



## Windsor Bridge Replacement Project

Roads and Maritime

Construction water quality monitoring report - October 2018 - September  
2019 (Year 1)

| Final

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Client Reference



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Project Manager: Tim Rodham  
Author: Kate Byrnes and Jorja Vernon  
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Jacobs Australia Pty Limited

Level 7, 177 Pacific Highway  
North Sydney NSW 2060 Australia  
PO Box 632 North Sydney  
NSW 2059 Australia  
T +61 2 9928 2100  
F +61 2 9928 2444  
[www.jacobs.com](http://www.jacobs.com)

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## 1. Introduction

### 1.1 The project

The Windsor Bridge Replacement Project requires a new road bridge over the Hawkesbury River at Windsor. The existing bridge over the Hawkesbury River requires replacement as it does not meet the current engineering and road design standards.

The following key features are proposed as part of the Project:

- Construction of a new bridge over the Hawkesbury River at Windsor, approximately 35 metres downstream of the existing Windsor Bridge.
- Construction of new approach roads and intersections to connect the new bridge to the existing road network.
- Modifications to local road and access arrangement including a shared pedestrian/cycle pathway for access to and across the new bridge.
- Removal and backfilling of the existing bridge approach roads.
- Demolition and removal of the existing road bridge, known as Windsor Bridge.
- Urban design and landscaping works, including within the parkland area of Thompson Square and adjacent to the norther intersection of Wilberforce Road, Freemans Reach Road and Macquarie Park access road.
- Ancillary works such as public utility adjustments, water management measures and scour protection works as required.

### 1.2 Project approval

The Instrument of Approval was granted by the Minister for Planning and Infrastructure on 20 December 2013 for the Windsor Bridge Replacement Project. The approval includes the following condition with respect to Soil and Water Quality:

**Condition C24 – Water Quality Monitoring Program:** *The applicant shall prepare and implement a Water Quality Management Program (WQMP) to monitor and minimise the impacts of the project on surface and groundwater quality and resources and wetlands, during construction and operation of the proposed Windsor Bridge, and demolition of the existing bridge. The program shall be developed in consultation with the office of Environment and Heritage (OEH), Environment Protection Authority (EPA), Department of Primary Industries (DPI) Fishing and Aquaculture and NOW (currently Department of Industry).*

### 1.3 Purpose of this report

The WQMP was developed in response to the Minister for Planning and Infrastructure approval granted on 20 December 2013 which detailed a condition (C24) that a Water Quality Management Program must be developed and implemented. The WQMP outlines the monitoring and assessment requirements for pre-construction, construction and post construction surface and groundwater quality and levels. This report addresses the first year of construction between 01 October 2018 and 30 September 2019 of surface and groundwater quality and

level monitoring requirements outlined in Chapter 5 and Chapter 6/7 of the WQMP, which include, but are not limited to:

- Undertaking surface and groundwater quality sampling monthly and at other intervals (wet weather) for the duration of the construction period.
- Updating baseline reference and upstream site data with collected data and recalculate trigger values.
- Collecting and analysing representative surface water samples for physical and chemical water quality indicators during dry and wet weather.
- Collecting and analysing representative groundwater samples for physical and chemical water quality indicators during dry and wet weather.
- Collecting and reporting of groundwater levels each month at the three groundwater piezometer locations for the duration of the active construction phase.
- Comparing surface water sampling results with corresponding site specific trigger values.
- Comparing upstream and downstream surface water sampling results to evaluate and determine whether any changes and/or impacts on water quality might be attributable to construction.
- Comparing groundwater quality data with corresponding baseline trigger values developed from baseline monitoring.
- Comparing groundwater levels to the 80<sup>th</sup> percentile trigger value.
- Identification of any impacts the construction is having on surface water and groundwater quality and groundwater levels.
- Providing an assessment of water quality control measures in place

## **1.4 Information about the report**

The findings presented in this report are professional opinions based solely upon information and data provided by Transport or NSW (previously Roads and Maritime Service) or otherwise available in the public domain. Results have been reported based on field assessment during the 2018-2019 construction period however physical and environmental conditions may exist that are beyond the scope of our investigations and this report.

Jacobs has relied upon and presumed that the information provided by Transport is accurate and Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete or if conditions change then it is possible that any conclusions as expressed in this report may change. For the reasons outlined, above no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report.

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## 2. Methodology

The Secretary approved method for surface and groundwater quality/level monitoring is outlined in detail in the WQMP. This chapter provides a summary of key elements of the program.

### 2.1 Monitoring sites

The location of the proposed works to the Hawkesbury River means that there is the potential to directly impact on surface water during the construction and operation of the new bridge and demolition of the existing bridge. As such, surface water quality monitoring sites were selected to ensure potential impacts from the project could be identified early so measures can be implemented to mitigate impacts where necessary.

The construction phase of Windsor Bridge Replacement presents a low risk groundwater through interference with local groundwater aquifer and/or contamination of groundwater from hazardous liquid spills.

Monitoring locations were identified for surface quality and groundwater quality/level monitoring during pre-construction, construction, demolition and operation. Additionally, control sites for surface water quality monitoring were selected to monitor during wet weather. Table 2-1 lists the surface and groundwater sites that were monitored as part of the construction phase. All surface water sites are within the Hawkesbury River.

Table 2-1 Water monitoring locations (surface and groundwater)

Water Type	Monitoring site	WQMP site nomenclature	Project Phase	Description and location details
Groundwater	South bank borehole 1	NP-BH01 (Sacrificial BH)	Pre-construction only  (Refer to Section 2.5.2 for further details).	South bank, 13.00m deep. Alluvium with Permian bedrock (4 – 13 m)
	North bank borehole 2	NP-BH02 (Sacrificial BH)	Pre-construction only  (Refer to Section 2.5.2 for further details).	North bank, 25.40m deep. Alluvial.
	Reference borehole	NC-RBH01 (S and D)  Referred to as NC-RBH01A & B on Figure A 1.	All Phases.	As per the pre-construction monitoring report, a new reference borehole with monitoring at the Alluvial layer and the Permian layer was drilled and the original reference borehole (RBH01) was not monitored post-preconstruction.  The new reference borehole has two monitoring levels and

Water Type	Monitoring site	WQMP site nomenclature	Project Phase	Description and location details
				is located in the stockpile yard north of Wilberforce Road. NC-RBH01S is 12 m deep and targets the alluvial layer. NC-RBH01D is 25m deep and targets the Permian bedrock layer.
	North bank borehole	NC-BH02 (S and D)  Referred to as NC-BH02 A & B on Figure A1.	Construction, Decommissioning  (Refer to Section 122.5.2 for further details).	2 adjacent wells located on northern bank. Well A is 6 – 12m deep and targets shallow alluvial material whilst Well B is 19 – 25m deep and targets the deep alluvial material.
	South bank borehole	SC-BH01	Construction, Decommissioning  (Refer to Section 2.5.2 for further details).	South bank, screened at base of alluvium layer.
Surface water	Reference site 1	NC-RS50	All Phases.	North bank, 50m upstream of existing bridge and upstream of control site (NC-CS1)
	Reference site 2	SC-RS100	All Phases.	South bank, 100m upstream of existing bridge and upstream of control site (SC-CS2)
	Impact site 1	NC-IS10 U/S NC-IS10 D/S	Construction, Decommissioning	North bank 10m upstream and downstream of proposed bridge
	Impact site 2	SC-IS10 U/S SC-IS10 D/S	Construction, Decommissioning	South bank 10m upstream and downstream of proposed bridge
	Impact site 3	NC-IS50 D/S	All Phases.	North bank 50m downstream of proposed bridge
	Impact site 4	SC-IS50 D/S	All Phases.	South bank 50m downstream of proposed bridge
	Control Site 1	NC-CS1	All Phases.	North bank stormwater outlet upstream of existing bridge (wet weather only)

Water Type	Monitoring site	WQMP site nomenclature	Project Phase	Description and location details
	Control Site 2	SC-CS2	All Phases.	South bank stormwater outlet upstream of existing bridge (wet weather only)

A figure of these surface and groundwater water monitoring locations is provided Appendix A.

## 2.2 Monitoring parameters

Water quality monitoring parameters were selected with consideration of:

- RTA's *Guideline for Construction Water Quality Monitoring* (RTA, nd)
- DPI (Water) Standard suite of analytes with additional analytes included based on what is expected to be potentially modified by the project.

Surface water quality included both field parameters and laboratory analysis and groundwater included field parameters only. The analytical suite is presented in Table 2-2. Additional information on monitoring parameters is provided in the WQMP.

Table 2-2 Water quality monitoring parameters

Parameter type	Surface (SW) or groundwater (GW)	Parameter	Unit of measurement	Analysis method
Chemical properties	SW and GW	pH	pH Units	Field measurement
Chemical properties	SW and GW	Dissolved oxygen (DO)	% saturation	Field measurement
Physical properties	SW and GW	Turbidity	NTU	Field measurement
Physical properties	SW and GW	Temperature	°C	Field measurement
Physical properties	SW and GW	Electrical conductivity	mS/cm	Field measurement
Physical properties	SW and GW	Salinity	ppt	Field measurement
Physical properties	SW and GW	Redox Potential	MV	Field measurement
Physical properties	SW	Total suspended solids (TSS)	mg/L	Laboratory measurement
Physical properties	SW	Total dissolved solids (TDS)	mg/L	Laboratory measurement
Major anions	SW	- Chloride (Cl) - Sulfate (SO <sub>4</sub> ) - Bicarbonate (HCO <sub>3</sub> )	mg/L	Laboratory measurement
Major cations	SW	- Calcium (Ca) - Magnesium (Mg) - Sodium (Na) - Potassium (K)		Laboratory measurement
Dissolved metals	SW	Dissolved metals - Aluminium (Al) - Antimony (Sb)	mg/L	Laboratory measurement

Parameter type	Surface (SW) or groundwater (GW)	Parameter	Unit of measurement	Analysis method
		<ul style="list-style-type: none"> <li>- Arsenic (As)</li> <li>- Barium (Ba)</li> <li>- Boron (B)</li> <li>- Cadmium (Cd)</li> <li>- Chromium (Cr)</li> <li>- Copper (Cu)</li> <li>- Iron (Fe)</li> <li>- Lead (Pb)</li> <li>- Lithium (Li)</li> <li>- Manganese (Mn)</li> <li>- Mercury (Hg)</li> <li>- Nickel (Ni)</li> <li>- Selenium (Se)</li> <li>- Silver (Ag)</li> <li>- Zinc (Zn)</li> </ul>		
Nutrients	SW	Total nitrogen (TN)	mg/L	Laboratory measurement
	SW	Total phosphorus (TP)	mg/L	Laboratory measurement
Organochlorine Pesticides (OC)	SW	Organochlorine Pesticides (OC) <ul style="list-style-type: none"> <li>- alpha-BHC</li> <li>- Hexachlorobenzene (HCB)</li> <li>- beta-BHC</li> <li>- gamma-BHC</li> <li>- delta-BHC</li> <li>- Heptachlor</li> <li>- Aldrin</li> <li>- Heptachlor epoxide</li> <li>- trans-Chlordane</li> <li>- alpha-Endosulfan</li> <li>- cis-Chlordane</li> <li>- Dieldrin</li> <li>- 4,4'-DDE</li> <li>- Endrin</li> <li>- beta-Endosulfan</li> <li>- 4,4'-DDD</li> <li>- Endrin aldehyde</li> <li>- Endosulfan sulfate</li> <li>- 4,4'-DDT</li> <li>- Endrin ketone</li> <li>- Methoxychlor</li> <li>- Total Chlordane (sum)</li> <li>- Sum of DDD + DDE + DDT</li> </ul>	µg/L	Laboratory measurement

Parameter type	Surface (SW) or groundwater (GW)	Parameter	Unit of measurement	Analysis method
		- Sum of Aldrin + Dieldrin		
Organophosphorus Pesticides (OP)	SW	Organophosphorus Pesticides (OP) - Dichlorvos - Demeton-S-methyl - Monocrotophos - Dimethoate - Diazinon - Chlorpyrifos-methyl - Parathion-methyl - Malathion - Fenthion - Chlorpyrifos - Parathion - Pirimphos-ethyl - Chlorgenvinphos - Bromophos-ethyl - Fenamiphos - Prothifos - Ethion - Carbophenothion - Azinphos Methyl	µg/L	Laboratory measurement
Polyaromatic hydrocarbons (PAHs)	SW	Polyaromatic hydrocarbons (PAHs) - Naphthalene - Acenaphthylene - Acenaphthene - Fluorene - Phenanthrene - Anthracene - Fluoranthene - Pyrene - Benz(a)anthracene - Chrysene - Benzo(b+j)fluoranthene - Benzo(k)fluoranthene - Benzo(a)pyrene - Indeno(1.2.3.cd)pyrene - Dibenz(a,h)anthracene - Benzo(g.h.i)perylene - Sum of polycyclic aromatic hydrocarbons	µg/L	Laboratory measurement

Parameter type	Surface (SW) or groundwater (GW)	Parameter	Unit of measurement	Analysis method
		- Benzo(a)pyrene TEQ (zero)		
BTEXN	SW	BTEXN - Benzene - Toluene - Ethylbenzene - meta- & para-Xylene - ortho-Xylene - Total Xylenes - Sum of BTEX - Naphthalene	µg/L	Laboratory measurement
Total Petroleum Hydrocarbons	SW	Total Petroleum Hydrocarbons - C6 - C9 Fraction - C10 - C14 Fraction - C15 - C28 Fraction - C29 - C36 Fraction - C10 - C36 Fraction (sum)	µg/L	Laboratory measurement
Total Recoverable Hydrocarbons	SW	Total Recoverable Hydrocarbons - C6 - C10 Fraction - C6 - C10 Fraction minus BTEX (F1) - >C10 - C16 Fraction - >C16 - C34 Fraction - >C34 - C40 Fraction - >C10 - C40 Fraction (sum) - >C10 - C16 Fraction minus Naphthalene (F2)	µg/L	Laboratory measurement
Groundwater levels	GW	Groundwater levels	Metres below top of casing	Field measurement by dip meter and continually monitored using dataloggers at hourly intervals, with data downloaded monthly.

## 2.4 Water quality analysis

Depending on the parameter, the analysis of surface water quality can be undertaken in one of two ways. Some physical and chemical properties due to their rapid degradation are analysed in the field as identified in Table 2-2. Field monitoring was performed *in situ* using a calibrated Horiba Water Quality Meter. The water quality meter was calibrated prior to each sampling event.

Laboratory analysis was undertaken using the NATA accredited laboratory ALS. Samples are collected on-site in laboratory supplied pre-sterilised sample bottles and preserved on ice during transport to the laboratory. A chain of custody form was completed on each sampling trip to keep track of samples from the field, to the laboratory and then to the database.

Groundwater monitoring consisted of field analysis of physical and chemical properties (outlined in Table 2-2) only. Data from groundwater level datalogger was downloaded in the field.

## 2.5 Monitoring frequency and duration

### 2.5.1 Surface water

As per the WQMP, during the construction surface water quality monitoring phase, sampling of all parameters provided in Table 2-2 are required to be undertaken for a minimum of one dry weather event per month. Additional monitoring (up to two sampling events) shall occur following a wet weather event or any controlled discharges. A wet-weather event is defined as more than 20 millimetres of rainfall within a 24-hour period. Sampling for a wet weather event commenced within 24 hours of the cessation of that rainfall. It should be noted that there were no controlled discharges from the site during the construction first year of construction and therefore this type of monitoring event did not occur. As such, monitoring during the construction phase comprised of a maximum of two events per month, one dry and one wet (when sufficient rainfall occurred).

Pre-construction monitoring ceased on the 11 October 2018 following the third and final wet weather event during pre-construction. Construction phase monitoring commenced on the 31 October 2018 and continued on a monthly basis. The ongoing requirements for construction, operation and decommissioning monitoring are detailed in the WQMP and will be outlined in subsequent monitoring reports.

### 2.5.2 Groundwater

There are three groundwater bores monitored as part of the construction phase, one reference borehole and two boreholes within the construction works. The reference borehole (NC-RBH01) is a paired site and monitors two geological formations – the alluvial layer (NC-RBH01S) and the Permian bedrock layer (NC-RBH01D). The boreholes within the construction works are located on the north and south bank of the river and are referred to as impact sites. The borehole on the north bank NCBH02 is a paired site and monitors two geological formations - the alluvial layer (NC-BH02S) and the Permian bedrock layer (NC-BH02D). The borehole on the south bank SC-BH01 monitors the alluvial layer.

Both boreholes that were located within the construction works area were relocated from the pre-construction phase as they were situated within the footprint of the new Windsor Bridge. Boreholes NC-BH02S and NC-BH02D replaced the north bank borehole NP-NH02 (sacrificial) and was built approximately 125 metres east of the sacrificial borehole location. SC-BH01 replaced the south bank borehole SP-BH01 (sacrificial) and was built approximately 50 metres east of the sacrificial borehole location (See Figure A 1). The preconstruction data however will be used to determine any changes to groundwater quality.

*In-situ* groundwater quality sampling was undertaken at the same time as surface water quality using a water quality probe. Hydrasleeves were installed at boreholes NC-RBH01 and NC-BH02 and therefore these bores did

not require purging prior to sampling. There is insufficient water to use a hyrdasieve at SCBH01 and therefore sampling of this bore consists of purging dry, leaving for a few hours and then sampling.

Groundwater levels were continually monitored using installed dataloggers at hourly intervals, with data downloaded monthly.

## **2.6 Rainfall records**

During the construction phase monitoring period (year 1), rainfall records were obtained from the Bureau of Meteorology (BoM) gauge at Richmond RAAF NSW – Station No. 067105. Rainfall records for this are provided in Appendix B.

## 3. Results

### 3.1 Prevailing climatic conditions

Rainfall during the first year of the construction phase monitoring has been mixed, with above average monthly rainfall recorded in October, November and December 2018, and January, March and September 2019. Below average rainfall was recorded in February, April, May and June, July and August 2019 (See Figure 3.1) and did not record enough rainfall to undertake wet weather monitoring.

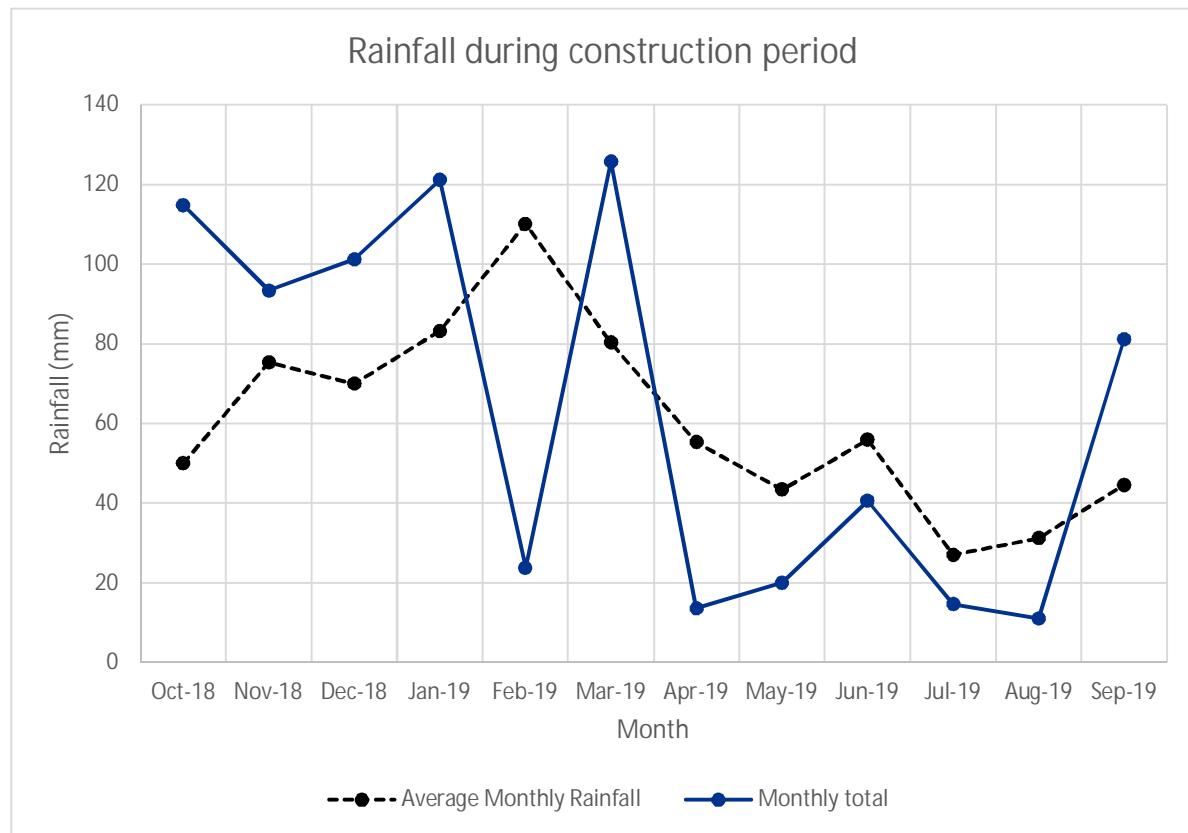


Figure 3.1 Average monthly rainfall compared to monthly rainfall total during year 1 of construction as recorded at Richmond RAAF Weather Station. (Source: BOM, 2019).

### 3.2 Summary of main construction activities

Construction activities across the project with the potential to impact on surface water quality and groundwater included:

- September - October 2018 - land clearing
- October – November 2018 – southern scour rock placement (no excavation on south side)
- October 2018 – March 2019 – northern scour excavation

- November 2018 – May 2019 – marine piling
- February 2019 – terrestrial piling north bank
- November 2018 – March 2019 – terrestrial piling south side, and
- May 2019 - September 2019 – pouring of concrete segments

### **3.2.1 Water quality control measures**

There are a number of water quality control measures that have been implemented to protect the water quality of the Hawkesbury-River during the construction of Windsor Bridge. These measures are outlined in onsite erosion and sediment control plans (ESCP) for activities such as land piling, bridge construction, local road works and earthworks.

The controls in the ESCP include the following.

- Separation of offsite and onsite water
- Installation of temporary erosion and sediment controls (sediment fences, mulch bunds, sandbags) prior to disturbance included
- Stockpile management (including diversion bank upslope, sediment fence downslope and temporary vegetation)
- Runoff control including earth bunds, silt curtains, geofab lined drains
- Dust control
- Regular inspection of controls undertaken by Environmental Site Representative (Georgiou), Lead Environment Officer (Transport), and Environmental Representative for the project.

### **3.3 Limitations**

- A total of eight wet weather events (>20mm of rain in 24 hours) occurred during the first year of construction with four of these captured under this monitoring program. Two events occurred in October 2018, one of which was recorded in during pre-construction monitoring and the other was missed due to handover of monitoring program. The other missed wet weather events occurred in January and March 2019 due to rain occurring on weekends, where access to site cannot be gained 24 hours after the event and due to unsafe river conditions.
- Wet weather monitoring undertaken in November and December 2018 occurred following significant rainfall events. A total of 62.6mm and 53mm fell prior to the November and December sampling respectively (as recorded at the BOM Richmond RAAF weather station). Wet weather monitoring undertaken in September 2019 was also following significant rainfall, with 55.6mm of rain prior to sampling.
- No dry weather sampling undertaken in November 2018, due to consistent rainfall throughout the month preventing collection a ‘representative’ dry sample.
- Whilst the 80<sup>th</sup> and 20<sup>th</sup> percentile trigger values have been recalculated for reference sites to incorporate pre-construction and construction dry weather data, technically they do not meet the minimum ANZG (2018) requirements of a minimum of 24 sampling events required to determine site specific trigger values. At the time of preparing this report, a total of 16 dry weather events had been undertaken (up to September 2019).

- Where a concentration of a particular parameter is found to be less than the limit of reporting (LOR), the LOR value is used as a conservative assumption.
- As per the WQMP monitoring of borehole SP-BH01 and NP-BH02 (sacrificial boreholes) were only sampled on 2 occasions during the construction phase as from December 2018 these boreholes were no longer accessible once construction commenced.
- On the 25<sup>th</sup> January 2019, the monitoring borehole located on the south bank (SC-BH01) was unable to be sampled due to access constraints, where a large skip bin was located on top of the borehole that was unable to be moved for monitoring.

### **3.4 Summary of results**

Appendix C and Appendix D provide a summary of results for surface water and groundwater quality/level results.

### **3.5 Discussion**

Figures included in Appendix D represent an aggregate summary of water quality results for surface water and groundwater reference sites, impact sites and control sites. In accordance with the WQMP, the 80<sup>th</sup> and 20<sup>th</sup> percentile for reference sites form the trigger values for median downstream results. Appendix C includes all monitoring results for this construction period.

