

Our Ref: CW/JK/JN1112  
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21<sup>st</sup> May 2018

Thetford Town Council  
**King's House**  
King Street  
Thetford  
Norfolk  
IP24 2AT

For the attention of Sarah Lewis

Dear Madam

Re: Quarterly Groundwater Monitoring at Thetford Cemetery, *London Road, Thetford*  
National Grid Reference: TL 862 825  
Geology: Lewes Nodular Chalk Formation (possible River Terrace Deposits)

### 1 Authority

Our authority for carrying out this work is contained in a completed project order form from Sarah Lewis, of Thetford Town Council, dated 23<sup>rd</sup> April 2018.

### 2 Background and Objectives

The purpose of this investigation was to continue and report on the ongoing quarterly monitoring of the groundwater depth at Thetford Cemetery, along with some limited chemical analysis and interpretation of the results. A previous report completed by Ground Technology dated August 2017 (ref: GTS-15-713), has been provided by the client for reference and to provide some background data to the project. The monitoring wells installed as part of that investigation are being used in this assessment.

### 3 Scope

This letter report presents our findings and test results and our interpretation of these data.

Wider contamination or geotechnical issues are not considered in this report.

The findings and opinions conveyed via this Site Investigation Report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Limited believes are reliable. Nevertheless, Southern Testing Laboratories Limited cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.



The site investigation was conducted and this report has been prepared for the sole internal use and reliance of Thetford Town Council and their appointed Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorization of Southern Testing Laboratories Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

Recommendations contained in this report may not be appropriate to alternative development schemes.

#### 4 Site Details

The site is located in the south-west of Thetford, approximately 1km from the town centre. The site is located within a mainly residential area, and consists of the Thetford Cemetery. The site is bounded to the north by London Road, with allotments bounding to the south-west. The remaining boundaries are made up of residential properties and associated gardens. The topography of the site is that it gently rises to the south, away from London Road.

#### 5 Groundwater monitoring

The site was visited on 4<sup>th</sup> May 2018. Prior to the sampling of each borehole, the water level was recorded, and the borehole purged of water. The borehole was allowed to recharge prior to the collection of the water sample using a dedicated bailer.

The results from the first monitoring visit are as follows:

Borehole ID	Depth of well (m bgl)	Top of Well (mOD)	Depth to groundwater (m bgl)	Depth to groundwater (m OD)	Sampling Method	Sample Colour
BH01	23.2	26.10	16	10.10	Bailer + Pipe	Pale, chalky
BH02	23.35	25.01	14.9	10.11	Bailer + Pipe	Chalky
BH03	18.7	20.99	10.94	10.05	Bailer + Pipe	Clear to light brown
BH04	19.85	20.46	10.40	10.06	Bailer + Pipe	Pale, chalky
BH05	19.7	20.01	10.0	10.01	Bailer + Pipe	Orange
BH06	25.4	25.06	15.0	10.06	Bailer + Pipe	Chalky

