

North Queensland Bulk Ports Corporation Mky

Southern Breakwater and Northern Breakwater

Ambient Air Quality Monitoring

Validated Report

1st January 2017 – 31st January 2017

Report No.: DAT11601

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Maintenance contract: MC2077

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Southern Breakwater and Northern
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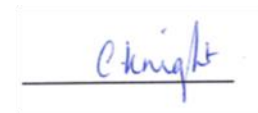
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| Revision History | | | |
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| Revision | Report ID | Date | Analyst |
| 0 | DAT11601 | 28/2/2017 | Caroline Knight |

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Executive Summary

North Queensland Bulk Ports Corporation has commissioned Ecotech P/L to conduct air quality monitoring for the Mackay Dust Monitoring Program. The monitoring stations at Loves Jetty and Northern Break Waters are each equipped with an E-Sampler measuring TSP.

The air quality stations were commissioned in July 2016.

This report presents the data collected from the Loves Jetty and Northern Break Waters stations during the month of January 2017.

Data capture for Southern Breakwater fell to 22.1% during the month due to a flow fault occurring between the 7th to 19th of January, and no connection to the station between the 19th and 31st January 2017.

Data capture for Northern Breakwater during 100.0% during January 2017.

The TSP monthly average for Southern Breakwater was 13 $\mu\text{g}/\text{m}^3$ with a standard deviation of 11 $\mu\text{g}/\text{m}^3$. The TSP monthly average for Northern Breakwater was 22 $\mu\text{g}/\text{m}^3$ with a standard deviation of 24 $\mu\text{g}/\text{m}^3$.

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1.0 Introduction

Ecotech Pty Ltd was commissioned by North Queensland Bulk Ports Corporation to provide monitoring and data reporting for the Mackay Dust Monitoring Program at Southern Breakwater and Northern Breakwater monitoring stations, located in Mackay Harbour, QLD, Australia as detailed in Table 1. Ecotech commenced data collection from both station on 20th July 2016.

This report presents the data for the 1st – 31st January 2017

The data presented in this report:

- Describes air quality measurements;
- Compares monitoring results;
- Has been quality assured;

2.0 Monitoring and Data Collection

2.1. Siting Details

Station locations and siting details are described below.

Table 1: Southern Breakwater and Northern Breakwater monitoring siting:

| Site Name | Geographical Coordinates | Height Above Sea Level (m) |
|---------------------|------------------------------------|----------------------------|
| Northern Breakwater | Lat: -21.101406° Long: 149.225057° | 5m |
| Southern Breakwater | Lat: -21.108898° Long: 149.226012° | 13m |

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Figure 1: Southern Breakwater and Northern Breakwater Monitoring Stations Location

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2.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at the Loves Jetty and Northern Break Waters stations. Appendix 1 defines any abbreviated parameter names used throughout the report.

Table 2: Parameters measured at the Southern Breakwater and Northern Breakwater monitoring stations

| Parameter Measured | Instrument and Measurement Technique |
|--------------------|---|
| TSP | Met One E-Sampler – light scatter aerosol monitor |

2.3. Data Collection Methods

Table 3 shows the methods used for data collection.

Table 3: Methods

| Parameter Measured | Data Collection Methods Used | Description of Method |
|--------------------|------------------------------------|------------------------------------|
| TSP (E-Sampler) | Met One E-Sampler Operation Manual | Met One E-Sampler Operation Manual |

2.3.1. Data Acquisition

Data is logged by the E-sampler at each monitoring site. Each E-sampler is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the E-samplers on a daily basis (using Airodis™ version 5.1.0) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5 minute intervals.

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2.4. Data Validation and Reporting

2.4.1. Validation

The Ecotech ERS department performs daily data checks to ensure maximum data capture rates are maintained. Any equipment failures are communicated to the responsible field engineers for urgent rectification. Ecotech ERS maintains two distinct databases containing non-validated and validated data respectively.

The validated database is created by duplicating the non-validated database and then flagging data affected by instrument faults, calibrations and other maintenance activities. The data validation software requires the analyst to supply a valid reason (e.g. backed by maintenance notes, calibration sheets etc) in the database for flagging any data as invalid.

Validation is performed by the Ecotech ERS operator, and the validation is reviewed. All data is checked and graphs and reports are generated based on the verified five minute data.