#### **3.5.1 Surface Water**

Based on the construction water quality monitoring program to date, the following observations with respect to surface water can be made:

Dry weather

- pH – pH levels during dry weather at the impact sites generally fell within the cumulative site-specific trigger values (SSTVs) for the reference sites with the exception of December 2018 when high pH was recorded at all impact sites. pH levels on this occasion were more than 1pH unit higher than the pre-construction SSTVs for impact sites and all other dry weather monitoring results for the construction period. As the increase in pH was also observed at the reference sites, it is unlikely that the cause is construction related.
- Turbidity – during dry weather, turbidity levels at the reference sites generally showed an increasing trend for the first 6 months of the construction period. Turbidity at the impact sites were generally slightly lower than the reference sites. There were occasions when noticeably higher turbidity levels were recorded at the impact sites, however corresponding increases in turbidity were also observed at the reference sites. Overall, turbidity levels have been higher during the construction period which corresponds to a much wetter sampling season than pre-construction.
- Dissolved oxygen – dissolved oxygen levels at the reference sites were generally compliant with the corresponding cumulative SSTVs. Elevated dissolved oxygen recorded in June and July 2019 was noticeably higher than the 80<sup>th</sup> percentile. Dissolved oxygen levels at the impact sites generally fell within the SSTVs for reference sites throughout the construction period and were within the pre-construction SSTVs (for impact sites) for the first 6 months of the construction period. When elevated dissolved oxygen was recorded it was not consistent between the impact sites. For example, elevated dissolved oxygen in March 2019 at most downstream sites on the north bank did not correspond to

elevated dissolved oxygen upstream. Similarly, elevated dissolved oxygen at the south bank immediately upstream and downstream of the impact did not coincide with elevated dissolved oxygen levels further downstream. Given the inconsistencies between sites, impacts attributable to construction are considered unlikely. It should be noted that dissolved oxygen concentrations are closely linked to surface water temperature, which warmer water resulting in lower dissolved oxygen and cooler water resulting in higher oxygen concentrations. The fluctuations in dissolved oxygen at the monitoring sites appear to correspond to fluctuating surface temperatures.

- Total nitrogen – total nitrogen concentrations recorded at the reference sites during the construction period were generally similar between the north and south banks. There were instances of very high TN concentrations recorded on the north bank which has resulted in higher cumulative SSTV. Nitrogen concentrations during construction at the impact sites were generally compliant with the SSTVs on the northern bank. The exception to this occurred in September 2019, when nitrogen concentrations were marginally higher than the 80<sup>th</sup> percentile aggregate concentrations 10m upstream and 50m downstream of the construction site. On the south bank, concentrations exceeded the aggregate SSTV for the 80<sup>th</sup> percentile at all impact sites in June, July and September 2019 and at the downstream impact sites in October 2018. The exceedances in June and September 2019 also exceeded the preconstruction SSTV for all impact sites. The elevated concentrations of nitrogen at the impacts sites in June appear unrelated to the project as there were no earthworks occurring and scour protection was in place. It is plausible that some smaller wet weather events prior to sampling may have resulted in runoff from the upstream catchment which includes agricultural land uses, namely irrigated plants such as market gardens and turf farms (Edge Land Planning 2019). These types of land uses typically contribute elevated levels of nutrients to runoff and could have contributed to elevated nitrogen.
- Total phosphorus – total phosphorus concentrations fluctuated between 0.01mg/L and 0.02mg/L each month at the reference sites with the exception in October 2018 when elevated TP (0.05) was recorded at the reference site on the south bank and August and September 2019 when elevated concentrations were recorded on the north bank reference site (TP 0.04). As these exceedances occurred at the reference site on an outgoing tide they are unrelated to construction. Similar fluctuations were recorded at the impact sites.
- Metals – concentrations of the dissolved metals antimony, arsenic, cadmium, selenium, silver and boron were recorded below the detection limit at all reference and impact sites during dry weather sampling. Dissolved lead was detected on one occasion in July 2019 at all sites except for the reference site NC-RS50 and the impact site SC-IS-50DS. Whilst dissolved aluminium was detected on all occasions in fluctuating concentrations, it only exceeded the recommended limit of 0.055mg/L on one occasion in January 2019 at SC-IS10DS.
- Hydrocarbons and pesticides – no derivatives of organochlorine or organophosphorus pesticides were detected in surface water during the construction monitoring period. No derivatives of polynuclear aromatic hydrocarbons, total petroleum hydrocarbons, total recoverable hydrocarbons or BTEXN were detected in surface water samples during the construction monitoring period. This finding is consistent with pre-construction monitoring.

#### Wet Weather

No SSTVs were calculated for wet weather data as there were only three wet weather events sampled during pre-construction and high variation in the volume of rain between each wet weather event.

- pH – pH levels during wet weather at the impact sites appeared to remain consistent with pH at the reference sites except for at Impact site 4 (SC-IS50 DS) in November 2018, where pH was recorded to be over 1 pH unit higher than the reference site. pH increased by over 1 pH unit at all monitoring sites

during December 2018 however since the increase in pH was also observed at the reference sites, it is unlikely that the cause is construction related.

- Turbidity – Turbidity at the impact sites were generally slightly lower than the reference sites on all wet weather sample events. At the control site on the south bank, turbidity level was recorded to be higher than at the reference site and all of the impact sites in March 2019. This could suggest stormwater entering the river, however, no evidence of this increase continues downstream at the impact sites.
- Dissolved oxygen – In November 2018, dissolved oxygen was in lower concentrations at impact sites as compared to the reference site and control site. This could suggest the change in DO is attributable to construction activities. However, during the next wet weather event in December 2018, all monitoring sites, including the reference site and control site, were found to have similar DO concentrations. Given the inconsistencies of data both temporally and spatially, impacts attributable to construction are considered unlikely.
- Total nitrogen – total nitrogen concentrations recorded at the reference sites during the construction period were generally similar between the north and south banks. On the north bank, TN was highest at the reference site on sampling date in November 2018. On the south bank, a very high concentration of TN was recorded at the control site on sampling date in November 2018, however this does not appear to have affected the downstream concentrations.
- Total phosphorus – total phosphorus concentrations varied spatially and temporally during the wet weather events, however it appeared that TP concentrations supplied by the stormwater drains entering the river at the control sites influenced concentrations downstream. This is evident in December 2018 on both the north and south banks, where TP concentrations were significantly higher at the control site than at the reference site, and the impact sites showed slightly elevated concentrations above the reference site downstream. In March 2019, it appears that the impact sites had slightly higher concentrations than the reference site and control site, implying that TP concentrations may have been attributable to construction.
- Metals – concentrations of the dissolved metals antimony, arsenic, lead, selenium, silver and mercury were recorded below the detection limit at all reference and impact sites during wet weather sampling. An elevated concentration of dissolved zinc was detected on one occasion in November 2018 at the south reference site but not at the north bank reference site or any impact/control sites downstream. Other minor metals concentrations during sample events were observed:
  - dissolved cadmium was detected at the reference sites RS100 in December 2018
  - dissolved boron was detected at the impacts site NC-IS10-DS in November 2018
  - dissolved lead was detected at both control sites (NC-CS1 and SC-CS2) in December 2018
  - dissolved barium was detected at all reference sites, control sites and impact sites during all wet weather sampling events
  - dissolved lithium was detected at all reference sites, control sites and impact sites during all wet weather sampling events
  - dissolved nickel was detected at all reference sites, control sites and impact sites during wet weather sampling events in November 2018 and March 2019, however only detected at RS100, NC- IS10 DS and SC-IS10 US in December 2018

- dissolved chromium was detected at impact site SCID50DS during the wet weather event in September 2019.
- Metals – elevated concentrations of dissolved aluminum were detected at all sites during all wet weather sampling events. November 2018 had the highest concentrations of aluminum across all sites however concentrations were most elevated at the reference sites and decreased downstream. This suggests that the elevated concentrations are unlikely to be attributable to construction activities.
- Metals – high concentrations of dissolved iron were detected at all sites during wet weather sampling in November and December 2018. The highest concentrations were recorded during November however all sites were consistent with the reference site.
- Hydrocarbons and pesticides – no derivatives of organochlorine or organophosphorus pesticides were detected in surface water during the construction monitoring period. No derivatives of polynuclear aromatic hydrocarbons, total petroleum hydrocarbons, total recoverable hydrocarbons or BTEXN were detected in surface water samples during the construction monitoring period. This finding is consistent with pre-construction monitoring.

### 3.5.2 Groundwater

Based on the construction water quality monitoring program to date, the following observations with respect to groundwater can be made:

- Groundwater level – groundwater is monitored at piezometers NC-BH02A/B and SC-BH01. Groundwater level trends remained relatively stable throughout the monitoring period with minor subdued increases associated with rainfall event. Tidal influences are observed at all three monitoring locations with the most pronounced effect observed at SC-BH01 which is in closest proximity to the river.
- pH – pH generally remained compliant with the ANZECC/ARMCANZ (2000) default trigger values for aquatic ecosystems across all groundwater monitoring wells throughout the construction phase. However, values from SC-BH01 and NC-BH02A were generally above the SSTVs at both shallow and deep reference bores, this is likely to be due to a higher amount of rainfall during the construction period. NC-BH02B remained within the SSTVs for the majority of the construction period. There were occasions when pH fell below the lower limit of 6.5, however these lower pH levels were generally observed at both the impact sites and reference site and therefore unlikely to be related to construction activities. pH levels following wet weather generally complied with the ANZECC/ARMCANZ (2000) guidelines at both reference and impact boreholes. Exceptions to this were following wet weather in December 2018 when boreholes NC-RBH01A/B were below the lower limit and in September 2019 NC-RBH01B was below the lower limit.
- Turbidity – Turbidity remained compliant with the ANZECC/ARMCANZ (2000) default trigger values for aquatic ecosystems across all groundwater monitoring wells throughout the construction phase except for at SC-BH01, where values were significantly higher (>200 NTU on all occasions). SC-BH01 was the only site that consistently remained above the SSTVs. The elevated turbidity can be attributed to the sampling methodology where purging with the bailer can resuspended sediments into the water column, a sampling method that only applies to this borehole. There were also a few exceedances of turbidity at NCRBH01A in February, March and September 2019.
- Electrical conductivity – Conductivity of groundwater is generally similar to the surface water and falls within both the SSTVs and the recommended guidelines at the reference site and north bank impact site. There were however recent occasions where the electrical conductivity was noticeably higher at the

impact sites, in particular, EC was recorded above ANZECC/ARMCANZ (2000) default trigger values at NC-BH02A in July and August 2019, which is likely to be related to prevailing dry weather conditions causing a reduction of rainfall recharge and flushing.

- Electrical conductivity (EC) – Similarly to EC recorded during the pre-construction monitoring period at the south bank monitoring bore (SC-BH01), elevated electrical conductivity was recorded on all occasions except December and March 2019 during the construction phase. The reduction in EC in December and March is likely to be related to increased rain during those months. The high variability in EC can be linked to the close proximity to river and the interaction with rainfall recharge.
- Dissolved oxygen – Dissolved oxygen was generally low across all sites during the construction period as expected however some elevated concentrations of DO were recorded at the deep level of both the reference bore and north bank impact site in January and February 2019 at NC-BH02A. Sampling was undertaken using a hand bailer on these occasions the elevated dissolved oxygen levels were recorded. Hand bailers can cause aeration during sampling and therefore the higher concentrations are an artefact of sampling methods and not related to construction activities.

### **3.5.3 Project response to water quality results**

Impacts on water quality attributable to the project were generally considered to be negligible during the monitoring period. Whilst total nitrogen and total phosphorus concentrations were detected above SSTVs on occasion at the impact sites, similar observations were generally recorded at the reference sites and therefore it is unlikely that the construction activities are contributing to elevated nutrient levels in the river.

Similarly, elevated turbidity levels were recorded on occasion at surface water impact sites. Similar increases in turbidity were recorded at reference sites which infers that increases are unlikely to be construction related, particularly as all monitoring is undertaken on an outgoing tide. Whilst the construction of Windsor bridge does not appear to be impacting on surface water quality, Transport for NSW and its construction partners will continue to manage and review procedures related to sedimentation management to ensure measures are working effectively.

### **3.5.4 Monitoring program improvement recommendations**

Based on results of water quality monitoring during the first 12-months of construction, the following recommendations are suggested to improve efficiency and relevance of the monitoring data going forward:

- Clarification on the sampling regime be finalised and the monitoring frequency be reduced to one wet and one dry weather sampling event per month, with dry weather monitoring to be scheduled for the last week of each calendar month.
- The monitoring frequency of groundwater sites be reduced as there are no further construction activities with the potential to impact on groundwater. Groundwater monitoring for the remainder of the construction phase will occur quarterly and comprise only of recording groundwater levels.

## 4. References

ANZECC/ARMCANZ (2000) *National Water Quality Management Strategy - Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at [www.waterquality.gov.au/anz-guidelines](http://www.waterquality.gov.au/anz-guidelines)

NSW Bureau of Meteorology (2019) *Daily Rainfall – Richmond RAAF (Weather Station: 67105)*. Available at: [http://www.bom.gov.au/isp/ncc/cdio/weatherData/av?p\\_nccObsCode=136&p\\_display\\_type=dailyDataFile&p\\_startYear=2019&p\\_c=-900746644&p\\_stn\\_num=067105](http://www.bom.gov.au/isp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=2019&p_c=-900746644&p_stn_num=067105)

RTA (nd) *Guideline for Construction Water Quality Monitoring*, Roads and Traffic Authority.

## Appendix A. Monitoring locations

Water Type	Site Name	Description
Groundwater	NC-RBH01S (NC-RBH01A)	Reference site – shallow
	NC-RBH01D (NC-RBH01B)	Reference site – deep
	SC-BH01	South bank borehole
	NC-BH02S (NC-BH02A)	North bank borehole – shallow
	NC-BH02D (NC-BH02B)	North bank borehole – deep
Surface Water	NC-RS50	Reference site (north bank)
	SC-RS100	Reference site (south bank)
	NC-IS10 US	Impact site 1 – upstream
	NC-IS10 DS	Impact site 1 – downstream
	SC-IS10 US	Impact site 2 – upstream
	SC-IS10 DS	Impact site 2 – downstream
	NC-IS50 DS	Impact site 3 – downstream
	SC-IS50 DS	Impact site 4 – downstream



Figure A 1 Monitoring locations (Source: Georgiou, 2019)

## Appendix B. Rainfall records

Date of Month	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
1st	0	0.2	0	3.4	1.4	0	0	0	0	0	0	0.2
2nd	0	0	0	0	4.8	0	0	0	0	0	0	0
3rd	0	3.6	0	0	0.8	0	2.6	0.2	0	0	0.2	0
4th	5.6	0	0	0	0.2	0	0.2	19.4	16.8	0.4	0	0
5th	37.6	0	0	0	0	0	2.4	0	0.2	6.2	0	0
6th	2.2	0	0	13.4	0	0	7.6	0	1.8	4.8	0	0.2
7th	0	0	0.2	0.8	0	3.6	0.2	0	0	2.2	0	0
8th	3.2	7.2	0	0.4	0	0	0	0	0.2	0.2	0	0
9th	0	0.2	0	4.8	6.8	0.2	0	0	0.2	0.6	0	0
10th	0	0	0	0.2	0.2	0.6	0	0	0	0.2	0	0
11th	23.8	0	0	7.6	0	0.2	0	0	0	0	0	0
12th	1.8	0	0	5.8	0	0	0	0	0	0	0	0
13th	1.2	0	1.4	0	0	1.4	0	0	0	0	0	0
14th	16.2	0	14.8	0	0	1.2	0	0	0	0	0	0
15th	9.6	0.4	27.0	0	0	2.8	0	0	0	0	0	0
16th	0	7.0	0	0	0	20.2	0	0	1.6	0	0	12.2
17th	0.2	0.2	0	0	0	23.2	0	0	0	0	0	55.6
18th	6.8	9.4	0	0	0	10.4	0.2	0	1	0	0	10.6
19th	4.4	0	0.2	0	0	3.6	0	0	1	0	0	0.8
20th	0	0	40.6	0	1.2	6.2	0	0	0	0	0	0.2
21st	2.0	0	13.4	37.2	3.4	0.2	0	0.2	0	0	0	0
22nd	0.2	1.8	1.4	38.6	4.8	0	0.2	0	0	0	0	0
23rd	0	0.8	2.0	0.2	0	1.4	0	0	0	0	0	0
24th	0	0	0.2	0.8	0	10	0	0	10.2	0	0	0

Date of Month	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
25th	0	0	0	0	0.2	7	0.2	0.2	4	0	0	0
26th	0	0	0	0	0	1	0	0	2.6	0	0	0
27th	0	0	0	0	0	0.2	0	0	0.6	0	1.2	0
28th	0	26.8	0	7.8	0	0	0	0	0.2	0	0	0
29th	0	35.8	0	0.2		0	0	0	0	0	0	1.4
30 <sup>th</sup>	0	0	0	0		32.2	0	0	0.2	0	8.8	0.2
31st	0		0	0		0.2		0		0	0.8	

## Appendix C. Surface and Groundwater Data Summary

## Results Summary Tables

### Year 1 construction surface water quality results at reference site 1 (NC-RS50)

	Date	Units	LOR	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018 dry	21 Dec 2018 wet	25 Jan 2019 dry	26 Feb 2019	15 Mar 2019 wet	29 Mar 2019 dry	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019	28 Aug 2019 dry	19 Sep 2019 wet	30 Sep 2019 dry	80th Percentile (cumulative)	20th Percentile (cumulative)	
Temperature		°C		NG	23.25	19.26	28.14	29.19	30.27	25.63	26.26	25.02	21.27	17.69	14.68	14.54	16.43	16.44	19.23	27.564	16.934	
Turbidity		NTU		<50	25.8	89.9	34	69.7	14.3	36.9	30	20.8	22.5	22.9	15.5	14.1	15.4	32.3	11.3	22.74	12.733333	
Dissolved Oxygen		% saturation		85-110	100.57	141.2	90.2	68.6	81	74.8	105.7	97.1	99.9	101	115.4	146.3	108.2	106.2	82.4	102.48	75.226667	
Electrical Conductivity		mS/cm		0.125-2.2	0.305	0.109	0.261	149	0.267	0.33	0.444	0.279	0.362	0.363	0.721	0.598	0.847	0.329	0.324	0.5345333	0.2984	
Salinity				NG	0.14	0.05	0.12	0.12	0.13	0.16	0.21	0.13	0.17	0.17	0.35	0.29	0.41	124	153	0.29	0.14	
ORP		MV		NG		221	94	0.255	266	177	117	173	160	31	144	46	200	0.16	0.55	198.45333	85.84	
pH		pH units		6.5-8.5	8	7.23	8.89	8.86	6.63	7.52	7.53	7.19	7.61	7.69	7.14	7.68	7.19	8.23	7.37	7.686	7.238	
Total Dissolved Solids		mg/L	10	NG	166	89	151	152	132	191	230	174	203	192	153	163	206	196	220	229.6	164.2	
Suspended Solids		mg/L	5	50	14	35	10	16	12	25	10	10	16	<5	7	<5	<5	12	36	18.2	10	
Hydroxide Alkalinity as CaCO <sub>3</sub>		mg/L	1	NG	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Carbonate Alkalinity as CaCO <sub>3</sub>		mg/L	1	NG	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Bicarbonate Alkalinity as CaCO <sub>3</sub>		mg/L	1	NG	40	12	36	40	44	55	67	41	48	60	52	44	58	48	46	57.4	44	
Total Alkalinity as CaCO <sub>3</sub>		mg/L	1	NG	40	12	36	40	44	55	67	41	48	60	52	44	58	48	46	57.2	44	
Sulfate as SO <sub>4</sub> - Turbidimetric		mg/L	1	NG	15	5	12	13	12	17	26	15	18	20	19	16	25	23	20	21.2	15.4	
Chloride		mg/L	1	NG	51	22	47	44	53	54	73	48	56	55	44	40	69	64	56	69	49.2	
Calcium		mg/L	1	NG	9	3	8	7	10	13	9	10	11	10	8	12	11	10	11	10	9	
Magnesium		mg/L	1	NG	6	2	6	6	5	7	8	7	7	8	7	6	8	8	8	8	6.4	
Sodium		mg/L	1	NG	35	13	33	31	32	43	59	35	42	44	40	33	47	44	38	48.2	35	
Potassium		mg/L	1	NG	4	2	4	3	3	4	6	4	4	5	5	4	6	6	5	5	4	
Dissolved Metals	Aluminium	mg/L	0.01	0.055	0.03	0.19	0.03	0.09	0.02	0.03	0.02	0.03	0.02	<0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.012	
	Antimony	mg/L	0.001	NG	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
	Arsenic	mg/L	0.001	0.024	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Barium	mg/L	0.001	NG	0.025	0.012	0.026	0.022	0.026	0.032	0.04	0.032	0.031	0.033	0.032	0.024	0.034	0.033	0.032	0.0336	0.028	
	Cadmium	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
	Chromium	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Copper	mg/L	0.001	0.0014	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Lead	mg/L	0.001	0.0034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.003	0.003	<0.001			
	Lithium	mg/L	0.001	NG	0.005	0.003	0.008	0.008	0.012	0.008	0.008	0.01	0.009	0.008	0.01	0.006	0.007	0.006	0.004	0.0094	0.002	
	Manganese	mg/L	0.001	1.9	0.002	0.061	<0.001	0.008	0.008	0.02	0.012	0.003	0.002	0.004	0.002	0.009	0.01	0.004	<0.001	0.0136	0.006	
	Nickel	mg/L	0.001	0.011	<0.001	0.002	0.001	<0.001	0.001	0.001	0.002	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	0.001	0.001	0.0005	
	Selenium	mg/L	0.01	0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
	Silver	mg/L	0.001	0.00005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Zinc	mg/L	0.005	0.008	<0.005	0.005	<0.005	<0.005	0.011	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0246	
	Boron	mg/L	0.05	0.37	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
	Iron	mg/L	0.05	0.3	0.05	0.34	0.14	0.18	0.16	<0.05	<0.05	0.08	0.05	0.05	<0.05	<0.0						

	Total Phosphorus as P	mg/L	0.01	0.025	0.02	0.06	0.02	0.07	0.01	0.02	0.02	0.01	0.02	0.01	<0.01	0.01	0.04	0.04	0.02	0.03	0.01
	Total Anions	meq/L	0.01	NG	2.55	0.96	2.29	2.31	2.62	2.98	3.94	2.48	2.91	3.17	2.68	2.34	3.46	3.24	2.92	3.564	2.578
	Total Cations	meq/L	0.01	NG	2.57	0.93	2.43	2.27	2.23	3.05	4.03	2.65	3	3.25	2.94	2.43	2.41	3.27	2.94	3.49	2.602
Organochlorine Pesticides	alpha-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Hexachlorobenzene (HCB)	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	beta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	gamma-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	delta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Heptachlor	µg/L	0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Aldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Heptachlor epoxide	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	trans-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	alpha-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	cis-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDE	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endrin	µg/L	0.5	0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	beta-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDD	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endrin aldehyde	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endosulfan sulfate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDT	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Endrin ketone	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Methoxychlor	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Total Chlordane (sum)	µg/L	0.5	0.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Sum of DDD + DDE + DDT	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Sum of Aldrin + Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Organophosphorus Pesticides	Dichlorvos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Demeton-S-methyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Monocrotophos	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Dimethoate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Diazinon	µg/L	5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Chlorpyrifos-methyl	µg/L	0.5	0.001	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Parathion-methyl	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Malathion	µg/L	0.5	0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Fenthion	µg/L	0.5	NG	<0.5																



