CORK CITY COUNCIL

KINSALE ROAD LANDFILL SITE

Waste Licence Register No: W0012-03

Annual Environmental Report

January 2015 – December 2015

Prepared by:-

Cork City Council,
Kinsale Road Landfill Site,
Cork.

June 2016

DOCUMENT CONTROL SHEET

Kinsale Road Landfill Site Annual Report

Reporting Period January 2015 to December 2015

User is Responsible for the Revision Status of this Document

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1 INTRODUCTION

1.1 Scope and Purpose of the Report

Cork City Council holds a Waste Licence (Register No. W0012-03) to operate a landfill site at the Kinsale Road, Cork. The aim of this Annual Environmental Report is to provide a review of activities at Kinsale Road landfill site within the past 12 months.

1.2 Background to the Report

The Landfill site at Kinsale Road has been in operation since the 1960's. The site was issued with a waste licence by the Environmental Protection Agency (EPA) on 2nd February 2000 (Register No. 12-1), with a new licence issued on 29th November 2002 (Register No. W0012-02). The most recent licence was issued on 3rd May 2011 (Register No. W0012-03).

In accordance with Condition 11.10 of the Waste Licence, Cork City Council is required to submit to the Agency for its agreement, an Annual Environmental Report for its activities during the previous 12 months.

This report covers the period from January 2015 to December 2015.

1.3 Site Location and Operator details

The landfill is owned and operated by Cork City Council, City Hall, Cork. The address of the facility is as follows.

Kinsale Road Landfill Site,
Ballyphehane,
Curraghconway,
Inchisarsfield,
South City Link Road,
Cork.
The National Grid Reference for the site is 168033E 069658N.

The facility contact details are as below

- Facility Manger: Kevin Ryan
- Contact No: 021 4705913
- Fax No: 021 4319930

- Landfill Technicians: Fiona O’Connor / Liam Brick
- Contact No: 021 4705914 / 4705911

- Supervisor: Michael Rawley

- Junior Foreman: Michael Reck

- Weighbridge Operator
- Contact No: 021 4705920

- Environment Department,
  City Hall,
  Cork
- Contact No: 021 4924726
- Fax No: 021 4924054

- City Hall
- Contact No. 021 4924000 / 4966222

2 SITE DESCRIPTION AND ACTIVITIES

2.1 Description of the Site

The facility was a municipal solid waste and non-hazardous industrial waste disposal facility. The site (including former land filling areas) is approximately 72 hectares.
Landfilling at the site ceased on the 15th July 2009.
Up to the 15th July 2009, the facility accepted domestic and commercial MSW and limited quantities of approved non-hazardous industrial sludges. The facility also includes a Civic Amenity Site and a Landfill Gas Combustion plant that operates on site.

The facility is located within 3 km of Cork City at the South City Link Road, in the townlands of Ballyphehane, Curraghconway and Inchisarsfield. The site occupies a large expanse of low-lying peat bog, bounded by the north and east by the Trabeg River, to the west by the South City Link Road and on the south by the Tramore River and South Ring Road.

The site has been operational since the early 1960's. The majority of the developments (commercial and residential) within 500m of the landfill have occurred subsequent to the commencement of waste disposal operations.

Works are ongoing at the site to upgrade the facility in accordance with the conditions of the Waste Licence. These works include leachate collection and treatment system, surface water collection, road infrastructure as well as final capping and restoration of the site.

2.2 Waste Management activities at the Facility

Waste Activities Licensed at the Kinsale Road Landfill Site are restricted to those outlined in the Waste Licence as outlined below in Tables 2.1 and 2.2.

Table 2.1 Licensed Waste Disposal Activities, in accordance with the Third Schedule of the Waste Management Acts 1996 – 2010.

Class 1.	Deposit on, in or under land (including landfill) [Principal Activity].
Class 2.	Land treatment, including biodegradation of liquid or sludge discards in soils
Class 4.	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
Class 5.	Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.
Class 7.	Physico-chemical treatment not referred to elsewhere in this Schedule which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 5 or paragraphs 8 to 10 of this Schedule (including evaporation, drying and calcination).
Class 11.	Blending or mixture prior to submission to any activity referred to in a preceding paragraph of this Schedule.
Class 12.	Repacking prior to submission to any activity referred to in a preceding paragraph of this Schedule.
Class 13.	Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.

Table 2.2 Licensed Waste Recovery Activities, in accordance with the Fourth Schedule of the Waste Management Acts 1996 – 2010.

Class 2.	Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological processes).
Class 3.	Recycling or reclamation of metals and metal compounds.
Class 4.	Recycling or reclamation of other inorganic materials.
Class 10.	The treatment of any waste on land with a consequential benefit for an agricultural activity or ecological system.
Class 11.	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
Class 12.	Exchange of waste for submission to any activity referred to in a preceding paragraph of this Schedule.
Class 13.	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.

2.3 Quantities and Composition of Waste Received, Disposed of and Recovered.

Kinsale Road landfill site is licensed to send municipal waste off site for disposal / recovery up to a maximum of 22,000 tonnes of per annum.
Other waste types and quantities allowed for disposal as per Schedule A of the Waste Licence are as per Table 2.3 below.

Table 2.3 Waste Acceptance Criteria

Waste Type			Maximum Note 2 (Tonnes Per Annum)
Non-Hazardous Wastes Note 1		Mixed Municipal Waste for recovery/disposal off-site *Accepted at Civic Waste Facility*	5,000
		Storage of Waste prior to Recovery *(including glass, beverage/food cans, textiles, paper and cardboard, plastics, timber, metals, non-hazardous batteries, non-hazardous WEEE accepted at the Civic Waste Facility)*	
		Construction & Demolition Waste *Accepted at the facility for recovery and use in site construction works and landfill restoration.*	300,000 Note 3
		Residual Municipal Waste for off–site recovery and/or disposal *Accepted at Waste Transfer Station*	22,000 Note 4
		Green Waste (for Composting) *Accepted at Civic Waste Facility*	**Note 5**
		Inert Waste - Imported for restoration purposes	**Note 6**
Non-Hazardous Waste Total			**327,000**
Hazardous Wastes **Note 7**	20 01 21	Fluorescent Tubes and other mercury-containing waste	6
	20 01 27 16 05 04	Paints, inks, adhesives and resins containing dangerous substances Gases in pressure containers (including halons) containing dangerous substances)	20
	20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	12
	All Chapter 13 Wastes Note 8	Waste Oils	12
	20 01 35	Discarded electrical and electronic equipment other that those mentioned in 20 01 21 & 20 01 23 containing hazardous components.	1,000
Hazardous Waste Total			**1,050**
TOTAL INCLUDING DISPOSAL AND RECOVERY			**328,050**

Note 1: Any proposals to accept other compatible non-hazardous waste types must be agreed in advance by the Agency.
Note 2: The limitation on individual non-hazardous waste types may be varied with the agreement of the Agency subject to the total limit for non-hazardous waste staying the same.
Note 3: The maximum tonnage to be processed at the Construction and Demolition Waste Recovery Area shall not exceed 2,000 tonnes per day, unless subject to the prior agreement of the Agency, subject to Condition 3.27.
Note 4: Acceptance of Residual Municipal Waste at the facility for off-site disposal, other than that received at the Civic Waste Facility from members of the public, shall not take place until such time as the Waste Transfer Station infrastructure has been installed to the satisfaction of the Agency in accordance with Condition 8.2 of this licence.
Note 5: Quantity of Green Waste/ Compost at the facility is limited to a maximum of 2,400m^3 at any one time.
Note 6: Quantity of waste imported for restoration purposes is limited to 100,000 tonnes per annum for a period of two years from the date of grant of licence, unless otherwise agreed by the Agency.
Note 7: Hazardous waste types as detailed, or as may otherwise be agreed in advance by the Agency.
Note 8: All Chapter 13 wastes: *Oil Wastes and Wastes of Liquid Fuels* (except, 13 01 01, 13 03 01, 13 05 01, 13 05 02, 13 05 03, 13 07 01, 13 07 02, 13 07 03 and 13 08 01) of the *European Waste Catalogue and Hazardous Waste List*.

Table 2.3.1 Quantities of Waste received prior to reporting period.

	Non-Hazardous Waste	*Hazardous Waste*
Deposited in landfill prior to report period.	2.737 million tonnes estimated	Not known if any
C&D waste stored at C&D facility prior to report period.	200 tonnes	Nil

No waste was landfilled at the site during the reporting period.

Table 2.3.2 Quantities of Waste transferred offsite during the reporting period

	Waste transferred off site in 2015 (tonnes)
Total	1288

Table 2.3.3 Classes of Waste received for recovery / recycling off site.

Waste Description	*EWC Code*	*Name of Recovery Company*
Paper	20 01 01	Greenstar
		Cork Recycling
Metal	20 01 06	Pouladuff Dismantlers
Timber	20 01 07	CTO Environmental
Plastic	20 01 03	Cork Recycling
Glass Bottles	20 01 02	Rehab Recycling Partnership
Aluminium Cans	20 01 05	Rehab Recycling Partnership
Oil	13 00 00	ENVA
Green Waste	20 02 01	CTO Environmental Solutions
Cardboard	20 01 01	Cork Recycling
WEEE	20 01 35	KMK
Aerosols	16 05 04	SLR
Paints	20 01 27	SLR
Car Batteries	16 06 01	KMK
Household Batteries	16 06 01 / 16 06 02 16 06 04 / 20 01 34	KMK

2.3.4 Landfill Inputs and Outputs (Waste and Recycling) {click for hyperlink}

2.4 Landfill Capacity

2.4.1 The landfilling of waste at the facility ceased as of 15th July 2009.

2.5 Economic Contribution

Provision made for Site Operations expenditure in the reporting period was €1,108,500

Waste Totals for Kinsale Road Landfill Site - 2015

All weights in tonnes

Commodity	Total
Municipal	1,074
Non Levy	0
Waste Rubble	214
Total Transferred Off Site	**1,288**

Domestic Recycling	Total
WEEE Out	354.52
Plastic Bottles	17.30
Plastic Wrappers	25.56
Cardboard	82.56
Paper	109.36
Metal	115.04
Green Waste (CA)	349.45
Timber (CA)	207.12
Glass	40.16
Drink Cans	
Oil	1.92
Paint & Aerosols	24.12
Batteries	0.74
Clothes	11.16
CA Site Recycling Total inc. WEEE Out	1339.01

3 SITE DEVELOPMENT WORKS

3.1 Site Development Works during the Reporting Period.

The Waste Licence sets out conditions relating to the completion of certain works within the designated periods following the date of grant of the licence. The works referred to generally formed part of site development works.

M&E works for landfill gas and leachate management

M & E works are ongoing. These include maintenance of the Leachate Conditioning Plant and the continued balancing of the landfill gas field.

Miscellaneous Works Completed in 2015:

1. Ongoing maintenance of Site Roads.
2. Regular cleaning of Gravel Trap at Leachate Conditioning Plant with replacement of gravel as required.
3. Establishment of a grass sward over capped areas as well as provisional tree planting.

Final Capping and Restoration Works (Contract 9)

Site capping works were completed in February 2015.

Other planned works for 2016 are as follows:

- SCADA system upgrades (reporting/management system)
- Upgrading of site roadways
- Miscellaneous minor capital works and works arising from Operational Procedures
- Phased implementation of landscape design plan for the Tramore Valley Park.

4 ENVIRONMENTAL INCIDENTS AND COMPLAINTS

4.1.1 Incidents
All Incidents, Non-Conformances and Non–Compliances are uploaded to the EDEN/ALDER System.

4.2 Complaints

There were no complaints during 2015.

4.3 Review of Nuisance Controls

In accordance with Condition 6 of the Waste License Cork City Council are required to ensure that vermin, birds, flies, mud, dust and litter do not give rise to nuisances at the facility or in the immediate area of the facility.
Cork City Council ensures that the activities are carried out in a manner such that odours do not result in significant impairment or interference with amenities or the environment beyond the facility boundary.
The road network in the vicinity of the facility is kept free from any debris caused by vehicles entering or leaving the facility. Any such debris or deposited materials is removed without delay.

Litter Control
Litter fencing is no longer required at the facility as landfilling has ceased (July 2009).
Litter picking teams are organised as required to collect any wind blown litter or other waste, placed on or in the vicinity of the facility.
All vehicles removing waste and materials from the facility (Civic Amenity Site) are appropriately covered.

Dust Control
In dry weather, site roads and any other areas used by vehicles are sprayed with water as and when required to minimise airborne dust nuisance.

Bird Control
This is no longer an issue as all the waste has been covered and final capping of the site is ongoing.

Odour
Odour from the landfill site is minimised through the extraction of landfill gas and through the application of odour control substances as required.
No odour complaints were received during the reporting period.

Flies
Flies are controlled through the use of control substances as deemed necessary by the pest control experts.

Vermin
Vermin are controlled through the use of baiting as deemed necessary by the pest control experts.

Noise

Noise is minimised / controlled by operating the facility between the hours of 8am – 4pm. Contractors may operate between the hours of 8am – 6pm in agreement with the City Council.

5 ENVIRONMENTAL MANAGEMENT PROGRAMME

5.1 Environmental Objectives

1 **Environmental Objective 1:** Amenity Park Development

Environmental Objectives and Targets

Management Programme

<table>
<tr><td colspan="5">Objective 1: Amenity Park Development</td></tr>
<tr><td colspan="3" rowspan="3">Responsibility:
Facility Management & appointed contractor</td><td colspan="2">Start Date: April 2012</td></tr>
<tr><td colspan="2">Revised Date: April 2016</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="5">Target: To restore & cap the northern area of the site to complete site capping and restoration with an aim to developing a regional amenity park</td></tr>
<tr><td>Task</td><td>Details</td><td>Due Date</td><td>By Whom</td><td>Status</td></tr>
<tr><td>1</td><td>Phase 1 site landscaping works and associated works</td><td>Q3 2014</td><td>CCC / BSM</td><td>Complete</td></tr>
<tr><td>2</td><td>Completion of final phase of capping works</td><td>Q1 2015</td><td>Wills Bros. Contractor</td><td>Complete</td></tr>
<tr><td>3</td><td>Opening of regional park to the public</td><td>Q 1 2016</td><td></td><td>Complete</td></tr>
<tr><td>4</td><td>Ongoing phased delivery of landscaping</td><td>2016 - 2018</td><td></td><td></td></tr>
<tr><td colspan="5">Objective Complete: Signed: ____________________________ Date: _______</td></tr>
</table>

5.2 Site Management Structure

The Staff Management Structure for the facility is detailed in the Organisational Chart. The responsibilities of the site staff are listed below.

Facility Manager

The Facility Manager has overall responsibility for operation of the facility in accordance with the conditions of the Waste Licence and best operational practices.

The Facility Manager co-ordinates all of the activities and contractors on site and implements procedures and practices in accordance with the Environmental Management Programme.

Landfill Technicians

The Environmental Technicians carry out monitoring, sampling and analysis at the facility under the supervision of the facility manager and are based at the landfill site.

Site Supervisor and Junior Foreman

The Supervisor and Junior Foreman are responsible for ensuring that the site staff carry out their designated duties, and liaises with the Facility Manager in the implementation of procedures and practices at the facility. They have completed the certified "Waste Management" course.

Relief Site Supervisor

The Relief Site Supervisor performs the functions of the Site Supervisor in the event of his / her absence. The Relief Site Supervisor has also completed the certified "Waste Management" course.

Weighbridge Operator

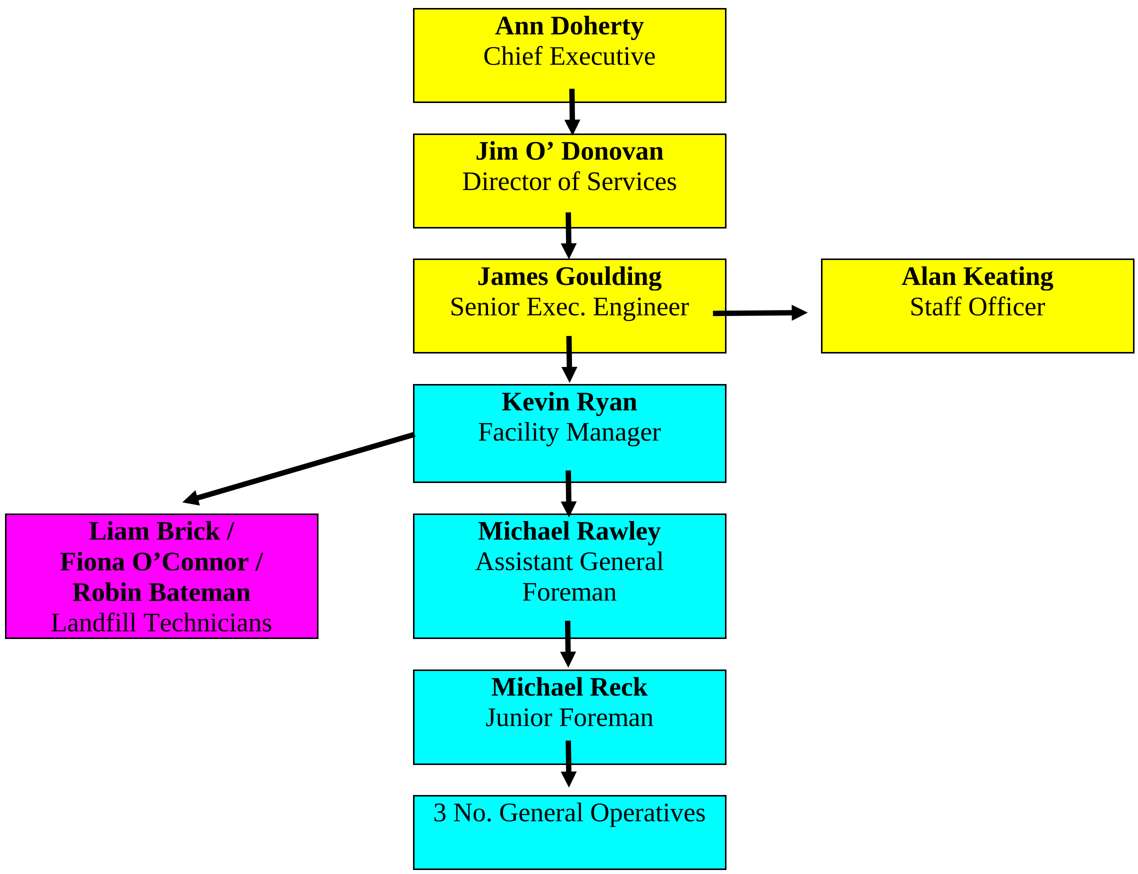
The Weighbridge Operator records incoming waste and controls access to the facility.

Staff Officer Environment

The Staff Officer Environment (not based on site) is responsible for the maintenance of the Waste Licence public file as well as dealing with queries from the public.

5.2.1 Organisational Chart

The Management Structure of Kinsale Road Landfill Site, including Environmental Monitoring (Site Technicians and Laboratory Analysis) and Administration (City Hall).



6 ENVIRONMENTAL MONITORING AND CONTROL

The following areas were monitored during the reporting period:

6 (a) Summary Report on Emissions

6.1 Dust

6.2 PM_{10}

6.3 Landfill Gas Monitoring

6.4 Groundwater

- Overburden Wells
- Deep Wells (NW)
- Greenhills & Nemo Rangers Wells
- Bedrock Wells (BR)

6.5 Surface Water Monitoring

6.6 Emissions to Sewer

- Selected Parameters
- Dissolved Methane

6.7 Discharge from Storm Water Pond and Reed Beds

External Reports

- Biological Survey of Streams Report
- Air Emissions Testing of the Landfill Gas Flare Unit
- Air Emissions Testing for the Landfill Gas Engine
- PRTR Table for Flare Unit & Gas Utilisation Engine
- Landfill Gas VOC / Surface Emissions Survey
- Meteorological Data

Parameter: **Dust Monitoring**
Frequency: **Quarterly**
Guide Limit: **350 (mg/m^2/day)**

Quarter 1

Location	Grid Co-Ordinates	Date	mg/m2/day
D1	168081E,069747N	No Access	
D2	168373E,070046N	13th Jan to 12th Feb 2015	132
D3	168600E,069691N	13th Jan to 12th Feb 2015	138
D4	168178E,069276N	13th Jan to 12th Feb 2015	188
D5	167982E,069648N	13th Jan to 12th Feb 2015	299

Quarter 2

Location	Grid Co-Ordinates	Date	mg/m2/day
D1	168081E,069747N	No Access	
D2	168373E,070046N	13th Apr to 13th May 2015	226
D3	168600E,069691N	13th Apr to 13th May 2015	217
D4	168178E,069276N	13th Apr to 13th May 2015	74
D5	167982E,069648N	13th Apr to 13th May 2015	383

Quarter 3

Location	Grid Co-Ordinates	Date	mg/m2/day
D1	168081E,069747N	No Access	
D2	168373E,070046N	7th July to 6th Aug 2015	170
D3	168600E,069691N	7th July to 6th Aug 2015	165
D4	168178E,069276N	7th July to 6th Aug 2015	98
D5	167982E,069648N	7th July to 6th Aug 2015	76

Quarter 4

Location	Grid Co-Ordinates	Date	mg/m2/day
D1	168081E,069747N	No Access	
D2	168373E,070046N	2nd Nov to 3rd Dec 2015	175
D3	168600E,069691N	2nd Nov to 3rd Dec 2015	132
D4	168178E,069276N	2nd Nov to 3rd Dec 2015	126
D5	167982E,069648N	2nd Nov to 3rd Dec 2015	138

Ambient Monitoring

Parameter: PM_{10} (µg/m^3)

Frequency: Quarterly

24 hour limit value of 50 µg/m^3

Quarter 1

Location	Grid Co-Ordinates	Date	PM_{10} µg/m^3
S1	168399E,069753N	04/02/2015	132
S2	168222E,069651N	Removed	Removed
S4	167982E,069648N	23/03/2015	36

Quarter 2

Location	Grid Co-Ordinates	Date	PM_{10} µg/m^3
S1	168399E,069753N	15/04/2015	21
S2	168222E,069651N	Removed	Removed
S4	167982E,069648N	12/05/2015	31

Quarter 3

Location	Grid Co-Ordinates	Date	PM_{10} µg/m^3
S1	168399E,069753N	08/07/2015	19
S2	168222E,069651N	Removed	Removed
S4	167982E,069648N	17/09/2015	26

Quarter 4

Location	Grid Co-Ordinates	Date	PM_{10} µg/m^3
S1	168399E,069753N	08/12/2015	25
S2	168222E,069651N	Removed	Removed
S4	167982E,069648N	30/12/2015	22

Parameter: Total Suspended Particulates
Frequency: Quarterly
Guide Limit: 150($\mu g/m^3$)

Quarter 1

Location	Grid Co-Ordinates	Date	$\mu g/m^3$
D1	168081E,069747N	No Access	No Access
D2	168373E,070046N	18th Feb 2015	43
D3	168600E,069691N	24thFeb 2015	26
D4	168178E,069276N	4th March 2015	29
D5	167982E,069648N	23rd March 2015	36

Quarter 2

Location	Grid Co-Ordinates	Date	$\mu g/m^3$
D1	168081E,069747N	No Access	No Access
D2	168373E,070046N	21st April 2015	50
D3	168600E,069691N	29th April 2015	29
D4	168178E,069276N	6th May 2015	15
D5	167982E,069648N	12th May 2015	31

Quarter 3

Location	Grid Co-Ordinates	Date	$\mu g/m^3$
D1	168081E,069747N	No Access	No Access
D2	168373E,070046N	3rd September 2015	14
D3	168600E,069691N	8th September 2015	44
D4	168178E,069276N	10th September 2015	28
D5	167982E,069648N	17th September 2015	26

Quarter 4

Location	Grid Co-Ordinates	Date	$\mu g/m^3$
D1	168081E,069747N	No Access	No Access
D2	168373E,070046N	14th Dec 2015	13
D3	168600E,069691N	17th Dec 2015	20
D4	168178E,069276N	21st Dec 2015	24
D5	167982E,069648N	30th Dec 2015	22

Landfill Gas Monitoring Report

AER gas well data compilation

Gas Well Graphs

- Blue Demons Gas Wells
- Perimeter and Greenhills Estate Gas Wells
- Park and Ride Gas Wells

Perimeter Gas Monitoring Wells

WELL NO.	DP3	
LOCATION	BLUEDEMONS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	1.00	4.60
Mean	0.05	1.23
n	42	42
Over limit	1	18

WELL NO.	DP4	
LOCATION	BLUEDEMONS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	1.60
Max	29.70	15.90
Mean	3.34	6.15
n	42	42
Over limit	12	42

WELL NO.	DP3A	
LOCATION	BLUEDEMONS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.10
Max	0.00	11.60
Mean	0.00	4.35
n	42	42
Over limit	0	29

WELL NO.	DP4A	
LOCATION	BLUEDEMONS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	13.20	11.30
Mean	0.54	4.68
n	42	42
Over limit	5	36

WELL NO.	DP3 OLD	
LOCATION	BLUEDEMONS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.30
Max	67.20	36.30
Mean	47.26	25.30
n	42	42
Over limit	36	38

WELL NO.	DP4 OLD	
LOCATION	BLUEDEMONS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	66.80	38.30
Mean	19.24	12.46
n	42	42
Over limit	21	40

WELL NO.	LG2	
LOCATION	LANDFILL NORTH	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	1.60
Max	0.00	6.90
Mean	0.00	3.40
n	42	
Over limit	0	42

WELL NO.	LG3	
LOCATION	LANDFILL NORTH	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	1.30
Max	1.00	9.60
Mean	0.04	4.99
n	42	
Over limit	1	41

WELL NO.	LG4	
LOCATION	LANDFILL NORTH	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.50
Max	0.00	4.60
Mean	0.00	2.23
n	42	
Over limit	0	24

WELL NO.	LG5	
LOCATION	GREENHILLS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.90	7.10
Mean	0.01	1.77
n	116	
Over limit	0	47

WELL NO.	LG5A	
LOCATION	GREENHILLS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	7.50
Max	35.80	15.40
Mean	10.25	11.86
n	115	
Over limit	95	115

WELL NO.	LG6	
LOCATION	GREENHILLS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	5.60
Mean	0.00	1.15
n	116	
Over limit	0	39

WELL NO.	LG6A	
LOCATION	GREENHILLS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.50
Max	0.00	8.60
Mean	0.00	4.75
n	115	
Over limit	0	114

WELL NO.	LG7A	
LOCATION	GREENHILLS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.10
Max	0.00	7.80
Mean	0.00	0.91
n	116	
Over limit	0	6

WELL NO.	LG8A	
LOCATION	GREENHILLS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.60
Max	0.00	0.00
Mean	0.00	5.40
n	116	
Over limit	0	104

WELL NO.	LG8	Well Flooded
LOCATION	GREENHILLS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	6.90
Max	0.00	6.90
Mean	0.00	6.90
n	1	
Over limit	0	1

WELL NO.	LG12	
LOCATION	LANDFILL SOUTH	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.10
Max	1.50	5.60
Mean	0.09	2.10
n	42	
Over limit	1	25

WELL NO.	LG13	
LOCATION	LANDFILL SOUTH	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	1.60
Mean	0.00	0.59
n	42	
Over limit	0	1

WELL NO.	LG14	
LOCATION	LANDFILL SOUTH	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	3.10
Max	0.00	13.40
Mean	0.00	6.94
n	42	
Over limit	0	42

WELL NO.	LG46	**Broken Well**
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	0.00
Mean	0.00	0.00
n	0	
Over limit	0	0

WELL NO.	LG47	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	3.50
Mean	0.00	0.37
n	116	
Over limit	0	9

WELL NO.	LG48	**Broken Well**
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	0.00
Mean	0.00	0.00
n	0	
Over limit	0	0

WELL NO.	LG49	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	8.60
Mean	0.00	0.82
n	112	
Over limit	0	13

WELL NO.	LG51	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.10	4.10
Mean	0.00	1.16
n	114	
Over limit	0	29

WELL NO.	LG52	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.50
Max	0.40	7.50
Mean	0.00	3.80
n	114	
Over limit	0	105

WELL NO.	LG53	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	0.90
Mean	0.00	0.52
n	115	
Over limit	0	1

WELL NO.	LG54	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.30
Max	0.00	4.80
Mean	0.00	2.76
n	116	
Over limit	0	113

WELL NO.	LG55	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.70
Max	0.00	6.50
Mean	0.00	3.26
n	116	
Over limit	0	109

WELL NO.	LG58	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.10
Max	0.00	2.10
Mean	0.00	0.91
n	116	
Over limit	0	14

WELL NO.	TP9	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.90
Max	1.60	11.70
Mean	0.03	5.89
n	116	
Over limit	2	115

WELL NO.	TP12	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	5.30
Mean	0.00	1.53
n	116	
Over limit	0	49

WELL NO.	TP17	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	5.40
Mean	0.00	0.71
n	116	
Over limit	0	17

WELL NO.	TP21	Broken Well
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	0.00
Mean	0.00	0.00
n	0	
Over limit	0	0

WELL NO.	TP27	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	3.20
Mean	0.00	1.49
n	114	
Over limit	0	50

WELL NO.	TP32	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	2.80
Max	0.00	7.90
Mean	0.00	4.90
n	107	
Over limit	0	107

WELL NO.	TP33	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.80
Max	0.00	8.30
Mean	0.00	4.16
n	116	
Over limit	0	114

WELL NO.	GH1	
LOCATION	GREENHILLS	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	3.90
Mean	0.00	0.79
n	97	
Over limit	0	26

WELL NO.	GH2	
LOCATION	GREENHILLS	
LICENSED	Y	
License Limit	0.01	0.02
	CH4 %	CO2 %
Min	0.00	0.10
Max	0	4.1
Mean	0	1.30
n	107	
Over limit	0	40

WELL NO.	GH3	
LOCATION	GREENHILLS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.10
Max	0.00	7.80
Mean	0.00	3.60
n	105	
Over limit	0	87

WELL NO.	GH4	
LOCATION	GREENHILLS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.80
Max	0.40	6.70
Mean	0.00	3.69
n	113	
Over limit	0	104

WELL NO.	GH5	
LOCATION	GREENHILLS	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	1.30
Max	0.00	8.20
Mean	0.00	2.94
n	113	
Over limit	0	112

WELL NO.	137	
LOCATION	PARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	12.40	11.10
Mean	0.10	0.16
n	128	128
Over limit	1	2

WELL NO.	138	
LOCATION	PARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	0.80
Mean	0.00	0.17
n	127	127
Over limit	0	0

WELL NO.	139	
LOCATION	ARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	2.20	4.60
Mean	0.02	0.14
n	127	127
Over limit	1	1

WELL NO.	140	
LOCATION	ARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	2.00	2.30
Mean	0.03	0.16
n	129	129
Over limit	2	1

WELL NO.	141	
LOCATION	ARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	0.90
Mean	0.00	0.24
n	127	128
Over limit	0	0

WELL NO.	142	
LOCATION	PARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	2.20
Mean	0.00	0.92
n	128	128
Over limit	0	15

WELL NO.	143	
LOCATION	PARK AND RIDE	
LICENSED	Y	
License Limit	0.01	0.015
	CH4 %	CO2 %
Min	0.00	0.10
Max	0.00	5.90
Mean	0.00	1.42
n	43	43
Over limit	0	19

WELL NO.	144	
LOCATION	PARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	0.40
Mean	0.00	3.80
n	43	43
Over limit	0	0

WELL NO.	145	
LOCATION	PARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.90
Max	0.00	4.30
Mean	0.00	2.32
n	41	41
Over limit	0	33

WELL NO.	146	
LOCATION	PARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	0.80
Mean	0.00	0.38
n	43	43
Over limit	0	0

WELL NO.	171	
LOCATION	PARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	1.30
Mean	0.00	0.76
n	43	43
Over limit	0	0

WELL NO.	172	
LOCATION	PARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	1.60
Mean	0.00	0.75
n	43	43
Over limit	0	1

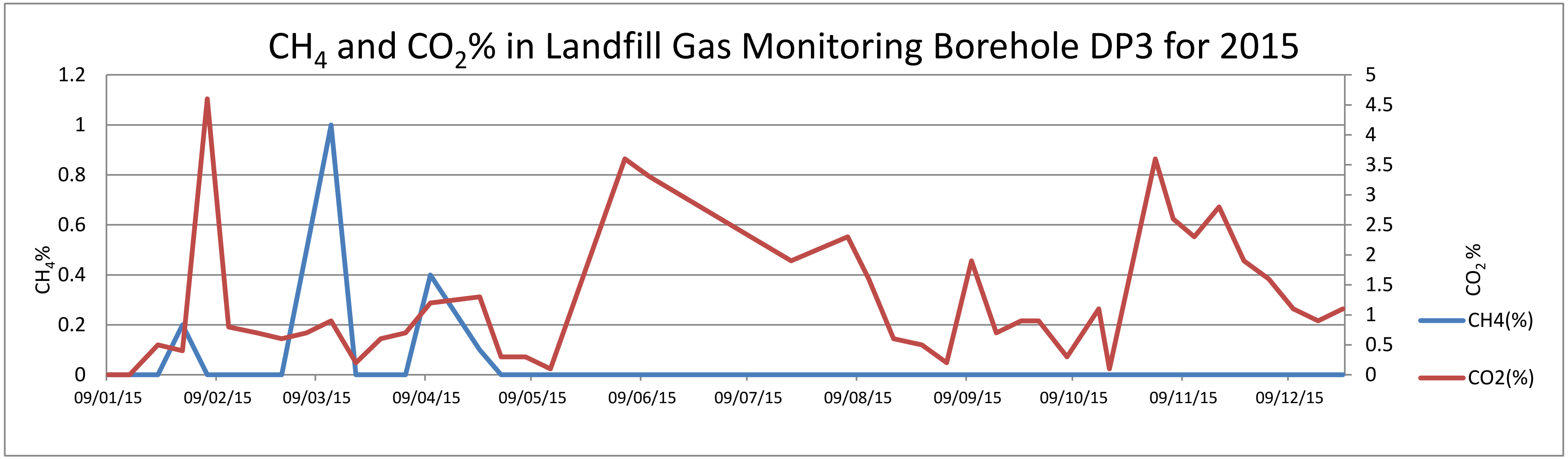
WELL NO.	173	
LOCATION	PARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.30
Max	0.00	2.60
Mean	0.00	1.09
n	43	43
Over limit	0	9

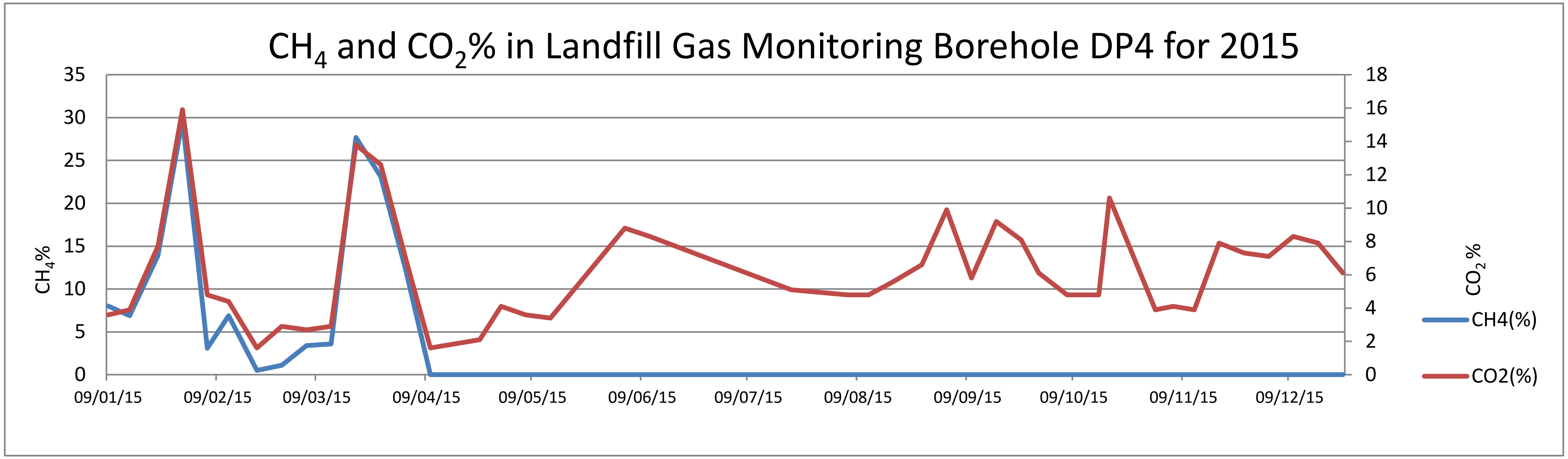
WELL NO.	174	
LOCATION	PARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.50
Max	0.00	1.80
Mean	0.00	0.97
n	43	43
Over limit	0	5

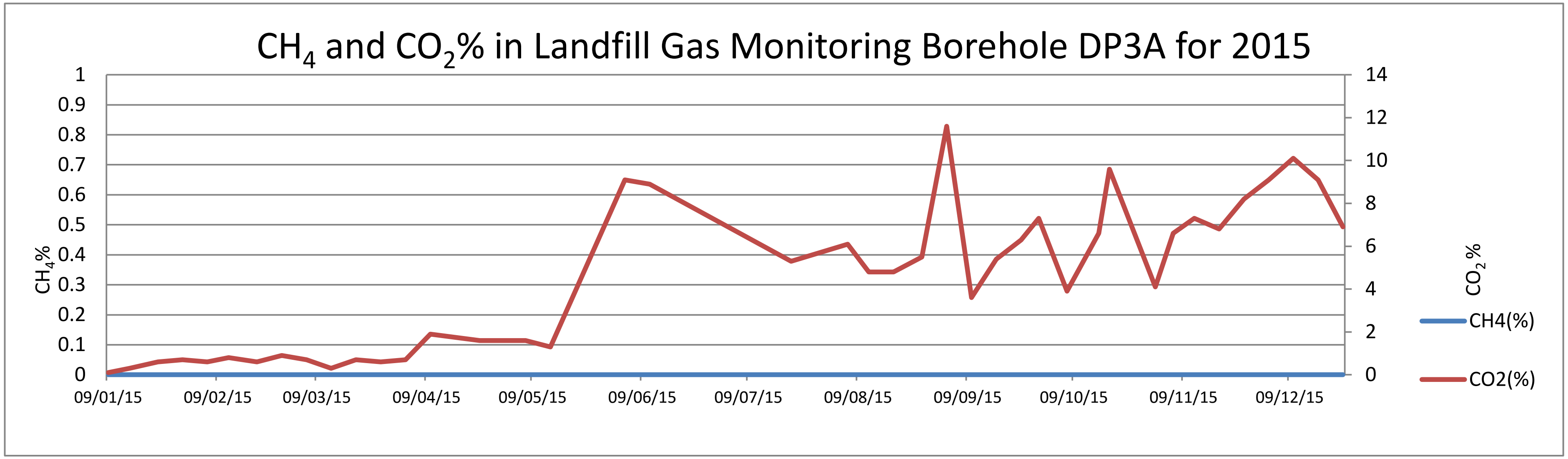
WELL NO.	175	
LOCATION	PARK AND RIDE	
LICENSED	Y	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.30
Max	0.00	4.30
Mean	0.00	2.59
n	43	43
Over limit	0	34

WELL NO.	TERMINAL	
LOCATION	PARK AND RIDE	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	0.00
Mean	0.00	0.00
n	126	126
Over limit	0	0

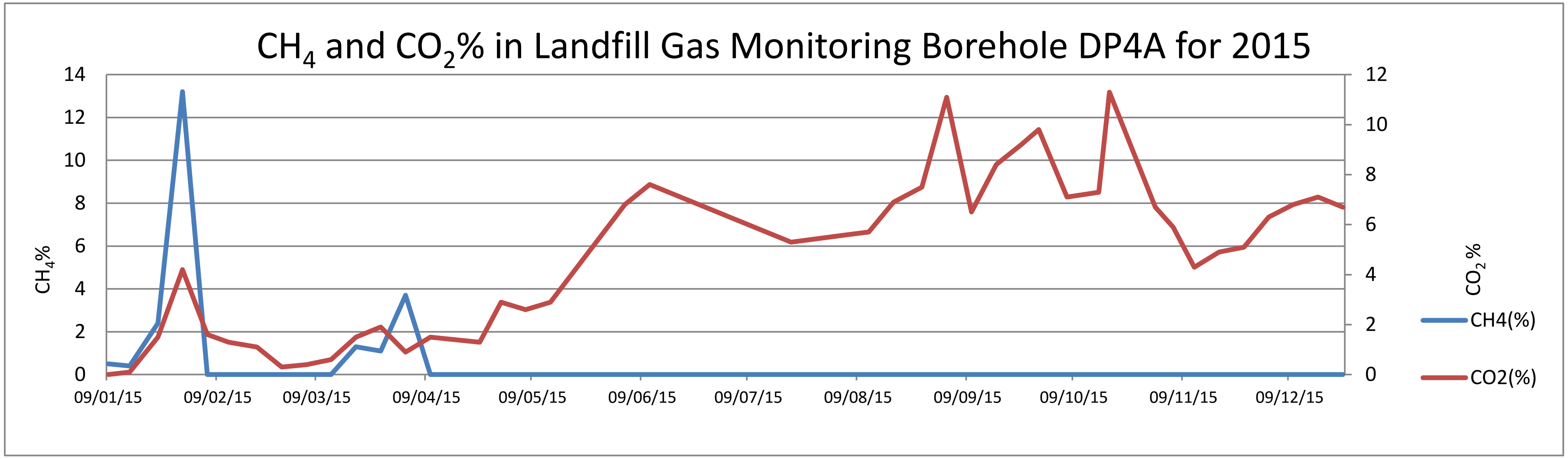
WELL NO.	KITCHEN	
LOCATION	PARK AND RIDE	
LICENSED	N	
License Limit	1%	1.50%
	CH4 %	CO2 %
Min	0.00	0.00
Max	0.00	0.00
Mean	0.00	0.00
n	126	126
Over limit	0	0


CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole DP3 for 2015
CH$_4$%
CO$_2$%
1.2
1
0.8
0.6
0.4
0.2
0
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4(%)
CO2(%)

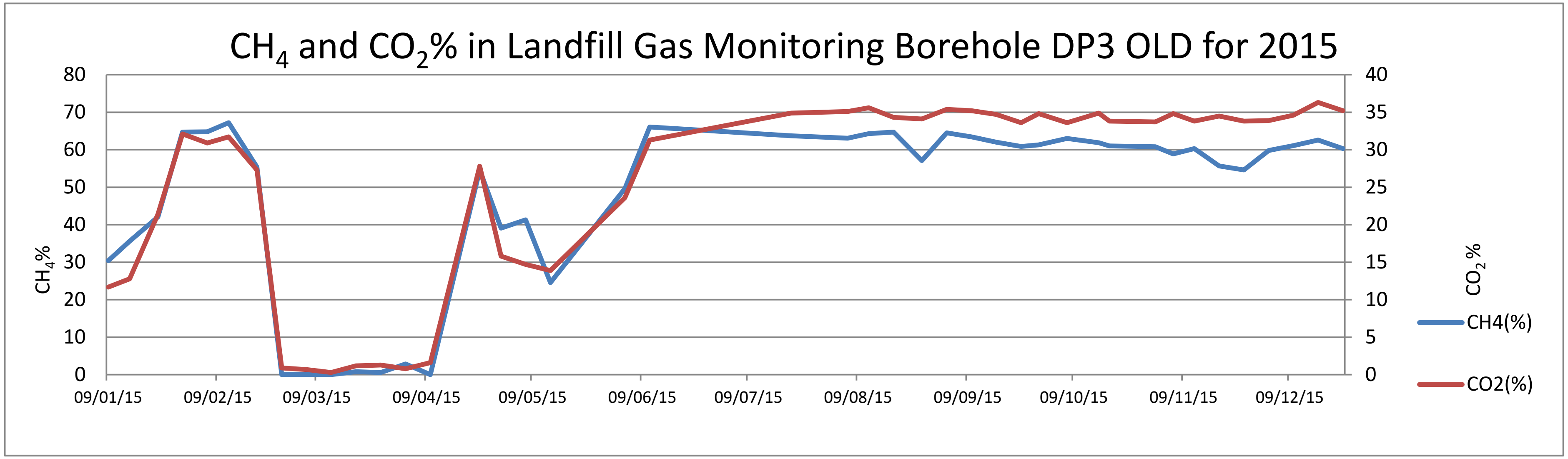

CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole DP4 for 2015
CH$_4$%
CO$_2$%
35
30
25
20
15
10
5
0
18
16
14
12
10
8
6
4
2
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4(%)
CO2(%)



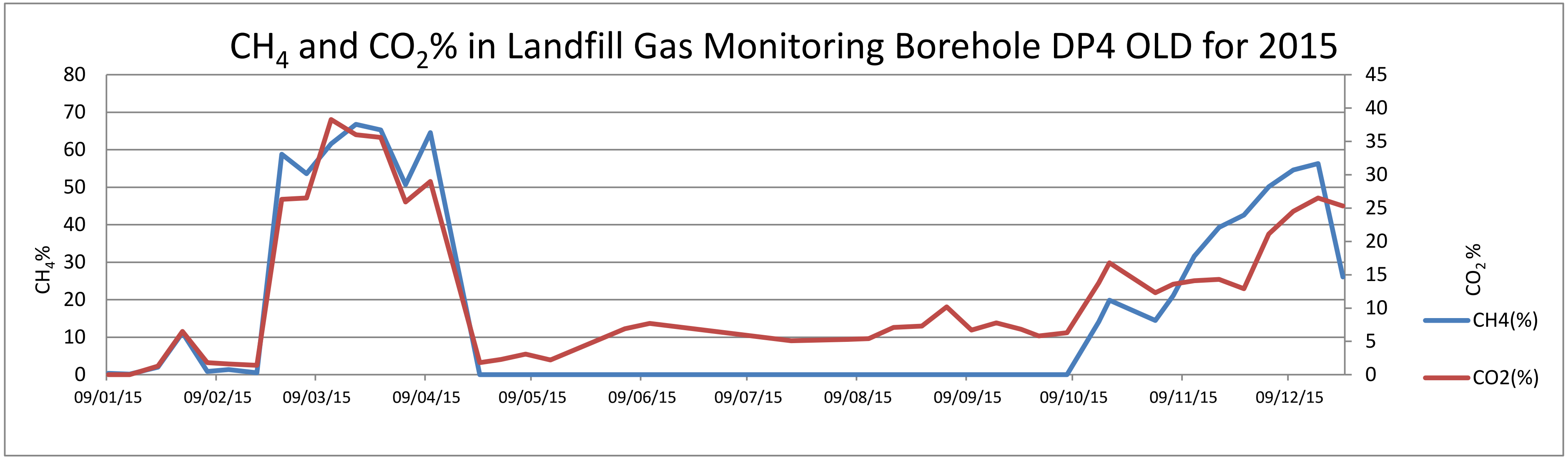
CH4 and CO2% in Landfill Gas Monitoring Borehole DP3A for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
14
12
10
8
6
4
2
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4(%)
CO2(%)



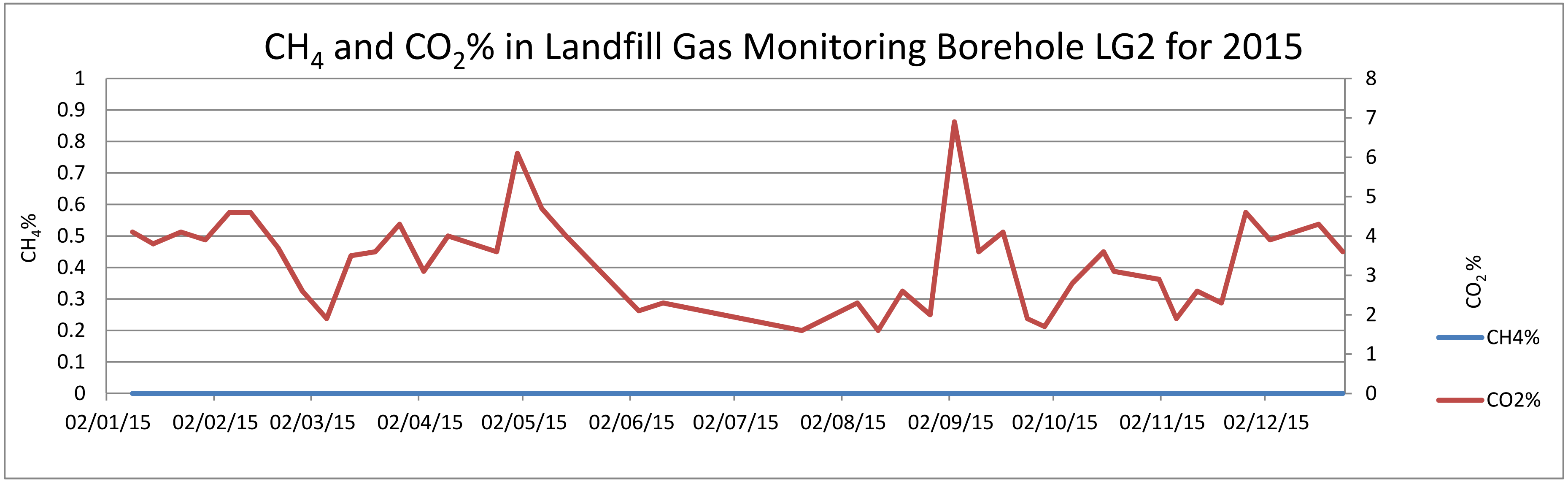
CH4 and CO2% in Landfill Gas Monitoring Borehole DP4A for 2015
CH4%
CO2%
14
12
10
8
6
4
2
0
12
10
8
6
4
2
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4(%)
CO2(%)



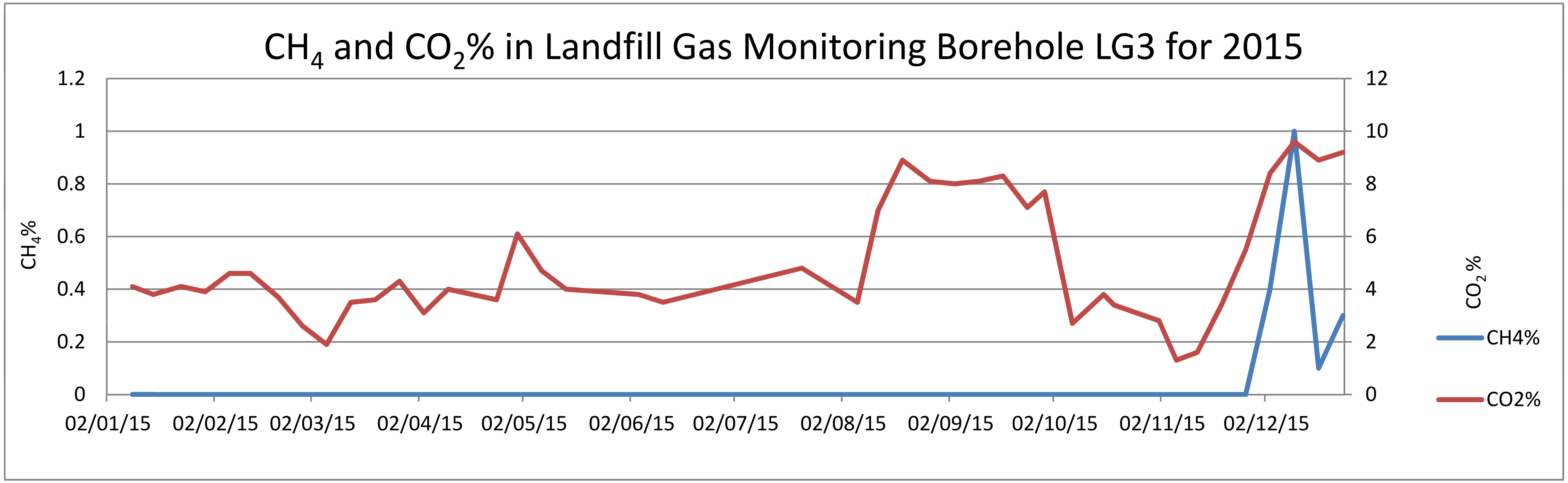
CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole DP3 OLD for 2015
CH$_4$%
CO$_2$%
80
70
60
50
40
30
20
10
0
40
35
30
25
20
15
10
5
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4(%)
CO2(%)



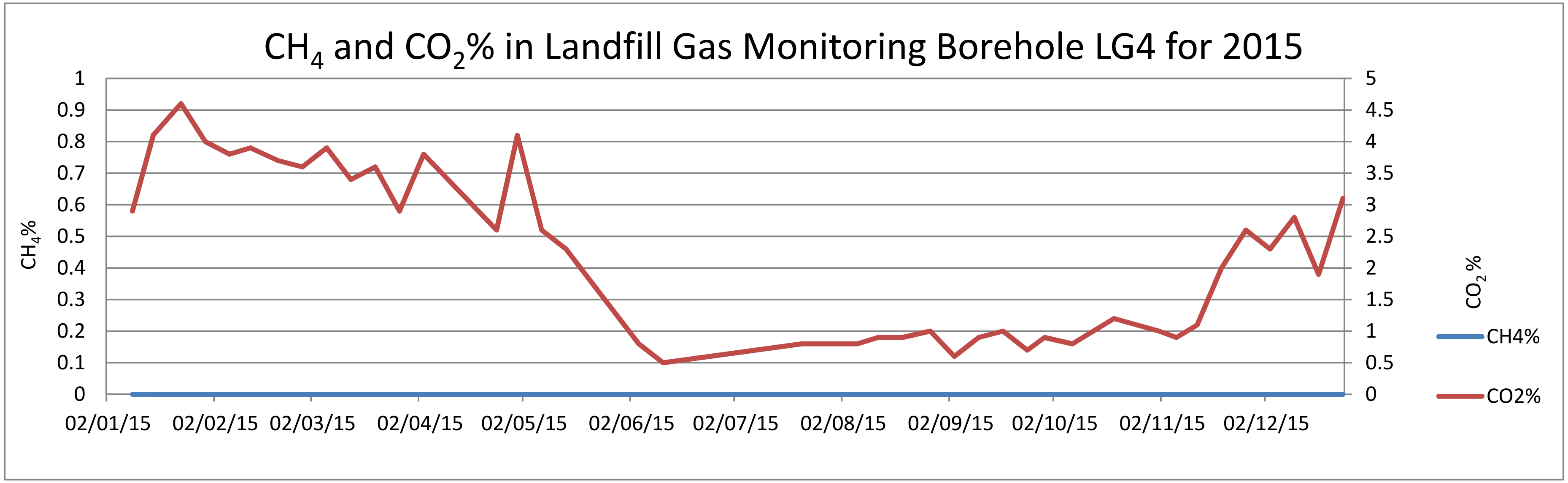
CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole DP4 OLD for 2015
CH$_4$%
CO$_2$%
80
70
60
50
40
30
20
10
0
45
40
35
30
25
20
15
10
5
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4(%)
CO2(%)



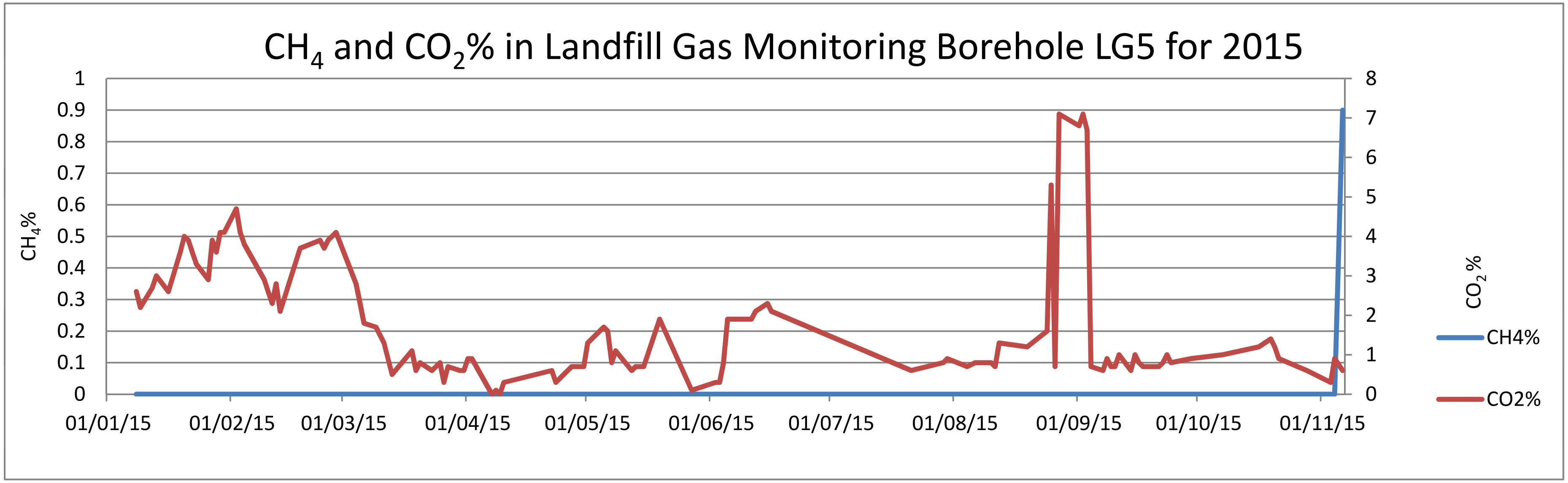
CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole LG2 for 2015
CH$_4$%
CO$_2$%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
8
7
6
5
4
3
2
1
0
02/01/15
02/02/15
02/03/15
02/04/15
02/05/15
02/06/15
02/07/15
02/08/15
02/09/15
02/10/15
02/11/15
02/12/15
CH4%
CO2%



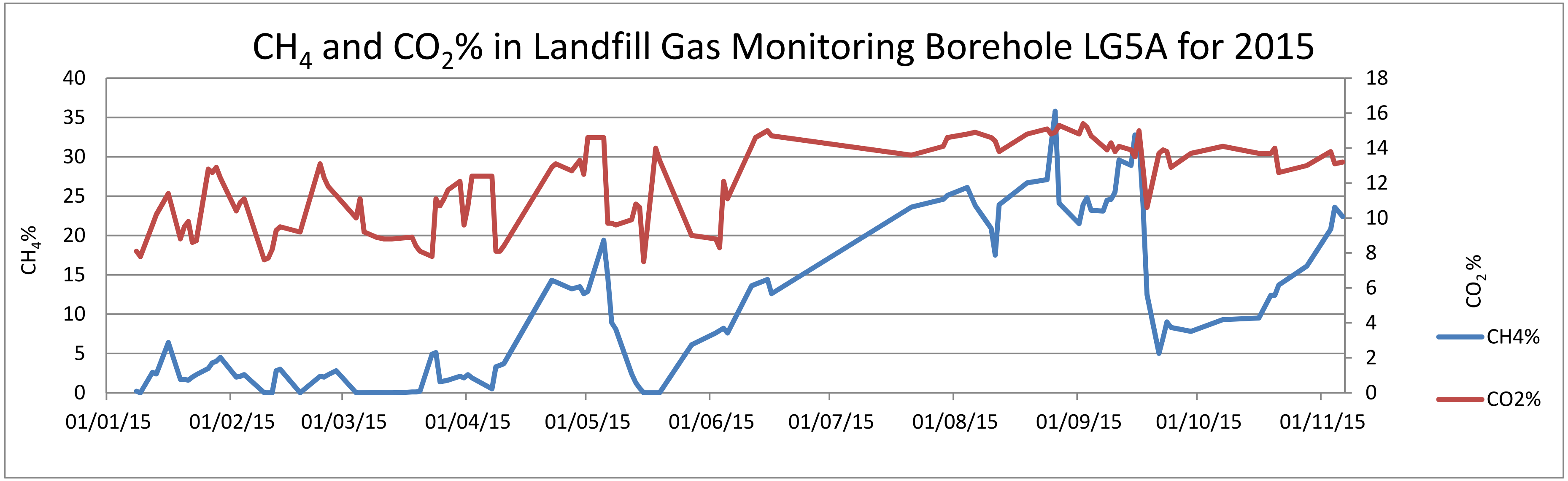
CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole LG3 for 2015
CH$_4$%
CO$_2$%
1.2
1
0.8
0.6
0.4
0.2
0
12
10
8
6
4
2
0
02/01/15
02/02/15
02/03/15
02/04/15
02/05/15
02/06/15
02/07/15
02/08/15
02/09/15
02/10/15
02/11/15
02/12/15
CH4%
CO2%

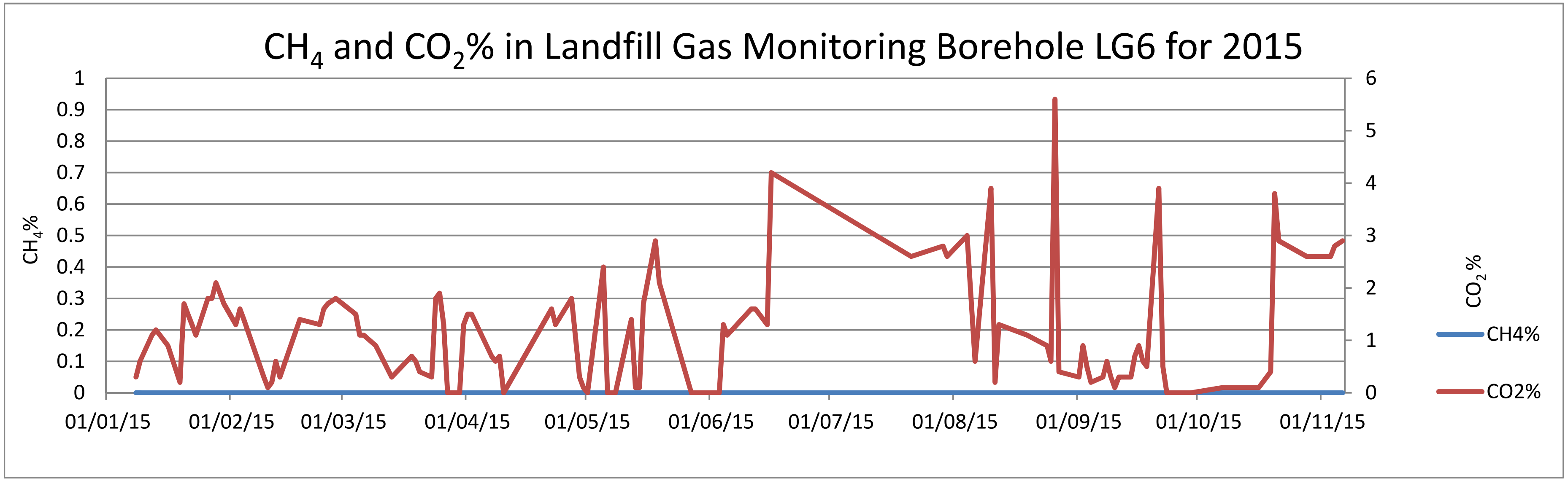


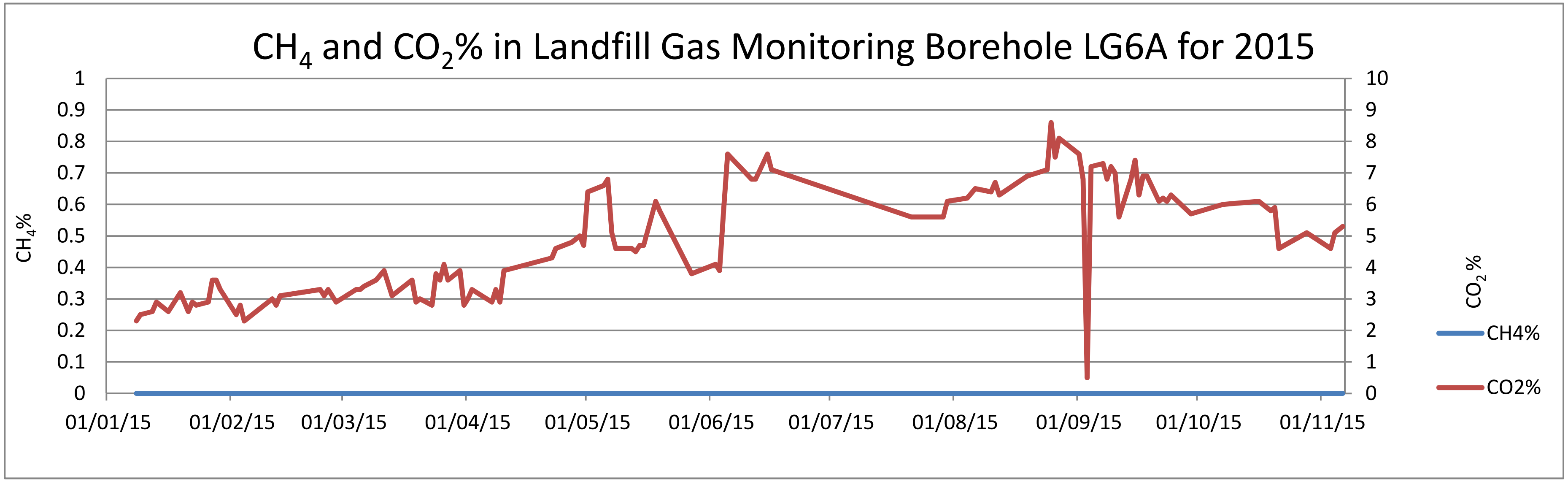
CH4 and CO2% in Landfill Gas Monitoring Borehole LG4 for 2015
CH4%
CO2 %
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
02/01/15
02/02/15
02/03/15
02/04/15
02/05/15
02/06/15
02/07/15
02/08/15
02/09/15
02/10/15
02/11/15
02/12/15
CH4%
CO2%



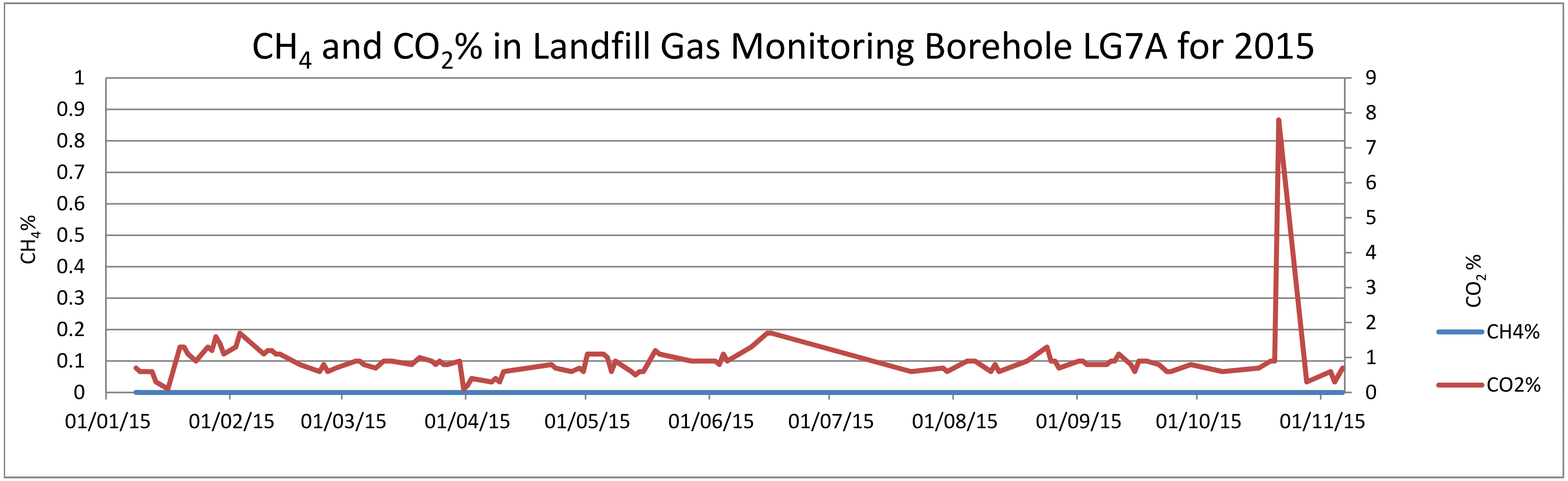
CH4 and CO2% in Landfill Gas Monitoring Borehole LG5 for 2015
CH4%
CO2 %
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
8
7
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%


CH4 and CO2% in Landfill Gas Monitoring Borehole LG5A for 2015
CH4%
40
35
30
25
20
15
10
5
0
18
16
14
12
10
8
6
4
2
0
CO2%
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%

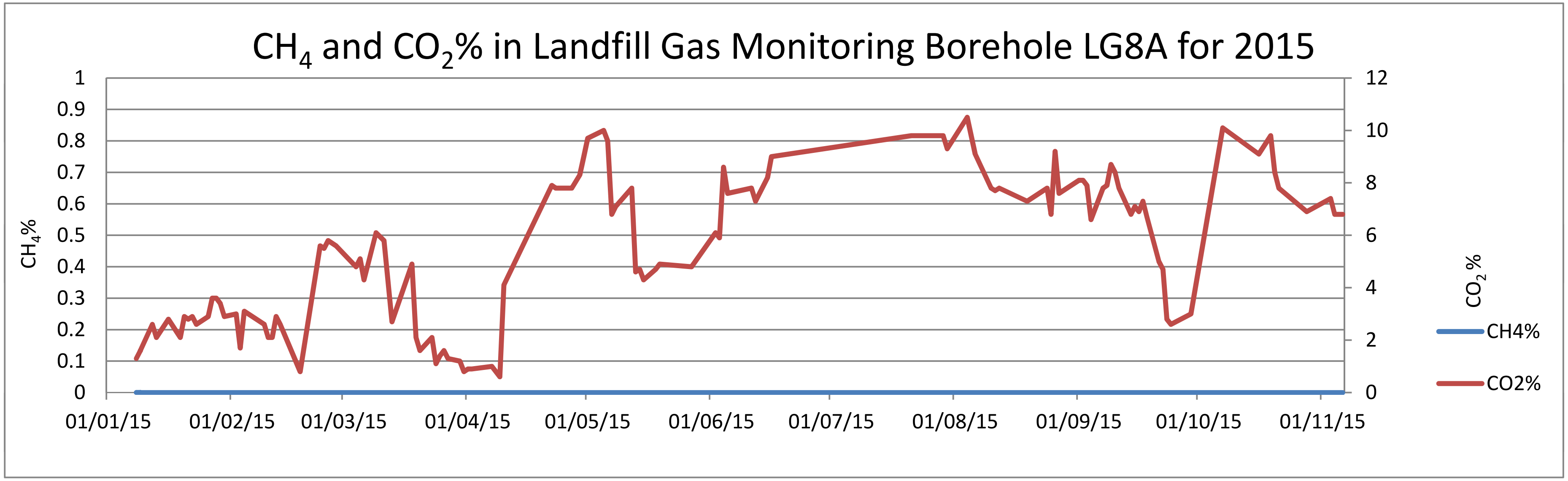

CH4 and CO2% in Landfill Gas Monitoring Borehole LG6 for 2015
CH4%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
6
5
4
3
2
1
0
CO2%
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%

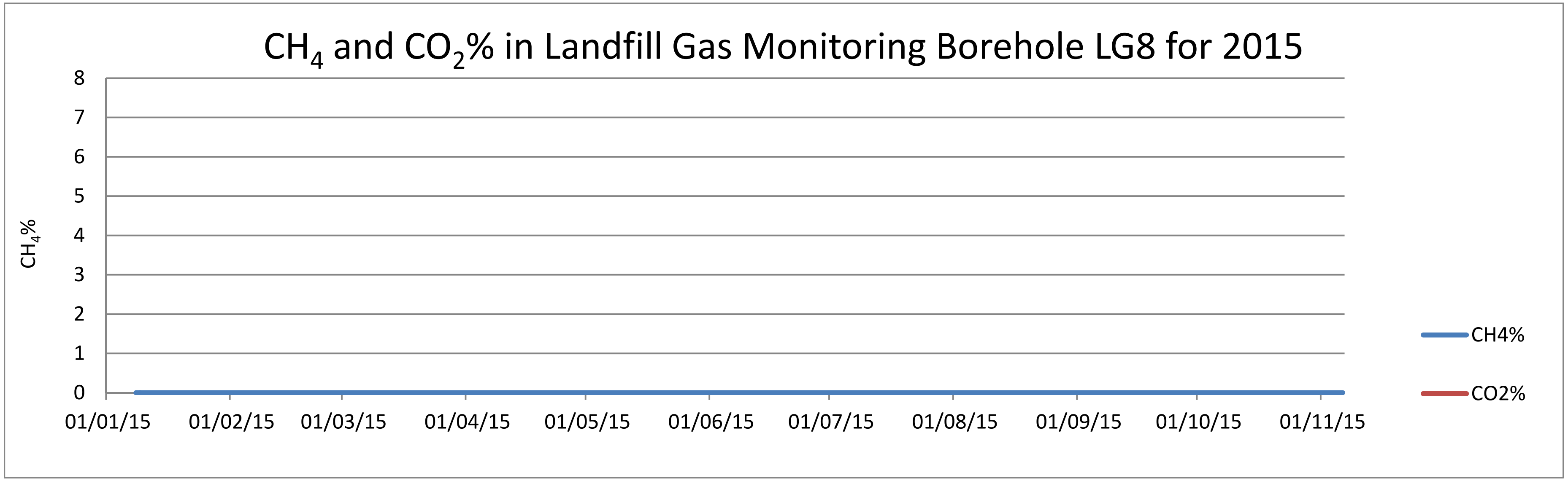


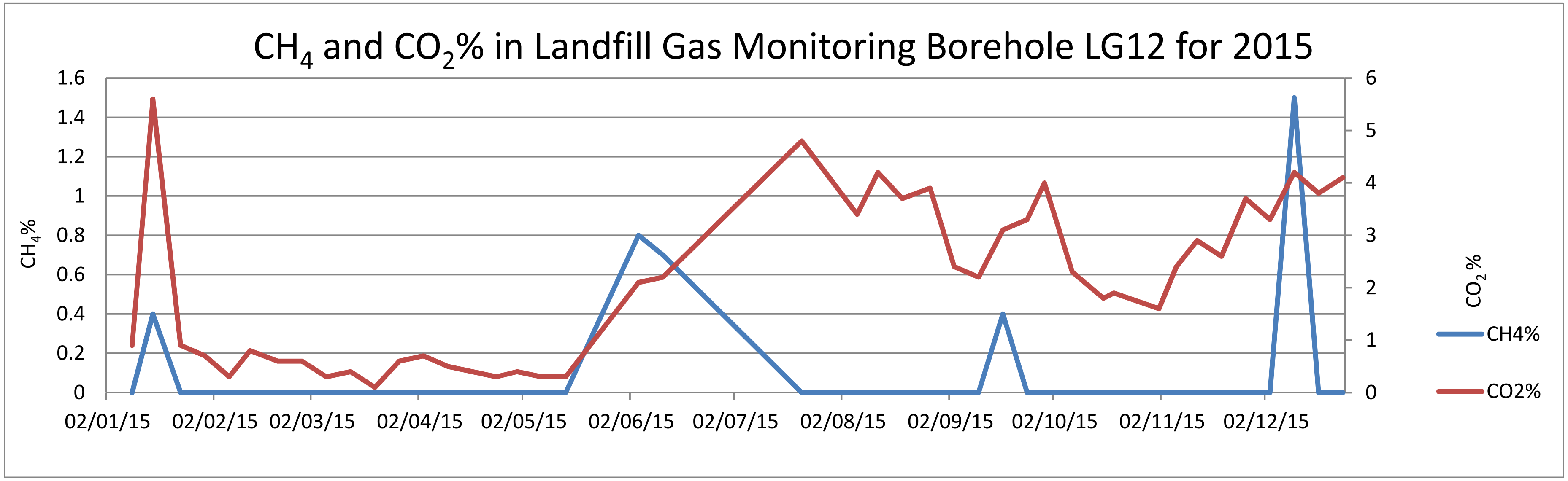
CH4 and CO2% in Landfill Gas Monitoring Borehole LG6A for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
10
9
8
7
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%

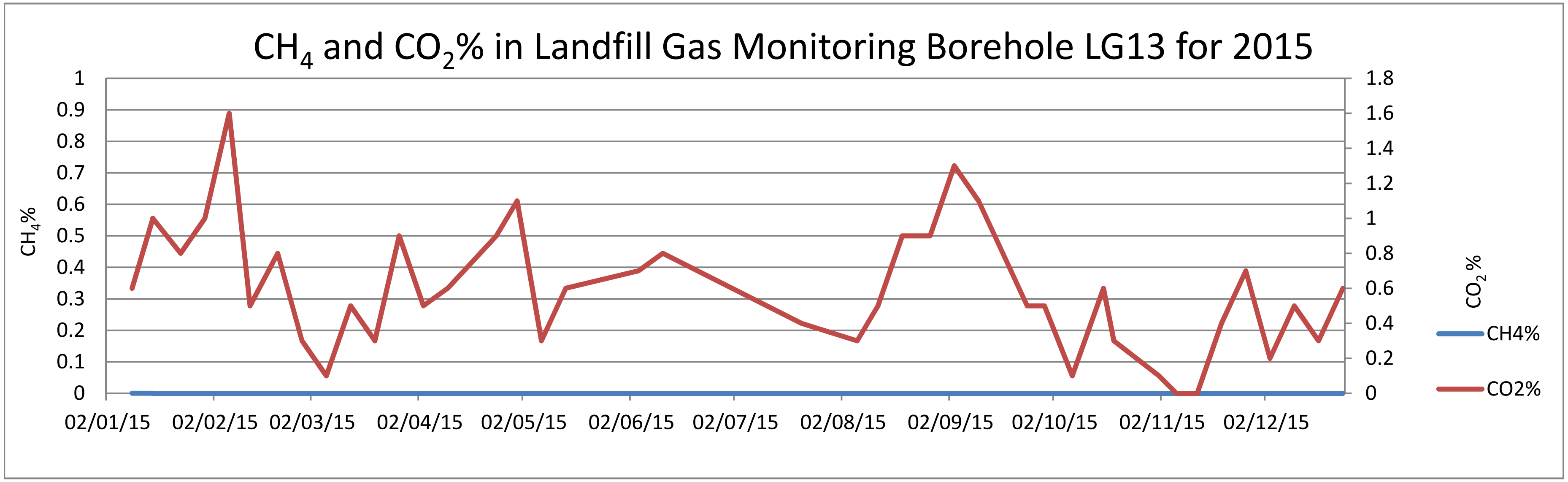


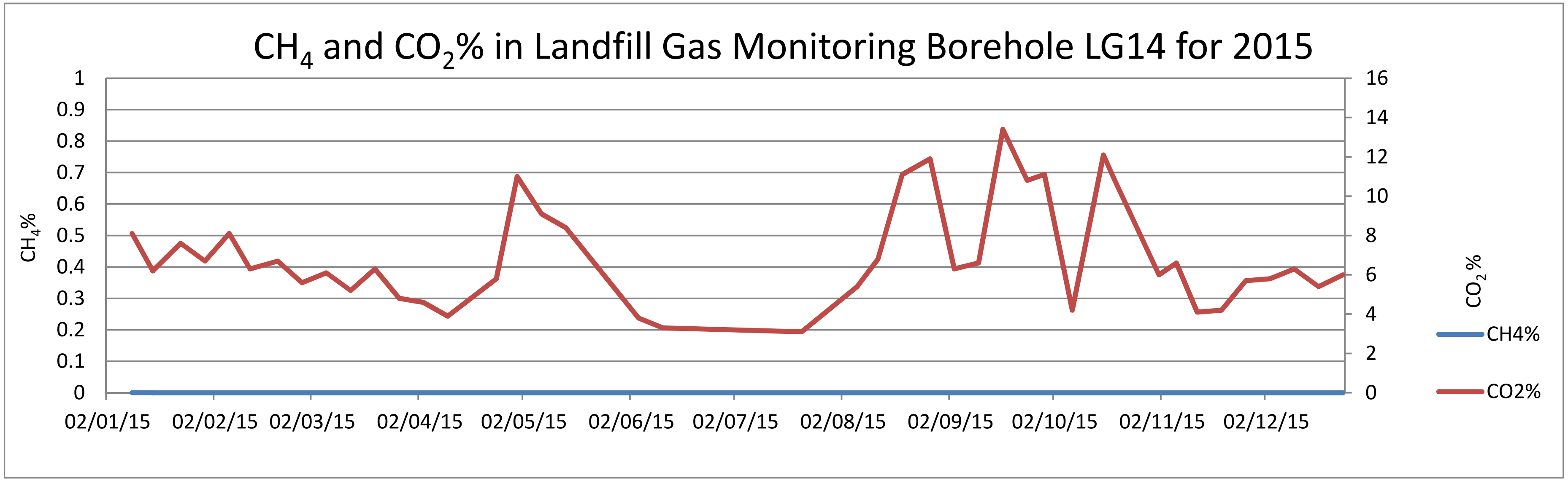
CH4 and CO2% in Landfill Gas Monitoring Borehole LG7A for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
9
8
7
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%

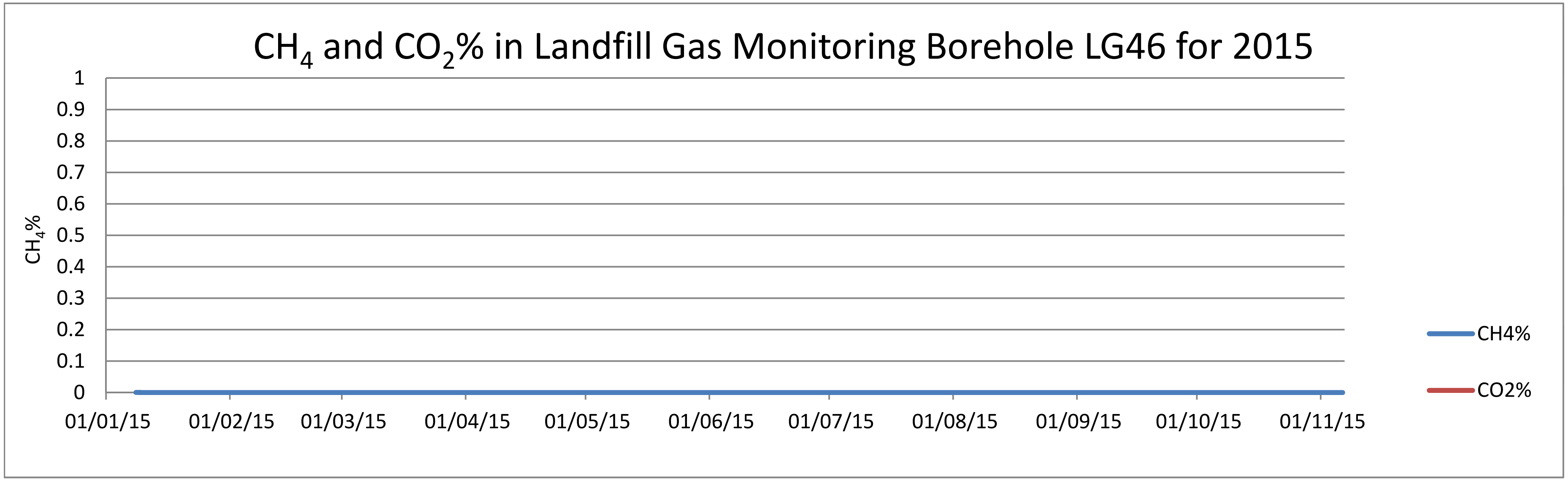

CH4 and CO2% in Landfill Gas Monitoring Borehole LG8A for 2015
CH4%
CO2 %
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
12
10
8
6
4
2
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%

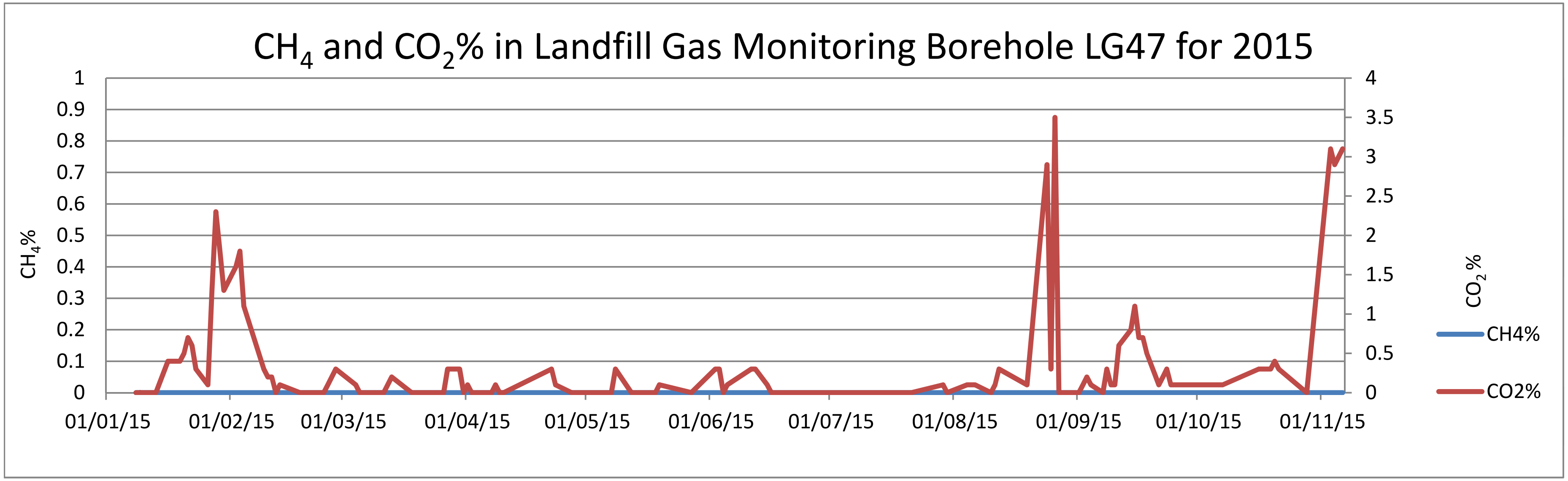

CH4 and CO2% in Landfill Gas Monitoring Borehole LG8 for 2015
CH4%
8
7
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%


CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole LG12 for 2015
CH$_4$%
CO$_2$ %
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
6
5
4
3
2
1
0
02/01/15
02/02/15
02/03/15
02/04/15
02/05/15
02/06/15
02/07/15
02/08/15
02/09/15
02/10/15
02/11/15
02/12/15
CH4%
CO2%

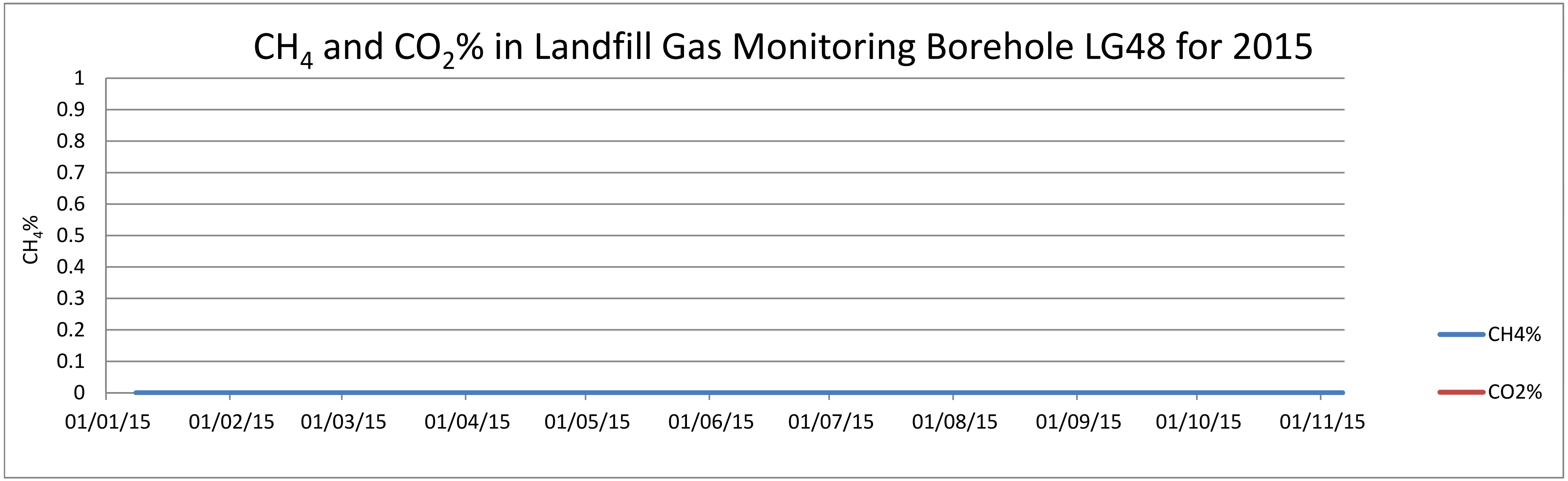

CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole LG13 for 2015
CH$_4$%
CO$_2$ %
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
02/01/15
02/02/15
02/03/15
02/04/15
02/05/15
02/06/15
02/07/15
02/08/15
02/09/15
02/10/15
02/11/15
02/12/15
CH4%
CO2%


CH4 and CO2% in Landfill Gas Monitoring Borehole LG14 for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
16
14
12
10
8
6
4
2
0
02/01/15
02/02/15
02/03/15
02/04/15
02/05/15
02/06/15
02/07/15
02/08/15
02/09/15
02/10/15
02/11/15
02/12/15
CH4%
CO2%

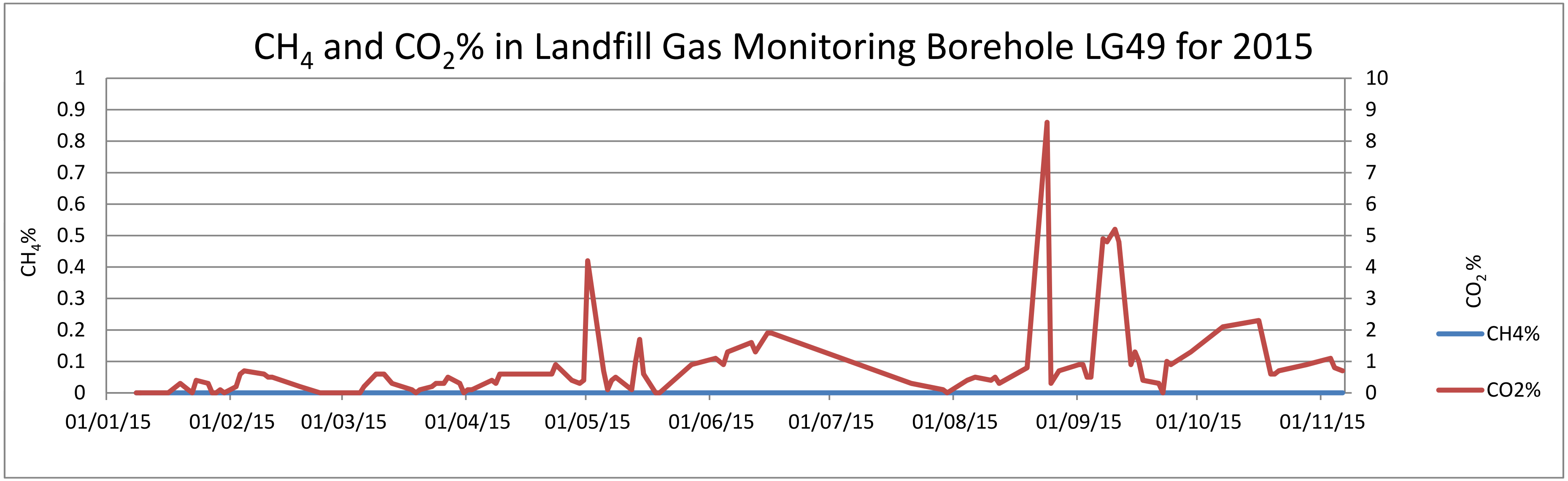

CH4 and CO2% in Landfill Gas Monitoring Borehole LG46 for 2015
CH4%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%



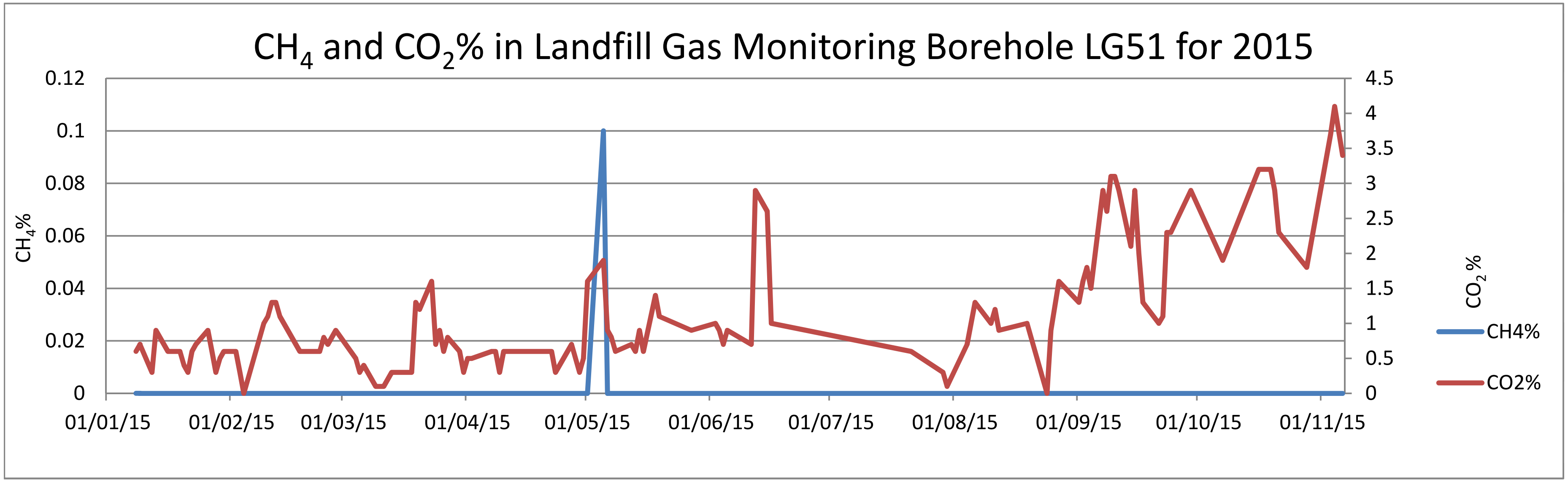
CH4 and CO2% in Landfill Gas Monitoring Borehole LG47 for 2015
CH4%
CO2 %
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
4
3.5
3
2.5
2
1.5
1
0.5
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%



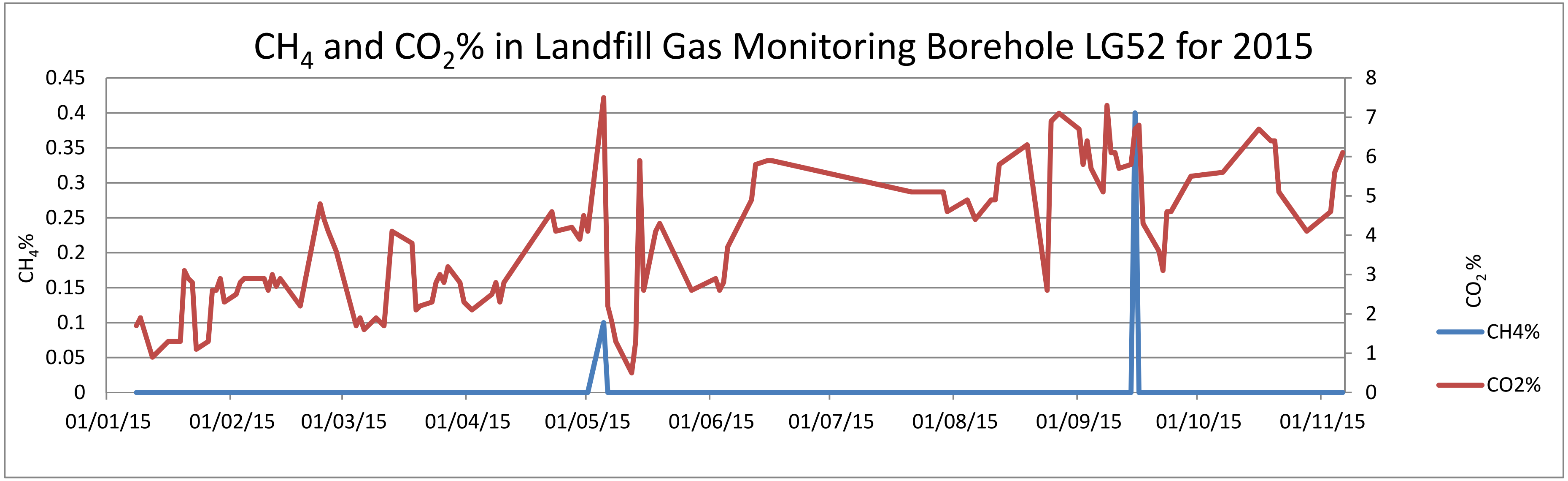
CH4 and CO2% in Landfill Gas Monitoring Borehole LG48 for 2015
CH4%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%



