Bi - Annual Surface Water Monitoring Report

July 2018 to December 2018

Project: Sydney Metro City & Southwest – TSE Works

Document No: SMCSWTSE-JCG-TPW-EM-RPT-097401

DOCUMENT APPROVAL

REVISION	DATE	PREPARED BY	REVIEWED BY	APPROVED BY	REMARKS
00	18/01/19	Rachael Labruyere	Robert Muir	Krissy Vajda	For Issue
					

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Compliance matrix

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<tr><th></th><th>Required Construction Monitoring Programs</th><th>Relevant government agencies to be consulted for each Construction Monitoring Program</th></tr>
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<tr><td>(h) procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory; and</td><td>Section 6.5 of the Construction Soil Water and Groundwater Management Plan (SMCSWTSE-JCG-</td></tr>
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Clause	Detail	Reference
		TPW-EM-PLN-002014)
	(i) any consultation to be undertaken in relation to the monitoring programs.	Section 5.0 Construction Soil Water and Groundwater Management Plan (SMCSWTSE-JCG-TPW-EM-PLN-002014)
C12	The Construction Monitoring Programs must be developed in consultation with relevant government agencies as identified in Condition C9 of this approval and must include, to the written satisfaction of the Secretary, information requested by an agency to be included in a Construction Monitoring Programs during such consultation. Details of all information requested by an agency including copies of all correspondence from those agencies, must be provided with the relevant Construction Monitoring Program.	Section 5.0 of the Construction Soil Water and Groundwater Management Plan (SMCSWTSE-JCG-TPW-EM-PLN-002014)
C16	The results of the Construction Monitoring Programs must be submitted to the Secretary for information, 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 report

1.0 Introduction

The purpose of the Surface Water Quality Monitoring Program (SWQMP) (detailed in Section 6.1 of the Construction Soil, Water and Groundwater Management Plan (CSWGMP): (SMCSWTSE-JCG-TPW-EM-PLN-002014) is to identify potential impacts of the JHCPBG Tunnel Station Excavation (TSE) Works on water quality in local receiving waters.

The data presented in the SWQMP Report (this report) is submitted in accordance with Condition C9 of the Project Planning Approval, which requires reporting the results of the TSE Works Water Quality Monitoring Program to the Department of Planning and Environment (DPE), the New South Wales (NSW) Environment Protection Authority (EPA) and the NSW Natural Resource Access Regulator (NRAR).

This report will highlight the results from of the construction phase of the surface water monitoring program against established baseline water quality developed during pre construction monitoring.

2.0 Compliance

2.1 Approvals

The NSW Department of Planning and Environment's list of Secretary's Environmental Assessment Requirements (SEARs) for the project require the assessment of groundwater and surface water quality impacts to reference the relevant public health and environmental water quality criteria, including those specified in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality in 2000 (the ANZECC (2000) guidelines), applicable regional, local or site specific guidelines and any licensing requirements .

The ANZECC guidelines provide specific assessment criteria and water quality guideline values that aim to protect and manage the environment supported by a water resource whilst maintaining economic and social development.

2.2 ANZECC (2000) Guidelines and Surface Water Monitoring Parameters

The ANZECC guidelines for marine water quality and fresh water quality specific to south-east Australian lowland rivers and NSW coastal rivers have been used throughout this report in accordance with the SEARs so as to inform ongoing assessments of potential impacts on water quality.

The guidelines consider a wide range of species in Australia and New Zealand, however they are not site specific and do not consider the local natural environment, i.e. the influence of local geology on water quality. An exceedance of an ANZECC guideline value is common, often a product of local natural environmental factors including water-rock hydrogeochemical interactions.

To address this, a risk-based approach has been developed (Figure 1) and implemented in the event of surface water sampling results exceeding the 80th percentile of the baseline values. The following items will be reviewed as part of the exceedance investigation.

- Climate data;
- Erosion and sediment control practices on sites discharging into the specific catchment
- Recent site discharges
- Incidents on site in the preceding three months, and

- Potential impacts of offsite land use practices that might have affected the results

The results of the investigation may result in the updating of site/project trigger values as per the ANZECC guidelines.

