Southwest Metro Early Works Construction Monitoring Report - August 2019 to January 2020

SMCSWSSJ-JHL-WEC-EM-REP-000007

Document and Revision History

Document Details	
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Revisions

Revision	Date	Description	Prepared by	Reviewed by
0	7/02/20	Issued for comment	Dan Keegan	Paul Fields
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Management reviews

Review date	Details	Reviewed by

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Compliance Matrix

Condition	Requirement	Reference
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.	Section 1.1

1. Introduction

The Construction Monitoring Program is being implemented to monitor impacts on surrounding surface water quality resources and impacts from noise and vibration on the surrounding areas during the construction phase. The surface water monitoring program and noise and vibration monitoring program are also both designed to assess the effectiveness of the mitigation measures applied as part of the Southwest Metro Early Works (SMEW).

1.1 Submission Requirements

In accordance with condition C14, this will be submitted to the following agencies for information:

- City of Canterbury Bankstown
- Inner West Council
- DPIE

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

1.2 Surface Water

The project site is located within the rail corridor n the T3 Bankstown line between Sydenham and Campsie, NSW.

The Project site forms 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.

Project works occur adjacent to the Cooks River at the Canterbury (Cooks River) Underbridge. Project works occurring adjacent to the Cooks River include embankments stabilisation, combined service route installation and construction of security fencing.

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

1.3 Noise and Vibration

The area surrounding the SMEW project contains a variety of land-use types and receivers, including residential receivers, commercial, industrial, sensitive non-residential receivers. These land-uses are mixed within the identified noise catchments, though in general there are clusters of industrial and commercial areas surrounding stations, and primarily residential areas between stations. The area surrounding the project is affected by rail noise and vibration.

The majority of works will occur within the rail corridor between stations, works will mainly occur adjacent to residential properties.

A number of sensitive non-residential receivers have been identified within the vicinity of the project works. These include;

- Casimir Catholic College
- St Maroun's College
- Dulwich Hill Childcare Centre
- Canterbury Family Day Care

To date, no noise or vibration intensive construction activities have taken place in in the vicinity of these facilities.

Objectives for noise and vibration management on the project are:

- Minimise unreasonable noise and vibration impacts on residents and businesses
- Avoid structural damage to buildings or heritages items as a result of construction vibration
- Maintain positive, co-operative relationships with schools, childcare centres, local residents and building owners and undertake active community consultation

Construction noise levels for some SMEW activities are expected to exceed the external noise management level at times, particularly during works outside of standard hours, resulting in noise impacts to outdoor spaces. Internal and external noise levels will be assessed as part of the OOHW protocol and monitored accordingly.

Most construction works will not generate vibration which would be perceptible within the nearest residences, but some works, such as compaction by vibratory roller may generate vibration levels above the vibration criteria at the nearest residences on Garnet Street, Dulwich Hill and Charles Street, Canterbury.

2. Methodology

2.1 Surface Water

Surface water monitoring is undertaken at four points adjacent to the Canterbury Cooks River Underbridge, two upstream (Cooks River East 1 and Cooks River West 1) and two downstream (Cooks River East 2 and Cooks River West 2). All locations are located at the bank of the Cooks River as these are the locations that are generally accessible. Refer to Figure 1 for sampling locations.

The Cooks River is tidal at the test locations. During low tide events some sample locations are inaccessible.

The channel is uncovered for the majority of its length along the project. The water level in the channel is generally fairly shallow outside of significant rain events (less than 20cm), with limited vegetation. Water sources are diverse urban run-off from collected stormwater.

The locations identified for surface water monitoring are the only locations that generally offer safe access. There are several drainage outlets between the upstream and downstream sampling points on both sides of the Cooks River.