2.4.2. Reporting

The reported data is in a Microsoft Excel format file named "NQBP Mky Southern Breakwater and Northern Breakwater Monthly Data Report January 2017.xls".

The Excel file consists of six worksheets:

1. Cover
2. 5 Min Averages
3. 15 Min Averages
4. 1 Hour Averages
5. 24 Hour Averages
6. Valid Data Exception Tables

The data contained in these reports is based on Australian Eastern Standard Time. Data is for all parameters measured continuously.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period. Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00am is for the data collected from 1:00am to 2:00am. One hour averages are calculated based on a clock hour. One day and one year averages are calculated based on calendar days.

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2.5. Calibrations and Maintenance

2.5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 4: Units and Uncertainties

| Parameter | Units | Resolution | Uncertainty | Measurement Range ¹ |
|--------------------|-------------------|---------------------|--|--------------------------------|
| TSP (E-Sampler) | µg/m ³ | 1 µg/m ³ | ± 10% to gravimetric method ² | 0 to 65,530 µg/m ³ |

2.5.2. Maintenance

Scheduled maintenance is completed quarterly by Ecotech.

2.5.2.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to verification, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

² Manufacturer's stated accuracy for nephelometer when calibrated for local particulate type.

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Table 5 indicates when the particulate equipment was last maintained/calibrated.

Table 5: Southern Breakwater and Northern Breakwater Maintenance Table January 2017

| Station | Parameter | Date of Last Maintenance | Maintenance Type | Date of Last Calibration |
|---------------------|-----------|--------------------------|-------------------------------|--------------------------|
| Southern Breakwater | TSP | 14/11/2016 | Monthly, 3 Monthly, 6 Monthly | 14/11/2016 |
| Northern Breakwater | TSP | 14/11/2016 | Monthly, 3 Monthly, 6 Monthly | 14/11/2016 |

3.0 Results

3.1. Data Capture

Data capture calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:

$$\text{Data capture} = (\text{Reported air quality data} / \text{Total data}) \times 100\%$$

Where:

- Reported air quality data = Number of instrument readings which have been verified through a quality assured process and excludes all data errors, zero data collection due to calibration, failures and planned and unplanned maintenance.
- Total data = Total number of instrument readings since the start of the term assuming no maintenance, errors, loss of data or calibration.

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Table 6 below displays data capture statistics for January 2017. **Bold** values in the table indicate data capture below 95%.

Table 6: Monthly Data Capture for Southern Breakwater and Northern Breakwater stations for January 2017

| Station | Parameter | Data Capture (%) |
|---------------------|-----------|------------------|
| Southern Breakwater | TSP | 22.1 |
| Northern Breakwater | TSP | 100.0 |

3.2. Air Quality Summary

Table 7 below presents some statistical parameters for January 2017. The standard deviation is calculated based on the hourly averaged data.

Table 7: General statistics for January 2017

| Station | Parameter | Time Period | Average ($\mu\text{g}/\text{m}^3$) | Standard Deviation ($\mu\text{g}/\text{m}^3$) |
|---------------------|-----------|-------------|--------------------------------------|---|
| Southern Breakwater | TSP | 1 month | 18 | 9 |
| Northern Breakwater | TSP | 1 month | 24 | 12 |

3.3. Tabulated Data

Table 8 details the daily averages for TSP measured at Southern Breakwater and Northern Breakwater during January 2017.

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Table 8: Southern Breakwater and Northern Breakwater Stations Summary Data Table
January 2017

| Date | Southern Breakwater ($\mu\text{g}/\text{m}^3$) | Northern Breakwater ($\mu\text{g}/\text{m}^3$) |
|------------|---|---|
| 1/01/2017 | 4 | 10 |
| 2/01/2017 | 5 | 17 |
| 3/01/2017 | 6 | 10 |
| 4/01/2017 | 15 | 13 |
| 5/01/2017 | 19 | 25 |
| 6/01/2017 | 22 | 26 |
| 7/01/2017 | 24 | 26 |
| 8/01/2017 | | 39 |
| 9/01/2017 | | 24 |
| 10/01/2017 | | 24 |
| 11/01/2017 | | 23 |
| 12/01/2017 | | 16 |
| 13/01/2017 | | 10 |
| 14/01/2017 | | 9 |
| 15/01/2017 | | 9 |
| 16/01/2017 | | 10 |
| 17/01/2017 | | 18 |
| 18/01/2017 | | 20 |
| 19/01/2017 | | 15 |
| 20/01/2017 | | 13 |
| 21/01/2017 | | 10 |
| 22/01/2017 | | 10 |
| 23/01/2017 | | 22 |
| 24/01/2017 | | 28 |
| 25/01/2017 | | 22 |
| 26/01/2017 | | 21 |
| 27/01/2017 | | 19 |
| 28/01/2017 | | 43 |
| 29/01/2017 | | 82 |
| 30/01/2017 | | 33 |
| 31/01/2017 | | 46 |

