

SIRIUS MINERALS PLC - DISCHARGE OF PLANNING CONDITIONS FOR PLANNING APPLICATION NYM/2014/0676/MEIA, THE YORK POTASH PROJECT

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REPORT	CONSTRUCTION AND OPERATION PHASE GROUND AND SURFACE WATER MONITORING SCHEME
SITE	PHASE 3 WORKS AT WOODSMITH MINE, NORTH YORKSHIRE
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CONSTRUCTION AND OPERATION PHASE GROUNDWATER AND SURFACE WATER MONITORING SCHEME FOR PHASE 3 WORKS AT WOODSMITH MINE, NORTH YORKSHIRE

1 INTRODUCTION

1.1 General Background

This document has been prepared on behalf of Sirius Minerals Plc (Sirius Minerals) and provides the Construction and Operation Phase Groundwater and Surface Water Monitoring Scheme for the Phase 3 Works at Woodsmith Mine (Phase 3 Works). This is required to discharge Condition 46 of the North York Moors National Park (NYMNP) planning permission NYM/2014/0676/MEIA.

This document details the hydrological, hydrogeological and ecological monitoring to be undertaken during the Phase 3 Works at Doves Nest Farm Mine Site, as defined in Section 1.2 below.

Subsequent revisions of this document will be issued to present the monitoring schemes to be adopted for future phases of the development, dates of which are to be confirmed.

1.2 Phase 3 Works

This report presents the Construction and Operation Phase Groundwater and Surface Water Monitoring Scheme that relates to the Phase 3 Works only. The works completed prior to and as part of Phase 3, comprise the following, as shown on Arup Drawing 40-ARI-WS-71-CI-DR-1050:-

Works Completed as Part of Phase 3

A summary description of the principal construction elements of the Phase 3 Works is presented below with reference to the Arup design drawings:-

- General site clearance including demolition of all farm buildings and sheds, and localised tree and scrub clearance, as shown on Arup Drawing 40-ARI-WS-71-CI-DR-1051;
- Excavation and construction of the south western extension of the upper tiered working platform at around 203m AOD, as shown on Arup Drawing 40-ARI-WS-71-CI-DR-1053 with earthworks volumes presented in 40-ARI-WS-71-CI-DR-1054;
- Excavation and construction of the Platform for the Construction Welfare Facility, Parking Area and Concrete Batching Plant, as shown on Arup Drawing 40-ARI-WS-71-CI-DR-1053 with earthworks volumes presented in 40-ARI-WS-71-CI-DR-1054;
- Construction of temporary and permanent soil mounds, including the basal liner for the future non-hazardous non-inert (NHNI) facility in the northeast corner of the site and three topsoil, subsoil and inert material storage bunds in the southwestern area of the site, as shown on Arup Drawing 40-ARI-WS-71-CI-DR-1053 and 40-ARI-WS-71-CI-DR-1055, with earthworks volumes presented in 40-ARI-WS-71-CI-DR-1054;

- Construction of surface water drainage, a temporary surface water attenuation pond and temporary wetland in the southern area and two permanent attenuation ponds and two wetland areas in the north eastern area, as shown on Drawing 40-ARI-WS-71-CI-DR-1050;
- Construction of a spring and groundwater drainage layer in the north eastern area, discharging into a wetland area, as shown in Arup Drawing 40-ARI-WS-71-CI-DR-1080;
- Installation and commissioning of temporary dewatering, as shown in Arup Drawing 40-ARI-WS-71-CI-DR-1058, in advance of future shaft sinking.
- Erection on site of the Concrete Batching Plant as shown in AMC UK Ltd (AMC) Drawing 40-AMC-WS-72-SW-DR-0005, complete with reticulated water supplies and tanks;
- Construction of the drilling platform and temporary saline lagoon area for the groundwater reinjection well as shown in Arup Drawing 40-ARI-WS-71-CI-DR-1057.
- Provision of Construction Welfare and Security Facilities - complete with hook-up of power, communications & water supplies and new waste water collection facilities.

In the following sections are presented details of the design levels and construction methodology for the Phase 3 Works.

1.3 Compliance with Conditions

The table below sets out the wording of Planning Condition 46 to Planning Consent Ref No. NYM/2014/0676/MEIA and details where the relevant material, to comply with this condition, has been provided within this report:-

NYMNP 46	Compliance with Condition 46
The scheme shall include: -	
Details of the number, type and location of monitoring points;	Section 3
A protocol for the removal and replacement of any existing monitoring points;	Section 4
Details of the frequency of monitoring during construction and operation;	Section 3.2.3, 3.3.4, 3.4.4, 3.5.3 and 3.6.4
A list of the ground and surface water determinands to be tested for;	Section 3.4.3, 3.5.6 and 3.6.3
Monitoring of ground water levels and spring flows;	Section 3.3.3 and 3.5.4
Monitoring of surface water quality including sediment, BOD, ammonia, pH;	Section 3.6.3
Geomorphology in Sneaton Thorpe Beck	Section 3.6.6
A list of SAC/SSSI habitat measures to be tested for;	Section 3.7.2
Groundwater quality and level triggers;	Section 3.35 and 3.4.5
Surface water quality triggers;	Section 3.6.5
Surface water geomorphology triggers;	Section 3.6.6
SAC/SSSI habitat triggers	Section 3.7.4
Monitoring of groundwater quality against groundwater triggers;	Section 3.4.5
A scheme for periodic review and refinement of the monitoring regime to take account of any	Section 5

approved changes to site layout/design, construction methods and monitoring data;	
A protocol for notifying the MPA of any breach of the Trigger Values, including the timing of any such notification;	Section 5
Details of the method and frequency with which monitoring results will be shared with the MPA, Natural England and the Environment Agency;	Section 5
The approved scheme shall thereafter be implemented in full, with monitoring continuing in accordance with the approved scheme until such time that it is agreed in writing by the MPA in consultation with Natural England and the Environment Agency that monitoring may cease.	Section 5

2 SITE DETAILS

2.1 Existing Development

The minesite covers an area of approximately 67 ha and is predominantly agricultural fields, with farm buildings located in the eastern area. The site slopes gently to the east away from the B1416 road along the western boundary of the site. Along this western boundary the topography rises from around 208 m AOD in the north to 214 m AOD in the south, and falls to around 200 m AOD on the eastern boundary. West and south of the minesite are areas of moorland that are designated as part of the North York Moors Special Area of Conservation (SAC) at Ugglebarnby Moor and Sneaton Low Moor, respectively, as shown on Drawing 1433DevOD215.

By commencement of the Phase 3 minesite construction works, the following Phase 2 construction works will have been completed:-

- General site clearance and construction of an acoustic fence / environmental barrier and installation of fencing, gates and security;
- Construction of the site road, a site compound to the east of the Welfare Access Road;
- Construction of the two tiered working platform, two temporary soil mounds north and two to the south of the Shaft Platform, and a permanent environmental screening bund (Bund A) along the western boundary, and;
- Construction of surface water drainage, a silt removal facility and an attenuation pond with outfalls to an existing drain.

2.2 Hydrogeological Receptors

2.2.1 Aquifers

The shallow aquifer units beneath the development are shown on Drawing 1433DevOD265 and detailed below:-

Aquifer	Designation	Description
Superficial Deposits	Non-aquifer	Present across the majority of the site, comprising low permeable firm to stiff clays, with discontinuous granular layers that sustain only limited and discontinuous horizontal and vertical flow through isolated sand lenses.
Moor Grit	Secondary A Aquifer	Present across the southern, central and western parts of Woodsmith Mine Site, extending to the west beneath Ugglebarnby Moor. It comprises interbedded mudstone, sandstone and siltstone of between 6 to 10m thick. The groundwater is locally used for a single dwelling drinking water supply via a spring discharge (Moorside Farm Spring MF2), feeds the hydrogeologically supported spring flush and provides a limited contribution of baseflow to Sneaton Thorpe Beck.
Scarborough Formation	Secondary A Aquifer	Present beneath the majority of the minesite and extends to the west beneath Ugglebarnby Moor. It comprises three horizontal to sub-horizontal bedded weathered mudstone and siltstone units of between 6.5 to 13m thick and some vertical hydraulic continuity with overlying Moor Grit. The groundwater in this aquifer locally supports non-continuous and continuous spring flows used locally for single dwelling drinking water supplies (Soulsgrave Farm Spring SF1), and may provide baseflow to a number of surface water bodies including Knaggy House Farm ponds and Sneaton Thorpe Beck.
Cloughton Formation	Secondary A Aquifer	Present beneath the entire mine site and adjacent SAC. It comprises a series of interbedded sandstones and mudstones with occasional siltstones of between 23.5 to 52 m thick. This groundwater is locally used for borehole drinking water supplies as it is capable of generating a high yield, and provides baseflow to surface water bodies, such as Little Beck.
Saltwick Formation	Secondary A Aquifer	Present beneath the entire mine site and adjacent SAC. It comprises a series of interbedded sandstones and mudstones with occasional siltstones of between 37 and 40 m thick. This groundwater locally provides baseflow to surface water bodies, such as Little Beck.