## **Year 1 construction surface water quality results at reference site 2 (SC-RS100)**

Date	Units	LOR	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018 dry	21 Dec 2018 wet	25 Jan 2019 dry	26 Feb 2019 dry	15 Mar 2019 wet	29 Mar 2019 dry	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019 dry	28 Aug 2019 dry	19 Sep 2019 wet	30 Sep 2019 dry	80th Percentile (cumulative)	20th Percentile (cumulative)
Temperature	°C		NG	23.52	19.33	28.1	27.01	30.2	25.61	26.47	25.02	22.22	17.74	15.75	14	16.42	16.78	19.23	27.6733333	16.948
Turbidity	NTU		<50	27.9	89.7	24.7	55	11	31.6	27.2	20.8	18.4	22.8	10.7	10.9	14.7	20.5	9.3	22	10.78
Dissolved Oxygen	% saturation		85-110	115.3	171	84.4	70	86.1	79.5	77	97.1	107	107.1	149.3	140.6	131.2	114.5	92.3	112.02	83.96
Electrical Conductivity	mS/cm		0.125-2.2	0.298	0.108	0.255	0.241	0.239	0.314	0.432	0.279	0.35	0.378	0.671	0.573	0.689	0.28	0.32	0.51006667	0.2966
Salinity			NG	0.14	0.05	0.12	0.11	0.12	0.15	0.21	0.13	0.17	0.18	0.33	0.28	0.39	0.13	0.15	0.2	0.14
ORP	MV		NG		220	118	140	286	151	120	173	120	16	122	-68	169	111	75	190.52	82.04
pH	pH units		6.5-8.5	7.71	7.29	8.98	9	5.41	7.57	7.43	7.19	7.1	7.76	7.58	7.45	7.34	8.36	7.44	7.686	7.32
Total Dissolved Solids	mg/L	10	NG	170	143	150	121	129	188	236	170	258	197	167	156	218	193	200	247.6	168.2
Suspended Solids	mg/L	5	50	17	34	10	12	12	21	11	9	14	5	<5	5	9	7	21	17	9
Hydroxide Alkalinity as CaCO3	mg/L	1	NG	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	1	NG	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	mg/L	1	NG	40	12	31	39	45	54	67	40	46	56	47	38	50	44	42	55.8	40.4
Total Alkalinity as CaCO3	mg/L	1	NG	40	12	31	39	45	54	67	40	46	56	47	38	50	44	42	55.6	40.8
Sulfate as SO4 - Turbidimetric	mg/L	1	NG	16	5	12	13	11	16	26	13	14	20	18	14	23	22	20	20.6	14
Chloride	mg/L	1	NG	53	21	50	43	50	53	71	47	54	54	43	38	65	61	55	69.6	50
Calcium	mg/L	1	NG	8	3	8	7	7	10	13	9	9	10	10	8	11	11	10	69.6	8.4
Magnesium	mg/L	1	NG	6	2	6	6	5	6	8	6	7	8	7	6	8	8	8	10.6	6.2
Sodium	mg/L	1	NG	36	14	32	30	32	39	57	33	38	42	37	32	44	42	37	48.6	35
Potassium	mg/L	1	NG	4	2	3	3	3	4	6	4	4	5	5	4	6	5	5	5	4
Dissolved Metals	Aluminium	mg/L	0.055	0.02	0.23	0.02	0.07	0.02	0.03	0.03	0.02	0.02	0.01	0.02	0.01	0.03	0.03	0.02	0.01	
	Antimony	mg/L	0.001	NG	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
	Arsenic	mg/L	0.024	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
	Barium	mg/L	0.025	0.013	0.025	0.022	0.025	0.031	0.039	0.032	0.031	0.032	0.031	0.024	0.032	0.033	0.031	0.0336	0.027	
	Cadmium	mg/L	0.0001	0.0002	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
	Chromium	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
	Copper	mg/L	0.0014	<0.001	0.001	<0.001	0.002	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
	Lead	mg/L	0.0034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	0.002	0.003	<0.001	<0.001	
	Lithium	mg/L	0.006	0.003	0.009	0.008	0.012	0.008	0.008	0.01	0.009	0.008	0.01	0.006	0.008	0.006	0.004	0.0096	0.006	
	Manganese	mg/L	1.9	0.004	0.063	<0.001	0.005	0.004	0.015	0.012	0.002	0.002	0.004	0.001	0.006	0.004	0.001	<0.001	0.0136	0.0022
	Nickel	mg/L	0.011	<0.001	0.002	<0.001	0.003	0.001	0.002	0.002	0.001	0.001	0.001	<0.001	<0.001	<0.002	<0.001	<0.001	0.0008	
	Selenium	mg/L	0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
	Silver	mg/L	0.00005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
	Zinc	mg/L	0.008	<0.005	0.012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.015	0.009
	Boron	mg/L	0.37	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
	Iron	mg/L	0.3	0.05	0.36	0.12	0.14	0.1	0.06	<0.05	0.08	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.064	0.025
	Mercury	mg/L	0.00006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Nitrates	Nitrite + Nitrate as N	mg/L	0.04	0.41	0.18	0.19	0.26	0.12	0.19	0.4	0.28	0.34	0.46	0.58	0.63	0.72	0.64	0.63	0.61	0.148
	Total Kjeldahl Nitrogen as N	mg/L	0.35	0.7	0.8	0.5	0.5	0.4	0.8	0.8	0.6	0.6	0.8	0.8	0.9	1.2	0.9	0.9	0.9	0.5
	Total Nitrogen as N	mg/L	0.35	0.7	0.8	0.5	0.5	0.4	0.8	0.8	0.6	0.6	0.8	0.8	0.9	1.2	0.9	0.9	0.9	0.5

	Total Phosphorus as P	mg/L	0.01	0.025	0.05	0.06	<0.01	0.03	<0.01	0.02	0.02	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	0.03	0.02	0.02	0.005
	Total Anions	meq/L	0.01	NG	2.63	0.94	2.28	2.26	2.54	2.91	3.88	2.4	2.73	3.06	2.53	2.12	3.31	3.06	2.81	3.556	2.534
	Total Cations	meq/L	0.01	NG	2.56	0.97	2.36	2.22	2.23	2.79	3.94	2.48	2.78	3.11	2.81	2.39	3.27	3.16	2.89	3.302	2.512
Organochlorine Pesticides	alpha-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Hexachlorobenzene (HCB)	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	beta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	gamma-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	delta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Heptachlor	µg/L	0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Aldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Heptachlor epoxide	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	trans-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	alpha-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	cis-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDE	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endrin	µg/L	0.5	0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	beta-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDD	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endrin aldehyde	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endosulfan sulfate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDT	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Endrin ketone	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Methoxychlor	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Total Chlordane (sum)	µg/L	0.5	0.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Sum of DDD + DDE + DDT	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Sum of Aldrin + Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Organophosphorus Pesticides	Dichlorvos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Demeton-S-methyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Monocrotophos	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Dimethoate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Diazinon	µg/L	5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Chlorpyrifos-methyl	µg/L	0.5	0.001	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Parathion-methyl	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Malathion	µg/L	0.5	0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Fenthion	µ																			





## Year 1 construction surface water quality results at Impact site 1 (NC-IS10 US)

Date	Units	LOR	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018 dry	21 Dec 2018 wet	25 Jan 2019 dry	26 Feb 2019 dry	15 Mar 2019 wet	29 Mar 2019 dry	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019 dry	28 Aug 2019 dry	19 Sep 2019 wet	30 Sep 2019 dry	80th Percentile (pre- construction)	20th Percentile (pre- construction)
Temperature	°C		NG	23.82	19.23	27.65	27.24	30.41	25.68	26.32	25.1	22.19	17.33	14.39	13.55	16.18	16.45	19.26	28.04	24.28
Turbidity	NTU		<50	24.3	87.2	88.2	60.9	14.2	35.4	32.1	26.3	20.1	18.7	14	13.2	15.4	19.5	10.5	17.75	12.11
Dissolved Oxygen	% saturation		85-110	92.3	121.1	105.4	70.1	82.5	75.9	100.3	91.4	100.5	100.8	91.8	118.6	102.9	91	99.6	93.2	84.7
Electrical Conductivity	mS/cm		0.125-2.2	0.228	0.108	0.187	0.248	0.236	0.328	0.461	0.292	0.344	0.38	0.716	0.597	0.827	0.366	0.324	0.42	0.37
Salinity			NG	0.14	0.05	0.09	0.12	0.12	0.16	0.22	0.14	0.16	0.18	0.35	0.29	0.4	0.18	0.15	0.18	0.17
ORP	MV		NG		224	130	138	198	194	130	168	155	74	143	184	187	88	69	205.1	134.11
pH	pH units		6.5-8.5	7.45	7.26	8.86	8.99	7.62	7.53	7.47	7.14	7.8	7.96	7.22	7.33	7.46	8.41	9.22	7.65	7.42
Total Dissolved Solids	mg/L	10	NG	164	85	149	135	133	199	240	176	204	190	173	156	204	200	200	236	226
Suspended Solids	mg/L	5	50	16	34	12	14	10	25	14	11	10	6	5	<5	<5	6	20	16	13
Hydroxide Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG	40	12	35	39	40	54	70	41	47	61	52	40	50	46	46	64	56
Total Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG	40	12	35	39	40	54	70	41	47	61	52	40	50	46	46	64	56
Sulfate as SO <sub>4</sub> - Turbidimetric	mg/L	1	NG	16	5	11	13	13	17	28	14	16	20	19	15	23	22	22	22	18
Chloride	mg/L	1	NG	52	20	44	44	51	55	77	50	54	54	43	40	66	64	60	72	59
Calcium	mg/L	1	NG	8	3	8	7	8	10	14	10	9	11	10	8	11	11	11	11	10
Magnesium	mg/L	1	NG	6	2	6	6	5	7	8	7	7	8	7	6	8	8	8	8	7
Sodium	mg/L	1	NG	36	13	32	31	32	42	63	35	39	43	39	32	45	44	41	49	47
Potassium	mg/L	1	NG	4	2	3	3	3	4	7	4	4	5	5	4	6	6	6	5	5
Dissolved Metals	Aluminium	mg/L	0.055	0.02	0.21	0.02	0.06	0.03	0.02	0.02	0.03	<0.01	<0.01	<0.01	0.01	0.02	0.02	0.02	0.034	0.018
	Antimony	mg/L	0.001	NG	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Arsenic	mg/L	0.024	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Barium	mg/L	0.025	0.012	0.026	0.021	0.026	0.033	0.041	0.031	0.031	0.033	0.031	0.024	0.033	0.033	0.037	0.034		
	Cadmium	mg/L	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
	Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	
	Copper	mg/L	0.0014	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001		
	Lead	mg/L	0.0034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Lithium	mg/L	0.006	0.003	0.009	0.008	0.012	0.008	0.007	0.01	0.009	0.008	0.009	0.006	0.007	0.005	0.004	0.007	0.006	
	Manganese	mg/L	1.9	0.002	0.062	<0.001	0.006	0.005	0.025	0.015	0.004	0.002	0.004	0.002	0.006	0.002	0.003	0.002	0.017	0.004
	Nickel	mg/L	0.011	0.001	0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	
	Selenium	mg/L	0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
	Silver	mg/L	0.00005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Zinc	mg/L	0.008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	0.01	
	Boron	mg/L	0.37	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
	Iron	mg/L	0.3	0.05	0.37	0.11	0.15	0.11	0.05	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.0132	0.078
	Mercury	mg/L	0.00006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
	Nitrite + Nitrate as N	mg/L	0.04	0.44	0.17	0.2	0.24	0.12	0.21	0.46	0.31	0.32	0.46	0.58	0.65	0.74	0.65	0.7	0.43	0.08
	Total Kjeldahl Nitrogen as N	mg/L	0.1	NG	0.4	0.7	0.2	0.2	0.1	0.3	0.3	0.2	0.3	0.2	0.3	0.4	0.5	0.5	0.4	0.4

	Total Nitrogen as N	mg/L	0.1	0.35	0.8	0.9	0.4	0.4	0.2	0.5	0.8	0.5	0.6	0.7	0.8	1	1.1	1	1.2	0.9	0.6
	Total Phosphorus as P	mg/L	0.01	0.025	0.04	0.06	<0.01	0.07	<0.01	0.02	0.02	<0.01	0.02	0.01	<0.01	0.01	<0.01	0.06	0.04	0.04	0.02
	Total Anions	meq/L	0.01	NG	2.6	0.91	2.17	2.29	2.51	2.98	4.15	2.52	2.8	3.16	2.65	2.24	3.34	3.18	3.07	3.68	3.24
	Total Cations	meq/L	0.01	NG	2.56	0.93	2.36	2.27	2.28	3	4.28	2.7	2.82	3.2	2.9	2.39	3.32	3.27	3.14	3.64	3.29
Organochlorine Pesticides	alpha-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Hexachlorobenzene (HCB)	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	beta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	gamma-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	delta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Heptachlor	µg/L	0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Aldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Heptachlor epoxide	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	trans-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	alpha-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	cis-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDE	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endrin	µg/L	0.5	0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	beta-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDD	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endrin aldehyde	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endosulfan sulfate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDT	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Endrin ketone	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Methoxychlor	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Total Chlordane (sum)	µg/L	0.5	0.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Sum of DDD + DDE + DDT	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Sum of Aldrin + Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Organophosphorus Pesticides	Dichlorvos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Demeton-S-methyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Monocrotophos	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Dimethoate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Diazinon	µg/L	5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Chlorpyrifos-methyl	µg/L	0.5	0.001	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Parathion-methyl	µg/L	2	nG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Malathion	µg/L	0.5	0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Fenthion	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Chlorpyrifos	µg/L	0.5	0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Parathion	µg/L	2	0.004	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Pirimphos-ethyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Chlorfenvinphos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Bromophos-ethyl	µ																			

	Azinphos Methyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Polynuclear Aromatic Hydrocarbons	Naphthalene	µg/L	1	16	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Acenaphthylene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Acenaphthene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Fluorene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Phenanthrene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Anthracene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Fluoranthene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Pyrene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Benz(a)anthracene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Chrysene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Benzo(b+j)fluoranthen e	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Benzo(k)fluoranthene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Benzo(a)pyrene	µg/L	1	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Indeno(1.2.3.cd)pyren e	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Dibenz(a,h)anthracene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Benzo(g,h,i)perylene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
	Sum of polycyclic aromatic hydrocarbons	µg/L	1	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Benzo(a)pyrene TEQ (zero)	µg/L	1	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Total Petroleum Hydrocarbons	C6 - C9 Fraction	µg/L	20	NG	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
	C10 - C14 Fraction	µg/L	50	NG	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	
	C15 - C28 Fraction	µg/L	100	NG	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
	C29 - C36 Fraction	µg/L	50	NG	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	
	C10 - C36 Fraction (sum)	µg/L	50	NG	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	
Total recoverable Hydrocarbons	C6 - C10 Fraction	µg/L	20	NG	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
	C6 - C10 Fraction minus BTEX (F1)	µg/L	20	NG	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
	>C10 - C16 Fraction	µg/L	100	NG	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
	>C16 - C34 Fraction	µg/L	100	NG	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
	>C34 - C40 Fraction	µg/L	100	NG	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
	>C10 - C40 Fraction (sum)	µg/L	100	NG	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
	>C10 - C16 Fraction minus Naphthalene (F2)	µg/L	100	NG	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
BTEX	Benzene	µg/L	1	950	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	Toluene	µg/L	2	NG	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
	Ethylbenzene	µg/L	2	NG	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
	meta- & para-Xylene	µg/L	2	NG	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
	ortho-Xylene	µg/L	2	350	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
	Total Xylenes	µg/L</																			

**Year 1 construction surface water quality results at Impact site 1 (NC-IS10 DS)**

	Date	Units	LOR	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018	21 Dec 2018 wet	25 Jan 2019 dry	26 Feb 2019	15 Mar 2019 wet	29 Mar 2019 dry	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019 dry	28 Aug 2019 dry	19 Sep 2019 wet	30 Sep 2019 dry	80th Percentile (pre-construction)	20th Percentile (pre-construction)
Temperature	°C		NG		23.86	19.47	28.1	27.24	30.41	25.61	26.22	25.12	22.21	17.69	14.42	13.51	16.09	16.33	19.26	28.04	24.28
Turbidity	NTU		<50		22.1	87.6	26.4	57.7	12.3	34.1	34.7	22.9	19.5	29.1	13.8	12.4	15	17.6	9	17.75	12.11
Dissolved Oxygen	% saturation		85-110		100.3	91.8	84	69.6	94.3	75.4	115	92.3	100.5	98.9	108.5	96.6	104.8	90.4	90.7	93.2	84.7
Electrical Conductivity	mS/cm		0.125-2.2		0.29	0.116	0.253	0.247	0.266	0.321	0.481	0.279	0.347	0.339	0.721	0.595	0.801	0.357	0.322	0.42	0.37
Salinity			NG		0.14	0.05	0.12	0.12	0.13	0.15	0.23	0.13	0.17	0.16	0.35	0.29	0.39	0.17	0.15	0.18	0.17
ORP	MV		NG			225	141	138	193	201	134	171	143	69	151	115	195	46	173	205.1	134.11
pH	pH units		6.5-8.5		7.45	7.26	8.86	8.99	7.62	7.53	7.47	7.14	7.8	7.96	7.22	7.89	7.46	8.34	7.37	7.65	7.42
Total Dissolved Solids	mg/L	10	NG		188	90	147	118	146	187	246	174	204	194	174	158	194	191	212	236	226
Suspended Solids	mg/L	5	50		14	33	13	12	13	25	13	12	12	<5	5	<5	9	19	16	13	
Hydroxide Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Carbonate Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		40	14	35	39	44	49	72	41	47	60	52	38	48	44	43	64	56
Total Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		40	14	35	39	44	49	72	41	47	60	52	38	48	44	43	64	56
Sulfate as SO <sub>4</sub> - Turbidimetric	mg/L	1	NG		16	5	11	13	12	17	28	24	16	20	19	15	23	21	19	22	18
Chloride	mg/L	1	NG		52	22	44	44	52	52	78	47	55	54	43	39	65	61	55	72	59
Calcium	mg/L	1	NG		8	3	7	7	10	14	9	10	11	10	8	11	11	10	11	10	10
Magnesium	mg/L	1	NG		6	2	5	6	5	7	8	7	7	8	7	6	8	8	8	8	7
Sodium	mg/L	1	NG		35	14	30	31	32	41	62	37	38	44	38	32	45	41	38	49	47
Potassium	mg/L	1	NG		3	2	3	3	3	4	7	4	4	5	5	4	6	5	5	5	
Dissolved Metals	Aluminium	mg/L	0.055	0.02	0.21	0.02	0.06	0.03	0.03	0.03	0.03	0.01	0.02	<0.01	0.01	0.02	0.03	0.03	0.034	0.018	
	Antimony	mg/L	0.001	NG	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
	Arsenic	mg/L	0.024	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
	Barium	mg/L	0.027	0.013	0.025	0.022	0.025	0.032	0.042	0.031	0.03	0.033	0.031	0.024	0.032	0.032	0.031	0.037	0.034		
	Cadmium	mg/L	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
	Chromium	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001		
	Copper	mg/L	0.0014	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
	Lead	mg/L	0.0034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				
	Lithium	mg/L	0.005	0.004	0.009	0.008	0.012	0.008	0.008	0.01	0.008	0.008	0.009	0.006	0.007	0.005	0.004	0.007	0.006		
	Manganese	mg/L	1.9	0.002	0.058	<0.001	0.006	0.004	0.017	0.016	0.003	0.001	0.004	0.002	0.006	0.002	0.001	<0.001	0.017	0.004	
	Nickel	mg/L	0.011	0.001	0.001	0.002	0.001	0.001	0.001	0.002	<0.001	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001		
	Selenium	mg/L	0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			
	Silver	mg/L	0.00005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
	Zinc	mg/L	0.008	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	0.01	
	Boron	mg/L	0.37	<0.05	0.23	<0.05	0.11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
	Iron	mg/L	0.3	0.06	0.33	0.11	0.16	0.11	0.05	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.0132	0.078







## Year 1 construction surface water quality results at Impact site 2 (SC-IS10 US)

Date	Units	LOR	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018 dry	21 Dec 2018 wet	25 Jan 2019 dry	26 Feb 2019 dry	15 Mar 2019 wet	29 Mar 2019 dry	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019 dry	28 Aug 2019 dry	19 Sep 2019 Wet	30 Sep 2019 dry	80th Percentile (pre-construction)	20th Percentile (pre-construction)	
Temperature	°C		NG	23.97	19.42	28.26	27.33	30.32	25.64	26.38	25	22.25	17.57	14.49	14.08	16.3	16.8	19.21	28.04	24.28	
Turbidity	NTU		<50	22.3	90.3	27.6	52.5	11.8	32.9	28.2	21.8	20.3	30.7	12	10.2	16.8	19.7	11.2	17.75	12.11	
Dissolved Oxygen	% saturation	85-110	89.7	90.95	78.1	67.1	85.6	80.1	75.1	99.1	96.5	104.1	113	145.3	104.8	104.6	87.5	93.2	84.7		
Electrical Conductivity	mS/cm	0.125-2.2	0.292	0.119	0.265	0.244	0.25	0.315	0.441	0.281	0.353	0.354	0.708	0.587	0.81	0.33	0.32	0.42	0.37		
Salinity		NG	0.14	0.05	0.12	0.11	0.11	0.15	0.21	0.13	0.17	0.17	0.34	0.29	0.4	0.16	0.15	0.18	0.17		
ORP	MV	NG		225	146	142	200	205	137	167	157	44	150	64	189	86	173	205.1	134.11		
pH	pH units	6.5-8.5	7.44	7.23	8.99	8.92	7.19	7.533	7.48	7.12	7.63	7.72	7.18	7.69	7.48	8.33	7.27	7.65	7.42		
Total Dissolved Solids	mg/L	10	NG	190	111	142	116	123	187	235	172	185	194	165	156	198	174	194	236	226	
Suspended Solids	mg/L	5	50	17	37	6	7	11	24	11	9	11	<5	<5	<5	<5	8	17	16	13	
Hydroxide Alkalinity as CaCO3	mg/L	1	NG	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Carbonate Alkalinity as CaCO3	mg/L	1	NG	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Bicarbonate Alkalinity as CaCO3	mg/L	1	NG	40	13	35	39	43	49	67	37	47	59	53	40	50	43	42	64	56	
Total Alkalinity as CaCO3	mg/L	1	NG	40	13	35	39	43	49	67	37	47	59	53	40	50	43	42	64	56	
Sulfate as SO4 - Turbidimetric	mg/L	1	NG	14	5	11	12	12	16	26	15	16	21	18	15	23	22	19	22	18	
Chloride	mg/L	1	NG	52	22	44	43	50	52	73	48	55	54	43	39	67	61	55	72	59	
Calcium	mg/L	1	NG	8	3	8	7	7	10	13	9	10	11	10	8	13	11	10	11	10	
Magnesium	mg/L	1	NG	6	2	6	6	5	6	8	6	7	8	7	6	8	8	8	8	7	
Sodium	mg/L	1	NG	35	14	31	31	31	40	59	34	40	44	40	32	46	42	37	49	47	
Potassium	mg/L	1	NG	3	2	3	3	3	4	6	4	4	5	5	4	6	5	5	5	5	
Dissolved Metals	Aluminium	mg/L	0.01	0.055	0.02	0.18	0.02	0.05	0.03	0.02	0.02	0.03	0.02	0.01	0.01	<0.01	0.01	0.03	0.02	0.034	0.018
	Antimony	mg/L	0.001	NG	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Arsenic	mg/L	0.001	0.024	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Barium	mg/L	0.001	NG	0.025	0.012	0.025	0.022	0.026	0.031	0.039	0.031	0.031	0.033	0.031	0.023	0.032	0.033	0.031	0.037	0.034
	Cadmium	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
	Chromium	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002	<0.001	0.001	
	Copper	mg/L	0.001	0.0014	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Lead	mg/L	0.001	0.0034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002	0.003	<0.001		
	Lithium	mg/L	0.001	NG	0.006	0.004	0.009	0.008	0.012	0.008	0.008	0.01	0.009	0.008	0.01	0.006	0.007	0.005	0.005	0.007	0.006
	Manganese	mg/L	0.001	1.9	0.002	0.059	0.001	0.005	0.003	0.014	0.013	0.002	0.002	0.004	0.003	0.006	0.002	0.002	<0.001	0.017	0.004
	Nickel	mg/L	0.001	0.011	0.001	0.001	0.001	0.002	0.001	0.001	0.001	<0.001	<0.001	0.001	<0.001	0.001	0.001	<0.001	0.001	0.001	
	Selenium	mg/L	0.01	0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
	Silver	mg/L	0.001	0.00005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Zinc	mg/L	0.005	0.008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	<0.005	
	Boron	mg/L	0.05	0.37	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
	Iron	mg/L	0.05	0.3	0.05	0.33	0.15	0.13	0.1	0.06	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.0132	0.078
	Mercury	mg/L	0.0001	0.00006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
	Nitrite + Nitrate as N	mg/L	0.01	0.04	0.42	0.18	0.2	0.23	0.12	0.21	0.41	0.28	0.35	0.46	0.6	0.64	0.72	0.64	0.62	0.43	0.08





