
Sandgate Nurseries, Henfield

Flood Risk Assessment, Drainage Strategy and Water Neutrality Report

Prepared by: **Tom Spawton MEng, Harvey Doran MEng**
Reviewed by: **Dimitris Linardatos BEng (Hons) MSc CEng MICE FIHE**
Job Number: **30512**

Date	Revision	Notes/Amendments/Issue Purpose
September 2024	P04	Groundwater abstraction section added
September 2024	P05	Revised water treated report added
October 2024	P06	Amendments following Natural England comments
February 2025	P07	Revised to address Natural England comments
October 2025	P08	Revised EA flood maps as per LLFA comments

Contents

Page

1	Introduction	4
1.1	Relevant Policy	
2	Site Description and Location	5
2.1	Existing Drainage	
3	Development Proposal	7
4	Flood Risk Assessment	8
4.1	Flood Risk from Watercourses	
4.2	Flood Risk from Groundwater	
4.3	Flood Risk from Surface Water and Overland Flows	
4.4	Flood Risk from Reservoirs	
4.5	Flood Risk from Sewers	
5	Surface Water Run-off Assessment	13
6	SuDS Strategy	14
6.2	Water Quality	
7	Surface Water Maintenance Strategy	17
8	Foul Water Assessment	19
9	Water Neutrality Assessment	20
9.1	Introduction	
9.2	Background	
9.3	Baseline Calculations	
9.4	Proposal Demand	
9.5	Water Reduction Measures	
9.6	Offsetting measures	
9.7	Groundwater Abstraction	
9.8	Conclusion	
10	Conclusions	23

Appendices:

Appendix A	Topographical Survey
Appendix B	Southern Water Sewer Records
Appendix C	Proposed Development Plans
Appendix D	Greenfield Run-off Rates
Appendix E	Infiltration Test Results
Appendix F	Below Ground Drainage Layout

Appendix G	Hydraulic Calculations
Appendix H	Hydrogeological Assessment
Appendix I	Groundwater Analysis and Treatment Design
Appendix J	Water Efficiency Calculations
Appendix K	Rainwater Harvesting Calculations

Contains Ordnance Survey material © Crown copyright. All rights reserved. Licence number 0100058197

Contains British Geological Survey materials © NERC 2023 All rights reserved.

Acronyms	
AOD	Above Ordnance Datum
BGL	Below Ground Level
BGS	British Geological Survey
CIRIA	Construction Industry Research and Information Association
DCG	Design and Construction Guidance
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
PRA	Preliminary Risk Assessment
SFRA	Strategic Flood Risk Assessment
SWMP	Surface Water Management Plan
SuDS	Sustainable Drainage Systems

1 Introduction

Price & Myers have been commissioned to undertake a Flood Risk Assessment (FRA), Drainage Strategy and Water Neutrality Assessment report for the proposed development at Sandgate Nurseries, located off West End Lane which forms part of West Sussex County Council and Horsham District Council.

The National Planning Policy Framework (NPPF) states that an appropriate FRA will be required for all development proposals of 1 ha or greater in Flood Zone 1 and for any development within Flood Zones 2 or 3.

The EA's flood risk map for planning shows that the site is in Flood Zone 1, however the total site area is greater than 1 ha. This assessment will therefore focus on the flood risk stormwater management, as well as assessing the flood risk from all other sources.

This report will also outline the proposed drainage strategy for the site including a detailed Sustainable Drainage Systems (SuDS) assessment and consider water neutrality.

1.1 Relevant Policy

This FRA has been carried out in accordance with the NPPF and the accompanying Planning Practice Guidance (PPG) "Flood Risk and Coastal Change". This FRA also incorporates advice and guidance from the Environment Agency (EA), the Horsham District Council Strategic Flood Risk Assessment (SFRA) (2010), The West Sussex LLFA Policy for the Management of Surface Water (2018) and CIRIA documents.

The surface water drainage strategy is in accordance with:

- the Department for Environment, Food and Rural Affairs (DEFRA) "Non-Statutory Technical Standards for Sustainable Drainage Systems".
- the Lead Local Flood Authority (LLFA) guidance document on SuDS/Drainage.

2 Site Description and Location

The site is located off West End Lane, within West Sussex County Council and Horsham District Council. The full site address is Sandgate Nurseries, West End Lane, Henfield, Horsham, West Sussex, BN5 9UL. The OS grid reference is 520425 X, 116061 Y.

