

Viking CCS pipeline

# Preliminary Environmental Information Report Volume IV

Technical Appendices



Appendix 11.1

# Water Environment Baseline Supporting Information



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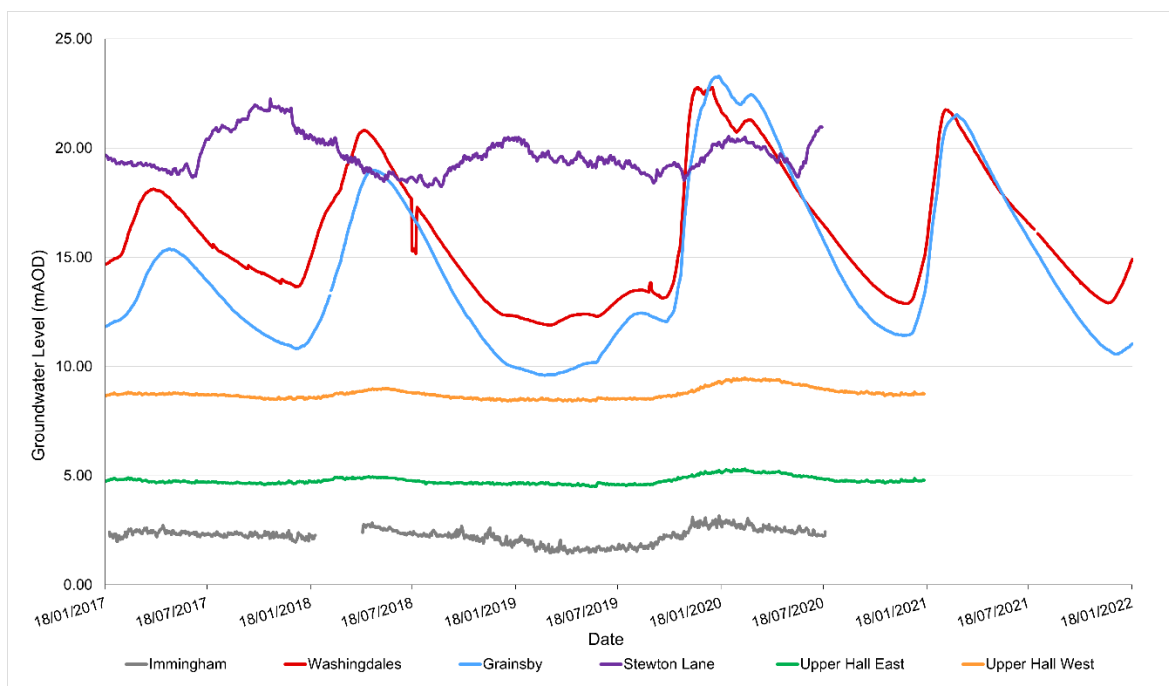
# 11 Introduction

11.1.1 This Appendix provides supporting information for the Water Environment Baseline Environment and Study Area.

## 11.2 Groundwater

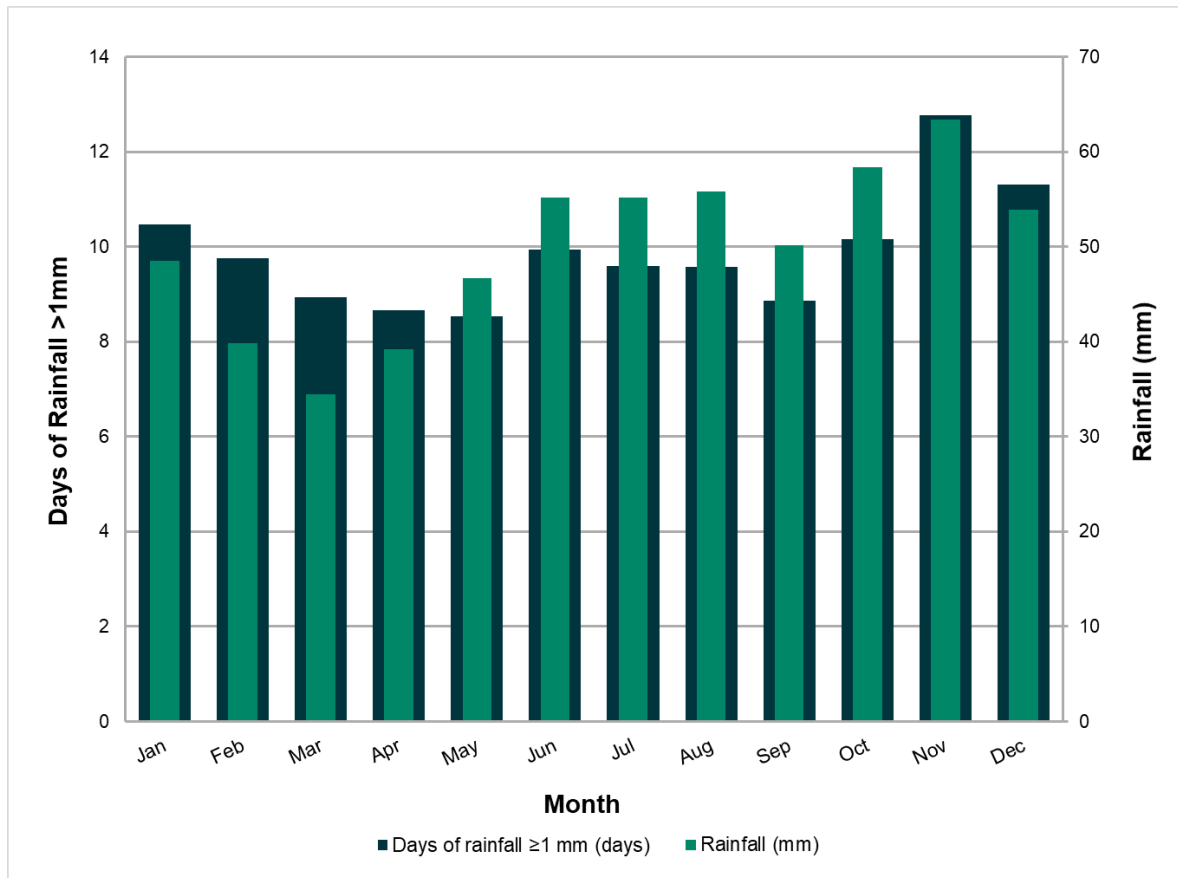
**Table 11-1: Groundwater Level Monitoring Sample Points**

| Sample Point    | NGR            | Borehole depth (m) | Borehole diameter (mm) | Aquifer monitored           |
|-----------------|----------------|--------------------|------------------------|-----------------------------|
| Immingham       | TA 21278 14951 | 89.4               | 150                    | Northern Lincolnshire Chalk |
| Washingdales    | TA 19486 07128 | 101.48             | 100                    | Northern Lincolnshire Chalk |
| Grainsby        | TF 26040 98230 | 84                 | 105                    | Northern Lincolnshire Chalk |
| Stewton Lane    | TF 34690 86450 | 116                | 150                    | Spilsby Sandstone           |
| Upper Hall East | TF 39480 86130 | 57                 | 100                    | Southern Lincolnshire Chalk |
| Upper Hall West | TF 39480 86130 | 70.43              | 80                     | Carstone Formation          |