**Year 1 construction surface water quality results at Impact site 2 (SC-IS10 DS)**

	Date	Units	LOR	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018 dry	21 Dec 2018 wet	25 Jan 2019 dry	26 Feb 2019 wet	15 Mar 2019 dry	29 Mar 2019 wet	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019 dry	28 Aug 2019 dry	19 Sep 2019 wet	30 Sep 2019 dry	80th Percentile (pre-construction)	20th Percentile (pre-construction)
Temperature	°C		NG		23.88	19.55	28.11	27.34	30.24	25.65	26.38	24.99	22.25	17.64	14.61	13.58	16.3	16.54	19.21	28.04	24.28
Turbidity	NTU		<50		24	90	29.8	49.7	13.3	32.2	28.5	21	19.9	28.7	13.5	11.7	18.4	16.5	11.6	17.75	12.11
Dissolved Oxygen	% saturation		85-110		99.2	89.9	83	70.6	83.4	77.1	83.6	102.9	96.6	100.9	85.7	159.5	103.1	104.1	88.1	93.2	84.7
Electrical Conductivity	mS/cm		0.125-2.2		0.284	0.12	0.259	0.242	0.244	0.32	0.441	0.277	0.351	0.34	0.737	0.605	0.806	0.352	0.326	0.42	0.37
Salinity			NG		0.13	0.06	0.12	0.11	0.11	0.15	0.21	0.13	0.17	0.16	0.36	0.29	0.39	0.17	0.15	0.18	0.17
ORP	MV		NG			207	150	142	200	211	143	170	140	56	147	89	191	43	174	205.1	134.11
pH	pH units		6.5-8.5		7.48	7.29	8.86	8.91	7.2	7.5	7.49	7.12	7.81	7.67	7.25	7.92	7.49	8.35	7.33	7.65	7.42
Total Dissolved Solids	mg/L	10	NG		168	117	128	154	133	184	238	168	187	196	171	143	198	187	192	236	226
Suspended Solids	mg/L	5	50		15	35	6	12	14	24	13	10	10	<5	6	<5	<5	8	13	16	13
Hydroxide Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Carbonate Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		40	14	35	39	43	48	67	34	45	63	53	40	49	43	44	64	56
Total Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		40	14	35	39	43	48	67	34	45	63	53	40	49	43	44	64	56
Sulfate as SO <sub>4</sub> - Turbidimetric	mg/L	1	NG		15	5	11	12	12	16	26	16	18	21	20	15	23	21	20	22	18
Chloride	mg/L	1	NG		52	23	44	43	50	53	73	47	53	54	44	39	66	61	56	72	59
Calcium	mg/L	1	NG		9	3	7	7	10	13	9	10	11	10	8	11	11	10	11	10	10
Magnesium	mg/L	1	NG		6	2	5	5	5	6	8	7	7	8	7	6	8	8	8	8	7
Sodium	mg/L	1	NG		35	15	30	31	31	40	58	34	40	44	38	32	45	43	37	49	47
Potassium	mg/L	1	NG		4	2	3	3	3	4	6	4	4	5	5	4	6	5	5	5	5
Dissolved Metals	Aluminium	mg/L	0.055	0.02	0.19	0.02	0.06	0.06	0.02	0.02	0.03	0.02	0.01	<0.01	0.01	0.01	0.03	0.02	0.034	0.018	
	Antimony	mg/L	0.001	NG	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Arsenic	mg/L	0.024	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Barium	mg/L	0.026	0.014	0.023	0.022	0.026	0.031	0.041	0.031	0.032	0.032	0.031	0.024	0.033	0.03	0.037	0.034			
	Cadmium	mg/L	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
	Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	
	Copper	mg/L	0.0014	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Lead	mg/L	0.0034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Lithium	mg/L	0.005	0.004	0.009	0.008	0.012	0.008	0.007	0.009	0.008	0.008	0.008	0.01	0.006	0.007	0.006	0.004	0.007	0.006	
	Manganese	mg/L	1.9	0.002	0.06	<0.001	0.006	0.004	0.016	0.012	0.003	0.002	0.004	0.002	0.007	0.002	0.003	<0.001	0.017	0.004	
	Nickel	mg/L	0.011	0.001	0.002	<0.001	<0.001	0.002	<0.001	0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	
	Selenium	mg/L	0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
	Silver	mg/L	0.00005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Zinc	mg/L	0.008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	<0.005	0.01
	Boron	mg/L	0.37	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
	Iron	mg/L	0.3	0.05	0.36	0.13	0.13	0.1	0.05	0.05	0.05	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.0132

	Mercury	mg/L	0.0001	0.00006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
	Nitrite + Nitrate as N	mg/L	0.01	0.04	0.42	0.18	0.2	0.23	0.12	0.2	0.42	0.28	0.34	0.46	0.63	0.66	0.7	0.62	0.63	0.43	0.08
	Total Kjeldahl Nitrogen as N	mg/L	0.1	NG	0.5	0.6	0.3	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.4	0.2	0.2	0.3	0.4	0.5	0.4
	Total Nitrogen as N	mg/L	0.1	0.35	0.9	0.8	0.5	0.4	0.3	0.5	0.7	0.6	0.5	0.7	1	0.9	0.9	0.9	1	0.9	0.6
	Total Phosphorus as P	mg/L	0.01	0.025	0.02	0.06	<0.01	0.06	<0.01	0.03	0.02	0.03	0.07	<0.01	0.02	0.01	<0.01	0.03	0.02	0.04	0.02
	Total Anions	,eq/L	0.01	NG	2.58	1.03	2.17	2.24	2.52	2.79	3.94	2.34	2.77	3.22	2.72	2.21	3.32	3.02	2.88	3.68	3.24
	Total Cations	meq/L	0.01	NG	2.57	1.02	2.14	2.18	2.18	2.84	3.98	2.61	2.92	3.25	2.86	2.39	3.32	3.2	2.89	3.64	3.29
Organochlorine Pesticides	alpha-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Hexachlorobenzene (HCB)	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	beta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	gamma-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	delta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Heptachlor	µg/L	0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Aldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Heptachlor epoxide	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	trans-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	alpha-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	cis-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDE	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endrin	µg/L	0.5	0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	beta-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDD	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endrin aldehyde	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endosulfan sulfate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDT	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Endrin ketone	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Methoxychlor	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Total Chlordane (sum)	µg/L	0.5	0.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Sum of DDD + DDE + DDT	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Sum of Aldrin + Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Organophosphorus Pesticides	Dichlorvos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Demeton-S-methyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Monocrotophos	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Dimethoate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Diazinon	µg/L	5	NG																	





**Year 1 construction surface water quality results at Impact site 3 (NC-IS50 DS)**

	Date	Units	LOR	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018 dry	21 Dec 2018 wet	25 Jan 2019 dry	26 Feb 2019 wet	15 Mar 2019 dry	29 Mar 2019 wet	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019 dry	28 Aug 2019 dry	19 Sep 2019 wet	30 Sep 2019 dry	80th Percentile (pre-construction)	20th Percentile (pre-construction)	
Temperature	°C		NG		23.92	19.75	28.26	27.25	30	28.63	26.33	25.09	22.22	17.74	14.33	13.49	16.13	16.58	19.26	28.04	24.28	
Turbidity	NTU		<50		23.7	89.7	27.6	56.7	14.3	51.8	28.8	22.3	22.8	21.7	13.3	12.5	16.5	19.1	12	17.75	12.11	
Dissolved Oxygen	% saturation		85-110		94.3	107.3	78.1	71.8	80.9	75	81.5	136.1	106.7	101.3	115.8	94.6	101.5	87.5	85.3	93.2	84.7	
Electrical Conductivity	mS/cm		0.125-2.2		0.291	0.126	0.265	0.248	0.267	0.327	0.442	0.283	0.356	0.377	0.708	0.595	0.797	0.363	0.327	0.42	0.37	
Salinity			NG		0.14	0.06	0.12	0.12	0.13	0.16	0.21	0.13	0.17	0.18	0.34	0.29	0.39	0.17	0.16	0.18	0.17	
ORP	MV		NG			197	146	148	197	213	144	172	158	67	150	134	201	49	175	205.1	134.11	
pH	pH units		6.5-8.5		7.59	7.38	8.99	8.84	7.1	7.5	7.46	7.16	7.78	7.65	7.22	7.41	7.42	8.37	7.36	7.65	7.42	
Total Dissolved Solids	mg/L	10	NG		180	88	131	121	149	194	234	174	198	187	172	147	196	189	197	236	226	
Suspended Solids	mg/L	5	50		19	33	22	15	19	39	12	14	12	<5	7	7	<5	11	20	16	13	
Hydroxide Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Carbonate Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		41	16	35	40	45	49	66	40	48	63	49	39	50	45	43	64	56	
Total Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		41	16	35	40	45	49	66	40	48	63	49	39	50	45	43	64	56	
Sulfate as SO <sub>4</sub> - Turbidimetric	mg/L	1	NG		15	6	12	12	14	18	26	10	16	21	18	15	22	22	20	22	18	
Chloride	mg/L	1	NG		52	24	45	44	56	53	73	48	56	54	42	38	65	62	55	72	59	
Calcium	mg/L	1	NG		8	3	7	7	8	10	13	9	10	11	9	8	11	11	10	11	10	
Magnesium	mg/L	1	NG		6	2	6	6	5	6	8	6	7	8	7	6	8	8	8	8	7	
Sodium	mg/L	1	NG		34	15	31	30	32	41	58	34	40	44	37	32	44	43	38	49	47	
Potassium	mg/L	1	NG		3	2	3	3	3	4	6	4	4	5	5	4	5	6	5	5	5	
Dissolved Metals	Aluminium	mg/L	0.055		0.03	0.19	0.03	0.07	0.03	0.02	0.02	0.03	<0.01	<0.01	<0.01	<0.01	0.02	0.03	0.03	0.034	0.018	
	Antimony	mg/L	0.001	NG	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
	Arsenic	mg/L	0.001	0.024	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
	Barium	mg/L	0.001	NG	0.024	0.014	0.023	0.022	0.026	0.033	0.04	0.032	0.031	0.033	0.031	0.024	0.033	0.033	0.032	0.037	0.034	
	Cadmium	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
	Chromium	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.001	0.001	
	Copper	mg/L	0.001	0.0014	<0.001	<0.001	<0.001	0.002	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004			
	Lead	mg/L	0.001	0.0034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.003	<0.001			
	Lithium	mg/L	0.001	NG	0.005	0.004	0.008	0.008	0.012	0.008	0.008	0.009	0.008	0.008	0.008	0.01	0.006	0.007	0.006	0.004	0.007	0.006
	Manganese	mg/L	0.001	1.9	<0.001	0.054	<0.001	0.007	0.009	0.022	0.012	0.002	0.004	0.001	0.006	0.003	0.002	<0.001	0.017	0.004		
	Nickel	mg/L	0.001	0.011	0.001	0.002	<0.001	0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.001	
	Selenium	mg/L	0.01	0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
	Silver	mg/L	0.001	0.00005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
	Zinc	mg/L	0.005	0.008	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	0.01	
	Boron	mg/L	0.05	0.37	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
	Iron	mg/L	0.05	0.3	0.05	0.35	0.13	0.15	0.15	0.06	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.0132	0.078







**Year 1 construction surface water quality results at Impact site 4 (SC-IS50 DS)**

	Date	Units	LOR	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018 dry	21 Dec 2018 wet	25 Jan 2019 dry	26 Feb 2019 wet	15 Mar 2019 dry	29 Mar 2019 wet	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019 dry	28 Aug 2019 dry	19 Sep 2019 wet	30 Sep 2019 dry	80th Percentile (pre-construction)	20th Percentile (pre-construction)
Temperature	°C		NG		24.01	19.77	28.17	27.31	30.2	25.66	26.37	25.05	22.24	17.63	14.49	13.55	16.07	16.94	19.26	28.04	24.51
Turbidity	NTU		<50		24.3	84.4	43.9	50.9	13.2	34.6	29.6	21.2	19.6	28.3	12.8	11.9	14.7	14.8	10.5	15.46	11.79
Dissolved Oxygen	% saturation	85-110			90.9	101.4	82	70.4	88.6	74.6	85.7	100	101.8	102.2	136.8	98.7	103.5	106.1	83.2	92.94	71.69
Electrical Conductivity	mS/cm	0.125-2.2			0.3	0.128	0.261	0.243	0.263	0.33	0.458	0.279	0.349	0.34	0.702	0.603	0.801	0.359	0.324	0.42	0.37
Salinity		NG			0.14	0.06	0.12	0.11	0.12	0.16	0.22	0.13	0.17	0.16	0.34	0.29	0.39	0.17	0.15	0.18	0.17
ORP	MV	NG				157	152	150	174	-45	151	170	151	57	152	170	192	54	173	211.39	115.95
pH	pH units	6.5-8.5			7.46	8.4	8.92	8.83	7.22	7.51	7.45	7.21	7.78	7.7	7.18	7.28	7.52	8.4	7.45	7.65	7.41
Total Dissolved Solids	mg/L	10	NG		180	95	155	120	131	190	239	166	182	205	162	141	209	186	180	244	214
Suspended Solids	mg/L	5	50		17	33	12	12	13	24	13	11	9	<5	6	6	<5	<5	18	15	7
Hydroxide Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Carbonate Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		41	16	36	39	46	49	69	39	47	63	48	39	47	43	44	64	54
Total Alkalinity as CaCO <sub>3</sub>	mg/L	1	NG		41	16	36	39	46	49	69	39	47	63	48	39	47	43	44	64	54
Sulfate as SO <sub>4</sub> - Turbidimetric	mg/L	1	NG		16	6	12	14	12	16	28	14	13	21	18	15	23	22	20	22	18
Chloride	mg/L	1	NG		54	24	55	39	51	54	77	47	55	55	41	40	66	62	56	72	57
Calcium	mg/L	1	NG		8	3	8	7	7	10	13	9	10	11	9	8	11	11	10	11	10
Magnesium	mg/L	1	NG		6	2	6	6	5	6	8	6	7	8	7	6	8	8	7	8	7
Sodium	mg/L	1	NG		35	16	32	31	33	41	60	34	40	43	37	32	44	42	37	50	48
Potassium	mg/L	1	NG		3	2	4	3	3	4	6	4	4	5	5	4	6	5	5	6	5
Dissolved Metals	Aluminium	mg/L	0.055	0.03	0.16	0.02	0.04	0.02	0.02	0.02	0.02	0.01	0.01	<0.01	<0.01	0.02	0.02	0.02	0.02	0.018	
	Antimony	mg/L	0.001	NG	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Arsenic	mg/L	0.001	0.024	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Barium	mg/L	0.001	NG	0.026	0.014	0.026	0.022	0.026	0.032	0.041	0.031	0.031	0.032	0.031	0.023	0.033	0.033	0.029	0.035	0.034
	Cadmium	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
	Chromium	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001		
	Copper	mg/L	0.001	0.0014	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Lead	mg/L	0.001	0.0034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.003	<0.001		
	Lithium	mg/L	0.001	NG	0.005	0.004	0.009	0.008	0.012	0.008	0.007	0.009	0.008	0.008	0.01	0.007	0.007	0.006	0.004	0.006	0.006
	Manganese	mg/L	0.001	1.9	<0.001	0.055	0.003	0.002	0.006	0.022	0.014	0.002	0.001	0.004	<0.001	0.006	0.003	0.001	<0.001	0.015	0.004
	Nickel	mg/L	0.001	0.011	0.001	0.002	0.001	<0.001	0.001	0.002	0.001	<0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.0016	0.001
	Selenium	mg/L	0.01	0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
	Silver	mg/L	0.001	0.00005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	Zinc	mg/L	0.005	0.008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.013	0.013
	Boron	mg/L	0.05	0.37	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
	Iron	mg/L	0.05	0.3	0.05	0.29	0.16	0.13	0.07	0.05	<0.05	0.07	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	0.07

	Mercury	mg/L	0.0001	0.00006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Organochlorine Pesticides	Nitrite + Nitrate as N	mg/L	0.01	0.04	0.42	0.21	0.21	0.23	0.12	0.21	0.42	0.27	0.34	0.46	0.59	0.64	0.73	0.63	0.63	0.51	0.11	
	Total Kjeldahl Nitrogen as N	mg/L	0.1	NG	0.5	0.7	0.4	0.2	0.1	0.3	0.3	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.4	0.4	0.3	
	Total Nitrogen as N	mg/L	0.1	0.35	0.9	0.9	0.6	0.4	0.2	0.5	0.7	0.5	0.5	0.7	0.9	0.8	1	0.9	1	0.9	0.6	
	Total Phosphorus as P	mg/L	0.01	0.025	0.07	0.06	0.02	0.07	<0.01	0.02	0.04	0.01	0.02	<0.01	<0.01	<0.01	0.04	0.04	0.03	0.2	0.02	
	Total Anions	meq/L	0.01	NG	2.68	1.12	2.52	2.17	2.61	2.84	4.13	2.4	2.76	3.25	2.49	2.22	3.28	3.07	2.88	3.68	3.16	
	Total Cations	meq/L	0.01	NG	2.49	1.06	2.39	2.27	2.27	2.88	4.07	2.52	2.92	3.2	2.76	2.39	3.27	3.16	2.81	3.51	3.34	
Organophosphorus Pesticides	alpha-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Hexachlorobenzene (HCB)	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	beta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	gamma-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	delta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Heptachlor	µg/L	0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Aldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Heptachlor epoxide	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	trans-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	alpha-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	cis-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDE	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endrin	µg/L	0.5	0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	beta-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDD	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endrin aldehyde	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Endosulfan sulfate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	4,4'-DDT	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Endrin ketone	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Methoxychlor	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Total Chlordane (sum)	µg/L	0.5	0.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Sum of DDD + DDE + DDT	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Sum of Aldrin + Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Organophosphorus Pesticides	Dichlorvos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Demeton-S-methyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
	Monocrotophos	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
	Dimethoate</td																					





**Year 1 construction surface water quality results at Control site 1 (NC-CS1)**

	Date	Units	LOR	Guideline	29 Nov 2018 wet	21 Dec 2018 wet	15 Mar 2019 wet	19 Sep 2019 wet
Temperature		°C		NG	19.51	27.09	26.22	16.83
Turbidity		NTU		<50	88	70.1	34.7	18.2
Dissolved Oxygen		% saturation		85-110	139.39	72.8	115	107.7
Electrical Conductivity		mS/cm		0.125-2.2	0.119	0.252	0.481	0.366
Salinity				NG	0.05	0.12	0.23	0.17
ORP		MV		NG	224	137	134	96
pH		pH units		6.5-8.5	7.25	9.04	7.47	8.4
Total Dissolved Solids		mg/L	10	NG	95	144	266	200
Suspended Solids		mg/L	5	50	35	14	14	10
Hydroxide Alkalinity as CaCO3		mg/L	1	NG	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3		mg/L	1	NG	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3		mg/L	1	NG	14	40	72	46
Total Alkalinity as CaCO3		mg/L	1	NG	14	40	72	46
Sulfate as SO4 - Turbidimetric		mg/L	1	NG	5	13	30	22
Chloride		mg/L	1	NG	22	44	81	65
Calcium		mg/L	1	NG	3	7	14	11
Magnesium		mg/L	1	NG	2	6	8	8
Sodium		mg/L	1	NG	14	31	65	45
Potassium		mg/L	1	NG	2	4	7	6
Dissolved Metals	Aluminium	mg/L	0.01	0.055	0.19	0.08	0.01	0.02
	Antimony	mg/L	0.001	NG	<0.001	<0.001	<0.001	<0.001
	Arsenic	mg/L	0.001	0.024	<0.001	<0.001	<0.001	<0.001
	Barium	mg/L	0.001	NG	0.013	0.023	0.042	0.034
	Cadmium	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001
	Chromium	mg/L	0.001	0.001	<0.001	<0.001	<0.001	0.001
	Copper	mg/L	0.001	0.0014	<0.001	0.002	<0.001	<0.001
	Lead	mg/L	0.001	0.0034	<0.001	0.002	<0.001	0.003
	Lithium	mg/L	0.001	NG	0.004	0.009	0.007	0.006
	Manganese	mg/L	0.001	1.9	0.06	0.007	0.018	0.003
	Nickel	mg/L	0.001	0.011	0.001	0.002	0.001	<0.001
	Selenium	mg/L	0.01	0.005	<0.01	<0.01	<0.01	<0.01
	Silver	mg/L	0.001	0.00005	<0.001	<0.001	<0.001	<0.001
	Zinc	mg/L	0.005	0.008	<0.005	<0.005	<0.005	<0.005
	Boron	mg/L	0.05	0.37	<0.05	<0.05	<0.05	<0.05
	Iron	mg/L	0.05	0.3	0.36	0.19	<0.05	<0.05
	Mercury	mg/L	0.0001	0.00006	<0.0001	<0.0001	<0.0001	<0.0001
	Nitrite + Nitrate as N	mg/L	0.01	0.04	0.18	0.24	0.53	0.65
	Total Kjeldahl Nitrogen as N	mg/L	0.1	NG	0.5	0.3	0.2	0.4
	Total Nitrogen as N	mg/L	0.1	0.35	0.7	0.5	0.7	1
	Total Phosphorus as P	mg/L	0.01	0.025	0.04	0.09	0.02	0.06
	Total Anions	meq/L	0.01	NG	1	2.31	4.35	3.21
	Total Cations	meq/L	0.01	NG	0.97	2.29	4.36	3.32
Organochlorine Pesticides	alpha-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Hexachlorobenzene (HCB)	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	beta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	gamma-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	delta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Heptachlor	µg/L	0.5	0.8	<0.5	<0.5	<0.5	<0.5
	Aldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Heptachlor epoxide	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	trans-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5

	alpha-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	cis-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	4,4'-DDE	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Endrin	µg/L	0.5	0.01	<0.5	<0.5	<0.5	<0.5
	beta-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	4,4'-DDD	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Endrin aldehyde	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Endosulfan sulfate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	4,4'-DDT	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0
	Endrin ketone	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Methoxychlor	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0
	Total Chlordane (sum)	µg/L	0.5	0.03	<0.5	<0.5	<0.5	<0.5
	Sum of DDD + DDE + DDT	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Sum of Aldrin + Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
Organophosphorus Pesticides	Dichlorvos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Demeton-S-methyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Monocrotophos	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0
	Dimethoate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Diazinon	µg/L	5	NG	<0.5	<0.5	<0.5	<0.5
	Chlorpyrifos-methyl	µg/L	0.5	0.001	<0.5	<0.5	<0.5	<0.5
	Parathion-methyl	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0
	Malathion	µg/L	0.5	0.05	<0.5	<0.5	<0.5	<0.5
	Fenthion	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Chlorpyrifos	µg/L	0.5	0.01	<0.5	<0.5	<0.5	<0.5
	Parathion	µg/L	2	0.004	<2.0	<2.0	<2.0	<2.0
	Pirimphos-ethyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Chlorfenvinphos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Bromophos-ethyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Fenamiphos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Prothiofos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Ethion	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Carbophenothion	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Azinphos Methyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
Polynuclear Aromatic Hydrocarbons	Naphthalene	µg/L	1	16	<1.0	<1.0	<1.0	<1.0
	Acenaphthylene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Acenaphthene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Fluorene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Phenanthrene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Anthracene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Fluoranthene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Pyrene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Benz(a)anthracene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Chrysene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Benzo(b+j)fluoranthene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Benzo(k)fluoranthene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Benzo(a)pyrene	µg/L	1	NG	<0.5	<0.5	<0.5	<0.5
	Indeno(1,2,3,cd)pyrene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Dibenz(a,h)anthracene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Benzo(g,h,i)perylene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0

	Sum of polycyclic aromatic hydrocarbons	µg/L	1	NG	<0.5	<0.5	<0.5	<0.5
	Benzo(a)pyrene TEQ (zero)	µg/L	1	NG	<0.5	<0.5	<0.5	<0.5
Total Petroleum Hydrocarbons	C6 - C9 Fraction	µg/L	20	NG	<20	<20	<20	<20
	C10 - C14 Fraction	µg/L	50	NG	<50	<50	<50	<50
	C15 - C28 Fraction	µg/L	100	NG	<100	<100	<100	<100
	C29 - C36 Fraction	µg/L	50	NG	<50	<50	<50	<50
	C10 - C36 Fraction (sum)	µg/L	50	NG	<50	<50	<50	<50
Total recoverable Hydrocarbons	C6 - C10 Fraction	µg/L	20	NG	<20	<20	<20	<20
	C6 - C10 Fraction minus BTEX (F1)	µg/L	20	NG	<20	<20	<20	<20
	>C10 - C16 Fraction	µg/L	100	NG	<100	<100	<100	<100
	>C16 - C34 Fraction	µg/L	100	NG	<100	<100	<100	<100
	>C34 - C40 Fraction	µg/L	100	NG	<100	<100	<100	<100
	>C10 - C40 Fraction (sum)	µg/L	100	NG	<100	<100	<100	<100
	>C10 - C16 Fraction minus Naphthalene (F2)	µg/L	100	NG	<100	<100	<100	<100
BTEXN	Benzene	µg/L	1	950	<1	<1	<1	<1
	Toluene	µg/L	2	NG	<2	<2	<2	<2
	Ethylbenzene	µg/L	2	NG	<2	<2	<2	<2
	meta- & para-Xylene	µg/L	2	NG	<2	<2	<2	<2
	ortho-Xylene	µg/L	2	350	<2	<2	<2	<2
	Total Xylenes	µg/L	2	NG	<2	<2	<2	<2
	Sum of BTEX	µg/L	1	NG	<1	<1	<1	<1
	Naphthalene	µg/L	5	NG	<5	<5	<5	<5