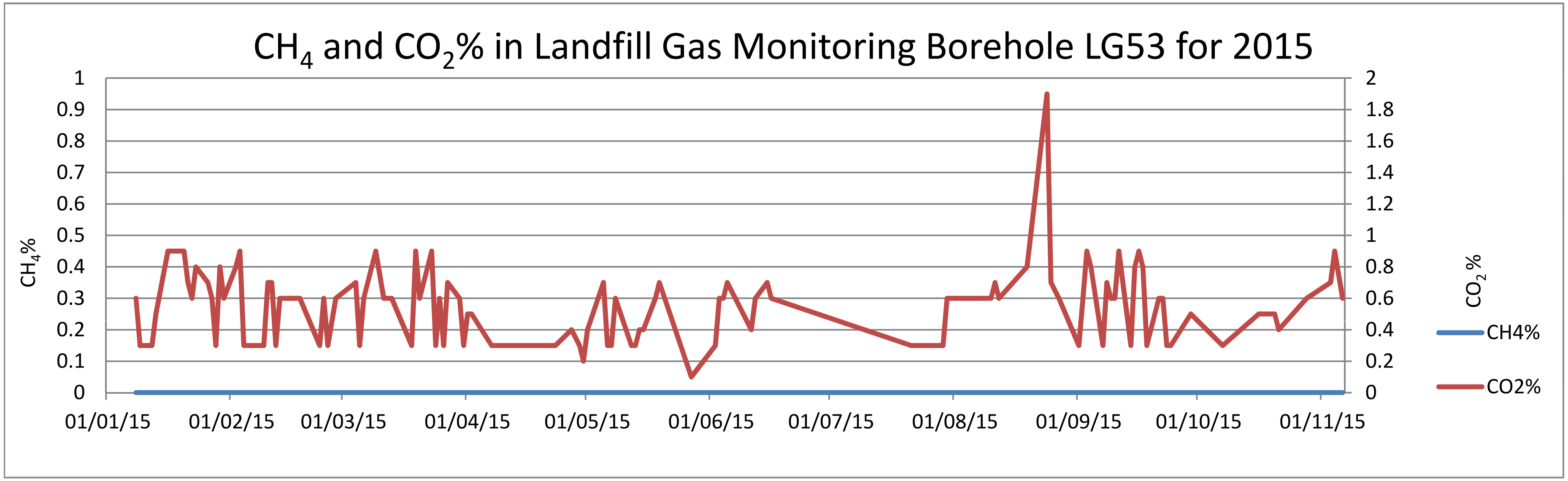
CH4 and CO2% in Landfill Gas Monitoring Borehole LG49 for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
10
9
8
7
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%



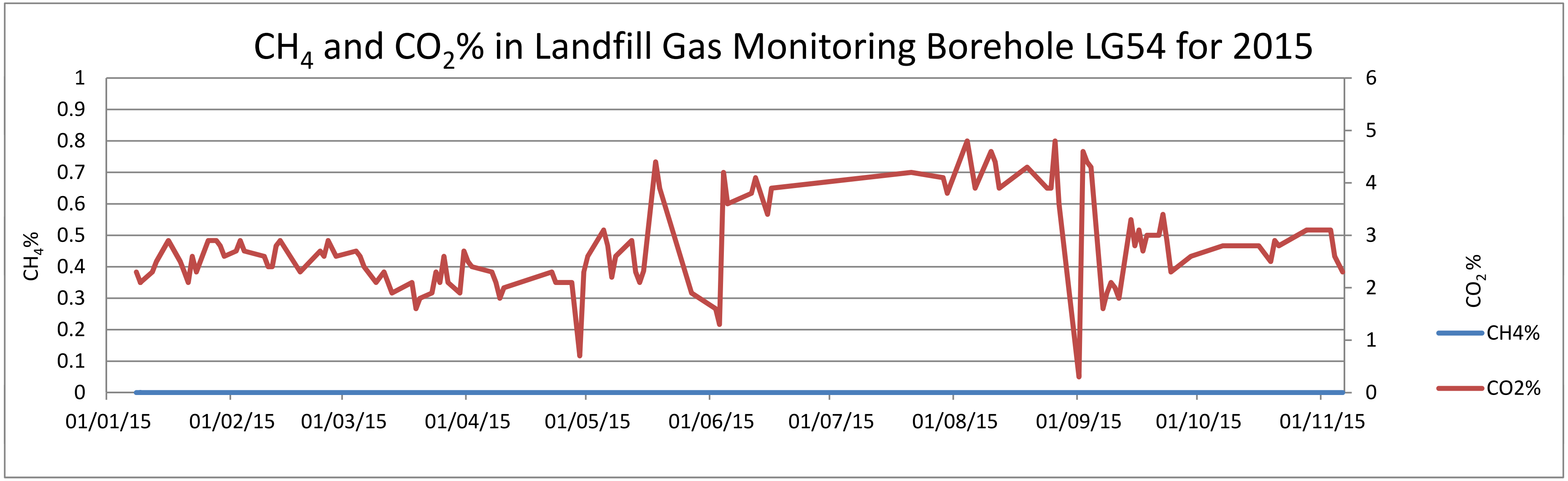
CH4 and CO2% in Landfill Gas Monitoring Borehole LG51 for 2015
CH4%
CO2%
0.12
0.1
0.08
0.06
0.04
0.02
0
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%



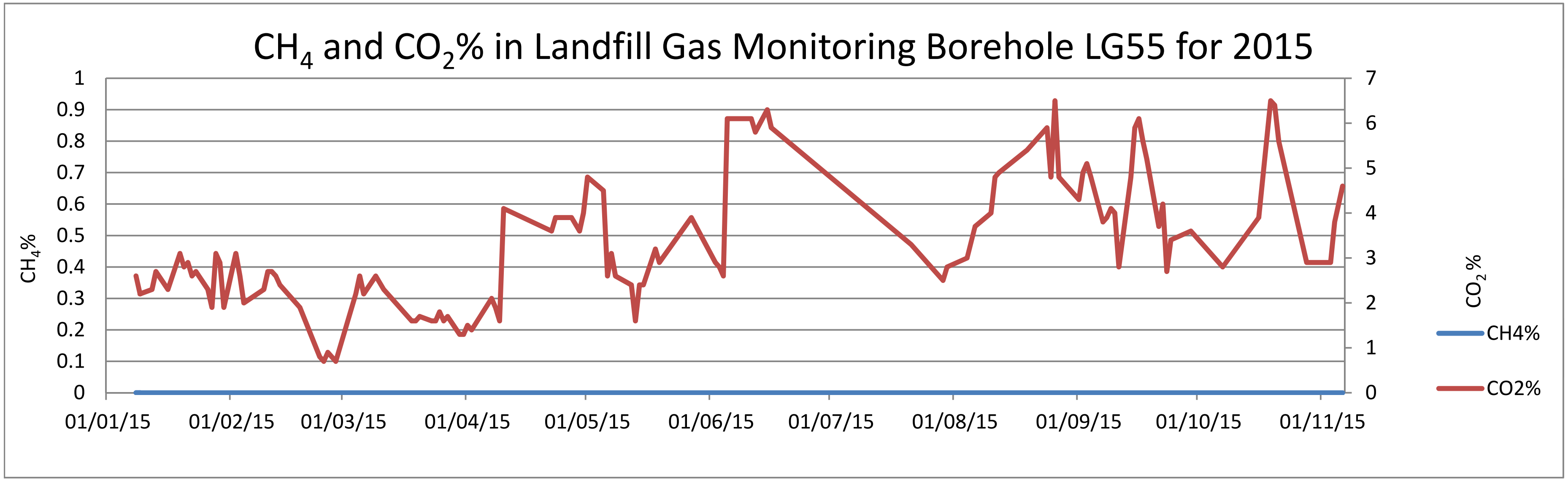
CH4 and CO2% in Landfill Gas Monitoring Borehole LG52 for 2015
CH4%
CO2 %
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
8
7
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%



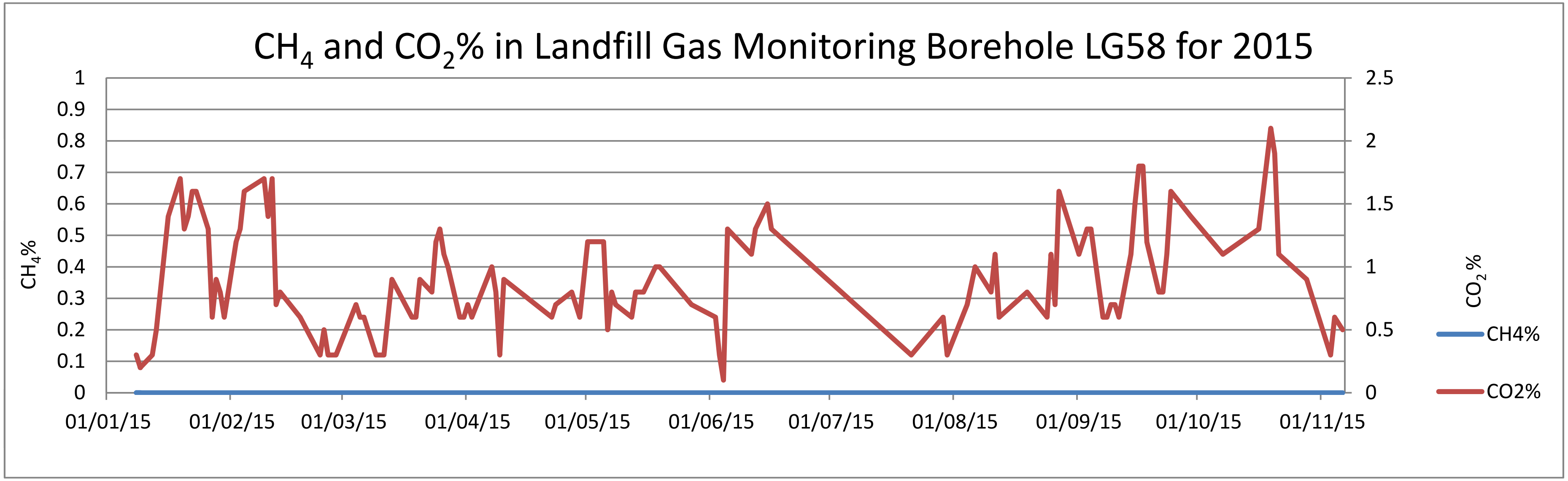
CH4 and CO2% in Landfill Gas Monitoring Borehole LG53 for 2015
CH4%
CO2 %
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%

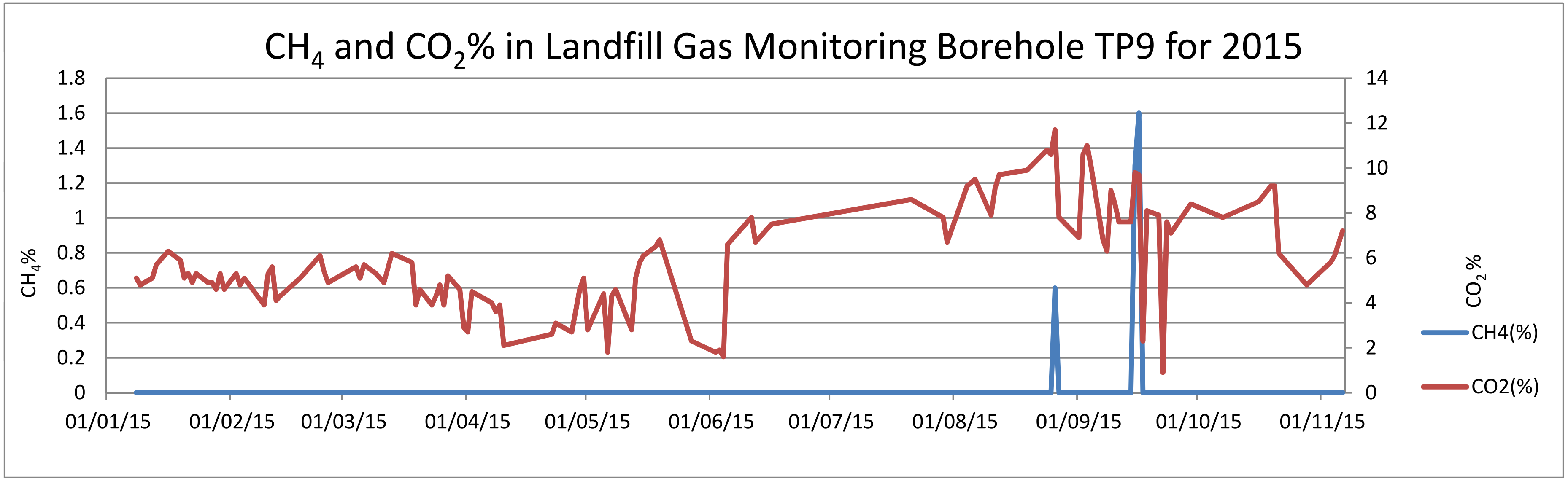


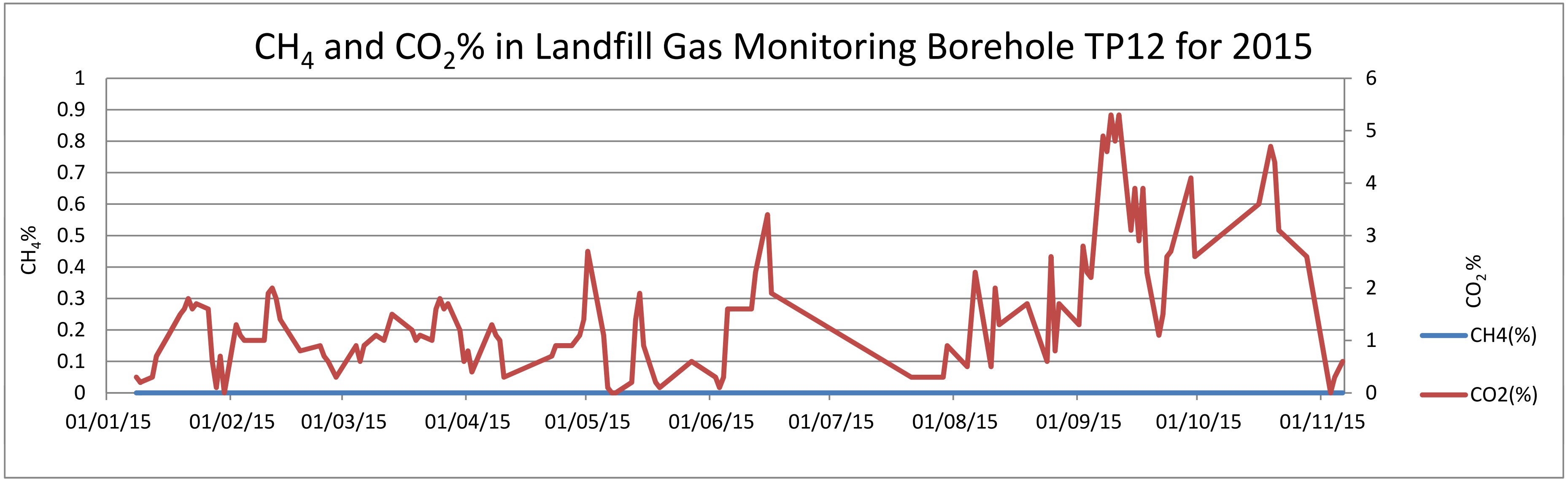
CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole LG54 for 2015
CH$_4$%
CO$_2$%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%



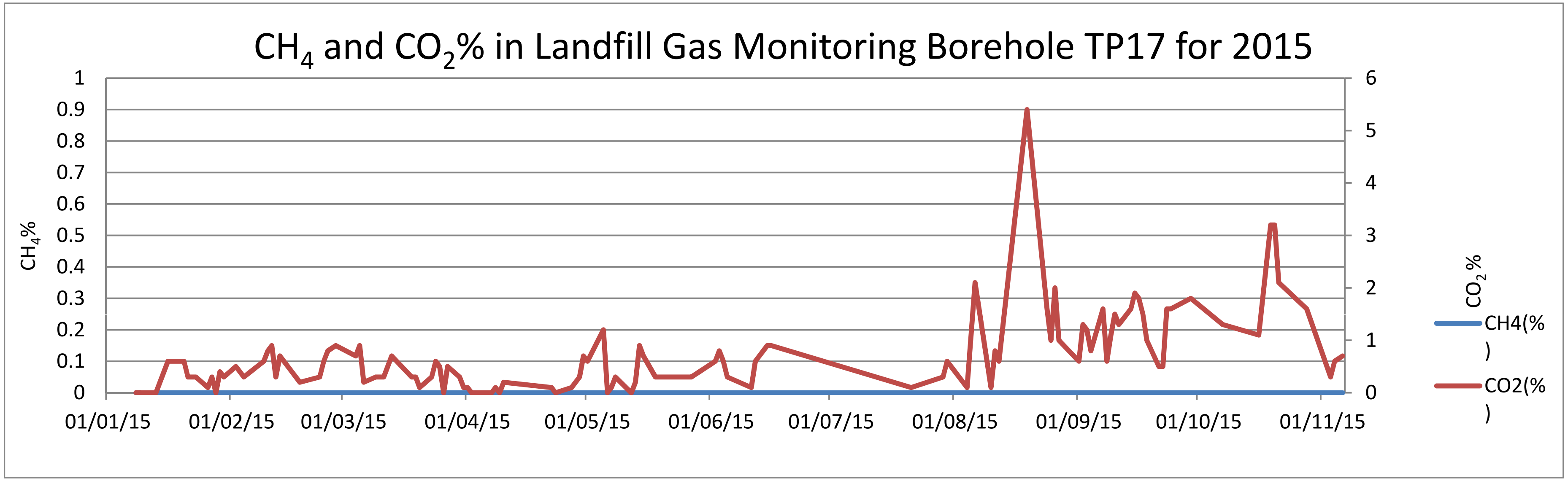
CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole LG55 for 2015
CH$_4$%
CO$_2$%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
7
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%


CH4 and CO2% in Landfill Gas Monitoring Borehole LG58 for 2015
CH4%
CO2 %
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2.5
2
1.5
1
0.5
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%

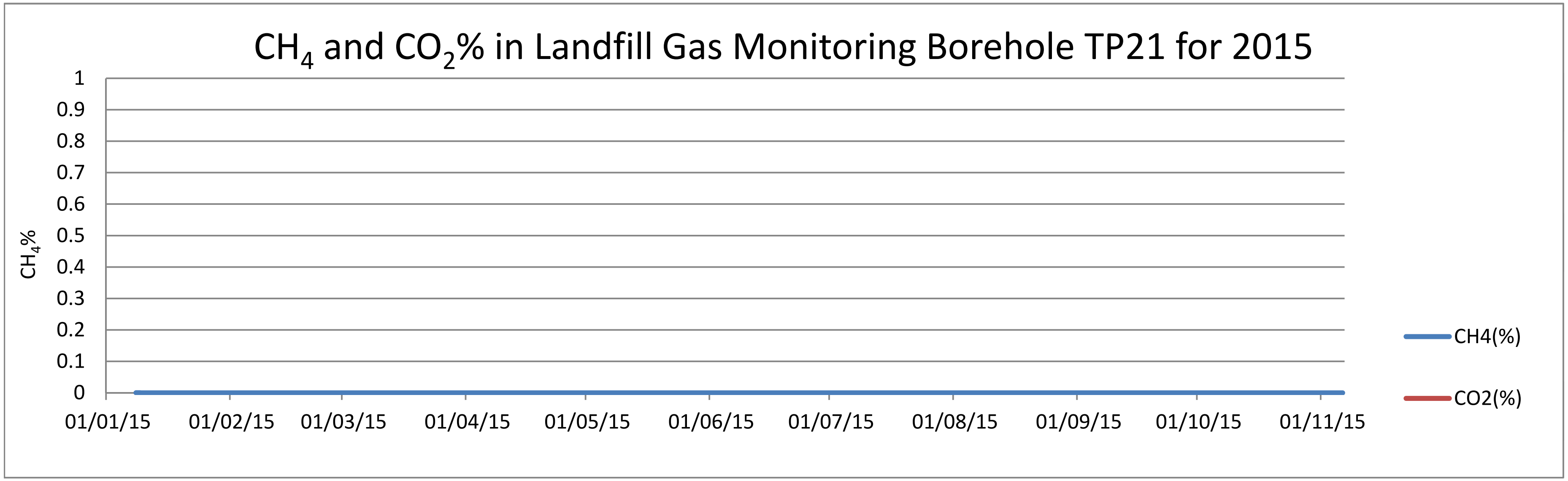

CH4 and CO2% in Landfill Gas Monitoring Borehole TP9 for 2015
CH4%
CO2 %
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
14
12
10
8
6
4
2
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4(%)
CO2(%)



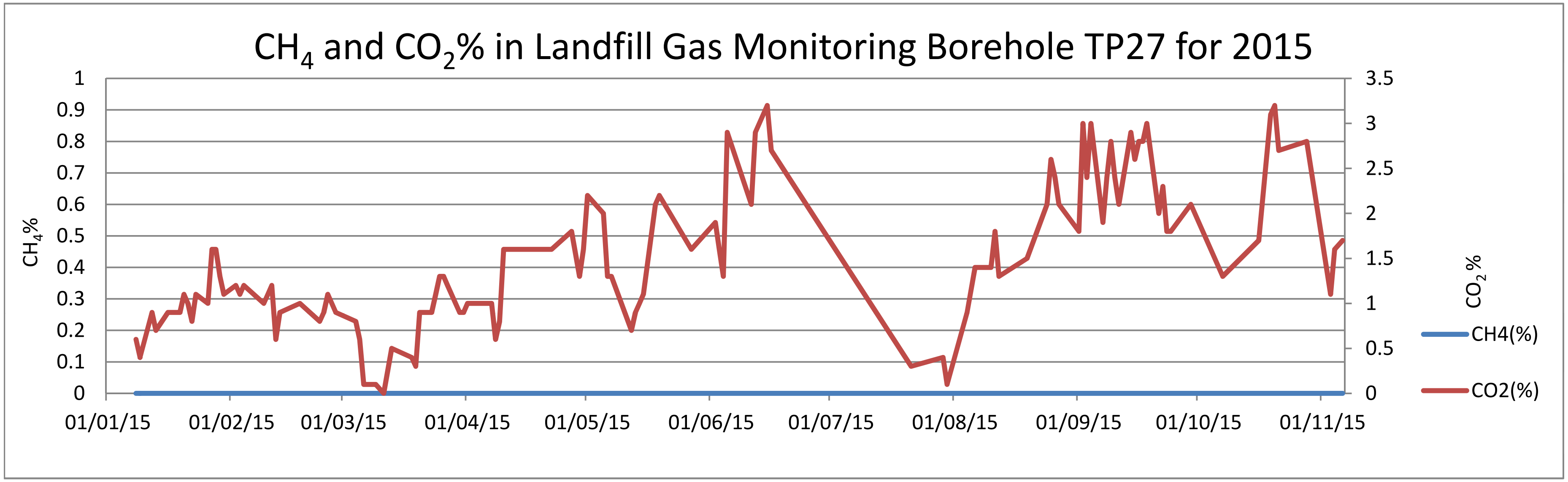
CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole TP12 for 2015
CH$_4$%
CO$_2$%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4(%)
CO2(%)



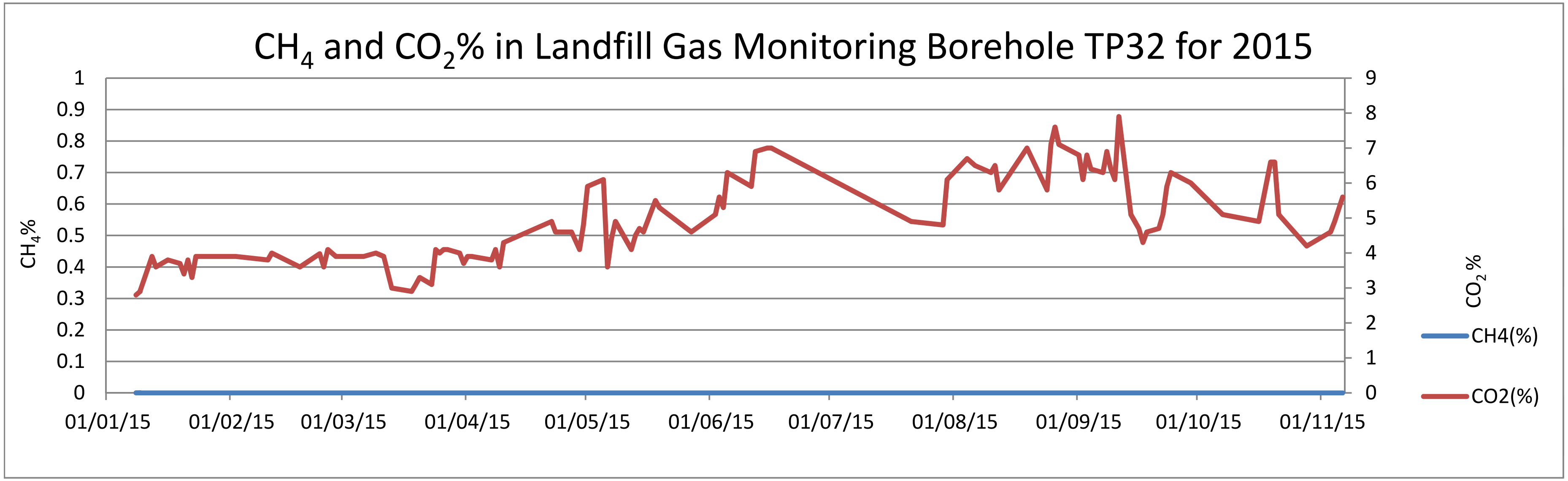
CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole TP17 for 2015
CH$_4$%
CO$_2$%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4(%)
CO2(%)



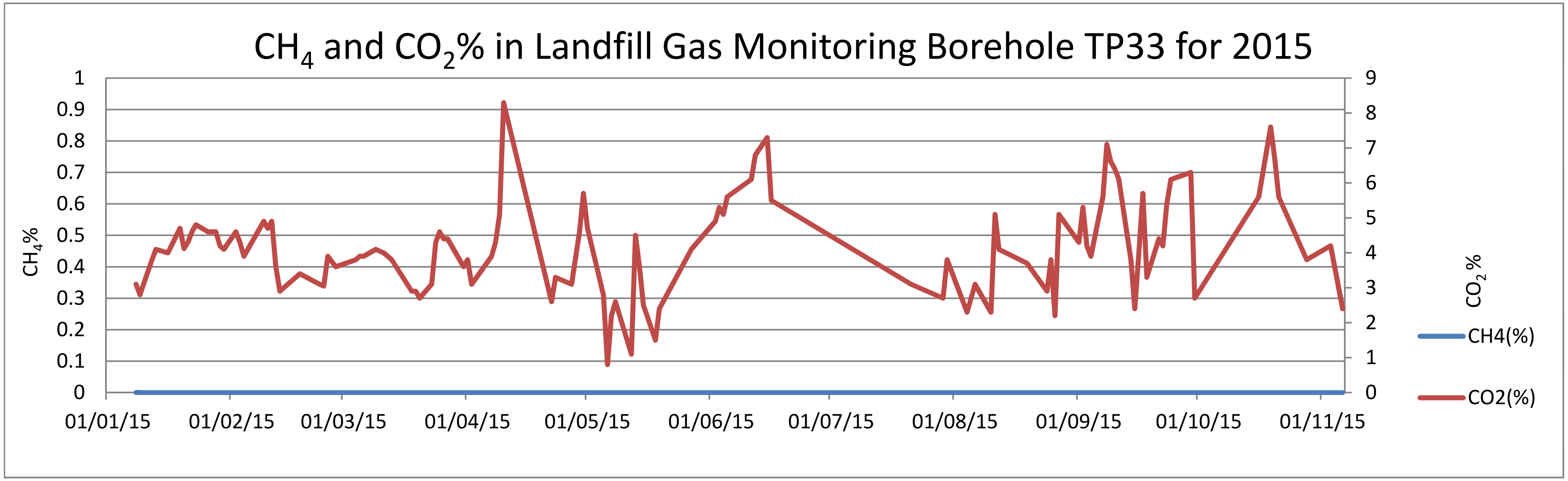
CH_4 and CO_2% in Landfill Gas Monitoring Borehole TP21 for 2015
CH_4%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4(%)
CO2(%)



CH_4 and CO_2% in Landfill Gas Monitoring Borehole TP27 for 2015
CH_4%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3.5
3
2.5
2
1.5
1
0.5
0
CO_2 %
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4(%)
CO2(%)

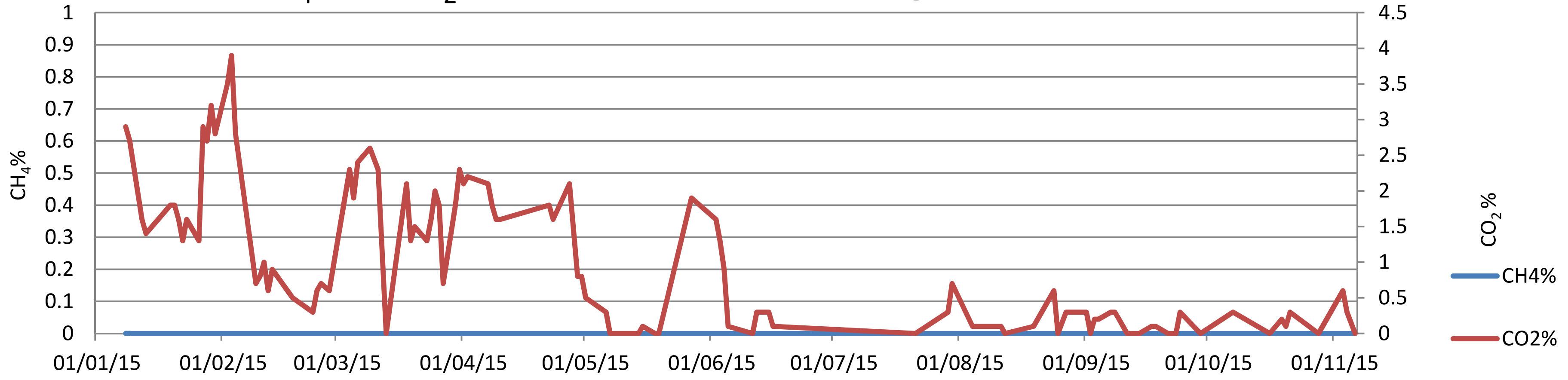


CH4 and CO2% in Landfill Gas Monitoring Borehole TP32 for 2015
CH4%
CO2 %
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
9
8
7
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4(%)
CO2(%)

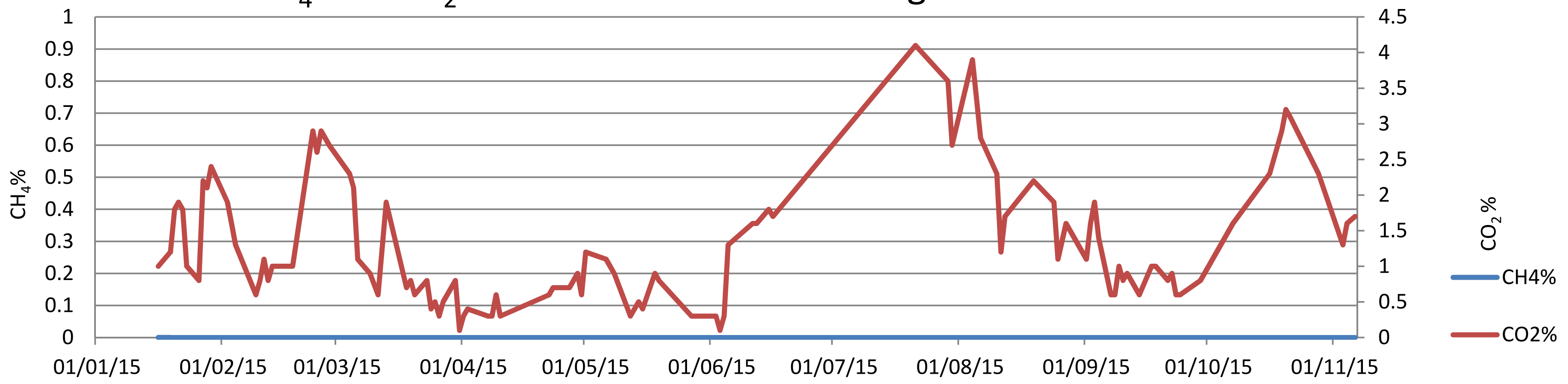


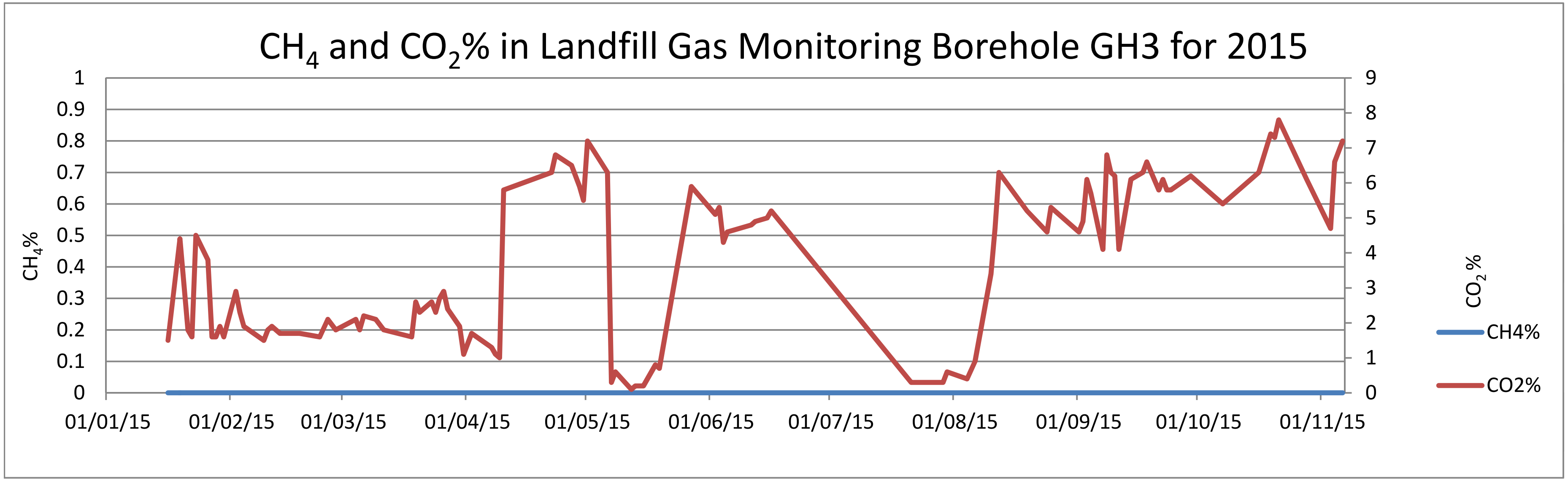
CH4 and CO2% in Landfill Gas Monitoring Borehole TP33 for 2015
CH4%
CO2 %
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
9
8
7
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4(%)
CO2(%)

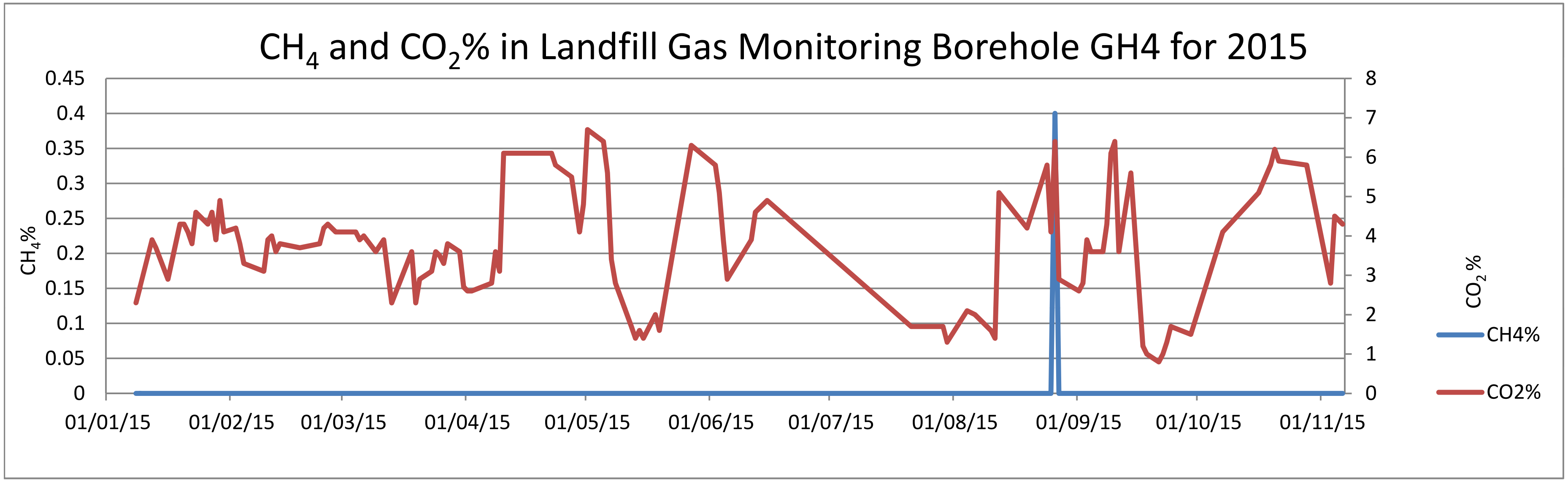
CH_4 and CO_2% in Landfill Gas Monitoring Borehole GH1 for 2015

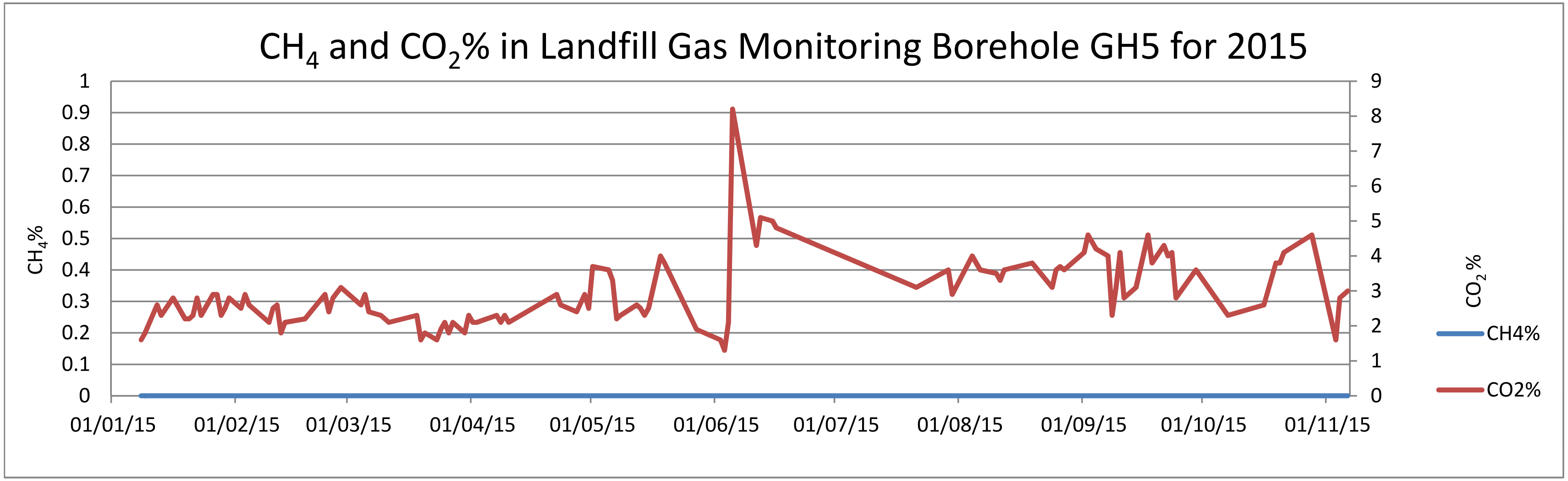


CH_4 and CO_2% in Landfill Gas Monitoring Borehole GH2 for 2015

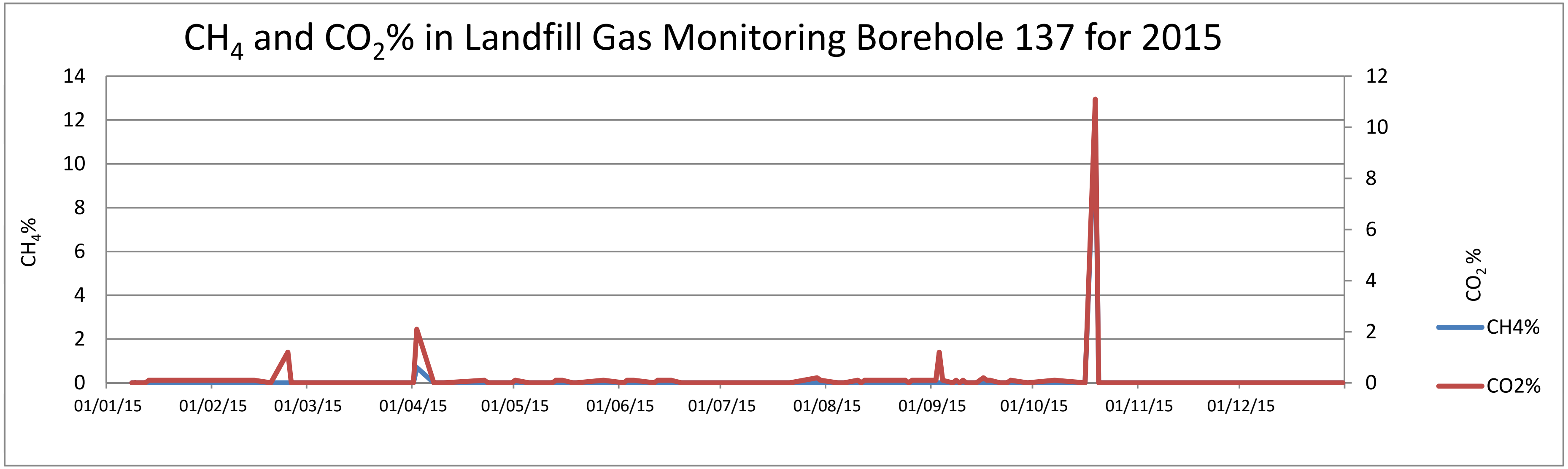


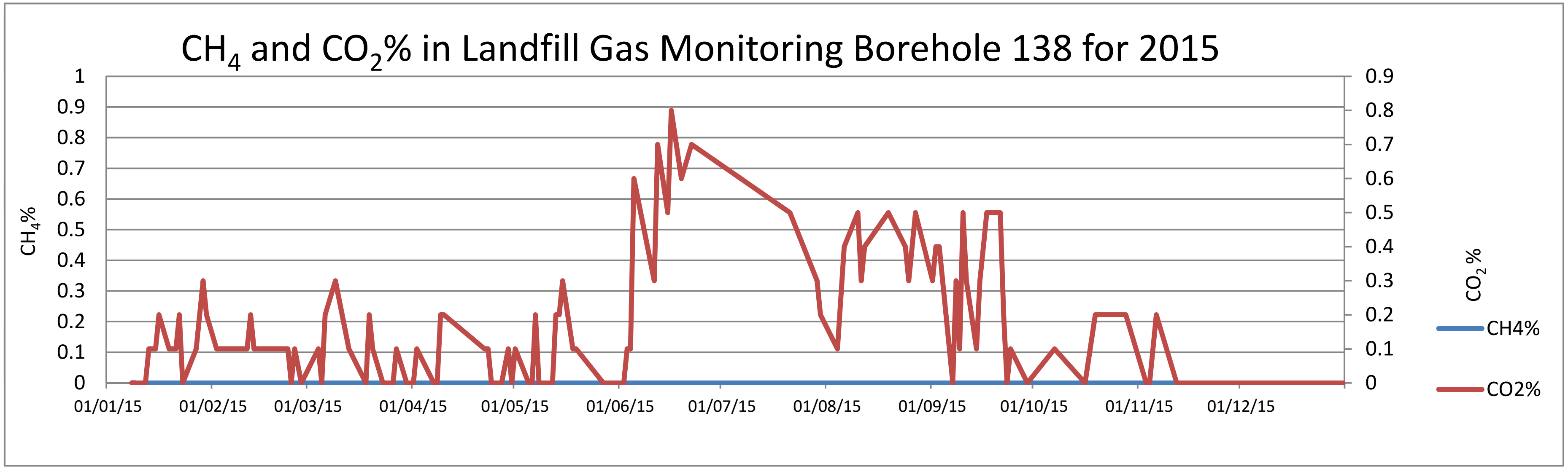

CH4 and CO2% in Landfill Gas Monitoring Borehole GH3 for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
9
8
7
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%

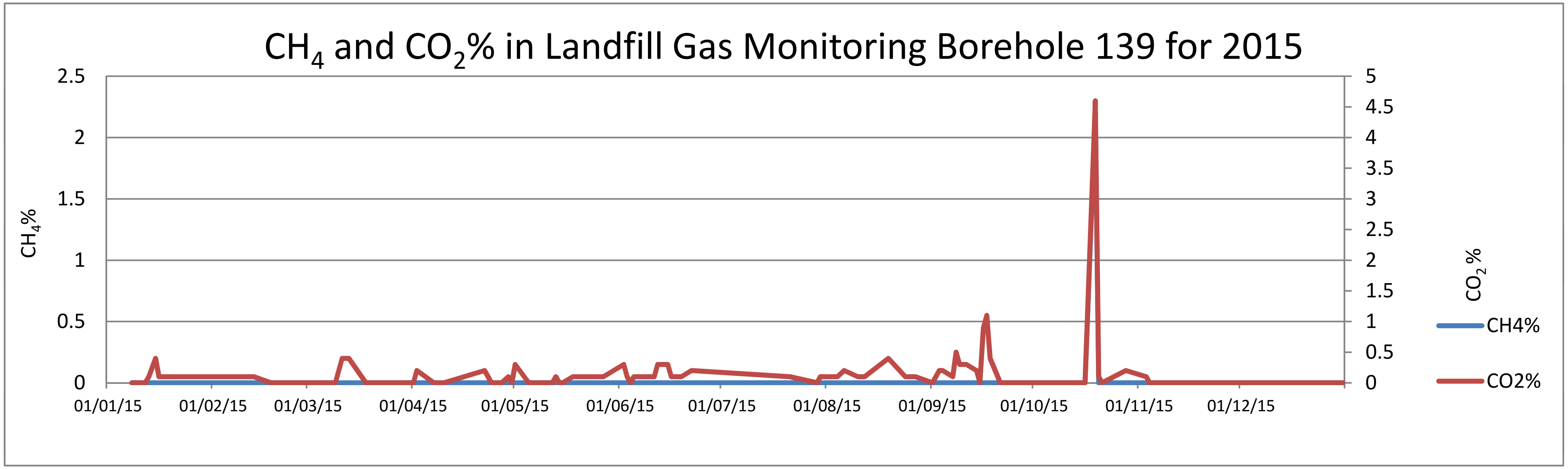

CH4 and CO2% in Landfill Gas Monitoring Borehole GH4 for 2015
CH4%
CO2%
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
8
7
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%

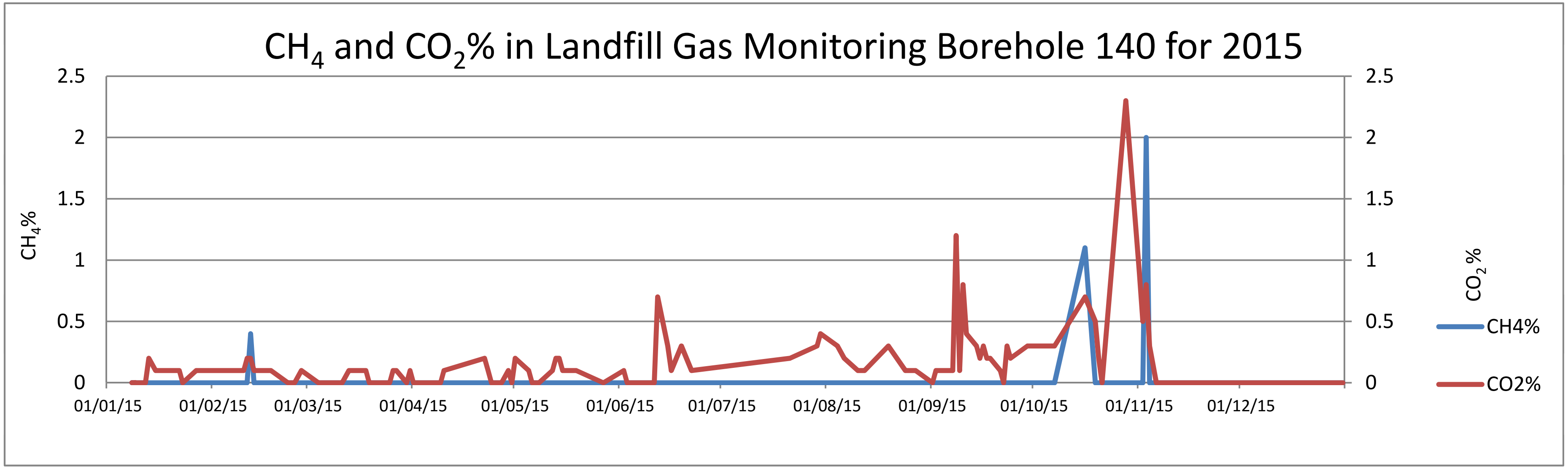


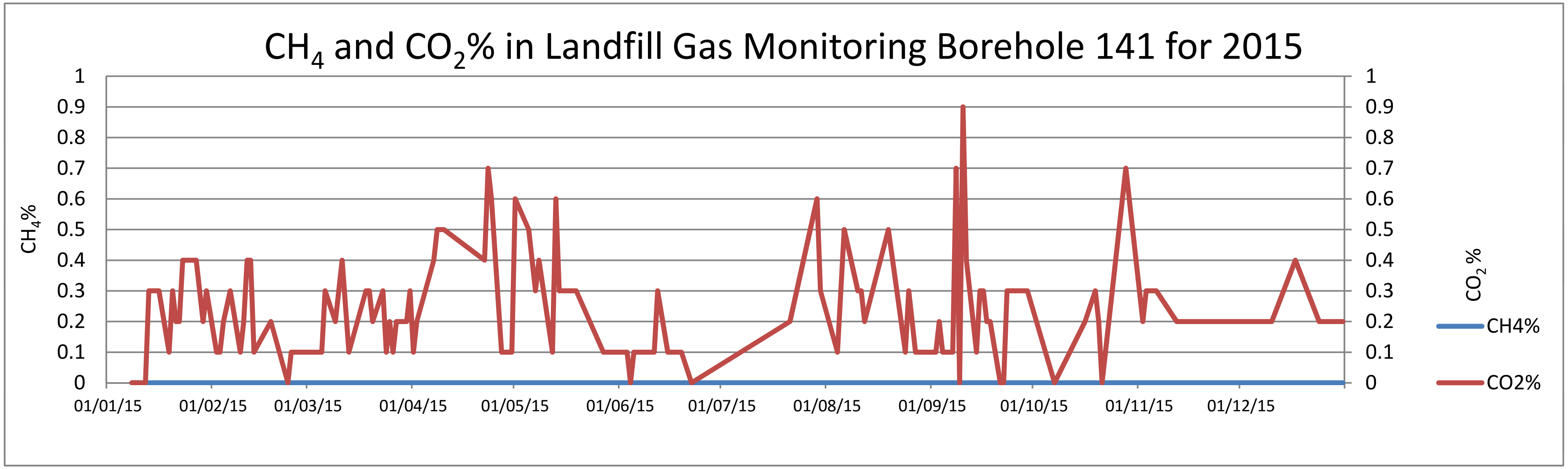
CH4 and CO2% in Landfill Gas Monitoring Borehole GH5 for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
9
8
7
6
5
4
3
2
1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
CH4%
CO2%


CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole 137 for 2015
CH$_4$%
CO$_2$%
14
12
10
8
6
4
2
0
12
10
8
6
4
2
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
01/12/15
CH4%
CO2%

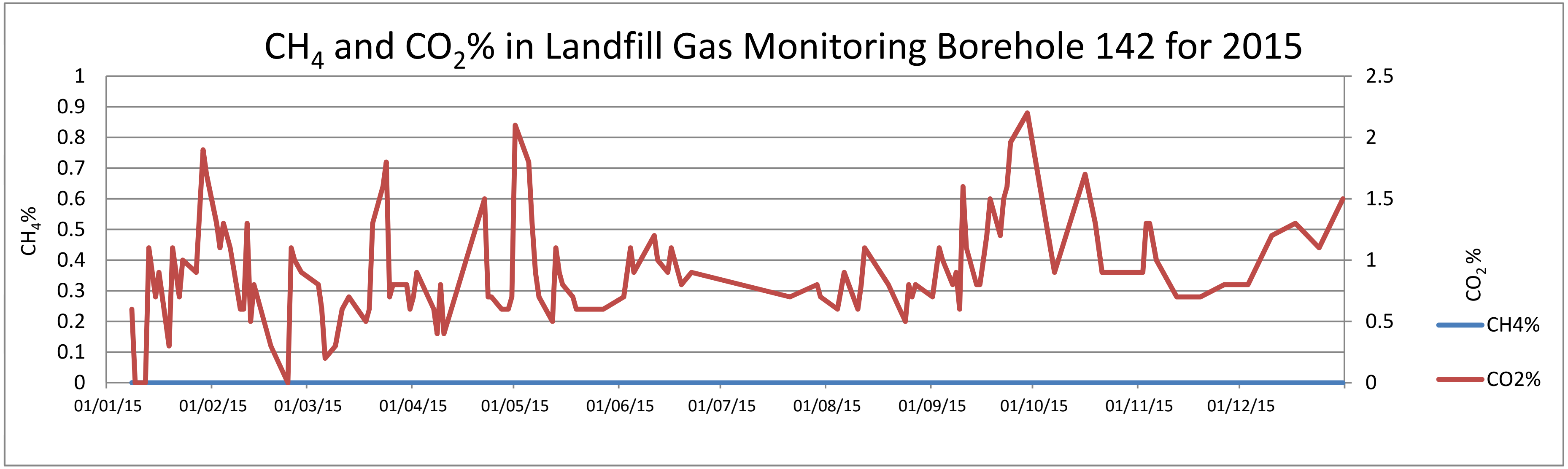

CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole 138 for 2015
CH$_4$%
CO$_2$%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
01/12/15
CH4%
CO2%


CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole 139 for 2015
CH$_4$%
CO$_2$ %
CH4%
CO2%
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
01/12/15

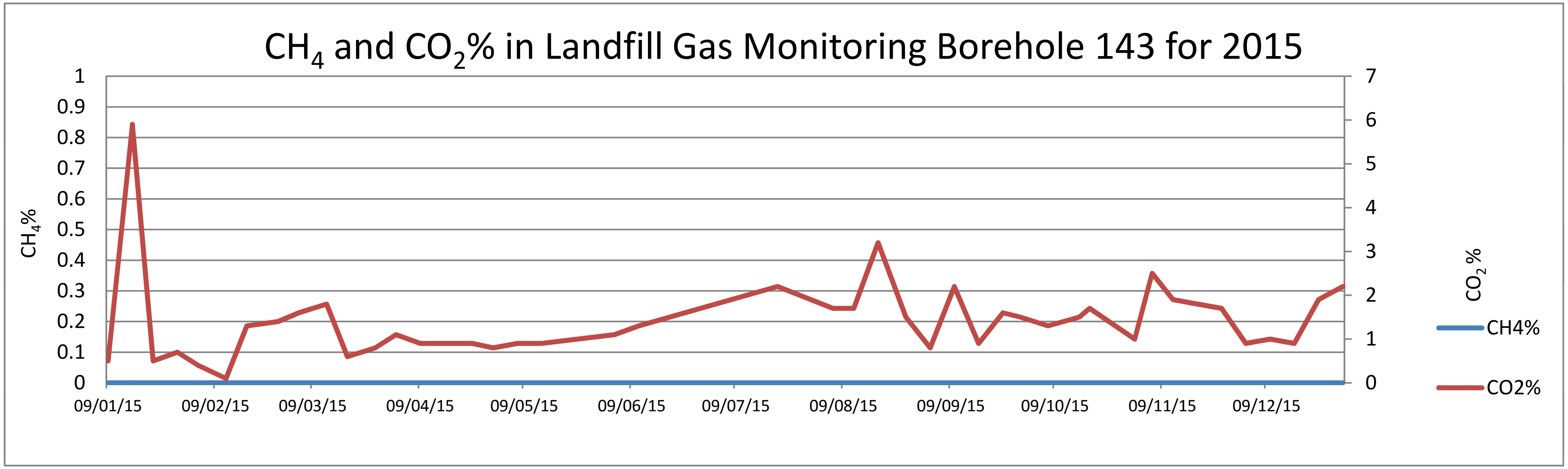

CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole 140 for 2015
CH$_4$%
CO$_2$ %
CH4%
CO2%
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
01/12/15

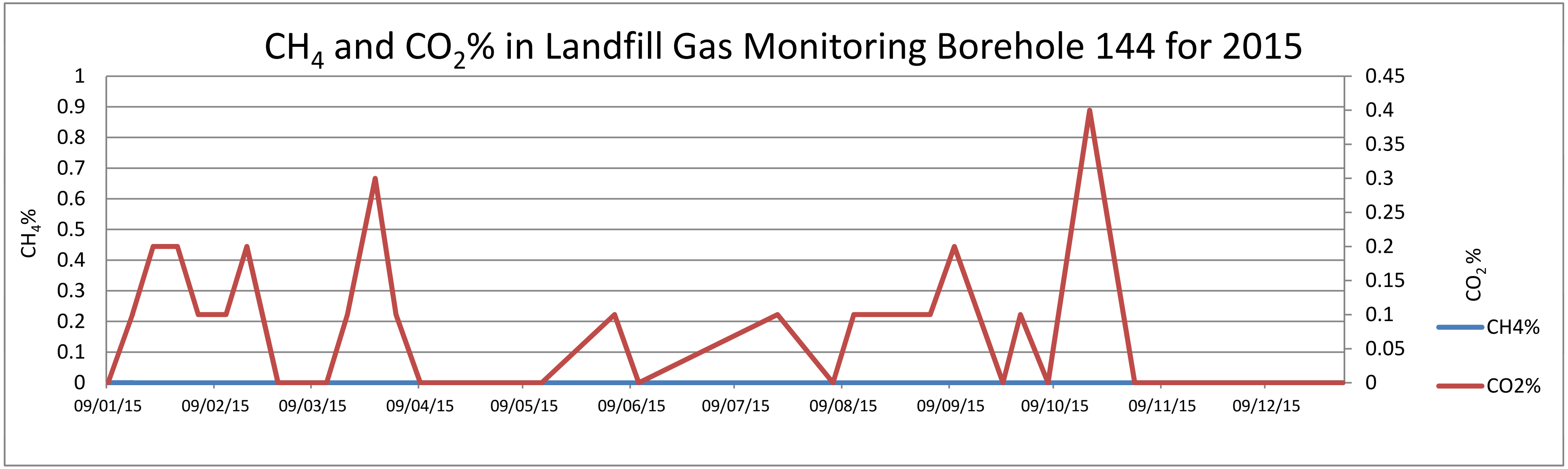


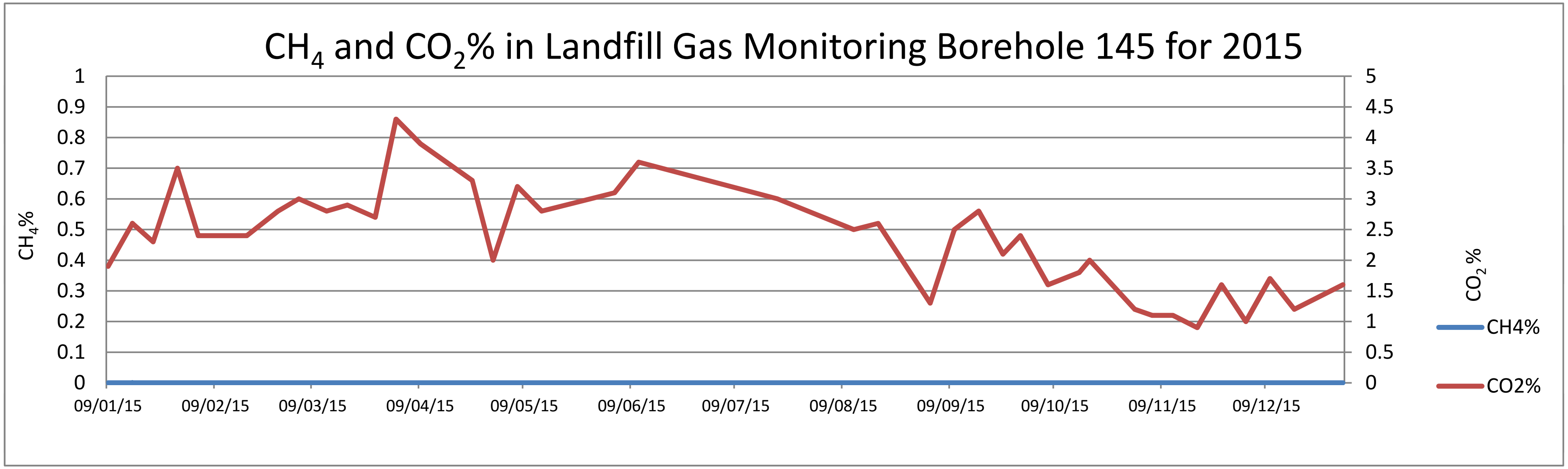
CH4 and CO2% in Landfill Gas Monitoring Borehole 141 for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
01/12/15
CH4%
CO2%

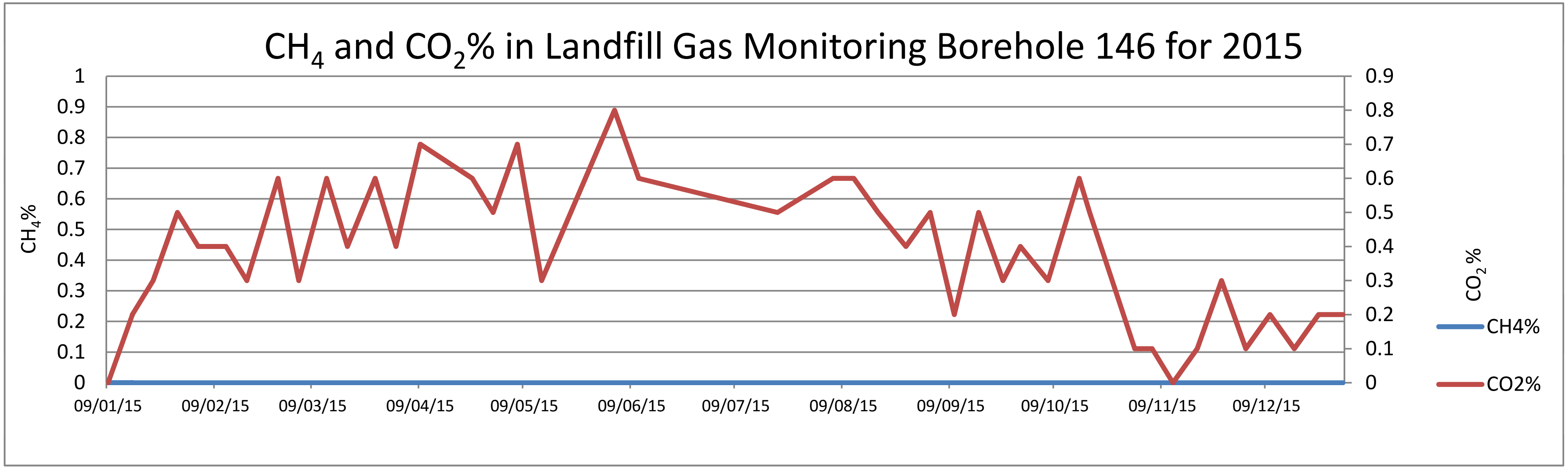


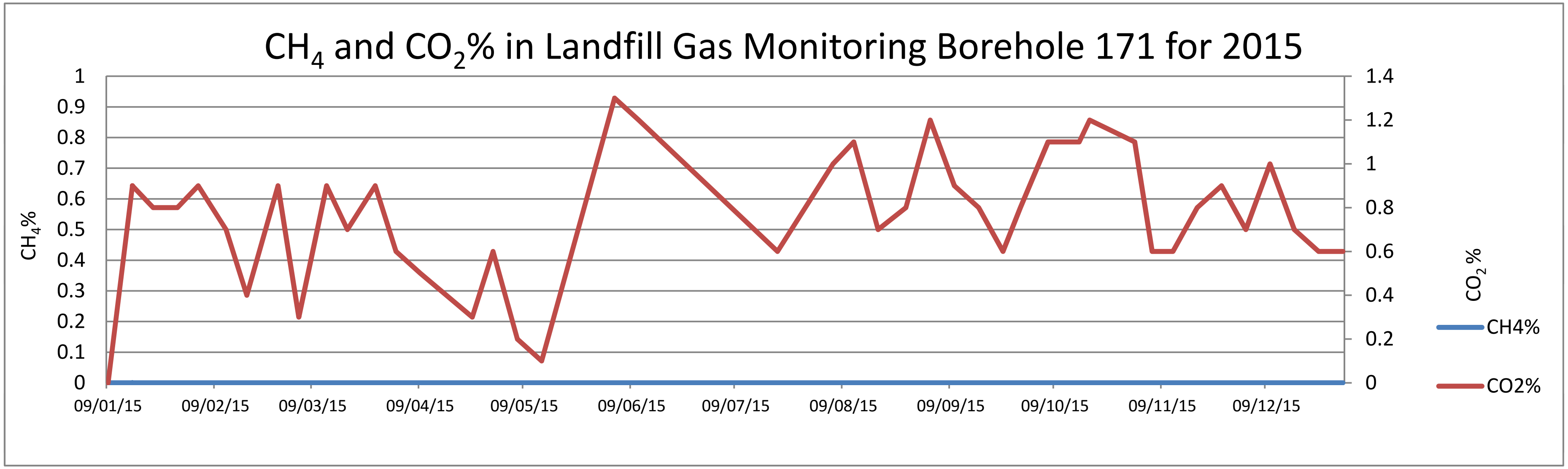
CH4 and CO2% in Landfill Gas Monitoring Borehole 142 for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2.5
2
1.5
1
0.5
0
01/01/15
01/02/15
01/03/15
01/04/15
01/05/15
01/06/15
01/07/15
01/08/15
01/09/15
01/10/15
01/11/15
01/12/15
CH4%
CO2%


CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole 143 for 2015
CH$_4$%
CO$_2$%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
7
6
5
4
3
2
1
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4%
CO2%

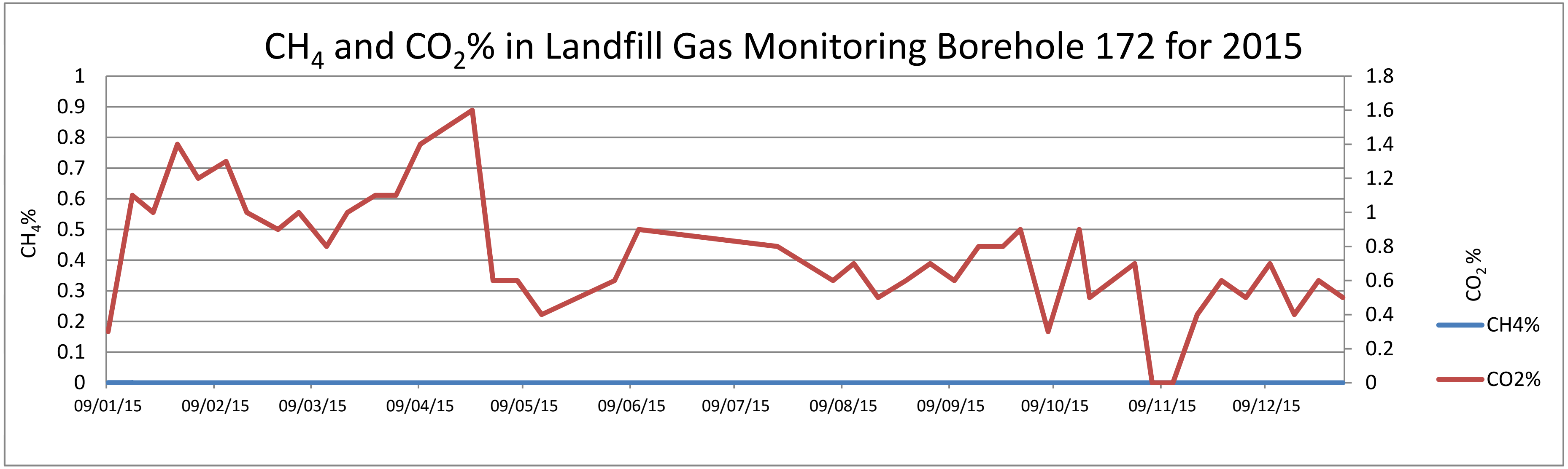

CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole 144 for 2015
CH$_4$%
CO$_2$%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4%
CO2%


CH4 and CO2% in Landfill Gas Monitoring Borehole 145 for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4%
CO2%

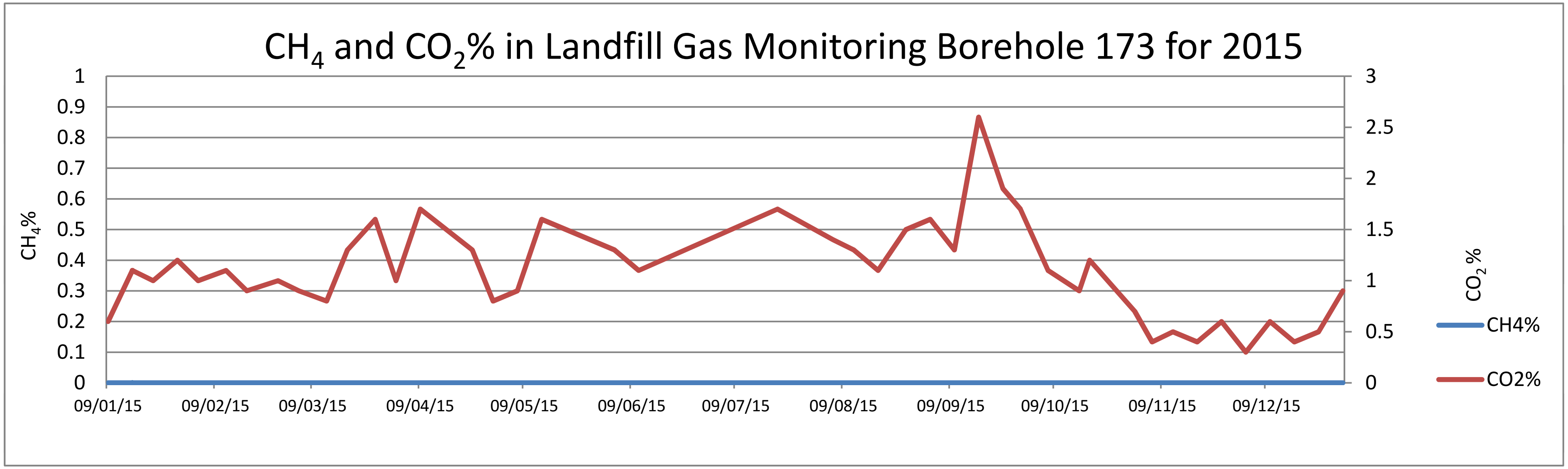

CH4 and CO2% in Landfill Gas Monitoring Borehole 146 for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4%
CO2%



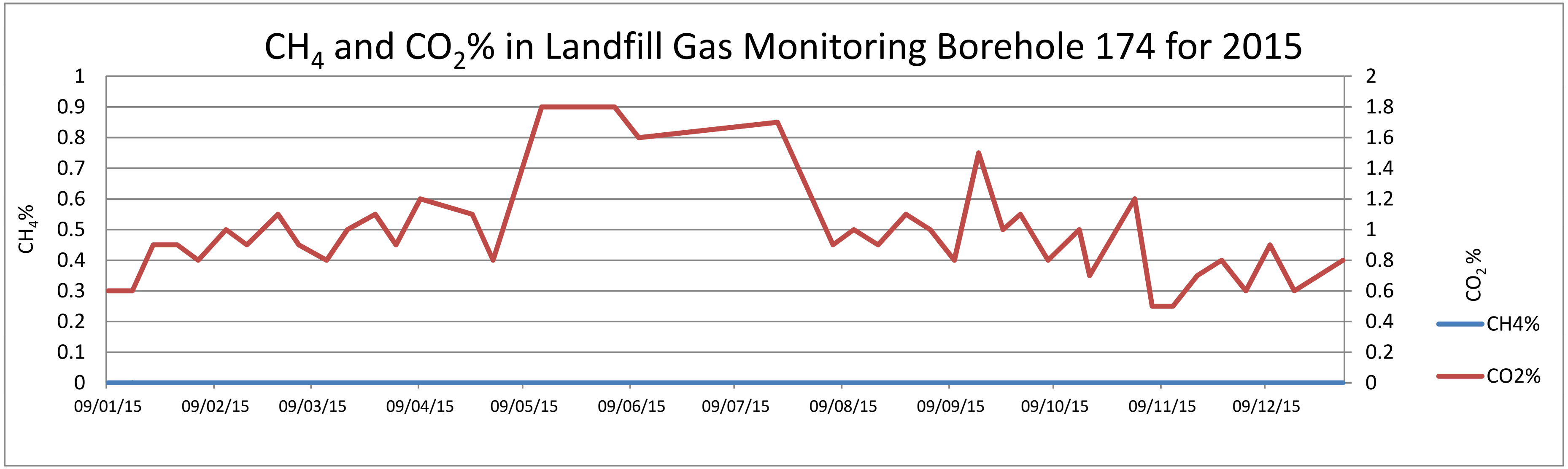
CH4 and CO2% in Landfill Gas Monitoring Borehole 171 for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1.4
1.2
1
0.8
0.6
0.4
0.2
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4%
CO2%



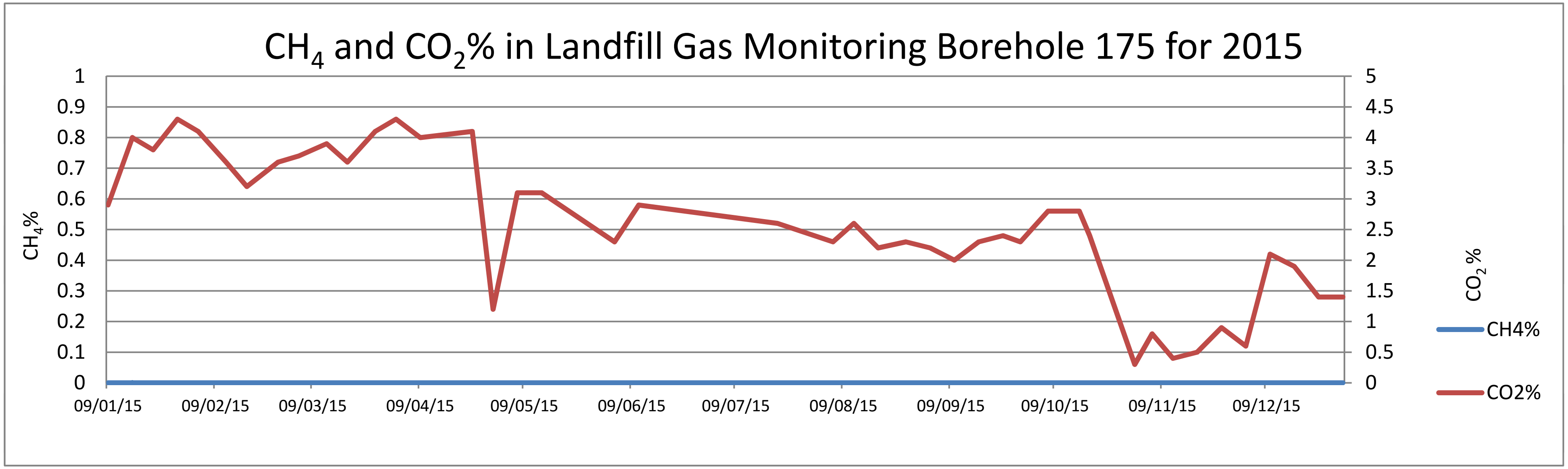
CH4 and CO2% in Landfill Gas Monitoring Borehole 172 for 2015
CH4%
CO2%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4%
CO2%



CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole 173 for 2015
CH$_4$%
CO$_2$%
CH4%
CO2%
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15



CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole 174 for 2015
CH$_4$%
CO$_2$%
CH4%
CO2%
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15



CH$_4$ and CO$_2$% in Landfill Gas Monitoring Borehole 175 for 2015
CH$_4$%
CO$_2$%
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
09/01/15
09/02/15
09/03/15
09/04/15
09/05/15
09/06/15
09/07/15
09/08/15
09/09/15
09/10/15
09/11/15
09/12/15
CH4%
CO2%

OverBurden Wells
Location: Landfill
Parameters: all data in mg/l unless stated otherwise

Well No. OB1										
DATE	**pH.**	**Temp.**	**Cond**	**NH_4**	**NH_4 (as N)**	**Vis/Od**	**Cl**	**O2**	**TOC**	**TON**
			uS/cm							
11/03/15	7.89	12.9.C	558	0.05	0.0389	POOR	24	6.7	1	4
08/09/15	7.95	15.5.C	497	0.04	0.03112	GOOD	25	4.2	2	3
01/12/15	7.75	15.C	528	0.05	0.0389	POOR	30	4.1	1	4

Well No. OB2										
DATE	**pH.**	**Temp.**	**Cond**	**NH_4**	**NH_4 (as N)**	**Vis/Od**	**Cl**	**O2**	**TOC**	**TON**
			uS/cm							
11/03/15	7.57	12.5.C	570	0.2	0.1556	POOR	25	4.7	3	3
08/09/15	8.22	12.8.C	572	0.12	0.09336	GOOD	25	2.4	5	2
01/12/15	7.87	11.4.C	610	0.11	0.08558	POOR	22	1.9	5	1

Well No. OB3										
DATE	**pH**	**Temp.**	**Cond**	**NH_4**	**NH_4 (as N)**	**Vis/Od**	**Cl**	**O2**	**TOC**	**TON**
			uS/cm							
11/03/15	7.42	12.7.C	4,230	280	217.84	POOR	404	3.2	66	4
08/09/15	8.09	13.2.C	4,300	350	272.3	FAIR	312	1.6	58	3
01/12/15	7.25	12.C	5,000	320	248.96	POOR	330	3	84	5

Well No. OB7										
DATE	**pH**	**Temp**	**Cond**	**NH_4**	**NH_4 (as N)**	**Vis/Od**	**Cl**	**O2**	**TOC**	**TON**
			uS/cm							
11/03/15	6.61	11.7.C	1,350	80	62.24	POOR	21	2	30	3
08/09/15	7.42	12.C	1,100	47	36.566	FAIR	85	1.4	19	2
01/12/15	7.32	11.5.C	1,227	50	38.9	POOR	57	3.5	28	4

OverBurden Wells
Location: Landfill
Parameters: all data in mg/l unless stated otherwise

	Frequency	Method	Range	Sample	**OB1**		**OB2**		**OB3**		**OB7**
Vis/Odour	q			Grab	POOR		POOR		POOR		POOR
Amonium	m	ISE	0.01-10		0.11		0.35		230		36
Chloride	q	ArgentSM	1-100		35.2		31.2		354		116
D.O.	q	Meter	0.1-20		5.2		2.3		3		2.7
Cond.us/cm	m	Meter	1-200000		512us		512us		4,000us		1,115
pH	m	Meter	1.0-14.0		7.9		7.9		7.9		7.1
Temp	m	Meter	1.0-100		12.1.C		10.5.C		12.7.C		10.6.C
Boron	a	GFAA	0.01-1.0		0.04		0.02		1		0.06
Cadmium	a	GFAA	0.001-0.5		<0.002		<0.002		<0.002		<0.002
Calcium	a	Titre SM	1-100		88		90		72		64
Chromium	a	GFAA	0.001-0.2		<0.002		<0.002		0.002		<0.002
Copper	a	AA	0.001-1.0		0.004		0.002		0.007		0.01
Cyanide	a	ISE	0.005-1.0		<0.001		<0.001		<0.001		0.02
Fluoride	a	ISE	0.5-1.0		0.14		0.09		0.13		0.07

OverBurden Wells
Location: Landfill
Parameters: all data in mg/l unless stated otherwise

	Frequency	Method	Range	Sample	**OB1**		**OB2**		**OB3**		**OB7**
Iron	a	AA	0.01-5.0		0.01		0.33		0.4		10
Lead	a	GFAA	0.001-0.1		<0.002		<0.002		<0.002		<0.002
Magnesium	a	AA	0.01-5.0		4.4		6.4		65		14
Manganese	a	AA	0.01-3.0		0.004		0.009		1.4		1.1
Mercury	a	Hydride-AA			<0.00002		<0.00002		<0.00002		<0.00002
Potassium	q	AA	0.1-5.0		2.3		1.5		150		29
Sulphate	a	Turb. SM	1.0-30		42		<5		6		<5
Sodium	q	AA	0.1-3.0		70		80		350		170
Tot Phos	a	Stann.SM	0.05-0.25		0.09		0.35		0.1		0.1
T.O.N.	q	SM			5		1		6		2
T.O.C.	q	SM	1-100		1		3		53		20
Res/Evap	a	SM	1.0-5000		1,286		476		1,952		904
Zinc	a	AA	0.01-5.0		0.003		0.003		0.007		0.02
Alkalinity	a	SM	1-1000		180		220		1,400		450
Nickel	a	GFFA	0.002-1		0.06		0.06		0.09		0.07

Overburden Wells - Depth 2015

	Jan	Feb	Mar	Apr	May	June	July	August	September	October	November	December
BOREHOLE	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)
OB1	1.48	1.49	1.47	1.51	1.52	1.05	1.52	1.51	1.6	1.5	1.41	1.4
OB2	0.89	0.96	0.43	1.01	0.92	0.7	1.1	0.89	1.05	0.53	Flooded	0.79
OB3	2.98	1.47	0.97	1.45	1.19	1.22	1.42	1.46	1.46	1.24	1.06	0.92
OB7	Flooded	0.72	0.59	0.67	0.66	0.72	0.93	0.78	0.83	Flooded	0.66	0.42
BR1	1.47	1.53	1.48	1.55	1.59	1.45	1.51	1.56	1.62	1.54	1.39	1.39
BR2	0.49	0.64	Flooded	0.76	0.42	0.4	0.9	0.61	0.74	Flooded	Flooded	Flooded
BR3	2.76	1.6	0.95	1.61	1.29	1.27	1.57	1.57	1.52	1.27	1.1	1.28
BR7	1.51	1.68	1.51	1.69	1.57	1.55	0.83	1.71	1.7	1.61	Flooded	1.51
BH1	gone	gone	gone	gone	gone	gone	gone	gone	gone	gone	gone	gone
BH12	gone	gone	gone	gone	gone	gone	gone	gone	gone	gone	gone	gone
KC8	4.16	4.44	4.25	4.46	4.29	4.31	4.71	4.59	4.64	4.44	4.9	4.24

Groundwater: NW Wells
Location: Landfill
Parameters: All data in mg/l unless stated otherwise

Well No.	NW1			
DATE	**pH.**	**Cond uS/cm**	**NH4.**	**TOC.**
27/01/2015	7.31	972	5	26
17/02/2015	7.29	836	1.3	21
11/03/2015	7.08	1,005	22	13
19/05/2015	7.11	633	2	12
09/06/2015	7.3	880	7	33
15/07/2015	6.73	967	28	45
25/08/2015	6.61	1,033	30	54
08/09/2015	7.08	850	15	50
22/10/2015	6.75	900	24	45
10/11/2015	6.66	920	28	37
01/12/2015	7.91	1,050	22	48

Well No.	NW3			
DATE	**pH.**	**Cond uS/cm**	**NH4.**	**TOC.**
Trigger levels	5.6-9.0	1500	60	100
27/01/2015	6.5	745	47	12
17/02/2015	6.6	527	13	14
11/03/2015	6.32	745	50	14
19/05/2015	6.82	647	43	13
09/06/2015	6.56	558	40	12
15/07/2015	6.45	591	36	12
25/08/2015	6.68	940	50	13
08/09/2015	6.21	630	32	9
22/10/2015	6.44	652	35	5
10/11/2015	6.5	700	42	12
01/12/2015	6.71	835	32	14

Well No.	NW1			
DATE	**pH.**	**Cond uS/cm**	**NH4.**	**TOC.**
27/01/2015	6.79	750	30	8
17/02/2015	7.17	590	35	17
11/03/2015	6.78	830	55	9
19/05/2015	7.45	624	34	10
09/06/2015	7.18	600	28	10
15/07/2015	7.26	622	30	11
25/08/2015	7.05	755	50	5
08/09/2015	7.23	510	1	5
22/10/2015	7.29	500	33	9
10/11/2015	7.33	633	31	5
01/12/2015	7.52	860	27	7

Well No.	NW4			
DATE.	**pH**	**Cond uS/cm**	**NH4.**	**TOC.**
27/01/2015	6.75	797	31	17
17/02/2015	6.77	720	26	16
11/03/2015	6.57	828	43	18
19/05/2015	6.69	750	41	17
09/06/2015	6.52	585	29	17
15/07/2015	6.49	640	38	18
25/08/2015	6.41	660	42	17
08/09/2015	6.44	570	70	16
22/10/2015	6.38	627	32	16
10/11/2015	6.62	725	27	14
01/12/2015	6.85	737	21	18

Well No.	NW5			
DATE	pH.	Cond uS/cm	NH4.	TOC.
27/01/2015	7.32	563	8	22
17/02/2015	7.45	580	4	17
11/03/2015	6.89	553	5	15
19/05/2015	7.95	533	0.11	14
09/06/2015	8.22	515	3	14
15/07/2015	7.63	532	0.15	15
25/08/2015	6.61	557	0.01	15
08/09/2015	8.19	550	1.6	17
22/10/2015	6.87	581	0.5	18
10/11/2015	7.11	570	0.05	17
01/12/2015	7.11	588	0.03	19

Well No.	NW7			
DATE.	pH.	Cond uS/cm	NH4.	TOC.
Trigger levels	5.6-9.0	6000	500	200
27/01/2015	7.37	290	0.5	18
17/02/2015	8	1,113	0.5	2
11/03/2015	7.11	651	7	9
19/05/2015	7.76	432	0.2	5
09/06/2015	7.9	314	5	3
15/07/2015	7.66	292	0.08	2
25/08/2015	6.97	340	0.03	2
08/09/2015	7.84	292	0.11	2
22/10/2015	7.28	476	0.11	1
10/11/2015	7.5	1,245	31	15
01/12/2015	7.24	324	0.17	2

Well No.	NW6			
DATE	pH.	Cond uS/cm	NH4.	TOC.
27/01/2015	7.23	1,320	37	24
17/02/2015	7.54	1,126	4	18
11/03/2015	7.36	890	1	15
19/05/2015	7.41	1,100	23	16
09/06/2015	7.28	1,270	15	17
15/07/2015	7.17	1,444	37	18
25/08/2015	7.09	1,409	54	17
08/09/2015	7.29	1,250	24	13
22/10/2015	7.22	1,495	43	18
10/11/2015	7.35	1,380	40	16
01/12/2015	6.93	1,112	32	16

Well No.	NW8			
DATE	pH.	Cond uS/cm	NH4	TOC.
27/01/2015	6.17	378	17	7
17/02/2015	6.18	314	11	10
11/03/2015	6.19	450	25	7
19/05/2015	6.18	380	16	9
09/06/2015	6.22	296	12	6
15/07/2015	6.16	364	20	6
25/08/2015	6.19	435	25	6
08/09/2015	5.84	323	14	5
22/10/2015	6.17	372	19	5
10/11/2015	6.14	340	21	4
01/12/2015	6.57	475	12	6

Well No.	NW9			
DATE	**pH**	**Cond uS/cm**	**NH4**	**TOC**
Trigger levels	5.6-9.0	1500	5	35
27/01/2015	7.12	1,320	22	16
17/02/2015	6.98	1,420	23	11
11/03/2015	7.08	1,500	31	11
19/05/2015	7.05	1,300	25	10
09/06/2015	7.25	1,189	20	7
15/07/2015	7.14	1,478	23	9
25/08/2015	7.01	1,450	25	7
08/09/2015	7.27	1,362	21	6
22/10/2015	6.87	1,350	20	6
10/11/2015	7.39	1,318	20	6
01/12/2015	6.75	1,500	22	10

Groundwater: NW Wells
Location: Landfill
Parameters: All data in mg/l unless stated otherwise

	Frequecy	Method	Range	**NW1**	**NW2**	**NW3**	**NW4**	**NW5**	**NW6**	**NW7**	**NW8**	**NW9**
Vis/Odour	q			POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	FAIR
Amonium	m	ISE	0.01-10	0.11	15	22	1	1.1	1.3	0.12	5	15
Chloride	q	Argent SM	1-100	85	25	78	49	28	68	28	42	177
D.O.	q	Meter	0.1-20	2.3	<1.0	1.5	1.4	1.3	3.3	2.8	1.2	2
Cond.us/cm	m	Meter	1-200000	980us	694us	732us	643us	500us	921us	300us	370us	1,386us
pH	m	Meter	1.0-11	7.5	7.4	6.6	7.1	7.4	7.5	7.5	6.3	7.2
Temp	m	Meter	1.0-50	12.C	11.2.C	10.7.C	11.3.C	12.C	10.1.C	12.C	11.9.C	10.C
Boron	a	GFAA	0.01-1.0	0.2	0.06	<0.02	0.07	0.03	0.1	<0.02	<0.02	0.1
Cadmium	a	GFAA	0.001-0.5	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Calcium	a	Titre SM	1.0-100	100	56	32	56	68	112	32	24	144
Copper	a	AA	0.001-1.0	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.02	0.02
Cyanide	a	ISE	0.01-1.0	<0.001	<0.001	<0.001	0.01	<0.001	<0.001	<0.001	0.5	<0.001
Fluoride	a	ISE	0.5-1.0	0.12	0.1	0.05	0.06	0.07	0.09	0.09	0.03	0.05

	Frequency	Method	Range	**NW1**	**NW2**	**NW3**	**NW4**	**NW5**	**NW6**	**NW7**	**NW8**	**NW9**
Iron	q	AA	0.01-5.0	0.32	1.2	4.5	12.5	0.35	0.32	0.56	6.6	0.05
Lead	a	GFFA	0.001-0.1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Magnesium	a	AA	0.01-5.0	14	14	6	8	10	13	7	2	27
Manganese	a	AA	0.01-3.0	2.6	0.8	1	2	0.16	3.9	0.25	0.8	2.6
Mercury	a	GFFA		<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Potassium	q	AA	0.1-5.0	32	2	15	15	6	26	2	1	19
Sulphate	a	Turb SM	1.0-30	<5	40	<5	<5	<5	48	<5	<5	58
Sodium	q	AA	0.1-3.0	125	100	120	115	110	140	125	125	180
TotPhos	a	Stann SM	0.05-0.25	0.04	0.45	0.1	0.24	0.03	0.02	0.15	0.07	0.07
T.O.N.	q	SM		10	4	1	1	4	2	1	2	2
Res/Evap	a	SM	1.0-5000	1,144	387	818	912	463	676	412	9,372	196
Zinc	a	AA	0.01-5.0	<0.002	<0.002	0.003	0.004	0.007	0.007	0.007	0.01	0.007
T.O.C.	q	HACH	15-150	15	6	11	15	10	11	5	8	4
Alkalinity	a	SM	1-1000	340	300	260	176	220	380	110	120	440
Ni	a	GFFA	.002-1	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.02
Cr	a	GFFA	.002-1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

NW Wells - Depth 2015

Jan-15

Date	LOCATION	WELL HEIGHT (m)	Depth to Ground water (m)	Water Height in Well (m)
27/01/2015	NW1	5.38	1.96	3.42
27/01/2015	NW2	5.4	1.36	4.04
27/01/2015	NW3	4.18	1.11	3.07
27/01/2015	NW4	4.6	1.31	3.29
27/01/2015	NW5	15	2.78	12.22
27/01/2015	NW6	3.79	0.71	3.08
27/01/2015	NW7	4.26	1.87	2.39
27/01/2015	NW8	4.2	1.78	2.42
27/01/2015	NW9	3.5	0	3.5

Feb-15

Date	LOCATION	WELL HEIGHT (m)	Depth to Ground water (m)	Water Height in Well (m)
17/02/2015	NW1	5.38	2.39	2.99
17/02/2015	NW2	5.4	1.7	3.7
17/02/2015	NW3	4.18	0.99	3.19
17/02/2015	NW4	4.6	1.6	3
17/02/2015	NW5	15	3.03	11.97
17/02/2015	NW6	3.79	0.85	2.94
17/02/2015	NW7	4.26	1.47	2.79
17/02/2015	NW8	4.2	1.31	2.89
17/02/2015	NW9	3.5	0	3.5

Mar-15

Date	LOCATION	WELL HEIGHT (m)	Depth to Ground water (m)	Water Height in Well (m)
11/03/2015	NW1	5.38	1.49	3.89
11/03/2015	NW2	5.4	1.03	4.37
11/03/2015	NW3	4.18	0.78	3.4
11/03/2015	NW4	4.6	0.82	3.78
11/03/2015	NW5	15	2.31	12.69
11/03/2015	NW6	3.79	0	3.79
11/03/2015	NW7	4.26	0.88	3.38
11/03/2015	NW8	4.2	1.18	3.02
11/03/2015	NW9	3.5	0	3.5

Apr-15

Date	LOCATION	WELL HEIGHT (m)	Depth to Ground water (m)	Water Height in Well (m)
07/04/2015	NW1	5.38	1.95	3.43
07/04/2015	NW2	5.4	1.72	3.68
07/04/2015	NW3	4.18	1.58	2.6
07/04/2015	NW4	4.6	1.45	3.15
07/04/2015	NW5	15	3.08	11.92
07/04/2015	NW6	3.79	0.82	2.97
07/04/2015	NW7	4.26	1.3	2.96
07/04/2015	NW8	4.2	1.3	2.9
07/04/2015	NW9	3.5	0.39	3.11

NW Wells - Depth 2015

May-15

Date	LOCATION	WELL HEIGHT (m)	Depth to Ground water (m)	Water Height in Well (m)
19/05/2015	NW1	5.38	1.12	4.26
19/05/2015	NW2	5.4	1.37	4.03
19/05/2015	NW3	4.18	0.74	3.44
19/05/2015	NW4	4.6	1.25	3.35
19/05/2015	NW5	15	2.94	12.06
19/05/2015	NW6	3.79	0	3.79
19/05/2015	NW7	4.26	1.09	3.17
19/05/2015	NW8	4.2	1.04	3.16
19/05/2015	NW9	3.5	0.42	3.08

Jun-15

Date	LOCATION	WELL HEIGHT (m)	Depth to Ground water (m)	Water Height in Well (m)
09/06/2015	NW1	5.38	1.69	3.69
09/06/2015	NW2	5.4	1.95	3.45
09/06/2015	NW3	4.18	0.98	3.2
09/06/2015	NW4	4.6	1.25	3.35
09/06/2015	NW5	15	1.22	13.78
09/06/2015	NW6	3.79	0.81	2.98
09/06/2015	NW7	4.26	1.12	3.14
09/06/2015	NW8	4.2	0.75	3.45
09/06/2015	NW9	3.5	0	3.5

Jul-15

Date	LOCATION	WELL HEIGHT (m)	Depth to Ground water (m)	Water Height in Well (m)
15/07/2015	NW1	5.38	1.97	3.41
15/07/2015	NW2	5.4	0.75	4.65
15/07/2015	NW3	4.18	0.95	3.23
15/07/2015	NW4	4.6	1.53	3.07
15/07/2015	NW5	15	3.14	11.86
15/07/2015	NW6	3.79	0	3.79
15/07/2015	NW7	4.26	1.37	2.89
15/07/2015	NW8	4.2	1.16	3.04
15/07/2015	NW9	3.5	0	3.5

Aug-15

Date	LOCATION	WELL HEIGHT (m)	Depth to Ground water (m)	Water Height in Well (m)
25/08/2015	NW1	5.38	1.72	3.66
25/08/2015	NW2	5.4	1.95	3.45
25/08/2015	NW3	4.18	0.89	3.29
25/08/2015	NW4	4.6	1.63	2.97
25/08/2015	NW5	15	4.23	10.77
25/08/2015	NW6	3.79	0.99	2.8
25/08/2015	NW7	4.26	0	4.26
25/08/2015	NW8	4.2	1.12	3.08
25/08/2015	NW9	3.5	1.47	2.03

NW Wells - Depth 2015

Sep-15

Date	LOCATION	WELL HEIGHT (m)	Depth to Ground water (m)	Water Height in Well (m)
08/09/2015	NW1	5.38	2.02	3.36
08/09/2015	NW2	5.4	1.85	3.55
08/09/2015	NW3	4.18	0.98	3.2
08/09/2015	NW4	4.6	2.03	2.57
08/09/2015	NW5	15	3.19	11.81
08/09/2015	NW6	3.79	0.83	2.96
08/09/2015	NW7	4.26	1.33	2.93
08/09/2015	NW8	4.2	1.21	2.99
08/09/2015	NW9	3.5	0	3.5

