



Immingham Green Energy Terminal

TR030008

Volume 6

6.4 Environmental Statement Appendices
Appendix 18.C: Water Quality Sampling 2023

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed
Forms and Procedure) Regulations 2009 (as
amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning
(Applications: Prescribed Forms and
Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.4 Environmental Statement Appendices

Appendix 18.C: Water Quality Sampling 2023

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1 Water Quality Sampling 2023

1.1. Introduction

- 1.1.1. Two rounds of water quality sampling were undertaken on 31st March 2023 and 18 May 2023 to provide baseline watercourse quality for the two drains that flow to the east and west boundaries of the Site for the Project. These results provided confirmation of water quality conditions currently in the two watercourses nearest to the Site; Habrough Marsh Drain (SW1 & 2) and North Beck Drain (SW3).
- 1.1.2. The sampling was undertaken to better understand baseline conditions in support of **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**. The Project has the potential to impact watercourses and so there is a need to understand baseline environment given that there is no Environment Agency (“EA”) data for Habrough Marsh Drain and some EA data to 2019 for North Beck Drain.
- 1.1.3. It has been reported by the EA that both watercourses have been affected by historical pollution incidents. The surrounding land-use is dominated by large heavy industrial areas (including refineries, power stations and ports) around the town of Immingham. This is mixed with interspersed pockets of flat open farmland, woodland, and natural coastal habitats. The site is within the tidal limit of the Humber estuary, so two samples were required to be undertaken at high and low tides due to the tidal influence of the River Humber.

1.2. Methodology

- 1.2.1. The works undertaken on site;
 - a. Two AECOM employees arrived on site and collected water samples for laboratory analysis.
 - b. Water samples were collected using a swing sampler (1-2m) length from the river.
 - c. Water samples were collected using a weighted 12L bucket and rope from bridge where the sampler could not safely reach.
 - d. Water samples were analysed on site using a multiparameter sonde.
 - e. Equipment was sanitised and cleaned to avoid cross-contamination between sampling locations using Virkon S.
 - f. Collected water samples were put into containers and taken back with employees to be analysed by a UKAS accredited laboratory.

Plate 1: Water quality sampling locations shown by yellow circles



1.3. Results

- 1.3.1. Two rounds of sampling were undertaken; the first round of sampling were collected between 09:00 and 11:30 on the 31 March 2023 on an outgoing tide (3.5m – 4.5m above chart datum (“ACD”)) and the second round of sampling was also collected between 09:00 and 11:30 on 18 May 2023 on an incoming tide (1.5m – 3m ACD).
- 1.3.2. The samples undertaken under different coastal conditions will provide a comparison to the opposite flow regime and if the tidal influence influences water quality. Since the Humber Estuary is tidal, the water within both the North Beck Drain and Habrough Marsh drain is heavily influenced by the river. Due to the saline influence of the Humber river, the water conditions are be compared to both the freshwater and saltwater Water Framework Directive (“WFD”) guidelines (where available).

Table 1: WFD Assessment of the water quality results taken on 31st of March 2023 and 18 May 2023

	Units	WFD Freshwater Standard 2015	WFD Saltwater Standard 2015	SW1	SW2	SW3	SW1	SW2	SW3
Sampled Date					31 March			18 May	
Sample Code					27786434	27786435	28018759	28018758	28018760
NGR				TA 20679 15370	TA 19948 14978	TA 21315 14966	TA 20679 15370	TA 19948 14978	TA 21315 14966
Weather				Overcast	Overcast	Overcast	Clear skies	Clear skies	Clear skies
Notes				Unable to sample ¹					
Inorganics									
Nitrate as N	mg/l				12.1	8.55	2.38	0.588	4.57
Nitrite as NO ₂	mg/l				0.111	0.15	0.197	0.178	0.203
Phosphate (Ortho as P) (Filtered)	mg/l	0.064			0.093	0.453	0.0852	0.0274	0.354
Alkalinity, Total as CaCO ₃	mg/l				223	243	255	177	268
BOD (Unfiltered) (Biochemical Oxygen Demand)	mg/l	5 (90 th Percentile)			<1	<1	<1	<1	<1
COD (Chemical Oxygen Demand)	mg/l				16.1	14.6	22.7	638	28.2
Electrical conductivity *(lab)	uS/cm				896	914	1070	2400	1260
pH by Meter	pH units	<=9(95 th Percentile)			8.32	8.2	8.28	7.92	8.15
Turbidity	NTU				25.1	8.12	7.32	73.7	13.3
Ammoniacal Nitrogen as N	mg/l	0.6			<0.2	<0.2	0.314	1.3	0.202

¹ SW1 water quality sampling was not possible during the first round, due to access issues as the bridge on ABP land was too high for sample collection using a telescopic sampling pole.