The site occupies an area of approximately 38,007m² (3.80 ha), the majority of which comprises of soft landscaping. The site can be accessed via an access road from West End Lane which leads to the existing vacant garden nurseries and associated structures (sheds and glasshouses).

The site is bound by West End Lane to the North, residential dwellings to the east, Hollands Lane to the south and a residential dwelling and agricultural land to the west.

The topographical survey for the site (available in Appendix A) shows that the levels in the northern half of the site generally fall from east to west, with levels ranging from approximately 21mAOD to 17mAOD. The southern half of the site generally slopes to the south towards a level of 16mAOD.



Figure 2.1: Existing site, showing site boundary

2.1 Existing Drainage

Due to the nature of the existing structures, it is assumed that there is no private drainage that serves the existing site.

The Southern Water Sewer Records show that the closest public sewer to the site is a 225mm diameter public foul water sewer and foul water pumping chamber that is located in Hollands Lane to the south-east corner of the site.

The Southern Water Sewer Records are available in full in Appendix B.



Figure 2.2: Southern Water Sewer Records.

3 Development Proposal

The development proposals comprise of the demolition of the existing vacant garden nurseries and erection of a continuing care retirement community of up to 72 units of accommodation (Use Class C2) and up to 10 starter homes (Use Class C3) with associated community facilities including a medical centre and on-site laundry and catering facilities, with access, infrastructure, open space, landscaping and associated works (all matters reserved except for access).

The proposed development proposals are available in full in Appendix C.



Figure 3.1: Proposed layout

4 Flood Risk Assessment

4.1 Flood Risk from Watercourses

The EA's flood map for planning shows that the site is located in Flood Zone 1 and is at very low risk of flooding (less than 0.1% annual probability of river or sea flooding) from watercourses. Developments in this flood zone do not have any restrictions, provided they do not increase the risk of flooding elsewhere.



Figure 4.1: EA Flood Map for Planning

The map also indicates that the site is expected to remain in Flood Zone 1 between the years 2070 and 2125, as shown in Figure 4.2.

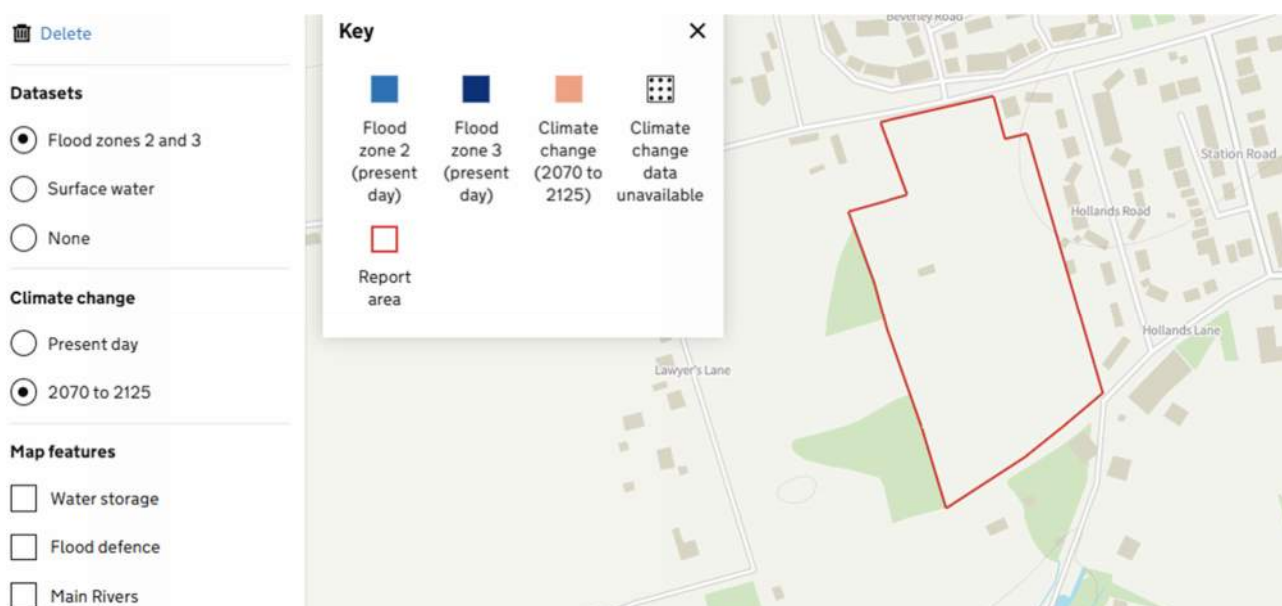


Figure 4.2: EA Flood Map for Planning, between the years 2070 to 2125

4.2 Flood Risk from Groundwater

Groundwater flooding occurs when water originating from sub-surface permeable strata emerges from the ground, typically after prolonged rainfall.