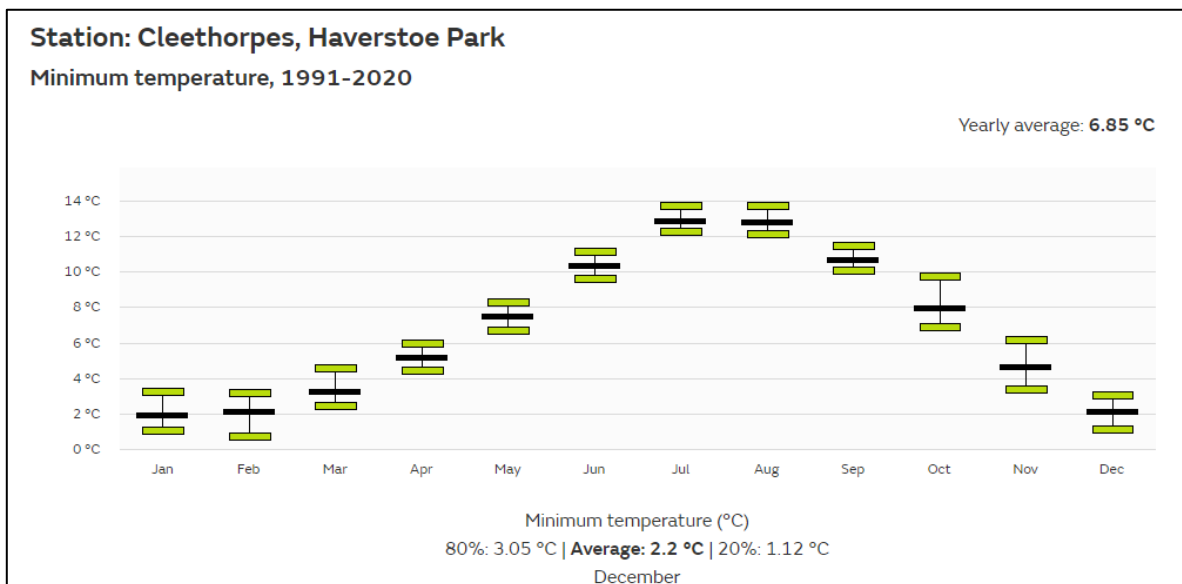


**Figure 11-1: Groundwater Level Monitoring throughout the Study Area**

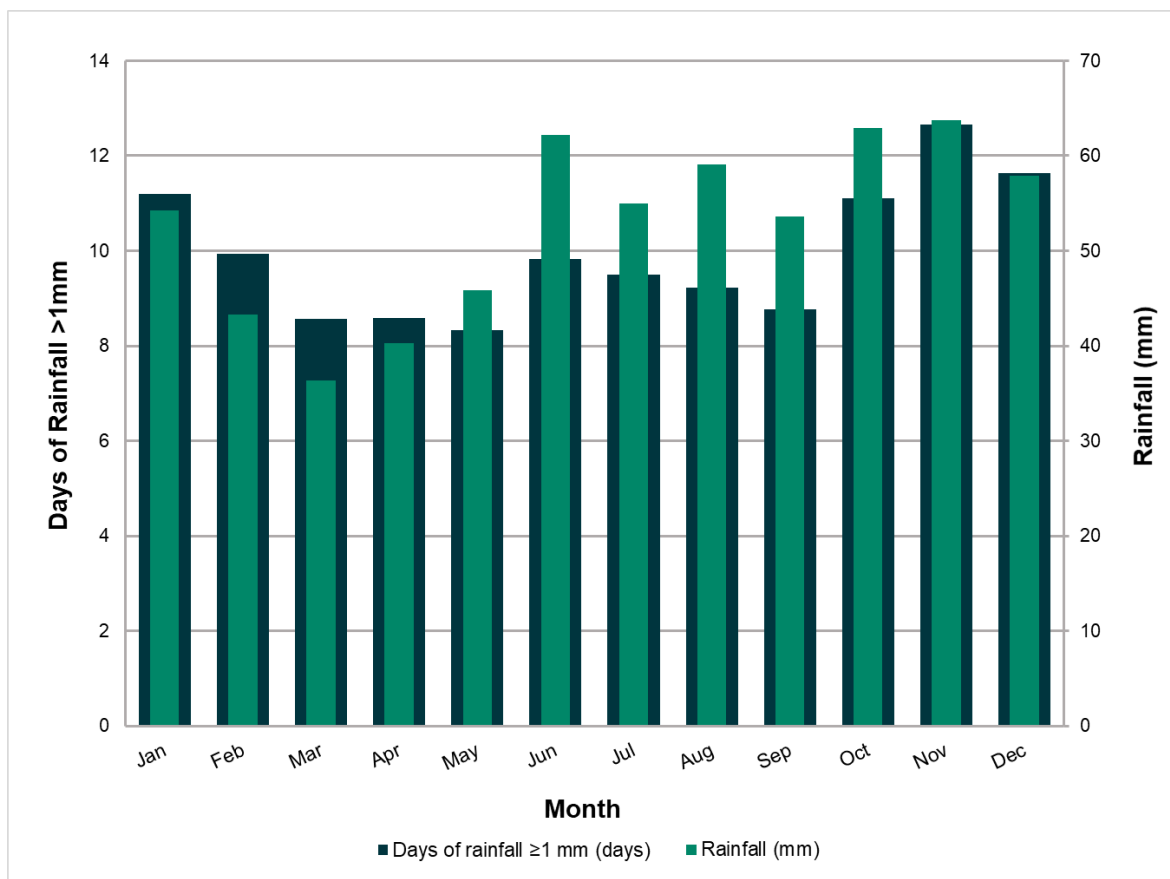
### 11.3 Rainfall



**Figure 11-2: Cleethorpes Weather Station: Monthly Rainfall and Days of Rainfall >1 mm (1991-2020)**



**Figure 11-3: Cleethorpes Weather Station Minimum Air Temperature Graph (1991 – 2010).**



**Figure 11-4: Manby Weather Station: Monthly Rainfall and Days of Rainfall >1 mm (1991-2020)**

## 11.4 Surface water flow

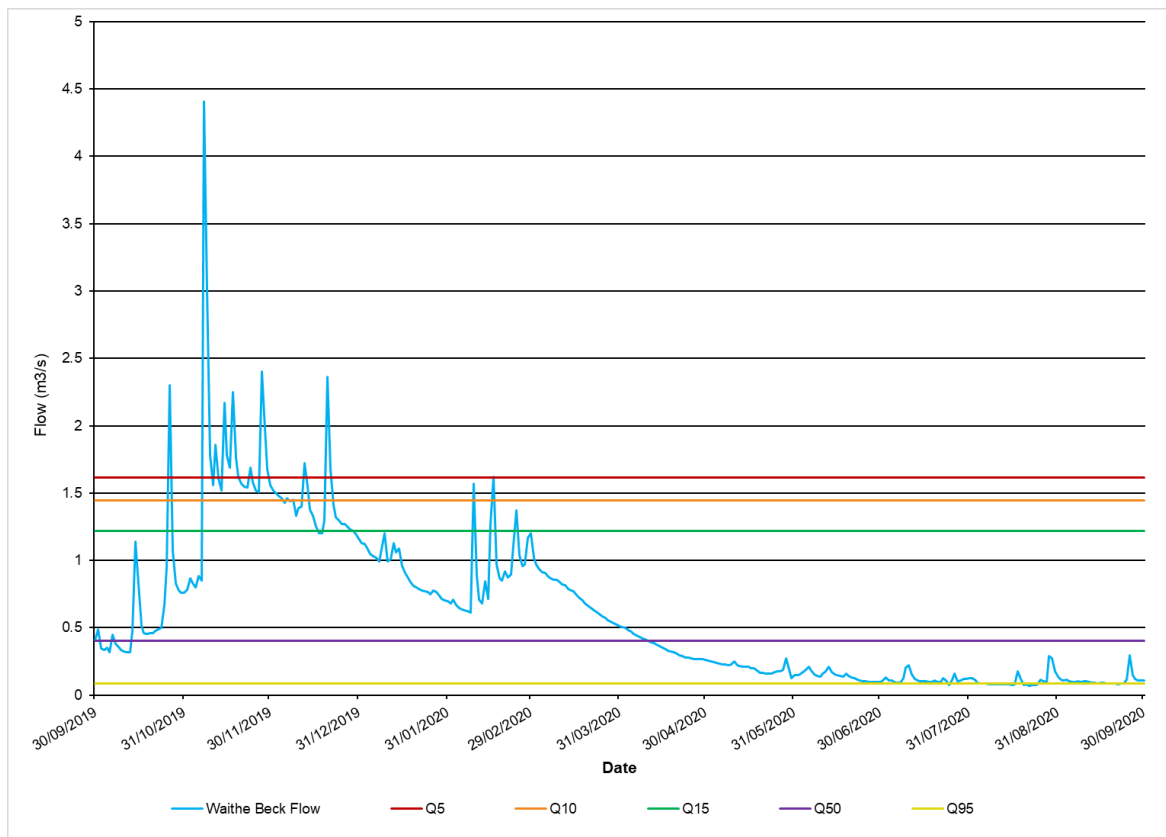
### Section 1

11.4.1 There are no gauging stations within the Draft Order Limits for this section.

### Section 2

11.4.2 The nearest gauging station Waithe Beck (GB104029062100) on the National River Flow Archive is Waithe Beck at Brigsley (gauging station reference 29001) which lies in the village of Brigsley. The station level is approximately 15.7 m AOD and is a broad trapezoidal flume. The average annual mean flow at this station is 0.304 m<sup>3</sup>/s with a maximum daily flow rate of 2.359 m<sup>3</sup>/s on the 07/11/2000. The flow that is exceeded 95% of the time (Q95) is 0.063 m<sup>3</sup>/s.

11.4.3 Gauged mean daily flow for September 2019 – 2020 are shown in **Figure 11-5**.



**Figure 11-5: Gauged mean daily flow for the Waithe Beck at Brigsley Gauging Station (30 September 2019 - 30 September 2020)**