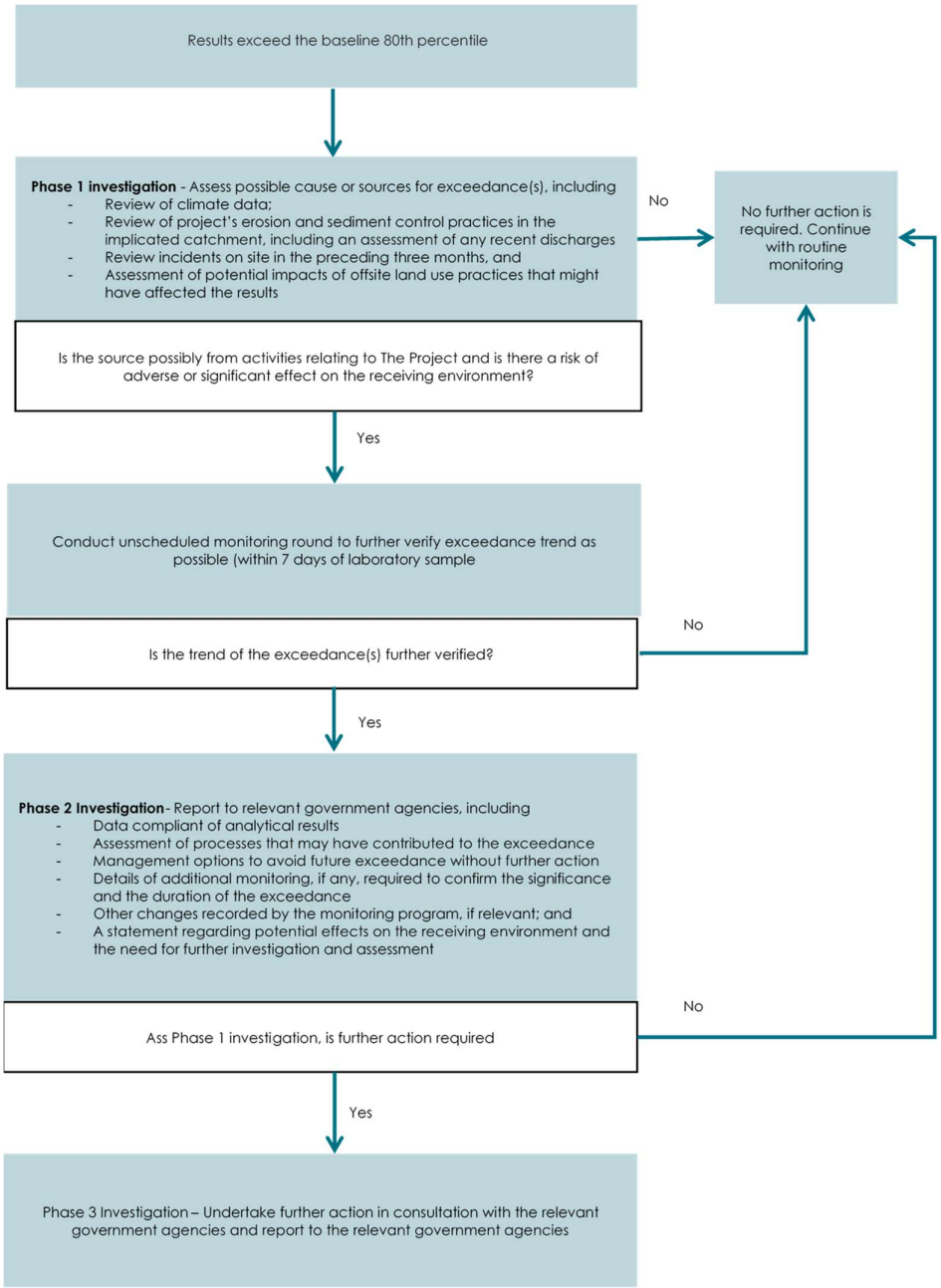

Figure 1 – Response Action Process for exceedances of Surface Water Quality

2.3 NSW Water Quality Objectives

The NSW Water Quality Objectives (WQOs) (NSW Government 2014) are the agreed environmental values and long-term goals for NSW surface waters and are to be considered when assessing and managing the likely impact of activities on waterways.

The environmental values for the project are the protection of:

1. Aquatic ecosystems;
2. Visual amenity
3. Secondary contact recreation (e.g. boating)
4. Primary contact recreation (eg swimming) in the longer term (10 year) and
5. For upper tributaries only, protection of aquatic foods (cooked).

'Aquatic ecosystems' is the primary environmental value of the project as the watercourses within the sub-catchments, intercepted by the project, support aquatic ecosystems.

There may be 'secondary contact recreation' and / or 'primary contact recreation' in parts of the surface water catchments within the project area. However, the objective of protection of aquatic ecosystems will also protect these additional environmental values since aquatic ecosystems are generally more sensitive to changes to the aquatic environment.

The WQOs are consistent with the agreed national framework for assessing water quality, set out in the ANZECC guidelines. While the WQOs provide environmental values for NSW waters, the ANZECC guidelines provide the technical guidance to assess the water quality needed to protect those values.

3.0 Site Characterisation

3.1 Rainfall

The Bureau of Meteorology (BoM) Sydney Observatory Hill weather station (BoM site ID 066062) is located approximately 200 metres from the Barangaroo Worksite, at the centre of the TSE Works alignment.

The average rainfall is 1216mm (based on records from 1858 – 2018). Autumn and winter have been identified as the wettest months in Sydney with on average the highest rainfall received in June (133mm). Spring is on average the driest season with September receiving the least rainfall (67.8mm).

Weather data (including rainfall) is collected using data from the Sydney Observatory Hill weather station, accessed via the Bureau of Meteorology website (http://www.bom.gov.au). Figure 2 depicts the total monthly rainfall for the monitoring period against the long term average for the same months. During 2018, higher than average rainfall was recorded during October and November with a maximum of 176mm recorded in November compared with a historic average of 84mm.

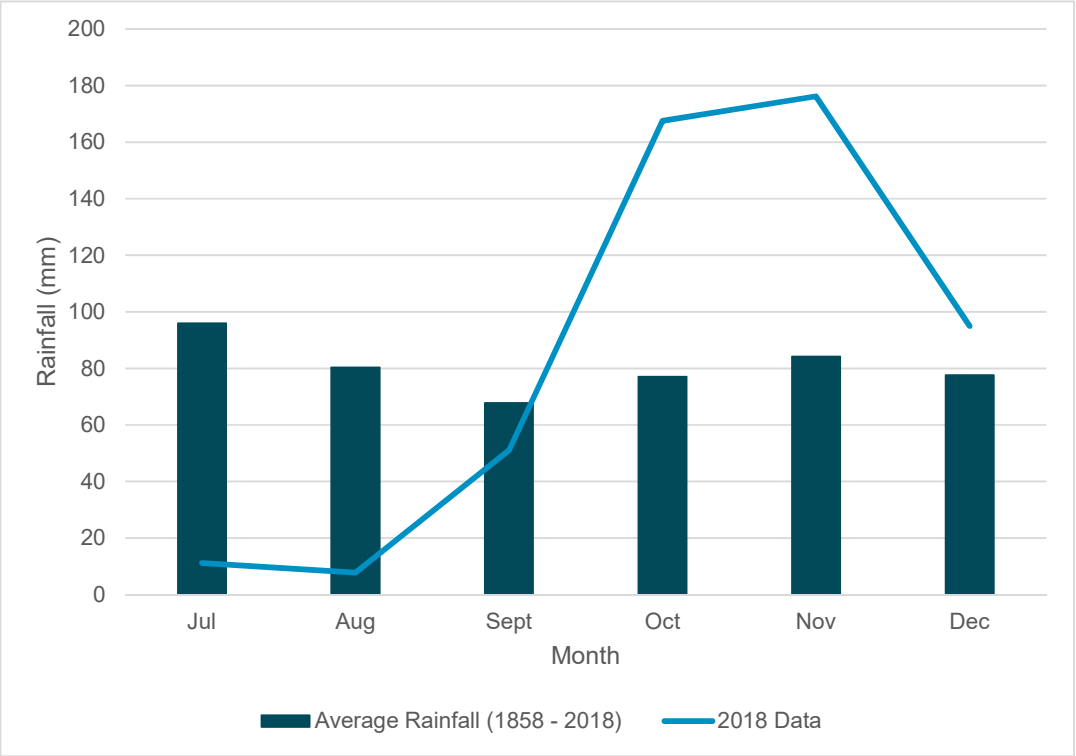

Figure 2 – Monthly average rainfall and monthly totals July to December 2018

3.2 Surface Hydrology

The project is located within the Sydney Harbour/Parramatta River catchment and the Cooks River catchment. Within these two catchments there are five local watercourses that are located along the tunnel and station excavation (TSE) works alignment, which drain into Middle Harbour, Sydney Harbour or Botany Bay (Figure 3).

Figure 3: Surface water catchments and watercourses (Source: Figure 21-1 of the Sydney Metro City & Southwest EIS)

The sub-catchments are well established urban catchments with predominantly residential and/or commercial/industrial land use. Watercourses near the TSE Works are heavily urbanised and surface water is generally captured by developed stormwater networks.

Treated construction water will be discharged into a number of waterways, including into the Sydney Harbour, via existing stormwater systems or directly into Sydney Harbour (Table 1).

