**New Zealand**

**Auckland**  
35 O'Rorke Road  
Penrose, Auckland 1061  
Phone : +64 9 526 45 51  
IANZ # 1327

**Christchurch**  
43 Detroit Drive  
Rolleston, Christchurch 7675  
Phone : 0800 856 450  
IANZ # 1290

<b>Company Name:</b>	Cardno (NSW/ACT) Pty Ltd	<b>Order No.:</b>		<b>Received:</b>	Mar 10, 2021 3:55 PM
<b>Address:</b>	Level 9, 203 Pacific Highway St Leonards NSW 2065	<b>Report #:</b>	779437	<b>Due:</b>	Mar 17, 2021
<b>Project Name:</b>	DOWNER SYDNEY METRO STATIONS	<b>Phone:</b>	0294967700	<b>Priority:</b>	5 Day
<b>Project ID:</b>	DOWNER WP	<b>Fax:</b>	02 9499 3902	<b>Contact Name:</b>	Ben Kortlever

**Eurofins Analytical Services Manager : Ursula Long**

Sample Detail						Chlorophyll a	Oil & Grease (HEM)	Phosphate total (as P)	Total Suspended Solids Dried at 103-105°C	Turbidity	Total Nitrogen Set (as N)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
Mayfield Laboratory											
External Laboratory											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
1	WP1	Mar 10, 2021		Water	S21-Ma20129	X	X	X	X	X	X
2	WP2	Mar 10, 2021		Water	S21-Ma20130	X	X	X	X	X	X
3	QA100	Mar 10, 2021		Water	S21-Ma20131		X	X	X	X	X
<b>Test Counts</b>						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.

**\*\*NOTE:** pH duplicates are reported as a range NOT as RPD

### Units

**mg/kg:** milligrams per kilogram

**mg/L:** milligrams per litre

**ug/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

<b>Dry</b>	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
<b>LOR</b>	Limit of Reporting.
<b>SPIKE</b>	Addition of the analyte to the sample and reported as percentage recovery.
<b>RPD</b>	Relative Percent Difference between two Duplicate pieces of analysis.
<b>LCS</b>	Laboratory Control Sample - reported as percent recovery.
<b>CRM</b>	Certified Reference Material - reported as percent recovery.
<b>Method Blank</b>	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.
<b>Surr - Surrogate</b>	The addition of a like compound to the analyte target and reported as percentage recovery.
<b>Duplicate</b>	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
<b>USEPA</b>	United States Environmental Protection Agency
<b>APHA</b>	American Public Health Association
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>COC</b>	Chain of Custody
<b>SRA</b>	Sample Receipt Advice
<b>QSM</b>	US Department of Defense Quality Systems Manual Version 5.3
<b>CP</b>	Client Parent - QC was performed on samples pertaining to this report
<b>NCP</b>	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.
<b>TEQ</b>	Toxic Equivalency Quotient

### QC - Acceptance Criteria

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%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

### 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. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. 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.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. 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	
<b>Method Blank</b>								
Nitrate & Nitrite (as N)	mg/L	< 0.05			0.05	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		
Total Suspended Solids Dried at 103–105°C	mg/L	< 1			1	Pass		
<b>LCS - % Recovery</b>								
Nitrate & Nitrite (as N)	%	98			70-130	Pass		
Oil & Grease (HEM)	%	80			70-130	Pass		
Phosphate total (as P)	%	106			70-130	Pass		
Total Kjeldahl Nitrogen (as N)	%	118			70-130	Pass		
Total Suspended Solids Dried at 103–105°C	%	108			70-130	Pass		
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
<b>Spike - % Recovery</b>								
				Result 1				
Nitrate & Nitrite (as N)	M21-Ma24781	NCP	%	99		70-130	Pass	
Phosphate total (as P)	M21-Ma20268	NCP	%	93		70-130	Pass	
Total Kjeldahl Nitrogen (as N)	M21-Ma20374	NCP	%	126		70-130	Pass	
Total Suspended Solids Dried at 103–105°C	B21-Ma24277	NCP	%	91		70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
<b>Duplicate</b>								
				Result 1	Result 2	RPD		
Nitrate & Nitrite (as N)	M21-Ma21606	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass
Oil & Grease (HEM)	M21-Ma10714	NCP	mg/L	650	630	3.0	30%	Pass
Phosphate total (as P)	M21-Ma20267	NCP	mg/L	0.03	0.03	3.0	30%	Pass
Total Kjeldahl Nitrogen (as N)	S21-Ma24829	NCP	mg/L	0.3	0.3	19	30%	Pass
<b>Duplicate</b>								
				Result 1	Result 2	RPD		
Total Suspended Solids Dried at 103–105°C	S21-Ma20131	CP	mg/L	4.0	2.4	6.0	30%	Pass
Turbidity	S21-Ma20131	CP	NTU	1.2	1.2	2.0	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](#).

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.

## CERTIFICATE OF ANALYSIS

**Work Order** : **ES2108619**  
**Client** : **CARDNO (NSW/ACT) PTY LTD**  
**Contact** : MR BEN WITHNALL  
**Address** : Level 9 The Forum 203 Pacific Highway  
 St Leonards NSW 2065  
**Telephone** : +61 2 9495 8188  
**Project** : Downer Sydney Metro Stations  
**Order number** :  
**C-O-C number** : ----  
**Sampler** : BW  
**Site** : ----  
**Quote number** : EN/024/20  
**No. of samples received** : 1  
**No. of samples analysed** : 1

**Page** : 1 of 2  
**Laboratory** : Environmental Division Sydney  
**Contact** : Shane Ellis  
**Address** : 277-289 Woodpark Road Smithfield NSW Australia 2164  
**Telephone** : +61 2 8784 8555  
**Date Samples Received** : 11-Mar-2021 12:30  
**Date Analysis Commenced** : 12-Mar-2021  
**Issue Date** : 18-Mar-2021 11:58



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
Ashesh Patel	Senior 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	10-Mar-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2108619-001	-----	-----	-----	-----
				Result	----	----	----	----
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
Suspended Solids (SS)	----	5	mg/L	<b>6</b>	----	----	----	----
<b>EA045: Turbidity</b>								
Turbidity	----	0.1	NTU	<b>1.0</b>	----	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	<b>0.74</b>	----	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<b>0.6</b>	----	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	<b>1.3</b>	----	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<b>0.09</b>	----	----	----	----
<b>EP020: Oil and Grease (O&amp;G)</b>								
Oil & Grease	----	5	mg/L	<b>8</b>	----	----	----	----

## QUALITY CONTROL REPORT

<b>Work Order</b>	: <b>ES2108619</b>	Page	: 1 of 3
<b>Client</b>	: <b>CARDNO (NSW/ACT) PTY LTD</b>	<b>Laboratory</b>	: Environmental Division Sydney
<b>Contact</b>	: MR BEN WITHNALL	<b>Contact</b>	: Shane Ellis
<b>Address</b>	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	<b>Address</b>	: 277-289 Woodpark Road Smithfield NSW Australia 2164
<b>Telephone</b>	: +61 2 9495 8188	<b>Telephone</b>	: +61 2 8784 8555
<b>Project</b>	: Downer Sydney Metro Stations	<b>Date Samples Received</b>	: 11-Mar-2021
<b>Order number</b>	:	<b>Date Analysis Commenced</b>	: 12-Mar-2021
<b>C-O-C number</b>	: ----	<b>Issue Date</b>	: 18-Mar-2021
<b>Sampler</b>	: BW		
<b>Site</b>	: ----		
<b>Quote number</b>	: EN/024/20		
<b>No. of samples received</b>	: 1		
<b>No. of samples analysed</b>	: 1		



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ashesh Patel	Senior 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

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 (%)
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 3567779)</b>									
ES2108507-013	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	24	23	0.00	No Limit
ES2108619-001	QA200	EA025H: Suspended Solids (SS)	----	5	mg/L	6	<5	18.2	No Limit
<b>EA045: Turbidity (QC Lot: 3561275)</b>									
ES2108520-006	Anonymous	EA045: Turbidity	----	0.1	NTU	0.2	0.2	0.00	No Limit
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3565269)</b>									
ES2108143-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.32	0.32	0.00	0% - 20%
ES2108624-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.03	0.03	0.00	No Limit
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 3565264)</b>									
ES2108143-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.8	1.3	32.3	No Limit
ES2108612-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.3	0.00	No Limit
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 3565265)</b>									
ES2108143-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.62	0.48	25.5	0% - 50%
ES2108612-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.04	0.04	0.00	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: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Acceptable Limits (%)	
						LCS	Low	High	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 3567779)</b>									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	100	83.0	129	
				<5	1000 mg/L	93.8	82.0	110	
				<5	463 mg/L	94.6	83.0	118	
<b>EA045: Turbidity (QCLot: 3561275)</b>									
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	101	91.0	105	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3565269)</b>									
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	101	91.0	113	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3565264)</b>									
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	80.5	69.0	101	
				<0.1	1 mg/L	90.6	70.0	118	
				<0.1	5 mg/L	85.4	70.0	130	
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3565265)</b>									
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	87.3	71.0	101	
				<0.01	0.442 mg/L	100	72.0	108	
				<0.01	1 mg/L	94.4	70.0	130	
<b>EP020: Oil and Grease (O&amp;G) (QCLot: 3562835)</b>									
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	91.8	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**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	
						MS	Low
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3565269)</b>							
ES2108143-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	99.5	70.0	130
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3565264)</b>							
ES2108143-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	25 mg/L	82.9	70.0	130
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3565265)</b>							
ES2108143-002	Anonymous	EK067G: Total Phosphorus as P	----	5 mg/L	93.2	70.0	130

## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES2108619	Page	: 1 of 4
Client	: CARDNO (NSW/ACT) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR BEN WITHNALL	Telephone	: +61 2 8784 8555
Project	: Downer Sydney Metro Stations	Date Samples Received	: 11-Mar-2021
Site	: ----	Issue Date	: 18-Mar-2021
Sampler	: BW	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
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>							
Clear Plastic Bottle - Natural (EA025H) QA200	10-Mar-2021	----	----	----	16-Mar-2021	17-Mar-2021	✓
<b>EA045: Turbidity</b>							
Clear Plastic Bottle - Natural (EA045) QA200	10-Mar-2021	----	----	----	12-Mar-2021	12-Mar-2021	✓
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>							
Clear Plastic Bottle - Sulfuric Acid (EK059G) QA200	10-Mar-2021	----	----	----	16-Mar-2021	07-Apr-2021	✓
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>							
Clear Plastic Bottle - Sulfuric Acid (EK061G) QA200	10-Mar-2021	16-Mar-2021	07-Apr-2021	✓	16-Mar-2021	07-Apr-2021	✓
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>							
Clear Plastic Bottle - Sulfuric Acid (EK067G) QA200	10-Mar-2021	16-Mar-2021	07-Apr-2021	✓	16-Mar-2021	07-Apr-2021	✓
<b>EP020: Oil and Grease (O&amp;G)</b>							
Miscellaneous Sulfuric Preserved - glass (EP020) QA200	10-Mar-2021	----	----	----	15-Mar-2021	07-Apr-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	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Laboratory Duplicates (DUP)</b>							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	18	11.11	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	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Laboratory Control Samples (LCS)</b>							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	18	5.56	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	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Method Blanks (MB)</b>							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	18	5.56	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	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	18	5.56	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)



## Australia

**Melbourne**

6 Monterey Road  
Dandenong South VIC 3175  
Phone : +61 3 8564 5000  
NATA # 1261  
Site # 1254 & 14271

**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

**Perth**

2/91 Leach Highway  
Kewdale WA 6105  
Phone : +61 8 9251 9600  
NATA # 1261  
Site # 23736

**Newcastle**

4/52 Industrial Drive  
Mayfield East NSW 2304  
PO Box 60 Wickham 2293  
Phone : +61 2 4968 8448

## New Zealand

**Auckland**

35 O'Rorke Road  
Penrose, Auckland 1061  
Phone : +64 9 526 45 51  
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:** Ben Withnall  
**Project name:** DOWNER SYDNEY METRO STATIONS  
**Project ID:** DOWNER WP  
**Turnaround time:** 5 Day  
**Date/Time received:** Mar 22, 2021 6:48 PM  
**Eurofins reference:** 782225

## 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 forwarded to ALS for analysis.  
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](mailto:UrsulaLong@eurofins.com)**

Results will be delivered electronically via email to Ben Withnall - [ben.withnall@cardno.com.au](mailto: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.*

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 and proficiency testing scheme providers  
 reports.

**Attention:** **Ben Withnall**

**Report** **782225-W-V2**  
 Project name **DOWNER SYDNEY METRO STATIONS**  
 Project ID **DOWNER WP**  
 Received Date **Mar 22, 2021**

Client Sample ID			WP1	WP2	QA100
Sample Matrix			Water	Water	Water
Eurofins Sample No.			S21-Ma41856	S21-Ma41857	S21-Ma41860
Date Sampled			Mar 20, 2021	Mar 20, 2021	Mar 20, 2021
Test/Reference	LOR	Unit			
Chlorophyll a	5	ug/L	< 5	< 5	-
Nitrate & Nitrite (as N)	0.05	mg/L	1.7	1.5	1.8
Oil & Grease (HEM)	10	mg/L	< 10	< 10	< 10
Phosphate total (as P)	0.01	mg/L	< 0.5	< 0.5	< 0.5
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	0.6	0.8	0.9
Total Nitrogen (as N)*	0.2	mg/L	2.3	2.3	2.7
Total Suspended Solids Dried at 103–105°C	1	mg/L	9.2	35	25
Turbidity	1	NTU	9.3	13	17

**Sample History**

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported. A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

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.

<b>Description</b>	<b>Testing Site</b>	<b>Extracted</b>	<b>Holding Time</b>
Chlorophyll a - Method: LTM-INO-4340 Chlorophyll a in Waters	Melbourne	Mar 24, 2021	2 Days
Oil & Grease (HEM) - Method: LTM-INO-4180 Oil and Grease (APHA 5520B)	Melbourne	Mar 24, 2021	28 Days
Phosphate total (as P) - Method: LTM-INO-4040 Phosphate by CFA	Melbourne	Mar 24, 2021	28 Days
Total Suspended Solids Dried at 103–105°C - Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry	Melbourne	Mar 24, 2021	7 Days
Turbidity - Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)	Melbourne	Mar 29, 2021	2 Days
Total Nitrogen Set (as N)			
Nitrate & Nitrite (as N) - Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA	Melbourne	Mar 24, 2021	28 Days
Total Kjeldahl Nitrogen (as N) - Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA	Melbourne	Mar 24, 2021	7 Days

**Australia**

**Melbourne**  
6 Monterey Road  
Dandenong South VIC 3175  
Phone : +61 3 8564 5000  
NATA # 1261  
Site # 1254 & 14271

**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

**Perth**  
2/91 Leach Highway  
Kewdale WA 6105  
Phone : +61 8 9251 9600  
NATA # 1261  
Site # 23736

**Newcastle**  
4/52 Industrial Drive  
Mayfield East NSW 2304  
PO Box 60 Wickham 2293  
Phone : +61 2 4968 8448

**New Zealand**

**Auckland**  
35 O'Rorke Road  
Penrose, Auckland 1061  
Phone : +64 9 526 45 51  
IANZ # 1327

**Christchurch**  
43 Detroit Drive  
Rolleston, Christchurch 7675  
Phone : 0800 856 450  
IANZ # 1290

<b>Company Name:</b>	Cardno (NSW/ACT) Pty Ltd	<b>Order No.:</b>		<b>Received:</b>	Mar 22, 2021 6:48 PM
<b>Address:</b>	Level 9, 203 Pacific Highway St Leonards NSW 2065	<b>Report #:</b>	782225	<b>Due:</b>	Mar 30, 2021
<b>Project Name:</b>	DOWNER SYDNEY METRO STATIONS	<b>Phone:</b>	0294967700	<b>Priority:</b>	5 Day
<b>Project ID:</b>	DOWNER WP	<b>Fax:</b>	02 9499 3902	<b>Contact Name:</b>	Ben Withnall

**Eurofins Analytical Services Manager : Ursula Long**

Sample Detail						Chlorophyll a	Oil & Grease (HEM)	Phosphate total (as P)	Total Suspended Solids Dried at 103-105°C	Turbidity	Total Nitrogen Set (as N)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
Mayfield Laboratory											
External Laboratory											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
1	WP1	Mar 20, 2021		Water	S21-Ma41856	X	X	X	X	X	X
2	WP2	Mar 20, 2021		Water	S21-Ma41857	X	X	X	X	X	X
3	QA100	Mar 20, 2021		Water	S21-Ma41860		X	X	X	X	X
<b>Test Counts</b>						2	3	3	3	3	3

## Internal Quality Control Review and Glossary

### General

- 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.
- All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
- All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
- Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
- Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
- SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
- Samples were analysed on an 'as received' basis.
- Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
- 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.

**\*\*NOTE:** pH duplicates are reported as a range NOT as RPD

### Units

**mg/kg:** milligrams per kilogram

**mg/L:** milligrams per litre

**ug/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

<b>Dry</b>	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
<b>LOR</b>	Limit of Reporting.
<b>SPIKE</b>	Addition of the analyte to the sample and reported as percentage recovery.
<b>RPD</b>	Relative Percent Difference between two Duplicate pieces of analysis.
<b>LCS</b>	Laboratory Control Sample - reported as percent recovery.
<b>CRM</b>	Certified Reference Material - reported as percent recovery.
<b>Method Blank</b>	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.
<b>Surr - Surrogate</b>	The addition of a like compound to the analyte target and reported as percentage recovery.
<b>Duplicate</b>	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
<b>USEPA</b>	United States Environmental Protection Agency
<b>APHA</b>	American Public Health Association
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>COC</b>	Chain of Custody
<b>SRA</b>	Sample Receipt Advice
<b>QSM</b>	US Department of Defense Quality Systems Manual Version 5.3
<b>CP</b>	Client Parent - QC was performed on samples pertaining to this report
<b>NCP</b>	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.
<b>TEQ</b>	Toxic Equivalency Quotient

### QC - Acceptance Criteria

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%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

### QC Data General Comments

- 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.
- 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.
- Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
- Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
- Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
- 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.
- Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
- Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
- For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
- 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
<b>Method Blank</b>								
Chlorophyll a		ug/L	< 5			5	Pass	
Nitrate & Nitrite (as N)		mg/L	< 0.05			0.05	Pass	
Total Kjeldahl Nitrogen (as N)		mg/L	< 0.2			0.2	Pass	
Turbidity		NTU	< 1			1	Pass	
<b>LCS - % Recovery</b>								
Nitrate & Nitrite (as N)		%	99			70-130	Pass	
Phosphate total (as P)		%	80			70-130	Pass	
Total Kjeldahl Nitrogen (as N)		%	102			70-130	Pass	
Total Suspended Solids Dried at 103–105°C		%	106			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
<b>Spike - % Recovery</b>								
				Result 1				
Total Kjeldahl Nitrogen (as N)	B21-Ma42195	NCP	%	90		70-130	Pass	
Total Suspended Solids Dried at 103–105°C	M21-Ma40162	NCP	%	116		70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
<b>Duplicate</b>								
				Result 1	Result 2	RPD		
Phosphate total (as P)	B21-Ma42194	NCP	mg/L	< 0.5	< 0.5	<1	30%	Pass
Total Suspended Solids Dried at 103–105°C	M21-Ma43729	NCP	mg/L	21	20	6.0	30%	Pass
Turbidity	S21-Ma41856	CP	NTU	9.3	9.0	3.0	30%	Pass

**Comments**

This report has been revised (V2) to exclude samples Ma41858 & Ma41859.

**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](#).

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.

## CERTIFICATE OF ANALYSIS

**Work Order** : **ES2110601**  
**Client** : **CARDNO (NSW/ACT) PTY LTD**  
**Contact** : MR BEN WITHNALL  
**Address** : Level 9 The Forum 203 Pacific Highway  
 St Leonards NSW 2065  
**Telephone** : +61 2 9495 8188  
**Project** : Downer Sydney Metro Stations  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : BEN WITHNALL  
**Site** : ----  
**Quote number** : EN/024/20  
**No. of samples received** : 1  
**No. of samples analysed** : 1

**Page** : 1 of 2  
**Laboratory** : Environmental Division Sydney  
**Contact** : Shane Ellis  
**Address** : 277-289 Woodpark Road Smithfield NSW Australia 2164  
**Telephone** : +61 2 8784 8555  
**Date Samples Received** : 24-Mar-2021 13:05  
**Date Analysis Commenced** : 26-Mar-2021  
**Issue Date** : 31-Mar-2021 13:19



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
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	20-Mar-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2110601-001	-----	-----	-----	-----
				Result	----	----	----	----
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
Suspended Solids (SS)	----	5	mg/L	31	----	----	----	----
<b>EA045: Turbidity</b>								
Turbidity	----	0.1	NTU	13.4	----	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	1.33	----	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.0	----	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	2.3	----	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	0.29	----	----	----	----
<b>EP020: Oil and Grease (O&amp;G)</b>								
Oil & Grease	----	5	mg/L	<5	----	----	----	----

## QUALITY CONTROL REPORT

<b>Work Order</b>	: <b>ES2110601</b>	Page	: 1 of 3
<b>Client</b>	: <b>CARDNO (NSW/ACT) PTY LTD</b>	<b>Laboratory</b>	: Environmental Division Sydney
<b>Contact</b>	: MR BEN WITHNALL	<b>Contact</b>	: Shane Ellis
<b>Address</b>	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	<b>Address</b>	: 277-289 Woodpark Road Smithfield NSW Australia 2164
<b>Telephone</b>	: +61 2 9495 8188	<b>Telephone</b>	: +61 2 8784 8555
<b>Project</b>	: Downer Sydney Metro Stations	<b>Date Samples Received</b>	: 24-Mar-2021
<b>Order number</b>	: ----	<b>Date Analysis Commenced</b>	: 26-Mar-2021
<b>C-O-C number</b>	: ----	<b>Issue Date</b>	: 31-Mar-2021
<b>Sampler</b>	: BEN WITHNALL		
<b>Site</b>	: ----		
<b>Quote number</b>	: EN/024/20		
<b>No. of samples received</b>	: 1		
<b>No. of samples analysed</b>	: 1		



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
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

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 (%)
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 3589785)</b>									
ES2109905-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	304	332	9.04	0% - 20%
ES2110767-002	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	902	814	10.2	0% - 20%
<b>EA045: Turbidity (QC Lot: 3590212)</b>									
ES2110277-001	Anonymous	EA045: Turbidity	----	0.1	NTU	2.4	2.2	8.55	0% - 20%
ES2110807-003	Anonymous	EA045: Turbidity	----	0.1	NTU	396	395	0.253	0% - 20%
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3590324)</b>									
ES2110562-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.22	0.22	0.00	0% - 20%
ES2110678-005	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	3.31	3.21	3.03	0% - 20%
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 3590327)</b>									
ES2110581-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.6	0.6	0.00	No Limit
ES2110678-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	5.9	5.6	5.60	No Limit
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 3590328)</b>									
ES2110581-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.24	0.25	0.00	0% - 20%
ES2110678-004	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	3.19	3.18	0.00	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: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 3589785)</b>								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	100	83.0	129
				<5	1000 mg/L	94.0	82.0	110
				<5	463 mg/L	114	83.0	118
<b>EA045: Turbidity (QCLot: 3590212)</b>								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	100	91.0	105
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3590324)</b>								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	101	91.0	113
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3590327)</b>								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	87.0	69.0	101
				<0.1	1 mg/L	79.0	70.0	118
				<0.1	5 mg/L	89.6	70.0	130
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3590328)</b>								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	84.6	71.0	101
				<0.01	0.442 mg/L	80.6	72.0	108
				<0.01	1 mg/L	90.2	70.0	130
<b>EP020: Oil and Grease (O&amp;G) (QCLot: 3593123)</b>								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	94.4	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**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Acceptable Limits (%) Low High	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3590324)</b>							
ES2110562-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	103	70.0	130
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3590327)</b>							
ES2110601-001	QA200	EK061G: Total Kjeldahl Nitrogen as N	----	10 mg/L	94.2	70.0	130
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3590328)</b>							
ES2110601-001	QA200	EK067G: Total Phosphorus as P	----	2 mg/L	97.3	70.0	130

## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES2110601	Page	: 1 of 4
Client	: CARDNO (NSW/ACT) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR BEN WITHNALL	Telephone	: +61 2 8784 8555
Project	: Downer Sydney Metro Stations	Date Samples Received	: 24-Mar-2021
Site	: ----	Issue Date	: 31-Mar-2021
Sampler	: BEN WITHNALL	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
<b>EA045: Turbidity</b>						
Clear Plastic Bottle - Natural QA200	----	----	----	27-Mar-2021	22-Mar-2021	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
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>							
Clear Plastic Bottle - Natural (EA025H) QA200	20-Mar-2021	----	----	----	26-Mar-2021	27-Mar-2021	✓
<b>EA045: Turbidity</b>							
Clear Plastic Bottle - Natural (EA045) QA200	20-Mar-2021	----	----	----	27-Mar-2021	22-Mar-2021	*
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>							
Clear Plastic Bottle - Sulfuric Acid (EK059G) QA200	20-Mar-2021	----	----	----	28-Mar-2021	17-Apr-2021	✓
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>							
Clear Plastic Bottle - Sulfuric Acid (EK061G) QA200	20-Mar-2021	28-Mar-2021	17-Apr-2021	✓	28-Mar-2021	17-Apr-2021	✓
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>							
Clear Plastic Bottle - Sulfuric Acid (EK067G) QA200	20-Mar-2021	28-Mar-2021	17-Apr-2021	✓	28-Mar-2021	17-Apr-2021	✓
<b>EP020: Oil and Grease (O&amp;G)</b>							
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020) QA200	20-Mar-2021	----	----	----	30-Mar-2021	17-Apr-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	Method	Count		Rate (%)			Quality Control Specification
Analytical Methods		QC	Reaular	Actual	Expected	Evaluation	
<b>Laboratory Duplicates (DUP)</b>							
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	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
<b>Laboratory Control Samples (LCS)</b>							
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	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
<b>Method Blanks (MB)</b>							
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	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
<b>Matrix Spikes (MS)</b>							
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	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)

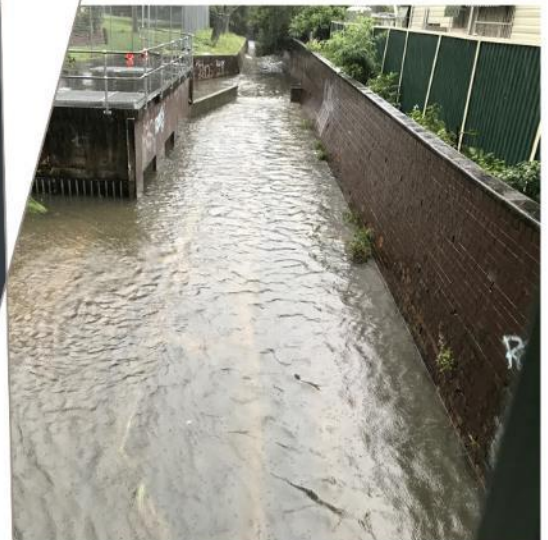
---

## Appendix 2 – Surface Water Monitoring Report - 4NE30187\_R002\_SWM\_WileyPark\_RevA

# Surface Water Monitoring Report - Wiley Park Station

Wiley Park Station

4NE30187



Prepared for  
Downer EDI Works Pty Ltd

2 June 2021

## Contact Information

### Cardno (NSW/ACT) Pty Ltd

ABN 95 001 145 035

Level 9 - The Forum  
203 Pacific Highway  
St Leonards NSW 2065  
PO Box 19

www.cardno.com

Phone +61 2 9496 7700

Fax +61 2 9439 5170

Author(s):

Chong Zeng  
Environmental Engineer

Approved By:

Mike Jorgensen  
Principal Hydrogeologist

## Document Information

Prepared for Downer EDI Works Pty Ltd

Project Name Wiley Park Station

File Reference 4NE30187\_R002\_SWM\_WileyPark\_RevA.docm

Job Reference 4NE30187

Date 2 June 2021

Version Number RevA

Effective Date 2/06/2021

Date Approved 2/06/2021

## Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
V1	2/06/2021	Draft for Internal Review	CZ	MJ
RevA	2/06/2021	Draft for Client Review	CZ	MJ

© Cardno. Copyright in the whole and every part of this document belongs to Cardno and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person other than by agreement with Cardno.

This document is produced by Cardno solely for the benefit and use by the client in accordance with the terms of the engagement. Cardno does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by any third party on the content of this document.

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

1	Introduction	1
	1.1 Background	1
	1.2 Objectives	1
	1.3 Scope of Works	1
2	Guidelines and Legislation	2
3	Monitoring Locations	3
	3.1 Monitoring Locations	3
4	Quality Management	3
	4.1 Data Quality Indicators	5
5	Field Investigation	7
6	Surface Water Assessment Criteria	8
7	Summary of Results	9
	7.1 Summary of Field Observations	9
	7.2 Field Parameters	10
	7.3 Surface Water Analytical Results	11
	7.4 Results Discussion	11
8	Conclusion	1
9	References	2
10	Limitations	3

## Appendices

<b>Appendix A</b>	Figures
<b>Appendix B</b>	Photographs
<b>Appendix C</b>	Field Records
<b>Appendix D</b>	Laboratory Summary tables
<b>Appendix E</b>	Quality Assurance/Quality control
<b>Appendix F</b>	Laboratory reports

## Tables

Table 1-1	Wiley Park Water Quality Monitoring Program	2
Table 3-1	Surface Water Monitoring Location Details	3
Table 4-1	Data Quality Objectives	3
Table 4-2	Summary of Data Quality Indicators	5
Table 5-1	Investigation Activity Summary	7
Table 6-1	Water Quality Monitoring Parameters and Adopted Criteria at Wiley Park	8
Table 7-1	Laboratory Physico-chemical Parameters and Field Observations	10

# 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 1-1**, 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 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 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. Note that during the baseline monitoring period no wet-weather events were able to be captured prior to commencement of construction.

This report presents the findings from the third surface water monitoring event, which was undertaken by Cardno on 5<sup>th</sup> May 2021. The event undertaken was a mid-construction wet-weather event.

## 1.2 Objectives

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 on the 5<sup>th</sup> May 2021 as a wet weather 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) field duplicate sample and one (1) field triplicate 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.

> Review of analytical and field data and preparation of this report.

Details of the monitoring program are shown in shown below.

Table 1-1 Wiley Park Water Quality Monitoring Program

Wiley Park Water Quality Monitoring Program	
<b>Waterway</b>	Sydney Water Cooks River Channel (first-order stream)
<b>Indicative monitoring points</b>	WP1 – Upstream
	WP2 – Downstream
<b>Interaction with Project works</b>	Channel within proximity to Wiley Park service building site
<b>Pre-construction works</b>	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 20mm of rain in 24 hours. The sampling will be undertaken immediately during construction hours and if it is safe to do so.
<b>During construction of the Wiley Park services building</b>	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 >20mm of rain in 24 hours. The sampling will be 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 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	-33.924014	151.065315	Immediately south of the Boulevard and east of 118 the Boulevard.
WP2	-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	Ongoing surface water monitoring is required to determine if the construction work is impacting the local surface water quality within the unnamed channel.
Step 2 Identify the Decisions	The decision that needs to be made are: <ul style="list-style-type: none"> <li>&gt; Are there any impacts to surface water quality from construction activities at the site?</li> </ul>
Step 3 Identify Inputs to the Decision	The primary inputs to the decisions described above are: <ul style="list-style-type: none"> <li>&gt; 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);</li> <li>&gt; Laboratory analysis of surface water samples for relevant parameters;</li> <li>&gt; Assessment of the suitability of the analytical data obtained, against the Data Quality Indicators (DQIs);</li> <li>&gt; Assessment of the analytical results against applicable guideline criteria; and</li> <li>&gt; Aesthetic observations of surface water bodies, including odours, sheen and condition, if encountered.</li> </ul>

DQO	Description
<p>Step 4 Define the Study Boundaries</p>	<p>The lateral extent of the study area is the channel within proximity to Wiley Park service building site.</p> <p>The temporal boundaries of the study will comprise the duration of the monitoring program, including pre-construction monitoring, construction phase, and post-construction monitoring as required.</p>
<p>Step 5 Develop a Decision Rule</p>	<p>The decision rules for the water quality monitoring sampling events included:</p> <ul style="list-style-type: none"> <li>&gt; Were primary and QA/QC samples analysed using methods endorsed by relevant regulatory guidelines at laboratories NATA-accredited for the requested analyses?</li> <li>&gt; 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?</li> <li>&gt; Were the laboratory limits of reporting (LORs) below the applicable guideline criteria for the analysed parameters?</li> <li>&gt; Were guideline criteria sourced from endorsed guidelines?</li> <li>&gt; Were surface water aesthetic characteristics evaluated including odours and sheen?</li> <li>&gt; 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 may have occurred.</li> </ul>
<p>Step 6 Specify Limits on Decision Errors</p>	<p>In accordance with the relevant guidelines as endorsed under the <i>Contaminated Land Management Act 1997</i>.</p> <p>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.</p> <p>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:</p> <ul style="list-style-type: none"> <li>▪ 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.</li> </ul> <p>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:</p> <ul style="list-style-type: none"> <li>▪ 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: <ul style="list-style-type: none"> <li>– Proposed samples are not collected due to access being restricted to a given location.</li> </ul> </li> <li>▪ 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.</li> <li>▪ Measurement errors can occur during sample collection, handling, preparation, analysis and data reduction. To address this the following measures are proposed: <ul style="list-style-type: none"> <li>– 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.</li> </ul> </li> </ul>

DQO	Description
	<ul style="list-style-type: none"> <li>- Laboratories to follow a standard procedure when preparing samples for analysis and undertaking analysis.</li> <li>- Laboratories to report quality assurance/ quality control data for comparison with the DQIs established for the project</li> </ul>
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: <ul style="list-style-type: none"> <li>&gt; Surface water samples was collected from two (2) sampling locations, as available due to access and water level;</li> <li>&gt; Surface water parameters were selected based on project monitoring requirements provided to Cardno;</li> <li>&gt; Samples were collected by suitably qualified and experienced environmental scientists;</li> <li>&gt; Samples were collected and preserved in accordance with relevant standards/guidelines; and</li> <li>&gt; Field and laboratory QA/QC procedures were adopted and reviewed to indicate the reliability of the results obtained.</li> </ul>

## 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
<b>Completeness</b>		
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
<b>Comparability</b>		
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
<b>Representativeness</b>		

Data Quality Indicator	Frequency	Data Acceptance Criteria
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
<b>Precision</b>		
Blind duplicates (intra-laboratory duplicates)	1 per 20 samples	<30% RPD No Limit RPD Result <10 x LOR
Split duplicates (inter-laboratory duplicates)	1 per 20 samples	<30% RPD No Limit RPD Result <10 x LOR
Laboratory duplicates	1 per 20 samples	Results greater than 10 x LOR: <30% RPD Results less than 10 x LOR: No limit on RPD
<b>Accuracy (Bias)</b>		
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 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	05 May 2021
Surface Water Sampling	<p>Cardno inspected two surface water monitoring locations. Primary samples were collected from the two locations during the sampling event. Cardno undertook the sampling as per the following procedures:</p> <p><u>Surface Water Body Inspection</u> - 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.</p> <p>Each surface water location was inspected for indicators of contamination and the presence of surface water. This information is recorded on the field sheets presented in <b>Appendix C</b>.</p> <p><u>Surface water sampling</u> - 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 <b>Appendix C</b>.</p> <p>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.</p>
Surface Water Analysis	<p>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:</p> <ul style="list-style-type: none"> <li>- Oil &amp; Grease;</li> <li>- Total Suspended Solids (TSS);</li> <li>- Nutrients (Total Phosphorous, Total Nitrogen);</li> <li>- Turbidity; and</li> <li>- Chlorophyll-a.</li> </ul> <p>Tabulated laboratory results are presented in <b>Appendix D</b>. The Data QA /QC program and data quality review including calibration certificates is presented in <b>Appendix E</b>.</p> <p>Copies of the original laboratory reports, NATA-stamped laboratory certificates, and CoC documentation are included in <b>Appendix F</b>.</p>
Decontamination	<p>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.</p>

## 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 <sup>1</sup>	Proposed Trigger Values	Proposed Actions
Temperature (°C)	>80% ile; <20% ile		
Dissolved Oxygen (DO)	Lower limit – 85% Upper limit -110%		
Turbidity (NTU)	6-50 NTU	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.	Environment Manager (or delegate) to re-test to confirm results and undertake an inspection of the adjacent works and propose actions where required.
Oil and grease	-		
pH	Lower limit – 6.5 Upper limit – 8.5		
Salinity (as EC)	125 – 2200 µS/cm	Downstream results are greater than upstream results during dry-weather sampling.	
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 baseline testing will indicate whether this existing water quality within the channel meet ANZECC guidelines, prior to construction of the services building. 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 were able to be accessed during the sampling events conducted on 5 May 2021. Photos of each sampling location are included in **Appendix B**. The following observations were made:

#### 7.1.1 Wet Weather Mid-Construction Event – 5 May 2021

> Sampling Event on 5 May 2021:

- The sampling event was undertaken during a rain event with 25.2 mm precipitation over the last 24 hours (rainfall data was obtained from the closest Bureau of Meteorology weather station, i.e. Canterbury Racecourse AWS - station ID: 066194);
- WP 1 (upstream of work area) contained medium flowing clear water with low to medium turbidity. The estimated depth of the water body was 0.05 m;
- WP 2 (downstream of work area) contained medium to high flowing clear water with low to medium turbidity. The estimated depth of the water body was 0.3 m; and
- During the wet-weather sampling event the two discharge points (including the one connecting the construction site and the unnamed channel) within the rail corridor immediately upstream / south from WP2 were observed to be not flowing and not contributing to the channel. Refer to photos of the discharge points taken during the monitoring event included in **Appendix B**.



## 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

Location ID	Water Depth (m)	Temperature (°C)	pH	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Redox Potential (mV)	Condition
<b>5 May 2021</b>								
WP1 (upstream of work area)	0.05	18.6	7.80	2,500	6.35	65.3	164.6	Clear Low to medium turbidity Sheen observed
WP2(downstream of work area)	0.3	18.2	7.73	92.9	5.95	62.8	109.2	Clear Low to medium 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: 5 May 2021

The results of the monitoring event indicate that:

- > Electrical Conductivity ( $\mu\text{S}/\text{cm}$ ) was reported outside of the target range (125-2,200  $\mu\text{S}/\text{cm}$ ) with results ranging from 2,500  $\mu\text{S}/\text{cm}$  upstream at WP1 and 92.9  $\mu\text{S}/\text{cm}$  downstream at WP2;
- > Dissolved Oxygen (%Sat) was reported outside of the target range (85%-110%) with results ranging from 65.3% saturation upstream at WP1 and 62.8% saturation downstream at WP2;
- > 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 samples;
- > Concentrations of Oil and Grease were reported below laboratory detection limit at all sample locations;
- > Concentrations of Chlorophyll-a were reported below the laboratory detection limit and adopted assessment criteria at all sample locations;
- > Total Suspended Solids (TSS) concentrations were detected within both WP1 and WP2, with concentrations of 4 mg/L at WP1 and 21 mg/L at WP2; and
- > Turbidity ranged from 4.3 NTU at WP1 to 21 NTU at WP2.

## 7.4 Results Discussion

### 7.4.1 Mid-Construction Wet-weather Event – 5 May 2021

Results for the mid-construction wet-weather event sampled on 5 May 2021 generally showed monitored parameters were within the adopted threshold criteria, with the exception of nitrogen, phosphorous, electrical conductivity and dissolved oxygen saturation.

Results for upstream and downstream sampling were comparable, with the exception of TSS and turbidity which were higher in the WP2 downstream location.

It should be noted that wet weather and storm event pre-construction monitoring was not able to be conducted, and therefore baseline data for comparison is not available. During the wet-weather sampling event the two discharge points (including the one connecting the construction site and the unnamed channel) within the rail corridor immediately upstream / south from WP2 were observed to be not flowing and not contributing to the channel.

Observed water flow and volume were higher at the downstream sampling point i.e. WP2, however the downstream discharge points were not flowing as described above, additional inspection of potential other inlet points is required in the next round.