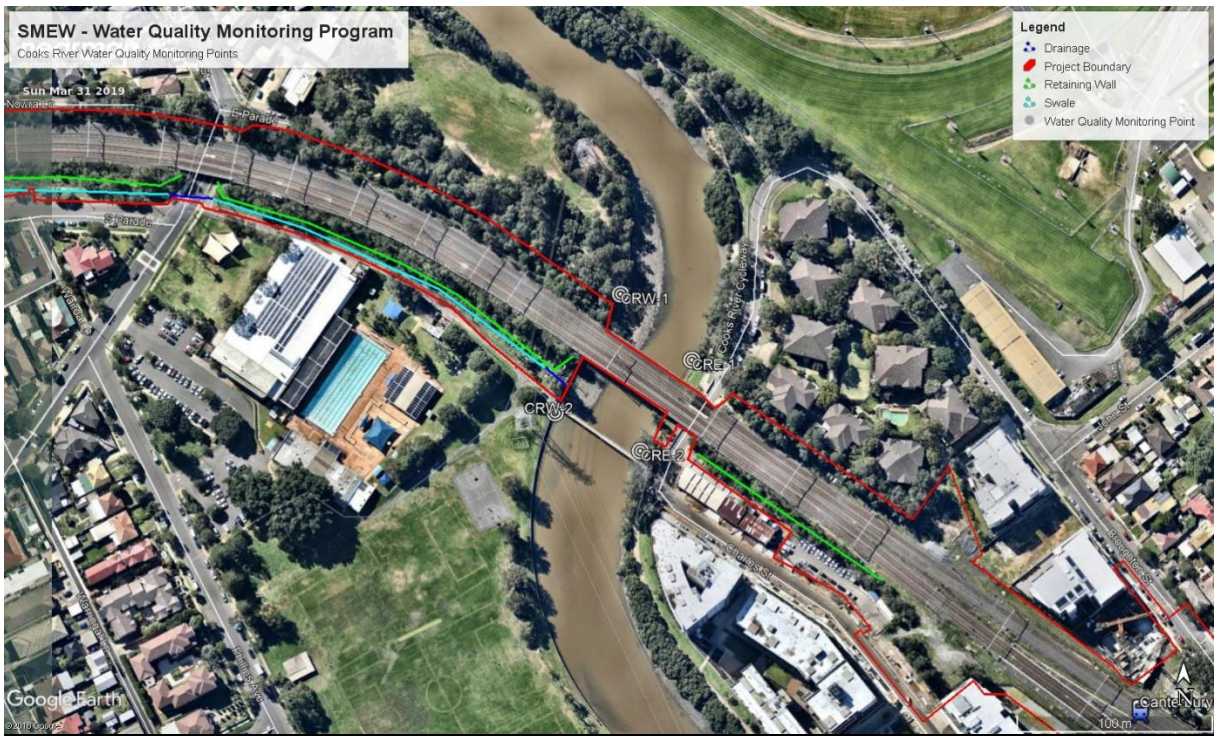

Figure 1 - Surface Water Monitoring Locations

In accordance with the Monitoring Program, surface water quality monitoring is to be undertaken as follows for the parameters in Table 1:

- Pre-construction – monthly, pending safe access
- SSJ construction stage – every three months & 4 wet weather events per year, pending safe access

Pre-construction monitoring was taken monthly. Surface water quality monitoring of the receiving environment prior to construction is highly unlikely to define suitable standards or benchmarks for water quality discharges from the SMEW site given that water quality from urban areas that contribute water to the Cooks River between upstream and downstream test locations are highly variable and change according to activities within the local catchment, prevailing weather patterns and day-to-day during rainfall.

Canterbury Racecourse BOM weather observations were used to report the amount of rainfall 24hrs prior to monitoring and to determine when reportable rain event occurs.

During the monitoring period, there was one occasion where the monitoring sites could not be safely accessed after heavy rain on 31st Aug 2019.