Table 1 Drainage Catchments

Catchment Area	Relevant TSE Works element	Surface water sub-catchment area	Receiving water
Sydney Harbour and Parramatta River	Chatswood northern dive site	Scotts Creek and Flat Rock Creek	Middle Harbour
	Artarmon substation	Flat Rock Creek	
	Crows Nest	Flat Rock Creek tributary	
	Victoria Cross Station	Milsons Park	Sydney Harbour
	Blues Point temporary site	N/A	
	Barangaroo Station	N/A	
	Martin Place Station	City area	
	Pitt Street Station	City area	
Cooks River	Waterloo Station	Alexandra Canal	Botany Bay (via Cooks River)
	Marrickville southern dive	Marrickville Valley	

Geologically, the project area is located within the Sydney Basin. The recognised hydrogeological units within the project area are shown in Table 2.

Table 2 Hydrogeological Units within the project area

Hydrogeological Unit	Aquifer Type	Properties
Unconsolidated sediments (fill, alluvium, marine sediments)	Unconfined aquifer	Partially saturated
Ashfield Shale (Wianamatta Group)	Leaky aquifer	Mostly saturated
Hawkesbury Sandstone (including Mittagong Formation transitional unit)	Unconfined/semi-confined aquifer	Mostly saturated

The extent of development within the catchments and watercourses was assessed within the EIS. Waterways were determined to be affected by poor water quality and changed flow regime. The waterways have been greatly modified, with creek systems extensively channelised or hard edged with concrete. Wetlands have been destroyed or degraded and, where natural remnants of vegetation exist, they are often affected by weeds and rubbish. Based on the assessment in the EIS and the Pre-Construction Surface Water Quality Monitoring Programme, ecosystem disturbance for each discharge location has been determined and included in Table 3.

4.0 Project Progress

The project tunnels will be largely constructed within the Ashfield Shale and the Hawkesbury Sandstone, and constructed below the water table. The Hawkesbury Sandstone is the main water bearing groundwater system in the region and forms an unconfined aquifer, and is semi-confined where it is overlain by the Ashfield Shale and alluvium, where present.

During the construction phase of the project, water from construction process activities (including piling and drilling and concreting works), surface water on site and tunnel groundwater inflows will be treated and discharged from the project water treatment plants (WTPs). Treated discharge water will be the primary source of discharge into the receiving environment (ie waterways and the harbours) and will be managed via eight WTPs (Table 3)

Table 3 Water treatment plant details

WTP	Processing Capacity (L/s)	Discharge Location	Receiving Environment	Level of ecosystem disturbance at discharge location	Groundwater system present at site
Chatswood	30	Local stormwater system	Scott's Creek, Castle Cove, Middle Harbour	Moderate to highly disturbed	Ashfield Shale, Hawkesbury Sandstone
Crows Nest	15	Local stormwater system	Flat Rock Creek, Long Bay, Middle Harbour	Moderately to highly disturbed	Hawkesbury Sandstone, minor Ashfield Shale
Victoria Cross	15	Local stormwater system	Milson Park, Sydney Harbour	Highly disturbed	Hawkesbury Sandstone
Barangaroo	50	Direct to Sydney Harbour	Sydney Harbour	Highly disturbed	Hawkesbury Sandstone
Martin Place	15	Local stormwater system	Sydney Harbour	Highly disturbed	Hawkesbury Sandstone
Pitt Street	15	Local stormwater system	Sydney Harbour	Highly disturbed	Hawkesbury Sandstone
Waterloo	15	Local stormwater system	Alexandra Canal, Cooks River, Botany Bay	Highly disturbed	Ashfield Shale, Hawkesbury Sandstone
Marrickville	30	Local stormwater system	Eastern Canal, Cooks River, Botany Bay	Highly disturbed	Ashfield Shale, minor Hawkesbury Sandstone

4.1 Water Treatment Plant (WTP) Discharge

The Environmental Protection Licence for the project (EPL 20971) states that for each monitoring/discharge point, the discharged water must comply with the criteria specified in Table 2.1 (Condition L2.8).

These parameters have been included as a general indicator of the overall water quality.

Table 4 WTP Discharge Criteria (EPL 20971 Condition L2.8)

Analyte	Unit	Discharge Criteria
pH	pH units	6.5 – 8.5
Total suspended solids	Milligrams per litre	50

Water captured in the station box/shaft excavations/tunnels, the Tunnel Boring Machines (TBMs) and conveyor wash boxes is pumped to water treatment plants located on the surface. There are two types of water treatment plants being installed on the TSE Works as follows:

- Coagulant/flocculation clarification
- Slurry (To be installed in 2019 as part of the Slurry TBM process. Water extracted from the Slurry TBM will be processed by the existing Barangaroo WTP prior to discharge.)

For the period July 2018 to December 2018, WTPs were installed at Marrickville, Crows Nest, Chatswood, Martin Place, Victoria Cross, Pitt Street and Waterloo. Commissioning of all WTPs was completed and plants were operational during the reporting period.

5.0 Water Monitoring Assessment Framework

5.1 Water Quality Trigger Values

The NSW State Government has endorsed the community's environmental values for water, known as Water Quality Objectives (WQOs) (ANZECC, 2000). The Soil and Water Quality Management Plan methodology for surface water sampling requires that during a sampling event both field measurements and laboratory analytical results are collected. **Error! Reference source not found.** details the parameters to be tested when monitoring the waterways. These measures also incorporate the conditions and parameters as stipulated by the TSE Works EPL: No. 20971 Section 3, L2).

A precautionary approach has been adopted for the surface water quality monitoring. Results collected in the current monitoring round are compared against the baseline data. If results are greater than the baseline data 80th percentile, further investigation is undertaken (refer to Figure 1). Dissolved oxygen results will be compared against the Baseline 20th percentile as this is a more accurate measure of environmental degradation over time (ANZECC, 2000).

As detailed in Figure 1, where erroneous results are identified, further investigation will be undertaken and may include:

- Analysis of weather conditions
- Review of construction works currently being undertaken onsite

- Re-sampling within 7 days of reviewing results where a link is established to TSE works.

Table 5 Surface water quality monitoring parameters

Parameter	Sampling Method	Analytical Method	ANZECC[1, 2] Trigger Values (Lowland River)[7]	ANZECC[1, 3] Trigger Values (Estuarine Water)[8]	EPL 20971[9]	Trigger Value
Temperature (ºC)	Probe	Field / Lab	-	-	-	Baseline 80th Percentile
Dissolved Oxygen (% Sat)	Probe	Field Analysis	85% - 110%	-	-	Baseline 20th Percentile
Turbidity (NTU)	Probe	Field Analysis	6 NTU-50 NTU	0.5 NTU–10 NTU	-	Baseline 80th Percentile
Oil and Grease	Visual / Grab Sample	Visual / Lab	-	-	No visible Oil and Grease	Baseline 80th Percentile
Conductivity (mS/cm)[6]	Grab Sample and Probe	Field / Lab	0.125mS/cm - 2.2mS/cm	-	-	Baseline 80th Percentile
Total Suspended Solids (mg/L)	Grab Sample	Lab Analysis	-	-	50 mg/L	Baseline 80th Percentile
Iron (mg/L)	Grab Sample	Lab Analysis	-	-	-	Baseline 80th Percentile
Manganese (mg/L)	Grab Sample	Lab Analysis	1.9 mg/L[10]	-		Baseline 80th Percentile
pH	Grab Sample and Probe	Field / Lab	6.5 – 8.0	7.0 – 8.5	6.5 - 8.5	Baseline 80th Percentile