2.2.2 Abstractions

The following groundwater abstractions shallow aquifer units beneath the development are shown on Drawing 1433DevOD271 detailed below:-

Abstractions	NGR coordinates	Geometry and physical properties	Source of groundwater
Moorside Farm Spring (MF2)	489063 504803	Moorside Farm Spring discharges from an elevation of 210m AOD and feeds a domestic water storage tank with an overflow from the tank at an elevation of 202.6 m AOD. A proportion of the flow from the spring provides flow sustaining hydrogeologically supported flora in the Spring Flush area	Superficials and the Moor Grit aquifer during winter

		within Ugglebarnby Moor. As the domestic water supply and hydrogeologically supported flora are dependent on this spring flow it has a very limited potential to accommodate chemical change. The spring, however, does not provide continuous flow throughout the year, with very low or no flow observed during the summer months.	Only low groundwater flows from the Moor Grit during spring and summer.
Soulsgrave Farm Spring (SF1 and SF1)	490198 504380	The storage chamber (SF1) used to collect spring water for Soulsgrave Farm is at an elevation of 198.0 m AOD. SF1 is a spring discharge in an area marked by distinctive rush-dominated vegetation at an elevation of 196.8 m AOD. This groundwater spring is used for drinking water purposes to this individual property and has, therefore, a very limited potential to accommodate chemical change. It does not provide continuous flow throughout the year, with no flow observed during the summer months.	Scarborough Formation

2.2.3 Springs

Spring discharges and groundwater seepages in the area of the Phase 3 Works at Woodsmith Mine are shown on Drawing 1433DevOD271 and summarised below:-

Base Flow Springs	NGR coordinates	Geometry and physical properties	Source of spring
Doves Nest Farm Springs (DNS1)	489510 505160	Located in the central eastern area of the minesite and discharges from a piped overflow at an elevation of 200 m AOD, from a buried tank into a drainage channel that ultimately outflows to Sneaton Thorpe Beck. Provides a limited and non-continuous discharge to this surface watercourse.	Moor Grit
Ugglebarnby Moor Spring (SP01)	488944 504557	This spring is located in the southern part of Ugglebarnby Moor SAC. It comprises a discharge to surface through moorland peat into a narrow channel that discharges into Little Beck. The ground level at SP01 is 207.3 m AOD. This groundwater spring is located 600 m to the east of Little Beck and provides a limited and non-continuous indirect discharge to this surface watercourse.	Combination of superficial deposits and Moor Grit
Springs North of Woodsmith Mine Site (SP04)	489290 505995	SP04 is located to the north of the minesite. The ground level at SP04 is 195.6 m AOD. This groundwater spring located 550 m south of Buskey Beck provides a limited, potentially indirect discharge to this surface watercourse.	Moor Grit
Springs North of Woodsmith Mine Site (KHF)	489530 505999	The Knaggy House Farm (KHF) spring is located approximately 30 m east of SP04 The ground level at KHF spring is 185.0 m AOD. This groundwater spring located 50 m west of the surface water ponds at Knaggy House Farm (KHF) provides a limited, potentially indirect discharge to this surface watercourse.	Scarborough Formation

2.3 Surface Water Receptors

2.3.1 Surface Water Courses

The surface water course in and around the Phase 3 Works area is summarised below:-

Surface water course	Geometry and physical properties	Water sources
Sneaton Thorpe Beck	<p>The Sneaton Thorpe Beck is located to the east of Woodsmith Mine and its headwaters are located in Haxby Plantation in the southeast of the site. The Woodsmith Mine Site lies within the catchment area of the Sneaton Thorpe Beck</p> <p>The headwaters of the Sneaton Thorpe Beck are located within the Moor Grit and Scarborough Formation whilst the main channel of the beck is within the Cloughton Formation.</p>	Numerous drains, issues, collects and un-named streams discharge into Sneaton Thorpe Beck.

2.3.2 Abstractions

There are no active surface water abstractions or discharges identified within 1 km of the site.

2.4 Ecological Receptors

2.4.1 Spring Flush

There are two principal areas of sensitive ecological receptors in close proximity to the site; Ugglebarnby Moor and Sneaton Low Moor, both of which are part of the North York Moors and are designated as Special Areas of Conservation (SACs), Special Protection Areas (SPA) and Sites of Special Scientific Interest (SSSI). Within these areas, the only ecological receptor that has been determined as containing flora that is hydrogeologically supported (Ref. 2) is the Spring Flush area within the Southern Dry Heath area of Ugglebarnby Moor (Drawing 1433DevOD231 Rev1).

Ecological Receptor	Geometry and physical properties	Water sources
Ugglebarnby Moor Southern Spring Flush	The Spring Flush area in the southern part of Ugglebarnby Moor lies to the southwest of the minesite, where ground levels slope from around 210 m AOD in the east down to around 197 m AOD in the west. Beneath the superficial deposits along the line of the Spring Flush are the Moor Grit, Scarborough Formation and Cloughton Formation.	Surface runoff and shallow groundwater (superficial deposits and Moor Grit)

3 MONITORING

3.1 General

In the following sections, the requirements for undertaking groundwater, surface water and ecological monitoring are presented in terms of the monitoring locations, frequency of monitoring, determinands to be analysed for, Trigger Values and reporting procedures.

The monitoring requirements have been determined specifically to enable monitoring the Phase 3 Works as outlined in the Groundwater Management Scheme (Ref. 3) and the Surface Water Drainage Scheme (Ref. 4). The following sections present details of the scope, data

requirements, frequency and Trigger Values (where appropriate) to be adopted for monitoring the following elements:-

- Meteorology (Section 3.2),
- Groundwater levels (Section 3.3) and quality (Section 3.4),
- Springs (Section 3.5),
- Surface Water (Section 3.6),
- Ecology (Section 3.7).

The meteorological monitoring is to be undertaken to enable comparison and informed assessment of impacts on groundwater, surface water and ecological conditions. These data are not evaluated in their own right and no Trigger Values have been set for this purpose.

3.2 Environmental Trigger Values

Environmental Trigger Values have been set to enable a structured evaluation of monitoring data, as detailed below, comprising a “Control Trigger Value” to enable early warning of potential adverse conditions developing and “Compliance Trigger Values” at which significant adverse environmental effects are deemed to have occurred.

Water Quality

Ground and surface water quality Trigger Values, comprising “Control” and “Compliance” Trigger Values, have been set, in accordance with Environment Agency guidance (Ref. 5), to enable evaluation of whether the works have an adverse chemical impact on water resources, as detailed below:-

- The Control Trigger Values are an early warning system designed to draw attention to the development of adverse trends in the monitoring data that may suggest the mitigation measures incorporated into the Phase 3 Works are not working as anticipated. These values have been derived from the baseline data, and, where the baseline data are less than the detection limit, the Control Trigger value has been set at the detection limit.
- The Compliance Trigger Values are defined as the levels at which significant adverse environmental effects have occurred, i.e. if a compliance value for a specific receptor has been breached there is a chemical impact occurring. These values have been derived from current Statutory Instruments for water quality, where available. Where the detection limit is greater than the Statutory Instrument value, the Compliance Trigger value has been set at the detection limit.

Groundwater Level

Groundwater level Trigger Values, comprising “Control” and “Compliance” values, have been set as summarised below to enable evaluation of whether the Phase 3 Works have an adverse impact on spring discharges from Soulsgrave Farm Spring, which supports the spring drinking water abstraction, and from Moorside Farm Spring, which supports the spring drinking water abstraction and surface flows to the hydrogeologically supported flora in the Spring Flush area:-

- The Control Trigger Values are an early warning system designed to draw attention to the development of adverse trends in the monitoring data that may be contrary to the groundwater level conditions anticipated from groundwater modelling of the Phase 3 Works (Ref 2). These values have been derived by consideration of the monthly baseline data and the results of the ESI modelling (Ref 2).
- The Compliance Trigger Values are defined as the levels at which significant adverse environmental effects have occurred at Moorside Farm Spring, i.e. if the compliance value at this receptor has been breached there is an adverse physical impact occurring. These values have been derived from evaluation of the historical monthly values determined from the baseline data.

Spring Flow Rate

Spring flow rate Trigger Values, comprising “Control” and “Compliance” values, have been set as summarised below to enable evaluation of whether the works have an adverse impact on spring discharges:-

- The Control Trigger values are an early warning system designed to draw attention to the development of adverse trends in the monitoring data that may be contrary to the spring flow conditions anticipated from groundwater modelling of the Phase 3 Works (Ref 2). These values have been derived by consideration of the mean monthly baseline data for the spring receptor.
- The Compliance Trigger values are defined as the levels at which significant adverse environmental effects have occurred at a spring receptor, i.e. if the compliance value at this receptor has been breached there is an adverse physical impact occurring. These values have been derived by consideration of the minimum monthly baseline data for the spring receptor.

Surface Water Geomorphology

For the geomorphological monitoring of Sneaton Thorpe Beck, it is proposed that a qualitative assessment of erosion and siltation conditions will be undertaken by comparison against pre-commencement geomorphological conditions at a number of locations in the stream banks and bed downstream of the consented discharges to this water course. As such, no control and compliance Trigger Values will be established for this purpose.

Ecological

Ecological habitat trigger criteria have been set, as summarised below, to enable evaluation of whether the works have an adverse impact on the flora within the Spring Flush area. The Habitat Trigger values are an early warning system designed to draw attention to the development of adverse trends in the monitoring data that may be contrary to the vegetation baseline surveys (Ref 2):-

- Change in National Vegetation Classification (NVC) class;
- Change in percentage cover (loss of 5%) of the key indicator species;
- Colonisation by new species.

3.3 Dewatering Trigger Values

During the temporary dewatering, to be undertaken to maintain groundwater levels at 3m below shaft platform level, Compliance Trigger Values have been set, above which groundwater levels may adversely impact on plant foundation installation. Control Trigger values are proposed to indicate when dewatering should be implemented, to maintain water levels below the maximum permissible Compliance Trigger Values

3.4 Meteorology

3.4.1 Objectives

The objectives of the meteorological monitoring are to provide rainfall and evapotranspiration information to confirm water balance inputs and outputs and to enable correlation with groundwater level, spring flow, surface water geomorphological and ecological data.

3.4.2 Monitoring Location

Meteorological monitoring will be undertaken of the following parameters (Section 3.4.4) from the automated permanent weather station to be located at the minesite.

3.4.3 Monitoring Frequency

The monitoring frequency will be set for 30 minute intervals for all parameters and the data recorded to a data logger to be downloaded on a weekly basis.

3.4.4 Meteorological Data

Meteorological monitoring will consist of:-

- Rainfall (mm);
- Evapotranspiration (mm);
- Temperature (°C);
- Wind Speed (km/hr) and Direction; and
- Barometric Pressure (m/bar).

3.4.5 Assessment & Compliance Values

None.