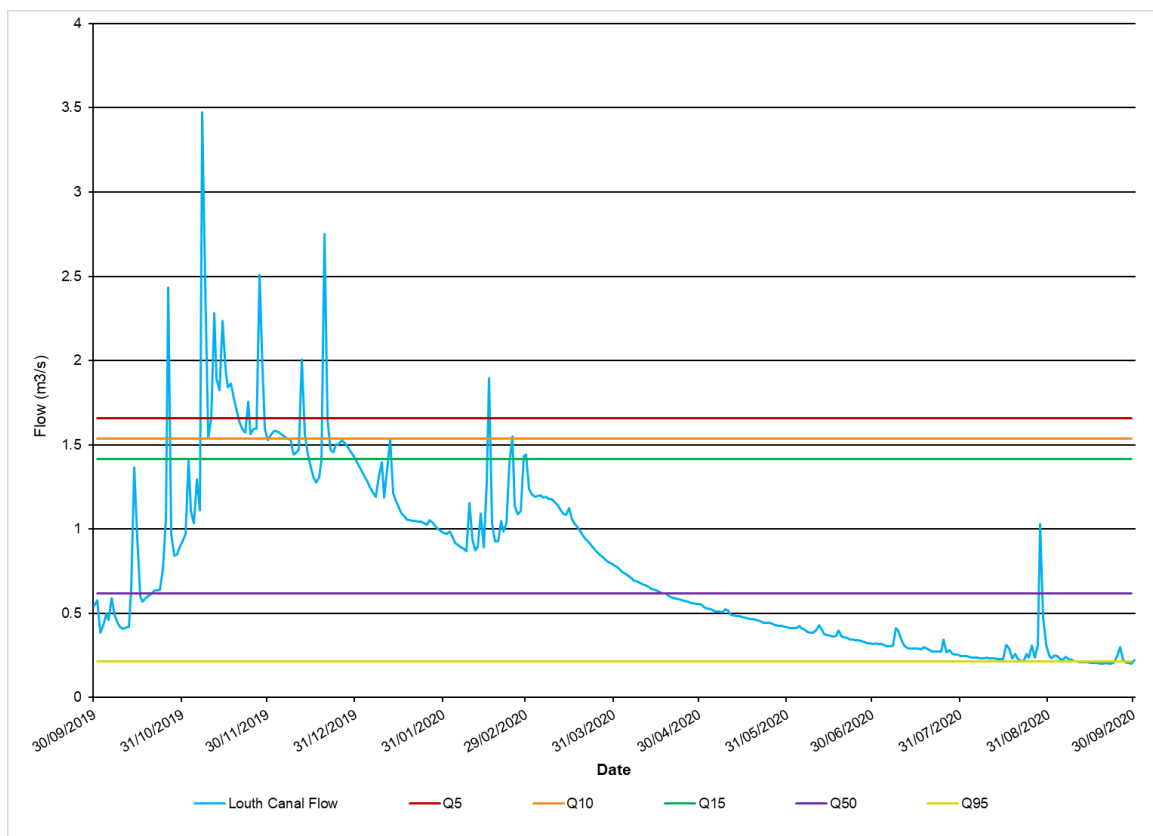
**Section 3**

11.4.4 There are no gauging stations within the Draft Order Limits for this section.

**Section 4**

11.4.5 The nearest gauging station for Louth Canal (GB104029061990) on the National River Flow Archive is Lud at Louth (gauging station reference 29003) which lies in the town of Louth. The station level is approximately 15.4 m AOD and is a crump profile weir, 4.6 m wide, at upstream end of long culvert. The average annual mean flow at this station is 0.455 m<sup>3</sup>/s with a maximum daily flow rate of 1.973 m<sup>3</sup>/s on the 06/11/2000. The flow that is exceeded 95% of the time (Q95) is 0.126 m<sup>3</sup>/s.

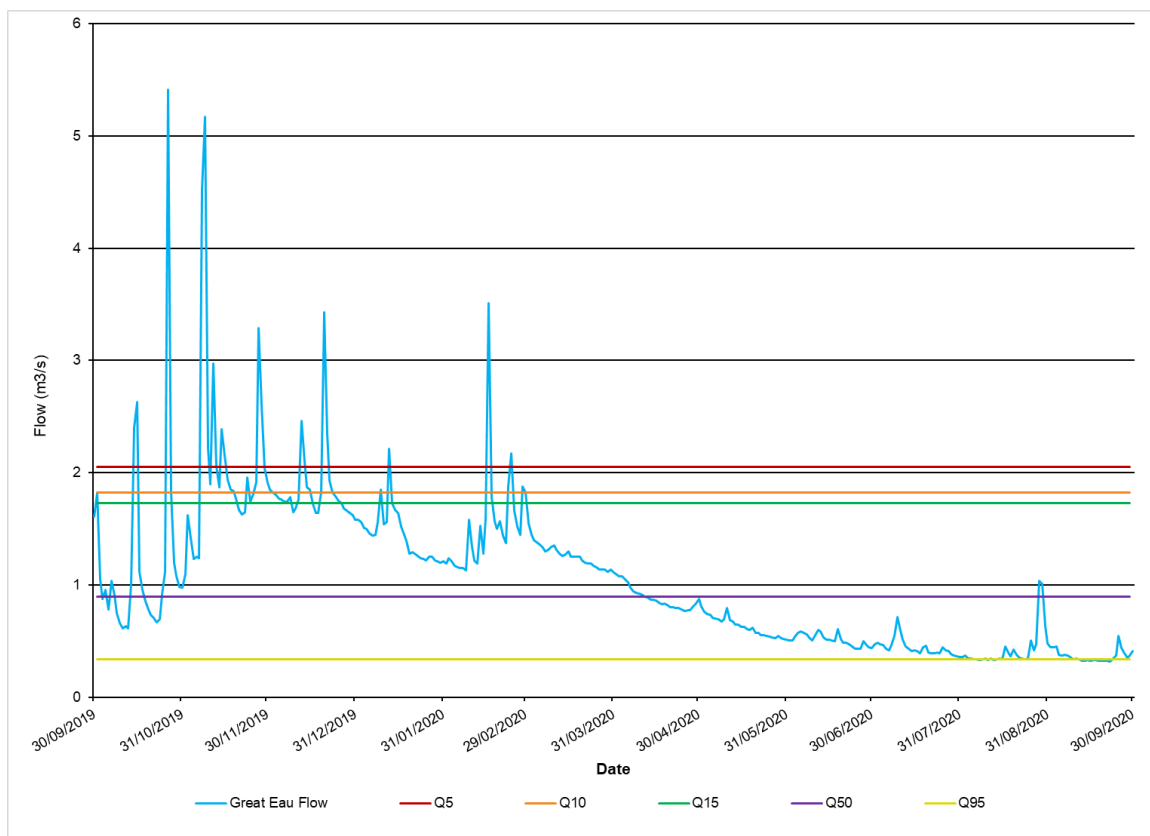
11.4.6 Gauged mean daily flow for September 2019 – 2020 are shown in **Figure 11-6**.



**Figure 11-6: Gauged Mean Daily Flow for the Lud at Louth Gauging Station (30 September 2019 - 30 September 2020)**

- 11.4.7 The nearest gauging station for Great Eau (GB105029061660) on the National River Flow Archive is Great Eau at Claythorpe Mill (gauging station reference 29002) which lies in the hamlet of Claythorpe. The station level is approximately 6.6 m AOD and is a simple low flow, crump profile weir 3.073m wide with flanking broad-crest sectors. The average annual mean flow at this station is 0.64 m<sup>3</sup>/s with a maximum daily flow rate of 4.073 m<sup>3</sup>/s on the 13/04/1970. The flow that is exceeded 95% of the time (Q95) is 0.249 m<sup>3</sup>/s.
- 11.4.8 Gauged mean daily flow for September 2019 – 2020 are shown in **Figure 11-6**.





**Figure 11-7: Gauged Mean Daily Flow for the Great Eau at Claythorpe Mill Gauging Station (30 September 2019 - 30 September 2020)**

**Section 5**

11.4.9 There are no gauging stations within the Draft Order Limits for this section.

**11.5 Water quality**

11.5.1 The Environment Agency’s Water Quality Archive website contains surface water quality data for several waterbodies that either lie within the Draft Order Limits or are hydraulically connected to a waterbody that lies within. Summary water quality data stations for the years 2018 – 2022 are presented in **Table 11-2** which occur in or near the Study Area.

