**Schedule 2 – Call Off Employer Contract Data and Terms**


**MF1 (Rev 6) Call off Contract**

# Anglian-Midlands MEICA Framework - 9U3H-XU7DNK

**A contract between**

**The Environment Agency**

**and Integrated Water Services Ltd**

**for: Shropshire Groundwater Scheme Phase 1 Pump Replacement**

**Contract Ref: 30710**

## FORM OF AGREEMENT

This Agreement is made the 19th day of November 2020 between:

(1) ENVIRONMENT AGENCY of [redacted] (the “Purchaser") of the one part; and

(2) INTEGRATED WATER SERVICES LTD (Company Number: 5283349) of [redacted] (the “Contractor") of the other part.

Recitals:

(A) The Purchaser wishes to have certain Works executed by the Contractor, briefly described as:

Submersible Pump Servicing/Replacement Hopton, Lodgebank No1&No2, Greenlane, Ellerdine Heath and Hodnet No1&No2 Pumping Stations and has appointed the Purchaser’s [redacted] as the Engineer for the purposes thereof (the “Engineer").

(B) The Purchaser has agreed to engage the Contractor for the design, manufacture, delivery to Site, installation, testing and completion of the Works and the remedying of defects in the Works in accordance with the Contract, under the direction of the Engineer, in the sum of [redacted]

It is agreed as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the General Conditions.
2. The following documents and their annexes which have been bound in herewith shall be deemed to form and be read and construed as part of the Contract:
   (a) this Agreement;
   (b) the General Conditions and Appendix;
   (c) the Special Conditions;
   (d) the Specification and the drawing (if any) annexed to, or referred to in, the Contract;
   (e) the Schedules;
   (f) the Letter of Acceptance; and
   (g) the Tender or Contractor’s submission.
3. In consideration of the payments to be made by the Purchaser to the Contractor in accordance with the Contract, the Contractor agrees to design, manufacture, deliver to Site, install, test and complete the Works and to remedy defects in the Works in conformity in all respects with the provisions of the Contract.
4. The Purchaser shall pay the Contractor, in consideration of the execution and completion of the Works and the remedying of defects in the Works, the Contract Price or such other sum as may become payable

under the provisions of the Contract together with the Value Added Tax properly chargeable on such sums, at the times and in the manner prescribed by the Contract.

5. If any question, dispute or difference shall arise between the Purchaser and the Contractor in relation to the Contract or in any way related to the Works which cannot be settled amicably it shall be referenced to arbitration in accordance with Clause 52 (Disputes) of the General Conditions.

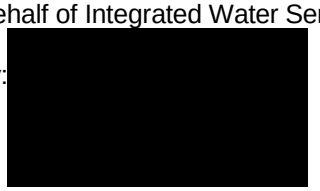
**IN WITNESS** whereof the parties have executed and delivered this Agreement as a deed on the date above written

**Signed** for and on behalf of the
**Environment Agency** by:

Authorised Signatory:
Name:
Position:
Date: 19th November 2020

**Signed** for and on behalf of Integrated Water Services Ltd by:

Authorised Signatory:



Name:

Position:
Date: 28th October 2023

The Terms and Conditions comprise the:

Model Form MF/1 (Rev 6) General Conditions of Contract (2014 Edition) including:

- Tender
- Form of Taking-Over Certificate
- Form of Sub-Contract

amended as set out in:

- the Appendix to the General Conditions of Contract attached hereto;
- the Amendments and Additions to the General Conditions of Contract contained in Schedule 2 of the Deed of Agreement concerning the Anglian-Midlands MEICA Framework; and
- the Special Conditions of Contract attached hereto.

## General Conditions of Contract

## Appendix

Where Clause numbers are specified here they refer to the General Conditions of Contract unless otherwise indicated.

### Clause 1 - Definitions

Sub-Clause 1.1m

The Engineer is [redacted] of The Environment Agency

Sub-Clause 1.1s

The Nominator is from the following institution:
The President of the Institution of Electrical Engineers or the President of the Institution of Mechanical Engineers as determined by the Purchaser

Sub Clause 1.1v

Performance Tests

The Performance Tests are to be detailed in the Specification or set out below (as may be further defined in the Specification) or otherwise agreed between the parties.

| Name of Performance Test | Performance requirements |
|---|---|
| As referenced in the project specification | |
| | |
| | |
| | |

Sub-Clause 1.1cc

Sections
The Works are divided into the following Sections:

| Name of Section | Definition of Section |
|---|---|
| As referenced in the project specification | |
| | |
| | |
| | |

Sub Clause 1.1ll

Time for Completion
Date for completion is 31st March 2021.

The date specified for the commencement of the Works is Monday 23rd November 2020.

| | |
|---|---|
| Sub-Clause 2.1 | Engineer's duties<br>The Engineer is required to obtain the Purchaser's prior specific approval before exercising the following duties:<br>N/A |
| Sub-Clause 4.1<br>Sub-Clause 10.1 | Precedence of documents<br>The order of precedence of the documents forming the Contract is as follows:<br>(a) this Agreement;<br>(b) the Letter of Acceptance;<br>(c) the Appendix;<br>(d) the Special Conditions;<br>(e) the General Conditions;<br>(f) the Specification;<br>(g) the drawing annexed to, or referred to in, the Contract<br>(h) the Schedules;<br>(i) the Tender or Contractor's submission |
| Sub-Clause 5.5 | Prime Cost items<br>Percentage to be added - N/A |
| Sub-Clause 6.2 | Labour, materials and transport<br>Sub-clause 6.2 of the General Conditions shall not apply |
| Sub-Clause 8.1 | Provision of bond or guarantee<br>Not required |
| Sub-Clause 10 | Notices<br><br>Purchaser's contact details:<br>Address: [redacted]<br>E-mail address: [redacted]<br><br>Engineer's contact details:<br>Address: [redacted]<br>E-mail address: [redacted]<br><br>Contractor's contact details:<br>Address: [redacted]<br>Facsimile Number: N/A<br>E-mail address: [redacted] |
| Sub-Clause 11.5 | The details of this Sub-Clause are set out in the Amendments and Additions to the General Conditions of Contract |
| Sub-Clause 11.6 | The details of this Sub-Clause are set out in the Amendments and Additions to the General Conditions of Contract |
| Sub-Clause 11.7 | Power, etc. for tests on Site<br>The following items will not be provided by the Purchaser:<br>Site welfare facilities<br><br>Use of the following items will be charged to the Contractor:<br>N/A |
| Sub-Clause 14.2 | Form of Programme<br>The details of this Sub-Clause are set out in the Amendments and Additions to the General Conditions of Contract |
| Sub-Clause 18.2 | Site Services<br>The rates for Site Services provided by the Purchaser:<br>N/A |

Sub-Clause 34.1

Delay in Completion
N/A

Sub-Clause 34.2

Prolonged delay
Maximum loss recoverable by the Purchaser
N/A

Sub-Clause 35.8

Consequences of failure to pass performance tests
The Time for completion of Performance Tests is set out in the Specification or set out below (as may be defined in the Specification)

| Name of Performance Test | Time for Completion of Performance Test (days after taking over) |
|---|---|
| N/A | |
| | |
| | |

(a) The liquidated damages for failure to pass Performance Tests are set out in the Specification or set our below (as may be further defined in the Specification)

| Name of Performance Test | Acceptable limit and liquidated damages |
|---|---|
| | |
| | |

If no details are inserted into the Specification or table, the damages shall be treated wherever they cause delay to the Programme as delays to Completion and the details for such delays are set out in the Sub-Clause 34.1 within this Appendix to the General Conditions of Contract

Sub-Clause 36.1

The Defects Liability Period shall be 12 Months after taking-over.

Sub-Clause 36.3

Notice of defects
The Defects Liability Period in respect of any repair or replacement shall not extend beyond 12 months from the date of taking-over under clause 29 (Taking-over)

Sub-Clause 39.1

Payments by instalments
The Contractor is entitled to the following milestone payments on achieving the corresponding milestone deliverables:

| Milestone deliverable | Milestone payment |
|---|---|
| [redacted] | |
| | |
| | |

Sub Clause 39.2

Where Sections are applicable, if any Sections of the Works is taken over separately under clause 29 (Taking-over) the release of retention on or after taking-over shall be made in respect of the Section taken over and reference to the retention shall mean such part of the retention as shall, in the absence of agreement, be apportioned to such Section by the Engineer.

Sub Clause 39.3

Time for application

(a) Time for applications for interim certificates of payment
Applications for interim payment certificates shall be made on or after the date that the relevant milestone deliverable has been achieved

If the whole or any part of the Works have been suspended pursuant to sub-clause 25.1 (Suspension of work, delivery or installation), applications for interim payment certificates shall be made on or after the last Friday of each month in relation to the Works affected by the suspension until the suspension is lifted, the suspended Works are omitted or the Contract is terminated.

Form of application

(d) Document to accompany applications for a certificate of payment

(i) Evidence required of the value of work done on the Site:
"Each application shall be supported by separate sheets setting forth in detail the order of the Schedules of Rates the Contract Price particulars of the Works executed on the Site and of the Plant delivered to the Site pursuant to the Contract since the period covered by the last preceding certificate (if any)"
……..
……..

(ii) Evidence required of the value of work done for Plant in the course of manufacture:
……...
…….