3.5 Groundwater Level Monitoring

3.5.1 Objectives

The purpose of the groundwater level monitoring strategy is three fold:-

- 1 To detect physical impacts on groundwater levels within the Moor Grit and Scarborough Formation Secondary A Aquifers that could impact on the hydrogeologically supported flora within the Spring Flush and Moorside Farm spring water supply (MF2) caused by the

- completed Phase 2 Works and ongoing Phase 3 Works, so that appropriate remedial measures can be adopted should potentially detrimental impacts arise.
- 2 To detect physical impacts on groundwater levels within the Scarborough Formation Secondary A Aquifer that could impact on the Soulsgrave Farm spring water supply (SF2) caused by the completed Phase 2 Works and the Phase 3 Works, so that appropriate remedial measures can be adopted should potentially detrimental impacts arise.
 - 3 To detect changes in the groundwater levels within the Moor Grit Aquifer that could impact on the construction around the Service Shaft, Production Shaft and MTS Shaft.

3.5.2 Monitoring Locations

From the design layout of the Phase 3 Works, monitoring of construction stage boreholes with response zones within the Moor Grit and Scarborough aquifers will be undertaken as summarised below, for which the monitoring well positions are shown on Drawing 1433DevOD260 Appendix 1:-

- 1 Groundwater levels will be monitored in the Moor Grit and Scarborough aquifers using the series of monitoring wells detailed overleaf that are orientated in a line approximately north to south between the Shaft Platform development and the Spring Flush and Moorside Farm Spring target receptors, as shown on Drawing 1433DevOD260 Appendix 1.
- 2 Groundwater levels will be measured within the superficial deposits using the series of monitoring wells detailed overleaf within the Spring Flush area, as shown on Drawing 1433DevOD260 Appendix 1, to identify potential variations in the soil moisture conditions in comparison with the baseline conditions.
- 3 Groundwater levels will be monitored in the Moor Grit aquifer using the series of monitoring wells detailed below that are located around the Service, Production and MTS Shafts, as shown on Drawing 1433DevOD269 Appendix 1.

Groundwater Level Monitoring Locations

Monitoring Well	Historical BH No.	NGR Coordinates	Purpose
GW132 GW132B GW132C GW132D GW132E	HG112 HG112B HG112C HG112D HG112E	488933.66, 504800.88 488940.91, 504799.24 489042.06, 504807.25 489038.61, 504798.07 489035.65, 504791.81	Monitor potential changes in the groundwater levels within the Superficial deposits within the Spring Flush and Moorside farm Spring target receptors.
GW122A (SAC1) GW124 (SAC3) GW125 (SAC4) GW129 (SAC5) GW118 GW130 (SAC6) GW131 (SAC7) GW116 (SAC8) GW133A	HG105A -- -- -- HG122 -- -- -- HG111A	489138.52, 505493.71 489184.48, 505377.01 489215.70, 505221.78 489219.39, 505118.00 489229.54, 505094.83 489236.10, 504928.69 489246.93, 504815.46 489270.51, 504711.77 489211.10, 504706.07	Monitor potential changes in the groundwater levels within the Moor Grit between the shaft platform development and the Spring Flush and Moorside Farm Spring target receptors.

GW126A GW117 GW139	HG108A -- HG5	489132.71, 505164.63 489236.66, 505102.82 489240.44, 504965.21	Monitor potential changes in the groundwater levels within the Scarborough Formation between the shaft platform development and the Spring Flush and Moorside Farm Spring target receptors.
GW112	HG119	489843.0, 504759.0	Monitor potential changes in the groundwater levels within the Scarborough Formation between the shaft platform development and Soulsgrave Farm Spring.
HG135 BH521 BHSS2		489335.7, 505348.0 489292.0, 505328.0 489340.8, 505315.6	Monitor potential changes in the groundwater levels in the Moor Grit caused by Dewatering.
BH505 BH507 BH520		489272.5, 505422.8 489305.3, 505457.3 489318.0, 505422.0	Monitor potential changes in the groundwater levels in the Moor Grit caused by Dewatering.
HG116 BH515 BH522		489206.5, 505526.0 489400.2, 505469.1 489388.0, 505456.0	Monitor potential changes in the groundwater levels in the Moor Grit caused by Dewatering.

If any of the above monitoring locations is damaged or lost as part of the Phase 2 and 3 Works, they will be re-installed.

3.5.3 Monitoring Frequency

From evaluation of the Moor Grit sandstone permeability data and the distance between the tiered Shaft Platform and Moorside Farm Spring/Spring Flush area, it is determined that physical draw down impacts on groundwater levels supporting the spring area, caused by natural groundwater drawdown at the platform, would take over three months to cause a noticeable change to spring flow conditions. On this basis, it is determined that whilst groundwater level data will be collected by the divers on an hourly basis, implementing a weekly collation of that data will be an adequate review period to enable detection of significant changes in groundwater levels and correlation with spring flow rates at Moorside Farm and Soulsgrave Farm Springs.

Monitoring of the groundwater levels around the future shafts is essential for their safe and effective construction, which requires the groundwater levels to be maintained, through dewatering, at a depth of 3 m below shaft platform level (bspl).

During the Phase 3 Works groundwater level monitoring will be undertaken at the following intervals.

Groundwater Level Monitoring Frequency

Receptor	Monitoring phase	Duration	Frequency
Spring Flush and Moorside Farm Spring	Phase 3 Works	Duration of works	The data loggers will be set at an hourly interval of reading and the data will be downloaded and reviewed on a weekly basis.
	Post Phase 3 Works	1 Month	
Soulsgrave Farm Spring	Phase 3 Works	Duration of works	The data loggers will be set at an hourly interval of reading and the data will be downloaded and reviewed on a weekly basis.
	Post Phase 3 Works	1 Month	

Shaft Construction and Dewatering	Phase 3 Works	Duration of works	The data loggers will be set at an hourly interval of reading and the data will be downloaded and reviewed on a daily basis.
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Phase 3 Works are scheduled to follow directly after completion of the Phase 2 Works. Consequently an assessment of any Trigger Values breaches will evaluate the cumulative impact of Phases 2 and 3 to determine the cause and appropriate remedial actions.

3.5.4 Groundwater Level Data

To meet the monitoring objectives, groundwater levels will be monitored using diver data loggers, calibrated against an onsite barometer, installed within the monitoring wells to provide continuous groundwater level data for comparison with the Control and Compliance Values Trigger values.

3.5.5 Environmental Assessment Trigger Values

Groundwater level (GWL) “Trigger Values” have been set, as detailed below, for all monitoring well locations detailed in Section 3.3.2, by consideration of the baseline groundwater level data and the ESI modelled impact of the Phase 3 Works on groundwater levels at these locations (Ref 2).

Monitoring for Spring Flush and Moorside Farm Spring Receptors

The GWL Control Trigger Value for water levels metres Above Ordnance Datum (m AOD) in the superficial deposits, the Moor Grit strata and the Scarborough Formation has been set for each monitoring location at a value equivalent to:-

$$\text{Control Trigger Value} = \text{mean baseline value for that monitoring location} - 1 \times \text{the Standard Deviation of baseline data for that monitoring location} - \text{the modelled impact for that modelled location}$$

The GWL Compliance Trigger Value has been set for the monitoring well, installed within the Moor Grit aquifer (GW133A; previouslyHG11A) immediately up hydraulic gradient of Moorside Farm Spring, at a value equivalent to the minimum monthly baseline value recorded, as presented overleaf.

Control and Compliance Trigger Values - Superficial Deposits

Monitoring Well	GW132	GW132B	GW132C	GW132D	GW132E
	HG112	HG112B	HG112C	HG112D	HG112E
Modelled Impact	N/A	N/A	N/A	N/A	N/A
GWL Control Trigger Value (m AOD)					
May	196.17	197.58	201.20	201.31	201.34
June	195.85	197.38	201.01	201.13	201.24
July	195.47	197.01	200.81	200.95	200.91
August	195.39	197.06	200.84	200.92	200.90
September	195.31	196.90	200.80	200.89	200.76
October	195.50	197.16	201.01	201.10	201.20
November	195.87	197.60	201.29	201.35	201.49
December	196.23	197.51	201.32	201.44	201.56

Control and Compliance Trigger Values - Moor Grit

Monitoring Well	GW122A (SAC1)	GW124 (SAC3)	GW125 (SAC4)	GW129 (SAC5)	GW118	GW130 (SAC6)	GW131 (SAC7)	GW116 (SAC8)	GW133A	
	HG105A	--	--	--	HG122	--	--	--	HG111A	
Modelled Impact (m)	-0.77	-1.62	-0.93	-0.88	-1.02	-0.87	-0.28	-0.13	-0.07	
(m OD)	GWL Control Trigger Value									GWL Compliance Trigger Value
May	203.53	No data	No data	No data	203.79	No data	No data	No Data	210.10	210.04
June	203.08	No data	No data	No data	203.52	No data	No data	No Data	209.21	208.33
July	201.61	No data	No data	No data	203.32	No data	No data	No Data	209.48	209.35
August	201.19	No data	No data	No data	203.11	No data	No data	No Data	209.22	209.17
September	200.91	199.05	197.05	202.99	202.88	205.17	203.98	208.87	209.09	209.08
October	201.16	198.79	202.49	202.52	202.55	204.52	203.72	208.79	209.21	209.13
November	203.10	198.77	202.84	202.54	202.49	205.22	203.82	209.25	209.85	209.66
December	205.17	200.71	203.88	203.19	203.11	205.55	204.99	210.70	211.34	211.31

Control and Compliance Trigger Values - Scarborough Formation

Monitoring Well	GW126A	GW117	HG5	GW 112
	HG108A	--	--	HG119
Modelled Impact	-0.07	-0.61	-0.08	0.0
(m OD)	GWL Control Trigger Value			
May	198.42	No data	188.30	195.72
June	198.08	No data	187.95	195.49
July	197.67	No data	187.74	195.28
August	197.54	No data	187.89	195.23
September	197.47	200.40	187.51	195.17
October	197.38	198.63	187.49	195.26
November	197.42	198.38	187.45	195.43
December	197.41	198.77	187.67	195.71

3.5.6 Dewatering Trigger Values

Dewatering GWL Control Trigger Values are proposed to indicate when dewatering should be implemented to maintain water levels below the maximum permissible Compliance Trigger Values.