The Environment Protection Licence (#21147) provides the project with criteria to discharge off-site through approved discharge points. These criteria must be met prior to discharge. A record of monitoring for dewatering on the project is maintained and made available on the Project website. There are currently no active sediment basins on the project, and none have been identified during the construction phase of the project to date.

Table 1 - Water Monitoring Parameters

Parameter	Sampling Methods	Analytical Method	ANZECC Criteria* Freshwater	Proposed Trigger Values	Proposed Actions
Temperature (°C)	Probe	Field analysis	> 80%ile < 20%ile	Downstream results are > than upstream results in rainfall events up to and including the significant event threshold of >20mm 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.
Dissolved Oxygen (DO)	Probe	Field analysis	Lower limit – 85 Upper limit – 110		
Turbidity (NTU)	Probe	Field analysis	6 – 50		
Oil and grease	Visual analysis, then grab sample if required	Visual assessment. Confirmed with lab analysis if required	-		
pH	Probe, grab sample if required	Field analysis, lab analysis if required	Lower limit – 6.5 Upper limit – 8.5		
Salinity (EC)	Probe	Field analysis	125 – 2200		
Total Suspended Solids (TSS)	Probe, grab sample if required	Field analysis, lab analysis if required	-		
Total phosphorus	Grab sample	Lab analysis	25ug/L		
Total nitrogen	Grab sample	Lab analysis	350ug/L		
Chlorophyll-a	Grab sample	Lab analysis	3ug/L		

2.2 Noise and Vibration monitoring

As part of the Noise and Vibration Assessment within the Sydney Metro Sydenham to Bankstown Upgrade Environmental Impact Statement, the area surrounding the SMEW site was divided into 7 Noise Catchment Areas (NCAs). Noise monitoring was undertaken in 2016 to determine the Rating Background Level for these catchments. The Rating Background Levels for all NCAs are shown in Table 2.

Table 2 - RBLs for SSJ Noise Catchment Areas

NCA	Daytime RBL (7am to 6pm)	Evening RBL (6pm to 10pm)	Night RBL (10pm to 7am)
1	38	38	33
2	38	38	33
3	38	38	34
4	40	40	35
5	36	36	32
6	45	42	35
7	41	41	35

Based on planned work in the construction phase, the areas most regularly impacted by construction noise and vibration are expected to be NCA4 and NCA5, adjacent to embankment stabilisation works. These two catchments contain a number of residential properties – See Figure 2 below.