A Preliminary Risk Assessment (PRA) was carried out by Aviron Associates Ltd in August 2022. The report includes information on the anticipated geology based on information provided by the British Geological Survey (BGS). The BGS data shows that the site comprises of superficial deposits of Brighton and Worthing (clay, silt, sand and gravel). The bedrock geology comprises of Lower Greensand Group (sandstone).

The report contains recorded borehole logs for historical drilling or excavation works within 1000m of the site. Out of the five closest borehole logs, the shallowest groundwater level was recorded at a depth of 7.4m below ground level (bgl).

Furthermore, the proposals do not comprise of lower ground floors or basements which are more prone to groundwater flooding. Therefore, the risk of flooding from groundwater is considered to be very low.

4.3 Flood Risk from Surface Water and Overland Flows

Surface water flooding occurs when intense rainfall is unable to soak into the ground or enter a drainage system due to blockages or the capacity of the system being exceeded. Overland flows can also be generated by burst water mains, failed dams and any failure in a system storing or transferring water.

The EA's surface water flooding map, Figure 4.3, shows that the majority of the site is at very low risk of surface water flooding (a chance of flooding of less than 0.1% each year). A small area to the north of the site, adjacent to the existing access road, is at low risk (between 0.1% and 1% chance of flooding each year) to high risk (more than 3.3% chance of flooding each year) of surface water flooding. A small, narrow strip of land along the western boundary is also shown to be at low risk of surface water flooding.

The map indicates that these areas are expected to remain at low to high risk of surface water flooding between the years 2040 and 2060 due to the effects of climate change, as shown in Figure 4.4.

Ground levels from the topographical survey indicate that the northern section of the site, which is at low to high risk of surface water flooding, corresponds to a local low point where surface water from the site may naturally accumulate due to existing ground levels, rather than being part of a defined surface water flow path. As part of the proposed development, this area will be retained as soft landscaping, incorporating meadow and native shrub planting, with the ground levels regraded. Therefore, the overall surface water flood risk to the development is considered to be very low.