[1] Australian and New Zealand Environment and Conservation Council
[2] Trigger values applicable to lowland river environments
[3] Trigger values applicable to estuarine environments
[4] Default trigger value for each ecosystem-type
[5] There is insufficient data at this stage to derive a reliable value for iron. The current Canadian guideline has been used.
[6] Conductivity will not be tested at monitoring points at Milsons Point, Blues Point, Darling Harbour and Farm Cove
[7] Applicable to monitoring locations SW-SC-01, SW-FR-02, SW-EC-01
[8] Applicable to monitoring locations SW-SC-01, SW-FR-02, SW-MP-01, SW-BP-01, SW-B-01, SW-FC-01, SW-AC-01
[9] Where EPL criteria differs from ANZECC Criteria, EPL conditions will be complied with.
[10] Manganese toxicant value for 95% species protection in a fresh water environment

6.0 Monitoring Program

6.1 Surface Water Monitoring Sites

Surface Water Quality is measured at ten locations along the project alignment, shown in **Error! Reference source not found.**. Locations were chosen to be representative of water quality and identify any potential impacts of the Project should they occur.

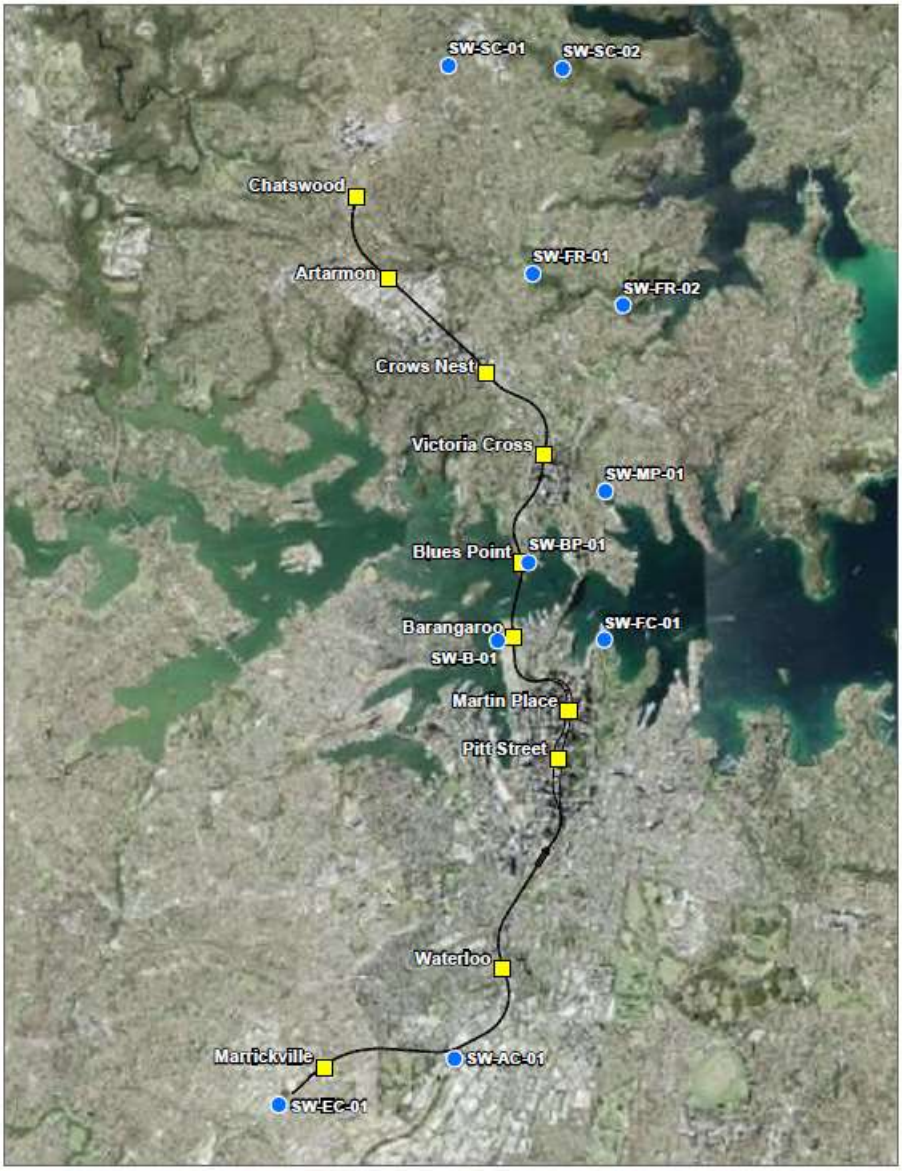

Figure 4: Surface Water Monitoring Locations

6.2 Surface Water Quality Sampling

Surface water sampling was undertaken in accordance with the Soil and Water Management Plan at the following frequencies:

- Quarterly (general sampling rounds);
- Up to four wet weather sampling events within a 12 month period (when at least 38.8mm of rain is received in the catchment in any 5 day period)

Grab samples will be collected manually from the sampling locations and analysed at a NATA accredited laboratory. The volume of sample collected was of sufficient volume for the required analyses, including any repeat analyses. Samples were collected into sampling bottles and jars provided by the laboratory.

All samples will be clearly labelled and stored in a refrigerated container prior to dispatch under the chain of custody procedures.

Sampling equipment will be rinsed well between samples and on return to the lab at the end of each sampling trip. De-ionised and tap water will be available for washing equipment in the field, in case a particularly dirty site is encountered during a sampling event.

6.2.1 In-situ measurements

Field water quality parameters including temperature, electric conductivity (EC) and pH will be measured at each sampling location using a multi-probe field water quality meter. Other observations including odour and colour will be recorded on the field sheets.

The multi-probe field water quality meter will be field calibrated at the start and completion of each day of water quality sampling. Calibration records (field and laboratory) will be maintained on JHCPBG's Oris system.

6.2.2 QA/QC Procedures

Quality Assurance / Quality Control (QA/QC) samples are collected to ensure the quality of the investigation procedures and sampling program. QA/QC samples provide analytical information that may be used to investigate anomalous results.

QA/QC sampling will be undertaken in accordance with AS 5667.1:1998. Only NATA registered laboratories will be used to undertake analysis.

7.0 Surface Water Quality Results

7.1 Baseline 80th Percentile Water Quality Results

Pre-construction surface water quality testing was carried out monthly from August 2017 to January 2018 to determine baseline water quality prior to discharge from construction works.