(iii) Evidence required for Plant delivered
…….
…….

| Milestone deliverable | Evidence required to demonstrate milestone deliverable has been achieved |
|---|---|
| | |
| | |

Sub-Clause 39.5

Final date for payment
The Final Date is 30 days after the Due Date

Sub-Clause 40.4

Delayed Payment
The rate of interest on overdue payment shall be 2% per annum above the Bank of England base rate in force from time to time during the period of delay

Sub-Clause 40.6

Advance Payment
Advance Payments does not apply

Sub-Clause 40.7

Currencies of Payment
The Contract Price (including any adjustments) shall be paid in the following currencies:
English Pound Sterling

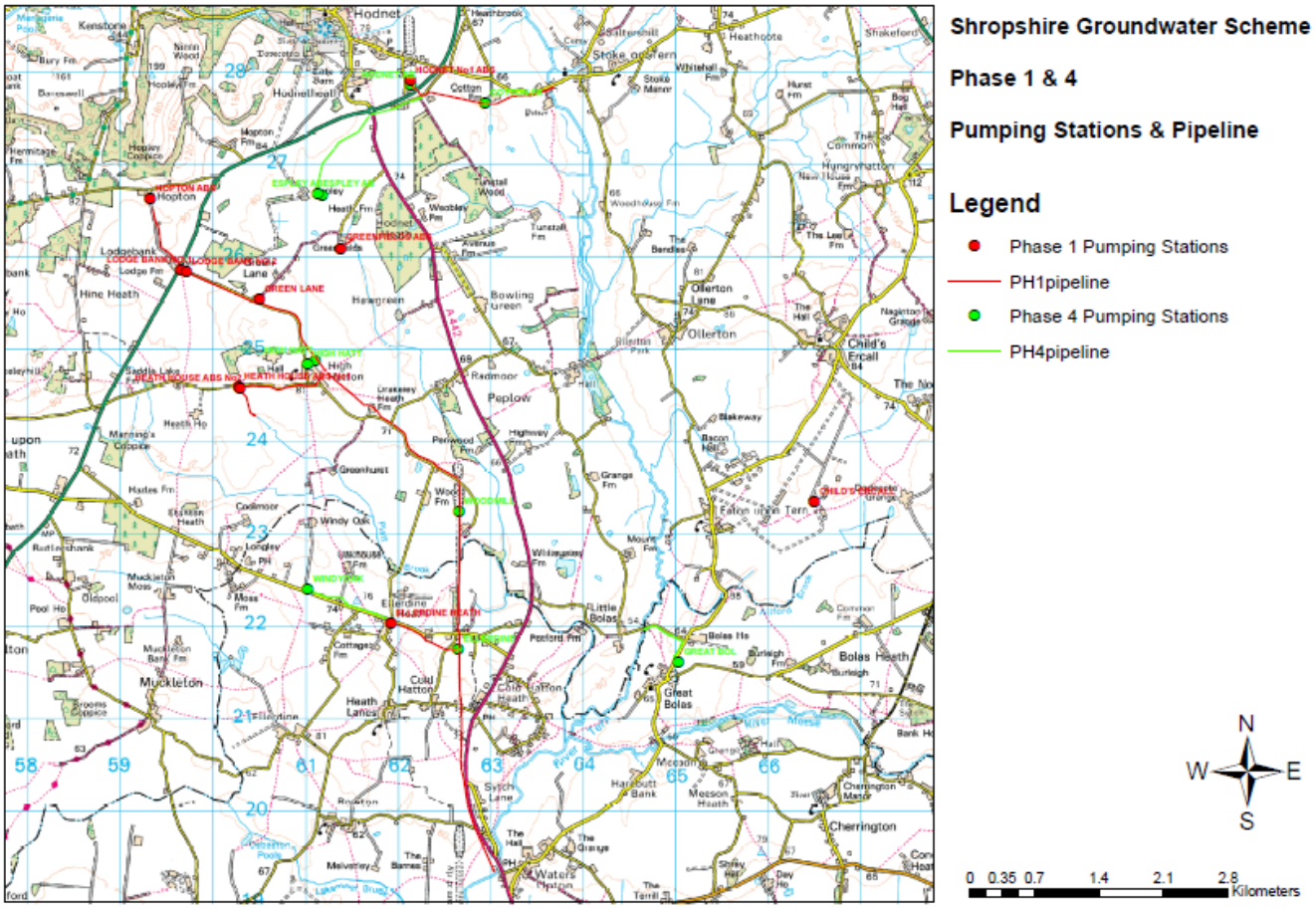
| | |
|---|---|
| Sub-Clause 40.8 | Taxes<br>The Purchaser is responsible for the following taxes:<br>Unless otherwise stated in the Contract the Contract Price is deemed to exclude Value Added Tax. To the extent that Value Added Tax is properly chargeable on the supply to the Purchaser of any goods or services provided by the Contractor under the Contract, the Purchaser shall pay such Value Added Tax as an addition to payments otherwise due to the Contractor under the Contract |
| Sub-Clause 41.2 | Allowance for profit on claims<br>Percentage to be added – nil % |
| Sub-Clause 44.3 | Limitation of contractor's liability<br>Limit of Liability - £5,000,000 (five million pounds) |
| Sub-Clause 47.4 | Third party insurance<br>The details of this Sub-Clause are set out in the Amendments and Additions to the General Conditions of Contract |
| Sub-Clause 52.1 | Arbitration<br>(c) The arbitration rules are Rules of Arbitration of the International Chamber of Commerce (2012)<br>(d) The seat of the arbitration is London, England<br>(where Special Condition 2: Adjudication applies) |
| Sub-Clause 52.4 | Adjudication<br><br>(c) The adjudication rules are: As set out in Construction Industry Council Model Adjudication Procedure: Fourth Edition |
| Sub-Clause 53.1 | Applicable law<br>The substantive law of the contract is the law of England |

# 25Environment Agency

# Shropshire Groundwater Scheme Phase 1

# Specification for Submersible Pump Servicing/Replacement Hopton, Lodgebank No1&No2, Greenlane, Ellerdine Heath and Hodnet No1&No2 Pumping Stations

# 2020/21 Programme




# 8 September 2020

**Project Contacts**

MEICA Advisor

MEICA Advisor

Senior Commercial Officer

Environment Agency SGS Project Manager

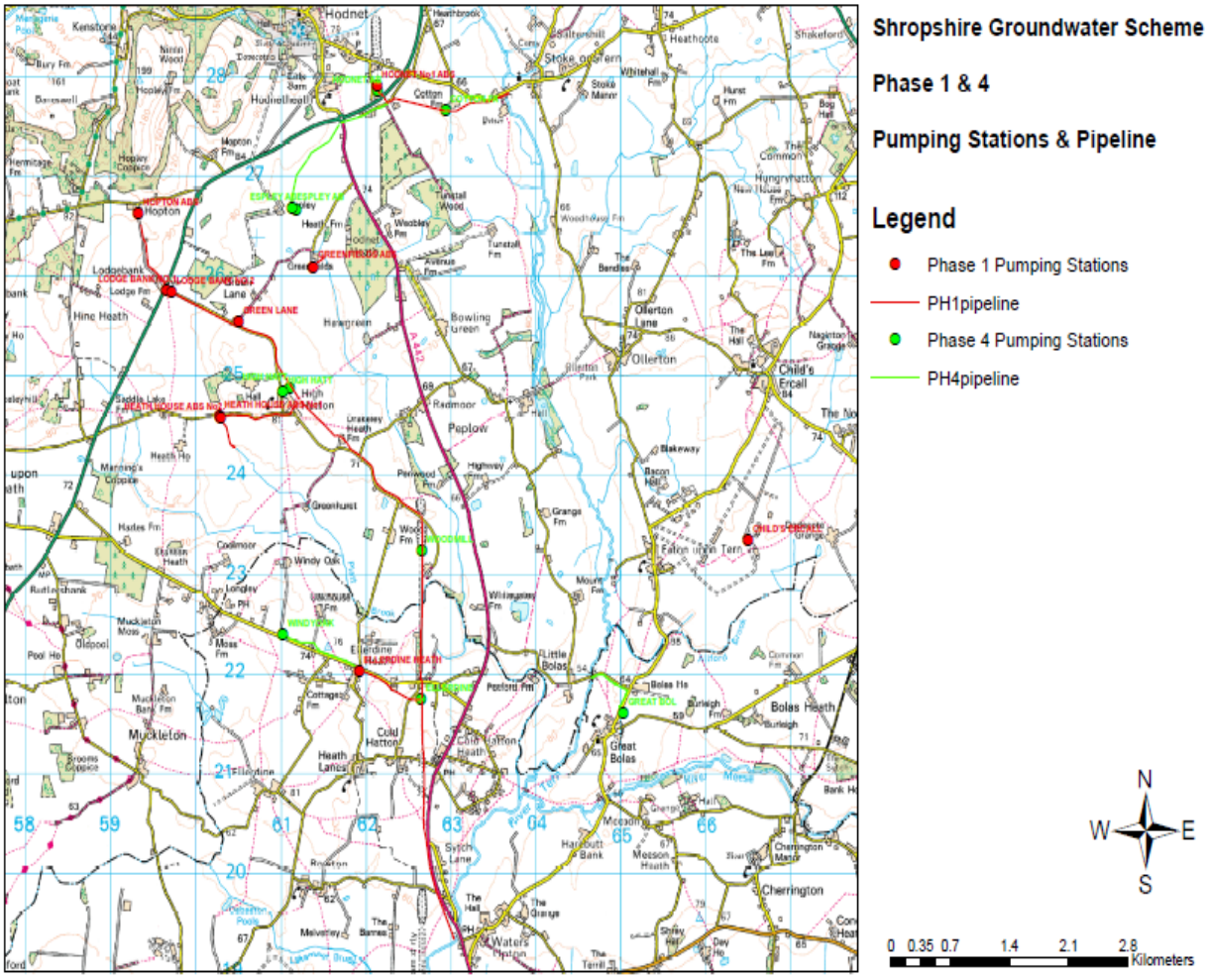
### 1.1 Background

Shropshire Groundwater Scheme is a category A strategically important groundwater transfer scheme owned and operated by the Environment Agency. Phase 1&4 of the scheme is located approximately 20km north east of Shrewsbury, North Shropshire.