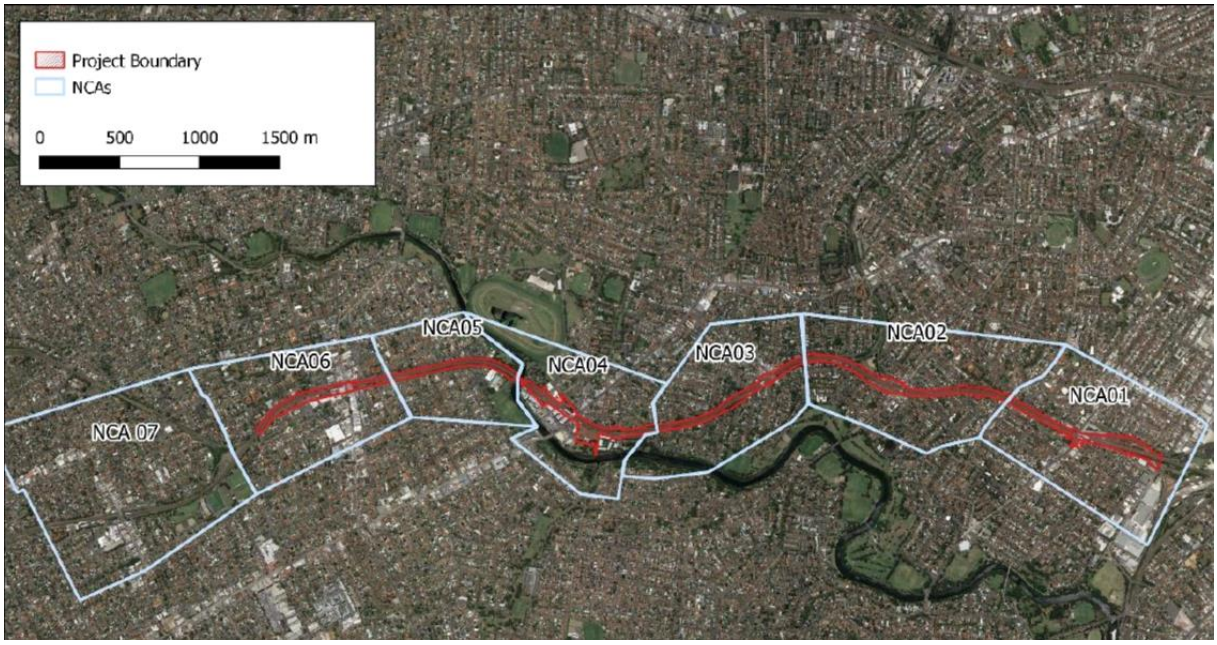

Figure 2 – Noise Catchment Areas

Monitoring is undertaken during construction activities (including out of hours works) where required in accordance with Section 8 of the CNVS and for validation purposes. Attended noise monitoring is undertaken in the event of a noise complaint. Where a complaint occurs, monitoring will be undertaken at the complainant's property, nearest to any work.

Vibration monitoring will be undertaken before and during works where buildings or structures exist within the safe work distances of vibratory plant. Monitoring will also be undertaken where vibration generating actives that have the potential to impact on heritage items. In accordance with the requirements of the CNVS, the vibration limits have been set out in the British Standard BS 7385-2:1993.

3. Results

3.1 Surface Water

Pre-construction monitoring took place over three months from May-July 2019, with four rounds of sampling collected from each of the four sampling points. Two rounds of sampling occurred during dry weather and two rounds of monitoring occurred during wet weather (i.e. greater than 20mm of rainfall in a 24 hour period). Although the pre-construction monitoring did not occur within the reporting period, the data is included within this report to provide context to the existing water quality within the Cooks River.

Pre-construction monitoring indicated that in some instances the existing pH, turbidity, salinity, dissolved oxygen, total phosphorus, total nitrogen and chlorophyll levels exceed the ANZECC lowlands river criteria on a number of occasions.

Monitoring during construction phase took place once per quarter. In addition, two wet weather monitoring events were recorded during the reporting period on 19/09/2019 and 20/01/2020 – see Table 3

Monitoring during the construction phase indicates that pH met the ANZECC criteria. Other parameters, including salinity, turbidity, dissolved oxygen, total phosphorus, total nitrogen and chlorophyll exceeded the ANZECC criteria, however the exceedances are comparable to those observed within the pre-Construction phase.

It is noted that SMEW also monitors water quality prior to any planned discharges to ensure water quality is within the parameters listed within the Environmental Protection Licence (No.21147), to minimise any potential impacts to surrounding waterways. This data is published monthly on the project website.

Table 3 - Surface Water Monitoring Results for Pre-construction and Construction Phases – Eastern and Western side of Cooks River for all 7 monitoring events