## 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 one mid-construction wet-weather event on 5 May 2021.

During the wet-weather event sampled on 5 May 2021, sampling results showed monitored parameters were generally within the adopted ANZECC screening criteria with the exception of nitrogen, phosphorous, electrical conductivity, and dissolved oxygen saturation. The results are generally consistent with the data obtained from previous monitoring events with the only exception of electrical conductivity results observed outside of the target range during this round of monitoring. TSS and turbidity results were observed to be higher in the downstream WP2 sampling point. Although baseline conditions for wet weather are unknown and no stormwater in-flow was observed at the two water discharge points located immediately upstream / south of the downstream sampling location, Cardno makes following recommendations to the Environment Manager (or delegate):

- > Undertake an inspection of the adjacent works and controls within the current worksite area and propose actions where required in accordance with the SMWP; and
- > Assess the area downstream of sampling point WP1 to confirm whether there are additional discharge points downstream of WP1 which may contribute the stormwater in-flow to the unnamed channel during the rainfall events.

## 9 References

---

- > Southwest Metro – Hurlstone Park, Belmore and Wiley Park Station Upgrades – Soil and Water Management Plan, dated 16<sup>th</sup> 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 (2018). 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').

DRAFT

## 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



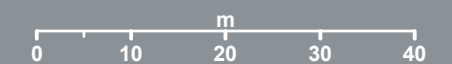
## Surface Water Monitoring

WILEY PARK STATION

### Legend

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

1:800 Scale at A3



APPENDIX

# B

PHOTOGRAPHS





**Photograph 1.** Condition observed from sampling location of WP1 during the monitoring event – 5 May.



**Photograph 2.** Condition observed from sampling location of WP2 during the monitoring event – 5 May.



**Photograph 3.** No water flow observed from the discharge (the one connecting the construction site and the unnamed channel) which is located within the rail corridor and immediately upstream / south from WP2 during the monitoring event – 5 May.



**Photograph 4.** No water flow observed from the discharge point which is located within the rail corridor and immediately upstream / south from WP2 during the monitoring event – 5 May.

APPENDIX

C

FIELD RECORDS

name.

**Surface Water Sampling Field Record**

Site / Project: <u>Wiley Park Station</u>	Sampling Point: <u>Wp1</u>
Client: <u>Downer</u>	Job No. <u>4023087</u>
Person Sampling: <u>BW</u>	Initials: <u>BW</u>

**Site Details**

Sampling Equipment – Directly into bottle / <u>Water Scoop</u> / Van Dorn Sampler / Other:	Date: <u>5.5.21</u>
Observations on Site: Last Rain Event / Recent Storms / Releases / Other: <u>Recent rain 720mm</u>	

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

Sample ID	<u>Wp1</u>			
Start Time:	<u>16:56</u>			
Easting				
Northing				
Sample Depth (m)	<u>0.0</u>			
Water Body Depth (m)	<u>0.05</u>			
Location – Onsite/Offsite /Inlet/Outlet/ Middle	<u>upstream channel</u>			
Flow Rate None/ Low / Med / High	<u>med</u>			
DO (mg/L)	<u>6.35</u>			
DO (%Sat)	<u>65.3</u>			
EC (µS/Cm)	<u>2500</u>			
pH	<u>7.80</u>			
Eh (mV)	<u>164.6</u>			
Temp (°C)	<u>18.6</u>			
Water Colour	<u>clear</u>			
Turbidity Low / Med / High	<u>L-M</u>			
Observations / Notes	<u>Some streen</u>			

**Sample Container & Preservation Data**

Number of sample containers:	<u>1</u>			
Container Volume				
Container Type				
Preservation				
Sample Number (for Lab ID):	<u>Wp1</u>			
QC Dup Sample No.:	<u>—</u>			

name.

**Surface Water Sampling Field Record**

Site / Project: <b>Wiley Park Station</b>	Sampling Point: <b>WP2</b>
Client: <b>Owner</b>	Job No. <b>AN E3087</b>
Person Sampling: <b>BW</b>	Initials: <b>BW</b>

**Site Details**

Sampling Equipment – Directly into bottle / Water Scoop / Van Dorn Sampler / Other: <b>2</b>	Date: <b>5.5.21</b>
Observations on Site: Last Rain Event / Recent Storms / Releases / Other: <b>Recent rain 7mm</b>	

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

Sample ID	<b>WP2</b>			
Start Time:	<b>17:30</b>			
Easting				
Northing				
Sample Depth (m)	<b>0.0</b>			
Water Body Depth (m)	<b>0.3</b>			
Location – Onsite/Offsite /Inlet/Outlet/ Middle	<b>offsite down stream</b>			
Flow Rate None/ Low / Med / High	<b>Med - High</b>			
DO (mg/L)	<b>5.95</b>			
DO (%Sat)	<b>62.8</b>			
EC (µS/Cm)	<b>92.9</b>			
pH	<b>7.73</b>			
Eh (mV)	<b>104.2</b>			
Temp (°C)	<b>18.2</b>			
Water Colour	<b>clear / Lh</b>			
Turbidity Low / Med / High	<b>L - M</b>			
Observations / Notes	<b>track inlets not flowing</b>			

**Sample Container & Preservation Data**

Number of sample containers:	<b>10</b>			
Container Volume				
Container Type				
Preservation				
Sample Number (for Lab ID):	<b>QA WP2</b>			
QC Dup Sample No.:	<b>QA100 QA200</b>			

APPENDIX

# D

LABORATORY SUMMARY TABLES



	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	Temperature	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	0.005	5	0.1	0.01	0.1	0.01	1	0.1	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%

Lab Report Number	Field ID	Date	Chlorophyll a	TPH	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrogen (Total as N)	Phosphorus (Total as P)	TSS	Turbidity	pH	Temperature	Electrical Conductivity	Dissolved Oxygen
793825	WP1	5/05/2021	<0.005	<10	NT	NT	5	0.21	4	4.3	7.80	18.6	2500	65.3
793825	WP2	5/05/2021	<0.005	<10	NT	NT	1	0.15	47	21	7.73	18.2	92.9	62.8
793825	QA100	5/05/2021	NT	<10	NT	NT	1	0.14	36	19	-	-	-	-
EM2108617	QA200	5/05/2021	NT	<5	0.8	0.62	1.4	0.11	58	35.1	-	-	-	-

Statistics

Maximum Concentration	<0.005	<10	0.8	0.62	5.0	0.21	58	35.1	7.80	-	2500.0	65.3
-----------------------	--------	-----	-----	------	-----	------	----	------	------	---	--------	------

\* 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 collection	sample 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 <b>Appendix F</b> . 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 <b>Appendix F</b> .
Laboratory QC	Internal 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	05/05/2021	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:

$$RPD = \frac{(C_o - C_s)}{\left(\frac{C_o + C_s}{2}\right)} \times 100$$

Where:

$C_o$  = Concentration of the original sample

$C_s$  = 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 three (3) 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.

DRAFT



RPD Table

Project Number: 4NE30187  
 Site Identification: Wiley Park Station  
 Report Title: Surface Water Monitoring

			Lab Report Number		793825		793825		793825		EM2108617	
			Field ID		WP2		QA100		WP2		QA200	
			Matrix Type		water		water		water		water	
			Date		5/05/2021		5/05/2021		5/05/2021		5/05/2021	
					RPD				RPD			
	Unit	EQL										
NA												
Chlorophyll a	µg/L	5										
TPH												
Oil and Grease	mg/L	5										
Inorganics												
Kjeldahl Nitrogen Total	mg/L	0.1									0.8	
Nitrate & Nitrite (as N)	mg/L	0.01									0.62	
Nitrogen (Total)	mg/L	0.1			1.0	1.0	0		1.0	1.4	<b>33</b>	
Phosphorus	µg/L	10			150	140	7		150	110	<b>31</b>	
TSS	mg/L	1			47	36	27		47	58	21	
Turbidity	NTU	0.1			21	19	10		21	35.1	<b>50</b>	

\*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 ) )

APPENDIX

F

LABORATORY REPORTS



# CHAIN OF CUSTODY AND ANALYSIS REQUEST

Contact Person: Ben Withnall  
 Telephone Number: 0436 687 417  
 Alternative Contact: Chong Zheng  
 Telephone Number:  
 Sampler: BW  
 Email Address (results and invoice): [ben.withnall@cardno.com.au](mailto:ben.withnall@cardno.com.au); [ContamNSW@cardno.com.au](mailto: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  
 Project Number: 4NE30187 Wiley Park  
 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		4	ICE	5/5/2021	Water	1	1	1	1	1	1										
WP2		4	ICE	5/5/2021	Water	1	1	1	1	1	1										
QA100		3	ICE	5/5/2021	Water		1	1	1	1	1										
QA200		3	ICE	5/5/2021	Water		1	1	1	1	1										Please send to ALS

Relinquished by: Ben Withnall (name / company) Cardno ACT/NSW Pty Ltd	Received by: Jake EF (name / company)	Relinquished by:	Received by:	Relinquished by:
Date & Time: 5/05/2021	Date & Time: 6/5	Date & Time:	Date & Time:	Date & Time:
Signature: BW	Signature: <i>Jake</i>	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

793825 Jake



# CHAIN OF CUSTODY AND ANALYSIS REQUEST

**Contact Person:** Ben Withnall  
**Telephone Number:** 0436 687 417  
**Alternative Contact:** Chong Zheng  
**Telephone Number:**  
**Sampler:** BW  
**Email Address (results and invoice):** [ben.withnall@cardno.com.au](mailto:ben.withnall@cardno.com.au); [ContamNSW@cardno.com.au](mailto:ContamNSW@cardno.com.au)  
**Address:** Level 9 - The Forum, 203 Pacific Highway, St Leonards, New South Wales 2068 Australia

**Project Name:** Downer Sydney Metro Stations  
**Project Number:** 4NE30187 Wiley Park  
**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

5

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		4	ICE	5/5/2021	Water	1	1	1	1	1	1											
WP2		4	ICE	5/5/2021	Water	1	1	1	1	1	1											
QA100		3	ICE	5/5/2021	Water		1	1	1	1	1											
QA200		3	ICE	5/5/2021	Water		1	1	1	1	1											
Please send to ALS																						

COPY

<b>Relinquished by:</b> Ben Withnall <small>(name / company)</small> Cardno ACT/NSW Pty Ltd	<b>Received by:</b> Jake EF <small>(name / company)</small>	<b>Relinquished by:</b> <small>(name / company)</small>	<b>Received by:</b> <small>(name / company)</small>	<b>Relinquished by:</b> <small>(name / company)</small>
<b>Date &amp; Time:</b> 5/05/2021	<b>Date &amp; Time:</b> 6/5	<b>Date &amp; Time:</b>	<b>Date &amp; Time:</b>	<b>Date &amp; Time:</b>
<b>Signature:</b> BW	<b>Signature:</b> <i>[Signature]</i>	<b>Signature:</b>	<b>Signature:</b>	<b>Signature:</b>
<b>Received by:</b> <small>(name / company)</small>	<b>Relinquished by:</b> <small>(name / company)</small>	<b>Received by:</b> <small>(name / company)</small>	<b>Relinquished by:</b> <small>(name / company)</small>	<b>Lab use:</b>
<b>Date &amp; Time:</b>	<b>Date &amp; Time:</b>	<b>Date &amp; Time:</b>	<b>Date &amp; Time:</b>	<b>Samples Received:</b> Cool or Ambient (circle one)
<b>Signature:</b>	<b>Signature:</b>	<b>Signature:</b>	<b>Signature:</b>	<b>Temperature Received at:</b> (If applicable)
				<b>Transported by:</b> Hand delivered / courier

## Australia

**Melbourne**

6 Monterey Road  
Dandenong South VIC 3175  
Phone : +61 3 8564 5000  
NATA # 1261  
Site # 1254 & 14271

**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

**Perth**

46-48 Banksia Road  
Welshpool WA 6106  
Phone : +61 8 9251 9600  
NATA # 1261  
Site # 23736

**Newcastle**

4/52 Industrial Drive  
Mayfield East NSW 2304  
PO Box 60 Wickham 2293  
Phone : +61 2 4968 8448  
NATA # 1261 Site # 25079

## New Zealand

**Auckland**

35 O'Rorke Road  
Penrose, Auckland 1061  
Phone : +64 9 526 45 51  
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:** Ben Withnall  
**Project name:** DOWNER SYDNEY METRO STATIONS  
**Project ID:** 4NE30187 WILEY PARK  
**Turnaround time:** 5 Day  
**Date/Time received:** May 6, 2021 11:28 AM  
**Eurofins reference:** 793825

## 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

## 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](mailto:UrsulaLong@eurofins.com)**

Results will be delivered electronically via email to Ben Withnall - [ben.withnall@cardno.com.au](mailto: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.*



**Australia**

**Melbourne**  
6 Monterey Road  
Dandenong South VIC 3175  
Phone : +61 3 8564 5000  
NATA # 1261  
Site # 1254 & 14271

**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

**Perth**  
46-48 Banksia Road  
Welshpool WA 6106  
Phone : +61 8 9251 9600  
NATA # 1261  
Site # 23736

**Newcastle**  
4/52 Industrial Drive  
Mayfield East NSW 2304  
PO Box 60 Wickham 2293  
Phone : +61 2 4968 8448  
NATA # 1261 Site # 25079

**New Zealand**

**Auckland**  
35 O'Rorke Road  
Penrose, Auckland 1061  
Phone : +64 9 526 45 51  
IANZ # 1327

**Christchurch**  
43 Detroit Drive  
Rolleston, Christchurch 7675  
Phone : 0800 856 450  
IANZ # 1290

<b>Company Name:</b>	Cardno (NSW/ACT) Pty Ltd	<b>Order No.:</b>		<b>Received:</b>	May 6, 2021 11:28 AM
<b>Address:</b>	Level 9, 203 Pacific Highway St Leonards NSW 2065	<b>Report #:</b>	793825	<b>Due:</b>	May 13, 2021
<b>Project Name:</b>	DOWNER SYDNEY METRO STATIONS	<b>Phone:</b>	0294967700	<b>Priority:</b>	5 Day
<b>Project ID:</b>	4NE30187 WILEY PARK	<b>Fax:</b>	02 9499 3902	<b>Contact Name:</b>	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 Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
Mayfield Laboratory - NATA Site # 25079											
External Laboratory											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
1	WP1	May 05, 2021		Water	M21-My16605	X	X	X	X	X	X
2	WP2	May 05, 2021		Water	M21-My16606	X	X	X	X	X	X
3	QA100	May 05, 2021		Water	M21-My16607		X	X	X	X	X
<b>Test Counts</b>						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 and proficiency testing scheme providers  
 reports.

**Attention:** **Ben Withnall**

**Report** **793825-W**  
 Project name **DOWNER SYDNEY METRO STATIONS**  
 Project ID **4NE30187 WILEY PARK**  
 Received Date **May 06, 2021**

Client Sample ID			WP1	WP2	QA100
Sample Matrix			Water	Water	Water
Eurofins Sample No.			M21-My16605	M21-My16606	M21-My16607
Date Sampled			May 05, 2021	May 05, 2021	May 05, 2021
Test/Reference	LOR	Unit			
Chlorophyll a	5	ug/L	< 5	< 5	-
Oil & Grease (HEM)	10	mg/L	< 10	< 10	< 10
Phosphate total (as P)	0.01	mg/L	0.21	0.15	0.14
Total Nitrogen (as N)	0.2	mg/L	5.0	1.0	1.0
Total Suspended Solids Dried at 103–105°C	1	mg/L	4.0	47	36
Turbidity	1	NTU	4.3	21	19

**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.

<b>Description</b>	<b>Testing Site</b>	<b>Extracted</b>	<b>Holding Time</b>
Chlorophyll a - Method: LTM-INO-4340 Chlorophyll a in Waters	Melbourne	May 11, 2021	2 Days
Oil & Grease (HEM) - Method: LTM-INO-4180 Oil and Grease (APHA 5520B)	Melbourne	May 10, 2021	28 Days
Phosphate total (as P) - Method: LTM-INO-4040 Phosphate by CFA	Melbourne	May 10, 2021	28 Days
Total Suspended Solids Dried at 103–105°C - Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry	Melbourne	May 10, 2021	7 Days
Turbidity - Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)	Melbourne	May 12, 2021	2 Days

**Australia**

**Melbourne**  
6 Monterey Road  
Dandenong South VIC 3175  
Phone : +61 3 8564 5000  
NATA # 1261  
Site # 1254 & 14271

**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

**Perth**  
46-48 Banksia Road  
Welshpool WA 6106  
Phone : +61 8 9251 9600  
NATA # 1261  
Site # 23736

**Newcastle**  
4/52 Industrial Drive  
Mayfield East NSW 2304  
PO Box 60 Wickham 2293  
Phone : +61 2 4968 8448  
NATA # 1261 Site # 25079

**New Zealand**

**Auckland**  
35 O'Rorke Road  
Penrose, Auckland 1061  
Phone : +64 9 526 45 51  
IANZ # 1327

**Christchurch**  
43 Detroit Drive  
Rolleston, Christchurch 7675  
Phone : 0800 856 450  
IANZ # 1290

<b>Company Name:</b>	Cardno (NSW/ACT) Pty Ltd	<b>Order No.:</b>		<b>Received:</b>	May 6, 2021 11:28 AM
<b>Address:</b>	Level 9, 203 Pacific Highway St Leonards NSW 2065	<b>Report #:</b>	793825	<b>Due:</b>	May 13, 2021
<b>Project Name:</b>	DOWNER SYDNEY METRO STATIONS	<b>Phone:</b>	0294967700	<b>Priority:</b>	5 Day
<b>Project ID:</b>	4NE30187 WILEY PARK	<b>Fax:</b>	02 9499 3902	<b>Contact Name:</b>	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 Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
Mayfield Laboratory - NATA Site # 25079											
External Laboratory											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
1	WP1	May 05, 2021		Water	M21-My16605	X	X	X	X	X	X
2	WP2	May 05, 2021		Water	M21-My16606	X	X	X	X	X	X
3	QA100	May 05, 2021		Water	M21-My16607		X	X	X	X	X
<b>Test Counts</b>						2	3	3	3	3	3

## Internal Quality Control Review and Glossary

### General

- 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.
- All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
- All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
- Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
- Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
- SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
- Samples were analysed on an 'as received' basis.
- Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
- 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.

**\*\*NOTE:** pH duplicates are reported as a range NOT as RPD

### Units

**mg/kg:** milligrams per kilogram

**mg/L:** milligrams per litre

**ug/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

<b>Dry</b>	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
<b>LOR</b>	Limit of Reporting.
<b>SPIKE</b>	Addition of the analyte to the sample and reported as percentage recovery.
<b>RPD</b>	Relative Percent Difference between two Duplicate pieces of analysis.
<b>LCS</b>	Laboratory Control Sample - reported as percent recovery.
<b>CRM</b>	Certified Reference Material - reported as percent recovery.
<b>Method Blank</b>	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.
<b>Surr - Surrogate</b>	The addition of a like compound to the analyte target and reported as percentage recovery.
<b>Duplicate</b>	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
<b>USEPA</b>	United States Environmental Protection Agency
<b>APHA</b>	American Public Health Association
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>COC</b>	Chain of Custody
<b>SRA</b>	Sample Receipt Advice
<b>QSM</b>	US Department of Defense Quality Systems Manual Version 5.3
<b>CP</b>	Client Parent - QC was performed on samples pertaining to this report
<b>NCP</b>	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.
<b>TEQ</b>	Toxic Equivalency Quotient

### QC - Acceptance Criteria

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%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

### QC Data General Comments

- 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.
- 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.
- Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
- Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
- Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
- 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.
- Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
- Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
- For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
- 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
<b>Method Blank</b>									
Phosphate total (as P)				mg/L	< 0.01		0.01	Pass	
Total Nitrogen (as N)				mg/L	< 0.2		0.2	Pass	
Turbidity				NTU	< 1		1	Pass	
<b>LCS - % Recovery</b>									
Phosphate total (as P)				%	103		70-130	Pass	
Total Nitrogen (as N)				%	97		70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Spike - % Recovery</b>									
				Result 1					
Phosphate total (as P)	P21-My10650	NCP	%	106			70-130	Pass	
Total Nitrogen (as N)	P21-My10650	NCP	%	83			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Duplicate</b>									
				Result 1	Result 2	RPD			
Chlorophyll a	M21-My16605	CP	ug/L	< 5	< 5	<1	30%	Pass	
Phosphate total (as P)	M21-My16605	CP	mg/L	0.21	0.21	1.0	30%	Pass	
Total Nitrogen (as N)	M21-My16605	CP	mg/L	5.0	5.0	1.0	30%	Pass	
<b>Duplicate</b>									
				Result 1	Result 2	RPD			
Turbidity	M21-My16607	CP	NTU	19	16	16	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:**

John Nguyen	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](#).

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.



# CHAIN OF CUSTODY AND ANALYSIS REQUEST

Contact Person: Ben Withnall  
 Telephone Number: 0436 687 417  
 Alternative Contact: Chong Zheng  
 Telephone Number:  
 Sampler: BW  
 Email Address (results and invoice): [ben.withnall@cardno.com.au](mailto:ben.withnall@cardno.com.au); [ContamNSW@cardno.com.au](mailto: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  
 Project Number: 4NE30187 Wiley Park  
 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

5

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		4	ICE	5/5/2021	Water	1	1	1	1	1	1
WP2		4	ICE	5/5/2021	Water	1	1	1	1	1	1
QA100	①	3	ICE	5/5/2021	Water	1	1	1	1	1	1
QA200		3	ICE	5/5/2021	Water	1	1	1	1	1	1

Environmental Division  
 Melbourne  
 Work Order Reference  
**EM2108617**



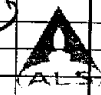
Telephone : + 61-3-8549 9600

Please send to ALS

Samples sent to ALS for  
 Micro Nitrate BOD<sub>5</sub> pH  
 Colour Turbidity RP

① TSS  
 Date BW 12/5

Received: 11/5, 10:10  
 Carrier:  
 C/note:  
 Temp: 6.5°C Seal: Y ①  
 Ice: Icebricks / NA



COPIES

Relinquished by: Ben Withnall  
 (name / company) Cardno ACT/NSW Pty Ltd  
 Date & Time: 5/05/2021  
 Signature: BW

Received by: Jake EF  
 (name / company)  
 Date & Time: 6/5  
 Signature: [Signature]

Relinquished by:  
 (name / company)  
 Date & Time:  
 Signature:

Received by: [Signature]  
 (name / company)  
 Date & Time:  
 Signature:

Relinquished by: BL  
 (name / company) EF  
 Date & Time: 11/5 @ 8:00-  
 Signature: [Signature]  
 Lab use:  
 Samples Received: Cool or Ambient (circle one)  
 Temperature Received at: (if applicable)  
 Transported by: Hand delivered / courier



## CERTIFICATE OF ANALYSIS

**Work Order** : **EM2108617**  
**Client** : **CARDNO (NSW/ACT) PTY LTD**  
**Contact** : MR BEN WITHNALL  
**Address** : Level 9 The Forum 203 Pacific Highway  
 St Leonards NSW 2065  
**Telephone** : +61 2 9495 8188  
**Project** : 4NE30187 Wiley Park  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : BW  
**Site** : ----  
**Quote number** : EN/222 - Secondary Work  
**No. of samples received** : 1  
**No. of samples analysed** : 1

**Page** : 1 of 2  
**Laboratory** : Environmental Division Melbourne  
**Contact** : Customer Services EM  
**Address** : 4 Westall Rd Springvale VIC Australia 3171  
**Telephone** : +61-3-8549 9600  
**Date Samples Received** : 11-May-2021 10:10  
**Date Analysis Commenced** : 12-May-2021  
**Issue Date** : 18-May-2021 11:30



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC



## 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	05-May-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM2108617-001	-----	-----	-----	-----
				Result	----	----	----	----
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
Suspended Solids (SS)	----	5	mg/L	<b>58</b>	----	----	----	----
<b>EA045: Turbidity</b>								
Turbidity	----	0.1	NTU	<b>35.1</b>	----	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	<b>0.62</b>	----	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<b>0.8</b>	----	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	<b>1.4</b>	----	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<b>0.11</b>	----	----	----	----
<b>EP020: Oil and Grease (O&amp;G)</b>								
Oil & Grease	----	5	mg/L	<5	----	----	----	----

## Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EP020: Oil and Grease (O&G)

## QUALITY CONTROL REPORT

<b>Work Order</b>	: <b>EM2108617</b>	<b>Page</b>	: 1 of 3
<b>Client</b>	: <b>CARDNO (NSW/ACT) PTY LTD</b>	<b>Laboratory</b>	: Environmental Division Melbourne
<b>Contact</b>	: MR BEN WITHNALL	<b>Contact</b>	: Customer Services EM
<b>Address</b>	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	<b>Address</b>	: 4 Westall Rd Springvale VIC Australia 3171
<b>Telephone</b>	: +61 2 9495 8188	<b>Telephone</b>	: +61-3-8549 9600
<b>Project</b>	: 4NE30187 Wiley Park	<b>Date Samples Received</b>	: 11-May-2021
<b>Order number</b>	: ----	<b>Date Analysis Commenced</b>	: 12-May-2021
<b>C-O-C number</b>	: ----	<b>Issue Date</b>	: 18-May-2021
<b>Sampler</b>	: BW		
<b>Site</b>	: ----		
<b>Quote number</b>	: EN/222 - Secondary Work		
<b>No. of samples received</b>	: 1		
<b>No. of samples analysed</b>	: 1		



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC



## 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

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 (%)
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 3674919)</b>									
EM2108514-005	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	62	48	24.0	0% - 50%
EM2108634-002	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	13	10	23.2	No Limit
<b>EA045: Turbidity (QC Lot: 3673594)</b>									
EM2108565-001	Anonymous	EA045: Turbidity	----	0.1	NTU	89.3	89.4	0.1	0% - 20%
EM2108565-011	Anonymous	EA045: Turbidity	----	0.1	NTU	30.3	30.6	1.0	0% - 20%
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3674855)</b>									
EM2108565-010	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EM2108587-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.30	0.30	0.0	0% - 20%
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 3674020)</b>									
EM2002273-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.6	0.0	No Limit
EM2002273-029	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	5.9	6.8	14.4	0% - 20%
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 3674019)</b>									
EM2002273-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.09	0.11	15.6	0% - 50%
EM2002273-029	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	1.03	1.18	13.5	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: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Acceptable Limits (%)	
						LCS	Low	High	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 3674919)</b>									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	98.7	91.0	109	
				<5	1000 mg/L	99.1	90.3	109	
<b>EA045: Turbidity (QCLot: 3673594)</b>									
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	105	88.1	110	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3674855)</b>									
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	113	90.0	117	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3674020)</b>									
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	5 mg/L	93.3	70.0	117	
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3674019)</b>									
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	2.21 mg/L	84.9	71.9	114	
<b>EP020: Oil and Grease (O&amp;G) (QCLot: 3679869)</b>									
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	87.8	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**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	
						MS	Low
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3674855)</b>							
EM2108565-011	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	91.9	70.0	130
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3674020)</b>							
EM2002273-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	96.8	70.0	130
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3674019)</b>							
EM2002273-002	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	97.8	70.0	130

## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: <b>EM2108617</b>	Page	: 1 of 4
Client	: <b>CARDNO (NSW/ACT) PTY LTD</b>	Laboratory	: Environmental Division Melbourne
Contact	: MR BEN WITHNALL	Telephone	: +61-3-8549 9600
Project	: 4NE30187 Wiley Park	Date Samples Received	: 11-May-2021
Site	: ----	Issue Date	: 18-May-2021
Sampler	: BW	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
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>						
Clear Plastic Bottle - Natural QA200	----	----	----	13-May-2021	12-May-2021	1
<b>EA045: Turbidity</b>						
Clear Plastic Bottle - Natural QA200	----	----	----	12-May-2021	07-May-2021	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
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>							
Clear Plastic Bottle - Natural (EA025H) QA200	05-May-2021	----	----	----	13-May-2021	12-May-2021	*
<b>EA045: Turbidity</b>							
Clear Plastic Bottle - Natural (EA045) QA200	05-May-2021	----	----	----	12-May-2021	07-May-2021	*
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>							
Clear Plastic Bottle - Sulfuric Acid (EK059G) QA200	05-May-2021	----	----	----	13-May-2021	02-Jun-2021	✓
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>							
Clear Plastic Bottle - Sulfuric Acid (EK061G) QA200	05-May-2021	12-May-2021	02-Jun-2021	✓	13-May-2021	02-Jun-2021	✓
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>							
Clear Plastic Bottle - Sulfuric Acid (EK067G) QA200	05-May-2021	12-May-2021	02-Jun-2021	✓	13-May-2021	02-Jun-2021	✓
<b>EP020: Oil and Grease (O&amp;G)</b>							
Amber Glass Bottle - Sulfuric Acid (EP020) QA200	05-May-2021	----	----	----	17-May-2021	02-Jun-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	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Laboratory Duplicates (DUP)</b>							
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	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	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Laboratory Control Samples (LCS)</b>							
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	19	5.26	5.00	✓	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	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	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Method Blanks (MB)</b>							
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	19	5.26	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	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>							
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	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)

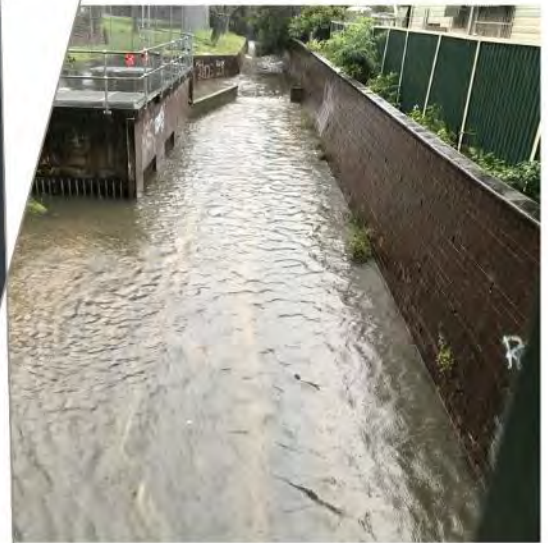
---

## Appendix 3 – Surface Water Monitoring Report – Wiley Park Station NE30161\_R003\_SWM\_WileyPark\_Rev0\_R1

# Surface Water Monitoring Report - Wiley Park Station

Wiley Park Station

NE30161



Prepared for  
Downer EDI Works Pty Ltd

3 November 2021

## Contact Information

### Cardno (NSW/ACT) Pty Ltd

ABN 95 001 145 035

Level 9 - The Forum  
203 Pacific Highway  
St Leonards NSW 2065  
PO Box 19

www.cardno.com

Phone +61 2 9496 7700

Fax +61 2 9439 5170

Author(s):

Chong Zeng  
Environmental Engineer

Approved By:

Mike Jorgensen  
Principal Hydrogeologist

## Document Information

Prepared for	Downer EDI Works Pty Ltd
Project Name	Wiley Park Station
File Reference	NE30161_R003_SWM_WileyPark_Rev0.docm
Job Reference	NE30161
Date	3 November 2021
Version Number	Rev0

Effective Date	3/11/2021
----------------	-----------

Date Approved	3/11/2021
---------------	-----------

## Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
RevA	11/08/2021	Draft for Client Review	CZ	MJ
Rev0	03/11/2021	Final Report	CZ/BW	MJ

© Cardno. Copyright in the whole and every part of this document belongs to Cardno and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person other than by agreement with Cardno.

This document is produced by Cardno solely for the benefit and use by the client in accordance with the terms of the engagement. Cardno does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by any third party on the content of this document.

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

---

1	Introduction	1
	1.1 Background	1
	1.2 Purpose and Objective	1
	1.3 Scope of Works	1
2	Guidelines and Legislation	2
3	Monitoring Locations	3
	3.1 Monitoring Locations	3
4	Quality Management	3
	4.1 Data Quality Indicators	5
5	Field Investigation	7
6	Surface Water Assessment Criteria	8
7	Summary of Results	9
	7.1 Summary of Field Observations	9
	7.2 Field Parameters	10
	7.3 Surface Water Analytical Results	11
	7.4 Results Discussion	13
8	Conclusion	13
9	References	14
10	Limitations	15

## Appendices

---

<b>Appendix A</b>	Figures
<b>Appendix B</b>	Photographs
<b>Appendix C</b>	Field Records
<b>Appendix D</b>	Laboratory Summary tables
<b>Appendix E</b>	Quality Assurance/Quality control
<b>Appendix F</b>	Laboratory reports

## Tables

---

Table 1-1	Wiley Park Water Quality Monitoring Program	2
Table 3-1	Surface Water Monitoring Location Details	3
Table 4-1	Data Quality Objectives	3
Table 4-2	Summary of Data Quality Indicators	5
Table 5-1	Investigation Activity Summary	7
Table 6-1	Water Quality Monitoring Parameters and Adopted Criteria at Wiley Park	8
Table 7-1	Laboratory Physico-chemical Parameters and Field Observations - 1 July 2021	10

# 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 1-1**, 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 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 fourth surface water monitoring event, which was undertaken by Cardno on 1 July 2021. The event undertaken was a quarterly mid-construction event.

## 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 1 July 2021 as a quarterly 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 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 1-1 Wiley Park Water Quality Monitoring Program

Wiley Park Water Quality Monitoring Program	
<b>Waterway</b>	Sydney Water Cooks River Channel (first-order stream)
<b>Indicative monitoring points</b>	WP1 – Upstream WP2 – Downstream
<b>Interaction with Project works</b>	Channel within proximity to Wiley Park service building site
<b>Pre-construction works</b>	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.
<b>During construction of the Wiley Park services building</b>	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 >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 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 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: <ul style="list-style-type: none"> <li>&gt; 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);</li> <li>&gt; Laboratory analysis of surface water samples for relevant parameters;</li> <li>&gt; Assessment of the suitability of the analytical data obtained, against the Data Quality Indicators (DQIs);</li> <li>&gt; Assessment of the analytical results against applicable guideline criteria; and</li> <li>&gt; Aesthetic observations of surface water bodies, including odours, sheen and condition, if encountered.</li> </ul>
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: <ul style="list-style-type: none"> <li>&gt; Were primary and QA/QC samples analysed using methods endorsed by relevant regulatory guidelines at laboratories NATA-accredited for the requested analyses?</li> <li>&gt; 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?</li> </ul>



DQO	Description
	<ul style="list-style-type: none"> <li>&gt; Were the laboratory limits of reporting (LORs) below the applicable guideline criteria for the analysed parameters?</li> <li>&gt; Were guideline criteria sourced from endorsed guidelines?</li> <li>&gt; Were surface water aesthetic characteristics evaluated including odours and sheen?</li> <li>&gt; 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.</li> </ul>
<p>Step 6 Specify Limits on Decision Error</p>	<p>In accordance with the relevant guidelines as endorsed under the <i>Contaminated Land Management Act 1997</i>.</p> <p>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.</p> <p>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:</p> <ul style="list-style-type: none"> <li>▪ 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.</li> </ul> <p>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:</p> <ul style="list-style-type: none"> <li>▪ 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: <ul style="list-style-type: none"> <li>– Proposed samples are not collected due to lack of water flow or access being restricted to a given location.</li> </ul> </li> <li>▪ 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.</li> <li>▪ Measurement errors can occur during sample collection, handling, preparation, analysis and data reduction. To address this the following measures are proposed: <ul style="list-style-type: none"> <li>– 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.</li> <li>– Laboratories to follow a standard procedure when preparing samples for analysis and undertaking analysis.</li> <li>– Laboratories to report quality assurance/ quality control data for comparison with the DQIs established for the project</li> </ul> </li> </ul>
<p>Step 7 Optimise the Design for Obtaining Data</p>	<p>To achieve the DQOs and DQIs, the following sampling procedures were implemented to optimise the design for obtaining data:</p> <ul style="list-style-type: none"> <li>&gt; Surface water samples was collected from two (2) sampling locations, as available due to access and water level;</li> <li>&gt; Surface water parameters were selected based on project monitoring requirements provided to Cardno;</li> <li>&gt; Samples were collected by suitably qualified and experienced environmental scientists;</li> </ul>

DQO	Description
	<ul style="list-style-type: none"> <li>&gt; Samples were collected and preserved in accordance with relevant standards/guidelines; and</li> <li>&gt; Field and laboratory QA/QC procedures were adopted and reviewed to indicate the reliability of the results obtained.</li> </ul>

## 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
<b>Completeness</b>		
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
<b>Comparability</b>		
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
<b>Representativeness</b>		
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
<b>Precision</b>		
Blind duplicates (intra-laboratory duplicates)	1 per 20 samples	<30% RPD No Limit RPD Result <10 × LOR
Split duplicates (inter-laboratory duplicates)	1 per 20 samples	<30% RPD No Limit RPD Result <10 × LOR

Data Quality Indicator	Frequency	Data Acceptance Criteria
Laboratory duplicates	1 per 20 samples	Results greater than 10 x LOR: <30% RPD Results less than 10 x LOR: No limit on RPD
<b>Accuracy (Bias)</b>		
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 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	1 July 2021
Surface Water Sampling	<p>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:</p> <p><u>Surface Water Body Inspection</u> - 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.</p> <p>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 <b>Appendix C</b>.</p> <p><u>Surface water sampling</u> - 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 <b>Appendix C</b>.</p> <p>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.</p>
Surface Water Analysis	<p>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:</p> <ul style="list-style-type: none"> <li>- Oil &amp; Grease;</li> <li>- Total Suspended Solids (TSS);</li> <li>- Nutrients (Total Phosphorous, Total Nitrogen);</li> <li>- Turbidity; and</li> <li>- Chlorophyll-a.</li> </ul> <p>Tabulated laboratory results are presented in <b>Appendix D</b>. The Data QA /QC program and data quality review including calibration certificates is presented in <b>Appendix E</b>.</p> <p>Copies of the original laboratory reports, NATA-stamped laboratory certificates, and CoC documentation are included in <b>Appendix F</b>.</p>
Decontamination	<p>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.</p>

## 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 <sup>1</sup>	Proposed Trigger Values	Proposed Actions
Temperature (°C)	>80% ile; <20% ile		
Dissolved Oxygen (DO)	Lower limit – 85% Upper limit -110%		
Turbidity (NTU)	6-50 NTU	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.	Environment Manager (or delegate) to re-test to confirm results and undertake an inspection of the adjacent works and propose actions where required.
Oil and grease	-		
pH	Lower limit – 6.5 Upper limit – 8.5		
Salinity (as EC)	125 – 2200 µS/cm	Downstream results are greater than upstream results during dry-weather sampling.	
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**

<sup>1</sup> 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 events conducted on 1 July 2021. Photos of each sampling location are included in **Appendix B**. The following observations were made:

#### 7.1.1 Quarterly Mid-Construction Event – 1 July 2021

- > The sampling event was undertaken during a rain event with 0.6 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);
- > 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 to medium flowing clear water with low turbidity. The estimated depth of the water body was 0.1 m;
- > Additional observation:
  - WP1 (upstream of work area):
    - Routine maintenance cleaning of the gross pollutant trap (GPT) was undertaken at the time of sampling via a vacuum truck. The GPT is located approximately 10 m south / upstream of the sampling location.
    - Minor visible sheen observed during the sampling work. Refer to **Appendix B**.
    - Inspection of area immediately downstream of the sampling point WP1 to confirm if there is any additional discharge point(s) downstream of WP1 was undertaken as per the recommendation from the last round of monitoring report. 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. No flow contribution from the discharge point WP2-DP1 was observed at the time of sampling, however, flow contribution from the discharge point WP2-DP2 was 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 Laboratory Physico-chemical Parameters and Field Observations - 1 July 2021

Location ID	WP1 (upstream of work area)	WP2 (downstream of work area)
<b>Water Depth (m)</b>	0.05	0.1
<b>Estimated Flow Rate</b>	Low	Low - Medium
<b>Temperature (°C)</b>	14.1	14.6
<b>pH</b>	9.01	8.83
<b>Electrical Conductivity (µS/cm)</b>	910	530.3
<b>Dissolved Oxygen (mg/L)</b>	11.21	7.92
<b>Dissolved Oxygen (%)</b>	108.8	77.9
<b>SHE<sup>1</sup> Redox Potential (mV)</b>	53.7	122.4
<b>Condition</b>	Clear Minor sheen observed	Clear Low turbidity

Note to Table

1 SHE – Standard Hydrogen Electrode

## 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 Quarterly Mid-Construction Event – 1 July 2021

The results of the monitoring event indicate that:

- > Field measurements – physio-chemical parameters:
  - pH was reported outside of the target range (6.5-8.5) with results ranging from 9.01 upstream at WP1 and 8.83 downstream at WP2.
  - Electrical Conductivity ( $\mu\text{S}/\text{cm}$ ) was reported within of the target range (125-2,200  $\mu\text{S}/\text{cm}$ ) at both sampling locations with results ranging from 910  $\mu\text{S}/\text{cm}$  upstream at WP1 and 530.3  $\mu\text{S}/\text{cm}$  downstream at WP2;
  - Dissolved Oxygen (%Sat) was reported outside of the target range (85%-110%) at downstream sampling point WP2. The results are ranging from 108.8% saturation upstream at WP1 and 77.9% saturation downstream at WP2;
- > 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 within both the WP1 and WP2 samples;
  - Total Suspended Solids (TSS) concentrations were detected within both WP1 and WP2, with concentrations of 4 mg/L at WP1 and 4.4 mg/L at WP2; and
  - Turbidity ranged from 4.1 NTU at WP1 to 6.3 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 1 July 2021. 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 1 July Results	WP2 1 July Results
Temperature (°C)	N/A	21.3	21.1	14.1	14.6
pH	6.5 - 8.5	7.90	7.61	9.01	8.83
Electrical Conductivity (µS/cm)	125 – 2,200	543	363	910	530.3
Dissolved Oxygen (mg/L)	<6	5.64	4.09	11.21	7.92
Dissolved Oxygen (%)	85% - 110%	63	45.9	108.8	77.9
SHE <sup>1</sup> Redox Potential (mV)	N/A	140.7	181.0	53.7	122.4
Chlorophyll a (µg/L)	0.003	<0.005	<0.005	<0.001	<0.001
Oil and Grease (mg/L)	Comparison	<10	29	<10	<10
Kjeldahl Nitrogen Total (mg/L)	N/A	1.3	0.8	<0.2	2.2
Nitrate & Nitrite (as N) (mg/L)	N/A	1.2	0.88	1.3	0.9
Nitrogen (Total) (mg/L)	0.35	2.5	1.68	1.3	3.1
Phosphorus (mg/L)	0.025	0.34	0.12	0.18	0.13
TSS (mg/L)	N/A	<1	<1	4	4.4
Turbidity (NTU)	6 - 50	2.9	<1	4.1	6.3

**Note to Table**

1 SHE – Standard Hydrogen Electrode

## 7.4 Results Discussion

### 7.4.1 Comparison to ANZG 2018 / ANZECC 2000 Criteria

Results for the quarterly mid-construction event sampled on 1 July 2021 generally showed monitored parameters were within the adopted threshold criteria, with the exception of nitrogen, phosphorous, pH and dissolved oxygen saturation.