Phase 1 was commissioned in 1984, it comprises eleven abstraction boreholes distributed between nine individual pumping stations. The phase is capable of generating a combined gross yield of up to 45 Ml/d drawing groundwater from the Permo-Triassic sandstone aquifer. Groundwater abstraction at each of the pumping stations is achieved via an electrically driven (3 phase) submersible pump. The pumps are set within large diameter abstraction boreholes, suspended from head plates on 200mm diameter bolted mild steel rising main at depths of 50 to 90m below ground level.

In 2005 the capacity of this area was increased with the installation of new groundwater pumping stations (Phase 4) interlinked with the existing Phase 1 network.

Figure 1 Shropshire Groundwater Scheme Phase 1&4 Location of Groundwater Pumping stations and Distribution Pipeline



### *1.2Purpose of contract*

The purpose of this document is to provide a specification for the removal /servicing / reinstallation of three electrical submersible pumps, and the removal/disposal of four existing electrical submersible pumps and their replacement/installation with four new electrical submersible pumps. Up to seven pumps in total are covered by this specification.

These units are currently installed in abstraction boreholes located across five groundwater pumping stations associated with the Phase 1 area of the Environment Agency's Shropshire Groundwater Scheme.

### *1.3Contract arrangements*

This work will be awarded via submission of competitive quotes from mechanical and electrical contractors within the Environment Agency's Midlands MEICA Framework Contract. The work must be completed and invoiced by no later than 31st March 2021.

The contract will be undertaken using the MF/1 (rev 6) contract as per the included documents. All works to comply with MEICA standards or where applicable the Water Industry Mechanical Electrical Standards may be used.

Summary of key refurbishment activities

| Pump Station | Submersible Pump | Rising Main | Instrumentation Tubes | Well Screen Design |
|---|---|---|---|---|
| Ellerdine Heath<br><br>Hodnet No1*<br><br>Hopton | Existing pump and power cable to be removed disposed of and replaced with new unit. | Existing rising main to be replaced with new 8" NPS schedule 40, flanged carbon steel rising main, with fusion bonded epoxy coating. | Plastic instrumentation tubes to be replaced with new clamped to the rising main. | Hodnet No1* Bespoke design required for rising main set to fit power cable and instrumentation tube within reduced diameter well screen. |
| Hodnet No2 | Existing pump and power cable to be removed disposed of and replaced with new unit at shallower depth. | Existing rising main to be retained and reused | Design and securing of plastic instrumentation tubes required for reduced diameter well screen. | Hodnet No2* Bespoke design required for rising main set to fit power cable and instrumentation tube within reduced diameter well screen. |
| Greenlane<br><br>Lodgebank No1<br><br>Lodgebank No2 | Existing pump and power cable to be removed serviced and reinstalled. | Existing rising main to be replaced with new 8" NPS, schedule 40 flanged carbon steel rising main, with fusion bonded epoxy coating. | Plastic instrumentation tubes to be replaced with new clamped to the rising main. | |

Figure 2: Summary of current installed submersible pumps to be replaced by this contract 2020/21 programme.

| *PHASE 1* | Installation Date | Pump Type | Model | Serial Number | N° Stages | Power Cable (pump to junction box) m | Pump Depth mbdat | Power kW | Amps A | Voltage V | Cycles Hz | Speed rpm | Flowrate m3/hr | Total Head m | Max static weight lift (pump+cable+rising main+instrumentation tubes+headplate) Tonne |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ellerdine Heath** | 1984 | Pleuger | P104/2A+V8-68 | B8095 | | ? | 61 | 42.5 | 70 | 415 | 50 | 2900 | 166 | 42 | |
| **Green Lane** | Dec 2010 | Flowserve | Q102/2+M8-580-2 | 591561-003-01 | | ? | 49 | 49 | 95 | 400 | 50 | 2900 | 270 | 45 | 2.3 |
| **Hodnet No 1** | 1984 | Pleuger | Q102/2+V10-60 | B8094 | | ? | 67 | 62 | 99 | 415 | 50 | 2900 | 270 | 49.5 | |
| **Hopton** | 1974 | Pleuger | Q102/2+V11-56 | B4458 | | ? | 50 | 54 | 86 | 415 | 50 | 2900 | 286 | 47 | |
| **Lodgebank No 1** | Jan 2010 | Flowserve | QN102-2+M8-580-2 | 582781-002-02 | | ? | 61 | 55 | 105 | 400 | 50 | 2900 | 270 | 49.5 | |
| **Lodgebank No 2** | Jan 2010 | Flowserve | QN102-2+M8-580-2 | 582781-002-01 | | ? | 81 | 55 | 105 | 400 | 50 | 2900 | 270 | 49.5 | 3.8 |
| **Hodnet No 2** | 2000 | Ingersoll-Dresser | PN122/1a + M8-330-2 | C3152 | | ? | 90 | 33 | 67 | 415 | 50 | 2900 | 270 | 30 | 3.6 |

Figure 3 : Schematic drawing of typical confined space chamber housing borehole headworks and abstraction borehole containing the submersible pump

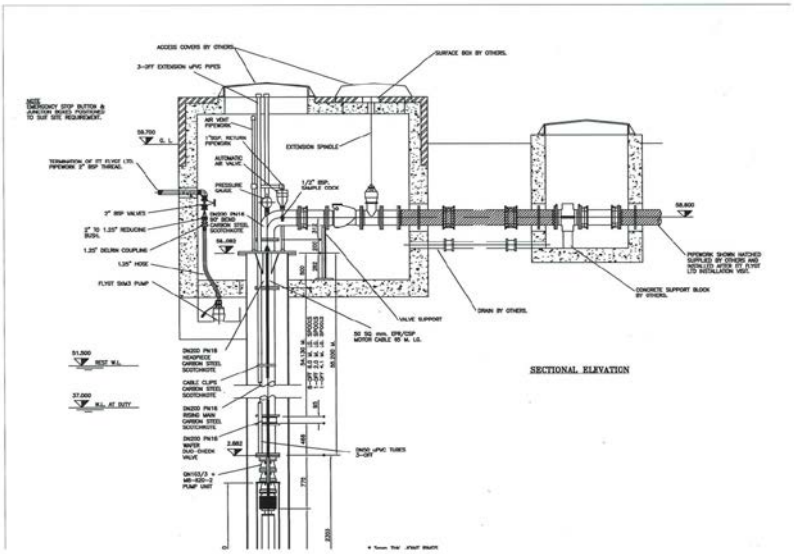



Figure 4 : Summary of borehole construction details in which the submersible pumps are installed

| Site Name | Grid Reference | Site TBM pin (mAOD) | Dip Tube Datum (mAOD) | Casing Depth (mbdat) | Casing Diameter (mm) | Low level cut off probe depth (mbdat) | Submersible pump depth (mbdat) | Borehole Depth (mbdat) | Borehole Diameter (mm) | Rest Water Level (mbdat) | Max pumping water level 2005 to 2020 (mbdat) | Head of water between pumping water level: cut off probe depth (m) | Head of water between pumping water level: submersible pump (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ELLERDINE HEATH | SJ 6192 2202 | 70.700 | 70.443 | 0 to 16<br>16 to 100 | 600mm mild steel plain casing<br>570mm uncreen sandstone bedrock | 55 | 61 | 100 | 570 | 4 | 42 | 13 | 19 |
| GREENLANE | SJ 6050 2553 | 85.050 | 84.94 | 0 to 20<br>20 to 120 | 600mm mild steel plain casing<br>570mm uncreen sandstone bedrock | 44 | 49 | 120 | 570 | 13 | 30 | 14 | 19 |
| HODNET No1 (north) | SJ 6213 2791 | 73.588 | 73.43 | 0 to 33<br>28 to 29<br>29 to 148<br>149 to 150 | 600 Steel liner<br>382 Plain stainless steel liner drop set<br>382 wire wound stainless steel well screen<br>382 Plain stainless steel liner | 63 | 67 | 150 | 570 | 3 | 46 | 17 | 21 |
| HODNET No2 (south) | SJ 6214 2786 | 73.870 | 73.91 | 0 to 50<br>0 to 47<br>47 to 148<br>148 to 150 | 570 Steel casing<br>370 Plain stainless steel liner<br>370 wire wound stainless steel well screen<br>370 Plain stainless steel liner | 86 | 90 | 150 | 570 | 3 | 43 | 43 | 47 |
| HOPTON | SJ 5932 2662 | 93.508 | 93.339 | 0 to 44<br>44 to 150 | 600mm mild steel plain casing<br>570mm uncreen sandstone bedrock | 45 | 50 | 150 | 570 | 17 | 30 | 15 | 20 |
| LODGE BANK No1 | SJ 5965 2585 | 87.267 | 87.1 | 0 to 17<br>17 to 120 | 600mm mild steel plain casing<br>570mm uncreen sandstone bedrock | 47 | 61 | 120 | 570 | 15 | 36 | 11 | 25 |
| LODGE BANK No2 | SJ 5971 2584 | 85.876 | 85.71 | 0 to 17<br>17 to 120 | 600mm mild steel plain casing<br>570mm uncreen sandstone bedrock | 46 | 61 or 81? | 120 | 570 | 13 | 35 | 11 | 26 or 46? |

## 2. **Schedule of Submersible Pumps to be Removed and Replaced**

These submersible pumps were originally installed in 1983/84 and have been removed twice for servicing in their 36 year deployment. These submersible pumps have exceeded their anticipated life expectancy and are to be replaced as part of the 2020/21 planned asset maintenance programme. The pumps are located at the following pumping stations.