Control and Compliance Trigger Values - Dewatering

Shaft Location	Temporary Monitoring Well	Control Trigger Value (m bspl) [m AOD]	Compliance Trigger Value (m bspl) [m AOD]
Production	BH 505, BH 507, BH520	4 m bspl [199.66 m AOD]	3 m bgl [200.66 m AOD]
Service	SS2, HG 135, BH 521	4 m bspl [199.17 m AOD]	3 m bgl [200.17 m AOD]
MTS	HG116, BH 515, BH 522	4 m bspl [196.66 m AOD]	3 m bgl [197.66 m AOD]

3.6 Groundwater Quality Monitoring

3.6.1 Objectives

The purpose of the groundwater quality monitoring strategy is to detect chemical impacts on groundwater quality within the Secondary A Aquifers caused by the then completed Phase 2 Works and the Phase 3 Works, so that appropriate remedial measures can be adopted should potentially detrimental impacts arise.

From the results of the Hydrogeological Risk Assessment (Ref. 2), the objectives of the groundwater quality monitoring is to determine whether the then completed Phase 2 Works and the Phase 3 Works have an adverse chemical impact on groundwater quality in the Moor Grit, Scarborough or Cloughton aquifers from hydrocarbon and salt pollution by construction surface water runoff in the vicinity of the tiered Shaft Platform, and platform extension, the working platform and compound areas that could infiltrate into the Moor Grit and Scarborough aquifers.

3.6.2 Monitoring Locations

As determined from the Hydrogeological Risk Assessment (Ref 2), due to the northeasterly hydraulic gradient across the Woodsmith Mine, should groundwater pollution arise from the completed Phase 2 Works or the Phase 3 Works, this would cause a chemical impact on groundwater receptors down hydraulic gradient of the works comprising the Secondary A Moor Grit and Scarborough aquifers. Such chemical impacts would, however, not occur to the more sensitive receptors up hydraulic gradient of the works, including Moorside Farm Spring, Soulsgrave Farm Spring or the Spring Flush vegetation habitat.

In accordance with current guidance (Ref. 5), groundwater quality sampling will be undertaken at a location up hydraulic gradient of the receiving aquifer and at two locations down hydraulic gradient within that aquifer of the potentially polluting activities associated with the Phase 3 works. As such, groundwater quality will be monitored in the Moor Grit, Scarborough and Cloughton aquifers using a series of boreholes both up and down gradient of the development areas, as listed below, at the positions shown on Drawing 1433DevOD271, Appendix 1. Water quality at each location will be assessed individually, as well as in relation to their up and down gradient positions to the Shaft Platform, Platform Extension, Working Platform, Access Roads and Compound Area.

Groundwater Quality Monitoring Locations

Shaft Development Platform, Platform Extension and Screening Bund

Monitoring Well		NGR Coordinates	Reason
GW101	--	489152.62, 505656.51	Monitor changes in the groundwater quality within the Moor Grit up gradient of the development areas
GW124 (SAC3)	--	489184.48, 505377.01	
GW125 (SAC4)	--	489215.70, 505221.78	
GW101A	--	489152.93, 505650.83	Monitor changes in the groundwater quality within the Scarborough Formation up gradient of the development areas
GW126A	HG108A	489132.71, 505164.63	
GW117	--	489236.66, 505102.82	
GW139A	HG5A	489243.5, 504952.9	Monitor changes in the groundwater quality within the Cloughton Formation up gradient of the development areas

GW103	--	489342.55, 505678.83	Monitor changes in the groundwater quality within the Moor Grit down hydraulic gradient of the tiered Shaft Platform.
GW105	--	489449.41, 505667.32	Monitor changes in the groundwater quality within the Scarborough Formation down hydraulic gradient of the tiered Shaft Platform.
GW137 GW106 GW108	HG2 -- --	489498.55, 505506.42 489559.62, 505668.15 489658.09, 505397.27	Monitor changes in the groundwater quality within the Cloughton Formation down hydraulic gradient of the tiered Shaft Platform.

Working Platform, Access Road and Compound Area

Name		NGR Coordinates	Reason
GW129 (SAC5) GW130 (SAC6)	-- --	489219.39, 505118.00 489236.10, 504928.69	Monitor changes in the groundwater quality within the Moor Grit up gradient of the development areas
GW117	--	489236.66, 505102.82	Monitor changes in the groundwater quality within the Scarborough Formation up gradient of the development areas
GW139A	HG5A	489243.5, 504952.9	Monitor changes in the groundwater quality within the Cloughton Formation up gradient of the development areas
GW109 GW140	-- HG120	489610.08, 505119.60 489606.05, 505068.86	Monitor changes in the groundwater quality within the Scarborough Formation down hydraulic gradient of the areas access road and site compound.
GW138	HG4	489496.28, 505206.94	Monitor changes in the groundwater quality within the Cloughton Formation down hydraulic gradient of the areas access road and site compound.

If any of the above monitoring locations is damaged or lost as part of the Phase 2 or 3 Works, they will be re-installed.

3.6.3 Monitoring Frequency

On the basis that the all construction activities will be managed in accordance with the Construction Environmental Management Plan (CEMP), the likelihood of pollution arising from these works is considered low and a monthly frequency for groundwater quality monitoring is therefore considered appropriate for these works and sampling for ground water quality analysis will be undertaken at the following intervals.

Groundwater Quality Monitoring Frequency

Monitoring phase	Duration	Frequency
Phase 3 Works	Duration of works	Monthly
Post Phase 3 Works	1 Month	Monthly

Monitoring of groundwater quality will continue for a minimum period of one month following completion of the Phase 3 Works and until it has been demonstrated that no significant variance from the Control Trigger Values has occurred and no exceedance above the Compliance Limits detailed below has been detected.

Phase 3 Works are scheduled to follow directly after completion of the Phase 2 Works. Consequently an assessment of any Trigger Value breaches will evaluate the cumulative impact of Phases 2 and 3 to determine the cause and appropriate remedial actions.

3.6.4 Groundwater Quality Data

To meet with the groundwater monitoring objectives, the minimum baseline suite of analysis will include both onsite water analysis and laboratory testing, as detailed below. The suite of determinands will include the specific Contaminants of Concern (CoC) identified by the Hydrogeological Risk Assessment (Ref 2) associated with the then completed Phase 2 Works and the Phase 3 Works.

Presented below are details of the onsite monitoring and of the sampling and laboratory testing that will be undertaken to obtain the groundwater quality data for the Phase 3 Works. All chemical analysis will be undertaken by an MCERTS accredited laboratory.

Onsite Water Analysis

On site monitoring, using appropriately calibrated field equipment, will be undertaken for the following determinands:-

- Temperature,
- pH,
- Electrical Conductivity; and,
- Total Dissolved Solids.

Sampling

Prior to sampling of the up and down gradient boreholes, each well will be developed by pumping and either purged to three well volumes or the establishment of stable pH and conductivity readings (typically three consecutive field measurements of +/- 0.1 pH units and +/- 250 $\mu\text{S}/\text{cm}$) to ensure the groundwaters sampled are representative of the surrounding groundwater quality in accordance with current guidance (Ref. 5).

Unfiltered samples will be collected in two 1-litre coloured glass jars, and one 100 ml vial and as required by the laboratory, to complete the specified testing suites.

Laboratory Analysis

The chemical analysis will be undertaken for the following suite of determinands:-

- pH;
- Conductivity;
- Chloride;
- Sodium;
- Sulphate;
- Aluminium;
- Cobalt;
- BTEX (Benzene, Toluene, Ethylbenzene and Xylene);
- Speciated Polycyclic Aromatic Hydrocarbons (including Anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene and Naphthalene); and
- Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG) (Aliphatic/Aromatic split)

3.6.5 Assessment Trigger Values

Groundwater Quality (GWQ) Control Trigger Values have been set for all monitoring well locations (as detailed in Section 3.4.2, above) for the determinands to be analysed by consideration of the baseline groundwater level range and typical variation. The GWQ Control Trigger value has been set at a value equivalent to the mean baseline value plus 2 x the Standard Deviation for that dataset. The GWQ Compliance Trigger Value has been set at the equivalent Drinking Water Standard (DWS), Environmental Quality Standard (EQS) or the baseline value determined where the current baseline value exceeds the EQS value. Where the analytical detection limit (MRV) has been adopted as the Compliance Trigger Value, then no Control Trigger Value is included, as presented below.