**Year 1 construction surface water quality results at Control site 2 (SC-CS2)**

	Date	Units	LOR	Guideline	29/11/2018 wet	21/12/2018 wet	15/03/2019 wet	19/09/2019 wet
Temperature		°C		NG	19.51	27.33	26.36	16.99
Turbidity		NTU		<50	88.1	52.8	40.2	19.8
Dissolved Oxygen		% saturation		85-110	91.2	69.4	103.1	109.3
Electrical Conductivity		mS/cm		0.125-2.2	0.12	0.243	0.452	0.295
Salinity				NG	0.06	0.11	0.22	0.11
ORP		MV		NG	236	141	138	110
pH		pH units		6.5-8.5	7.02	8.97	7.5	8.43
Total Dissolved Solids		mg/L	10	NG	107	107	238	165
Suspended Solids		mg/L	5	50	36	12	12	7
Hydroxide Alkalinity as CaCO <sub>3</sub>		mg/L	1	NG	<1	<1	<1	<1
Carbonate Alkalinity as CaCO <sub>3</sub>		mg/L	1	NG	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO <sub>3</sub>		mg/L	1	NG	15	39	69	44
Total Alkalinity as CaCO <sub>3</sub>		mg/L	1	NG	15	39	69	44
Sulfate as SO <sub>4</sub> - Turbidimetric		mg/L	1	NG	6	12	28	
Chloride		mg/L	1	NG	23	43	75	62
Calcium		mg/L	1	NG	3	7	13	11
Magnesium		mg/L	1	NG	2	5	8	8
Sodium		mg/L	1	NG	14	31	60	43
Potassium		mg/L	1	NG	2	3	7	5
Dissolved Metals	Aluminium	mg/L	0.01	0.055	0.19	0.06	0.02	0.02
Antimony	mg/L	0.001	NG	<0.001	<0.001	<0.001	<0.001	
Arsenic	mg/L	0.001	0.024	<0.001	<0.001	<0.001	<0.001	
Barium	mg/L	0.001	NG	0.013	0.023	0.04	0.033	
Cadmium	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	mg/L	0.001	0.001	<0.001	<0.001	<0.001	0.002	
Copper	mg/L	0.001	0.0014	<0.001	0.002	<0.001	<0.001	
Lead	mg/L	0.001	0.0034	<0.001	0.002	<0.001	0.003	
Lithium	mg/L	0.001	NG	0.004	0.01	0.008	0.005	
Manganese	mg/L	0.001	1.9	0.059	0.005	0.014	0.001	
Nickel	mg/L	0.001	0.011	0.001	<0.001	0.001	<0.001	
Selenium	mg/L	0.01	0.005	<0.01	<0.01	<0.01	<0.01	
Silver	mg/L	0.001	0.00005	<0.001	<0.001	<0.001	<0.001	
Zinc	mg/L	0.005	0.008	<0.005	<0.005	<0.005	<0.005	
Boron	mg/L	0.05	0.37	<0.05	<0.05	<0.05	<0.05	
Iron	mg/L	0.05	0.3	0.34	0.14	<0.05	<0.05	
Mercury	mg/L	0.0001	0.00006	<0.0001	<0.0001	<0.0001	<0.0001	
Organochlorine Pesticides	Nitrite + Nitrate as N	mg/L	0.01	0.04	2.26	0.23	0.43	0.62
Total Kjeldahl Nitrogen as N	mg/L	0.1	NG	0.9	0.3	0.3	0.4	
Total Nitrogen as N	mg/L	0.1	0.35	3.2	0.5	0.7	1	
Total Phosphorus as P	mg/L	0.01	0.025	0.09	0.08	0.02	0.04	
Total Anions	meq/L	0.01	NG	1.07	2.24	4.08	3.06	
Total Cations	meq/L	0.01	NG	0.97	2.18	4.1	3.2	
alpha-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
Hexachlorobenzene (HCB)	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
beta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
gamma-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
delta-BHC	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
Heptachlor	µg/L	0.5	0.8	<0.5	<0.5	<0.5	<0.5	
Aldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
Heptachlor epoxide	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
trans-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
alpha-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
cis-Chlordane	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
4,4'-DDE	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
Endrin	µg/L	0.5	0.01	<0.5	<0.5	<0.5	<0.5	
beta-Endosulfan	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	
4,4'-DDD	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5	

	Endrin aldehyde	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Endosulfan sulfate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	4,4'-DDT	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0
	Endrin ketone	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Methoxychlor	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0
	Total Chlordane (sum)	µg/L	0.5	0.03	<0.5	<0.5	<0.5	<0.5
	Sum of DDD + DDE + DDT	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Sum of Aldrin + Dieldrin	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
Organophosphorus Pesticides	Dichlorvos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Demeton-S-methyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Monocrotophos	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0
	Dimethoate	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Diazinon	µg/L	5	NG	<0.5	<0.5	<0.5	<0.5
	Chlorpyrifos-methyl	µg/L	0.5	0.001	<0.5	<0.5	<0.5	<0.5
	Parathion-methyl	µg/L	2	NG	<2.0	<2.0	<2.0	<2.0
	Malathion	µg/L	0.5	0.05	<0.5	<0.5	<0.5	<0.5
	Fenthion	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Chlorpyrifos	µg/L	0.5	0.01	<0.5	<0.5	<0.5	<0.5
	Parathion	µg/L	2	0.004	<2.0	<2.0	<2.0	<2.0
	Pirimphos-ethyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Chlorfenvinphos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Bromophos-ethyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Fenamiphos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Prothiofos	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Ethion	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Carbophenothion	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
	Azinphos Methyl	µg/L	0.5	NG	<0.5	<0.5	<0.5	<0.5
Polynuclear Aromatic Hydrocarbons	Naphthalene	µg/L	1	16	<1.0	<1.0	<1.0	<1.0
	Acenaphthylene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Acenaphthene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Fluorene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Phenanthren	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Anthracene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Fluoranthene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Pyrene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Benz(a)anthracene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Chrysene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Benzo(b+)fluoranthene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Benzo(k)fluoranthene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Benzo(a)pyrene	µg/L	1	NG	<0.5	<0.5	<0.5	<0.5
	Indeno(1,2,3,cd)pyrene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Dibenz(a,h)anthracene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Benzo(g,h,i)perylene	µg/L	1	NG	<1.0	<1.0	<1.0	<1.0
	Sum of polycyclic aromatic hydrocarbons	µg/L	1	NG	<0.5	<0.5	<0.5	<0.5
	Benzo(a)pyrene TEQ (zero)	µg/L	1	NG	<0.5	<0.5	<0.5	<0.5
Total Petroleum Hydrocarbons	C6 - C9 Fraction	µg/L	20	NG	<20	<20	<20	<20
	C10 - C14 Fraction	µg/L	50	NG	<50	<50	<50	<50
	C15 - C28 Fraction	µg/L	100	NG	<100	<100	<100	<100
	C29 - C36 Fraction	µg/L	50	NG	<50	<50	<50	<50
	C10 - C36 Fraction (sum)	µg/L	50	NG	<50	<50	<50	<50
Total recoverable Hydrocarbons	C6 - C10 Fraction	µg/L	20	NG	<20	<20	<20	<20
	C6 - C10 Fraction minus BTEX (F1)	µg/L	20	NG	<20	<20	<20	<20
	>C10 - C16 Fraction	µg/L	100	NG	<100	<100	<100	<100
	>C16 - C34 Fraction	µg/L	100	NG	<100	<100	<100	<100
	>C34 - C40 Fraction	µg/L	100	NG	<100	<100	<100	<100
	>C10 - C40 Fraction (sum)	µg/L	100	NG	<100	<100	<100	<100
	>C10 - C16 Fraction minus Naphthalene (F2)	µg/L	100	NG	<100	<100	<100	<100
BTEXN	Benzene	µg/L	1	950	<1	<1	<1	<1
	Toluene	µg/L	2	NG	<2	<2	<2	<2
	Ethylbenzene	µg/L	2	NG	<2	<2	<2	<2
	meta- & para-Xylene	µg/L	2	NG	<2	<2	<2	<2

ortho-Xylene	µg/L	2	350	<2	<2	<2	<2
Total Xylenes	µg/L	2	NG	<2	<2	<2	<2
Sum of BTEX	µg/L	1	NG	<1	<1	<1	<1
Naphthalene	µg/L	5	NG	<5	<5	<5	<5

## Groundwater Results

### Year 1 construction groundwater quality results at Reference Borehole – shallow (NC-RBH01A) (referred to as NC-RBH01S in preconstruction monitoring report)

Date	Units	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018 dry	21 Dec 2018 wet	25 Jan 2019 dry	26 Feb 2019 dry	29 Mar 2019 dry	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019 dry	28 Aug 2019 wet	19 Sep 2019 dry	30 Sep 2019 dry	80th Percentile (Cumulative)	20th Percentile (Cumulative)
Temperature	°C	NG	22.02	22.01	22.30	21.40	21.60	22.89	22.38	21.20	18.34	15.48	20.83	18.55	21.30	20.06	22.014	19.456
Turbidity	NTU	<50	33.60	31.40	30.40	32.50	32.40	57.20	57.20	21.70	49.00	33.60	7.90	28.00	33.60	96.40	39.76	26.52
Dissolved Oxygen	% saturation	85-110	38.70	47.00	55.80	41.90	29.32	41.20	50.30	38.50	35.50	42.63	44.40	28.70	42.10	18.10	43.338	33.026
Electrical Conductivity	mS/cm	0.125-2.2	0.546	0.620	0.670	0.436	0.530	0.563	0.694	0.715	0.753	0.659	1.630	1.600	0.447	0.694	0.7302	0.5396
Salinity	ppt	NG	0.26	0.18	0.25	0.88	0.29	0.27	0.31	0.35	0.37	0.35	0.82	0.81	0.30	0.34	0.546	0.266
ORP	MV	NG	93.00	-28.00	-86.50	-36.00	-48.60	-45.00	-63.00	-67.00	-51.00	-62.80	-75.00	-68.00	-39.60	-65.00	-38.16	-67.4
pH	pH units	6.5-8.5	6.54	7.18	7.15	6.29	7.28	6.65	6.96	6.70	6.49	6.78	6.49	6.69	6.34	6.60	6.928	6.49

### Year 1 construction groundwater quality results at Reference Borehole – deep (NC-RBH01B) (referred to as NC-RBH01D in preconstruction monitoring report)

Date	Units	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018 dry	21 Dec 2018 wet	25 Jan 2019 dry	26 Feb 2019 dry	29 Mar 2019 dry	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019 dry	28 Aug 2019 wet	19 Sep 2019 dry	30 Sep 2019 dry	80th Percentile (Cumulative)	20th Percentile (Cumulative)
Temperature	°C	NG	21.38	22.01	20.40	21.40	22.60	22.91	21.47	21.47	18.39	15.30	21.51	18.86	16.00	21.66	22.444	18.672
Turbidity	NTU	<50	31.00	31.40	32.80	32.50	25.40	31.60	24.30	35.40	44.30	30.41	29.80	29.00	38.00	27.20	33.84	27.86
Dissolved Oxygen	% saturation	85-110	39.00	47.00	35.00	41.90	105.30	116.50	39.68	32.90	31.70	46.30	104.80	52.50	47.80	17.50	73.42	34.16
Electrical Conductivity	mS/cm	0.125-2.2	0.69	0.620	2.03	0.436	0.64	0.69	0.585	0.730	0.738	0.745	1.540	1.630	0.763	2.190	1.576	0.6912
Salinity	ppt	NG	0.34	0.18	0.28	0.88	0.26	0.34	0.29	0.36	0.36	0.35	0.80	0.82	0.31	1.12	0.808	0.31
ORP	MV	NG	-38.00	-28.00	-24.60	-36.00	-22.60	-97.00	-55.00	-73.00	-71.00	-69.00	-60.00	-77.00	-61.00	-174.00	-27.24	-74.6
pH	pH units	6.5-8.5	7.14	7.18	6.93	6.29	6.64	6.94	6.77	6.83	6.53	6.75	6.41	6.52	6.75	8.83	7.134	6.596

**Year 1 construction groundwater quality results at North Bank Borehole – Shallow (NC-BH02A)**

Date	Units	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018 dry	21 Dec 2018 wet	25 Jan 2019 dry	26 Feb 2019 dry	29 Mar 2019 dry	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019 dry	28 Aug 2019 dry	19 Sep 2019 wet	30 Sep 2019 dry
Temperature	°C	NG	21.30	20.80	22.30	21.40	21.40	21.50	19.86	19.13	21.58	16.35	20.80	17.04	21.45	19.44
Turbidity	NTU	<50	22.40	34.70	29.60	32.10	26.60	27.00	25.30	26.80	13.70	18.40	16.80	34.50	33.60	12.30
Dissolved Oxygen	% saturation	85-110	60.10	21.60	43.00	26.80	74.30	81.40	33.40	28.20	54.90	63.80	26.60	44.30	25.30	84.60
Electrical Conductivity	mS/cm	0.125-2.2	0.40	0.88	0.65	0.54	0.53	0.67	0.689	0.712	0.680	0.75	1.51	1.63	0.66	0.69
Salinity	ppt	NG	0.20	0.64	0.72	0.76	0.34	0.33	0.34	0.35	0.33	0.33	0.76	0.82	0.35	0.33
ORP	MV	NG	-58.00	-55.00	-87.30	-48.60	-49.80	-57.00	-56.00	-58.00	-58.00	-59.80	-87.00	-55.00	-54.00	-50.00
pH	pH units	6.5-8.5	6.80	7.43	6.82	7.02	6.83	7.31	7.19	7.27	7.53	7.36	7.01	7.61	7.06	6.30

**Year 1 construction groundwater quality results at North Bank Borehole – Deep (NC-BH02B)**

Date	Units	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018 dry	21 Dec 2018 wet	25 Jan 2019 dry	26 Feb 2019 dry	29 Mar 2019 dry	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019 dry	28 Aug 2019 dry	19 Sep 2019 wet	30 Sep 2019 dry
Temperature	°C	NG	20.40	20.80	21.60	20.50	21.90	21.80	20.60	19.42	20.39	16.80	19.47	17.98	18.63	19.47
Turbidity	NTU	<50	23.40	36.70	32.10	31.20	24.60	23.10	19.50	14.50	31.70	27.30	16.00	18.50	17.30	9.70
Dissolved Oxygen	% saturation	85-110	63.10	21.60	58.90	26.70	42.30	41.80	36.40	23.10	29.70	28.90	41.90	33.60	27.50	66.20
Electrical Conductivity	mS/cm	0.125-2.2	0.45	0.88	0.51	0.62	0.48	0.42	0.447	0.463	0.419	0.534		0.96	0.46	0.522
Salinity	ppt	NG	0.20	0.64	0.36	0.71	0.10	0.20	0.21	0.22	0.20	0.34	0.46	0.47	0.21	0.25
ORP	MV	NG	-56.90	-55.00	-55.30	-61.80	-52.00	-54.00	-31.00	-22.00	0.00	-53.50	12.00	-12.00	-54.20	-60.00
pH	pH units	6.5-8.5	6.75	7.43	6.84	7.10	6.89	6.28	6.78	6.55	6.10	6.85	5.69	6.15	7.05	6.81

**Year 1 construction groundwater quality results at South Bank Borehole (SC-BH01)**

Date	Units	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	18 Dec 2018 dry	21 Dec 2018 wet	25 Jan 2019*	26 Feb 2019 dry	29 Mar 2019 dry	29 Apr 2019 dry	27 May 2019 dry	27 Jun 2019 dry	26 Jul 2019 dry	28 Aug 2019 dry	19 Sep 2019 wet	30 Sep 2019 dry
Temperature	°C	NG	23.10	22.10	23.79	21.90		23.74	23.00	24.20	21.16	16.80	21.81	20.27	19.32	19.42
Turbidity	NTU	<50	230	215	488	126		576	386	184	357	402	305	200	216	230
Dissolved Oxygen	% saturation	85-110	25.60	27.80	29.60	34.60		29.40	60.70	66.30	44.90	62.30	104.80	27.80	60.40	25.00
Electrical Conductivity	mS/cm	0.125-2.2	1.850	5.300	0.542	2.230		1.980	0.716	1.740	1.930	1.640	1.540	4.620	0.798	0.734
Salinity	ppt	NG	2.300	0.66	0.26	1.840		1.000	0.94	0.88	0.98	0.82	0.8	0.86	0.65	0.36
ORP	MV	NG	163.40	134.50	12.00	53.66		-7.00	70.00	74.00	10.00	68.60	-60.00	-31.00	56.30	-83.00
pH	pH units	6.5-8.5	6.94	6.95	7.91	7.32		7.67	7.85	7.38	7.05	7.67	6.41	6.81	7.24	6.66

\*borehole was unable to be accessed.

**Groundwater quality results at South bank borehole 1 (Sacrificial Borehole)**

Date	Units	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	80th Percentile (pre-construction)	20th Percentile (pre-construction)
Temperature	°C	NG	21.38	21.02	22.456	19.82
Turbidity	NTU	<50	31	27.00	43.86	11.076
Dissolved Oxygen	% saturation	85-110	39	45.00	18.5	10.6
Electrical Conductivity	mS/cm	0.125-2.2	0.692	1.53	1.95	1.79
Salinity	ppt	NG	0.34	0.21	1	0.926
ORP	MV	NG	-38	-30.00	23.32	-35.86
pH	pH units	6.5-8.5	7.14	7.21	6.578	6.49

**Groundwater quality results at North bank borehole 2 (Sacrificial Borehole)**

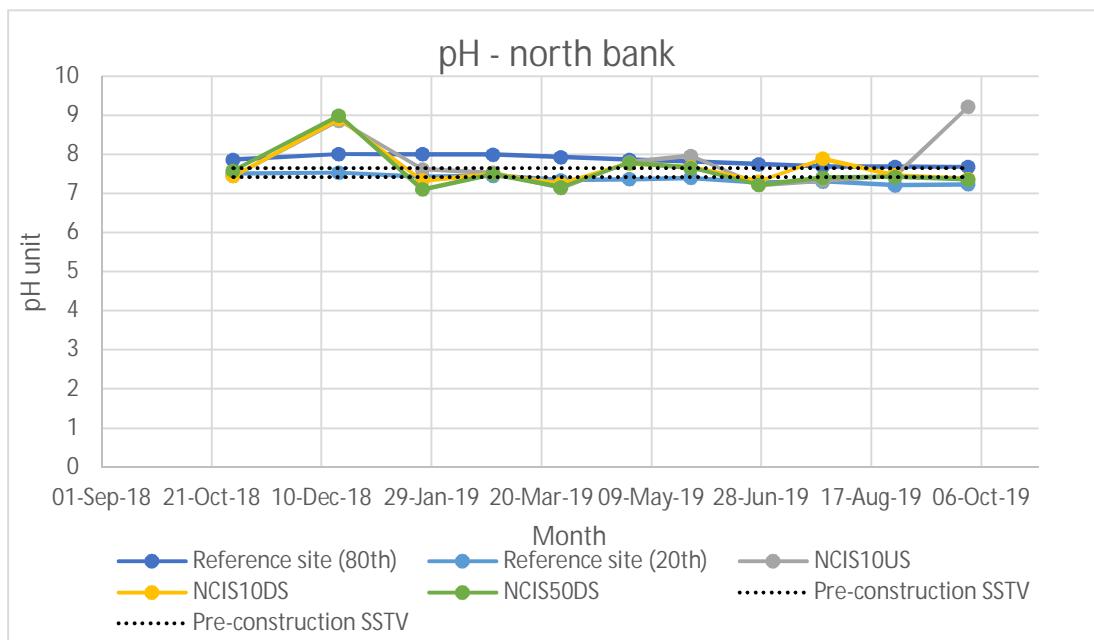
Date	Units	Guideline	31 Oct 2018 dry	29 Nov 2018 wet	80th Percentile (pre-construction)	20th Percentile (pre-construction)
Temperature	°C	NG	20.27	19.83	25.24	21.724
Turbidity	NTU	<50	23.2	25.00	371.4	33.22
Dissolved Oxygen	% saturation	85-110	32.2	30.23	26.96	18.38
Electrical Conductivity	mS/cm	0.125-2.2	1.84	1.990	5.6392	5.276
Salinity	ppt	NG	0.93	0.940	3.222	2.904
ORP	MV	NG	-14	-6.000	190.36	70.24
pH	pH units	6.5-8.5	7.12	6.49	6.93	6.792

## Appendix D. Surface and Groundwater Relevant Plots

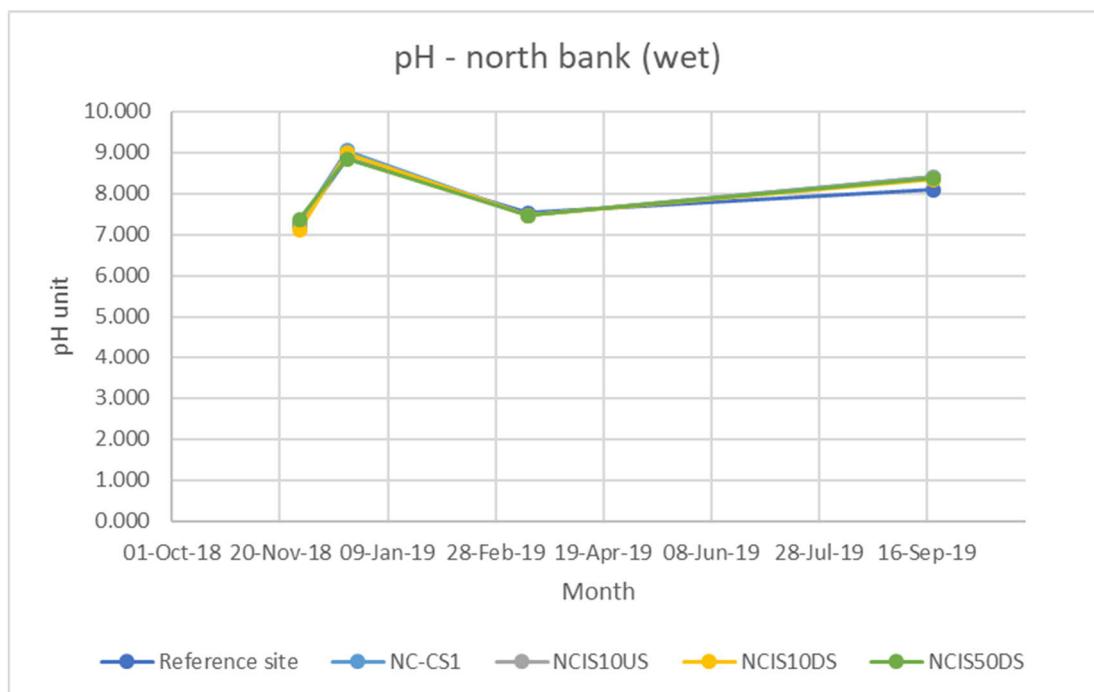
## 1. Surface Water

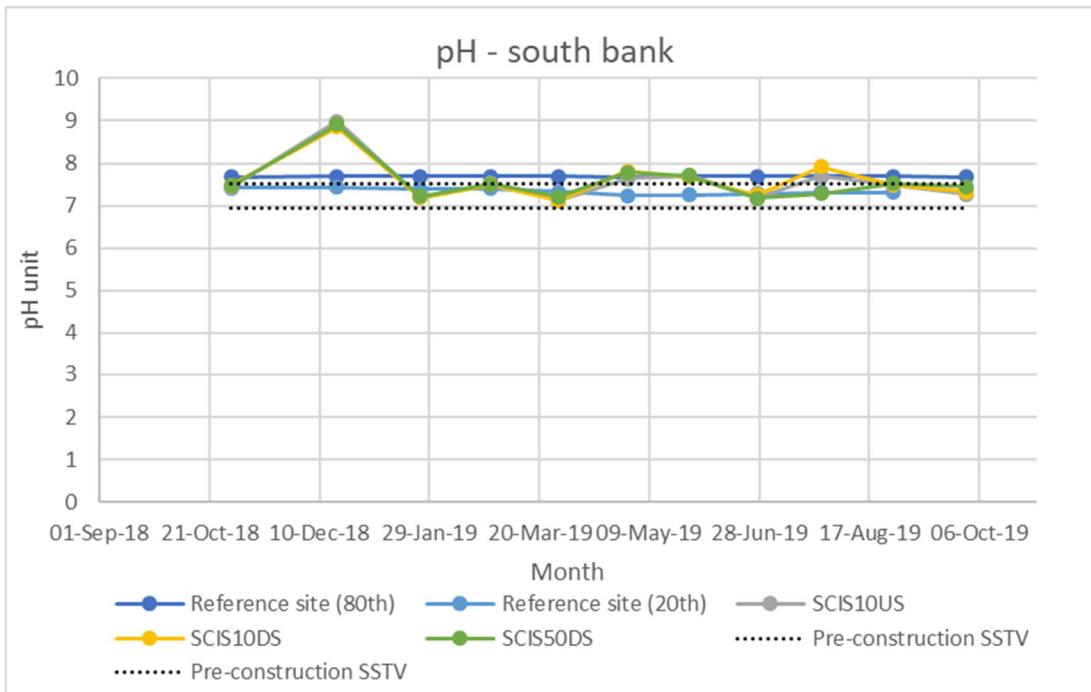
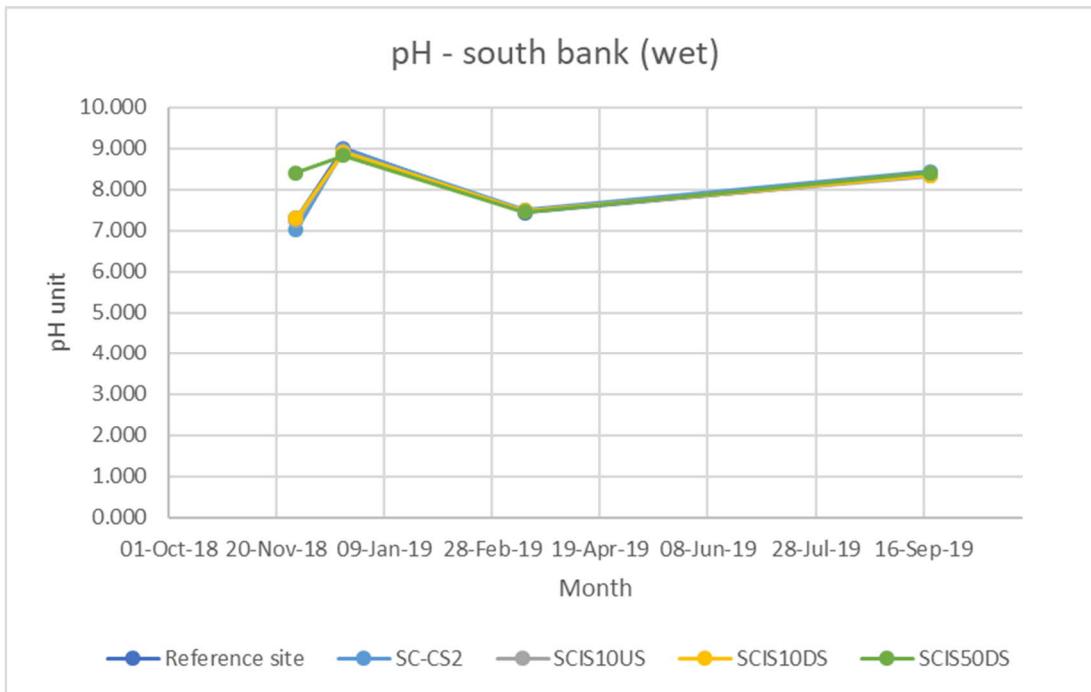
### 1.1 pH