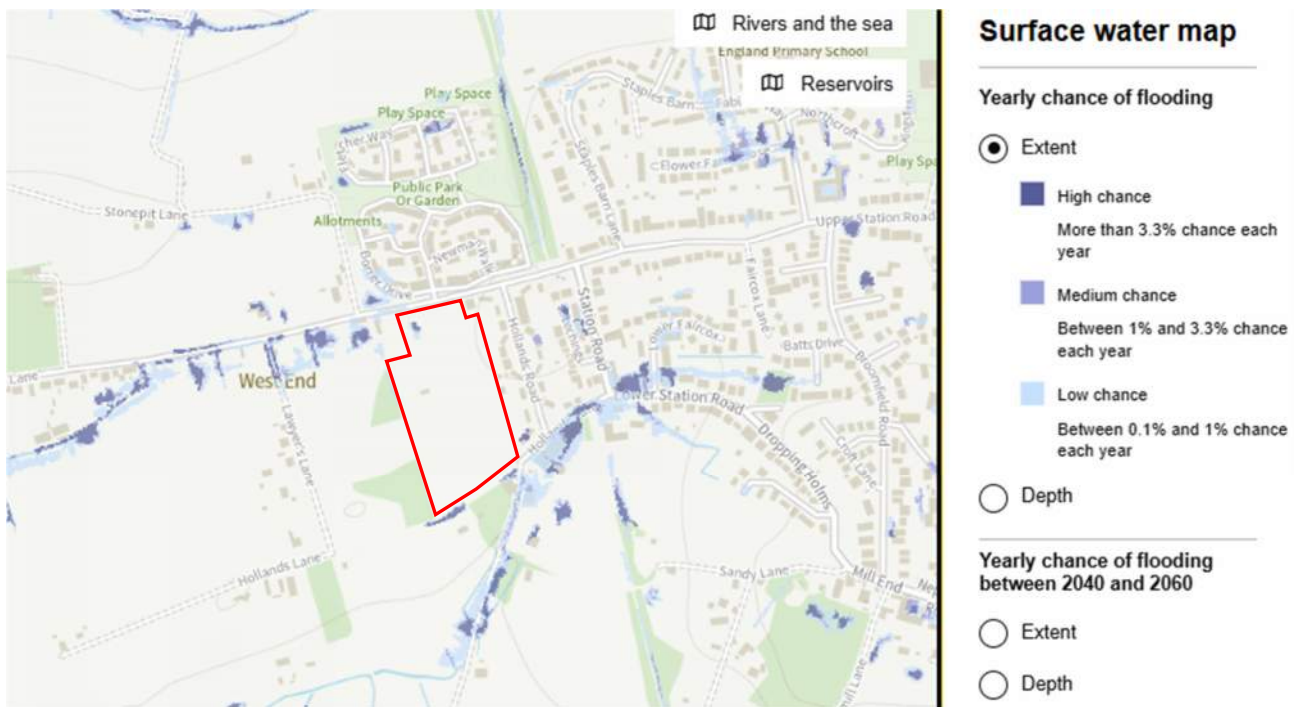


Figure 4.3: EA Surface Water Flood Risk Map

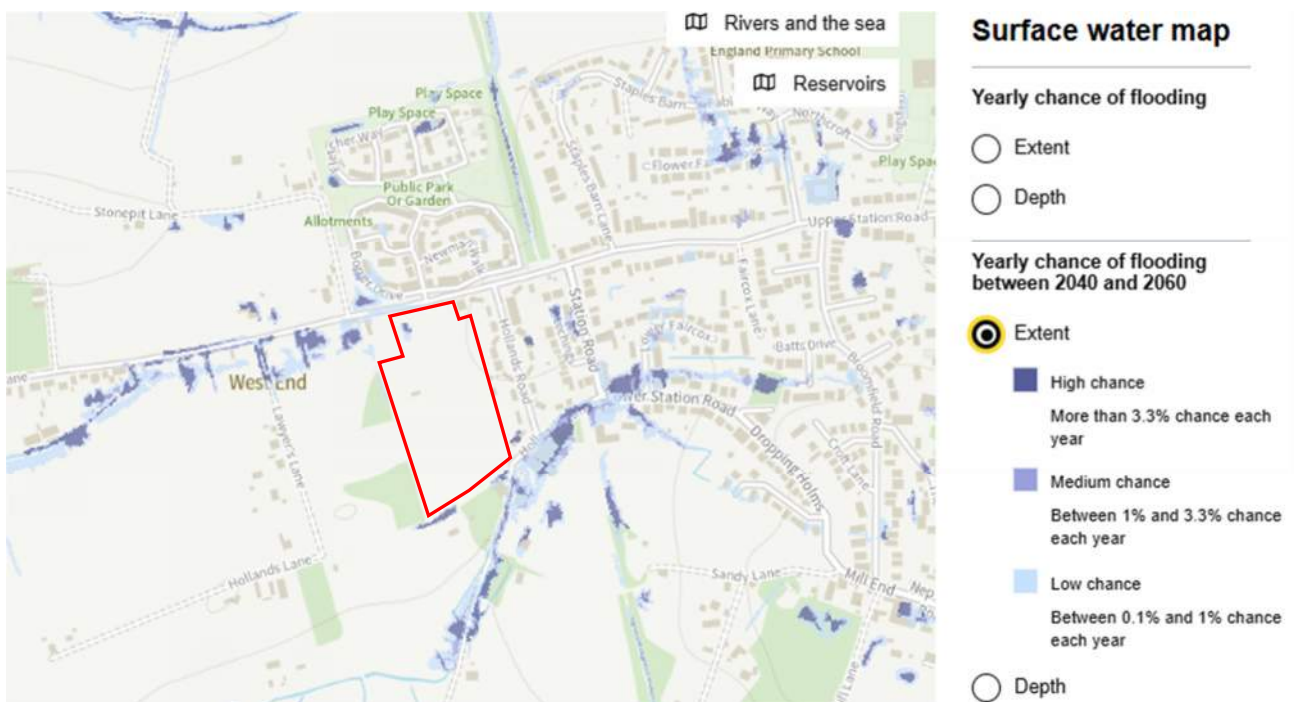


Figure 4.4: EA Surface Water Flood Risk Map, between the years 2040 and 2060

The Flood Estimation Handbook (FEH) hydraulic catchment information that covers the site is shown in Figure 4.5. The site is seen to be located near the upper edges of the catchment, with a small area of land in the catchment located to the north. Therefore, it is expected that there will not be significant overland flow from these areas entering the site. This is especially evident when considering that any upstream catchment flows will have to cross West End Lane, which is assumed to have a formal drainage arrangement, as well as upstand kerbs which provide barriers to overland flows.