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	Units	WFD Freshwater Standard 2015	WFD Saltwater Standard 2015	SW1	SW2	SW3	SW1	SW2	SW3
Metals									
Dissolved Calcium (Filtered)	mg/l				133	148	140	244	148
Dissolved Arsenic (Filtered)	ug/l	50 long term average	25		0.642	0.796	1.15	2.02	1.26
Dissolved Boron (Filtered)	ug/l				105	75.2	169	1870	202
Dissolved Cadmium (Filtered) (depending on water hardness classes) ²	ug/l	0.25 (Class 5)			<0.08	<0.08	<0.08	0.272	<0.08
Dissolved Copper (Filtered)	ug/l	1 bioavailable	3.76 µg/l dissolved, where DOC ≤1mg		2.58	1.32	2.41	3.53	2.61
Dissolved Iron (Filtered) ³	ug/l	1					0.0367	<0.019	0.0204
Dissolved Lead (Filtered)	ug/l	1.2 (bioavailable)			<0.2	0.264	<0.2	<0.2	0.318
Dissolved Mercury	ug/l	0.07			<0.01	<0.01	<0.01	<0.01	<0.01
Dissolved Nickel	ug/l	4 (bioavailable)			2.12	2.07	1.95	2.42	4.1
Dissolved Selenium (Filtered)	ug/l				<1	<1	<1	<1	<1
Dissolved Zinc (Filtered)	ug/l	10.9	6.8		5.92	6.38	4.24	16.7	10.7
Total Arsenic	ug/l	50	25		<2	<2	<2	3.41	<2
Total Boron	ug/l				117	70.7	176	1900	213

² For cadmium and its compounds (No 6) the EQS values vary depending on the hardness of the water as specified in five class categories (≤ 0.08 ug/l Class 1: < 40 mg CaCO₃/l, 0.08 ug/l Class 2: 40 to < 50 mg CaCO₃/l, 0.09 ug/l Class 3: 50 to < 100 mg CaCO₃/l, 0.15 ug/l Class 4: 100 to < 200 mg CaCO₃/l and 0.25 ug/l Class 5: ≥ 200 mg CaCO₃/l)

³Further analysis was required due to change in river conditions

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	Units	WFD Freshwater Standard 2015	WFD Saltwater Standard 2015	SW1	SW2	SW3	SW1	SW2	SW3
Total Cadmium (depending on water hardness classes)	ug/l	0.25 (Class 5)			<0.5	<0.5	<0.5	<0.5	<0.5
Total Chromium	ug/l	3.4 (Cr VI)			<3	<3	7.62	10.3	12.7
Total Copper	ug/l	1 bioavailable			3.97	2.02	2.37	5.62	3.37
Total Iron ³	ug/l	1					0.45	1.92	0.603
Total Lead	ug/l	1.2 (dissolved = 1.2 bioavailable)			1.63	1.61	<1	6.27	3.15
Total Mercury	ug/l	0.07 (dissolved, 0.07 bioavailable)			<0.02	<0.02	<0.02	<0.02	<0.02
Total Nickel	ug/l	4 (dissolved, 4ug/l bioavailable)			3.3	1.94	2.64	4.29	3.91
Total Phosphorus	ug/l	196			183	333	118	263	468
Total Selenium	ug/l				<1	<1	<1	<1	<1
Total Zinc	ug/l	10.9 (bioavailable)			13.7	7.66	8.05	33.3	22.3
Polycyclic Aromatic Hydrocarbon (PAH) Mass Spectrometry (MS)									
Acenaphthylene	ug/l				<0.005	<0.005	<0.005	<0.005	<0.005
Acenaphthene	ug/l				<0.005	<0.005	<0.005	<0.005	<0.005
Fluorene	ug/l				<0.005	<0.005	<0.005	<0.005	<0.005
Phenanthrene	ug/l				0.0135	0.00639	<0.005	0.012	<0.005
Anthracene	ug/l	0.1			<0.005	<0.005	<0.005	<0.005	<0.005
Fluoranthene	ug/l	0.0063			0.0309	0.0244	0.0124	0.0263	0.0202
Pyrene	ug/l				0.0484	0.0347	<0.005	0.0287	0.0291
Benzo(a)anthracene	ug/l				0.0206	0.013	<0.005	0.0129	<0.005
Chrysene	ug/l				0.0373	0.0243	<0.005	0.0179	<0.005
Benzo(a)pyrene	ug/l	0.00017*			<0.002	0.0212	<0.002	0.0197	<0.002
Indeno(1,2,3- cd)pyrene	ug/l				0.0154	0.0121	<0.005	0.0114	<0.005