Oct-15

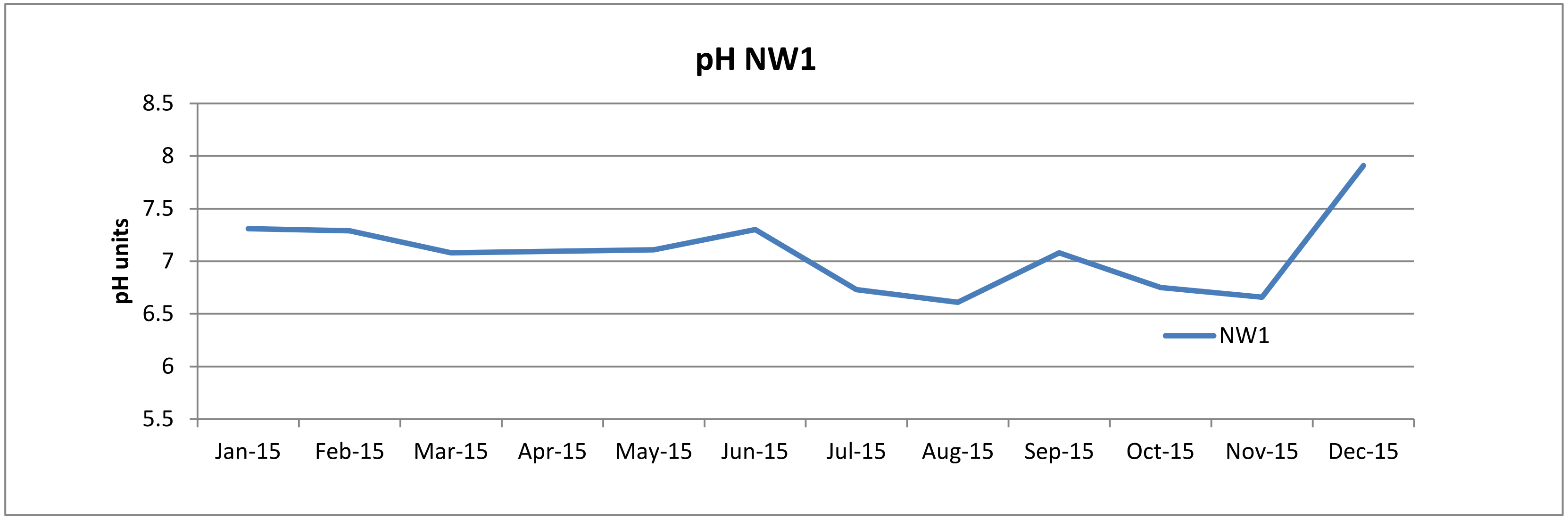
Date	LOCATION	WELL HEIGHT (m)	Depth to Ground water (m)	Water Height in Well (m)
27/10/2015	NW1	5.38	1.85	3.53
27/10/2015	NW2	5.4	2.27	3.13
27/10/2015	NW3	4.18	0.85	3.33
27/10/2015	NW4	4.6	1.39	3.21
27/10/2015	NW5	15	3.05	11.95
27/10/2015	NW6	3.79	0	3.79
27/10/2015	NW7	4.26	1.2	3.06
27/10/2015	NW8	4.2	1.01	3.19
27/10/2015	NW9	3.5	0	3.5

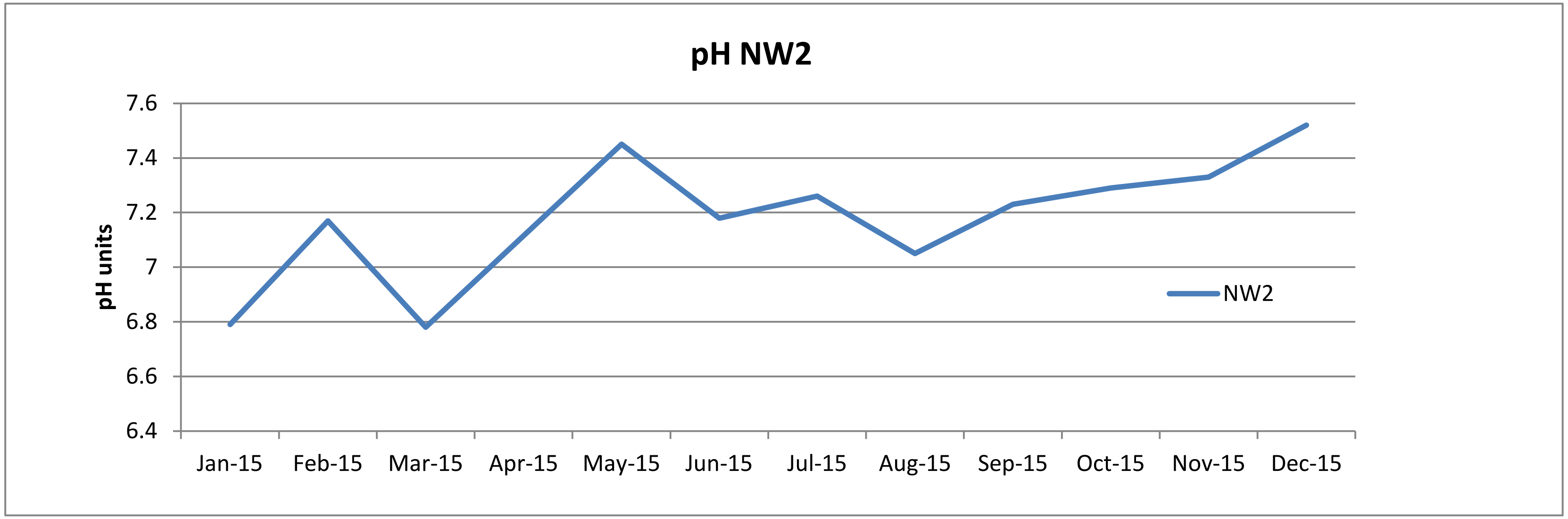
Nov-15

Date	LOCATION	WELL HEIGHT (m)	Depth to Ground water (m)	Water Height in Well (m)
10/11/2015	NW1	5.38	1.84	3.54
10/11/2015	NW2	5.4	0.94	4.46
10/11/2015	NW3	4.18	0.74	3.44
10/11/2015	NW4	4.6	0.82	3.78
10/11/2015	NW5	15	2.78	12.22
10/11/2015	NW6	3.79	0	3.79
10/11/2015	NW7	4.26	0.73	3.53
10/11/2015	NW8	4.2	1.07	3.13
10/11/2015	NW9	3.5	0	3.5

Dec-15

Date	LOCATION	WELL HEIGHT (m)	Depth to Ground water (m)	Water Height in Well (m)
01/12/2015	NW1	5.38	2.03	3.35
01/12/2015	NW2	5.4	1.48	3.92
01/12/2015	NW3	4.18	0.84	3.34
01/12/2015	NW4	4.6	1.24	3.36
01/12/2015	NW5	15	2.98	12.02
01/12/2015	NW6	3.79	0	3.79
01/12/2015	NW7	4.26	0.99	3.27
01/12/2015	NW8	4.2	1.06	3.14
01/12/2015	NW9	3.5	0	3.5


pH NW1
8.5
8
7.5
7
6.5
6
5.5
pH units
NW1
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15


pH NW2
7.6
7.4
7.2
7
6.8
6.6
6.4
pH units
NW2
Jan-15
Feb-15
Mar-15
Apr-15
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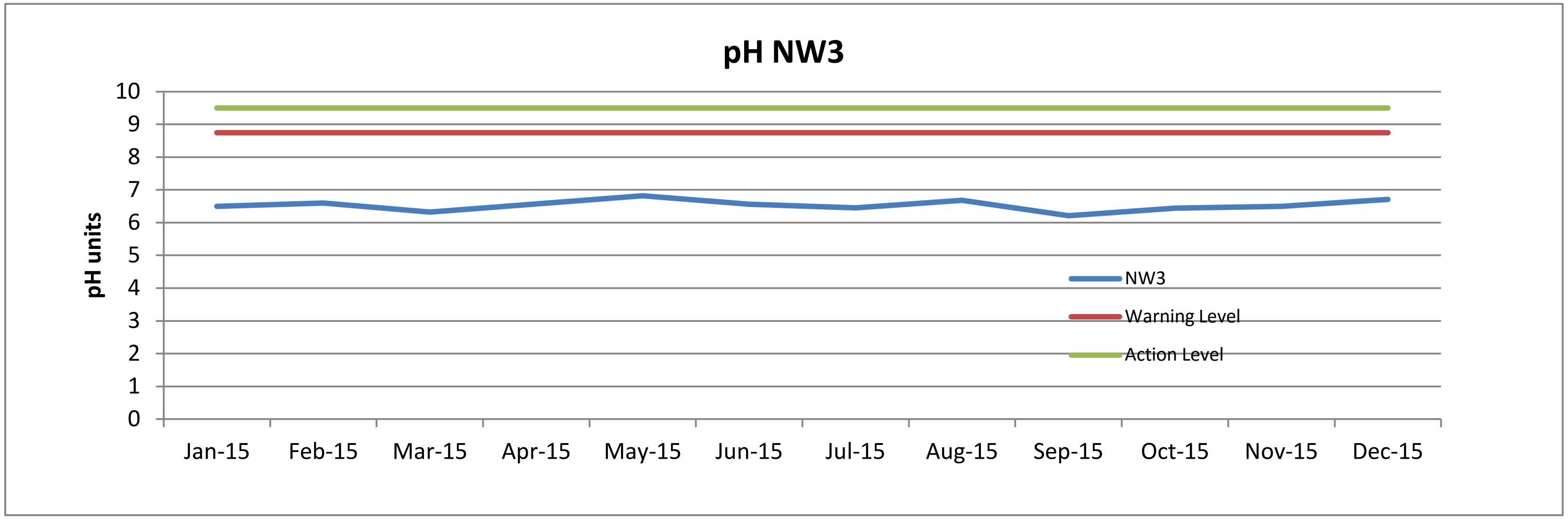
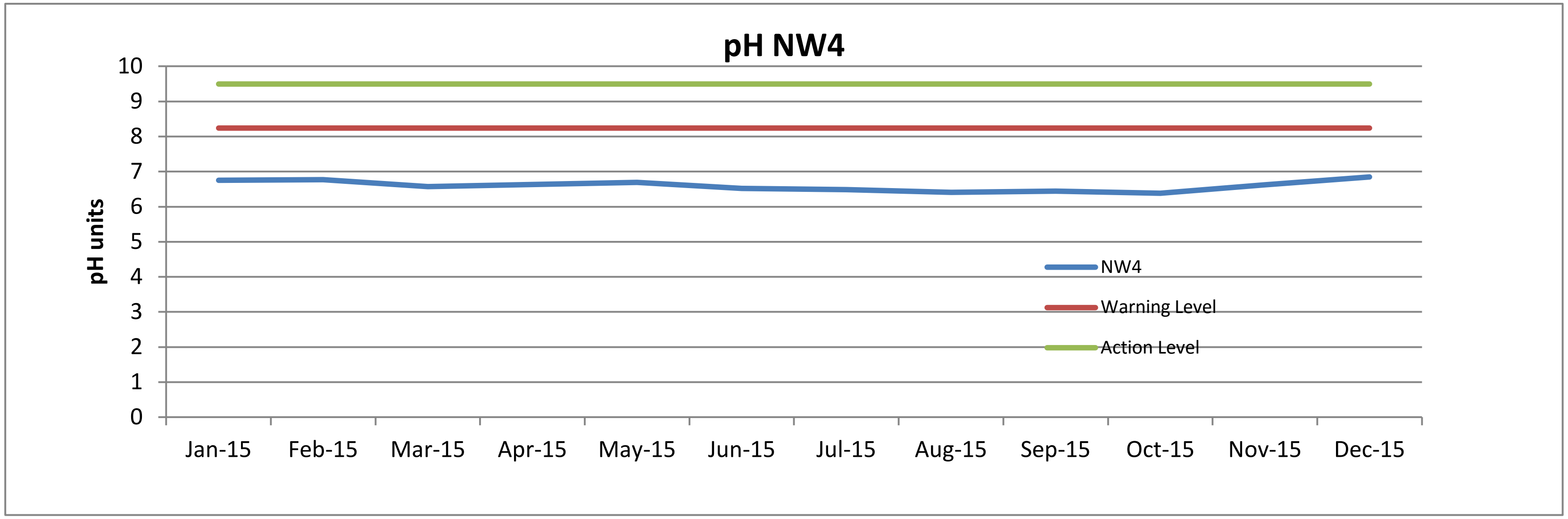
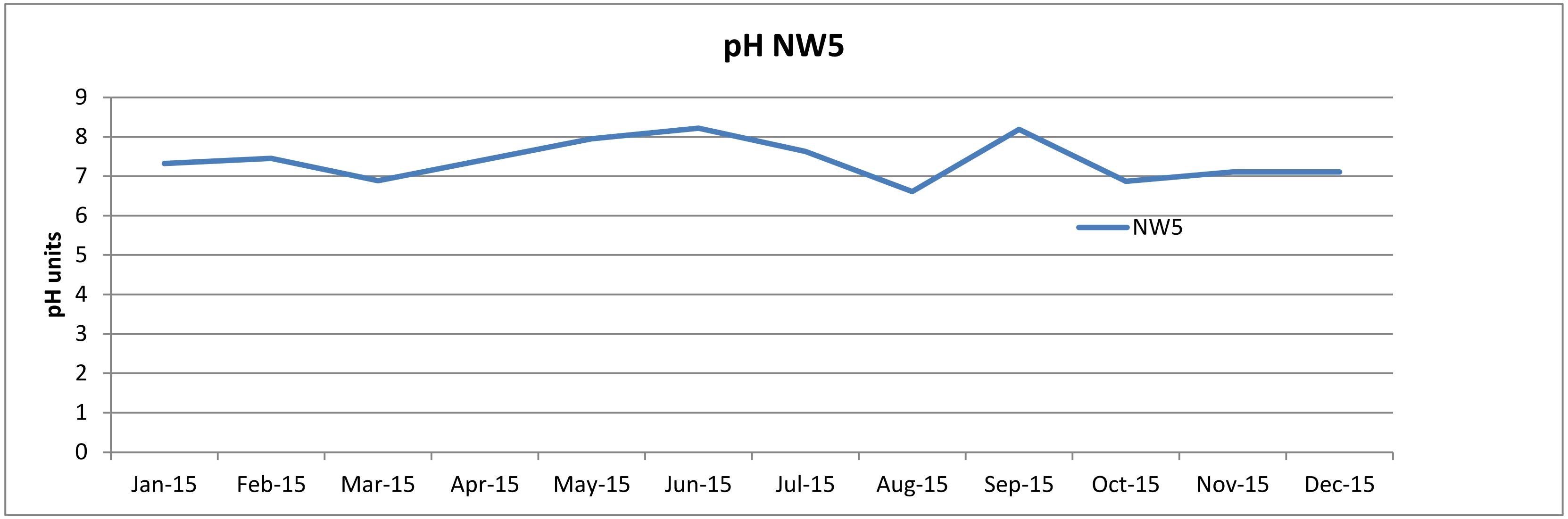
Oct-15
Nov-15
Dec-15


pH NW3
10
9
8
7
6
5
4
3
2
1
0
pH units
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
NW3
Warning Level
Action Level


pH NW4
10
9
8
7
6
5
4
3
2
1
0
pH units
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
NW4
Warning Level
Action Level


pH NW5
pH units
9
8
7
6
5
4
3
2
1
0
Jan-15
Feb-15
Mar-15
Apr-15
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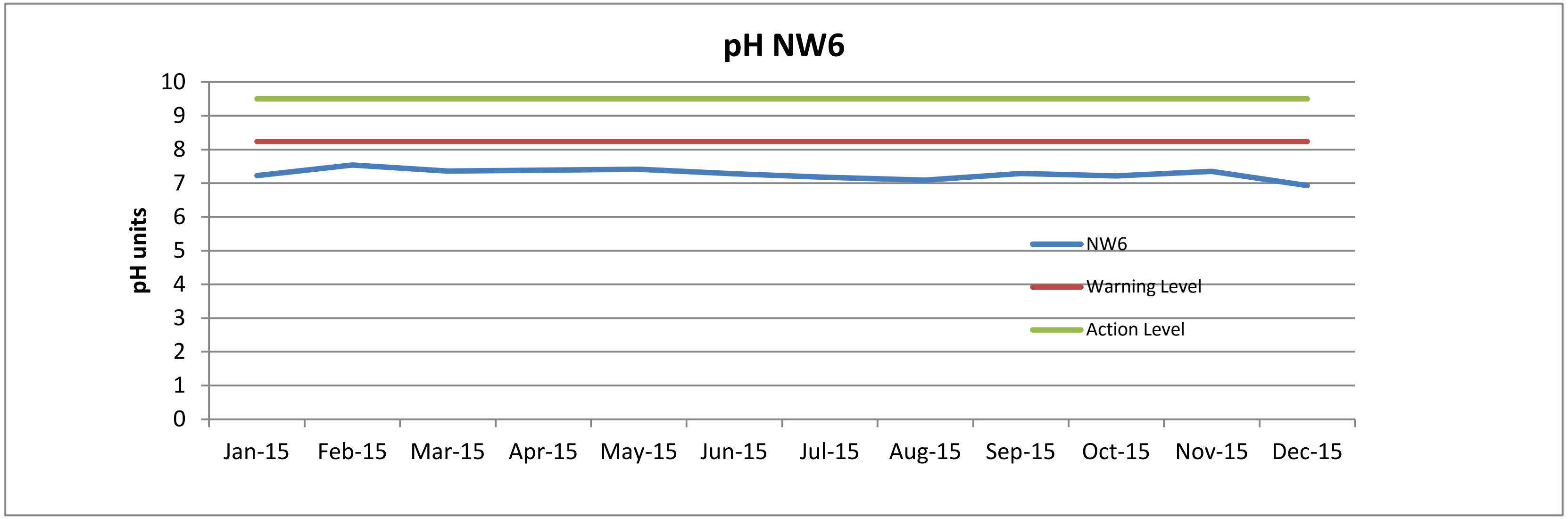
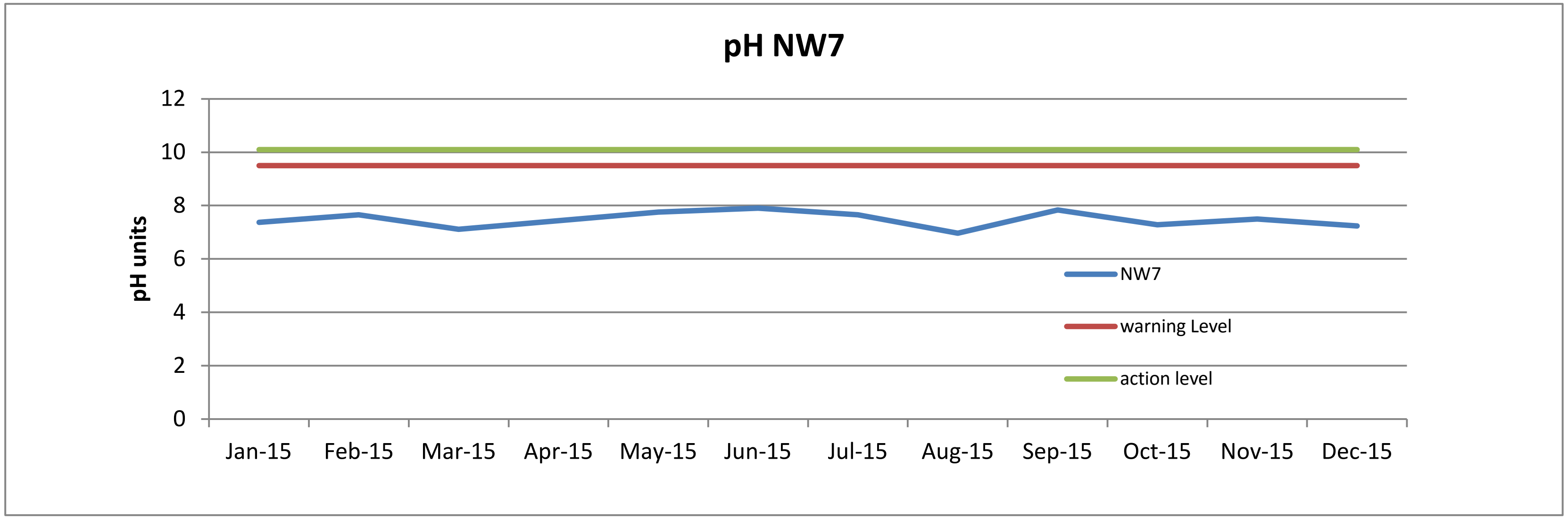
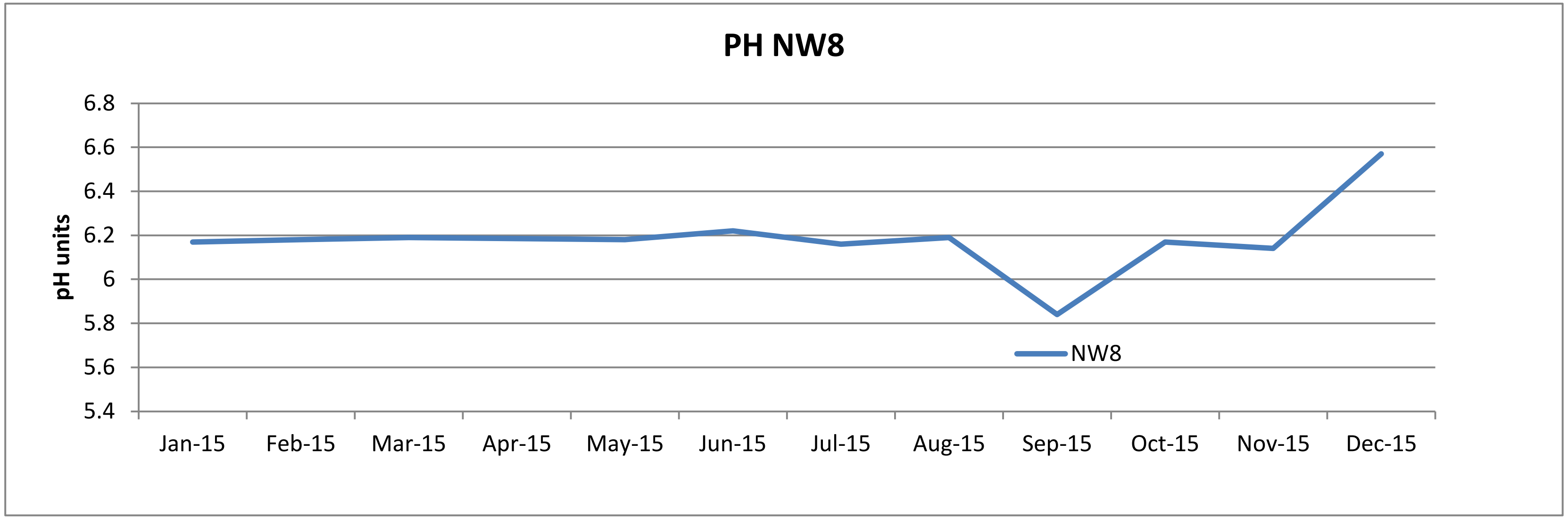
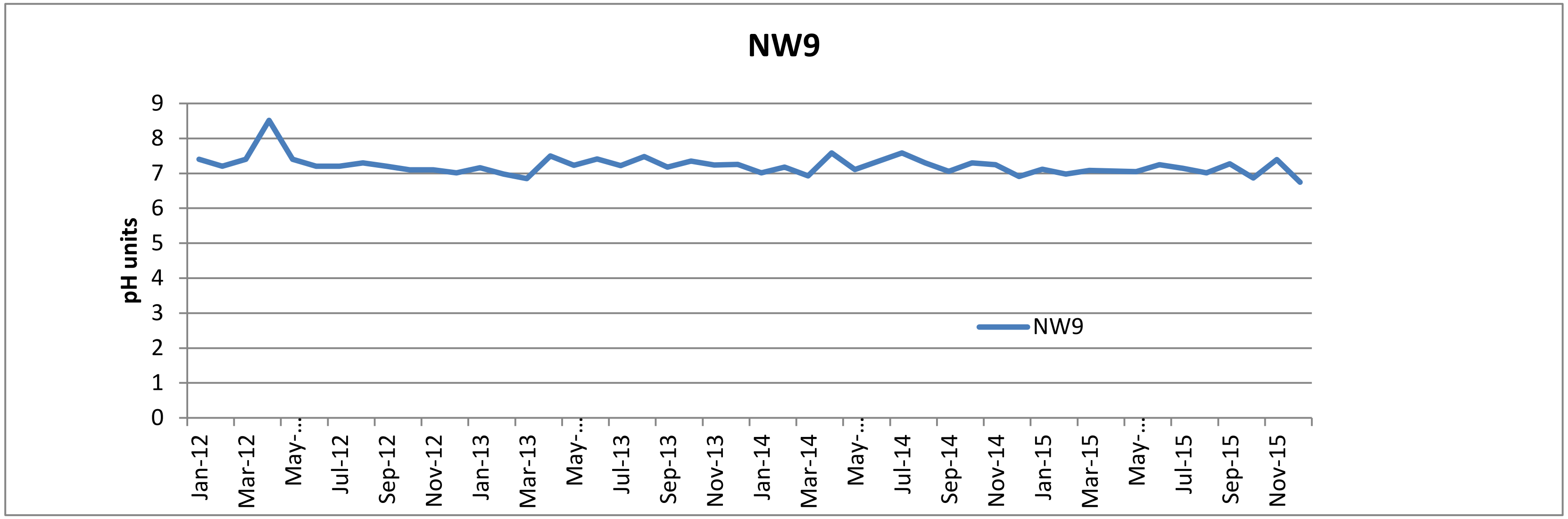
Oct-15
Nov-15
Dec-15
NW5

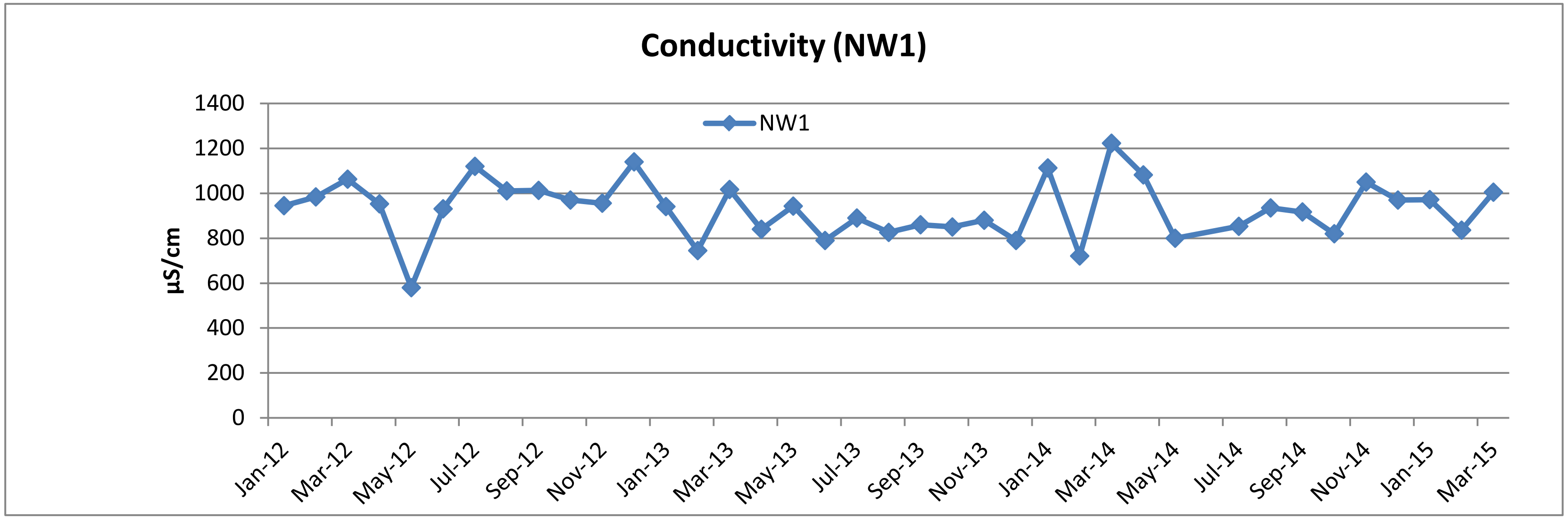

pH NW6
pH units
10
9
8
7
6
5
4
3
2
1
0
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
NW6
Warning Level
Action Level


pH NW7
12
10
8
6
4
2
0
pH units
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
NW7
warning Level
action level


PH NW8
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
pH units
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
NW8



NW9
pH units
9
8
7
6
5
4
3
2
1
0
Jan-12
Mar-12
May-…
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-…
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-…
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-…
Jul-15
Sep-15
Nov-15
NW9



Conductivity (NW1)
NW1
µS/cm
1400
1200
1000
800
600
400
200
0
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
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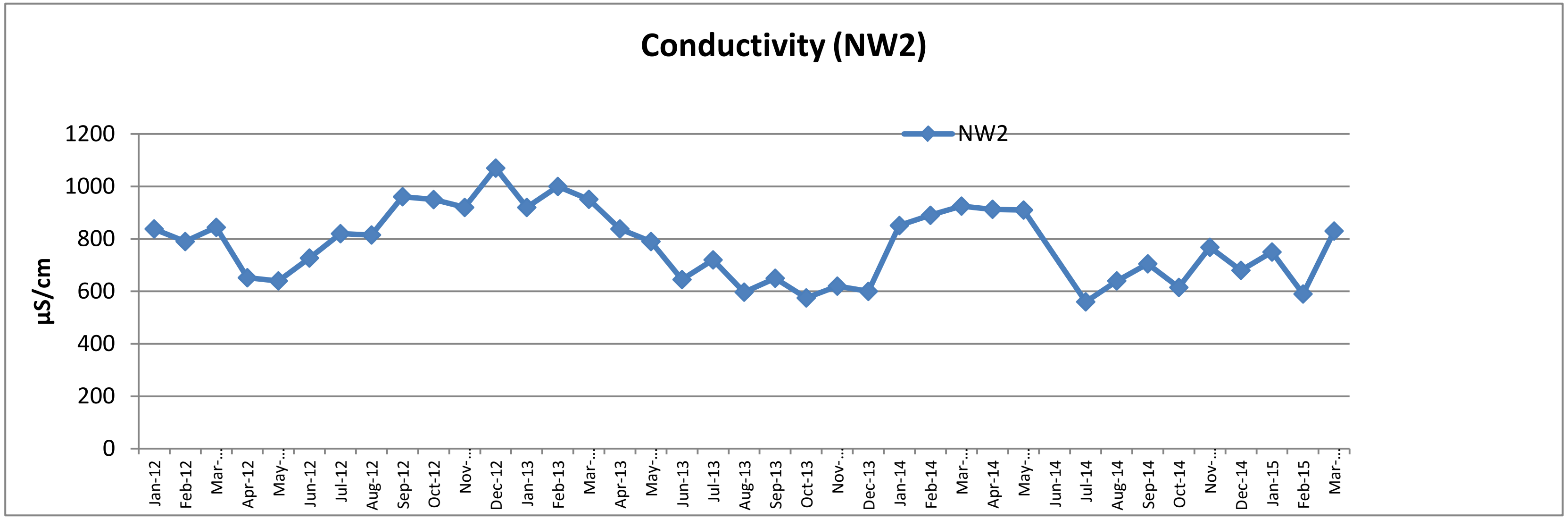
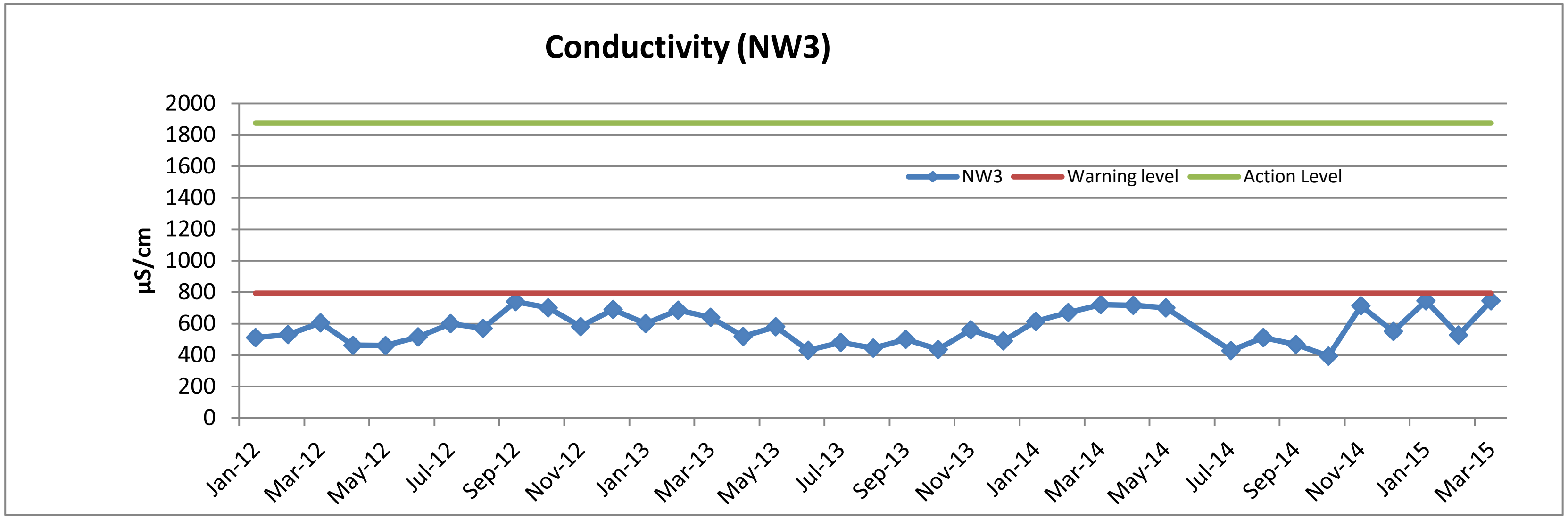
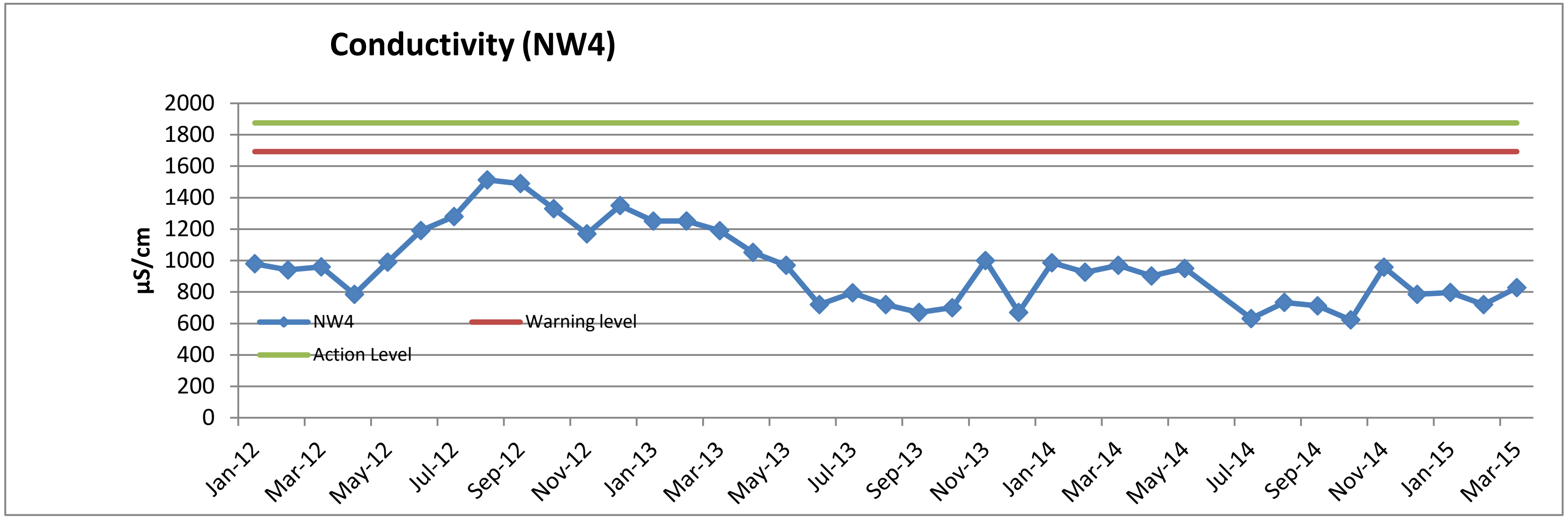
Sep-14
Nov-14
Jan-15
Mar-15



Conductivity (NW2)
NW2
µS/cm
1200
1000
800
600
400
200
0
Jan-12
Feb-12
Mar-...
Apr-12
May-...
Jun-12
Jul-12
Aug-12
Sep-12
Oct-12
Nov-...
Dec-12
Jan-13
Feb-13
Mar-...
Apr-13
May-...
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-...
Dec-13
Jan-14
Feb-14
Mar-...
Apr-14
May-...
Jun-14
Jul-14
Aug-14
Sep-14
Oct-14
Nov-...
Dec-14
Jan-15
Feb-15
Mar-...


Conductivity (NW3)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
µS/cm
NW3
Warning level
Action Level
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15


Conductivity (NW4)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
µS/cm
NW4
Warning level
Action Level
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
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Nov-13
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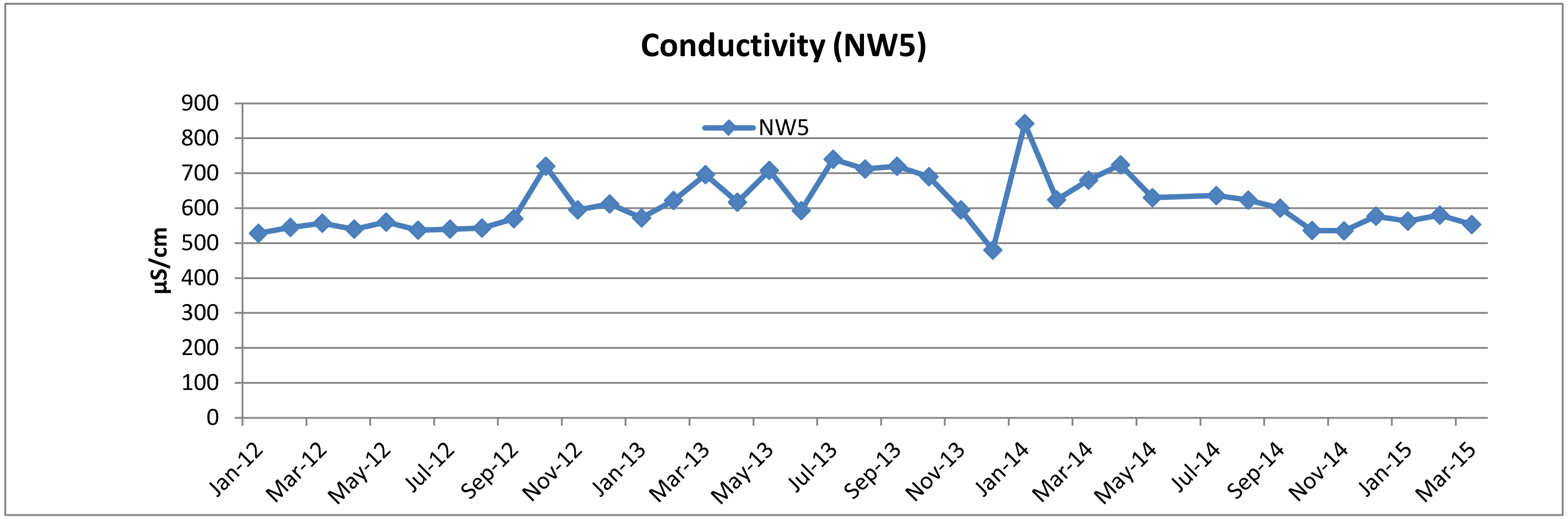
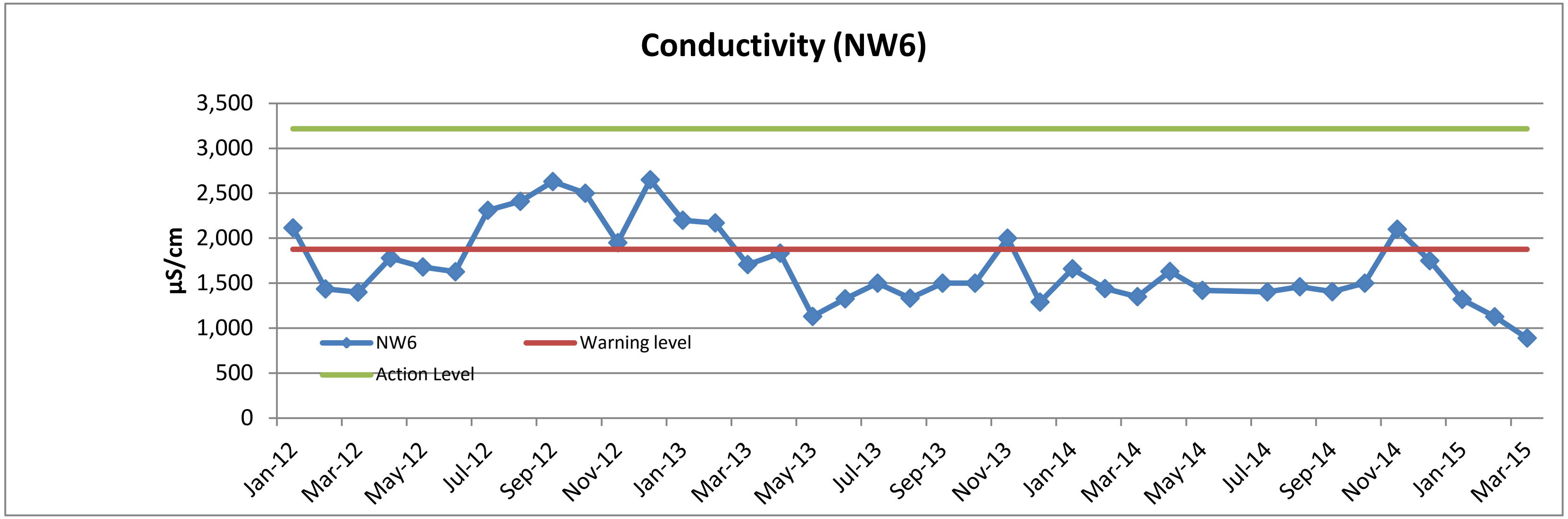
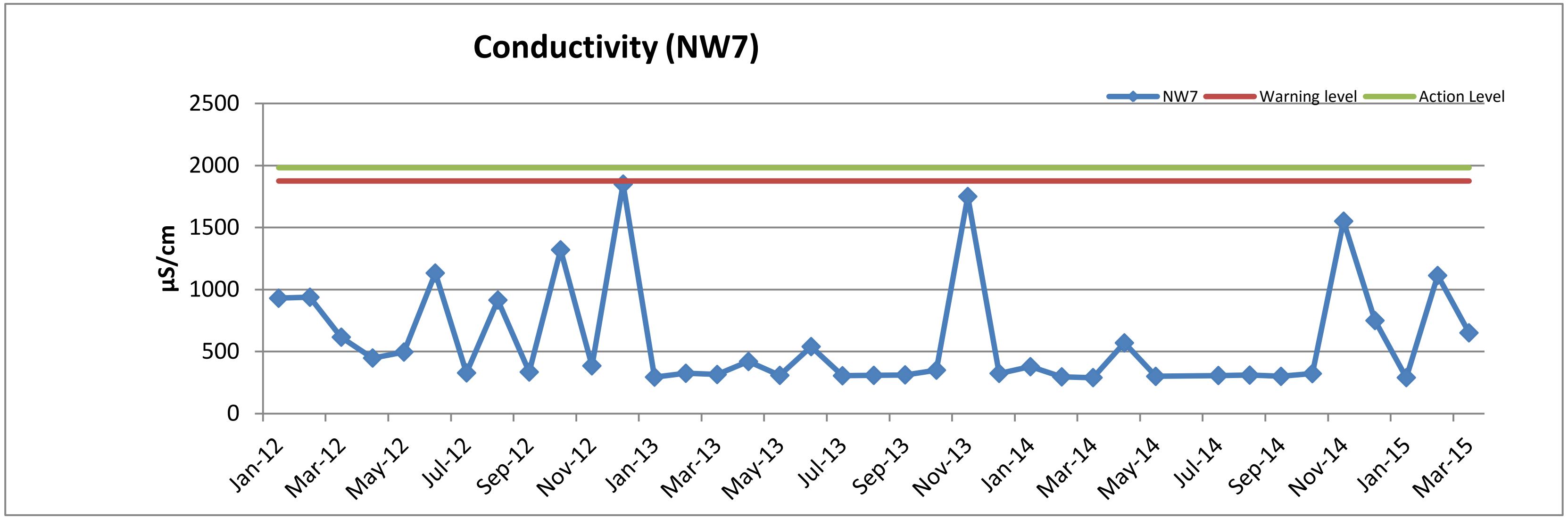
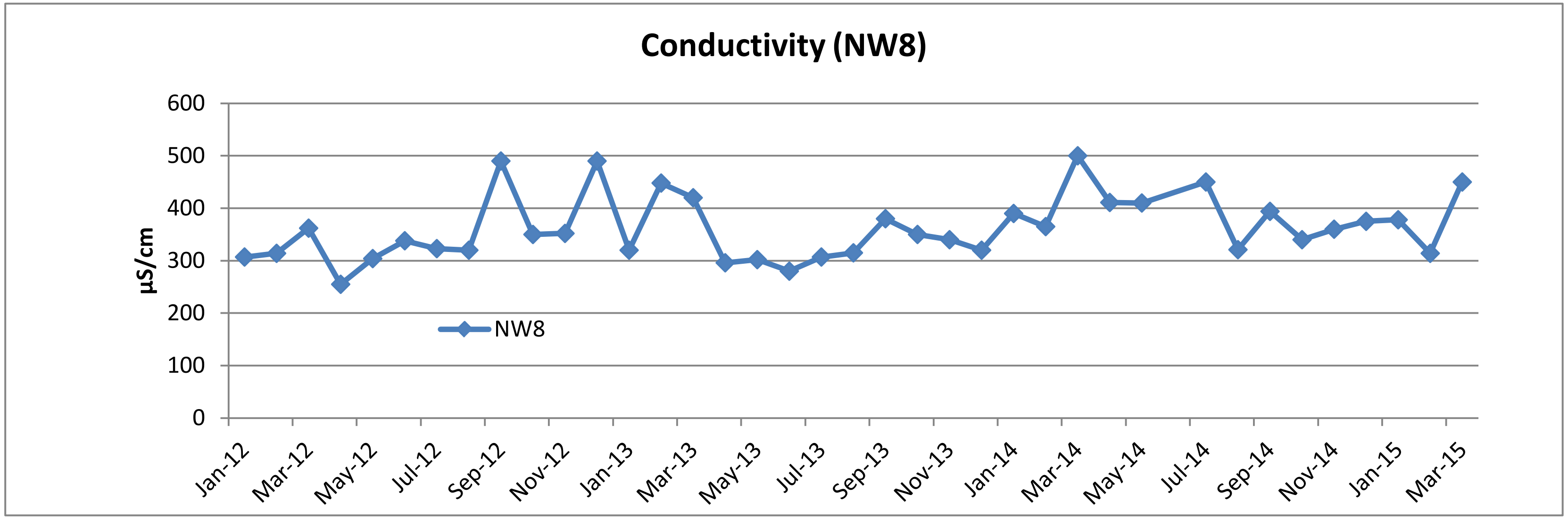
Sep-14
Nov-14
Jan-15
Mar-15


Conductivity (NW5)
NW5
µS/cm
900
800
700
600
500
400
300
200
100
0
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15

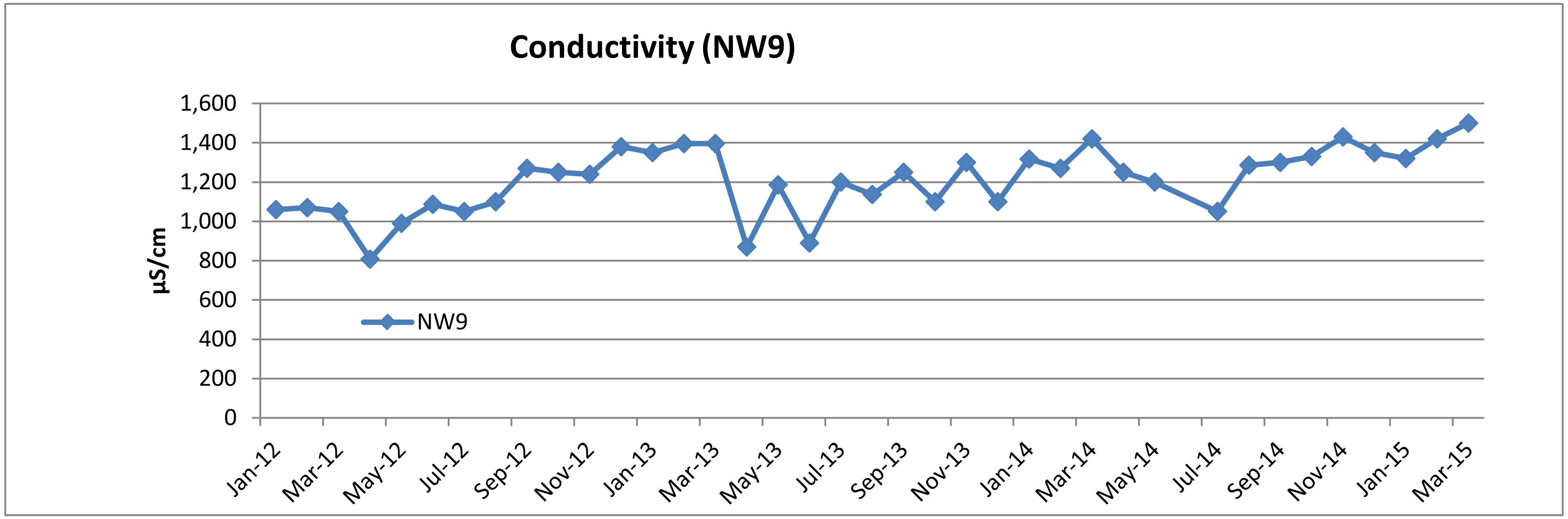

Conductivity (NW6)
µS/cm
3,500
3,000
2,500
2,000
1,500
1,000
500
0
NW6
Warning level
Action Level
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15



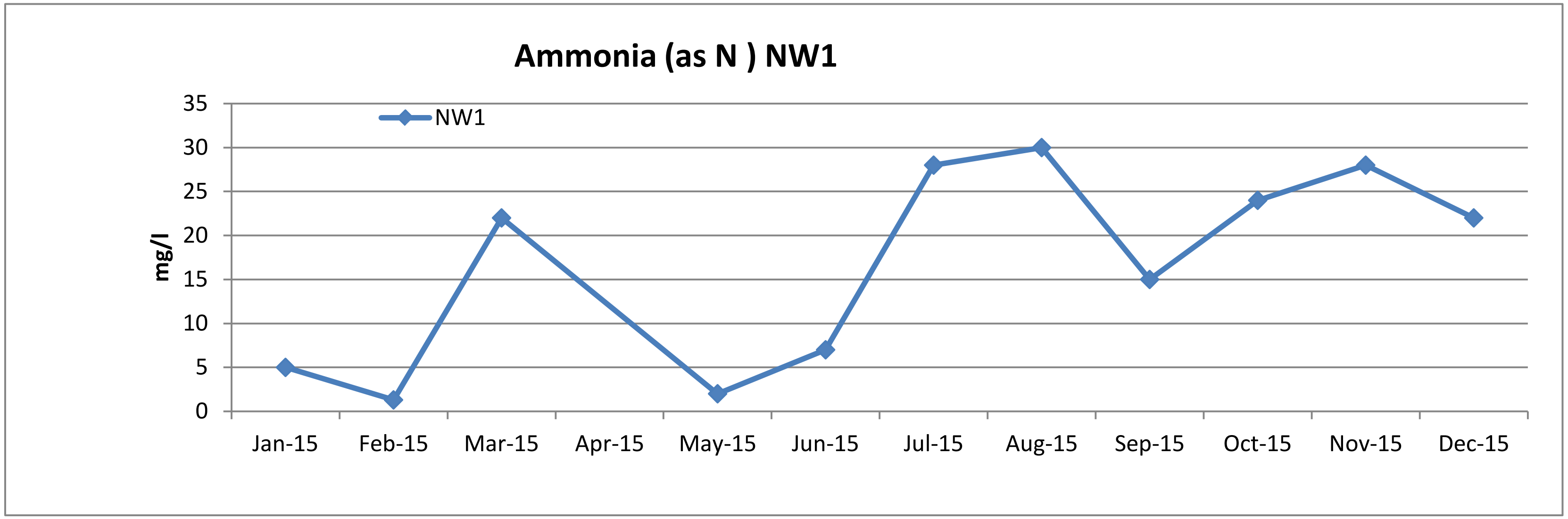
Conductivity (NW7)
NW7
Warning level
Action Level
2500
2000
1500
1000
500
0
µS/cm
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15

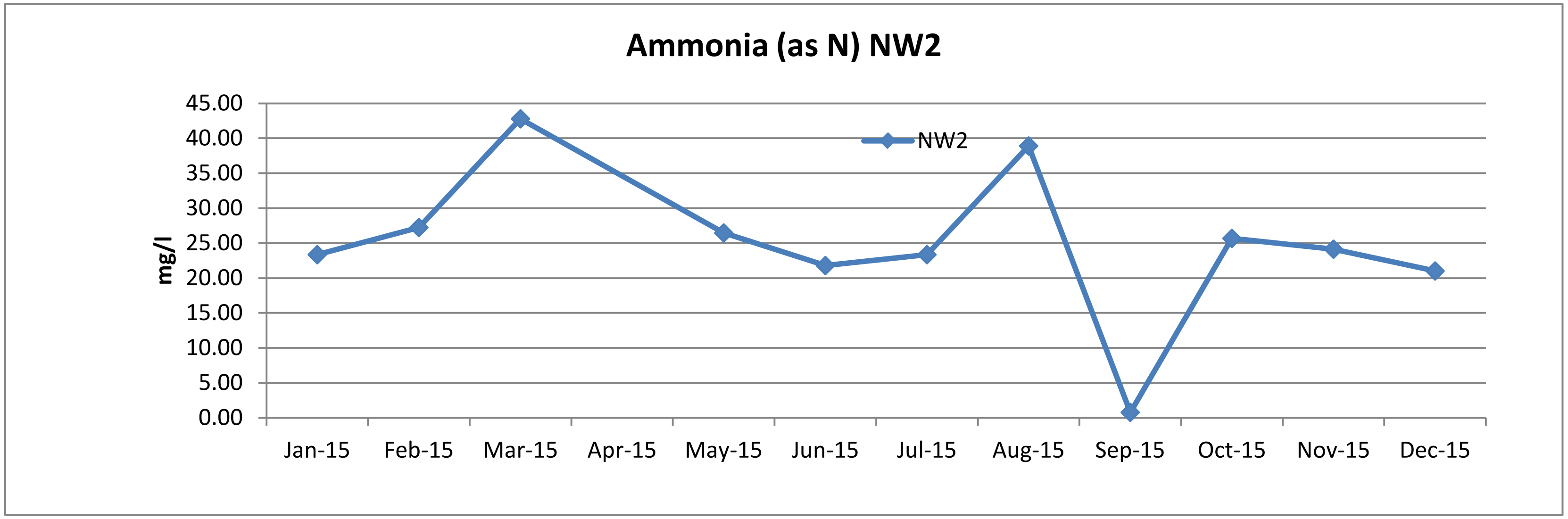


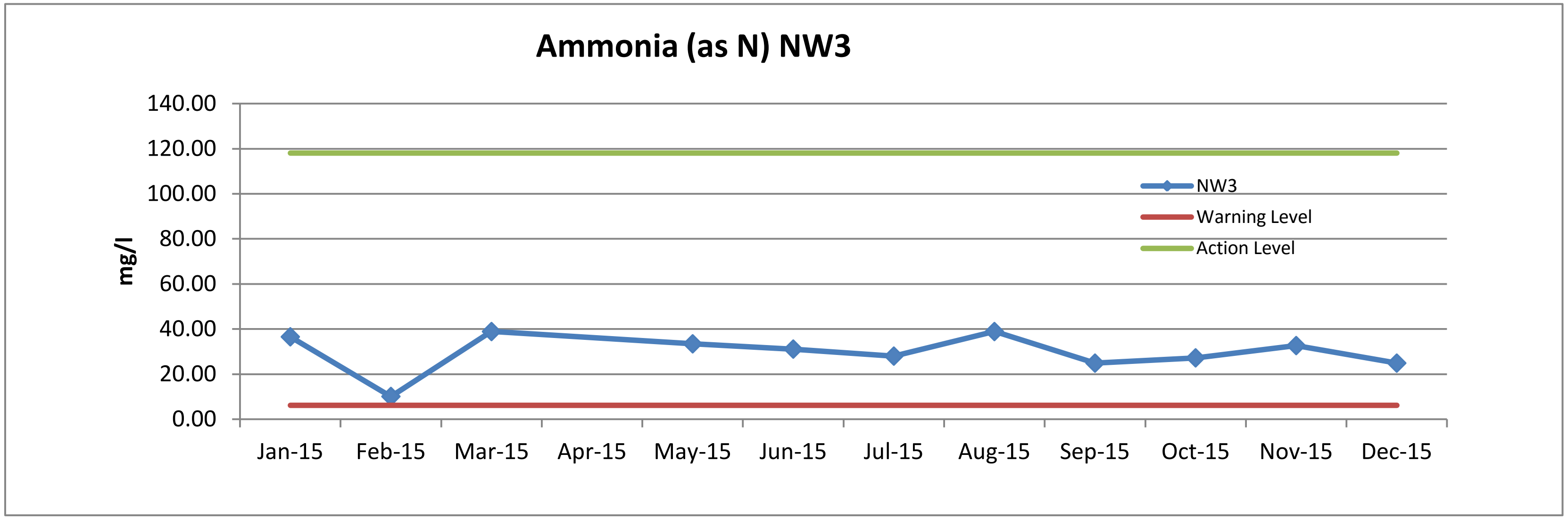
Conductivity (NW8)
600
500
400
300
200
100
0
µS/cm
NW8
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15

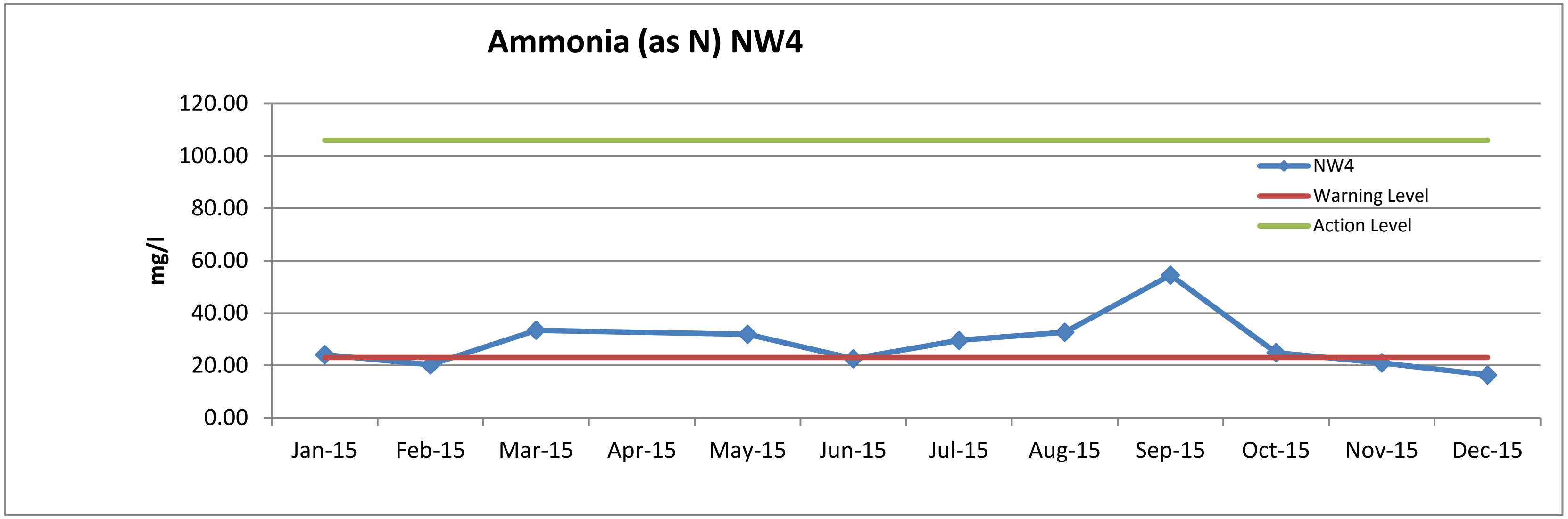


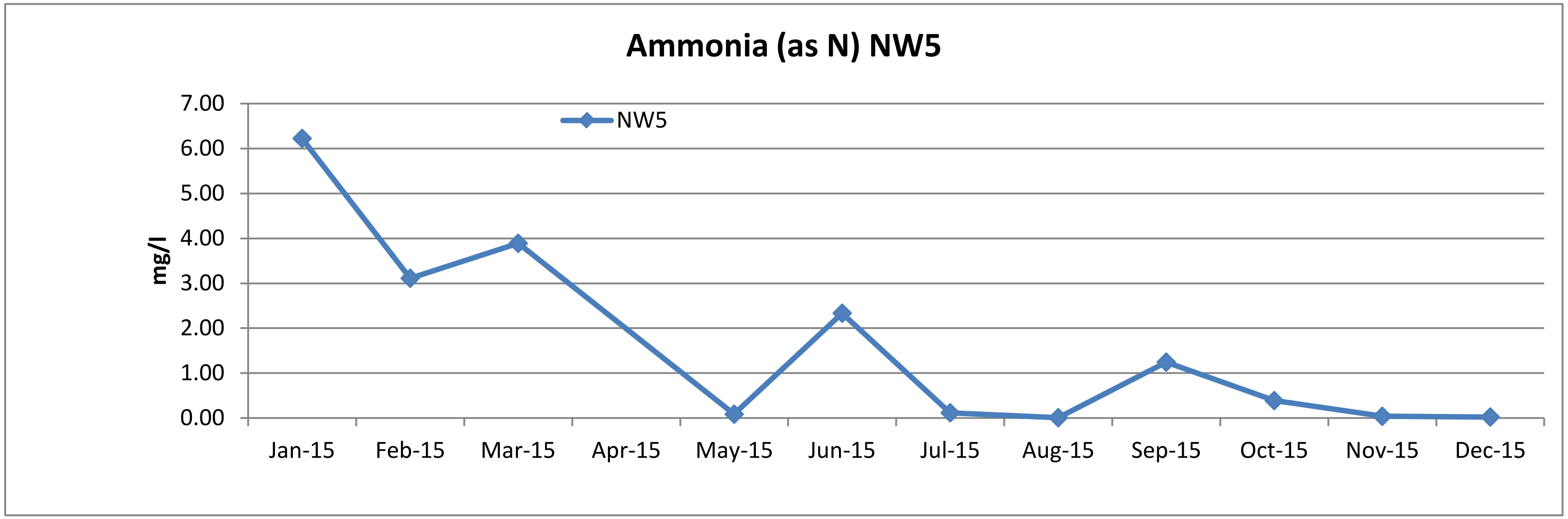
Conductivity (NW9)
1,600
1,400
1,200
1,000
800
600
400
200
0
µS/cm
NW9
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15

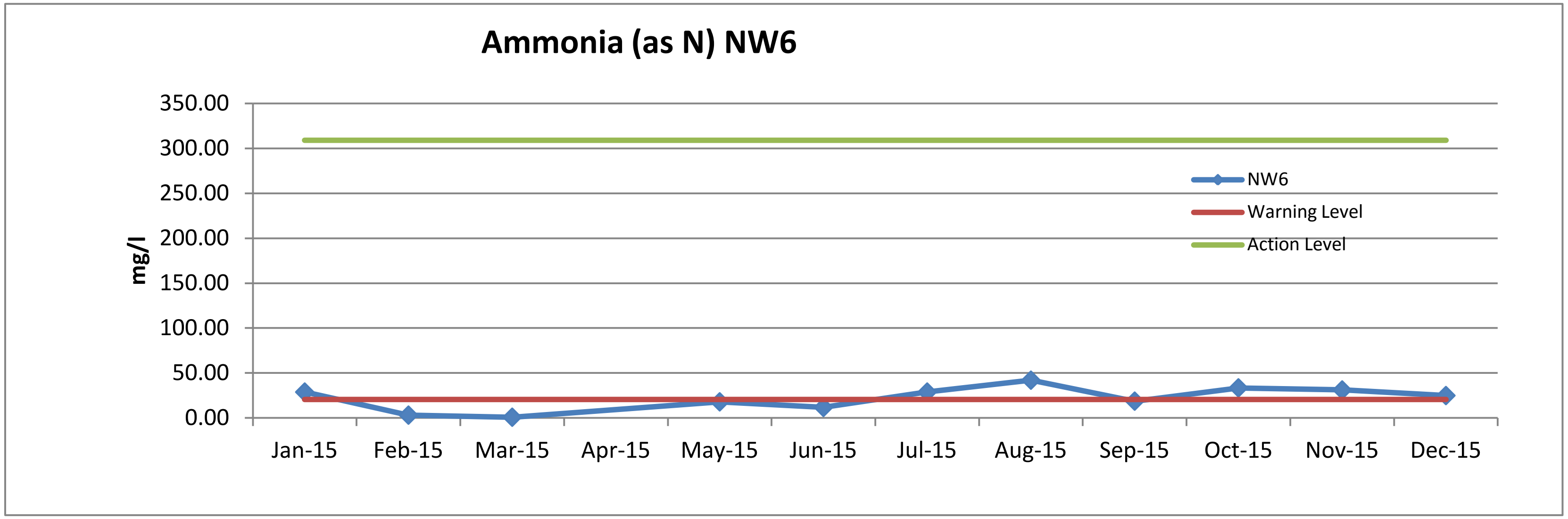

Ammonia (as N) NW1
NW1
mg/l
35
30
25
20
15
10
5
0
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15

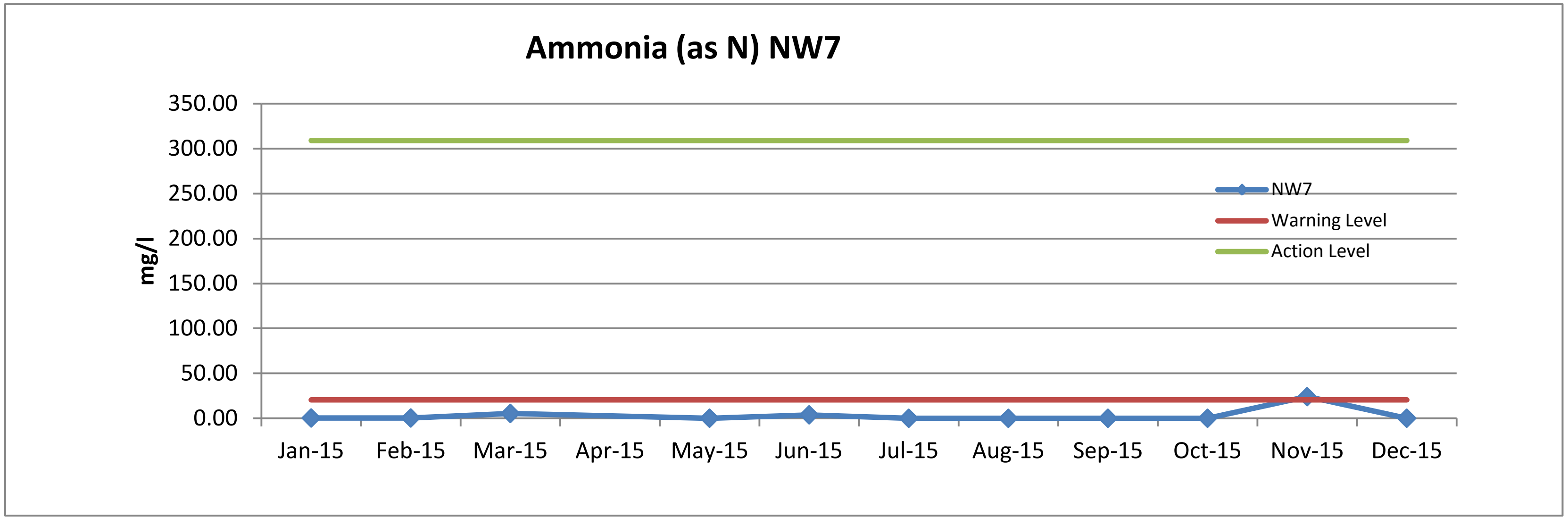

Ammonia (as N) NW2
NW2
mg/l
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15


Ammonia (as N) NW3
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
mg/l
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
NW3
Warning Level
Action Level

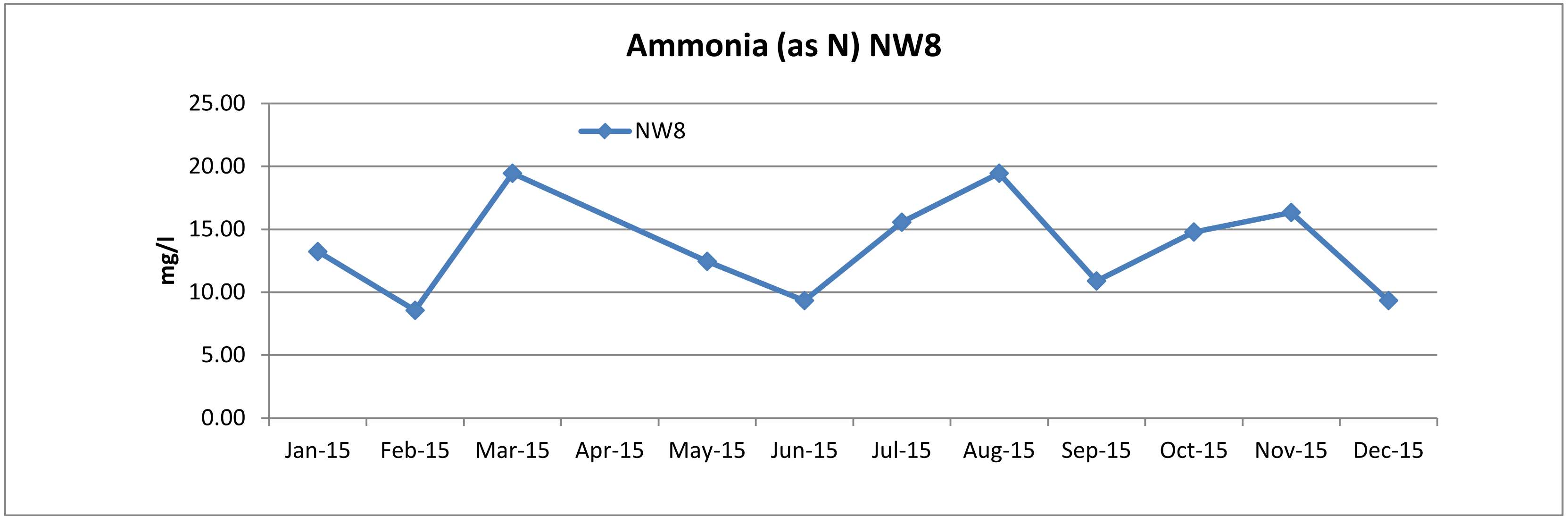

Ammonia (as N) NW4
120.00
100.00
80.00
60.00
40.00
20.00
0.00
mg/l
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
NW4
Warning Level
Action Level


Ammonia (as N) NW5
NW5
mg/l
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15

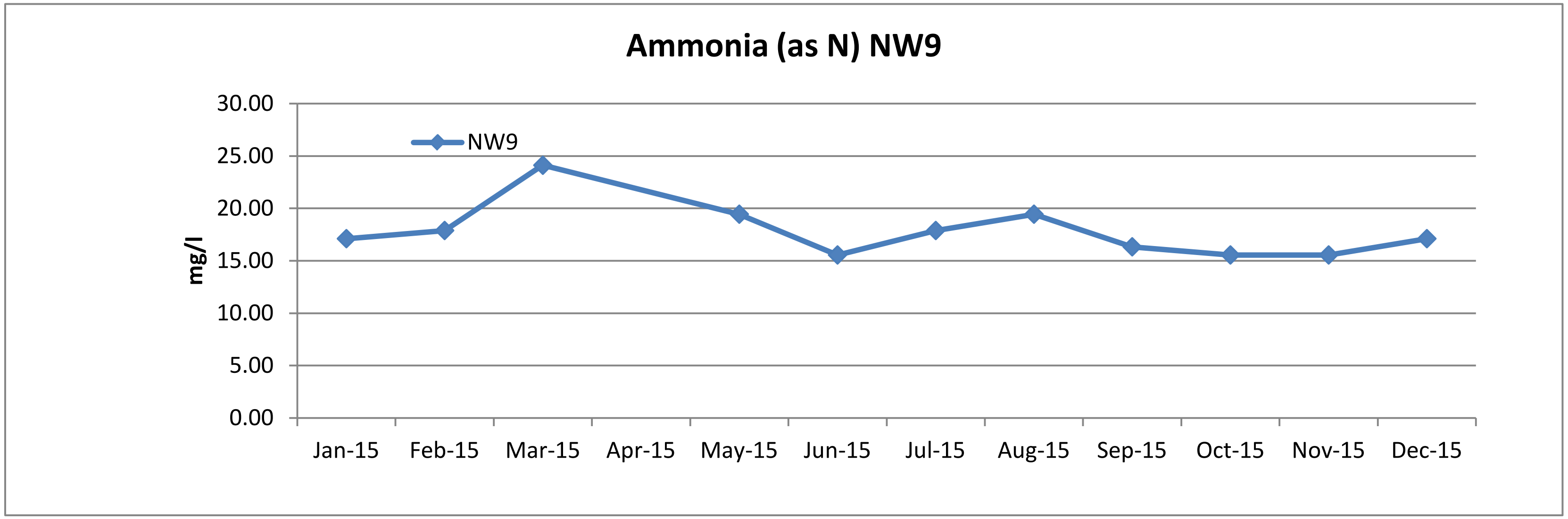

Ammonia (as N) NW6
NW6
Warning Level
Action Level
mg/l
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15



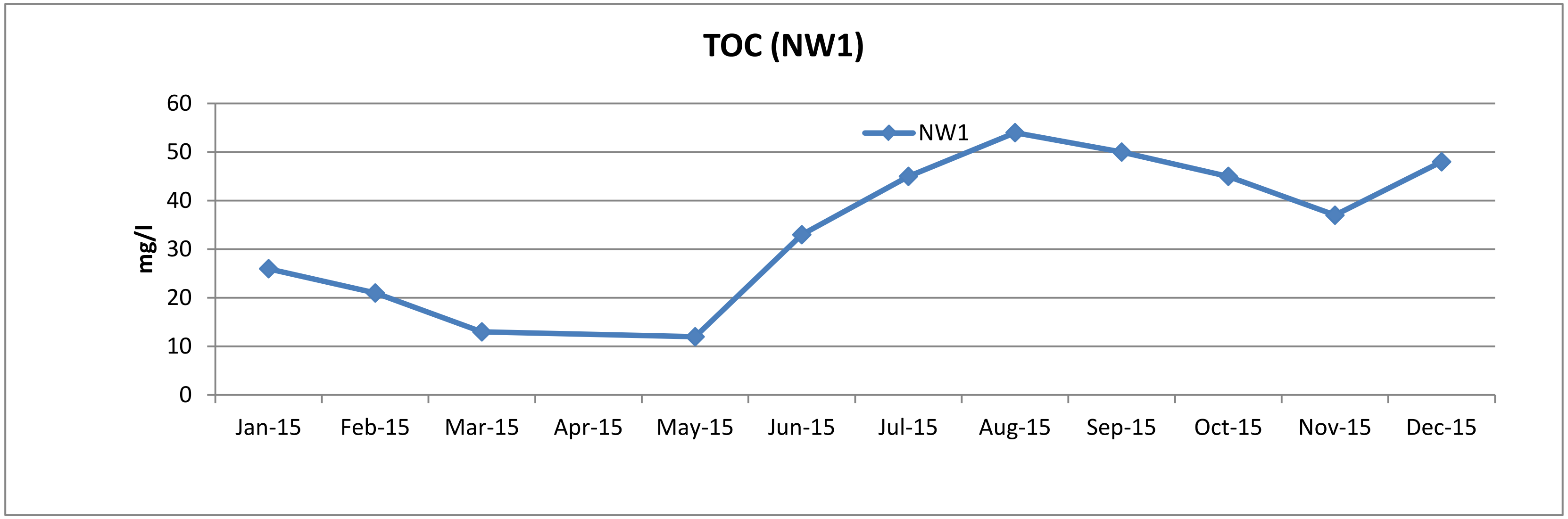
Ammonia (as N) NW7
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
mg/l
NW7
Warning Level
Action Level
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15



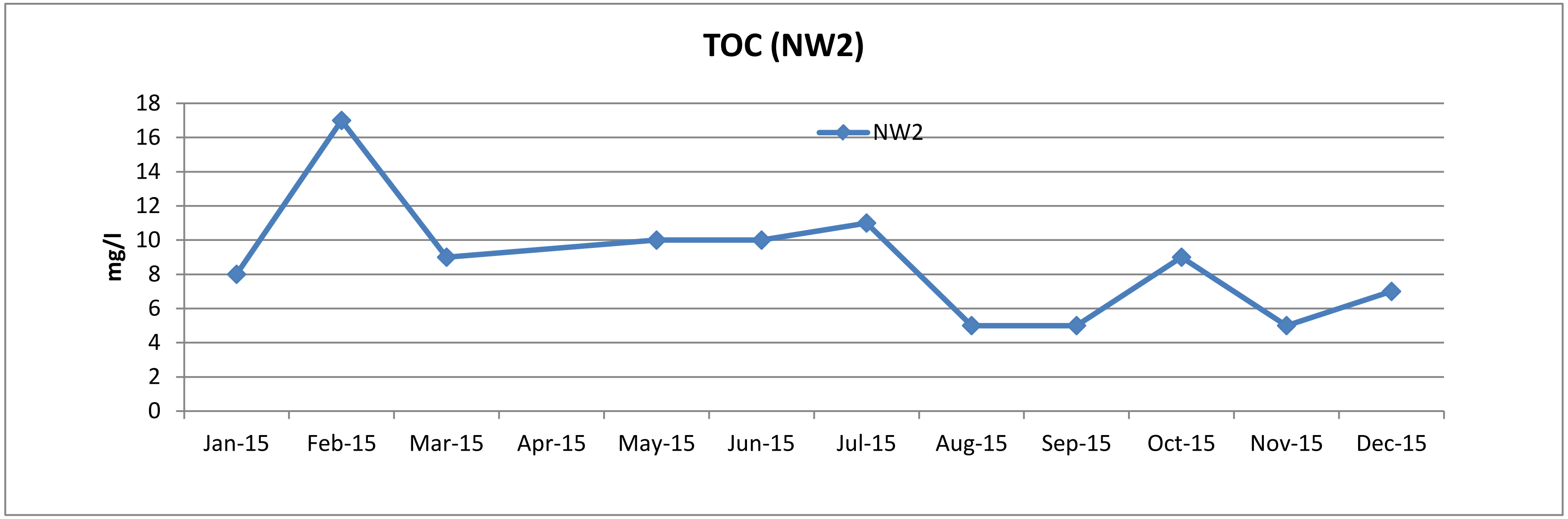
Ammonia (as N) NW8
25.00
20.00
15.00
10.00
5.00
0.00
mg/l
NW8
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15



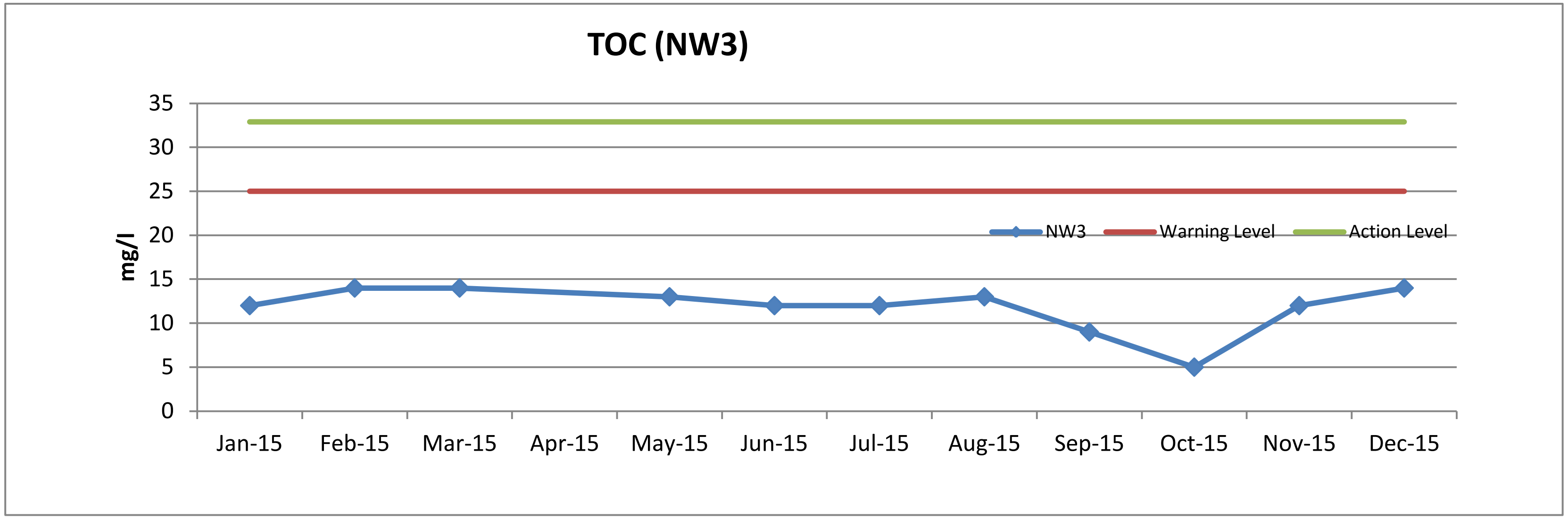
Ammonia (as N) NW9
NW9
mg/l
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15

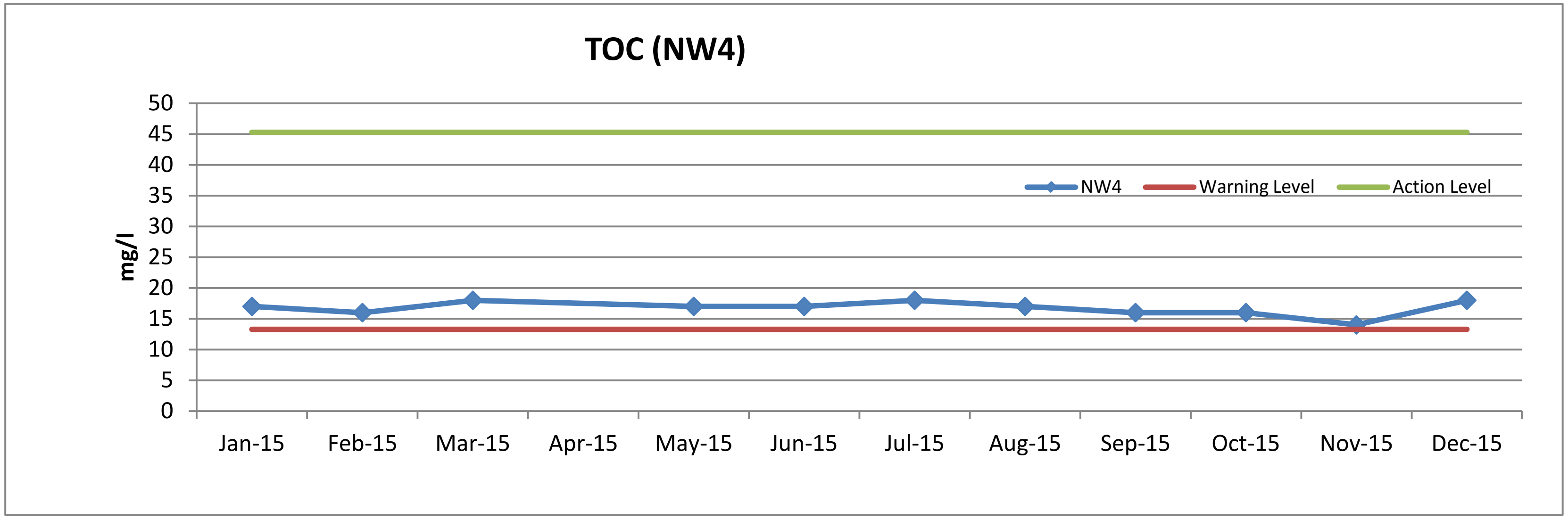


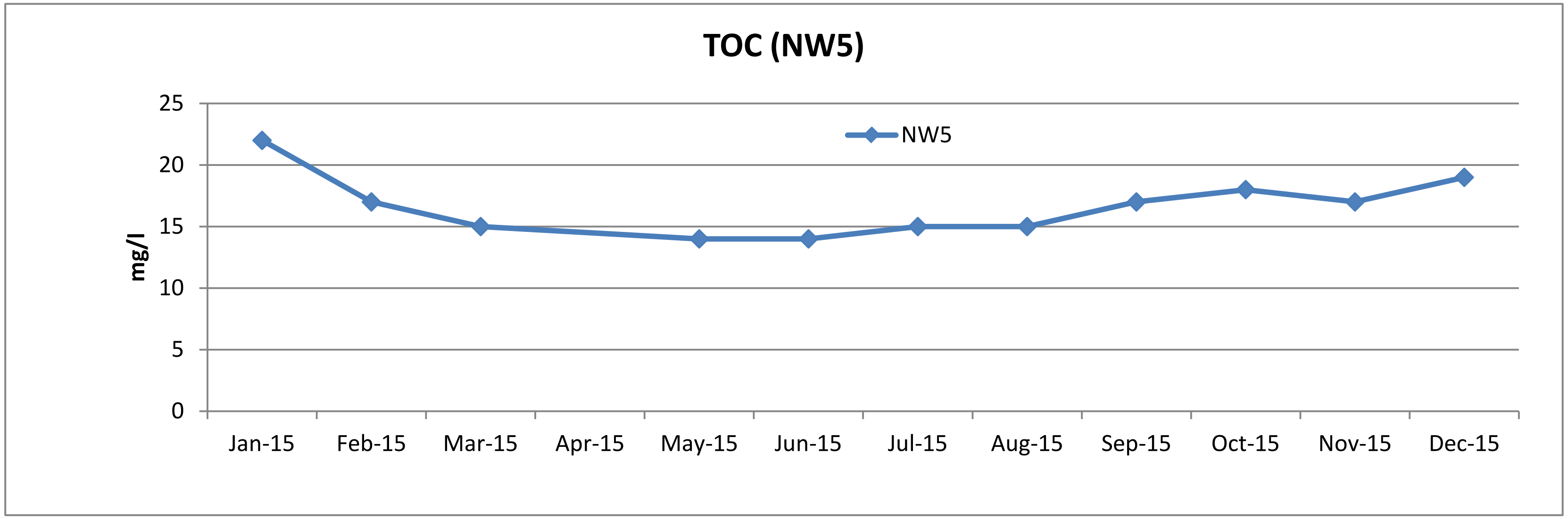
TOC (NW1)
60
50
40
30
20
10
0
mg/l
NW1
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15

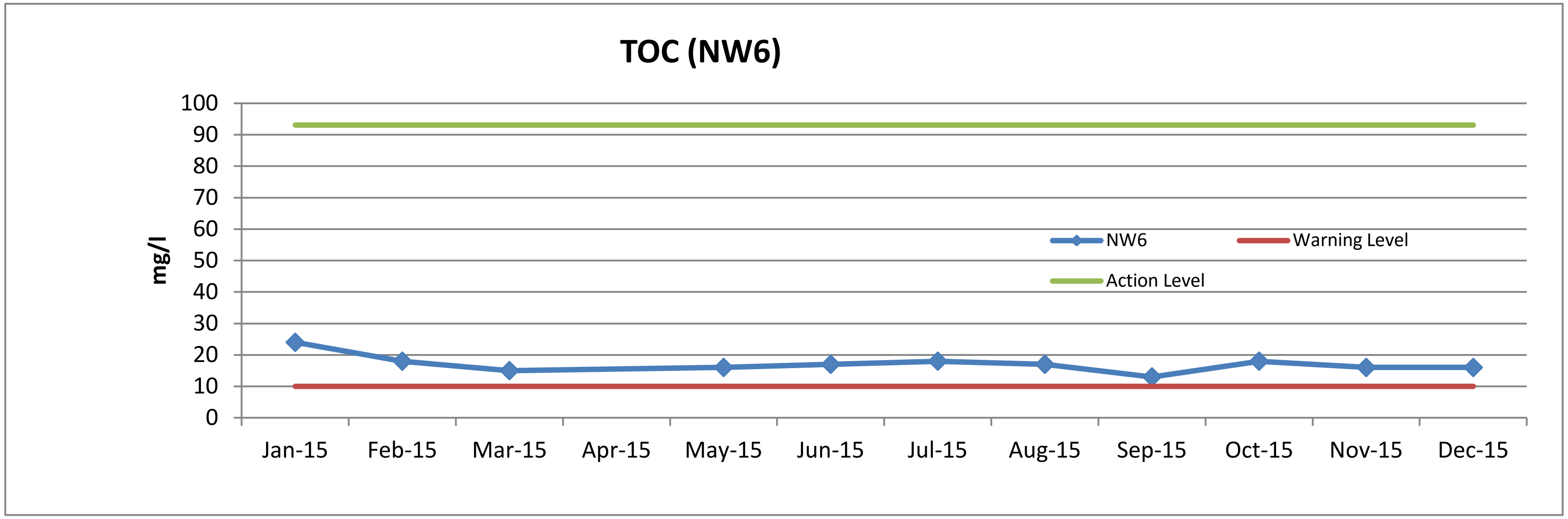


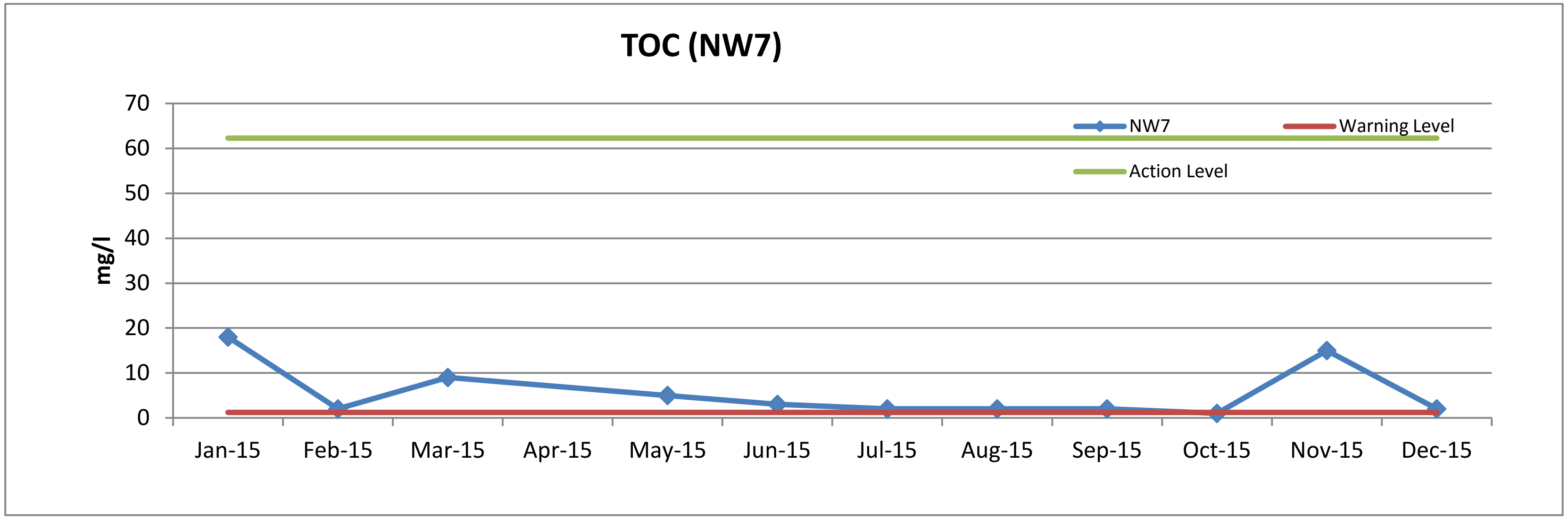
TOC (NW2)
18
16
14
12
10
8
6
4
2
0
mg/l
NW2
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15


TOC (NW3)
mg/l
35
30
25
20
15
10
5
0
NW3
Warning Level
Action Level
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15

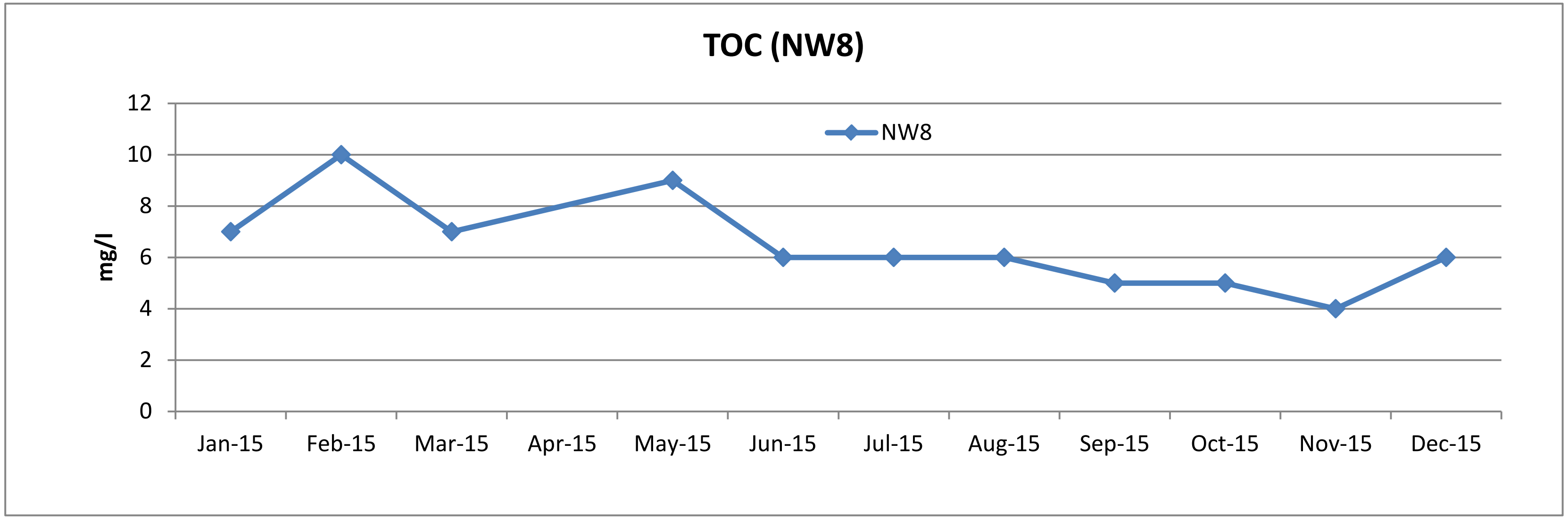

TOC (NW4)
mg/l
50
45
40
35
30
25
20
15
10
5
0
NW4
Warning Level
Action Level
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15


TOC (NW5)
NW5
mg/l
25
20
15
10
5
0
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15

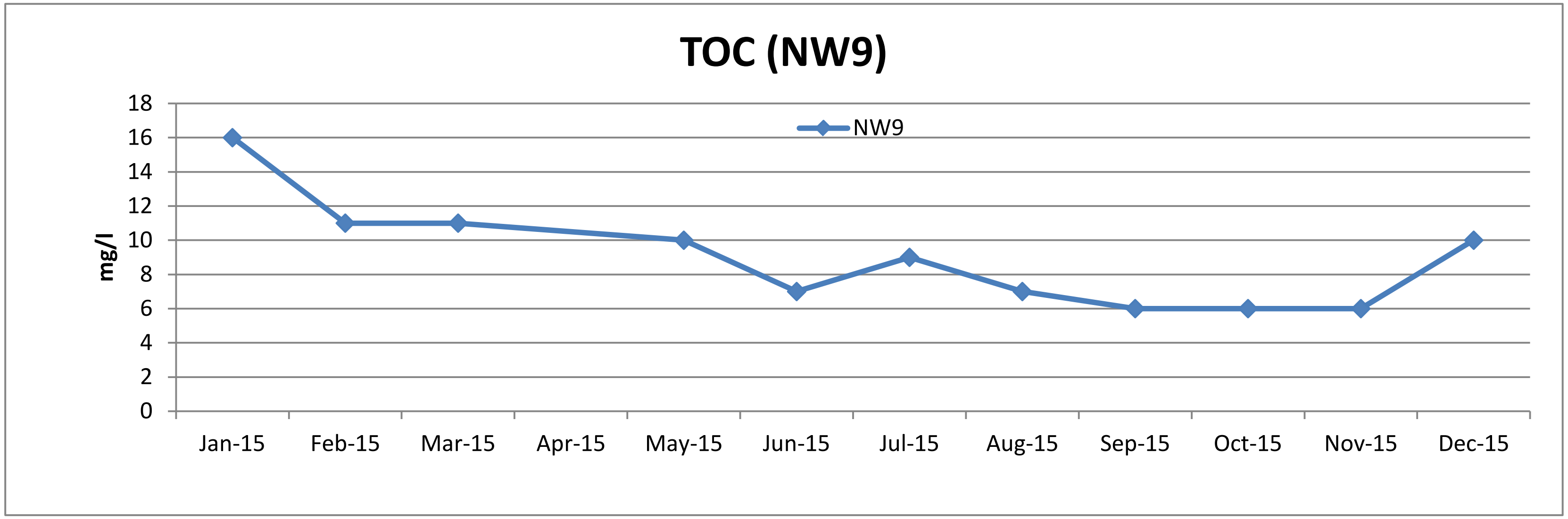

TOC (NW6)
NW6
Warning Level
Action Level
mg/l
100
90
80
70
60
50
40
30
20
10
0
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15



TOC (NW7)
70
60
50
40
30
20
10
0
mg/l
NW7
Warning Level
Action Level
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15



TOC (NW8)
12
10
8
6
4
2
0
mg/l
NW8
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15