- Ellerdine Heath
- Hodnet No1 & No2
- Hopton

The contract will include the removal and disposal of the existing four submersible pump units and the procurement, replacement, installation and commissioning of four like-for-like replacement electrical submersible pumps. The pumps are set within large diameter abstraction boreholes, suspended from head plates on 200mm diameter bolted rising main at depths of 50 to 90m below ground level.

Ellerdine Heath and Hopton boreholes are unscreened with the top cased section leading to 570mm diameter open-hole unscreened sandstone bedrock aquifer. The submersible pumps in the No1 and No2 boreholes at Hodnet sit within stainless steel Johnson well screens 370 to 382mm internal diameter. The abstraction boreholes are located on established groundwater pumping station sites in the ownership of the Environment Agency with proven direct access from the public highway for mobile cranes.

### *2.1 Ellerdine Heath (site location OS Grid SJ 6192 2202, what3words FLICKERS.WOES.GLARE)*

**Borehole design:**
Rest water level: ~3mbdat
Pumping water level (under combined group pumping conditions): ~42mbdat
Borehole total depth: 100m
0 – 16m, 600mm diameter mild steel plain casing
16 – 100m, 571mm diameter unscreened sandstone bedrock

**Site access & layout**: Direct access gated from public highway leading to self-contained pumping station compound. There is sufficient room for a mobile crane and other vehicles to park up and area to safely lay down rising main. Borehole headworks housed in below ground concrete chamber with two pneumatically hinged access covers. Confined spaces entry procedures will be required to access and work in the borehole chamber.

**Pump summary**: Pleuger-Dresser electro-submersible unit; pump type P104/2A+V8-68 rated at 42kW, designed to deliver 47 litres per second against a total head of 42 metres. First installed in 1984, this unit has exceeded its life expectancy and is to be replaced with a brand new unit replicating the pump yield performance.

**Rising Main:** Pump set at a depth of 61metres, suspended from the borehole head plate on 61 metres of 200mm nominal bore flanged NP16 uncoated mild steel rising main. At 36 years old

the rising main has exceeded its life expectancy. It is to be replaced with 8" NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating. Maximum 6m pipe length. Allowance should be made to include enough cable to run from the submersible pump through the borehole flange plate to the junction box located on the wall of the borehole chamber.

Borehole head plate is designed to suspend the weight of the submersible pump, cable, rising main and the three instrumentation tubes carrying; the pressure transducer for groundwater level measurement, the low level cut off probes and the tube to allow a dip tape access. The three plastic instrumentation tubes are attached to the rising main. The instrumentation tubes are to be replaced as part of this refurbishment programme clamped to the rising main.

The borehole headworks contain single orifice air valve with venting to outside of borehole chamber provided to control surge pressure on start-up and shut down. Leading from the borehole headworks on the 200mm diameter delivery main is a non-return valve an isolating gate valve (DN200, BS4504, PN16 flanges) and a tapping point for the raw water sample tap.

Summary of key points

- **Submersible pump**: existing unit to be removed disposed of and new replacement pump installed.
- **Rising Main**: current mild steel rising main to be replaced with new 8" NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating, maximum 6m pipe length.
- **Instrumentation tubes**: are to be replaced with new tubes bracketed to the rising main.

Ellerdine Heath borehole headworks

### *2.2 Hopton Pumping Station (site location OS Grid SJ 5932 2662, what3words COMPLIES.BRIEFING.POST )*

**Borehole design:**

Rest water level: ~17mbdat

Pumping water level (under combined group pumping conditions): ~30mbdat

Borehole total depth: 150m
0 – 44m, 600mm diameter mild steel plain casing
44 – 150m, 570mm diameter unscreened sandstone bedrock

**Site access & layout**: Direct access from public highway via a partially tarmacked access track. Gated access to self-contained pumping station compound leads. There is sufficient room for mobile crane and some vehicles to park up and space to safely lay down rising main. A pole mounted 3 phase electricity transformer is present on the edge of the site.

Borehole headworks housed in below ground concrete chamber with two pneumatically hinged access covers. Confined spaces entry procedures will be required to access and work in the borehole chamber.

**Pump summary**: Pleuger-Dresser electro-submersible unit; pump type Q102/2+V11-56 rated at 54kW, designed to deliver 80 litres per second against a total head of 47 metres. First installed in 1984, this unit has exceeded its life expectancy and is to be replaced with a brand new unit replicating the pump yield performance.

**Rising Main:** Pump set at a depth of 50 metres, suspended from the borehole head plate on 50 metres of 200mm nominal bore flanged NP16 uncoated mild steel rising main At 36 years old the rising main has exceeded its life expectancy. It is to be replaced with 8” NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating. Maximum 6m pipe length. Allowance should be made to include enough cable to run from the submersible pump through the borehole flange plate to the junction box located on the wall of the borehole chamber.

Borehole head plate is designed to suspend the weight of the submersible pump, cable, rising main and the three instrumentation tubes carrying; the pressure transducer for groundwater level measurement, the low level cut off probes and the tube to allow a dip tape access. The three plastic instrumentation tubes are attached to the rising main. The instrumentation tubes are to be replaced as part of this refurbishment programme clamped to the rising main.

The borehole headworks contain single orifice air valve with venting to outside of borehole chamber provided to control surge pressure on start-up and shut down. Leading from the borehole headworks on the 200mm diameter delivery main is a non-return valve an isolating gate valve (DN200, BS4504 PN16 flanges) and a tapping point for the raw water sample tap.

Summary of key points

- **Submersible pump**: existing unit to be removed disposed of and new replacement pump installed.
- **Rising Main**: current mild steel rising main to be replaced with new 8” NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating, maximum 6m pipe length.
- **Instrumentation tubes**: are to be replaced with new tubes bracketed to the rising main.

Hopton borehole headworks

**2.3 Hodnet Pumping Station No1 Pump (site location OS Grid SJ 6213 2791, what3words SOUND.CLASHING.STAR)**

**Borehole design:**

Rest water level: ~3mbdat
Pumping water level (under combined group pumping conditions): ~46mbdat
Borehole total depth: 150m
0 – 46m, 600mm diameter mild steel plain casing
28 to 29m, 382mm diameter stainless steel plain casing
29 to 148m, 382mm diameter stainless steel well screen casing
148 to 150m, 382mm diameter stainless steel plain casing end cap

**Site access & layout**: Direct access from Webster Lane public highway leading to a joint shared access track leading to single residential static caravan, access track to residential property and fenced self-contained pumping station compound. The compound houses the Hodnet pump control building, the No1 and No2 groundwater chambers and a large brick storage building. CCTV cameras are set on a pole providing live and recorded images of the No1 compound area. The large brick storage building is in an unsafe condition and plans are under way to demolish the building between October and December 2020. This is required before safe access can be permitted to remove the No2 pump. Access to the No1 borehole area is via double gate. Wooden post and rail fencing to be temporarily removed opposite gateways to allow room for cranes to access the compound from the track.

There is sufficient room for the mobile crane to set up and lay down rising main. Consideration will have to be given to crane position and the boom movement in relation to overhead BT cables. Incoming mains supply is underground at this site. Additional parking of vehicles will be available on the No2 borehole compound area once the building has been demolished.

Previous residents of the static caravan had given rise to hostile behaviour, particularly with the parking of vehicles on the southern bend approach to the pumping station. Thankfully the family have sold up and moved out. The caravan site is currently under redevelopment and the Relationship with the new occupants is amicable. Prior notice of any works will be given to the caravan residents to ensure the access is clear for the crane and other works traffic.

Third party access along the track running through the site is used daily by owners of the residential property to the north of the pumping station. The safe passage of the residents driving up and down the access track during the works will have to be considered under the construction phase plan.

Borehole headworks housed in below ground chamber with two pneumatically hinged access covers. Confined spaces entry procedures will be required to access and work in the borehole chamber.

**Pump summary:** Pleuger-Dresser electro-submersible unit; pump type Q102/2+V10-60 rated at 62kW, designed to deliver 75 litres per second against a total head of 50 metres. First installed in 1984, this unit has exceeded its life expectancy and is to be replaced with a brand new unit replicating the pump yield performance.

**Rising Main**: Pump set at a depth of 67 metres, suspended from the borehole head plate on 67 metres of 200mm nominal bore flanged NP16 uncoated mild steel rising main. At 36 years old the rising main has exceeded its life expectancy. It is to be replaced with 8" NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating, maximum 6m pipe length. Allowance should be made to include enough cable to run from the submersible pump through the borehole flange plate to the junction box located on the wall of the borehole chamber.