				CRE 1												CRE 2											
Date	**Site Activities**	**Total Rainfall in Previous 24hrs (mm)**	**Comments**	**Time**	**TSS (mg/l)**	**Temp (°C)**	**pH**	**Salinity (mS/cm)**	**Turbidity (NTU)**	**DO%**	**TDS (g/l)**	**Visible Oil / Grease**	**TP(ug/L)**	**TN (ug/L)**	**Chlorophyll**	**Time**	**TSS (mg/l)**	**Temp (°C)**	**pH**	**Salinity (mS/cm)**	**Turbidity (NTU)**	**DO%**	**TDS (g/l)**	**Visible Oil / Grease**	**TP(ug/L)**	**TN (ug/L)**	**Chlorophyll**
ANZECC Criteria					**N/A**	**>80% Percentile & <20% Percentile**	**6.5-8.5^**	**0.125-2.2***	**6-50**	**Lower Limit - 85 Upper Limit - 110**	**N/A**	**N/A**	**25**	**350**	**3**		**N/A**	**>80% Percentile & <20% Percentile**	**6.5-8.5^**	**0.125-2.2***	**6-50**	**Lower Limit - 85 Upper Limit - 110**	**N/A**	**N/A**	**25**	**350**	**3**
31/05/2019	Pre-construction - Baseline	0mm	Low tide Sample taken from top of water column	12:21	26	16.79	8.01	0.304	9.9	111.8	18.5	No	0	0	30	12:30	17	16.33	8	0.321	7.1	139.4	19.6	No	0	0	28
6/06/2019	Pre-construction - Baseline - wet weather event	Extended rainfall event - 29.0mm over past 72 hours	High tide Sample taken from top of water column	12:13	71	15.46	7.85	0.496	58.4	84.1	3.17	No	160	1500	8	12:05	58	13.92	7.84	0.601	47.1	88.6	3.79	No	140	1400	7
25/06/2019	Pre-construction - Baseline	9mm	Mid tide Sample taken from top of water column	14:50	93	15.66	7.69	625	55.8	61.1	0.4	No	190	2400	0	14:39	94	15.92	7.72	0.619	57.4	52.1	0.396	No	190	2400	1
29/07/2019	Pre-construction - Baseline	0mm	Low tide CRW1 and CRW2 taken from middle of water column with sampling pole CRE1 and CRE2 taken from top of water column with bottle (only practicable way to reach water)	12:44	40	15.78	6.19	27.6	25.2	84.5	17.1	No	50	1100	57	14:31	78	16.38	7.27	25.3	54.2	147.2	15.7	No	130	1200	56
19/09/2019	Construction - Wet weather	106mm	106mm fell over past 3 days No works in	15:24	81	19.13	7.5	0.656	57.4	68.6	0.42	Yes	200	3000	100	15:14	39	18.65	7.4	0.565	29.8	77.5	0.362	No	210	4200	0

			vicinity of Cooks River																					
30/09/2019	Quarterly	0mm	High tide Sample taken from top of water column No works in vicinity of Cooks River	7:56	21	18.32	7.8	26.4	8.4	146.2	16.4	Yes	70	600	2	7:45	25	18.18	7.9	26	15.7	40.8	16.1	No	70	500	2
12/12/2019	Quarterly	0mm	High tide Sample taken from top of water column Embankment stabilisation preparation works	11:08	36	23.54	7.24	33.5	39.1	75.3	20.4	Yes	700	200	23	11:01	38	23.34	7.26	35.1	38.6	76.9	21.4	No	230	800	16
20/01/2020	Construction - Wet weather	Extended rainfall event - 66.0mm over past 72 hours	Mid tide Sample taken from top of water column	15:30	28	22.45	6.99	4.98	9.9	60.8	3.17	No	240	1000	5	15:30	24	22.43	7.07	4.9	8.5	58.3	3.14	No	250	1000	7