**Table 11-2: Summary of Available Water Quality Data from the Environment Agency’s Water Quality Archive**

| Section | Waterbody        | Monitoring station          | NGR            | Duration of sampling | Number of samples |
|---------|------------------|-----------------------------|----------------|----------------------|-------------------|
| 3       | Lacey Beck       | R. Freshney Lacey Bridge    | TA 21718 06486 | 2018 - 2022          | 420               |
|         | Waithe Beck      | Waithe Beck Brigsley Bridge | TA 25221 01690 | 2020 - 2022          | 424               |
|         | Bond Croft Drain | N Thoresby STW F E          | TF 29075 98961 | 2018 - 2022          | 143               |

| Section | Waterbody       | Monitoring station                       | NGR            | Duration of sampling | Number of samples |
|---------|-----------------|--|----------------|----------------------|-------------------|
| 4       | Poulton Drain   | Poulton Drain Catchment Trib Louth Canal | TF 33942 94339 | 2020 - 2021          | 145               |
|         | Yarburgh Beck   | Black Dyke Catchment Trib Louth          | TF 35061 92723 | 2020 and 2022        | 72                |
|         | Louth Canal     | Louth STW Crude Sewage At Inlet          | TF 35708 90191 | 2018 - 2022          | 150               |
|         |                 | Louth STW F/E                            | TF 35882 90315 | 2018 - 2022          | 394               |
|         |                 | Louth Canal Alvingham Lock               | TF 36484 90849 | 2019 - 2022          | 457               |
|         | Grayfleet Drain | Grayfleet Drain U S Saltfleetby          | TF 42382 90247 | 2020 - 2022          | 288               |
| 5       | Long Eau        | Long Eau Three Bridges                   | TF 43887 88189 | 2020 and 2022        | 72                |
|         | Great Eau       | Gt. Eau Cloves Bridge                    | TF 46836 90356 | 2019 - 2022          | 179               |
|         |                 | Withern Mill Trout Farm                  | TF 42350 82040 | 2018 - 2020          | 121               |

11.5.2 The results for the last five years from the Environmental Agency Water Quality Archive shown in **Table 11-3** to **Table 11-7**.

**Table 11-3: Environment Agency Water Quality Monitoring Summary for Laceby Beck, Waithe Beck and Bond Croft Drain**

| Determinand                               | Units | Laceby Beck              |        |        |                       |                       | Waithe Beck                 |        |        |                       |                       | Bond Croft Drain   |       |      |                       |                       |
|---|-------|--------------------------|--------|--------|-----------------------|-----------------------|-----------------------------|--------|--------|-----------------------|-----------------------|--------------------|-------|------|-----------------------|-----------------------|
|   |       | R.FRESHNEY LACEBY BRIDGE |        |        |                       |                       | WAITHE BECK BRIGSLEY BRIDGE |        |        |                       |                       | N THORESBY STW F E |       |      |                       |                       |
|   |       | Min                      | Max    | Mean   | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile | Min                         | Max    | Mean   | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile | Min                | Max   | Mean | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile |
| Alkalinity to pH 4.5 as CaCO <sub>3</sub> | mg/l  | 141.00                   | 270.00 | 226.35 | 267.00                | 190.00                | 197.00                      | 240.00 | 214.07 | 229.30                | 200.00                |                    |       |      |                       |                       |
| Ammonia un-ionised as N                   | mg/l  | 0.0002                   | 0.0052 | 0.0008 | 0.0012                | 0.0003                | 0.0004                      | 0.0018 | 0.0006 | 0.0010                | 0.0004                |                    |       |      |                       |                       |
| Ammoniacal Nitrogen as N                  | mg/l  | 0.03                     | 0.39   | 0.05   | 0.08                  | 0.03                  | 0.03                        | 0.06   | 0.03   | 0.05                  | 0.03                  |                    |       |      |                       |                       |
| BOD: 5 Day ATU                            | mg/l  | 1.00                     | 2.20   | 1.25   | 1.58                  | 1.00                  | 1.00                        | 1.20   | 1.07   | 1.16                  | 1.00                  | 3.34               | 26.80 | 8.02 | 13.89                 | 4.21                  |
| Conductivity at 25 C                      | us/cm | 473.0                    | 1256.0 | 889.6  | 1175.6                | 706.9                 | 620.0                       | 696.0  | 656.5  | 685.4                 | 631.0                 |                    |       |      |                       |                       |
| Nitrate as N                              | mg/l  | 4.78                     | 19.30  | 10.47  | 12.14                 | 7.45                  | 6.77                        | 12.00  | 9.02   | 11.00                 | 7.36                  |                    |       |      |                       |                       |
| Nitrite as N                              | mg/l  | 0.004                    | 0.071  | 0.022  | 0.043                 | 0.007                 | 0.007                       | 0.044  | 0.019  | 0.029                 | 0.011                 |                    |       |      |                       |                       |
| Nitrogen, Total Oxidised as N             | mg/l  | 4.80                     | 19.30  | 10.49  | 12.14                 | 7.49                  | 6.79                        | 12.00  | 9.03   | 11.00                 | 7.37                  |                    |       |      |                       |                       |
| Orthophosphate, reactive as P             | mg/l  | 0.01                     | 0.25   | 0.06   | 0.10                  | 0.01                  | 0.03                        | 0.17   | 0.08   | 0.14                  | 0.03                  |                    |       |      |                       |                       |
| Oxygen, Dissolved as O <sub>2</sub>       | mg/l  | 7.98                     | 13.30  | 10.82  | 12.18                 | 9.25                  | 9.31                        | 13.20  | 11.25  | 12.66                 | 9.78                  |                    |       |      |                       |                       |

| Determinand                     | Units    | Laceby Beck              |        |       |                       |                       | Waithe Beck                 |        |       |                       |                       | Bond Croft Drain   |       |       |                       |                       |
|---------------------------------|----------|--------------------------|--------|-------|-----------------------|-----------------------|-----------------------------|--------|-------|-----------------------|-----------------------|--------------------|-------|-------|-----------------------|-----------------------|
|                                 |          | R.FRESHNEY LACEBY BRIDGE |        |       |                       |                       | WAITHE BECK BRIGSLEY BRIDGE |        |       |                       |                       | N THORESBY STW F E |       |       |                       |                       |
|                                 |          | Min                      | Max    | Mean  | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile | Min                         | Max    | Mean  | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile | Min                | Max   | Mean  | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile |
| Oxygen, Dissolved, % Saturation | %        | 75.10                    | 114.90 | 95.41 | 106.25                | 86.61                 | 80.90                       | 110.10 | 98.38 | 105.20                | 94.08                 |                    |       |       |                       |                       |
| pH                              | pH units | 7.61                     | 8.36   | 7.90  | 8.16                  | 7.69                  | 8.01                        | 8.47   | 8.28  | 8.36                  | 8.19                  |                    |       |       |                       |                       |
| Solids, non-volatile at 105 C   | mg/l     |                          |        |       |                       |                       | 3.18                        | 30.00  | 15.03 | 23.60                 | 4.94                  | 1.00               | 51.00 | 11.88 | 19.30                 | 4.70                  |
| Temperature of Water            | cel      | 5.70                     | 14.10  | 9.87  | 13.21                 | 6.20                  | 5.00                        | 16.10  | 9.71  | 16.00                 | 5.10                  |                    | 6.80  | 21.70 | 18.28                 | 12.75                 |
| Turbidity                       | ntu      |                          |        |       |                       |                       | 1.70                        | 27.00  | 11.60 | 18.20                 | 4.25                  |                    |       |       |                       |                       |