Borehole head plate is designed to suspend the weight of the submersible pump, cable, rising main and the three instrumentation tubes carrying; the pressure transducer for groundwater level measurement, the low level cut off probes and the tube to allow a dip tape access. The three plastic instrumentation tubes are attached to the rising main. The instrumentation tubes are to be replaced as part of this refurbishment programme clamped to the rising main.

The borehole headworks contain single orifice air valve with venting to outside of borehole chamber provided to control surge pressure on start-up and shut down. Leading from the borehole headworks on the 200mm diameter delivery main is a non-return valve an isolating gate valve (DN200, BS4504 PN16 flanges) and a tapping point for the raw water sample tap. The submersible pump sits within a stainless steel Johnson well screen forming part of the borehole design.

Given the reduced diameter of the well screen at 382mm a design proposal for the rising main set is required to accommodate the inclusion of the three instrumentation tubes (manual dip tape access, pressure transducer and low level cut off probes) plus the power cable.

Summary of key points

- **Submersible pump**: existing unit to be removed disposed of and new replacement pump installed.
- **Rising Main** : current mild steel rising main to be replaced with new 8" NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating, maximum 6m pipe length.

- **Rising Main Design** : design proposal for the rising main set is required to accommodate the inclusion of the three instrumentation tubes (manual dip tape access, pressure transducer and low level cut off probes) plus the power cable
- **Instrumentation tubes**: are to be replaced with new tubes bracketed to the rising main.

Hodnet No1 borehole headworks



**2.4 Hodnet Pumping Station No2 Pump (site location OS Grid SJ 6213 2786, what3words UNFOCUSED.RACKS.LIBERATED)**

**Borehole design:**

Rest water level: ~3mbdat
Pumping water level (under combined group pumping conditions): ~50mbdat
Borehole total depth: 150m
0 to 47m, 370mm diameter mild steel plain casing
47 to 148m, 370mm diameter stainless steel well screen casing
148 to 150m, 370mm diameter stainless steel plain casing end cap

**Site access & layout**: Same access as for Hodnet No1. The No2 pump is house in an underground cast concrete chamber in front of the southern gable end of the large brick storage building. The large brick storage building is in an unsafe condition and plans are under way to demolish the building between October and December 2020. This is required before safe access can be permitted to remove the No2 pump. Access is via double gate. Wooden post and rail fencing to be temporarily removed opposite gateways to allow room for cranes to access the compound from the track.

There is sufficient room for the mobile crane to set up and lay down rising main. Consideration will have to be given to crane position and the boom movement in relation to overhead BT cables. Incoming mains supply is underground at this site. Additional parking of vehicles will be available on the No1 borehole compound area once the building has been demolished.

Previous residents of the static caravan had given rise to hostile behaviour, particularly with the parking of vehicles on the southern bend approach to the pumping station. Thankfully the family have sold up and moved out. The caravan site is currently under redevelopment and the

Relationship with the new occupants is amicable. Prior notice of any works will be given to the caravan residents to ensure the access is clear for the crane and other works traffic.

Third party access along the track running through the site is used daily by owners of the residential property to the north of the pumping station. The safe passage of the residents driving up and down the access track during the works will have to be considered under the construction phase plan.

Borehole headworks housed in below ground chamber with two pneumatically hinged access covers. Confined spaces entry procedures will be required to access and work in the borehole chamber.

**Pump summary:** Pleuger-Dresser electro-submersible unit; pump type PN122/1a + M8-330-2 rated at 33kW, designed to deliver 74 litres per second against a total head of 30 metres. First installed in 2000, this unit has never really achieved its design yield and the pump has not be operated since 2016 and is to be replaced with a brand new unit. The new submersible unit is to be sized to sit and operate within the 370mm well screen and deliver a yield of 65 litres per second against a head of 50m. The motor size and amp rating must be compatible with the incoming electrical supply to the pump control panel. This is fed from a 400V 3-phase supply – the contractor must refer to the drawings in Appendix H and investigate on site to ensure this is accurate. Both Hodnet pumps 1 and 2 are powered and controlled by this panel. The FLC of both pumps plus ancillary loads such as sump pumps should be factored and checked during pump selection. The new pumps must be compatible with the existing motor starters with no detriment to safety, performance and operation of the system for continued use.

**Rising Main**: the replacement pump is to be at a depth of 78 metres (12m shallower than the current unit depth of 90m), suspended from the borehole head plate on 78 metres of 200mm nominal bore flanged NP16 uncoated mild steel rising main. At 20 years old the rising main is still within its life expectancy and subject to inspection is proposed to be reused. Allowance should be made to include enough cable to run from the submersible pump through the borehole flange plate to the junction box located on the wall of the borehole chamber.

Borehole head plate is designed to suspend the weight of the submersible pump, cable, rising main and the three instrumentation tubes carrying; the pressure transducer for groundwater level measurement, the low level cut off probes and the tube to allow a dip tape access. The three plastic instrumentation tubes are attached to the rising main. The instrumentation tubes are to be replaced as part of this refurbishment programme and secured to the rising main.

The borehole headworks contain single orifice air valve with venting to outside of borehole chamber provided to control surge pressure on start-up and shut down. Leading from the borehole headworks on the 200mm diameter delivery main is a non-return valve an isolating gate valve (DN200, BS4504 PN16 flanges) and a tapping point for the raw water sample tap.

Given the reduced diameter of the well screen at 370mm a design proposal for the rising main set is required to accommodate the inclusion of the three instrumentation tubes (manual dip tape access, pressure transducer and low level cut off probes) plus the power cable.

Summary of key points

- **Submersible pump**: existing unit to be removed disposed of and new replacement pump installed at a shallower target depth of 78m.
- **Rising Main**: current mild steel rising main to be inspected, retained and reused. If replaced use 8" NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating, maximum 6m pipe length.
- **Rising Main Design**: design proposal for the rising main set is required to accommodate the inclusion of the three instrumentation tubes (manual dip tape access, pressure transducer and low level cut off probes) plus the power cable
- **Instrumentation tubes**: are to be replaced with new tubes bracketed to the rising main.

## Hodnet No2 borehole headworks

3. **Schedule of Submersible Pumps to be serviced**

These submersible pumps were originally installed in 2009/10 and have not been removed in their 10/11 year deployment. It is anticipated that submersible pumps are half way through their expected life expectancy and are to be removed, inspected and serviced as part of the 2020/21 planned asset maintenance programme. The pumps are located at the following pumping stations.

- Greenlane
- Lodgebank Pump No1
- Lodgebank Pump No2

The contract will include the removal of the three existing submersible pump units. They are to be sent away for inspection, and if economical to do so, servicing of the pumps at a qualified submersible pump engineering firm. A condition report is to be generated for each pump reporting on the condition of the pump and its motor and any servicing work carried out. The serviced units are to be tank tested to compare their serviced yield performance with the manufacturers original pump curves. Once tested the pumps are to be reinstalled and recommissioned.

If any of the pumps do not prove economically viable to service they are to be disposed of and the procurement, replacement, installation and commissioning of a like-for-like replacement electrical submersible pump(s). The pumps are set within 570mm diameter abstraction boreholes, suspended from head plates on 200mm diameter bolted rising main at depths of 49 to 81m below ground level.

There are no well screens installed in any of the boreholes with the top cased section leading to open-hole unscreened sandstone bedrock aquifer. The abstraction boreholes are located to on established groundwater pumping station sites in the ownership of the Environment Agency with direct access from the public highway.

***3.1 Greenlane (site location OS Grid SJ 6050 2551, what3words GRUNT.SUCCESS.SHORTEN)***

**Borehole design:**

Rest water level: ~13mbdat
Pumping water level (under combined group pumping conditions): ~30mbdat
Borehole total depth: 120m
0 – 20m, 600mm diameter mild steel plain casing
20 – 120m, 570mm diameter unscreened sandstone bedrock

**Site access & layout**: Direct access from country lane public highway leading to self-contained pumping station compound. There is sufficient room for a mobile crane and some vehicles to park up and area to safely lay down rising main. Additional parking on grass verge outside the station. No pole mounted 3 phase transformer is located within the site boundary with the incoming power cable buried underground. Buried poly crate soakaway located in soil on the edge of the tarmac area to the left of the borehole chamber. Borehole headworks housed in below ground confined spaces chamber with two pneumatically hinged access covers.

Confined spaces entry procedures will be required to access and work in the borehole chamber.

**Pump summary**: Flowserve electro-submersible unit; pump type Q102/2+M8-580-2 rated at 49kW, designed to deliver 81 litres per second against a total head of 45 metres. Pump set at a depth of 49 metres. The submersible pump is half way through its life expectancy and is to be removed, inspected, serviced, reinstalled at the same target depth and recommissioned. If the pump does not prove economically viable to service it is be disposed of and the procurement, replacement, installation and commissioning of a like-for-like replacement electrical submersible pump.

**Rising Main**: Pump set at a depth of 49 metres, suspended from the borehole head plate on 49 metres of 200mm nominal bore flanged NP16 uncoated mild steel rising main. At 36 years old the rising main has exceeded its life expectancy. It is to be replaced with 8" NPS schedule, 40 flanged, carbon steel rising main, with fusion bonded epoxy coating, maximum 6m pipe length. Allowance should be made to include enough cable to run from the submersible pump through the borehole flange plate to the junction box located on the wall of the borehole chamber.