#### North Bank - Dry Weather



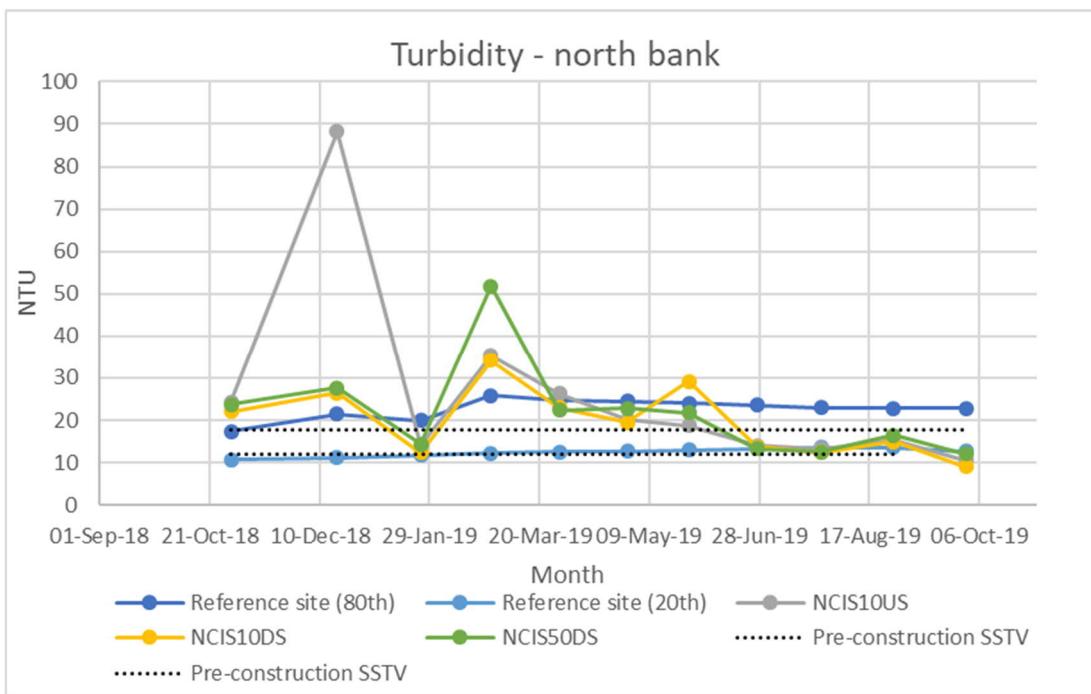
#### North Bank - Wet Weather



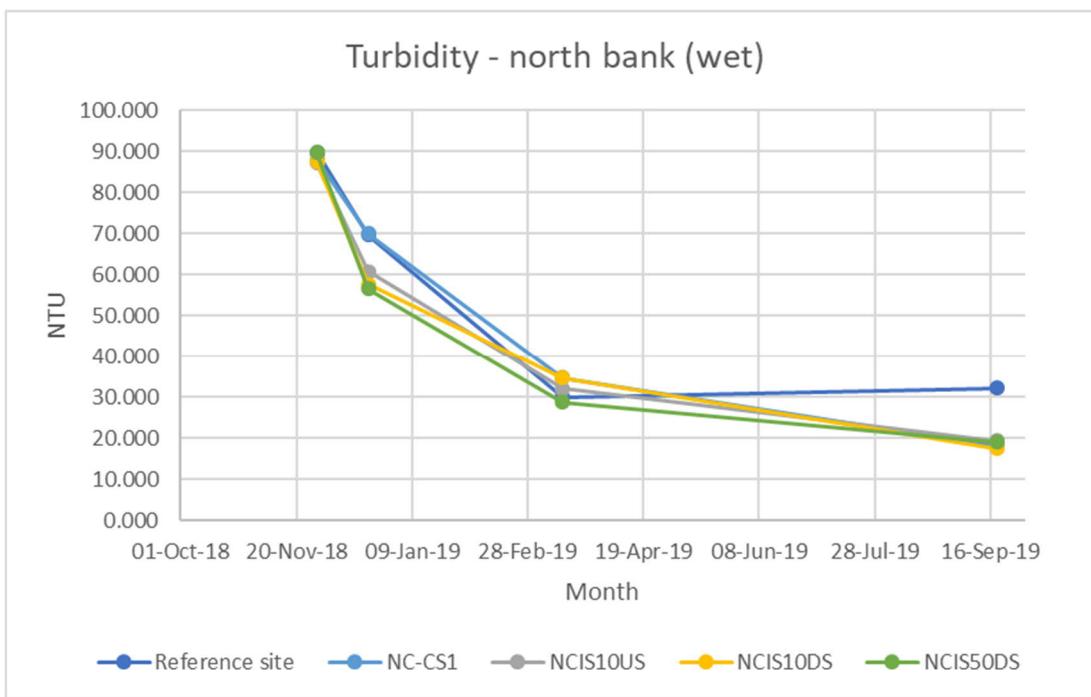
**South Bank - Dry Weather****South Bank - Wet Weather**

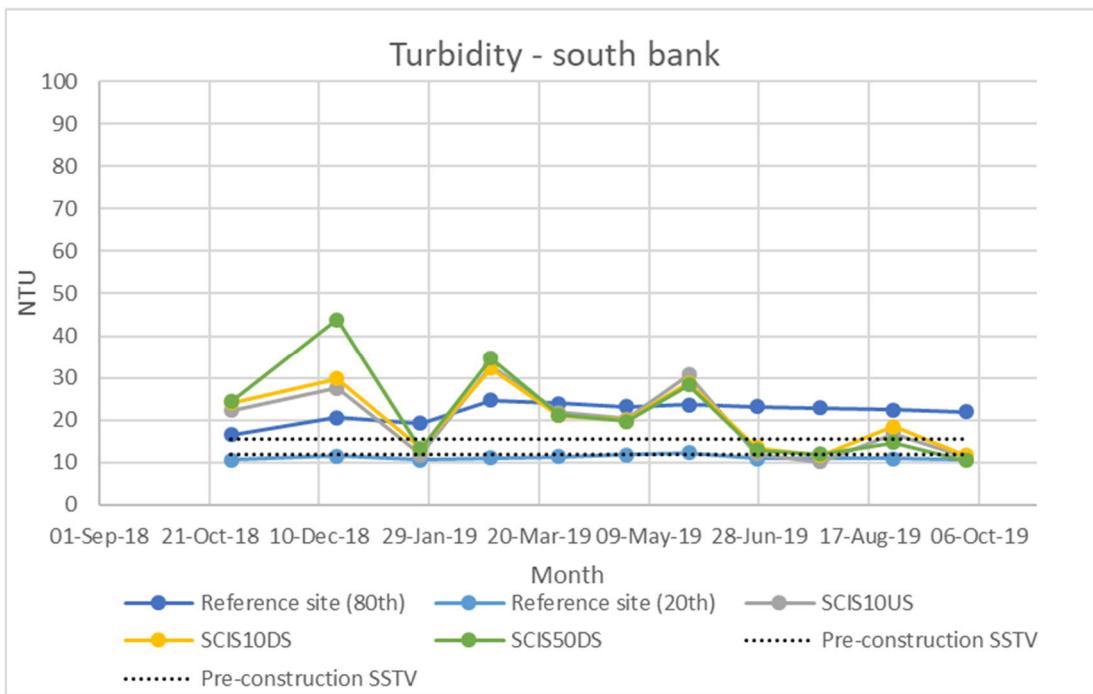
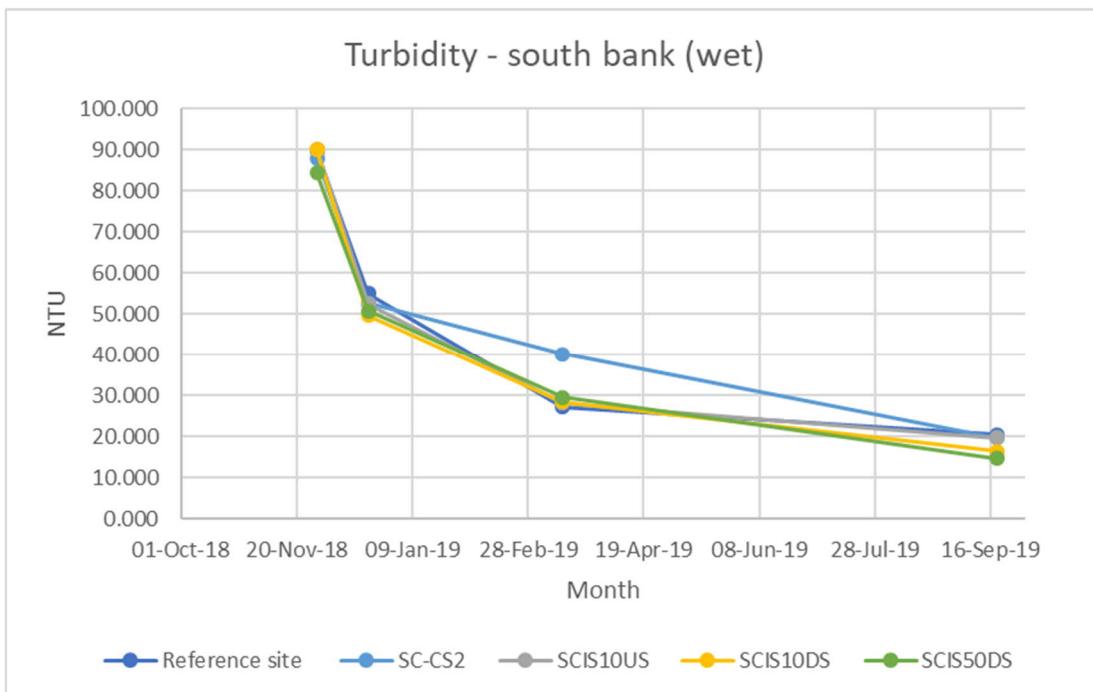
## 1.2 Turbidity

### North Bank - Dry Weather



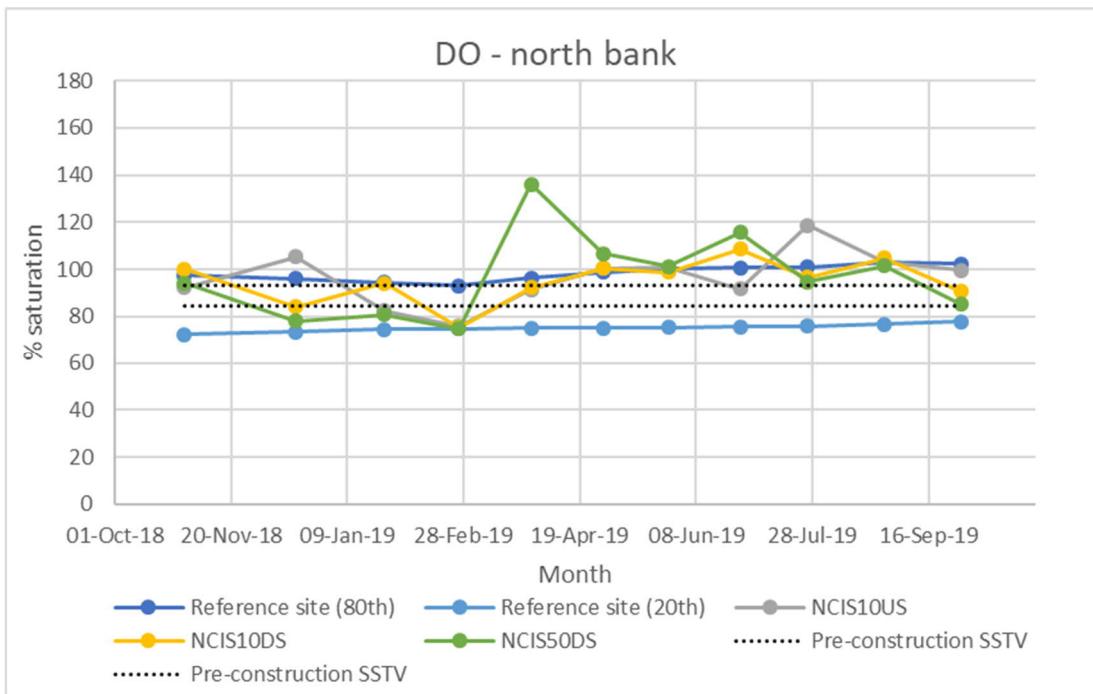
### North Bank - Wet Weather



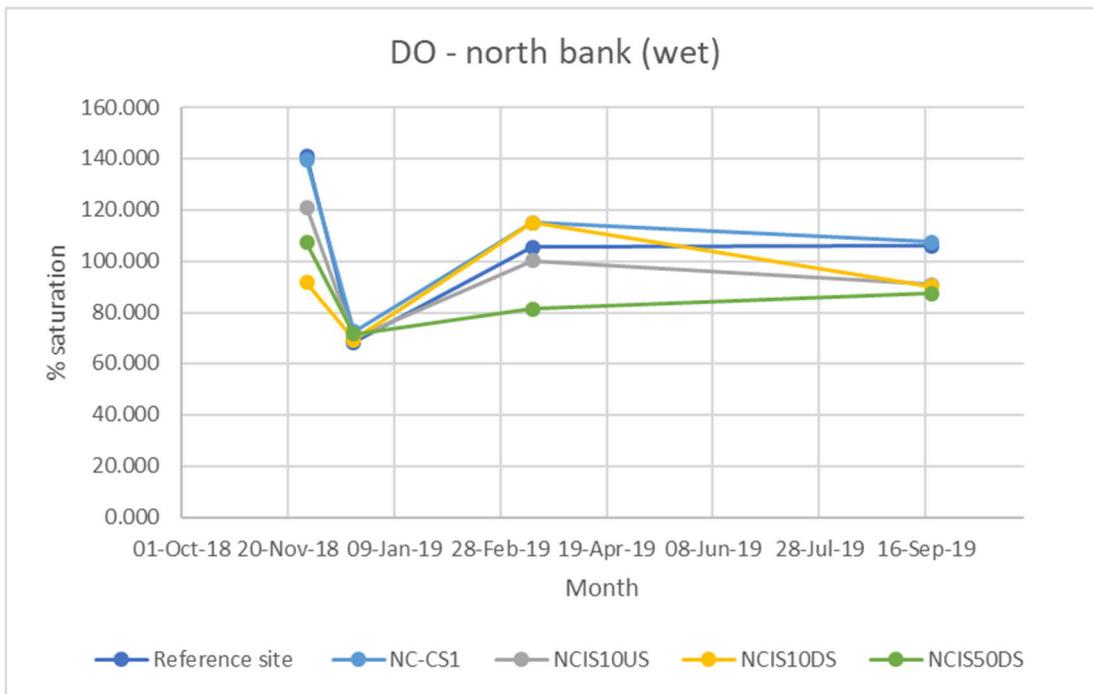
**South Bank - Dry Weather****South Bank - Wet Weather**

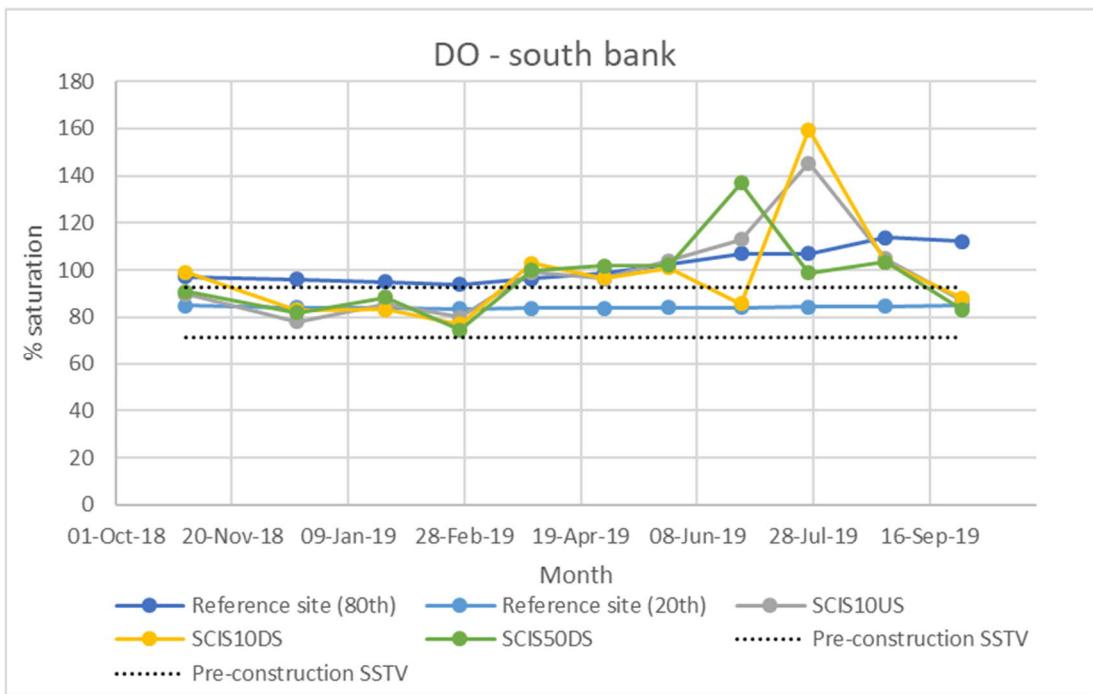
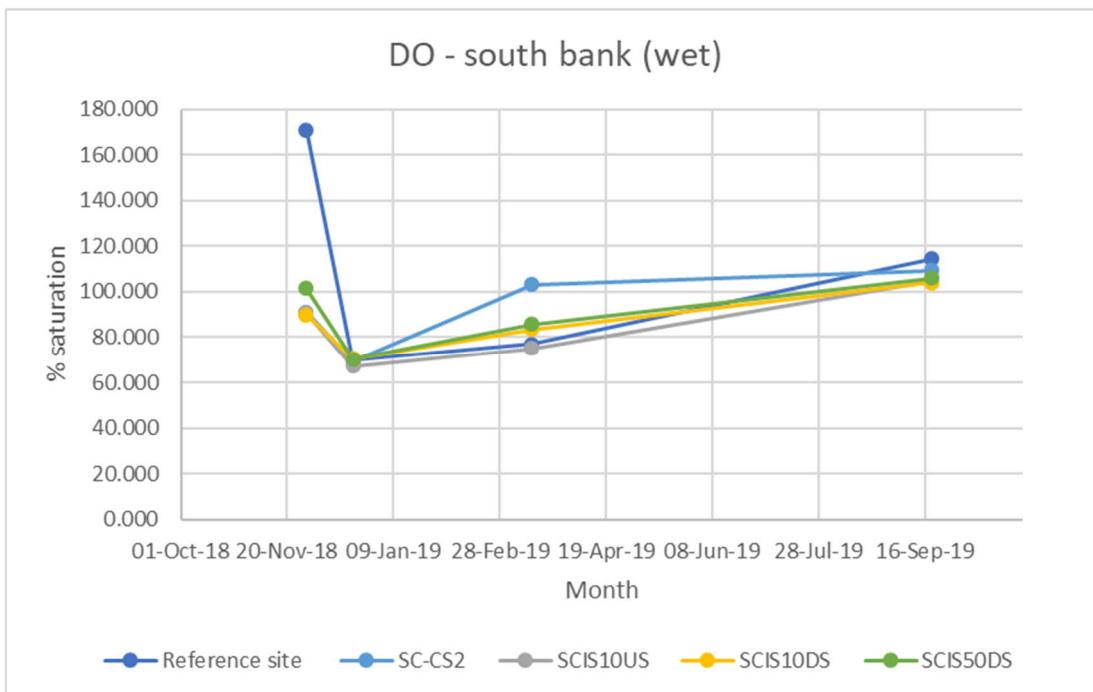
### 1.3 Dissolved Oxygen