				CRW 1												CRW 2										
Date	**Site Activities**	**Total Rainfall in Previous 24hrs (mm)**	**Comments**	**Time**	**TSS (mg/l)**	**Temp (°C)**	**pH**	**Salinity (mS/cm)**	**Turbidity (NTU)**	**DO%**	**TDS (g/l)**	**Visible Oil / Grease**	**TP(ug/L)**	**TN (ug/L)**	**Chlorophyll**	**Time**	**TSS (mg/l)**	**Temp (°C)**	**pH**	**Salinity (mS/cm)**	**Turbidity (NTU)**	**DO%**	**TDS (g/l)**	**Visible Oil / Grease**	**TP(ug/L)**	**TN (ug/L)**	**Chlorophyll**
ANZECC Criteria					**N/A**	**>80% Percentile & <20% Percentile**	**6.5-8.5^**	**0.125-2.2***	**6-50**	**Lower Limit - 85 Upper Limit - 110**	**N/A**	**N/A**	**25**	**350**	**3**		**N/A**	**>80% Percentile & <20% Percentile**	**6.5-8.5^**	**0.125-2.2***	**6-50**	**Lower Limit - 85 Upper Limit - 110**	**N/A**	**N/A**	**25**	**350**	**3**
31/05/2019	Pre-construction - Baseline	0mm	Low tide Sample taken from top of water column	12:56	36	17.51	7.87	0.305	26.8	112.8	18.6	Yes	70	900	24	12:41	23	17.34	7.96	0.259	10.8	232.7	16	No	0	800	20
6/06/2019	Pre-construction - Baseline - wet weather event	Extended rainfall event - 29.0mm	High tide Sample taken from top of water column	11:39	59	15.45	7.74	0.554	53.2	57	3.49	Yes	150	1400	4	11:51	86	15.87	7.73	0.69	88.4	80.9	4.35	Yes	220	1700	8

		over past 72 hours																							
25/06/2019	Pre-construction - Baseline	9mm	Mid tide Sample taken from top of water column	14:05	65	16.59	2.45	0.594	54	66	0.38	No	140	2200	0	14:28	107	16.22	7.79	0.596	81	73.5	0.382	No	260	2700	3
29/07/2019	Pre-construction - Baseline	0mm	Low tide CRW1 and CRW2 taken from middle of water column with sampling pole CRE1 and CRE2 taken from top of water column with bottle (only practicable way to reach water)	11:57	169	16.55	8.04	25.3	132	137	15.7	Yes	90	1200	69	12:18	144	18.65	7.95	24.8	58.6	60.6	15.4	Yes	110	1300	42
19/09/2019	Construction - Wet weather	106mm	106mm fell over past 3 days No works in vicinity of Cooks River	14:46	51	18.85	7.1	0.624	39.2	66.2	0.399	Yes	190	3800	0	15:02	48	19.54	7.4	0.702	42.2	71.8	0.449	Yes	190	4200	0
30/09/2019	Quarterly	0mm	High tide Sample taken from top of water column No works in vicinity of Cooks River	7:22	18	17.73	7.9	22.9	9	125.4	14.2	Yes	140	900	3	7:36	23	18.35	8	26.7	9.9	73	16.6	Yes	80	600	1
12/12/2019	Quarterly	0mm	High tide Sample taken from top of water column Embankment stabilisation preparation works	10:34	39	22.95	7.15	33.4	39.8	70.2	20.4	No	220	900	18	10:51	39	23.1	7.27	34.7	38.3	77.2	21.2	Yes	210	800	21
20/01/2020	Construction - Wet weather	Extended rainfall event - 66.0mm over past 72 hours	Mid tide Sample taken from top of water column	15:30	31	22.46	6.99	4.9	10	61.7	3.14	No	260	1100	6	15:30	27	22.43	7.04	4.98	9.8	68.2	3.12	No	230	1000	6

3.2 Noise and Vibration Monitoring

Attended noise monitoring was undertaken as required for OOHW and possessions, where noise modelling predicted significant exceedance of Rating Background Levels or otherwise required validation using this method. Works during the period occurred predominately in the following noise catchment areas;

- NCA1 – Combined Service Route (CSR) works
- NCA2 – CSR works
- NCA5 – embankment stabilisation works

Results from attended noise monitoring are summarised in Table 4. Noise monitoring results from the reporting period indicated that works occurred at noise levels at or below predicted levels. It is noted that wind speeds exceeded the recommended maximum level for noise monitoring as described within "*AS1055-2018 Description and measurement of environmental noise*" on a number of occasions, leading to exceedances. Monitoring was undertaken during these periods to provide indicative noise monitoring results only.