Moor Grit

Contaminant of Concern	Detection Limit	Groundwater Quality Control Trigger Value	Groundwater Quality Compliance Trigger Value	Source of Compliance Trigger Value
pH (Laboratory)		5.6 – 6.9	4.75 – 8.0	Max Baseline Range
Conductivity (Laboratory)	1 µS/cm	3145 µS/cm	4170 µS/cm	Max Baseline Value
Chloride	5 mg/l	875 mg/l	1,200 mg/l	Max Baseline Value
Aluminium	10 µg/l	949 µg/l	1600 µg/l	Max Baseline Value
Cobalt	0.16 µg/l	26 µg/l	100 µg/l	DWS
Sodium	70 µg/l	493 mg/l	740 mg/l	Max Baseline Value
Sulphate	100 µg/l	25 mg/l	250 mg/l	DWS
Benzene	1 µg/l	--	1 µg/l	DWS/Detection Limit
Toluene	1 µg/l	--	1 µg/l	Detection Limit
Ethylbenzene	1 µg/l	--	1 µg/l	Detection Limit
Xylene	1 µg/l	--	1 µg/l	Detection Limit
Anthracene	0.01 µg/l	0.01 µg/l	0.1 µg/l	Detection Limit
Benzo(a)pyrene	0.01 µg/l	--	0.01 µg/l	DWS/Detection Limit
Benzo(b)fluoranthene	0.01 µg/l	0.01 µg/l	0.03 µg/l	EQS
Benzo(g,h,i)perylene	0.01 µg/l	0.01 µg/l	0.03 µg/l	EQS
Benzo(k)fluoranthene	0.01 µg/l	--	0.01 µg/l	Detection Limit
Fluoranthene	0.01 µg/l	0.03 µg/l	1 µg/l	EQS
Indeno(1,2,3-cd)pyrene	0.01 µg/l	--	0.01 µg/l	Detection Limit
Naphthalene	0.01 µg/l	0.01 µg/l	2.4 µg/l	EQS
TPH Aliphatic C5-C6	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aliphatic C6-C8	0.1 µg/l	12.9 µg/l	33 µg/l	Max Baseline Value
TPH Aliphatic C8-C10	0.1 µg/l	11 µg/l	28 µg/l	Max Baseline Value
TPH Aliphatic C10-C12	1 µg/l	--	1 µg/l	Detection Limit
TPH Aliphatic C12-C16	1 µg/l	--	1 µg/l	Detection Limit
TPH Aliphatic C16-C21	1 µg/l	1.6 µg/l	3.2 µg/l	Max Baseline Value
TPH Aliphatic C21-C35	1 µg/l	5 µg/l	12 µg/l	Max Baseline Value
TPH Aromatic C5-C7	0.1 µg/l	4.7 µg/l	12 µg/l	Max Baseline Value
TPH Aromatic C7-C8	0.1 µg/l	0.4 µg/l	0.9 µg/l	Max Baseline Value
TPH Aromatic C8-C10	0.1 µg/l	0.2 µg/l	0.4 µg/l	Max Baseline Value
TPH Aromatic C10-C12	1 µg/l	--	1 µg/l	Detection Limit
TPH Aromatic C12-C16	1 µg/l	7 µg/l	17 µg/l	Max Baseline Value
TPH Aromatic C16-C21	1 µg/l	3 µg/l	6.9 µg/l	Max Baseline Value
TPH Aromatic C21-C35	1 µg/l	--	1 µg/l	Detection Limit
Total TPH	10 µg/l	33.9 µg/l	74 µg/l	Max Baseline Value

Scarborough Formation

Contaminant of Concern	Detection Limit	Groundwater Quality Control Value	Groundwater Quality Compliance Value	Source of Compliance Value
pH		5.9 – 7.1	5.2 – 8.0	Max Baseline Range
Conductivity	1 µS/cm	1,816 µS/cm	2,500 µS/cm	EQS
Chloride	5 mg/l	622 mg/l	630 mg/l	Max Baseline Value
Aluminium	10 µg/l	581 µg/l	1100 µg/l	Max Baseline Value
Cobalt	0.16 µg/l	20 µg/l	100 µg/l	DWS
Sodium	70 µg/l	--	290 mg/l	Max Baseline Value
Sulphate	100 µg/l	79 mg/l	250 mg/l	DWS
Benzene	1 µg/l	--	1 µg/l	DWS/Detection Limit
Toluene	1 µg/l	--	1 µg	Detection Limit
Ethylbenzene	1 µg/l	--	1 µg/l	Detection Limit
Xylene	1 µg/l	--	1 µg/l	Detection Limit
Anthracene	0.01 µg/l	0.05 µg/l	0.15 µg/l	Max Baseline Value
Benzo(a)pyrene	0.01 µg/l	--	0.01 µg/l	DWS
Benzo(b)fluoranthene	0.01 µg/l	0.01 µg/l	0.03 µg/l	EQS
Benzo(g,h,i)perylene	0.01 µg/l	--	0.01 µg/l	Detection Limit
Benzo(k)fluoranthene	0.01 µg/l	0.01 µg/l	0.03 µg/l	EQS
Fluoranthene	0.01 µg/l	0.01 µg/l	1 µg/l	EQS
Indeno(1,2,3-cd)pyrene	0.01 µg/l	--	0.01 µg/l	Detection Limit
Naphthalene	0.01 µg/l	0.01 µg/l	2.4 µg/l	EQS
TPH Aliphatic C5-C6	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aliphatic C6-C8	0.1 µg/l	1 µg/l	2.3 µg/l	Max Baseline Value
TPH Aliphatic C8-C10	0.1 µg/l	5 µg/l	16 µg/l	Max Baseline Value
TPH Aliphatic C10-C12	1 µg/l	--	1 µg/l	Detection Limit
TPH Aliphatic C12-C16	1 µg/l	1.4 µg/l	3.6 µg/l	Max Baseline Value
TPH Aliphatic C16-C21	1 µg/l	2 µg/l	5.5 µg/l	Max Baseline Value
TPH Aliphatic C21-C35	1 µg/l	11.4 µg/l	36 µg/l	Max Baseline Value
TPH Aromatic C5-C7	0.1 µg/l	0.9 µg/l	2.6 µg/l	Max Baseline Value
TPH Aromatic C7-C8	0.1 µg/l	0.3 µg/l	0.9 µg/l	Max Baseline Value
TPH Aromatic C8-C10	0.1 µg/l	1.1 µg/l	3.1 µg/l	Max Baseline Value
TPH Aromatic C10-C12	1 µg/l	--	1 µg/l	Detection Limit
TPH Aromatic C12-C16	1 µg/l	5.5 µg/l	15 µg/l	Max Baseline Value
TPH Aromatic C16-C21	1 µg/l	5.7 µg/l	16 µg/l	Max Baseline Value
TPH Aromatic C21-C35	1 µg/l	--	1.0 µg/l	Detection Limit
Total TPH	10 µg/l	19.6 µg/l	36µg/l	Max Baseline Value

Note – Values thought to represent a hydrocarbon plume detected November/December 2015 have been excluded from the Baseline data.

Cloughton Formation

Contaminant of Concern	Detection Limit	Groundwater Quality Control Value	Groundwater Quality Compliance Value	Source of Compliance Value
pH		6.1 – 7.4	4.9 – 8.4	Max Baseline Range
Conductivity	1 µS/cm	722 µS/cm	2,500 µS/cm	EQS
Chloride	5 mg/l	137 mg/l	250 mg/l	EQS
Aluminium	10 µg/l	912 µg/l	1500 µg/l	Max Baseline Value
Cobalt	0.16 µg/l	13 µg/l	100 µg/l	DWS
Sodium	70 µg/l	49 mg/l	200 mg/l	DWS
Sulphate	100 µg/l	45 mg/l	250 mg/l	DWS
Benzene	1 µg/l	--	1 µg/l	DWS/Detection Limit
Toluene	1 µg/l	0.98 µg/l	2.3 µg/l	Max Baseline Value
Ethylbenzene	1 µg/l	--	1 µg/l	Detection Limit
Xylene	1 µg/l	--	1 µg/l	Detection Limit
Anthracene	0.01 µg/l	0.05 µg/l	0.16 µg/l	Max Baseline Value

Benzo(a)pyrene	0.01 µg/l	--	0.01 µg/l	DWS
Benzo(b)fluoranthene	0.01 µg/l	0.01 µg/l	0.03 µg/l	EQS
Benzo(g,h,i)perylene	0.01 µg/l	--	0.01 µg/l	Detection Limit
Benzo(k)fluoranthene	0.01 µg/l	0.01 µg/l	0.03 µg/l	EQS
Fluoranthene	0.01 µg/l	0.11 µg/l	1 µg/l	EQS
Indeno(1,2,3-cd)pyrene	0.01 µg/l	--	0.01 µg/l	Detection Limit
Naphthalene	0.01 µg/l	0.01 µg/l	2.4 µg/l	EQS
TPH Aliphatic C5-C6	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aliphatic C6-C8	0.1 µg/l	0.7 µg/l	2.6 µg/l	Max Baseline Value
TPH Aliphatic C8-C10	0.1 µg/l	10 µg/l	39 µg/l	Max Baseline Value
TPH Aliphatic C10-C12	1 µg/l	--	1 µg/l	Detection Limit
TPH Aliphatic C12-C16	1 µg/l	2.3 µg/l	7.4 µg/l	Max Baseline Value
TPH Aliphatic C16-C21	1 µg/l	2.2 µg/l	7.1 µg/l	Max Baseline Value
TPH Aliphatic C21-C35	1 µg/l	--	1.0 µg/l	Detection Limit
TPH Aromatic C5-C7	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aromatic C7-C8	0.1 µg/l	0.7 µg/l	2.3 µg/l	Max Baseline Value
TPH Aromatic C8-C10	0.1 µg/l	--	1 µg/l	Detection Limit
TPH Aromatic C10-C12	1 µg/l	--	1 µg/l	Detection Limit
TPH Aromatic C12-C16	1 µg/l	--	1 µg/l	Detection Limit
TPH Aromatic C16-C21	1 µg/l	--	1 µg/l	Detection Limit
TPH Aromatic C21-C35	1 µg/l	7.5 µg/l	27 µg/l	Max Baseline Value
Total TPH	10 µg/l	17.3 µg/l	44 µg/l	Max Baseline Value

3.7 Springs

3.7.1 Objectives

The purpose of the spring water monitoring strategy is to detect chemical and physical impact on Soulsgrave Farm and Moorside Farm springs caused by the then completed Phase 2 Works and the Phase 3 Works, so that appropriate remedial measures can be adopted should potentially detrimental impacts arise.

From the results of the Hydrogeological Risk Assessment (Ref. 2), the principal impact on spring receptors that could arise from these works, is the alteration of groundwater flow paths and levels in the shallow aquifers sustaining spring flows to Moorside Farm (MF2) and Soulsgrave Farm (SF1).

Due to the north-easterly hydraulic gradient in the vicinity of Woodsmith Mine, chemical impacts would, however, not occur up hydraulic gradient of the works. Therefore pollution of surface water runoff by hydrocarbon spillage/leakage in the vicinity of the shaft platform and compound areas that infiltrates into the shallow aquifers is inferred to result in a negligible impact on water quality at the spring receptors at Moorside Farm (MF2) and Soulsgrave Farm (SF1).