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	Units	WFD Freshwater Standard 2015	WFD Saltwater Standard 2015	SW1	SW2	SW3	SW1	SW2	SW3
Dibenzo(a,h)anthracene	ug/l				<0.005	<0.005	<0.005	<0.005	<0.005
PAH 16 Total	ug/l				0.216	0.192	<0.082	0.169	<0.082
Benzo(b)fluoranthene	ug/l	0.017			0.0348	0.0279	<0.005	0.0239	0.0194
Benzo(g,h,i)perylene	Ug/l	0.0082			<0.005	0.014	<0.005	0.0084	<0.005
Benzo(k)fluoranthene	ug/l	0.017			0.0152	0.0143	<0.005	0.0079	<0.005
Napthalene	ug/l				<0.01	<0.01	<0.01	<0.01	<0.01
Non Metals									
Total Organic Carbon	mg/l				6.53	3.9	5.71	<3	5.33
Sulphate as SO4	mg/l	400,000 (ug/l) = 400 mg/l			151	160	210	1250	270
Chloride	mg/l	250,000 ug/l = 200 mg/l			66.2	70.8	105	8280	133
Total Cyanide	mg/l	1ug/l = 0.001 mg/l			<5	<5	<5	<5	<5
EPH (Extractable Petroleum Hydrocarbons)									
EPH (DRO) (C10-C40) (diss.filt)	µg/l				108	107	<100	107	126
EPH Range >C10 - C40 (aq)	µg/l				<100	<100	119	<100	173
Miscellaneous Organics									
Branched PFOS	µg/l				0.0265	0.000906	0.0468	0.0277	0.00214
Linear PFOS (1763-23-1)	µg/l				0.0566	0.00126	0.082	0.049	0.00303
PFOA (335-67-1) (Perfluorooctanoic acid)	µg/l				0.00748	0.00198	0.0114	>0.0065	0.00353
Total PFOS (Perfluorooctane sulfonic acid)	µg/l	36			0.0831	0.00216	0.129	0.0767	0.00517
Aliphatics >C16-C35 Aqueous	µg/l				<10	<10	<10	<10	<10