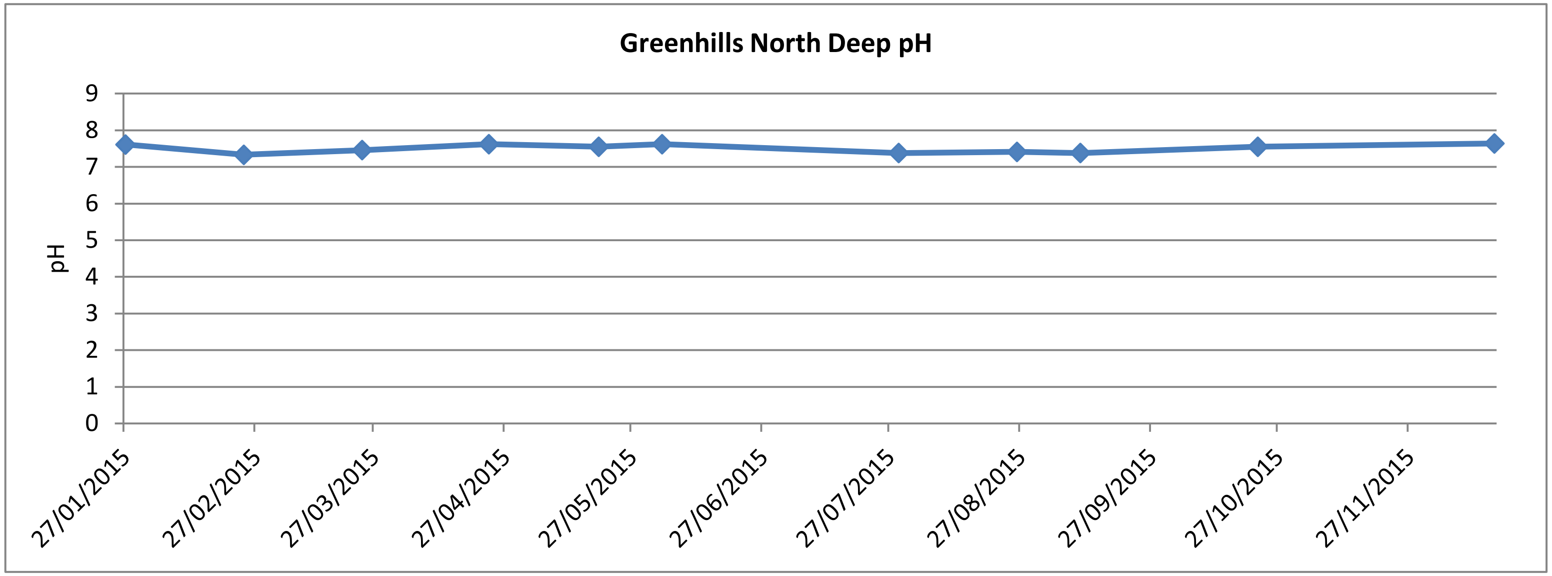


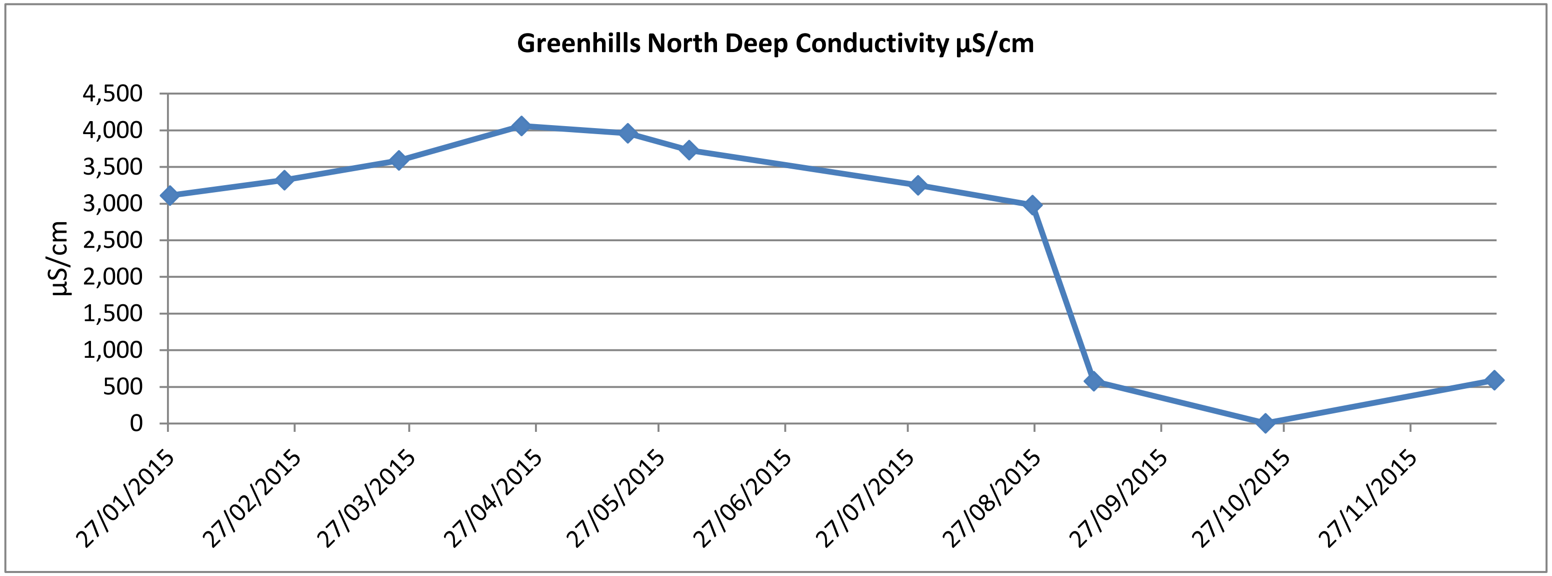
TOC (NW9)
NW9
mg/l
0
2
4
6
8
10
12
14
16
18
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15

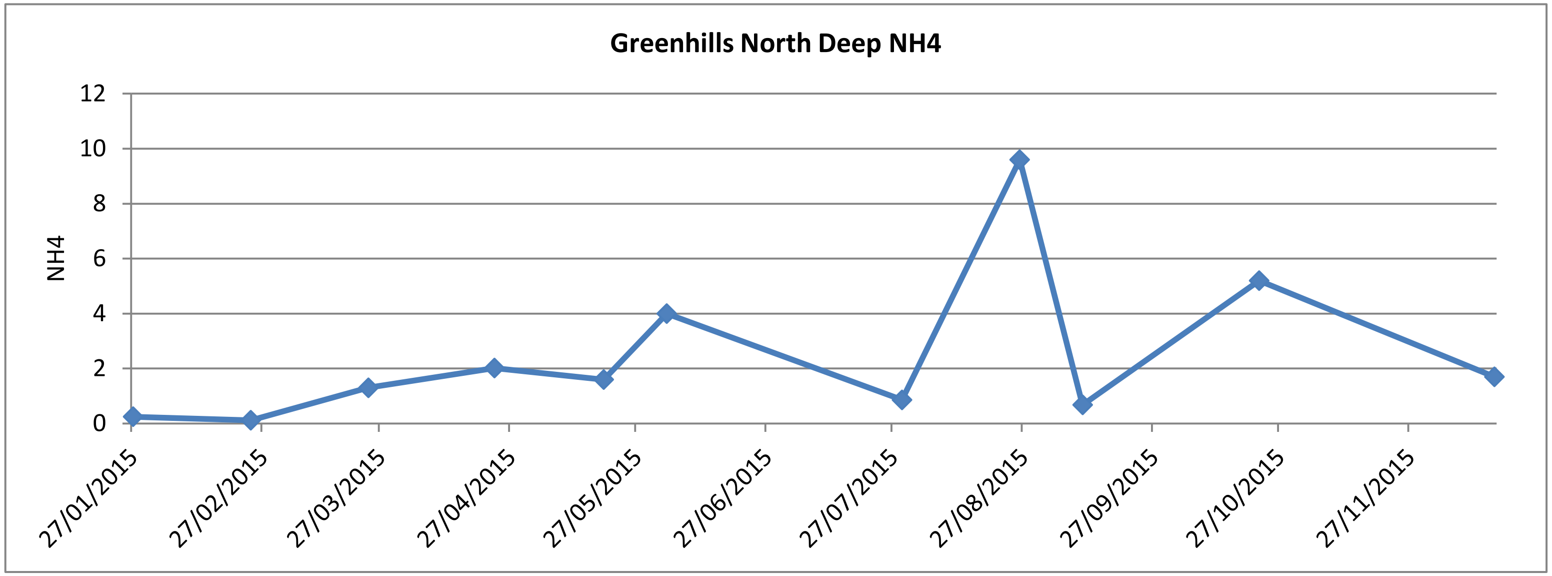
Well: Greenhills & Nemo Groundwater Wells (mg/l)
Location: Greenhills Green and Nemo Rangers GAA Pitch
All parameter data in mg/l unless stated otherwise

Greenhills North Deep 2015

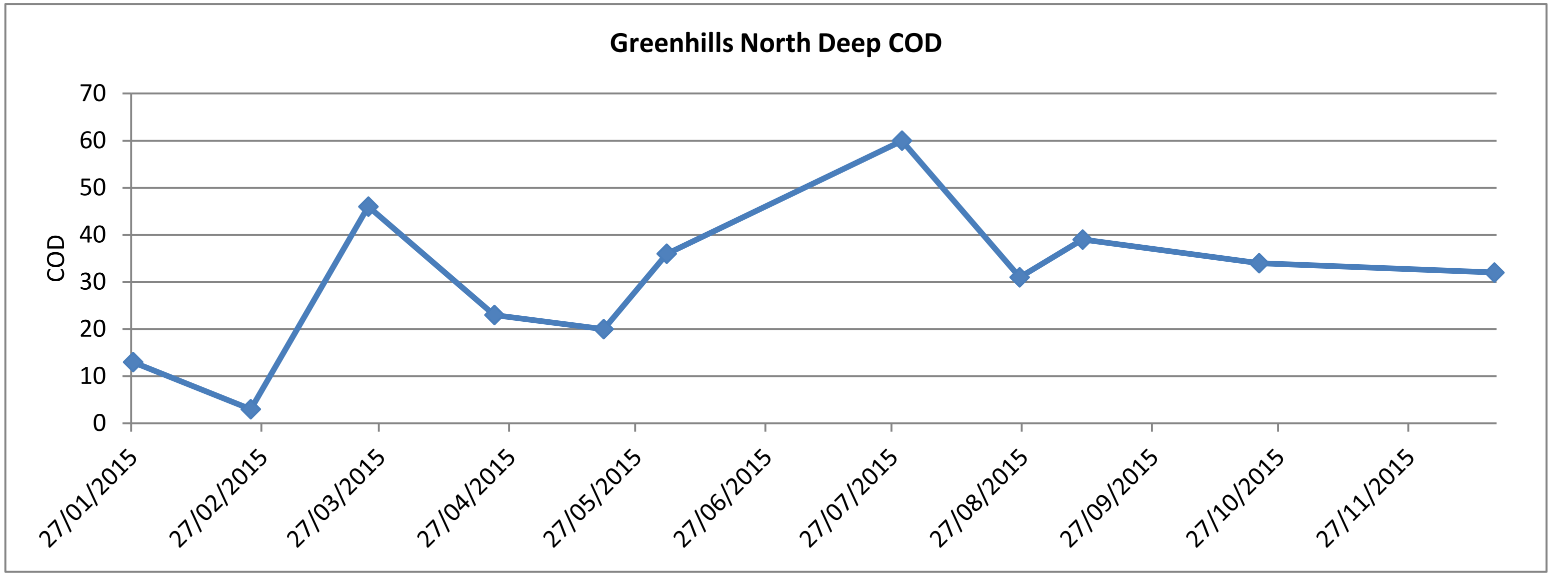
Date	Temp *C	pH	Conductivity µS/cm	NH4	Ammonia (as N)	Chloride	Oxygen	COD	TON	TOC	S. Solids	Well Depth (m)	Depth to Water (m)	Water Height in Well (m)
27/01/2015	13.4	7.61	3,110	0.25	0.19	921	7.44	13	0.84	19.5	29	35	1.46	33.54
24/02/2015	11.6	7.33	3,320	0.12	0.09	1,028	3.93	3	1.27	19.8	112	35	1.52	33.48
24/03/2015	16.3	7.46	3,590	1.3	1.01	1,106	7.81	46	1.54	19.5	26.4	35	1.32	33.68
23/04/2015	14.9	7.62	4,060	2.02	1.57	1,240	9.4	23	1.51	19.6	8.4	35	1.66	33.34
19/05/2015	13.4	7.55	3,960	1.6	1.24	1,226	2.83	20	0.76	18.8	41.2	35	1.44	33.56
03/06/2015	15.8	7.62	3,730	4	3.11	1389	8.36	36	2.58	19.3	307	35	1.51	33.49
29/07/2015	14.3	7.38	3,250	0.86	0.67	744	4.72	60	1.34	19.9	12.6	35	1.48	33.52
26/08/2015	22.5	7.41	2,980	9.6	7.47	1063	7.72	31	0.98	20.1	128	35	1.68	33.32
10/09/2015	19.5	7.38	577	0.68	0.53	36.86	3.24	39	0.48	15.1	80.2	35	1.53	33.47
22/10/2015	13.7	7.55	3	5.2	4.05	27	2.48	34	0.98	20.1	616	35	1.47	33.53
												35	0	35
17/12/2015	14.6	7.64	591	1.7	1.32	1048	9.19	32	1.16	8.4	30.4	35	1.39	33.61


Greenhills North Deep pH
pH
0
1
2
3
4
5
6
7
8
9
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

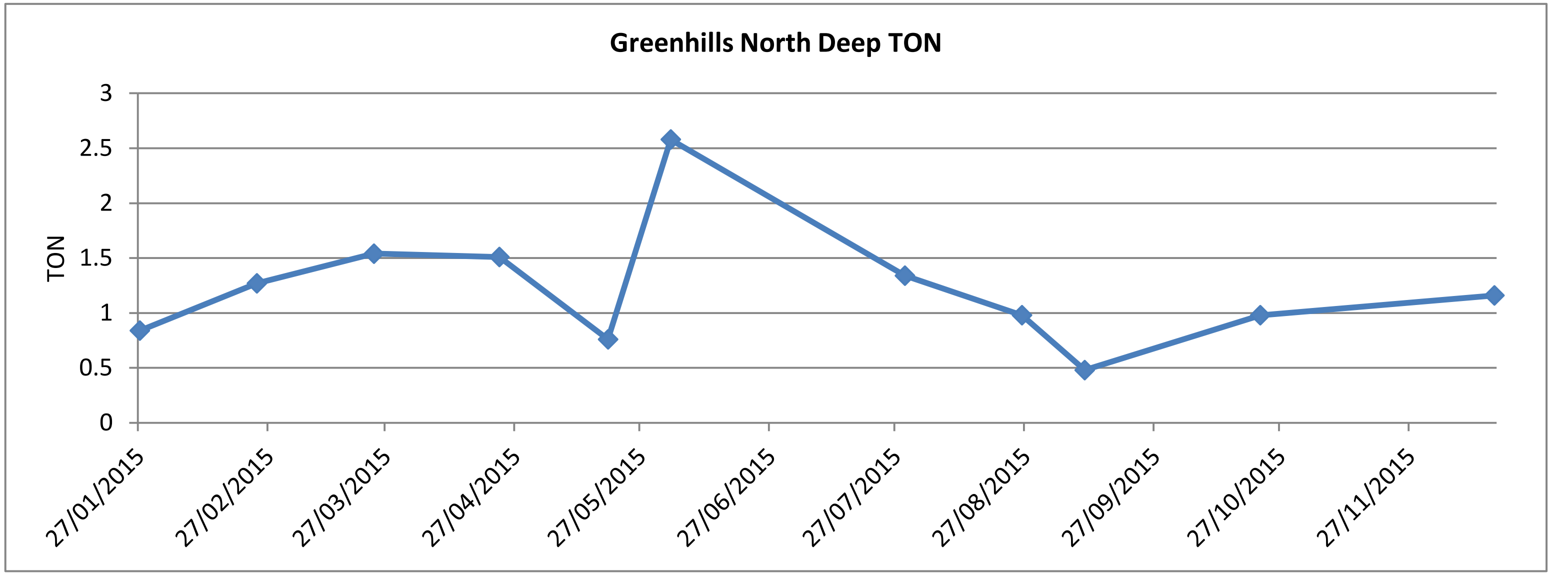

Greenhills North Deep Conductivity µS/cm
µS/cm
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

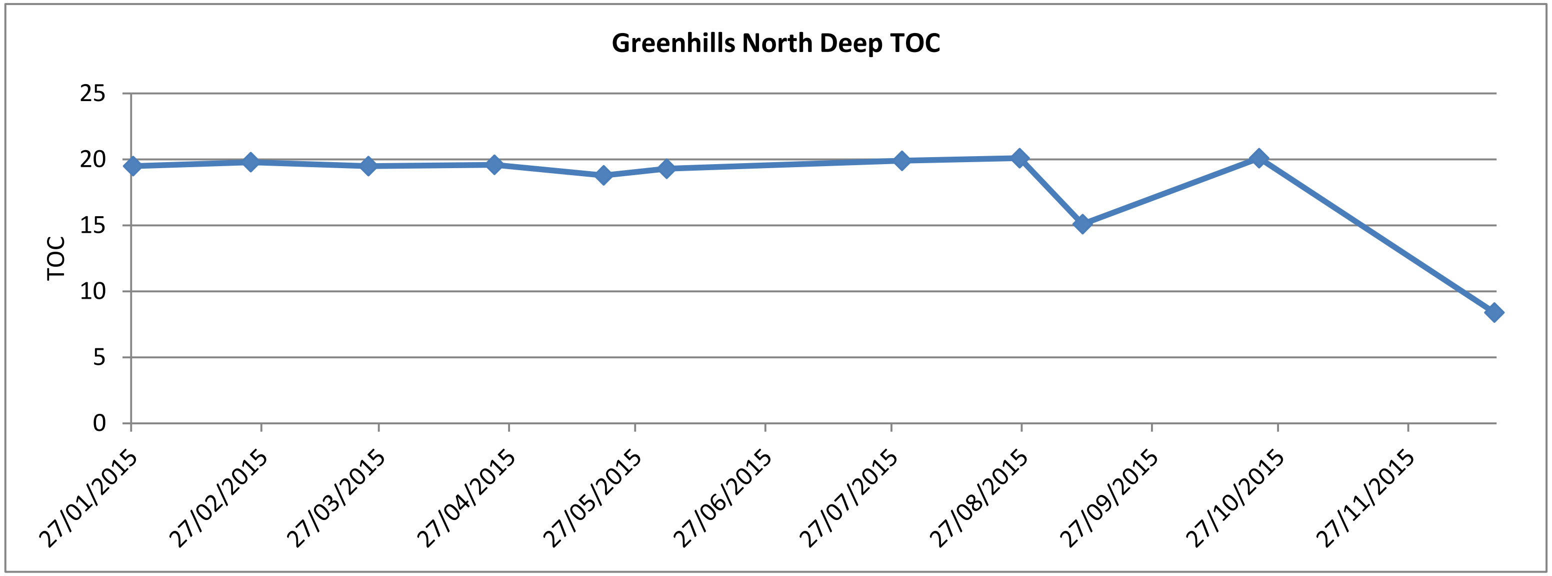


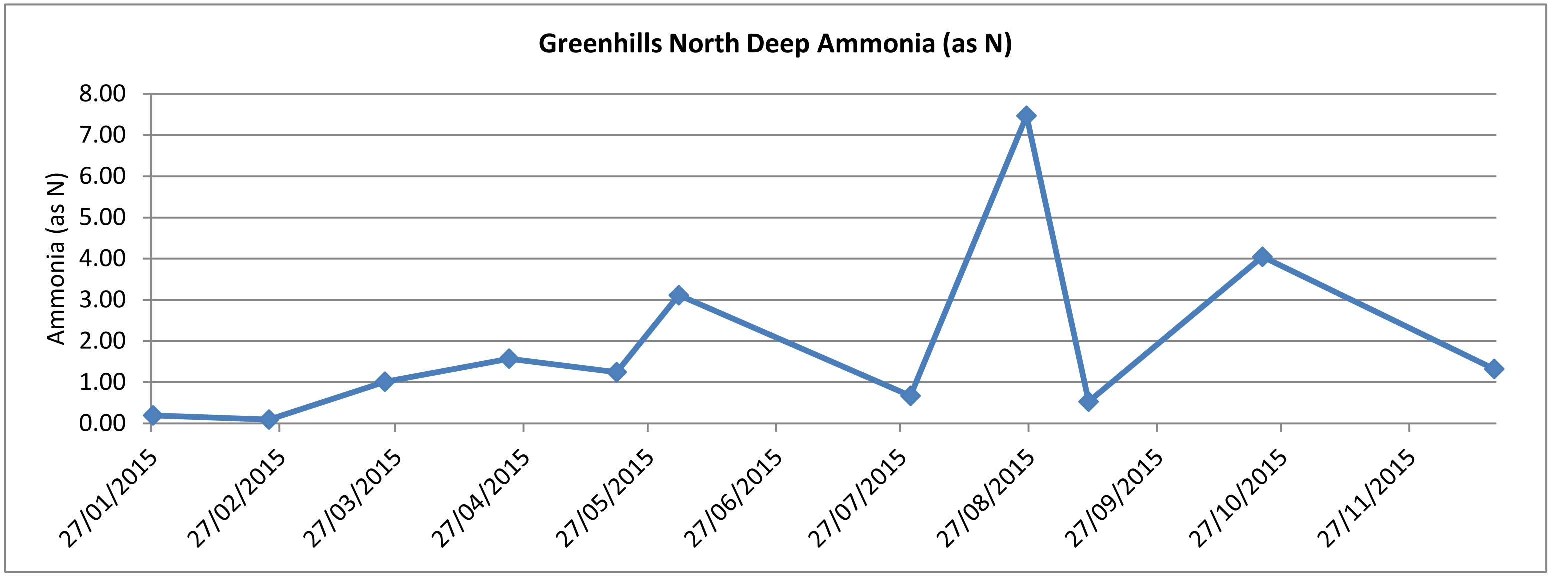
Greenhills North Deep NH4
NH4
0
2
4
6
8
10
12
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

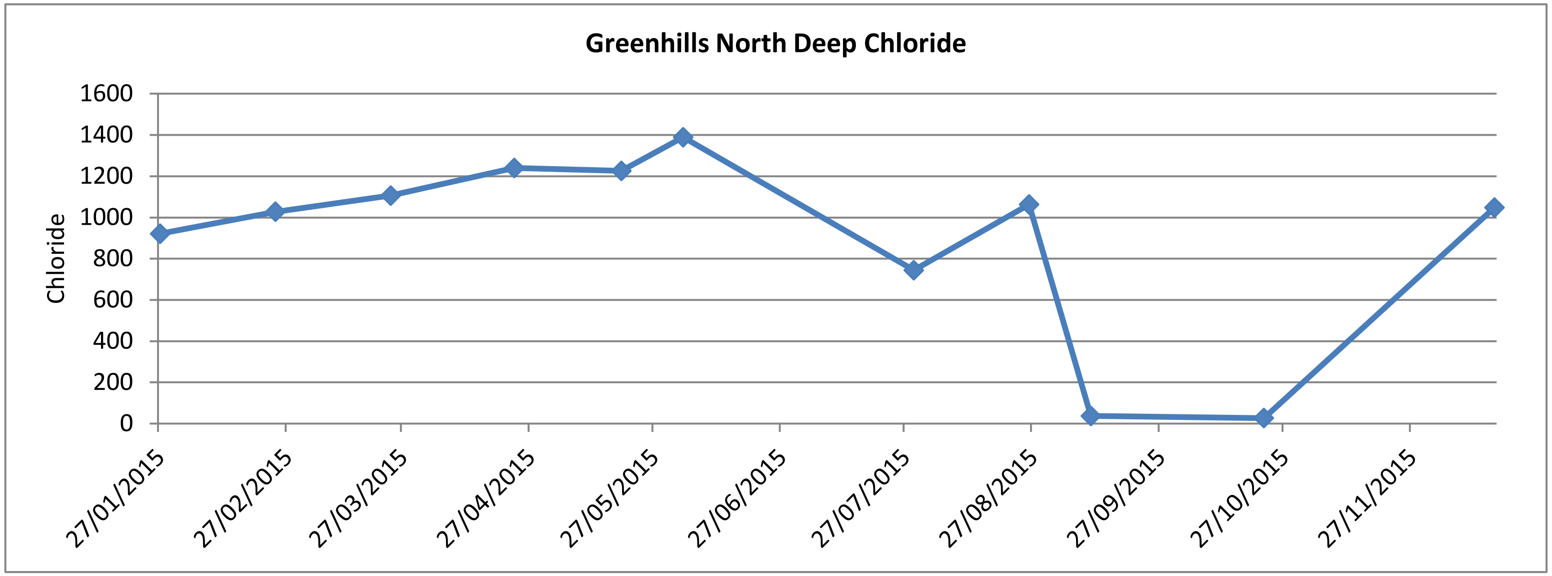


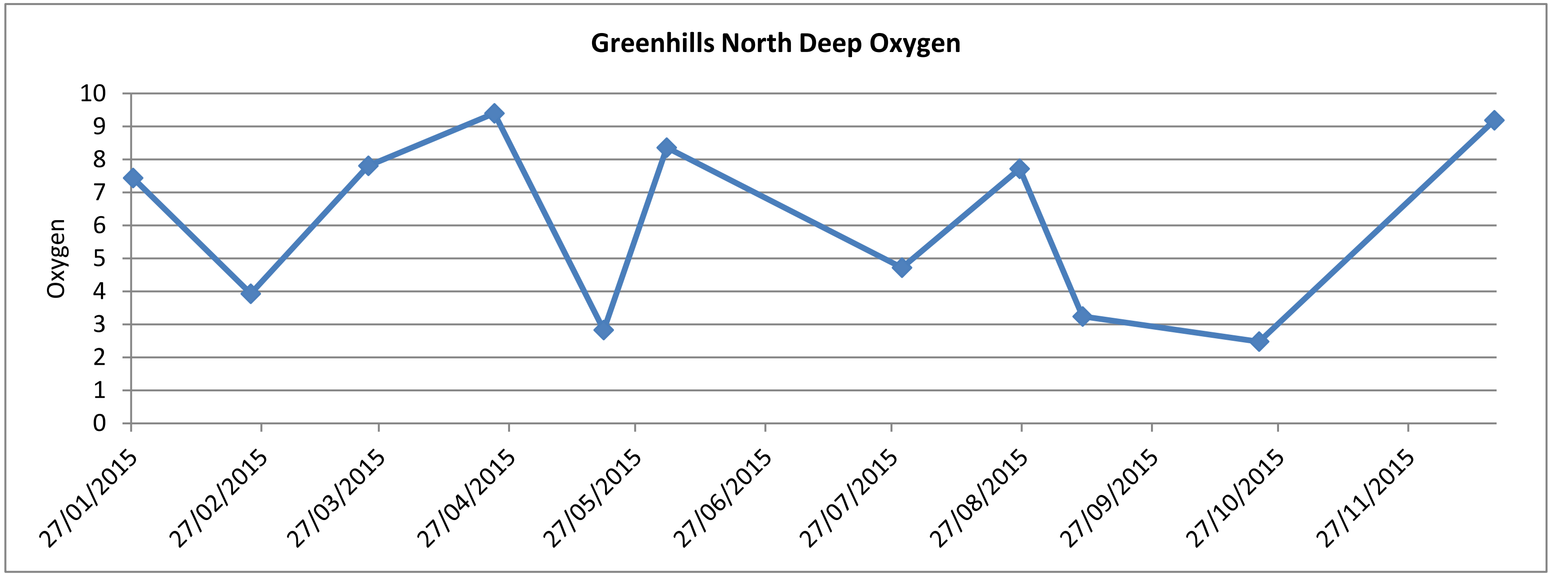
Greenhills North Deep COD
COD
0
10
20
30
40
50
60
70
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

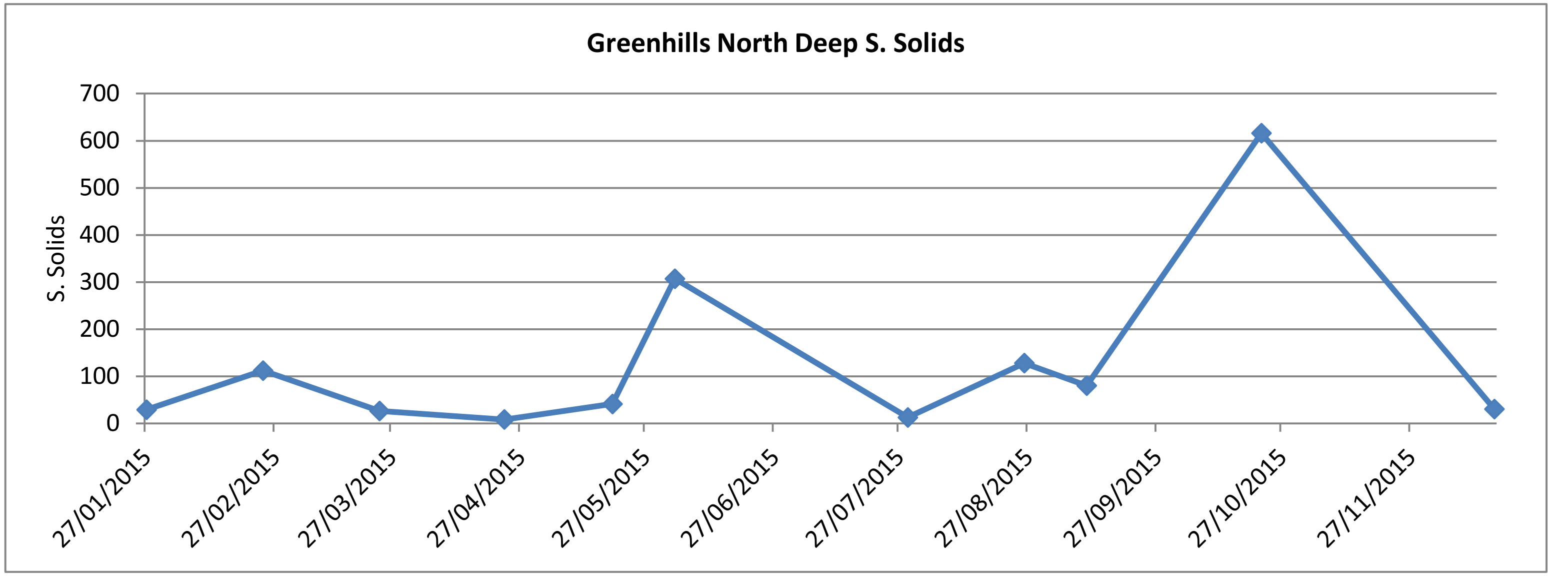

Greenhills North Deep TON
TON
3
2.5
2
1.5
1
0.5
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015


Greenhills North Deep TOC
TOC
25
20
15
10
5
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015


Greenhills North Deep Ammonia (as N)
Ammonia (as N)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015


Greenhills North Deep Chloride
Chloride
1600
1400
1200
1000
800
600
400
200
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

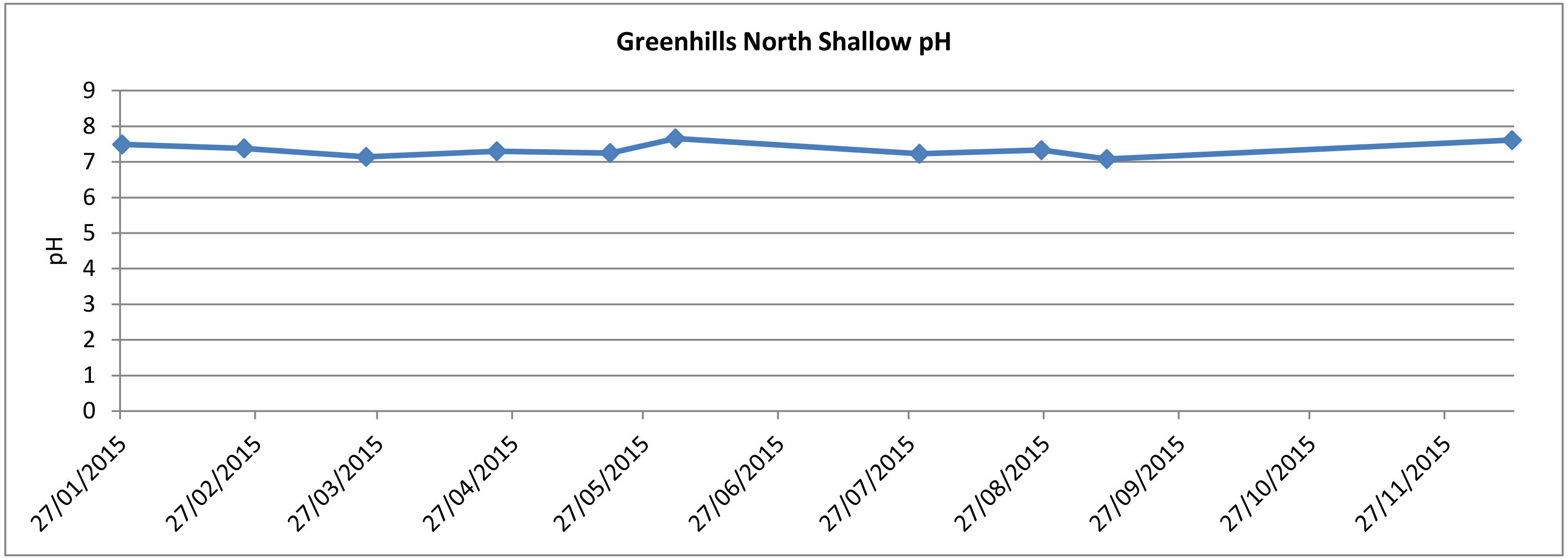

Greenhills North Deep Oxygen
Oxygen
10
9
8
7
6
5
4
3
2
1
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

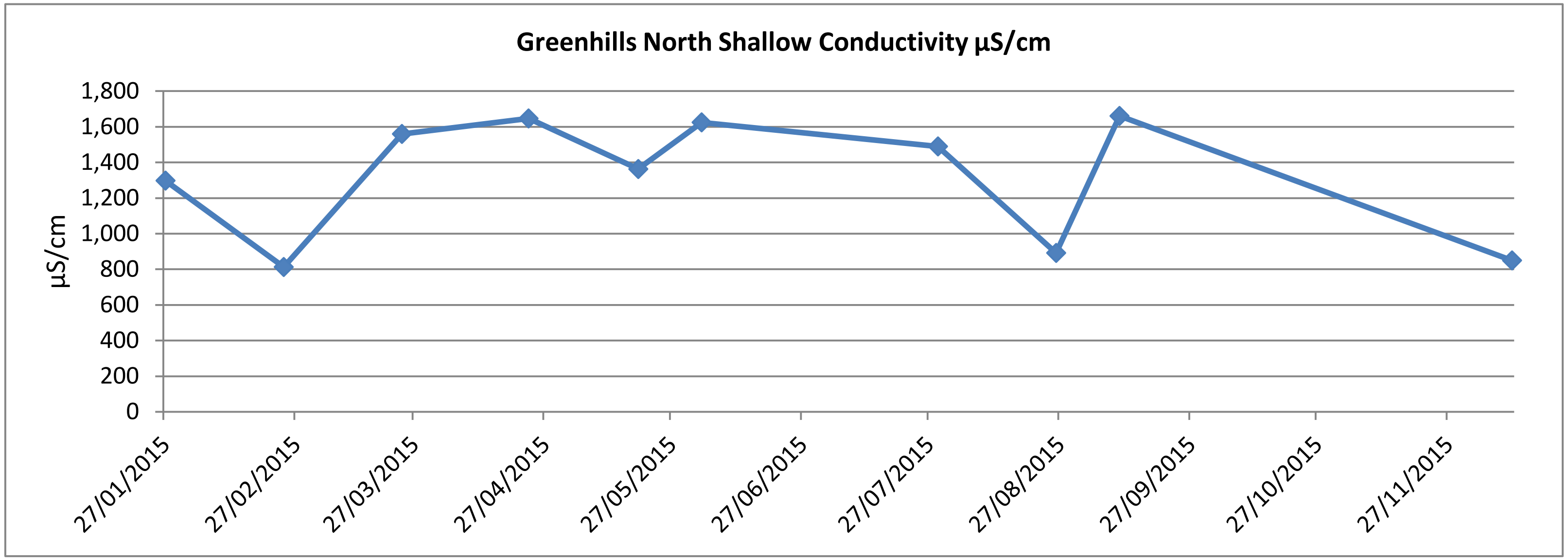

Greenhills North Deep S. Solids
S. Solids
700
600
500
400
300
200
100
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

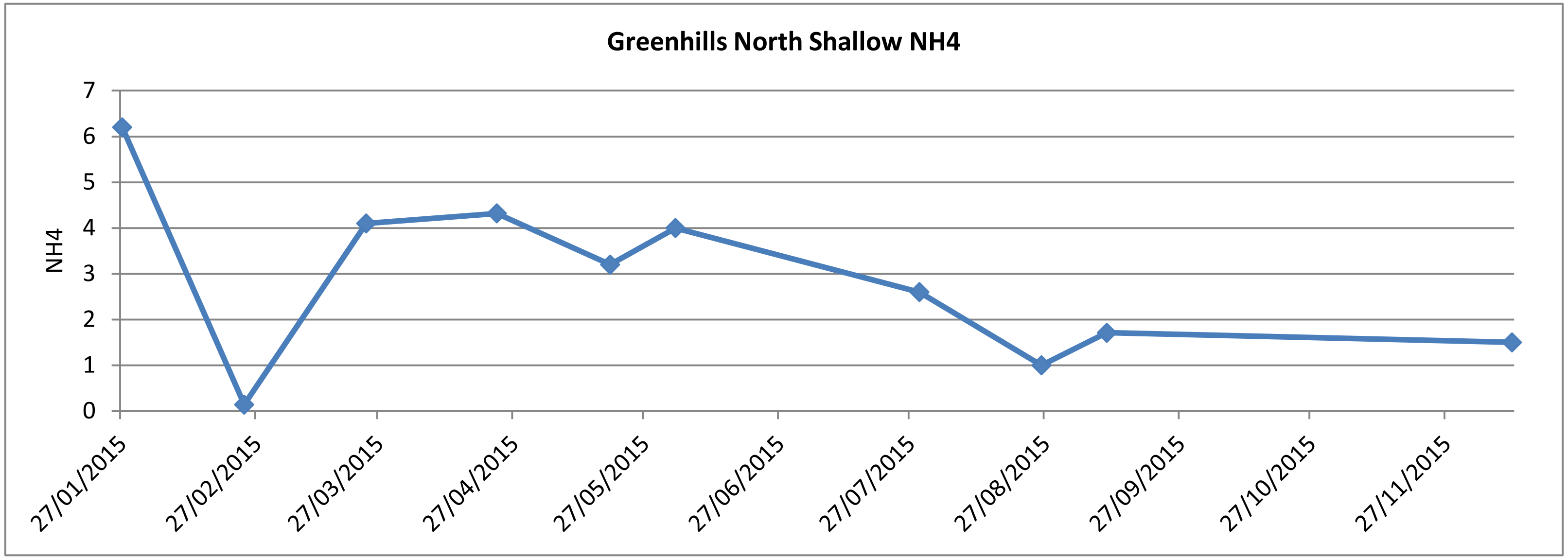
Well: Greenhills & Nemo Groundwater Wells (mg/l)
Location: Greenhills Green and Nemo Rangers GAA Pitch
All parameter data in mg/l unless stated otherwise

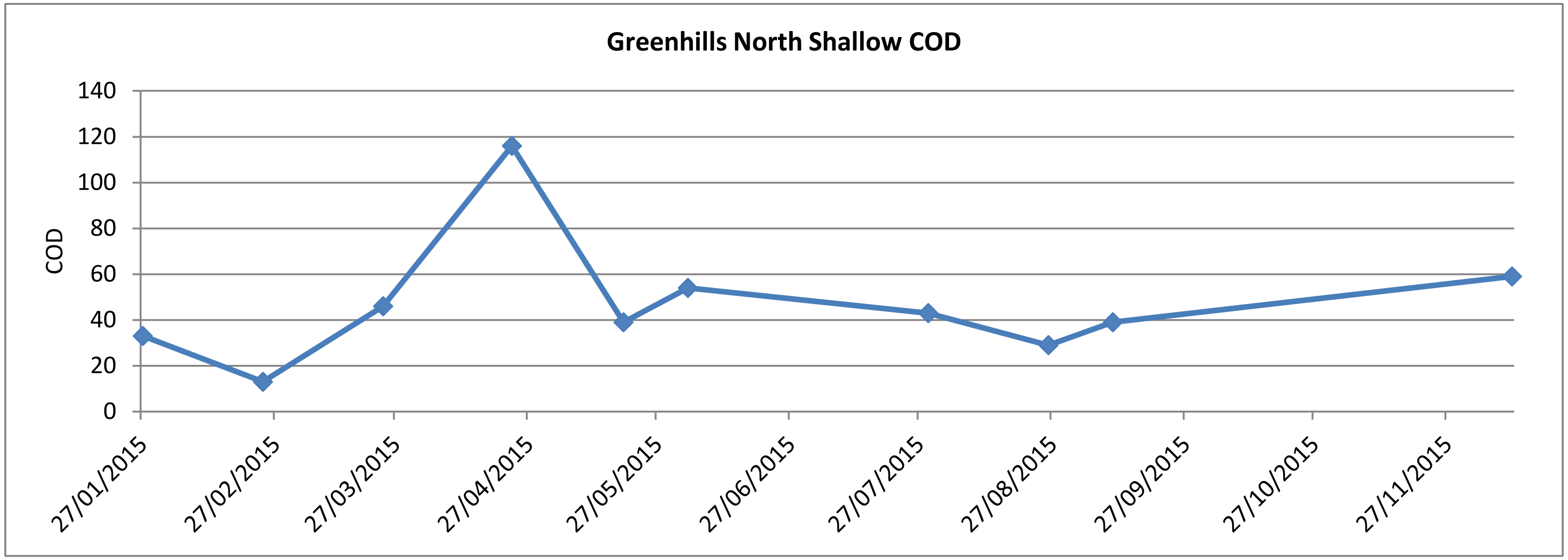
Greenhills North Shallow 2015

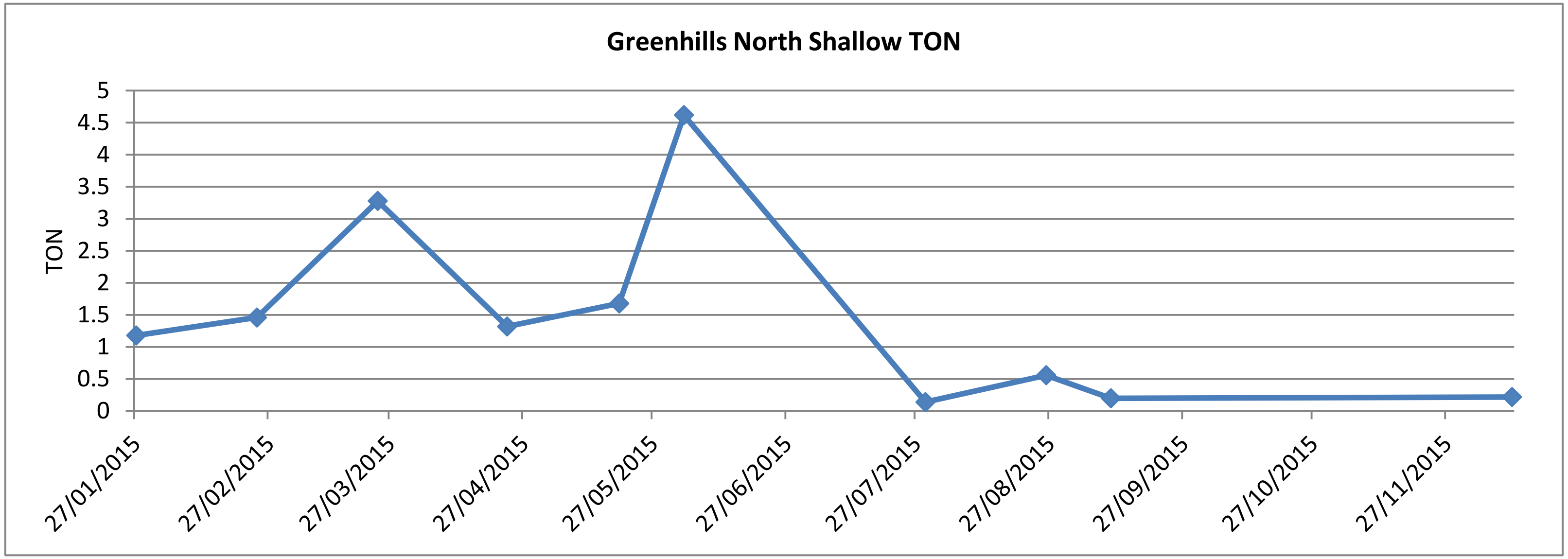
Date	Temp *C	pH	Conductivity µS/cm	NH4	Ammonia (as N)	Chloride	Oxygen	COD	TON	TOC	S. Solids	Well Depth (m)	Depth to Water (m)	Water Height in Well (m)
27/01/2015	15.1	7.49	1,298	6.2	4.82	4.25	4.25	33	1.18	3.4	55	2.61	1.18	1.43
24/02/2015	10.3	7.38	813	0.14	0.11	18.4	6.76	13	1.46	1.7	631	2.61	1.42	1.19
24/03/2015	16	7.14	1,560	4.1	3.19	51	4.29	46	3.28	13.6	13.6	2.61	1.45	1.16
23/04/2015	13.1	7.3	1,647	4.32	3.36	51	3.36	116	1.32	2.1	18.4	2.61	1.68	0.93
19/05/2015	13.2	7.25	1,363	3.2	2.49	95	4.5	39	1.68	13.7	4.4	2.61	1.44	1.17
03/06/2015	14.4	7.66	1,625	4	3.11	28.36	6.37	54	4.62	15.8	548	2.61	1.52	1.09
29/07/2015	16.8	7.23	1,490	2.6	2.02	22.7	4.89	43	0.14	10.5	20.6	2.61	1.63	0.98
26/08/2015	23.8	7.33	892	1	0.78	15.598	6.73	29	0.56	16.6	4492	2.61	1.72	0.89
10/09/2015	20.4	7.08	1,661	1.71	1.33	32.61	2.8	39	0.2	19	386	2.61	1.56	1.05
												2.61	0	2.61
												2.61	0	2.61
12/12/2015	15.2	7.61	850	1.5	1.17	30.2	8.24	59	0.22	14.1	68.3	2.61	1.45	1.16

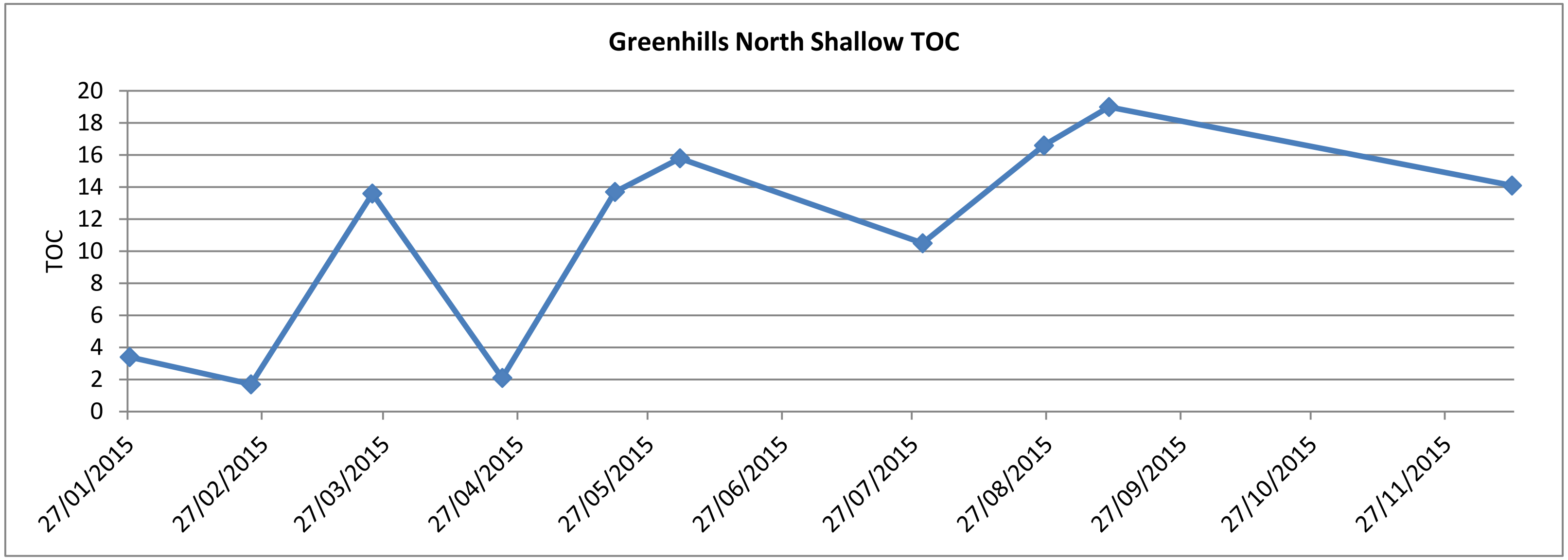

Greenhills North Shallow pH
pH
0
1
2
3
4
5
6
7
8
9
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

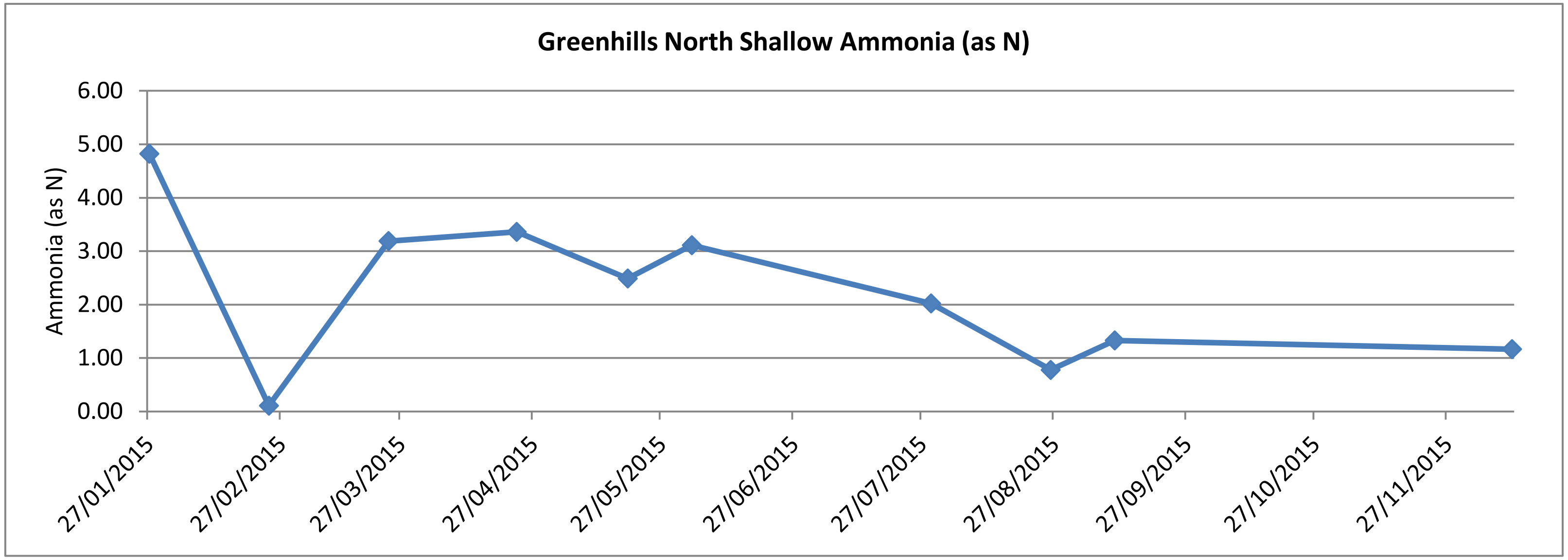

Greenhills North Shallow Conductivity µS/cm
µS/cm
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015


Greenhills North Shallow NH4
NH4
0
1
2
3
4
5
6
7
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

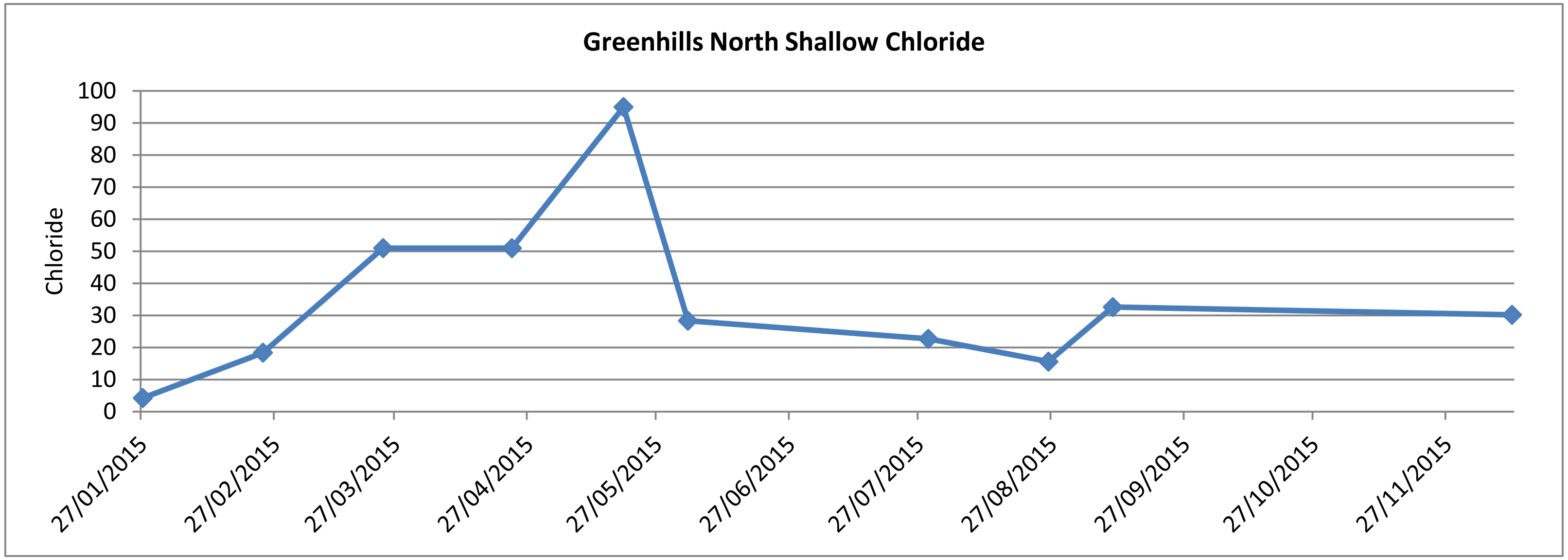

Greenhills North Shallow COD
COD
0
20
40
60
80
100
120
140
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015


Greenhills North Shallow TON
TON
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

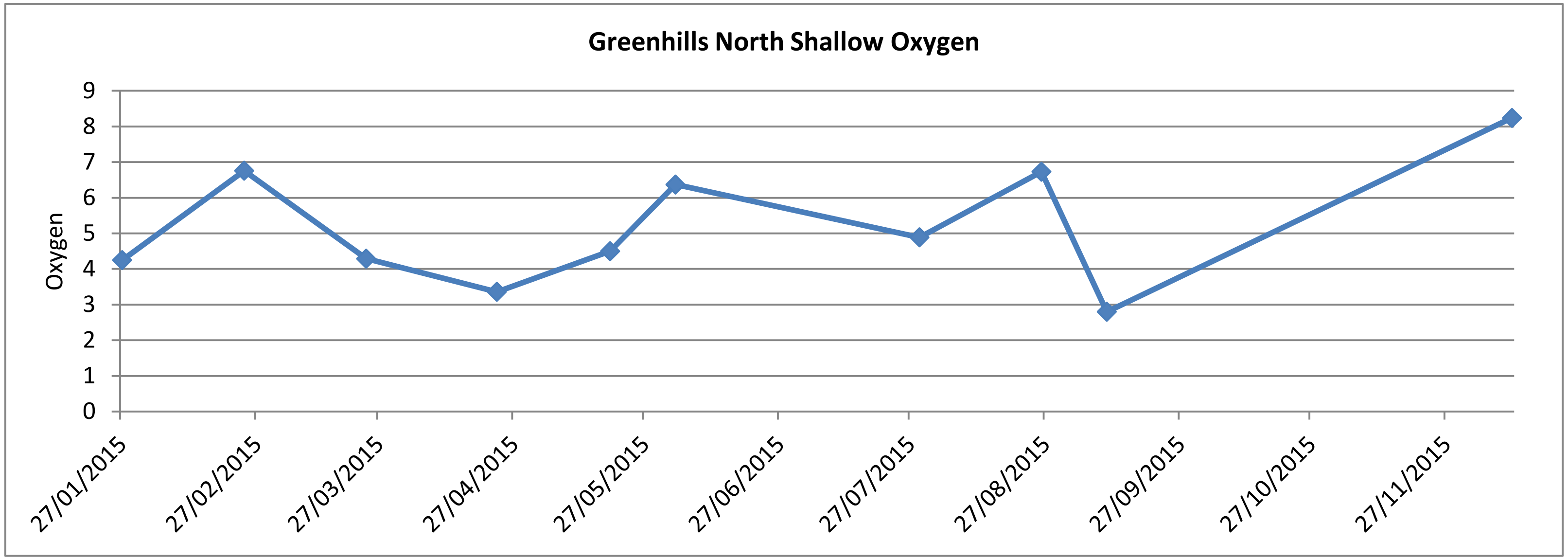

Greenhills North Shallow TOC
TOC
20
18
16
14
12
10
8
6
4
2
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015



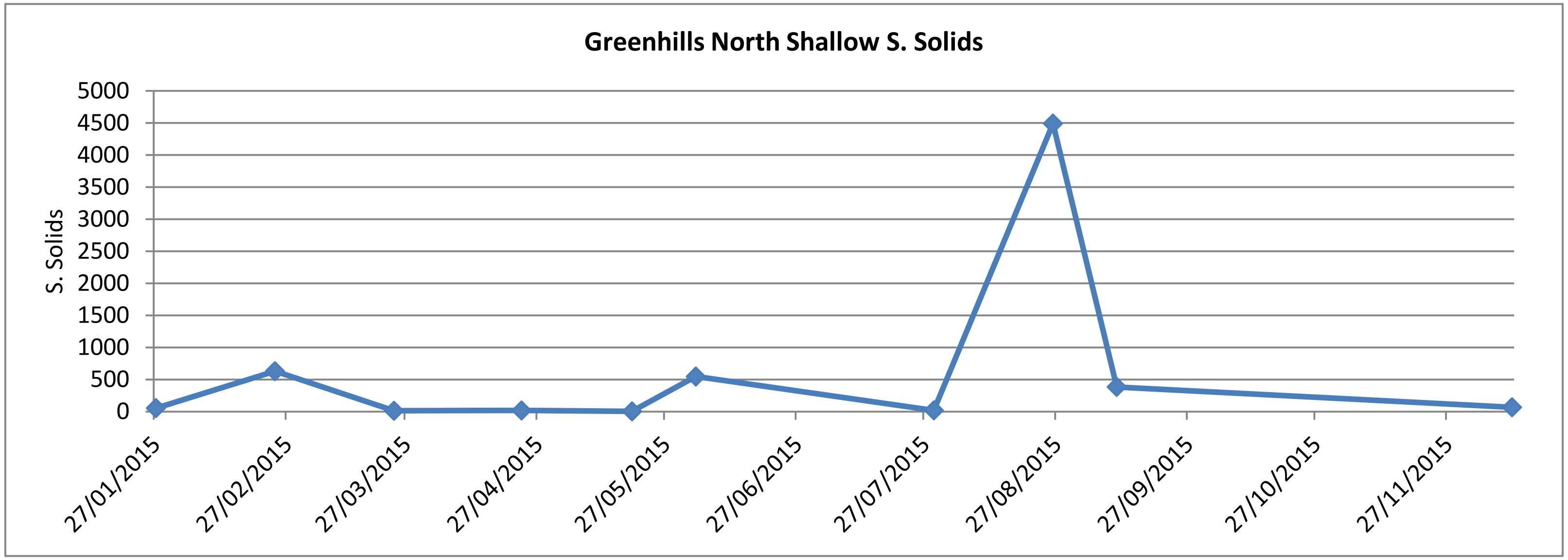
Greenhills North Shallow Ammonia (as N)
Ammonia (as N)
6.00
5.00
4.00
3.00
2.00
1.00
0.00
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015



Greenhills North Shallow Chloride
Chloride
100
90
80
70
60
50
40
30
20
10
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015



Greenhills North Shallow Oxygen
Oxygen
0
1
2
3
4
5
6
7
8
9
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

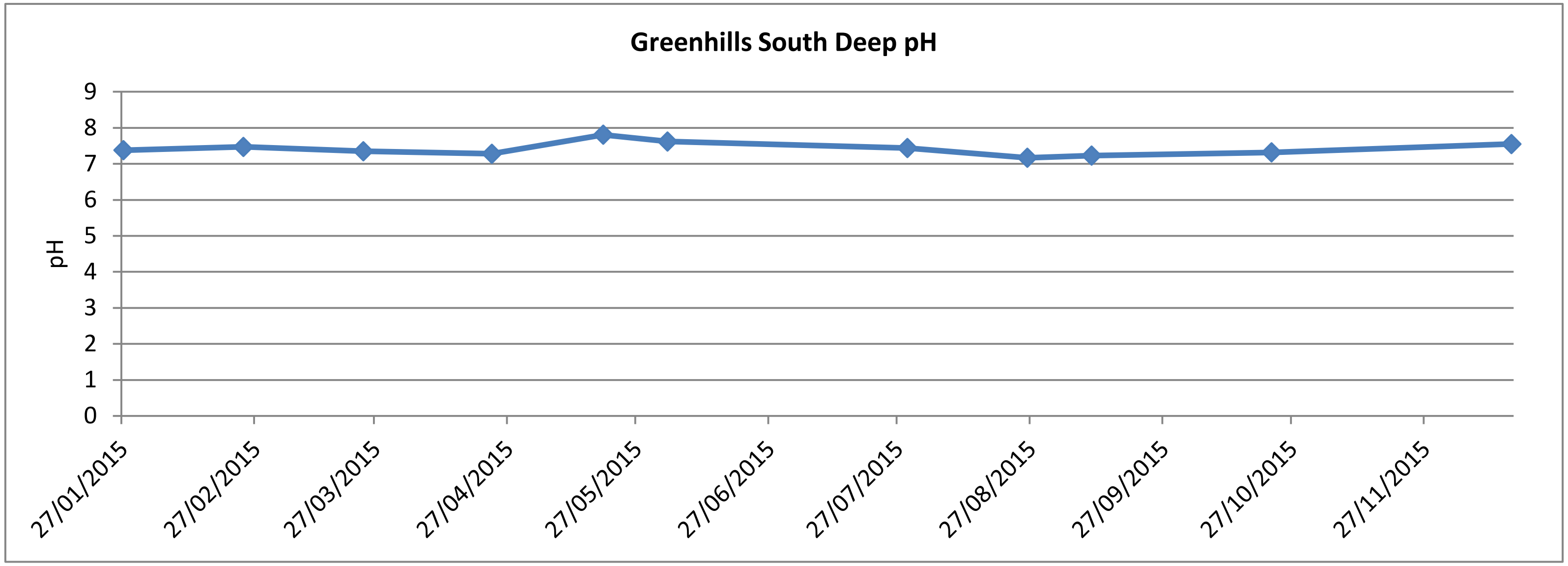


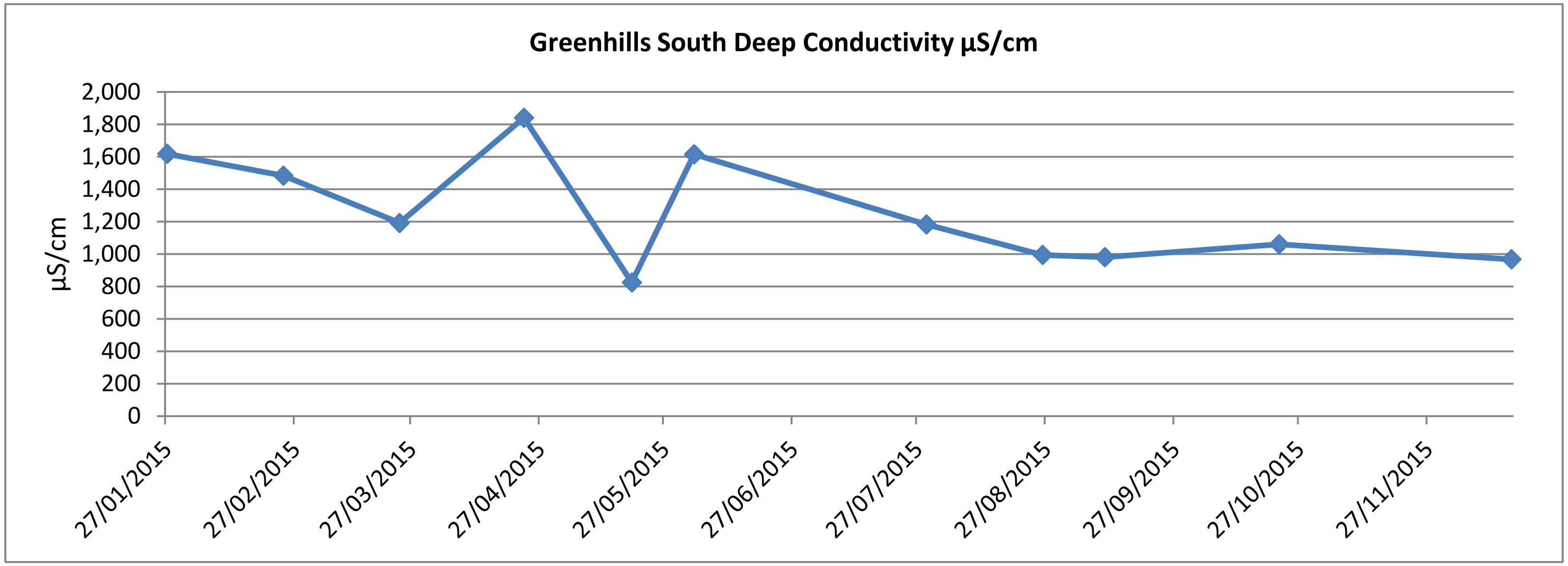
Greenhills North Shallow S. Solids
S. Solids
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

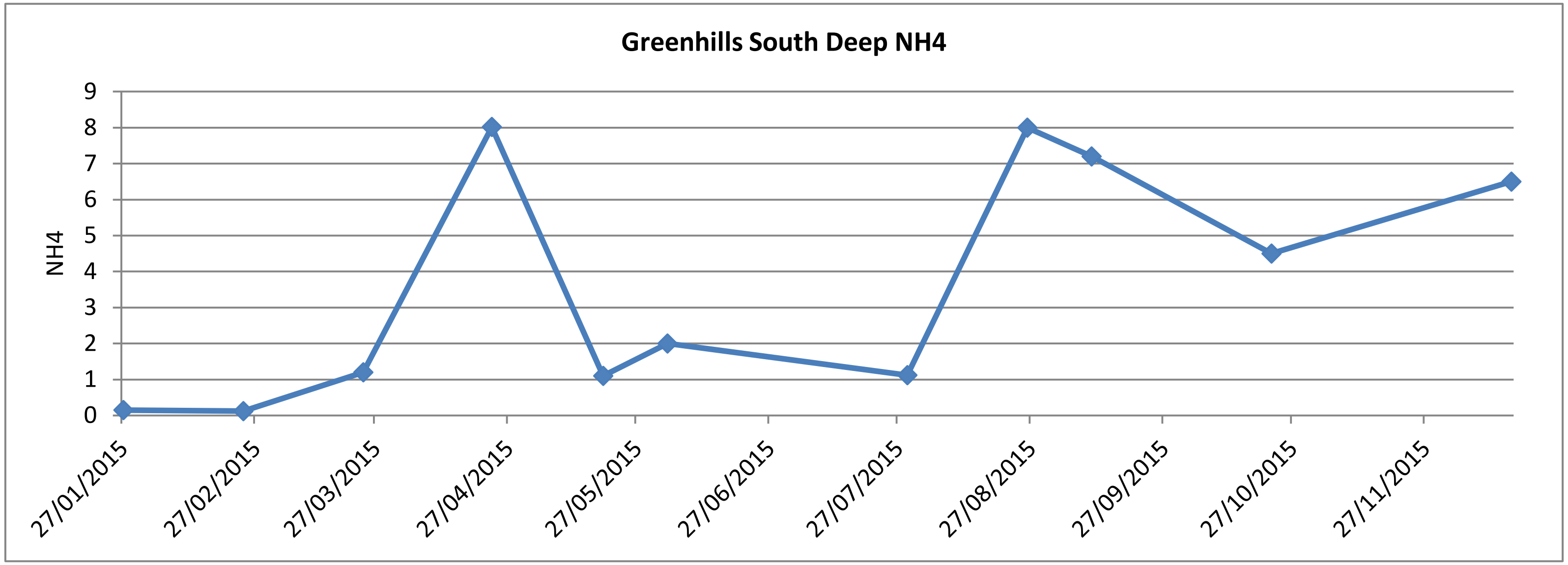
Well: Greenhills & Nemo Groundwater Wells (mg/l)
Location: Greenhills Green and Nemo Rangers GAA Pitch
All parameter data in mg/l unless stated otherwise

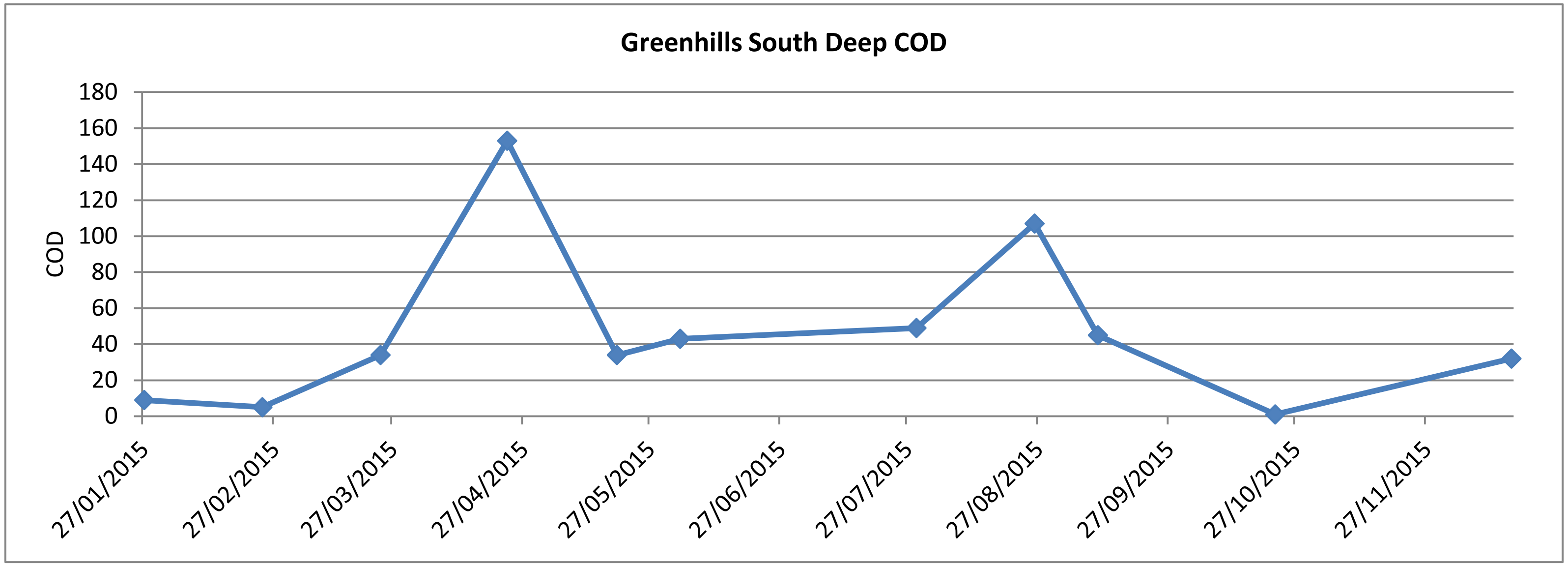
Greenhills South Deep 2015

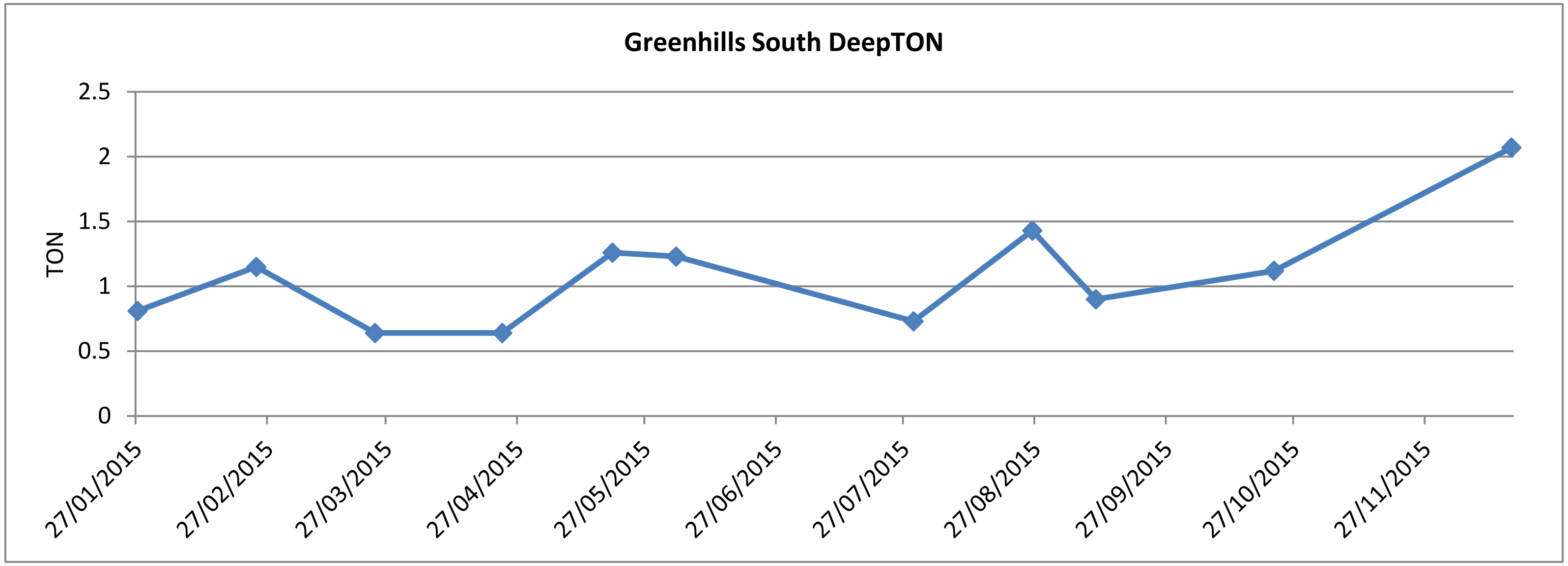
Date	Temp *C	pH	Conductivity µS/cm	NH4	Ammonia (as N)	Chloride	Oxygen	COD	TON	TOC	S. Solids	Well Depth (m)	Depth to Water (m)	Water Height in Well (m)
27/01/2015	13.7	7.38	1,619	0.15	0.12	397	2.89	9	0.81	12.7	25	34.7	1.41	33.29
24/02/2015	12	7.47	1,484	0.12	0.09	365	3.78	5	1.15	5.6	28.4	34.7	1.61	33.09
24/03/2015	16.7	7.35	1,192	1.2	0.93	268	6.26	34	0.64	11.5	22.4	34.7	1.51	33.19
23/04/2015	14.4	7.28	1,841	8.02	6.24	469	3.5	153	0.64	19.3	55.6	34.7	1.71	32.99
19/05/2015	13	7.81	825	1.1	0.86	100	2.94	34	1.26	12.1	0.8	34.7	1.58	33.12
03/06/2015	14.9	7.62	1,616	2	1.56	415	9.09	43	1.23	6	384	34.7	1.63	33.07
29/07/2015	14	7.44	1,183	1.12	0.87	260	5.24	49	0.73	8.8	50.4	34.7	1.64	33.06
26/08/2015	22.3	7.17	995	8	6.22	248.15	5.01	107	1.43	35	1880	34.7	1.48	33.22
10/09/2015	20.5	7.23	981	7.2	5.60	46.79	3.07	45	0.9	16.8	208	34.7	1.46	33.24
22/10/2015	13	7.32	1,061	4.5	3.50	98	2.62	1	1.12	8.4	88	34.7	1.38	33.32
												34.7	0	34.7
17/12/2015	15.2	7.55	968	6.5	5.06	325	9.41	32	2.07	4.8	74.9	34.7	1.32	33.38

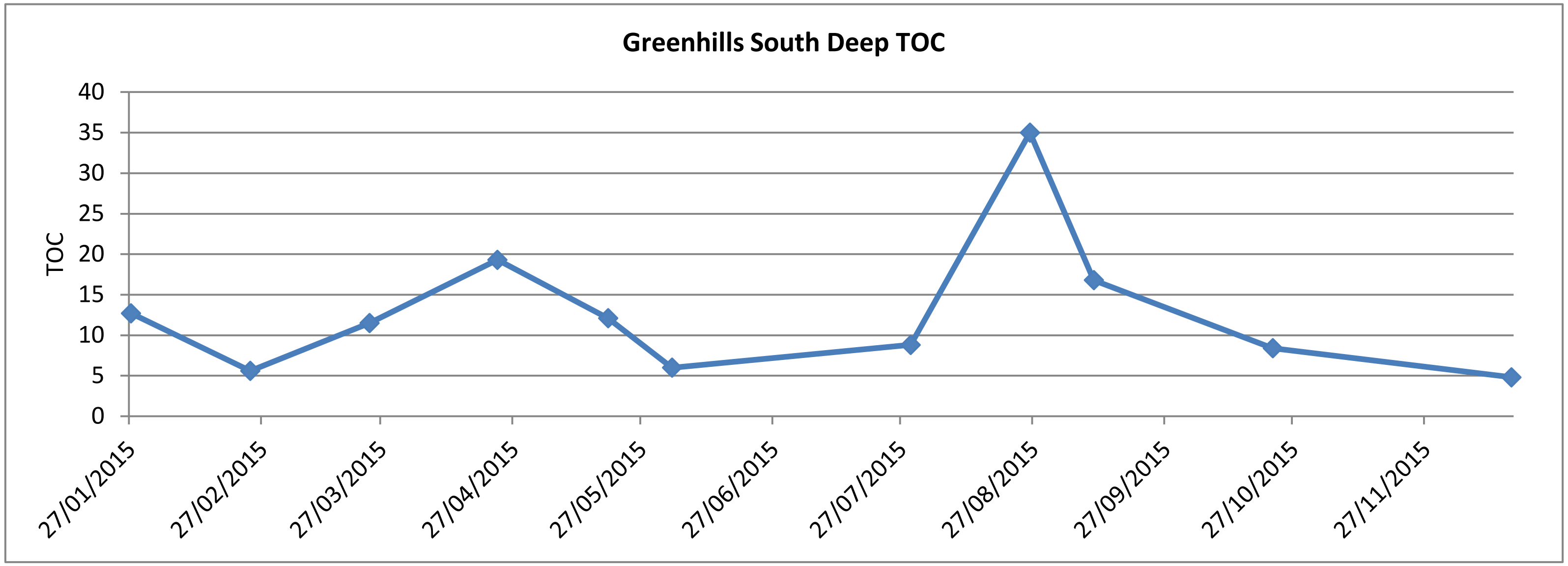

Greenhills South Deep pH
pH
9
8
7
6
5
4
3
2
1
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

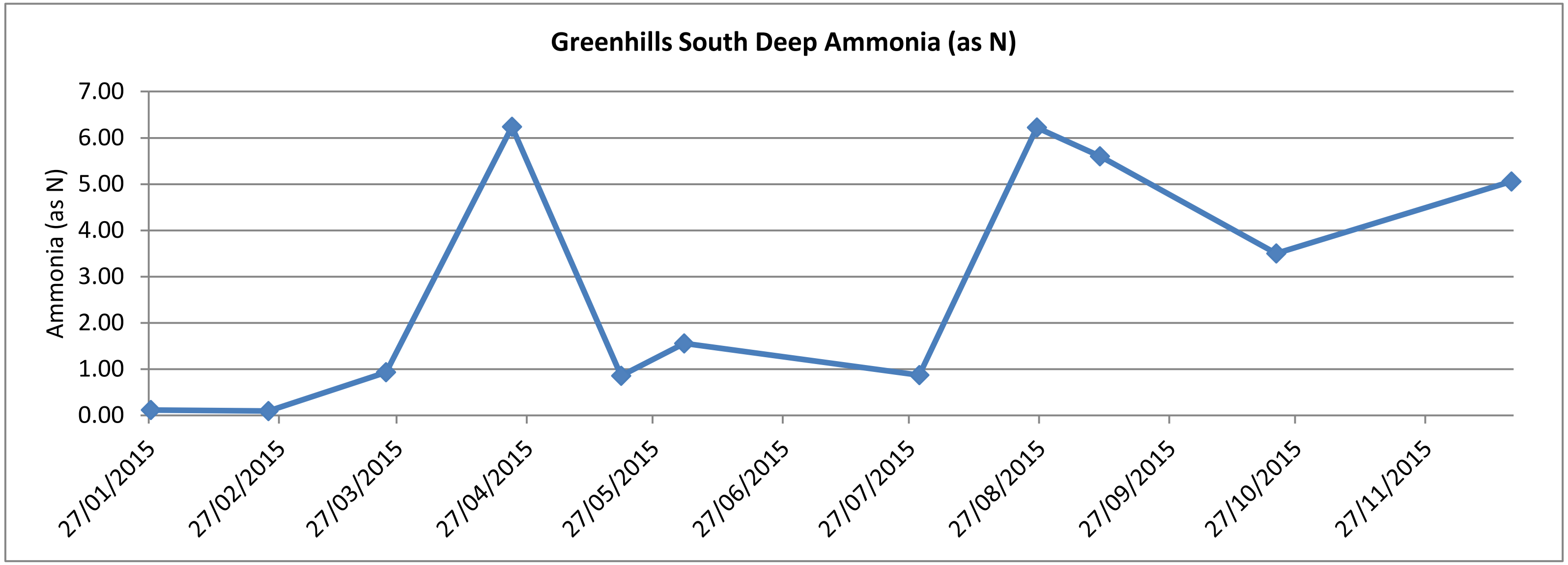

Greenhills South Deep Conductivity µS/cm
µS/cm
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015


Greenhills South Deep NH4
NH4
0
1
2
3
4
5
6
7
8
9
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

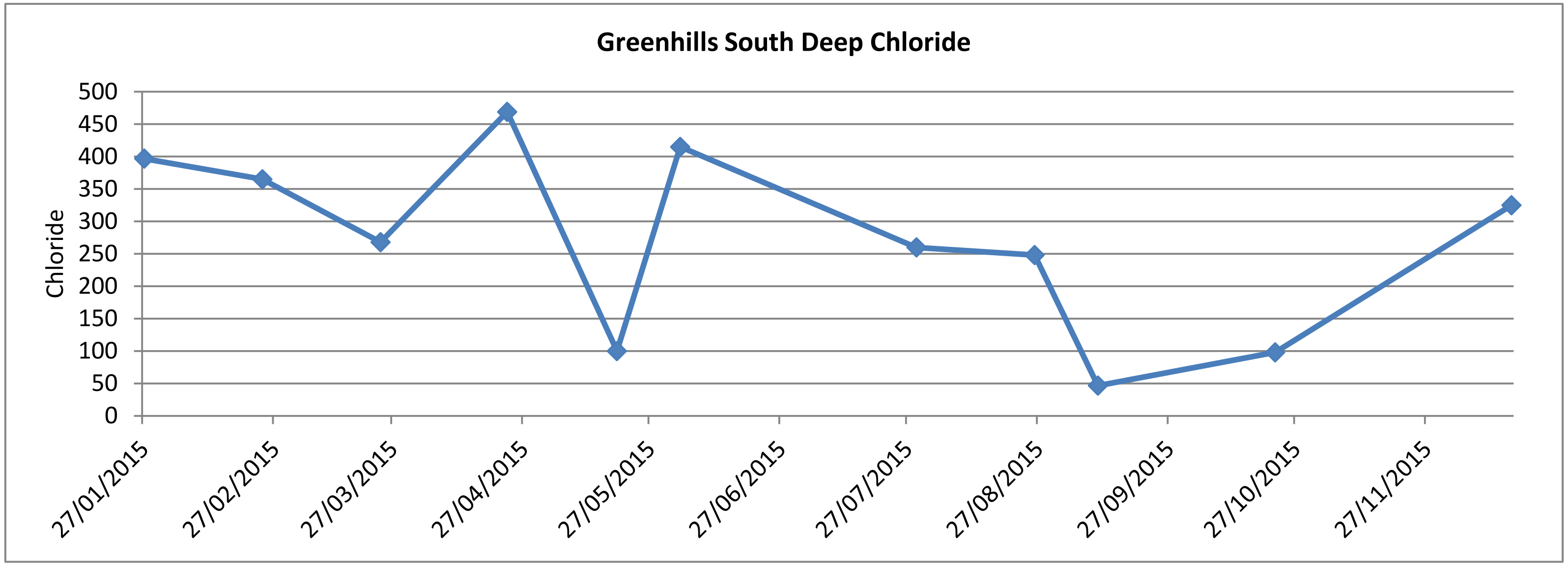

Greenhills South Deep COD
COD
0
20
40
60
80
100
120
140
160
180
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015


Greenhills South DeepTON
TON
2.5
2
1.5
1
0.5
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

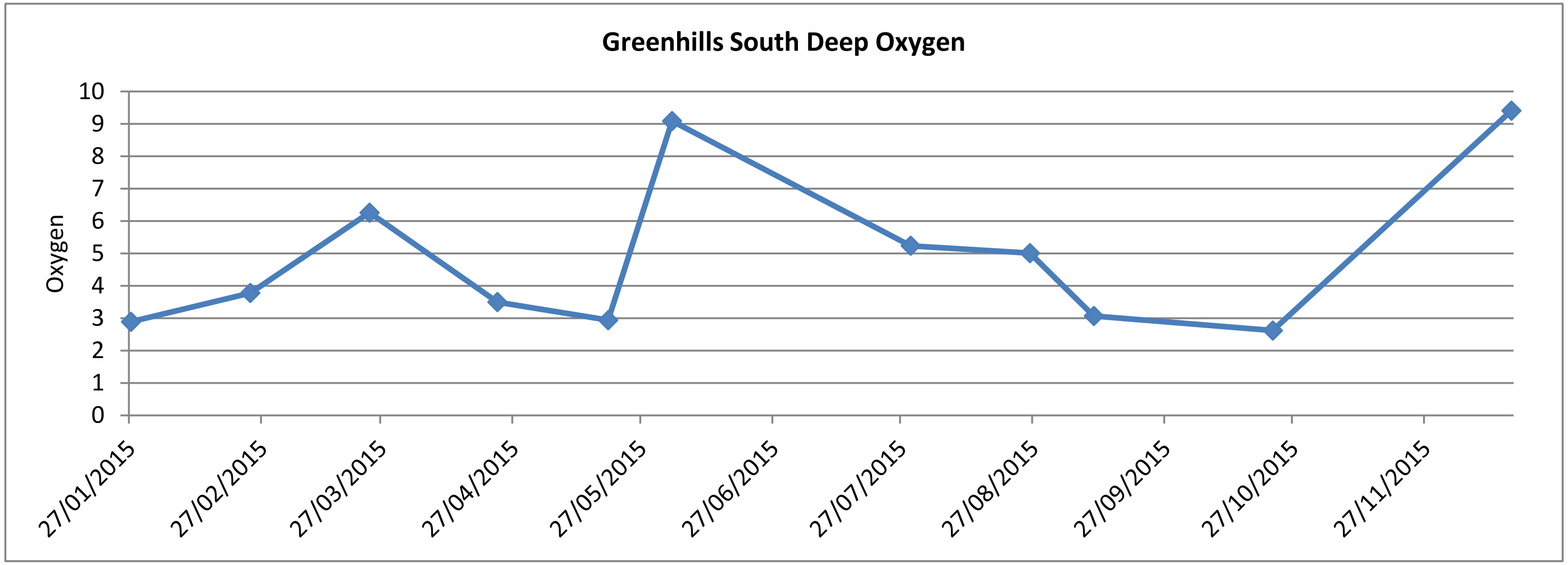

Greenhills South Deep TOC
TOC
40
35
30
25
20
15
10
5
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

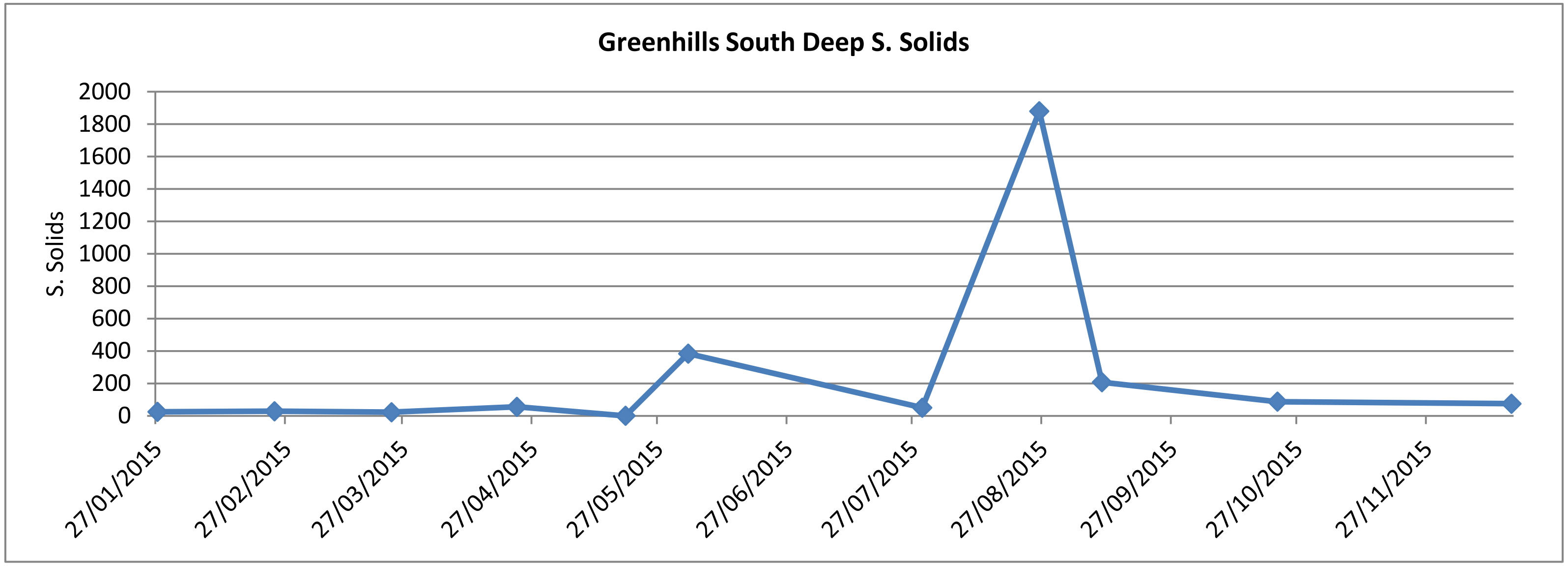


Greenhills South Deep Ammonia (as N)
Ammonia (as N)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015



Greenhills South Deep Chloride
Chloride
500
450
400
350
300
250
200
150
100
50
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

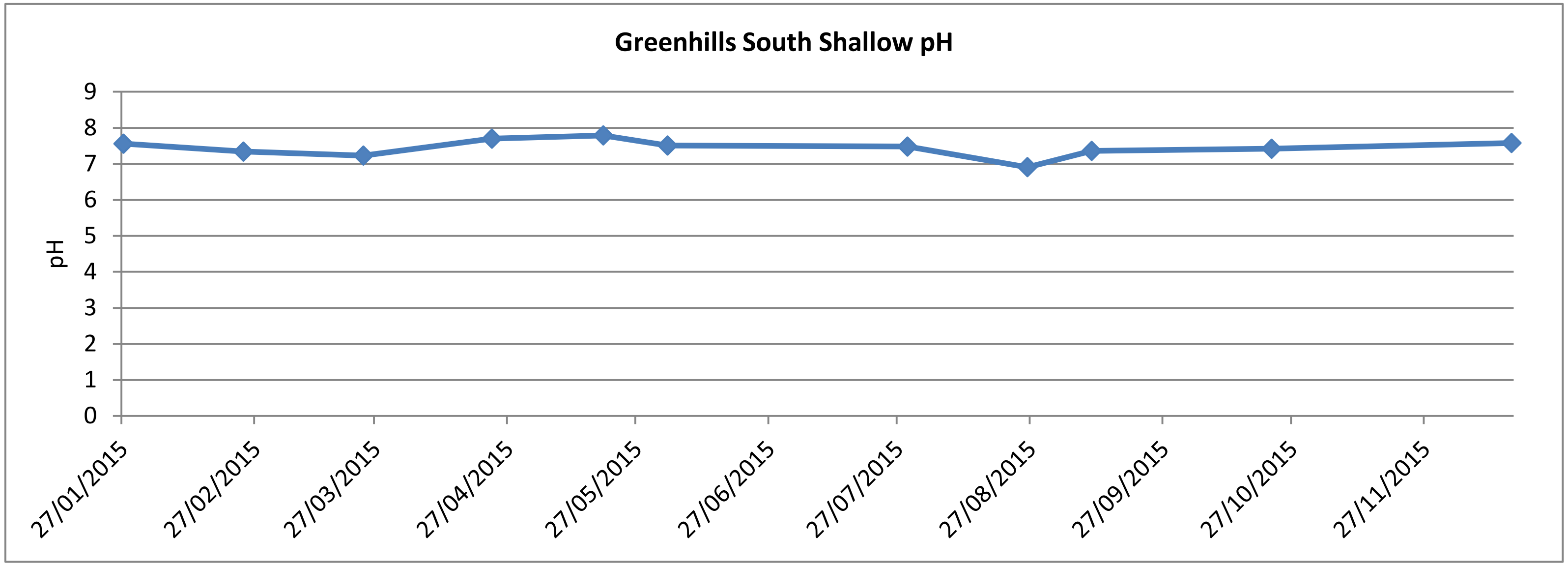

Greenhills South Deep Oxygen
Oxygen
0
1
2
3
4
5
6
7
8
9
10
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015


Greenhills South Deep S. Solids
S. Solids
0
200
400
600
800
1000
1200
1400
1600
1800
2000
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

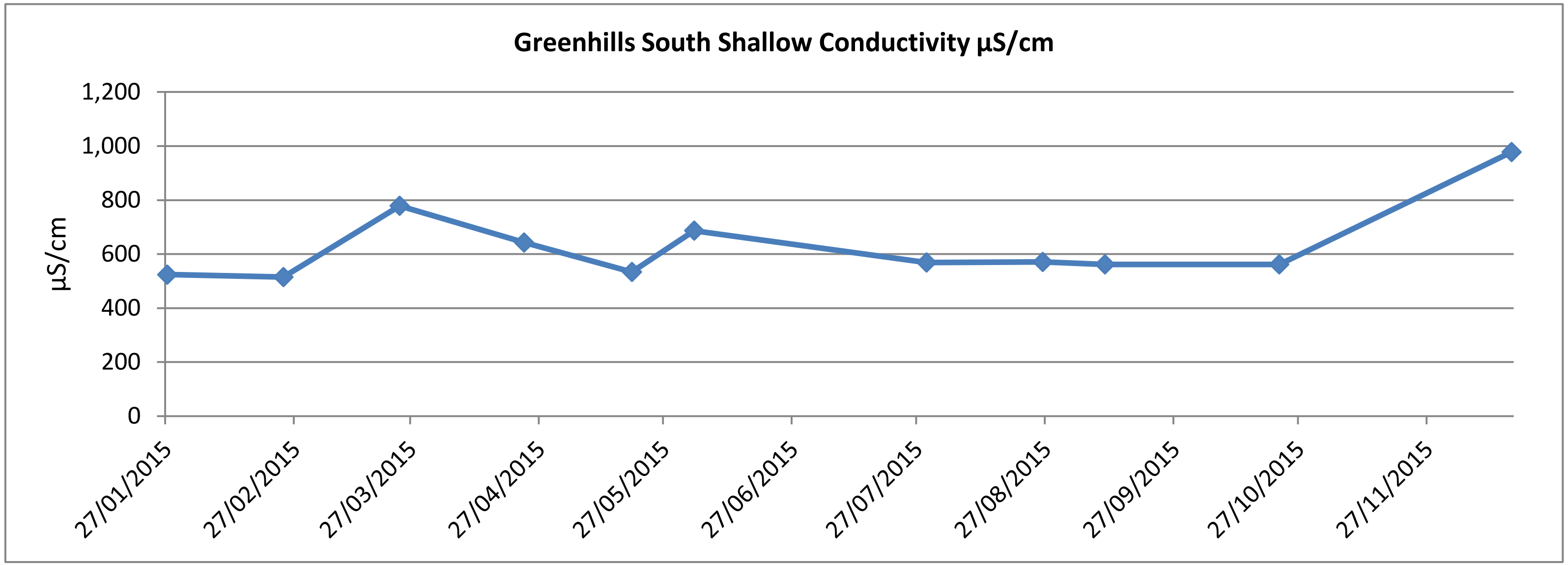
Well: Greenhills & Nemo Groundwater Wells (mg/l)
Location: Greenhills Green and Nemo Rangers GAA Pitch
All parameter data in mg/l unless stated otherwise