**Table 11-4: Environment Agency Water Quality Monitoring Summary for Poulton Drain and Yarburgh Beck**

| Determinand                   | Units | Poulton Drain                            |         |         |                       |                       | Yarburgh Beck                   |        |        |                       |                       |
|-------------------------------|-------|--|---------|---------|-----------------------|-----------------------|---------------------------------|--------|--------|-----------------------|-----------------------|
|                               |       | POULTON DRAIN CATCHMENT TRIB LOUTH CANAL |         |         |                       |                       | BLACK DYKE CATCHMENT TRIB LOUTH |        |        |                       |                       |
|                               |       | Min                                      | Max     | Mean    | 90 <sup>th</sup> Tile | 10 <sup>th</sup> %ile | Min                             | Max    | Mean   | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile |
| Alkalinity to pH 4.5 as CaCO3 | mg/l  | 110.00                                   | 340.00  | 251.67  | 317.00                | 156.00                | 210.00                          | 280.00 | 251.67 | 270.00                | 230.00                |
| Ammonia un-ionised as N       | mg/l  | 0.00034                                  | 0.00107 | 0.00060 | 0.00093               | 0.00039               | 0.0004                          | 0.0012 | 0.0007 | 0.0011                | 0.0004                |
| Ammoniacal Nitrogen as N      | mg/l  | 0.030                                    | 0.078   | 0.037   | 0.045                 | 0.030                 | 0.030                           | 0.087  | 0.045  | 0.076                 | 0.030                 |
| Conductivity at 25 C          | us/cm | 464.00                                   | 907.00  | 765.25  | 855.30                | 573.80                | 677.00                          | 872.00 | 775.33 | 842.00                | 711.00                |
| Nitrate as N                  | mg/l  | 0.91                                     | 11.00   | 5.88    | 9.70                  | 2.30                  | 2.09                            | 7.09   | 5.28   | 6.58                  | 3.69                  |

| Determinand                     | Units    | Poulton Drain                            |        |       |                       |                       | Yarburgh Beck                   |        |        |                       |                       |
|---------------------------------|----------|--|--------|-------|-----------------------|-----------------------|---------------------------------|--------|--------|-----------------------|-----------------------|
|                                 |          | POULTON DRAIN CATCHMENT TRIB LOUTH CANAL |        |       |                       |                       | BLACK DYKE CATCHMENT TRIB LOUTH |        |        |                       |                       |
|                                 |          | Min                                      | Max    | Mean  | 90 <sup>th</sup> Tile | 10 <sup>th</sup> %ile | Min                             | Max    | Mean   | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile |
| Nitrite as N                    | mg/l     | 0.008                                    | 0.050  | 0.021 | 0.035                 | 0.009                 | 0.008                           | 0.033  | 0.019  | 0.032                 | 0.010                 |
| Nitrogen, Total Oxidised as N   | mg/l     | 0.92                                     | 11.00  | 5.90  | 9.73                  | 2.32                  | 2.10                            | 7.10   | 5.30   | 6.60                  | 3.70                  |
| Orthophosphate, reactive as P   | mg/l     | 0.027                                    | 0.170  | 0.087 | 0.155                 | 0.045                 | 0.041                           | 0.084  | 0.059  | 0.077                 | 0.043                 |
| Oxygen, Dissolved as O2         | mg/l     | 76.50                                    | 108.60 | 96.01 | 106.97                | 78.86                 | 11.90                           | 14.10  | 12.60  | 13.60                 | 11.95                 |
| Oxygen, Dissolved, % Saturation | %        | 7.55                                     | 13.00  | 11.31 | 12.77                 | 8.91                  | 97.60                           | 119.60 | 103.58 | 112.60                | 97.75                 |
| pH                              | pH units | 7.98                                     | 8.49   | 8.20  | 8.43                  | 8.05                  | 8.25                            | 8.56   | 8.35   | 8.48                  | 8.25                  |
| Temperature of Water            | cel      | 3.70                                     | 15.90  | 8.45  | 10.65                 | 5.41                  | 4.30                            | 10.10  | 6.87   | 9.10                  | 4.70                  |

**Table 11-5: Environment Agency Water Quality Monitoring Summary for Louth Canal**

| Determinand                   | Units | Louth Canal                     |        |        |                       |                       |               |       |      |                       |                       |                            |         |         |                       |                       |
|-------------------------------|-------|---------------------------------|--------|--------|-----------------------|-----------------------|---------------|-------|------|-----------------------|-----------------------|----------------------------|---------|---------|-----------------------|-----------------------|
|                               |       | LOUTH STW CRUDE SEWAGE AT INLET |        |        |                       |                       | LOUTH STW F/E |       |      |                       |                       | LOUTH CANAL ALVINGHAM LOCK |         |         |                       |                       |
|                               |       | Min                             | Max    | Mean   | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile | Min           | Max   | Mean | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile | Min                        | Max     | Mean    | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile |
| Alkalinity to pH 4.5 as CaCO3 | mg/l  |                                 |        |        |                       |                       |               |       |      |                       |                       | 160.00                     | 220.00  | 202.48  | 220.00                | 185.20                |
| Ammonia un-ionised as N       | mg/l  |                                 |        |        |                       |                       |               |       |      |                       |                       | 0.00001                    | 0.01250 | 0.00275 | 0.00676               | 0.00047               |
| Ammoniacal Nitrogen as N      | mg/l  |                                 |        |        |                       |                       | 0.11          | 3.13  | 0.89 | 2.01                  | 0.12                  | 0.030                      | 0.484   | 0.128   | 0.349                 | 0.032                 |
| BOD: 5 Day ATU                | mg/l  | 46.10                           | 328.00 | 152.69 | 212.10                | 92.74                 | 3.39          | 20.30 | 8.85 | 11.48                 | 5.86                  | 1.30                       | 3.50    | 2.04    | 3.02                  | 1.36                  |