As such, the objectives of the spring monitoring are to enable evaluation of the impacts on both the flow rates and water quality at these receptors. As these two springs provide a domestic water supply and as Moorside Farm Spring also supports the vegetation within the Spring Flush habitat they are classified as having a high sensitivity to both physical and chemical impacts. Due to the negligible risk of groundwater pollution from these works impacting on these receptors up hydraulic gradient, in particular since dewatering operations will concentrate groundwater flow into the shaft platform area and away from the receptors up hydraulic gradient, therefore further reducing the risk of pollution impact offsite, it is proposed that a monthly monitoring frequency is adopted. Due to the low risk of the construction and dewatering works impacting on

groundwater levels and spring flow rates, a weekly monitoring frequency is proposed to enable rapid evaluation and implementation of remedial actions, should contravention of the Control Trigger Values arise.

3.7.2 Monitoring Locations

From the design layout of the Phase 3 Works, monitoring of the spring receptors at Moorside Farm (MF2) and Soulsgrave Farm (SF2) will be undertaken at the locations listed below and shown in Drawing 1433DevOD271 (Appendix 1). Due to the diffuse nature of the Moorside Farm spring (MF2) discharge, it is not possible to monitor either the flow or water quality at this location and, therefore, the first collection chamber at MF1 is to be used as a surrogate representation of the spring.

Spring Monitoring Locations

Name	NGR Coordinates	Purpose
Moorside Farm Spring (MF1)	489063 504803	Monitor potential changes in the spring flow rate and water quality providing a discharge collected for domestic water and supporting the spring flush target receptor.
Soulsgrave Farm (SF2)	490198 504380	Monitor potential changes in the spring flow rate to domestic water supply.

3.7.3 Monitoring Frequency

Spring flow rate and water quality monitoring will be undertaken at the following intervals.

Spring Monitoring Frequency

Monitoring phase	Duration	Flow Rate Frequency	Water Quality Frequency
Phase 3 Works	Duration of works	Weekly	Monthly
Post Phase 3 Works	1 Month	Weekly	Monthly

Monitoring of spring flow rates and water quality shall continue for a minimum period of one month following completion of the completed Phase 2 Works and the Phase 3 Works and until it has been demonstrated that no significant variance from the Control Trigger Values has occurred and no exceedance above the Compliance Limits detailed below has been detected.

Phase 3 Works are scheduled to follow directly after completion of the Phase 2 Works. Consequently an assessment of any Trigger Value breaches will evaluate the cumulative impact of Phases 2 and 3 to determine the cause and appropriate remedial actions.

3.7.4 Spring Flow Rate Data

To meet the monitoring objectives, spring flow (SpWF) rates will be monitored by manual measurement for comparison with the SpWF Control and Compliance Trigger Values derived from the baseline data.

3.7.5 Assessment Trigger Values

SpWF Control and Compliance Trigger Values have been set for the two spring monitoring locations, as detailed below, by consideration of the baseline flow rate range and typical variation. Due to the relatively narrow natural variation/range of flow rates recorded, the SpWF

Control Trigger value has been set at a value equivalent to the mean baseline flow rate value for that dataset and the SpWF Compliance Trigger Value as the minimum baseline flow rate value recorded, as presented below. It should be noted that baseline monitoring of flow from these springs has demonstrated intermittent flows in response to seasonal conditions. As such, where baseline monitoring has demonstrated sustained “No flow” conditions can occur during a month, no SpWF Compliance Trigger Value is deemed appropriate.

Monitoring Location	Baseline Flow Rate Statistics (l/s)				SpWF Control Trigger Value (l/s)	SpWF Compliance Trigger Value (l/s)
	Mean	Minimum	Maximum	Standard Deviation		
Moorside Farm (MF1)						
May	0.10	0.04	0.25	0.09	0.10	0.04
June	0.04	0.03	0.06	0.01	0.04	0.03
July	0.03	0.00	0.07	0.02	0.03	*
August	0.03	0.02	0.04	0.01	0.03	0.02
September	0.02	0.00	0.05	0.01	0.02	*
October	0.02	0.00	0.04	0.02	0.02	*
November	0.03	0.00	0.07	0.02	0.03	*
December	0.06	0.03	0.08	0.02	0.06	0.03
Soulsgrave Farm (SF1)						
May	0.16	0.03	0.61	0.22	0.16	0.03
June	0.17	0.01	0.55	0.20	0.17	0.01
July	0.04	0.00	0.13	0.05	0.04	*
August	0.05	0.00	0.20	0.07	0.05	*
September	0.01	0.00	0.08	0.03	0.01	*
October	0.01	0.00	0.06	0.02	0.01	*
November	0.27	0.00	0.53	0.22	0.27	*
December	0.35	0.11	1.01	0.34	0.35	0.11

Note - * No Compliance Trigger Value is appropriate as no flow conditions have been recorded

3.7.6 Spring Water Quality Data

To meet with the spring water quality monitoring objectives, the minimum baseline suite of analysis will include onsite analysis and sampling for laboratory testing, as detailed below. The suite of determinands will include the specific Contaminants of Concern (CoC) associated with the Phase 2 Works, as detailed in Section 3.5.1.

Onsite Monitoring

On site monitoring using calibrated field equipment will be undertaken for the following determinands:-

- Temperature;
- pH;
- Electrical Conductivity; and
- Total Dissolved Solids.

Sampling

Unfiltered samples will be collected in two 1-litre coloured glass jars, and one 100 ml vial, or as required by the laboratory to complete the specified testing suites.

Laboratory Analysis

All chemical analysis will be undertaken by an MCERTS accredited laboratory and will include the following:-

- pH,
- Conductivity,
- Chloride,
- Sodium,
- Sulphate,
- Aluminium,
- Cobalt,
- BTEX (Benzene, Toluene, Ethylbenzene and Xylene),
- Speciated Polycyclic Aromatic Hydrocarbons (including Anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Indeno(1,2,3 cd)pyrene and Naphthalene),
- Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG) (Aliphatic/Aromatic split)

3.7.7 Assessment Trigger Values

Spring specific water quality (SpWQ) Control SpWFValues have been set for the two springs by consideration of their respective baseline water quality and typical variation. The SpWQ Control Trigger Value has been set at a value equivalent to the mean baseline value plus 1 or 2 x the Standard Deviation for that dataset, dependent on the magnitude of variation of the data. The SpWQ Compliance Trigger Value has been set at the equivalent Environmental Quality Standard (EQS) or the minimum baseline value determined where baseline data exceeds the EQS value. Where the analytical detection limit has been adopted as the SpWQ Compliance Trigger Value, then no SpWQ Control Trigger Value is included, as presented below.

Moorside Farm (MF1)

Contaminant of Concern	Detection Limit	Spring Quality Control Trigger Value	Spring Quality Compliance Trigger Value	Source of Compliance Trigger Value
pH (Laboratory)		5.6 – 6.4	4.8 – 7.4	Max Baseline Range
Conductivity (Laboratory)	1 µS/cm	226 µS/cm	2,500 µS/cm	EQS
Chloride	5 mg/l	60 mg/l	250 mg/l	EQS
Benzene	1 µg/l	--	1 µg/l	DWS/Detection Limit
Toluene	1 µg/l	--	1 µg/l	Detection Limit
Ethylbenzene	1 µg/l	1.8 µg/l	2.6 µg/l	Max Baseline Value
Xylene	1 µg/l	1.4 µg/l	2 µg/l	Max Baseline Value
Anthracene	0.01 µg/l	0.01 µg/l	0.1 µg/l	EQS
Benzo(a)pyrene	0.01 µg/l	0.01 µg/l	0.01 µg/l	DWS
Benzo(b)fluoranthene	0.01 µg/l	0.01 µg/l	0.03 µg/l	EQS
Benzo(g,h,i)perylene	0.01 µg/l	--	0.01 µg/l	Detection Limit
Benzo(k)fluoranthene	0.01 µg/l	0.01 µg/l	0.03 µg/l	EQS
Fluoranthene	0.01 µg/l	0.01 µg/l	1 µg/l	EQS
Indeno(1,2,3-cd)pyrene	0.01 µg/l	--	0.01 µg/l	Detection Limit
Naphthalene	0.01 µg/l	0.01 µg/l	2.4 µg/l	EQS
TPH Aliphatic C5-C6	0.1 µg/l	--	0.1 µg/l	Detection Limit

TPH Aliphatic C6-C8	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aliphatic C8-C10	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aliphatic C10-C12	1 µg/l	--	1 µg/l	Detection Limit
TPH Aliphatic C12-C16	1 µg/l	3.1 µg/l	4.9 µg/l	Max Baseline Value
TPH Aliphatic C16-C21	1 µg/l	2.7 µg/l	4.3 µg/l	Max Baseline Value
TPH Aliphatic C21-C35	1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aromatic C5-C7	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aromatic C7-C8	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aromatic C8-C10	0.1 µg/l	2.6 µg/l	4.5 µg/l	Max Baseline Value
TPH Aromatic C10-C12	1 µg/l	1.3 µg/l	1.8 µg/l	Max Baseline Value
TPH Aromatic C12-C16	1 µg/l	1.4 µg/l	2.1 µg/l	Max Baseline Value
TPH Aromatic C16-C21	1 µg/l	1.4 µg/l	2.1 µg/l	Max Baseline Value
TPH Aromatic C21-C35	1 µg/l	--	1 µg/l	Detection Limit
Total TPH	10 µg/l	--	10 µg/l	Detection Limit

Soulsgrave Farm (SF1)