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3.4. Graphic Representations

Validated TSP data was used to construct the following monthly graphic representations.

Southern Breakwater TSP 24 Hour Averages

January 2017

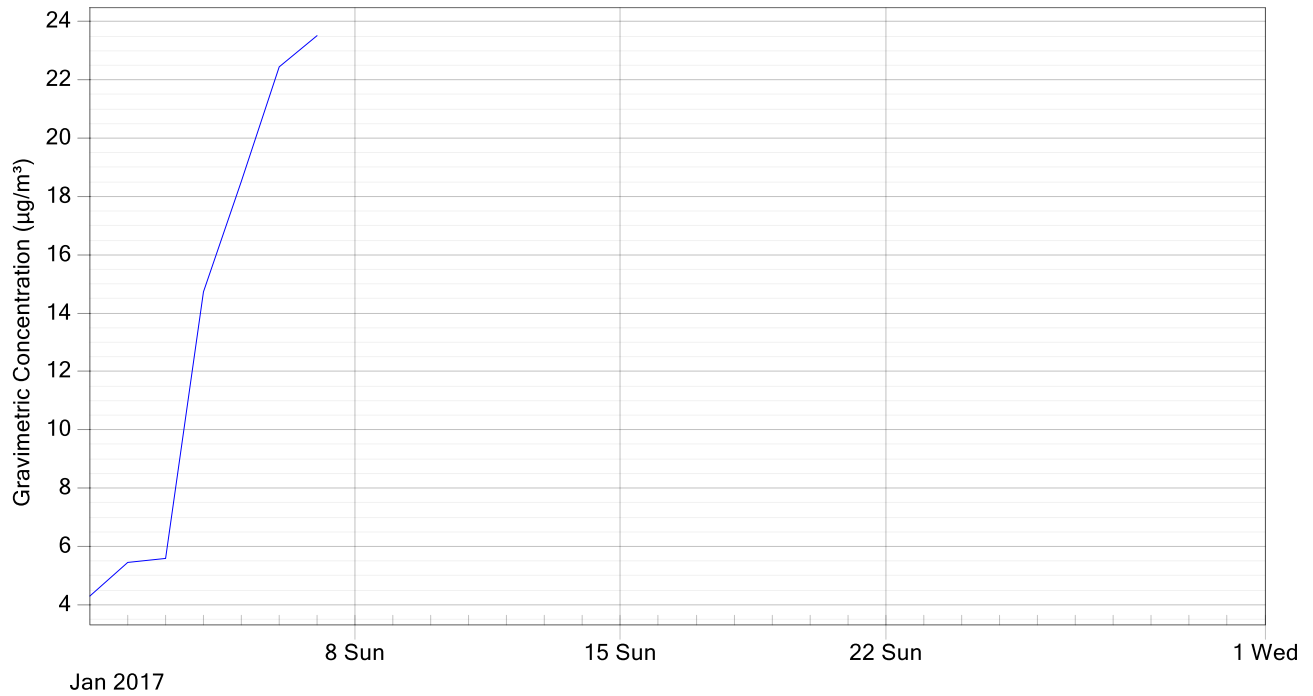


Figure 2: Southern Breakwater TSP 24 Hour Averages January 2017

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Northern Breakwater TSP 24 Hour Averages