Figure 4.5: UK Centre for Ecology & Hydrology: Flood Estimation Handbook Catchment Outline

4.4 Flood Risk from Reservoirs

The EA provides information on flood risk from reservoirs. The map showing the maximum extent of flooding from reservoirs was updated in 2021 and now shows the combined effects of flooding from reservoirs and rivers. The Figure 4.6 overleaf shows that the site is at very low risk of reservoir flooding.

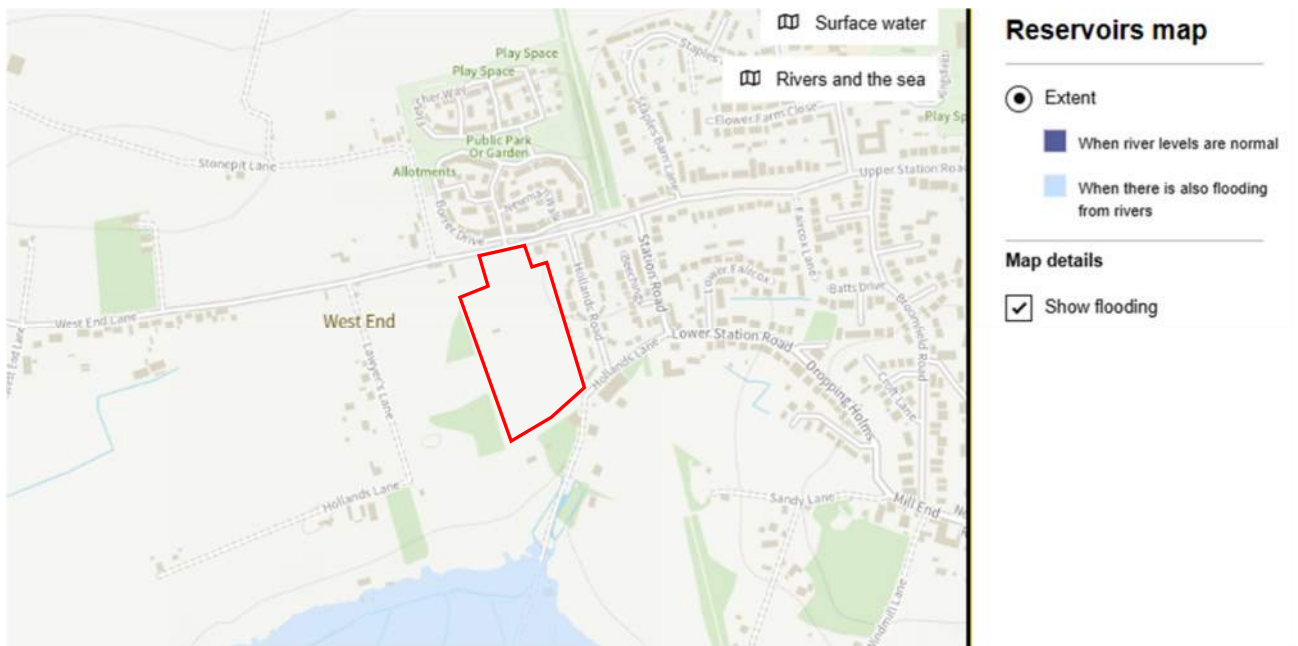


Figure 4.6: EA Risk of Reservoir Flooding Map

4.5 Flood Risk from Sewers

Sewer flooding occurs when the flow entering the sewerage network is greater than the capacity of the sewers.

There are no surface water sewers in close proximity to the site. Therefore, the risk from sewer flooding is very low.