As part of attended noise monitoring, significant extraneous noise has been recorded as impacting receivers and monitoring results, including throughout the night-time period, well above the given RBLs. Monitoring locations and timing has been adjusted where necessary to try to isolate construction impact, however this is often not feasible. Common extraneous noise sources include:

- Noise from passing freight trains on the ARTC line
- Road traffic, particularly rail replacement buses during rail possessions

Attended noise monitoring has been conducted for activities with significant predicted exceedances of noise management levels, mostly occurring where works are conducted in the evening or night-time periods. This occurred for four rail possessions within the reporting period. SMEW have committed to review impacts and mitigation of construction activity and document outcomes where an exceedance is recorded or a complaint is made related to project construction activities. To date there have been no exceedances of predicted construction related noise levels or complaints assessed as relating to ongoing construction activities on the project. All exceedances recorded by attended monitoring have been attributed to extraneous noise rather than construction activity. These are detailed in the results shown below in Table 4

To date, there have been no exceedances of vibration from construction activities, and recorded vibration (PPV in mm/s) has been well below cosmetic vibration limits for affected structures.

Table 4 - Attended Noise Monitoring Results

Date	Time (hrs)	Duration	Time Units	Construction Activities	Audible noise from SSJ construction activities	Main source of noise	LA(eq)	LA_{Max}	Period	Predicted construction sound pressure level (LA(eq,15min))	Compliance	Comments
10/08/2019	7:37	15	minutes	Tree Lopping	Chainsaws and brushcutting	Wind	64.0	81.7	Night	70	Y	Wind exceeded limit in Australian Standard - max noise associated with traffic
10/08/2019	8:24	15	minutes	Tree Lopping	Chainsaws and mulcher	Wind/Mulcher	74.8	87.4	Day	70	Y	Wind exceeded limit in Australian Standard - max noise associated with traffic
10/08/2019	8:50	15	minutes	Tree Lopping	Chainsaws and brushcutting	Wind	67.6	90.0	Day	70	Y	Wind exceeded limit in Australian Standard - max noise associated with traffic
11/08/2019	7:48	15	minutes	Tree Lopping	Chainsaws and mulcher	Wind/Mulcher	68.6	85.4	Night	70	Y	Wind exceeded limit in Australian Standard - max noise associated with traffic
11/08/2019	10:38	15	minutes	GST	power tools	Wind	63.1	82.4	Day	75	Y	Wind exceeded limit in Australian Standard - max noise associated with traffic
28/09/2019	7:37	15	minutes	Tree Lopping	Chainsaws and brushcutting	Traffic, mulcher	68.6	102.4	Day	70	Y	Wind exceeding AS - Lamax associated with bus beeping
28/09/2019	8:24	15	minutes	Tree Lopping	Chainsaws and mulcher	Wind/Mulcher	70.2	86.2	Day	70	Y	Wind exceeding AS
28/09/2019	8:50	15	minutes	CSR lift	Crane	Wind	68.0	85.6	Day	72	Y	Wind exceeding AS - traffic was main source of noise
29/09/2019	7:48	15	minutes	CSR lift	Chainsaws and mulcher	Wind traffic	64.7	83.1	Day	70	Y	Wind exceeding AS - traffic was main source of noise
9/11/2019	6:23	15	minutes	High Level Retaining Wall and CSR Pile works	Excavator tracking	Excavator	60.0	75.2	Night	68	Y	
9/11/2019	10:44	15	minutes	High Level Retaining Wall and CSR Pile works	Augering	Excavator	61.2	79.0	Night	68	Y	
10/11/2019	2:26	15	minutes	High Level Retaining Wall and CSR Pile works	Concreting	Concrete pump & concrete truck	63.2	77.3	Night	68	Y	Wind exceeding AS