### 7.4.2 Comparison of Upstream and Downstream Results

Results for upstream and downstream sampling were comparable, with the exception of:

- > Total nitrogen was higher in the WP2 downstream location compared to the upstream WP1 location; however, it is noted that this predominantly reflects the contribution of the TKN result (likely a function of organic matter), whereas nitrate and nitrite concentrations were similar between the upstream and downstream locations, and consistent with the pre-construction monitoring event undertaken.
- > Turbidity was marginally higher (6.3 NTU) in the WP2 downstream location compared to the upstream WP1 location (4.1 NTU); it is noted that whilst this does exceed the direct comparison criteria for upstream versus downstream results, the sample results were only 2 NTU higher downstream, and at the lower limit of expected Lowland River criteria (6 – 50 NTU) and therefore do not indicate a significant risk to water quality.
- > Dissolved oxygen saturation was below the adopted threshold at WP2 but within range at WP1. 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 mid-construction results are closer to the adopted thresholds than the pre-construction event.
- > pH results were above the adopted threshold in both sampling locations, with the downstream result at WP2 being lower (and therefore closer to the adopted range) than the upstream WP1 location.

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 from one quarterly mid-construction event on 1 July 2021. 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 nitrogen, phosphorous, pH, and dissolved oxygen saturation. The results are generally consistent with the data obtained from previous monitoring events with the only exception of pH results observed outside of the target range during this round of monitoring at both sampling locations.

Nitrogen and turbidity results within the samples were observed to be higher in the downstream WP2 sampling point. In addition dissolved oxygen saturation was below the adopted range within WP2. Based on comparison to the criteria, and pre-construction monitoring event, these results 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 16<sup>th</sup> 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

## Surface Water Monitoring

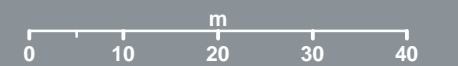
WILEY PARK STATION

### Legend

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



1:800 Scale at A3





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.** Condition observed from sampling location of WP1 during the monitoring event – 1 July.



**Photograph 2.** Condition observed from sampling location of WP2 during the monitoring event – 5 May.





**Photograph 3.** No stormwater in-flow observed from the discharge point WP1-DP1 which is located within the rail corridor and immediately downstream / north from WP1 during the monitoring event – 1 July.



**Photograph 4.** No stormwater in-flow observed from the discharge point WP2-DP1 which is located within the rail corridor and immediately upstream / south from WP2 during the monitoring event – 1 July.



**Photograph 5.** Stormwater in-flow observed from the discharge point WP2-DP2 which is located within the rail corridor and immediately upstream / south from WP2 during the monitoring event – 1 July.

APPENDIX

C

FIELD RECORDS

name.

### Surface Water Sampling Field Record

Site / Project: <i>Wiley Park.</i>		Sampling Point: <i>WPI/WP2</i>	
Client: <i>Downer</i>		Job No. <i>4NE30187</i>	
Person Sampling: <i>CZ</i>		Initials: <i>CZ</i>	
Site Details			
Sampling Equipment – Directly into bottle / <u>Water Scoop</u> / Van Dorn Sampler / Other:		Date: <i>01.07.21.</i>	
Observations on Site: <u>Last Rain Event</u> / Recent Storms / Releases / Other :			
Sample Details, Observations, GPS Coordinates & Field Physiochemical Measurements (if possible, record parameters once stable)			
Sample ID	WPI	WP2	
Start Time:	<i>1030</i>	<i>1130</i>	
Easting	<i>/</i>	<i>/</i>	
Northing	<i>/</i>	<i>/</i>	
Sample Depth (m)	<i>0.0-0.05</i>	<i>0.0-0.1</i>	
Water Body Depth (m)	<del><i>0.05</i></del>	<i>0.1</i>	
Location – Onsite/Offsite /Inlet/Outlet/ Middle	<i>upstream</i>	<i>downstream</i>	
Flow Rate None/ Low / Med / High	<i>low</i>	<i>* low higher than upstream point</i>	
DO (mg/L) / %	<i>11.21/108.8</i>	<del><i>8.84/84.9</i></del> <i>7.92/77.9</i>	
EC (µS/Cm) <u>(SPC)</u>	<i>910</i>	<i>530.3</i>	
pH	<i>9.01</i>	<i>8.83</i>	
Eh (mV)	<i>53.7</i>	<i>122.4</i>	
Temp (°C)	<i>14.1</i>	<i>14.6</i>	
Water Colour	<i>clear</i>	<i>clear</i>	
Turbidity Low / Med / High	<i>low</i>	<i>low</i>	
Observations / Notes	<i>- walls dividing flow</i> <i>- GPT currently being cleaned @ inlet close to MSB building - no flow</i> <i>- rubbish present on the off-set channel outlet - flow contribution to main stream</i>		
Sample Container & Preservation Data			
Number of sample containers:	<i>4</i>	<i>4</i>	
Container Volume	<i>- one inlet directly downstream</i>		
Container Type	<i>of WPI has been observed</i>		
Preservation	<i>but no flow.</i>		
Sample Number (for Lab ID):			
QC Dup Sample No.:		<i>-QA100</i>	
		<i>-QA200</i>	

APPENDIX

# D

LABORATORY SUMMARY TABLES



	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	Temperature	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	0.001	5	0.1	0.01	0.1	0.01	1	0.1	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%

Lab Report Number	Field ID	Date	Chlorophyll a	TPH	Kjeldahl Nitrogen Total	Nitrate & Nitrite (as N)	Nitrogen (Total as N)	Phosphorus (Total as P)	TSS	Turbidity	pH	Temperature	Electrical Conductivity	Dissolved Oxygen
807266	WP1	1/07/2021	<0.001	<10	<0.2	1.3	1.3	0.18	4	4.1	9.01	14.1	910	108.8
807266	WP2	1/07/2021	<0.001	<10	2.2	0.9	3.1	0.13	4.4	6.3	8.83	14.6	530.3	77.9
807266	QA100	1/07/2021	NT	<10	0.3	0.87	1.17	0.12	5.8	4.6	-	-	-	-
ES2124553	QA200	1/07/2021	NT	<5	0.9	0.75	1.6	0.12	6	5.8	-	-	-	-

## Statistics

Maximum Concentration	<0.000005	<10	2.2	1.30	3.1	0.18	6	6.3	9.01	-	910.0	108.8
-----------------------	-----------	-----	-----	------	-----	------	---	-----	------	---	-------	-------

\* 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 collection	sample 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 <b>Appendix F</b> . 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 <b>Appendix F</b> .
Laboratory QC	Internal 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	01/07/2021	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:

$$RPD = \frac{(C_o - C_s)}{\left(\frac{C_o + C_s}{2}\right)} \times 100$$

Where:

$C_o$  = Concentration of the original sample

$C_s$  = 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 five (5) 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.



RPD Table

Project Number: NE30161  
Site: Wiley Park Station

		Lab Report Number	807266			807266	ES2124553	
		Field ID	WP2	QA100		WP2	QA200	
		Matrix Type	water	water		water	water	
		Date	1/07/2021	1/07/2021	RPD	1/07/2021	1/07/2021	RPD
	Unit	EQL						
NA								
Chlorophyll a	µg/L	5	<0.001			<0.001		
TPH								
Oil and Grease	mg/L	5	<10	<10	0	<10	<5	0
Inorganics								
Kjeldahl Nitrogen Total	mg/L	0.1	2.2	0.3	152	2.2	0.9	84
Nitrate & Nitrite (as N)	mg/L	0.01	0.90	0.87	3	0.90	0.75	18
Nitrogen (Total)	mg/L	0.1	3.1	1.17	90	3.1	1.6	64
Phosphorus	µg/L	10	130	120	8	130	120	8
TSS	mg/L	1	4.4	5.8	27	4.4	6	31
Turbidity	NTU	0.1	6.3	4.6	31	6.3	5.8	8

\*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



**Australia****Melbourne**

6 Monterey Road  
Dandenong South VIC 3175  
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

**Perth**

46-48 Banksia Road  
Welshpool WA 6106  
Phone : +61 8 9251 9600  
NATA # 1261  
Site # 23736

**Newcastle**

4/52 Industrial Drive  
Mayfield East NSW 2304  
PO Box 60 Wickham 2293  
Phone : +61 2 4968 8448  
NATA # 1261 Site # 25079

**New Zealand****Auckland**

35 O'Rorke Road  
Penrose, Auckland 1061  
Phone : +64 9 526 45 51  
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:** Ben Withnall  
**Project name:** DOWNER SYDNEY METRO STATIONS  
**Project ID:** 4NE30187 WILEY PARK  
**Turnaround time:** 5 Day  
**Date/Time received:** Jul 1, 2021 2:27 PM  
**Eurofins reference:** 807266

## 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 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](mailto:UrsulaLong@eurofins.com)**

Results will be delivered electronically via email to Ben Withnall - [ben.withnall@cardno.com.au](mailto: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.*



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 807266-W  
 Project name DOWNER SYDNEY METRO STATIONS  
 Project ID 4NE30187 WILEY PARK  
 Received Date Jul 01, 2021

Client Sample ID			WP1	WP2	QA100
Sample Matrix			Water	Water	Water
Eurofins Sample No.			S21-JI01111	S21-JI01112	S21-JI01113
Date Sampled			Jul 01, 2021	Jul 01, 2021	Jul 01, 2021
Test/Reference	LOR	Unit			
Chlorophyll a	5	ug/L	< 0.001	< 0.001	-
Nitrate & Nitrite (as N)	0.05	mg/L	1.3	0.90	0.87
Oil & Grease (HEM)	10	mg/L	< 10	< 10	< 10
Phosphate total (as P)	0.01	mg/L	0.18	0.13	0.12
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	< 0.2	2.2	0.3
Total Nitrogen (as N)*	0.2	mg/L	1.3	3.1	1.17
Total Suspended Solids Dried at 103–105°C	1	mg/L	4.0	4.4	5.8
Turbidity	1	NTU	4.1	6.3	4.6



**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 - Method: LTM-INO-4340 Chlorophyll a in Waters	Melbourne	Jul 02, 2021	2 Days
Oil & Grease (HEM) - Method: LTM-INO-4180 Oil and Grease (APHA 5520B)	Melbourne	Jul 02, 2021	28 Days
Phosphate total (as P) - Method: LTM-INO-4040 Phosphate by CFA	Melbourne	Jul 02, 2021	28 Days
Total Suspended Solids Dried at 103–105°C - Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry	Melbourne	Jul 02, 2021	7 Days
Turbidity - Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)	Melbourne	Jul 06, 2021	2 Days
Total Nitrogen Set (as N)			
Nitrate & Nitrite (as N) - Method: LTM-INO-4120 Analysis of NOx NO2 NH3 by FIA	Melbourne	Jul 02, 2021	28 Days
Total Kjeldahl Nitrogen (as N) - Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA	Melbourne	Jul 02, 2021	7 Days



## Internal Quality Control Review and Glossary

### General

- 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.
- All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
- All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
- Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
- Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
- SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
- Samples were analysed on an 'as received' basis.
- Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
- 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.

**\*\*NOTE:** pH duplicates are reported as a range NOT as RPD

### Units

**mg/kg:** milligrams per kilogram

**mg/L:** milligrams per litre

**ug/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

<b>Dry</b>	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
<b>LOR</b>	Limit of Reporting.
<b>SPIKE</b>	Addition of the analyte to the sample and reported as percentage recovery.
<b>RPD</b>	Relative Percent Difference between two Duplicate pieces of analysis.
<b>LCS</b>	Laboratory Control Sample - reported as percent recovery.
<b>CRM</b>	Certified Reference Material - reported as percent recovery.
<b>Method Blank</b>	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.
<b>Surr - Surrogate</b>	The addition of a like compound to the analyte target and reported as percentage recovery.
<b>Duplicate</b>	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
<b>USEPA</b>	United States Environmental Protection Agency
<b>APHA</b>	American Public Health Association
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>COC</b>	Chain of Custody
<b>SRA</b>	Sample Receipt Advice
<b>QSM</b>	US Department of Defense Quality Systems Manual Version 5.3
<b>CP</b>	Client Parent - QC was performed on samples pertaining to this report
<b>NCP</b>	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.
<b>TEQ</b>	Toxic Equivalency Quotient

### QC - Acceptance Criteria

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%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

### QC Data General Comments

- 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.
- 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.
- Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
- Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
- Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
- 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.
- Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
- Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
- For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
- 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
<b>Method Blank</b>									
Nitrate & Nitrite (as N)			mg/L	< 0.05			0.05	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	
Total Suspended Solids Dried at 103–105°C			mg/L	< 1			1	Pass	
Turbidity			NTU	< 1			1	Pass	
<b>LCS - % Recovery</b>									
Nitrate & Nitrite (as N)			%	102			70-130	Pass	
Oil & Grease (HEM)			%	82			70-130	Pass	
Phosphate total (as P)			%	107			70-130	Pass	
Total Kjeldahl Nitrogen (as N)			%	71			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Spike - % Recovery</b>									
				Result 1					
Nitrate & Nitrite (as N)	M21-JI08929	NCP	%	70			70-130	Pass	
Phosphate total (as P)	B21-Jn62694	NCP	%	110			70-130	Pass	
Total Kjeldahl Nitrogen (as N)	B21-JI02227	NCP	%	105			70-130	Pass	
Total Suspended Solids Dried at 103–105°C	M21-JI00149	NCP	%	91			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Duplicate</b>									
				Result 1	Result 2	RPD			
Nitrate & Nitrite (as N)	M21-JI08929	NCP	mg/L	3.9	3.9	1.0	30%	Pass	
Total Kjeldahl Nitrogen (as N)	S21-JI01856	NCP	mg/L	< 0.2	< 0.2	<1	30%	Pass	
Total Suspended Solids Dried at 103–105°C	M21-JI01374	NCP	mg/L	15	18	15	30%	Pass	
<b>Duplicate</b>									
				Result 1	Result 2	RPD			
Phosphate total (as P)	S21-JI01112	CP	mg/L	0.13	0.13	<1	30%	Pass	
<b>Duplicate</b>									
				Result 1	Result 2	RPD			
Turbidity	S21-JI01113	CP	NTU	4.6	4.3	6.0	30%	Pass	

**Comments**

Chlorophyll a analysis performed by Eurofins ARL, report reference 21-12812.

**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](#).

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.

**LABORATORY REPORT**

**ADDRESS:** Eurofins Environment Testing Australia Pty Ltd  
 6 Monterey Road  
 Dandenong South VIC 3175  
  
**ATTENTION:** Eurofins Sydney  
  
**DATE RECEIVED:** 12/07/2021  
  
**YOUR REFERENCE:** 807266  
  
**PURCHASE ORDER:** B21--807266



**APPROVALS:**



Sam Becker  
 Inorganics Manager

**REPORT COMMENTS:**

This report is issued by Eurofins ARL Pty Ltd. The report shall not be reproduced except in full without written approval from the laboratory.

Samples are analysed on an as received basis unless otherwise noted.

**METHOD REFERENCES:**

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377  
 Methods prefixed with "PM" and "EDP" are covered under NATA Accreditation Number: 2561

Method ID	Method Description
ARL No. 141	Chlorophyll-a and Pheophytin-a in Water

## LABORATORY REPORT

Physical Parameters		Sample No	21-12812-1	21-12812-2
Sample Description			S21-JI01111 WP1	S21-JI01112 WP2
Sample Date			8/07/2021	8/07/2021
ANALYTE	LOR	Units	Result	Result
Chlorophyll-a	0.001	mg/L	<0.001	<0.001

### Result Definitions

LOR Limit of Reporting                    [NT] Not Tested                    [ND] Not Detected at indicated Limit of Reporting  
 \* Denotes test not covered by NATA Accreditation

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.




# CHAIN OF CUSTODY AND ANALYSIS REQUEST

**Contact Person:** Ben Withnall  
**Telephone Number:** 0438 687 417  
**email Contact:** Chong Zhang  
**Telephone Number:** 0451 760 991  
**Facsimile:** CZ / BW  
**Mail Address (results and invoice):** ben.withnall@cardno.com.au, chong.zhang@cardno.com.au, Cardno NSW@cardno.com.au  
**Address:** Level 9 - The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia

**Project Name:** Downer Sydney Metro Stations  
**Project Number:** 4NE30187 Wilby Park  
**PO No.:**  
**Project Specific Quote No.:** 190498CDNN\_1  
**Turnaround Requirements:** Standard TAT  
**Lab:** Eurofins | Unit F3, Building F, 16 Mars Rd, Lane Cove West NSW2066  
**Attn:** Sample Receipt



Cardno Sample ID	Laboratory Sample ID	No. Containers	Preservation	Date sampled	Matrix	Analyse Required						Comments
						Chlorophyll-a	TSS	Turbidity	Oil and Grease	Total Phosphorus	Total Nitrogen	
WP1		4	ICE		Water	1	1	1	1	1	1	
WP2		4	ICE	01/07/2021	Water	1	1	1	1	1	1	
QA100		3	ICE		Water	1	1	1	1	1	1	
QA200		3	ICE		Water	1	1	1	1	1	1	Please send to ALS
Environmental Division Sydney Work Order Reference <b>ES2124553</b>  Telephone: +61-2-8786-8555												

<b>Received by:</b> Chong Zeng (name / company) Cardno ACTNSW Pty Ltd <b>Date &amp; Time:</b> 01.07.2021 <b>Signature:</b> CZ	<b>Received by:</b> (name / company) <b>Date &amp; Time:</b> <b>Signature:</b>	<b>Received by:</b> (name / company) <b>Date &amp; Time:</b> <b>Signature:</b>	<b>Received by:</b> (name / company) <b>Date &amp; Time:</b> <b>Signature:</b>
<b>Received by:</b> Sep M. (name / company) ALS <b>Date &amp; Time:</b> 02/07/21 1340 <b>Signature:</b>	<b>Received by:</b> (name / company) <b>Date &amp; Time:</b> <b>Signature:</b>	<b>Received by:</b> (name / company) <b>Date &amp; Time:</b> <b>Signature:</b>	<b>Received by:</b> (name / company) <b>Date &amp; Time:</b> <b>Signature:</b>
<b>Received by:</b> (name / company) <b>Date &amp; Time:</b> <b>Signature:</b>	<b>Received by:</b> (name / company) <b>Date &amp; Time:</b> <b>Signature:</b>	<b>Received by:</b> (name / company) <b>Date &amp; Time:</b> <b>Signature:</b>	<b>Received by:</b> (name / company) <b>Date &amp; Time:</b> <b>Signature:</b>

**Reinquired by:** (name / company)  
**Date & Time:**  
**Signature:**

**Lab use:**  
 Samples Received: Cool or Ambient (circle one)  
 Temperature Received at: (if applicable)  
 Transported by: Hand delivered / courier





ALS Environmental

ÄÄ !"#%\$&#&#!(\$)\*('+'&Ä('\*\$ ,Ä%) -

.01\$*0230	4#Ä5657889		
&'()*\$	Ä&Ä%:)*\$,)Ä.;Ä&-\$!(<\$":	Ä !"# \$%"#	Ä+*,(##"-)*\$ './(,(0("".1%2*)%
&"*\$ 3\$	Ä45.6+7.89:;7<ÄÄ	&"*\$ 3\$	Ä1= *)+"(0
<22#)00	ÄÄ),)'>.:)=.?#"@-.ABC.D 3(E(3. ;(F=G % 1\$.Ä)"*#20.718.ABHI	<22#)00	ÄAJJKAL>.8""2M #N.5" 2.1-(\$=E())'2. 718.<@0\$# '( .AOHP
+K- (' )M="")	Ä!)*QG(\$=" R3 #2**Q3"-Q @ ÄTHO.A.>P>I.LOLL	+K- (' )M="")	Ä1= *)Q+"(0R<Ä1S"" 'Q3"- ÄTHO.A.LJLP.LIII
? 30(-('	ÄKKKK	? 30(-('	ÄTHOKAKLJLP.LIBB
D#"U)3\$	ÄKKKK	D F)	ÄQ"EA
V#2)#. * @-!)#	ÄKKKK	W@("\$). * @-!)#	Ä+6ABOJ&<5718<&:BBBO.X+7YAAA.K. 1)3**2 #%.8"#NZ
&KVK&. * @-!)#	ÄKKKK	W&.).)'	Ä7+D4.ABOC.6C.[<Ä1.W&.1\$ *2 #2
1(\$)	ÄKKKK		
1 -M)#	Ä&Y68		

ÄÄ !"			
/ \$).1 -M)0.5)3)(,.)2	ÄBAK]@'KABAO.OCÄPB	900@)./ \$)	Ä BAK]@'KABAO
&'()*\$.5)^@)0\$)2./@).	ÄB>K]@'KABAO	13=)2@')2.5)M"#\$( *F./ \$)	Ä ==>?@AB?5=56
/ \$)			

Ä!#\$%&'&'Ä! Ä\$#"			
4"2)."E./)(,)#%	Ä& ##)(#	1)3@#(\$%.1) '	Ä7"\$.<. (' !)
7"Q."E.3""")#0Y!"_)	ÄO	:)-M)# \$@#)	ÄO AQH'&.K.93).M#)0)*\$
5)3)(M\$./)\$( ('	Ä	7"Q."E.0 -M)0.#)3)(,.)2.Y. * %0)2	ÄO.Y.O

)!\*&Ä#(+,--!\* "

- :=(0.#)M"#\$.3\*\*\$ (\*0.\$=).E""G(\*F.( \*E"#- \$(\*\*Ä  
K 1 -M).&"\*\$ (\*)#X0ZYD#)0)#. \$(\*\*."7\*\*K&"-M(' \*3)0  
K 1@-- #%. "E.1 -M)X0Z. \*2.5)^@)0\$)2.<\* %0(0  
K D#" 3\$(,).;"2(\*F.:(-).5)M"#\$  
K 5)^@)0\$)2./)(,)# !)0
- !B3CD3\$03E30F\$FG3\$!0/CHFJ3\$K/B2ILM\$(IN3%30/0F\$FCPB3\$FG3E4AN)C0ID3D\$P03CHG3D\$/E\$  
03H/NN3L232\$G/B2ILM\$FIN3D\$FGCF\$GCGJ3\$/HHA0032R\$(G3\$BCPB3\$FG3E4AN)D\$FG3D3\$DCNOB3D\$  
ALB3DD\$ILDF0AHFI/LD\$C03\$03H3I32\$E0/N\$S/A\$IL2IHCFFILM\$S0A03E/500/H332R\$(G3\$CPD3LH3\$/E\$  
FGID\$DANNC0\$FCPB3\$IL2IHCFF3D\$FGCF\$CBB\$DCNOB3D\$G03\$E3L\$E83303H/NN3L232\$  
G/B2ILM\$FIN3D\$E/0\$FG3\$CLCBSDID\$03TA3DF32R
- D) 0).2(#)3\$. \*%.^@)#(0.%)@.= .)#)F #2(\*F.\$=(0.G"#N."#2)#. \$\$=). !").<Ä1.' !"# \$%"#%.3\*\*\$ 3\$Q
- <\* %\$(3 'G"#N.E"#.\$=(0.G"#N."#2)#.G("!.).3\*\*2@3\$)2. \$.<Ä1.2%#Q
- 1 -M)/(0M"0 'K.<^@)"@0.XC.G))N0Za.1""(2.XA.-""\$=0.b.O.G))NZE"-.#)3)(M\$.E.0 -M)0Q
- D) 0)!.). G #).\$=\$.<D;<Y7+D4.#)3"--)\*20.G \$)#. \*2.0('0 -M) 0!).3=("")2.\$".)00.\$= \*"#.^@'\$.Hc&E"#.3=)-(3 '  
\* %0(0a. \*2.)00.\$= \*"#.^@'\$.OBc&!.@\$.@\*E"#d)\*.E"#.4(3#""F(3 ' . \* %0(0Q.8=#)0 -M)0. #).#)3)(,.)2. !").\$=(0.  
\$)-M)# \$@#)a.(\$.0="@2!).)N)\*(\$".3\*\*0(2)# \$("G=)\*.(\$)#M#(\$\*F.#)0@\$0Q.5)E)#.\$.<Ä1.+\*(#"4 ('.L.I.E"#.<Ä1.  
#)3"--)\*2 (\*\*0."E.\$=).!)0\$.M# 3\$(3).E"#.3=("(F.0 -M)0. E\$)# .0 -M(\*F. \*2.E"#- (\*\$ (\*F. .3""\$.)-M)# \$@#).2@#(\*F.# \*0(\$ Q

900@)./ \$) ÅBAKJ@'KABAO  
D F) ÅA"EA  
8\*#N.V#2# Å+1AOAPIIC.<)\*2)\*\$.B  
&'()\*\$ Å&<5/7V.X718Y<&:Z.D:e.Ä:/



.Ä-#/(+,\*Ä\$\*!&0"123&!&!%Ä\$,\*(4,\*5+,-/\$Ä\*6!"

<"3"-M # (0\*\*0.#).- 2). F (\*0\$.M#)\$#)-\*\$YM#)0)#, (\$\*\*.<1a.< D;<a.f1+D<.0\$ \*2 #20Q

3FG2 Sample ID	ÄCNOB3\$&/LFCIL30\$3H3IJ32	! 03E30032\$ÄCNOB3\$&/LFCIL30\$E/0\$ÄCDSDI
*IB\$CL2\$U03CD3\$4\$#!=5=		
VÄ5==	K.4(03)" *")@0.1@'M=@#(3. M#)0)#.)2	K.<-1)#.] #.K.1@'E@#(3.<3(2."#1"2(@-. 6(0@E \$)

.7--Ä&'8(Ä-#/#0"1(Ä\*9(:!;7!" !9(<-Ä#" "\$

1"-). (\$)-0. 2)03#(!)2. !)"G. - %. !). M #\$. "E. . '!"# \$#%  
M#"3)00. \*)3)00 #%. E"#. \$=). )\_3@\$("". "E. 3'()\*\$. #^@)0\$)2  
\$ 0N0Q.D 3N F)0. - %. 3\*\*\$ (\* 22\$(\$\*\*'. \*'%0)0a. 0@3=  
0. \$). 2)\$#-(\*\$("". "E. - "(0\$@#).3\*\*\$)\*\$. \*2. M#)M # \$(""  
\$ 0N0a.\$= \$. #).(\*3'@2)2.(\*.\$=).M 3N F)Q  
9E.\*\*. 0-M'(\*F. \$(-). (0. M#".(2)2a. \$). 0-M'(\*F. \$(-). G"  
2)E @'BBÄBB."\*\$=). 2 \$). "E.0-M'(\*FQ. . 9E\*\*.. 0-M'(\*F. 2 \$)  
(0. M#".(2)2a. \$). 0-M'(\*F. 2 \$). G(" . !). 00@-)2. !%. \$)  
'!"# \$"#%. \*2. 2(0M' %2. (\* !# 3N)\$0. G(\$="@.\$ . \$(-)  
3"-M\*\*)\*\$

4 \$#(Ä#%)

>Ä?.&Ä ,&'(Ä-#/( Ä-#/\$@'(9Ä !2( Ä-#/(=Ä  
=Ä \$!

+1AOAPIICKBBO	BOKJ@'KABAO.BBÄBB<ABB	8<.+5.K.+<BAI; 1@0M)2.1"(20.K.1\$ 2 #2Ä.)	8<.+5.K.+<BPI @#(2(\$#)	8<.+5.K.+DBAB V(';S# 0)XV(SZ	8<.+5.K.7:K00 ".\$.7(\$#F) ".2."\$. :D="0M=#@0
		✓	✓	✓	✓

3&Ä6 \$%!(A,#9@BS-!( / ,&

1-M)X0Z.= ,.!)\*)#3)(.2.G(\$=\*.\$#)3"-)2)2="2("F.\$(- )0.E"#.\$=)#^@)0\$)2. \*'%0(0Q

!:7!" !9(Ä!#\$%&!&Ä?#!"

W#)\$.(K)Ä""

K g<f.&)#\$(E(3 \$). "E.<* '%0(0.K.7<:<.X&V<Z	+-'	!) *QG(\$=* "R3 #2**Q3"-Q @
K g<f.9*\$)#M#)\$(.W&.5)M"#\$.K./+?<fÄ.:X<***.W&9.5)MZ.XW&9Z	+-'	!) *QG(\$=* "R3 #2**Q3"-Q @
K g<f.W&.5)M"#\$.K./+?<fÄ.:X<***.W&5)MZ.K.7<:<.XW&Z	+-'	!) *QG(\$=* "R3 #2**Q3"-Q @
K <P.K.<f.1 -M'.5)3)(M\$.7)"\$(E(3 \$("*.K.+*(#"*)\$ '.,.:X157Z	+-'	!) *QG(\$=* "R3 #2**Q3"-Q @
K &= (*."E.&@0\$2%.X&"&Z.X&V&Z	+-'	!) *QG(\$=* "R3 #2**Q3"-Q @
K +/9.?"#- \$.K.+745S.X+745SZ	+-'	!) *QG(\$=* "R3 #2**Q3"-Q @
K +/9.?"#- \$.K.+1/<.:X+1/<:Z	+-'	!) *QG(\$=* "R3 #2**Q3"-Q @

&G/LM\$X3LM

K g<f.&)#\$(E(3 \$). "E.<* '%0(0.K.7<:<.X&V<Z	+-'	3="*FQd)*FR3 #2**Q3"-Q @
K g<f.9*\$)#M#)\$(.W&.5)M"#\$.K./+?<fÄ.:X<***.W&9.5)MZ.XW&9Z	+-'	3="*FQd)*FR3 #2**Q3"-Q @
K g<f.W&.5)M"#\$.K./+?<fÄ.:X<***.W&5)MZ.K.7<:<.XW&Z	+-'	3="*FQd)*FR3 #2**Q3"-Q @
K <P.K.<f.1 -M'.5)3)(M\$.7)"\$(E(3 \$("*.K.+*(#"*)\$ '.,.:X157Z	+-'	3="*FQd)*FR3 #2**Q3"-Q @
K &= (*."E.&@0\$2%.X&"&Z.X&V&Z	+-'	3="*FQd)*FR3 #2**Q3"-Q @
K +/9.?"#- \$.K.+745S.X+745SZ	+-'	3="*FQd)*FR3 #2**Q3"-Q @
K +/9.?"#- \$.K.+1/<.:X+1/<:Z	+-'	3="*FQd)*FR3 #2**Q3"-Q @

&/LFCN)Ä.

K g<f.&)#\$(E(3 \$). "E.<* '%0(0.K.7<:<.X&V<Z	+-'	3**\$ -*0GR3 #2**Q3"-Q @
K g<f.9*\$)#M#)\$(.W&.5)M"#\$.K./+?<fÄ.:X<***.W&9.5)MZ.XW&9Z	+-'	3**\$ -*0GR3 #2**Q3"-Q @
K g<f.W&.5)M"#\$.K./+?<fÄ.:X<***.W&5)MZ.K.7<:<.XW&Z	+-'	3**\$ -*0GR3 #2**Q3"-Q @
K <P.K.<f.1 -M'.5)3)(M\$.7)"\$(E(3 \$("*.K.+*(#"*)\$ '.,.:X157Z	+-'	3**\$ -*0GR3 #2**Q3"-Q @
K &= (*."E.&@0\$2%.X&"&Z.X&V&Z	+-'	3**\$ -*0GR3 #2**Q3"-Q @
K +/9.?"#- \$.K.+745S.X+745SZ	+-'	3**\$ -*0GR3 #2**Q3"-Q @
K +/9.?"#- \$.K.+1/<.:X+1/<:Z	+-'	3**\$ -*0GR3 #2**Q3"-Q @

)Y\* &#Ä

K <P.K.<f.: _9*,"(3).X97hZ	+-'	M(*,"(3)0R3 #2**Q3"-Q @
----------------------------	-----	-------------------------



# Environmental

## ÄÄ !"# Ä\$!Ä%&#%'\$()\*+,-

```

+,-.%&-'0-
123$4/
1*4/&</
D,:$99
!$2$OE'4$
%'S$</
U,"$Ä4#7,$"
1MUM1A4#7,$"
:&7O2$"
:3/$
X#/'$Ä4#7,$"
@*Ä+Ä9&7O2$9Ä"$-$<36$;
@*Ä+Ä9&7O2$9Ä&4&209$;
()Ä+Ä
(5463***47$4/82Ä836393*4Ä:0,4$0
):E&4$Ä52239
(,LLM,NFAA**;O&"PÄ"&Ä;73'E+3$2;Ä@:ÄÄD#9/'&23&Ä,)JQ
(RJ)Ä,ÄNLNQÄNKKK
(Ä,MT#2M,Ä,)Ä)H(QÄ
(ÄHMT#2M,Ä,)
(ÄFMT#2M,Ä,)Ä)Q(HÄ
%&$
-&.*'/'*0
1*4/&</
D,:$99
!$2$OE'4$
8&/$Ä.&7O2$9Ä>$-$<36$;
8&/$ÄD4&20939Ä1*77$4-$;
B99#$$8&/$
(RJ)Ä,ÄNLNQÄNKKK
(Ä,MT#2M,Ä,)Ä)H(QÄ
(ÄHMT#2M,Ä,)
(ÄFMT#2M,Ä,)Ä)Q(HÄ

```



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

```

IE39Ä"$O**/Ä9#O"$9$;9Ä&40ÄO"$63*#9Ä"$O**/9ZÄ3(EÄ/E39Ä$+$4$Ä>$9#2/9Ä&O20ÄÄ/E$Ä9&7O2$9ZÄ9Ä9#73/;$[Ä #42$99ÄE$Ä9&7O234Ä&9Ä <4;#;</$;Ä .0Ä D.: Ä IE39Ä;*<#7$4/Ä 9E&22
4*/Ä,$Ä"$O**;#<$;[Ä$)\<O/Ä34Ä+#22 Ä
IE39Ä1$'/3+3-<8/$Ä*ÄD4&20939Ä<*4/8349Ä/E$Ä+22'134(Ä34+**7&/3*4
• ]$4$"&ZÄ1*77$4/9
• D4&20/3<&2Ä>$9#2/9
$/<=<.>?@%>A,-B?=<,>%C0.-=<0>=%% =D<E%0C,-=%F<@%$%ÄH>/% <=>%=D0%A,@@,F<>I%0C?.-?>0?%=?JDB0>=E1%KH?@<=<=Ä?=-,@%0C,-=M%K$9KÄ%Ä,BC@<?>J0%EE0EEB0>=%/=#,%?EE<E=76=D
KH?@<=L% 0N<0F%?>/%*?BC@0% 0J0<C=%;=<A<J?=<,>O

```

```

ÄÄ !"# $% &'
IE39Ä,*<#7$4/AE&9Ä,$$4Ä$2</'*43<&220Ä93'4$;Ä.0Ä/E$Ä&#B$4&7$;Ä$9Ä,$2*1 Ä52$</'*43<Ä93434Ä39Ä<&"*3$;Ä*#/Ä34Ä$ÄÄBÄO**<$;#"$9Ä9O$<3+3$;Ä34Ä,)Ä1G>Ä%&("Ä))
ÄÄ !"# $% &'
ÄÄ !"# $% &'
A39&7Ä=&"&998
B4***&43<9Ä1***;34&/'**
:0,4$0ÄB4***&43<9Ä|Ä.73'E+3$2;Ä@:ÄÄD#9/'&23&Ä,)JQ

```





Environmental

ÄÄ !"#\$\$%&'(#)!%)\*+)'#

```

-:~!'.01.
2 *34546718
& )9'(%:(3,; &#<%+##$%#9
>?#@7A#BC'DAE00
0"8" #G#F"Ä-(9#H&/#Ä=5.5=#D5+FIÄ3
:2#0"-6Ä(<#A;B#H&JK
RJS##H#GQK#N$NN
QA7&$N#B5 "3*Ä(P
, MMMM
M MMM
4VW@B
, MMMM
:52"
X)-2*#6)91"
A-%#-#Ä90 "#("= "58"<
A-%#-#Ä90 "#Ä6Ä 3!"<
, $
, $
*Ä+*
, $#. #
, 7685(-69"62Ä #.585I5-6#.3<6"3
; FÄ6" #7 5!
, HLLMHNG#B-<OÄ(P#?Ä-<#;952F.5" <#A;B#E)2(Ä 5Ä#H$JQ
" "OF-6"
:Ä2"#Ä90 "#?"="58"<
:Ä2"#E6Ä 3!5!#4-99"6="<
C!)#":Ä2"
RJS##H#NLI#Q#NKKK
&HMT) MH&H$
&(MT) MH&H$
&GMT) MH&H$

```



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

```

'F5# ("O-(2#)O"(!"<"# Ä63#Q"85-)# ("O-(2YZ#I52F#2F5#H". "V6 ="%#?"!) 2!# ÄOO 3## 2F"iÄ9O " YIZ#Ä# ! )19522"<[#]6 "i!# 2F"iÄ9 O 56+#Ä!# =-6<)" 13#E0:%#F5# <=<=)9"62# IFÄ
6-2#1#"("O(<)"O 5=<Ä2" #Y>@Z#Ä6<#OÄ1-(Ä2-(3#4-62(- #O5P"#Y04;Z##G-Ä(3#Ä6<#E=="O2Ä6="#05952!
'F5#X)Ä 523#44-62(- #?O-(2#)-62Ä56!#2F"#.- -156+#56-(9Ä25-6,
• 0Ä1-(Ä2-(3#):O 5=<Ä2" #Y>@Z#Ä6<#OÄ1-(Ä2-(3#4-62(- #O5P"#Y04;Z##G-Ä(3#Ä6<#E=="O2Ä6="#05952!
• >"2F-<#@ Ä6P#Y>@Z#Ä6<#OÄ1-(Ä2-(3#4-62(- #O5P"#Y04;Z##G-Ä(3#Ä6<#E=="O2Ä6="#05952!
• >Ä2(5#:#O5P"#Y>@Z#Ä6<#OÄ1-(Ä2-(3#4-62(- #O5P"#Y04;Z##G-Ä(3#Ä6<#E=="O2Ä6="#05952!