Water monitoring results were recorded and the eightieth percentile maximum calculated to define the baseline criteria of the waterway.

During baseline monitoring, the Upper Flat Rock Creek sampling location was dry and no water samples were able to be collected from this site. Milson Park (SW-MP-01) and Alexandra Canal (SW-AC-01) were both determined to be freshwater environments during the baseline survey, however, following re-assessment of these sites during 2018 monitoring, it was determined the water in these catchments was tidal and predominantly influenced by the adjacent marine environments (Sydney Harbour and Cooks River/Botany Bay). As such

results from these catchments will be assessed against the ANZECC marine/estuarine criteria.

Water quality results were found to be influenced by external factors within the catchment and surrounding areas including industrial and construction discharges not associated with the JHCPBG works.

7.2 Wet Weather Monitoring

Wet weather monitoring was undertaken on 8 October 2018, results have been included alongside the quarterly surface water quality monitoring.

The highest results were recorded at Milsons Point where field records indicated that the water was turbid, with a grey/white appearance. No discharge from the site occurred prior to or during the sampling events. Inspections undertaken at the Victoria Cross Site indicate no sediment laden water was leaving site. It is therefore considered unlikely that elevated suspended solids were related to the TSE works.

7.3 Surface Water Quality Results July – December 2018

The Surface water quality results collected from the July to December 2018 monitoring period (two quarterly samples on the 22 August 2018 (Q3) and 22 November 2018 (Q4), and one post wet weather event on the 08 October 2018 (PR)) are presented in Appendix B alongside the baseline 80th percentile results for each catchment area.

Field results are based on the readings from the Horiba water quality meter taken at the time of monitoring, samples were also collected simultaneously and submitted for analysis at a NATA accredited laboratory.

Where sampling results (either field or laboratory) were found to be outside the baseline 80th percentile trigger values, an assessment of the results against ANZECC trigger values was carried out.

Tables 6 to 9 present the sampling results which exceeded both baseline 80th percentile and ANZECC trigger values or EPL license conditions (if available).

7.3.1 **pH**

Table 6: Surface Water pH exceedances of the Baseline 80th Percentile and ANZECC Trigger Values.

LOCATION	SAMPLING ROUND	FIELD RECORDED VALUE	FIELD 80TH PERCENTILE BASELINE DATA	LABORATORY RECORDED VALUE	LABORATORY 80TH PERCENTILE BASELINE DATA	ANZECC TRIGGER VALUE	WTP DISCHARGE
SW-BP-01	Q3	**9.3**	7.9	8.1	8.1	7.0 – 8.5	N
SW-BP-01	Q4	**5.9**	7.9	8.1	8.1	7.0 – 8.5	N
SW-FC-01	Q3	**9.0**	7.9	8.0	8.0	7.0 – 8.5	N
SW-FC-01	PR	**9.0**	7.9	8.1	8.0	7.0 – 8.5	Y
SW-FC-01	Q4	**6.0**	7.9	8.0	8.0	7.0 – 8.5	N
SW-B-01	Q3	**9.3**	7.7	8.0	8.0	7.0 – 8.5	N

LOCATION	SAMPLING ROUND	FIELD RECORDED VALUE	FIELD 80TH PERCENTILE BASELINE DATA	LABORATORY RECORDED VALUE	LABORATORY 80TH PERCENTILE BASELINE DATA	ANZECC TRIGGER VALUE	WTP DISCHARGE
SW-B-01	Q4	**6.0**	7.7	8.0	8.0	7.0 – 8.5	N
SW-AC-01	PR	**9.6**	7.3	**9.2**	8.0	7.0 – 8.5	Y
SW-AC-01	Q4	**6.0**	7.3	**6.8**	8.0	7.0 – 8.5	N
SW-EC-01	PR	**8.6**	7.3	**8.3**	7.7	6.5 – 8.0	Y
SW-EC-01	Q4	**6.1**	7.3	6.6	7.7	6.5 – 8.0	Y

Surface water pH results were generally within the field 80th percentile and ANZECC trigger values. The laboratory data has been considered more reliable than the field readings from the Horiba where readings can be influenced by the moisture levels on the probe.

Where the Phase 1 investigation found there was no discharge prior to or during the sampling from the relevant Sydney Metro site, other local area construction works, and industry have been considered the likely cause of the high pH readings.

The following conclusions have been established for results where discharge was occurring from Sydney Metro sites:

- Discharge from Pitt Street North (PS) was occurring on the 22 October 2018, during the sample collected from SW-FC-01. The recorded pH on the PS water treatment plant was 7.4, which is within the ANZECC trigger value.
- Laboratory testing of the SW-FC-01 PR sample found a pH within the ANZECC Trigger values. The field result could have been caused due to sensitivities within the probe on the Horiba.
- The result recorded at SW-AC-01 during the post rainfall monitoring was consistent with both field and laboratory results. The Waterloo WTP recorded a pH of 7.7 for the discharge on the 22 October 2018. No other project discharges were occurring at this time into catchment SW-AC-01 and the high pH reading is therefore considered to be associated with external sources.
- The post rainfall and Q4 results recorded at SW-EC-01 (Eastern Canal), were found to marginally exceed the freshwater ANZECC trigger values for freshwater and were within the project's EPL criteria for the laboratory results. The recorded pH from discharges at the Marrickville Dive Site (7.6 PR and 8.1 Q4) was within the EPL criteria and not comparable to the surface water results. The surface water pH reading at SW-EC-01 are therefore considered to be associated with external sources.

During the monitoring period, no exceedances of surface water pH were found to be associated with site discharge or works.

7.3.2 Turbidity

Table 7: Surface Water Turbidity/TSS exceedances of the Baseline 80th Percentile and ANZECC Trigger Values.

LOCATION	SAMPLING ROUND	FIELD RECORDED VALUE (NTU)	FIELD 80TH PERCENTILE BASELINE DATA	LABORATORY RECORDED VALUE (TSS)	LABORATORY 80TH PERCENTILE BASELINE DATA	ANZECC TRIGGER VALUE (NTU)	WTP DISCHARGE
SW-SC-01	Q4	**74.3**	38.8	9.0	12.6	6 – 50	Y
SW-SC-02	PR	**16.2**	2.4	<5.0	10.4	0.5 – 10	Y
SW-FR-02	PR	**66.7**	0.4	**13.0**	10.0	0.5 – 10	N
SW-MP-01	Q3	**59.9**	35.2	**12.0**	58.4	0.5 – 10	N
SW-MP-01	PR	**85.0**	35.2	**22.0**	58.4	0.5 – 10	N
SW-AC-01	Q3	**50.8**	14.9	6.0	10.0	0.5 – 10	Y
SW-AC-01	PR	0.0	14.9	**820.0**	10.0	0.5 – 10	Y
SW-AC-01	Q4	**203.0**	14.9	**76.0**	10.0	0.5 – 10	N
SW-EC-01	Q4	**687.0**	170.2	**230.0**	57.0	6 – 50	Y

The monitoring field sheets noted during Q4 and the Post Rainfall monitoring, high water levels and cloudy/debris filled fast flowing water at both SW-AC-01 and SW-EC-01, which is consistent with the elevated results recorded at these sites. Discharges into these catchments from the Waterloo and Marrickville sites had monitored NTU well below the project discharge EPL requirements and generally consistent with the ANZECC trigger values.