The submersible pump is possibly housed within a steel shroud. A replacement shroud should be priced by the contractor.

Borehole head plate is designed to suspend the weight of the submersible pump, cable, rising main and the three instrumentation tubes carrying; the pressure transducer for groundwater level measurement, the low level cut off probes and the tube to allow a dip tape access. The three instrumentation tubes are currently attached to the rising main.

The borehole headworks contain two single orifice air valves with venting to outside of borehole chamber provided to control surge pressure on start-up and shut down. Leading from the borehole headworks on the 200mm diameter delivery main is a non-return valve, an isolating gate valve (DN200, BS4504 PN16 flanges) and a tapping point for the raw water sample tap.

Summary of key points

- **Submersible pump**: existing unit to be removed, serviced, reinstalled and commissioned.
- **Rising Main** : current mild steel rising main to be replaced with new 8" NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating., maximum 6m pipe length.
- **Instrumentation tubes**: are to be replaced with new tubes bracketed to the rising main.

Greenlane borehole headworks

### *3.2 Lodgebank Pumping Station No1 Pump (site location OS Grid SJ 5965 2585, what3words CARDS.SUBMERGED.FEUDS)*

**Borehole design:**

Rest water level: ~15mbdat
Pumping water level (under combined group pumping conditions): ~36mbdat
Borehole total depth: 120m
0 – 17m, 600mm diameter mild steel plain casing
17 – 120m, 570mm diameter unscreened sandstone bedrock

**Site access & layout**: Direct access from country lane public highway leading to large self-contained pumping station compound containing the No1 and No2 pumps. There is sufficient room for a mobile crane and vehicles to park up and area to safely lay down rising main. There is a pole mounted 3 phase transformer located within the north east corner of the site boundary. The incoming power cable from the transformer is routed underground to the pump control building. Borehole headworks housed in below ground confined spaces chamber with two pneumatically hinged access covers. Confined spaces entry procedures will be required to access and work in the borehole chamber. A public footpath crosses through and in front of the No1 borehole chamber area.

**Pump summary**: Flowserve electro-submersible unit; pump type QN102-2+M8-580-2 rated at 55kW, designed to deliver 75 litres per second against a total head of 50 metres. Pump set at a depth of 61 metres. The submersible pump is half way through its life expectancy and is to be removed, inspected, serviced, reinstalled at the same target depth and recommissioned. If the pump does not prove economically viable to service it is be disposed of and the procurement, replacement, installation and commissioning of a like-for-like replacement electrical submersible pump.

**Rising Main**: Pump set at a depth of 61 metres, suspended from the borehole head plate on 61 metres of 200mm nominal bore flanged NP16 uncoated mild steel rising main. At 36 years old the rising main has exceeded its life expectancy. It is to be replaced with 8” NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating, maximum 6m pipe length. Allowance should be made to include enough cable to run from the submersible pump through the borehole flange plate to the junction box located on the wall of the borehole chamber.

The submersible pump is possibly housed within a steel shroud. A replacement shroud should be priced by the contractor.

Borehole head plate is designed to suspend the weight of the submersible pump, cable, rising main and the three instrumentation tubes carrying; the pressure transducer for groundwater level measurement, the low level cut off probes and the tube to allow a dip tape access. The three instrumentation tubes are currently attached to the rising main.

The borehole headworks contain two single orifice air valves with venting to outside of borehole chamber provided to control surge pressure on start-up and shut down. Leading from the borehole headworks on the 200mm diameter delivery main is a non-return valve, an

isolating gate valve (DN200, BS4504 PN16 flanges) and a tapping point for the raw water sample tap.

Summary of key points

- **Submersible pump**: existing unit to be removed, serviced, reinstalled and commissioned.
- **Rising Main**: current mild steel rising main to be replaced with new 8" NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating., maximum 6m pipe length.
- **Instrumentation tubes**: are to be replaced with new tubes bracketed to the rising main.

Lodgebank No1 borehole headworks

### *3.3 Lodgebank Pumping Station No2 Pump (site location OS Grid SJ 5965 2585, what3words CARDS.SUBMERGED.FEUDS)*

**Borehole design:**
Rest water level: ~13mbdat
Pumping water level (under combined group pumping conditions): ~35mbdat
Borehole total depth: 120m
0 – 17m, 600mm diameter mild steel plain casing
17 – 120m, 570mm diameter unscreened sandstone bedrock

**Site access & layout**: Direct access from country lane public highway leading to large self-contained pumping station compound containing the No1 and No2 pumps. The No2 pump is the one furthest away from the pump control building. There is sufficient room for a mobile crane and vehicles to park up and area to safely lay down rising main. There is a pole mounted 3 phase transformer located within the north east corner of the site boundary. The incoming power cable from the transformer is routed underground to the pump control building. Borehole headworks housed in below ground confined spaces chamber with two pneumatically hinged access covers. Confined spaces entry procedures will be required to access and work in the borehole chamber. A public footpath crosses through and in front of the No1 borehole chamber area.

**Pump summary**: Flowserve electro-submersible unit; pump type QN102-2+M8-580-2 rated at 55kW, designed to deliver 75 litres per second against a total head of 50 metres. Pump set at a depth of either 61 or 81metres. The submersible pump is half way through its life expectancy and is to be removed, inspected, serviced, reinstalled at the same target depth and recommissioned. If the pump does not prove economically viable to service it is be disposed of and the procurement, replacement, installation and commissioning of a like-for-like replacement electrical submersible pump.

**Rising Main**: Pump set at a depth of either 61 or 81metres, suspended from the borehole head plate on 61 or 81metres of 200mm nominal bore flanged NP16 uncoated mild steel rising main. At 36 years old the rising main has exceeded its life expectancy. It is to be replaced with 8" NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating, maximum 6m pipe length. Allowance should be made to include enough cable to run from the submersible pump through the borehole flange plate to the junction box located on the wall of the borehole chamber.

The submersible pump is possibly housed within a steel shroud. A replacement shroud should be priced by the contractor.

Borehole head plate is designed to suspend the weight of the submersible pump, cable, rising main and the three instrumentation tubes carrying; the pressure transducer for groundwater level measurement, the low level cut off probes and the tube to allow a dip tape access. The three instrumentation tubes are currently attached to the rising main.

The borehole headworks contain two single orifice air valves with venting to outside of borehole chamber provided to control surge pressure on start-up and shut down. Leading from the borehole headworks on the 200mm diameter delivery main is a non-return valve, an isolating gate valve (DN200, BS4504 PN16 flanges) and a tapping point for the raw water sample tap.

Summary of key points

- **Submersible pump**: existing unit to be removed, serviced, reinstalled and commissioned.
- **Rising Main**: current mild steel rising main to be replaced with new 8" NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating, maximum 6m pipe length.
- **Instrumentation tubes**: are to be replaced with new tubes bracketed to the rising main.

Lodgebank No2 borehole headworks

## 4. Design Considerations

### *4.1 Design Life*

- Pumps shall be designed and constructed to meet the conditions of the water within the boreholes as per the water chemistry data sheets (appendix C) supplied to a design life of 25 years. Where a better standard of pump can be supplied at additional cost this can be recommended as part of the innovations sections but must be clearly priced.

- The pumps shall meet the requirements of the Water Industry Mechanical and Electrical standards and the MEICA Standards from the Environment Agency. Where a difference occurs advice should be sought from the Supra Area MEICA Team.

### *4.2 Groundwater Chemistry (see appendix C)*

Statistical information on site specific groundwater quality analyses for each of the sites are presented in appendix C. This provides a statistical analysis mean, minimum and maximum recorded concentrations for a number of parameters relating to the hydrochemistry of the groundwater drawn from the Permo-Triassic Sandstone aquifer. The design and use of materials for each pump should be based on this information to ensure that the required design life of 25 years is achieved.

### *4.3 Submersible Pump Depth Review (see appendix D)*

A review of the submersible pump depths and historic operational pumping water levels (2005 to 2020) throughout the group are presented in appendix D. Pumping water levels represent the maximum observed groundwater level measured in the abstraction borehole under group operational pumping conditions. These levels reflect the group interference effect as individual cones of depression merge and interact to generate the combined wellfield.

Analysis of pump depths against historic pumping water levels under combined wellfield operating conditions calculates that each pump has at least 20 to 25m head of water above the pump.

- Hodnet No2 - Of the 7 pumps included in the programme only the replacement pump at Hodnet No2 is to be installed at different depth. The existing pump is set a depth of 90m. The new pump will be re-installed at shallower target depth of 78m.

- Lodgebank No2 – there is uncertainty as to the exact installed depth of this pump. It is recorded at either 61 or 81m. The precise depth of the pump will need to be clarified. This minimum target depth for this pump is 61m.

### *4.4 Variable Speed Drive Compatibility*

The seven submersible pumps are currently controlled by a combination of fixed speed soft start drives and variable speed drive installed within the pump control panel. The submersible pumps supplied must be compatible with and able to be driven by both drive systems across a range of operating speeds from 35 to 50Hz.

The pump at Green Lane, which is currently on a fixed speed, soft start is believed to have a motor compatible with a variable speed drive. The contractor is to check and ensure this compatibility during servicing, and highlight to the Environment Agency if the motor is not compatible.