```

```

ÄÄ !"#$$%&'
'F5#<=<=)9"62#FÄ!""6# " =2(-65=Ä 3#I5+6" <#13#2F"Ä)2F-(5I5+6Ä2-(5"i#1" -!%#7 " =2(-65=#I5+656+#5#=#Ä(5" <#- )2#56#B=9059Ä#O(-="<)"!#I"O"=5.5" <#56#H$#4A?#Ä(2#$$%
AA !"#$$%&'
B5Ä9#>Ä(Ä!Ä
C6-(+Ä65=#4-(<56Ä2-(
)!)%&*Ä#"Ä$!+, "#& $%-
;3<6"3#C6-(+Ä65=#4-(+56Ä2-

```







Environmental

ÄÄ Ä!"!#\$%&'()\*+,"-./:;<=>??@

4#56"758+5	9;:<=>??@	"#\$!	%&()*
/012-	%Ä2AB7"CB,4 ÄIDE"FDG"HDA	+#,Ä#(Ä.	%3241Ä(2512-#0614171(28.92).
/2#:-	%<=3>?@AA>B++	Ä10ICD(2!	%EF&G'HIH"*HJJ
"Ä(Ki:-	%>3LM&HI"?10!.""#ÄN	6#18#5C017<!11419	%MGOP 00GIMG&
81-J	%0000	@77 !6#-!	%MQOP 00GIMG&
8#5C0iÄ	%RS=?	>(T)7#5C017Ä!11419	%&
UÄ9iÄ'2.5,iÄ	%0000	>(T)7#5C017#2#0.7!9	%&

DI,"5+%#5-,"(0-#\$(-(&&1"i)+5(+8"J1"-/+ÄH;"HKL,-/5#0!/" )-+5%5+(-#"#M"-/+ÄH;"Ä0(&-1"i#)-5&"2+%#5-"(8" +3+5(&Ä0-1"Ä.,05()"+%"(5(\$+-+5,"\$+(,05+8"J1"ÄH;N"D!;"(0-#\$(+8"5+%#5-)"!/&V-,"(1"i)O#)M#5\$(+,"P"M("&-(-,"M(-,+5(" )8"\$#5+("50(-+8(-("3(&8(-#"i)8"";8+, !)+8"-#"i,,""-) +5)(&"+Q,%+5-"(8"+Q,+5)(&"Ä08-#5"5+3+N"L(1""#5%#)+,-;"#M"-/5+%#5-""#)-/+-#"#3+5(&&"ÄÄ7"(.+,\$+)-"i)8"5+%#5-)"!M#5"i0+8&)+""#5%&()"+N"

"

=Ä!i)5!D(97 55#Ä117#29Ä)iÄ!2:17#Ä!#07(CÄ(419!9:-(#771 7-12-Ä#:#,101-.T

Summary of Outliers

Outliers : Quality Control Samples

ÄD17ÄIC(Ä-D1\$D01\$D-7(-01Ä7)0#\$\$912-DiV #01-./(2XÄ(X<IC(Ä-T

- B7" L+ -#8"R&06"3(&0+ "#0-&+5,"#\*\*05N
- B7" A0%&\*( -+ "#0-&+5,"#\*\*05N
- B7" L(-5"Q",%6+ "#0-&+5,"#\*\*05N
- H(J#5(-#51"i#)-5#&"#0-&+5,"+Q,-"O"%&+(+,"++"M#&.&#.)!"%(M#5"i0&&"8+-(&.N
- S#5"(&&"5+10&(5",(\$%&+ "\$(-5"+#7""",055#l(-+ "5+ #3+51"#0-& +5#\*\*05N

Outliers : Analysis Holding Time Compliance

- B7" Ä(&1,"T#&8)"!D"\$+70-&+5,"+Q,-N

Outliers : Frequency of Quality Control Samples

- B7" Ä0(&-1"i#)-5#&"i(\$%&+"S5+U0+)"170-&+5,"+Q,-N







"#\$!  
 ?(ÄN)UÄ9IÄ  
 /0112-  
 "Ä(KI)-  
 %L()!\*  
 %38G&G\*JUL  
 %/B<6>UW>8?SB/ÄX"ÄY"+A6  
 %>3LM&HI?10I."#AN

### Quality Control Parameter Frequency Compliance

ADI!)(00("12\$ÄIÇÄ-7 55\$ÄI717-DI)ÄIa I2.:()9#(Ä#-Ä.Ä/ 7#5C0I7#2#0.719'-1-D12-DI#2#0.-1#00(C-W7X'12'D1:D-DI'7 j5-97#5C0IW7X'#7W'ÄIX'ÇÄ:(7719TB:- #0Ä#-I7D( 09;!\$Ä#-Ä-Ä-D#2(Ä'Ia #0(-  
 -DIIZCI:-19Ä#-ITB017-12\$ (j:Ä#DI7'17'ÇÄ(41919'12-DI'8 5 5#Ä.()U -01Ä7T

V #01-/(2-Ä08#5C0IÄ.CI		*&%+,-		5.Ä/%		C\$%Ä A		BÄ\$!(%#j)5./3.)6 &#>#"\$%'/	
9/\$%#Sj)*&%+,-'		B5	C&DÄI\$3	Actual	Expected	=S/Ä\$%'/			
#.(Ä#-Ä.Ä 6 C01.#-I7W6eX									
>1-Ä1-!#29>1-Ä#-!#7>W>UZX', '617-ÄI-!B2#0.7IÄ	3JMJQI	G	GM	"=VNVV	"=VNVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
8 7C2I919'8(0197'WA1SD'+I4I0X	3BMGJA	G	GM	"=VNVV	"=VNVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
Ä(-#0'K109#DD0>1-Ä(\$I2#7>=, '617-ÄI-!B2#0.7IÄ	3JMF&I	G	GM	"=VNVV	"=VNVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
Ä(-#0'D(7CD(Ä 7#7"'=, '617-ÄI-!B2#0.7IÄ	3JMF I	G	GM	"=VNVV	"=VNVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
Ä Ä, 191-.	3BM*J	G	GM	"=VNVV	"=VNVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
#.(Ä#-Ä.Ä/(2-Ä08#5C0I7W+8X									
>1-Ä1-!#29>1-Ä#-!#7>W>UZX', '617-ÄI-!B2#0.7IÄ	3JMJQI	&	GM	"?NVV	"?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
U10#29I(Ä#7I	3"MGM	&	&J	"N^Y	"?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
8 7C2I919'8(0197'WA1SD'+I4I0X	3BMGJA	L	GM	"=?NVV	"=?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
Ä(-#0'K109#DD0>1-Ä(\$I2#7>=, '617-ÄI-!B2#0.7IÄ	3JMF&I	L	GM	"=?NVV	"=?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
Ä(-#0'D(7CD(Ä 7#7"'=, '617-ÄI-!B2#0.7IÄ	3JMF I	L	GM	"=?NVV	"=?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
Ä Ä, 191-.	3BM*J	&	GM	"?NVV	"?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
!-D(9=#2N7W;=X									
>1-Ä1-!#29>1-Ä#-!#7>W>UZX', '617-ÄI-!B2#0.7IÄ	3JMJQI	&	GM	"?NVV	"?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
U10#29I(Ä#7I	3"MGM	&	&J	"N^Y	"?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
8 7C2I919'8(0197'WA1SD'+I4I0X	3BMGJA	&	GM	"?NVV	"?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
Ä(-#0'K109#DD0>1-Ä(\$I2#7>=, '617-ÄI-!B2#0.7IÄ	3JMF&I	&	GM	"?NVV	"?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
Ä(-#0'D(7CD(Ä 7#7"'=, '617-ÄI-!B2#0.7IÄ	3JMF I	&	GM	"?NVV	"?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
Ä Ä, 191-.	3BM*J	&	GM	"?NVV	"?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
#-ÄI Z8C1N7W;8X									
>1-Ä1-!#29>1-Ä#-!#7>W>UZX', '617-ÄI-!B2#0.7IÄ	3JMJQI	&	GM	"?NVV	"?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
Ä(-#0'K109#DD0>1-Ä(\$I2#7>=, '617-ÄI-!B2#0.7IÄ	3JMF&I	&	GM	"?NVV	"?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	
Ä(-#0'D(7CD(Ä 7#7"'=, '617-ÄI-!B2#0.7IÄ	3JMF I	&	GM	"?NVV	"?NVV	✓		>3";GM&L=L'cB+8V/!8-#29##Ä9	



#\$!  
 ?(ÄNUÄ9IÄ  
 /012-  
 "Ä(KI:-  
 %\*( ))\*  
 %38G&G\*JUL  
 %/B<6>UW>8?SB/ÄX""ÄY"+A6  
 %>3LM&HI?10I."#ÄN

### Brief Method Summaries

ÄDI#2#0.-1.#0CÄ:(9 ÄI7 7I9.-DI324IÄ(25I2-#0614171(2D# 4I!!I29I4I0(CI9)Ä(5I7-#017DI9I12-IÄ2#-1(2#00.ÄI:(\$2I2I9C Ä:(9 ÄI77 7-D#7-D(7IC .017DI9I.-DI'e8'3'Bb'B'AbB#B8#29> 3":T.@2D(7I'  
 9I4I0(CI9CÄ:(9 ÄI7#ÄI!5C0(19I12-DI# 7I2:I(0)9(: 5I2-I9' 7-#29#Ä97(Ä. :01I2-ÄIa I7-TÄDI!)00( 12SÄIC(Ä-CÄ(4I9I7ÄI)9I7Ä1C-(27I-DI)#2#0.-1.#0CÄ:(9 ÄI715C0(19)ÄÄI7 0-7ÄIC(Ä:9I12-DI'  
 /IÄ-1I)-#I(0)B2#0.7I17T8( ÄI7)Ä(5'D1:DI#85I-D(97D#4I!! I29I4I0(CI9#ÄI7CÄ(4I9I9'-1-DI2-DI':D(96I7-ÄI1C-1(27T

9(\$4%#8I)*%+,-'	*%+,-	*\$%3'8	*%+,-)Ä&#3' %' /
8 7CI29I98(0I97WA1\$D+I4I0X	3BMGJA	?BÄ3<	@2'D( 7I%<I)ÄI2:I9-(B'AB'GJ*M6T"B\$Ä415I-Ä1:CÄ:(9 ÄI15 C0(19-(9I-Ä5I2I-DI)#5( 2-'0) g2(2O)10-IÄ#0I9ÄI7I9 I'12##a I( 7#5C0ITÄDI'CAI7:Ä1I9Ih /W&TG 5X)10-IÄ'17Ä127I9'-1-D9I1(2I7I9'-#-IÄB' (4I29Ä1I9#29'1I\$DI9CÄI(Ä-('#2#0.7I17T"B'10005I2I97#5C0I7)10-IÄI9-DÄ(\$D#\$0#77)1,ÄI)10-IÄW&TG 5XT" ÄDIÄI7I9 I(2-DI!)10-IÄC#CÄI'79Ä1I9#-&M*ESOG/TÄDI7I7B:17:(5C0I#2.-1-D>3":8:DI9 0I'=WLX
Ä Ä, 19I.-	3BM*J	?BÄ3<	@2'D( 7I%<I)ÄI2:I9-(B'AB'G&LM=TÄDI7'5I-D(9I17:(5C0I#2.-1-D>3":8:DI9 0I'=WLX
>1-Ä1-#29>1-Ä#-I#7>W>UZx':617:ÄI-!' B2#0.7IÄ	3JMUQI	?BÄ3<	@2'D( 7I%<I)ÄI2:I9-(B'AB**JMMO>ULOHT"/(5,12I9(ZI9I7I9I9>1 -Ä(\$I2'W>UGE>ULX'179I-IÄ5I2I9. , /DI5I'#0<I9 -:1(2#299IÄI.-:(0(Ä15I-Ä. ,617:ÄI-IB2#0.7IÄ TÄDI7'5I-D(9I17:(5C0I#2.-1-D>3":8:DI9 0I'=WLX
Ä(-#0)KI09#D0>1-Ä(\$I2#7>= :617:ÄI-!' B2#0.7IÄ	3JMF&I	?BÄ3<	@2'D( 7I%<I)ÄI2:I9-(B'AB**JMMO>(Ä\$6'W@2'DI 7IXT'B2#01a (I)7#5C0I179I\$17-I9' 7I2\$#D1\$D' -I5CÄ#- ÄI)KI09#D0'9I\$17-1(2-'(24IÄ-2I-Ä\$2( 7:(5C( 297 -(#55(2I#T"B55(2I#179I-IÄ5I2I9 :0(Ä15I-Ä1:#00. ,9I7-ÄI-I#2#0.7IÄTÄDI7'5I-D(9I17:(5C0I#2I-D>3":8:DI9 0I'=WLX
Ä(-#0>1-Ä(\$I2#7>WÄI)>E'>(ZX'=- :617:ÄI-!' B2#0.7IÄ	3JMF&G	?BÄ3<	@2'D( 7I%<I)ÄI2:I9-(B'AB**JMMO>(Ä\$S*JMMO>ULOTÄDI7'5I-DI7:(5C0I#2.-1-D>3":8:DI9 0I'=WLX
Ä(-#0"7CD(Ä 7#7""= :617:ÄI-!' B2#0.7IÄ	3JMF I	?BÄ3<	@2'D( 7I%<I)ÄI2:I9-(B'AB**JMMO"AbPIÄN#I-#0bRD#2\$!-#0ÄDI7'CA:(19 ÄI'124(04I77 0CD Ä1:#19' 9I\$17-1(2I)#7#5C0I#01a (-I-ÄI#NCD(7CD(Ä 79'(2-'(Ä-D( CD(7CD#ITÄDI"(Ä-D(CD(7CD#IÄI#-7'1-D' #55(2I 5'5(0 .9#-I#29#2-15(2'C(#77I 5-#Ä-Ä#I-(I)Ä5#:( 5C0IZ'D1:D17-DI2ÄI9 :I9#29I-7 :2:I2-Ä#-1(2'5I#7 ÄI9#-H#M25' 7I2\$9I7:ÄI-I#2#0.7IÄTÄDI7'5 I-D(9I17:(5C0I#2.-1-D>3":8:DI9 0I'=WLX
U10#29IÄI#7I	3'MGM	?BÄ3<	@2'D( 7I%<I)ÄI2:I9-(B'AB'JGM"=T"U10c\$ÄI#7I17#5Ä#415I! -Ä1:CÄ:(9 ÄI-(9I-IÄ5I2I-DI)#5( 2-'(10'c \$ÄI#7IÄI7I9 I'12#2#Ä I( 7'7#5C0ITÄDI7'5C0I17I7IÄ#400.IZ-Ä#-I9-DÄI!-15I7ZODIZ#2ITÄDIÄI7 0-#2.- IZ-Ä#-7#ÄI:(5,12I9b9ID.9Ä#-I9#29:(2:I2-Ä#-I9CÄI(Ä-(SÄ# 415I-Ä1-9I-IÄ5I2I#-1(2TÄDI7'5I-D(9I17:(5C0I#2.-1-D>3":8:DI9 0I'=WLX
<3& \$3%#) *%+,-' ÄI>SA"6I\$17-1(2	*%+,-	*\$%3'8	*%+,-)Ä&#3' %' /
	3JMF&S3JMF	?BÄ3<	@2'D( 7I%<I)ÄI2:I9-(B'AB**JMMI">(Ä\$O'6_'B'AB*JMM"OATÄD 175I-D(9I17:(5C0I#2.-1-D>3":8:DI9 0I'=WLX

## Appendix 4 – TL927-1-02F02 WE42 NOISE AND VIBRATION MONITORING REPORT (R2)

1 March 2022

TL927-1-02F02 WE42 Noise and Vibration Monitoring Report (r2)

Downer EDI Works Pty Ltd

76 Berry Street

Nth Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - OOHW WE42 Possession Works

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct noise and vibration monitoring during the OOHW Station Upgrade WE42 Possession works for Sydney Metro Southwest. The monitoring was undertaken to verify predicted noise levels in the Out of Hours Work Application (OOHWA) No. 2 Revision 3<sup>1</sup>. This report provides a summary of the measured noise levels.

### 2 Details of monitoring

Vibration monitoring was undertaken at Hurlstone Park Station during the demo saw works between 08:00pm and 10:00pm on 19<sup>th</sup> April 2021. Noise monitoring was undertaken during out of hours work between 08:00pm and 01:00am on 19<sup>th</sup> and 20<sup>th</sup> April 2021. During this period, the possession works were occurring at Dulwich Hill Station, Hurlstone Park Station, Campsie Station, Wiley Park Station and Punchbowl Station. Note that there were no works being carried out at Belmore station during this period.

#### 2.1 Measurement location

The noise measurements were conducted at the worst affected residential receiver, relative to the measured works. The vibration monitoring was conducted on the station platform at Hurlstone Park Station. The measurement locations are listed in Table 2-1. Figures depicting the monitoring locations are included in APPENDIX A.

---

<sup>1</sup> DOWNER SM OOHWA WK42 WK 43 Rev3 Approval \_COMMS\_ER, dated: 15 April 2021.

**Table 2-1: Measurement locations**

Assessment Point	Date	Time	Measured plant	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
1 Ewart Lane, Dulwich Hill	19.04.2021	09:54pm – 10:00pm	Lighting tower	18 metres	No
	19.04.2021	10:02pm – 10:17pm	Lighting tower	18 metres	No
	20.04.2021	08:08pm – 08:23pm	Demo saw	35 metres	Yes
	20.04.2021	10:28pm – 10:43pm	Lighting tower	18 metres	No
Hurlstone Park Station	19.04.2021	09:09pm – 09:15pm	Demo saw (Vibration)	0.2 and 0.5 metres away	N/A
107 Duntroon Street, Hurlstone Park	19.04.2021	09:21pm – 10:00pm	Demo saw	40 metres	Yes
	19.04.2021	10:26pm – 10:41pm	Hand tools	37 metres	Yes
13-15 Anglo Road, Campsie	20.04.2021	09:50pm – 10:00pm	Lighting Tower	115 metres	No
	20.04.2021	11:28pm – 11:43pm	Excavator with clamp attachment	100 metres	no
1-3 Shadforth Street, Wiley Park	19.04.2021	11:22pm – 11:37pm	Hand tools	30 metres	Yes
	20.04.2021	09:15pm – 09:30pm	Hand tools	30 metres	Yes
14 Arthur Street, Punchbowl	19.04.2021	11:59pm – 12:14am	Vacuum truck	85 metres	Yes
	20.04.2021	08:53pm – 09:08pm	- <sup>1</sup>	-	-

Notes:

1: The demo saw was inaudible during this measurement.

## 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)	NTi	XL2	A2A-02386-D2	08 July 2019
Type 1 Sound Level Meter Calibrator	B&K	Type 4231	2677710	03 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
Type 1 Signal Analyser	Soundbook-2
Accelerometer	Endevco 61C3

## 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**

Assessment Point	Date and Start Time	Environmental Conditions
1 Ewart Lane, Dulwich Hill	19.04.2021 09:54pm	Clear sky; air temperature 21°C; wind speed <5 m/s; relative humidity 35%
	19.04.2021 10:02pm	Clear sky; air temperature 21°C, wind speed <5 m/s; relative humidity 35%
	20.04.2021 08:08pm	Clear sky; air temperature 22°C, wind speed <5 m/s; relative humidity 42%
	20.04.2021 10:28pm	Clear sky; air temperature 20°C, wind speed <5 m/s; relative humidity 39%
Hurlstone Park Station	19.04.2021 09:09pm	Clear sky; air temperature 21°C, wind speed <5 m/s; relative humidity 35%.
107 Duntroon Street, Hurlstone Park	19.04.2021 09:21pm	Clear sky; air temperature 21°C, wind speed <5 m/s; relative humidity 35%.
	19.04.2021 10:26pm	Clear sky; air temperature 21°C, wind speed <5 m/s; relative humidity 35%.
13-15 Anglo Road, Campsie	20.04.2021 09:50pm	Clear sky; air temperature 20°C, wind speed <5 m/s; relative humidity 39%
	20.04.2021 11:28pm	Clear sky; air temperature 20°C, wind speed <5 m/s; relative humidity 39%
1-3 Shadforth Street, Wiley Park	19.04.2021 11:22pm	Clear sky; air temperature 20°C, wind speed <5 m/s; relative humidity 35%
	20.04.2021 09:15pm	Clear sky; air temperature 21°C, wind speed <5 m/s; relative humidity 39%
14 Arthur Street, Punchbowl	19.04.2021 11:59pm	Clear sky; air temperature 20°C, wind speed <5 m/s; relative humidity 35%
	20.04.2021 08:53pm	Clear sky; air temperature 21°C, wind speed <5 m/s; relative humidity 39%

## 3 Noise Monitoring results

The results of the noise monitoring are presented in Table 3-1 below.

**Table 3-1: Measured noise levels  $L_{Aeq(15min)}$**

Assessment Point	Measured plant	Predicted noise level dB(A)	Measured noise level dB(A)		Above predicted noise level?	Comments
			$L_{Aeq(15min)}$	$L_{Amax}$		
1 Ewart Lane, Dulwich Hill	Demo saw	72 <sup>H</sup>	61	66	No ( $L_{Aeq, 15min}$ )	Temporary noise barriers were setup correctly during the measurement. The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.

Assessment Point	Measured plant	Predicted noise level dB(A)	Measured noise level dB(A)		Above predicted noise level?	Comments
			L <sub>Aeq</sub> (15min)	L <sub>Amax</sub>		
	Lighting tower	68 <sup>T</sup>	61	75	No (L <sub>Aeq</sub> , 15min)	Lighting tower setup on 19.04.2021. The measured L <sub>Aeq</sub> , 15min is lower than the predicted noise level.
	Lighting tower*	68 <sup>T</sup>	55	58	No (L <sub>Aeq</sub> , 15min)	Lighting tower setup on 20.04.2021. Note that a different lighting tower was setup on the Tuesday night, which produced lower noise levels. The measured L <sub>Aeq</sub> , 15min is lower than the predicted noise level.
107 Duntroon Street, Hurlstone Park	Demo saw	67 <sup>^</sup>	52	57	No (L <sub>Aeq</sub> , 15min)	Temporary noise barriers were setup correctly during the measurement. The measured L <sub>Aeq</sub> , 15min is lower than the predicted noise level.
	Hand tools	56 <sup>^</sup>	46	53	No (L <sub>Aeq</sub> , 15min)	Temporary noise barriers were setup correctly during the measurement. The measured L <sub>Aeq</sub> , 15min is lower than the predicted noise level.
13-15 Anglo Road, Campsie	Lighting Tower	68 <sup>T</sup>	49	61	No (L <sub>Aeq</sub> , 15min)	The lighting tower was not audible at this monitoring location. As a result, the noise contribution from the lighting tower can be assumed to be at least 10dB less than the measured L <sub>Aeq</sub> , 15min.
	Excavator with clamp attachment	68 <sup>T</sup>	61	78	No (L <sub>Aeq</sub> , 15min)	The measured L <sub>Aeq</sub> , 15min is lower than the predicted noise level during the demolition of shed works.
1-3 Shadforth Street, Wiley Park	Hand tools on 19.04.2021	72 <sup>T</sup>	54	61	No (L <sub>Aeq</sub> , 15min)	The measured L <sub>Aeq</sub> , 15min is lower than the predicted noise level.
	Hand tools on 20.04.201	72 <sup>T</sup>	70	85	No (L <sub>Aeq</sub> , 15min)	The measured L <sub>Aeq</sub> , 15min is lower than the predicted noise levels. Note that this measurement included the activity of hammering which produced higher noise levels.
14 Arthur Street, Punchbowl	Vacuum truck	46 <sup>T</sup>	52 (42)	64	No (L <sub>Aeq</sub> , 15min)	The vacuum truck was not audible at this monitoring location. As a result, the noise contribution from the vacuum truck can be assumed to be at least 10dB less than the measured L <sub>Aeq</sub> , 15min.

Note: \* – Note that a different lighting tower was setup on the 20.04.2021, which produced lower noise levels.

H – The corresponding predicted noise level for high impact activities

T – The corresponding predicted noise level for typical activities

^ – Access to the most affected facade was not available. As a result, the predicted noise level for the relevant facade has been presented.



It can be seen from Table 3-1 that, the measured  $L_{Aeq, 15min}$  noise levels were consistent with and below the predicted noise levels. The mitigation and management measures implemented were therefore considered suitable for this activity.

## 4 Vibration Monitoring results

The established vibration criteria for cosmetic damage in the Construction Noise & Vibration – OOHWA Assessment Stage 2 Possession Works (CNV-OOHWA)<sup>2</sup> 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 present in below.

**Table 4-1: Measured vibration levels**

Plant	Distance from source	95 <sup>th</sup> percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
Demo Saw	0.2m	2.38	2.72	At 0.2 metres away, the concrete saw produced a maximum PPV value of 2.72 mm/s. This maximum PPV value exceeds the screening level for Heritage structures (2.5 mm/s)
	0.5m	1.46	1.78	At 0.5 metres away, the concrete saw produced vibration levels that are below the established vibration criteria.

It can be seen from Table 4-1 that, the demo saw produced vibration levels were below the vibration criterion of 2.5 mm/s for cosmetic damage, at a distance of 0.5 metres away. However, at 0.2 metres away, the demo saw produced a maximum PPV value of 2.72 mm/s. This maximum PPV value exceeds the vibration criterion of 2.5 mm/s for cosmetic damage. As a result, the site specific minimum working distance for the demo 0.5 metres for heritage structures and 0.2 metres for reinforced or unreinforced structures.

## 5 Conclusion

Renzo Tonin & Associates completed noise and vibration monitoring of the out of hours works for the WE42 possession works. The results of the noise measurements were consistent with and below the predicted  $L_{Aeq 15minutes}$  levels presented in the CNV-OOHWA prepared for the works. The vibration measurements established new, site specific minimum working distances for the demo saw, allowing works at  $\geq 0.5$  metres for heritage structures and  $\geq 0.2$  metres for reinforced or unreinforced structures.

<sup>2</sup> TL927-1-02F01 CNV\_OOHWA WE42 Possession April 2021 (r4), dated: 06 April 2021

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
03.05.2021	First Issue	0	1	R. Zhafranata	T. Gowen	T. Gowen
01.03.2022	Report revised to address client's comments	-	2	R. Zhafranata	T. Gowen	T. Gowen

File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\02 April WE42 possession\TL927-1-02F02 WE42 Noise and Vibration Monitoring Report (r2).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.

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.

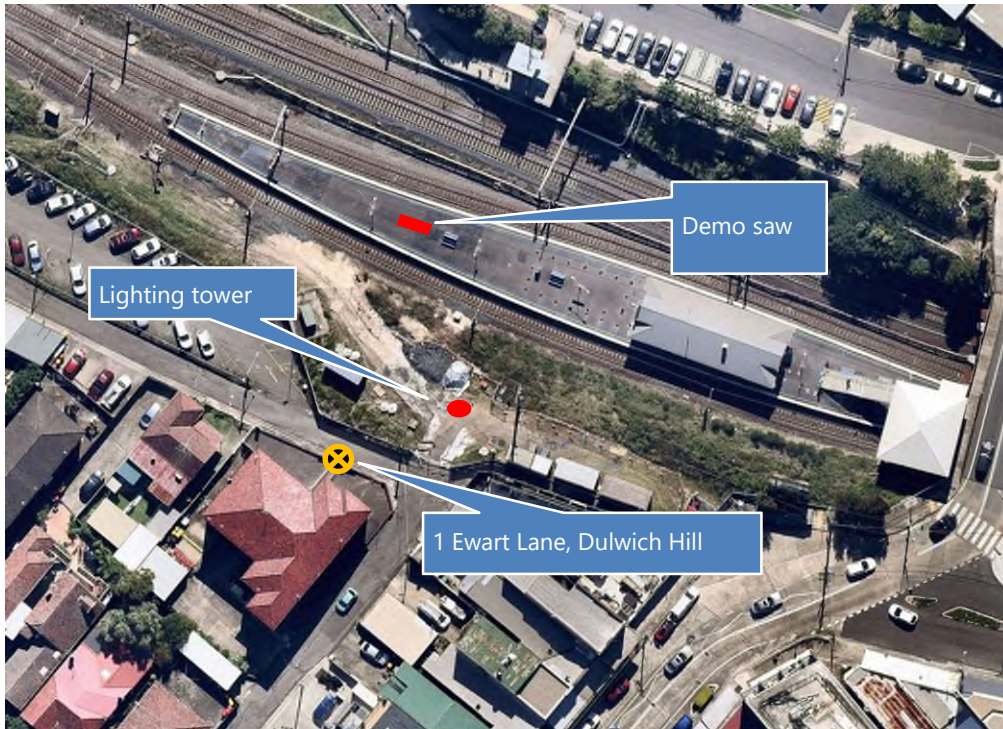
We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, 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 systems (eg facade / 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 1 Ewart Lane, Dulwich Hill



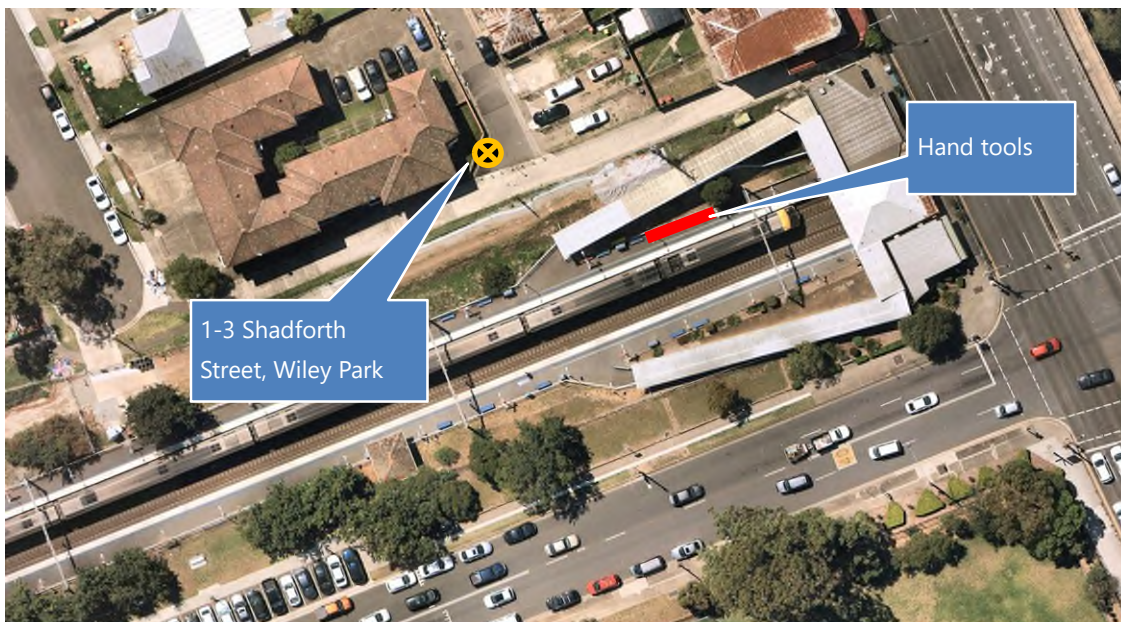
### A.2 107 Duntroon Street, Hurlstone Park



**A.3 13-15 Anglo Road, Campsie**



**A.4 1-3 Shadforth Street, Wiley Park**



### A.5 14 Arthur Street, Punchbowl



## Appendix 5 – TL927-1-07F01 WE48 NOISE AND VIBRATION MONITORING REPORT (R1)

2 June 2021

TL927-1-07F01 WE48 Noise and Vibration Monitoring Report (r1)

Downer EDI Works Pty Ltd

76 Berry Street

Nth Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - OOHW WE48 Possession Works

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct noise and vibration monitoring during the OOHW Station Upgrade WE48 Possession works for Sydney Metro Southwest. The noise monitoring was undertaken to verify predicted noise levels in the corresponding Gatewave model (Gatewave scenario ID: 1855). The vibration monitoring was undertaken to establish site specific minimum working distances for vibration intensive plants and monitor affected heritage structures. This report provides a summary of the monitoring results.

### 2 Details of monitoring

Vibration monitoring was undertaken at Hurlstone Park Station, Wiley Park Station and Punchbowl Station during the WE48 possession works between 10:00pm 28 May 2021 and 09:00pm 29<sup>th</sup> May 2021. Noise monitoring was undertaken at Dulwich Hill Station, Hurlstone Park Station, Campsie Station, Belmore Station, Wiley Park Station and Punchbowl Station during the WE48 possession works between 10:00pm 28 May 2021 and 09:00pm 29<sup>th</sup> May 2021.

#### 2.1 Measurement location

The noise measurements were conducted at the worst affected residential receiver, relative to the measured works. The vibration monitoring was conducted on the station platforms. The measurement locations are listed in Table 2-1. Figures depicting the monitoring locations are included in APPENDIX A.

**Table 2-1: Measurement locations**

Assessment Point	Date	Time	Measured plant	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
Wiley Park Station	28.05.2021	10:11pm – 10:50pm	Concrete saw (Vibration)	3 metres	N/A
	29.05.2021	01:27am – 01:41am	Handheld jackhammer (Vibration)	3, 7 metres	N/A
	29.05.2021	01:13pm – 01:20pm	90 Pound handheld jackhammer (Vibration)	1 metre	N/A
1A Shadforth Street, Wiley Park	28.05.2021	10:15pm – 10:50pm	Concrete saw, vacuum truck, lighting tower	20 metres	No
	29.05.2021	12:36am – 12:52am	Jackhammering	20 metres	No
2 Shadforth Street, Wiley Park	28.05.2021	10:54pm – 11:09pm	Concrete saw	20 metres	No
	29.05.2021	12:46pm – 01:01pm	Chainsaw, wood chipper	50 metres	No
1 Cornelia Street, Wiley Park	28.05.2021	11:13pm – 11:28pm	Crane mounted truck	7 metres	No
2A Cornelia Street, Wiley Park	28.05.2021	11:29pm – 11:45pm	Excavator with bucket, lighting tower	10 metres	No
1 Ewart Lane, Dulwich Hill	29.05.2021	02:17am – 02:32am	Excavator	10 metres	No
	29.05.2021	04:48pm – 05:03pm	Excavator with bucket, lighting tower, truck and dogs	20 metres	No
41 Uranga Parade, Punchbowl	29.05.2021	09:54am – 10:09am	5T excavator with auger attachment	100 metres	No
Punchbowl Station	29.05.2021	12:17pm – 12:25pm	5T excavator with auger attachment (Vibration)	1, 1.5, 2 metres	N/A
13-15 Anglo Road, Campsie	29.05.2021	01:43pm – 01:58pm	Excavator with bucket, generator	20 metres	Yes
Hurlstone Park Station	29.05.2021	02:40pm – 04:42pm	2.5T Excavator with hammer attachment (Vibration), 10T excavator with hammer attachment (Vibration)	1, 3, 4, 5 metres	N/A
103 Duntroon Street, Hurlstone Park	29.05.2021	03:49pm – 04:04pm	Excavator with hammer attachment	20 metres	No
1 Accacia Street, Belmore	29.05.2021	05:46pm – 06:01pm	Vacuum truck	50 metres	No
2 Hopetoun Street, Hurlstone Park	29.05.2021	07:07pm – 07:22pm	Excavator with hammer attachment, moxy trucks, boring and trenching activities, lighting tower	40 metres	No



## 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)	NTi	XL2	A2A-02386-D2	08 July 2019
Type 1 Sound Level Meter Calibrator	B&K	Type 4231	2677710	03 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
Type 1 Signal Analyser	Soundbook-2
Accelerometer	Endevco 61C3

## 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**

Assessment Point	Date and Start Time	Environmental Conditions
1A Shadforth Street, Wiley Park	28.05.2021 10:15pm	Clear sky; air temperature 13°C, wind speed <5 m/s; relative humidity 64%.
2 Shadforth Street, Wiley Park	28.05.2021 10:54pm	Clear sky; air temperature 12°C, wind speed <5 m/s; relative humidity 62%.
	29.05.2021 12:46pm	Clear sky; air temperature 15°C, wind speed <5 m/s; relative humidity 50%.
1 Cornelia Street, Wiley Park	28.05.2021 11:13pm	Clear sky; air temperature 11°C, wind speed <5 m/s; relative humidity 56%.
2A Cornelia Street, Wiley Park	28.05.2021 11:29pm	Clear sky; air temperature 10°C, wind speed <5 m/s; relative humidity 58%.
1 Ewart Lane, Dulwich Hill	29.05.2021 02:17am	Clear sky; air temperature 12°C, wind speed <5 m/s; relative humidity 56%.
	29.05.2021 04:48pm	Clear sky; air temperature 14°C, wind speed <5 m/s; relative humidity 50%.
41 Uranga Parade, Punchbowl	29.05.2021 09:54am	Clear sky; air temperature 12°C, wind speed <5 m/s; relative humidity 50%.
13-15 Anglo Road, Campsie	29.05.2021 01:43pm	Clear sky; air temperature 15°C, wind speed <5 m/s; relative humidity 50%.

Assessment Point	Date and Start Time	Environmental Conditions
103 Duntroon Street, Hurlstone Park	29.05.2021 03:49pm	Clear sky; air temperature 14°C, wind speed <5 m/s; relative humidity 50%.
1 Accacia Street, Belmore	29.05.2021 05:46pm	Clear sky; air temperature 14°C, wind speed <5 m/s; relative humidity 50%.
2 Hopetoun Street, Hurlstone Park	29.05.2021 07:07pm	Clear sky; air temperature 13°C, wind speed <5 m/s; relative humidity 40%.

### 3 Noise Monitoring results

The results of the noise monitoring are presented in Table 3-1 below.

**Table 3-1: Measured noise levels  $L_{Aeq(15min)}$**

Assessment Point	Measured plant	Predicted noise level dB(A)	Measured noise level dB(A)		Above predicted noise level?	Comments
			$L_{Aeq(15min)}$	$L_{Amax}$		
1A Shadforth Street, Wiley Park	Concrete saw (south platform), vacuum truck, lighting tower	73 <sup>N</sup>	71	83	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
	Concrete (north platform), vacuum truck, lighting tower	73 <sup>N</sup>	67	72	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
	Jackhammering	73 <sup>N</sup>	66	83	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
2 Shadforth Street, Wiley Park	Concrete saw	80 <sup>N</sup>	63	78	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. During this measurement, the station platform building was in between the measured plant and the receiver. As a result, the measured noise level is significantly lower than the predicted noise level.
	Chainsaw, wood chipper	82 <sup>D</sup>	70	80	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
1 Cornelia Street, Wiley Park	Crane mounted truck	78 <sup>N</sup>	72	100	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. The measured $L_{Amax}$ of 100 dB(A) was caused by dropping chocks.
2A Cornelia Street, Wiley Park	Crane mounted truck	69 <sup>N</sup>	60	74	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
1 Ewart Lane, Dulwich Hill	Excavator	77 <sup>N</sup>	65	80	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
	Excavator with bucket, lighting tower, truck and dogs	78 <sup>D</sup>	67	82	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.

Assessment Point	Measured plant	Predicted noise level dB(A)	Measured noise level dB(A)		Above predicted noise level?	Comments
			L <sub>Aeq</sub> (15min)	L <sub>Amax</sub>		
41 Uranga Parade, Punchbowl	5T Excavator with auger attachment	68 <sup>D</sup>	63	77	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
13-15 Anglo Road, Campsie	Excavator with bucket, generator	79 <sup>D</sup>	60	62	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level. During this measurement, only the generator was audible at the closest residential receiver. Furthermore, noise barriers were installed around the generator. As a result, the measured noise level is significantly lower than the predicted noise level.
103 Duntroon Street, Hurlstone Park	Excavator with hammer attachment	93 <sup>D</sup>	66	74	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level. The predicted noise level was calculated for the most affected facade. Note that there was no access to the most affected facade. The property building provided shielding from the measured plant. As a result, the measured noise level is significantly lower than the predicted noise level.
1 Acacia Street, Belmore	Vacuum truck	71 <sup>D</sup>	71	78	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is consistent with the predicted noise level.
2 Hopetoun Street, Hurlstone Park	Excavator with hammer, lighting tower, moxy trucks, boring and trenching activities	69 <sup>E</sup>	57	62	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level. Note that the boring and trenching activities were not audible at this monitoring location.

Note: D – The corresponding predicted noise level for the worst-case scenario during day period

E – The corresponding predicted noise level for the worst-case scenario during evening period

N – The corresponding predicted noise level for the worst-case scenario during night period

It can be seen from Table 3-1 that, the measured L<sub>Aeq, 15min</sub> noise levels were consistent with and below the predicted noise levels. The mitigation and management measures implemented were therefore considered suitable for the measured activities.

## 4 Vibration Monitoring results

The established vibration criteria for cosmetic damage in the Construction Noise & Vibration – OOHWA Assessment Stage 2 Possession Works (CNV-OOHWA)<sup>1</sup> is as follows:

<sup>1</sup> TL927-1-02F01 CNV\_OOHWA WE42 Possession April 2021 (r4), dated: 06 April 2021

- 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 present in below.