Laboratory TSS results recorded for the field exceedances at SW-SC-02 and SW-FR-02 demonstrated low levels of TSS within the surface water at these locations and within ANZECC Trigger Values.

7.3.3 Iron and Manganese

Table 8: Surface Water Iron and Manganese exceedances of the Baseline 80th Percentile and ANZECC Trigger Values.

LOCATION	SAMPLING ROUND	FE (MG/L) RECORDED VALUE	FE (MG/L) 80TH PERCENTILE BASELINE DATA	MN (MG/L) RECORDED VALUE	MN (MG/L) 80TH PERCENTILE BASELINE DATA	ANZECC TRIGGER VALUE (MN)	WTP DISCHARGE
SW-FR-02	PR	**0.45**	0.1	0.02	0.00	-	N
SW-FR-02	Q4	**0.27**	0.1	0.02	0.00	-	N
SW-MP-01	PR	**1.90**	0.9	0.07	0.00	-	N
SW-BP-01	PR	**0.24**	0.1	0.02	0.00	-	N

LOCATION	SAMPLING ROUND	FE (MG/L) RECORDED VALUE	FE (MG/L) 80TH PERCENTILE BASELINE DATA	MN (MG/L) RECORDED VALUE	MN (MG/L) 80TH PERCENTILE BASELINE DATA	ANZECC TRIGGER VALUE (MN)	WTP DISCHARGE
SW-FC-01	PR	**0.58**	0.1	0.02	0.00	-	Y
SW-FC-01	Q4	**0.20**	0.1	0.01	0.00	-	N
SW-AC-01	PR	**18.00**	0.9	0.40	0.03	-	Y
SW-AC-01	Q4	**3.80**	0.9	0.10	0.03	-	N
SW-EC-01	Q4	**4.60**	2.8	0.20	0.3	1.9	Y

All monitoring results for manganese were within the 80th percentile baseline for the monitoring period.

For iron in marine water, there is no high reliability ANZECC trigger value and in general the Hawkesbury sandstone has naturally elevated iron levels.

Sampling results from WTP discharges recorded significantly lower levels of iron than recorded within the surface water. Additionally, visual inspections of the discharge water noted no reddish discolouration indicative of elevated iron levels.

The recorded elevated iron levels have been attributed to non-project sources.

Table 9: Surface Water Oil and Grease exceedances of the Baseline 80th Percentile and ANZECC Trigger Values.

LOCATION	SAMPLING ROUND	OIL AND GREASE RECORDED VALUE (MG/L)	OIL AND GREASE 80TH PERCENTILE BASELINE DATA (MG/L)	ANZECC TRIGGER VALUE	WTP DISCHARGE
SW-SC-02	Q4	**7.0**	5.0	-	Y
SW-MP-01	Q4	**6.0**	5.0	-	N
SW-AC-01	Q4	6.0	5.0	-	N
SW-EC-01	Q4	**8.0**	5.0	-	Y

Oil and grease results were generally within the 80th percentile baseline for all sampling points. Marginal exceedances were recorded at SW-SC-02 and SW-EC-01 (when discharging was occurring from the Chatswood and Marrickville sites). However, no visible oil and grease was noted within the discharge water.

No visible oil and grease was noted at any of the monitoring locations during Q4 sampling.

8.0 Conclusions

Water monitoring was conducted on three occasions during the monitoring period in accordance with the requirements outlined in the CSWMP.

In general, the variability of the monitoring results has been attributed to the local environment in the catchment.

Sampling of discharge water from the WTPs found levels to be in line with the requirements outlined in the Project EPL and no exceedances of the 80th percentile baseline were found to be associated with the TSE works.

Results highlighted that the catchment areas have external influences from surrounding residential and industrial sites, as well as other construction sites. It is not possible to identify the exact influence on water quality however JHCPBG's process for testing water prior to discharge off site ensures water quality is within the required parameters.

9.0 Recommendations

It is recommended, SW-FR-01 is removed from sampling rounds due to lack of water at this location.

Due to the limited nature of the baseline data it is recommended that continued assessment of surface water quality occurs against both the 80th percentile baseline and ANZECC trigger values.

10.0 Appendices

Appendix A – Sampling Results

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LOCATION	SAMPLING ROUND	FIELD RECORDED VALUE	FIELD 80TH PERCENTILE BASELINE DATA	LABORATORY RECORDED VALUE	LABORATORY 80TH PERCENTILE BASELINE DATA	ANZECC TRIGGER VALUE	WTP DISCHARGE
SW-SC-01	Q3	7.6	7.7	7.7	7.9	6.5 – 8.0	Y
SW-SC-01	PR	7.7	7.7	7.9	7.9	6.5 – 8.0	Y
SW-SC-01	Q4	**8.3**	7.7	7.4	7.9	6.5 – 8.0	Y
SW-SC-02	Q3	**8.3**	7.3	7.8	7.8	7.0 – 8.5	Y
SW-SC-02	PR	**7.4**	7.3	7.8	7.8	7.0 – 8.5	Y
SW-SC-02	Q4	**7.7**	7.3	7.7	7.8	7.0 – 8.5	Y
SW-FR-02	Q3	**8.5**	7.6	8.0	8.0	7.0 – 8.5	N
SW-FR-02	PR	**8.1**	7.6	8.0	8.0	7.0 – 8.5	N
SW-FR-02	Q4	**7.8**	7.6	7.5	8.0	7.0 – 8.5	N
SW-MP-01	Q3	8.0	8.0	**8.1**	8.0	7.0 – 8.5	N
SW-MP-01	PR	**8.2**	8.0	7.9	8.0	7.0 – 8.5	N
SW-MP-01	Q4	**8.3**	8.0	7.9	8.0	7.0 – 8.5	N
SW-BP-01	Q3	**9.3**	7.9	8.1	8.1	7.0 – 8.5	N
SW-BP-01	PR	**8.4**	7.9	**8.2**	8.1	7.0 – 8.5	N
SW-BP-01	Q4	**5.9**	7.9	8.1	8.1	7.0 – 8.5	N
SW-FC-01	Q3	**9.0**	7.9	8.0	8.0	7.0 – 8.5	N
SW-FC-01	PR	**9.0**	7.9	8.1	8.0	7.0 – 8.5	Y
SW-FC-01	Q4	**6.0**	7.9	8.0	8.0	7.0 – 8.5	N
SW-B-01	Q3	**9.3**	7.7	8.0	8.0	7.0 – 8.5	N
SW-B-01	PR	**8.1**	7.7	8.0	8.0	7.0 – 8.5	N
SW-B-01	Q4	**6.0**	7.7	8.0	8.0	7.0 – 8.5	N
SW-AC-01	Q3	**8.2**	7.3	7.9	8.0	7.0 – 8.5	Y
SW-AC-01	PR	**9.6**	7.3	**9.2**	8.0	7.0 – 8.5	Y
SW-AC-01	Q4	**6.0**	7.3	**6.8**	8.0	7.0 – 8.5	N
SW-EC-01	Q3	**8.1**	7.3	7.6	7.7	6.5 – 8.0	Y
SW-EC-01	PR	**8.6**	7.3	**8.3**	7.7	6.5 – 8.0	Y
SW-EC-01	Q4	**6.1**	7.3	**6.6**	7.7	6.5 – 8.0	Y