- 1.3.3. Both sites monitored were weakly alkaline with high electrical conductivity. Biochemical oxygen demand (“BOD”) is below limits of detection, while nutrients such as nitrate and phosphate are somewhat elevated.
- 1.3.4. Both the Habrough Marsh Drain and North Beck Drain are currently failing to meet good Environmental Quality Standards (“EQS”) based on the Water Framework Directive (Standards and Classification Directions (England and Wales) 2015. There are currently failures against freshwater standards for phosphate (Ortho as P), dissolved copper, total copper, total lead, fluoranthene, and total zinc for only SW2. The status of all other priority substances, priority hazardous substances, specific pollutants and other pollutants are either good, or have not been assessed. However, the relevant substances and pollutants remains below the WFD Standard 2015 for saltwater. The lack of data from SW1 for the first round of monitoring was due to access issues as the bridge on Associated British Ports (“ABP”) land was too high for sample collection using a telescopic sampling pole. In addition, it is important to note that the standards under the Water Framework Directive are based on annual averages or other long-term statistics.
- 1.3.5. Several exceedances of PAHs were recorded at both locations, with the majority of exceedances recorded within the North Beck Drain (SW3) during the first monitoring round. However, the exceedances of benzo(b)fluoranthene and fluoranthene were recorded within the same order of magnitude and one order of magnitude above the EQS freshwater standard. Therefore, these exceedances are marginal. However, the maximum concentrations of benzo(a)pyrene and benzo(g,h,i)perylene are two orders of magnitude above the EQS freshwater standard. These exceedances were recorded in SW3 within the North Beck Drain during the first monitoring round. During the second monitoring round, exceedances of polycyclic aromatic hydrocarbons (“PAHs”) were also recorded mostly within SW2 and SW3. Exceedances of fluoranthene at one order of magnitude above the EQS (0.0063 µg/l) and benzo(b)fluoranthene within the same order of magnitude as the EQS (0.017 µg/l) were recorded as SW2 and SW3. The concentration of benzo(a)pyrene (0.0197 µg/l) was recorded at two orders of magnitude above the EQS (0.00017 µg/l) and benzo(g,h,i)perylene (0.00084 µg/l) was recorded at one order of magnitude above the EQS at SW2 (0.00082 µg/l). An exceedance of fluoranthene (0.0124µg/l) at one order of magnitude above the EQS (0.0063 µg/l) was recorded at SW1. Compared to the first monitoring round, the maximum recorded concentration of PAHs at SW2 and SW3 has reduced. Given the distance from the Site to the North Beck Drain (approximately 450m east) and the exceedances of metals were recorded at SW2 and SW3 during both monitoring rounds. The maximum concentration of copper and lead were recorded within the same order of magnitude as the EQS freshwater standard during both monitoring rounds. During the second monitoring round, exceedances of prevailing historical and current industrial land use immediately adjacent to the North Beck Drain and Habrough Marsh Drain, it is considered that these exceedances are associated with off-site industrial land use. Cadmium and iron were recorded at SW2. However, these exceedances are considered marginal as they are within the same order of magnitude as the EQS freshwater standard. During the first and second monitoring rounds, the maximum concentration of zinc was also recorded one order of magnitude above

the EQS freshwater standards. Therefore, these exceedances are considered marginal and do not pose a risk to surface water. Maximum concentrations of copper, lead and zinc were higher within samples from the second monitoring round than in the first monitoring round. This could be due to the saline influence of the Humber estuary with the incoming tide.

- 1.3.6. The concentration of inorganic nitrogen exceeded the EQS by one order of magnitude at SW2 during the first monitoring round and within the same order of magnitude at SW3 during the first and second monitoring rounds. The concentration of inorganic nitrogen was lower within samples from the second monitoring round, with only one exceedance recorded at SW3 (4.83mg/l). These exceedances are considered marginal. As a result, inorganic nitrogen does not pose a risk to surface water.
- 1.3.7. Exceedances of ammoniacal nitrogen were recorded at all sampling locations during the second monitoring round, with the highest concentration recorded at SW2 (1.3 mg/l) at two orders of magnitude above the EQS (0.021 mg/l). The exceedances at SW1 and SW3 were recorded at one order of magnitude above the EQS.
- 1.3.8. Overall, it is considered that the exceedances of PAHs, metals and inorganics are indicative of wider contamination within nearby surface watercourses associated with the historical and current industrial land use within the wider Immingham area. Sampling location SW1 is located within Habrough Marsh Drain approximately 40m west from the East Site (Hydrogen Production site). Within the surrounding area to SW1, there are pipelines and industrial infrastructure. Sampling location SW2 is located upstream of the West Site adjacent to pipelines, railway sidings and industrial properties. Therefore, it is likely that the elevated concentrations are associated with off-site sources. Sampling location SW3 is also located approximately 450m from the East Site. Multiple industrial properties and chemical works are located immediately adjacent to the North Beck Drain. Therefore, the elevated concentrations are likely associated with off-site sources. As part of the Ground Investigation, PAH exceedances in surface water samples were not recorded in soil leachate or groundwater samples from the site, therefore indicating an off-site source. The elevated metals in surface water may be indicative of natural conditions, with the soil leachate and groundwater across the wider site recording elevated concentrations.