January 2017

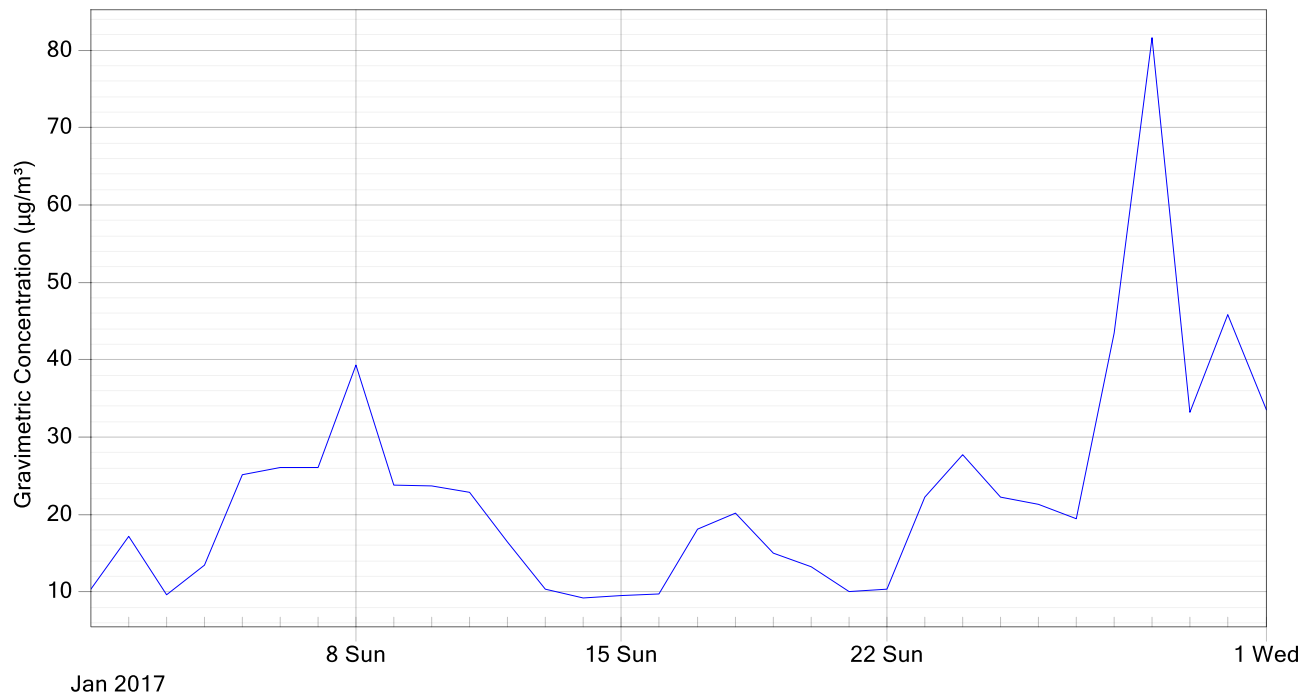
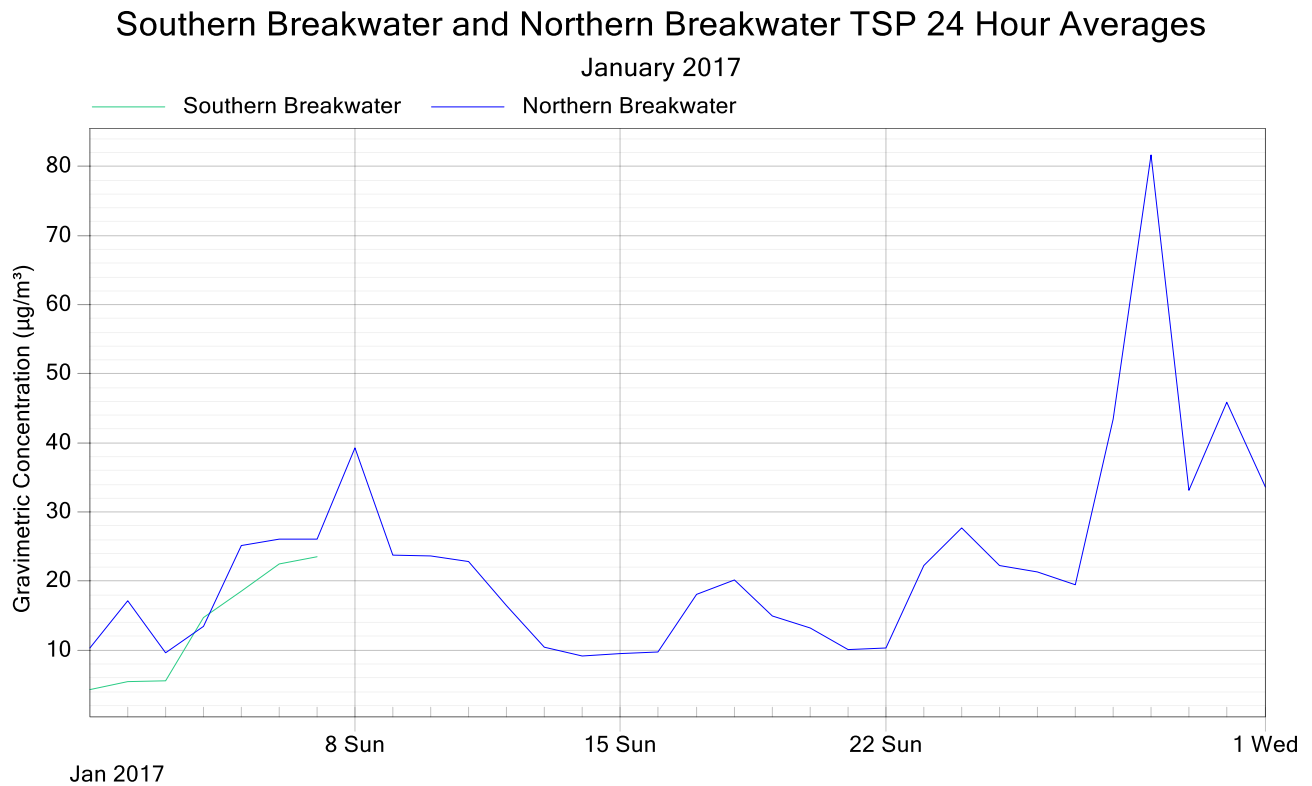