**Table 4-1: Measured vibration levels**

Plant	Distance from source	95 <sup>th</sup> percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
Concrete saw	3m, measured at the affected heritage structure	<0.5	<0.5	The vibration monitor was mounted on the North platform building. During the concrete sawing activity, the vibration signals from the concrete saw could not be detected. As a result, the concrete saw was allowed to be operated.
Handheld jackhammer	3m	0.95	1.05	At 3 metres and at 7 metres away, the handheld jackhammer produced vibration levels that are below the established vibration criteria.
	7m	0.13	0.26	
5T excavator with auger attachment	1m	0.35	1.15	The 5T excavator with auger attachment produced vibration levels that are below the established vibration criteria at 2 m, 1.5 m and 1 m away. Since the bored piling works are greater than 1 metre away from the platform building, the 5T excavator with auger attachment was allowed to be operated.
	1.5m	0.29	0.96	
	2m	0.26	0.81	
90 pound handheld jackhammer	1m, Measured at the affected heritage structure	0.97	1.12	The vibration monitor was mounted on the North platform building. During the jackhammering activity, the 90 pound handheld jackhammer produced vibration levels that are below the established vibration criteria. As a result, the 90 pound handheld jackhammer was allowed to be operated.
10T excavator with hammer attachment	2m	3.69	6.06	At 2 metres away, the 10T excavator with hammer attachment produced a 95 <sup>th</sup> percentile PPV value of 3.69 mm/s. As a result, the 10T excavator with hammer attachment shall not be used within 2 metres of heritage structures.
	3m	1.55	2.40	At 4 metres and 3 metres away, the 10T excavator with hammer attachment produced vibration levels that are below the established vibration criteria. As a result, the 10T excavator with hammer attachment can be operated with a minimum working distance of 3 metres for heritage structures.
	4m	0.90	1.20	
2.5T excavator with hammer attachment	2m, Measured at the affected heritage structure	1.39	1.82	The vibration monitor was mounted on the South platform building. During the rockhammering activity, the 2.5T excavator with hammer attachment produced vibration levels that are below the established vibration criteria. As a result, the 2.5T excavator with hammer attachment was allowed to be operated.

It can be seen from Table 4-1 that the measured vibration intensive plant listed above met the established vibration criteria. Site specific minimum working distances to reduce the likelihood of exceedance of the vibration criterion for heritage structures .

## 5 Conclusion

Renzo Tonin & Associates completed noise and vibration monitoring for the WE48 possession works. The results of the noise measurements were consistent with and below the predicted  $L_{Aeq\ 15minutes}$  levels presented in the Gatewave model prepared for the works. The results of the vibration measurements were consistent with the established vibration criteria presented in the CNV-OOWA prepared for the works.

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
02.06.2021	First Issue	0	1	R. Zhafranata	T. Gowen	T. Gowen

File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\07 May WE48 possession\TL927-1-07F01 WE48 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.

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.

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.

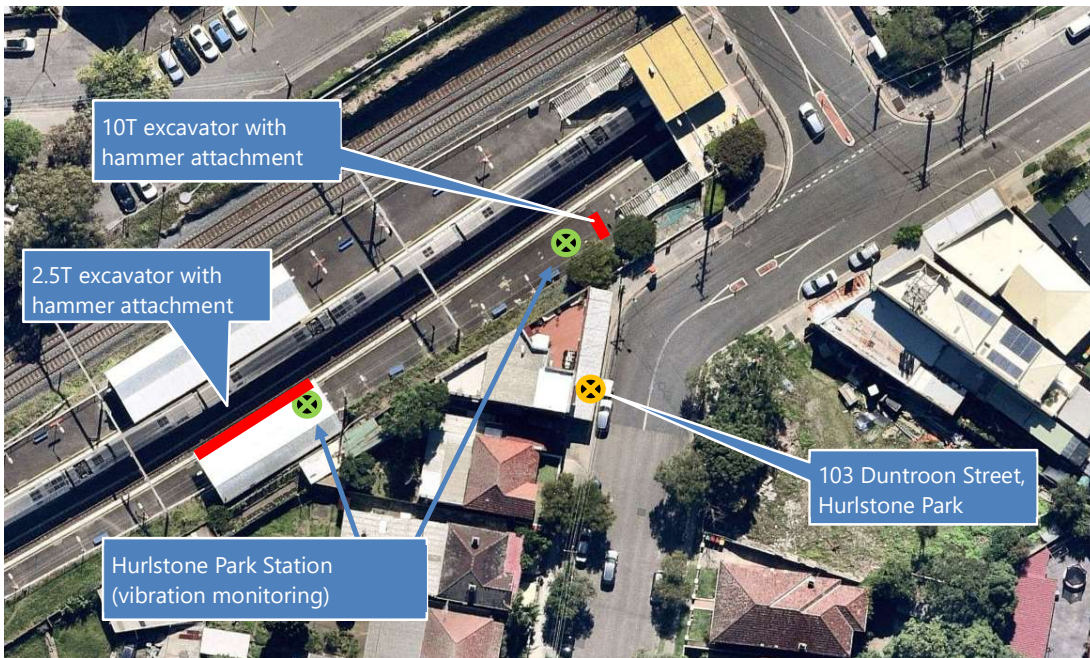
External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions 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 1 Ewart Lane, Dulwich Hill



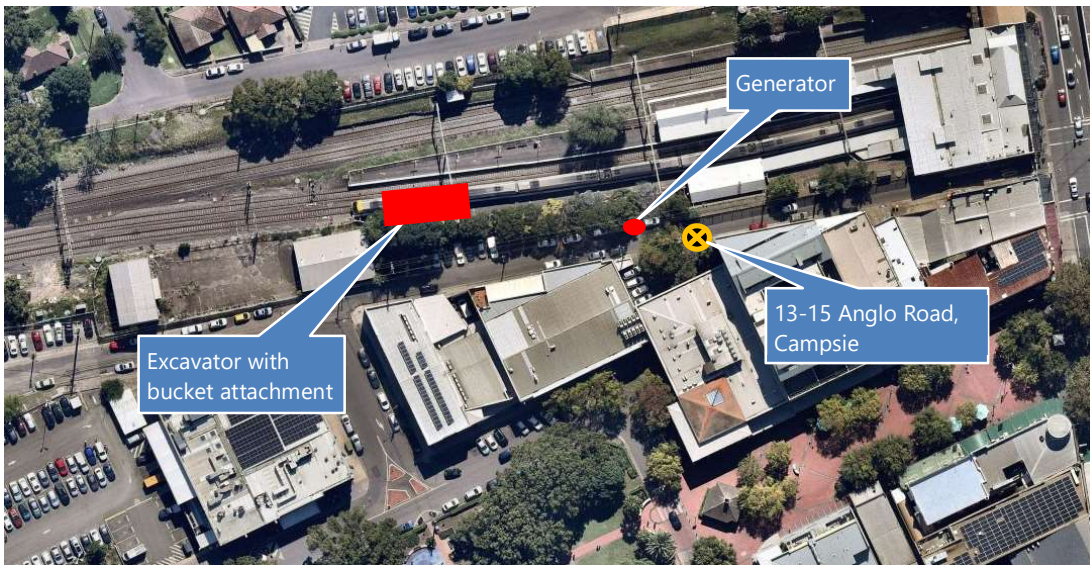
### A.2 103 Duntroon Street, Hurlstone Park



### A.3 2 Hopetoun Street, Hurlstone Park

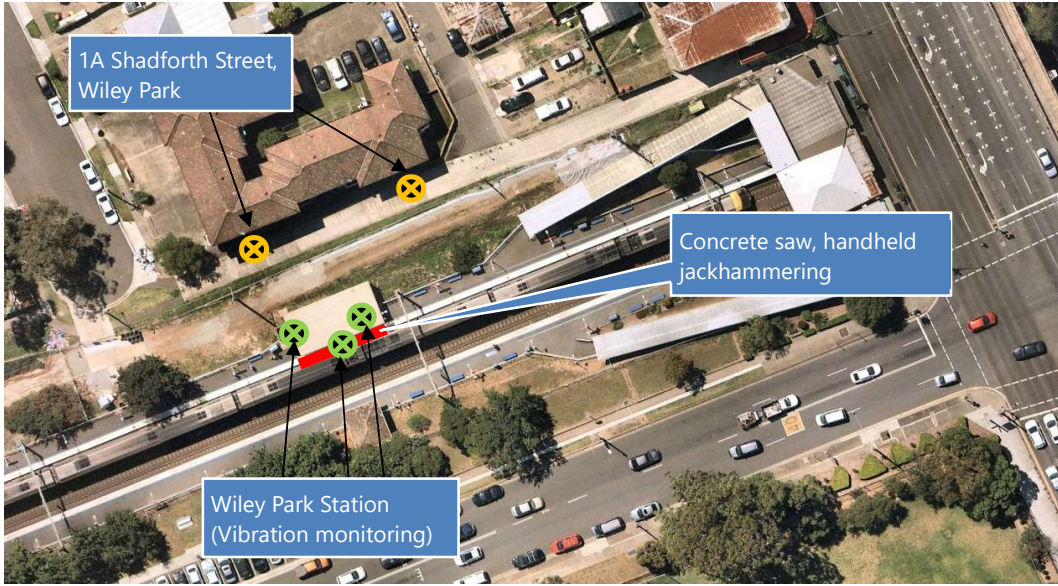


### A.4 13-15 Anglo Road, Campsie





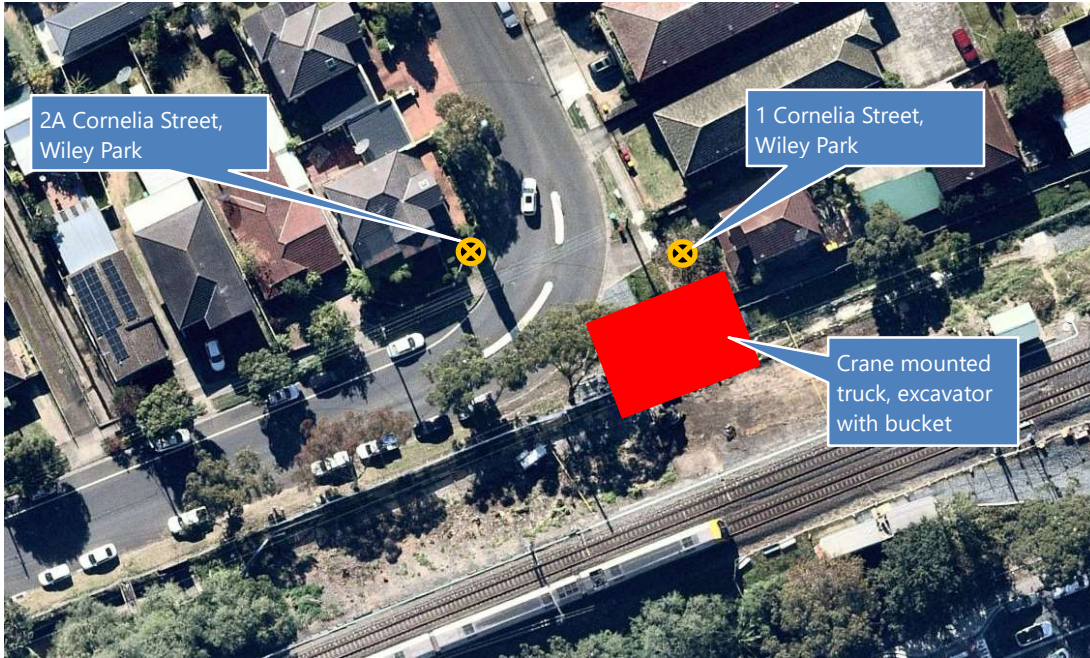
**A.5 1A Shadforth Street, Wiley Park**



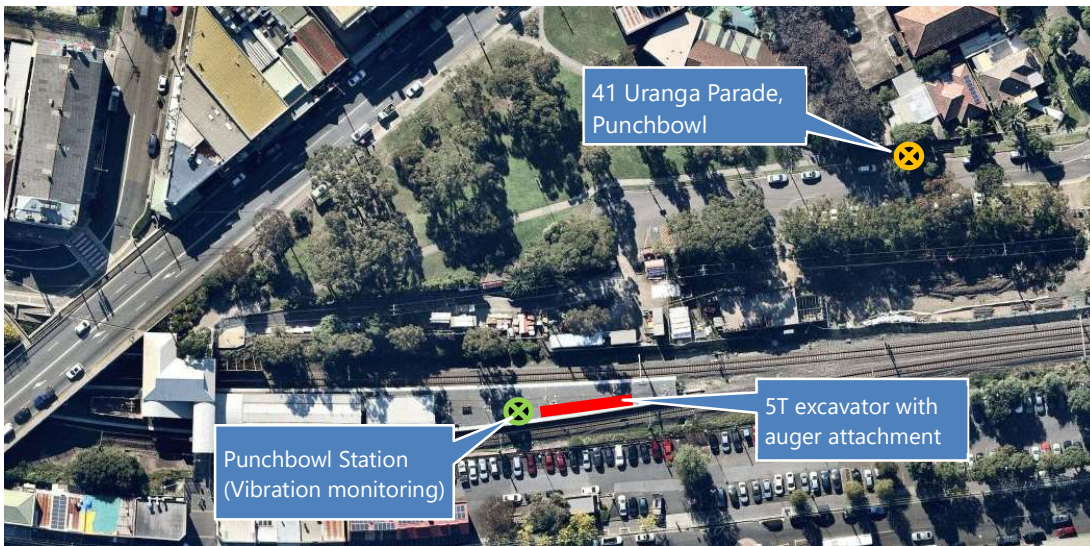
**A.6 2 Shadforth Street, Wiley Park**



**A.7 1 Cornelia Street, Wiley Park**



**A.8 41 Uranga Parade, Punchbowl**



### A.9 1 Accacia Street, Belmore



## Appendix 6 – TL927-1-08F01 WE49 NOISE AND VIBRATION MONITORING REPORT (R2)

4 February 2022

TL927-1-08F01 WE49 Noise and Vibration Monitoring Report (r2)

Downer EDI Works Pty Ltd

76 Berry Street

Nth Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - OOHW WE49 Possession Works

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct noise and vibration monitoring during the OOHW Station Upgrade WE49 Possession works for Sydney Metro Southwest. The noise monitoring was undertaken to verify predicted noise levels in the corresponding Gatewave model (Gatewave scenario ID: 1862). The vibration monitoring was undertaken to monitor potentially affected heritage structures. This report provides a summary of the monitoring results.

### 2 Details of monitoring

Noise monitoring was undertaken at Dulwich Hill Station, Hurlstone Park Station, Campsie Station, Belmore Station, Wiley Park Station and Punchbowl Station during the WE49 possession works between 08:00am and 03:00pm 5<sup>th</sup> June 2021. Vibration monitoring was undertaken at Belmore Station during the WE49 possession works between 03:00pm and 03:30pm 5<sup>th</sup> June 2021.

#### 2.1 Measurement location

The noise measurements were conducted at the worst affected residential receiver, relative to the measured works. The vibration monitoring was conducted 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**

Assessment Point	Date	Time	Measured plant	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
7 Bedford Crescent, Dulwich Hill	05.06.2021	08:34am – 08:49am	Flatbed truck, excavator, generator	55	Yes
3A Commons Street, Hurlstone Park	05.06.2021	09:24am – 09:39am	Generator, excavator, hi-rail loading vehicles	8	No
12 Railway Street, Hurlstone Park	05.06.2021	09:50am – 10:05am	Telescopic crane, flatbed truck and van	50	No
5-9 London Street, Campsie	05.06.2021	10:40am – 11:00am	Chainsaw, concrete truck	60	No
1A Shadforth Street, Wiley Park	05.06.2021	12:09pm – 12:24pm	Excavator with hammer attachment	25	No
41 Uranga Parade, Punchbowl	05.06.2021	01:13pm- 01:28pm	Hiab truck, excavator	45	No
1 Acacia Street, Belmore	05.06.2021	02:36pm – 02:51pm	Vacuum truck, excavator with bucket and auger attachment	40	No
Belmore Station	05.06.2021	03:09pm – 03:25pm	XD9-1 excavator with auger attachment (vibration)	4	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)	NTi	XL2	A2A-02386-D2	08 July 2019
Type 1 Sound Level Meter Calibrator	B&K	Type 4231	2677710	03 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
Type 1 Signal Analyser	Soundbook-2
Accelerometer	Endevco 61C3

## 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**

Assessment Point	Date and Start Time	Environmental Conditions
7 Bedford Crescent, Dulwich Hill	05.06.2021 08:34am	Clear sky; air temperature 11°C, wind speed <5 m/s; relative humidity 53%.
3A Commons Street, Hurlstone Park	05.06.2021 09:24am	Clear sky; air temperature 13°C, wind speed <5 m/s; relative humidity 53%.
12 Railway Street, Hurlstone Park	05.06.2021 09:50am	Clear sky; air temperature 14°C, wind speed <5 m/s; relative humidity 60%.
5-9 London Street, Campsie	05.06.2021 10:40am	Clear sky; air temperature 16°C, wind speed <5 m/s; relative humidity 57%.
1A Shadforth Street, Wiley Park	05.06.2021 12:09pm	Clear sky; air temperature 18°C, wind speed <5 m/s; relative humidity 63%.
41 Uranga Parade, Punchbowl	05.06.2021 01:13pm	Clear sky; air temperature 18°C, wind speed <5 m/s; relative humidity 49%.
1 Acacia Street, Belmore	05.06.2021 02:36pm	Clear sky; air temperature 20°C, wind speed <5 m/s; relative humidity 63%.

## 3 Noise Monitoring results

The results of the noise monitoring are presented in Table 3-1 below.

**Table 3-1: Measured noise levels  $L_{Aeq}(15min)$**

Assessment Point	Measured plant	Predicted noise level dB(A)	Measured noise level dB(A)		Above predicted noise level?	Comments
			$L_{Aeq}(15min)$	$L_{Amax}$		
7 Bedford crescent, Dulwich Hill	Flatbed truck, excavator, generator	67 <sup>D</sup>	54	66	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. The hoardings on the station platform provided partial shielding for this monitoring location.
3A Commons Street, Hurlstone Park	Generator, excavator, hi-rail loading vehicles	73 <sup>D</sup>	69	77	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
12 Railway Street, Hurlstone Park	Telescopic crane, flatbed truck and van	72 <sup>D</sup>	59	90	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. Explain about the distance of the measured plant
5-9 London Street, Campsie	Chainsaw	74 <sup>D</sup>	61	80	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
1A Shadforth Street, Wiley Park	excavator with hammer attachment	80 <sup>D</sup>	66	87	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.

Assessment Point	Measured plant	Predicted noise level dB(A)	Measured noise level dB(A)		Above predicted noise level?	Comments
			L <sub>Aeq</sub> (15min)	L <sub>Amax</sub>		
41 Uranga Parade, Punchbowl	Hiab truck, excavator	68 <sup>D</sup>	53	79	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level. Occasional distant noise impacts from the excavator was audible at this monitoring location.
1 Acacia Street, Belmore	Vacuum truck, excavator with bucket and auger attachment	68 <sup>D</sup>	57	80	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.

Note: D – The corresponding predicted noise level for the worst-case scenario during day period

It can be seen from Table 3-1 that, the measured L<sub>Aeq, 15min</sub> noise levels were below the predicted noise levels. The mitigation and management measures implemented were therefore considered suitable for the measured activities.

## 4 Vibration Monitoring results

The established vibration criteria for cosmetic damage in the Construction Noise & Vibration – OOHWA Assessment Stage 2 Possession Works (CNV-OOHWA)<sup>1</sup> 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 present in below.

**Table 4-1: Measured vibration levels**

Plant	Distance from source	95 <sup>th</sup> percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
XD9-1 excavator (piling works)	4m, measured at the affected heritage structure	0.12	0.29	The vibration monitor was mounted on the external platform building. During the piling activity, the vibration signals from the XD9-1 excavator produced vibration levels that are below the established vibration criteria. As a result, the XD9-1 excavator was allowed to be operated.

It can be seen from Table 4-1 that the XD9-1 excavator met the established vibration criteria. As a result, the XD9-1 excavator was allowed to be operated during the piling works.

<sup>1</sup> TL927-1-02F01 CNV\_OOHWA WE42 Possession April 2021 (r4), dated: 06 April 2021



## 5 Conclusion

Renzo Tonin & Associates completed noise and vibration monitoring for the WE49 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 vibration measurements were consistent with the established vibration criteria presented in the CNV-OOWA prepared for the works.

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
02.06.2021	First Issue	0	1	R. Zhafranata	T. Gowen	T. Gowen
04.02.2022	Report revised to rectify measurement month on page 1	-	2	R. Zhafranata	T. Gowen	T. Gowen

File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\08 June WE49 possession\TL927-1-08F01 WE49 Noise and Vibration Monitoring Report (r2).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.

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 systems (eg facade / 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 7 Bedford Crescent, Dulwich Hill



### A.2 3A Commons Street, Hurlstone Park



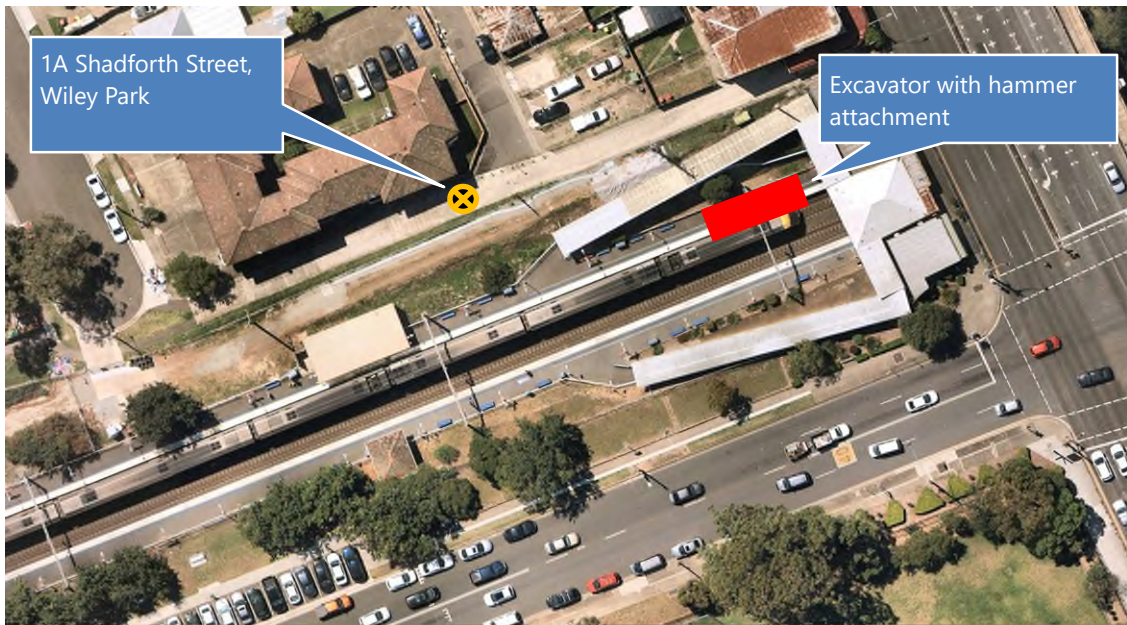
### A.3 12 Railway Street, Hurlstone Park



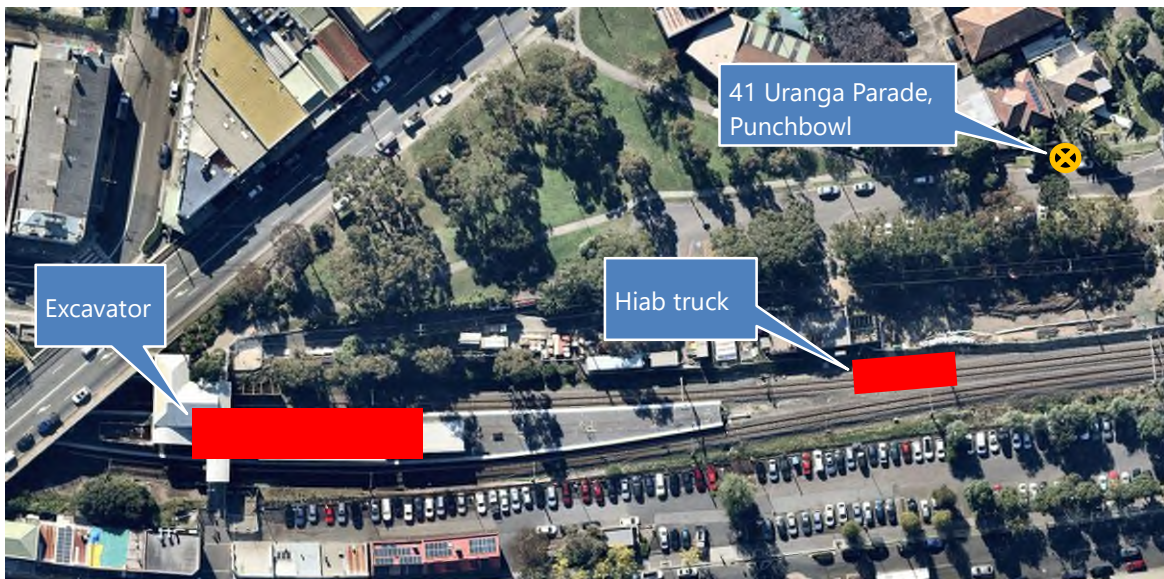
### A.4 5-9 London Street, Campsie



**A.5 1A Shadforth Street, Wiley Park**



**A.6 41 Uranga Parade, Punchbowl**



### A.7 1 Acacia Street, Belmore



## Appendix 7 – TL927-1-09F01 WE52 WK1 NOISE AND VIBRATION MONITORING REPORT (R3)

7 July 2021

TL927-1-09F01 WK52-WK1 Noise and Vibration Monitoring Report (r3)

Downer EDI Works Pty Ltd

76 Berry Street

Nth Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - WK52-WK1 Possession Works

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct noise and vibration monitoring during the Station Upgrade WK52-WK1 Possession works for Sydney Metro Southwest. The noise monitoring was undertaken to verify predicted noise levels in the corresponding Gatewave model (Gatewave scenario ID: 2139 for typical activities and Gatewave scenario ID: 2212 for high impact 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 Dulwich Hill Station, Hurlstone Park Station, Campsie Station, Belmore Station, Wiley Park Station and Punchbowl Station during the WK52-WK1 possession works between 08:00am 28<sup>th</sup> June 2021 and 06:00pm 1<sup>st</sup> July 2021. Vibration monitoring was undertaken at Dulwich Hill Station, Hurlstone Park Station, Belmore Station, Wiley Park Station and Punchbowl Station during the WK52-WK1 possession works between 08:00am 28<sup>th</sup> June 2021 and 06:00pm 1<sup>st</sup> July 2021.

#### 2.1 Measurement location

The noise measurements were conducted at the worst affected residential receiver, relative to the measured works. The vibration monitoring was conducted on the station platform and worksite. The measurement locations are listed in Table 2-1. Figures depicting the monitoring locations are included in APPENDIX A.



**Table 2-1: Measurement locations**

Assessment Point	Date	Time	Measured plant	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
2 Shadforth Street, Wiley Park	28.06.2021	08:43am – 09:00am	Excavators with bucket attachment, handheld grinder, truck deliveries	15m	No
Wiley Park Station	28.06.2021	09:30am – 11:50am	14T excavator with bucket attachment	3m	N/A
Belmore Station	28.06.2021	02:00pm – 02:40pm	3.5T excavator with rockhammer attachment	10m	N/A
30 Redman Parade, Belmore	28.06.2021	02:07pm – 02:32pm	3.5T excavator with rockhammer attachment, excavators with bucket attachment	50m	No
103/105 Duntroon Street, Hurlstone Park	28.06.2021	03:07pm – 03:29pm	Excavators with bucket attachment, Moxy trucks	20m	No
	29.06.2021	10:50pm – 11:09pm	Excavator with rockhammer attachment, excavator with bucket attachment, generator	20m	No
Dulwich Hill Station	28.06.2021	04:15pm – 05:50pm	6T excavator with rockdrill attachment	15m	N/A
1 Ewart Lane, Dulwich Hill	28.06.2021	04:21pm – 04:40pm	Generator, truck deliveries, excavator with rockdrill attachment	30m	No
71 Ewart Street, Dulwich Hill	28.06.2021	04:44pm – 05:00pm	Excavator with rockdrill attachment	120m	No
5 Bedford Crescent, Dulwich Hill	28.06.2021	05:16pm – 05:35pm	Excavator with rockdrill attachment and generator	60m	No
199 Beamish Street, Campsie	29.06.2021	09:30am – 10:01am	Two 5T excavators with bucket and gripper attachment, truck deliveries (construction bin)	15m	No
		10:02am – 10:27am	Two 5T excavators with gripper attachment	15m	No
8 -10 Shadforth Street, Wiley Park	29.06.2021	12:19pm – 12:37pm	15T excavator with bucket attachment and Moxy truck	75m	No
115 Duntroon Street, Hurlstone Park	29.06.2021	11:11pm – 11:26pm	Excavator with rockhammer attachment	60m	No
5 Commons Street, Hurlstone Park	29.06.2021	11:31pm – 12:00am	Excavator with bucket attachment, Moxy trucks, lighting tower, concrete agitator	50m	No
41 Urunga Parade, Punchbowl	30.06.2021	09:45am – 10:01am	Excavator with bucket attachment, stockpile management, Moxy truck	40m	No
Punchbowl Station	30.06.2021	10:25am – 11:00am	Handheld electric jackhammer	2m	N/A
50 Floss Street, Hurlstone Park	30.06.2021	12:18pm – 12:37pm	Two excavators with rockhammer attachment, concrete saw	20m	No
107 Duntroon Street, Hurlstone Park	30.06.2021	12:48pm – 01:18pm	Concrete saw, excavator with rockhammer attachment, generator, electric rotary cutter	35m	No

Assessment Point	Date	Time	Measured plant	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
Hurlstone Park Station	01.07.2021	08:50am – 09:00am	3T roller on static mode	10m	N/A
	01.07.2021	12:15pm – 12:25pm	8T roller on static mode	5m	N/A
	01.07.2021	04:00pm – 05:15pm	35T pilling rig with auger	20m	N/A
5 Railway Street, Hurlstone Park	01.07.2021	12:30pm – 12:46pm	15T excavator with bucket attachment, truck delivery, fuel truck, 8T roller	25m	No
	01.07.2021	04:50pm – 05:05pm	35T pilling rig with auger, concrete truck	25m	No
7 Commons Street, Hurlstone Park	01.07.2021	02:47pm – 03:05pm	5T excavator with bucket attachment, concrete truck, jackhammer	50m	No

## 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 Brüel & Kjær 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)	NTi	XL2	A2A-02386-D2	08 July 2019
Type 1 Sound Level Meter Calibrator	B&K	Type 4231	2677710	03 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 C22 (SN: 102478)
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 two noise measurements. As a result, the two noise

measurements were deemed as invalid. For the remaining measurements, the environmental conditions did not have an adverse effect on the measured noise and vibration levels.

**Table 2-4: Environmental conditions**

Assessment Point	Date and Start Time	Environmental Conditions
2 Shadforth Street, Wiley Park	28.06.2021 08:43am	Overcast; air temperature 11°C, wind speed <5 m/s; relative humidity 69%.
30 Redman Parade, Belmore	28.06.2021 02:07pm	Overcast; air temperature 18°C, wind speed <5 m/s; relative humidity 70%.
103/105 Duntroon Street, Hurlstone Park	28.06.2021 03:07pm	Overcast; air temperature 18°C, wind speed <5 m/s; relative humidity 68%.
	29.06.2021 10:50pm	Overcast; air temperature 16°C, wind speed <5 m/s; relative humidity 71%.
1 Ewart Lane, Dulwich Hill	28.06.2021 04:21pm	Overcast; air temperature 17°C, wind speed <5 m/s; relative humidity 61%.
71 Ewart Street, Dulwich Hill	28.06.2021 04:44pm	Overcast; air temperature 17°C, wind speed <5 m/s; relative humidity 61%.
5 Bedford Crescent, Dulwich Hill	28.06.2021 05:16pm	Overcast; air temperature 16°C, wind speed <5 m/s; relative humidity 66%.
199 Beamish Street, Campsie	29.06.2021 09:30am	Raining. As a result, this measurement is invalid.
	29.06.2021 10:02am	Raining. As a result, this measurement is invalid.
8 -10 Shadforth Street, Wiley Park	29.06.2021 12:19pm	Overcast; air temperature 10°C, wind speed <5 m/s; relative humidity 90%.
115 Duntroon Street, Hurlstone Park	29.06.2021 11:11pm	Overcast; air temperature 16°C, wind speed <5 m/s; relative humidity 76%.
5 Commons Street, Hurlstone Park	29.06.2021 11:31pm	Overcast; air temperature 16°C, wind speed <5 m/s; relative humidity 76%.
41 Urunga Parade, Punchbowl	30.06.2021 09:45am	Overcast; air temperature 15°C, wind speed <5 m/s; relative humidity 40%.
50 Floss Street, Hurlstone Park	30.06.2021 12:18pm	Overcast; air temperature 15°C, wind speed <5 m/s; relative humidity 40%.
107 Duntroon Street, Hurlstone Park	30.06.2021 12:48pm	Overcast; air temperature 14°C, wind speed <5 m/s; relative humidity 40%.
5 Railway Street, Hurlstone Park	01.07.2021 12:30pm	Overcast; air temperature 14°C, wind speed <5 m/s; relative humidity 40%.
	01.07.2021 04:50pm	Overcast; air temperature 13°C, wind speed <5 m/s; relative humidity 45%.
7 Commons Street, Hurlstone Park	01.07.2021 02:47pm	Overcast; air temperature 13°C, wind speed <5 m/s; relative humidity 65%.

### 3 Noise Monitoring results

The results of the noise monitoring are presented in Table 3-1 below.

**Table 3-1: Measured noise levels  $L_{Aeq(15min)}$** 

Assessment Point	Measured plant	Predicted noise level dB(A)	Measured noise level dB(A)		Above predicted noise level?	Comments
			$L_{Aeq(15min)}$	$L_{Amax}$		
2 Shadforth Street, Wiley Park	Excavators with bucket attachment, handheld grinder, truck deliveries	81 <sup>T</sup>	64	84	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
30 Redman Parade, Belmore	3.5T excavator with rockhammer attachment, excavators with bucket attachment	65 <sup>H</sup>	63*	76	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
103/105 Duntroon Street, Hurlstone Park	Excavators with bucket attachment, Moxy trucks	82 <sup>T</sup>	65	85	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
	Excavator with rockhammer attachment, excavator with bucket attachment, generator	84 <sup>H</sup>	66*	76	No ( $L_{Aeq, 15min}$ )	Note that there was no access to the most affected facade. The property building provided shielding between the rockhammering activity and the measurement location. As a result, the measured $L_{Aeq, 15min}$ noise level is significantly lower than the predicted noise level.
1 Ewart Lane, Dulwich Hill	Generator, truck deliveries, excavator with rockdrill attachment	74 <sup>H</sup>	73*	86	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
71 Ewart Street, Dulwich Hill	Excavator with rockdrill attachment	84 <sup>H</sup>	64*	75	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. During this measurement, only the rockdrilling activity is audible from the works. There were no concurrent works in the work area directly across from the monitoring location. As a result, the measured noise level is significantly lower than the predicted noise level.
5 Bedford Crescent, Dulwich Hill	Excavator with rockdrill attachment and generator	74 <sup>H</sup>	69*	78	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
199 Beamish Street, Campsie	Two 5T excavators with bucket and gripper attachment, truck deliveries (construction bin)	70 <sup>T</sup>	75	92	Not applicable	These measurements were deemed invalid as the environmental conditions caused adverse effect on the measured noise levels.
	Two 5T excavators with gripper attachment	70 <sup>T</sup>	75	91	Not applicable	
8 -10 Shadforth Street, Wiley Park	15T excavator with bucket attachment and Moxy truck	64 <sup>T</sup>	55	73	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
115 Duntroon Street, Hurlstone Park	Excavator with rockhammer attachment	67 <sup>H</sup>	63*	83	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
5 Commons Street, Hurlstone Park	Excavator with bucket attachment, Moxy trucks, lighting tower, concrete agitator	68 <sup>T</sup>	54	75	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.

Assessment Point	Measured plant	Predicted noise level dB(A)	Measured noise level dB(A)		Above predicted noise level?	Comments
			L <sub>Aeq</sub> (15min)	L <sub>Amax</sub>		
41 Urunga Parade, Punchbowl	Excavator with bucket attachment, stockpile management, Moxy truck	73 <sup>T</sup>	58	72	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
50 Floss Street, Hurlstone Park	Two excavators with rockhammer attachment, concrete saw	73 <sup>H</sup>	68*	74	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
107 Duntroon Street, Hurlstone Park	Concrete saw, excavator with rockhammer attachment, generator, electric rotary cutter	79 <sup>H</sup>	66*	87	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
5 Railway Street, Hurlstone Park	15T Excavator with bucket attachment, truck delivery, fuel truck, 8T roller	83 <sup>T</sup>	63	82	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
	35T Pilling rig with auger, concrete truck	83 <sup>T</sup>	65	72	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
7 Commons Street, Hurlstone Park	5T Excavator with bucket attachment, concrete truck, jackhammer	75 <sup>T</sup>	59	74	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level. Jackhammering was not the dominant noise source, as it was just audible at this monitoring location. As a result, the measured noise level is compared to the predicted noise level for a typical activity.

Note: T: Predicted L<sub>Aeq, 15min</sub> for typical activities (Gatewave ID: 2139)

H: Predicted L<sub>Aeq, 15min</sub> for high impact activities (Gatewave ID: 2212)

\*: Including 5 dB penalty for high impact activities

It can be seen from Table 3-1 that, the measured L<sub>Aeq, 15min</sub> noise levels were below the predicted noise levels. The mitigation and management measures implemented were therefore considered suitable for the measured activities.

## 4 Vibration Monitoring results

The established vibration criteria for cosmetic damage in the Construction Noise & Vibration – OOHWA Assessment Stage 2 Possession Works (CNV-OOHWA)<sup>1</sup> 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 present in below.

<sup>1</sup> TL927-1-02F01 CNV\_OOHWA WE42 Possession April 2021 (r4), dated: 06 April 2021

Table 4-1: Measured vibration levels

Assessment point	Plant	Distance from source	95th percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
Wiley Park Station (refer to figure A.1)	14T excavator with bucket attachment	3m, measured at the affected heritage structure	0.55	1.00	The vibration monitor was mounted on the platform building. During the excavating activity, the vibration signals from the 14T excavator with bucket attachment produced vibration levels that are below the established vibration criteria. As a result, the 14T excavator with bucket attachment was allowed to be operated.
Belmore Station (refer to figure A.2)	3.5T excavator with rockhammer attachment	10m, measured at the affected heritage structure	0.25	0.45	The vibration monitor was mounted on the platform building. During the rockhammering activity, the vibration signals from the 3.5T excavator with rockhammer attachment produced vibration levels that are below the established vibration criteria. As a result, the 3.5T excavator with rockhammer attachment was allowed to be operated.
Dulwich Hill Station (refer to figure A.4)	6T excavator with rockdrill attachment	15m, measured at the affected heritage structure	< 0.5	1.15	The vibration monitor was mounted on the platform building. During the rockdrilling activity, the vibration signals from the 6T excavator with rockdrill attachment produced vibration levels that are below the established vibration criteria. As a result, the 6T excavator with rockdrill attachment was allowed to be operated.
Punchbowl Station (refer to figure A.10)	Handheld electric jackhammer	1m	0.90	1.65	The vibration monitor was mounted on the platform building. It was understood that the affected wall of the platform building is not heritage. As a result, the screening criterion for unreinforced structures (7.5 mm/s) was used for this measurement. During the jackhammering activity, the vibration signals from the handheld electric jackhammer produced vibration levels that are below the established screening criterion for unreinforced structures (7.5 mm/s). As a result, the handheld electric jackhammer was allowed to be operated.
Hurlstone Park Station (refer to figure A.13)	3T roller – static mode	10m, measured at the closest residential structure	< 0.5	< 0.5	During the rolling activity, the vibration signals from the 3T roller on static mode produced vibration levels that are below the established screening criterion for unreinforced structures (7.5 mm/s). As a result, the 3T roller on static mode was allowed to be operated.
Hurlstone Park Station (refer to figure A.13)	8T roller – static mode	5m	0.90	1.50	During the rolling activity, the vibration signals from the 8T roller on static mode produced vibration levels that are below the established screening criterion for unreinforced structures (7.5 mm/s). As a result, the 8T roller on static mode can be operated at a minimum distance of 5 metres from unreinforced structures.
Hurlstone Park Station (refer to figure A.13)	35T piling rig with auger	20m, measured at the closest residential structure	< 0.5	< 0.5	During the piling activity, the vibration signals from the 35T piling rig with auger produced vibration levels that are below the established screening criterion for unreinforced structures (7.5 mm/s). As a result, the 35T piling rig with auger was allowed to be operated.