Greenhills South Shallow 2015

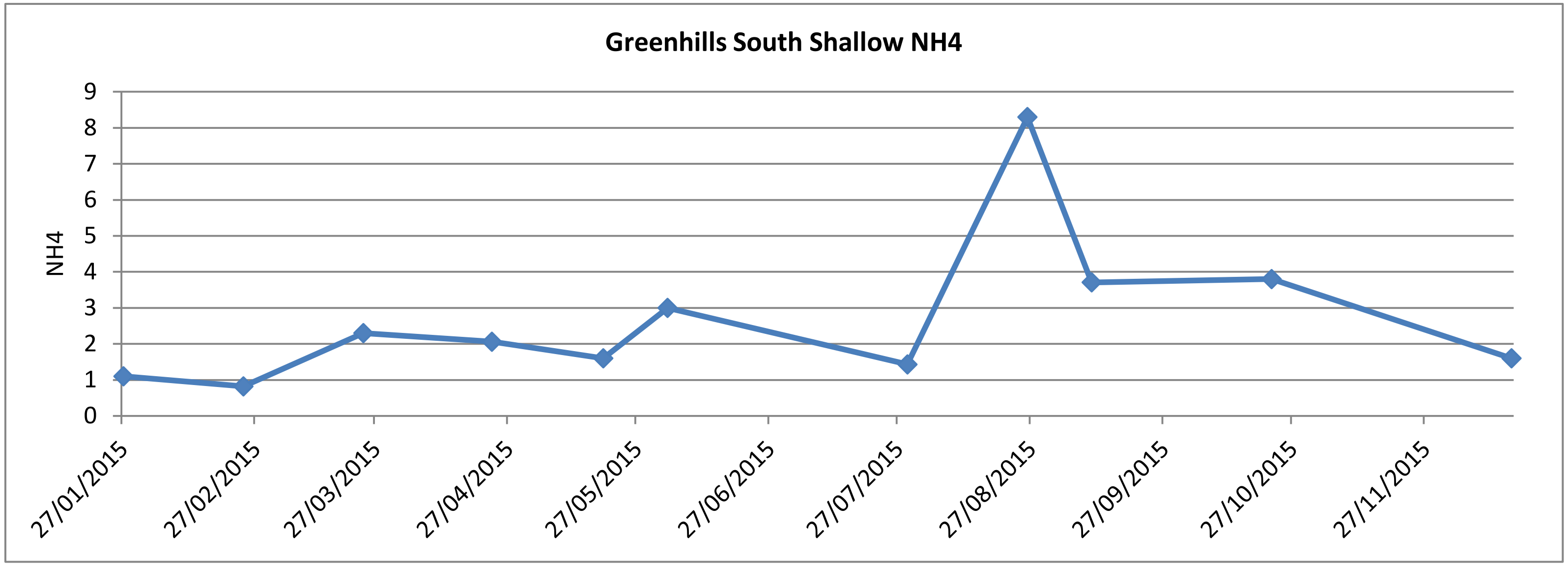
Date	Temp *C	pH	Conductivity µS/cm	NH4	Ammonia (as N)	Chloride	Oxygen	COD	TON	TOC	S. Solids	Well Depth (m)	Depth to Water (m)	Water Height in Well (m)
27/01/2015	13.8	7.56	524	1.1	0.86	52	3.05	1	0.56	3	18	11.94	1.43	10.51
24/02/2015	11.9	7.34	515	0.82	0.64	61	2.82	1	0.94	0.1	113	11.94	1.57	10.37
24/03/2015	16.5	7.23	779	2.3	1.79	148	4.25	14	1.57	1.5	548	11.94	1.5	10.44
23/04/2015	13.4	7.7	643	2.06	1.60	91	3.14	14	0.11	1.6	21.2	11.94	1.73	10.21
19/05/2015	13	7.79	534	1.6	1.24	83	3.15	9	0.7	2.6	4	11.94	1.55	10.39
03/06/2015	14.9	7.51	687	3	2.33	113	8.64	22	1.09	4.9	486	11.94	1.59	10.35
29/07/2015	13.8	7.48	569	1.43	1.11	51	4.68	50	8.8	0.8	154	11.94	1.61	10.33
26/08/2015	18.6	6.91	571	8.3	6.46	425	2.79	53	0.14	18.5	248	11.94	1.52	10.42
10/09/2015	20.2	7.36	562	3.71	2.89	108	3.58	8	0.98	0.8	168	11.94	1.34	10.6
22/10/2015	13.1	7.42	562	3.8	2.96	1048	3.08	21	0.99	1.8	260	11.94	1.29	10.65
												11.94	0	11.94
17/12/2015	14.5	7.58	978	1.6	1.24	71	8.55	6	0.47	0.6	20	11.94	1.28	10.66

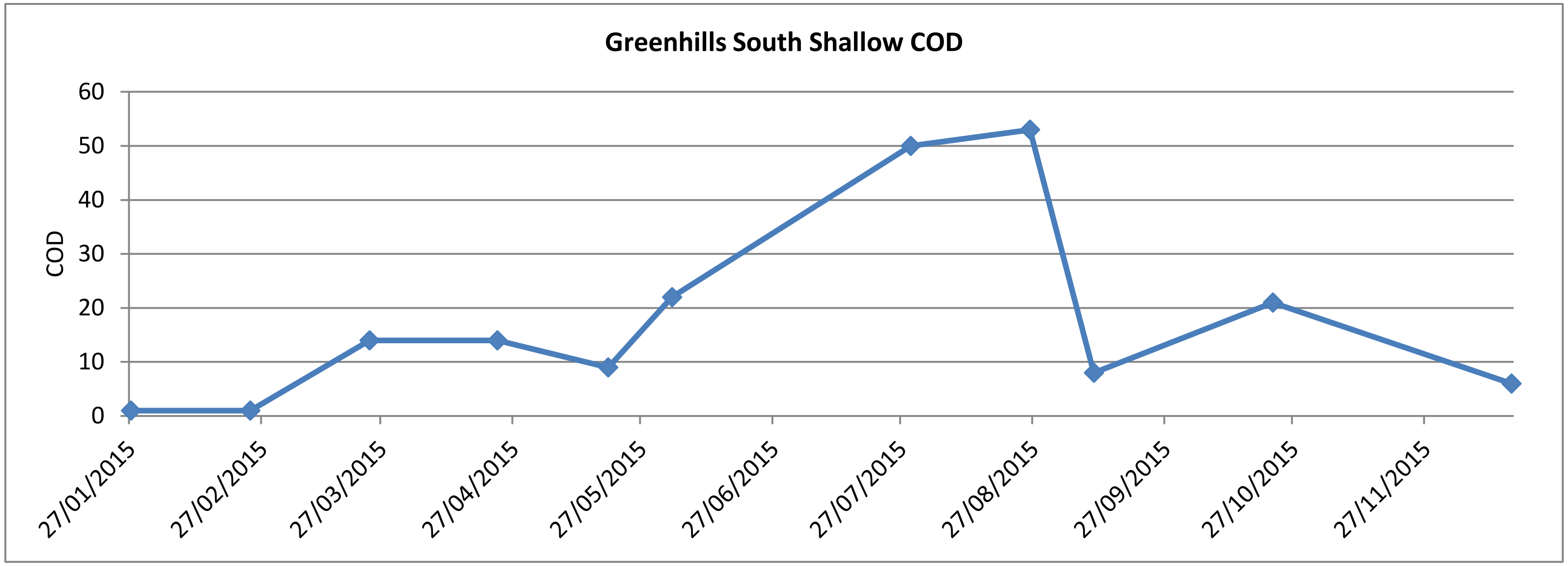


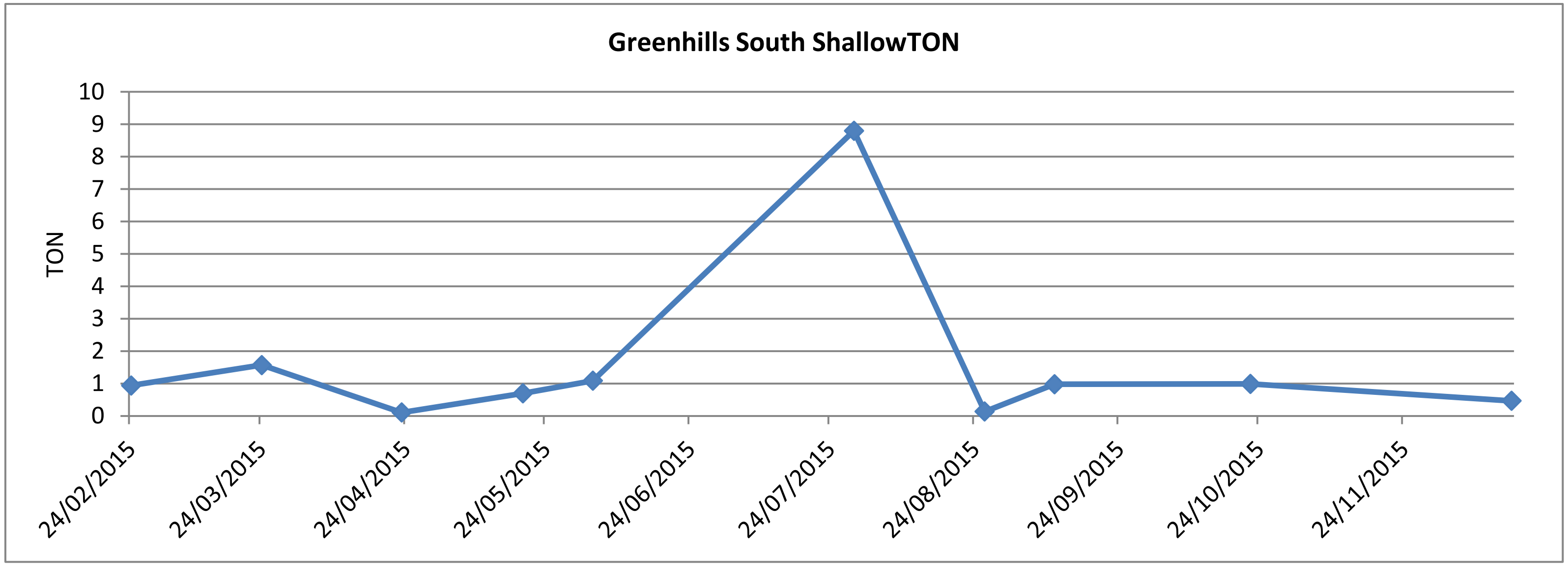
Greenhills South Shallow pH
pH
0
1
2
3
4
5
6
7
8
9
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

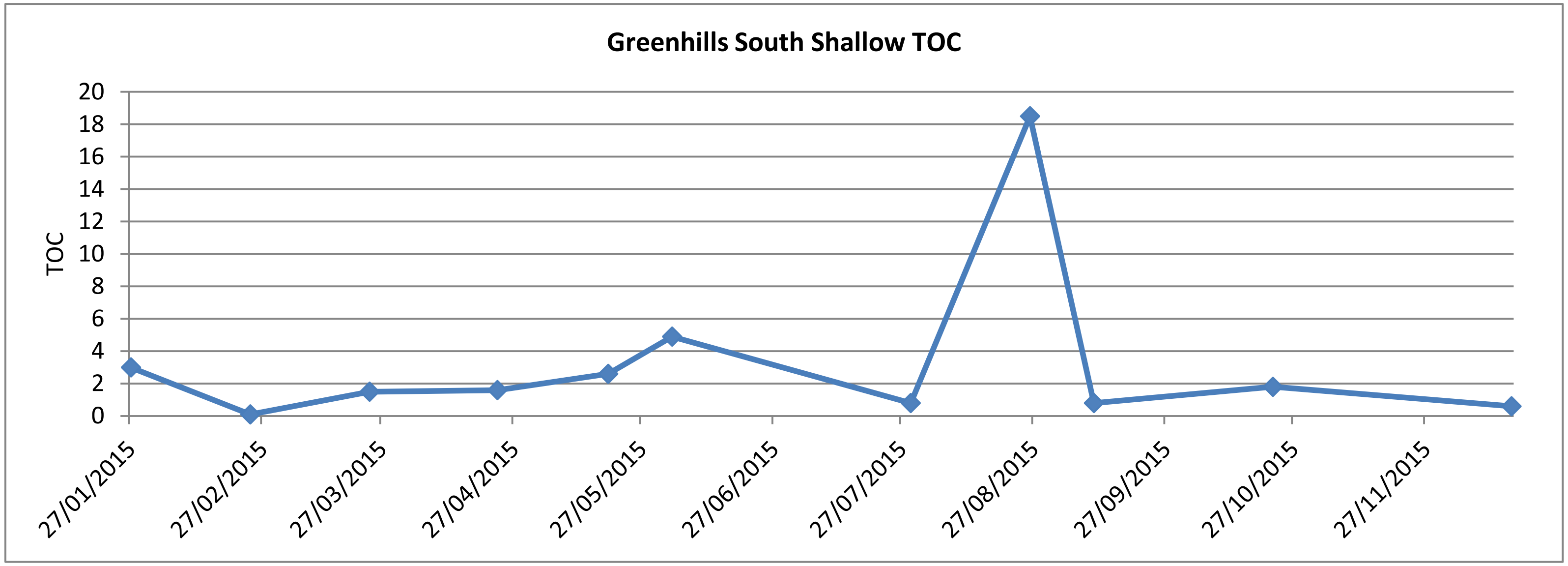


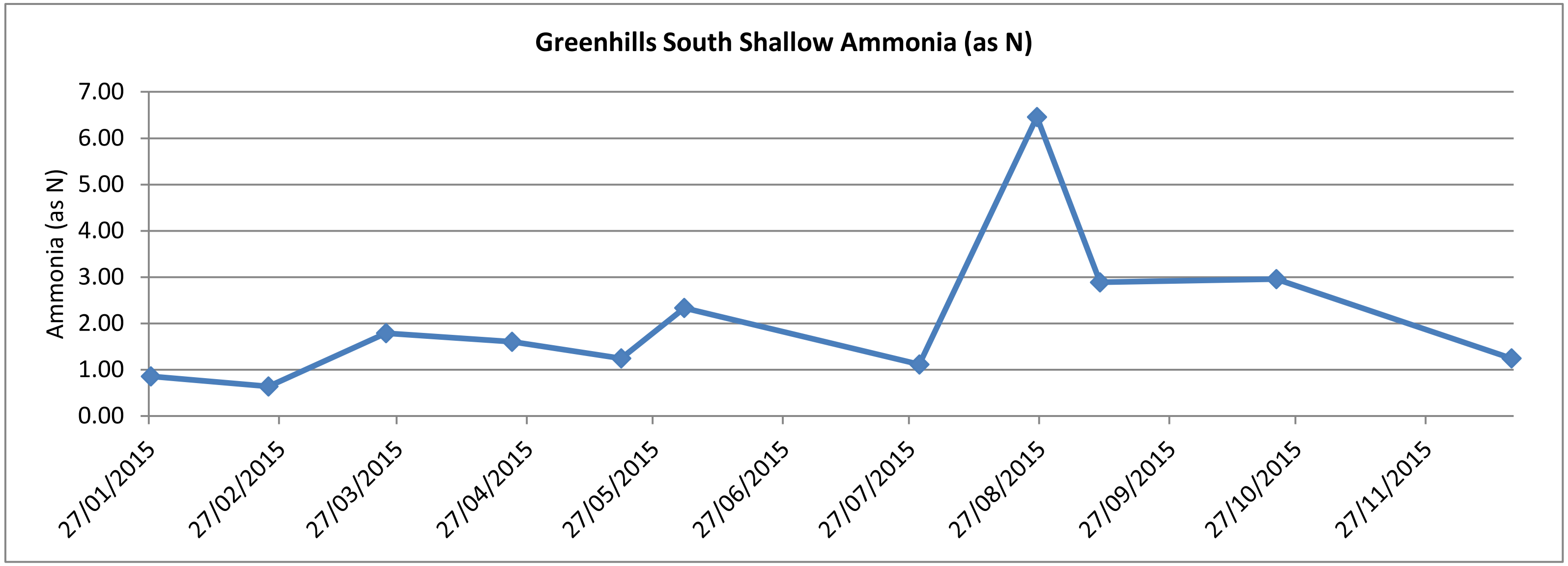
Greenhills South Shallow Conductivity µS/cm
µS/cm
0
200
400
600
800
1,000
1,200
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015


Greenhills South Shallow NH4
NH4
9
8
7
6
5
4
3
2
1
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

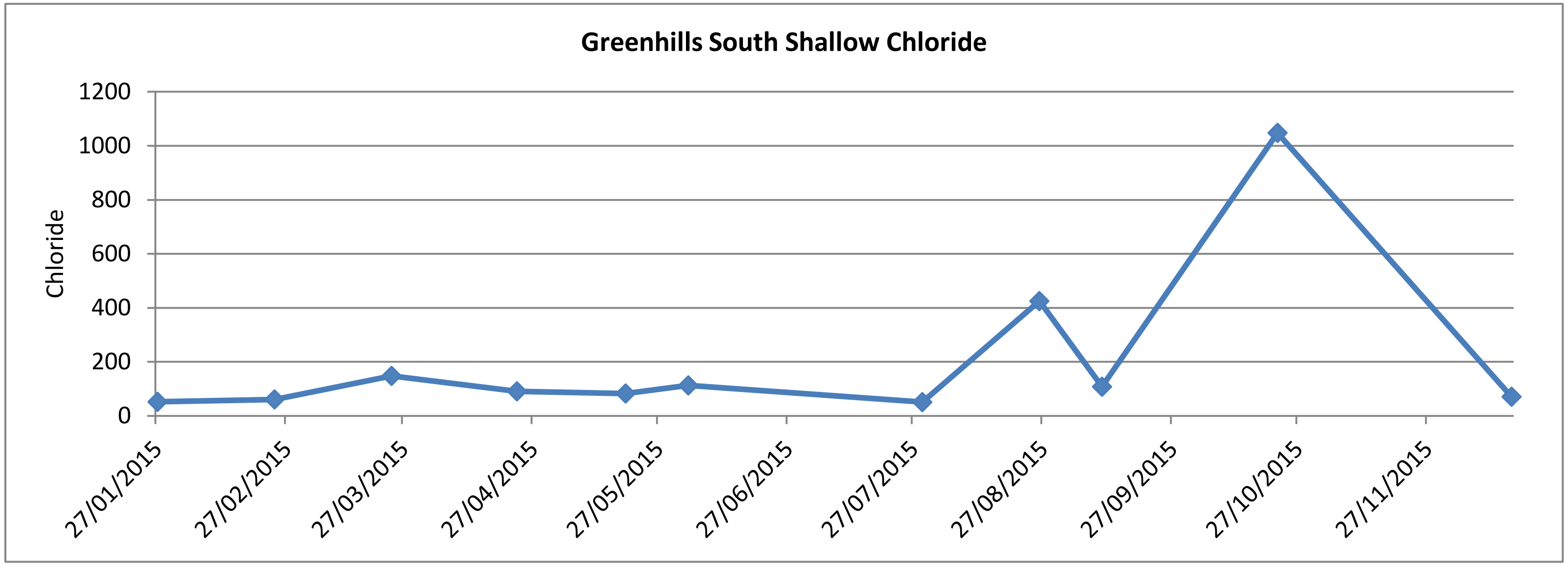

Greenhills South Shallow COD
COD
60
50
40
30
20
10
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015


Greenhills South ShallowTON
TON
10
9
8
7
6
5
4
3
2
1
0
24/02/2015
24/03/2015
24/04/2015
24/05/2015
24/06/2015
24/07/2015
24/08/2015
24/09/2015
24/10/2015
24/11/2015

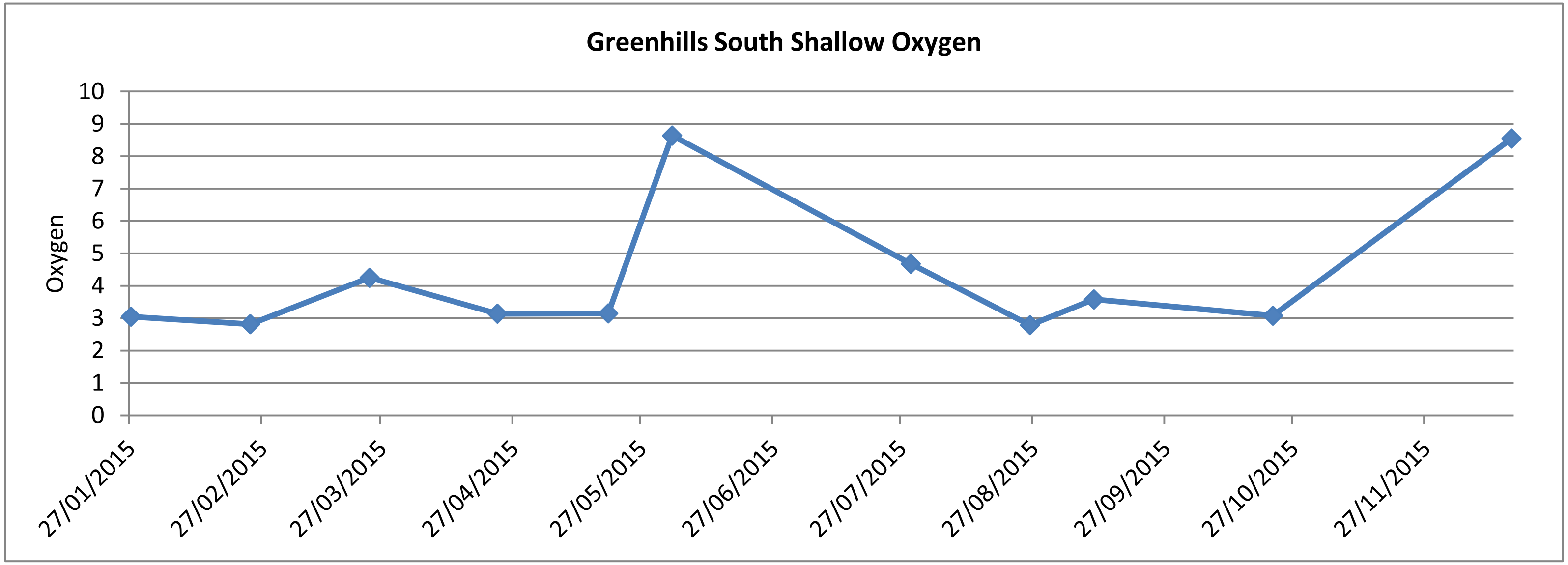

Greenhills South Shallow TOC
TOC
20
18
16
14
12
10
8
6
4
2
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

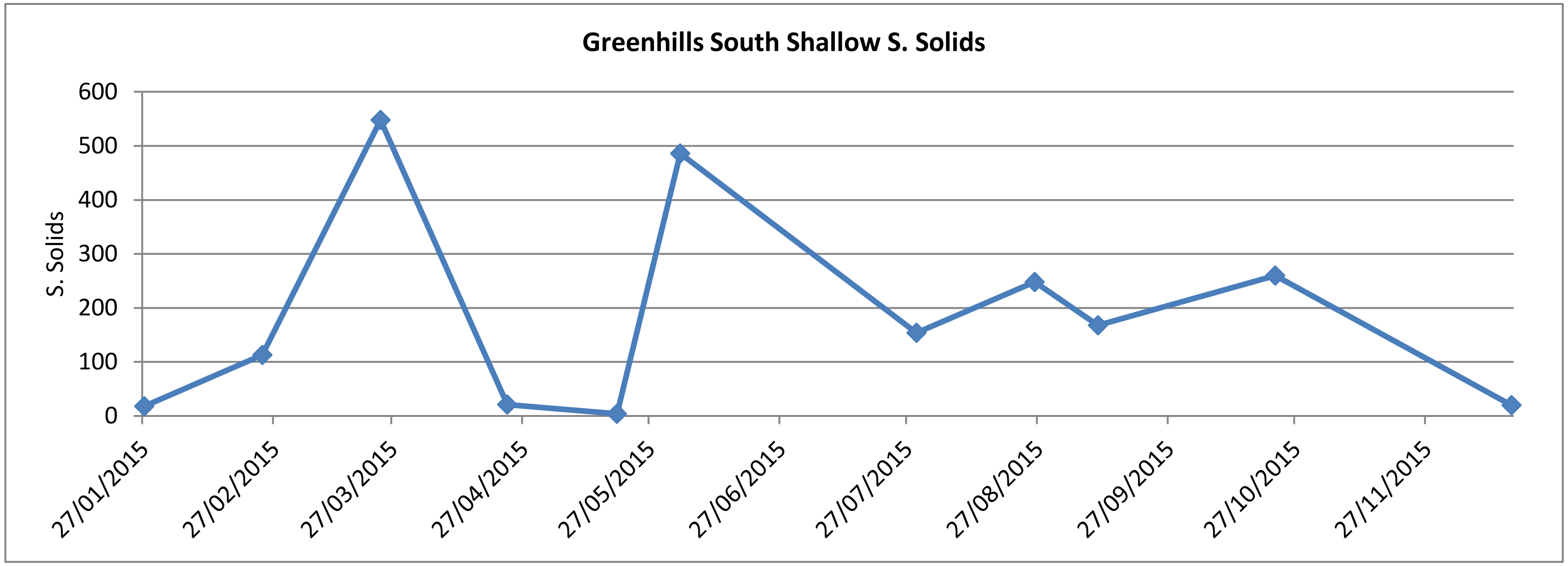


Greenhills South Shallow Ammonia (as N)
Ammonia (as N)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015



Greenhills South Shallow Chloride
Chloride
1200
1000
800
600
400
200
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

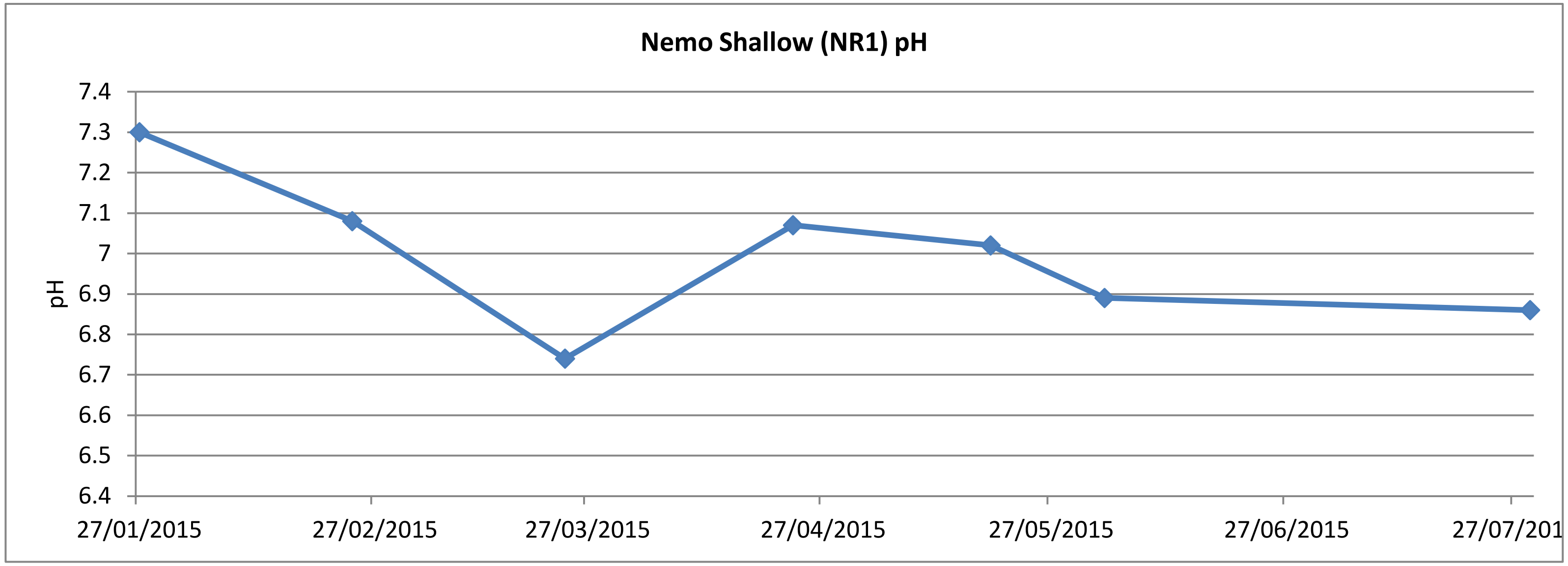

Greenhills South Shallow Oxygen
Oxygen
10
9
8
7
6
5
4
3
2
1
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

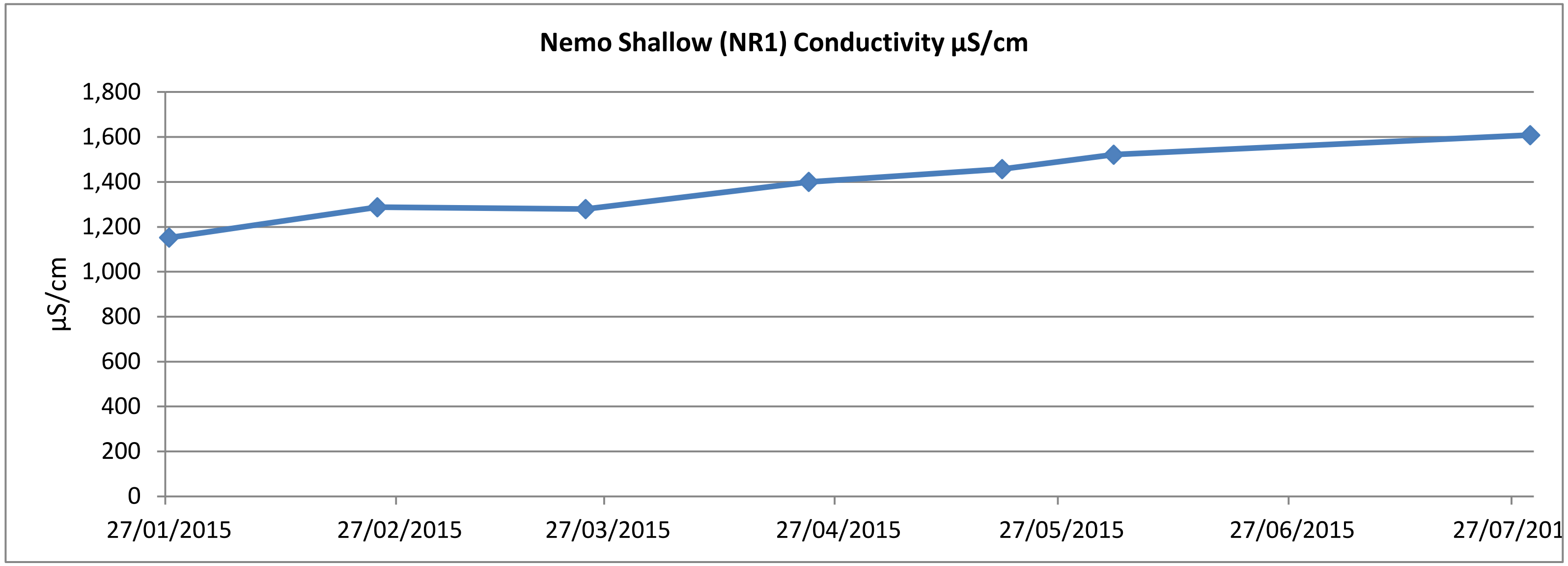

Greenhills South Shallow S. Solids
S. Solids
600
500
400
300
200
100
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015
27/10/2015
27/11/2015

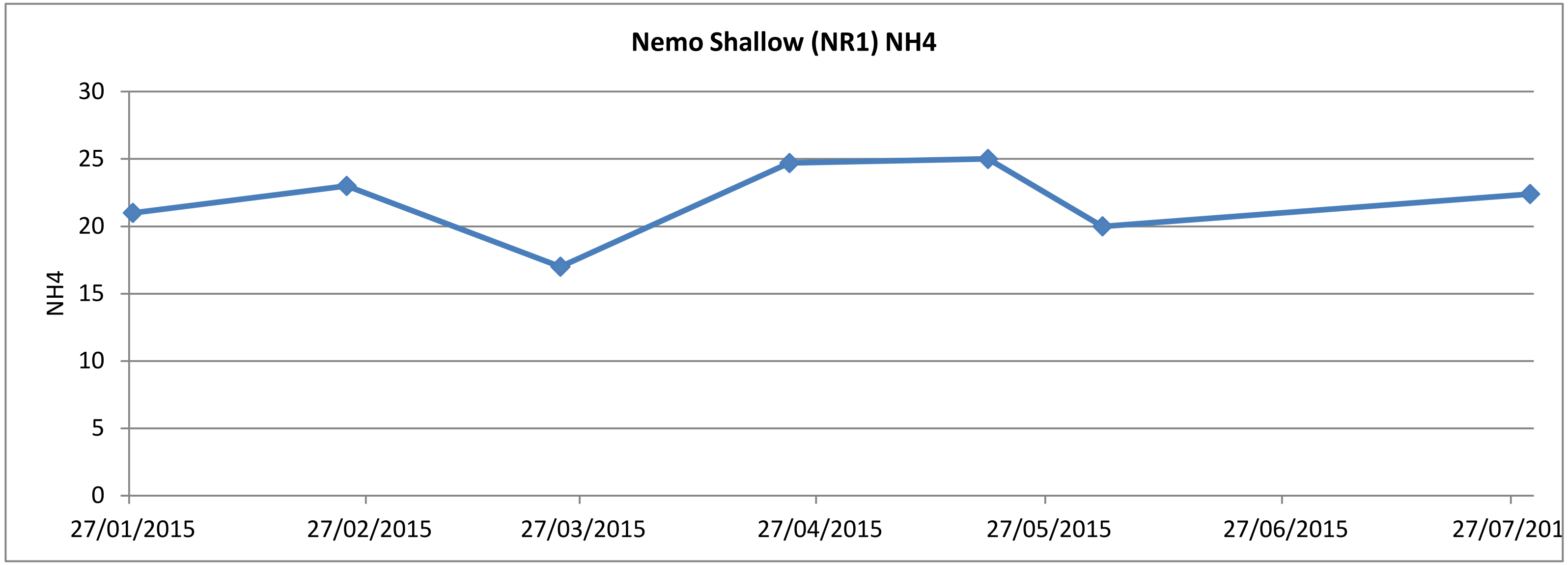
Well: Greenhills & Nemo Groundwater Wells (mg/l)
Location: Greenhills Green and Nemo Rangers GAA Pitch
All parameter data in mg/l unless stated otherwise

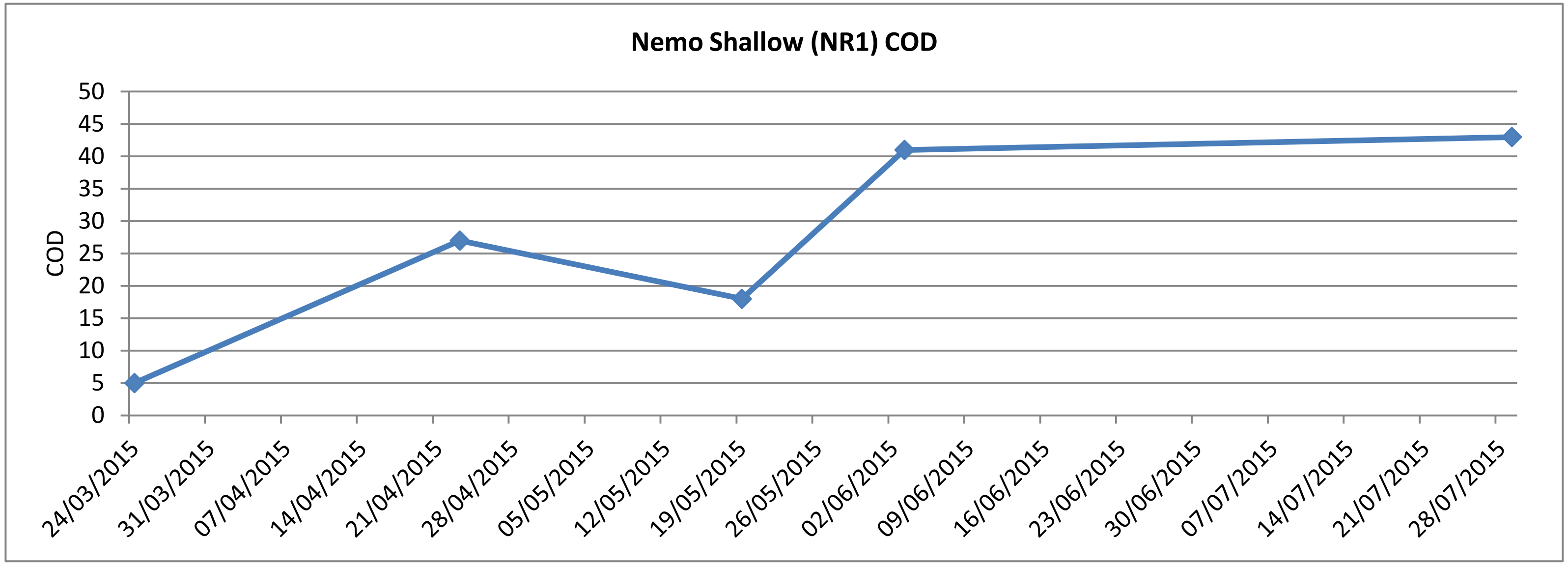
Nemo Shallow (NR1) 2015

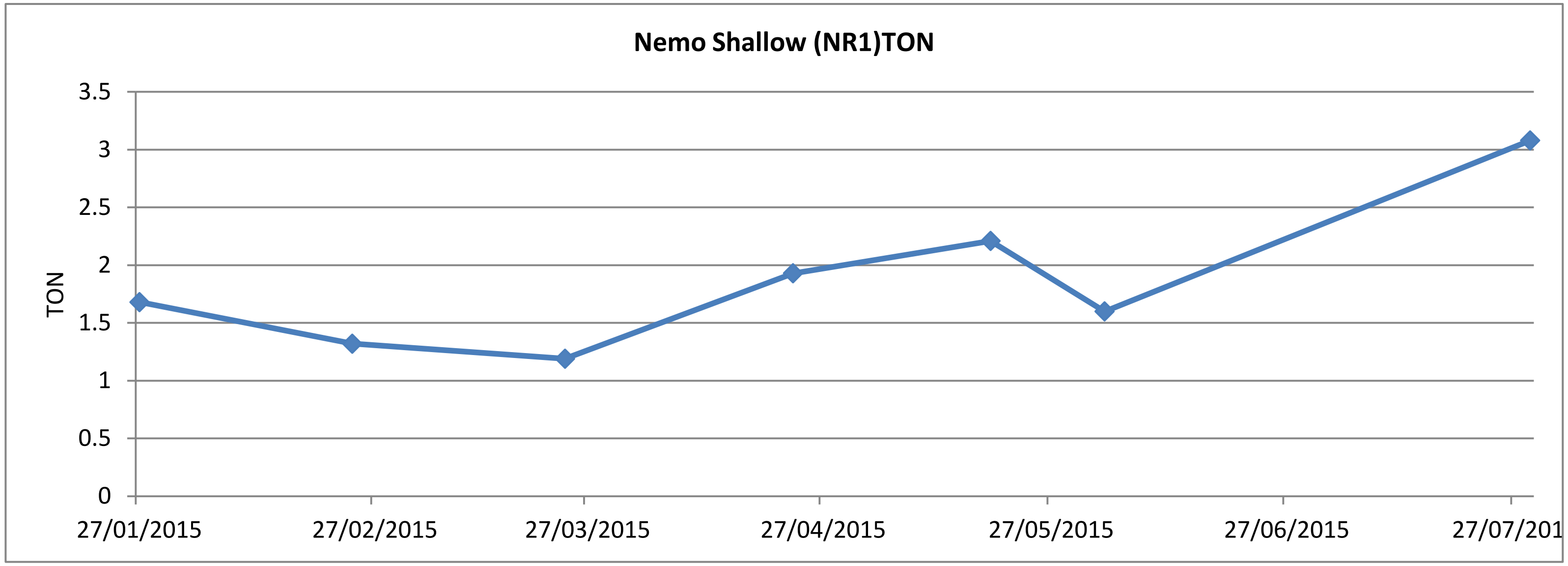
Date	Temp *C	pH	Conductivity µS/cm	NH4	Ammonia (as N)	Chloride	Oxygen	COD	TON	TOC	S. Solids	Well Depth (m)	Depth to Water (m)	Water Height in Well (m)
27/01/2015	13.5	7.3	1,152	21	16.34	232	2.55	11	1.68	2.4	1000	5.9	1.28	4.62
24/02/2015	11.5	7.08	1,287	23	17.89	250	2	7	1.32	4.3	275	5.9	1.14	4.76
24/03/2015	15.6	6.74	1,279	17	13.23	231	0.87	5	1.19	6	39.2	5.9	1.31	4.59
23/04/2015	12.8	7.07	1,400	24.7	19.22	224	2.08	27	1.93	10.7	98.8	5.9	1.37	4.53
19/05/2015	12.8	7.02	1,457	25	19.45	265	1.96	18	2.21	16.4	5.2	5.9	1.24	4.66
03/06/2015	14	6.89	1,521	20	15.56	259	1.29	41	1.6	14.3	1393	5.9	1.36	4.54
29/07/2015	13.6	6.86	1,608	22.4	17.43	51	4.76	43	3.08	14.3	364	5.9	1.35	4.55
												5.9	0	5.9
												5.9	0	5.9
												5.9	0	5.9
												5.9	0	5.9
												5.9	0	5.9

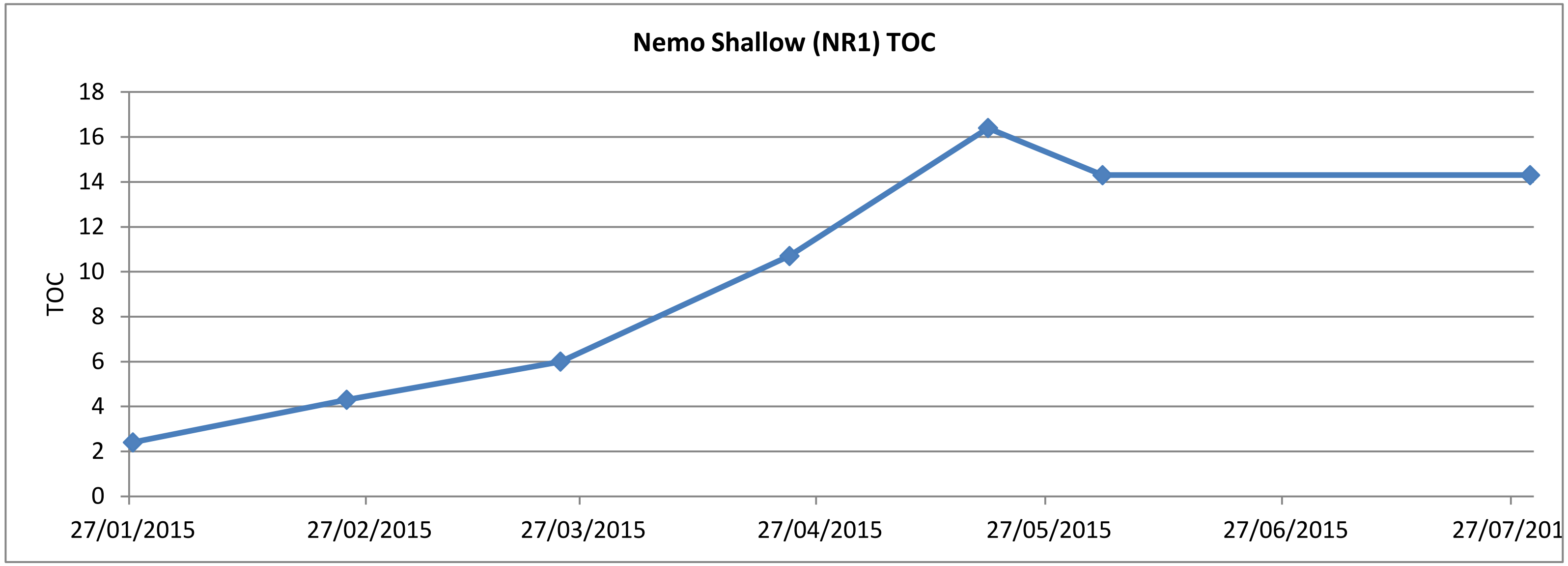

Nemo Shallow (NR1) pH
7.4
7.3
7.2
7.1
7
6.9
6.8
6.7
6.6
6.5
6.4
pH
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/201

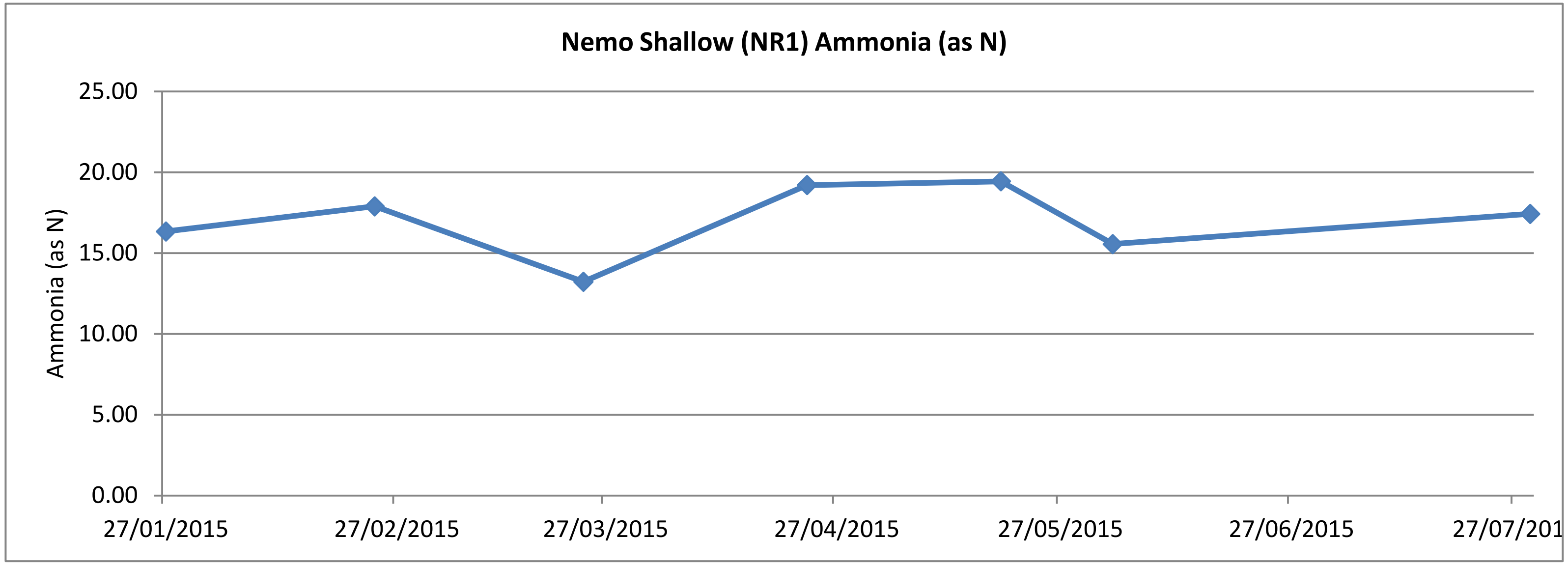

Nemo Shallow (NR1) Conductivity µS/cm
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
µS/cm
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/201

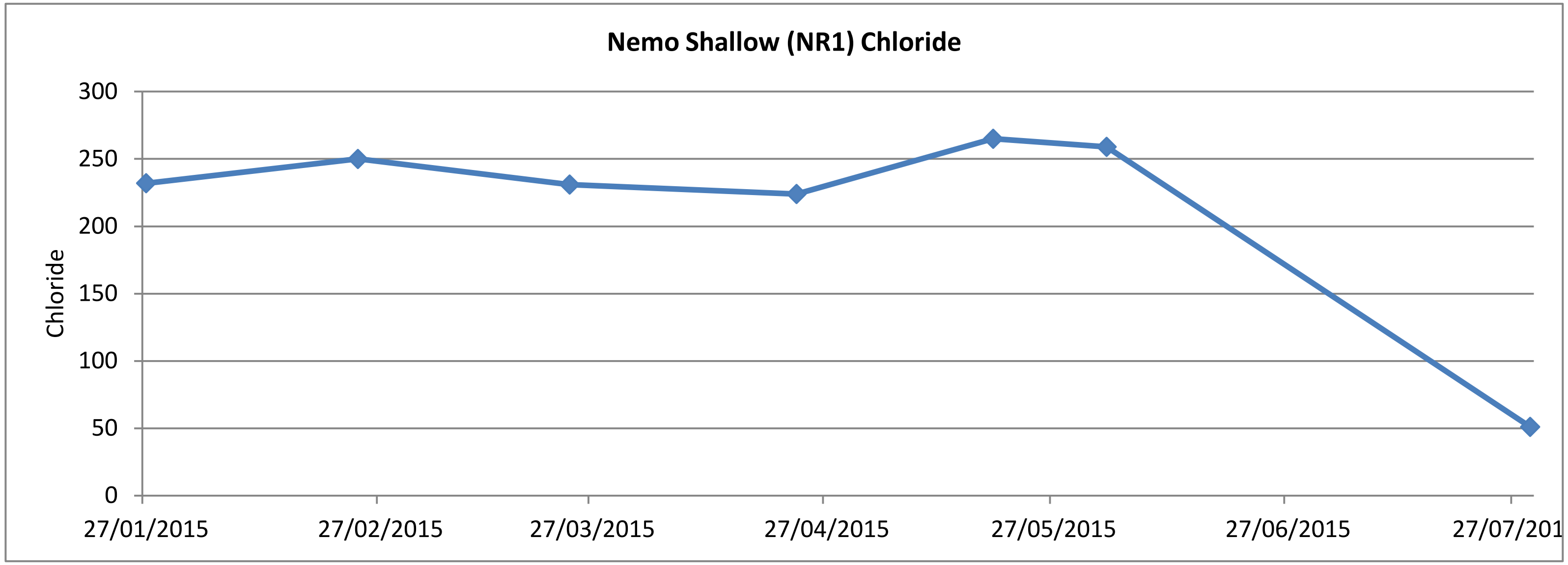

Nemo Shallow (NR1) NH4
NH4
30
25
20
15
10
5
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/201

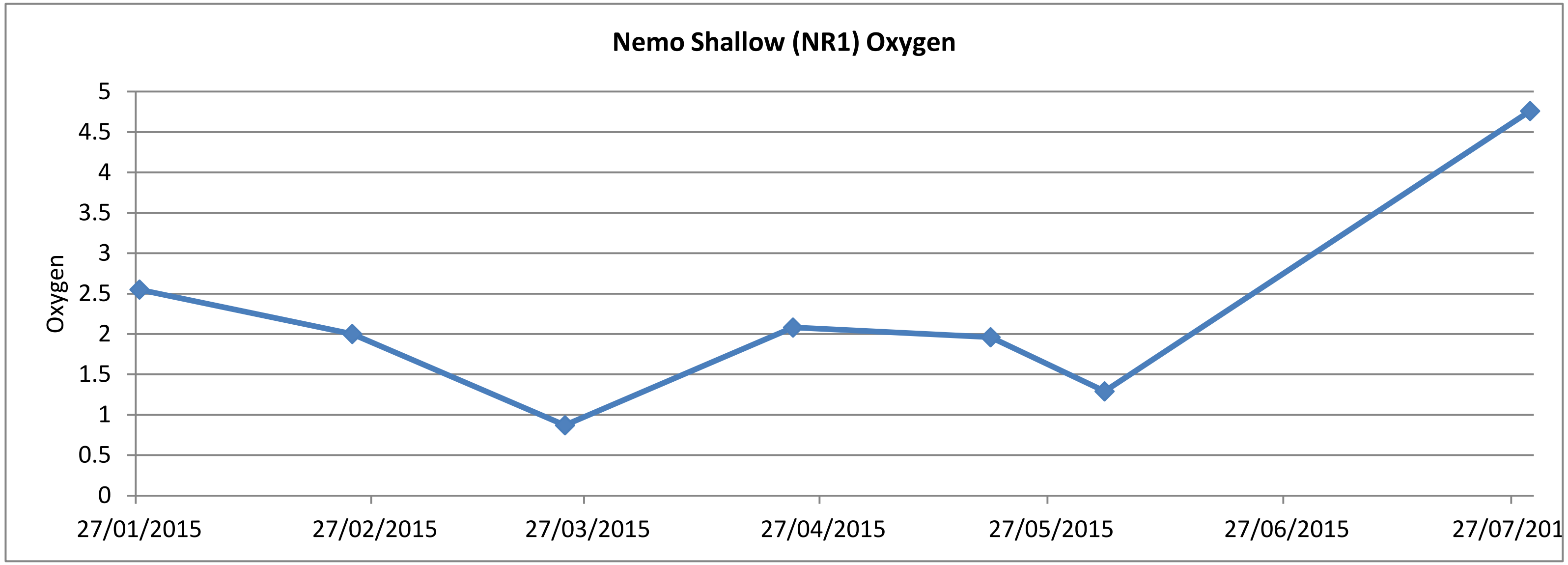

Nemo Shallow (NR1) COD
COD
50
45
40
35
30
25
20
15
10
5
0
24/03/2015
31/03/2015
07/04/2015
14/04/2015
21/04/2015
28/04/2015
05/05/2015
12/05/2015
19/05/2015
26/05/2015
02/06/2015
09/06/2015
16/06/2015
23/06/2015
30/06/2015
07/07/2015
14/07/2015
21/07/2015
28/07/2015

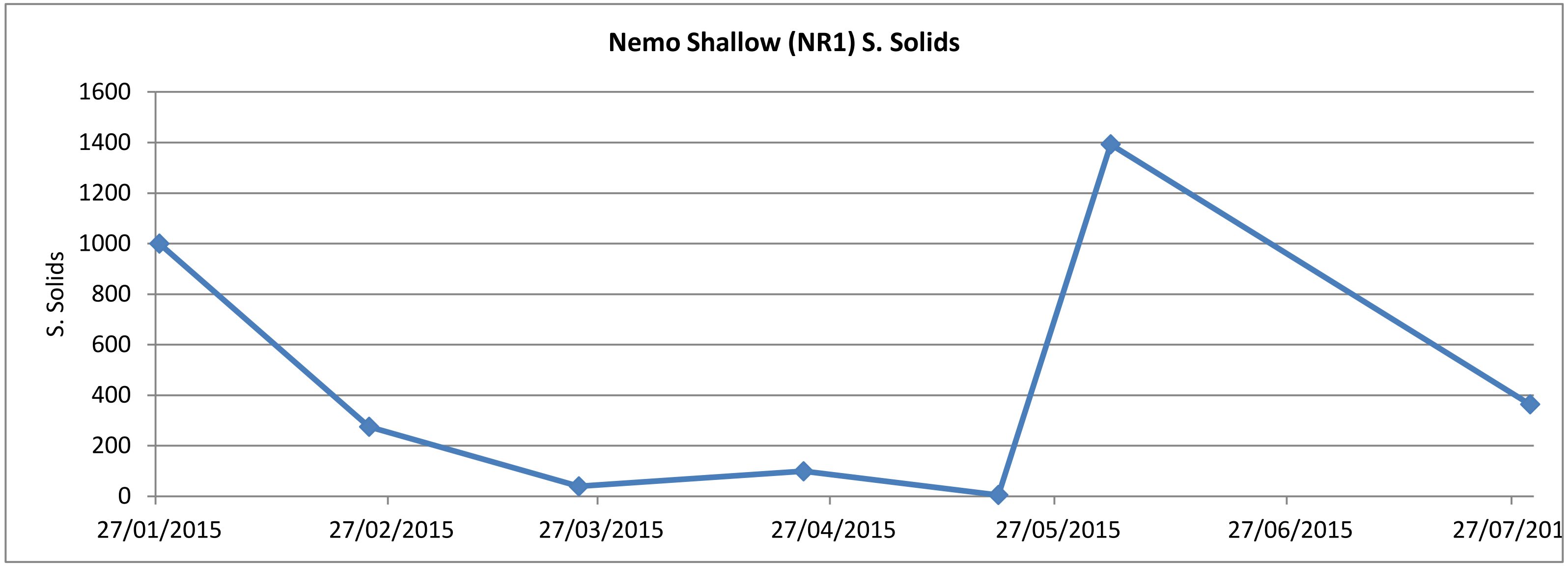

Nemo Shallow (NR1)TON
TON
3.5
3
2.5
2
1.5
1
0.5
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/201


Nemo Shallow (NR1) TOC
TOC
18
16
14
12
10
8
6
4
2
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/201


Nemo Shallow (NR1) Ammonia (as N)
Ammonia (as N)
25.00
20.00
15.00
10.00
5.00
0.00
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/201


Nemo Shallow (NR1) Chloride
Chloride
300
250
200
150
100
50
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/201


Nemo Shallow (NR1) Oxygen
Oxygen
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/201


Nemo Shallow (NR1) S. Solids
S. Solids
1600
1400
1200
1000
800
600
400
200
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/201

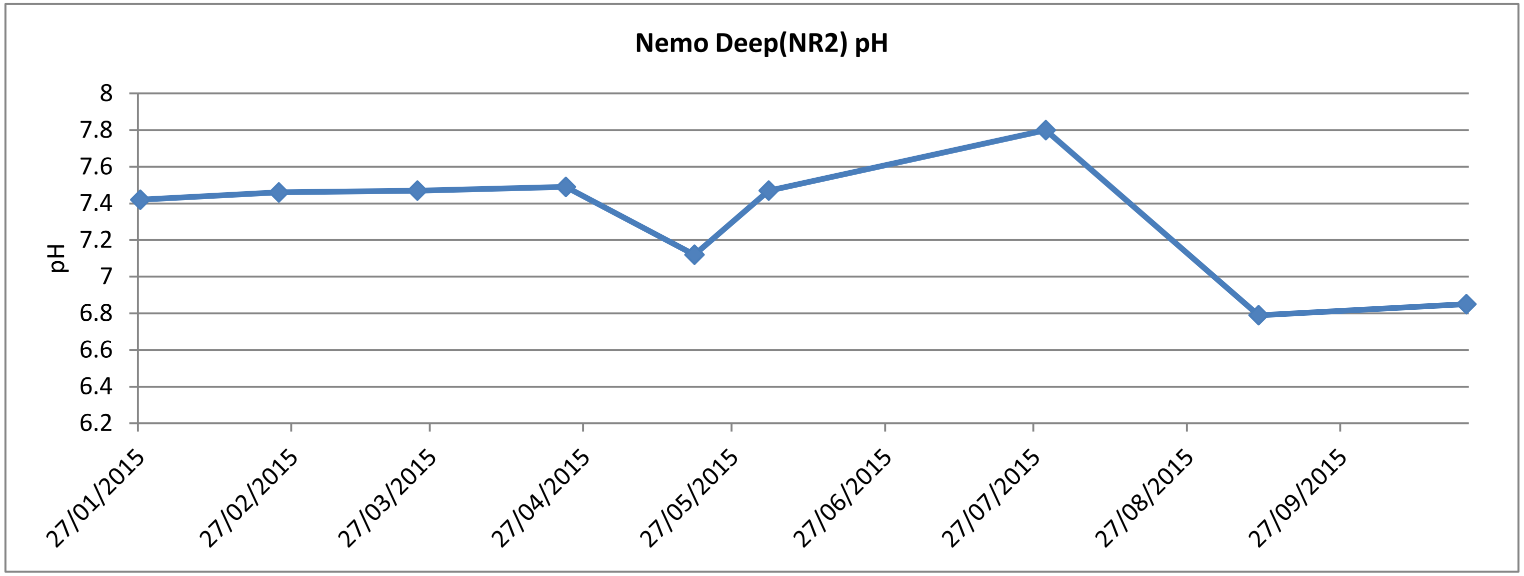
Well: Greenhills & Nemo Groundwater Wells (mg/l)

Location: Greenhills Green and Nemo Rangers GAA Pitch

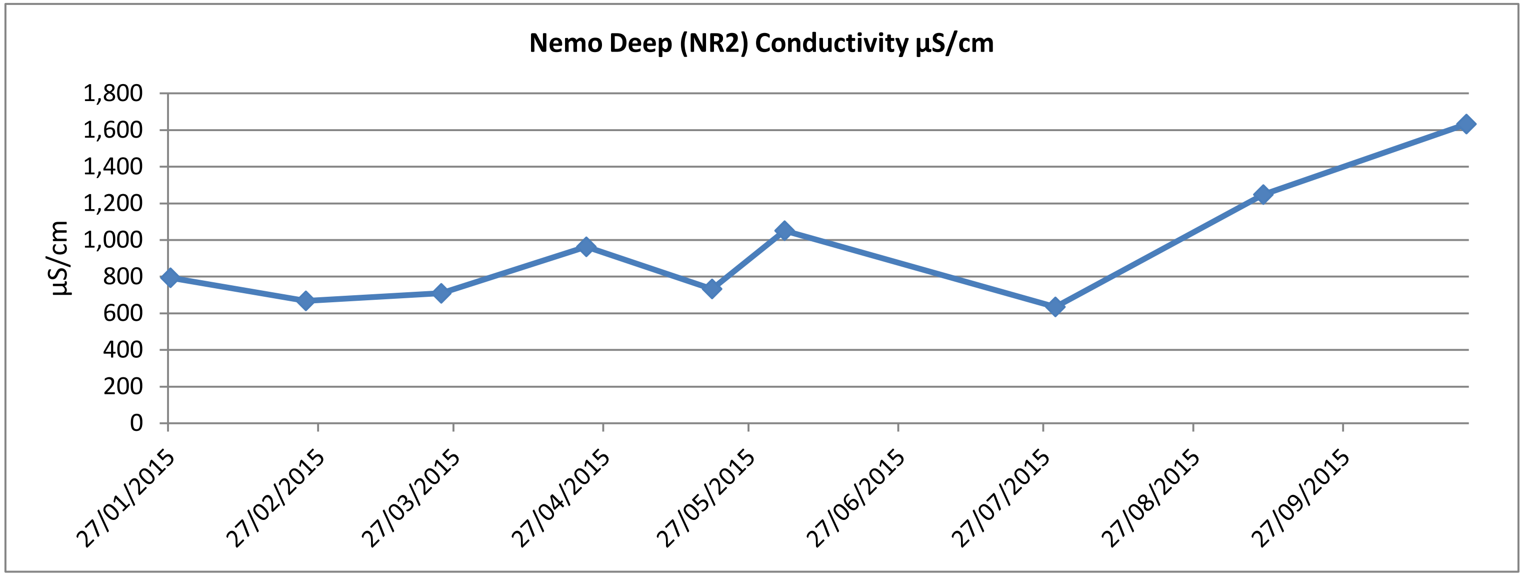
All parameter data in mg/l unless stated otherwise

Nemo Deep (NR2) 2015

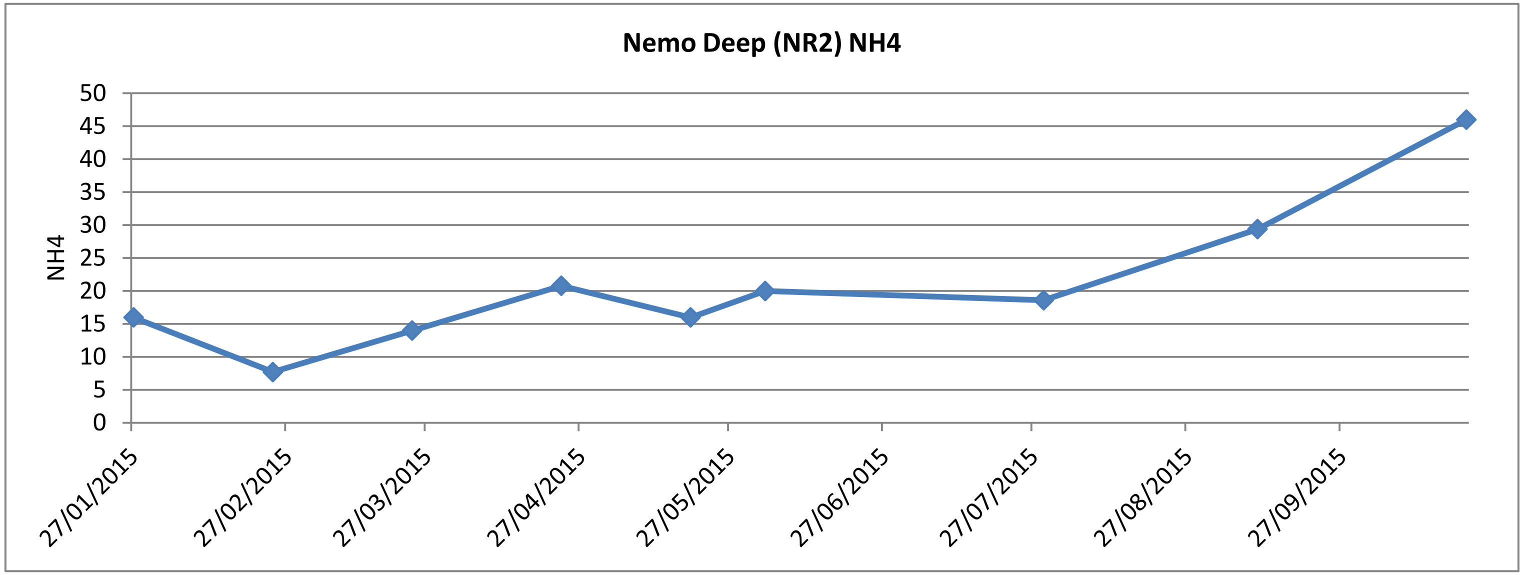
Date	Temp *C	pH	Conductivity µS/cm	NH4	Ammonia (as N)	Chloride	Oxygen	COD	TON	TOC	S. Solids	Well Depth (m)	Depth to Water (m)	Water Height in Well (m)
27/01/2015	13.8	7.42	794	16	12.45	145	3.2	9	4	1.7	48	16.8	0.89	15.91
24/02/2015	12	7.46	668	7.7	5.99	102	4.89	2	1.19	4.8	107	16.8	1.01	15.79
24/03/2015	16.4	7.47	709	14	10.89	120	3.18	18	1.43	1.9	14.8	16.8	0.91	15.89
23/04/2015	13.4	7.49	963	20.8	16.18	185	2.86	19	0.9	2.9	16	16.8	1.16	15.64
19/05/2015	13.6	7.12	733	16	12.45	137	3.4	11	2.66	3	512	16.8	0.98	15.82
03/06/2015	14.5	7.47	1,051	20	15.56	223	9.14	21	4.51	1.8	29	16.8	1.05	15.75
29/07/2015	13.3	7.8	635	18.6	14.47	96	7.62	52	1.99	1	50	16.8	1.13	15.67
												16.8	0	16.8
10/09/2015	20.5	6.79	1,248	29.4	22.87	271	2.14	47	1.68	14.7	40.8	16.8	1.02	15.78
22/10/2015	13.1	6.85	1,633	46	35.79	186	1.51	1	2.1	12.6	14967	16.8	0.98	15.82
												16.8	0	16.8
												16.8	0	16.8

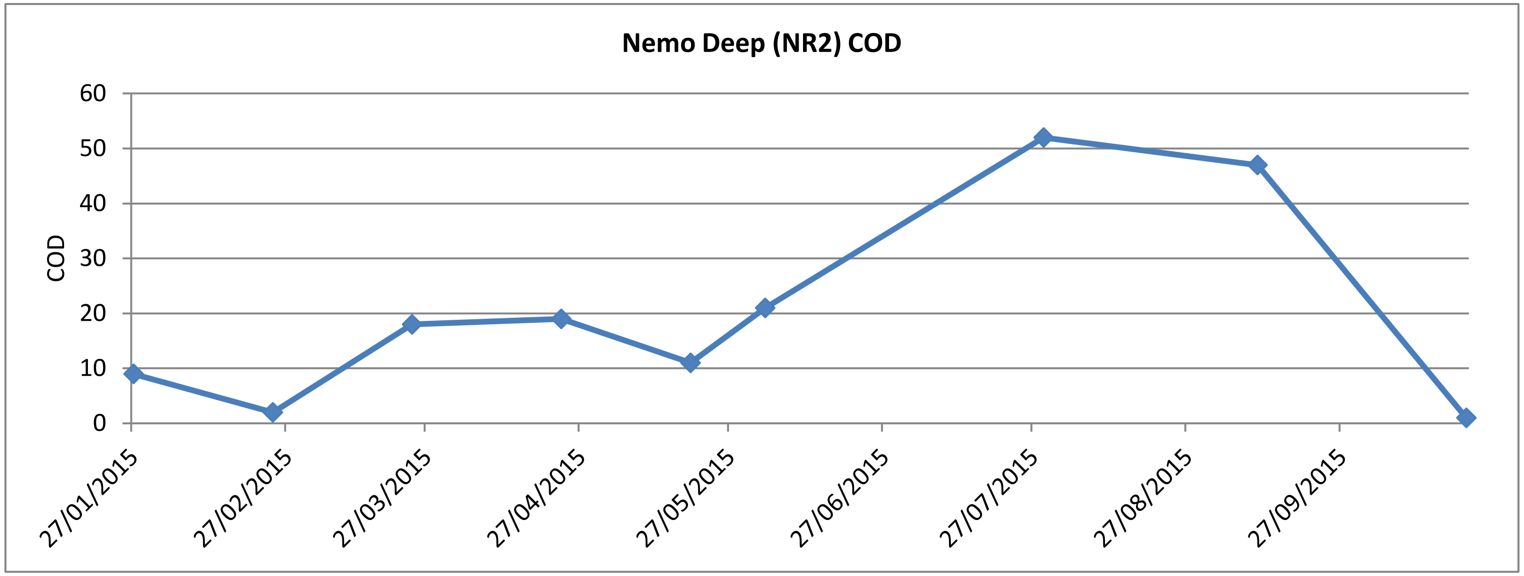


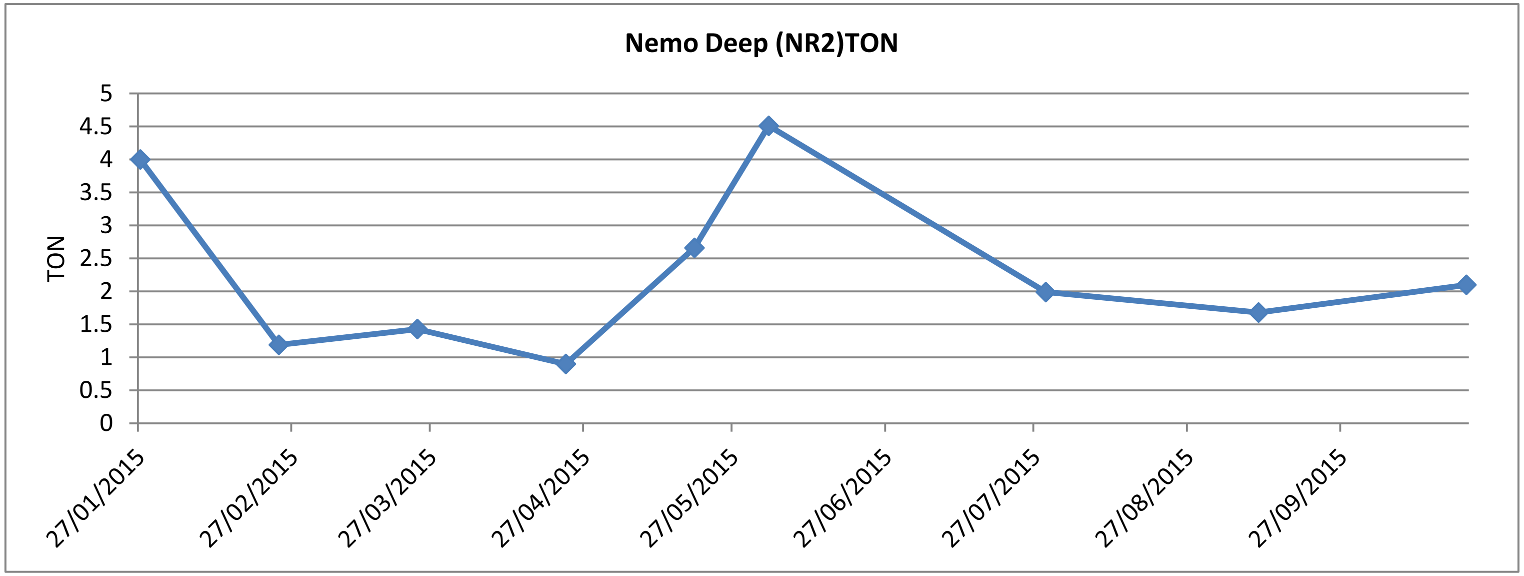
Nemo Deep(NR2) pH
pH
8
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015



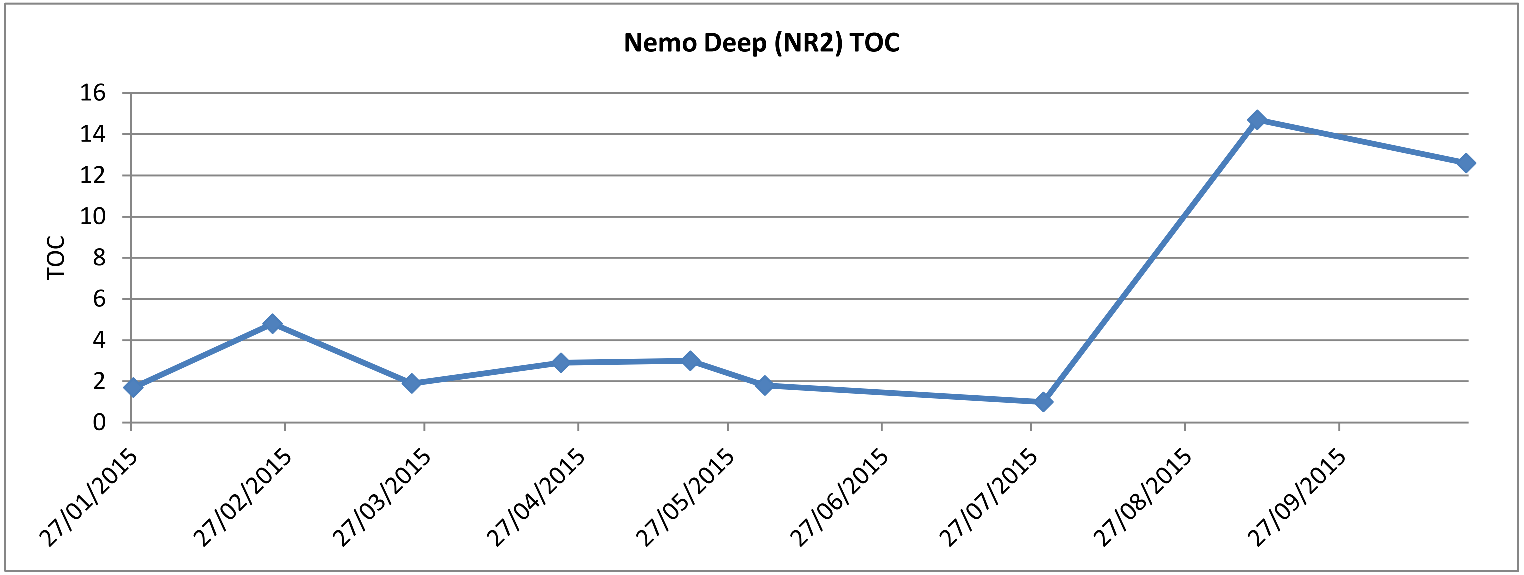
Nemo Deep (NR2) Conductivity µS/cm
µS/cm
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015


Nemo Deep (NR2) NH4
NH4
0
5
10
15
20
25
30
35
40
45
50
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015

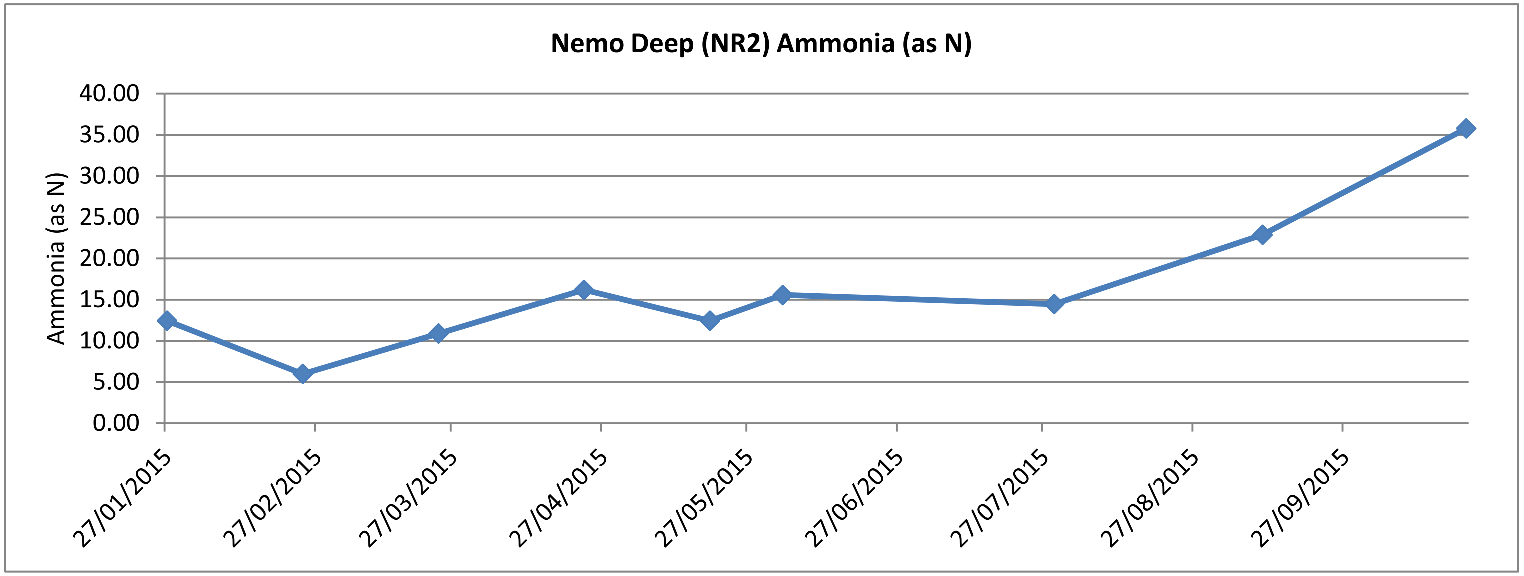

Nemo Deep (NR2) COD
COD
0
10
20
30
40
50
60
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015



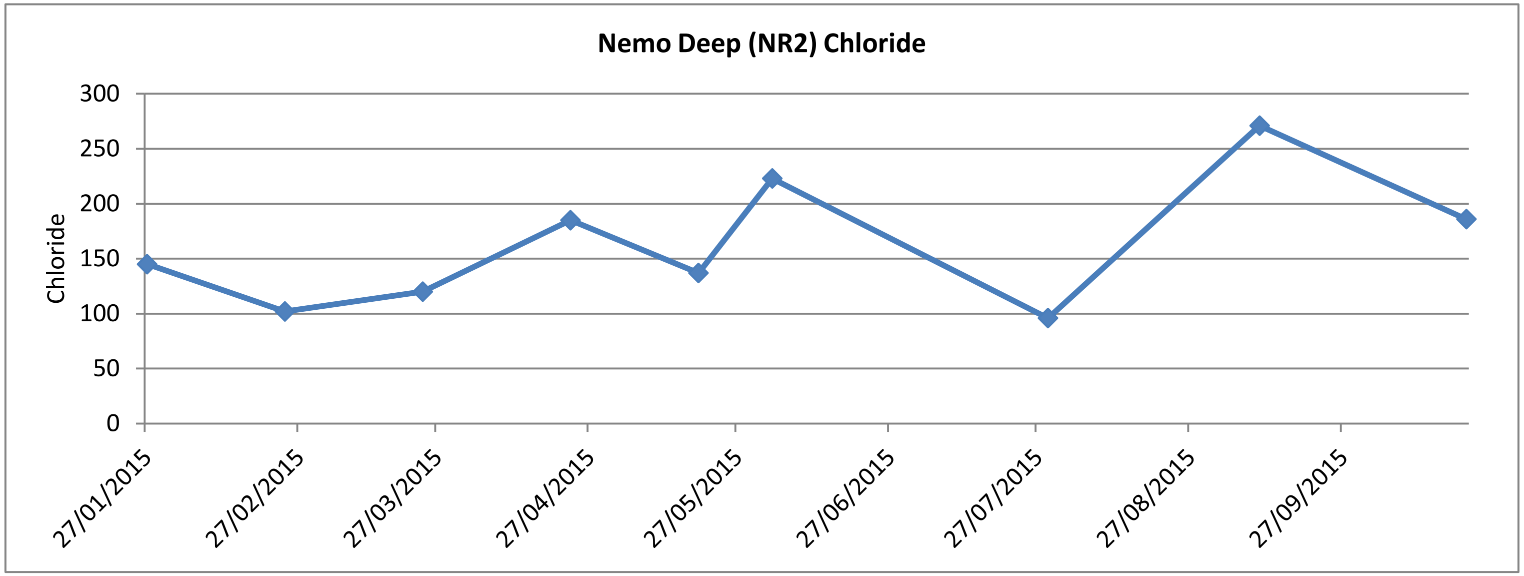
Nemo Deep (NR2)TON
TON
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015



Nemo Deep (NR2) TOC
TOC
16
14
12
10
8
6
4
2
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015

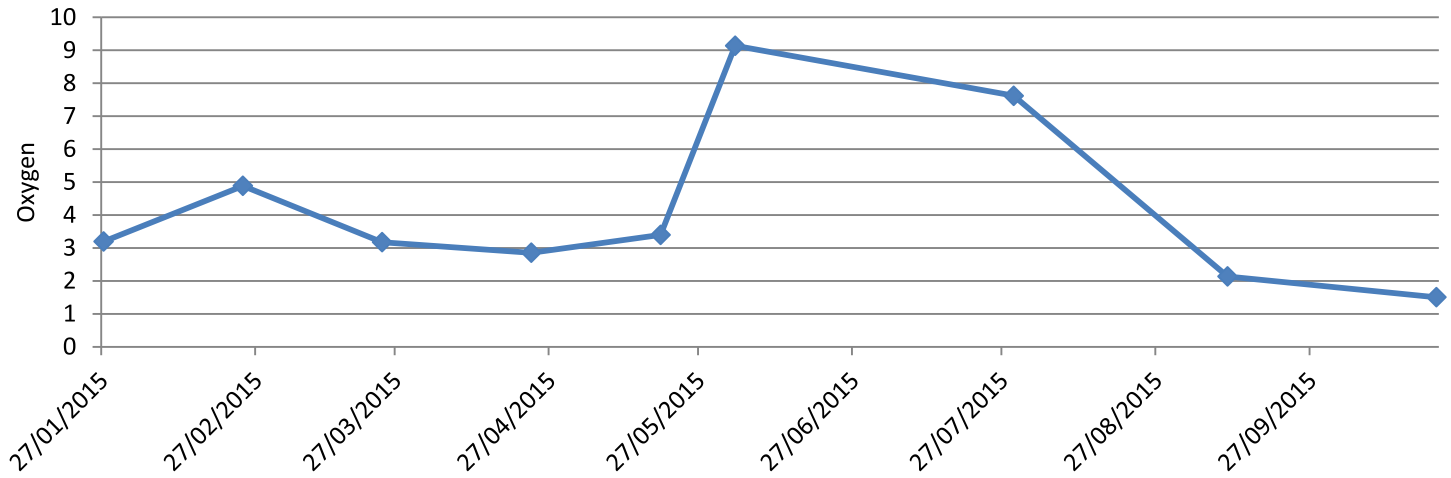


Nemo Deep (NR2) Ammonia (as N)
Ammonia (as N)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015

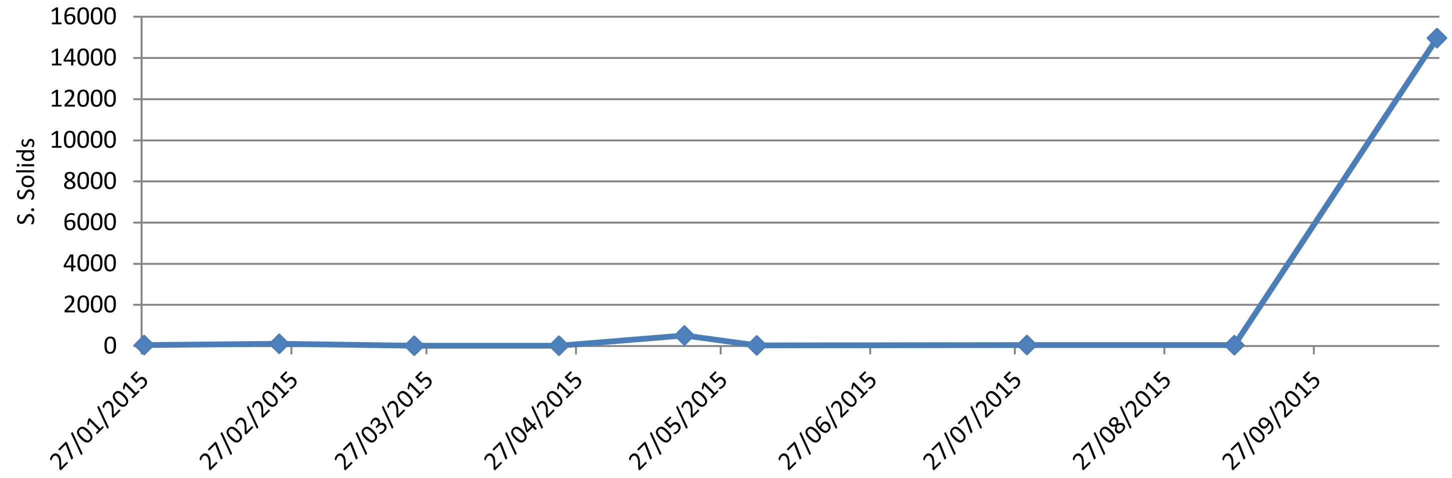


Nemo Deep (NR2) Chloride
Chloride
300
250
200
150
100
50
0
27/01/2015
27/02/2015
27/03/2015
27/04/2015
27/05/2015
27/06/2015
27/07/2015
27/08/2015
27/09/2015

Nemo Deep (NR2) Oxygen

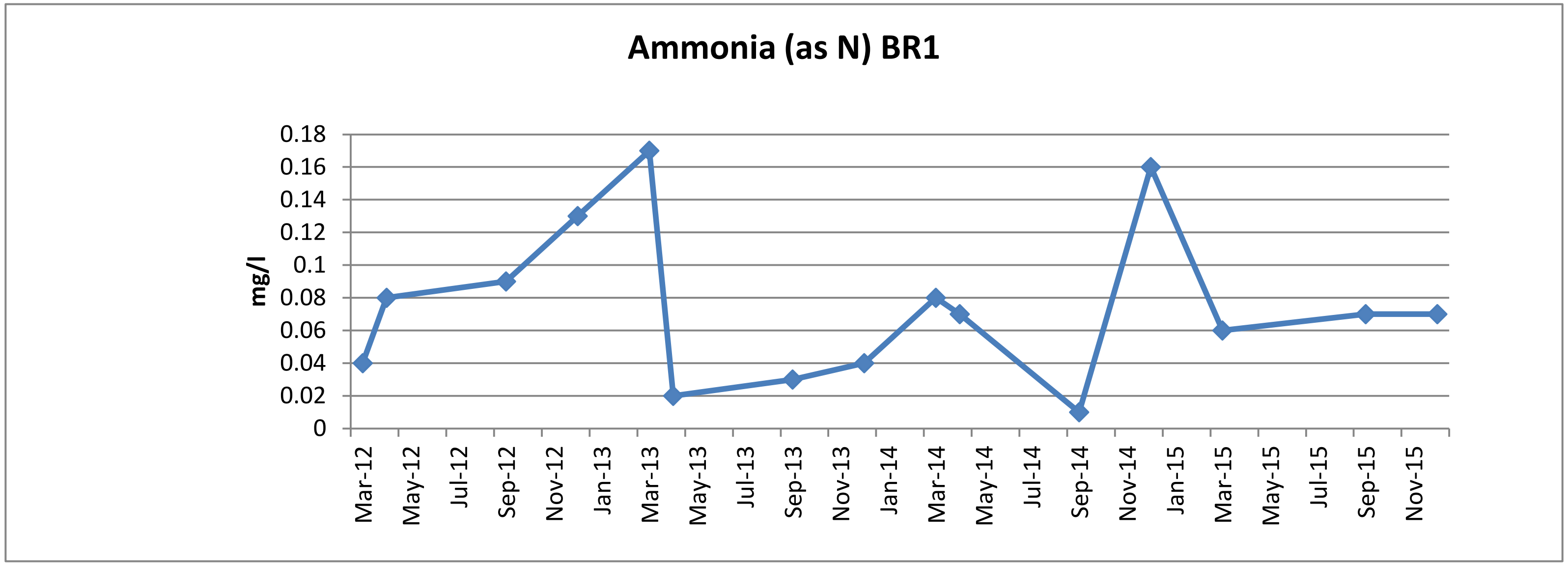


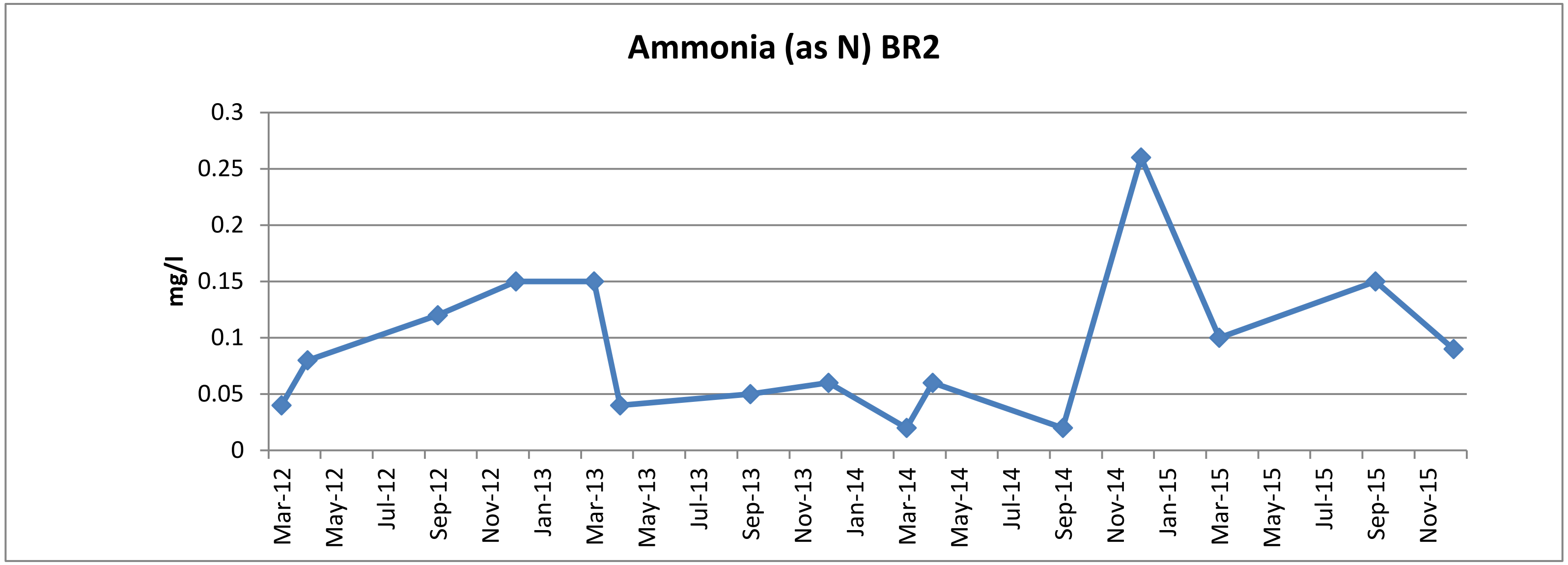
Nemo Deep (NR2) S. Solids

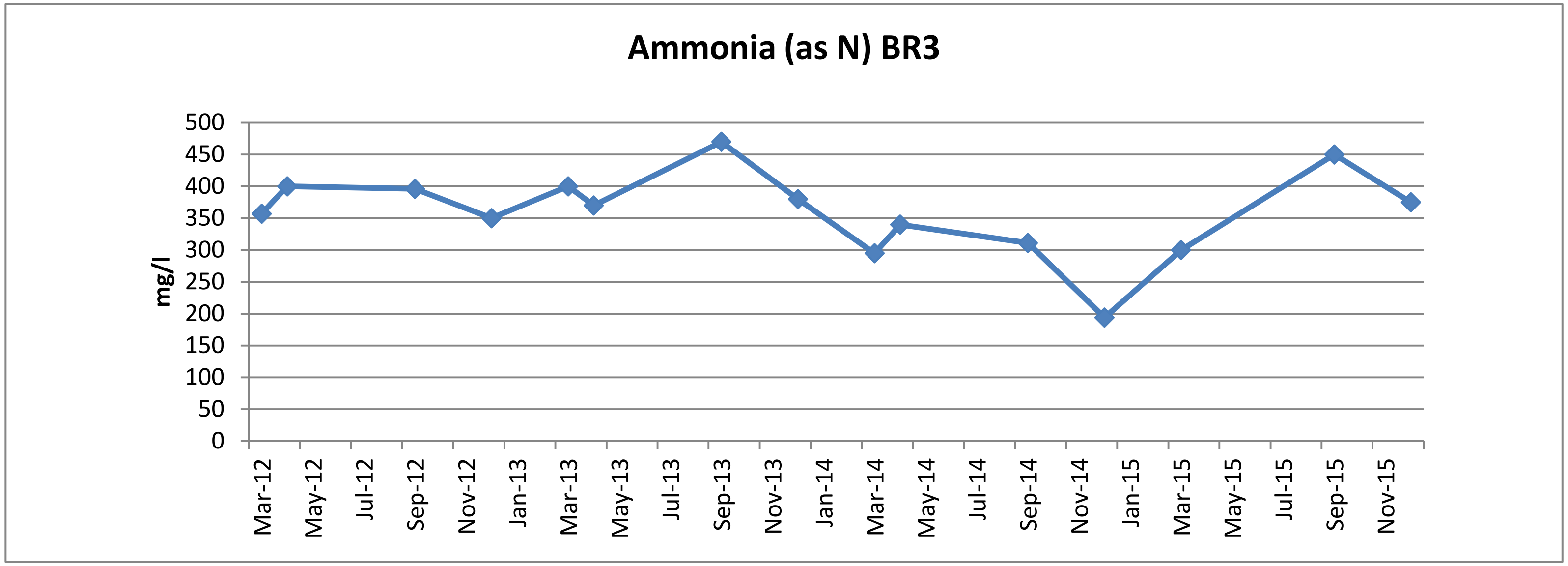


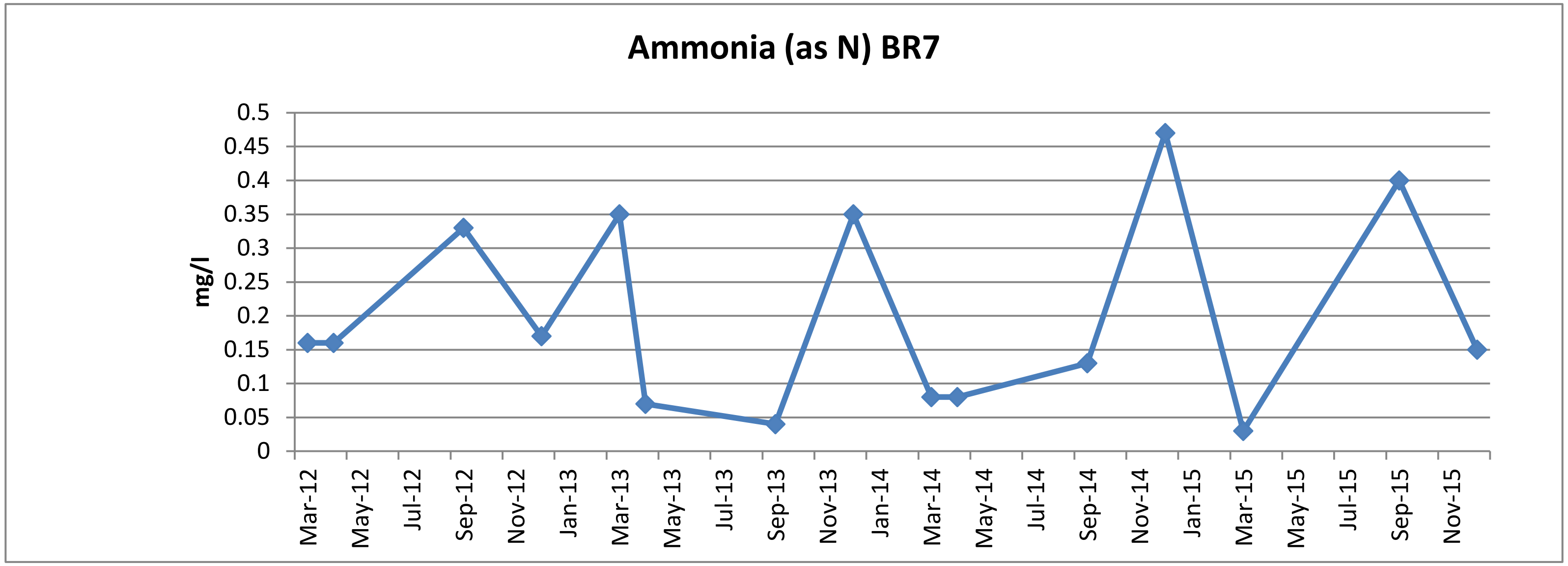
Bedrock Wells

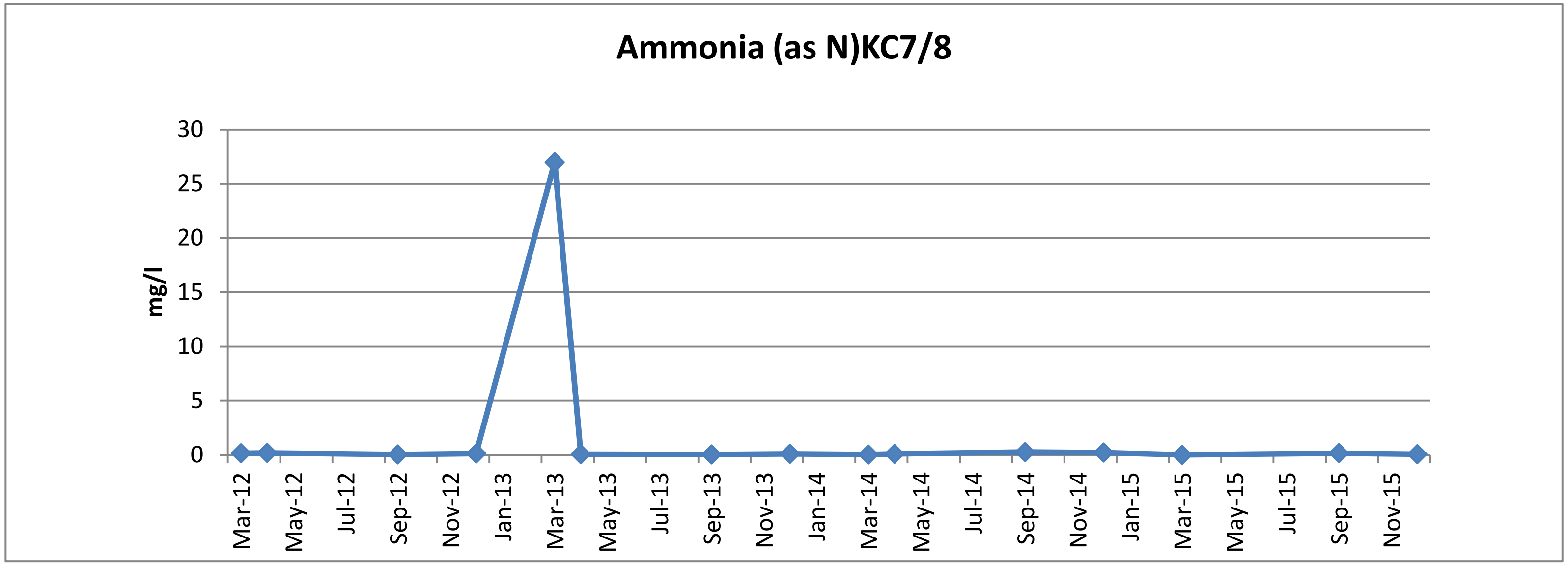
Ammonia (N) (mg/l)					
Date	BR1	BR2	BR3	BR7	KC7/8
Mar-12	0.04	0.04	357	0.16	0.16
Apr-12	0.08	0.08	400	0.16	0.2
Sep-12	0.09	0.12	396	0.33	0.05
Dec-12	0.13	0.15	350	0.17	0.14
Mar-13	0.17	0.15	400	0.35	27
Apr-13	0.02	0.04	370	0.07	0.07
Sep-13	0.03	0.05	470	0.04	0.05
Dec-13	0.04	0.06	380	0.35	0.11
Mar-14	0.08	0.02	295	0.08	0.04
Apr-14	0.07	0.06	340	0.08	0.1
Sep-14	0.01	0.02	311	0.13	0.27
Dec-14	0.16	0.26	194	0.47	0.23
Mar-15	0.06	0.1	300	0.03	0.01
Sep-15	0.07	0.15	450	0.4	0.17
Dec-15	0.07	0.09	375	0.15	0.08