| Determinand                         | Units    | Louth Canal                     |       |      |                       |                       |               |       |       |                       |                       |                            |        |        |                       |                       |
|-------------------------------------|----------|---------------------------------|-------|------|-----------------------|-----------------------|---------------|-------|-------|-----------------------|-----------------------|----------------------------|--------|--------|-----------------------|-----------------------|
|                                     |          | LOUTH STW CRUDE SEWAGE AT INLET |       |      |                       |                       | LOUTH STW F/E |       |       |                       |                       | LOUTH CANAL ALVINGHAM LOCK |        |        |                       |                       |
|                                     |          | Min                             | Max   | Mean | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile | Min           | Max   | Mean  | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile | Min                        | Max    | Mean   | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile |
| Conductivity at 25 C                | us/cm    |                                 |       |      |                       |                       |               |       |       |                       |                       | 617.00                     | 765.00 | 694.28 | 711.20                | 673.60                |
| Nitrate as N                        | mg/l     |                                 |       |      |                       |                       |               |       |       |                       |                       | 9.31                       | 14.40  | 12.22  | 13.06                 | 10.90                 |
| Nitrite as N                        | mg/l     |                                 |       |      |                       |                       |               |       |       |                       |                       | 0.020                      | 0.212  | 0.083  | 0.151                 | 0.025                 |
| Nitrogen, Total Oxidised as N       | mg/l     |                                 |       |      |                       |                       |               |       |       |                       |                       | 9.40                       | 14.50  | 12.30  | 13.18                 | 11.00                 |
| Orthophosphate, reactive as P       | mg/l     |                                 |       |      |                       |                       |               |       |       |                       |                       | 0.05                       | 0.31   | 0.14   | 0.21                  | 0.07                  |
| Oxygen, Dissolved as O <sub>2</sub> | mg/l     |                                 |       |      |                       |                       |               |       |       |                       |                       | 7.25                       | 14.20  | 11.92  | 13.40                 | 10.24                 |
| Oxygen, Dissolved, % Saturation     | %        |                                 |       |      |                       |                       |               |       |       |                       |                       | 70.80                      | 144.30 | 108.55 | 124.84                | 97.78                 |
| pH                                  | pH units |                                 |       |      |                       |                       |               |       |       |                       |                       | 2.00                       | 8.57   | 8.01   | 8.45                  | 8.03                  |
| Phosphorus, Total as P              | mg/l     | 1.95                            | 10.40 | 5.00 | 6.31                  | 3.52                  | 0.73          | 2.40  | 1.36  | 1.84                  | 0.95                  |                            |        |        |                       |                       |
| Solids, non-volatile at 105 C       | mg/l     |                                 |       |      |                       |                       | 7.00          | 42.00 | 18.42 | 26.00                 | 12.00                 |                            |        |        |                       |                       |
| Temperature of Water                | cel      |                                 |       |      |                       |                       | 8.40          | 19.10 | 13.09 | 17.49                 | 9.50                  | 5.60                       | 16.40  | 11.10  | 14.46                 | 7.44                  |

**Table 11-6: Environment Agency Water Quality Monitoring Summary for Grayfleet Drain and Long Eau**

| Determinand                     | Units    | Grayfleet Drain                 |         |         |                          |                          | Long Eau               |        |        |                          |                          |
|---------------------------------|----------|---------------------------------|---------|---------|--------------------------|--------------------------|------------------------|--------|--------|--------------------------|--------------------------|
|                                 |          | GRAYFLEET DRAIN U S SALTFLEETBY |         |         |                          |                          | LONG EAU THREE BRIDGES |        |        |                          |                          |
|                                 |          | Min                             | Max     | Mean    | 90 <sup>th</sup><br>%ile | 10 <sup>th</sup><br>%ile | Min                    | Max    | Mean   | 90 <sup>th</sup><br>%ile | 10 <sup>th</sup><br>%ile |
| Alkalinity to pH 4.5 as CaCO3   | mg/l     | 160.00                          | 300.00  | 255.56  | 300.00                   | 207.00                   | 185.00                 | 250.00 | 233.00 | 250.00                   | 204.60                   |
| Ammonia un-ionised as N         | mg/l     | 0.00001                         | 0.01610 | 0.00269 | 0.00655                  | 0.00037                  | 0.0004                 | 0.0019 | 0.0008 | 0.0013                   | 0.0004                   |
| Ammoniacal Nitrogen as N        | mg/l     | 0.03                            | 1.30    | 0.18    | 0.45                     | 0.03                     | 0.030                  | 0.066  | 0.039  | 0.058                    | 0.030                    |
| BOD: 5 Day ATU                  | mg/l     | 1.00                            | 6.00    | 1.97    | 3.00                     | 1.10                     | 1.00                   | 5.26   | 1.56   | 1.96                     | 1.00                     |
| Conductivity at 25 C            | us/cm    | 591.00                          | 901.00  | 758.50  | 860.10                   | 667.50                   | 679.00                 | 842.00 | 730.92 | 750.20                   | 697.40                   |
| Nitrate as N                    | mg/l     | 0.19                            | 13.00   | 5.66    | 9.73                     | 0.75                     | 6.64                   | 13.10  | 9.57   | 11.72                    | 7.90                     |
| Nitrite as N                    | mg/l     | 0.01                            | 0.19    | 0.05    | 0.12                     | 0.02                     | 0.03                   | 0.13   | 0.07   | 0.11                     | 0.04                     |
| Nitrogen, Total Oxidised as N   | mg/l     | 2.60                            | 11.00   | 7.43    | 10.70                    | 3.65                     | 6.77                   | 13.20  | 9.64   | 11.80                    | 7.96                     |
| Orthophosphate, reactive as P   | mg/l     | 0.01                            | 0.32    | 0.09    | 0.16                     | 0.03                     | 0.12                   | 0.29   | 0.18   | 0.24                     | 0.13                     |
| Oxygen, Dissolved as O2         | mg/l     | 2.65                            | 15.50   | 10.04   | 12.50                    | 5.35                     | 5.02                   | 20.50  | 11.19  | 14.26                    | 7.44                     |
| Oxygen, Dissolved, % Saturation | %        | 26.60                           | 120.50  | 84.07   | 101.47                   | 54.66                    | 45.80                  | 222.60 | 105.05 | 146.50                   | 65.48                    |
| pH                              | pH units | 2.00                            | 8.31    | 7.73    | 8.26                     | 7.66                     | 7.75                   | 8.95   | 8.17   | 8.43                     | 8.00                     |
| Temperature of Water            | cel      | 3.50                            | 18.90   | 8.85    | 15.83                    | 4.37                     | 6.00                   | 19.20  | 11.76  | 18.00                    | 6.54                     |