It can be seen from Table 4-1 that the listed vibration intensive equipment have met the established vibration criteria. As a result, the listed vibration intensive equipment were allowed to be operated during the station upgrade works.

## 5 Conclusion

Renzo Tonin & Associates completed noise and vibration monitoring for the WK52-WK1 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 vibration measurements were consistent with the established vibration criteria presented in the CNV-OOWA prepared for the works.

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
06.07.2021	First Issue	0	1	R. Zhafranata	T. Gowen	T. Gowen
06.07.2021	Report revised to address client's comment	-	2	R. Zhafranata	T. Gowen	T. Gowen
07.06.2021	Appendix A.9 amended	-	3	R. Zhafranata	T. Gowen	T. Gowen
File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\09 June WK52-WK1 possession\TL927-1-09F01 WK52-WK1 Noise and Vibration Monitoring Report (r3).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.

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.

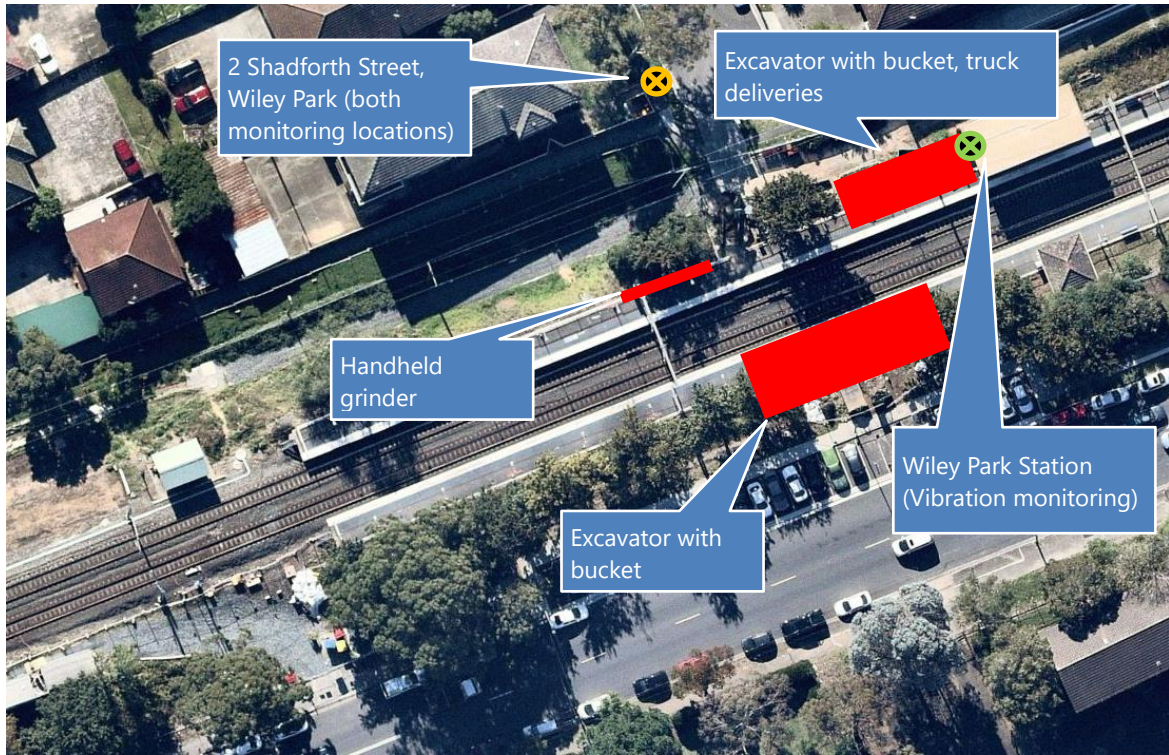
The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural 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 systems (eg facade / 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

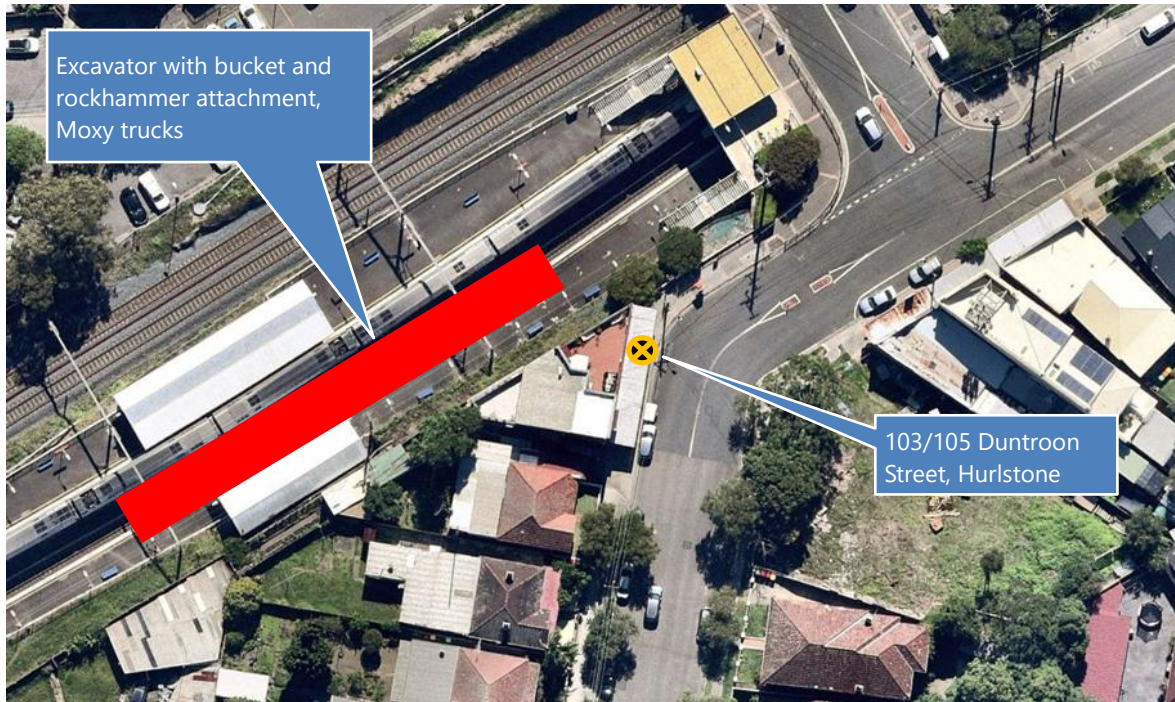
### A.1 2 Shadforth Street, Wiley Park



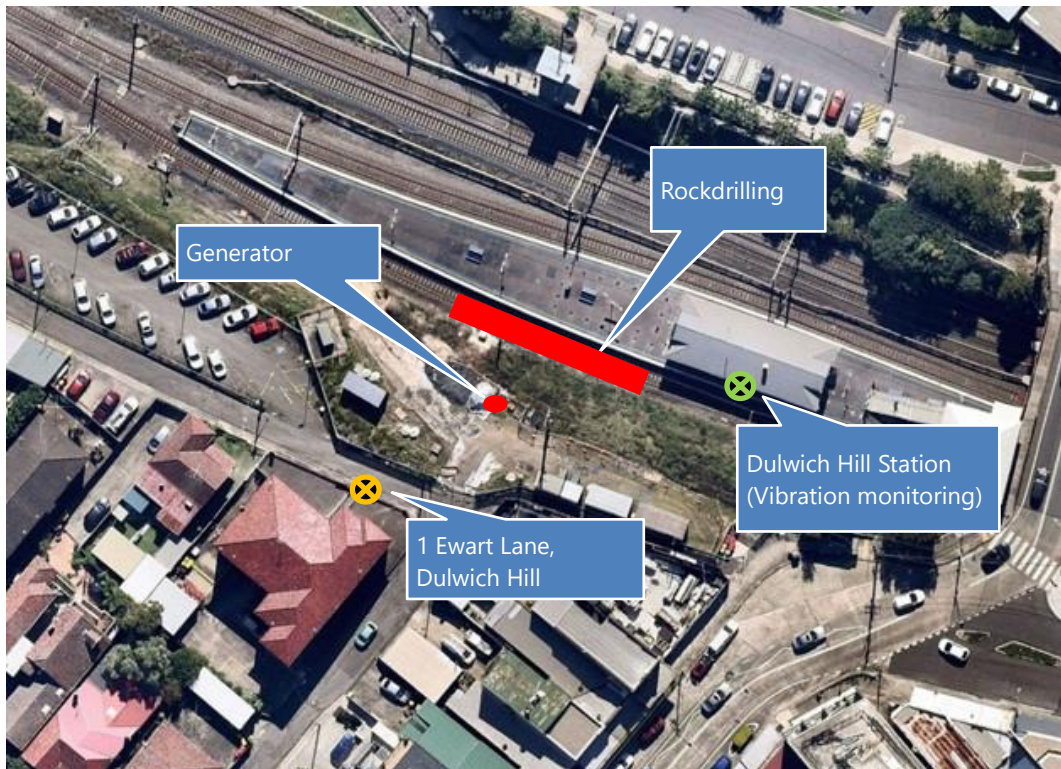
### A.2 30 Redman Parade, Belmore



### A.3 103/105 Duntroon Street, Hurlstone Park



### A.4 1 Ewart Lane, Dulwich Hill



**A.5 71 Ewart Street, Dulwich Hill**



**A.6 5 Bedford Crescent, Dulwich Hill**



**A.7 8 – 10 Shadforth Street, Wiley Park**



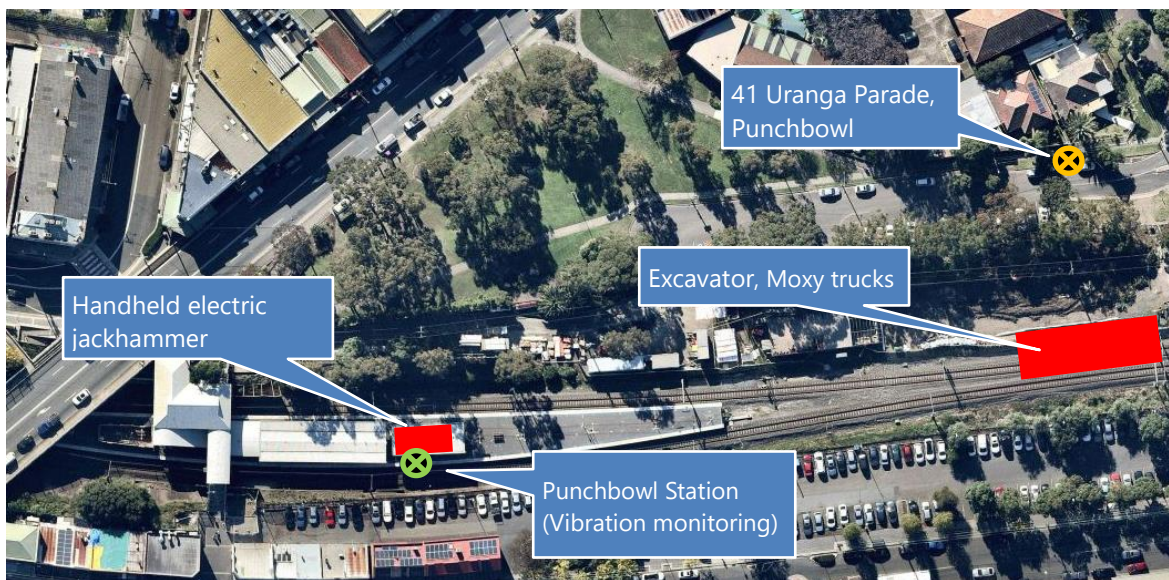
**A.8 115 Duntroon Street, Hurlstone Park**



**A.9 5 Commons Street, Hurlstone Park**



**A.10 41 Uranga Parade, Punchbowl**



**A.11 50 Floss Street, Hurlstone Park**



**A.12 107 Duntroon Street, Hurlstone Park**



**A.13 5 Railway Street, Hurlstone park**



**A.14 7 Commons Street, Hurlstone Park**



## Appendix 8 – TL927-1-10F01 WK52-WE2 NOISE AND VIBRATION MONITORING REPORT (R1)



16 July 2021

TL927-1-10F01 WK01-WE2 Noise and Vibration Monitoring Report (r1)

Downer EDI Works Pty Ltd

76 Berry Street

Nth Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - WK52-WK2 Possession Works

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct noise and vibration monitoring during the Station Upgrade WK01-WE02 Possession works for Sydney Metro Southwest. The noise monitoring was undertaken to verify predicted noise levels in the corresponding Gatewave model (Gatewave scenario ID: 2139 for typical activities and Gatewave scenario ID: 2131 for low impact 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 Dulwich Hill Station, Hurlstone Park Station, Belmore Station, Campsie Station and Punchbowl Station between 7<sup>th</sup> July 2021 and 11<sup>st</sup> July 2021. Vibration monitoring was undertaken at Hurlstone Park Station and Wiley Park Station on 8<sup>st</sup> July 2021.

#### 2.1 Measurement location

The noise measurements were conducted at the worst affected residential receiver, relative to the measured works. The vibration monitoring was conducted on the station platform and worksite. The noise measurement locations are listed in Table 2-1. Figures depicting the monitoring locations are included in APPENDIX A.

**Table 2-1: Noise measurement locations**

Assessment Point	Date	Time	Measured plant	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
5 Railway Street, Hurlstone Park	7/07/2021	10:05 pm 10:25 pm	35T piling rig, generator, delivery truck	35 m	Yes
5A Foord Avenue, Hurstone Park	7/07/2021	10:32 pm 10:47 pm	Concrete pumping, cleaning	25 m	No
5 Foord Avenue, Hurstone Park	7/07/2021	11:06 pm 11:21 pm	Excavator 15T with bucket	15 m	No
5 Railway Street, Hurlstone Park	7/07/2021	11:27 pm 11:42 pm	35T pilling rig with auger, Excavator 15T (2)	35 m	Yes
5 Foord Avenue, Hurlstone Park	8/07/2021	10:05 pm 10:25 pm	Crane Truck delivery	40 m	No
5 Railway Street, Hurlstone Park	8/07/2021	10:43 pm 10:59 pm	35T pilling rig with auger, 15T excavator with bucket, Delivery truck (Crane Truck)	36 m	Yes
5 Railway Street, Hurlstone Park	8/07/2021	11:06 pm 11:22 pm	35T pilling rig with auger, 15T excavator with bucket	36 m	Yes
254 Wardell Road, Dulwich Hill	9/07/2021	00:25 am 00:47 am	Concrete pumping, Crane truck idling, 13T excavator with Moxy truck	90 m	No
5 Foord Avenue, Hurlstone Park	09/07/2021	10:08 pm 10:23 pm	Crane Truck delivery	90 m	No
17 Burnett Street, Hurlstone Park	09/07/2021	10:26 pm 10:50 pm	Crane Truck delivery	18 m	No
5 Railway Street, Hurlstone Park	09/07/2021	11:14 pm 11:30 pm	35T pilling with auger, 15T excavator with bucket. Electric rotary cutter	37 m	Yes
7 Bedford Crescent, Dulwich Hill	09/07/2021	02:22 pm 02:37 pm	Concrete truck, excavators with bucket, hand tools	50 m	No
1 Ewart Lane, Dulwich Hill	09/07/2021	03:03 pm 03:18 pm	Concrete truck, delivery trucks	16 m	No
1 Acacia Street, Belmore	10/07/2021	07:12 am 07:27 am	Lighting tower	28 m	No
30 Redman Parade, Belmore	10/07/2021	07:31 am 07:46 am	Excavator with bucket, power tools	55 m	No
3 Wilfred Avenue, Campsie	10/07/2021	08:05 am 08:20 am	Excavator with bucket, dump trucks	40 m	No
13 Angelo Road, Campsie	10/07/2021	08:29 am 08:44 am	Excavator with bucket, wacker-packer	15 m	No
279 The Boulevard, Punchbowl	10/07/2021	09:19 am 09:24 am	Excavator with auger, hand tools, concrete pump	10 m	No
709 Punchbowl Road, Punchbowl	10/07/2021	09:38 am 09:53 am	Pressure washer, hand tools	50 m	No
103 Duntroon Street, Hurlstone Park	10/07/2021	10:20 am 10:35 am	Concrete truck and pump	5 m	Yes
5 Foord Ave, Hurlstone Park	10/07/2021	10:43 am 10:58 am	Excavator with bucket, skip bin truck	15 m	No
12 Railway Street, Hurlstone Park	10/07/2021	11:01 am 11:16 am	Concrete truck, excavator with bucket, street sweeper	20 m	No

Assessment Point	Date	Time	Measured plant	Approx. distance to measured plant	Temporary noise barrier between measured plant/receiver
107 Duntroon St, Hurlstone Park	11/07/2021	09:54 pm 10:09 pm	Electric jackhammer, Generator	50m	Yes

## 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)	NTi	XL2	A2A-10578-E0	03 March 2021
Type 1 Sound Level Meter Calibrator	B&K	Type 4231	2162834	08 March 2021

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 C22 (SN: 102478)
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 not have an adverse effect on the measured noise and vibration levels.

**Table 2-4: Environmental conditions**

Assessment Point	Date and Start Time	Environmental Conditions
5 Railway Street, Hurlstone Park	07/07/2021 10:05 pm	Overcast; air temperature 8°C, wind speed <5 m/s; relative humidity 85%.
5A Foord Ave, Hurlstone Park	07/07/2021 10:32 pm	Overcast; air temperature 9°C, wind speed <5 m/s; relative humidity 80%.
5 Foord Ave, Hurlstone Park	07/07/2021 11:06 pm	Overcast; air temperature 9°C, wind speed <5 m/s; relative humidity 80%.
5 Railway Street, Hurlstone Park	07/07/2021 11:27 pm	Overcast; air temperature 8°C, wind speed <5 m/s; relative humidity 80%.

Assessment Point	Date and Start Time	Environmental Conditions
5 Foord Ave, Hurlstone Park	08/07/2021 10:05 pm	Overcast; air temperature 9°C, wind speed <5 m/s; relative humidity 65%.
5 Railway st. Hurlstone Park	08/07/2021 10:43 pm	Overcast; air temperature 8°C, wind speed <5 m/s; relative humidity 80%.
5 Railway st. Hurlstone Park	08/07/2021 11:06 pm	Overcast; air temperature 8°C, wind speed <5 m/s; relative humidity 80%.
254 Wardell Rd, Dulwich Hill	09/07/2021 00:25 am	Overcast; air temperature 8°C, wind speed <5 m/s; relative humidity 70%.
5 Foord Ave, Hurlstone Park	09/07/2021 10:08 pm	Overcast; air temperature 11°C, wind speed <5 m/s; relative humidity 90%.
17 Burnett St, Hurlstone Park	09/07/2021 10:26 pm	Overcast; air temperature 11°C, wind speed <5 m/s; relative humidity 90%.
5 Railway St. Hurlstone Park	09/07/2021 11:14 pm	Overcast; air temperature 8°C, wind speed <5 m/s; relative humidity 80%.
7 Bedford Crescent, Dulwich Hill	09/07/2021 02:22 pm	Overcast; air temperature 17°C, wind speed <5 m/s; relative humidity 72%.
1 Ewart Lane, Dulwich Hill	09/07/2021 03:03 pm	Overcast; air temperature 17°C, wind speed <5 m/s; relative humidity 72%.
1 Acacia Street, Belmore	10/07/2021 07:12 am	Overcast; air temperature 13°C, wind speed <5 m/s; relative humidity 79%.
30 Redman Parade, Belmore	10/07/2021 07:31 am	Overcast; air temperature 13°C, wind speed <5 m/s; relative humidity 79%.
3 Wilfred Avenue, Campsie	10/07/2021 08:05 am	Overcast; air temperature 14°C, wind speed <5 m/s; relative humidity 66%.
13 Angelo Road, Campsie	10/07/2021 08:29 am	Overcast; air temperature 14°C, wind speed <5 m/s; relative humidity 66%.
279 The Boulevard, Punchbowl	10/07/2021 09:19 am	Overcast; air temperature 15°C, wind speed <5 m/s; relative humidity 61%.
709 Punchbowl Road, Punchbowl	10/07/2021 09:38 am	Overcast; air temperature 15°C, wind speed <5 m/s; relative humidity 61%.
103 Duntroon Street, Hurlstone Park	10/07/2021 10:20 am	Overcast; air temperature 16°C, wind speed <5 m/s; relative humidity 55%.
5 Foord Ave, Hurlstone Park	10/07/2021 10:43 am	Overcast; air temperature 16°C, wind speed <5 m/s; relative humidity 55%.
12 Railway Street, Hurlstone Park	10/07/2021 11:01 am	Overcast; air temperature 16°C, wind speed <5 m/s; relative humidity 55%.
107 Duntroon St, Hurlstone Park	11/07/2021 09:54 pm	Overcast; air temperature 9°C, wind speed <5 m/s; relative humidity 80%.

### 3 Noise Monitoring results

The results of the noise monitoring are presented in Table 3-1 below.

**Table 3-1: Measured noise levels  $L_{Aeq}(15min)$**

Assessment Point	Measured plant	Predicted noise level dB(A)	Measured noise level dB(A)		Above predicted noise level?	Comments
			$L_{Aeq}(15min)$	$L_{Amax}$		
5 Railway Street, Hurlstone Park	35T piling rig, generator, delivery truck	82 <sup>T</sup>	56 (58)	80	No ( $L_{Aeq, 15min}$ )	Note that there was no access to the most affected facade. As a result, the measured $L_{Aeq, 15min}$ noise level in the bracket was the estimated noise level at the nearest residential façade, based on distance correction.
5A Foord Ave, Hurstone Park	Concrete pumping, cleaning	82-84 <sup>T</sup>	60 (67)	73	No ( $L_{Aeq, 15min}$ )	Note that there was no access to the most affected facade. As a result, the measured $L_{Aeq, 15min}$ noise level in the bracket was the estimated noise level at the nearest residential façade, based on distance correction. Plant in use different to predicted plant.
5 Foord Ave, Hurstone Park	Excavator 15T with bucket	82-84 <sup>T</sup>	56 (59)	81	No ( $L_{Aeq, 15min}$ )	Measurement was performed at 7m from the worst effected façade. The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
5 Railway Street, Hurlstone Park	35T pilling rig with auger, Excavator 15T (2)	82 <sup>T</sup>	67 (69)	89	No ( $L_{Aeq, 15min}$ )	Note that there was no access to the most affected facade. As a result, the measured $L_{Aeq, 15min}$ noise level in bracket was the estimated noise level at the nearest residential façade, based on distance correction.
5 Foord Ave, Hurlstone Park	Crane Truck delivery	73-75 <sup>L</sup>	55	68	No ( $L_{Aeq, 15min}$ )	Measurement was performed at 7m from the worst effected façade. The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.
5 Railway st. Hurlstone Park	35T pilling rig with auger, 15T excavator with bucket, Crane Truck delivery	82 <sup>T</sup>	60 (62)	77	No ( $L_{Aeq, 15min}$ )	Note that there was no access to the most affected façade. As a result, the measured $L_{Aeq, 15min}$ noise level in bracket was the estimated noise level at the nearest residential façade, based on distance correction.
5 Railway st. Hurlstone Park	35T pilling rig with auger, 15T excavator with bucket	82 <sup>T</sup>	63 (65)	78	No ( $L_{Aeq, 15min}$ )	Note that there was no access to the most affected facade. As a result, the measured $L_{Aeq, 15min}$ noise level in bracket was the estimated noise level at the nearest residential façade, based on distance correction.
254 Wardell Rd, Dulwich Hill	Concrete pumping, Crane truck idling, 13T excavator with Moxy truck	58 <sup>T</sup>	50	61	No ( $L_{Aeq, 15min}$ )	Measurement performed on the Wardell Rd. facing Dulwich Hill station. The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.

Assessment Point	Measured plant	Predicted noise level dB(A)	Measured noise level dB(A)		Above predicted noise level?	Comments
			L <sub>Aeq</sub> (15min)	L <sub>Amax</sub>		
5 Foord Ave, Hurlstone Park	Crane Truck delivery	73-75 <sup>L</sup>	48	45	No (L <sub>Aeq, 15min</sub> )	Measurement was performed at 7m from the worst effected façade. The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
17 Burnett St, Hurlstone Park	Crane Truck delivery	64 <sup>T</sup>	51	70	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
5 Railway St. Hurlstone Park	35T pilling with auger, 15T excavator with bucket. Electric rotary cutter	82 <sup>T</sup>	61 (63)	79	No (L <sub>Aeq, 15min</sub> )	Note that there was no access to the most affected facade. As a result, the measured L <sub>Aeq, 15min</sub> noise level in bracket was the estimated noise level at the nearest residential façade, based on distance correction.
7 Bedford Crescent, Dulwich Hill	Concrete truck, excavators with bucket, hand tools	73 <sup>T</sup>	60	78	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
1 Ewart Lane, Dulwich Hill	Concrete truck, delivery trucks	72 <sup>T</sup>	69	86	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
1 Acacia Street, Belmore	Lighting tower	62 <sup>T</sup>	57	77	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
30 Redman Parade, Belmore	Excavator with bucket, power tools	63 <sup>T</sup>	59	85	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
3 Wilfred Avenue, Campsie	Excavator with bucket, dump trucks	69 <sup>T</sup>	57	72	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
13 Angelo Road, Campsie	Excavator with bucket, wacker-packer	74 <sup>T</sup>	62	79	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level. Measurement location is on the corridor boundary fence. Sensitive receivers are on upper floors only.
279 The Boulevard, Punchbowl	Excavator with auger, hand tools, concrete pump	76 <sup>T</sup>	68	85	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level. Measurement location is affected by road traffic. Sensitive receivers are on upper floors only.
709 Punchbowl Road, Punchbowl	Pressure washer, hand tools	73 <sup>T</sup>	71	84	No (L <sub>Aeq, 15min</sub> )	Dominated by road traffic. Sensitive receivers are on upper floors only.
103 Duntroon Street, Hurlstone Park	Concrete truck and pump	82 <sup>T</sup>	72	90	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
5 Foord Ave, Hurlstone Park	Excavator with bucket, skip bin truck	84 <sup>T</sup>	61 (64)	79	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.
12 Railway Street, Hurlstone Park	Concrete truck, excavator with bucket, street sweeper	71 <sup>T</sup>	70	88	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.

Assessment Point	Measured plant	Predicted noise level dB(A)	Measured noise level dB(A)		Above predicted noise level?	Comments
			L <sub>Aeq</sub> (15min)	L <sub>Amax</sub>		
107 Duntroon St, Hurlstone Park	Electric jackhammer, Generator	73 <sup>L</sup>	58	63	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level.

Note: T: Predicted L<sub>Aeq, 15min</sub> for typical activities (Gatewave ID: 2139)

L: Predicted L<sub>Aeq, 15min</sub> for low impact activities (Gatewave ID: 2131)

(XX): Estimated noise level at the nearest residential façade, based on distance correction

It can be seen from Table 3-1 that, the measured L<sub>Aeq, 15min</sub> noise levels were below the predicted noise levels. The mitigation and management measures implemented were therefore considered suitable for the measured activities.

## 4 Vibration Monitoring results

The established vibration criteria for cosmetic damage in the Construction Noise & Vibration – OOHWA Assessment Stage 2 Possession Works (CNV-OOHWA)<sup>1</sup> 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 present below.

**Table 4-1: Measured vibration levels**

Assessment point	Plant	Distance from source	95th percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
Hurlstone Park Station (Refer to Figure A.11)	Vibratory plate compactor	1m, measured at the affected Station building	3.0	3.8	The vibration monitor was mounted on the platform building. During the asphalt compacting activity, the vibration signals from the vibratory plate produced vibration levels that are below the established vibration criteria. As a result, the Vibratory plate compactor was allowed to be operated.
Wily Park station (Refer to Figure A.12)	5T Asphalt Roller (non-vibratory)	1m	<0.5	<0.5	The vibration monitor was mounted on the platform. During the asphalt compacting activity, the vibration signals from the 5T non-vibratory roller produced vibration levels that are below the established vibration criteria. As a result, the 5T non-vibratory roller was allowed to be operated.

<sup>1</sup> TL927-1-02F01 CNV\_OOHWA WE42 Possession April 2021 (r4), dated: 06 April 2021

Assessment point	Plant	Distance from source	95th percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
Wily Park station (Refer to Figure A.12)	Vibratory plate compactor	1m	3.0	3.2	The vibration monitor was mounted on the platform. During the asphalt compacting activity, the vibration signals from the vibratory plate produced vibration levels that are below the established vibration criteria. As a result, the Vibratory plate compactor was allowed to be operated.

It can be seen from Table 4-1 that the listed vibration intensive equipment has met the established vibration criteria. As a result, the listed vibration intensive equipment were allowed to be operated during the station upgrade works.

## 5 Conclusion

Renzo Tonin & Associates completed noise and vibration monitoring for the WK01-WE02 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 vibration measurements were consistent with the established vibration criteria presented in the CNV-OOWA prepared for the works.



## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
16.07.2021	First Issue	0	1	J. Liang	T. Gowen	T. Gowen

File Path: \\SYD-SERVER\rtagroups\syd\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\14 July WK52-WK2 possession\TL927-1-10F01 WK01-WE2 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.

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.

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.

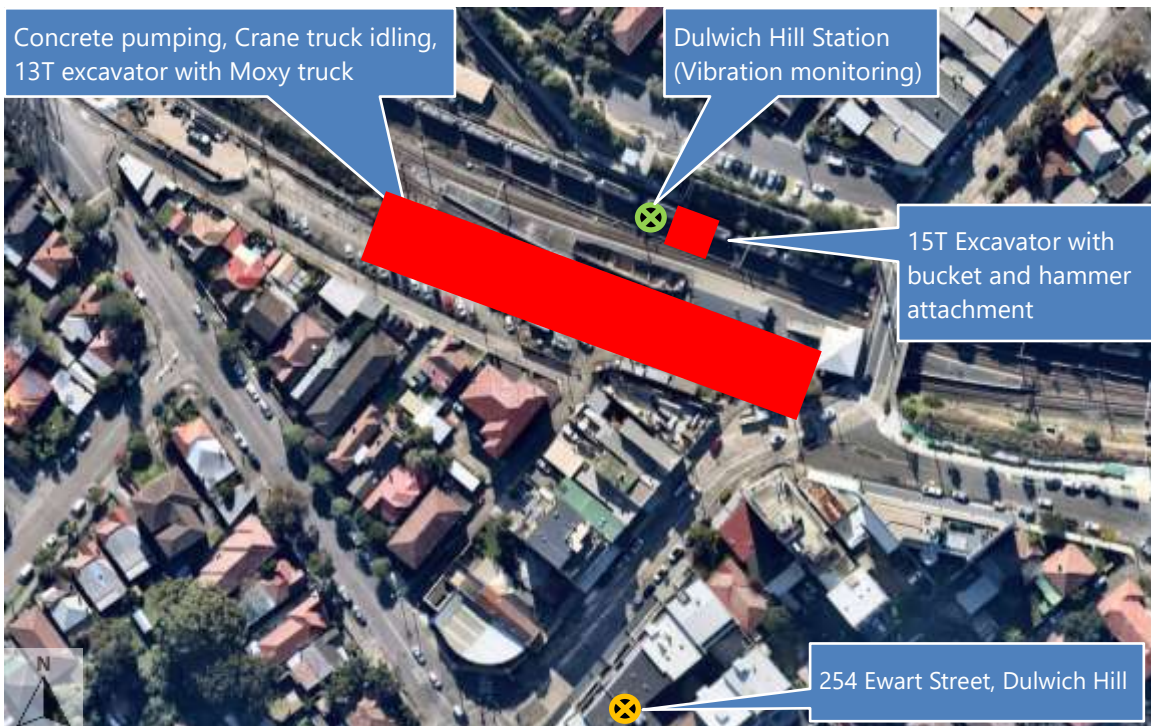
External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions 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 5 Railway Street, Hurlstone Park



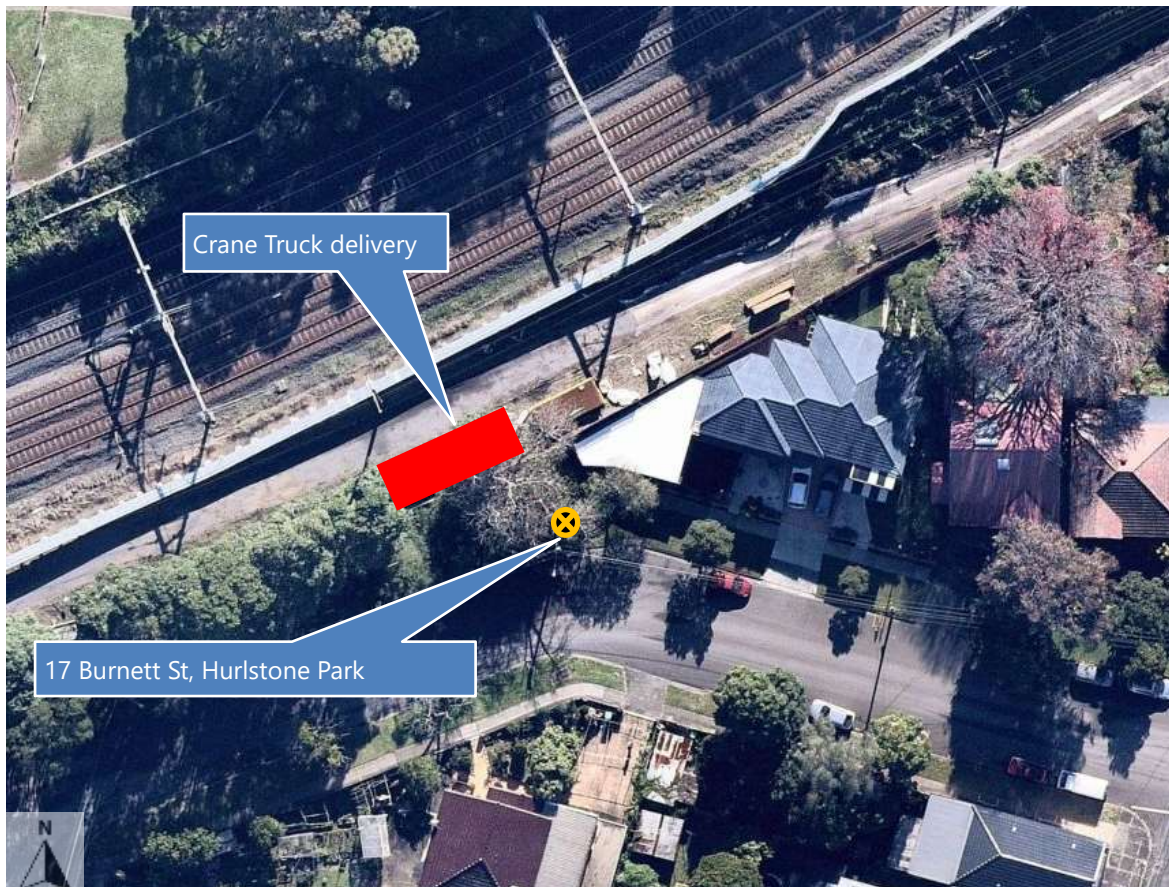
### A.2 254 Wardell Rd, Dulwich Hill



**A.3 107 Duntroon Street, Hurlstone Park**



**A.4 17 Burnett St, Hurlstone Park**



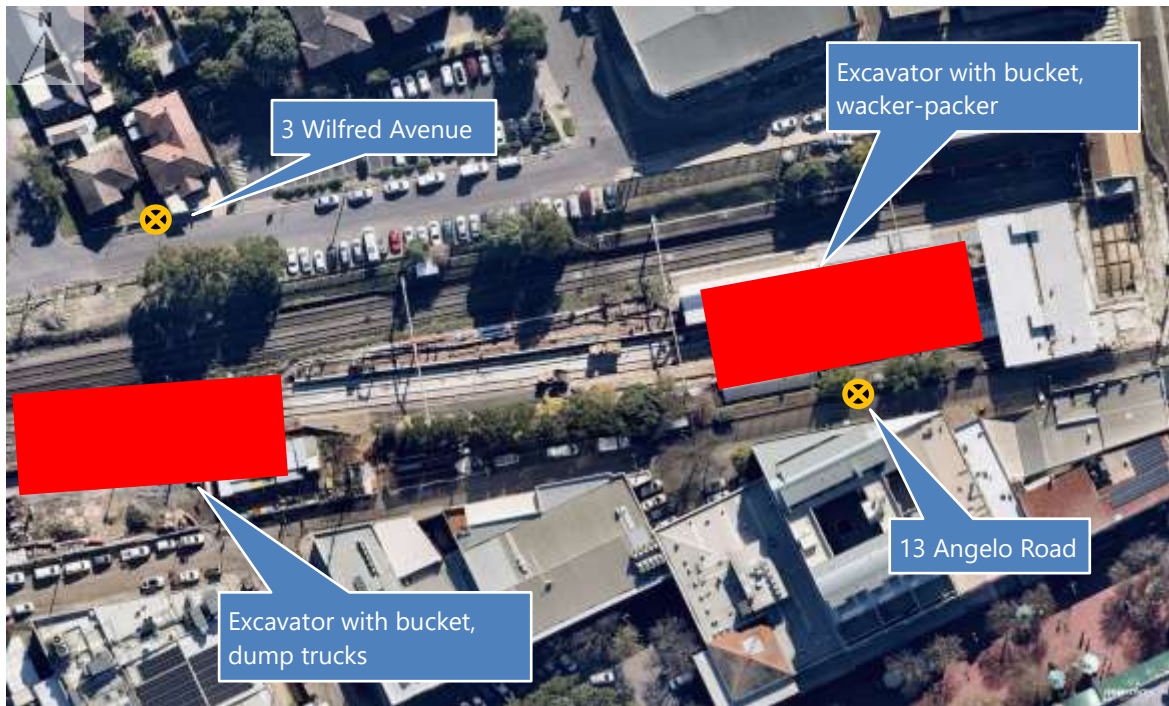
**A.5 7 Bedford Crescent & 1 Ewart Lane, Dulwich Hill**



**A.6 1 Acacia Street & 30 Redman Parade, Belmore**



**A.7 3 Wilfred Avenue & 13 Angelo Road, Campsie**



**A.8 279 The Boulevard & 709 Punchbowl Road, Punchbowl**



**A.9 103 Duntroon Street, Hurlstone Park**



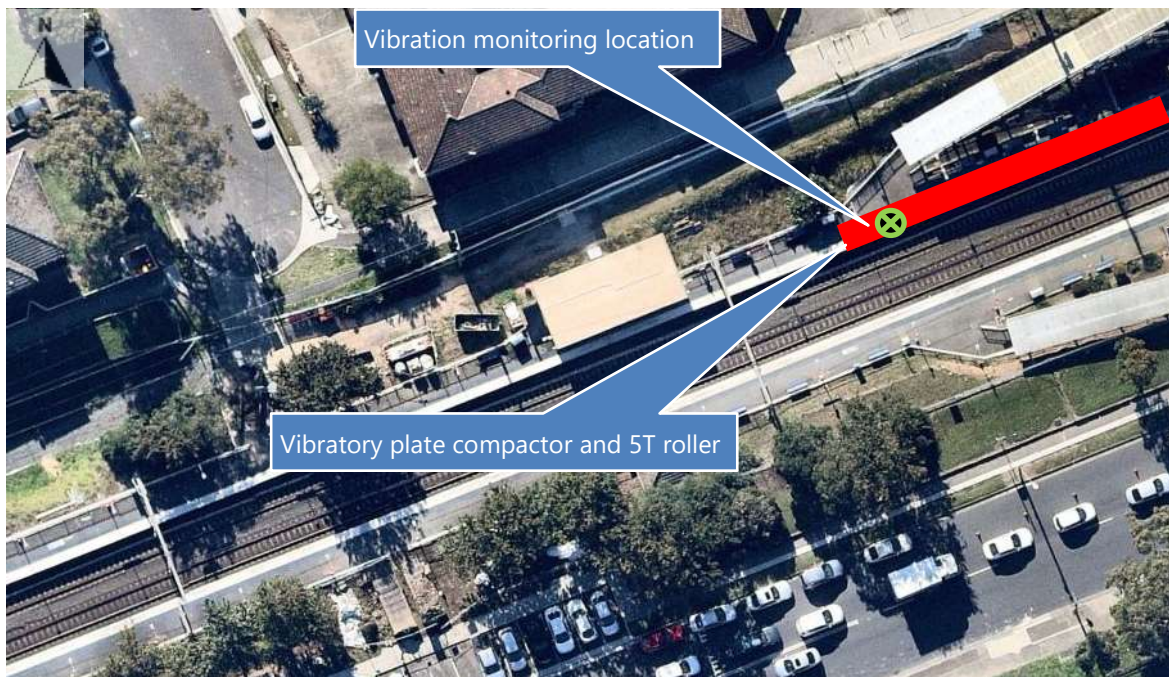
**A.10 5 Foord Ave & 12 Railway Street, Hurlstone Park**



**A.11 Hurlstone Park Station (Vibration monitoring location)**



**A.12 Wily Park station (Vibration monitoring location)**



## Appendix 9 – TL927-1-15F01 WK16 NOISE AND VIBRATION MONITORING REPORT (R6)



4 November 2021

TL927-1-15F01 WE16 Noise and Vibration Monitoring Report (r6)

Downer EDI Works Pty Ltd

76 Berry Street

Nth Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - WE16 Possession Works

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct noise and vibration monitoring during the Station Upgrades WE16 Possession works for Sydney Metro Southwest. The noise monitoring was undertaken to verify predicted noise levels in the corresponding Gatewave model (Gatewave scenario ID: 2975 for Hurlstone Park Station works and Gatewave scenario ID: 2971 Punchbowl Station works). The vibration monitoring was undertaken to establish site specific minimum working distances for vibration intensive plants and monitor potentially affected structures. This report provides a summary of the monitoring results.