#### North Bank - Dry Weather



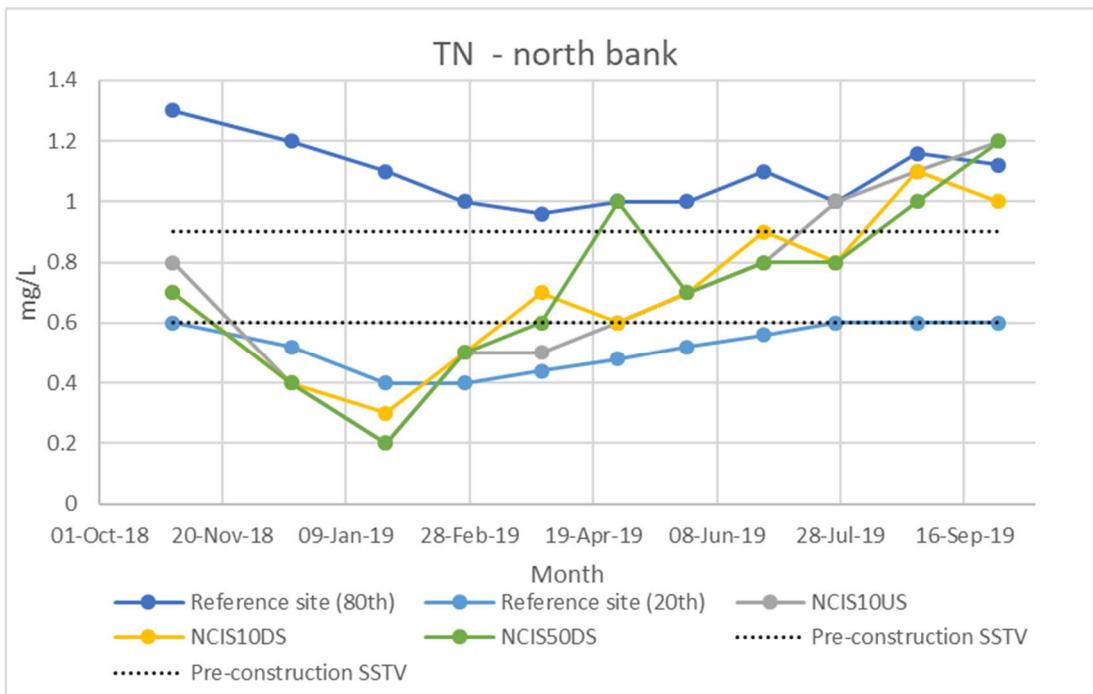
#### North Bank - Wet Weather



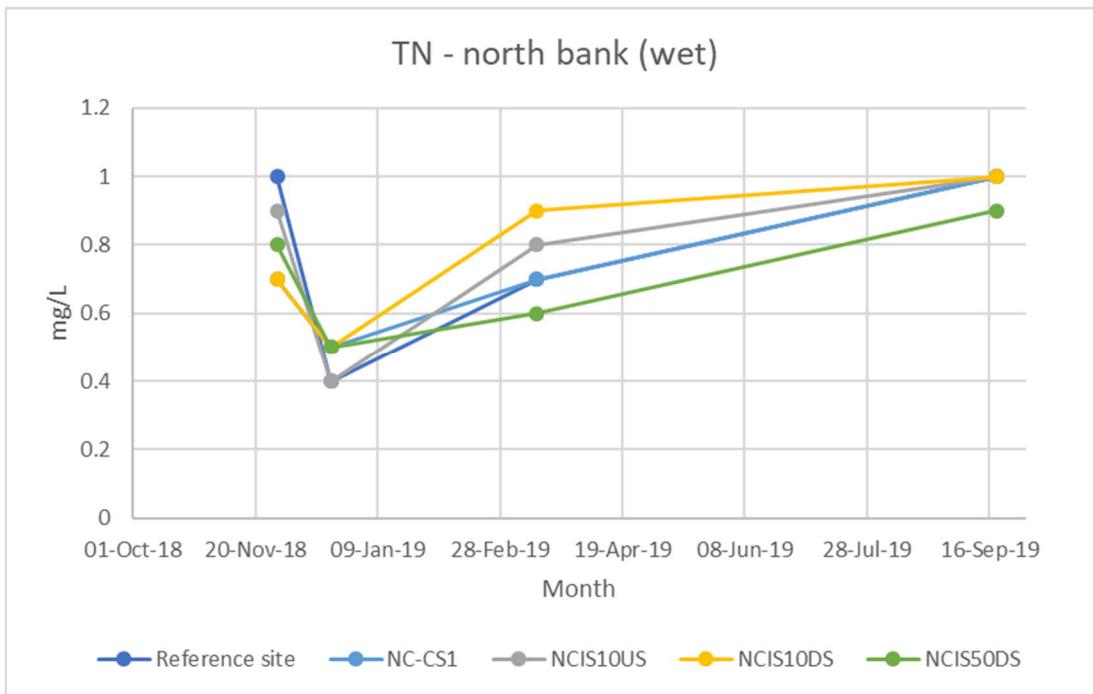
**South Bank - Dry Weather****South Bank - Wet Weather**

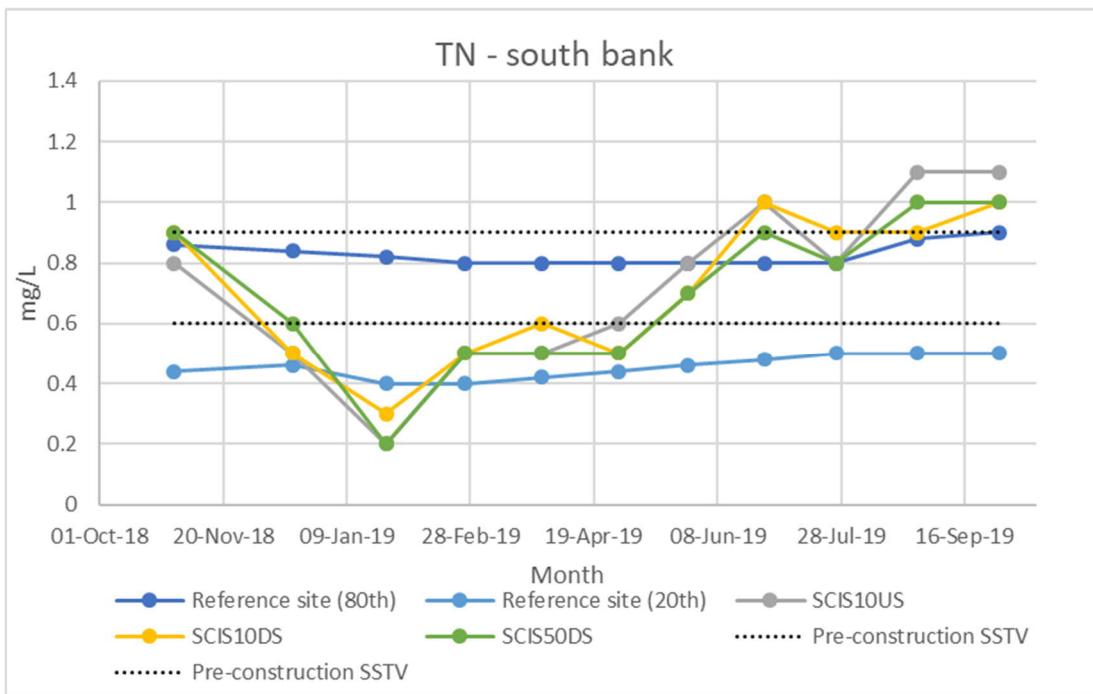
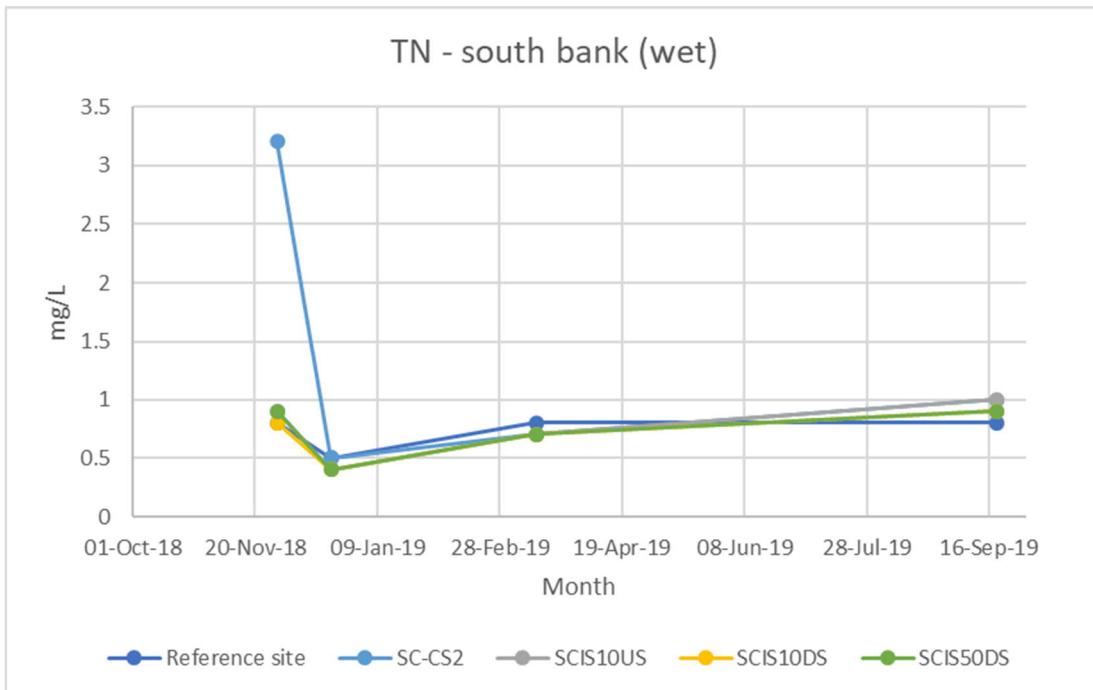
## 1.4 Total Nitrogen

### North Bank - Dry Weather



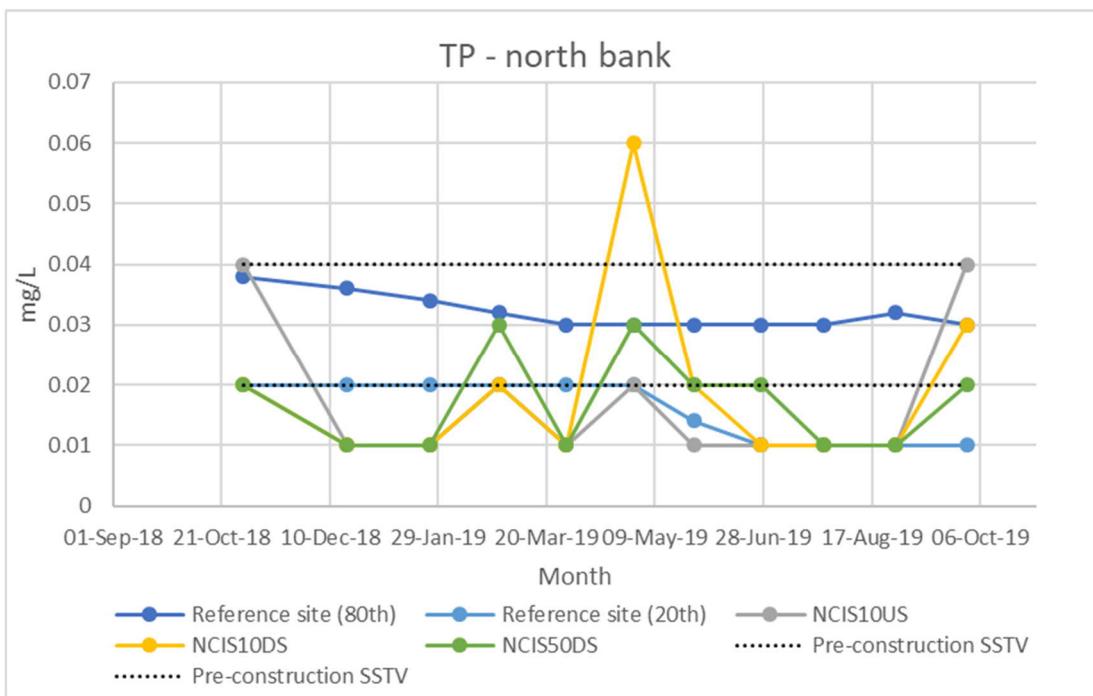
### North Bank - Wet Weather



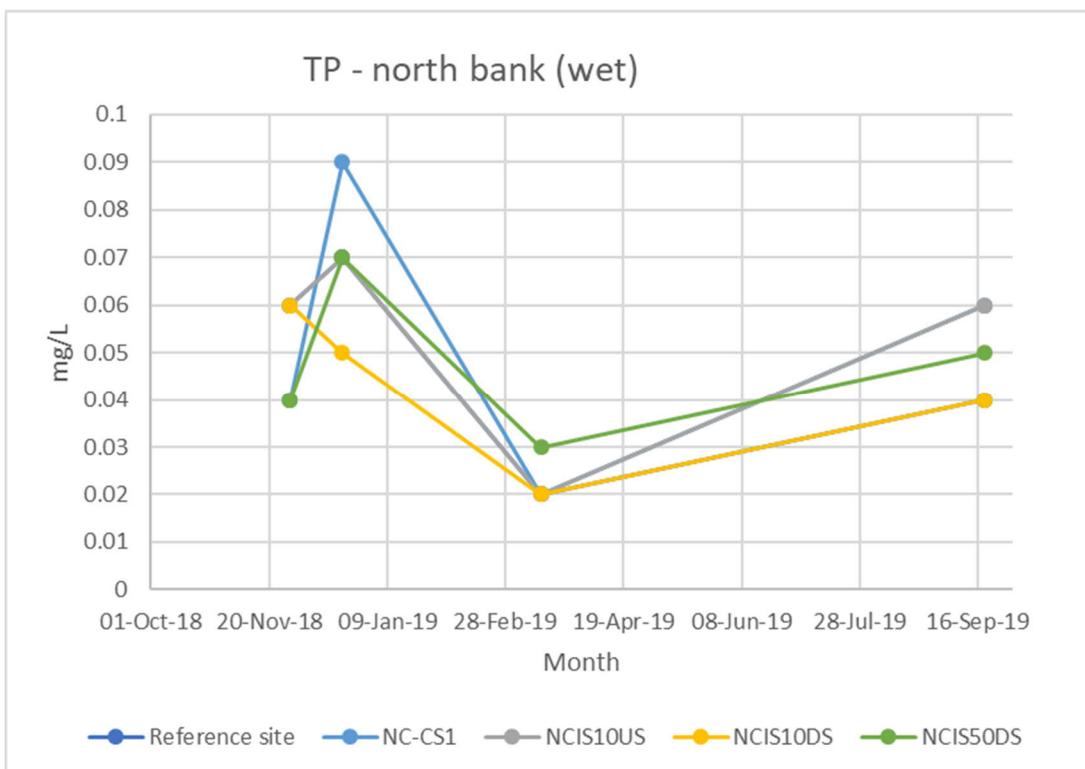
**South Bank - Dry Weather****South Bank - Wet Weather**

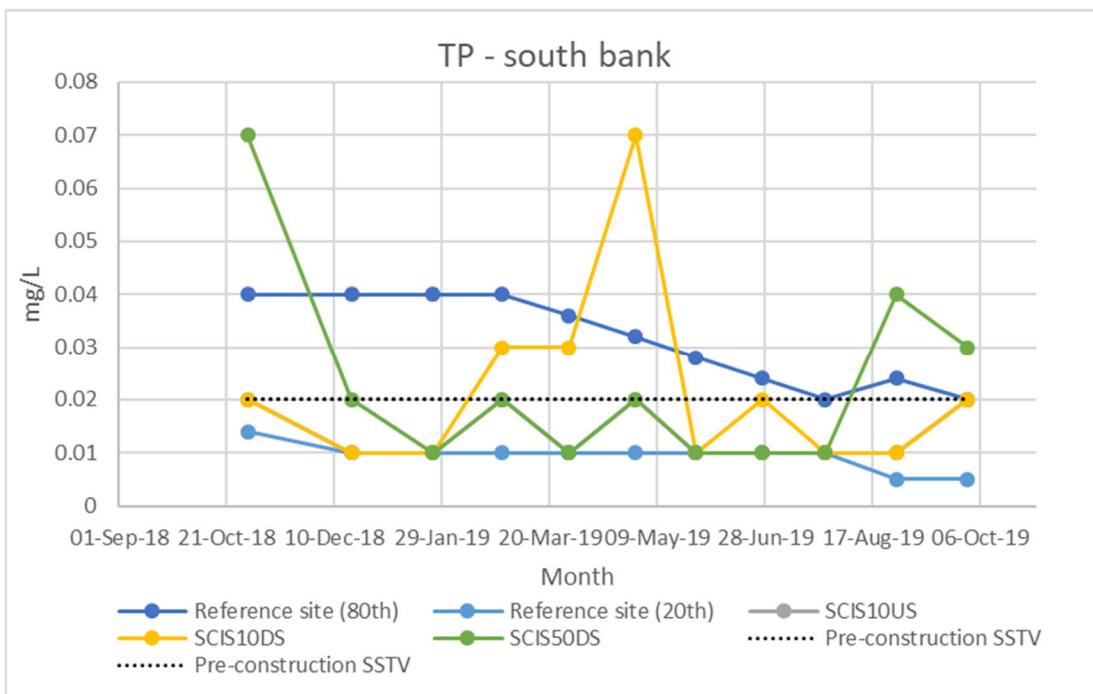
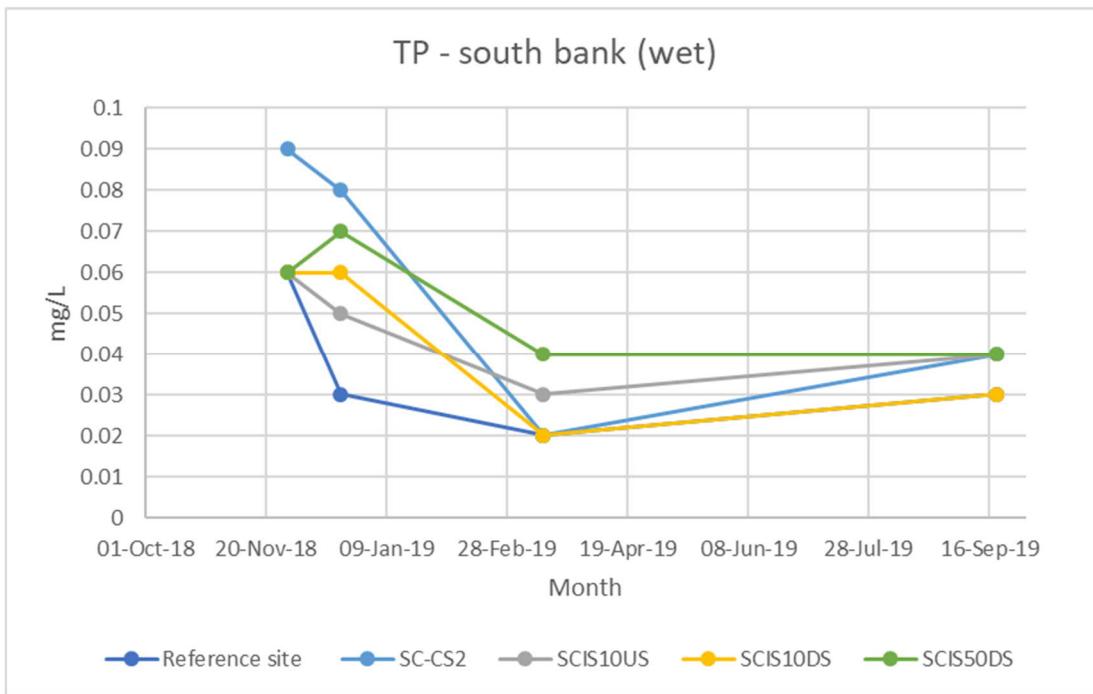
## 1.5 Total Phosphorous

### North Bank - Dry Weather



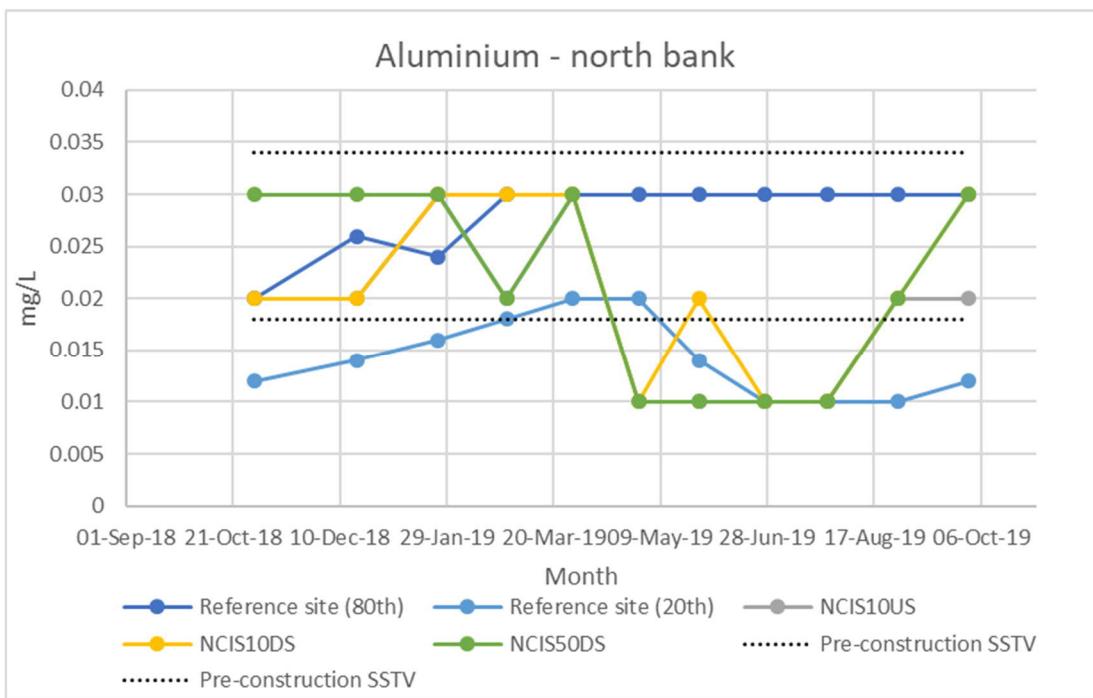
### North Bank - Wet Weather



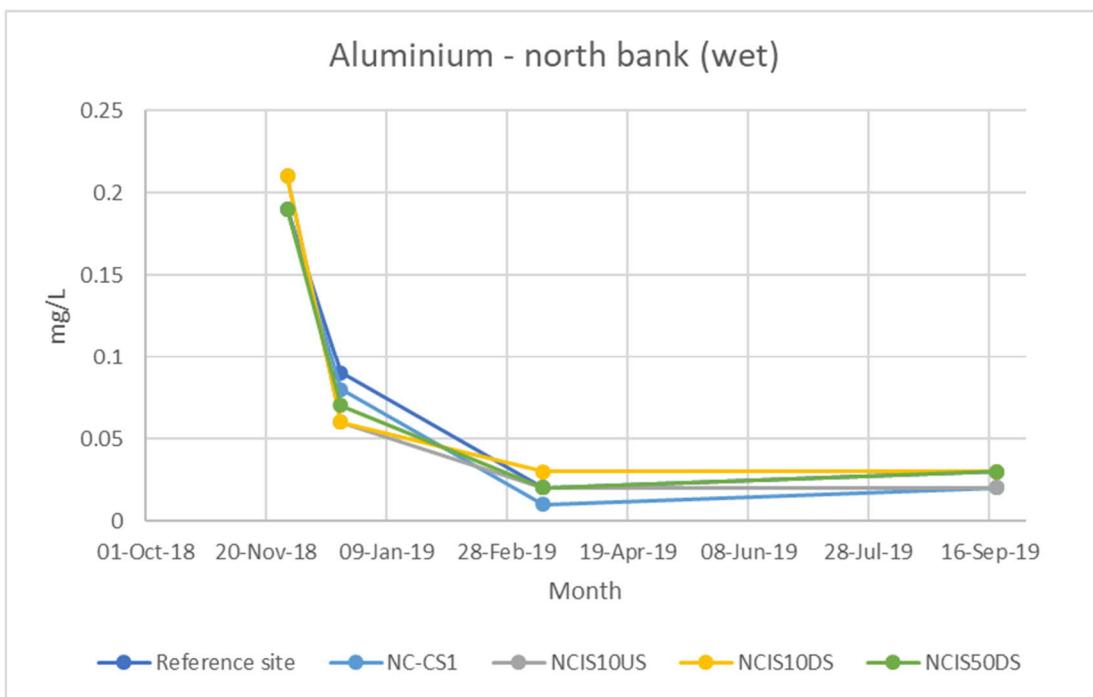
**South Bank - Dry Weather****South Bank - Wet Weather**