**Table 11-7: Environment Agency Water Quality Monitoring Summary for Great Eau**

| Determinand                               | Units    | Great Eau            |        |        |                       |                       |                         |        |       |                       |                       |
|---|----------|----------------------|--------|--------|-----------------------|-----------------------|-------------------------|--------|-------|-----------------------|-----------------------|
|   |          | GT.EAU CLOVES BRIDGE |        |        |                       |                       | WITHERN MILL TROUT FARM |        |       |                       |                       |
|   |          | Min                  | Max    | Mean   | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile | Min                     | Max    | Mean  | 90 <sup>th</sup> %ile | 10 <sup>th</sup> %ile |
| Alkalinity to pH 4.5 as CaCO <sub>3</sub> | mg/l     | 130.00               | 240.00 | 201.00 | 220.00                | 164.80                |                         |        |       |                       |                       |
| Ammonia un-ionised as N                   | mg/l     | 0.0004               | 0.0024 | 0.0010 | 0.0018                | 0.0004                | 0.06                    | 0.26   | 0.16  | 0.22                  | 0.10                  |
| Ammoniacal Nitrogen as N                  | mg/l     | 0.030                | 0.130  | 0.054  | 0.083                 | 0.030                 |                         |        |       |                       |                       |
| BOD: 5 Day ATU                            | mg/l     | 1.00                 | 3.28   | 1.70   | 2.91                  | 1.00                  | 1.39                    | 2.30   | 1.73  | 1.98                  | 1.40                  |
| Conductivity at 25 C                      | us/cm    | 479.00               | 870.00 | 683.57 | 794.20                | 581.30                |                         |        |       |                       |                       |
| Nitrate as N                              | mg/l     | 6.43                 | 12.00  | 9.30   | 11.35                 | 7.37                  |                         |        |       |                       |                       |
| Nitrite as N                              | mg/l     | 0.03                 | 0.12   | 0.05   | 0.08                  | 0.03                  |                         |        |       |                       |                       |
| Nitrogen, Total Oxidised as N             | mg/l     | 6.55                 | 12.00  | 9.35   | 11.42                 | 7.43                  | 9.46                    | 12.00  | 10.65 | 12.00                 | 9.83                  |
| Orthophosphate, reactive as P             | mg/l     | 0.010                | 0.092  | 0.039  | 0.083                 | 0.010                 | 0.01                    | 8.05   | 1.48  | 8.00                  | 0.01                  |
| Oxygen, Dissolved as O <sub>2</sub>       | mg/l     | 7.09                 | 14.1   | 11.185 | 13.17                 | 8.21                  |                         |        |       |                       |                       |
| Oxygen, Dissolved, % Saturation           | %        | 65.30                | 144.60 | 102.07 | 138.24                | 75.60                 | 78.20                   | 101.40 | 89.92 | 95.11                 | 81.27                 |
| pH  | pH units | 7.68                 | 8.98   | 8.11   | 8.43                  | 7.81                  | 7.86                    | 8.18   | 8.02  | 8.11                  | 7.92                  |
| Solids, non-volatile at 105 C             | mg/l     | 5.90                 | 17.60  | 10.93  | 16.99                 | 6.28                  | 7.40                    | 15.40  | 10.95 | 14.23                 | 7.67                  |



## 11.6 Aquatic Ecology and Designated Sites

- 11.6.1 Aquatic ecology data from the Environment Agency has shown that a total of nine monitoring points have been surveyed across the catchments within the Study Area and the 1 km buffer from 2017 – 2022.
- 11.6.2 Several locations lie outside of the 1km study area; however they lie on waterbodies that are hydraulically linked to those that fall within the boundary.
- 11.6.3 There are no fish surveys available from the Environment Agency within Section 1 and the 1km buffer.

**Table 11-8: Fish monitoring locations and their associated WFD catchments**

| Section | Site Name            | NGR            | Waterbody   | WFD Operational catchment | WFD Catchment                                | WFD ID          |
|---------|----------------------|----------------|-------------|---------------------------|--|-----------------|
| 2       | Lacey Acres          | TA 22716 07913 | Lacey Beck  | Becks Northern            | Lacey Beck / River Freshney Catchment        | GB10402 9067530 |
| 3       | Thorganby            | TF 20937 97586 | Waithe Beck |                           | Waithe Beck upper catchment                  | GB10402 9062040 |
|         | Brigsley             | TA 25251 01640 | Waithe Beck |                           | Waithe Beck lower catchment (to Tetney Lock) | GB10402 9062100 |
|         | Waithe               | TA 29144 00855 | Waithe Beck |                           |  |                 |
| 4       | Alvinham High Bridge | TF 37453 92134 | Louth Canal |                           | Louth Canal                                  | GB10402 9061990 |
| 5       | Little Carlton Mill  | TF 40125 85379 | The Beck    | Seeping and Eaus          | Long Eau                                     | GB10502 9061670 |
|         | Walk Farm            | TF 42296 86984 | Long Eau    |                           |  |                 |
|         | Three Bridges No1    | TF 43700 88100 | Long Eau    |                           |  |                 |
|         | Gayton Engine        | TF 45794 88002 | Great Eau   |                           | Great Eau (downstream of South Thorseby)     | GB10502 9061660 |

**Table 11-9: Distribution of Fish Species present within the Study Area**

| Site Species         | Lacey Acres | Thorganby | Brigsley | Waithe | Alvinham High Bridge | Little Carlton Mill | Walk Farm | Three Bridges No1 | Gayton Engine |
|----------------------|-------------|-----------|----------|--------|----------------------|---------------------|-----------|-------------------|---------------|
| Brown trout          | ✓           | ✓         | ✓        | ✓      | ✓                    |                     |           |                   |               |
| Bullhead             | ✓           |           |          |        |                      |                     |           |                   |               |
| European eel         |             | ✓         | ✓        | ✓      | ✓                    | ✓                   | ✓         | ✓                 | ✓             |
| Lamprey              |             |           |          |        |                      | ✓                   |           |                   |               |
| Stone Loach          |             |           | ✓        | ✓      | ✓                    |                     |           | ✓                 |               |
| Dace                 |             |           | ✓        | ✓      | ✓                    |                     |           | ✓                 |               |
| Gudgeon              |             |           |          |        | ✓                    |                     |           |                   |               |
| Rudd                 |             |           |          |        |                      |                     |           | ✓                 |               |
| Roach                |             |           |          |        | ✓                    |                     |           | ✓                 |               |
| 3 spined stickleback | ✓           |           |          |        | ✓                    | ✓                   |           |                   | ✓             |
| Pike                 |             |           |          |        |                      |                     |           | ✓                 | ✓             |
| Perch                |             |           |          | ✓      |                      |                     |           |                   |               |