5 Surface Water Run-off Assessment

The total site area is approximately 38,000m² or 3.80 ha which can largely be described as greenfield land. The proposed impermeable areas total to approximately 16,500m² or 1.65 ha.

The existing greenfield run-off rates, of the new impermeable areas, for storm events of several different return periods were calculated using the Greenfield Run-off Estimator tool from uksuds.com, as shown below. Supporting documentation is contained in Appendix D.

$Q_{1\text{ Gr}}$	= 5.3 l/s
Q_{BAR}	= 6.3 l/s
$Q_{30\text{ Gr}}$	= 14.4 l/s
$Q_{100\text{Gr}}$	= 23.4 l/s

5.1.1 Climate Change

The EA's Climate Change Allowances for Peak Rainfall in England Maps show that the site is within the Adur and Ouse Management Area. These maps show that the upper end allowance of 45% must be used in the hydraulic calculations for the proposed development.

6 SuDS Strategy

In accordance with EA guidelines and CIRIA documents, surface water run-off should be managed as close to its source as possible. The West Sussex LLFA Policy for the Management of Surface Water states that the following drainage hierarchy should be used to determine run-off destination.

6.1.1 Rainwater Used as a Resource (e.g., Rainwater Harvesting)

Rainwater harvesting promotes the storage and re-use of rainwater collected from roofs and hard surfaced areas. This type of system contributes to the reduction of runoff rates and volumes within a development.

There is potential to implement rainwater harvesting tanks on the individual dwellings to collect surface water runoff from the roof areas (discussed further in Section 9).

The capacity of rainwater harvesting systems to attenuate rainwater depends on the water use within the building. If there is no activity in the building or other water use and the harvester is full, no attenuation will be provided during a subsequent storm event. In the worst case scenario, the rainwater harvester will provide no attenuation.

6.1.2 Infiltration Into the Ground

Infiltration testing to BRE365 was carried out on site in March 2023 by Land Science. Three tests were carried out. Two of the three tests failed to infiltrate 50% of the required water depth demonstrating the soil conditions are not suitable permeable (see Appendix E). Therefore, soakaways or other infiltration systems are not considered to be viable for surface water disposal.

6.1.3 To a Surface Water Body

There is an existing watercourse located along the unnamed road that splits Hollands Lane to the north west and the Southern Water pumping station to the east. An adequate discharge point to this watercourse is located approximately 320m down the unnamed road from the fork with Hollands Lane (N:520459, E:115604). According to LIDAR data, at the discharge point, the watercourse has a base level of approximately 2.60 mAOD and a bank level of approximately 3.40 mAOD. From here the watercourse flows, out of the catchment, south east for approximately 1.50 km, through undeveloped fields, until its confluence with the River Adur.

It is proposed to make a new connection to the watercourse from the proposed surface water drainage system that will serve the development. The discharge rate will be restricted to 5.3 l/s, the Q_1 greenfield runoff rate for the drainage area, for all storm events up to and including the 100 year plus 45% climate change event, in line with the West Sussex LLFA Policy for the Management of Surface Water. The watercourse is an ordinary watercourse and an application for Ordinary Watercourse Consent will be made with Horsham District Council.

Due to the large change in levels, of approximately 10m, from the flow control on site to the outfall along with satisfactory channel depth and conveyance routes, this discharge location is suitable even in high water levels.

Based on a development impermeable drained area of 1.65 ha and allowing for 10% urban creep (1.815ha), preliminary calculations have been carried out to determine the volume of attenuation

storage required to restrict the discharge rate to 5.3 l/s for the 100 year plus 45% climate change event which show that approximately 1,750m³ of storage is required (see Appendix F- please note that FEH 22 data for the site has been used however, the MicroDrainage printout incorrectly indicates the rainfall version used is FEH 13).

The attenuation storage will be provided in four detention basins. Three are located along the western boundary of the site, together with one in the south eastern corner. The detention basin will not only provide attenuation storage but will additionally provide biodiversity and amenity benefits to the site. Permeable paving is proposed to be incorporated into the private driveways and hardstanding areas. Rainwater harvesting will also be incorporated (discussed further in Section 9) and the use of hybrid systems that provide attenuation and rainwater harvesting will be incorporated at detailed design stage. The below ground drainage strategy drawing is available in Appendix G.