Ammonia (as N) BR1
mg/l
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15


Ammonia (as N) BR2
mg/l
0.3
0.25
0.2
0.15
0.1
0.05
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15


Ammonia (as N) BR3
mg/l
500
450
400
350
300
250
200
150
100
50
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

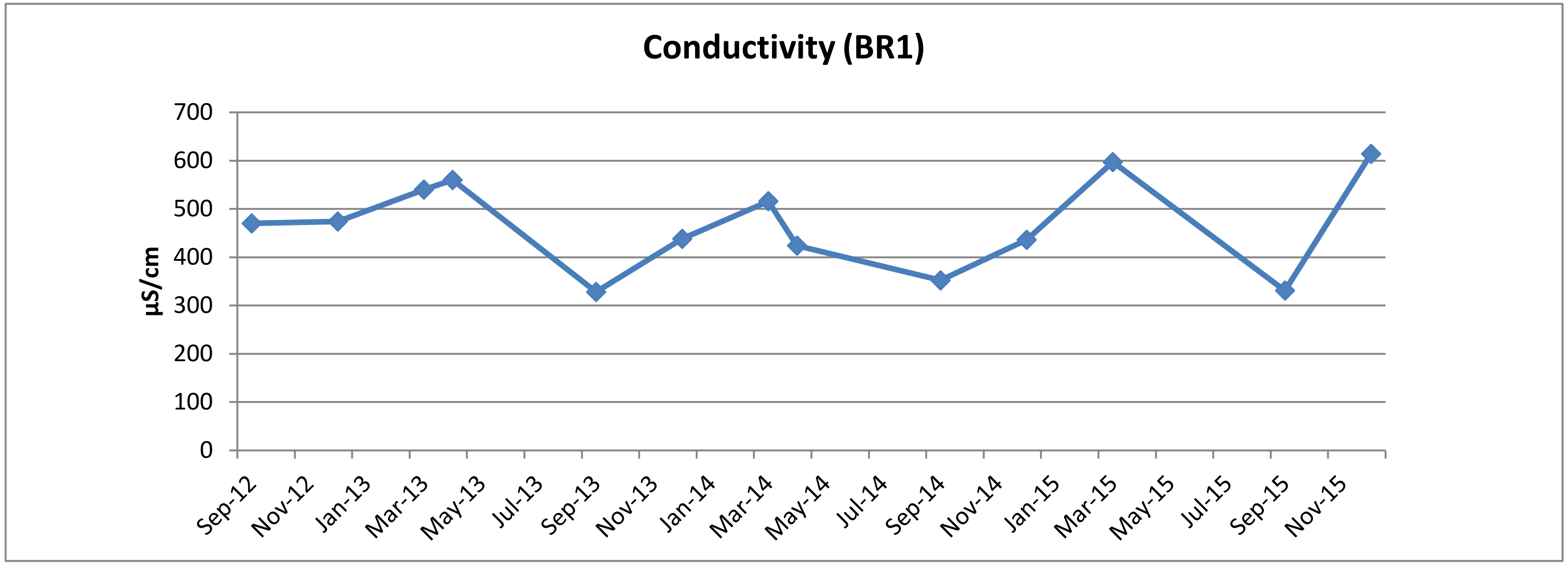

Ammonia (as N) BR7
mg/l
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

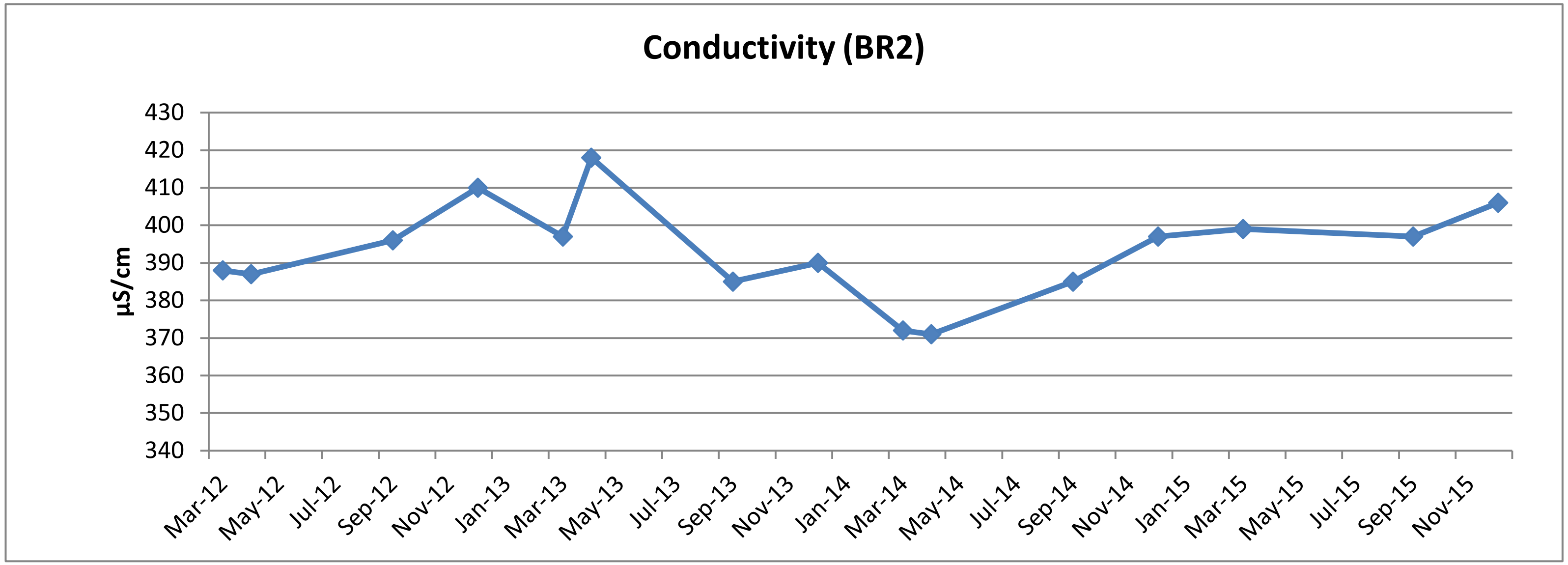


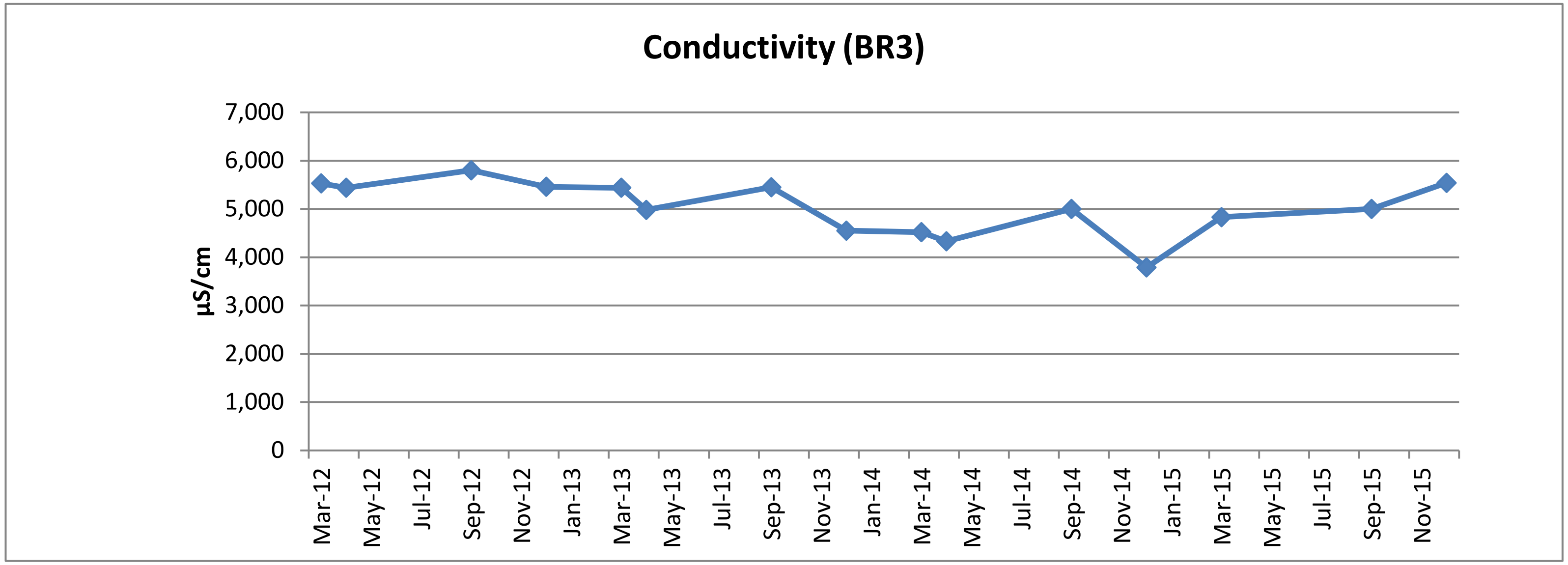
Ammonia (as N)KC7/8
mg/l
30
25
20
15
10
5
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

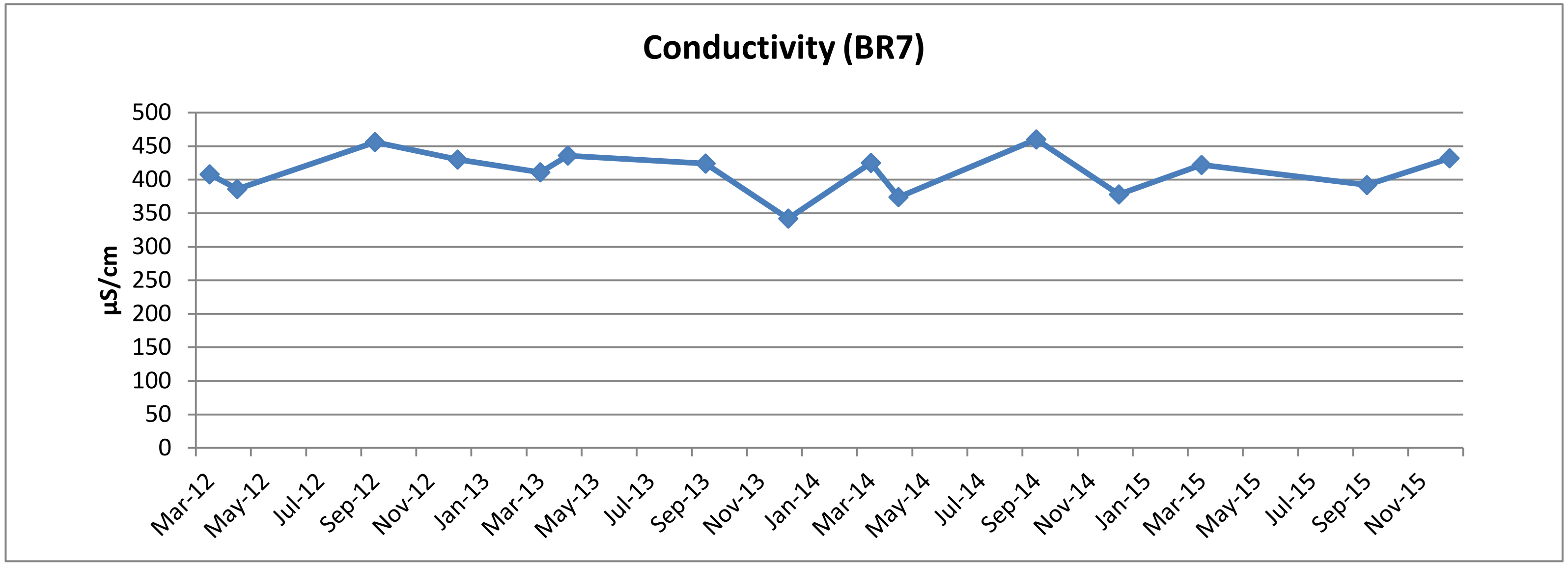
Bedrock Wells

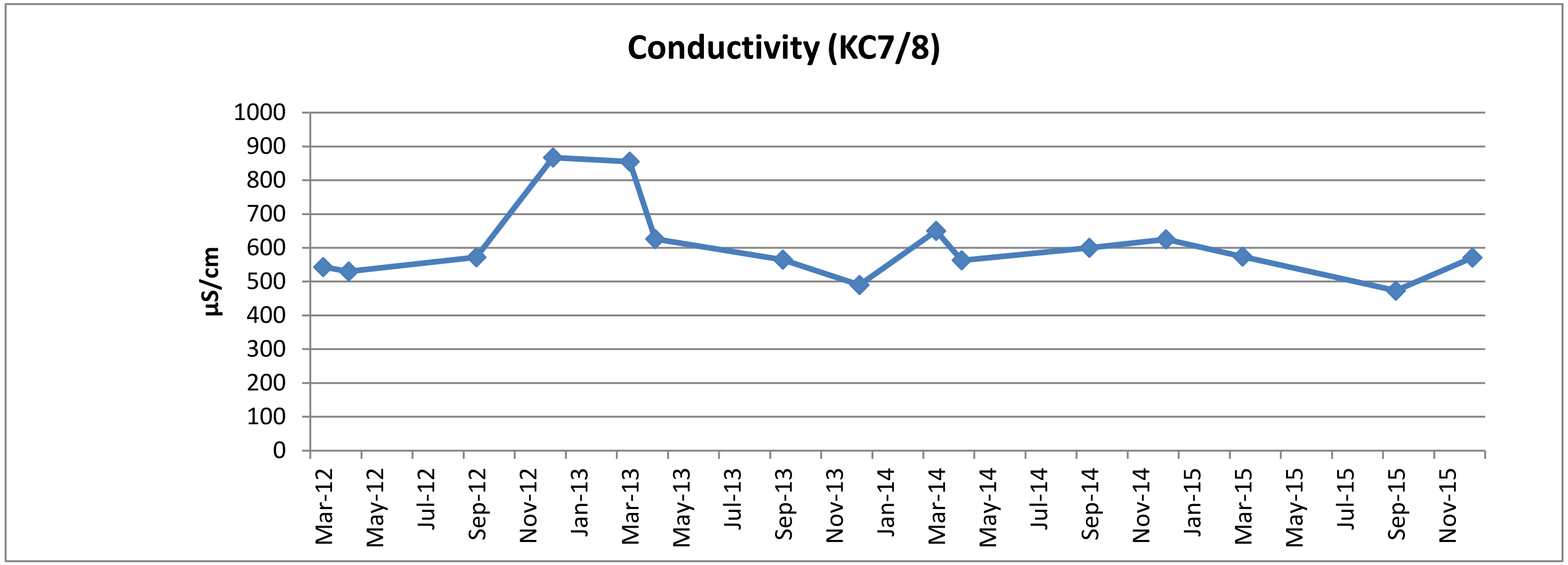
Conductivity (µS/cm)					
Date	BR1	BR2	BR3	BR7	KC7/8
Mar-12	540	388	5,530	408	543
Apr-12	537	387	5,440	386	530
Sep-12	470	396	5,800	456	572
Dec-12	474	410	5,460	430	867
Mar-13	540	397	5,440	411	855
Apr-13	560	418	4,980	436	626
Sep-13	328	385	5,450	424	565
Dec-13	438	390	4,550	342	490
Mar-14	516	372	4,520	425	650
Apr-14	424	371	4,331	374	563
Sep-14	352	385	5,000	460	600
Dec-14	436	397	3,790	378	625
Mar-15	597	399	4,830	422	574
Sep-15	331	397	5,000	392	473
Dec-15	614	406	5,540	432	571


Conductivity (BR1)
µS/cm
700
600
500
400
300
200
100
0
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15


Conductivity (BR2)
µS/cm
430
420
410
400
390
380
370
360
350
340
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15


Conductivity (BR3)
µS/cm
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

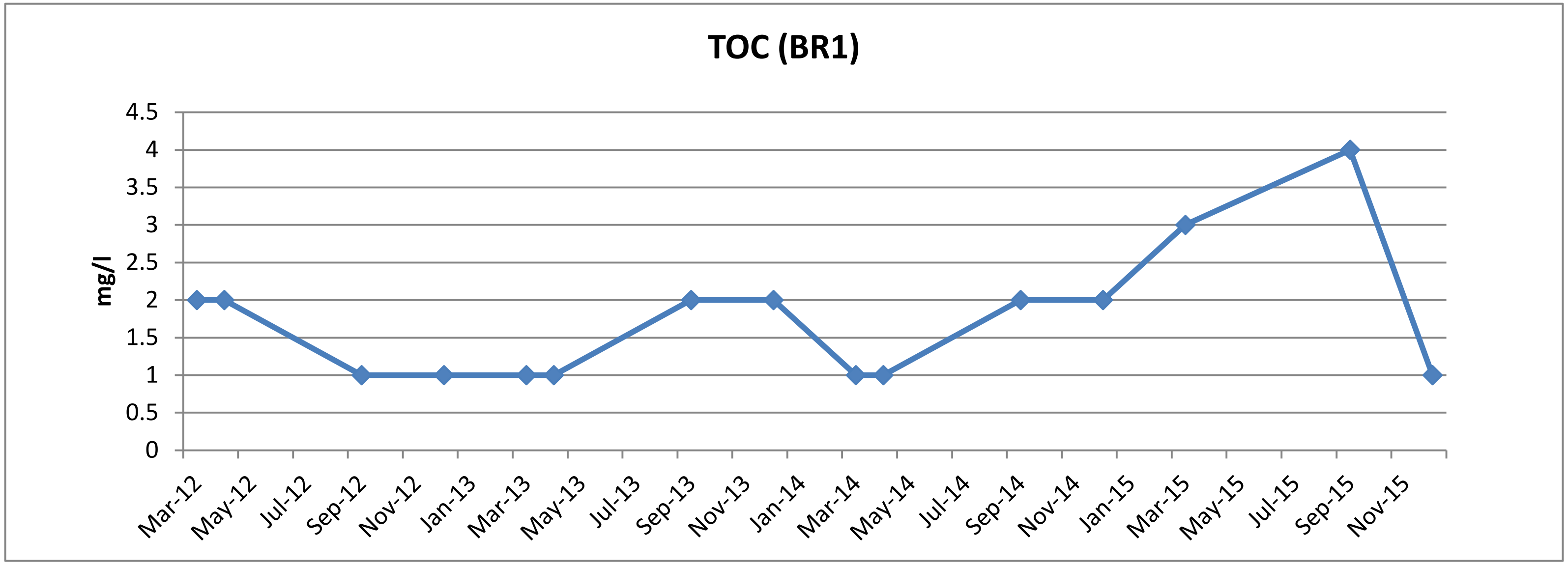

Conductivity (BR7)
µS/cm
500
450
400
350
300
250
200
150
100
50
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

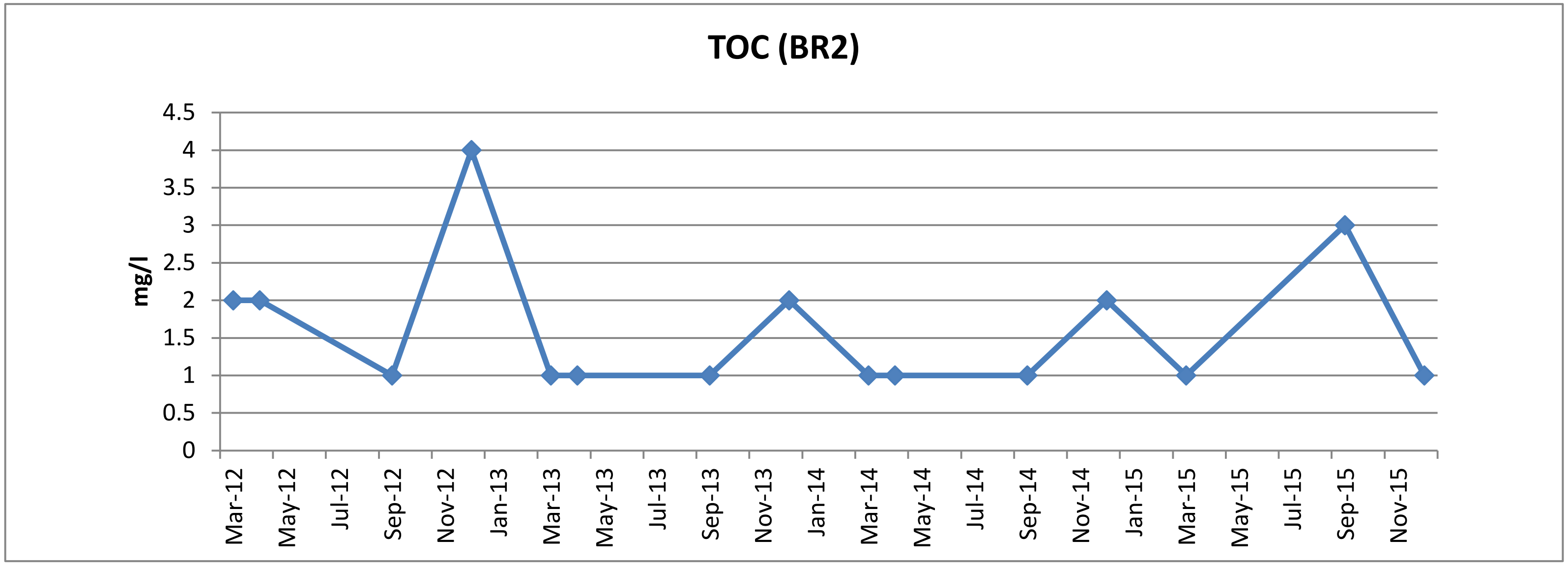


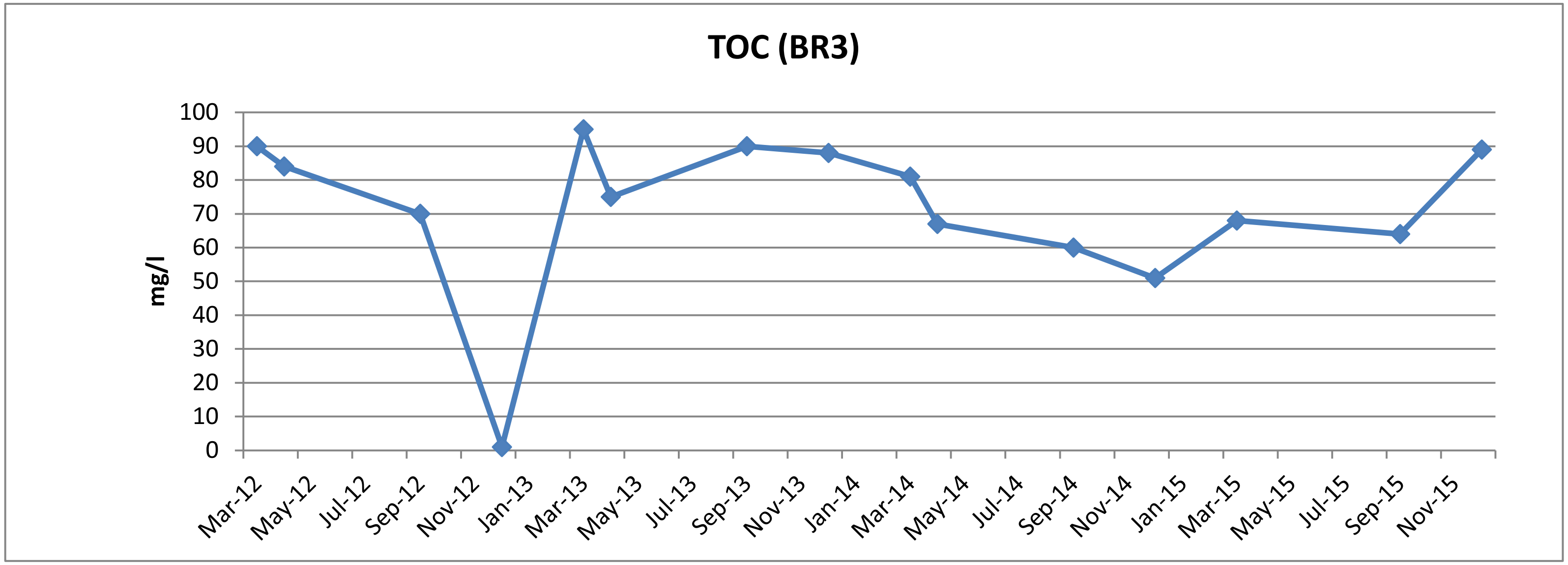
Conductivity (KC7/8)
µS/cm
1000
900
800
700
600
500
400
300
200
100
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

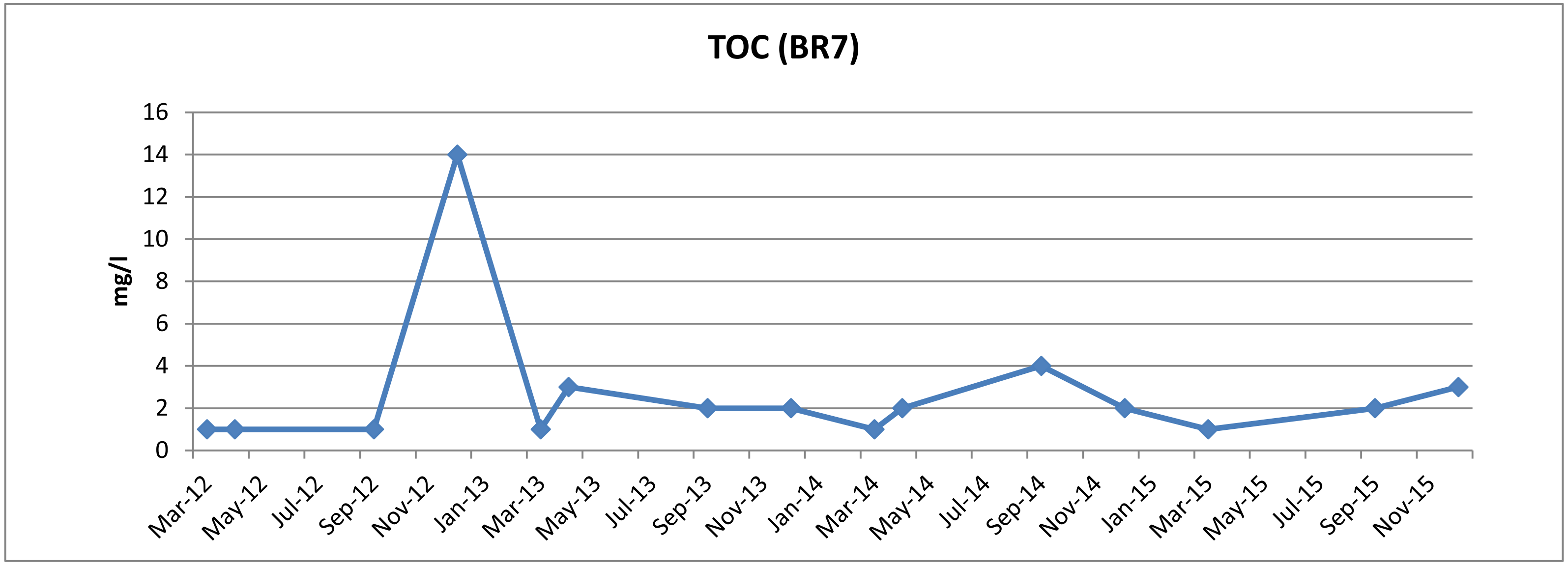
Bedrock Wells

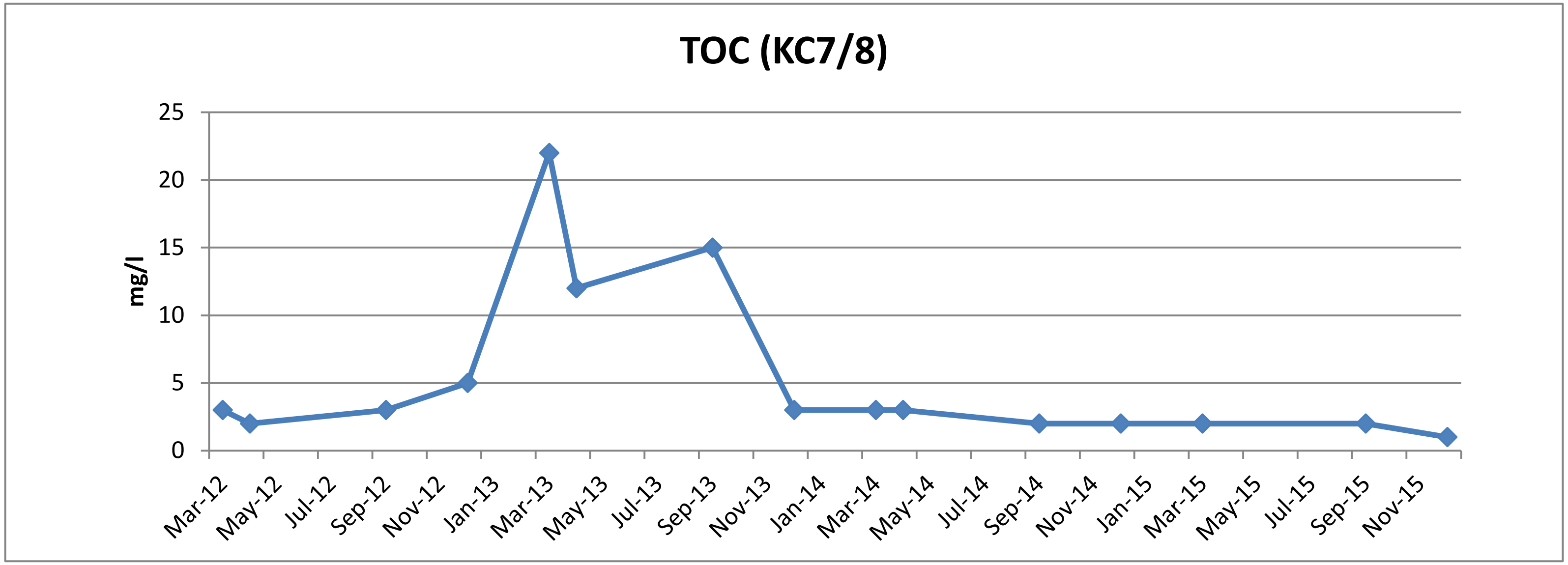
TOC (mg/l)					
Date	BR1	BR2	BR3	BR7	KC7/8
Mar-12	2	2	90	1	3
Apr-12	2	2	84	1	2
Sep-12	1	1	70	1	3
Dec-12	1	4	1	14	5
Mar-13	1	1	95	1	22
Apr-13	1	1	75	3	12
Sep-13	2	1	90	2	15
Dec-13	2	2	88	2	3
Mar-14	1	1	81	1	3
Apr-14	1	1	67	2	3
Sep-14	2	1	60	4	2
Dec-14	2	2	51	2	2
Mar-15	3	1	68	1	2
Sep-15	4	3	64	2	2
Dec-15	1	1	89	3	1


TOC (BR1)
mg/l
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15


TOC (BR2)
mg/l
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15


TOC (BR3)
mg/l
100
90
80
70
60
50
40
30
20
10
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

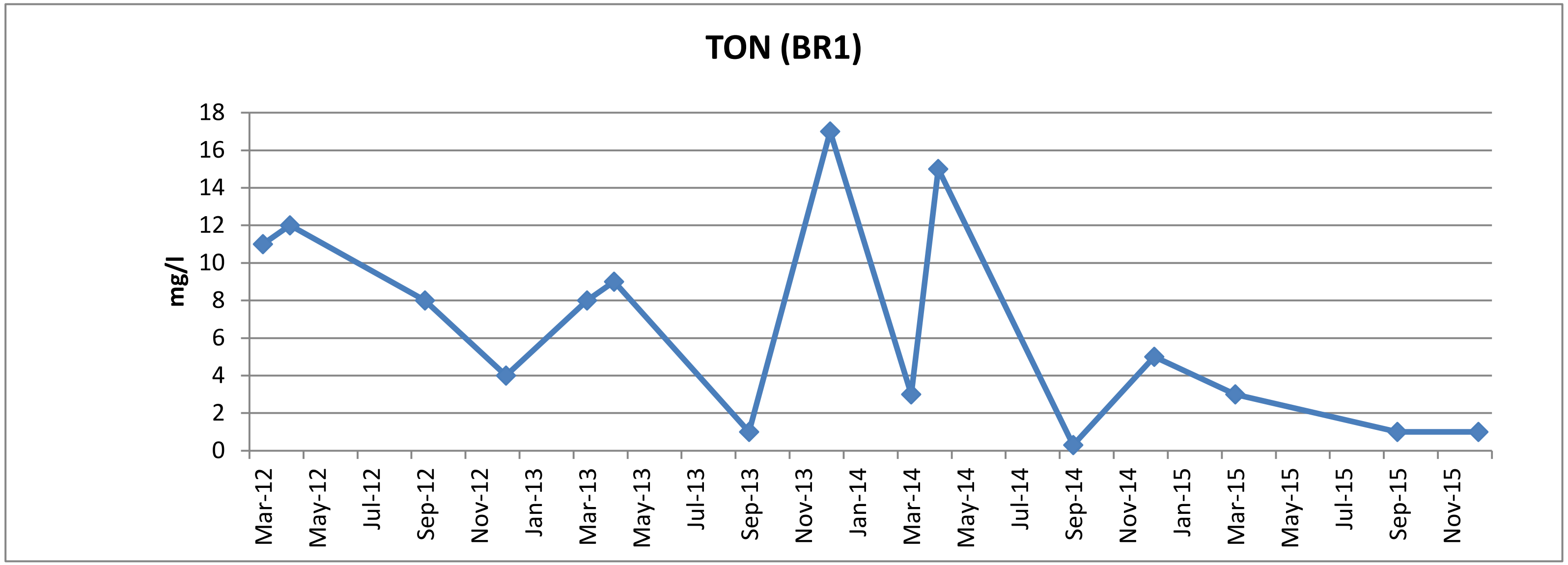

TOC (BR7)
mg/l
16
14
12
10
8
6
4
2
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

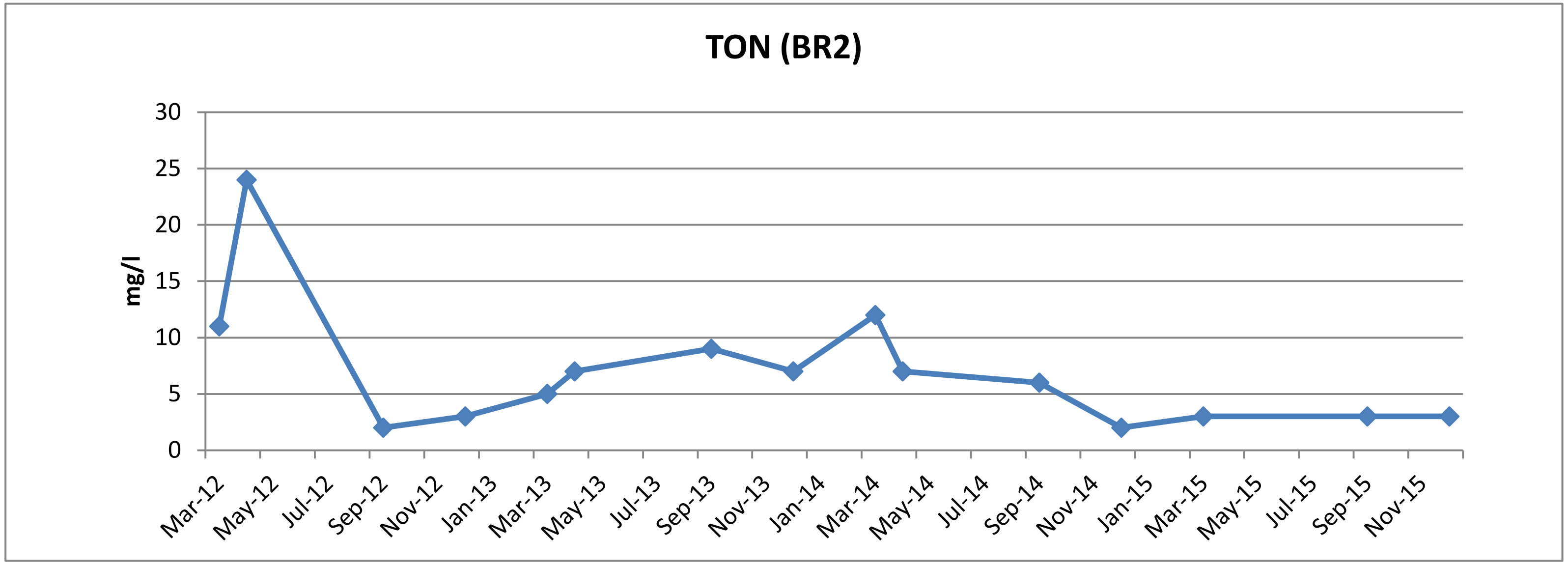


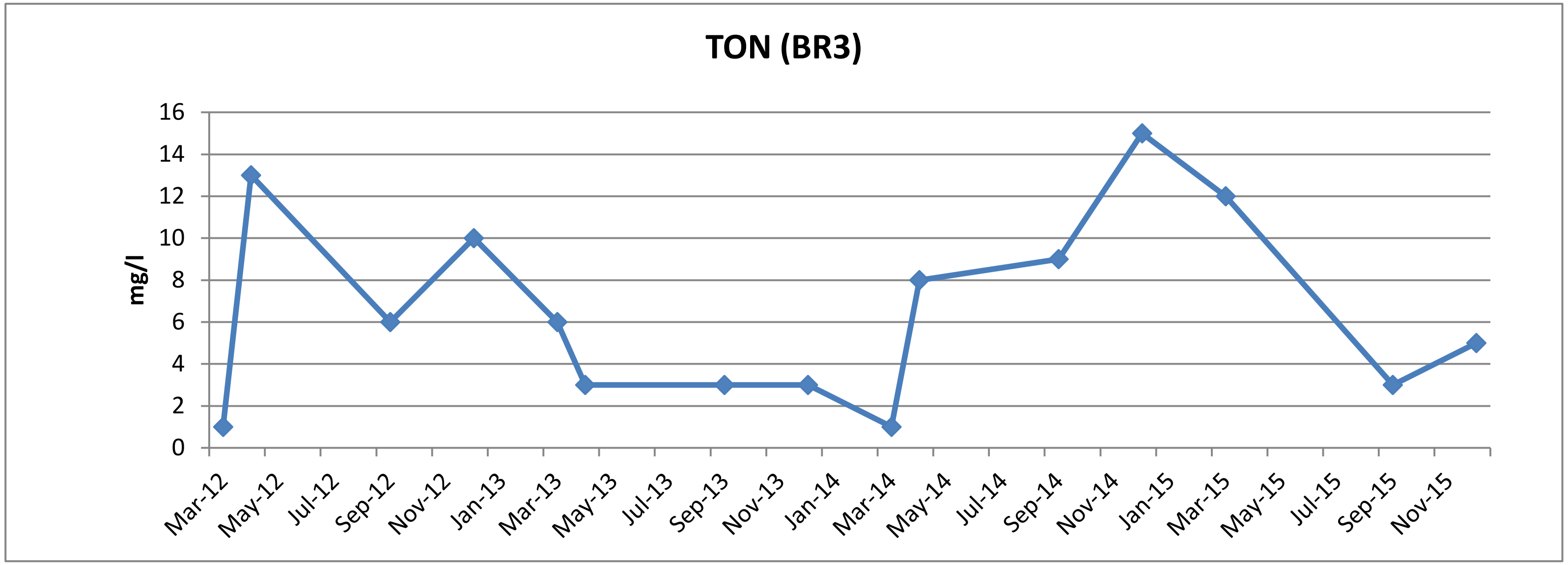
TOC (KC7/8)
mg/l
25
20
15
10
5
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

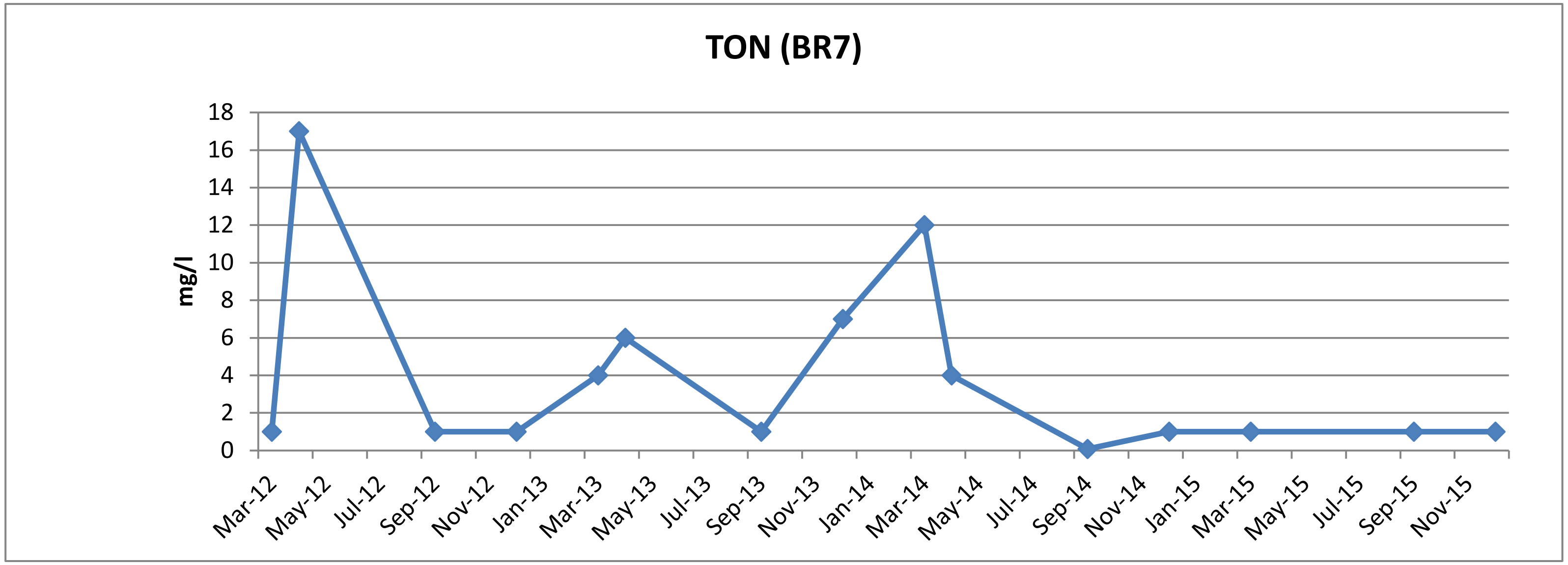
Bedrock Wells

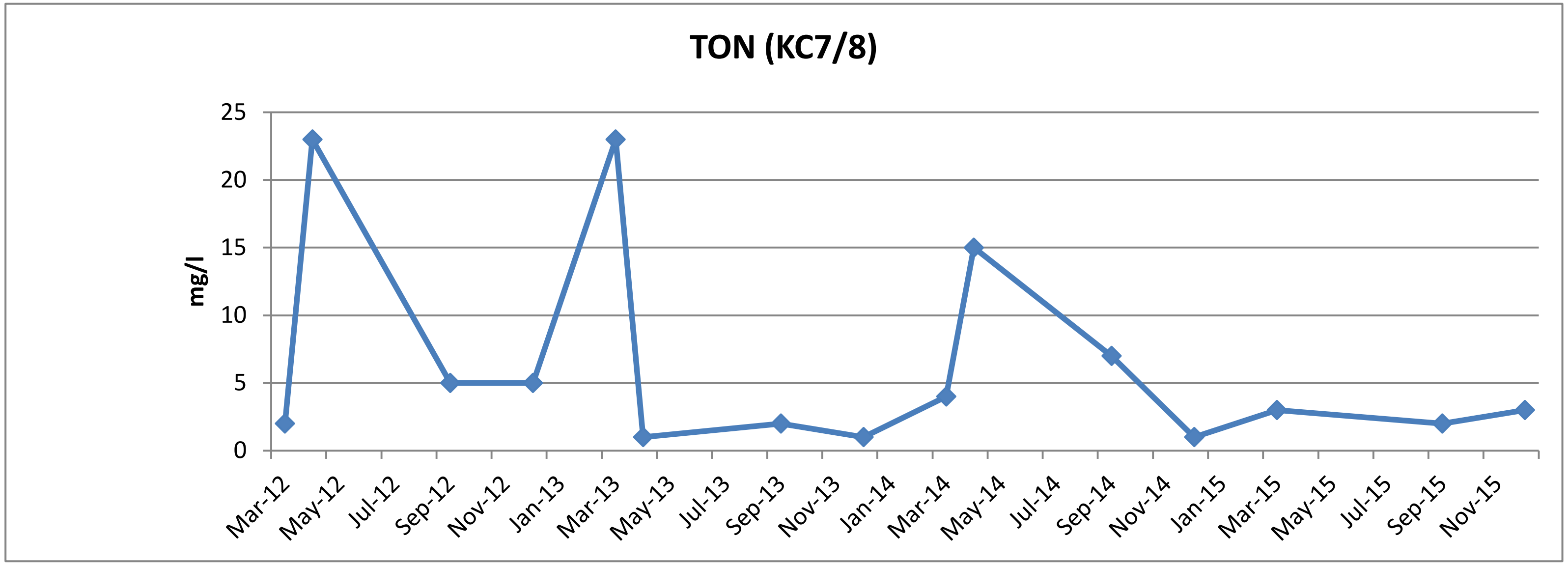
TON (mg/l)					
Date	BR1	BR2	BR3	BR7	KC7/8
Mar-12	11	11	1	1	2
Apr-12	12	24	13	17	23
Sep-12	8	2	6	1	5
Dec-12	4	3	10	1	5
Mar-13	8	5	6	4	23
Apr-13	9	7	3	6	1
Sep-13	1	9	3	1	2
Dec-13	17	7	3	7	1
Mar-14	3	12	1	12	4
Apr-14	15	7	8	4	15
Sep-14	0.3	6	9	0.08	7
Dec-14	5	2	15	1	1
Mar-15	3	3	12	1	3
Sep-15	1	3	3	1	2
Dec-15	1	3	5	1	3


TON (BR1)
mg/l
18
16
14
12
10
8
6
4
2
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15


TON (BR2)
mg/l
30
25
20
15
10
5
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15


TON (BR3)
mg/l
0
2
4
6
8
10
12
14
16
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

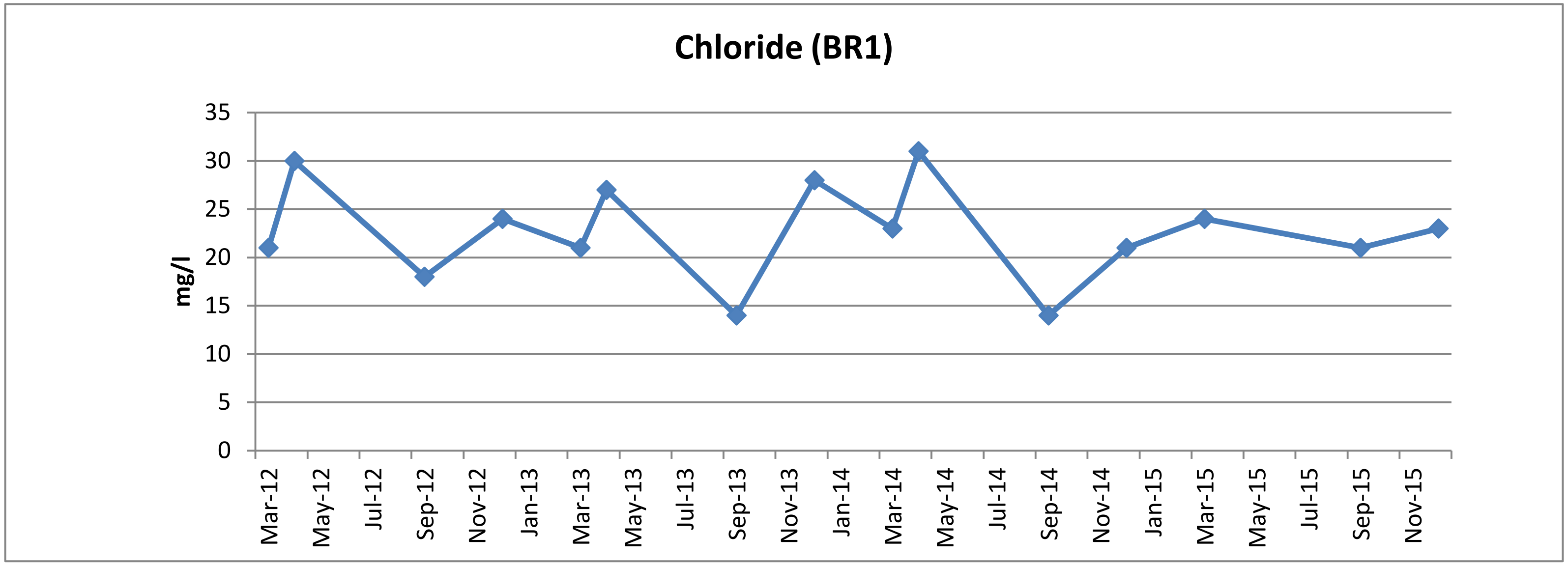

TON (BR7)
mg/l
0
2
4
6
8
10
12
14
16
18
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15



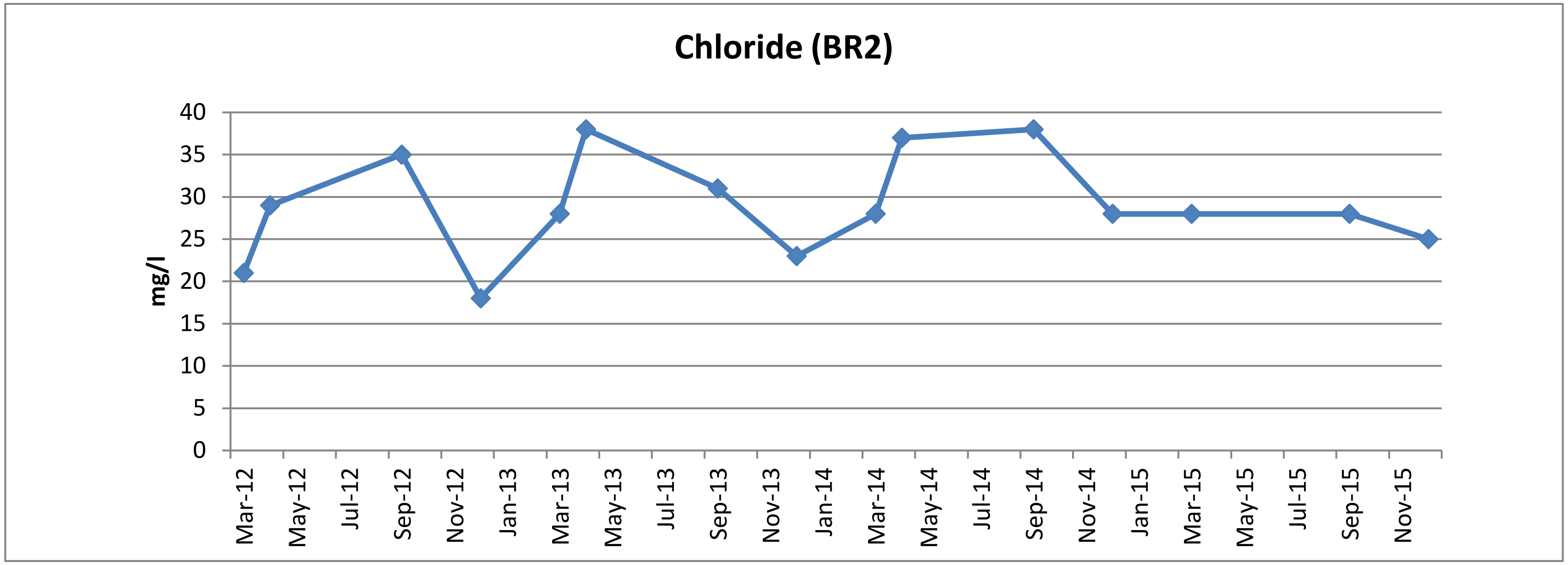
TON (KC7/8)
mg/l
25
20
15
10
5
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

Bedrock Wells

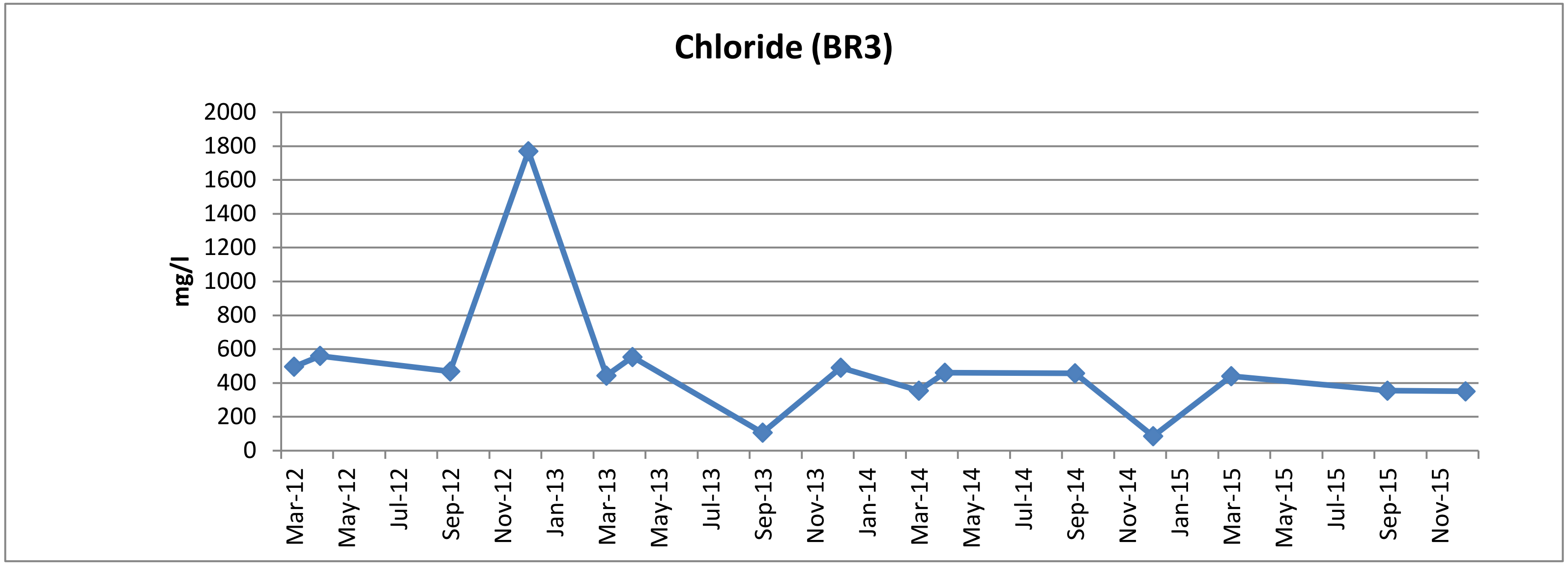
Chloride (mg/l)					
Date	BR1	BR2	BR3	BR7	KC7/8
Mar-12	21	21	496	14	24
Apr-12	30	29	560	21	24
Sep-12	18	35	468	35	28
Dec-12	24	18	1,770	27	49
Mar-13	21	28	443	31	28
Apr-13	27	38	553	35	31
Sep-13	14	31	106	22	17
Dec-13	28	23	490	21	28
Mar-14	23	28	354	25	28
Apr-14	31	37	460	23	35
Sep-14	14	38	457	28	35
Dec-14	21	28	85	21	28
Mar-15	24	28	440	21	24
Sep-15	21	28	354	20	22
Dec-15	23	25	350	17	25

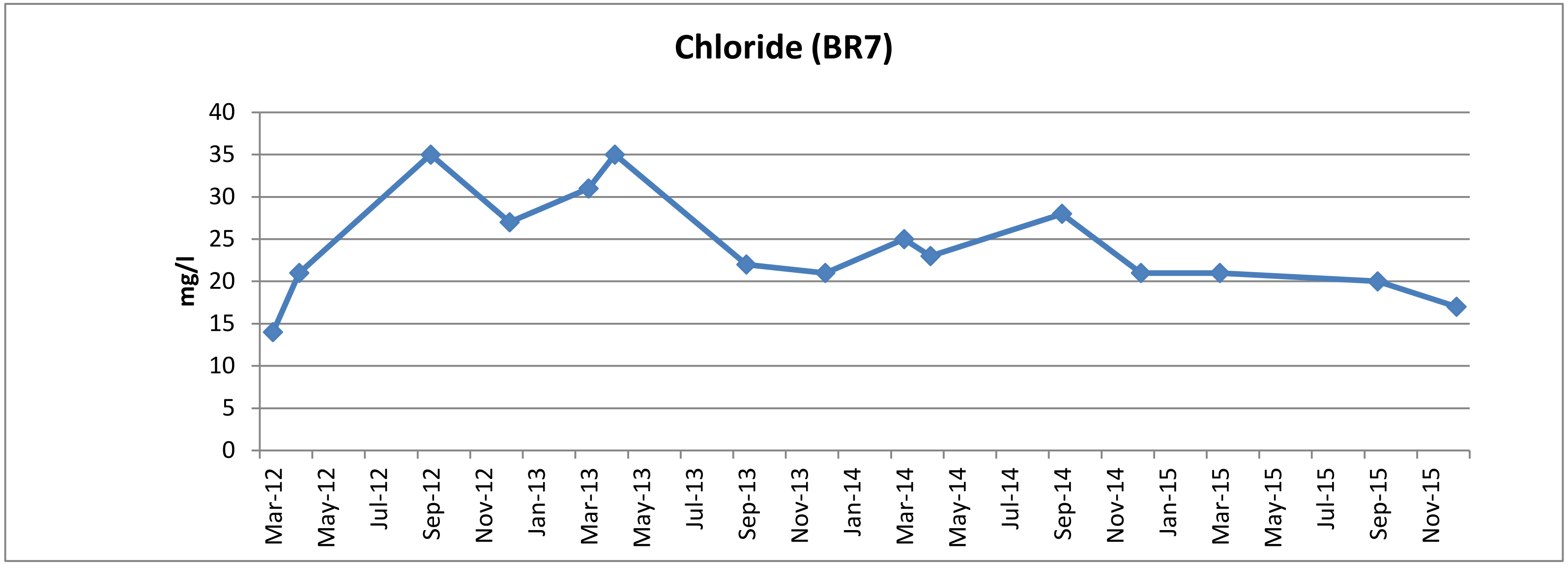


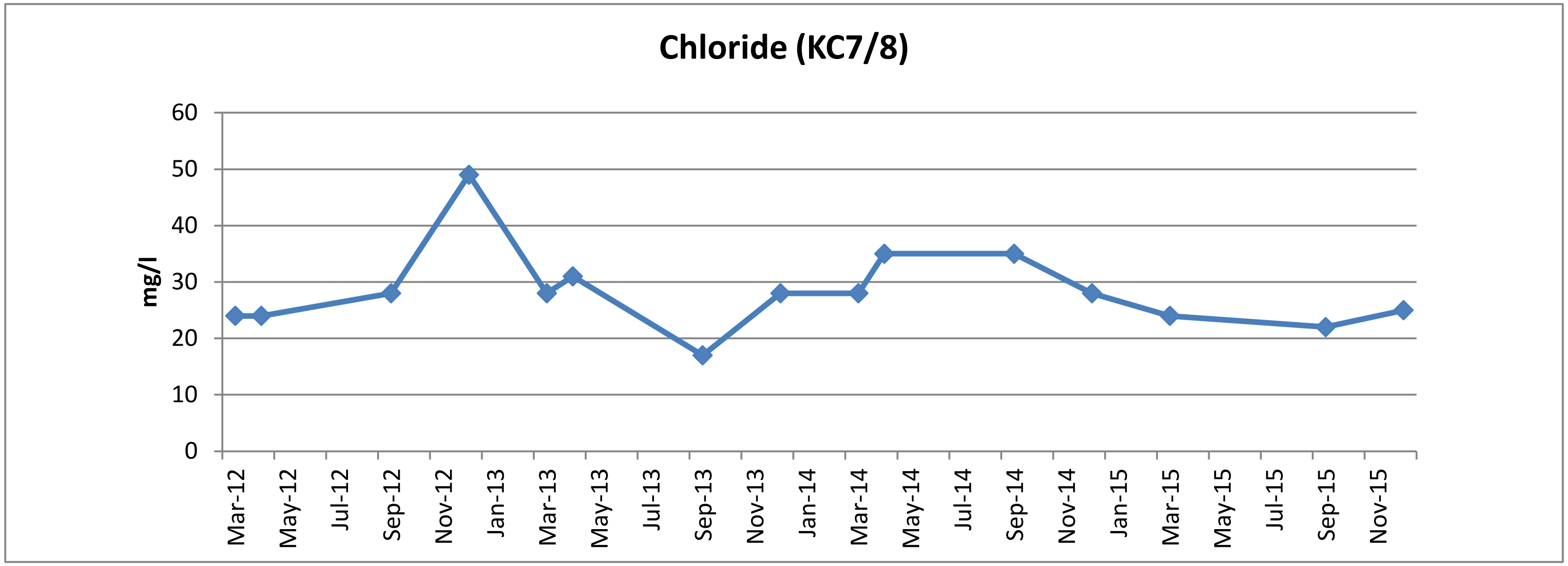
Chloride (BR1)
mg/l
35
30
25
20
15
10
5
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15



Chloride (BR2)
mg/l
40
35
30
25
20
15
10
5
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

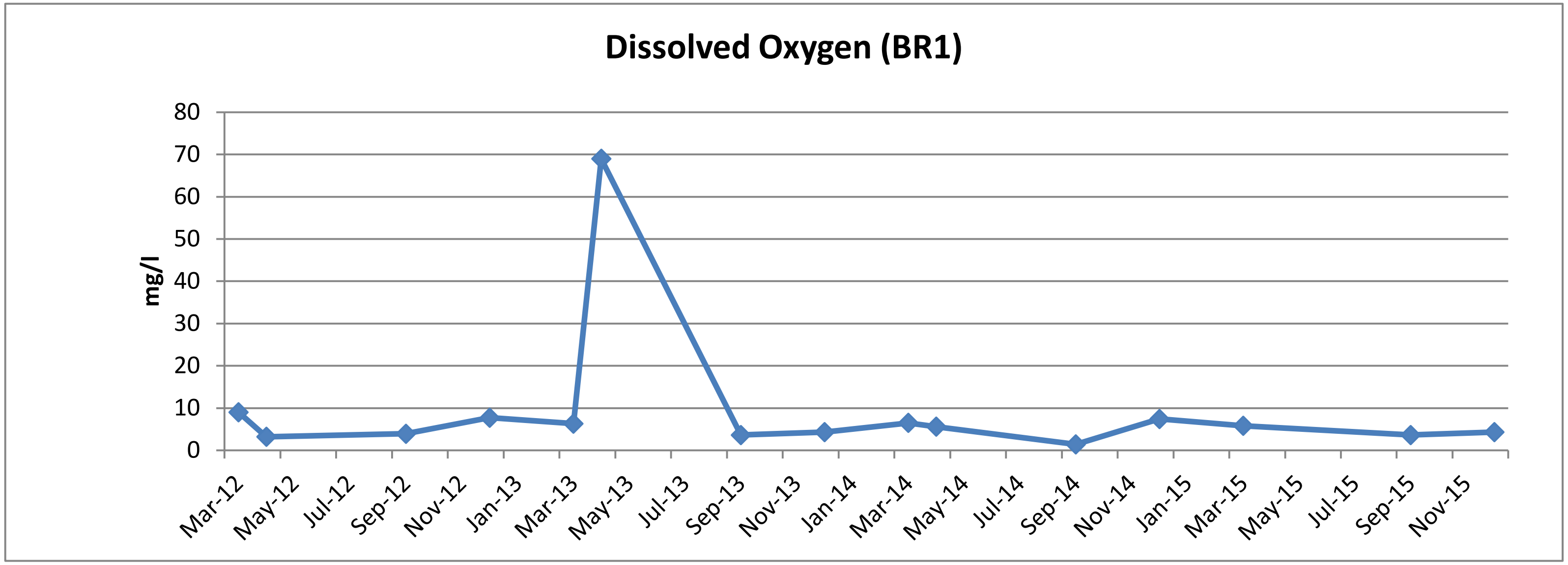

Chloride (BR3)
mg/l
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

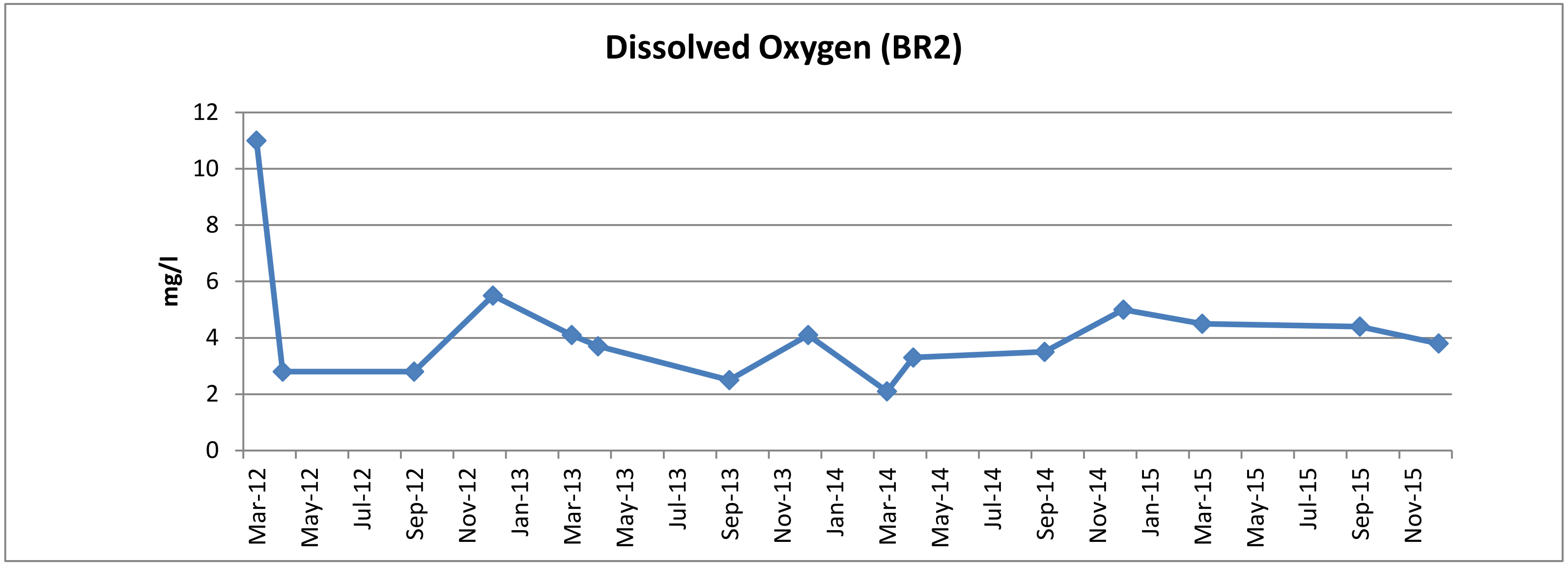

Chloride (BR7)
mg/l
40
35
30
25
20
15
10
5
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

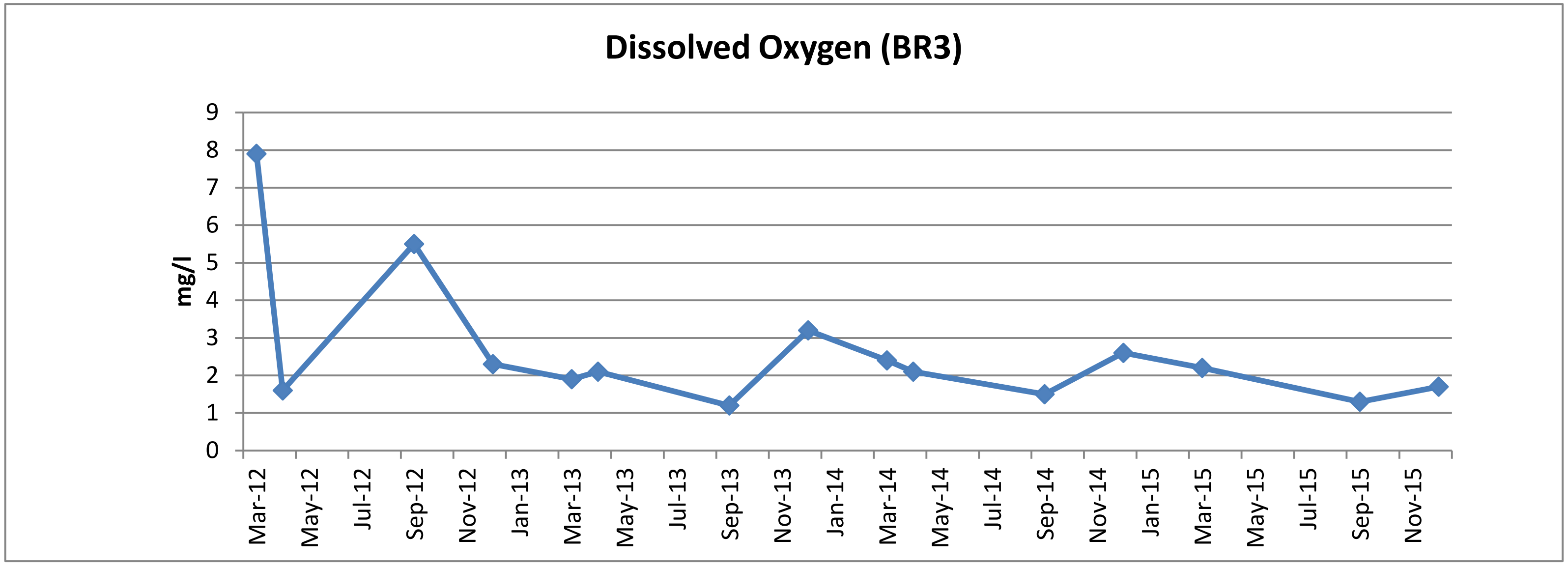

Chloride (KC7/8)
mg/l
60
50
40
30
20
10
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

Bedrock Wells

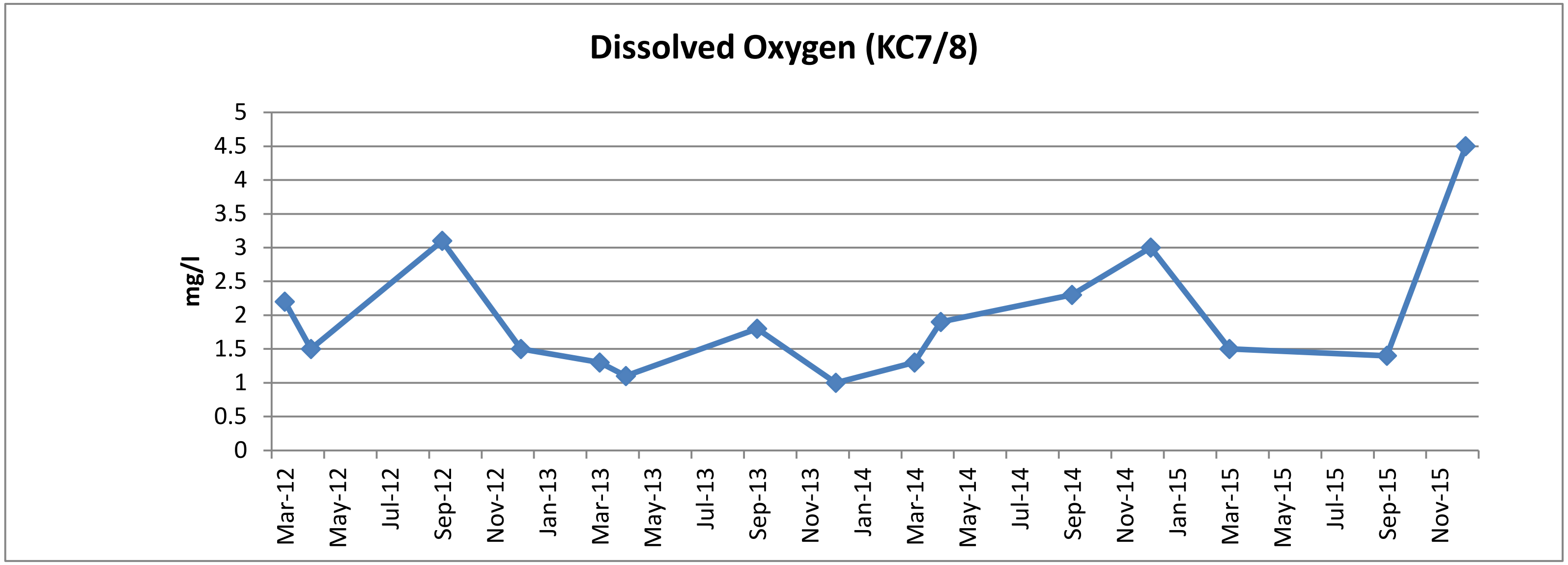
Dissolved Oxygen (mg/l)					
Date	BR1	BR2	BR3	BR7	KC7/8
Mar-12	9	11	7.9	1.7	2.2
Apr-12	3.2	2.8	1.6	1.8	1.5
Sep-12	3.9	2.8	5.5	3.1	3.1
Dec-12	7.7	5.5	2.3	1.3	1.5
Mar-13	6.3	4.1	1.9	2.1	1.3
Apr-13	69	3.7	2.1	1.4	1.1
Sep-13	3.6	2.5	1.2	2	1.8
Dec-13	4.3	4.1	3.2	2.5	1
Mar-14	6.5	2.1	2.4	1	1.3
Apr-14	5.6	3.3	2.1	2.4	1.9
Sep-14	1.4	3.5	1.5	1	2.3
Dec-14	7.4	5	2.6	2.9	3
Mar-15	5.8	4.5	2.2	2	1.5
Sep-15	3.6	4.4	1.3	1.4	1.4
Dec-15	4.3	3.8	1.7	5.8	4.5


Dissolved Oxygen (BR1)
mg/l
80
70
60
50
40
30
20
10
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

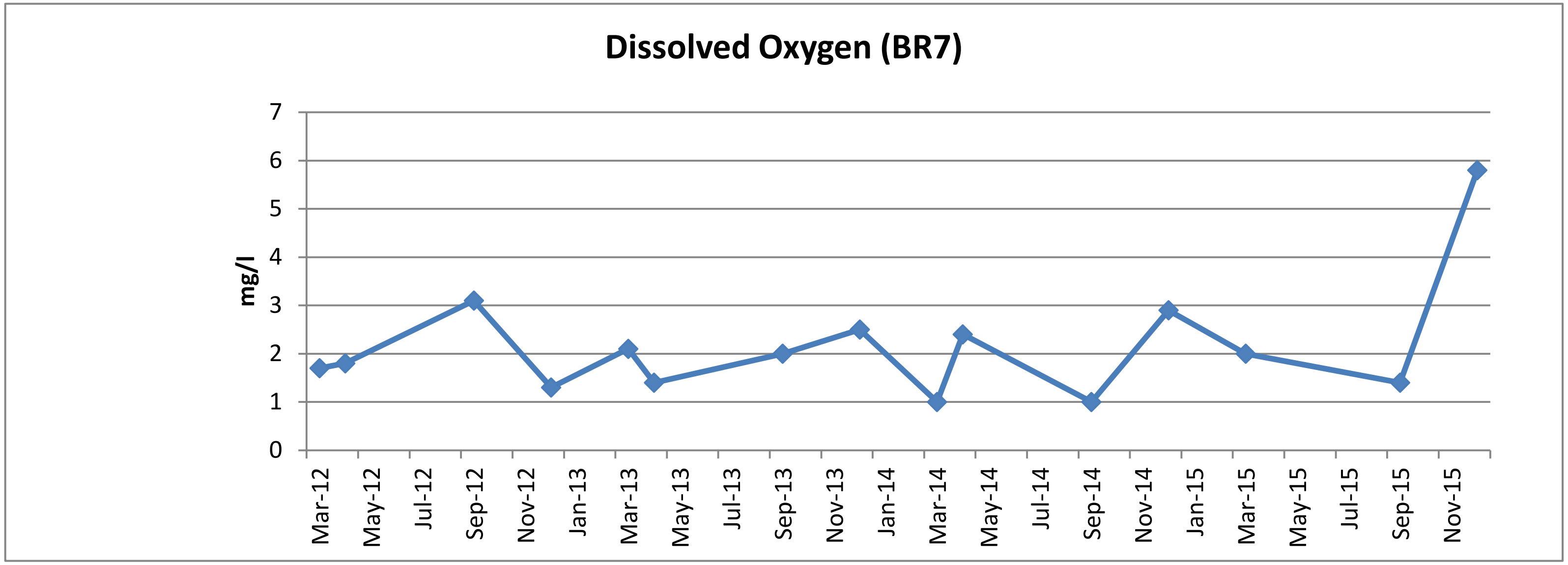

Dissolved Oxygen (BR2)
mg/l
12
10
8
6
4
2
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15



Dissolved Oxygen (BR3)
mg/l
9
8
7
6
5
4
3
2
1
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15



Dissolved Oxygen (KC7/8)
mg/l
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15



Dissolved Oxygen (BR7)
mg/l
7
6
5
4
3
2
1
0
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15

Surface Water:
Location: Trabeg Stream & Tramore river
Parameters: see below mg/l

Sampling Point:	EM7									
DATE	pH	Temp.C	DO	Cond.	NH4	Ammonia (as N)	BOD	COD	Sus.Sol	Chloride
				uS/cm						
11/03/2015	7.82	12.1.C	5.8	632	0.3	0.2334	8	10	11	34
08/09/2015	UNABLE TO OBTAIN									
01/12/2015	7.57	12.9.C	4.3	640	0.21	0.16338	4.6	7	9	22

Sampling Point:	EM8									
DATE	pH	Temp.C	DO	Cond.	NH4	Ammonia (as N)	BOD	COD	Sus Sol	Chloride
				uS/cm						
11/03/2015	7.91	12.9.C	6.6	690	0.2	0.1556	7	12	7	54
08/09/2015	8.04	14.C	3.2	485	0.13	0.10114	2	5	9	31
01/12/2015	7.85	11.7.C	1.1	645	0.07	0.05446	4.8	6	8	35

Sampling Point:	EM0										
DATE	pH	Temp.C	D.O.	Cond.	NH4	Ammonia (as N)	BOD	COD	Sus.Sol	Chloride	
				uS/cm							
11/03/2015	7.13	10.8.C	9.1	212	0.18	0.14004	4.8	12	199*	17	*River in Flood
08/09/2015	8.36	13.C	8.1	389	0.13	0.10114	<1	2	6	21	
01/12/2015	7.27	12.1.C	7.4	360	0.11	0.08558	<1	7	6	18	

Sampling Point:	EM1									
DATE	pH	Temp.C	D.O.	Cond.	NH4	Ammonia (as N)	BOD	COD	Sus.Sol.	Chloride
				uS/cm						
11/03/2015	7.24	11.2.C	8.8	217	0.11	0.08558	3.3	6	194	22
08/09/2015	8.35	13.2.C	7.5	377	0.17	0.13226	<1	9	4	19
01/12/2015	7.55	12.1.C	7.8	340	0.15	0.1167	<1	7	4	10

Sampling Point:		EM2									
DATE	pH	Temp.C	D.O.	Cond	NH4	Ammonia (as N)	BOD	COD	Sus.Sol	Chloride	TOC
				uS/cm							
11/03/2015	7.67	11.6.C	9.5	388	0.3	0.2334	1	3	14	31	1
08/09/2015	8.06	13.2.C	5.7	380	0.16	0.12448	1.7	9	3	21	2
01/12/2015	7.71	12.C	9.4	360	0.09	0.07002	1.2	12	4	25	1

Sampling Point:		EM11									
DATE	pH	TEMP.C	D.O.	COND	NH4	Ammonia (as N)	BOD	COD	Sus.Sol	Chloride	TOC
				uS/cm							
11/03/2015	7.71	11.6.C	7.3	399	0.8	0.6224	2.5	4	10	35	1
08/09/2015	8.33	13.1.C	6.8	380	0.14	0.10892	2.9	13	4	21	2
01/12/2015	7.53	11.9.C	7.2	360	0.17	0.13226	1.6	5	8	25	1

Sampling Point:		EM6/10								
DATE	pH	TEMP.C	D.O.	COND	NH4	Ammonia (as N)	BOD	COD	Sus.Sol	Chloride
				uS/cm						
11/03/2015	7.22	11.6.C	8.2	240	0.2	0.1556	4.3	7	52	31
08/09/2015	8.41	13.4.C	7.2	440	0.13	0.10114	1.1	9	5	31
01/12/2015	8.11	12.1.C	6.3	383	0.07	0.05446	1.2	5	8	29

Surface Water:
Location: Trabeg Stream & Tramore river
Parameters: see below mg/l

	Frequency	Method		Range	Sample	**EM0**	**EM1**	**EM2**	**EM11**	**EM6/10**	**EM7**	**EM8**
Vis/Odour	W				Grab	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
Ammonium	q	ISE		0.01-10		0.08	0.4	0.3	0.5	0.3	0.5	0.3
B.O.D.	q	Meter Brit		0.1-8.0		1.5	1.4	2.8	3.6	1.9	11.4	3
C.O.D.	q	Closed Tube		1-500		3	3	4	5	5	15	7
Chloride	q	Argent SM		1-100		28	31	28	28	27	28	39
D.O.	q	Meter		0.1-20		10.9	10.6	8.8	9.8	8.4	7	7.3
Cond.us/cm	q	Meter		1-200000		395us	385us	412us	394us	421us	546us	550us
pH	q	Meter		05-Nov		8.1	8.2	8.1	8.1	8.2	7.9	8.1
Sus.Sol.	q	Grav		0.1-200		12	9	8	24	34	67	26
Temp.	q	Meter		0-50		8.7.C	9.8.C	13.1.C	11.9.C	9.5.C	12.1.C	12.2.C
Cadmium	a	GFAA		0.001-0.5		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Calcium	a	AA		1-100		60	50	50	48	64	75	84
Chromium	a	GFAA		0.001-0.2		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Copper	a	AA		0.001-1.0		0.02	0.02	0.02	0.02	0.02	0.02	0.02

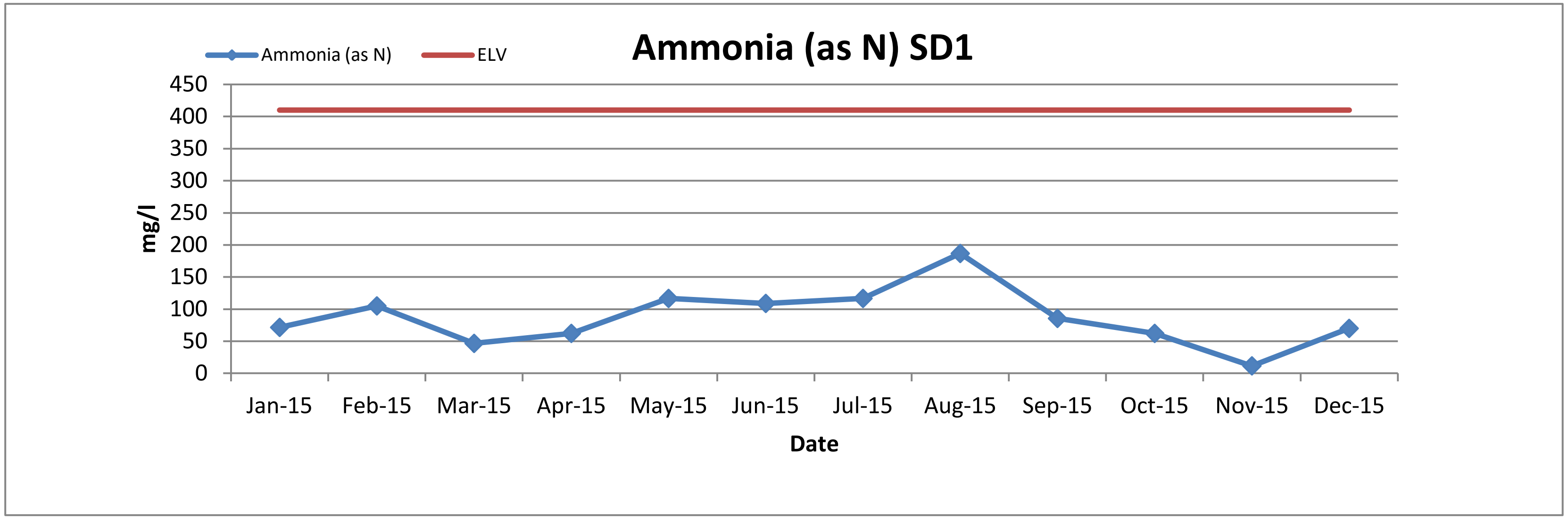
Surface Water:
Location: Trabeg Stream & Tramore river
Parameters: see below mg/l

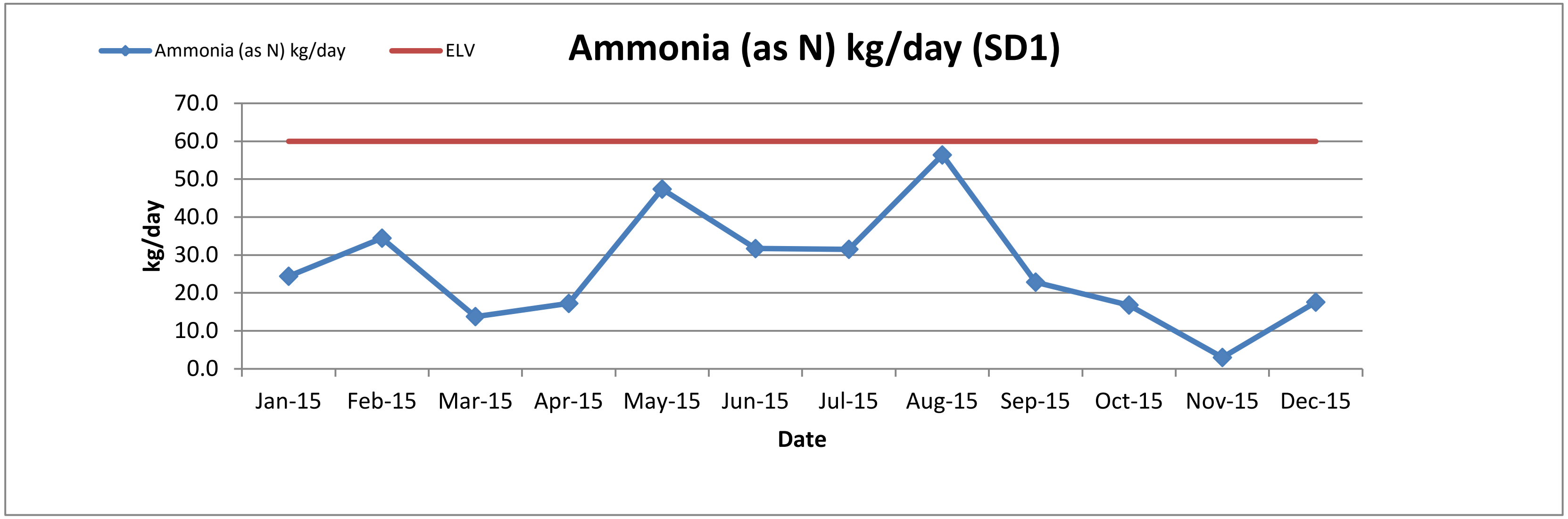
	Frequency		Method	Range	Sample	**EM0**	**EM1**	**EM2**	**EM11**	**EM6/10**	**EM7**	**EM8**
					Grab							
Iron	a		AA	0.01-5.0		0.002	0.16	0.09	0.08	0.06	0.08	0.08
Lead	a		GFAA	0.001-0.1		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Magnesium	a		AA	0.01-5.0		8	7	8	7	8	7	7
Manganese	a		AA	0.01-3.0		0.15	0.15	0.14	0.14	0.15	0.18	0.16
Mercury	a		GFAA			<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Potassium	a		AA	0.1-5.0		1	1.5	1.1	1.5	1.2	6	6
Sulphate	a		Turb. SM	1.0-3.0		2	26	27	28	29	39	39
Sodium	a		AA	0.1-3.0		16	17	21	20	22	25	25
Tot Phos	a		Stann SM	0.05-0.25		0.06	0.07	0.06	0.07	0.12	0.05	0.04
T.O.N.	a		SM			7	5	3	4	5	8	6
Zinc	a		AA	0.01-5.0		<0.002	0.002	0.005	0.006	0.009	0.009	0.008
Ni	a		GFFA	0.002-1		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Alk	a		SM	1-1000		140	140	140	140	150	190	200
Boron	a		GFFA	0.01-1.0		0.02	<0.02	0.03	<0.02	0.02	0.08	0.07
T.O.C								2	2			

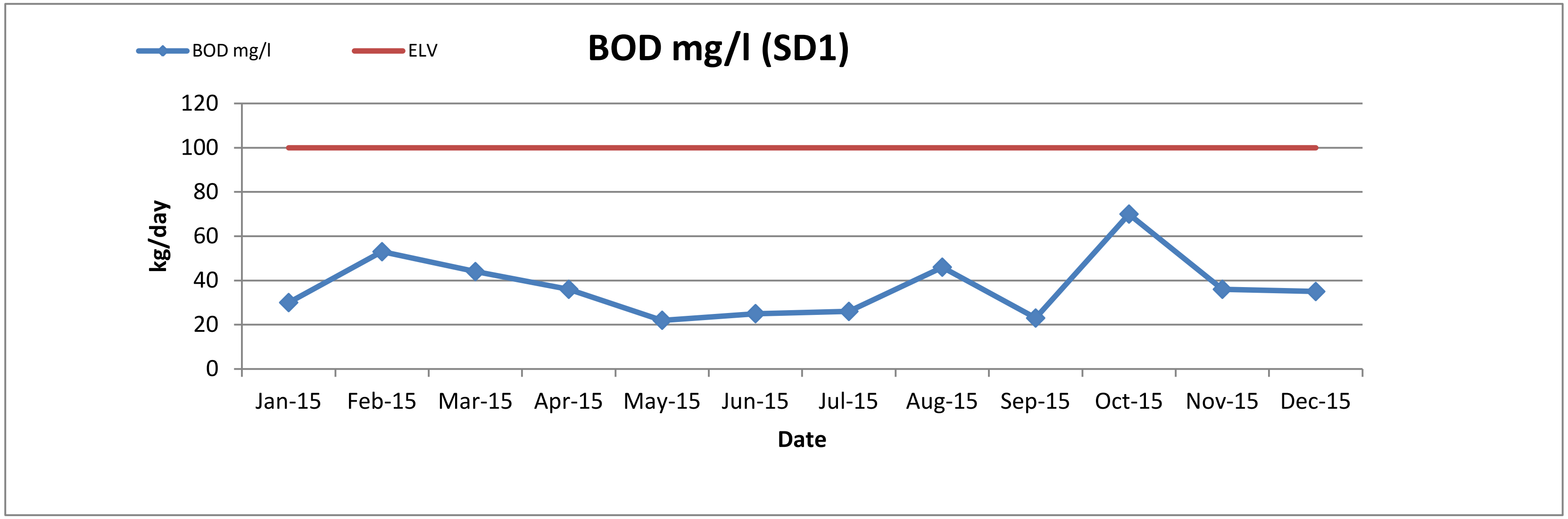
Emission Poi SD1
Location: Sewer Outlet
Year: 2015

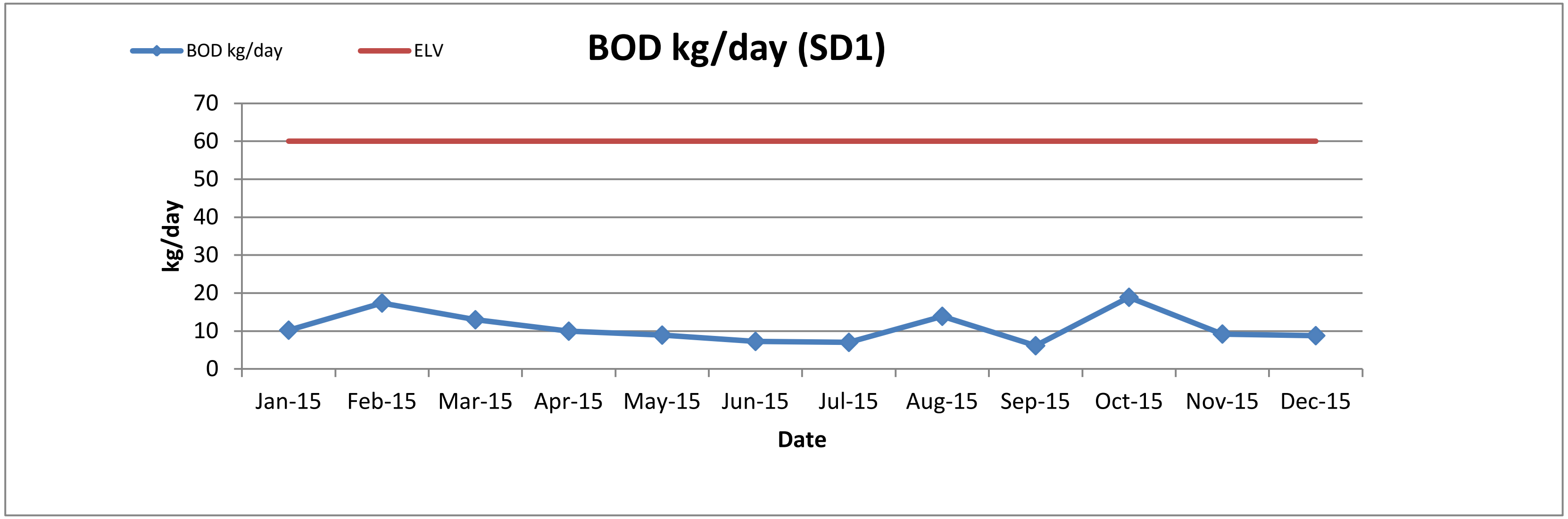
EMISSIONS TO SEWER 2014 (mg/l)