### 2 Details of monitoring

Noise monitoring and vibration monitoring was undertaken at Hurlstone Park Station and Punchbowl Station on 16<sup>th</sup> October 2021. Two unattended vibration monitors were installed at the neighbouring garage structure at 3A Commons Street, Hurlstone Park between 7:30am 16<sup>th</sup> October and 6:00pm 17<sup>th</sup> October 2021.

#### 2.1 Measurement location

The noise measurements were conducted at the worst affected residential receiver, relative to the measured works. The vibration monitoring was conducted on the station platform and residential building. The noise 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	2 Hoptoun Street, Hurlstone Park (Appendix A.1)	16.10.21 08:29am – 08:46am	Two 15T excavator with bucket attachment	Noise	20m	No
M2	103-105 Duntroon Street, Hurlstone Park (Appendix A.2)	16.10.2021 09:33am – 09:48am	Two 5T excavator with bucket attachment	Noise	12m to 25m	No
M3	24 Floss Street, Hurlstone Park (Appendix A.3)	16.10.2021 10:28am – 10:43am	Chainsaw and BC1800 shredder	Noise	11m	No
M4	41 Urunga Parade, Punchbowl (Appendix A.4)	16.10.2021 12:05pm – 12:20pm	Chainsaw and BC1800 shredder	Noise	150m	No
M5	7 Commons Street, Hurlstone Park (Appendix A.5)	16.10.2021 02:14pm – 02:33pm	Two 15T excavator with bucket attachment, plate compactor	Noise	20m to 40m	No
M6	103-105 Duntroon Street, Hurlstone Park (Appendix A.6)	16.10.2021 09:30am – 11:50am	5T excavator with bucket attachment and 5T excavator with hammer attachment	Vibration	12m to 25m	N/A
M7	Punchbowl Station (Appendix A.7)	16.10.2021 12:00pm – 12:30pm	2T excavator with hammer attachment	Vibration	1m	N/A
M8	103-105 Duntroon Street, Hurlstone Park (Appendix A.6)	16.10.2021 03:08pm – 03:18pm	5T excavator with hammer attachment	Vibration	12m	N/A
M9	Neighbouring garage structure at 3A Commons Street, Hurlstone Park (Appendix A.8)	16.10.2021 – 17.10.2021 07:30am – 06:00pm	5T excavator with bucket attachment and 5T excavator with hammer attachment	Vibration	6.5m	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 C22 (SN: 102478)
Triaxial Transducers	Sigicom C22 (SN: 102479)
Accelerometer	Endevco 61C13
Type 1 Signal Analyser	Soundbook-2

## 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	2 Hopetoun Street, Hurlstone Park	16.10.2021 08:29 am	Clear sky; air temperature 15°C, wind speed <5 m/s; relative humidity 50%.
M2	103-105 Duntroon Street, Hurlstone Park	16.10.2021 09:33 am	Clear sky; air temperature 17°C, wind speed <5 m/s; relative humidity 42%.
M3	24 Floss Street, Hurlstone Park	16.10.2021 10:28 am	Clear sky; air temperature 18°C, wind speed <5 m/s; relative humidity 41%.
M4	41 Urunga Parade, Punchbowl	16.10.2021 12:05 pm	Clear sky; air temperature 21°C, wind speed <5 m/s; relative humidity 41%.
M5	7 Common Street, Hurlstone Park	16.10.2021 02:14 pm	Clear sky; air temperature 22°C, wind speed <5 m/s; relative humidity 33%.

## 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	2 Hopetoun Street, Hurlstone Park	Vacuum truck, electrical chainsaw, hand tools, mobile crane, skid steer/bobcat, piling rig, street sweeper, plate compactor, compressor, concrete agitator, concrete pump, drill rig, excavator with pulveriser attachment, excavator with bucket attachment, dump truck and a roller	73 <sup>T</sup>	Two 15T excavator with bucket attachment	64	89	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 two 15T excavator with bucket attachment were operating during this measurement.
M2	103-105 Duntroon Street, Hurlstone Park	Vacuum truck, electrical chainsaw, hand tools, mobile crane, skid steer/bobcat, piling rig, street sweeper, plate compactor, compressor, concrete agitator, concrete pump, drill rig, excavator with pulveriser attachment, excavator with bucket attachment, dump truck and a roller	84 <sup>T</sup>	Two 5T excavator with bucket attachment	65	78	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 two 5T excavator with bucket attachment were operating during this measurement. Furthermore, access to the most affected facade for this receiver was not provided. As a result, the measurement was taken on the facade facing Duntroon Street. In the prediction model, the distance between the closest work area and the most affected facade is approximately 4 metres. However, it was noted on site that the two 5T excavators with bucket attachment were approximately 12 to 25 metres away from the measurement location.
M3	24 Floss Street, Hurlstone Park	Not applicable	Not applicable	Electrical chainsaw and BC1800 shredder	85	98	Not applicable	This activity was not included in the OOHW application because it was scheduled to be carried out during standard construction hours. As a result, the predicted noise levels from the OOHW application do not include the vegetation works.
M4	41 Urunga Parade, Punchbowl	Vacuum truck, electrical chainsaw, hand tools, mobile crane, skid steer/bobcat, piling rig, street sweeper, plate compactor, compressor, concrete agitator, concrete pump, drill rig, excavator with pulveriser attachment, excavator with bucket attachment, dump truck and a roller	78 <sup>T</sup>	Electrical chainsaw and BC1800 shredder	58	71	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 electrical chainsaw and the BC1800 shredder were operating during this measurement. Furthermore, it was noted on site that the electrical chainsaw and the BC1800 shredder were approximately 150 metres away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 30 metres.
M5	7 Common Street, Hurlstone Park	Vacuum truck, electrical chainsaw, hand tools, mobile crane, skid steer/bobcat, piling rig, street sweeper, plate compactor, compressor, concrete agitator, concrete pump, drill rig, excavator with pulveriser attachment, excavator with bucket attachment, dump truck and a roller	77 <sup>T</sup>	Two 15T excavator with bucket attachment, plate compactor	62	80	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 two 5T excavator with bucket attachment and a plate compactor were operating during this measurement. Furthermore, it was noted on site that the two 15T excavator with bucket attachment and the plate compactor were approximately 20 to 40 metres 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: T: Predicted  $L_{Aeq, 15min}$  for typical activities

It can be seen from Table 3-1 that, the measured  $L_{Aeq, 15min}$  noise levels were below the predicted noise levels. The mitigation and management measures implemented were therefore considered suitable for the measured activities.

## 4 Vibration Monitoring results

The established vibration criteria for cosmetic damage in the Construction Noise & Vibration – OOHWA Assessment Stage 2 Possession Works (CNV-OOHWA)<sup>1</sup> 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	Baseline 95 <sup>th</sup> percentile PPV	95th percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
M6	Hurlstone Park Station	Two 5T excavator with bucket attachment	12m	0.03	0.03	0.04	The accelerometer was mounted on the residential building at 103-105 Duntroon Street, Hurlstone Park. The measured results show that the baseline value did not change during the excavation work. Therefore, the vibration signals from the two 5T excavators with bucket attachment could not be detected at this measurement location. As a result, the 5T excavators with bucket attachment was allowed to be operated.
M7	Punchbowl Station	2T Excavator with hammer	1m	0.13	1.09	2.28	The accelerometer was mounted on the station structure at the station building. During the hammering activity, the vibration signals from the hammer produced vibration levels that are below the established vibration criteria. As a result, the 2T excavator with hammer attachment was allowed to be operated.

<sup>1</sup> TL927-1-02F01 CNV\_OOHWA WE42 Possession April 2021 (r4), dated: 06 April 2021

Measurement ID	Assessment point	Plant	Distance from source	Baseline 95 <sup>th</sup> percentile PPV	95th percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
M8	Hurlstone Park Station	5T excavator with hammer attachment	12m	0.03	0.04	0.09	The accelerometer was mounted on the residential building at 103-105 Duntroon Street, Hurlstone Park. The measured results show that the baseline value did not change during the excavation work. Therefore, the vibration signals from the 5T excavator with hammer attachment could not be detected at this measurement location. As a result, the 5T excavator with hammer attachment was allowed to be operated.

It can be seen from Table 4-1 that the listed vibration intensive equipment has met the established vibration criteria. As a result, the listed vibration intensive plants were allowed to be operated during the station upgrade works.

### 4.1 Neighbouring garage structure at 3A Commons Street Vibration Monitoring

In accordance with the Hurlstone Park Station Vibration Monitoring Plan<sup>2</sup>, 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)

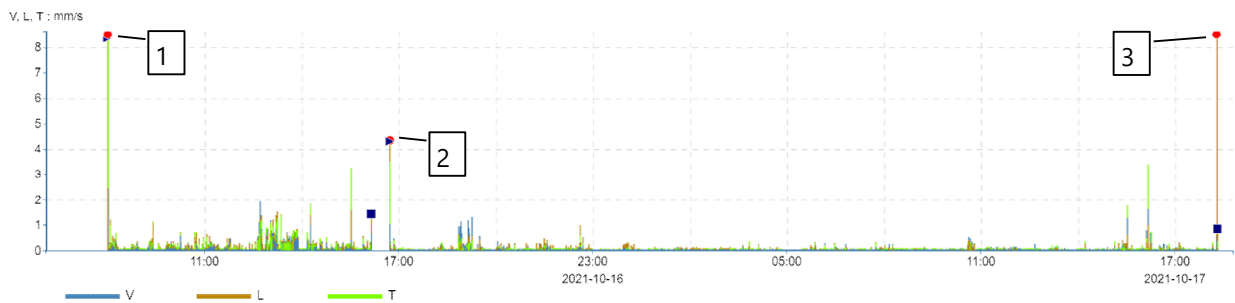
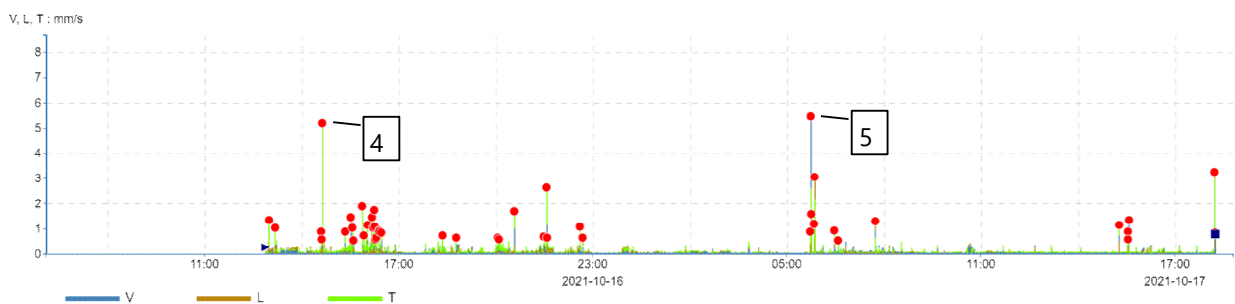


Figure 4-2: Unattended vibration monitoring location 2 results (refer to Appendix A.8)



<sup>2</sup> 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 are summarised in the table below.

**Table 4-2: Unattended vibration summary**

Exceedance ID	Date and Time	Cause of exceedance
1	16.10.2021 08:00am	At this time, the vibration monitor was mounted on the ground spike to commence monitoring. As a result, this exceedance was not caused by the nearby construction activities.
2	16.10.2021 04:42pm	At this time, a Renzo Tonin & Associates engineer checked and tested if the vibration monitor was operating correctly. As a result, this exceedance was not caused by the nearby vibration intensive activities.
3	17.10.2021 06:16pm	At this time, the vibration monitor was removed from the ground spike to complete the monitoring. As a result, this exceedance was not caused by the nearby vibration intensive activities.
4	16.10.2021 02:37pm	At this time, materials were dropped nearby the vibration monitor. The operator was then notified to unload the materials with caution and as far away as practicable from the vibration sensitive structure to minimise vibrational impact.
5	17.10.2021 05:43am	At this time, the vibration monitor measured an instantaneous vibration level of 5.45 mm/s. Upon analysing this exceedance, it was noted that the impulsive characteristic of the exceedance was likely caused by an extraneous event not related to 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 which are justified in Table 4-2.

## 5 Conclusion

Renzo Tonin & Associates completed noise and vibration monitoring for the WE16 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 vibration measurements were below the established vibration criteria presented in the CNV-OOWHA and Hurlstone Park Station Vibration Monitoring Plan prepared for the works (except for a few events that resulted in an instantaneous vibration level of above 4 mm/s which are justified in Table 4-2).

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
25.10.2021	First Issue	0,1,2,3	4	J. Liang	T. Gowen	M. Tabacchi
04.11.2021	Report revised to address Client's comments	5	6	R. Zhafranata	T. Gowen	T. Gowen

File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\15 October WE16 possession\TL927-1-15F01 WE16 Noise and Vibration Monitoring Report (r6).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.

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.

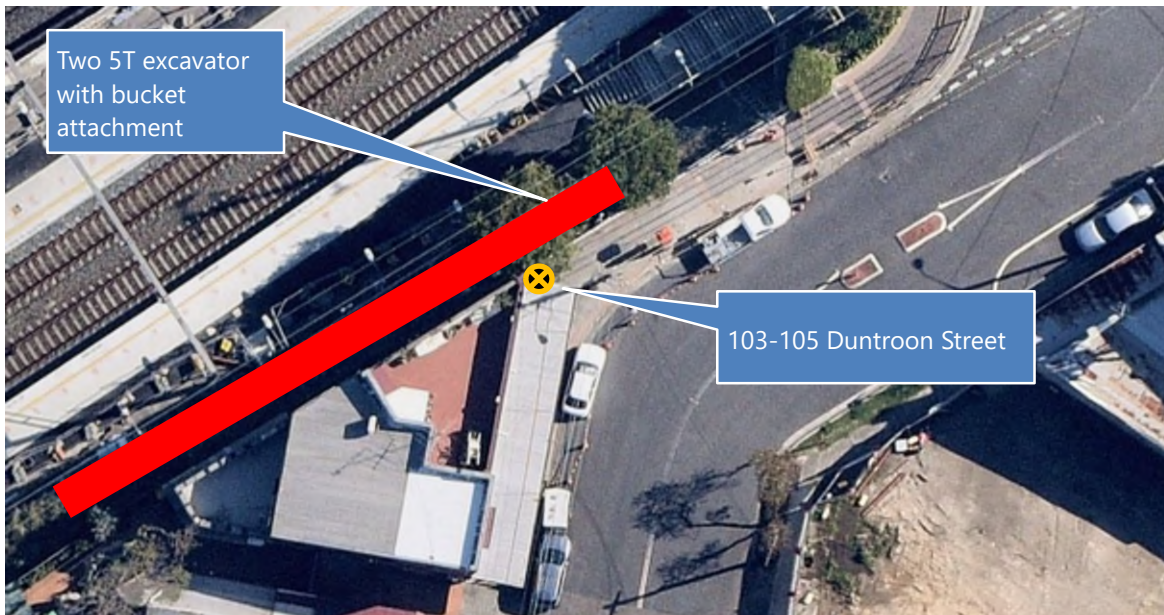
External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions 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 2 Hopetoun Street, Hurlstone Park



### A.2 103-105 Duntroon Street, Hurlstone Park



**A.3 24 Floss Street, Hurlstone Park**



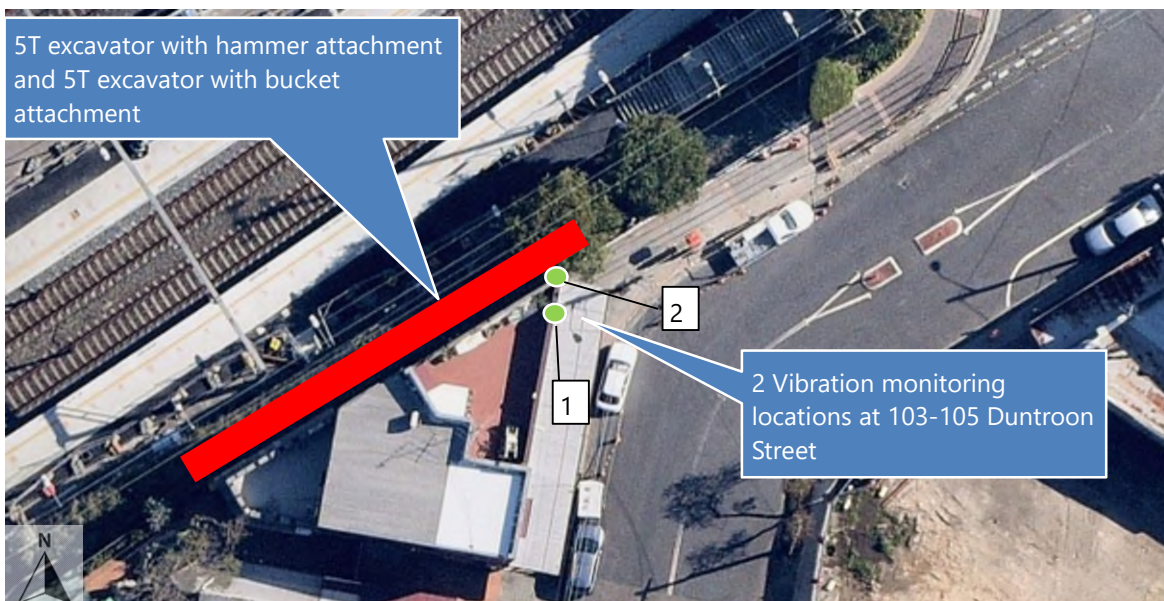
**A.4 41 Urunga Parade, Punchbowl**



**A.5 7 Commons Street, Hurlstone Park**



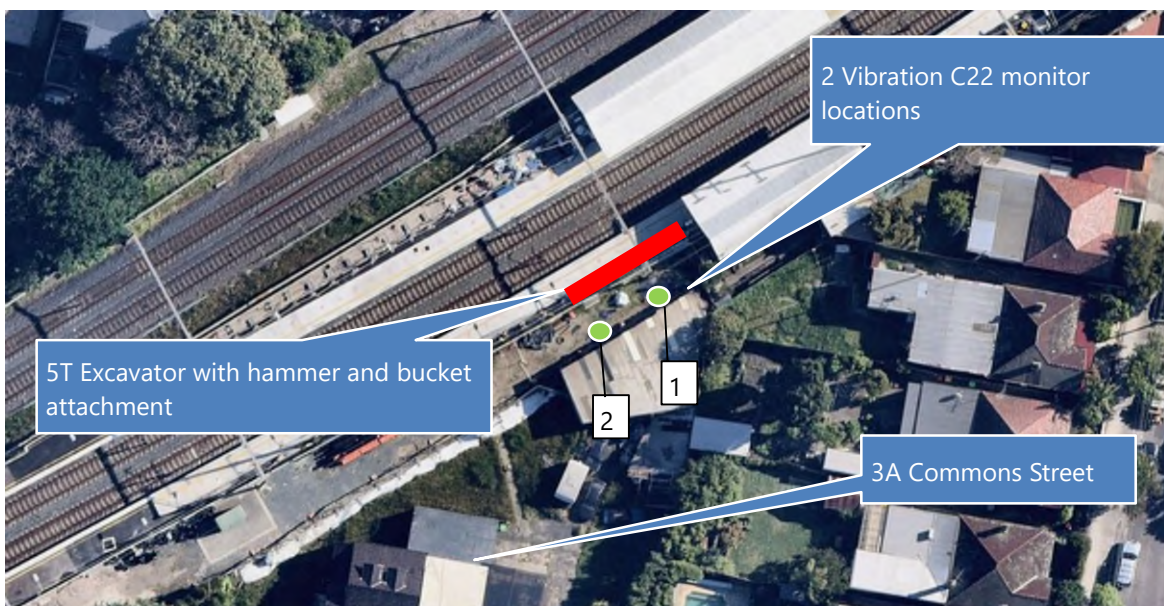
**A.6 103-105 Duntroon Street, Hurlstone Park**



### A.7 Punchbowl station



### A.8 Hurlstone Park Station



---

## Appendix 10 – TL927-1-16F01 WK17 NOISE AND VIBRATION MONITORING REPORT (R3)

4 November 2021

TL927-1-16F01 WE17 Noise and Vibration Monitoring Report (r3)

Downer EDI Works Pty Ltd

76 Berry Street

Nth Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - WE17 Possession Works

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct noise and vibration monitoring during the Station Upgrades WE17 possession works for Sydney Metro Southwest. The noise monitoring was undertaken to verify predicted noise levels in the corresponding Gatewave model (Gatewave scenario ID: 2975 for Hurlstone Park Station works, Gatewave scenario ID: 2971 for Belmore Station works, Gatewave scenario ID: 2973 for Wiley Park Station works and Gatewave scenario ID: 2973 Dulwich Hill Station works). The vibration monitoring was undertaken to establish site specific minimum working distances for vibration intensive plants 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 Station, Belmore Station, Wiley Park Station and Dulwich Hill Station on 23<sup>rd</sup> October 2021. Attended vibration monitoring was undertaken at Wiley Park Station on 23<sup>rd</sup> October 2021. Two unattended vibration monitors were installed at the neighbouring garage structure at 3A Commons Street, Hurlstone Park between 7:30am 23<sup>rd</sup> October and 6:00pm 24<sup>th</sup> October 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 on the station structure at Wiley Park Station. The noise 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	7 Commons Street, Hurlstone Park (Appendix A.1)	23.10.2021 08:25am - 08:40am	2T excavator unloading with delivery truck, 7T hi-rail excavator transporting materials, concrete saw	Noise	14m (concrete sawing activity was approx. 100m away)	No
M2	3A Commons Street, Hurlstone Park (Appendix A.1)	23.10.2021 08:40am - 08:56am	7T excavator with bucket, 5T excavator idling, fencing removal	Noise	17m	No
M3	20 Redman Parade, Belmore (Appendix A.2)	23.10.2021 09:20am - 09:35am	Hi-rail dump truck, stockpile management, 5T excavator with bucket	Noise	40m	No
M4	17 Redman Parade, Belmore (Appendix A.2)	23.10.2021 09:37am - 09:53am	Hi-rail dump truck, stockpile management, 5T Excavator with bucket	Noise	20m	No
M5	1A Shadforth Street, Wiley Park (Appendix A.3)	23.10.2021 10:20am - 10:35am	5T Excavator with hammer attachment, handheld jackhammer	Noise	50m	No
M6	1A Shadforth Street, Wiley Park (Appendix A.3)	23.10.2021 10:41am - 10:59am	5T excavator with hammer attachment, handheld jackhammer	Noise	50m	No
M7	51 Ewart Lane, Dulwich Hill (Appendix A.4)	23.10.2021 01:17pm - 01:32pm	8T excavator with hammer attachment, concrete truck	Noise	12m to 30m	No
M8	57 Ewart Lane, Dulwich Hill (Appendix A.4)	23.10.2021 01:33pm - 01:49pm	8T excavator with hammer attachment, concrete truck	Noise	27m to 30m	No
M9	2 Hopetoun Street, Hurlstone Park (Appendix A.5)	23.10.2021 02:10pm - 02:28pm	Vacuum truck, hi-rail dump truck	Noise	11m	No
M10	3A Commons Street, Hurlstone Park (Appendix A.1)	23.10.2021 02:33pm - 02:48pm	Power hand tools, 5T excavator with bucket attachment, 5T excavator with hammer attachment, hi-rail dump truck	Noise	7m to 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
M11	3A Commons Street, Hurlstone Park (Appendix A.1)	23.10.2021 02:48pm - 03:03pm	Power handtools, 5T excavator with bucket attachment, 5T excavator with hammer attachment, hi-rail dump truck	Noise	7m to 40m	No
M12	105 Duntroon Street, Hurlstone Park (Appendix A.6)	23.10.2021 03:06pm - 03:21pm	Two 5T Excavator with bucket attachment, two hi-rail dump truck, handheld power drill	Noise	23m	No
M13	48 Floss Street, Hurlstone Park (Appendix A.7)	23.10.2021 04:07pm - 04:22pm	Concrete saw, two 5T excavator with bucket attachment, two hi-rail dump truck	Noise	47m to 50m	No
M14	Neighbouring garage structure at 3A Commons Street, Hurlstone Park (Appendix A.8)	23.10.2021 – 24.10.2021 07:30am – 06:00pm	5T excavator with bucket attachment and 5T excavator with hammer attachment	Vibration	5m to 6.5m	N/A
M15	Wiley Park Station, location 1 (Appendix A.9)	23.10.2021 11:44am – 11:55am	Handheld jackhammer	Vibration	10m	N/A
M16	Wiley Park Station, location 2 (Appendix A.9)	23.10.2021 11:55am – 12:05pm	5T excavator with hammer attachment	Vibration	10m	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-2

## 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	3A Commons Street, Hurlstone Park	23.10.2021 08:25am	Clear sky; air temperature 20°C, wind speed <5 m/s; relative humidity 34%.
M2	3A Commons Street, Hurlstone Park	23.10.2021 08:40am	Clear sky; air temperature 25°C, wind speed <5 m/s; relative humidity 34%.
M3	20 Redman Parade, Belmore	23.10.2021 09:20am	Clear sky; air temperature 25°C, wind speed <5 m/s; relative humidity 34%.
M4	17 Redman Parade, Belmore	23.10.2021 09:37am	Clear sky; air temperature 27°C, wind speed <5 m/s; relative humidity 40%.
M5	1A Shadforth Street, Wiley Park	23.10.2021 10:20am	Clear sky; air temperature 26°C, wind speed <5 m/s; relative humidity 40%.
M6	1A Shadforth Street, Wiley Park	23.10.2021 10:41am	Clear sky; air temperature 26°C, wind speed <5 m/s; relative humidity 40%.

Measurement ID	Assessment Point	Date and Start Time	Environmental Conditions
M7	51 Ewart Lane, Dulwich Hill	23.10.2021 01:17pm	Clear sky; air temperature 27°C, wind speed <5 m/s; relative humidity 40%.
M8	57 Ewart Lane, Dulwich Hill	23.10.2021 01:33pm	Clear sky; air temperature 27°C, wind speed <5 m/s; relative humidity 40%.
M9	2 Hopetoun Street, Hurlstone Park	23.10.2021 02:10pm	Clear sky; air temperature 27°C, wind speed <5 m/s; relative humidity 42%.
M10	3A Commons Street, Hurlstone Park	23.10.2021 02:33pm	Clear sky; air temperature 26°C, wind speed <5 m/s; relative humidity 41%.
M11	3A Commons Street, Hurlstone Park	23.10.2021 02:48pm	Clear sky; air temperature 26°C, wind speed <5 m/s; relative humidity 41%.
M12	105 Duntroon Street, Hurlstone Park	23.10.2021 03:06pm	Clear sky; air temperature 26°C, wind speed <5 m/s; relative humidity 41%.
M13	48 Floss Street, Hurlstone Park	23.10.2021 04:07pm	Clear sky; air temperature 26°C, wind speed <5 m/s; relative humidity 41%.

### 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	7 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	77 <sup>H</sup>	2T excavator unloading with delivery truck, 7T hi-rail excavator transporting materials, concrete saw	63	86	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 2T excavator unloading with delivery truck, 7T hi-rail excavator transporting materials and concrete saw were operating during this measurement. Furthermore, it was noted on site that the measured concrete sawing activity was approximately 100 metres away from the measured location. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 15 metres.
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 <sup>H</sup>	7T excavator with bucket attachment, 5T excavator idling, fencing removal	65	96	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. $L_{Amax}$ caused by nearby steel fence dropping. Note that the measured noise level is significantly lower than the predicted noise level because only the 7T excavator with bucket attachment and 5T excavator were operating during this measurement. Furthermore, it was noted on site that there were no high impact activities occurring during this measurement. In the prediction model, the distance between the closest high impact work area and the most affected facade is approximately 10 metres.
M3	20 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	66 <sup>T</sup>	Hi-rail dump truck, stockpile management, 5T excavator with bucket attachment	58	75	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 hi-rail dump truck, stockpile management and 5T excavator with bucket attachment were operating during this measurement. Furthermore, it was noted on site that the measured construction activity was approximately 40 metres away from the measurement location. In the prediction model, the distance between the closest work area and the most affected facade is approximately 30 metres.
M4	17 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	60 <sup>T</sup>	Hi-rail dump truck, stockpile management, 5T Excavator with bucket	60	82	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is consistent with the predicted noise level.
M5	1A 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 <sup>H</sup>	5T Excavator with hammer attachment, handheld jackhammer	62	74	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. It was noted on site that the hammering works were occurring underneath the station concourse. As a result, the noise source was shielded by the station structure. Furthermore, only the 5T Excavator with hammer attachment and the handheld jackhammer were operating during this measurement. It was also noted on site that the measured construction activity was approximately 50 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 15 metres. Therefore, the measured noise level is significantly below the predicted noise level.
M6	1A 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 <sup>H</sup>	5T excavator with hammer attachment, handheld jackhammer	63	82	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. It was noted on site that the hammering works were occurring underneath the station concourse. As a result, the noise source was shielded by the station structure. Furthermore, only the 5T Excavator with hammer attachment and the handheld jackhammer were operating during this measurement. It was also noted on site that the measured construction activity was approximately 50 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 15 metres. Therefore, the measured noise level is significantly below the predicted noise level.
M7	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 <sup>H</sup>	8T excavator with hammer attachment, concrete truck	69	81	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 8T excavator with hammer attachment and concrete truck were operating during this measurement.
M8	57 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 <sup>H</sup>	8T excavator with hammer attachment, concrete truck	70	82	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 8T excavator with hammer attachment and concrete truck were operating during this measurement.
M9	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	73 <sup>T</sup>	Vacuum truck, hi-rail dump truck	69	76	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level.

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 <sub>Aeq</sub> (15min)	L <sub>Amax</sub>		
M10	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 <sup>H</sup>	Power hand tools, 5T excavator with bucket attachment, 5T excavator with hammer attachment, hi-rail dump truck	62	78	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level. Note that the measured noise level is significantly lower than the predicted noise level because only the power hand tools, 5T excavator with bucket attachment, 5T excavator with hammer attachment and a hi-rail dump truck were operating during this measurement. Furthermore, it was noted that the measured construction activity was approximately 7 to 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 10 metres.
M11	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 <sup>H</sup>	Power hand tools, 5T excavator with bucket attachment, 5T excavator with hammer attachment, hi-rail dump truck	63	78	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level. Note that the measured noise level is significantly lower than the predicted noise level because only the power hand tools, 5T excavator with bucket attachment, 5T excavator with hammer attachment and a hi-rail dump truck were operating during this measurement. Furthermore, it was noted that the measured construction activity was approximately 7 to 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 10 metres.
M12	105 Duntroon 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	84 <sup>H</sup>	Two 5T Excavator with bucket attachment, two hi-rail dump truck, handheld power drill	67	86	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level. Note that the measured noise level is significantly lower than the predicted noise level because only the two 5T Excavator with bucket attachment, two hi-rail dump truck and a handheld power drill were operating during this measurement. Furthermore, access to the most affected facade for this receiver was not provided. As a result, the measurement was taken on the facade facing Duntroon Street. In the prediction model, the distance between the closest work area and the most affected facade is approximately 4 metres. However, it was noted on site that the measured construction activity were approximately 23 metres away from the measurement location.
M13	48 Floss 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	76 <sup>T</sup>	Concrete saw, two 5T excavator with bucket attachment, two hi-rail dump truck	52	69	No (L <sub>Aeq, 15min</sub> )	The measured L <sub>Aeq, 15min</sub> is lower than the predicted noise level. Note that the measured noise level is significantly lower than the predicted noise level because only the concrete saw, two 5T excavator with bucket attachment and two hi-rail dump truck were operating during this measurement. Furthermore, access to the most affected facade for this receiver was not provided. As a result, the measurement was taken on the facade facing Floss Street. In the prediction model, the distance between the closest work area and the most affected facade is approximately 20 metres. However, it was noted on site that the measured construction activity were approximately 47 to 50 metres away from the measurement location.

Note: T: Predicted L<sub>Aeq, 15min</sub> for Typical activities  
H: Predicted L<sub>Aeq, 15min</sub> for High impact activities

It can be seen from Table 3-1 that, the measured L<sub>Aeq, 15min</sub> noise levels were below the predicted noise levels. The mitigation and management measures implemented were therefore considered suitable for the measured activities.

## 4 Vibration Monitoring results

### 4.1 Attended vibration monitoring

The established vibration criteria for cosmetic damage in the Construction Noise & Vibration – OOHWA Assessment Stage 2 Possession Works (CNV-OOHWA)<sup>1</sup> 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	Baseline 95 <sup>th</sup> percentile PPV	95 <sup>th</sup> percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
M15	Wiley Park Station, location 1	Handheld jackhammer	10m	0.06	0.64	0.88	The accelerometer was mounted on the concourse station structure at Wiley Park Station. During the hammering activity, the handheld jackhammer produced vibration levels that were below the established vibration criteria. As a result, the handheld jackhammer was allowed to be operated.
M16	Wiley Park Station, location 2	5T excavator with hammer attachment	10m	0.06	0.25	0.56	The accelerometer was mounted on the concourse station structure at Wiley Park Station. During the hammering activity, the handheld jackhammer produced vibration levels that were below the established vibration criteria. As a result, the 5T excavator with hammer attachment was allowed to be operated.

It can be seen from Table 4-1 that the listed vibration intensive equipment has met the established vibration criteria at the referenced distance between the vibration source and the sensitive structure. As a result, the listed vibration intensive plant were allowed to be operated during the station upgrade works.

<sup>1</sup> 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<sup>2</sup>, 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)

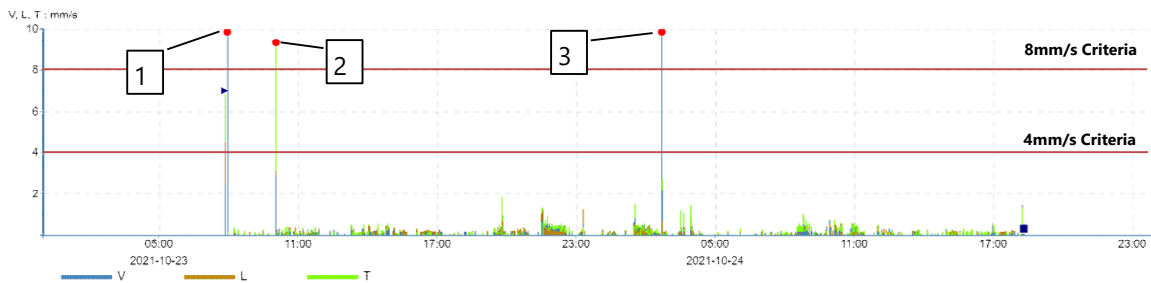
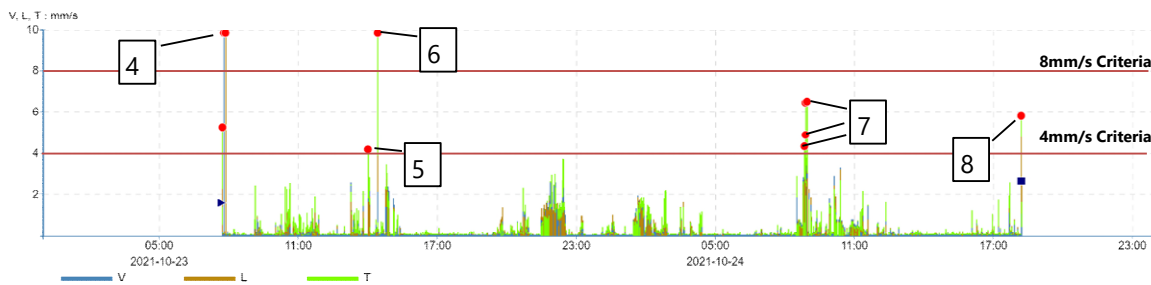


Figure 4-2: Unattended vibration monitoring location 2 results (refer to Appendix A.8)



<sup>2</sup> 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	23.10.2021 7:45am	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	23.10.2021 9:58am	At this time, the vibration monitor measured an instantaneous vibration level of 17.00 mm/s. Analysis of the exceedance found that the impulsive characteristic of the exceedance was likely caused by an extraneous event not related to construction activities.
3	24.10.2021 2:40am	At this time, a construction worker accidentally tripped on the vibration monitor. Therefore, this exceedance was not caused by the nearby construction activities.
4	23.10.2021 7:50am	At this time, the vibration monitor was mounted on the ground spike to commence monitoring. Exceedance was not caused by the nearby construction activities.
5	23.10.2021 2:00am	At this time, the vibration monitor measured 4.2 mm/s. It was noted on site that this exceedance was caused by the excavation bucket impacting the sandstone during earth works. The works were stopped after the exceedance message was received. Wall inspection was carried out per structural engineer's advice. It was noted that there was no apparent cosmetic damage.
6	23.10.2021 2:25pm	At this time, the vibration monitor measured an instantaneous vibration level of 13.9 mm/s. It was noted on site that this exceedance was caused by the excavation spotter bumping the monitor. Exceedance was not caused by the nearby construction activities.
7	24.10.2021 8:50am	At this time, the site engineer confirmed that the exceedances were caused by a rockhammering activity. The rockhammering works were stopped and the methodology was changed to reduce the vibration impact. The revised methodology rockhammering works were below the 4 mm/s criterion.
8	24.10.2021 6:00pm	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 which are justified in Table 4-2.

## 5 Conclusion

Renzo Tonin & Associates completed noise and vibration monitoring for the WE17 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 vibration measurements were typically below the established vibration criteria presented in the CNV-OOWHA and Hurlstone Park Station Vibration Monitoring Plan prepared for the works. There were several events that resulted in an instantaneous vibration level of above 4 mm/s. The likely cause of each event is outlined in Table 4-2. Where exceedance was found to be caused by construction activity, the methodology was changed and subsequent vibration generated by the revised methodology construction was below the trigger levels.

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
28.10.2021	First Issue	0,1	2	J. Liang	M. Tabacchi/ T. Gowen	T. Gowen
04.11.2021	Report revised to address Client's comments	-	3	R. Zhafranata	T. Gowen	T. Gowen
File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\16 October WE17 possession\TL927-1-16F01 WE17 Noise and Vibration Monitoring Report (r3).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.