Figure 3: Northern Breakwater TSP 24 Hour Averages January 2017

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**Figure 4: Southern Breakwater and Northern Breakwater TSP 24 Hour Averages comparison
January 2017**

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4 Valid Data Exception Tables

The tables below detail all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 9: Southern Breakwater TSP Valid Data Exception Table

| Start Date | End Date | Reason | Change Details | User Name | Change Date |
|------------------|------------------|--------------------------|----------------|-----------|-------------|
| 07/01/2017 20:30 | 19/01/2017 11:10 | Flow fault | TSP | CK | 13/02/2017 |
| 19/01/2017 11:10 | 01/02/2017 00:00 | No connection to station | TSP | CK | 13/02/2017 |

Table 10: Northern Breakwater TSP Valid Data Exception Table

| Start Date | End Date | Reason | Change Details | User Name | Change Date |
|------------------|------------------|---------------------|----------------|-----------|-------------|
| 01/01/2017 00:00 | 01/02/2017 00:00 | No data invalidated | TSP | CK | 13/02/2017 |

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5 Report Summary

- Data capture for Southern Breakwater was 22.1% due to a flow fault occurring between the 7th to 19th of January, and no connection to the station between the 19th and 31st January 2017.
- Data capture at Northern Breakwater was 100% during January 2017.
- The TSP monthly average for Southern Breakwater was 13 $\mu\text{g}/\text{m}^3$ with a standard deviation of 11 $\mu\text{g}/\text{m}^3$.
- The TSP monthly average for Northern Breakwater was 22 $\mu\text{g}/\text{m}^3$ with a standard deviation of 24 $\mu\text{g}/\text{m}^3$.

-----END OF REPORT-----

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Appendix 1 - Definitions & Abbreviations

| | |
|--------------------------|---|
| $\mu\text{g}/\text{m}^3$ | Micrograms per cubic metre at standard temperature and pressure (0°C and 101.3 kPa) |
| TSP | Total suspended particulates |

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Appendix 2 - Explanation of Exception Table

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data transmission error refers to a period of time when the instrument could not transmit data. This may be due to interference, or a problem with the phone line or modem.

Equipment malfunction/instrument fault refers to a period of time when the instrument was not in the normal operating mode and did not measure a representative value of the existing conditions.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

Instrument out of service refers to a lack of data due to an instrument being shut down for repair, maintenance, or factory calibration.

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

Maintenance refers to a period of time when the logger/instrument was switched off due to maintenance.

Power Interruption refers to no power to the station therefore no data was collected at this time.

Warm up after power interruption refers to the startup period of an instrument after power has been restored.