Electrical Conductivity (mS/cm)

LOCATION	SAMPLING ROUND	FIELD RECORDED VALUE	FIELD 80TH PERCENTILE BASELINE DATA	LABORATORY RECORDED VALUE	LABORATORY 80TH PERCENTILE BASELINE DATA	ANZECC TRIGGER VALUE	WTP DISCHARGE
SW-SC-01	Q3	**0.8**	0.5	-	0.5	0.1 – 2.2	Y
SW-SC-01	PR	0.4	0.5	-	0.5	0.1 – 2.2	Y
SW-SC-01	Q4	**1.1**	0.5	0.5	0.5	0.1 – 2.2	Y
SW-SC-02	Q3	34.8	43.8	-	36.4	-	Y
SW-SC-02	PR	0.4	43.8	-	36.4	-	Y
SW-SC-02	Q4	29.6	43.8	2.3	36.4	-	Y
SW-FR-02	Q3	**54.1**	52.7	-	49.6	-	N
SW-FR-02	PR	4.3	52.7	-	49.6	-	N
SW-FR-02	Q4	37.3	52.7	39.0	49.6	-	N
SW-MP-01	Q3	1.2	18.0	-	45.0	-	N
SW-MP-01	PR	1.2	18.0	-	45.0	-	N
SW-MP-01	Q4	**44.8**	18.0	46.0	45.0	-	N
SW-BP-01	Q3	**55.1**	51.3	-	52.2	-	N
SW-BP-01	PR	48.3	51.3	-	52.2	-	N
SW-BP-01	Q4	50.6	51.3	52.0	52.2	-	N
SW-FC-01	Q3	**54.7**	53.0	-	49.4	-	N
SW-FC-01	PR	52.1	53.0	-	49.4	-	Y
SW-FC-01	Q4	48.7	53.0	51.0	49.4	-	N
SW-B-01	Q3	**54.8**	53.0	-	52.0	-	N
SW-B-01	PR	48.3	53.0	-	52.0	-	N
SW-B-01	Q4	49.5	53.0	52.0	52.0	-	N
SW-AC-01	Q3	0.5	0.6	-	0.6	-	Y
SW-AC-01	PR	0.3	0.6	-	0.6	-	Y
SW-AC-01	Q4	0.2	0.6	0.2	0.6	-	N
SW-EC-01	Q3	0.3	0.6	-	0.6	0.1 – 2.2	Y
SW-EC-01	PR	0.2	0.6	-	0.6	0.1 – 2.2	Y
SW-EC-01	Q4	0.2	0.6	0.2	0.6	0.1 – 2.2	Y

Turbidity (Field)/TSS (Laboratory)

LOCATION	SAMPLING ROUND	FIELD RECORDED VALUE (NTU)	FIELD 80TH PERCENTILE BASELINE DATA	LABORATORY RECORDED VALUE (TSS)	LABORATORY 80TH PERCENTILE BASELINE DATA	ANZECC TRIGGER VALUE (NTU)	WTP DISCHARGE
SW-SC-01	Q3	14.0	38.8	12.0	12.6	6 – 50	Y
SW-SC-01	PR	24.4	38.8	8.0	12.6	6 – 50	Y
SW-SC-01	Q4	**74.3**	38.8	9.0	12.6	6 – 50	Y
SW-SC-02	Q3	0.8	2.4	<5.0	10.4	0.5 – 10	Y
SW-SC-02	PR	**16.2**	2.4	<5.0	10.4	0.5 – 10	Y
SW-SC-02	Q4	**0.0**	2.4	<5.0	10.4	0.5 – 10	Y
SW-FR-02	Q3	**6.1**	0.4	<5.0	10.0	0.5 – 10	N
SW-FR-02	PR	**66.7**	0.4	**13.0**	10.0	0.5 – 10	N
SW-FR-02	Q4	4.4	0.4	7.0	10.0	0.5 – 10	N
SW-MP-01	Q3	**59.9**	35.2	12.0	58.4	0.5 – 10	N
SW-MP-01	PR	**85.0**	35.2	22.0	58.4	0.5 – 10	N
SW-MP-01	Q4	12.2	35.2	8.0	58.4	0.5 – 10	N
SW-BP-01	Q3	0.0	0.2	6.0	10.8	0.5 – 10	N
SW-BP-01	PR	**0.4**	0.2	<5.0	10.8	0.5 – 10	N
SW-BP-01	Q4	0.0	0.2	6.0	10.8	0.5 – 10	N
SW-FC-01	Q3	**8.0**	1.6	9.0	11.6	0.5 – 10	N
SW-FC-01	PR	1.1	1.6	5.0	11.6	0.5 – 10	Y
SW-FC-01	Q4	0.0	1.6	<5.0	11.6	0.5 – 10	N
SW-B-01	Q3	0.0	1.6	<5.0	10.4	0.5 – 10	N
SW-B-01	PR	0.5	1.6	<5.0	10.4	0.5 – 10	N
SW-B-01	Q4	0.0	1.6	<5.0	10.4	0.5 – 10	N
SW-AC-01	Q3	**50.8**	14.9	6.0	10.0	0.5 – 10	Y
SW-AC-01	PR	0.0	14.9	**820.0**	10.0	0.5 – 10	Y
SW-AC-01	Q4	**203.0**	14.9	**76.0**	10.0	0.5 – 10	N
SW-EC-01	Q3	39.5	170.2	10.0	57.0	6 – 50	Y
SW-EC-01	PR	144.0	170.2	13.0	57.0	6 – 50	Y
SW-EC-01	Q4	**687.0**	170.2	**230.0**	57.0	6 – 50	Y

Dissolved Oxygen (%)