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 systems (eg facade / 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

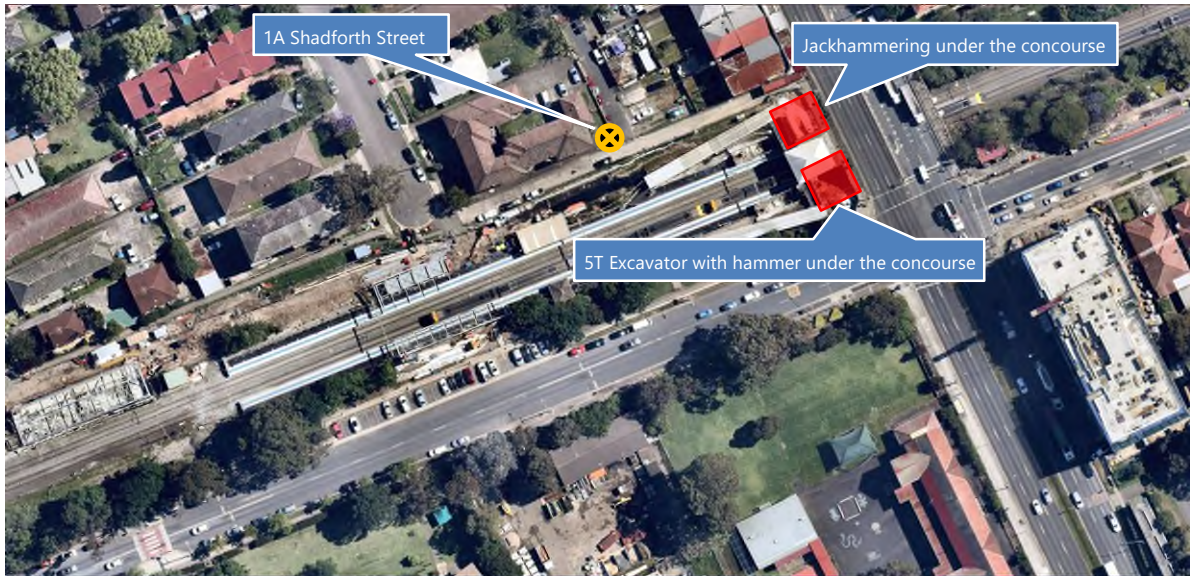
### A.1 3A and 7 Commons Street, Hurlstone Park



### A.2 20 Redman Parade, Belmore



### A.3 1A Shadforth Street, Wiley Park



### A.4 51 and 57 Ewart Lane, Dulwich Hill



### A.5 2 Hopetoun Street, Hurlstone Park



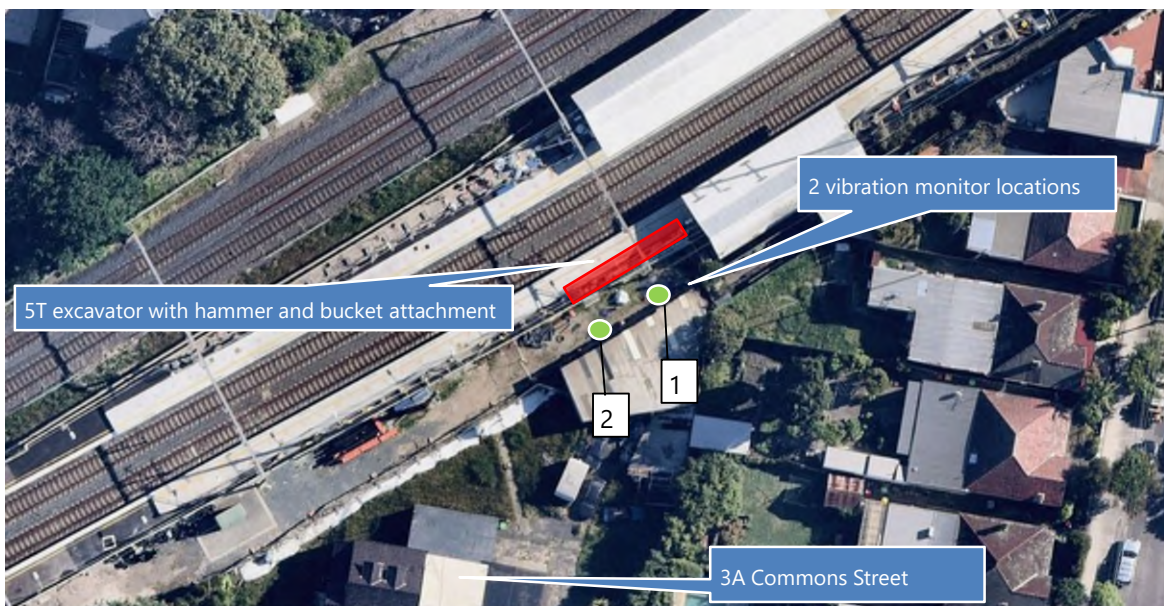
### A.6 105 Duntroon Street, Hurlstone Park



### A.7 48 Floss Street, Hurlstone Park



### A.8 Hurlstone Park Station



### A.9 Wiley Park Station





## Appendix 11 – TL927-1-17F01 WK19 NOISE AND VIBRATION MONITORING REPORT (R2)

11 November 2021

TL927-1-17F01 WE19 Noise and Vibration Monitoring Report (r2)

Downer EDI Works Pty Ltd

76 Berry Street

Nth Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - WE19 Possession Works

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct noise and vibration monitoring during the Station Upgrades WE19 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 Dulwich Hill Station works). The vibration monitoring was undertaken to establish site specific minimum working distances for vibration intensive plants and monitor potentially affected structures. This report provides a summary of the monitoring results.

### 2 Details of monitoring

Noise monitoring was undertaken at Dulwich Hill Station on 6<sup>th</sup> November 2021. Attended vibration monitoring was undertaken at Dulwich Hill Station on 6<sup>th</sup> November 2021. Two unattended vibration monitors were installed at the neighbouring garage structure at 3A Commons Street, Hurlstone Park between 5:00pm 5<sup>th</sup> November and 4:30pm 7<sup>th</sup> November 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 Dulwich Hill Station during rockhammering activity. 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	51A Ewart Lane, Dulwich Hill (Appendix A.1)	06.11.2021 08:52am - 09:07am	5T excavator with hammer attachment, delivery truck and vacuum truck	Noise	30m	No
M2	57A Ewart Lane, Dulwich Hill (Appendix A.1)	06.11.2021 09:08am - 09:23am	5T excavator with hammer attachment, 3T excavator moving materials	Noise	35m	No
M3	59 Ewart Steet, Dulwich Hill (Appendix A.1)	06.11.2021 09:24am - 09:40am	5T excavator with hammer attachment, rotary cutter, reversing beeper and vacuum truck	Noise	50m	No
M4	Dulwich Hill Station (Appendix A.2)	06.11.2021 10:00am – 11:00am	5T excavator with hammer attachment	Vibration	3m, 5m and 6m	N/A
M5	Neighbouring garage structure at 3A Commons Street, Hurlstone Park (Appendix A.3)	05.11.2021 – 07.11.2021 05:00pm – 04:30pm	Power hand tools, excavator with bucket 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-2

## 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	51A Ewart Lane, Dulwich Hill	06.11.2021 08:52am	Clear sky; air temperature 24°C, wind speed <5 m/s; relative humidity 46%.
M2	57A Ewart Lane, Dulwich Hill	06.11.2021 09:08am	Clear sky; air temperature 24°C, wind speed <5 m/s; relative humidity 46%.
M3	59 Ewart Steet, Dulwich Hill	06.11.2021 09:24am	Clear sky; air temperature 24°C, wind speed <5 m/s; relative humidity 46%.

### 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	51A 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 <sup>H</sup>	5T excavator with hammer attachment, delivery truck and vacuum truck	74*	82	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is consistent with the predicted noise level.
M2	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 <sup>H</sup>	5T excavator with hammer attachment, 3T excavator moving materials	70*	86	No ( $L_{Aeq, 15min}$ )	The measured $L_{Aeq, 15min}$ is lower than the predicted noise level. The measured $L_{Amax}$ was caused by a construction worker dropping materials. Note that the measured noise level is lower than the predicted noise level because the rockhammering activity is intermittent during the measurement. Furthermore, the rockhammering work area is at a lower ground level compared to the measurement location. Therefore, the rockhammering activity was partially shielded at this monitoring location.
M3	59 Ewart Steet, 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 <sup>H</sup>	5T excavator with hammer attachment, rotary cutter, reversing beeper and vacuum truck	63*	78	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 the rockhammering activity is intermittent during the measurement. The rockhammering work area is at a lower ground level compared to the measurement location. Therefore, the rockhammering activity was partially shielded at this monitoring location. Furthermore, it was noted on site that the measured construction activity was approximately 50 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: H: Predicted  $L_{Aeq, 15min}$  for high impact activities  
 \*: Added 5dB(A) penalty for high impact activities

It can be seen from Table 3-1 that, the measured  $L_{Aeq, 15min}$  noise levels were below the predicted noise levels (measured  $L_{Aeq, 15min}$  for 51A Ewart Lane was consistent with the predicted noise level). The mitigation and management measures implemented were therefore considered suitable for the measured 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 – OOHWA Assessment Stage 2 Possession Works (CNV-OOHWA)<sup>1</sup> 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	Baseline 95 <sup>th</sup> percentile PPV	95 <sup>th</sup> percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
M4	Dulwich Hill Station	5T excavator with hammer attachment	6m	0.04	0.90	0.95	At a distance of 6 metres away, the 5T excavator with hammer attachment produced vibration levels that are below the established vibration screening criteria.
		5T excavator with hammer attachment	5m	0.04	1.08	1.13	At a distance of 5 metres away, the 5T excavator with hammer attachment produced vibration levels that are below the established vibration screening criteria.
		5T excavator with hammer attachment	3m	0.04	1.60	1.66	At a distance of 3 metres away, the 5T excavator with hammer attachment produced vibration levels that are below the established vibration screening criteria.

It can be seen from Table 4-1 that the 5T excavator with hammer attachment produced vibration levels that were below the established vibration criteria, at a distance of 3 metres away. As a result, the site specific minimum working distance for the 5T excavator with hammer attachment is 3 metres for heritage, reinforced or unreinforced structures.

<sup>1</sup> 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<sup>2</sup>, the established vibration limits for the affected garage structure are shown below:

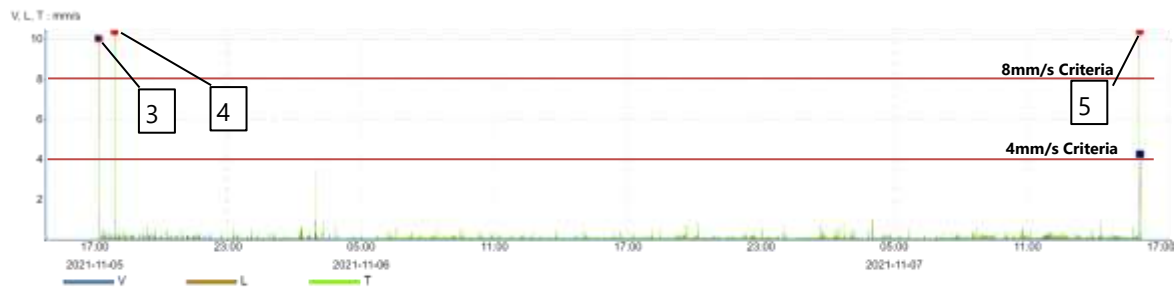
- Greater than or equal to 4 mm/s (cosmetic damage is possible);
- Greater than or equal to 8 mm/s (cosmetic damage becoming more likely).

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.3)



Figure 4-2: Unattended vibration monitoring location 2 results (refer to Appendix A.3)



<sup>2</sup> 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	05.11.2021 05:32pm	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	07.11.2021 04:06pm	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.
3	05.11.2021 05:12pm	At this time, the vibration monitor was mounted on the ground spike to commence monitoring. Exceedance was not caused by the nearby construction activities.
4	05.11.2021 05:54pm	At this time, a Renzo Tonin & Associates engineer checked and tested if the vibration monitor was operating correctly. Exceedance was not caused by the nearby construction activities.
5	07.11.2021 03:54pm	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 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 which are justified in Table 4-2.

## 5 Conclusion

Renzo Tonin & Associates completed noise and vibration monitoring for the WE19 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 Dulwich Hill Station, the site specific minimum working distance for the 5T excavator with hammer attachment was established at 3 metres away 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 is outlined in Table 4-2.

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
11.11.2021	First Issue	0, 1	2	J. Liang	M. Tabacchi/ T. Gowen	T. Gowen
File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\17 October WE19 possession\TL927-1-17F01 WE19 Noise and Vibration Monitoring Report (r2).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.

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 systems (eg facade / 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

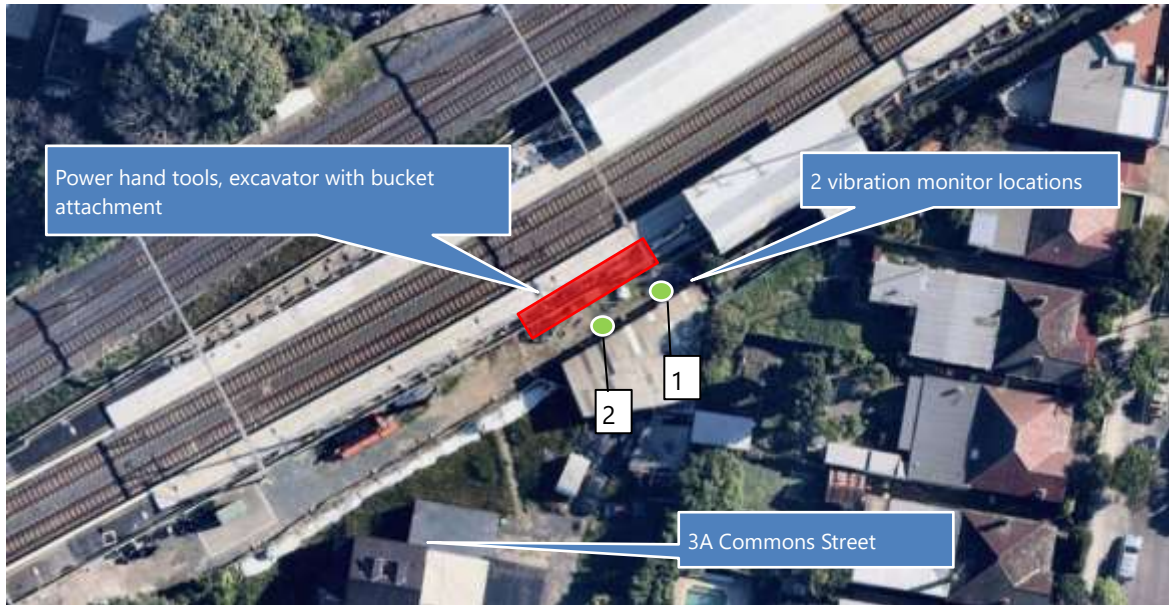
### A.1 51A Ewart Lane, 57 Ewart Lane and 59 Ewart Street, Dulwich Hill



### A.2 Dulwich Hill Station (Vibration)



### A.3 Hurlstone Park Station (Vibration)



---

## Appendix 12 – TL927-1-03F01 HURLSTONE PARK STN VIB MON REPORT (R1)

13 May 2021

TL927-1-03F01 Hurlstone Park Stn VIB MON Report (r1)

Downer EDI Works Pty Ltd  
76 Berry Street  
North Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - Hurlstone Park Station Vibration Report

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct vibration monitoring during the Station Upgrade works for Sydney Metro Southwest. The monitoring was undertaken to determine the site specific minimum working distances, when a specific handheld jackhammer is being operated.

### 2 Details of monitoring

Vibration monitoring was undertaken at Hurlstone Park Station during the jackhammering works on 12<sup>th</sup> May 2021.

#### 2.1 Measurement location

The vibration monitoring was conducted on the station platform at Hurlstone Park Station. The measurement location is listed in Table 2-1. Figures depicting the monitoring location is included in APPENDIX A.

**Table 2-1: Measurement location**

Assessment Point	Date	Time	Measured plant	Measured distance
Hurlstone Park Station	12.05.2021	09:20am – 09:35am	96 pounds handheld jackhammer*	0.5, 1, 2, 3 metres away from the source

Notes \* The plant specification provided by the operator

The instrumentation used for the vibration measurement is summarised in Table 2-2. The accelerometers used in the measurements have current calibration certificates.

**Table 2-2 – Instrumentation**

Type	Make / Model
Type 1 Signal Analyser	Soundbook-2
Accelerometer	Endevco 61C3

### 3 Vibration Monitoring results

The established vibration criteria for cosmetic damage 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 present in below.

**Table 3-1: Measured vibration levels**

Plant	Distance from source	95 <sup>th</sup> percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
96 pound handheld jackhammer	0.5m	1.17	1.35	At 0.5 metres away, the 96 pounds handheld jackhammer produced vibration levels that are below the established vibration criteria.
	1m	0.97	1.11	At 1 metre away, the 96 pounds handheld jackhammer produced vibration levels that are below the established vibration criteria.
	2m	0.85	1.11	At 2 metres away, the 96 pounds handheld jackhammer produced vibration levels that are below the established vibration criteria.
	3m	0.30	0.32	At 3 metres away, the 96 pounds handheld jackhammer produced vibration levels that are below the established vibration criteria.

It can be seen from Table 3-1 that, the 96 pound handheld jackhammer produced vibration levels that were below the vibration criterion of 2.5 mm/s for heritage structures, at a distance of 0.5 metres away. As a result, the site specific minimum working distance for the 96 pounds handheld jackhammer is 0.5 metres for heritage, reinforced or unreinforced structures.

### 4 Conclusion

Renzo Tonin & Associates completed vibration monitoring for the Station Upgrade works for Sydney Metro Southwest. The vibration measurements established the site specific minimum working distances for the 96 pounds handheld jackhammer, allowing works at  $\geq 0.5$  metres for heritage, reinforced or unreinforced structures.

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
13.05.2021	First Issue	0	1	R. Zhafranata	T. Gowen	T. Gowen
File Path: \\syd-server\rtagroups\syd\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\03 VIB MON Hurlstone Park Stn 20210512\TL927-1-03F01 Hurlstone Park Stn VIB MON 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.

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.

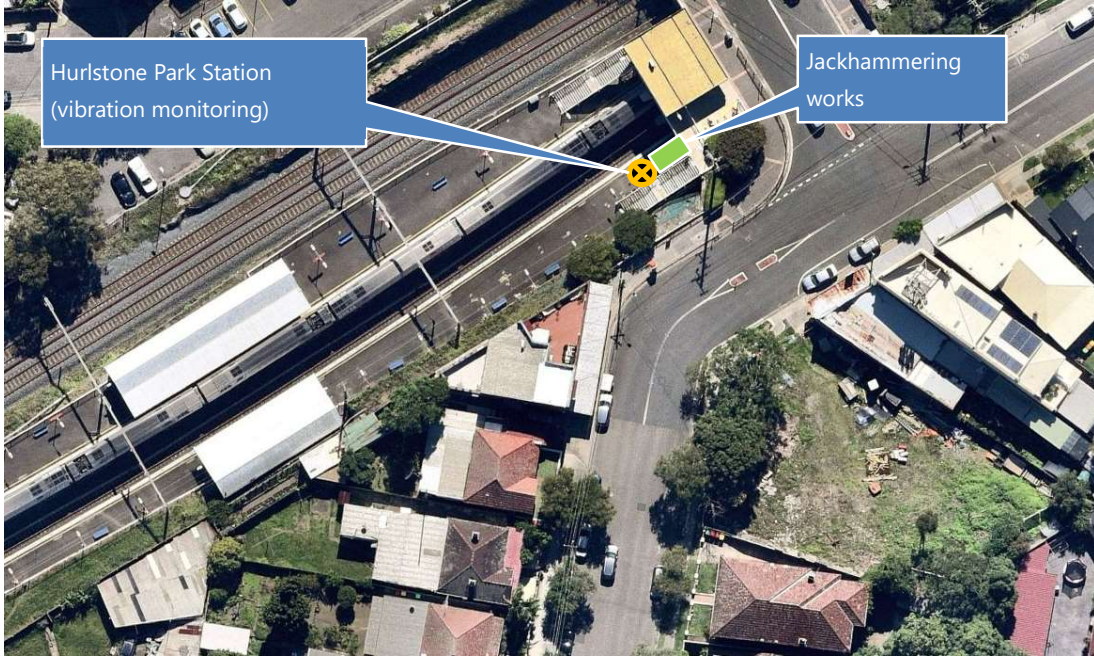
The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural 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 systems (eg facade / 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 location

### A.1 Hurlstone Park Station



---

## Appendix 13 – TL927-1-04F01 WILEY PARK STN VIB MON REPORT (R1)

25 May 2021

TL927-1-04f01 Wiley Park Stn VIB MON Report (r1)

Downer EDI Works Pty Ltd  
76 Berry Street  
North Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - Wiley Park Station Vibration Report

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct vibration monitoring during the Station Upgrade works for Sydney Metro Southwest. The monitoring was undertaken to determine the site specific minimum working distances, when a specific excavator with hammer attachment is being operated.

### 2 Details of monitoring

Vibration monitoring was undertaken at Hurlstone Park Station during the jackhammering works on 14<sup>th</sup> May 2021.

#### 2.1 Measurement location

The vibration monitoring was conducted on the station platform at Wiley Park Station. The measurement location is listed in Table 2-1. Figures depicting the monitoring location is included in APPENDIX A.

**Table 2-1: Measurement location**

Assessment Point	Date	Time	Measured plant	Measured slant distance
Wiley Park Station	14.05.2021	09:17am – 10:00am	1.7T Kubota excavator with hammer attachment*	3, 4, 5 metres away from the source

Notes \* The plant specification provided by the operator

The instrumentation used for the vibration measurement is summarised in Table 2-2. The accelerometers used in the measurements have current calibration certificates.

**Table 2-2 – Instrumentation**

Type	Make / Model
Type 1 Signal Analyser	Soundbook-2
Accelerometer	Endevco 61C3

### 3 Vibration Monitoring results

The established vibration criteria for cosmetic damage 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 present in below.

**Table 3-1: Measured vibration levels**

Plant	Slant distance from source	95 <sup>th</sup> percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
1.7T Kubota excavator with hammer attachment	3m	0.73	1.24	At a slant distance of 3 metres away, the 1.7T Kubota excavator with hammer attachment produced vibration levels that are below the established vibration criteria.
	4m	0.23	0.56	At a slant distance of 4 metres away, the 1.7T Kubota excavator with hammer attachment produced vibration levels that are below the established vibration criteria.
	5m	0.20	0.24	At a slant distance of 5 metres away, the 1.7T Kubota excavator with hammer attachment produced vibration levels that are below the established vibration criteria.

It can be seen from Table 3-1 that, the 1.7T Kubota excavator with hammer attachment produced vibration levels that were well below the vibration criterion of 2.5 mm/s for heritage structures, at a slant distance of 3 metres away. As a result, the site specific minimum working distance for the 1.7T Kubota excavator with hammer attachment is 3 metres for heritage, reinforced or unreinforced structures.

### 4 Conclusion

Renzo Tonin & Associates completed vibration monitoring for the Station Upgrade works for Sydney Metro Southwest. The vibration measurements established the site specific minimum working distances for the 1.7T Kubota excavator with hammer attachment, allowing works at  $\geq 3$  metres for heritage, reinforced or unreinforced structures.

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
25.05.2021	First Issue	0	1	R. Zhafranata	T. Gowen	T. Gowen

File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\04 VIB MON Wiley Park Stn 20210514\TL927-1-04f01 Wiley Park Stn VIB MON 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.

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.

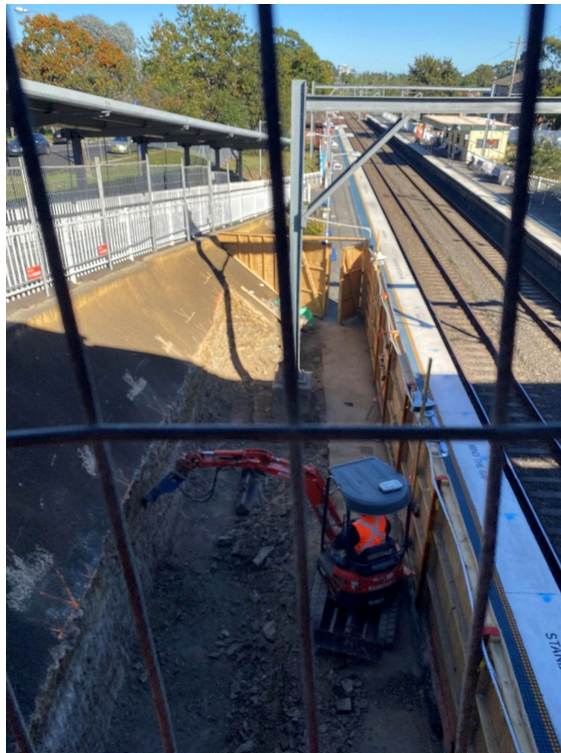
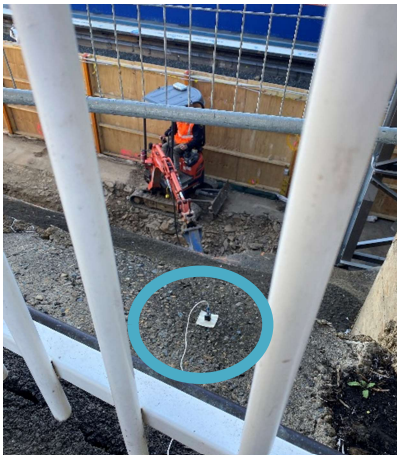
We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, 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 systems (eg facade / 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 location

### A.1 Wiley Park Station



---

## Appendix 14 – TL927-1-05F01 PUNCHBOWL STN VIB MON REPORT (R1)

19 May 2021

TL927-1-05F01 Punchbowl Stn VIB MON Report (r1)

Downer EDI Works Pty Ltd  
76 Berry Street  
North Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - Punchbowl Station Vibration Report

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct vibration monitoring during the Station Upgrade works for Sydney Metro Southwest. The monitoring was undertaken to determine the site specific minimum working distances when a specific plate compactor is being operated.

### 2 Details of monitoring

Vibration monitoring was undertaken at Punchbowl Station during the plate compacting works on 18<sup>th</sup> May 2021.

#### 2.1 Measurement location

The vibration monitoring was conducted on the station platform at Punchbowl Station. The measurement location is listed in Table 2-1. Figures depicting the monitoring location are included in APPENDIX A.

**Table 2-1: Measurement location**

Assessment Point	Date	Time	Measured plant	Measured distance
Punchbowl Station	18.05.2021	11:38am – 11:45am	80kg plate compactor*	1, 2, 3 metres away from the source

Notes \* The plant specification provided by the operator

The instrumentation used for the vibration measurement is summarised in Table 2-2. The accelerometers used in the measurements have current calibration certificates.



**Table 2-2 – Instrumentation**

Type	Make / Model
Type 1 Signal Analyser	Soundbook-2
Accelerometer	Endevco 61C3

### 3 Vibration Monitoring results

The established vibration screening criteria for cosmetic damage are 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 present in below.

**Table 3-1: Measured vibration levels**

Plant	Distance from source	95 <sup>th</sup> percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
80kg plate compactor	1m	2.26	2.38	At a distance of 1 metre away, the 80kg plate compactor produced vibration levels that are below the established vibration screening criteria.
	2m	0.85	1.22	At a distance of 2 metres away, the 80kg plate compactor produced vibration levels that are below the established vibration screening criteria.
	3m	0.75	0.86	At a distance of 3 metres away, the 80kg plate compactor produced vibration levels that are below the established vibration screening criteria.

It can be seen from Table 3-1 that, the 80kg plate compactor produced vibration levels that were below the vibration criterion of 2.5 mm/s for heritage structures, at a distance of 1 metre away. As a result, the site specific minimum working distance for the 80kg plate compactor is 1 metre for heritage, reinforced or unreinforced structures.

### 4 Conclusion

Renzo Tonin & Associates completed vibration monitoring for the Station Upgrade works for Sydney Metro Southwest. The vibration measurements established the site specific minimum working distances for the 80kg plate compactor, allowing works at  $\geq 1$  metre for heritage, reinforced or unreinforced structures.

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
19.05.2021	First Issue	0	1	R. Zhafranata	T. Gowen	T. Gowen

File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\05 VIB MON Punchbowl Stn 20210518\TL927-1-05F01 Punchbowl Stn VIB MON 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.

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 systems (eg facade / 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 location

### A.1 Punchbowl Station



## Appendix 15 – TL927-1-06F01 BELMORE METRO BUILDING SITE VIB MON REPORT (R1)

24 May 2021

TL927-1-06F01 Belmore Metro Building Site VIB MON Report (r1)

Downer EDI Works Pty Ltd

76 Berry Street

North Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - Belmore Metro Service Building Site Vibration Report

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct vibration monitoring during the Station Upgrade works for Sydney Metro Southwest. The monitoring was undertaken to determine the site specific minimum working distances when a specific smooth drum roller is being operated.

### 2 Details of monitoring

Vibration monitoring was undertaken at the Belmore Metro Service site during the vibratory roller works on 20<sup>th</sup> May 2021.

#### 2.1 Measurement location

The measurement location is listed in Table 2-1. Figures depicting the monitoring location are included in APPENDIX A.

**Table 2-1: Measurement location**

Assessment Point	Date	Time	Surface Geology	Measured plant	Measured distance
Belmore Metro Service Building site	20.05.2021	11:23am – 12:00pm	Clay	10T smooth drum roller*	3, 4, 5 metres away from the source

Notes \* The plant specification provided by the operator

The instrumentation used for the vibration measurement is summarised in Table 2-2. The accelerometers used in the measurements have current calibration certificates.

**Table 2-2 – Instrumentation**

Type	Make / Model
Type 1 Signal Analyser	Soundbook-2
Accelerometer	Endevco 61C3

### 3 Vibration Monitoring results

The established vibration screening criteria for cosmetic damage are 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 present in below.

**Table 3-1: Measured vibration levels**

Plant	Distance from source	Mode	95 <sup>th</sup> percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
10T smooth drum roller	3m	Static	<0.5	<0.5	During this measurement, vibration signals from the source could not be detected.
		Vibratory	1.74	1.87	At a distance of 3 metres away with vibratory mode, the 10T smooth drum roller produced vibration levels that are below the established vibration screening criteria.
	4m	Static	<0.5	<0.5	During this measurement, vibration signals from the source could not be detected.
		Vibratory	1.26	1.39	At a distance of 4 metres away with vibratory mode, the 10T smooth drum roller produced vibration levels that are below the established vibration screening criteria.
	5m	Static	<0.5	<0.5	During this measurement, vibration signals from the source could not be detected.
		Vibratory	0.76	0.85	At a distance of 5 metres away with vibratory mode, the 10T smooth drum roller produced vibration levels that are below the established vibration screening criteria.

It can be seen from Table 3-1 that, the 10T smooth drum roller produced vibration levels that were below the vibration criterion of 2.5 mm/s for heritage structures, at a distance of 3 metres away. As a result, the site specific minimum working distance for the 10T smooth drum roller operating on a clay surface is 3 metres for heritage, reinforced or unreinforced structures.

## 4 Conclusion

Renzo Tonin & Associates completed vibration monitoring for the Station Upgrade works for Sydney Metro Southwest. The vibration measurements established the site specific minimum working distances for the 10T smooth drum roller, allowing works at  $\geq 3$  metres for heritage, reinforced or unreinforced structures.

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
24.05.2021	First Issue	0	1	R. Zhafranata	T. Gowen	T. Gowen

File Path: \\syd-server\rtagroups\syd\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\06 VIB MON Belmore Metro Service Building Site 20210520\TL927-1-06F01 Belmore Metro Building Site VIB MON 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.

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 systems (eg facade / 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 location

### A.1 Belmore Metro Service Building site



---

## Appendix 16 – TL927-1-12F01 HURLSTONE PARK STN VIB MON REPORT (R1)

11 October 2021

TL927-1-12F01 Hurlstone Park Stn VIB MON Report (r1)

Downer EDI Works Pty Ltd

76 Berry Street

North Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - Hurlstone Park Station Vibration Report

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct vibration monitoring during the Station Upgrade works for Sydney Metro Southwest. The monitoring was undertaken to determine the site specific minimum working distances when a specific handheld jackhammer is being operated.

### 2 Details of monitoring

Vibration monitoring was undertaken at Hurlstone Park Station during the jackhammering works on 7<sup>th</sup> October 2021.

#### 2.1 Measurement location

The vibration monitoring was conducted on the station platform at Hurlstone Park Station. The measurement location is listed in Table 2-1. Figures depicting the monitoring location is included in APPENDIX A.

**Table 2-1: Measurement location**

Assessment Point	Date	Time	Measured plant	Measured distance
Hurlstone Park Station	07.10.2021	10:00am – 10:30am	96 pound handheld jackhammer*	1 and 2 metres away from the source

Notes \* The plant specification provided by the operator

The instrumentation used for the vibration measurement is summarised in Table 2-2. The accelerometers used in the measurements have current calibration certificates.

**Table 2-2 – Instrumentation**

Type	Make / Model
Type 1 Signal Analyser	Soundbook-2
Accelerometer	Endevco 61C3

### 3 Vibration Monitoring results

The established conservative vibration screening levels for cosmetic damage are as follows:

- Reinforced or frame structures: 25.0 mm/s
- Unreinforced or light framed structures (including sound heritage structures): 7.5 mm/s
- (Unsound) heritage structures: 2.5 mm/s

The results of the vibration monitoring are presented in Table 3-1.

**Table 3-1: Measured vibration levels**

Plant	Distance from source	95 <sup>th</sup> percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
96 pound handheld jackhammer	1m	3.93	4.05	At 1 metre away, the 96 pound handheld jackhammer produced vibration levels that are below the established vibration screening level for unreinforced or light framed structures (including sound heritage structures).
	2m	1.99	2.02	At 2 metres away, the 96 pound handheld jackhammer produced vibration levels that are below the established vibration screening levels.

It can be seen from Table 3-1 that, the measured vibration levels were higher than the previous handheld jackhammer vibration measurements<sup>1</sup>. The higher vibration levels were recorded likely due to a harder and more consistent rock (As shown in Appendix A.1). As a result, the revised specific minimum working distances for the 96 pound handheld jackhammer is 1 metre for unreinforced or light framed structures/sound heritage structures and 2 metres for (unsound) heritage structures.

### 4 Conclusion

Renzo Tonin & Associates has completed vibration monitoring for the Station Upgrade works for Sydney Metro Southwest. The vibration measurements established the site specific minimum working distances for the 96 pound handheld jackhammer, allowing works at  $\geq 1$  metre for reinforced or unreinforced structures (including sound heritage structures) and  $\geq 2$  metres for (unsound) heritage structures.

<sup>1</sup> TL927-1-03F01 Hurlstone Park Stn VIB MON Report (r1), dated 13.05.2021

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
11.10.2021	First Issue	0	1	R. Zhafranata	T. Gowen	T. Gowen

File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\12 VIB MON Hurlstone Park Stn 20211007\TL927-1-12D01 Hurlstone Park Stn VIB MON Report (r0).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.

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.

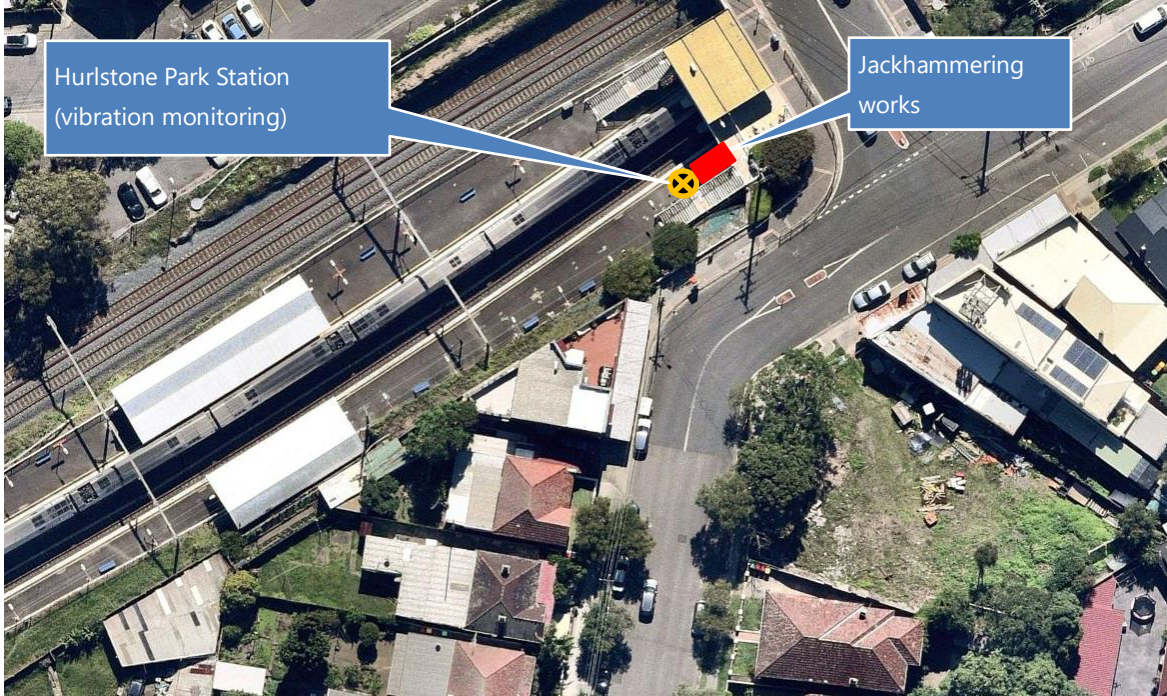
We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, 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 systems (eg facade / 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 location

### A.1 Hurlstone Park Station



---

## Appendix 17 – TL927-1-13F01 DULWICH HILL STN VIB MON REPORT (R1)

11 October 2021

TL927-1-13F01 Dulwich Hill Stn VIB MON Report (r1)

Downer EDI Works Pty Ltd

76 Berry Street

North Sydney NSW 2060

## Sydney Metro Southwest - Station Upgrades - Dulwich Hill Station Vibration Report

### 1 Introduction

Renzo Tonin & Associates was engaged by Downer EDI Works to conduct vibration monitoring during the Station Upgrade works for Sydney Metro Southwest. Downer EDI was advised of a complaint from the resident 1 Ewart Lane, Dulwich Hill regarding vibration impact from the works at Dulwich Hill Station site. The monitoring was undertaken in response to the complaint.

### 2 Details of monitoring

Vibration monitoring was undertaken at the boundary of 1 Ewart Lane, Dulwich Hill during the rockhammering works on 7<sup>th</sup> October 2021.

#### 2.1 Measurement location

The vibration monitoring was conducted at the boundary of 1 Ewart Lane, Dulwich Hill. The vibration monitoring was not conducted inside the property because access to the property was not permitted. The measurement location is listed in Table 2-1. Figures depicting the monitoring location is included in APPENDIX A.

**Table 2-1: Measurement location**

Assessment Point	Date	Time	Measured plant	Measured distance
1 Ewart Lane, Dulwich Hill	07.10.2021	11:00am – 11:30am	5T excavator with a hammer attachment*	The vibration monitor was 7 metres away from the rockhammering activity

Notes \* The plant specification provided by the operator

The instrumentation used for the vibration measurement is summarised in Table 2-2. The accelerometers used in the measurements have current calibration certificates.



**Table 2-2 – Instrumentation**

Type	Make / Model
Type 1 Signal Analyser	Soundbook-2
Accelerometer	Endevco 61C3

### 3 Vibration Monitoring results

The established conservative vibration screening levels for cosmetic damage are as follows:

- Reinforced or frame structures: 25.0 mm/s
- Unreinforced or light framed structures (including sound heritage structures): 7.5 mm/s
- (Unsound) heritage structures: 2.5 mm/s

The results of the vibration monitoring are presented in Table 3-1.

**Table 3-1: Measured vibration levels**

Plant	Distance from source	95 <sup>th</sup> percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
5T excavator with hammer attachment	7m	1.74	1.78	At the affected property boundary, the 5T excavator with hammer attachment produced vibration levels that are below the established vibration screening levels.

It can be seen from Table 3-1 that, the 5T excavator with hammer produced vibration levels that are below the established vibration screening levels at the affected property boundary. Given that the distance between the rockhammering activity and the closest facade of the affected property is approximately 13 metres, the risk of cosmetic damage from the works is negligible.

### 4 Conclusion

Renzo Tonin & Associates has completed vibration monitoring for the Station Upgrade works for Sydney Metro Southwest. The vibration measurement has shown that the 5T excavator with hammer attachment complies with the established screening levels at 7 metres away from the works. As the complainant's property is approximately 13 metres away from the works, the risk of cosmetic damage is negligible.

## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
11.10.2021	First Issue	0	1	R. Zhafranata	T. Gowen	T. Gowen

File Path: R:\AssocSydProjects\TL901-TL950\TL927 Southwest Metro - Stations Upgrades\1 Docs\13 VIB MON Dulwich Hill Stn 20211007\TL927-1-13D01 Dulwich Hill Stn VIB MON Report (r0).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.

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 systems (eg facade / 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 location

### A.1 Dulwich Hill Station