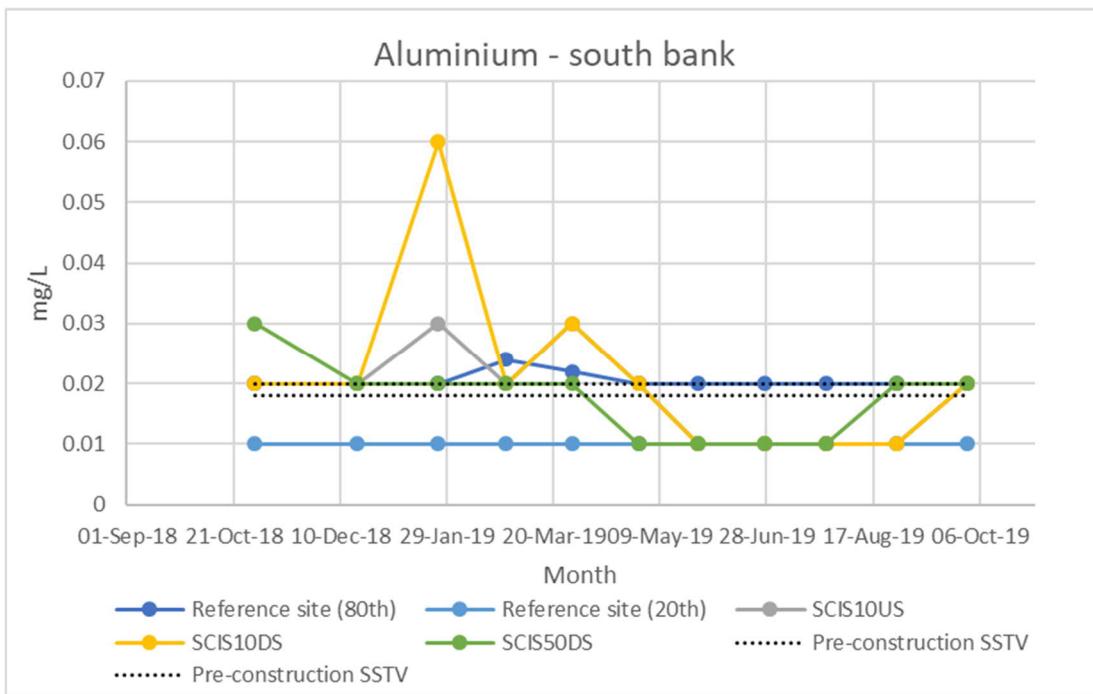
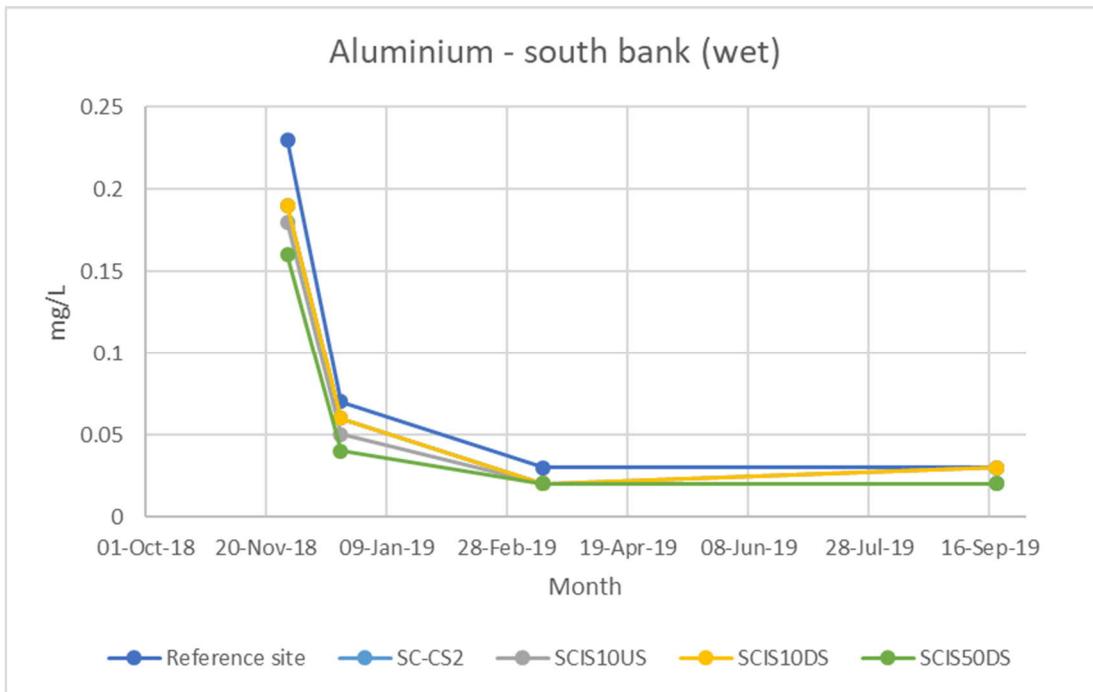
## 1.6 Dissolved Aluminium

### North Bank - Dry Weather



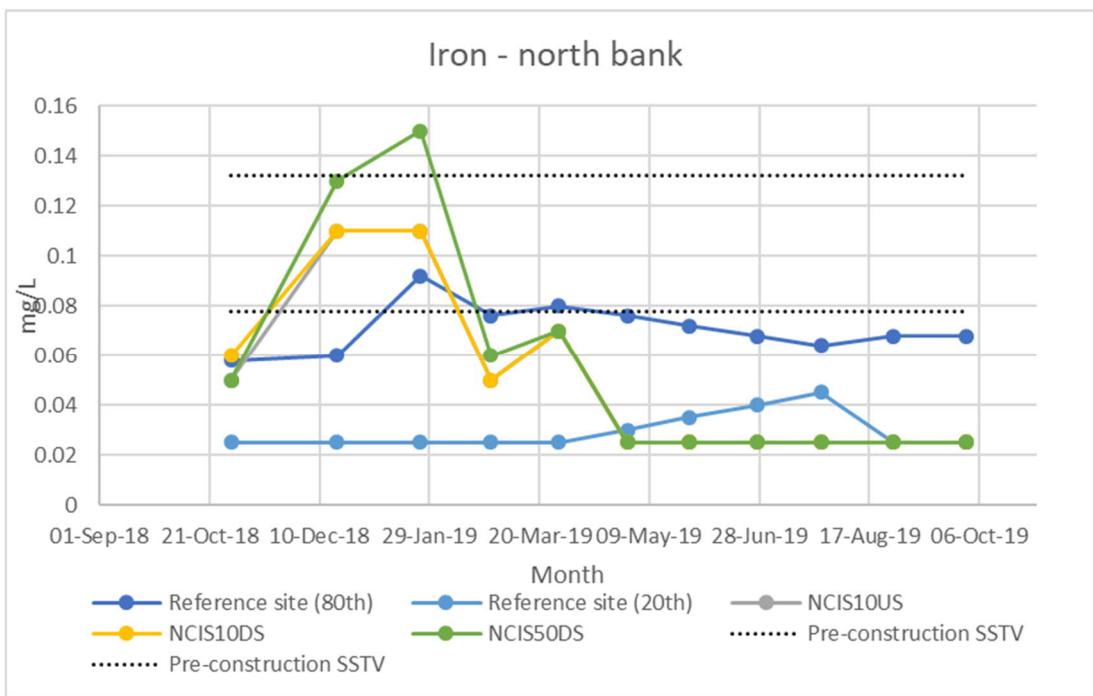
### North Bank - Wet Weather



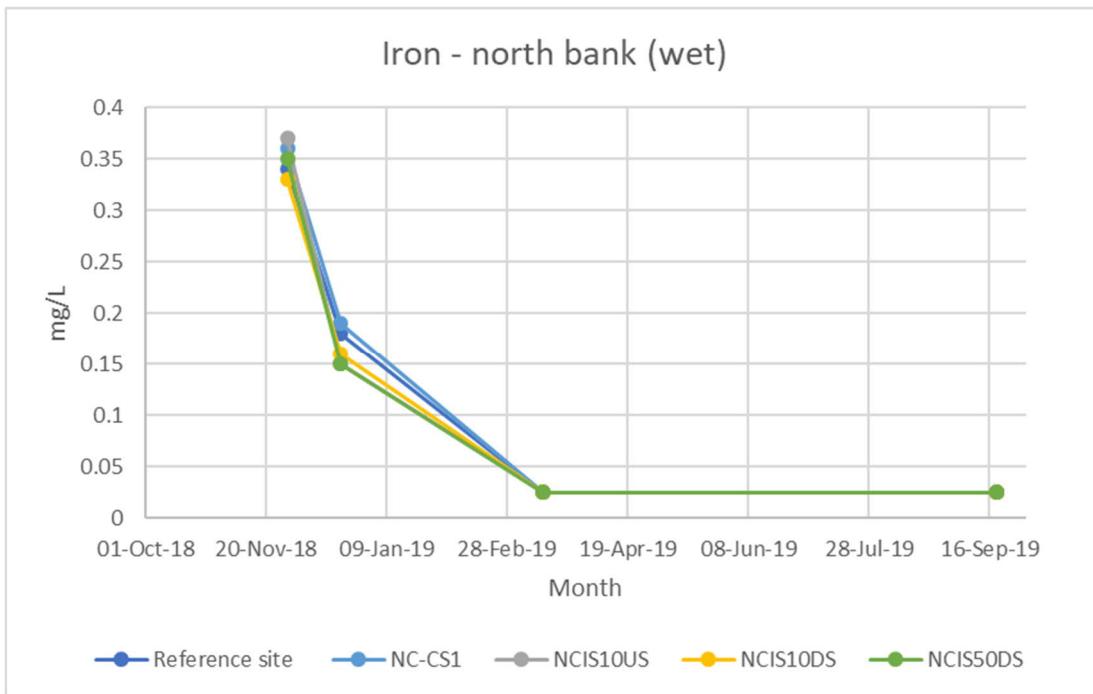
**South Bank - Dry Weather****South Bank - Wet Weather**

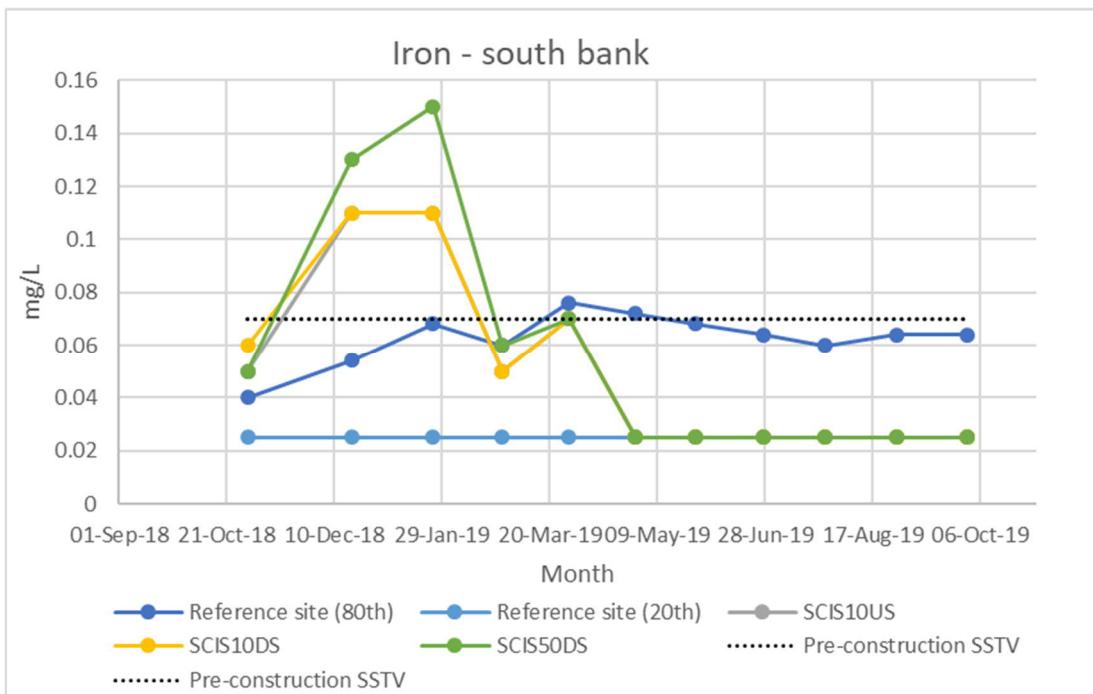
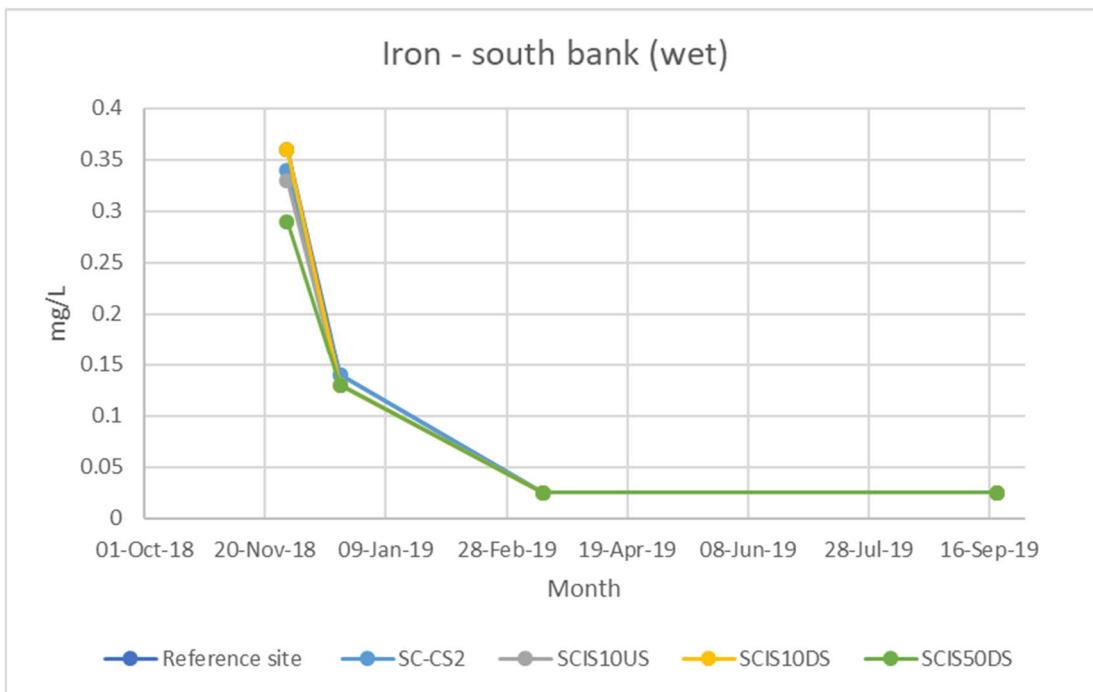
## 1.7 Dissolved Iron

### North Bank - Dry Weather



### North Bank - Wet Weather

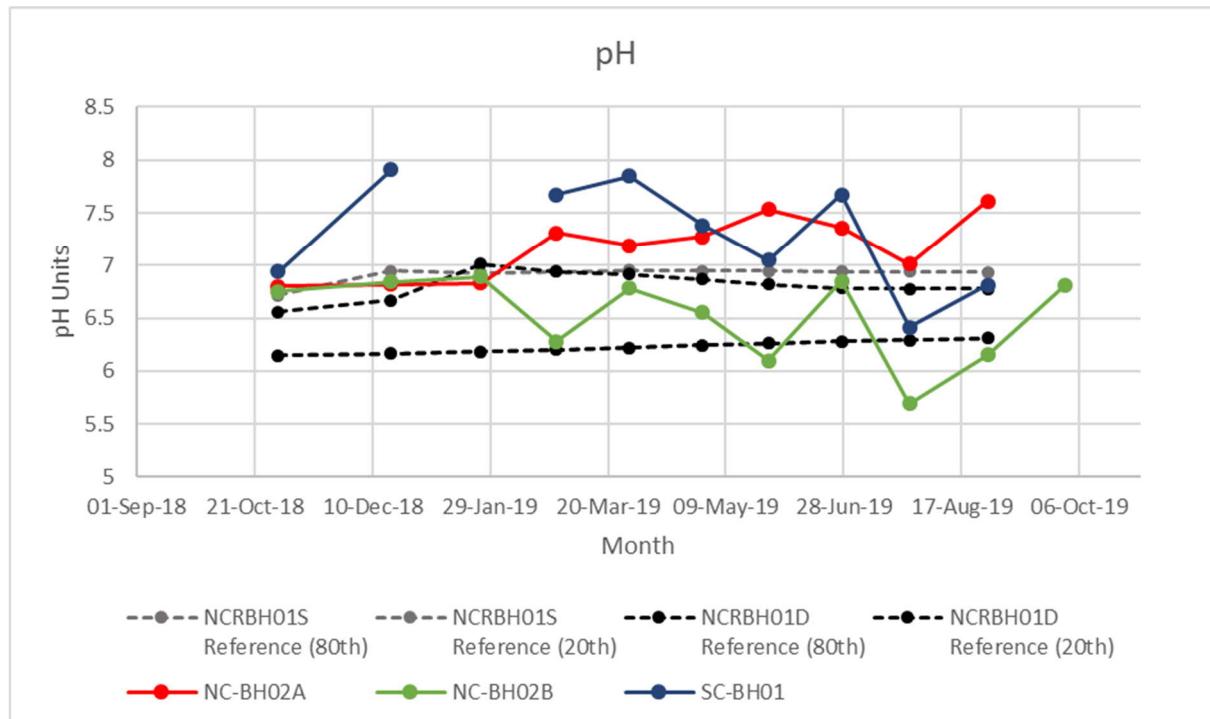


**South Bank - Dry Weather****South Bank - Wet Weather**

## 2. Groundwater Results

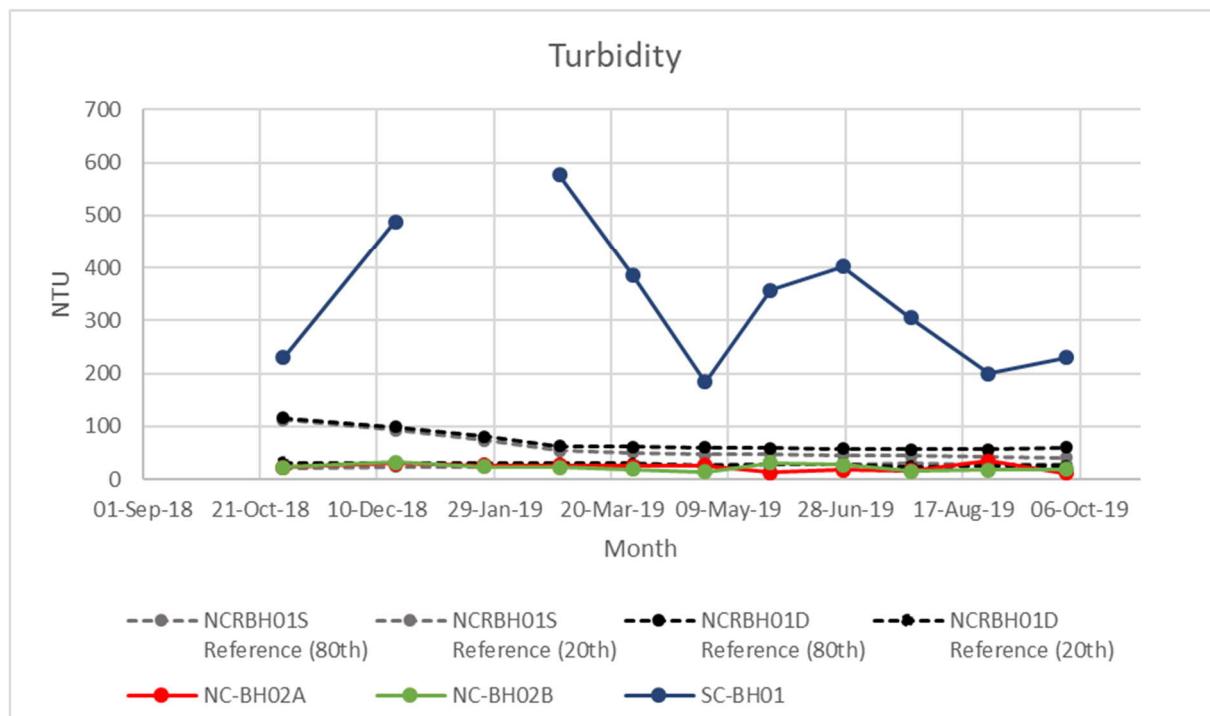
### 2.1 pH

All sites – dry weather



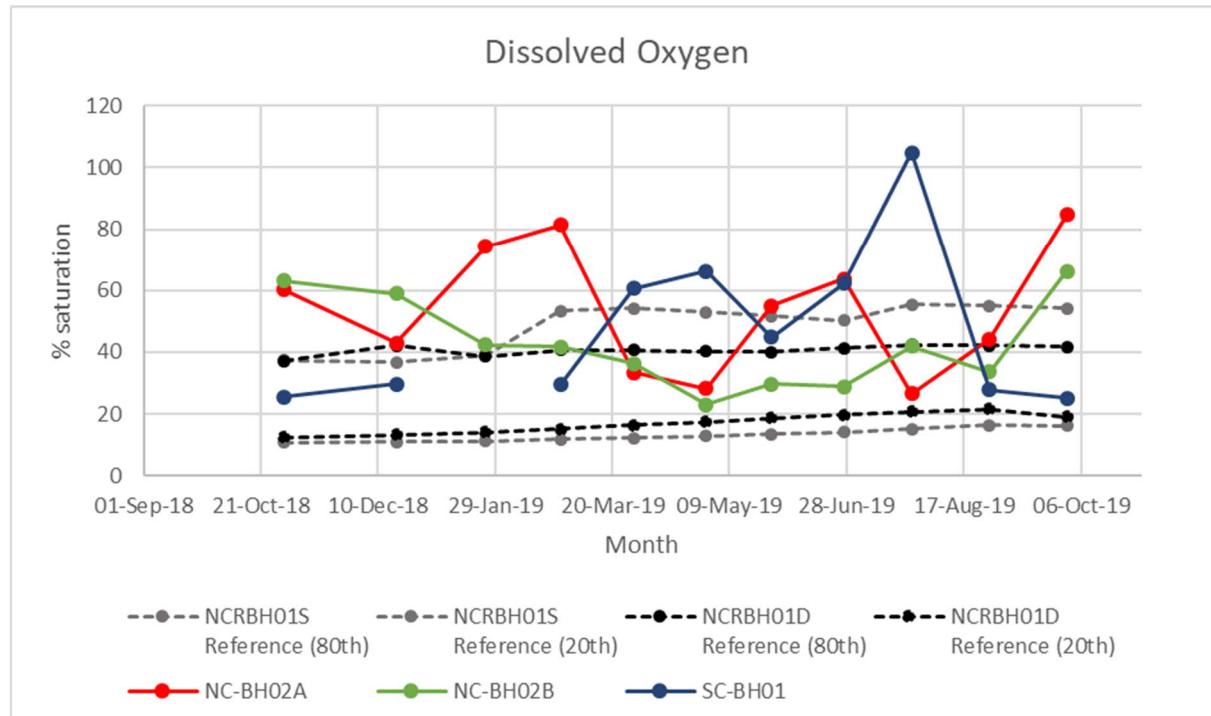
### 2.2 Turbidity

All sites – dry weather



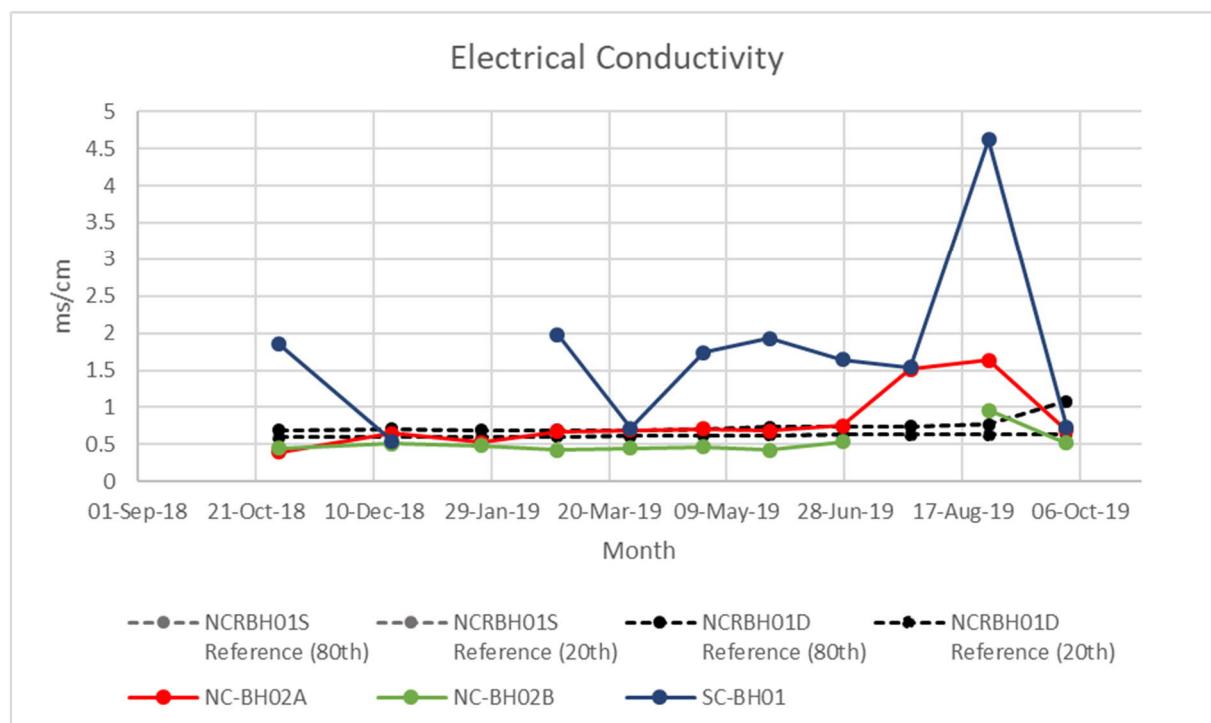
## 2.3 Dissolved Oxygen

All sites – dry weather



## 2.4 Electrical Conductivity

All sites – dry weather



## 2.5 Groundwater levels

Impact sites – November to May.