LOCATION	SAMPLING ROUND	DO (MG/L) RECORDED VALUE	DO (MG/L) 80TH PERCENTILE BASELINE DATA	DO % RECORDED VALUE	DO% 80TH PERCENTILE BASELINE DATA	ANZECC TRIGGER VALUE	WTP DISCHARGE
SW-SC-01	Q3	7.8	7.5	78.4	86.4	85 - 110	Y
SW-SC-01	PR	**8.7**	7.5	**94.8**	86.4	85 - 110	Y
SW-SC-01	Q4	7.4	7.5	83.7	86.4	85 - 110	Y
SW-SC-02	Q3	**8.9**	6.9	**98.0**	86.3	80 - 110	Y
SW-SC-02	PR	**10.4**	6.9	**111.1**	86.3	80 - 110	Y
SW-SC-02	Q4	5.5	6.9	70.9	86.3	80 - 110	Y
SW-FR-02	Q3	5.6	6.6	71.2	84.7	80 - 110	N
SW-FR-02	PR	**8.5**	6.6	**90.8**	84.7	80 - 110	N
SW-FR-02	Q4	5.5	6.6	72.6	84.7	80 - 110	N
SW-MP-01	Q3	6.5	8.8	67.3	105.3	80 - 110	N
SW-MP-01	PR	**10.9**	8.8	**119.8**	105.3	80 - 110	N
SW-MP-01	Q4	7.3	8.8	97.8	105.3	80 - 110	N
SW-BP-01	Q3	8.4	8.9	105.6	118.6	80 - 110	N
SW-BP-01	PR	6.5	8.9	89.0	118.6	80 - 110	N
SW-BP-01	Q4	8.6	8.9	118.4	118.6	80 - 110	N
SW-FC-01	Q3	8.1	8.7	101.5	112.4	80 - 110	N
SW-FC-01	PR	**14.6**	8.7	**193.0**	112.4	80 - 110	Y
SW-FC-01	Q4	8.1	8.7	110.2	112.4	80 - 110	N
SW-B-01	Q3	7.4	8.3	93.8	107.3	80 - 110	N
SW-B-01	PR	**9.2**	8.3	**119.1**	107.3	80 - 110	N
SW-B-01	Q4	7.9	8.3	**109.0**	107.3	80 - 110	N
SW-AC-01	Q3	8.5	9.6	86.2	103.7	80 - 110	Y
SW-AC-01	PR	**14.2**	9.6	**150.0**	103.7	80 - 110	Y
SW-AC-01	Q4	9.7	9.6	110.8	103.7	80 - 110	N
SW-EC-01	Q3	5.8	7.6	51.1	80.4	85 - 110	Y
SW-EC-01	PR	**20.9**	7.6	**220.7**	80.4	85 - 110	Y
SW-EC-01	Q4	**9.2**	7.6	**108.3**	80.4	85 - 110	Y

Iron and Manganese (mg/L)

LOCATION	SAMPLING ROUND	FE (MG/L) RECORDED VALUE	FE (MG/L) 80TH PERCENTILE BASELINE DATA	MN (MG/L) RECORDED VALUE	MN (MG/L) 80TH PERCENTILE BASELINE DATA	ANZECC TRIGGER VALUE (MN)	WTP DISCHARGE
SW-SC-01	Q3	0.42	0.8	0.04	0.00	1.9	Y
SW-SC-01	PR	0.30	0.8	0.02	0.00	1.9	Y
SW-SC-01	Q4	0.33	0.8	0.03	0.00	1.9	Y
SW-SC-02	Q3	0.45	0.6	0.03	0.10	-	Y
SW-SC-02	PR	0.25	0.6	0.01	0.10	-	Y
SW-SC-02	Q4	0.42	0.6	0.02	0.10	-	Y
SW-FR-02	Q3	0.05	0.1	0.01	0.00	-	N
SW-FR-02	PR	**0.45**	0.1	0.02	0.00	-	N
SW-FR-02	Q4	**0.27**	0.1	0.02	0.00	-	N
SW-MP-01	Q3	0.82	0.9	0.03	0.00	-	N
SW-MP-01	PR	**1.90**	0.9	0.07	0.00	-	N
SW-MP-01	Q4	0.20	0.9	0.01	0.00	-	N
SW-BP-01	Q3	0.06	0.1	0.01	0.00	-	N
SW-BP-01	PR	**0.24**	0.1	0.02	0.00	-	N
SW-BP-01	Q4	0.10	0.1	0.01	0.00	-	N
SW-FC-01	Q3	0.10	0.1	0.01	0.00	-	N
SW-FC-01	PR	**0.58**	0.1	0.02	0.00	-	Y
SW-FC-01	Q4	**0.20**	0.1	0.01	0.00	-	N
SW-B-01	Q3	0.04	0.00	0.01	0.00	-	N
SW-B-01	PR	**0.27**	0.00	0.02	0.00	-	N
SW-B-01	Q4	0.04	0.00	0.01	0.00	-	N
SW-AC-01	Q3	0.45	0.9	0.02	0.03		Y
SW-AC-01	PR	**18.00**	0.9	0.40	0.03		Y
SW-AC-01	Q4	**3.80**	0.9	0.10	0.03		N
SW-EC-01	Q3	0.10	2.8	0.02	0.3	1.9	Y
SW-EC-01	PR	0.68	2.8	0.02	0.3	1.9	Y
SW-EC-01	Q4	**4.60**	2.8	0.20	0.3	1.9	Y

Oil and Grease

LOCATION	SAMPLING ROUND	OIL AND GREASE RECORDED VALUE (MG/L)	OIL AND GREASE 80TH PERCENTILE BASELINE DATA	ANZECC TRIGGER VALUE (MG/L)	WTP DISCHARGE
SW-SC-01	Q3	<5	5.0	-	Y
SW-SC-01	PR	<5	5.0	-	Y
SW-SC-01	Q4	<5	5.0	-	Y
SW-SC-02	Q3	<5	5.0	-	Y
SW-SC-02	PR	<5	5.0	-	Y
SW-SC-02	Q4	**7.0**	5.0	-	Y
SW-FR-02	Q3	<5	5.0	-	N
SW-FR-02	PR	<5	5.0	-	N
SW-FR-02	Q4	<5	5.0	-	N
SW-MP-01	Q3	<5	5.0	-	N
SW-MP-01	PR	<5	5.0	-	N
SW-MP-01	Q4	**6.0**	5.0	-	N
SW-BP-01	Q3	<5	5.0	-	N
SW-BP-01	PR	<5	5.0	-	N
SW-BP-01	Q4	<5	5.0	-	N
SW-FC-01	Q3	<5	5.0	-	N
SW-FC-01	PR	<5	5.0	-	Y
SW-FC-01	Q4	<5	5.0	-	N
SW-B-01	Q3	<5	5.0	-	N
SW-B-01	PR	<5	5.0	-	N
SW-B-01	Q4	<5	5.0	-	N
SW-AC-01	Q3	<5	5.0	-	Y
SW-AC-01	PR	<5	5.0	-	Y
SW-AC-01	Q4	6.0	5.0	-	N
SW-EC-01	Q3	<5	5.0	-	Y
SW-EC-01	PR	<5	5.0	-	Y
SW-EC-01	Q4	**8.0**	5.0	-	Y