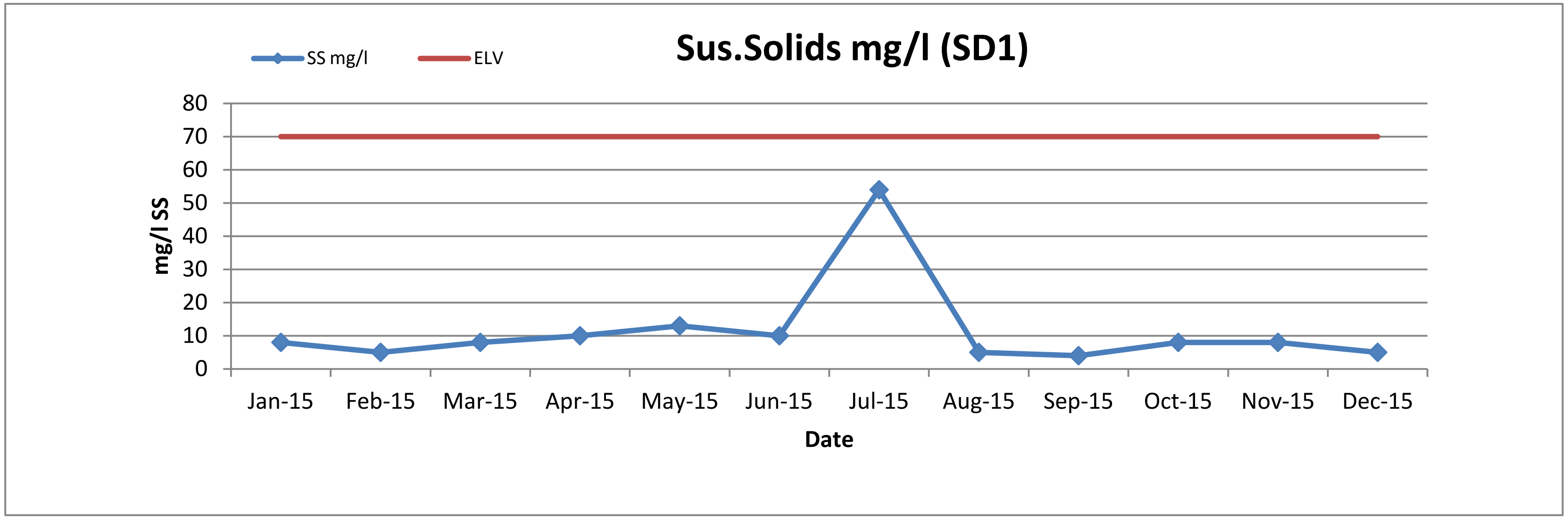
			mg/l	kg/d	mg/l	kg/d	mg/l	kg/d	mg/l	kg/d
DATE	M^3/day	pH	NH_4 mg/l	NH_4 kg/day	BOD mg/l	BOD kg/day	Sulphate mg/l	Sulphate kg/day	SS mg/l	SS kg/day
27/01/15	341	7.6	92	31.4	30	10.2	5	1.71	8	2.73
17/02/15	328	7.5	135	44.3	53	17.4	5	1.64	5	1.64
11/03/15	295	7.7	60	17.7	44	13.0	7	2.07	8	2.36
07/04/15	277	7.7	80	22.2	36	10.0	5	1.39	10	2.77
19/05/15	406	7.6	150	60.9	22	8.9	5	2.03	13	5.28
09/06/15	291	7.4	140	40.7	25	7.3	5	1.46	10	2.91
15/07/15	270	7.6	150	40.5	26	7.0	5	1.35	54	14.58
25/08/15	302	7.9	240	72.5	46	13.9	5	1.51	5	1.51
08/09/15	267	7.5	110	29.4	23	6.1	5	1.34	4	1.07
22/10/15	270	7.7	80	21.6	70	18.9	5	1.35	8	2.16
10/11/15	256	7.4	15	3.8	36	9.2	5	1.28	8	2.05
04/12/15	251	7.6	90	22.6	35	8.8	5	1.26	5	1.26


Ammonia (as N) SD1
Ammonia (as N)
ELV
mg/l
450
400
350
300
250
200
150
100
50
0
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Date

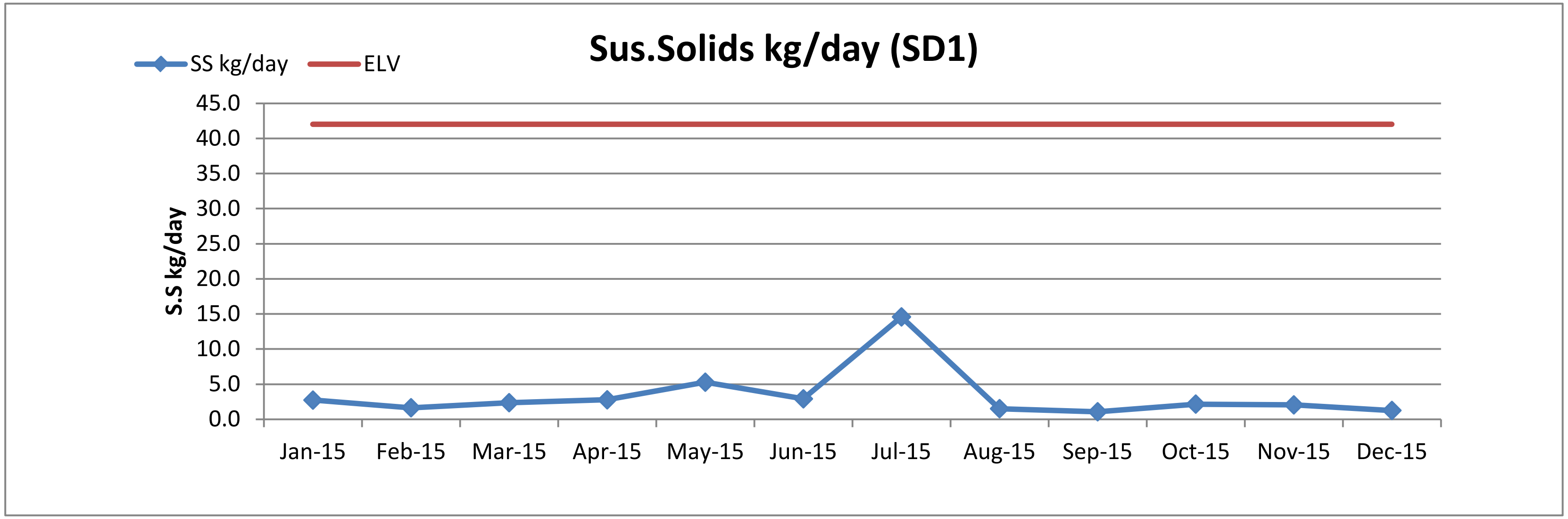

Ammonia (as N) kg/day (SD1)
Ammonia (as N) kg/day
ELV
kg/day
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Date


BOD mg/l
ELV
BOD mg/l (SD1)
120
100
80
60
40
20
0
kg/day
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Date

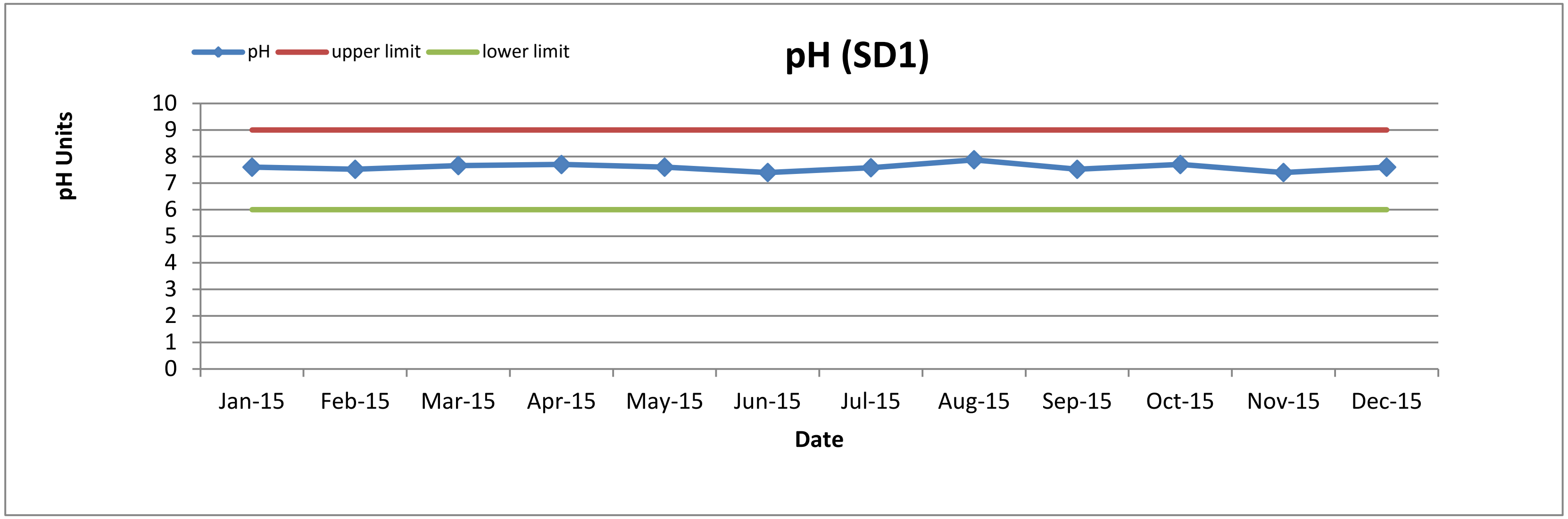

BOD kg/day
ELV
BOD kg/day (SD1)
70
60
50
40
30
20
10
0
kg/day
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Date



Sus.Solids mg/l (SD1)
SS mg/l
ELV
mg/l SS
80
70
60
50
40
30
20
10
0
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Date

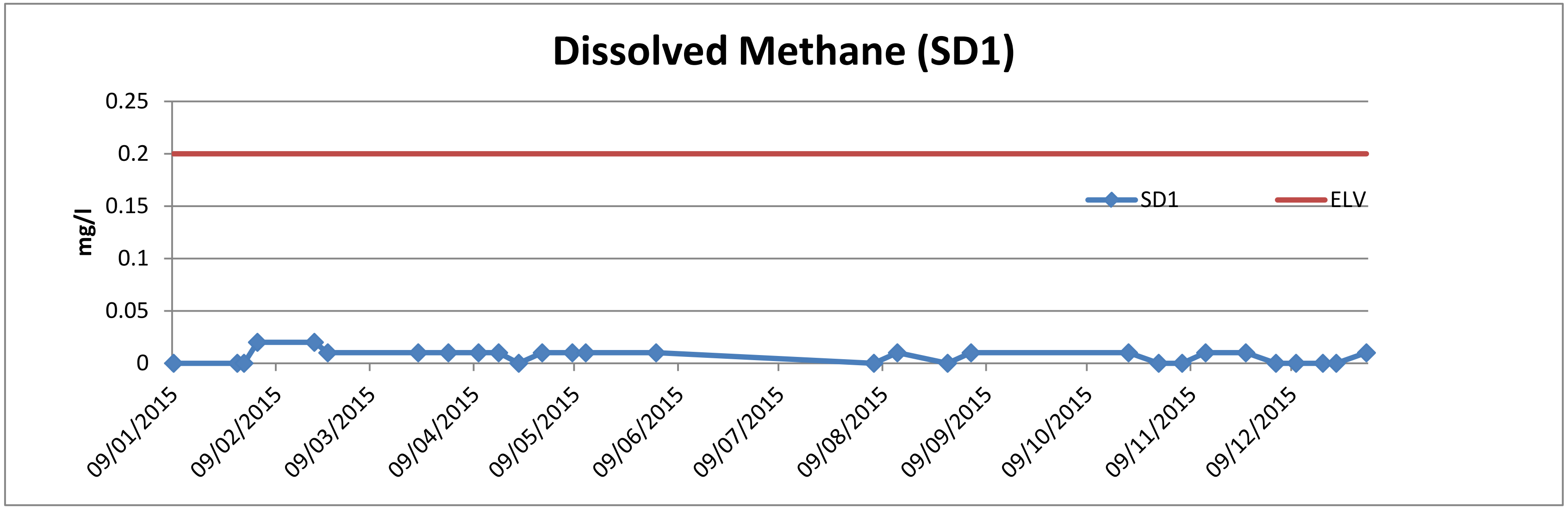


Sus.Solids kg/day (SD1)
SS kg/day
ELV
S.S kg/day
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15


pH (SD1)
pH
upper limit
lower limit
pH Units
10
9
8
7
6
5
4
3
2
1
0
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Date

Emission Point: **SD1**
Location: **Sewer Outlet**
Parameter: **Dissolved Methane**

Date	Inlet (Balance Tank)(mg/l)	FHS Tank (mg/l)	SD1	ELV
09/01/2015	0.02	<0.01	<0.01	0.2
28/01/2015	0.43	<0.01	<0.01	0.2
30/01/2015	0.83	0.03	<0.01	0.2
03/02/2015	0.9	0.06	0.02	0.2
20/02/2015	1.8	0.08	0.02	0.2
24/02/2015	1.18	0.05	0.01	0.2
23/03/2015	0.66	0.03	0.01	0.2
01/04/2015	1.24	0.02	0.01	0.2
10/04/2015	0.89	0.03	0.01	0.2
16/04/2015	0.95	0.03	0.01	0.2
22/04/2015	0.41	0.02	<0.01	0.2
29/04/2015	0.04	0.01	0.01	0.2
08/05/2015	1.42	0.02	0.01	0.2
12/05/2015	0.6	0.02	0.01	0.2
02/06/2015	0.93	0.02	0.01	0.2
06/08/2015	0.32	<0.01	<0.01	0.2
13/08/2015	1.01	0.01	0.01	0.2
28/08/2015	0.77	0.01	<0.01	0.2
04/09/2015	1.27	0.01	0.01	0.2
21/10/2015	1.23	0.01	0.01	0.2
30/10/2015	0.2	0.01	<0.01	0.2
06/11/2015	0.28	0.01	<0.01	0.2
13/11/2015	0.49	0.01	0.01	0.2
25/11/2015	0.57	0.01	0.01	0.2
04/12/2015	0.27	0.01	<0.01	0.2
10/12/2015	0.38	<0.01	<0.01	0.2
18/12/2015	0.39	0.01	<0.01	0.2
22/12/2015	0.32	<0.01	<0.01	0.2
31/12/2015	0.27	0.01	0.01	0.2

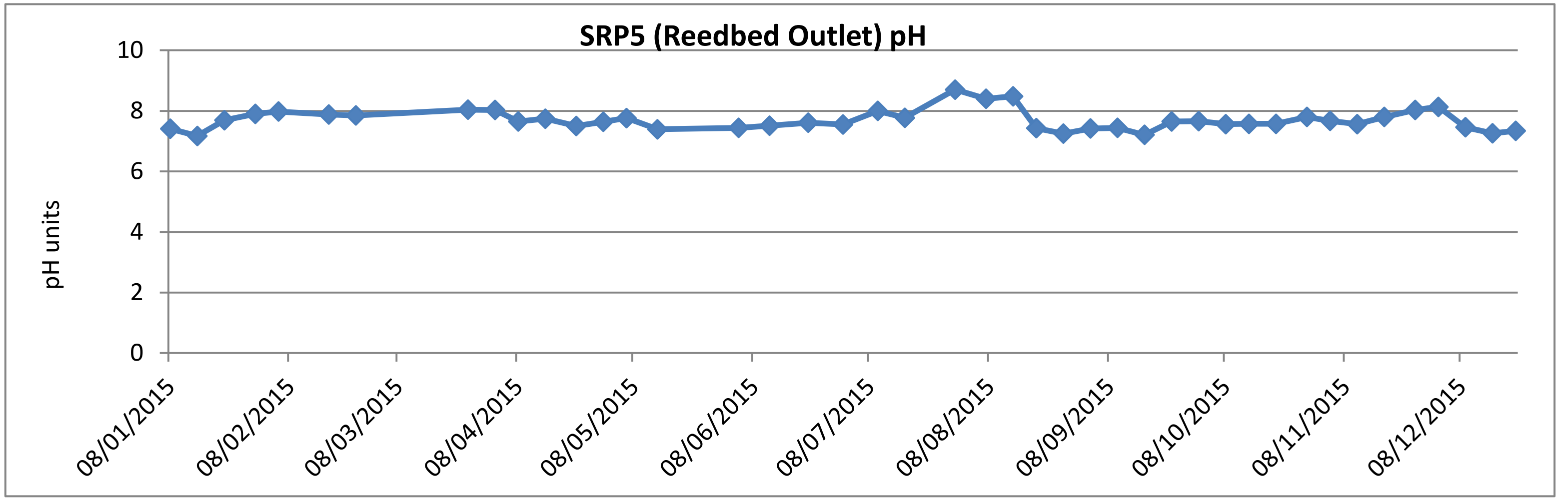

Dissolved Methane (SD1)
0.25
0.2
0.15
0.1
0.05
0
mg/l
SD1
ELV
09/01/2015
09/02/2015
09/03/2015
09/04/2015
09/05/2015
09/06/2015
09/07/2015
09/08/2015
09/09/2015
09/10/2015
09/11/2015
09/12/2015

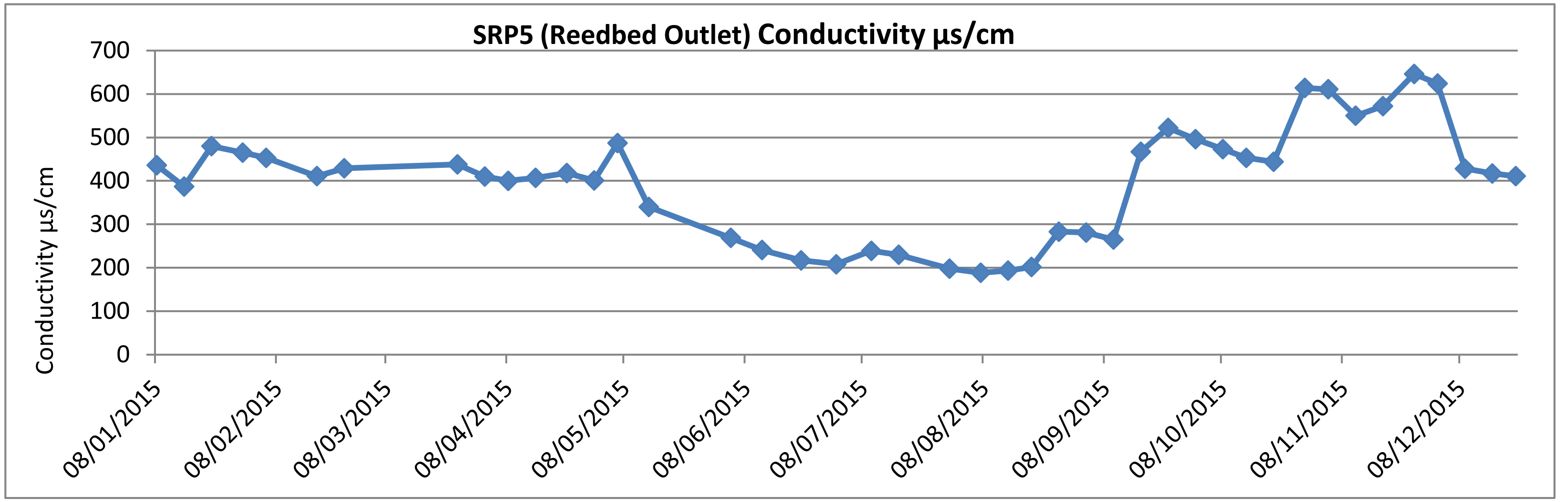
Stormpond Inlet Parameter Data

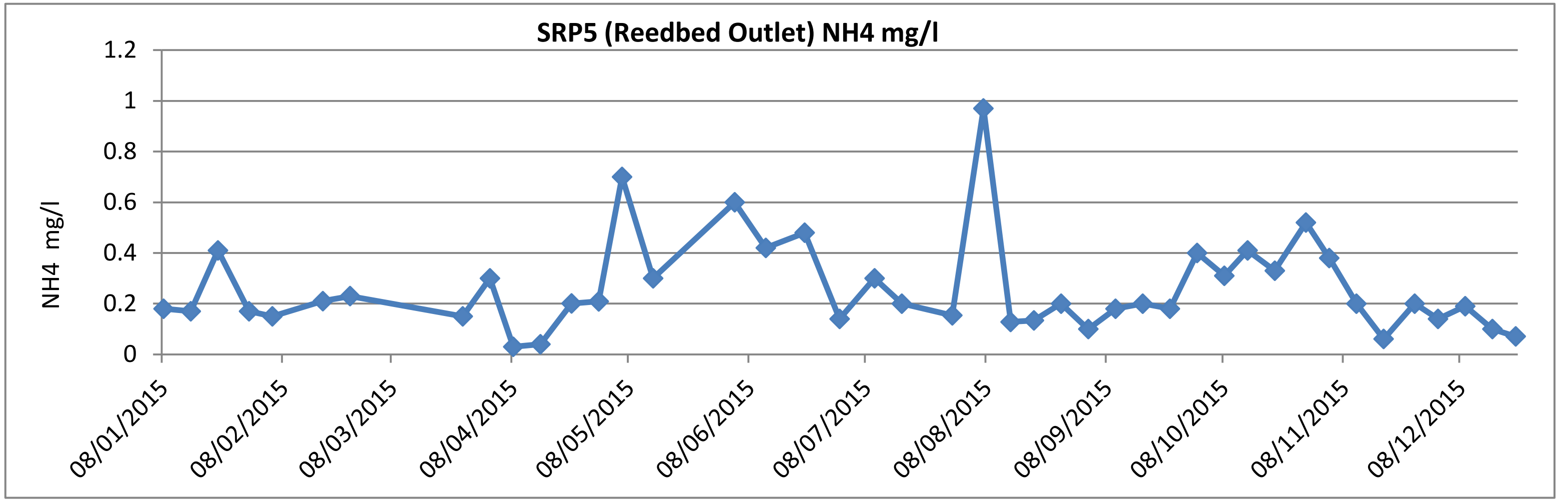
All data in mg/l unless stated otherwise

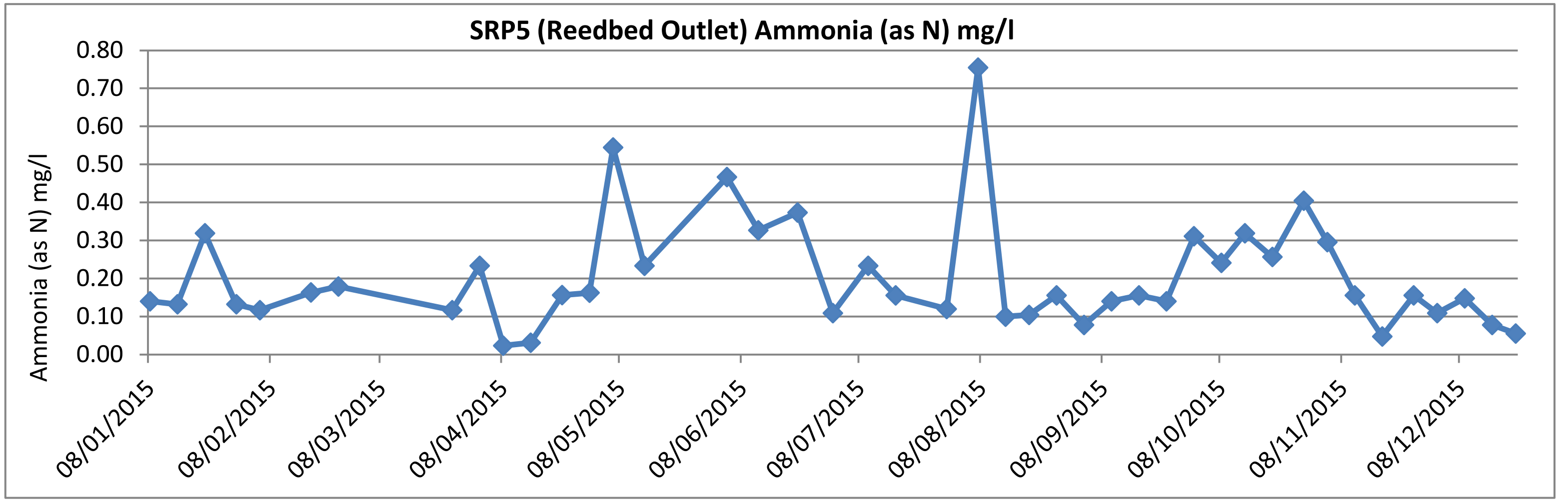
Date	Temp *C	pH	Conductivity µs/cm	NH4	Ammonia (as N)	Chloride	COD	TOC	BOD	Suspended solids
08/01/2015	8.8	7.41	436	0.18	0.14	16	19	1.4	1.52	0.4
15/01/2015	5.8	7.17	387	0.17	0.13	17	28	11.1	1.65	8
22/01/2015	6.6	7.69	480	0.41	0.32	13	21	4.3	1.34	2
30/01/2015	9.1	7.9	465	0.17	0.13	21	12	0.8	2.65	1.6
05/02/2015	6.6	7.98	453	0.15	0.12	23	11	0.1	3.07	0.8
18/02/2015	11.8	7.88	411	0.21	0.16	24	32	197	1.83	0.8
25/02/2015	9.4	7.85	429	0.23	0.18	18.4	10	2.4	1.68	0.8
26/03/2015	10	8.04	438	0.15	0.12	31	23	6.8	5.52	4.8
02/04/2015	11.6	8.03	410	0.3	0.23	27	25	8.9	6.74	9.6
08/04/2015	16.7	7.65	400	0.03	0.02	28	26	8.5	6.71	10.4
15/04/2015	15.2	7.74	407	0.04	0.03	28	20	1	3.74	2.4
23/04/2015	14.8	7.5	418	0.201	0.16	33	32	2.8	2.82	2.8
30/04/2015	13	7.64	401	0.209	0.16	37	31	14.1	3.89	3.2
06/05/2015	15.3	7.76	487	0.7	0.54	38	36	6.6	4.92	5.2
14/05/2015	15	7.39	340	0.3	0.23	25.5	36	9.1	0	3.2
04/06/2015	16.4	7.44	269	0.6	0.47	29.78	7	0.9	4.76	7.2
12/06/2015	17.9	7.51	241	0.42	0.33	12	27	3.2	2.26	2
22/06/2015	18.9	7.61	217	0.48	0.37	12.7	34	5.3	2.73	1.2
01/07/2015	19.8	7.55	208	0.14	0.11	12.76	33	2.1	1.96	3.2
10/07/2015	19.9	8	239	0.3	0.23	7.09	30	7.4	1.74	1.2
17/07/2015	18.2	7.77	230	0.2	0.16	22.7	30	0.9	0.94	2
30/07/2015	21	8.7	198	0.154	0.12	22.7	24	8.3	2.63	3.2
07/08/2015	21.2	8.4	188.6	0.97	0.75	22.7	44	7.5	1	4
14/08/2015	19.3	8.48	193.6	0.128	0.10	18.4	13	10	0.86	4.8
20/08/2015	18.4	7.43	202	0.134	0.10	25.5	10	8.1	1.48	2.8
27/08/2015	18.1	7.25	283	0.2	0.16	21.27	22	9.3	2.45	4
03/09/2015	19.8	7.42	281	0.1	0.08	18.43	26	10.9	2.36	3.3
10/09/2015	20.3	7.44	265	0.18	0.14	15.6	15	8.7	2.01	1.85
17/09/2015	18.5	7.21	467	0.2	0.16	8.51	32	13.8	2.13	7.85
24/09/2015	18.9	7.65	522	0.18	0.14	12.76	34	9.1	3.37	0
01/10/2015	17.8	7.66	496	0.4	0.31	19.85	24	8.9	2.15	12
08/10/2015	17.5	7.56	473	0.31	0.24	14.18	32	7.3	1.7	6
14/10/2015	15.4	7.57	453	0.41	0.32	14.89	32	5.9	2.11	8
21/10/2015	17	7.57	444	0.33	0.26	14.18	23	9	2.43	0
29/10/2015	12.5	7.8	614	0.52	0.40	19	33	14	3.54	11.2

04/11/2015	16.5	7.67	611	0.38	0.3	11.34	21	9.9	1.77	8
11/11/2015	17.7	7.56	550	0.2	0.16	15.6	22	12.8	1.41	12
18/11/2015	16.5	7.8	572	0.061	0.05	12.76	1	12.6	1.09	4
26/11/2015	15.9	8.03	646	0.2	0.16	14.18	23	19.8	0.98	12
02/12/2015	16.1	8.13	624	0.14	0.11	15.59	19	8.1	1.25	4
09/12/2015	15.8	7.46	428	0.19	0.15	19.85	45	8.3	0.98	0
16/12/2015	17.7	7.26	417	0.1	0.08	11.34	19	8.5	1.1	0
22/12/2015	16.1	7.34	411	0.071	0.06	14.18	25	9.8		0


SRP5 (Reedbed Outlet) pH
pH units
10
8
6
4
2
0
08/01/2015
08/02/2015
08/03/2015
08/04/2015
08/05/2015
08/06/2015
08/07/2015
08/08/2015
08/09/2015
08/10/2015
08/11/2015
08/12/2015


SRP5 (Reedbed Outlet) Conductivity µs/cm
Conductivity µs/cm
700
600
500
400
300
200
100
0
08/01/2015
08/02/2015
08/03/2015
08/04/2015
08/05/2015
08/06/2015
08/07/2015
08/08/2015
08/09/2015
08/10/2015
08/11/2015
08/12/2015


SRP5 (Reedbed Outlet) NH4 mg/l
NH4 mg/l
1.2
1
0.8
0.6
0.4
0.2
0
08/01/2015
08/02/2015
08/03/2015
08/04/2015
08/05/2015
08/06/2015
08/07/2015
08/08/2015
08/09/2015
08/10/2015
08/11/2015
08/12/2015


SRP5 (Reedbed Outlet) Ammonia (as N) mg/l
Ammonia (as N) mg/l
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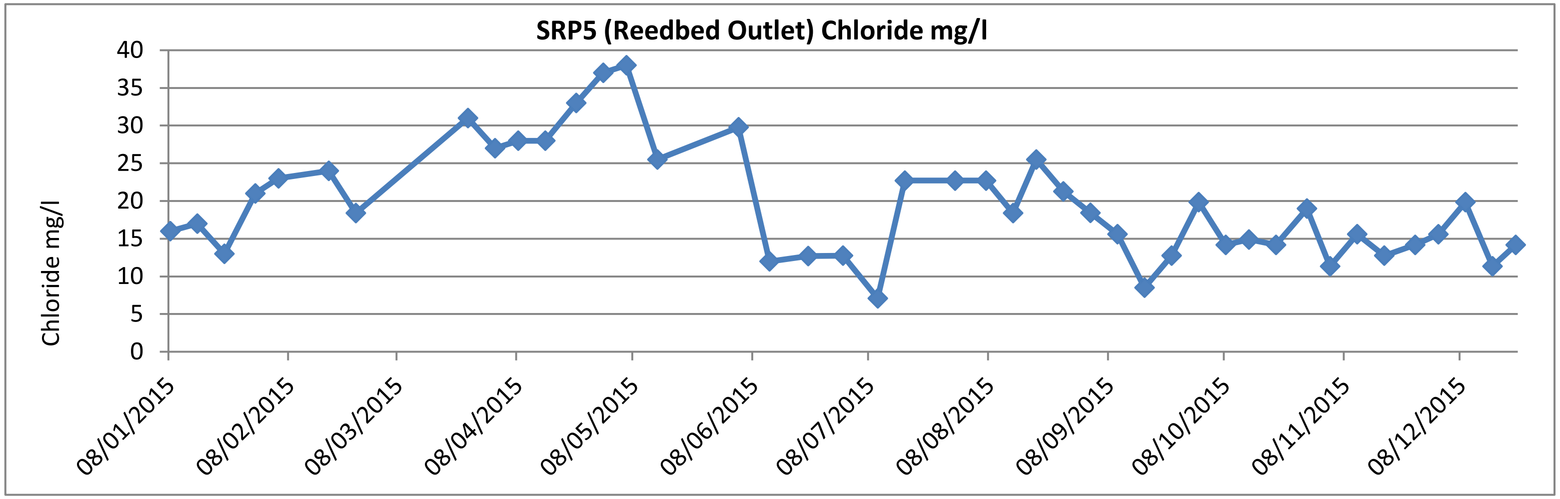
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
08/01/2015
08/02/2015
08/03/2015
08/04/2015
08/05/2015
08/06/2015
08/07/2015
08/08/2015
08/09/2015
08/10/2015
08/11/2015
08/12/2015


SRP5 (Reedbed Outlet) Chloride mg/l
Chloride mg/l
40
35
30
25
20
15
10
5
0
08/01/2015
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08/03/2015
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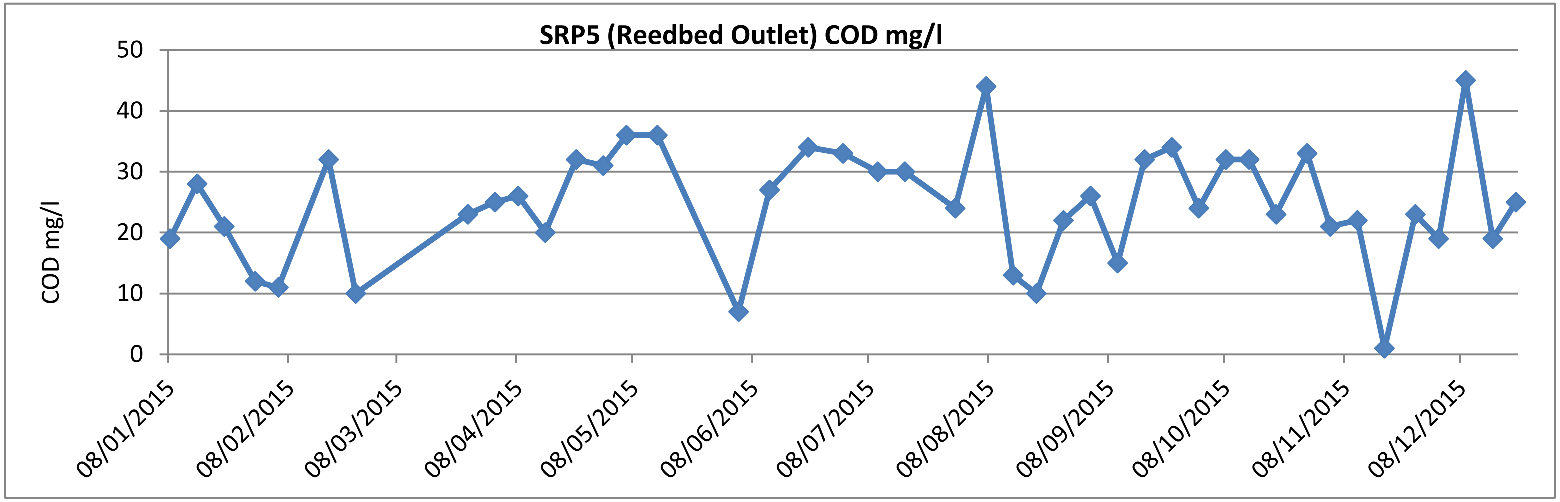
08/11/2015
08/12/2015


SRP5 (Reedbed Outlet) COD mg/l
COD mg/l
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40
30
20
10
0
08/01/2015
08/02/2015
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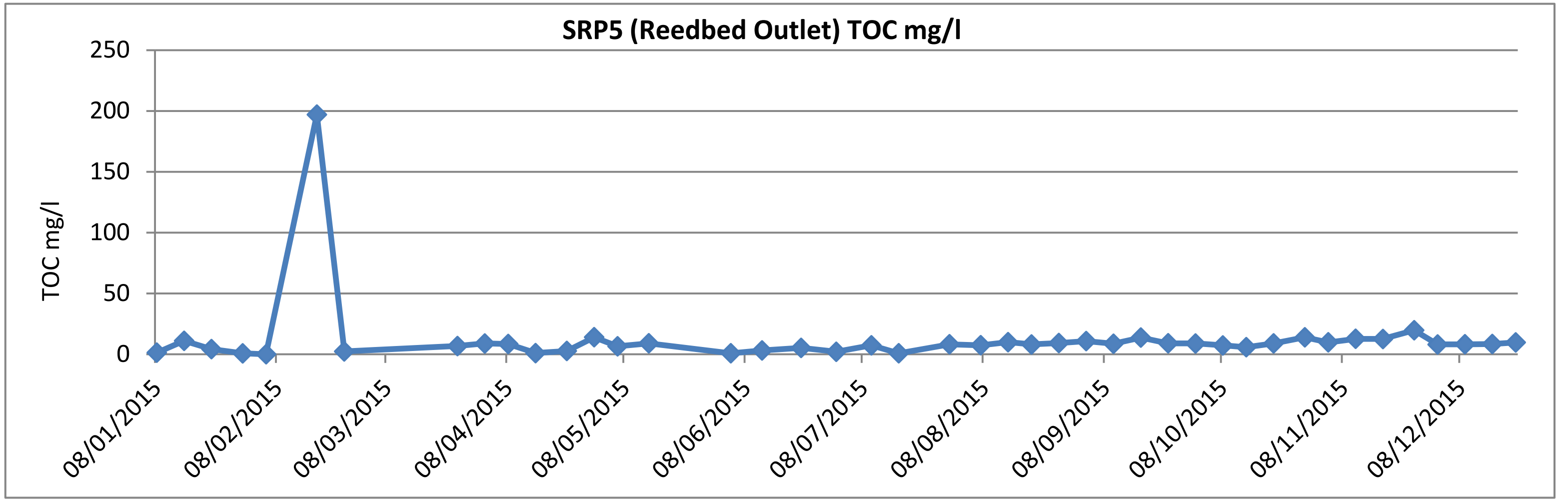
08/11/2015
08/12/2015


SRP5 (Reedbed Outlet) TOC mg/l
TOC mg/l
250
200
150
100
50
0
08/01/2015
08/02/2015
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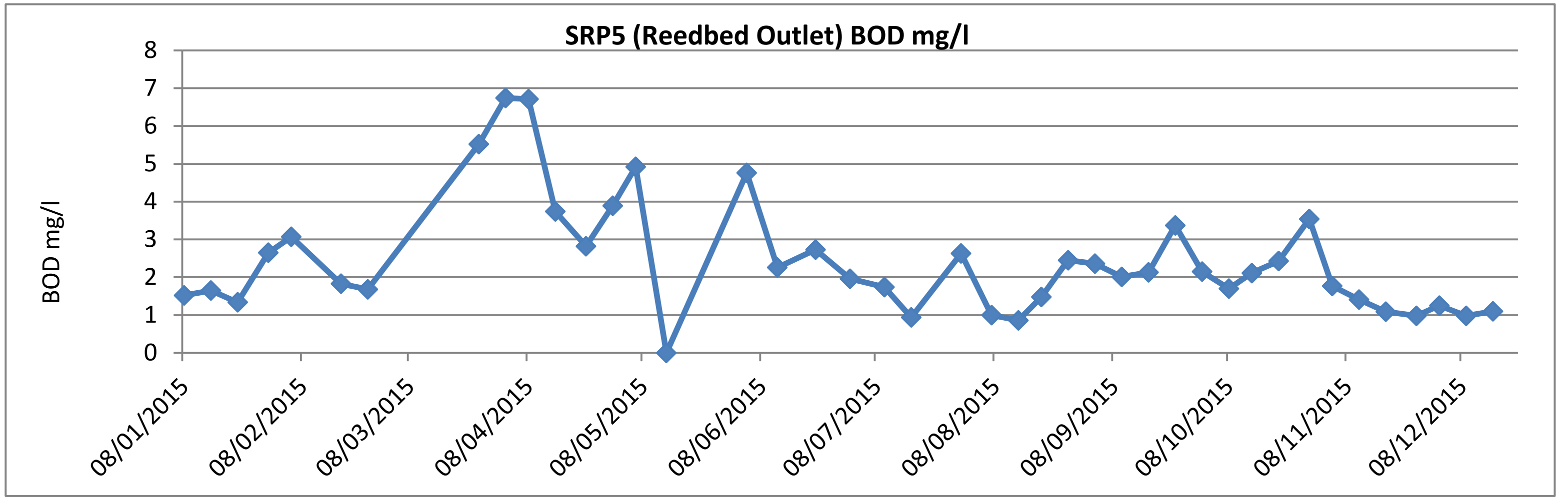
08/11/2015
08/12/2015


SRP5 (Reedbed Outlet) BOD mg/l
BOD mg/l
8
7
6
5
4
3
2
1
0
08/01/2015
08/02/2015
08/03/2015
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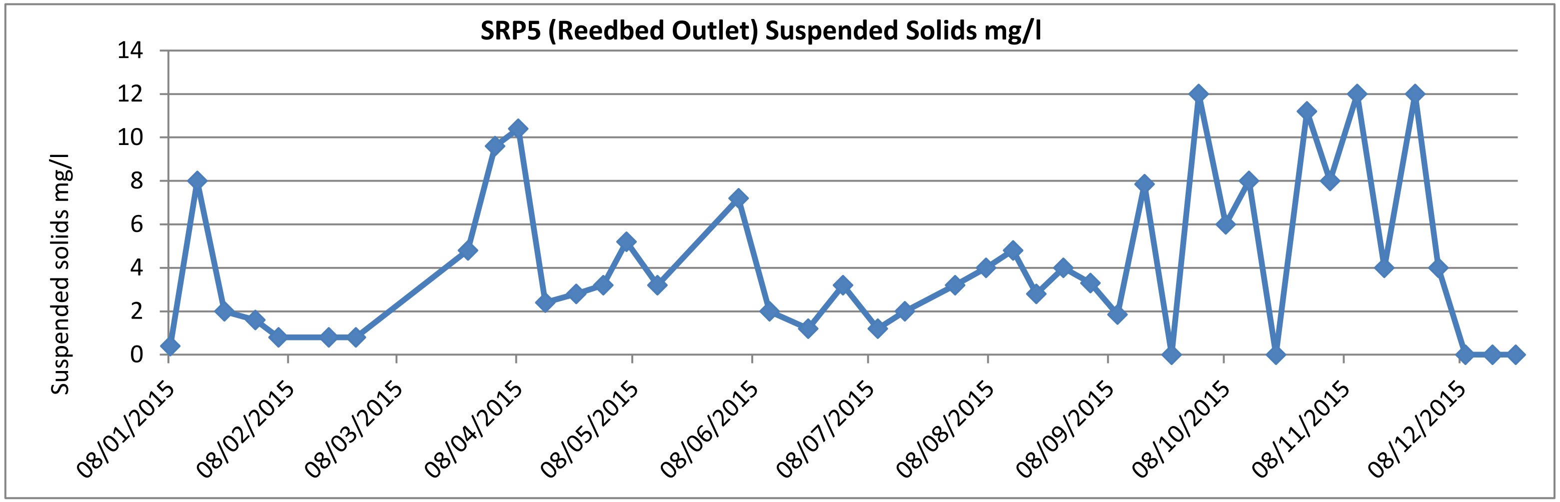
08/11/2015
08/12/2015


SRP5 (Reedbed Outlet) Suspended Solids mg/l
Suspended solids mg/l
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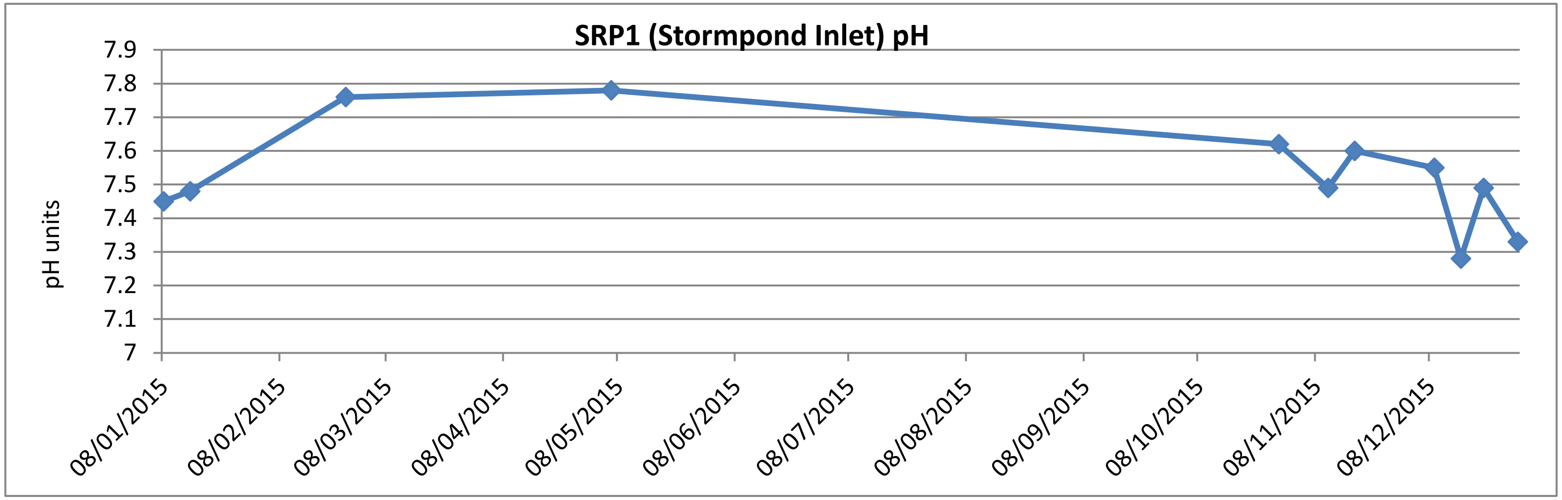
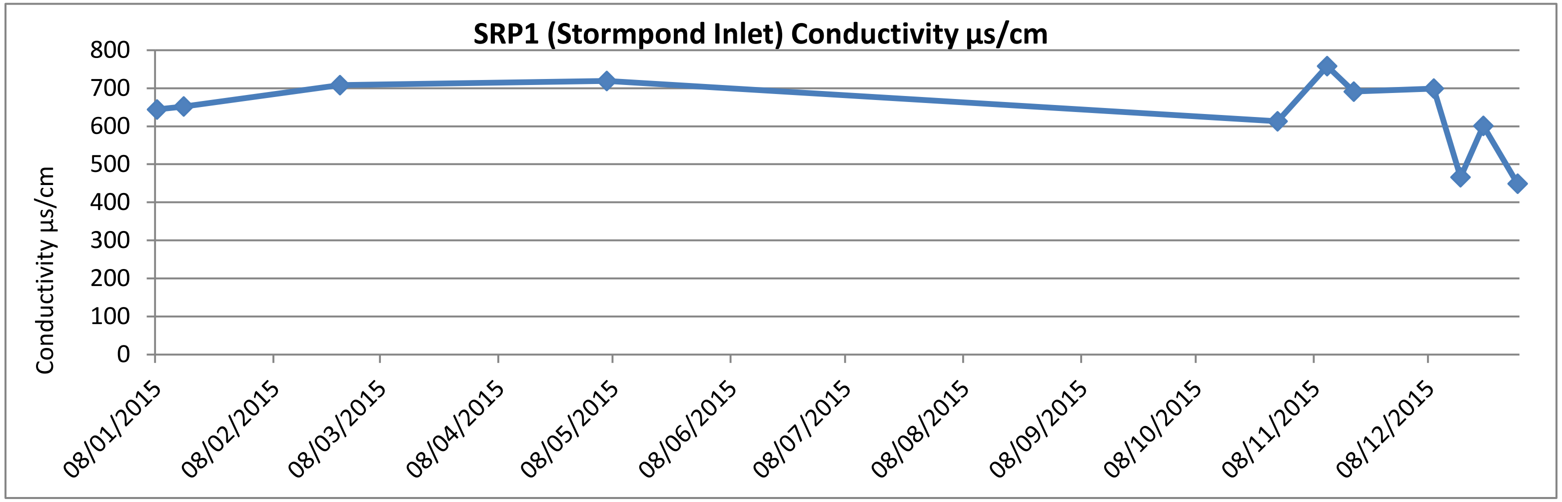
2
4
6
8
10
12
14
08/01/2015
08/02/2015
08/03/2015
08/04/2015
08/05/2015
08/06/2015
08/07/2015
08/08/2015
08/09/2015
08/10/2015
08/11/2015
08/12/2015

Stormpond Inlet Parameter Data

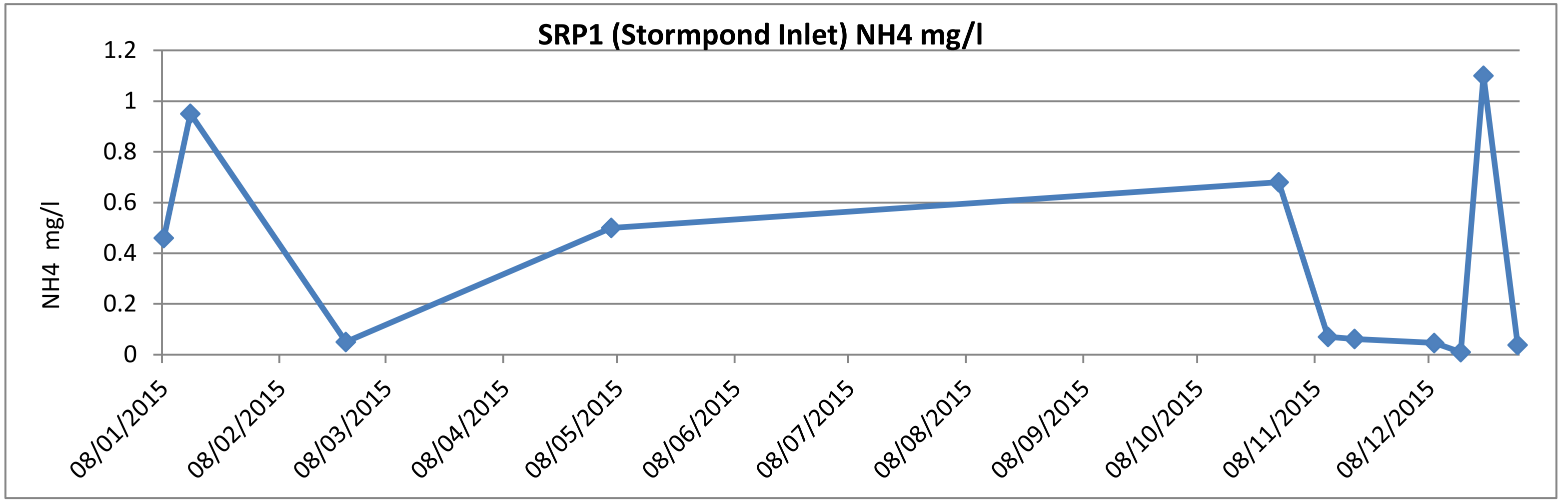
All data in mg/l unless stated otherwise

Date	Temp *C	pH	Conductivity µs/cm	NH4	Ammonia (as N)	Chloride	COD	TOC	BOD	Suspended solids
08/01/2015	8.1	7.45	644	0.46	0.36	30	22	2.6	1.48	1.6
15/01/2015	5.9	7.48	652	0.95	0.74	23	15	0.2	1.98	4.8
25/02/2015	11.5	7.76	708	0.05	0.04	15.5	14	6.6	0.9	1.2
06/05/2015	13.5	7.78	719	0.5	0.39	28	31	9.6	0.76	1.2
29/10/2015	12.4	7.62	613	0.68	0.53	12	18	12	1.18	7.6
11/11/2015	18	7.49	758	0.07	0.05	5.67	17	8.2	1.11	8
18/11/2015	17.1	7.6	691	0.062	0.05	15.6	115	8.9	0.64	8
09/12/2015	16.3	7.55	699	0.046	0.04	32.61	30	6.4	1.4	4
16/12/2015	17.9	7.28	466	0.01	0.01	9.92	17	5.3	0.88	4
22/12/2015	16.1	7.49	601	1.1	0.86	19.85	20	5.8		4
31/12/2015	13.1	7.33	449	0.038	0.03	11.34	1	3.7	1.22	0





SRP1 (Stormpond Inlet) Conductivity µs/cm
Conductivity µs/cm
800
700
600
500
400
300
200
100
0
08/01/2015
08/02/2015
08/03/2015
08/04/2015
08/05/2015
08/06/2015
08/07/2015
08/08/2015
08/09/2015
08/10/2015
08/11/2015
08/12/2015



SRP1 (Stormpond Inlet) NH4 mg/l
NH4 mg/l
1.2
1
0.8
0.6
0.4
0.2
0
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08/02/2015
08/03/2015
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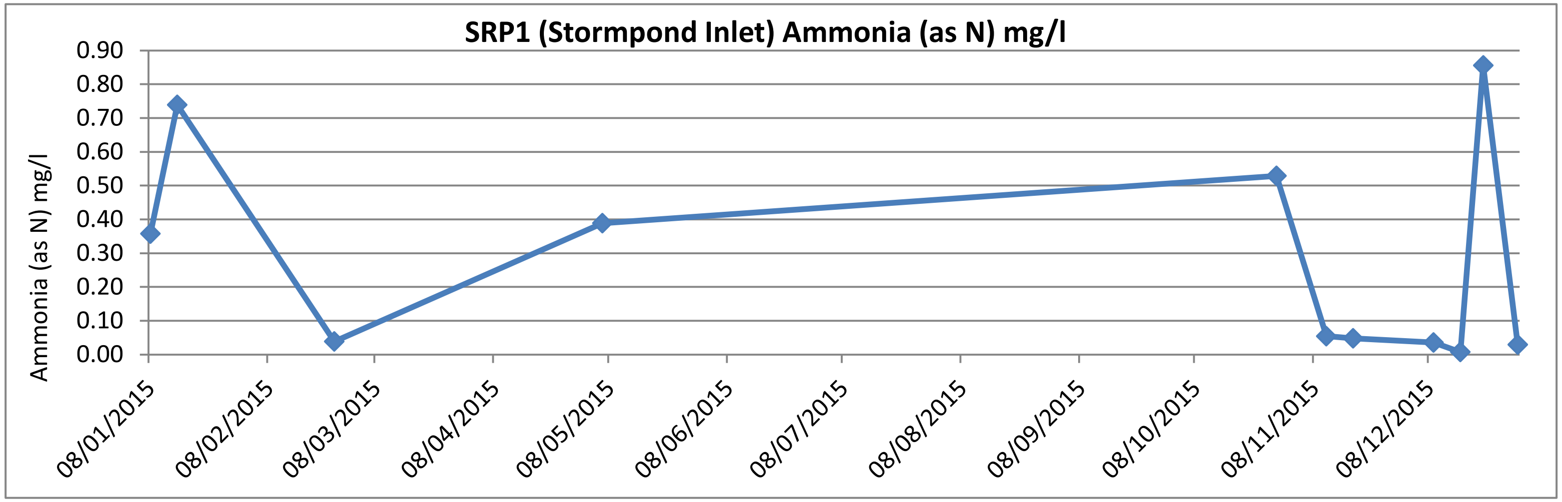
08/11/2015
08/12/2015



SRP1 (Stormpond Inlet) Ammonia (as N) mg/l
Ammonia (as N) mg/l
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
08/01/2015
08/02/2015
08/03/2015
08/04/2015
08/05/2015
08/06/2015
08/07/2015
08/08/2015
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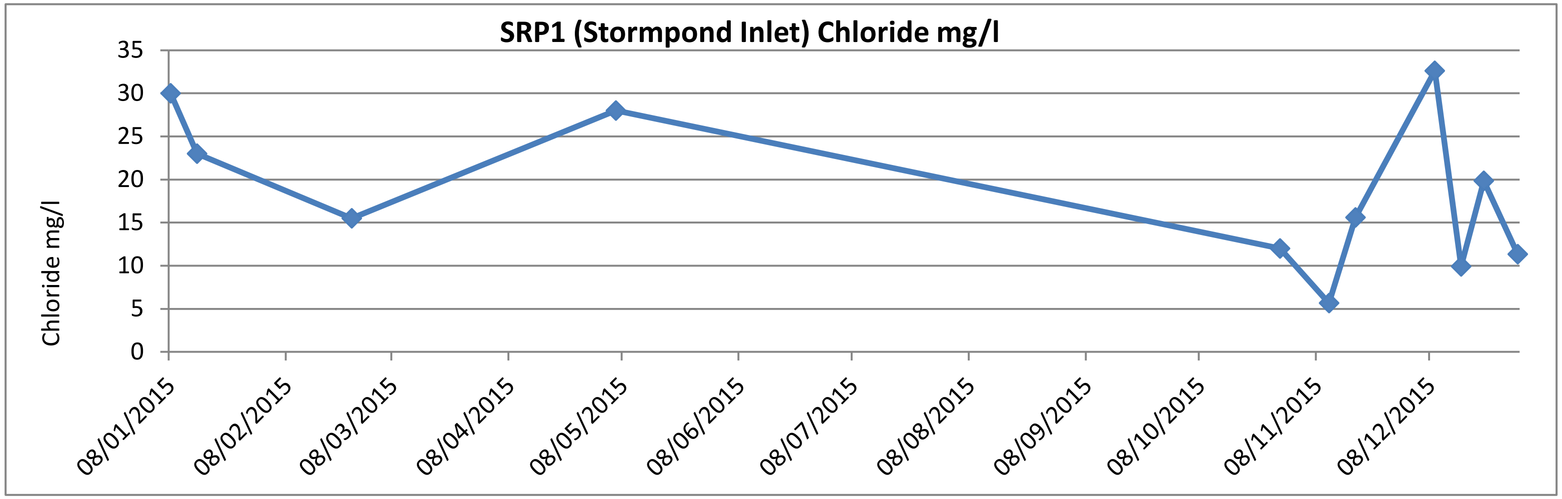
08/11/2015
08/12/2015



SRP1 (Stormpond Inlet) Chloride mg/l
Chloride mg/l
35
30
25
20
15
10
5
0
08/01/2015
08/02/2015
08/03/2015
08/04/2015
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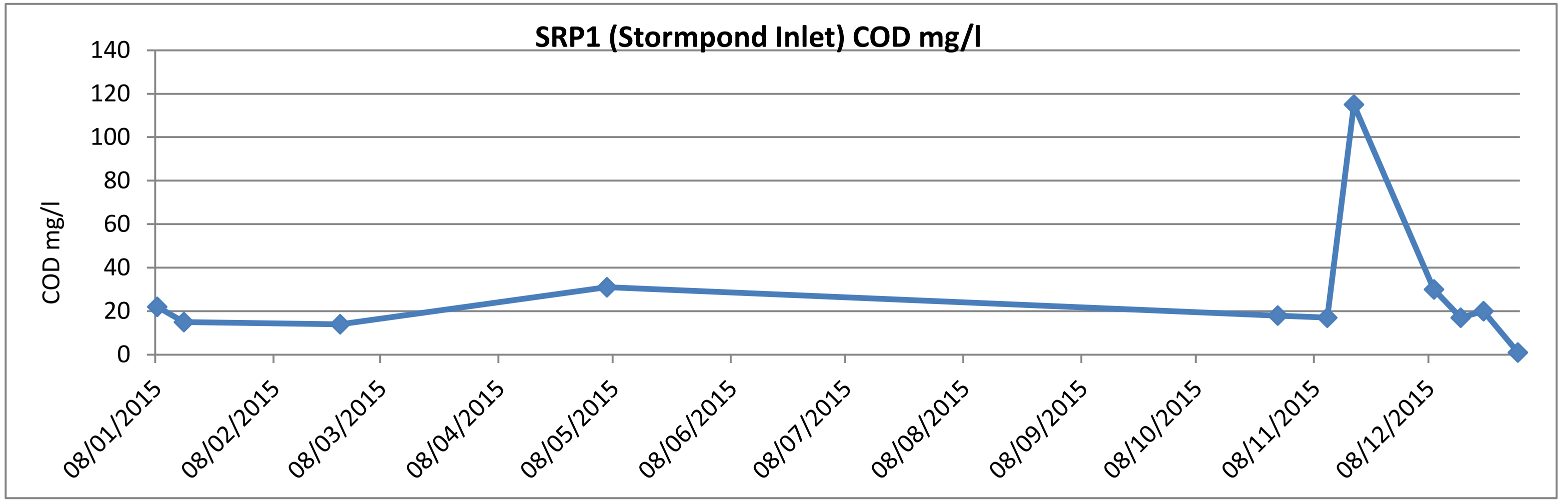
08/11/2015
08/12/2015


SRP1 (Stormpond Inlet) COD mg/l
COD mg/l
140
120
100
80
60
40
20
0
08/01/2015
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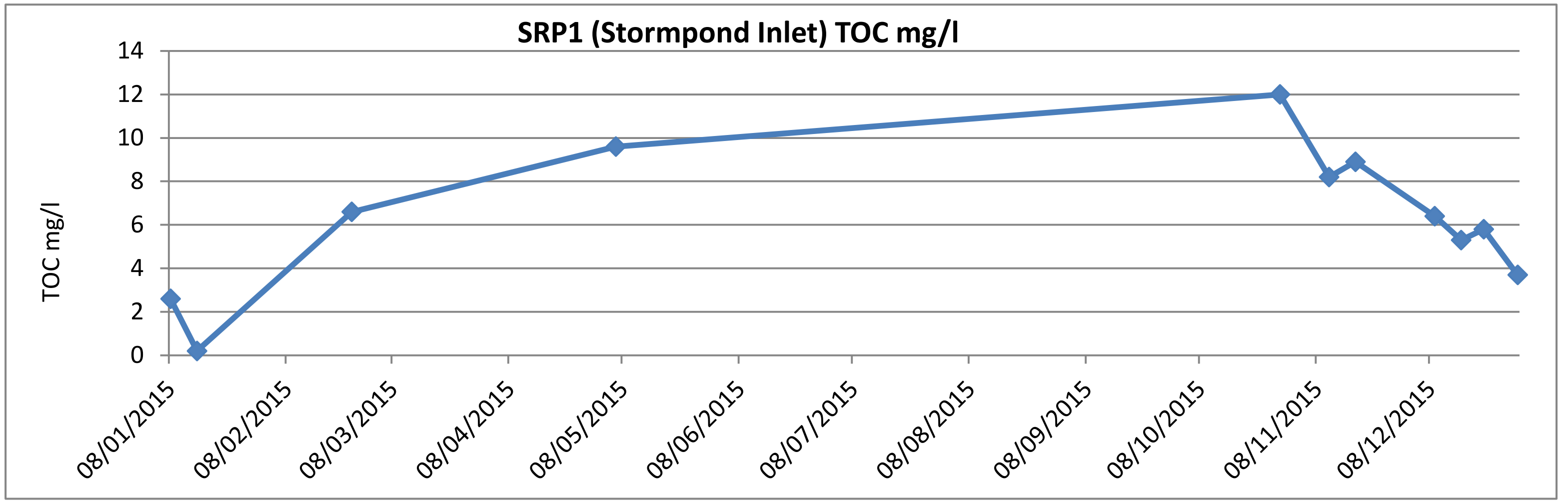
08/11/2015
08/12/2015


SRP1 (Stormpond Inlet) TOC mg/l
TOC mg/l
14
12
10
8
6
4
2
0
08/01/2015
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08/03/2015
08/04/2015
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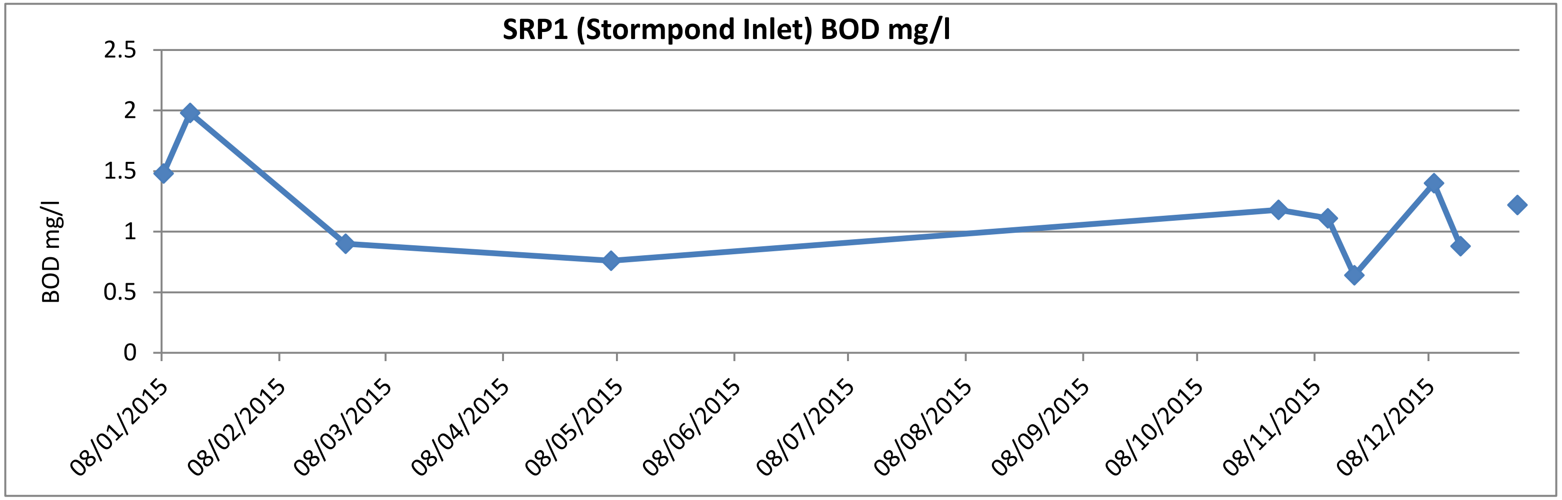
08/11/2015
08/12/2015


SRP1 (Stormpond Inlet) BOD mg/l
BOD mg/l
2.5
2
1.5
1
0.5
0
08/01/2015
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08/03/2015
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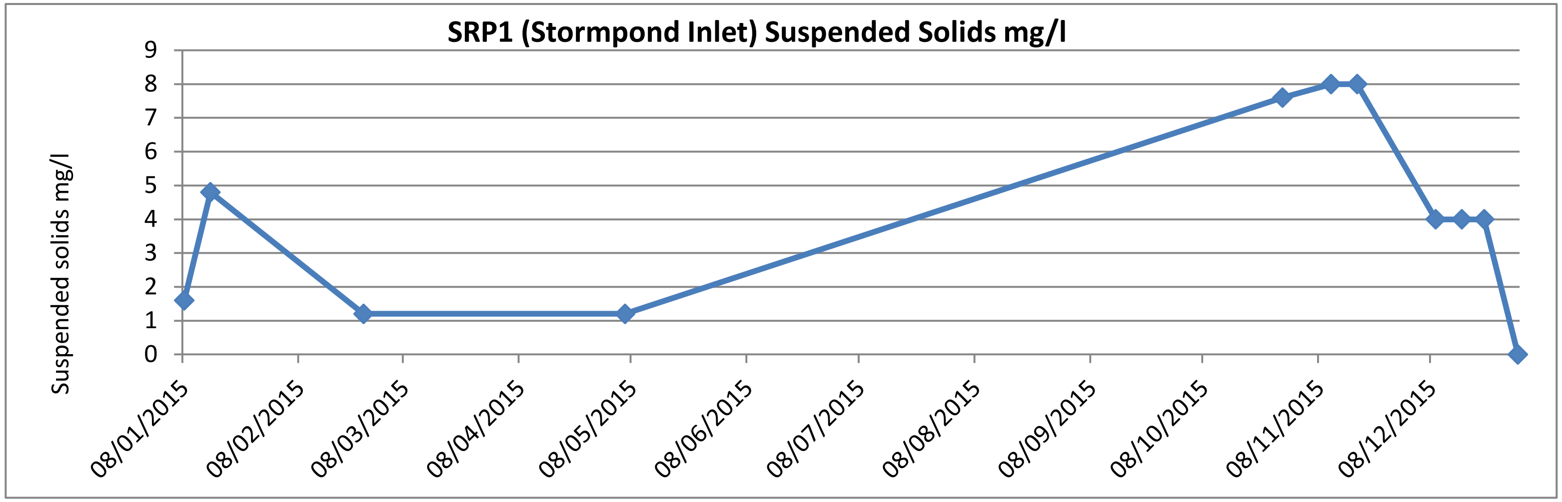
08/11/2015
08/12/2015


SRP1 (Stormpond Inlet) Suspended Solids mg/l
Suspended solids mg/l
9
8
7
6
5
4
3
2
1
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08/01/2015
08/02/2015
08/03/2015
08/04/2015
08/05/2015
08/06/2015
08/07/2015
08/08/2015
08/09/2015
08/10/2015
08/11/2015
08/12/2015

AN ASSESSMENT OF THE WATER QUALITY STATUS OF SELECTED SITES ON THE TRAMORE AND TRABEG RIVERS USING BIOLOGICAL METHODS

(October - 2015)

Commissioned by: Cork City Council
Carried out by: Aquatic Services Unit – UCC.
(December 2015)

Introduction

As part of the their waste licence conditions for the Kinsale Road Landfill, Cork City Council commissioned the Aquatic Services Unit, to undertake a biological assessment of the water quality status of selected sites on the Tramore and Trabeg rivers. Both rivers flow adjacent to or through the site of the landfill and have in the past, at least, been impacted by leachate from the landfill. The fieldwork for the 2015 monitoring was undertaken on October 16th and 17th.

Methods

Two samples (combined as one composite) were taken at each site using a kick-sample technique, where this was possible. Each sample was collected in areas of moderate to shallow swift current in coarse substrate usually comprising small to large stones and cobbles. The samples were then sieved to remove silt and poured into a white sorting tray. There the macroinvertebrates present are identified and their notional abundance estimated. The macroinvertebrate data arising is then assessed using the same biotic index system used by the Environmental Protection Agency (EPA) in their ongoing monitoring of biological quality in Irish rivers. The index assigns a score to the macroinvertebrate collection at a given site depending on the relative proportion of pollution sensitive and pollution tolerant organisms present. The greater the number and diversity of pollution sensitive types present (particularly, certain mayflies, stoneflies and cased caddis flies) the higher the score or quality class assigned to a given site. The highest score category is Q5 which indicates pristine water quality conditions and is recognised by having a high proportion of pollution sensitive species and very few or any pollution tolerant forms, whereas Q1 at the other end of the scale indicates gross pollution. The table below indicates the Q-value scores, which can be assigned and the corresponding degree of pollution associated with them.

Q-Value	**Degree of Pollution**
Q5, Q4-5, Q4	Unpolluted
Q3-4	Slightly Polluted
Q3, Q2-3	Moderately Polluted
Q2, Q 1-2, Q1	Serious to Gross Pollution

It’s important to point out that few sites on the Tramore and Trabeg rivers have sites, which could be said to be ideal for this system of biological monitoring, and some are completely un-suitable (e.g. Sites A and B). In the latter cases the flow is very sluggish and the bottom material consists mainly of mud and submerged macrophytes. In these cases the samples are collected as nets weeps through submerged macrophytes and surface sweeps through the underlying mud, and general observations and experience are used in order to gauge the likely biological water quality status. Furthermore, the second most upstream site on the Tramore River at the ‘ford’ within the landfill was partially modified since the survey in 2009 by the installation of a crump weir for discharge gauging. This weir has resulted in the water upstream becoming stiller and more sluggish than usual and this appears to be increasing the rate of siltation and plant encroachment at Site C upstream of the landfill, which in 2013 was even more pronounced.

Results

Samples were taken on October 16th and 17th, 2015 at sites the positions for which were agreed with the EPA and listed in the conditions of the licence.

Site A *(Trabeg River: Upstream Site*)

This site had an almost imperceptible flow with a grey muddy bottom covered almost entirely with submerged and floating Water starwort (*Callitriche* sp.) and marginally emergent stands of Reed canary-grass (*Phalaris arundinacea*) (Plate 1). The left bank was dominated upstream by Willow and downstream by bramble, Fuchsia, bindweed and nettle. The right bank had isolated Osier as well as, nettle, *Phalaris*, thistle, *Angelica* and grass. The sample comprised a net sweep through the submerged macrophytes and a surface scoop of the sediment. The Q-rating was the same as in 2014.

Common Name of Group	**Scientific Name**	**Notional Abundance**
Non-biting Midges	Chironomidae	++
Beetles	*Dytiscidae*	+
Water Hoglouse	*Asellus aquaticus*	++++
Wandering Snail	*Lymnaea peregra*	+++/+
Pea mussels	*Sphaeridae*	++/+
Flat worm	*Polycelis nigra*	+++
Leeches	*Helobdella stagnalis*	+/+
EPA Q-value		**Q2-3**

Site B *(Trabeg River: 2nd Site Downstream)*

This site is like Site 1 in having a very slack flow dominated by a muddy bottom. Neither site showed evidence of outgassing at the time and no filamentous green algae was evident at either site. The banks were dominated by *Phragmites* (Common reed) (Plate 2), while in-channel emergent *Phalaris* constituted 25-30% cover and submerged/floating *Callitriche* constituted 60-70% cover over the muddy bottom (Plate 3). Like Site A, the conditions were unsuitable for Q-ratings because of the muddy substrate and almost standing water conditions. Conditions as revealed in the kick-sample were similar to last year although with a lower diversity and a Q-rating of Q2 is suggested.

Common Name of Group	Scientific Name	Notional Abundance
Non-biting Midges	Chironomidae	+++
Water Hoglouse	*Asellus aquaticus*	+
Pond Snail	*Lymnaea stagnalis*	+
Flat worm	*Polycelis nigra*	++/+
Flat worm	*Dugesia*	+
Leeches	*Helobdella*	+
Segmented worms	Oligochaetes	++++
EPA Q-value		**Q2**

Site C *(Tramore River: most upstream site within the landfill boundary)*

This site is at a fording point in the Tramore River within the precincts of landfill and at the same point is crossed by a kind of bridge for carrying pipes. Since the 2009 sampling, a crump weir has been built at this site for flow gauging and this has had the effect of creating a very shallow stilling basin immediately upstream, with water backed-up and very laminar. However, in 2015, the weir was undercut and the water level upstream had clearly dropped (Plate 4), creating faster shallower flows and giving rise to an 8m length of riffle/run habitat over the limestone cobble substrate. Upstream, instream and marginal stands of *Typha* and *Sparganium erectum* were seasonally died back and so also was the normally heavy cover of *Potamogeton natans* immediately upstream of these tall herb stands (Plate 5). The kick-samples were taken in the main flow immediately upstream of the weir in a spot with a moderate to swift flow over gravel and cobble. At and immediately upstream of this point the substrate was covered with a heavy (40%) silted cover of *Vaucheria* and a 15-20% cover of sewage fungus. The results are at presented in the table below. They indicate similarly polluted conditions as in 2014.

Macroinvertebrates in Site C kick-samples

Common Name of Group	Scientific Name	Notional Abundance
Blackfly larvae	*Simulidae*	++++
Non-biting Midges	Chironomidae	++++D
Wandering Snail	*Lymnaea peregra*	+
Ramshorn snails	*Planorbidae*	+
Pea mussels	*Sphaeridae*	+++
Water Hoglouse	*Asellus aquaticus*	+++/+
Leech	*Helobdella stagnalis*	+
Segmented worms	Oligochaeta	++
EPA Q-value		**Q2 (Q2-3)**

Site D *(Tramore River: 2nd site downstream of boundary)*

The sampling point is at a constriction in the river where the channel flows over a small loose limestone cobble-boulder weir (Plate 6) immediately downstream of a sluggish stretch, which was dominated by Broad-leaved Pondweed which had died-back considerably at the time and therefore much reduced in cover. The coarse angular cobble at and immediately upstream and downstream of the weir had a reduced cover of filamentous green alga (*Vaucheria ~5%*). Due to the seasonal die-back the banks were more open and cast less shade at the site (Plate 7). The right bank was dominated by nettle, Himalayan balsam, grass and *Angelica* backed by Alder, while the left bank was dominated by nettle, Himalayan balsam, grass and backed by Willow.

In channel, the substrate of the kick-sampling area at the weir comprised angular limestone cobbles and small boulders in a moderate to swift turbulent flow. The water was very slightly clouded and the assigned Q-rating the same as in 2014.

Kick-sample results Site D:

Common Name of Group	**Scientific Name**	**Notional Abundance**
Mayflies	*Baetis*	++
Non-biting Midges	Chironomidae	+/+
Blackfly larvae	*Simuliidae*	++++
Freshwater shrimp	*Gammarus*	+
Water Hoglouse	*Asellus aquaticus*	++++D
FW Limpet	*Ancylus*	++
Wandering snail	*Lymnaea peregra*	++
Flat worms	*Dendrocoelum*	+
Segmented worms	*Lumbriculus*	+++
EPA Q-value		**Q2-3**

Site E *(Tramore River upstream of the landfill: outside the boundary to the west)*

Here the channel, which has been generally over-widened upstream as a result of drainage, narrows through the eye of Black Ash (W6780 6943). The upstream area is completely silted up due to urban siltation and is destined to become a wetland or marsh over the next decade if it continues at the current rate of sedimentation without maintenance dredging. This site was chosen as it is the only one in this section of channel which can be sampled; the listed site (200m u/s) is pure sandy mud and therefore unsuitable. Normally, the crump weir within the landfill (Site C) is thought to have caused the water at this site to back, so that when it came to kick-sampling under the bridge there was extremely slow flow and all that could be done was to disturb the heavily silted cobbles with the heel of a wader boot and sweep the pond net through the suspension to sample any dislodged invertebrates. On this occasion however, perhaps because the weir within the landfill site had been undercut, the water levels at the bridge were lower, some of the substrate was exposed and a localised moderate to swift flow was apparent over a small section of substrate, where the kick-sample was taken (Plate 8). Elsewhere, both upstream and downstream the flow was laminar and slow and the bed heavily silted (Plate 9).

The channel here is 2-3m wide. The site is very shaded and effectively plant free (under the bridge). Immediately upstream of the bridge the channel is much wider (>10m) and, as mentioned already, comprises a deeply silted channel with large stands of *Typha* and *Sparganium erectum*. At the time of sampling these appeared to be more died-back than usual. At the sampling site the right bank had bramble, nettle, water figwort, and grass, while the left bank was vegetated with dock, nettle, Water figwort, Bindweed and Alder.

Kick-sample results Site E:

Common Name of Group	**Scientific Name**	**Notional Abundance**
Mayflies	*Baetis*	+/+
Non-biting Midges	*Chironomus*	++++
Blackfly larvae	Simulidae	++++D
Freshwater shrimp	*Gammarus*	+
Water Hoglouse	*Asellus aquaticus*	++
Pea mussels	Sphaeridae	+
Segmented worms	Lumbriculidae	++++
Leeches	Helobdella	+
Leeches	Trocheta	+
EPA Q-value	**Q2**	

Site F *(150m downstream of the confluence of the Tramore and Trabeg Rivers)*

This site was 150m to 200m downstream of the confluence of the Tramore and Trabeg Rivers. Samples were taken in a shallow riffle where the substrate comprised fine gravel (55%) coarse gravel/small cobble (30%) and sand (15%). (Plate 10). The substrate had a heavy cover of long trailing Cladophora with a fair amount of Vaucheria (5-10% cover) and small amounts of *Stigeoclonium* and *Enteromorpha/Ulva*. The left side bank margin was dominated by a mix of Apium and Watercress interspersed with stands of *Phalaris*. The right bank was dominated by a narrow margin Apium backed by grass, nettle and a Willow screen. The water was 10-15 cm deep in the kick-sampling area. . These were backed by bramble, goes and isolated shrubs and trees. The right bank was dominated by willow with an understorey of loose grass, with some marginal *Apium*.

Kick-samples results indicate a fairly similar mix of species to previous years with the same Q rating as in 2014.

Kick-sample results Site F:

Common Name of Group	**Scientific Name**	**Notional Abundance**
Non-biting Midges	Chironomidae	++++
Non-biting Midges	*Chironomus*	+
Water Hoglouse	*Asellus aquaticus*	+++
Freshwater shrimp	*Gammarus* sp.	++
Jenkin's Spire shell	*Potamopyrgus jenkinsi*	++/+
Wandering snail	*Lymnaea peregra*	++
Pea mussels	Sphaeridae	+++
Leeches	*Glossiphonia*	+
Leeches	*Helobdella stagnalis*	+
Segmented worms	Oligochaetes	++
Fish (Stickleback)	*Gasterosteus aculeatus*	+
EPA Q-value		**Q2-3**

Conclusion

The 2015 survey produced very similar results to 2014 with only marginal differences in macroinvertebrate communities. There was a noticeable die-back in both algae and macrophytes at most sites, probably as a result of the later sampling date compared and higher water levels experienced in 2015. Overall the water quality was very similar at all sites to that noted in 2014.

Plate 1 Trabeg River: Site A – Showing *Phalaris* in the foreground and with submerged and floating Starwort behind, with patches of bare mud also visible (16-10-2015)

Plate 2 Trabeg River: Site B - view of channel with *Phragmites* (16-10-2015)

Plate 3 Trabeg River: Site A showing Starwort *(Callitriche)* over mud (16-10-2015)

Plate 4 Tramore River: Site C – showing undercut crump weir (16-10-2014)

Plate 5 Tramore River: Site C - view upstream showing reduced water levels and died-back marginal stand of *Typha* (16-10-2015).

Plate 6 Tramore River: Site D – showing natural cobble boulder weirs where kick samples were taken (16-10-2015).

Plate 7 Tramore River: Site D - view of upstream of kick-sample (16-10-2015)

Plate 8 Tramore River: Site E showing kick-sampling site just d/s Black Ash Bridge (16-10-2015)

Plate 9 Tramore River: Site E showing silted channel immediately downstream of kick-sampling point (16-10-2015).

Plate 10 Tramore River Site F: kick-sampling site – view upstream (17-10-2015)

Report Title	Air Emissions Compliance Monitoring Emissions Report
Company address	Air Scientific Ltd., 32 DeGranville Court, Dublin road, Trim, Co. Meath
Stack Emissions Testing Report Commissioned by	Cork City Council
Facility Name	Kinsale Road Facility
Contact Person	Kevin Ryan
EPA Licence Number	WL012-03
Licence Holder	Cork City Council Kinsale F1
Stack Reference Number	F1
Dates of the Monitoring Campaign	27/01/2016
Job Reference Number	KIRDTL2270116 - 2016018
Report Written By	Dr. John Casey
Report Approved by	Dr. Brian Sheridan
Stack Testing Team	Dr. John Casey, Dr. Brian Sheridan
Report Date	12/02/2016
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Brian Sheridan Technical Manager

Contents

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1. Executive Summary

I. Monitoring Objectives

Overall Aim of the monitoring Campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

Special Requirements

There were no special requirements.

Target Parameters

Carbon Monoxide (CO)
Oxides of Nitrogen (NOx) as NO_2
Total Volatile Organic Carbon (TOC)
Hydrogen Chloride (HCL)
Hydrogen Fluoride (HF)
T A Luft Organics
Sulphur Dioxide (SO_2)
Stack Gas Temperature
Volume ($m^3.h^{-1}$)

Emission Limit Values

Emission Limit Values / Mass Emissions Limit Values	$mg.m^{-3}$	$kg.h^{-1}$
CO	50	-
NOx as NO_2	150	-
TOC	10	-
HCL	50	-
HF	5	-
T A Luft Organics	-	-
SO_2	-	-
Stack Gas Temperature	-	-
Volume ($m^3.h^{-1}$)	-	-

Reference Conditions

Reference Conditions	Value
Oxygen Reference %	3
Temperature °C	273.15
Total Pressure kPa	101.3
Moisture %	Yes

Executive Summary

Overall Results

	Concentration				
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Compliant**
Carbon Monoxide (CO)	$mg.m^{-3}$	7.99	3.04	50	Yes
Oxides of Nitrogen (NOx) as NO_2	$mg.m^{-3}$	113.82	9.77	150	Yes
Total Volatile Organic Carbon (VOC)	$mgC.m^{-3}$	5.06	0.60	10	Yes
Hydrogen Chloride (HCL)	$mg.m^{-3}$	0.19	0.00	50	Yes
Hydrogen Fluoride (HF)	$mg.m^{-3}$	0.15	0.00	5	Yes
Sulphur Dioxide (SO_2)	$mg.m^{-3}$	24.63	3.74	-	N/A
Oxygen (%)	% v/v	9.36	0.16	-	N/A
Stack Gas Temperature	K	1301.15	-	-	N/A

Accreditation details

Air Scientific Limited	INAB319T
External Analytical Laboratory	UKAS1549
Other	-

Executive Summary

Monitoring Dates & Times

Parameter	Run	Location ID	Sampling Dates	Sampling Time On	Sampling Time Off	Duration (mins.)
Carbon Monoxide (CO)	Run 1	F1	27/01/2016	16:23:00	16:57:00	00:34:00
	Run 2					
	Run 3					
Oxides of Nitrogen (NOx) as NO_2	Run 1	F1	27/01/2016	16:23:00	16:57:00	00:34:00
	Run 2					
	Run 3					
Total Volatile Organic Carbon (VOC)	Run 1	F1	27/01/2016	16:23:51	16:56:51	00:33:00
	Run 2					
	Run 3					
Hydrogen Chloride (HCL)	Run 1	F1	27/01/2016	17:05:00	17:41:00	00:36:00
	Run 2					
	Run 3					
Hydrogen Fluoride (HF)	Run 1	F1	27/01/2016	17:06:00	17:54:00	00:48:00
	Run 2					
	Run 3					
Sulphur Dioxide (SO_2)	Run 1	F1	27/01/2016	16:23:00	16:57:00	00:34:00
	Run 2					
	Run 3					
Oxygen (%)		F1	27/01/2016	16:23:00	16:57:00	00:34:00

Process details

Parameter	
Process status	Normal
Capacity (per/hour) (if applicable)	N/a
Continuous or Batch Process	Continuous
Feedstock	Landfill Gas
Abatement System	No
Abatement Systems Running Status	N/A
Fuel	Landfill Gas
Plume Appearance	None
Other information	N/A

Monitoring, Equipment & Analytical Methods

	Monitoring				Analysis	
Parameter	**Standard**	**Technical Procedure**	**Accredited Testing**	**Testing Lab**	**Analytical Technique**	**Analysis Lab**
Carbon Monoxide (CO)	EN15058:2006	SOP 2004	Yes	AirSci	NCIR By Horiba PG-250	AirSci
Oxides of Nitrogen (NOx)	EN14792:2006	SOP 2002	Yes	AirSci	Chemiluminescence	AirSci
Total Volatile Organic Carbon (TOC)	EN12619:2013	SOP 2009	Yes	AirSci	Flame Ionisation Detection	AirSci
Hydrogen Chloride (HCL)	EN1911:2010	SOP 2014	Yes	AirSci	Ion Chromatography	SAL
Hydrogen Fluoride (HF)	EN15713:2006	SOP 2024	No	AirSci	Ion Chromatography	SAL
Sulphur Dioxide (SO2)	TGN 21	SOP 2012	Yes	AirSci	NDIR Absorption	AirSci
Oxygen (%)	EN14789:2005	SOP 2008	Yes	AirSci	Paramagnetic	AirSci
Stack Gas Temperature	EN16911:2013	SOP 2005	No	AirSci	Thermocouple	AirSci

List of Equipment

ID	Item of Equipment	Manufacturer	Serial No.
ASLTM12EQ501	Airflow PVM 620	TSI Airflow	PVM621143 007
ASLTM12EQ504	SKC Aircheck Sampler	SKC	826914
ASLTM12EQ508	DryCal DC Lite Primary Flow Metre	BIOS	7298
ASLTM12EQ509	3010 MinfiFID	Signal Instruments	16764
ASLTM12EQ512	Horiba PG2500 Portable Gas Analzer	Horiba	41343020031
ASLTM12EQ518	5 metre heated line 342 470 (Only used with 3010)	Signal Instruments	16838
ASLTM14EQ505	Stanley 5m Measuring Tape	Stanley	30-696
ASLTM14EQ509	5 metre heated line, filters and temp controller box 1 & 2	Neptech	14A052
ASLTM14EQ510	5 metre heated line, filters and temp controller box 1 & 2	Neptech	14B052
ASLTM14EQ511	Buhler Sample Gas Cooler	Buhler Technologies	100094941
ASLTM15EQ502	Mass flow meter	Siargo	A3J04318
ASLTM15EQ504	Mass flow meter	Siargo	B3J04198

Sampling Deviations

Parameter	Deviation
Standard ID	Flow theoretically calculated
Standard ID	Absorption efficiency < 95% - EN1911
Standard ID	Absorption efficiency < 95% - EN15713
Standard ID	-

Reference Documents

Risk Assessment (RA)	SOP1011
Site Review (SR)	SOP1015
Site Specific Protocol (SSP)	SOP1015

Executive Summary

Suitability of sampling location

General Information	Value
Permanent/Temporary	Temporary
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements	**Value**	**Comment**
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self closing gates at top of ladders	Yes	-
There are no obstructions present which hamper insertion of sampling equipment	No	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-

Sampling Location / Platform Improvement Recommendations
None

BSEN 15259 Homogeneity Test Requirements
1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack
E.g. Select Option **1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack** **2: Test results were obtained from previous Homogeneity test carried out by ASL** **3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor** **4: Other: Enter Description**

Stack diagram

II. Appendix I Monitoring Personnel & Equipment

Stack Emissions Monitoring Personnel

Team Leader	**Name**	John Casey
	Qualifications	PhD. (Eng.), MSc. (Agr.), B. Agr. Sc.
	System approval	Air Scientific Limited Approved
		-
Team Leader	**Name**	Brian Sheridan
	Qualifications	PhD. (Eng.), MSc. (Agr.), BSc. (Hons.)
	System approval	Air Scientific Limited Approved
		-

III. Appendix II Stack Details & flow characteristics

Preliminary stack survey calculations

General Stack Details		
Stack details	**Units**	**Value**
Date of survey		27/01/2016
Time of survey		-
Type		Circular
Stack Diameter / Depth, D	m	-
Stack Width, W	m	-
Average Stack Gas Temp., Ta	C	1028
Average Static Pressure, P static	kPa	-
Average Barometric Pressure, Pb	kPa	99.3
Type of Pitot		-
Are Water Droplets Present ?		-
Average Pitot Tube Calibration Coeff, Cp		-
Negative flow		-
Highly homogeneous flow stream/gas velocity		Yes

Sample Port Size	mm	25
Initial Pitot Leak Check	Pa	-
Final Pitot Leak Check	Pa	-
Orientation of Duct		Vertical
Pitot Tube Cp		0.998
Number of Lines Available		-
Number of Lines Used		1

Sampling Line A						
Point	**Distance to duct (m)**	**Pa**	**Temp °C**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Sampling Line B						
Point	**Distance to duct (m)**	**Pa**	**Temp °C**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Component	Conc. ppm	Conc. Dry % v/v	Conc. Wet % v/v	Molar Mass
Carbon Dioxide CO_2	-	9.2	-	44.01
Oxygen O_2	-	9.36	-	32
Nitrogen N_2	-	81.44	-	28.1
Moisture (H_2O)	-	-	9	18.02

Reference Conditions	Units	Numbers
Temperature	°C	273.15
Total Pressure	kPa	101.3
Moisture	%	-
Oxygen (Dry)	%	3

Stack Gas Composition & Molecular Weights								
Component	**Molar Mass M**	**Density Kg/m^3 p**	**Conc. Dry % v/v**	**Dry Volume Fraction r**	**Dry Conc. kg/m^3 pi**	**Conc. wet % v/v**	**Wet Volume Fraction r**	**Wet Conc.kg/m^3 pi**
Carbon Dioxide CO_2	44.01	1.96	9.2	0.092	0.18	8.37	0.08	0.16
Oxygen O_2	32	1.43	9.36	0.0936	0.13	8.52	0.09	0.12
Nitrogen N_2	28.1	1.25	81.44	0.8144	1.02	74.11	0.74	0.93
Moisture (H_2O)	18.02	0.80	-	-	-	9	0.09	0.07
	-	-	-	-	-	-	-	-
where p=M/22.41	-	-	-	-	-	-	-	-
pi = r x p	-	-	-	-	-	-	-	-

Calculation of Stack Gas Densities		
Determinand	**Units**	**Result**
Dry Density (STP), P STD	$kg.m^{-3}$	1.336
Wet Density (STP), P STW	$kg.m^{-3}$	1.292
Dry Density (Actual), P Actual	$kg.m^{-3}$	0.275
Average wet Density (Actual), P ActualW	$kg.m^{-3}$	0.266
Where		
P STD = sum of component concentrations, kg/m3 (excluding water vapour)	-	-
P STW = (P STD + pi of H2O) / (1 + (pi of H2O / 0.8036))	-	-
P actual = P STD x (T STP / (P STP)) x (Pa / Ta)	-	-
P actual W (at each sampling point) = P STW x (Ts / Ps) x (Pa / Ta)	-	-

Sampling Plane Validation Criteria	Value	Units	Requirement	Compliance	Method
Lowest Differential Pressure	-	Pa	>5 Pa	N/A	EN16911:2013
Lowest Gas Velocity	-	m/s	-	N/A	-
Highest Gas Velocity	-	m/s	-	N/A	-
Ratio of Above	-	:1	<3:1	N/A	EN16911:2013
Mean Velocity	-	m/s	-	N/A	-
Angle of flow with regard to duct axis	-	degrees	< 15	N/A	EN16911:2013
No local negative flow	-	-	-	N/A	-
Homogeneous flow stream/gas velocity	-	-	-	N/A	-

Calculation of stack Gas Velocity, V	
Velocity at Traverse Point, V = Kcp * Sqroot ((2 * DP) / Density)	-
Where	
Kpt = Pitot tube calibration coefficient	-
Compressibility correction factor, assumed at a constant 0.998	0.998

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flow Rate (Actual)	$m^3.h^{-1}$	-
Gas Volumetric Flow Rate (STP, Wet)	$m^3. h^{-1}$	-
Gas Volumetric Flowrate (STP, Dry)	$m^3. h^{-1}$	-
Gas Volumetric Flowrate REF to Oxygen	$m^3. h^{-1}$	-

IV. Appendix 3 Individual parameter sampling details and results

Carbon Monoxide Quality Assurance

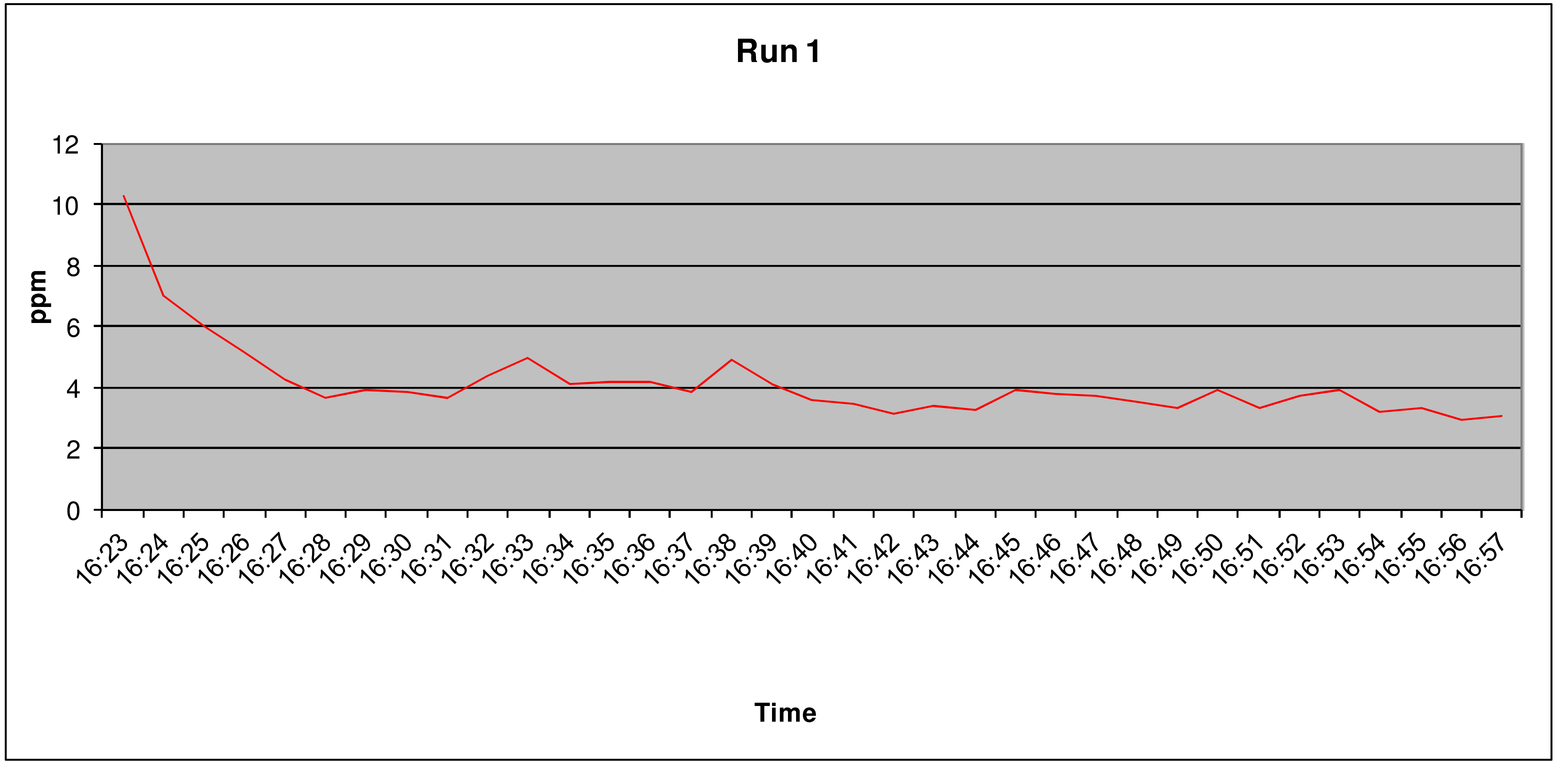
Sampling Details		
Stack ID	F1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	16:22
Sampling Dates	-	27/01/2016
Instrument Range	ppm	200
Span Gas Value	ppm	149
Acceptable Gas Range	-	Yes
Quality Assurance	**Units**	**Run 1**
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.5
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	0
Zero Down Sampling Line (Post)	ppm	0.2
Zero drift	ppm	0.2
Allowable Zero Drift	ppm	2.98
Zero Drift Acceptable	-	Yes
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	149
Span Down Sampling Line (Post)	ppm	149.3
Span Drift	ppm	0.3
Allowable Span Drift	ppm	2.98
Span Drift Acceptable (Y/N)	-	Yes
Leak Check		
Span Gas Conc.	ppm	149
Recorded Conc. down Line	ppm	149.3
Leak check acceptable (< 2%)	(Y/N)	Yes
Test Conditions	**Units**	**Run 1**
Run Ambient Temperature Range	C	11

Carbon Monoxide Results & Sampling details

Parameter	Units	Run 1
Concentration	$mg.m^{-3}$	5.15
Uncertainty	$mg.m^{-3}$	3.04
Mass Emission	kg.h	-

General Sampling Information	
Parameter	**Value**
Standard	EN15058
Technical Procedure	SOP2004
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	180
Span Gas Reference Number	ASLTM15ING528
Span Gas Expiry Date	Oct-16
Span Gas Start Pressure (bar)	50
Gas Cylinder Concentration (ppm)	149
Span Gas Uncertainty (%)	<2
Zero Gas Type	Nitrogen
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Carbon Monoxide Trend