Date	Time (hrs)	Duration	Time Units	Construction Activities	Audible noise from SSJ construction activities	Main source of noise	LA(eq)	LA_{Max}	Period	Predicted construction sound pressure level (LA(eq,15min))	Compliance	Comments
10/11/2019	6:02	15	minutes	High Level Retaining Wall and CSR Pile works	Augering	Excavator	62.0	90.5	Night	68	Y	
3/01/2020	8:04	15	minutes	High Level Retaining Wall	Concrete truck idling	Concrete truck	56.3	73.0	Day	61	Y	Works occurred during standard hours in accordance with CNVIS
3/01/2020	8:37	15	minutes	High Level Retaining Wall	Pouring concrete with kibble	Excavator	62.3	77.5	Day	67	Y	Works occurred during standard hours in accordance with CNVIS
4/01/2020	7:53	15	minutes	High Level Retaining Wall and CSR Pile works	Concreting	Concrete pump & concrete truck	66.9	84.8	Night	68	Y	
22/01/2020	22:52	15	minutes	EWP - Breaking feeder	EWP engine	Road traffic	61.1	77.5	Night	67	Y	Regular cars on South Parade. In final minutes of monitoring, loud bike and car pulled up and idled in driveway immediately next to monitor, discounted from LAmax

3.3 Vibration

Table 5 - Vibration monitoring data

Monitoring Location	Date	Works being carried out	Attended or continuous	Event Base Monitoring Y/N	Measured PPV (mm/s)	Cosmetic Damage criteria (mm/s)	Compliant Y/N	Comments
Albermarle St	2/09/19 to 10/09/19	Under Road Crossing – trenching and backfill	Continuous	Y	6.09	7.5*	Y	Some exceedances recorded at the start of the monitoring period related to moving the accelerometer into place. It is noted that due to access restrictions the vibration monitor could not be placed at the foundation of the nearest structure – the vibration monitor was placed within the worksite and as such the result should be considered to be conservative.
Cooks River Bridge (country side)	23/01/20	Concrete Injection Column (piling)	Attended	Y	0.4	25	Y	Note 1. A maximum reading of 0.7mm/s was recorded; this reading was associated with a train travelling over the bridge. The 0.4mm/s was associated with CIC piling. Note 2. The SMEW Construction Noise and Vibration Impact Statement states “The Cooks River Bridge has been identified as a heritage structure; however, it is of reinforced construction and already subject to vibration due to the rail line that it holds. It is therefore not structurally unsound and the same screening criteria applies”

*It is noted that the operating frequency of the jackhammer is 20-40Hz. Using 20Hz as conservative approach the vibration limit under DIN 4150-3 becomes 7.5mm/s – applied proportionally.

4. Mitigation Measures

4.1 Noise and Vibration

Standard mitigation measure were implemented as per Section 7 of the Construction Noise and Vibration Management Plan, and Sections 6.2 and 6.4 of the Construction Noise and Vibration Impact Statement. These were effective during the reporting period.

4.2 Water

Standard mitigation measures were implemented as per Section 6 of the Construction Soil and Water Management Plan. Controls were repaired as required and were effective during the reporting period.

5. Conclusion

Pre-construction surface water monitoring began in May 2019, with results showing exceedances to a number of parameters under existing conditions. Construction monitoring results from locations upstream and downstream of channel show pH has remained within acceptable range, but all other parameters vary between rain events and river conditions, including between upstream and downstream samples. Surface water data does not provide clear relation between construction activities and water quality.

Erosion-sediment control plans are maintained and reviewed regularly, and JHLOR conducts weekly and post rain environmental inspections. The Environment Representative also conducts bi-weekly inspections and any observations are closed out within agreed timeframes.

Monitoring records have validated modelled noise and are consistent with the predicted impact of construction activities on noise catchment areas, including sensitive receivers. There have not been any recorded exceedances or project-related complaints regarding noise and vibration impacts.