Contaminant of Concern	Detection Limit	Spring Quality Control Trigger Value	Spring Quality Compliance Trigger Value	Source of Compliance Trigger Value
pH		5.5 – 6.6	5.5 – 7.4	Max Baseline Range
Conductivity	1 µS/cm	576 µS/cm	2,500 µS/cm	EQS
Chloride	5 mg/l	169 mg/l	250 mg/l	EQS
Benzene	1 µg/l	--	1 µg/l	DWS/Detection Limit
Toluene	1 µg/l	--	1 µg/l	Detection Limit
Ethylbenzene	1 µg/l	--	1 µg/l	Detection Limit
Xylene	1 µg/l	--	1 µg/l	Detection Limit
Anthracene	0.01 µg/l	0.00 µg/l	0.05 µg/l	EQS
Benzo(a)pyrene	0.01 µg/l	0.01 µg/l	0.01 µg/l	DWS
Benzo(b)fluoranthene	0.01 µg/l	0.01 µg/l	0.03 µg/l	EQS
Benzo(g,h,i)perylene	0.01 µg/l	--	0.02 µg/l	Detection Limit
Benzo(k)fluoranthene	0.01 µg/l	0.01 µg/l	0.03 µg/l	EQS
Fluoranthene	0.01 µg/l	0.04 µg/l	1 µg/l	EQS
Indeno(1,2,3-cd)pyrene	0.01 µg/l	--	0.01 µg/l	Detection Limit
Naphthalene	0.01 µg/l	0.01 µg/l	2.4 µg/l	EQS
TPH Aliphatic C5-C6	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aliphatic C6-C8	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aliphatic C8-C10	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aliphatic C10-C12	1 µg/l	--	1 µg/l	Detection Limit
TPH Aliphatic C12-C16	1 µg/l	--	1 µg/l	Detection Limit
TPH Aliphatic C16-C21	1 µg/l	--	1 µg/l	Detection Limit
TPH Aliphatic C21-C35	1 µg/l	--	1 µg/l	Detection Limit
TPH Aromatic C5-C7	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aromatic C7-C8	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aromatic C8-C10	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aromatic C10-C12	1 µg/l	--	1 µg/l	Detection Limit
TPH Aromatic C12-C16	1 µg/l	--	1 µg/l	Detection Limit
TPH Aromatic C16-C21	1 µg/l	--	1 µg/l	Detection Limit
TPH Aromatic C21-C35	1 µg/l	--	1 µg/l	Detection Limit
Total TPH	10 µg/l	--	10 µg/l	Detection Limit

3.8 Surface Water

3.8.1 Objectives

The purpose of the surface water monitoring strategy is to detect chemical and physical impact on surface waters within Sneaton Thorpe Beck caused by the then completed Phase 2 Works and the Phase 3 Works, so that appropriate remedial measures can be adopted should potentially detrimental impacts arise.

From the results of the Revised Hydrogeological Risk Assessment (Ref. 2) and the Surface Water Drainage Scheme (Ref. 4), potential impacts on Sneaton Thorpe Beck that could arise from the then completed Phase 2 Works and the Phase 3 Works, and therefore require evaluation by the surface water monitoring strategy include:-

- Chemical pollution in the form of hydrocarbon (fuel, hydraulic oil, lubricant oil) spillage or leakage from construction plant and silt/particulate suspended solids entering surface water drainage via runoff and discharging into controlled waters.
- Physical impacts of the groundwater and surface water discharges to the surface water outfall system on Sneaton Thorpe Beck by causing siltation, scour or erosion of the stream bed.

3.8.2 Monitoring Locations

To meet the above objectives, the surface water monitoring locations have been designed to provide:-

- a) a baseline (Pre Phase 3 Works) survey of Sneaton Thorpe Beck,
- b) early monitoring of surface water drainage within the onsite construction activities,
- c) monitoring of surface water outfalls at downstream compliance points prior to discharge to Sneaton Thorpe Beck,
- d) An end of Phase 3 Works survey of Sneaton Thorpe Beck.

From the design layout of the Phase 3 Works, monitoring of the construction stage discharges up and down stream of the surface water drainage outfall points will be undertaken as summarised below and shown in Drawing 1433DevOD272 (Appendix 1):-

- Surface drainage discharge points from key outfalls from the construction works denoted OF2, OF5, OF7 and OF8, to monitor the water quality from the works area prior to discharge to Sneaton Thorpe Beck;

Surface Water Monitoring Locations - Outfalls

Monitoring Location	Coordinates	Monitoring
OF2	499621, 505388	Outfall from Silt Removal Facility
OF5	499497, 504743	Outfall from Reinjection Well Platform
OF7	499629, 505517	Outfall from Groundwater Drainage Layer
OF8	499583, 505078	Outfall from Working Platform post Attenuation Pond and Wetland

- Downstream Sneaton Thorpe Beck (STB1, STB2, STB3, and STB4A) to monitor the water quality and impacts on stream geomorphology of surface drainage discharges (STB2 and STB1) downstream of the Phase 3 works and exiting the development site.

Surface Water Monitoring Locations – Sneaton Thorpe Beck

Monitoring Location	Coordinates	Monitoring
STB1	499621, 505388	Sneaton Thorpe Beck
STB2	499497, 504743	Sneaton Thorpe Beck Off Site
STB3	499629, 505517	Drain Tributary to Sneaton Thorpe Beck
STB4A	499583, 505078	Outfall Wetland

3.8.3 Monitoring Frequency

Sampling for surface water quality analysis will be undertaken at the following intervals.

Surface Water Monitoring Frequency

Monitoring phase	Duration	Frequency
Phase 3 Works - Quality and Geomorphology	Duration of works	Weekly
Post Phase 3 Works - Quality and Geomorphology	1 Month	Weekly

Monitoring of surface water quality shall continue for a minimum period of 1 month following completion of the Phase 3 Works and until it has been demonstrated that no significant variance from the Control Trigger Values has occurred and no exceedance above the Compliance Trigger Values detailed below has been detected.

Phase 3 Works are scheduled to follow directly after completion of the Phase 2 Works. Consequently an assessment of any Trigger Values breaches will evaluate the cumulative impact of Phases 2 and 3 to determine the cause and appropriate remedial actions.

3.8.4 Surface Water Data

To meet with the surface water monitoring objectives, the minimum baseline suite of analysis will include onsite analysis, sampling and laboratory testing, together with geomorphological inspection will be carried out as detailed below.

The suite of determinands to be analysed to evaluate construction related pollution will include the specific Contaminants of Concern (CoC) associated with the Phase 3 Works, as detailed in Section 3.6.1. In addition, NYMNPA have advised within Condition 46 that they also require the surface water quality analysis to include pH, sediment (suspended solids), Biological Oxygen Demand (BOD) and ammonia (Section 1.3).

Sampling

During the sampling visits, surface water sampling of the downstream monitoring points (STB1, STB2, STB3, and STB4A) will be collected first, to minimise disturbed sediment impacting on the results. These samples are to be taken from sections of fast flowing water, where possible. The specific monitoring locations of the outfall piped discharge points (OF2, OF5, OF7 and OF8) will be confirmed during the first monitoring visit after each water feature has been constructed.

Unfiltered samples will be collected in two litre coloured glass jars, and one 100 ml vial, or as required by the laboratory to complete the specified testing suites.

Onsite Monitoring

Visual inspection will be undertaken of the construction works surface water drainage systems to observe for evidence of high suspended solids, discolouration or hydrocarbon pollution.

On site monitoring using calibrated equipment will be undertaken for the following determinands:-

- Temperature;
- pH;
- Electrical Conductivity;
- Total Dissolved Solids; and
- Turbidity.

Laboratory Analysis

All chemical analysis will be undertaken by an MCERTS accredited laboratory.

From the expected potentially polluting activities associated with Phase 3 Works the CoC that are to be analysed will include:-

- pH;
- Conductivity;
- Suspended Solids;
- Biological Oxygen Demand;
- Free ammonia (NH₃);
- Chloride;
- Sodium;
- Sulphate;
- Aluminium;
- Cobalt;
- BTEX (Benzene, Toluene, Ethylbenzene and Xylene);
- Speciated Polycyclic Aromatic Hydrocarbons (including Anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene and Naphthalene); and
- Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG) (Aliphatic/Aromatic split).

Geomorphological Data

A baseline geomorphological survey of the full length of Sneaton Thorpe Beck, which may be impacted by the works, will be undertaken at the end Phase 2 Works/beginning of the Phase 3 Works, and again at the end of the Phase 3 Works. The extent of this survey will be from its source to its confluence with Rigg Mill Beck (approximately 4 km in total), including the tributary to the west, as shown on Drawing 1433DevOD264.

Geomorphological stream surveys will also be undertaken at weekly intervals during Phase 3 works at two downstream locations (STB01 and 02) on Sneaton Thorpe Beck, which will entail the geomorphological survey of a 100 m long section of the stream banks at these locations. At STB02 the survey will cover a 100m reach on both Sneaton Thorpe Beck and of the western tributary, as shown on Drawing 1433DevOD264. The survey will be undertaken in accordance with current guidance (Ref. 8), utilising a reconnaissance record sheet adapted from current guidance (Ref. 9). The data that will be obtained from this inspection will include:-

- A photographic record of the stream section in the form of fixed point photography (Locations shown in Drawing 1433DevOD264, and photos from each location are included in Appendix 3);
- A description of the channel;
- A description of the stream bed sediment;
- A description of the left and right bank characteristics;
- A description of the left and right bank face vegetation;
- A description of visual evidence of left and right bank erosion;
- A description of visual evidence of left and right bank geotechnical failure;
- A description of visual evidence of left and right bank toe sediment accumulation;
- Visual evidence of construction related debris within or adjacent to the stream;
- A visual description of evidence of pollution/discolouration; and
- A Geomorphological map recording the bed and bank features present in the channel.

Flow rates won't be routinely monitored; however, consideration will be made of climatic conditions, particularly after high runoff storm events.

3.8.5 Assessment Trigger Values

Surface Water Quality Control and Compliance Trigger Values

Surface Water Quality (SWQ) Control Trigger Values have been set for all of the determinands to be analysed for by consideration of the baseline surface water quality testing undertaken to date from Sneaton Thorpe Beck. The SWQ Control Trigger Value has been set at a value equivalent to the mean baseline value plus 2 x the Standard Deviation for that dataset. The Compliance Value has been set at the appropriate Environmental Quality Standard (EQS) or the minimum baseline value where this exceeds the EQS value. Where the analytical detection limit (MRV) has been adopted as the Compliance Trigger Value, then no Control Trigger Value is included, as presented below.