Pumps with fixed speed soft start drives

- Greenlane
- Hodnet No1
- Hodnet No2

Pumps with variable speed drives

- Ellerdine Heath
- Hopton
- Lodgebank No1
- Lodgebank No2

The above stations control panels use an IMO Jaguar VXM55K variable speed drive for borehole pump control.

The maximum pump yields are achieved when applying 50 hertz. Under normal operating yields the pumps are run at between 45 to 50Hz to deliver the target deployable yields at the optimum energy consumption. The VSDs are required to replace the need to throttle back individual pump yield by partially closing the main delivery gate valve in the borehole head works.

When river flows rise temporarily above the regulation support flow target, the pumps will be reduced to minimum operating yield by running the pumps at a minimum of 35Hz. Pumps will be expected to operate at this minimum operating yield for a minimum of five to seven consecutive days.

## *5. Submersible Pump Provision and Installation*

### 5.1 General

Pumps must consist of a single or multi-stage water-lubricated centrifugal pump having non-overloading characteristics, vertically mounted above and directly coupled to a water-lubricated wet stator type squirrel cage motor, continuously rated for underwater use.

The pumping unit must be suitable for continuous operation and capable of discharging into an empty pipework system.

The pump must be fitted with:

- removable shaft-bearing sleeves;
- bearing bushes;
- casing wear rings;
- Impeller wear rings.

### 5.2 Materials and fabrication

The suction casing, pump bowls and delivery casing must be manufactured of similar materials such as high-grade cast iron or stainless steel, or zinc-free bronze.

The pump must have zinc-free bronze or stainless steel impellers and high-tensile steel shafts and fittings.

Mechanical seals must be used with faces of tungsten carbide or ceramic. Shaft bearings must be sealed for life.

The pump body must have separate sections for each stage, which must have matching faces machined and spigoted, to allow accurate location and alignment of the sections during assembly.

The fixing nuts, bolts, washers and studs or bolts must be stainless steel.

### 5.3 Bearings

Bearings must be water-lubricated.

Where rubber-type bearings are used, the bearing material must be securely bonded to a metal housing. Rubber-type bearings must be only used where there is sufficient pressure difference through the bearing to afford adequate lubrication and cooling of the bearing, and where the bearing is submerged under all operating and starting conditions. Natural rubber must not be used.

Bearings must be positively retained within the pump body to prevent the possibility of the bearing rotating; a press fit alone is not acceptable.

### 5.4 Check valve

The pump must be fitted with a lifting-disc type check valve.

The check valve must be designed for a minimum friction loss.

It must have its disc drilled with a suitably-sized hole to allow the water column to slowly drain down on cessation of pumping without excessive reverse rotation of the pump.

### 5.5 Impeller

Each impeller must be located on the shaft by identifiable distance sleeves or similar, such that re-assembly of the rotating element can be carried out without the necessity of accurate measurement.

### 5.6 Suction case

The pump must be; fitted with a suction case of a material suitable for the liquid being pumped; provided with long bearings to stabilise the shaft and motor shaft and to avoid radial thrust on the motor bearing.

A screen must be incorporated having a minimum open area of four times the eye of the impeller.

### 5.7 Motor

The submersible motor must be of the completely enclosed type for continuous duty under water operation on 415V, 50 Hz, three-phase a.c.

The motor windings must be protected by non-aging, water-resistant and heat-resistant insulation. They must be joined to the motor tails brought out through rubber grommets and securely clamped and protected.

Motor performance must be in accordance with the relevant section of BS EN 60034.

Motor thrust-bearing ratings must be designed to carry the thrust load imposed by the pump when operating under the maximum anticipated pumping head.

Motor thrust bearings must be capable of operating with rotation in both direction and the thrust capacity when operating in reverse must not be less than the rated capacity.
The motor will have a flow shroud.
Pumps must be provided with the manufacturer's recommended seal leak detection units.

### 5.8 Expansion chamber or diaphragm

An expansion chamber or diaphragm must be provided to relieve thermal expansion of internal motor fluid due to temperature. This must provide motor internal and external pressure balance under all conditions of temperature and pressure.

### 5.9 Cooling

It is essential that enough water flows over or past the motor casing to provide sufficient cooling during operation.

With the exception of Hodnet No1 and Hodnet No2 where the well screen diameter is too narrow a shroud must be provided if the pump cannot otherwise meet this

requirement. The design of the shroud should also minimise the ingress of sand into the pump.

Consideration must be given to the extra diameter of the pump unit when a shroud is fitted.

### 5.10 Drive shaft

The drive shaft must be a 13 per cent chromium steel or equivalent corrosion-resistant material.

The outer shell must not be less than 12 mm thick and of material to resist corrosion.

### 5.11 Bolting Standards

Bolting will conform to BS EN ISO 3506. All nuts and bolts must be stainless steel.

### 5.12 Temperature Detection

Temperature detection *{thermistor}* embedded in the motor windings and bearings will be required with single cable relayed back to the control panel. Modification to the panel to accept the thermistor relay will be required.

### 5.13 Seal Integrity Detection

Seal integrity detection sensors *are not currently used on this system*. Pumps must be provided with the manufacturer's recommended seal leak detection units. Modification to the control panel to accept the associated relay will be required and is to be included.

### 5.14 Condition Monitoring Option

Not currently required. The contractor is to advise the client if monitoring is required.

### 5.15 Submersible Pump Power Cable

The power cable to the submersible pump shall conform to Water Industry Mechanical and Electrical Standards and include an earth. The top of the power cable will connect to a junction box/isolator located on the wall of the borehole chamber. Sufficient cable length should be allowed to connect the pump to the junction box. All cable dimension and lengths shall be checked prior to ordering and delivery of pumps to site. Careful consideration should be given at Hodnet No1 and Hodnet No2 which employ narrower well screens and the design of the cable size and the rising main flange diameter.

### 5.16 Protective Coatings

The pump / motor unit shall have a protective coating. This task should be performed as late as possible during its manufacture to prevent damage to this protective layer. Protection requirements and guidelines are to be found in the **MEICA 369_13_SD02** document.

### 5.17 Pump Lubrication Requirements

The pumps will require a suitable internal lubrication system and the vast majority are likely to be sealed units. Please make reference and act in accordance with general guidelines laid out in the **MEICA 369_13_SD09** document.

### 5.18 Pump Installation Considerations

Installation shall conform to **MEICA standard 369_13_SD01.** The pump/motor unit should be of known weight. Lifting eyes and hoist requirements shall be considered by the framework supplier to ensure safe working during the installation / replacement and future maintenance process. Asset labels are required on the pump and a duplicate label is needed for the panel.

### 5.19 Lifting Plans

The supplier shall propose and supply where necessary, suitable lifting arrangements for pumps provided including a detailed lift plan. **MEICA standard 369_13_SD07** shall be used as a design standard and the completed installation shall comply fully with the **Lifting Operations and Lifting Equipment Regulations (LOLER) 1998**.

### 5.20 General Site Guidelines Health & Safety Requirements

The supplier shall assess the site and propose safe systems of working for all site personnel during the pump unit replacement process and in compliance with the Construction (Design & Management) Regulations 2015 (CDM 2015). The framework supplier shall be responsible for any sub-contractors that they may employ on the site and ensure that all Staff will have valid CSCS or equivalent cards. All staff will have appropriate health and safety training for the work tasks to be done, such as confined space training, LOLER 1998, Electrical isolation etc.

For the duration of the works functional isolation of each pump within the Northern and Southern Phase 1&4 group will be required. A temporary pump control handover notice will be issued by the Environment Agency to the principle contractor to cover this activity.

Schedule of Pumps – Northern Group Functional Isolation

| **Pump(s) to be functionally isolated** | |
|---|---|
| 1. Espley No1 | 4. Hodnet No2 |
| 2. Espley No2 | 5. Cotton |
| 3. Hodnet No1 | |

Schedule of Pumps – Southern Group Functional Isolation

| **Pump(s) to be functionally isolated** | |
|---|---|
| 1. Hopton | 7. Heath House No1 |
| 2. Lodgebank No1 | 8. Woodmill |
| 3. Lodgebank No2 | 9. Windyoak |
| 4. Greenlane | 10. Ellerdine Heath |
| 5. High Hatton No1 | 11. Ellerdine Station |
| 6. High Hatton No2 | |

### 5.21 Instrumentation Tubes

Each pump employs three plastic hollow instrumentation tubes 50mm nominal bore designed to house a groundwater level transducer, low level cut off protection probes and to allow manual groundwater level measurement via a standard groundwater dip tape. These tubes are currently attached to the rising main from just above the pump and protrude through the top flange of the headworks to finish at a set datum height above the safety grill beneath the borehole access cover.

Each tube set will be replaced as part of the pump replacement programme. These tubes should be hollow plastic tubes of 50mm nominal bore, with flush screwed joints. The tubes should be fixed at regular intervals to the rising main. Details of the proposed fixing methodology should be submitted with the tender. An example of a previously accepted bracket design is shown on the following page. The bottom sections of the tubes are to be perforated/screened to allow good hydraulic contact with the groundwater level in the borehole and the instrument tubes. The bottom ends of the tubes should be capped to prevent any instruments or other debris from entering the borehole and endangering the pump.

The narrow well screen at Hodnet No1 and No2 will require a bespoke design to be considered for the rising main set and the inclusion of narrower diameter instrumentation tubes along with the pump power cable.