## 6 Chemical Testing

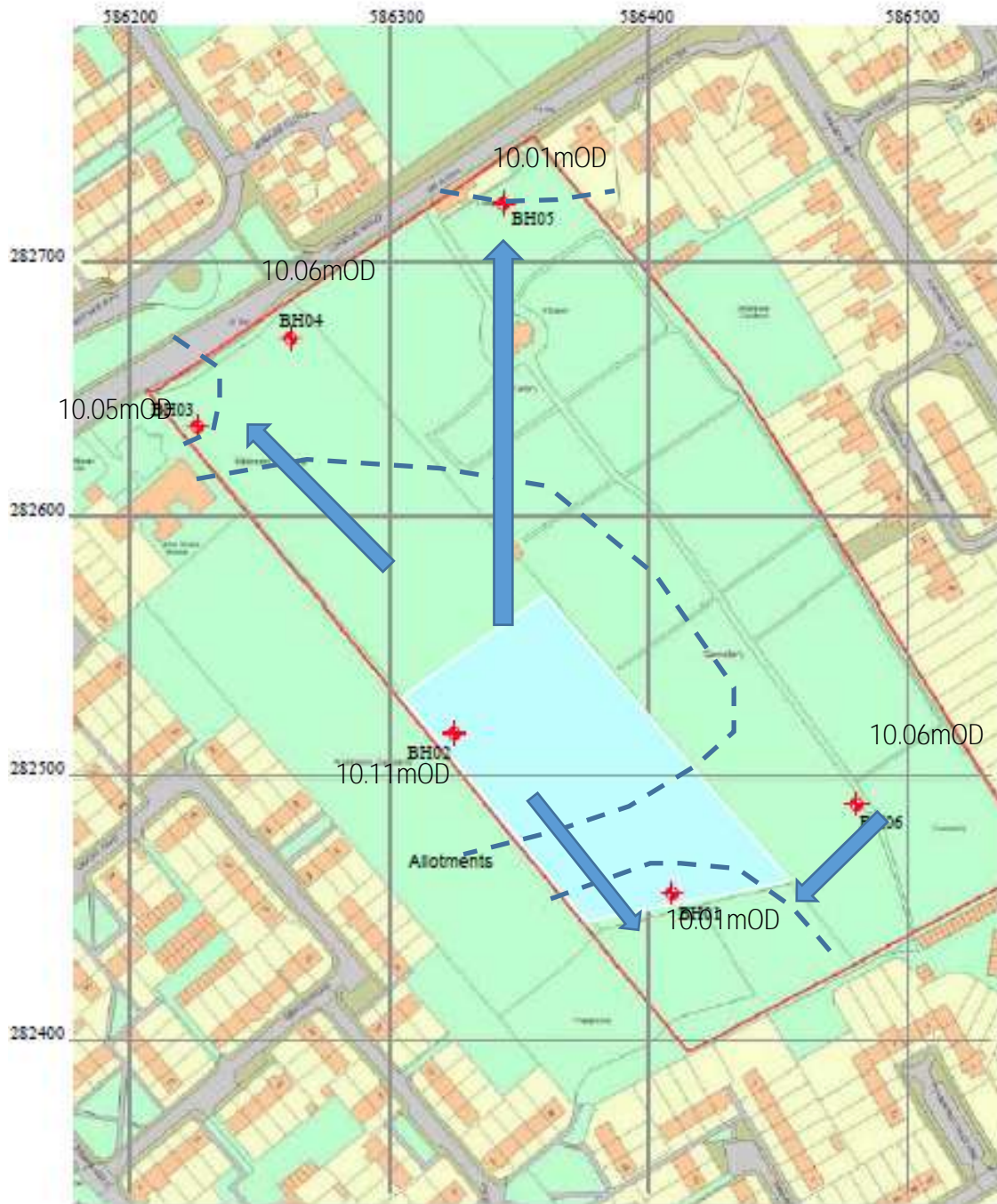
Based upon the previous report provided, a groundwater sample from each borehole sample was analysed for the following suite: Nitrate, Ammonia, pH, Chloride, Total Organic Carbon, Chemical Oxygen Demand, Calcium, Potassium and Iron. The results from the first visit are attached for reference.

With reference to the report provided, the results from BH01 are to be taken as a baseline for the site.

In summary, the pH results for the six samples analysed were in the range reported by Ground Technology last year (ref: GTS-15-713). Relative to the baseline, the remainder of the results indicated, at times, elevated concentrations of ammonia (especially BH03 210µg/l and BH04 150 µg/l) and nitrate (BH02 23.3mg/l and BH04 24.3mg/l) although, in the absence of additional data, further interpretation or discussion is not feasible at this time.

## 7 Groundwater Flow Direction

Based upon the groundwater data collected on the 4<sup>th</sup> May 2018, the following limited interpretation of the groundwater can be ascertained.



In general, the groundwater appears to be flowing in a northern, and south-eastern direction. The previous report (Ground Technology dated August 2017 - ref: GTS-15-713), also noted a flow towards the north-west, at times, although some variations within this were also recorded.

## 8 Discussion and Conclusions

Based upon the monitoring undertaken and the test results to date, it can be concluded that the underlying groundwater appears to be flowing towards the northern and south-eastern corners of the site. Whilst the chemical analysis indicated some elevated concentrations of nitrate and ammonia, within certain boreholes, relative to the baseline reported in BH101.

It is understood that quarterly monitoring is to be undertaken, which will increase the volume of data available for interpretation.

If you have any queries or we can be of further assistance, please do not hesitate to contact us

Yours faithfully,



Callum Ward BSc FGS  
For and on behalf of  
Southern Testing Laboratories Limited  
DDI: 01604 500022  
Email: [cward@stconsult.co.uk](mailto:cward@stconsult.co.uk)

## Groundwater Monitoring Sheet –

Job: JN1112 Thetford Cemetery

Date: 04/05/2018

Borehole ID	Time of level	Depth of well (m bgl)	Top of Well (mOD)	Depth to groundwater (m bgl)	Depth to groundwater (m OD)	Volume Purged	Time of sample	Sample ID	Sampling Method	Sample Colour
BH01	12:40	23.2	26.10	16	10.10	7m	13:10	BH01	Bailer + Pipe	Pale, chalky
BH02	12:00	23.35	25.01	14.9	10.11	9m	12:30	BH02	Bailer + Pipe	Chalky
BH03	10:40	18.7	20.99	10.94	10.05	8m	11:00	BH03	Bailer + Pipe	Clear to light brown
BH04	11:30	19.85	20.46	10.40	10.06	9m	11:50	BH04	Bailer + Pipe	Pale, chalky
BH05	10:05	19.7	20.01	10.0	10.01	9m	10:15	BH05	Bailer + Pipe	Orange
BH06	13:20	25.4	25.06	15.0	10.06	10m	13:40	BH06	Bailer + Pipe	Chalky



**Callum Ward**

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**Analytical Report Number : 18-84507**