Carbon Monoxide Measurement Uncertainty

	Units	**Run 1**
Measured Quantities		
Certified Range of Analyser	ppm	1.36 to 1000
Operational Range of Analyser	ppm	200
Measured Reading	ppm	4.12
Measured Quantities	**Units**	**Run 1**
Nonlinearity	%	0.9
Temperature Dependent Zero drift	%	0.14
Temperature Dependent Span drift	%	-0.12
Cross-sensitivity	%	0.08
Leak	%	0
Calibration Gas Uncertainty	%	<2
Parameter	**Units**	**Run 1**
Combined uncertainty	$mg.m^{-3}$	0.96
Expanded uncertainty	$mg.m^{-3}$	1.92
Uncertainty corrected to std conds.	$mg.m^{-3}$	3.04
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	6.07
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	3.04
Expanded uncertainty expressed with a level of confidence of 95%	% of value	58.90
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Oxides of Nitrogen Quality Assurance

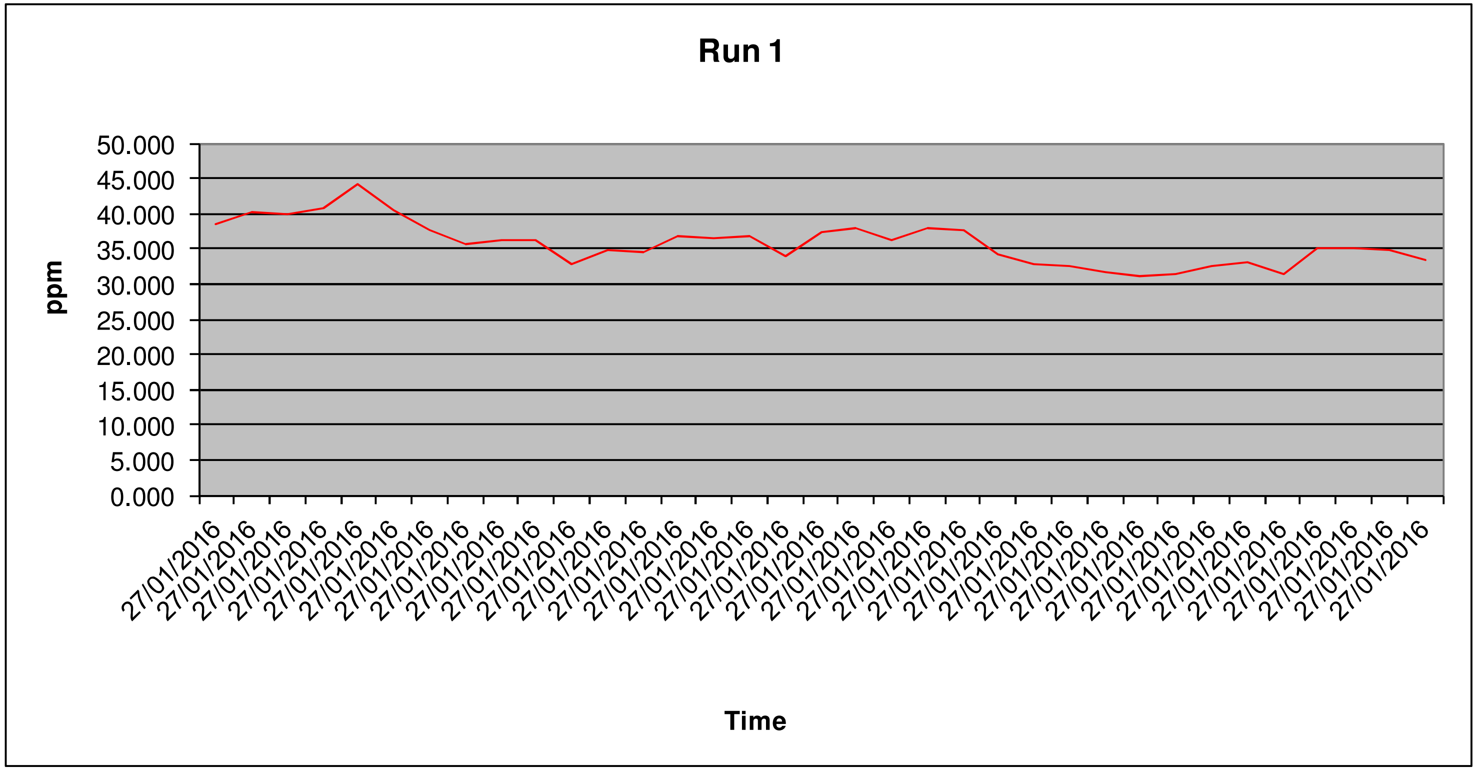
Sampling Details		
Stack ID	F1	-
	Units	Run 1
Parameter		
Sampling Times	-	16:22
Sampling Dates	-	27/01/2016
Instrument Range	ppm	250
Span Gas Value	ppm	161
Acceptable Gas Range	-	Yes
Quality Assurance	Units	Run 1
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.5
Zero Drift	Units	Run 1
Zero Down Sampling Line (Pre)	ppm	0.1
Zero Down Sampling Line (Post)	ppm	0.4
Zero drift	ppm	0.3
Allowable Zero Drift	ppm	3.22
Zero Drift Acceptable	-	Yes
Span Drift	Units	Run 1
Span Down Sampling Line (Pre)	ppm	161
Span Down Sampling Line (Post)	ppm	161.4
Span Drift	ppm	0.4
Allowable Span Drift	ppm	3.22
Span Drift Acceptable (Y/N)	-	Yes
Leak Check		
Span Gas Conc.	ppm	161
Recorded Conc. down Line	ppm	161.3
Leak check acceptable (< 2%)	(Y/N)	Yes
Test Conditions	Units	Run 1
Run Ambient Temperature Range	C	11
NOx Converter Efficiency	%	95.5

Oxides of Nitrogen Results & Sampling details

Parameter	Units	Run 1
Concentration	$mg.m^{-3}$	73.40
Uncertainty	$mg.m^{-3}$	9.77
Mass Emission	$kg.h^{-1}$	-

General Sampling Information	
Parameter	**Value**
Standard	EN14792
Technical Procedure	SOP2002
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	180
Date & Result of last converter check	95.5 23/01/2016
Span Gas Reference Number	ASLTM15ING529
Span Gas Expiry Date	Dec-16
Span Gas Start Pressure (bar)	59
Gas Cylinder Concentration (ppm)	161
Span Gas Uncertainty (%)	<2
Zero Gas Type	Nitrogen
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Oxides of Nitrogen Trend



Oxides of Nitrogen Measurement Uncertainty

Measured Quantities	**Units**	**Run 1**
Nonlinearity	%	1.4
Temperature Dependent Zero drift	%	-0.04
Temperature Dependent Span drift	%	-0.25
Cross-sensitivity	%	0.5
Leak	%	0
Calibration Gas Uncertainty	%	<2
Mass Flow Controllers (Dilution) Uncertainty	%	<1
NOx Converter Efficiency	%	95.5
Parameter	**Units**	**Run 1**
Combined uncertainty	$mg.m^{-3}$	2.24
Expanded uncertainty	$mg.m^{-3}$	4.47
Uncertainty corrected to std conds.	$mg.m^{-3}$	9.77
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	6.51
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	9.77
Expanded uncertainty expressed with a level of confidence of 95%	% of value	13.31
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Total Volatile Organic Carbon Quality Assurance

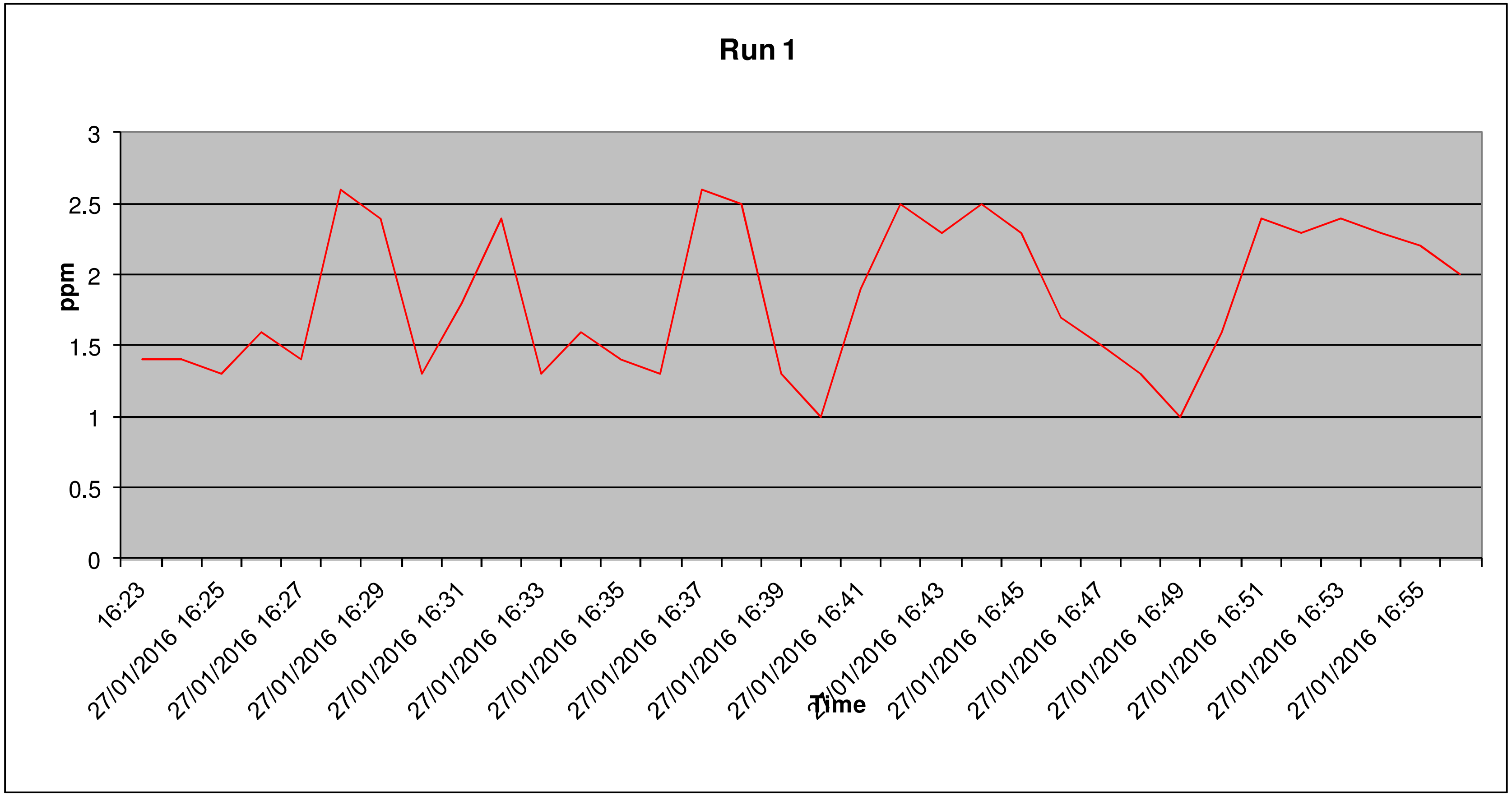
Sampling Details		
Stack ID	F1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	16:23
Sampling Dates	-	27/01/2016
Instrument Range	ppm	100
Span Gas Value	ppm	78
Acceptable Gas Range	-	Yes
Quality Assurance	**Units**	**Run 1**
Oven Temperature	C	193
Average Temperature	< C	-
Temperature Acceptable	-	Yes
Sample line temperature	C	180
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	0.1
Zero Down Sampling Line (Post)	ppm	0.2
Zero drift	ppm	0.1
Allowable Zero Drift	ppm	1.56
Zero Drift Acceptable	-	Yes
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	78
Span Down Sampling Line (Post)	ppm	78.2
Span Drift	ppm	0.2
Allowable Span Drift	ppm	1.56
Span Drift Acceptable (Y/N)	-	Yes
Leak Check		
Span Gas Conc.	ppm	78
Recorded Conc. down Line	ppm	78.1
Leak check acceptable (< 2%)	(Y/N)	Yes

Total Volatile Organic Carbon Results and Sampling Details

Parameter	Units	Run 1
Concentration	$mgC.m^{-3}$	3.26
Uncertainty	$mgC.m^{-3}$	0.30
Mass Emission	$kg.h^{-1}$	-

General Sampling Information	
Parameter	**Value**
Standard	EN12619
Technical Procedure	SOP2009
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	180
Span Gas Reference Number	ASLTM15ING530
Span Gas Expiry Date	01/12/2018
Span Gas Start Pressure (bar)	60
Gas Cylinder Concentration (ppm)	78
Span Gas Uncertainty (%)	<2
Zero Gas Type	Ambient
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	-
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Total Volatile Organic Carbon Trend



Total Volatile Organic Carbon Measurement Uncertainty

	Units	Run 1
Measured Quantities		
Certified Range of Analyser	ppm	0.5 to 1000
Operational Range of Analyser	ppm	100
Measured Reading	ppm	1.85
Measured Quantities	Units	**Run 1**
Nonlinearity	%	0.068
Temperature Dependent Zero drift	%	0.3
Temperature Dependent Span drift	%	0.3
Cross-sensitivity	%	-
Leak	%	<2
Calibration Gas uncertainty	%	<2
Parameter	Units	**Run 1**
Combined uncertainty	$mg.m^{-3}$	3.26
Expanded uncertainty	$mg.m^{-3}$	0.30
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	9.15
Expanded uncertainty expressed with a level of confidence of 95%	% of value	18.31
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	0.60
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Hydrogen Chloride Sampling Details & Results

Stack ID	F1	**Run 1**
Sample ID	F1 HCL	**mls**
Impinger 1 ID	F1 HCL1+2	120
Impinger 2 ID	-	-
Impinger 3 ID	F1 HCL3	76
Time on	17:05	
Time off	17:41	
Leak Check Results		
Prior to test:	0.01	l/min
Post Test:	0.01	l/min
Sample Volume Flow Rate:	2.02	l/min
Standard Requirement:	<2	%
Test Result:	0	%
Test Status	Pass	
Calibration Details		
Pump Number:	-	
Calibration Unit:	ASLTM15EQ502	
Calibration Rate Before Test:	2.2	litres per minute
Calibration Rate After Test:	2.200	litres per minute
Average sample Volume:	2.2	litres per minute
Sample Test Time:	36	minutes
Pump Gas Temperature:	0	^{o}C
Pump Sample Pressure:	101.3	kPa
Actual Sample Volume:	0.07920	m^3
Normalised Gas Volume:	0.07920	Nm^3

Hydrogen Chloride Quality Assurance

Stack ID	F1	-
Date	27/01/2016	-
Start time	-	17:05:00
Finish Time	-	17:41:00
	Units	**Run 1**
Leak test results		
Mean Sampling Rate	l/min	2.02
Pre-sampling leak rate	l/min	0.01
Post-sampling leak rate	l/min	0.01
Leak rate	l/min	0
Acceptable leak rate (<2%)	Y/N	Yes
Filtration		
Filter Material	-	N/A
Filter Size	mm	N/A
Max. Filter Temp	degrees	N/A
Absorbers Type	Glass/PTFE/ Other	PTFE
Absorption Solution	-	Di H2O
Absorption Efficiency		
Total Imp1 + Imp 2 + Imp 3	ug	9.8
Impinger 3	ug	3.8
Absorption efficiency	%	61
Acceptable Absorption Eff.	>95% (Y/N)	N
Blank sample		
Blank sample ID	-	GE1 HCLB
Blank result	mg/m^3	<0.06
Acceptable Blank	<10% ELV (Y/N)	Y
Testing laboratory		
Laboratory Name	-	UKAS1549
Test certificate Number	-	544169

Hydrogen Chloride Results & Measurement Uncertainty

Stack ID	F1	**Run 1**
Date	-	
Start time	17:05	
Finish Time	17:41	
Results		
Laboratory Result	9.8	µg/ml
Impinger final Volume	196	ml
Concentration	0.01	mg
Sample Volume	0.079	Nm^3
Emissions Concentration	0.12	$mg.m^{-3}$
Mass Emissions	-	$kg.h^{-1}$

	Units	**Run 1**
	Units	Run 1
Parameter		
Combined Uncertainty	$mg.m^{-3}$	0.002
Expanded uncertainty as percentage of measured value	% of measured value	4.16
Expanded uncertainty in units of measurement	$mg.m^{-3}$	0.003
Expanded uncertainty as percentage of limit value	% Of ELV	0.01

Hydrogen Fluoride Sampling Details & Results

Sampling Details		**Run 1**
Stack ID	F1	
Start time	17:06	
Finish Time	17:54	
Leak Check Results		
Prior to test:	0.01	l/min
Post Test:	0.01	l/min
Sample Volume Flow Rate:	2.18	l/min
Standard Requirement:	<2	%
Test Result:	0	%
Test Status	Pass	
Calibration Details		
Pump Number:	-	
Calibration Unit:	ASLTM15EQ504	
Calibration Rate Before Test:	2.18	l/min
Calibration Rate After Test:	2.18	l/min
Average sample Volume:	2.18	l/min
Sample Test Time:	38	min
Pump Gas Temperature:	0	^{O}C
Pump Sample Pressure:	101.3	kPa
Actual Sample Volume:	0.08284	m^3
Normalised Gas Volume:	0.08284	Nm^3

Hydrogen fluoride Quality Assurance

Start time	-	17:06:00
Finish Time	-	17:54:00
	Units	**Run 1**
Leak test results		
Mean Sampling Rate	l/min	2.18
Pre-sampling leak rate	l/min	0.01
Post-sampling leak rate	l/min	0.01
Leak rate	l/min	0.00
Acceptable leak rate (<2%)	Y/N	Yes
Filtration		
Filter Material	-	N/A
Filter Size	mm	N/A
Max. Filter Temp	degrees	N/A
Absorbers Type	Glass/PTFE/ Other	Glass
Absorption Solution	-	0.1m NaOH
Absorption Efficiency		
Total Imp 1 + Imp2 + Imp3	ug	8
Impinger 3	ug	4.3
Absorption efficiency	%	46
Acceptable Absorption Eff.	>95% (Y/N)	N
Blank sample		
Blank sample ID	-	GE1 HF B
Blank result	mg/m^3	<0.04
Acceptable Blank	<10% ELV (Y/N)	Y

Hydrogen Fluoride Results & Measurement Uncertainty

Sampling Details		**Run 1**
Stack ID	F1	
Date	-	
Start time	17:06:00	
Finish Time	17:54:00	
Results		
Laboratory Result	8	µg/ml
Impinger final Volume	160	ml
Concentration	0.01	mg
Sample Volume	0.08	Nm^3
Emissions Concentration	0.10	$mg.m^{-3}$
Mass Emissions	-	$kg.h^{-1}$

	Units	**Run 1**
	Units	Run 1
Parameter		
Combined Uncertainty	$mg.m^{-3}$	0.002
Expanded uncertainty as percentage of measured value	% of measured value	4.096
Expanded uncertainty in units of measurement	$mg.m^{-3}$	0.004
Expanded uncertainty as percentage of limit value	% Of ELV	0.079

Sulphur Dioxide Quality Assurance

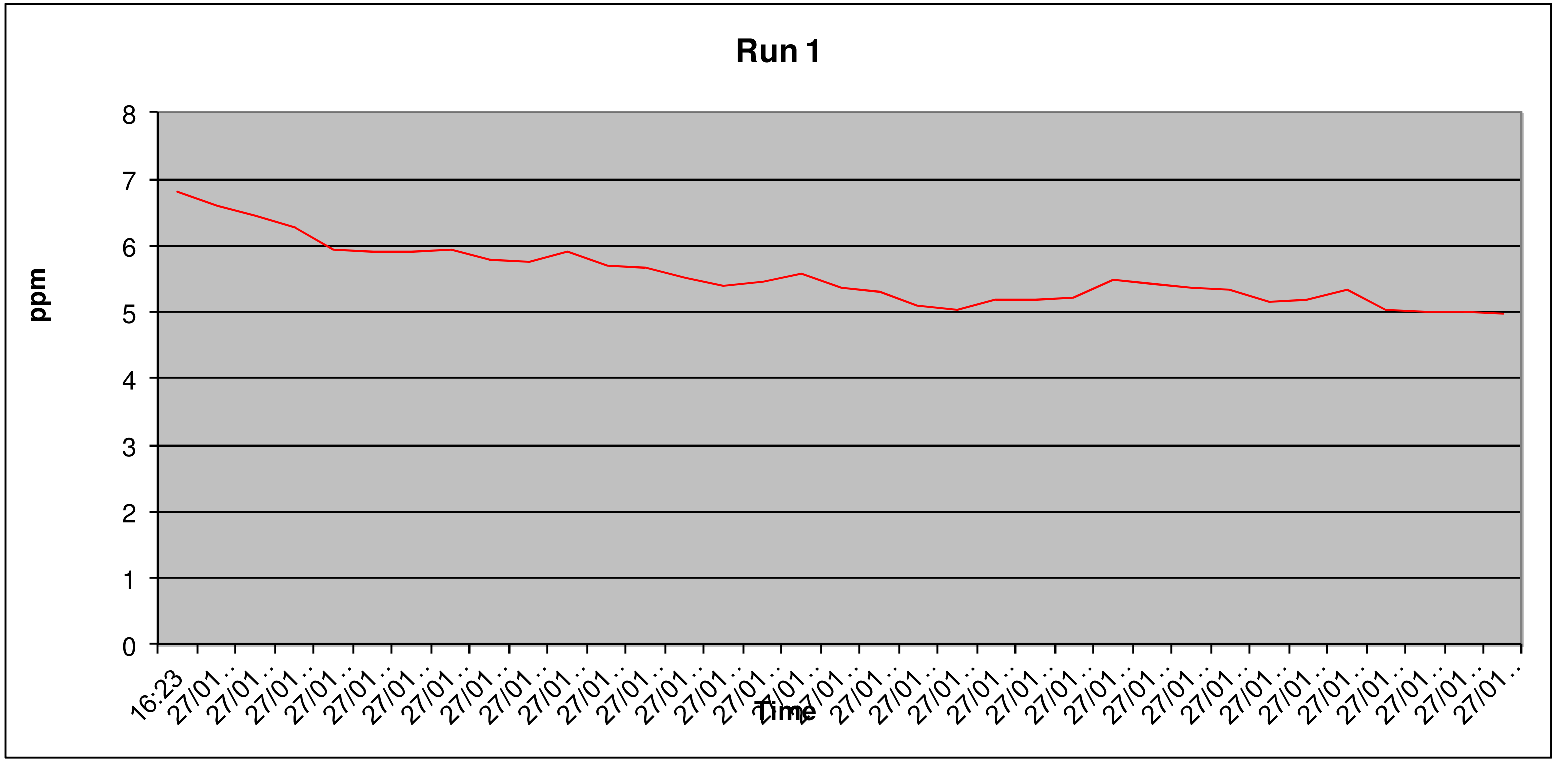
Sampling Details		
Stack ID	F1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	16:22
Sampling Dates	-	27/01/2016
Instrument Range	ppm	200
Span Gas Value	ppm	164
Acceptable Gas Range	-	Yes
	-	-
Quality Assurance	**Units**	**Run 1**
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.5
	-	-
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	0.1
Zero Down Sampling Line (Post)	ppm	0.9
Zero drift	ppm	0.8
Allowable Zero Drift	ppm	8.2
Zero Drift Acceptable	-	Yes
	-	-
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	164
Span Down Sampling Line (Post)	ppm	168.3
Span Drift	ppm	4.3
Allowable Span Drift	ppm	8.2
Span Drift Acceptable (Y/N)	-	Yes
	-	-
Leak Check		
Span Gas Conc.	ppm	164
Recorded Conc. down Line	ppm	169.3
Leak check acceptable (< 2%)	(Y/N)	Yes
	-	-
Test Conditions	**Units**	**Run 1**
Run Ambient Temperature Range	C	11

Sulphur Dioxide Results & Sampling details

Parameter	Units	Run 1
Concentration	mg.m^{-3}	15.88
Uncertainty	mg.m^{-3}	3.74
Mass Emission	kg.h	-

General Sampling Information	
Parameter	**Value**
Standard	TGN 21
Technical Procedure	2012
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	180
Date & Result of last converter check	-
Span Gas Reference Number	ASLTM15ING508
Span Gas Expiry Date	Jul-16
Span Gas Start Pressure (bar)	30
Gas Cylinder Concentration (ppm)	164
Span Gas Uncertainty (%)	<2
Zero Gas Type	N
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Sulphur Dioxide Trend



Sulphur Dioxide Measurement Uncertainty

	Units	Run 1
Measured Quantities		
Certified Range of Analyser	ppm	2.14 to 1000
Operational Range of Analyser	ppm	200
Measured Reading	ppm	5.55
Measured Quantities	**Units**	**Run 1**
Nonlinearity	%	0.8
Temperature Dependent Zero drift	%	0.8
Temperature Dependent Span drift	%	2
Cross-sensitivity	%	1.5
Leak	%	0
Calibration Gas Uncertainty	%	<2 %
Parameter	**Units**	**Run 1**
Combined uncertainty	$mg.m^{-3}$	1.10
Expanded uncertainty	$mg.m^{-3}$	2.19
Uncertainty corrected to std conds.	$mg.m^{-3}$	3.74
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	-
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	3.74
Expanded uncertainty expressed with a level of confidence of 95%	% of value	23.54
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

AirScientific

Report Title	Air Emissions Compliance Monitoring Emissions Report
Company address	Air Scientific Ltd., 32 DeGranville Court, Dublin road, Trim, Co. Meath
Stack Emissions Testing Report Commissioned by	Cork City Council
Facility Name	Kinsale Road Facility
Contact Person	Kevin Ryan
EPA Licence Number	WL012-03
Licence Holder	Cork City Council Kinsale GE1
Stack Reference Number	GE1
Dates of the Monitoring Campaign	27/01/2016
Job Reference Number	KIRDTL2270116 - 2016018
Report Written By	Dr. John Casey
Report Approved by	Dr. Brian Sheridan
Stack Testing Team	Dr. John Casey, Dr. Brian Sheridan
Report Date	12/02/2016
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Brian Sheridan Technical Manager

Contents

1. Executive Summary

I. Monitoring Objectives

Overall Aim of the monitoring Campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter (TPM)
Carbon Monoxide (CO)
Oxides of Nitrogen (NOx) as NO_2
Total Volatile Organic Carbon (TOC)
Hydrogen Chloride (HCL)
Hydrogen Fluoride (HF)
T A Luft Organics
Sulphur Dioxide (SO_2)
Stack Gas Temperature
Volume ($m^3.h^{-1}$)

Emission Limit Values

Emission Limit Values / Mass Emissions Limit Values	$mg.m^{-3}$	$kg.h^{-1}$
TPM	130	-
CO	1400	-
NOx as NO_2	500	-
TOC	-	-
HCL	50	-
HF	5	-
T A Luft Organics	20	-
SO_2	-	-
Stack Gas Temperature	-	-
Volume ($m^3.h^{-1}$)	3,000	-

Reference Conditions

Reference Conditions	Value
Oxygen Reference %	5
Temperature °C	273.15
Total Pressure kPa	101.3
Moisture %	Yes

Executive Summary

Overall Results

	Concentration					Mass Emission	
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Compliant**	**Units**	**Result**
Total Particulate Matter (TPM)	$mg.m^{-3}$	12.39	0.92	130	Yes	$kg.h^{-1}$	0.019
Carbon Monoxide (CO)	$mg.m^{-3}$	754.46	43.84	1400	Yes	$kg.h^{-1}$	1.181
Oxides of Nitrogen (NOx) as NO_2	$mg.m^{-3}$	277.20	21.07	500	Yes	$kg.h^{-1}$	0.434
Total Volatile Organic Carbon (VOC)	$mgC.m^{-3}$	698.42	15.96	-	N/A	$kg.h^{-1}$	1.093
Hydrogen Chloride (HCL)	$mg.m^{-3}$	<0.17	0.00	50	Yes	$kg.h^{-1}$	<0.0003
Hydrogen Fluoride (HF)	$mg.m^{-3}$	<0.15	0.01	5	Yes	$kg.h^{-1}$	<0.0002
T A Luft Organics	$mg.m^{-3}$	1.65	0.34	20	Yes	$kg.h^{-1}$	0.003
Sulphur Dioxide (SO_2)	$mg.m^{-3}$	398.81	23.61	-	N/A	$kg.h^{-1}$	0.624
Oxygen (%)	% v/v	6.59	0.14	-	N/A	-	-
Stack Gas Temperature	K	699.15	-	-	N/A	-	-
Stack Gas Velocity	$m.s^{-1}$	14.91	-	-	N/A	-	-
Volumetric Flow Rate	$m^3.h^{-1}$	1751	-	-	N/A	-	-
Volumetric Flow Rate (Ref.)	$m^3.h^{-1}$	1565	-	3,000	Yes	-	-

Accreditation details

Air Scientific Limited	INAB319T
External Analytical Laboratory	UKAS1549
Other	-

Executive Summary

Monitoring Dates & Times

Parameter	Run	Location ID	Sampling Dates	Sampling Time On	Sampling Time Off	Duration (mins.)
Total Particulate Matter (TPM)	Run 1	GE1	27/01/2016	14:35:00	15:05:00	00:30:00
	Run 2					
	Run 3					
Carbon Monoxide (CO)	Run 1	GE1	27/01/2016	14:25:00	14:59:00	00:34:00
	Run 2					
	Run 3					
Oxides of Nitrogen (NOx) as NO_2	Run 1	GE1	27/01/2016	14:25:00	14:59:00	00:34:00
	Run 2					
	Run 3					
Total Volatile Organic Carbon (VOC)	Run 1	GE1	27/01/2016	15:03:00	15:44:00	00:41:00
	Run 2					
	Run 3					
Hydrogen Chloride (HCL)	Run 1	GE1	27/01/2016	15:20:00	15:52:00	00:32:00
	Run 2					
	Run 3					
Hydrogen Fluoride (HF)	Run 1	GE1	27/01/2016	15:21:00	15:55:00	00:34:00
	Run 2					
	Run 3					
T A Luft Organics	Run 1	GE1	27/01/2016	14:45:00	15:18:00	00:33:00
	Run 2					
	Run 3					
Sulphur Dioxide (SO_2)	Run 1	GE1	27/01/2016	14:25:00	14:59:00	00:34:00
	Run 2					
	Run 3					
Oxygen (%)		GE1	27/01/2016	14:25:00	14:59:00	00:34:00

Process details

Parameter	
Process status	Normal
Capacity (per/hour) (if applicable)	N/a
Continuous or Batch Process	Continuous
Feedstock	Landfill Gas
Abatement System	No
Abatement Systems Running Status	N/A
Fuel	Landfill Gas
Plume Appearance	None
Other information	N/A

Monitoring, Equipment & Analytical Methods

	Monitoring				Analysis	
Parameter	**Standard**	**Technical Procedure**	**Accredited Testing**	**Testing Lab**	**Analytical Technique**	**Analysis Lab**
Total Particulate Matter (TPM)	EN13284-1:2002	SOP 2000	Yes	AirSci	Gravimetric	SAL
Carbon Monoxide (CO)	EN15058:2006	SOP 2004	Yes	AirSci	NCIR By Horiba PG-250	AirSci
Oxides of Nitrogen (NOx)	EN14792:2006	SOP 2002	Yes	AirSci	Chemiluminescence	AirSci
Total Volatile Organic Carbon (TOC)	EN12619:2013	SOP 2009	Yes	AirSci	Flame Ionisation Detection	AirSci
Hydrogen Chloride (HCL)	EN1911:2010	SOP 2014	Yes	AirSci	Ion Chromatography	SAL
Hydrogen Fluoride (HF)	EN15713:2006	SOP 2024	No	AirSci	Ion Chromatography	SAL
T A Luft Organics	EN13649:2002	SOP 2019	No	AirSci	Thermal Desorption	SAL
Sulphur Dioxide (SO2)	TGN 21	SOP 2012	Yes	AirSci	NDIR Absorption	AirSci
Oxygen (%)	EN14789:2005	SOP 2008	Yes	AirSci	Paramagnetic	AirSci
Stack Gas Temperature	EN16911:2013	SOP 2005	Yes	AirSci	Thermocouple	AirSci
Stack Gas Velocity	EN16911:2013	SOP 2005	Yes	AirSci	Pitot tubes	AirSci

List of Equipment

ID	Item of Equipment	Manufacturer	Serial No.
ASLTM12EQ501	Airflow PVM 620	TSI Airflow	PVM621143 007
ASLTM12EQ503	SKC Aircheck Sampler	SKC	826925
ASLTM12EQ508	DryCal DC Lite Primary Flow Metre	BIOS	7298
ASLTM12EQ509	3010 MinfiFID	Signal Instruments	16764
ASLTM12EQ512	Horiba PG2500 Portable Gas Analzer	Horiba	41343020031
ASLTM12EQ518	5 metre heated line 342 470 (Only used with 3010)	Signal Instruments	16838
ASLTM13EQ502	6" Vernier Caliper	MEDID	N/A
ASLTM13EQ505	S TYPE PITOT TUBE	Tecora	1347
ASLTM14EQ505	Stanley 5m Measuring Tape	Stanley	30-696
ASLTM14EQ509	5 metre heated line, filters and temp controller box 1 & 2	Neptech	14A052
ASLTM14EQ510	5 metre heated line, filters and temp controller box 1 & 2	Neptech	14B052
ASLTM14EQ511	Buhler Sample Gas Cooler	Buhler Technologies	100094941
ASLTM14EQ513	ISO Stack Sampling Machine and associated equipment	TCR Tecora	070205976 & 049039P
ASLTM14EQ517	Data Logger Thermometer	YCT	14021192
ASLTM14EQ519	S TYPE PITOT TUBE	Tecora	33011
ASLTM14EQ520	GemRed Electronic Level 0 to 180 Degrees	GemRed	8119
ASLTM15EQ502	Mass flow meter	Siargo	A3J04318
ASLTM15EQ504	Mass flow meter	Siargo	B3J04198

Sampling Deviations

Parameter	Deviation
Standard ID	Flow theoretically calculated
Standard ID	Absorption efficiency < 95% - EN1911
Standard ID	Absorption efficiency < 95% - EN15713
Standard ID	-

Reference Documents

Risk Assessment (RA)	SOP1011
Site Review (SR)	SOP1015
Site Specific Protocol (SSP)	SOP1015

Executive Summary

Suitability of sampling location

General Information	Value
Permanent/Temporary	Temporary
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements	**Value**	**Comment**
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self closing gates at top of ladders	Yes	-
There are no obstructions present which hamper insertion of sampling equipment	No	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-

Sampling Location / Platform Improvement Recommendations
None

BSEN 15259 Homogeneity Test Requirements
1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack
E.g. Select Option **1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack** **2: Test results were obtained from previous Homogeneity test carried out by ASL** **3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor** **4: Other: Enter Description**

Stack diagram

II. Appendix I Monitoring Personnel & Equipment

Stack Emissions Monitoring Personnel

Team Leader	**Name**	John Casey
	Qualifications	PhD. (Eng.), MSc. (Agr.), B. Agr. Sc.
	System approval	Air Scientific Limited Approved
		-
Team Leader	**Name**	Brian Sheridan
	Qualifications	PhD. (Eng.), MSc. (Agr.), BSc. (Hons.)
	System approval	Air Scientific Limited Approved
		-

III. Appendix II Stack Details & flow characteristics

Preliminary stack survey calculations

General Stack Details		
Stack details	**Units**	**Value**
Date of survey		27/01/2016
Time of survey		15:10
Type		Circular
Stack Diameter / Depth, D	m	0.35
Stack Width, W	m	-
Average Stack Gas Temp., Ta	C	426
Average Static Pressure, P static	kPa	0.03
Average Barometric Pressure, Pb	kPa	99.3
Type of Pitot		S
Are Water Droplets Present ?		No
Average Pitot Tube Calibration Coeff, Cp		0.885
Negative flow		No
Highly homogeneous flow stream/gas velocity		Yes

Sample Port Size	mm	50
Initial Pitot Leak Check	Pa	300
Final Pitot Leak Check	Pa	310
Orientation of Duct		Vertical
Pitot Tube Cp		0.998
Number of Lines Available		2
Number of Lines Used		1

Sampling Line A						
Point	**Distance to duct (m)**	**Pa**	**Temp °C**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	0.02	-	-	-	-	-
2	0.05	68	-	14.6	-	<15
3	0.1	74	-	15.2	-	<15
4	0.24	61	-	13.8	-	<15
5	0.29	82	-	16.0	-	<15
6	0.33	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	71.25	-	14.91	-	<15
Min	-	61	-	13.81	-	<15
Max	-	82	-	16.02	-	<15

Sampling Line B						
Point	**Distance to duct (m)**	**Pa**	**Temp °C**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Component	Conc. ppm	Conc. Dry % v/v	Conc. Wet % v/v	Molar Mass
Carbon Dioxide CO_2	-	11.4	-	44.01
Oxygen O_2	-	6.69	-	32
Nitrogen N_2	-	81.91	-	28.1
Moisture (H_2O)	-	-	8.9	18.02
Reference Conditions	**Units**	**Numbers**		
Temperature	^{o}C	273.15		
Total Pressure	kPa	101.3		
Moisture	%	-		
Oxygen (Dry)	%	5		

Stack Gas Composition & Molecular Weights								
Component	**Molar Mass M**	**Density Kg/m^3 p**	**Conc. Dry % v/v**	**Dry Volume Fraction r**	**Dry Conc. kg/m^3 pi**	**Conc. wet % v/v**	**Wet Volume Fraction r**	**Wet Conc.kg/m^3 pi**
Carbon Dioxide CO_2	44.01	1.96	11.4	0.114	0.22	10.39	0.10	0.20
Oxygen O_2	32	1.43	6.69	0.0669	0.10	6.09	0.06	0.09
Nitrogen N_2	28.1	1.25	81.91	0.8191	1.03	74.62	0.75	0.94
Moisture (H_2O)	18.02	0.80	-	-	-	8.9	0.09	0.07
	-	-	-	-	-	-	-	-
where p=M/22.41	-	-	-	-	-	-	-	-
pi = r x p	-	-	-	-	-	-	-	-

Calculation of Stack Gas Densities		
Determinand	**Units**	**Result**
Dry Density (STP), P STD	$kg.m^{-3}$	1.346
Wet Density (STP), P STW	$kg.m^{-3}$	1.302
Dry Density (Actual), P Actual	$kg.m^{-3}$	0.516
Average wet Density (Actual), P ActualW	$kg.m^{-3}$	0.499
Where		
P STD = sum of component concentrations, kg/m3 (excluding water vapour)	-	-
P STW = (P STD + pi of H2O) / (1 + (pi of H2O / 0.8036))	-	-
P actual = P STD x (T STP / (P STP)) x (Pa / Ta)	-	-
P actual W (at each sampling point) = P STW x (Ts / Ps) x (Pa / Ta)	-	-

Sampling Plane Validation Criteria	Value	Units	Requirement	Compliance	Method
Lowest Differential Pressure	61	Pa	>5 Pa	Yes	EN16911:2013
Lowest Gas Velocity	13.81	m/s	-	N/A	-
Highest Gas Velocity	16.02	m/s	-	N/A	-
Ratio of Above	1.16	:1	<3:1	Yes	EN16911:2013
Mean Velocity	14.91	m/s	-	N/A	-
Angle of flow with regard to duct axis	<15	degrees	< 15	Yes	EN16911:2013
No local negative flow	No	-	-	Yes	-
Homogeneous flow stream/gas velocity	Yes	-	-	Yes	-

Calculation of stack Gas Velocity, V	
Velocity at Traverse Point, V = Kcp * Sqroot ((2 * DP) / Density)	-
Where	
Kpt = Pitot tube calibration coefficient	0.885
Compressibility correction factor, assumed at a constant 0.998	0.998

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flow Rate (Actual)	$m^3.h^{-1}$	5018
Gas Volumetric Flow Rate (STP, Wet)	$m^3. h^{-1}$	1922
Gas Volumetric Flowrate (STP, Dry)	$m^3. h^{-1}$	1751
Gas Volumetric Flowrate REF to Oxygen	$m^3. h^{-1}$	1565

IV. Appendix III Individual parameter sampling details and results

Total Particulate Matter : Sampling details and results

Run 1			**Time On**	14:35:00	-
Stack ID	GE1	-	**Time Off**	15:05:00	-
Filter ID	719	-	**Uncertainty Data**	-	-
Start Dry Gas Meter	-	Nm3	**Temperature at Pump**	14.54	Deg C
Finish Dry Gas Meter	-	Nm3	**Pressure at Pump**	99.5	kPa
Average Stack Temperature	426	degrees	**Air Volume at Pump**	0.28	m^3
Moisture Content	8.90	%	**Humidity at Pumps**	0.1	%
Stack Flow Rate STP, Dry	1751	$m^3 \cdot h^{-1}$	**Filter Weight**	2.6	mg
Volume of Air Sampled	0.26	$m^{3\ (VgN)}$	**Front End Weight**	0.3	mg
Balance Calibration	**Weight**				
300.0	-	g	-	-	-
500.0	-	g	-	-	-
1000.0	-	g	-	-	-
Inpinger Weights	**Initial**	**Final**	**Difference**		
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	-	-	-	-	-
Volume of Air Sampled	-	Nm3	0	-	-
Moisture Content (EN 14790)	-	%	-	-	-
Leak Check Results	**Result**	-	**% Leak**		
Before Blank	0.11	l/min	0.4	-	-
After Blank	0.11	l/min	0.4	-	-
Before Sample 1	0.11	l/min	0.4	-	-
After Sample 1	0.11	l/min	0.4	-	-
Average Flow Rate	25	l/min	0.4	-	-
Standard Maximum	0.5	l/min	2%	-	-
Back Pressure	-	bar	-	-	-
Leak check acceptable	Yes	-	Yes/No	-	-
Water droplets present	No	-	Yes/No	-	-
Standard Criteria to be Met	**Result**	**Standard Requirement**			
Angle of Flow	<15	<15 Degrees			
Negative Flow in the Stack	None	None			
Pitot Pressure Difference	>5Pa	>5Pa			
Ratio of Flow Measurement	<3:1	<3:1			
Pitot Tube Leak Check	**Result**				
Positive Pressure	Pass	-			
Negative Pressure	Pass	-			

Number of Ports	2	2			
Straight length before sample point	> 5	> 5 Hydraulic Diameters			
Straight length after sample point	> 5	> 5 Hydraulic Diameters			
Sample Calculations	-	-			
Blank (Filter and Front Wash Combined)	<0.35	mg			
Sample 1 (Filter and Front Combined)	2.9	mg			
Volume of Air Sampled	0.26	m^3			
Blank Result	<1.35	$mg.m^{-3}$			
Sample Result	11.15	$mg.m^{-3}$			
Emission Limit Value	130	$mg.m^{-3}$			
Blank as Percentage of ELV	1.0	%	**Standard Requirement**	**<10% ELV**	-
Isokinetic Criterion Compliance					
Isokinetic Variation	%	0	-	-	-
Allowable IsoKinetic Range	%	95-115	-	-	-
Iso Kineticity Acceptable	-	Yes	-	-	-

Total Particulates Quality Assurance

Stack ID	GE1	-
Parameter	**Units**	**Run 1**
Sampling Times	-	14:35:00
Sampling dates	-	27/01/2016
Sampling Device	-	Basic
Volume Sampled (REF.)	m3	0.26
Filter ID Number	-	719
Probe rinse ID	-	GE1 W
Total Filter Mass	mg	3
Probe Rinse Solids Mass	mg	<0.3
Total Mass Collected	mg	2.9
General information		
Standard	ISEN13284-1	**Run 1**
Technical Procedure	-	2000
Probe Material	-	SS
Filter Housing	-	SS
Positioning of Filter	-	In-stack
Filter Size and Material	-	47
Number of Sampling lines used	-	1
Number of Sampling Points used	-	8

Carbon Monoxide Quality Assurance

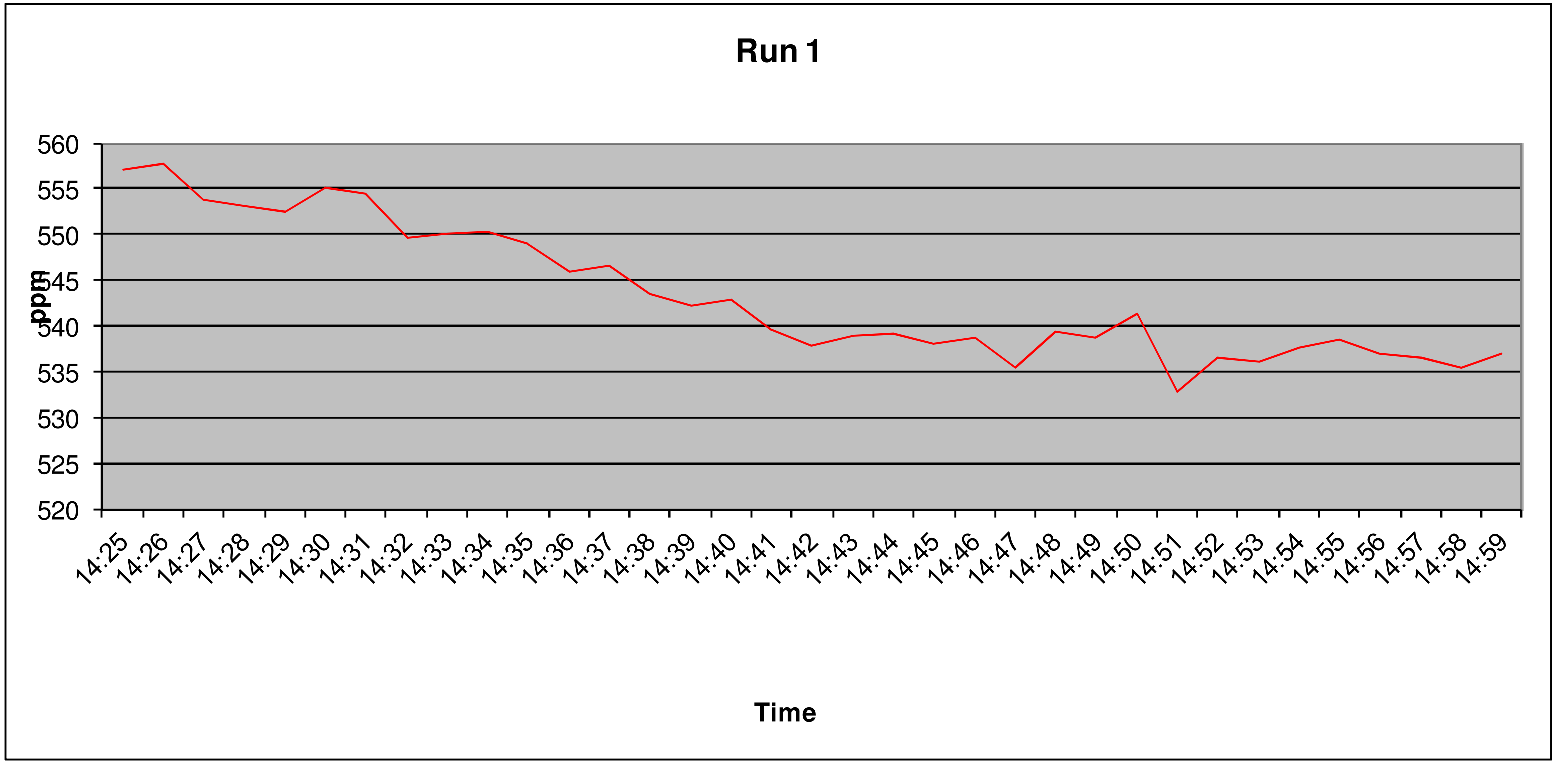
Sampling Details		
Stack ID	GE1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	16:22
Sampling Dates	-	27/01/2016
Instrument Range	ppm	1000
Span Gas Value	ppm	598
Acceptable Gas Range	-	Yes
Quality Assurance	**Units**	**Run 1**
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.5
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	0.1
Zero Down Sampling Line (Post)	ppm	0.9
Zero drift	ppm	0.8
Allowable Zero Drift	ppm	11.96
Zero Drift Acceptable	-	Yes
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	598
Span Down Sampling Line (Post)	ppm	600
Span Drift	ppm	2
Allowable Span Drift	ppm	11.96
Span Drift Acceptable (Y/N)	-	Yes
Leak Check		
Span Gas Conc.	ppm	598
Recorded Conc. down Line	ppm	598
Leak check acceptable (< 2%)	(Y/N)	Yes
Test Conditions	**Units**	**Run 1**
Run Ambient Temperature Range	C	11

Carbon Monoxide Results & Sampling details

Parameter	Units	Run 1
Concentration	$mg.m^{-3}$	679.19
Uncertainty	$mg.m^{-3}$	43.84
Mass Emission	kg.h	1.18

General Sampling Information	
Parameter	**Value**
Standard	EN15058
Technical Procedure	SOP2004
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	180
Span Gas Reference Number	ASLTM14ING524
Span Gas Expiry Date	Jan-17
Span Gas Start Pressure (bar)	60
Gas Cylinder Concentration (ppm)	598
Span Gas Uncertainty (%)	<2
Zero Gas Type	Nitrogen
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	GE1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	5

Carbon Monoxide Trend



Carbon Monoxide Measurement Uncertainty

	Units	Run 1
Measured Quantities		
Certified Range of Analyser	ppm	1.36 to 1000
Operational Range of Analyser	ppm	1000
Measured Reading	ppm	543.35
Measured Quantities	**Units**	**Run 1**
Nonlinearity	%	0.9
Temperature Dependent Zero drift	%	0.14
Temperature Dependent Span drift	%	-0.12
Cross-sensitivity	%	0.08
Leak	%	0
Calibration Gas Uncertainty	%	<2
Parameter	**Units**	**Run 1**
Combined uncertainty	$mg.m^{-3}$	8.62
Expanded uncertainty	$mg.m^{-3}$	17.25
Uncertainty corrected to std conds.	$mg.m^{-3}$	43.84
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	3.13
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	43.84
Expanded uncertainty expressed with a level of confidence of 95%	% of value	6.46
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Oxides of Nitrogen Quality Assurance

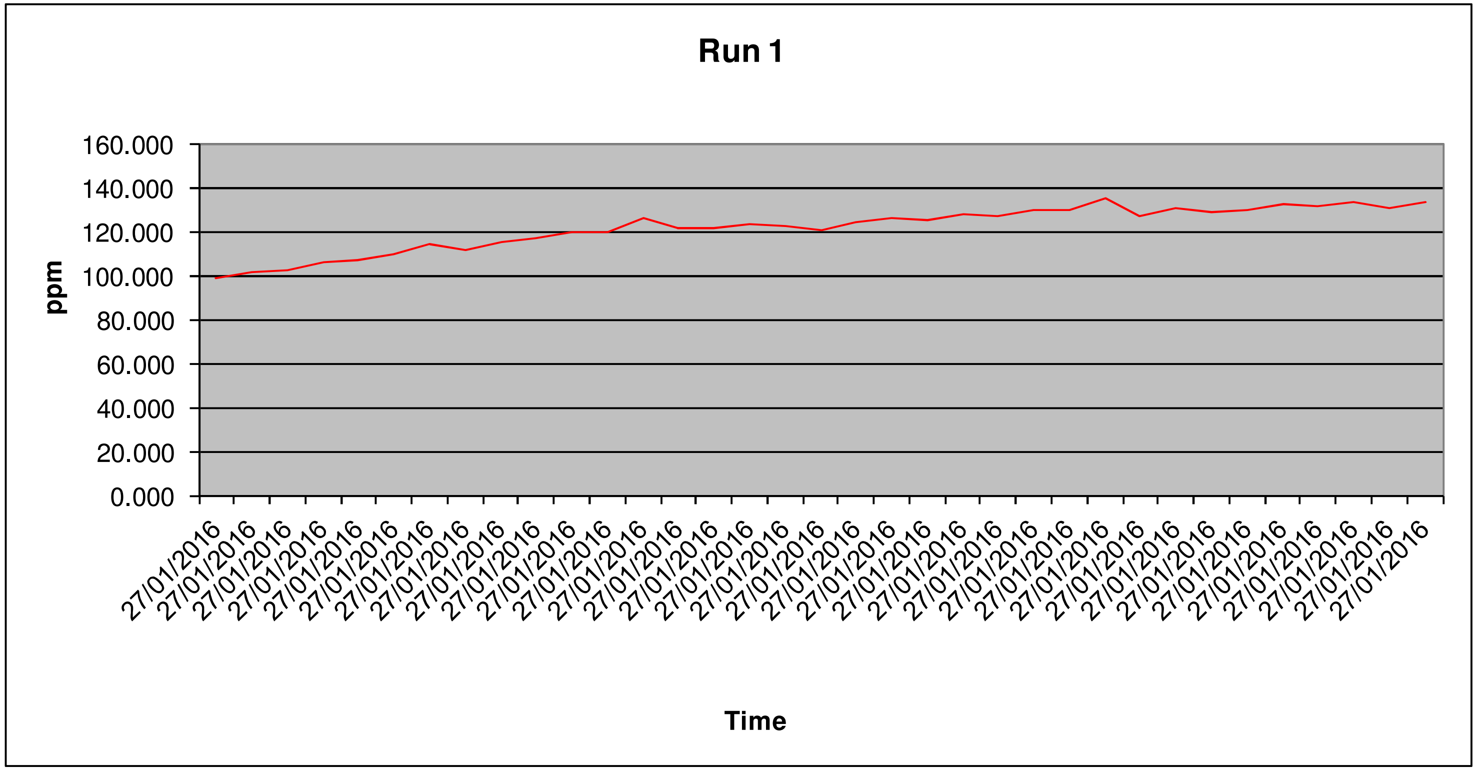
Sampling Details		
Stack ID	GE1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	14:25
Sampling Dates	-	27/01/2016
Instrument Range	ppm	250
Span Gas Value	ppm	161
Acceptable Gas Range	-	Yes
Quality Assurance	**Units**	**Run 1**
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.5
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	0
Zero Down Sampling Line (Post)	ppm	0.2
Zero drift	ppm	0.2
Allowable Zero Drift	ppm	3.22
Zero Drift Acceptable	-	Yes
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	161
Span Down Sampling Line (Post)	ppm	161.3
Span Drift	ppm	0.3
Allowable Span Drift	ppm	3.22
Span Drift Acceptable (Y/N)	-	Yes
Leak Check		
Span Gas Conc.	ppm	161
Recorded Conc. down Line	ppm	161.2
Leak check acceptable (< 2%)	(Y/N)	Yes
Test Conditions	**Units**	**Run 1**
Run Ambient Temperature Range	C	11
NOx Converter Efficiency	%	95.5

Oxides of Nitrogen Results & Sampling details

Parameter	Units	Run 1
Concentration	$mg.m^{-3}$	249.55
Uncertainty	$mg.m^{-3}$	21.07
Mass Emission	$kg.h^{-1}$	0.43

General Sampling Information	
Parameter	**Value**
Standard	EN14792
Technical Procedure	SOP2002
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	180
Date & Result of last converter check	95.5 23/01/2016
Span Gas Reference Number	ASLTM15ING529
Span Gas Expiry Date	Dec-16
Span Gas Start Pressure (bar)	59
Gas Cylinder Concentration (ppm)	161
Span Gas Uncertainty (%)	<2
Zero Gas Type	Nitrogen
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	GE1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	5

Oxides of Nitrogen Trend



Oxides of Nitrogen Measurement Uncertainty

Measured Quantities	**Units**	**Run 1**
Nonlinearity	%	1.4
Temperature Dependent Zero drift	%	-0.04
Temperature Dependent Span drift	%	-0.25
Cross-sensitivity	%	0.5
Leak	%	0
Calibration Gas Uncertainty	%	<2
Mass Flow Controllers (Dilution) Uncertainty	%	<1
NOx Converter Efficiency	%	95.5
Parameter	**Units**	**Run 1**
Combined uncertainty	$mg.m^{-3}$	7.20
Expanded uncertainty	$mg.m^{-3}$	14.41
Uncertainty corrected to std conds.	$mg.m^{-3}$	21.07
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	4.21
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	21.07
Expanded uncertainty expressed with a level of confidence of 95%	% of value	8.45
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Total Volatile Organic Carbon Quality Assurance

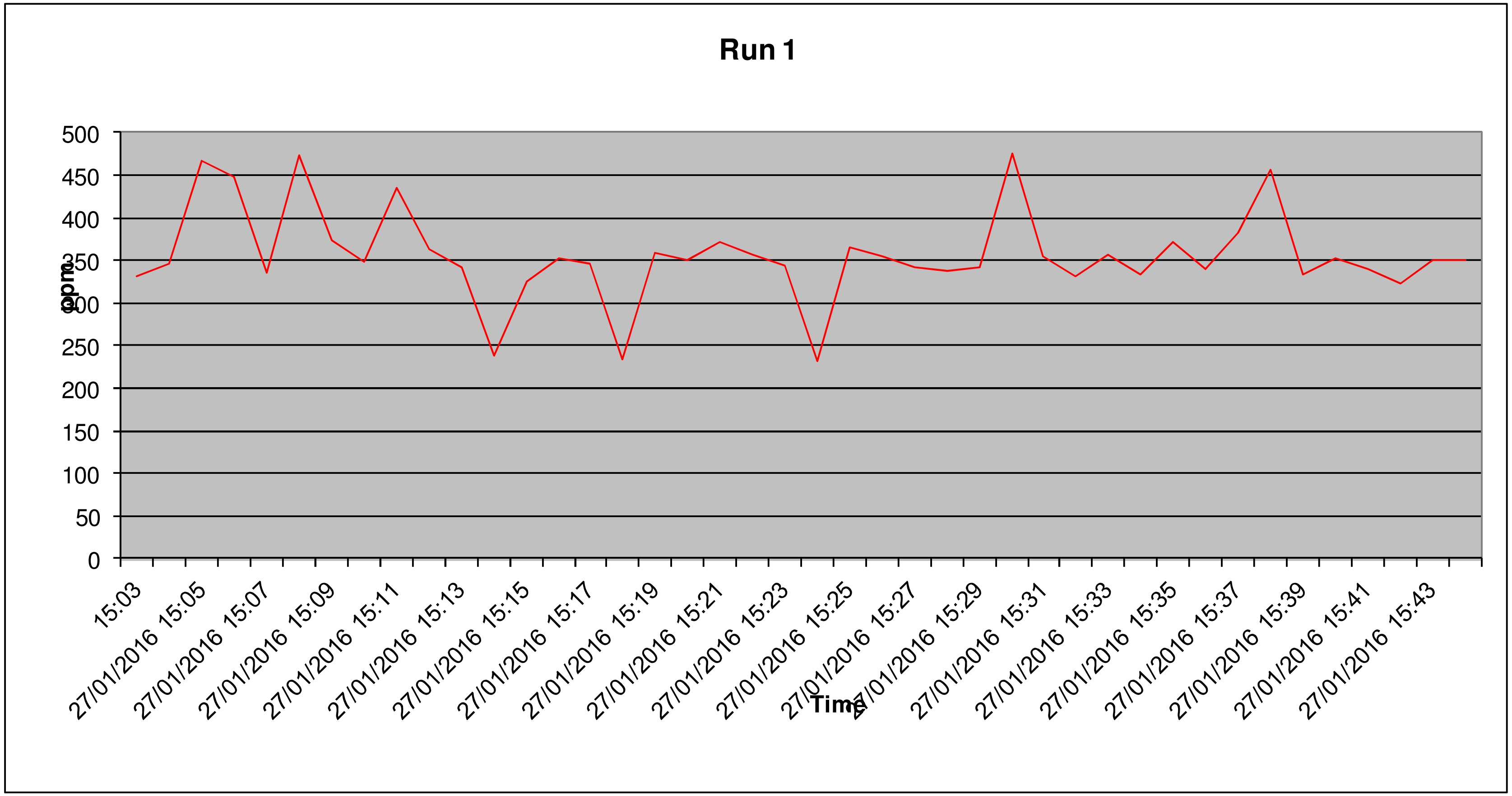
Sampling Details		
Stack ID	GE1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	15:03
Sampling Dates	-	27/01/2016
Instrument Range	ppm	1000
Span Gas Value	ppm	699
Acceptable Gas Range	-	Yes
Quality Assurance	**Units**	**Run 1**
Oven Temperature	C	193
Average Temperature	< C	-
Temperature Acceptable	-	Yes
Sample line temperature	C	180
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	0.2
Zero Down Sampling Line (Post)	ppm	0.6
Zero drift	ppm	0.4
Allowable Zero Drift	ppm	13.98
Zero Drift Acceptable	-	Yes
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	699
Span Down Sampling Line (Post)	ppm	699.8
Span Drift	ppm	0.8
Allowable Span Drift	ppm	13.98
Span Drift Acceptable (Y/N)	-	Yes
Leak Check		
Span Gas Conc.	ppm	699
Recorded Conc. down Line	ppm	699.3
Leak check acceptable (< 2%)	(Y/N)	Yes

Total Volatile Organic Carbon Results and Sampling Details

Parameter	Units	Run 1
Concentration	$mgC.m^{-3}$	628.74
Uncertainty	$mgC.m^{-3}$	7.98
Mass Emission	$kg.h^{-1}$	1.09

General Sampling Information	
Parameter	**Value**
Standard	EN12619
Technical Procedure	SOP2009
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	180
Span Gas Reference Number	ASLTM15ING512
Span Gas Expiry Date	01/11/2017
Span Gas Start Pressure (bar)	60
Gas Cylinder Concentration (ppm)	699
Span Gas Uncertainty (%)	<2
Zero Gas Type	Ambient
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	GE1
Reference Conditions	-
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	5

Total Volatile Organic Carbon Trend



Total Volatile Organic Carbon Measurement Uncertainty

	Units	**Run 1**
Measured Quantities		
Certified Range of Analyser	ppm	0.5 to 1000
Operational Range of Analyser	ppm	1000
Measured Reading	ppm	356.43
Measured Quantities	Units	**Run 1**
Nonlinearity	%	0.068
Temperature Dependent Zero drift	%	0.3
Temperature Dependent Span drift	%	0.3
Cross-sensitivity	%	-
Leak	%	<2
Calibration Gas uncertainty	%	<2
Parameter	Units	**Run 1**
Combined uncertainty	$mg.m^{-3}$	628.74
Expanded uncertainty	$mg.m^{-3}$	7.98
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	1.27
Expanded uncertainty expressed with a level of confidence of 95%	% of value	2.54
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	15.96
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Hydrogen Chloride Sampling Details & Results

Stack ID	GE1	**Run 1**
Sample ID	GE1 HCL	**mls**
Impinger 1 ID	GE1 HCL1+2	130
Impinger 2 ID	-	-
Impinger 3 ID	GE1 HCL3	74
Time on	15:20	
Time off	15:52	
Leak Check Results		
Prior to test:	0.01	l/min
Post Test:	0.01	l/min
Sample Volume Flow Rate:	2.14	l/min
Standard Requirement:	<2	%
Test Result:	0	%
Test Status	Pass	
Calibration Details		
Pump Number:	-	
Calibration Unit:	ASLTM15EQ502	
Calibration Rate Before Test:	2.14	litres per minute
Calibration Rate After Test:	2.140	litres per minute
Average sample Volume:	2.14	litres per minute
Sample Test Time:	32	minutes
Pump Gas Temperature:	0	^{o}C
Pump Sample Pressure:	101.3	kPa
Actual Sample Volume:	0.06848	m^3
Normalised Gas Volume:	0.06848	Nm^3

Hydrogen Chloride Quality Assurance

Stack ID	GE1	-
Date	27/01/2016	-
Start time	-	15:20:00
Finish Time	-	15:52:00
	Units	**Run 1**
Leak test results		
Mean Sampling Rate	l/min	2.14
Pre-sampling leak rate	l/min	0.01
Post-sampling leak rate	l/min	0.01
Leak rate	l/min	0
Acceptable leak rate (<2%)	Y/N	Yes
Filtration		
Filter Material	-	N/A
Filter Size	mm	N/A
Max. Filter Temp	degrees	N/A
Absorbers Type	Glass/PTFE/ Other	PTFE
Absorption Solution	-	Di H2O
Absorption Efficiency		
Total Imp1 + Imp 2 + Imp 3	ug	10.2
Impinger 3	ug	3.7
Absorption efficiency	%	64
Acceptable Absorption Eff.	>95% (Y/N)	N
Blank sample		
Blank sample ID	-	GE1 HCLB
Blank result	mg/m^3	<0.06
Acceptable Blank	<10% ELV (Y/N)	Y
Testing laboratory		
Laboratory Name	-	UKAS1549
Test certificate Number	-	544169

Hydrogen Chloride Results & Measurement Uncertainty

Stack ID	GE1	**Run 1**
Date	-	
Start time	15:20	
Finish Time	15:52	
Results		
Laboratory Result	10.2	µg/ml
Impinger final Volume	204	ml
Concentration	0.01	mg
Sample Volume	0.068	Nm^3
Emissions Concentration	<0.15	$mg.m^{-3}$
Mass Emissions	<0.0003	$kg.h^{-1}$

	Units	**Run 1**
	Units	Run 1
Parameter		
Combined Uncertainty	$mg.m^{-3}$	0.002
Expanded uncertainty as percentage of measured value	% of measured value	4.41
Expanded uncertainty in units of measurement	$mg.m^{-3}$	0.003
Expanded uncertainty as percentage of limit value	% Of ELV	0.01

Hydrogen Fluoride Sampling Details & Results

Sampling Details		**Run 1**
Stack ID	GE1	
Start time	15:21	
Finish Time	15:55	
Leak Check Results		
Prior to test:	0.01	l/min
Post Test:	0.01	l/min
Sample Volume Flow Rate:	2.26	l/min
Standard Requirement:	<2	%
Test Result:	0	%
Test Status	Pass	
Calibration Details		
Pump Number:	-	
Calibration Unit:	ASLTM15EQ504	
Calibration Rate Before Test:	2.26	l/min
Calibration Rate After Test:	2.26	l/min
Average sample Volume:	2.26	l/min
Sample Test Time:	34	min
Pump Gas Temperature:	0	^{o}C
Pump Sample Pressure:	101.3	kPa
Actual Sample Volume:	0.07684	m^3
Normalised Gas Volume:	0.07684	Nm^3

Hydrogen fluoride Quality Assurance

Start time	-	15:21:00
Finish Time	-	15:55:00
	Units	**Run 1**
Leak test results		
Mean Sampling Rate	l/min	2.26
Pre-sampling leak rate	l/min	0.01
Post-sampling leak rate	l/min	0.01
Leak rate	l/min	0.00
Acceptable leak rate (<2%)	Y/N	Yes
Filtration		
Filter Material	-	N/A
Filter Size	mm	N/A
Max. Filter Temp	degrees	N/A
Absorbers Type	Glass/PTFE/ Other	Glass
Absorption Solution	-	0.1m NaOH
Absorption Efficiency		
Total Imp 1 + Imp2 + Imp3	ug	10.2
Impinger 3	ug	4.7
Absorption efficiency	%	54
Acceptable Absorption Eff.	>95% (Y/N)	N
Blank sample		
Blank sample ID	-	GE1 HF B
Blank result	mg/m^3	<0.04
Acceptable Blank	<10% ELV (Y/N)	Y

Hydrogen Fluoride Results & Measurement Uncertainty

Sampling Details		**Run 1**
Stack ID	GE1	
Date	-	
Start time	15:21:00	
Finish Time	15:55:00	
Results		
Laboratory Result	10.2	µg/ml
Impinger final Volume	204	ml
Concentration	0.01	mg
Sample Volume	0.08	Nm^3
Emissions Concentration	<0.13	$mg.m^{-3}$
Mass Emissions	<0.0002	$kg.h^{-1}$

	Units	**Run 1**
	Units	Run 1
Parameter		
Combined Uncertainty	$mg.m^{-3}$	0.003
Expanded uncertainty as percentage of measured value	% of measured value	4.210
Expanded uncertainty in units of measurement	$mg.m^{-3}$	0.006
Expanded uncertainty as percentage of limit value	% Of ELV	0.112

Sulphur Dioxide Quality Assurance

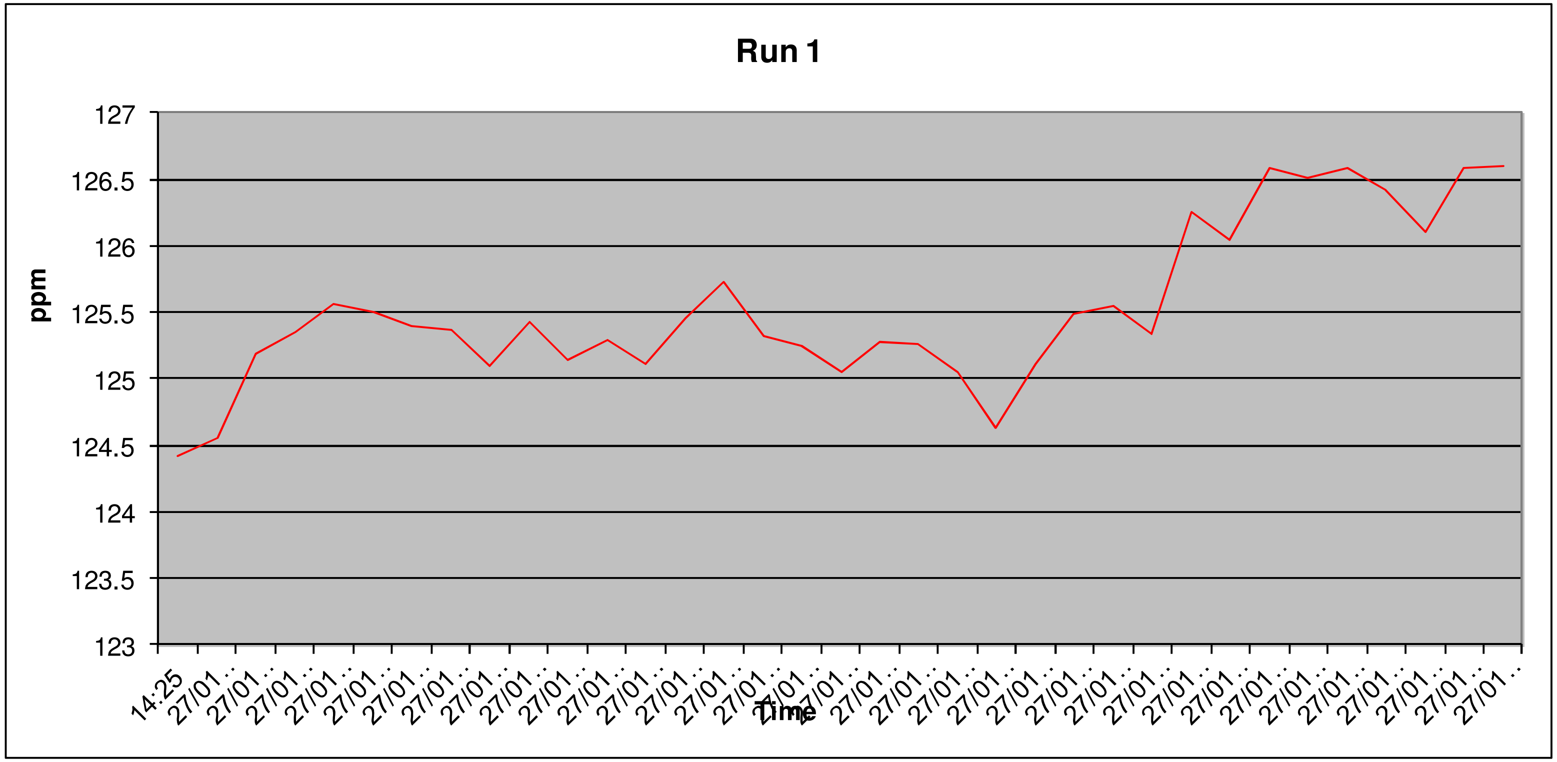
Sampling Details		
Stack ID	GE1	-
	Units	**Run 1**
Parameter		
Sampling Times	-	14:25
Sampling Dates	-	27/01/2016
Instrument Range	ppm	200
Span Gas Value	ppm	164
Acceptable Gas Range	-	Yes
	-	-
Quality Assurance	**Units**	**Run 1**
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.5
	-	-
Zero Drift	Units	**Run 1**
Zero Down Sampling Line (Pre)	ppm	0.1
Zero Down Sampling Line (Post)	ppm	0.3
Zero drift	ppm	0.2
Allowable Zero Drift	ppm	8.2
Zero Drift Acceptable	-	Yes
	-	-
Span Drift	Units	**Run 1**
Span Down Sampling Line (Pre)	ppm	164
Span Down Sampling Line (Post)	ppm	169.3
Span Drift	ppm	5.3
Allowable Span Drift	ppm	8.2
Span Drift Acceptable (Y/N)	-	Yes
	-	-
Leak Check		
Span Gas Conc.	ppm	164
Recorded Conc. down Line	ppm	168.3
Leak check acceptable (< 2%)	(Y/N)	Yes
	-	-
Test Conditions	**Units**	**Run 1**
Run Ambient Temperature Range	C	11

Sulphur Dioxide Results & Sampling details

Parameter	Units	Run 1
Concentration	$mg.m^{-3}$	359.02
Uncertainty	$mg.m^{-3}$	23.61
Mass Emission	kg.h	0.62

General Sampling Information	
Parameter	**Value**
Standard	TGN 21
Technical Procedure	2012
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	180
Date & Result of last converter check	-
Span Gas Reference Number	ASLTM15ING508
Span Gas Expiry Date	Jul-16
Span Gas Start Pressure (bar)	30
Gas Cylinder Concentration (ppm)	164
Span Gas Uncertainty (%)	<2
Zero Gas Type	N
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	GE1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	5

Sulphur Dioxide Trend



Sulphur Dioxide Measurement Uncertainty

	Units	Run 1
Measured Quantities		
Certified Range of Analyser	ppm	2.14 to 1000
Operational Range of Analyser	ppm	200
Measured Reading	ppm	125.53
Measured Quantities	**Units**	**Run 1**
Nonlinearity	%	0.8
Temperature Dependent Zero drift	%	0.8
Temperature Dependent Span drift	%	2
Cross-sensitivity	%	1.5
Leak	%	0
Calibration Gas Uncertainty	%	<2 %
Parameter	**Units**	**Run 1**
Combined uncertainty	$mg.m^{-3}$	4.98
Expanded uncertainty	$mg.m^{-3}$	9.96
Uncertainty corrected to std conds.	$mg.m^{-3}$	23.61
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	-
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	23.61
Expanded uncertainty expressed with a level of confidence of 95%	% of value	6.57
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Total Volatile Organic Carbon (Tube) Sampling details

Sampling Details	**Run 1**	
Stack ID	GE1	
	Tube	
Leak Check Results		
Prior to test:	0.001	l/min
Post Test:	0.001	l/min
Sample Volume Flow Rate:	0.2968	l/min
Standard Requirement:	<2	%
Test Result:	0.336927	%
Test Status	Pass	
Calibration Details		
Pump Number:	ASLTM12EQ503	
Calibration Unit:	ASLTM12EQ508	
Calibration Rate Before Test:	0.2968	l/min
Calibration Rate After Test:	0.2968	l/min
Average sample Volume:	0.2968	l/min
Sample Test Time:	33	Min.
Pump Gas Temperature:	21	^{O}C
Pump Sample Pressure:	99.2	kPa
Actual Sample Volume:	0.00979	m^3
Normalised Gas Volume:	0.01075	m^3

Air Scientific

Total Volatile Organic Carbon (Tube) Quality Assurance

Site Name	-	-
Stack ID	GE1	-
Date	27/01/2016	**Run 1**
Start time	-	14:45:00
Finish Time	-	15:18:00
	Units	**Run 1**
Leak test results		
Mean Sampling Rate	l/min	0.2968
Pre-sampling leak rate	l/min	0.001
Post-sampling leak rate	l/min	0.001
Leak rate	l/min	0.33692722
Acceptable leak rate (<2%)	Y/N	Y
Filtration		
Filter Material	-	N/A
Filter Size	mm	N/A
Max. Filter Temp	degrees	N/A
Absorbers Type	Glass/PTFE/ Other	226-09
Blank sample	-	
Blank sample ID	mg/m^3	5817110101
Blank result	<10% ELV (Y/N)	0.0008
Acceptable Blank	-	Y

Total Volatile Organic Carbon (Tube) Results and Measurement Uncertainty

Sampling Details		Run 1
Stack ID	GE1	
Date	-	
Start time	14:45:00	
Finish Time	15:18:00	
Results		
Laboratory Result	16	µg
Sample Volume	0.010751	m^3
Emissions Concentration	1.488197	$mg.m^{-3}$
Mass Emission	0.003	$kg.h^{-1}$

Parameter	Units	Run 1
Combined Uncertainty	$mg.m^{-3}$	0.17
Expanded uncertainty as percentage of measured value	% of measured value	22.70
Expanded uncertainty in units of measurement	$mg.m^{-3}$	0.34
Expanded uncertainty as percentage of limit value	% Of ELV	1.69

Title:	**Determination of Speciated Organic Compounds**			
Method:	EN 13649			
Client:	Cork City Council			
Log Sheet Complete by:	Brian Sheridan			
Test Date:	27/01/2016			
Laboratory Used:	UKAS1549			
Certificate Numbers:	544169			
Stack Reference:	GE1			
Leak Check Results				
Prior to test:	0.001	l/min		
Post Test:	0.001	l/min		
Sample Volume Flow Rate:	0.2968	l/min		
Standard Requirement:	<2	%		
Test Result:	0.336927224	%		
Test Status	Pass			
Calibration Details				
Pump Number:	ASLTM12EQ503			
Calibration Unit:	ASLTM12EQ508			
Calibration Rate Before Test:	0.2968	l/min		
Calibration Rate After Test:	0.2968	l/min		

Average sample Volume:	0.2968	l/min		
Sample Test Time:	33	minutes		
Pump Gas Temperature:	21	^{o}C		
Pump Sample Pressure:	99.2	kPa		
Actual Sample Volume:	0.00979	m^3		
Normalised Gas Volume:	0.01075	Nm^3		
Tube Details				
Tube Type:	226-09			
Tube Identification Number:	5817110105			
Blank Identification Number:	5817110101			
Test Details				
Adsorption Tube Temperature:	21	^{o}C		
Max Temperature Allowable:	40	^{o}C		
Stack Flow Rates				
Diameter:	0.35	m		
Average Velocity:	14.91	m/s		
Average Temperature:	426	^{o}C		
Average Pressure:	99.3	kPa		
Actual Flow Rate:	5018	m^3/Hr		
Normalised Flow Rate:	1751	Nm^3/Hr		
Speciated Organic Results				
Results	***µg/tube***	***mg/Nm3***	***kg/hr***	
VOC's (excluding targets)	16	1.49	0.0026	
Total	***1.49***	***mg/Nm3***	***0.002606***	***kg/Hr***

PRTR Table 2015

	Carbon Monoxide (CO) (kg/yr)	Carbon dioxide (CO_2) (kg/yr)	Nitrogen Oxides (NO_x as NO_2) (kg/yr)	TNMVOC's (kg/yr)	Sulphur dioxide (SO_2) (kg/yr)	Total particulates (kg/yr)	Methane (kg/yr)
Flare	39	917,527	562	--	122	-	25
Engine	10,231	2,692,918	3,798	23	5,456	170	9,569

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W0012-03-VOC/SURFACEEMISSIONS/2016/1 LANDFILL GAS SURFACE EMISSIONS SURVEY AT KINSALE ROAD LANDFILL FACILITY, BALLYPHEHANE, CURRAGHCONWAY, INCHISARSFIELD, SOUTH CITY LINK ROAD, CORK., CORK.

PERFORMED BY ODOUR MONITORING IRELAND ON BEHALF OF CORK CITY COUNCIL

PREPARED BY:	Dr. John Casey
ATTENTION:	Mr. Kevin Ryan
LICENCE NUMBER:	W0012-3
LICENCE HOLDER:	Cork City Council
FACILITY NAME:	Kinsale Landfill Facility
DATE OF MONITORING VISIT:	27/01/2016
NAME AND ADDRESS OF CLIENT ORGANISATION:	Kinsale Road landfill facility, Ballyphehane, Curraghconway, Inchisarsfield, South City Link Road, Cork., Cork
NAME AND ADDRESS OF MONITORING ORGANISATION:	Odour Monitoring Ireland, Unit 32 DeGranville Court, Dublin Road, Trim, Co. Meath
DATE OF REPORTING:	11/02/2016
NAME AND THE FUNCTION OF THE PERSON APPROVING THE REPORT:	Dr. Brian Sheridan, Managing Partner, Odour Monitoring Ireland
REPORT NUMBER:	2016034(1)
REVIEWERS:	

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DOCUMENT AMENDMENT RECORD

Client: ***Cork City Council***

Title: W0012-03-VOC/SurfaceEmissions/2016/1 Landfill Gas Surface emissions Survey at Kinsale Road landfill facility, Ballyphehane, Curraghconway, Inchisarsfield, South City Link Road, Cork., Cork.

Project Number: 2016034			**Document Reference:** W0012-03-VOC/SurfaceEmissions/2016/1		
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Revision	**Purpose/Description**	**Originated**	**Checked**	**Authorised**	**Date**

Executive Summary

Cork City Council commissioned Odour Monitoring Ireland to perform a landfill gas surface emissions survey of Kinsale Road landfill facility (i.e. Waste licence number 12-03) in order to ascertain any likely sources of landfill gas surface emissions from the landfill site. Landfill gas surface emissions are the predominant source of odour emissions from landfills in Ireland. The survey was carried out on the 27th Jan. 2016.

The site including former landfill areas occupies approximately 72 Ha. The acceptance of waste ceased on the 15th July 2009.

During the surface emissions survey, the following tasks were performed on site:

1. Identification the key mechanisms that lead to the release of landfill gas surface emissions from the site.
2. Identify geographically on a site map, the locations of landfill gas surface emissions in order to perform remediation of the identified surface emissions areas.

The following conclusions were drawn from survey:

- No zones of surface emissions were identified within the landfill facility that exceeded recommended trigger levels.
- Two zones of surface emissions were identified within the landfill facility that exceeded recommended trigger levels on the 20/05/2015.

1. Introduction

1.1. Background to work

Odour Monitoring Ireland was commissioned by Cork City Council to perform a specified independent Volatile organic compound surface emissions survey at Kinsale Road landfill facility. The assessment involved a Volatile organic compound (VOC) surface emissions survey of the landfill facility in order to ascertain the VOC emission points and mark them upon a map for remediation. This report presents a summary of the findings of a VOC surface emissions survey at Kinsale Road landfill facility, Ballyphehane, Curraghconway, Inchisarsfield, South City Link Road, Cork. The report is based on scientific measurements and observations made during a site visit conducted on the 27th Jan. 2016.

1.2. Scope of work

The main aims of the survey included:

- Surface emissions monitoring in accordance with AG6 requirements.
- Discussion meeting with landfill manager once survey was complete in order to communicate main surface emissions areas for immediate remediation, where necessary.
- Identification of short-term mitigation measured to be implemented within the landfill site to reduce surface emissions,

2. Techniques used

This section describes the techniques used throughout the study. The surface emissions surveying and reporting was performed by Dr. John Casey, Odour Monitoring Ireland. Dr. John Casey has preformed surface emissions monitoring survey's on behalf of Odour Monitoring Ireland for regulatory bodies in Ireland and Northern Ireland, local authorities in Ireland, private waste operators in Ireland and borough councils in Northern Ireland. A full documented list of previous survey's is available upon request.

2.1. "Odour hog" monitoring within the landfill

The "Odour hog" (i.e. Version 2, 4 years old with less than 3.5 second response time for the FID) VOC analyser is a portable, intrinsically safe, survey VOC dual monitor, which provides fast and accurate readings of organic and inorganic vapours. A Photo ionisation detector (PID) uses an Ultraviolet (UV) light source (*photo*) to ionise a gas sample and detect its concentration. Ionisation occurs when a molecule absorbs the high energy UV light, ejecting a negatively charged electron and forming of positively charged molecular ion. The gas becomes electrically charged. These charged particles produce a current that is easily measured at the sensor electrodes. Only a small fraction of the VOC molecules are ionised. A PID does not respond to methane. A FID is similar to a flame thermocouple detector, but measures the ions from the flame instead of the heat generated. The FID detects the methane fraction, which provides greater sensitivity in terms of methane surface emissions detection but not necessarily odour hence why the PID data is also interpreted. The FID/PID analyser was calibrated with certified reference material isobutylene and methane before commencement of the survey, see calibration certificates for gases used in Appendix II. The calibration readings were rechecked in accordance with AG6 requirements.

Using the continuous kinematic "Odour hog" with integrated GPS (i.e Magellan Professional with sub centimetre accuracy post processed), the capping of the landfill was surveyed for potential surface emissions areas. Those areas identified were geo-referenced and highlighted for remediation. This technique is useful for comparison in surface emissions area within the same landfill facility on different surveys. The surface emissions maps generated for the particular facility can be used to assess the effectiveness of implemented mitigation techniques and to qualitatively assess the nature of surface emissions from the facility. All surface emissions surveying was carried out in accordance with *"Surface VOC Emissions Monitoring on Landfill Facilities (AG6)".*

Efforts should be made to attain surface emissions <100 ppm from open surfaces and <500 ppm around features such as vertical wells, leachate collection sumps, leachate slope risers and other projections out of the waste body (Casey et al., 2008). These are minimum standards, which should lead to greater landfill collection efficiencies thus reducing the impact on the general environment.

2.2. Meteorological conditions

Table 2.1 illustrates the predominant wind direction during the monitoring exercise. The meteorological conditions were characterised for the day of monitoring and were as follows:

Table 2.1. Meteorological conditions during TVOC survey.

27th Jan. 2016	
Average wind speed 2 m s^{-1}	Wind direction northerly
Temperature 8^0C	1009 mbar
Dry weather	Capping moisture content high
Relative Humidity --%	Cloud cover -- Okta

During the TVOC and gas field survey, wind deviated from a southerly direction. Capping moisture content was low.

2.3 Current landfill gas collection infrastructure on the facility

There is a total of 4 vertical deep borehole wells (pumps to be installed in latter part 2012), 10 periphery pumping stations and 46 gravity condensate / leachate removal devices on the facility. There are 2 no. installed and operational landfill gas enclosed flares (1,250 m^3/hr (Duty), & 2,500 m^3/hr (Duty) capacity. In addition there is a landfill gas utilisation engine on the facility. At the time of the survey the engine was in operation. The central dome of the site (20 ha) is capped (*see Figure 6.1*).

3. Results

3.1. Volatile organic compound surface emissions locations identified within Kinsale Road landfill facility

Figure 6.2 and Table 3.1 illustrates the results obtained for the capping surface emissions survey. There were no surface emissions zones identified.

Table 3.1. Capping VOC surface emissions locations results with source identities correlating with *Figure 6.2 (see Appendix I)*.

Location ID	Easting (m)	Northing (m)	Max VOC conc. (ppm)	Identification and Mitigation	Recommended trigger levels
--	--	--	--	--	--

There were no sources of landfill gas surface emissions identified (*see Figures 6.2 and Table 3.1*) within the landfill.

3.2. Close out meeting with landfill manager

Following completion of the surface emissions survey, the surface emissions team and the landfill manager discussed all aspects and general conclusions of the survey. The landfill manager was informed of the potential areas of surface emissions.

4. Conclusions

The following conclusions were drawn from the survey of Kinsale Road Landfill facility:

- The surface emissions contour map generated from the kinematic Volatile organic compound (VOC) survey illustrated surface areas of landfill gas emissions.
- There were 0 surface emissions zones greater than or equal to 500 ppm around identified features. There was 0 surface emissions zone greater than or equal to 100 ppm instantaneous reading on open surfaces within the landfill footprint.

5. References

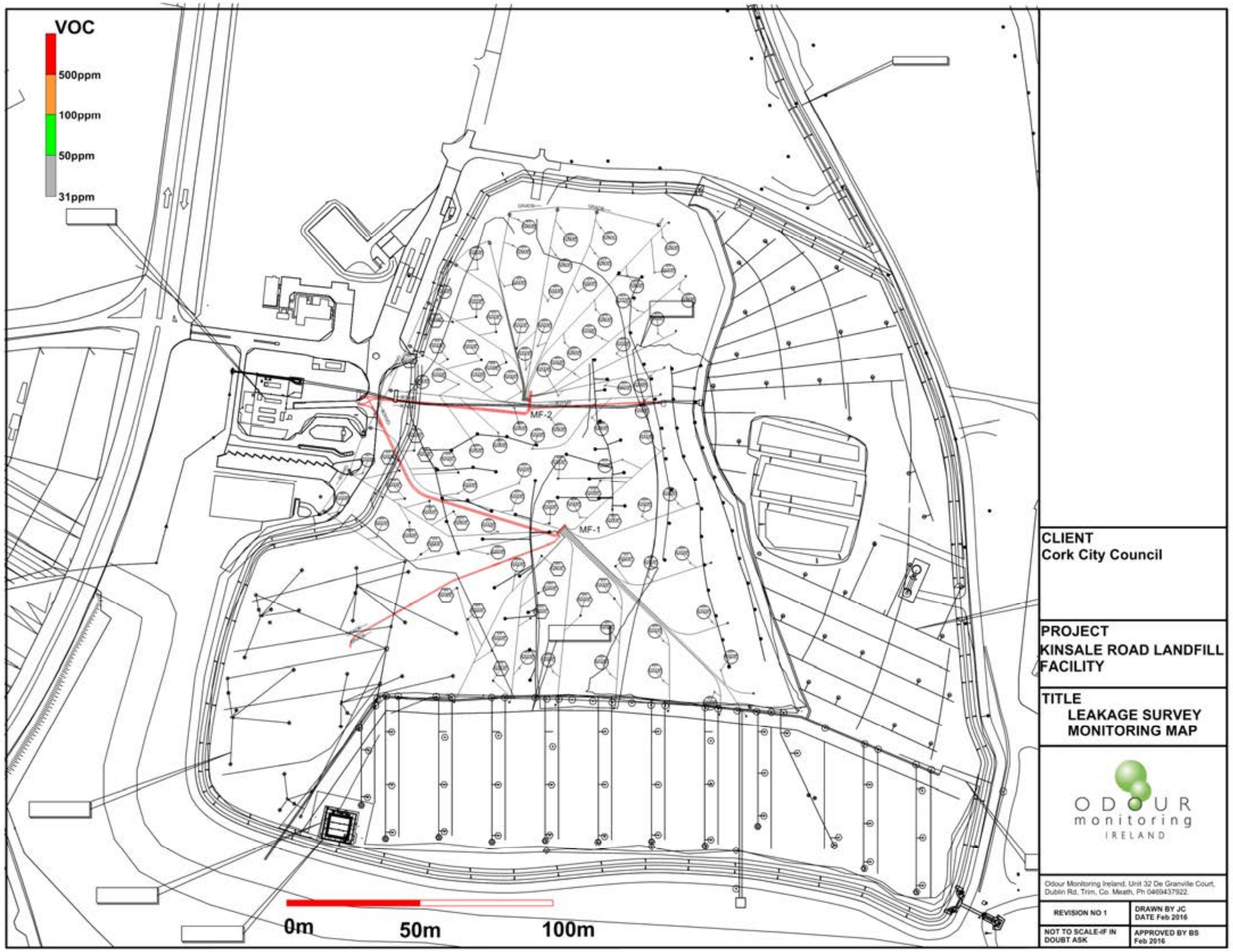
- Casey, J.W., Sheridan, B.A., Henry, M., Reynolds, K., (2008). Effective tools for managing odours from landfill facilities. International Conference on Environmental Odour Monitoring and Control**,** Rome, Italy, July 6-8, 2008**.**

6. *Appendix I*- Volatile organic compound surface emissions contour map & Cell capping outline & LFG infrastructure map

Figure 6.1. Cell capping outline & LFG infrastructure on the facility.


Permanent Cap & Survey Area
MF-2
MF-1
0m
50m
100m
CLIENT
Cork City Council
PROJECT
KINSALE ROAD LANDFILL FACILITY
TITLE
CAPPING OUTLINE
ODOUR monitoring IRELAND
Odour Monitoring Ireland, Unit 32 De Granville Court, Dublin Rd, Trim, Co. Meath, Ph 0469437922.
REVISION NO 1
DRAWN BY JC
DATE Oct. 2013
NOT TO SCALE-IF IN DOUBT ASK
APPROVED BY BS
Oct. 2013

Figure 6.2. Landfill gas surface emissions monitoring within the landfill facility (colour scale area indicating TVOC gas colour scale).


VOC
500ppm
100ppm
50ppm
31ppm
MF-2
MF-1
0m
50m
100m
CLIENT
Cork City Council
PROJECT
KINSALE ROAD LANDFILL FACILITY
TITLE
LEAKAGE SURVEY
MONITORING MAP
ODOUR monitoring IRELAND
Odour Monitoring Ireland, Unit 32 De Granville Court, Dublin Rd, Trim, Co. Meath, Ph 0469437922.
REVISION NO 1
DRAWN BY JC
DATE Feb 2016
NOT TO SCALE-IF IN DOUBT ASK
APPROVED BY BS
Feb 2016

7. *Appendix II*-Calibration certificates and procedures.

7.1 Span & Calibration procedure

Necessary Calibration gases: Zero gas (0ppm), 100ppm and 500ppm methane (Calibration certificates below).

Calibration is carried out in accordance with manufacturers guidelines.

Location: Zero span instrument onsite.

Frequency: Before, midway through, and after the surface emissions survey, typically therefore at 3-4 hour intervals. If the survey only lasts 2 to 3 hours the instrument is checked before and after the event.

Instrument settling: The FID is switched on and left to settle for a period of 30 minutes minimum.

Span Procedure: The zero and span gases shall be introduced under the same flow and pressure conditions using the sample probe at the end of the sample line. The adjustment procedure shall be as follows:

a) Feed the zero gas (0ppm) into the FID and set the zero;

b) Feed the span gas (100ppm) and adjust the instrument accordingly;

c) Feed the zero gas into the FID once more and check that the reading returns to zero; if not repeat steps a) to c).

d) repeat procedure A to C to verify

Equipment is maintained and operated as specified by the manufacturer.

Scientific & Technical
Gases Ltd

Certificate of Composition 1975-6-1

Order No E-MAIL Cylinder No Customer ODOUR MONITORING I

Cylinder Valve C10 Our Ref 29485 Cylinder Size 112DA Nett Wt

(Kg) 0.12 Gross Wt (Kg) 1.2

Component Requested Value Certified Value

METHANE 500PPM 500PPM AIR (ZERO GRADE) BALANCE BALANCE

Pressure 1000PSI Volume 112LTR

Please note all units are in *MOL%* and accuracy is +/-2%. Relative mixtures traceable to standards calibrated at the National Physics Labratory, Teddington, Middlesex, England

Certified by S. Banks UN NO 1956 Date 13/03/2014

Scientific & Technical
Gases Ltd

Certificate of Composition 19585-1-1

Order No E-MAIL Cylinder No Customer ODOUR MONITORING I Cylinder Valve C10 Our Ref 29485 Cylinder Size 112DA Nett Wt (Kg) 0.12 Gross Wt (Kg) 1.2

Component Requested Value Certified Value

AIR ZERO GRADE ZERO GRADE

Pressure 1000PSI Volume 1000PSI

Please note all units are in *MOL%* and accuracy is +/-2%. Relative mixtures traceable to standards calibrated at the National Physics Labratory, Teddington, Middlesex, England

Certified by S. Banks UN NO 1002 Date 13/03/2014

Scientific & Technical
Gases Ltd

Certificate of Composition 19185-5-1

Order No E-MAIL Cylinder No Customer ODOUR MONITORING I

Cylinder Valve C10 Our Ref 29485 Cylinder Size 112DA Nett Wt

(Kg) 0.12 Gross Wt (Kg) 1.2

Component Requested Value Certified Value

METHANE 100PPM 100PPM AIR (ZERO GRADE) BALANCE BALANCE

Pressure 1000PSI Volume 112LTR

Please note all units are in *MOL%* and accuracy is +/-2%. Relative mixtures traceable to standards calibrated at the National Physics Labratory, Teddington, Middlesex, England

Certified by S. Banks UN NO 1956 Date 14/03/2014

Meteorological Data for Kinsale Road Landfill Site - 2015

Station Name:	Cork Airport
Distance from Site:	4 KM
Station Height:	155 m
Latitude:	51.850
Longitude:	-8.480

Abbreviations

	Detail	Unit
maxtp:	Maximum Air Temperature	(*C)
mintp:	Minimum Air Temperature	(*C)
mnmax:	Mean Maximum Temperature	(*C)
mnmin:	Mean Minimum Temperature	(*C)
rain:	Precipitation Amount	(mm)
gmin:	Grass Minimum Temperature	(*C)
wdsp:	Mean Wind Speed	(knot)
mxgt:	Highest Gust	(knot)
sun:	Sunshine duration	(hours)

year	month	maxtp	mintp	mnmax	mnmin	rain	gmin	wdsp	maxgt	sun
2015	1	13.8	-2.5	8.4	2.3	117.1	-8.2	11.9	57	70.4
2015	2	13.6	-2.4	7.7	1.8	52.4	-6	9.5	47	81.3
2015	3	14	-1.8	10	3	88.8	-7.1	10.7	46	134.7
2015	4	16.4	0.5	12.8	4.8	16	-4.5	9.1	44	223.7
2015	5	18.5	3.1	13.7	6.5	137.3	-0.8	10.4	39	156.1
2015	6	21.5	4.2	16.9	9.1	54.3	-1	9.1	44	188.3
2015	7	20.7	7.6	17	10.5	158.8	2.6	9.7	37	145.3
2015	8	20.9	7.4	17.2	10.3	101.1	2	8.6	38	155.9
2015	9	18.1	7.1	15.5	9.5	97.6	2.8	8.7	30	115.6
2015	10	16.4	3.5	13.7	8.3	82.5	-1.4	8.3	39	81.7
2015	11	14.9	1.1	12.2	6.7	139.3	-1.5	12.4	53	47.3
2015	12	12.9	-0.9	11	5.5	402.2	-3.2	14.8	56	24.3