Both Hodnet No1 and Hodnet No2 boreholes employ wedge wire wound stainless steel Johnson well screens with a 1.25mm slot size. These screens contain a 1 to 4mm silica granular fill filter that occupies the annular space between the sandstone borehole wall and the outer surface of the well screen. Care should be taken when designing the submersible pump and rising main set (instrumentation tubes and power cable) to ensure the whole pump assembly can be safely removed and installed without jamming, damaging or rupturing the well screen.

Figure 5 summarises the pump depth and calculates the total linear meters of tube required for each pump set. This includes the 2m section of each of the three tubes (6m total) extending from the flange plate to the grill plate beneath the access covers.

Example instrument tube clamp

When replacing the tubes these are to be set at the same elevation as the existing sets, as these have been levelled in to Ordnance Datum and are critical to the historic time series datasets. All three tubes will protrude above the metal safety grill and set at the same level beneath the access cover. All pipework and tubing should be to **MEICA 369_13_SD01** and the associated British Standards referenced within.

Figure 5 – Instrumentation Tube Linear lengths

| Borehole | Proposed reinstalled pump depth | Total linear metre of instrumentation tubing required x3 tubes (including 2m of tube above flange plate cut to suit set datum point 6m total) |
|---|---|---|
| Ellerdine Heath | 61m | 189m |
| Greenlane | 49m | 153m |
| Hopton | 50m | 156m |
| Lodgebank No1 | 61m | 189m |
| Lodgebank No2 | 61m or 81m?<br>Precise depth of pump uncertain | 189m or 249m? |
| Hodnet No1 | 67m<br>Narrower diameter tubes may have to be considered due to well screen constraints | 207m |
| Hodnet No2 | 78m<br>Narrower diameter tubes may have to be considered due to well screen constraints | 240m |

### *5.22 Screened Cabling Needs*

Wet well pumps' fitted with control and detection facilities, shall have their detection instrument provided with an earthed screened sheathing around the cable.

### *5.23 Pump Power Supply Cable*

The Contractor must include a cost for the replacement of the power cable from the pump control panel to borehole chamber junction box via the existing 100mm diameter ducted route

at each site. The cables must comply with **MEICA Standard Specification 369_13** and particularly **369_13_SD11** Electrical installations.

Measured cable distances are given in the table below. These should be used for the contractor's tender submission purposes, but must be checked and verified by the contractor on site prior to ordering the replacement cable. Alternatively, the existing cable to be replaced can be removed and measured. Cable jointing will not be permitted on these lengths.

| Borehole | Cable run distance from Pump Control Panel to Junction Box in Borehole Chamber (ducting 100mm dia) |
|---|---|
| Ellerdine Heath | 15m |
| Greenlane | 10m |
| Hopton | 10m |
| Lodgebank No1 | 10m |
| Lodgebank No2 | 90m |
| Hodnet No1 | 10m |
| Hodnet No2 | 70m |

### *5.24 Rising Main*

At 36 years old the existing rising main at Ellerdine Heath, Hopton, Hodnet No1, Greenlane, Lodgebank No1 and Lodgebank No2 has exceeded its life expectancy. It is to be replaced with 8" NPS schedule 40, flanged, carbon steel rising main, with fusion bonded epoxy coating, maximum 6m pipe length.

Hodnet No2. Where practicable it is proposed to reuse the existing 200mm NB flanged NP16 mild steel rising mains to re-suspend and install the pump. The condition of the existing rising main should be inspected and recommendation made for its suitability to be reused. The rising main condition should be deemed competent if the assessed remaining life expectancy is greater than 10 years.

The Agency has 12 x 6m lengths of 200mm NB flanged NP16 epoxy coated rising main pipes in storage at Hodnet pumping station. These will only be available for use during the demolition of the building programmed for October to December 2020. These may supplement part of the new replacement rising main sections. While the pipe range is removed the rubber gaskets will be replaced with new gaskets on all pipe joints and any mild steel bolts replaced with new stainless steel of suitable lifting capacity. All new pipework shall conform to **MEICA Pipeline Specification LIT 55174**. All flanges are to conform to **BS EN 1092-1.**

The tender submission should include pricing for the collection from each of the pumping station sites and transportation to a registered metal recycling facility the redundant rising main pipes (including ancillary and nuts and bolts) that are to be replaced under this contract.

Photo of rising main pipes in storage at Hodnet (only blue coated pipes are available stock for reuse)

### *5.25 Pump Commissioning*

In addition to the manufacturer's certificates of calibration, allowance should be made to undertake In-situ commissioning trials of all pumps to ensure correction rotation. A two stage commissioning process will be required.

- Stage 1 – Contractor start-up. Check pump rotation and electrical parameters
- Stage 2 – Individual pump operation at a range of yields using the gate valves or variable speed drives if they are available to generate a range of flow rates. These commissioning trials are to be witnessed by Environment Agency representatives.

- Stage 3 – A 4 to 5 day 24 hour continuous group operation of the pumps at their target production yields. EA will provide pump monitoring team.

### *5.26 Maintenance Proposals – Health & Safety File*

Contractor to supply paper and electronic copies of all manufacturer technical manuals, data sheets, pump conformance certificates and any information relevant to the future operation and maintenance of the pumps and rising main sets. The client is eager for applicants to consider the long term maintenance requirements of the pump systems.

- Tenderers are to provide a maintenance schedule for the pumping system scenario and parts replacement schedules if required.
- The upgrade of the pumping system is to use CDM principles and the system should be designed for maintenance requirements.
- Suppliers shall provide as part of the manufacturers O&M manual, procedures for inspection and servicing of the pumping system.
- Suppliers shall provide all pump data sheets and specifications prior to the purchasing of any pumps. A brief specification and details of the proposed pump is required for the purposes of this tender.
- Innovative approaches can be proposed but to ensure a like for like comparison they are advised to be supplementary comments and associated costs.

### *5.27 Geophysical Logging Abstraction Boreholes*

Time should be included within the programme to allow the full length of each abstraction borehole to be geophysically logged after the submersible pump has been removed and the before the new submersible pump is installed. Allow one day per borehole. The geophysical logging requirements are;

- CCTV camera inspection with colour DVD/memory stick recording.
- Caliper log of borehole diameter profile.
- Fluid temperature and conductivity of the column of groundwater (including differential plots).
- The data from each borehole logging exercise should be presented as colour plots in pdf format.

## *6.* Information to be supplied by the Tenderer

The tenderer shall provide the following information:

### 6.1 System & Pump Specification

The technical specification of the pump should be optimised for the system characteristics provided for the pumping stations. The tenderer shall assess the pumping requirements and the hydraulic system in its entirety. The manometric heads reflect total pressure heads (pumping water lift plus pipeline hydraulic resistance) for each pump under group operational conditions i.e. combined wellfield interference on pumping groundwater level head in sandstone aquifer and hydraulic resistance of main pipeline. Any suggestions for system improvement will be welcome. The submersible pumps must be compatible with and able to be driven by soft start fixed speed drives and variable speed drive technology currently installed at all sites. Innovative technology options would be welcome to maximise and improve the efficiency of the pump operation.

Shropshire Groundwater Scheme is Category A Strategically Important water supply asset. We aim to only invest in reliable proven submersible pump products to achieve resilience in the scheme's statutory duty to contribute to river regulation. Promotion of proven reliable submersible pumps from reputable manufacturer(s) are expected for the tender submission options.

### 6.2 Supply Installation & Commissioning

It is intended that canister or submersible pumps shall be utilised as replacement pumps within all selected pumping stations, therefore the tenderer shall consider the supply, installation and commissioning of only these types of pump unit.

### 6.3 Costs

The tenderer should provide any costs associated with client witnessed factory acceptance testing and labour rates for craftsmen and technicians for work beyond the immediate scope of the installation and commissioning of the pump system.

### 6.4 Hodnet Pumping station No1 & 2 Pump Set Design

Hodnet No1 and Hodnet No2 a bespoke design proposal is to be submitted for the replacement of these submersible pumps, their rising main sets, instrumentation tubes and pump power cable. These borehole employ 382mm and 370mm diameter stainless steel well screen within which the pump set will have to sit.

### 6.5 Work Schedule & Time Planning

The intended work schedule & planning timeline will be issued to the client for approval in this regard to consider the 'pump station down-time'. Completion of the works and final invoicing will be required by no later than 31st March 2021.

A site hand over procedure and pump lock of system is required to ensure that the sites safely isolated during the works. This will require the attendance to each site prior to the first pump removal to lock off pumps and gate valves, following the lock off procedure. At the end of the works or on requested by the client the lock off and site handover procedure is to be removed. All other permits system required for activities relating to the work will be the responsibility of the contractor completing the works to ensure they have control of their own safety.

### 6.6 Health & Safety Information

This could include evidence of CDM Regulation compliance, plus any relevant supporting information from similar projects - such as RAMS, lift plans, confined space entry information, electrical and functional isolation procedures etc.

# Appendix A – Site location and layout plans

# Appendix B – Individual pump details (current installed submersible pump units)

# Appendix C – Groundwater Chemistry

# Appendix D – Submersible pump depth review and historic actual groundwater level hydrographs

# Appendix E – Borehole Headworks and Rising Main Installation Drawing Extracts

# Appendix F – Generic Risk Assessments for Shropshire Groundwater operations

# Appendix G – MEICA Standards

# Appendix H – Electrical Drawings