Annex 1: Tides at Immingham with Sample Times

Plate 2: Sampling time for first round of monitoring with an incoming tide between 08:00 – 24:00 on the 31 March 2023

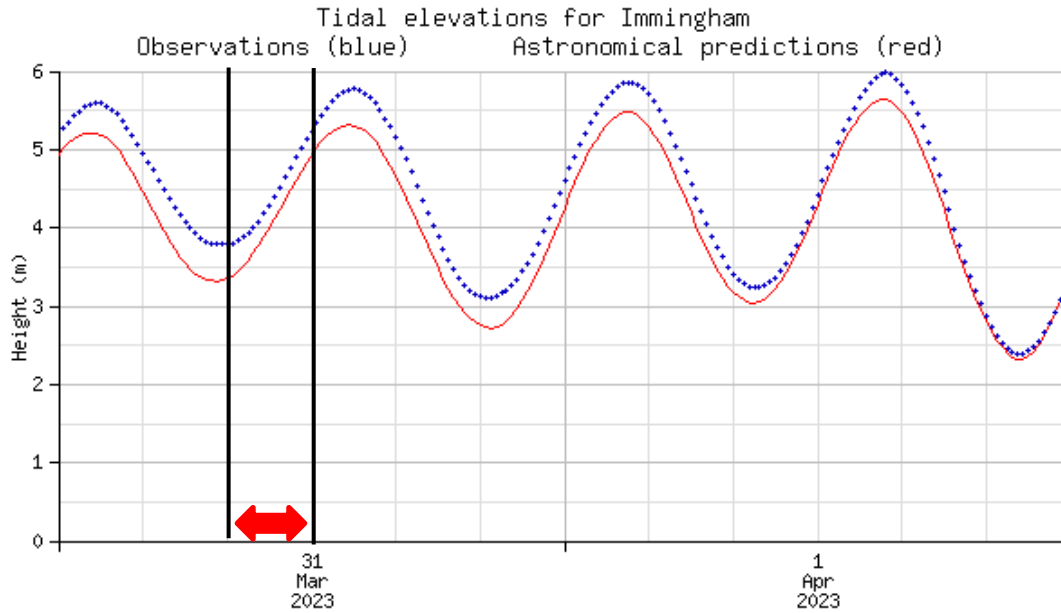
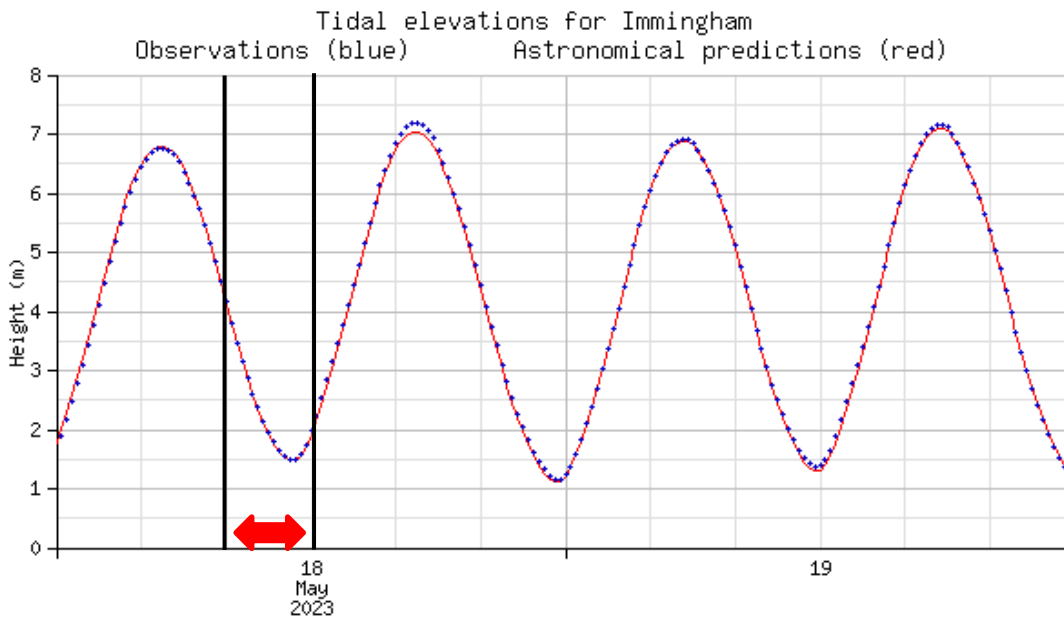


Plate 3: Sampling time for the second round of monitoring with an outgoing tide between 08:00 – 24:00 on the 18 May 2023



National Tidal and Sea Level Facility (2023) UK National Tide Gauge Network: Immingham.

Annex 2: Site photos

Plate 4: SW 1



Plate 5: SW2



Plate 6: SW3