<b>Project / Site name:</b>	London Road, Thetford	<b>Samples received on:</b>	08/05/2018
<b>Your job number:</b>	JN1112	<b>Samples instructed on:</b>	08/05/2018
<b>Your order number:</b>		<b>Analysis completed by:</b>	14/05/2018
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	14/05/2018
<b>Samples Analysed:</b>	6 water samples		

**Signed:**

Jordan Hill  
Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Analytical Report Number: 18-84507

Project / Site name: London Road, Thetford

Lab Sample Number	955995				955996	955997	955998	955999
Sample Reference	BH1				BH2	BH3	BH4	BH5
Sample Number	None Supplied				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	None Supplied				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled	Deviating				Deviating	Deviating	Deviating	Deviating
Time Taken	None Supplied				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

**General Inorganics**

	pH Units	N/A	ISO 17025	7.4	7.3	7.2	7.3	7.4
pH								
Chloride	mg/l	0.15	ISO 17025	45	35	18	31	11
Ammonia as NH <sub>3</sub>	µg/l	15	ISO 17025	< 15	50	210	150	43
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	1.95	2.54	5.79	3.78	3.82
Nitrate as N	mg/l	0.01	ISO 17025	16.3	23.3	9.12	24.3	5.16
Chemical Oxygen Demand (Total)	mg/l	2	ISO 17025	19	33	97	390	390

**Heavy Metals / Metalloids**

	mg/l	0.012	ISO 17025	110	130	130	140	59
Calcium (dissolved)								
Iron (dissolved)	mg/l	0.004	ISO 17025	0.012	< 0.004	0.20	0.048	0.24
Potassium (dissolved)	mg/l	0.025	ISO 17025	2.7	1.8	8.9	6.5	0.95

U/S = Unsuitable Sample I/S = Insufficient Sample





Analytical Report Number: 18-84507

Project / Site name: London Road, Thetford

<b>Lab Sample Number</b>				956000				
<b>Sample Reference</b>				BH6				
<b>Sample Number</b>				None Supplied				
<b>Depth (m)</b>				None Supplied				
<b>Date Sampled</b>				Deviating				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Water Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					

**General Inorganics**

pH	pH Units	N/A	ISO 17025	7.4				
Chloride	mg/l	0.15	ISO 17025	46				
Ammonia as NH <sub>3</sub>	µg/l	15	ISO 17025	< 15				
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	2.25				
Nitrate as N	mg/l	0.01	ISO 17025	15.4				
Chemical Oxygen Demand (Total)	mg/l	2	ISO 17025	16				

**Heavy Metals / Metalloids**

Calcium (dissolved)	mg/l	0.012	ISO 17025	100				
Iron (dissolved)	mg/l	0.004	ISO 17025	0.011				
Potassium (dissolved)	mg/l	0.025	ISO 17025	2.3				

U/S = Unsuitable Sample I/S = Insufficient Sample



**Analytical Report Number : 18-84507**

**Project / Site name: London Road, Thetford**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)**

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Ammonia as NH <sub>3</sub> in water	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Chemical Oxygen Demand in Water (Total)	Determination of total COD in water by reflux oxidation with acidified K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> followed by colorimetry. Accredited matrices: SW, PW, GW.	HACH DR/890 Colorimeter Procedures Manual (48470-22) (Ref 0170.2)	L065-PL	W	ISO 17025
Chloride in water	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260. Accredited matrices: SW, PW, GW.	L082-PL	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Nitrate as N in water	Determination of nitrate by reaction with sodium salicylate and colorimetry. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	W	ISO 17025
Total organic carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR analyser. Accredited matrices: SW PW GW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	ISO 17025

**For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.**

**For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.**

**Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**

## Sample Deviation Report



Sample ID	Other ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
BH1		W	18-84507	955995	ad	Ammonia as NH3 in water	L082-PL	d
BH1		W	18-84507	955995	ad	Ammoniacal Nitrogen as N in water	L082-PL	d
BH2		W	18-84507	955996	ad	Ammonia as NH3 in water	L082-PL	d
BH2		W	18-84507	955996	ad	Ammoniacal Nitrogen as N in water	L082-PL	d
BH3		W	18-84507	955997	ad	Ammonia as NH3 in water	L082-PL	d
BH3		W	18-84507	955997	ad	Ammoniacal Nitrogen as N in water	L082-PL	d
BH4		W	18-84507	955998	ad	Ammonia as NH3 in water	L082-PL	d
BH4		W	18-84507	955998	ad	Ammoniacal Nitrogen as N in water	L082-PL	d
BH5		W	18-84507	955999	ad	Ammonia as NH3 in water	L082-PL	d
BH5		W	18-84507	955999	ad	Ammoniacal Nitrogen as N in water	L082-PL	d
BH6		W	18-84507	956000	ad	Ammonia as NH3 in water	L082-PL	d
BH6		W	18-84507	956000	ad	Ammoniacal Nitrogen as N in water	L082-PL	d