A Control Trigger Value will be derived for turbidity based on the initial three months monitoring data using the same methodology.

Surface Water Quality Control and Compliance Trigger Values

Contaminant of Concern	Detection Limit	Surface Water Quality Control Trigger Value	Surface Water Quality Compliance Trigger Value	Source of Compliance Trigger Value
pH		6.9 – 7.6	6.4 – 7.8	Max Baseline Range
Conductivity	1 µS/cm	980 µS/cm	2,500 µS/cm	EQS
Chloride	5 mg/l	40.8 mg/l	250 mg/l	EQS
Aluminium	10 µg/l	TBC	200 µg/l	DWS

Cobalt	0.16 µg/l	TBC	100 µg/l	DWS
Sodium	0.7 mg/l	29mg/l	200 mg/l	DWS
Sulphate	100 µg/l	TBC	250 mg/l	DWS
Turbidity	TBC	TBC	TBC	Max Baseline Value
Suspended Solids	5 mg/l	6 mg/l	25 mg/l	EQS
Biological Oxygen Demand (BOD)	1 mg/l	3.8 mg/l	6 mg/l	Max Baseline Value
Free Ammonia (NH ₃)	0.02 mg/l	0.18 mg/l	0.29 mg/l	Max Baseline Value
Benzene	1 µg/l	--	1 µg/l	Detection Limit
Toluene	1 µg/l	--	1 µg/l	Detection Limit
Ethylbenzene,	1 µg/l	--	1 µg/l	Detection Limit
Xylene	1 µg/l	--	1 µg/l	Detection Limit
Anthracene	0.01 µg/l	0.01 µg/l	0.1 µg/l	EQS
Benzo(a)pyrene	0.01 µg/l	0.02 µg/l	0.01 µg/l	DWS/Detection Limit
Benzo(b)fluoranthene	0.01 µg/l	0.01 µg/l	0.03 µg/l	EQS
Benzo(g,h,i)perylene	0.01 µg/l	0.04 µg/l	0.05 µg/l	EQS
Benzo(k)fluoranthene	0.01 µg/l	0.01 µg/l	0.03 µg/l	EQS
Fluoranthene	0.01 µg/l	0.09 µg/l	1 µg/l	EQS
Indeno(1,2,3-cd)pyrene	0.01 µg/l	0.03 µg/l	0.04 µg/l	Max Baseline Value
Naphthalene	0.01 µg/l	0.4 µg/l	2.4 µg/l	EQS
TPH Aliphatic C5-C6	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aliphatic C6-C8	0.1 µg/l	1.93 µg/l	2.9 µg/l	Max Baseline Value
TPH Aliphatic C8-C10	0.1 µg/l	0.41 µg/l	0.6 µg/l	Max Baseline Value
TPH Aliphatic C10-C12	1 µg/l	--	1 µg/l	Detection Limit
TPH Aliphatic C12-C16	1 µg/l	--	1 µg/l	Detection Limit
TPH Aliphatic C16-C21	1 µg/l	--	1 µg/l	Detection Limit
TPH Aliphatic C21-C35	1 µg/l	--	1 µg/l	Detection Limit
TPH Aromatic C5-C7	0.1 µg/l	--	0.1 µg/l	Detection Limit
TPH Aromatic C7-C8	0.1 µg/l	1.47 µg/l	2.2 µg/l	Max Baseline Value
TPH Aromatic C8-C10	0.1 µg/l	1.60 µg/l	2.4 µg/l	Max Baseline Value
TPH Aromatic C10-C12	1 µg/l	--	1 µg/l	Detection Limit
TPH Aromatic C12-C16	1 µg/l	1.55 µg/l	12 µg/l	Max Baseline Value
TPH Aromatic C16-C21	1 µg/l	0.97 µg/l	5.7 µg/l	Max Baseline Value
TPH Aromatic C21-C35	1 µg/l	--	1 µg/l	Detection Limit
Total TPH	10 µg/l	14 µg/l	18 µg/l	Max Baseline Value

Surface Water Geomorphology Control and Compliance Trigger Values

The stream reconnaissance survey to monitor the visual evidence of physical impacts of the Phase 3 Works on the geomorphology of Sneaton Thorpe Beck is a qualitative assessment and no specific Trigger Values are appropriate. As such, this visual assessment will provide a qualitative evaluation of observed changes in relation to the baseline conditions observed, during the baseline monitoring period.

3.9 Ecological Monitoring

3.9.1 Objectives

The objective of the ecological monitoring is to determine whether the then completed Phase 2 and the Phase 3 Works are impacting on the groundwater dependant flora in the Spring Flush. Any changes in the habitat or its diversity in this area will be compared to changes in the groundwater levels and spring flow rates monitored at Moorside Farm Spring to determine whether these changes in habitat conditions are related to hydrogeological changes.

3.9.2 Scope of Monitoring

The key indicator species to be monitored in the Spring Flush are:-

- purple moor grass;
- deer grass;
- cross leaved heath;
- sharp flowered rush; and
- bog mosses.

The monitoring is not to be limited to these species and the presence of all species, and changes in their populations, will be assessed.

Monitoring Locations

The survey area will be the Spring Flush area shown in Drawing 1433DevOD271. A series of ten fixed monitoring locations for quadrat sampling will be identified on site during the first baseline sampling visit and a wooden stake left to demarcate the location for future monitoring. The grid coordinates for these locations will be identified by the use of GPS and a photographic record will be used to enable identification for all future sampling. The areas for sampling will be selected based on those areas where habitats show more diversity although some areas of lesser diversity will also be selected.

3.9.3 Monitoring Frequency

The window for National Vegetation Classification (NVC) surveys is April to September with the optimal time for monitoring being July to September when the plants are in bloom. All NVC monitoring will be undertaken in accordance with the NVC methodology set out in the NVC guidance (Ref. 11). Following preconstruction baseline monitoring, undertaken in April 2017, prior to Phase 2 Works, and a further survey will be undertaken in August or September 2017. Surveys will be undertaken in August or September for each subsequent construction year.

3.9.4 Assessment Trigger Values

The ecological habitat Control Trigger Values will be set on the following basis:-

Change in NVC class	The quadrats will allow the detailed definition of NVC class(es) for each habitat type and location. A change in NVC class will indicate a change in assemblage sufficient to cause a change in vegetation thereby impacting the interest of the site.
Change in percentage cover (loss of 5%) of the key indicator species	The quadrats will allow determination of the percentage cover. Should the coverage of the key indicator species drop by 5% or more, this will trigger a review of the significance of the change in the context of the wider habitat conditions.
Colonisation by new species	An evaluation will be undertaken to determine evidence of colonisation by new species. Where colonisation by a new species has been identified a review will be carried out of the significance and consequence of the change;

4 REMOVAL AND REPLACEMENT OF EXISTING MONITORING POINTS

The following monitoring wells, as shown on Drawing 1433DevOD271, will be decommissioned as part of the Phase 3 Works:-

- GCBH4, GCBH6R, GCBH9, HG117, BH3A, HG7.

Borehole decommissioning will be undertaken in accordance with current guidance (Ref. 7) and will adopt one of the three decommissioning options detailed below:-

OPTION 1	In boreholes where there is 1m or less of plain pipework	Grout up standpipe from the base to 1.5m below ground level. Remove headworks and plain pipe from 0-1m bgl. Remove the gravel pack and slotted pipework from 1.0-1.5m and replace with a bentonite/grout plug. Replace upper section 0-1.0m bgl with appropriate topsoil/arising mix.
OPTION 2	In boreholes where there is greater than 1 m of plain pipework	Grout up standpipe from the base to 1m below ground level. Remove headworks and plain pipe from 0-1m bgl and replace with appropriate topsoil mix.
OPTION 3	In boreholes located on land that may be ploughed:-	Where boreholes are located on land that may be ploughed then guidance recommends that installations are removed to a minimum of 2.0 m bgl. Grout up standpipe from base to 2 m bgl. Remove headworks and plain pipe from 0-2m bgl . Remove the gravel pack and slotted pipework from 2.0-2.5m and replace with a bentonite/grout plug. Replace upper section 0-2.0m bgl with appropriate topsoil/arising mix.

On completion of the decommissioning, a report of the works undertaken will be prepared.

5 MONITORING REPORTING

5.1 Scope

Reporting will assess the monitoring results against the Control and Compliance Trigger Values to highlight breaches and to record if remedial action is required as outlined in the Remedial Action Plan (compiled to discharge Condition 46 of planning permission NYM/2014/0676/MEIA).

In compliance with Condition 46 of planning permission NYM/2014/0676/MEIA, should any monitoring result exceed those Control and Compliance Trigger Values set out within this document, the Local Planning Authority, the Environment Agency and Natural England will be informed as soon as practicable, and the approved Remedial Action shall be implemented in accordance with the Remedial Action Plan.

Summary reports will review the weekly/monthly monitoring reports, and review the adopted Control Trigger Values, and where necessary, suggest amendments.

5.2 Frequency

Monitoring reports will be prepared on a weekly basis during the Phase 3 Works, and for one month thereafter. Where breaches are recorded above the agreed Control and Compliance Trigger Values, the monitoring report will be issued to the NYMNPA, the Environment Agency and Natural England.

Monthly summary reports will be issued during the Phase 3 Works and on completion of the works. A final report will be issued to the NYMNPA, the Environment Agency and Natural England one month after the completion of the Phase 3 Works.

5.3 Format

The format for the weekly/ monthly reports will include:-

- Summary of weekly construction activities;
- Record of monitoring positions decommissioned;
- Summary of meteorological data;
- Comparison of monitoring data to control and compliance Trigger Values;
- Conclusions; and
- Recommendations for remedial actions.

The format of the summary reports will include:-

- Summary of monthly activities;
- Summary of meteorological data;
- Comparison of monitoring data to control and compliance Trigger Values;
- Analysis of baseline data and review of control values;
- Review of any remedial actions taken;
- Conclusions; and
- Recommendations for remedial actions.

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6 REFERENCES

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