6.2 Water Quality

SuDS have the potential to provide water quality benefits to run-off entering the environment. The SuDS Manual states that SuDS should be designed to treat run-off to reduce the risk of environmental pollution. Chapter 26 of The SuDS Manual sets out the 'simple index approach' to water quality risk management. This approach has been used to quantify the benefits of the proposed SuDS scheme on water quality.

Step 1 of the simple index approach is to identify the pollution hazard indices for the proposed land use. The proposed residential development is considered to have a 'very low' pollution hazard level and Table 6.1 below shows the associated pollution hazard indices:

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Other roofs	Low	0.3	0.2	0.05
Individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change	Low	0.5	0.4	0.4

Table 6.1: Pollution Hazard Indices, taken from Table 26.2 of The SuDS Manual (CIRIA, 2015)

Step 2 of the simple index approach is to select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index.

As the destination of the runoff is to a watercourse, the surface water pollution mitigation indices should be used as shown in Table 6.2 below:

Type of SuDS Component	TSS	Metals	Hydrocarbons
Permeable Pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6

Table 6.2 Surface Water Pollution Mitigation Indices, taken from Table 26.3 of The SuDS Manual

Provided that the mitigation indices of the treatment techniques are greater than or equal to the hazard indices for the proposed development then there should be no reduction in the overall water quality within the receiving watercourse or groundwater body. Therefore, the incorporation of permeable paving and detention basins will provide suitable prevention from pollution to the receiving surface water bodies.

7 Surface Water Maintenance Strategy

The successful implementation and operation of a SuDS system depends on a robust and clear maintenance strategy being implemented. The following measures should form part of the site's proposed management plan.

It is envisaged that the majority of the SuDS will be maintained by the client and will form part of the overall maintenance regime for the site.

SuDS Element	Maintenance		
	Activity	Required Action	Typical Frequency
Detention Basins	Monitoring / Inspections	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
		Inspect banksides, structures, pipework etc. for evidence of physical damage	
		Inspect infiltration surfaces for compaction and ponding	
		Inspect inlets and pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies	Half yearly
	Regular Maintenance	Remove litter, debris and trash	Monthly
		Cut grass – for landscaped areas and access routes	Monthly during growing season or as required
		Cut grass – meadow grass in and around basin	Half yearly: before nesting season in spring and in autumn
		Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Occasional Maintenance	Reseed areas of poor vegetation growth	Annually, or as required
		Prune and trim trees and remove cuttings	As required
		Remove sediment from pre-treatment system when 50% full	
	Remedial Actions	Repair erosion or other damage by reseedling or re-turfing	As required
		Realign the rip-rap	
		Repair or rehabilitate inlets, outlets and overflows	
		Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	
		Relevel uneven surfaces and reinstate design levels	

SuDS Element	Maintenance		
	Activity	Required Action	Typical Frequency
Permeable Paving	Monitoring / Inspections	Initial inspection	Monthly for three months after installation
		Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 hours after large storms in first six months
		Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	Annually
	Regular Maintenance	Brushing and vacuuming -standard cosmetic sweep over whole surface	Once a year after autumn leaf fall
		Rubbish and litter removal	As required
	Remedial Actions	Remediate any landscaping which through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required
		Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	
		Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required

Table 7.1: SuDS Maintenance Strategy

Effective SuDS design must assess all foreseeable risks during construction and maintenance. These must be mitigated during the detailed design stages where effective design will aim to avoid, reduce and mitigate risks.

This process will also require input from the principal contractor who will ensure the construction of SuDS components are carried out in a safe and sustainable manner.

8 Foul Water Assessment

As outlined in Section 2.1, it is assumed that there is no private drainage that serves the existing site. Therefore, the foul water drainage from the site is proposed to connect to the public foul water sewer located in Hollands Lane via a new gravity connection.

All proposed networks will be designed to Adoptable Standards as outlined in the Design and Construction Guidance (Appendix C of the Sewerage Sector Guidance in relation to the adoption of sewerage assets) (DCG) and in accordance with Building Regulations Part H.

The proposed peak foul water flows from the site are calculated using the figure of 4000 l/dwelling/day as outlined in the DCG.

The development will include the construction of 82 residential dwellings which, assuming a total gravity connection, equates to a potential proposed peak foul water flow of:

$$82 \text{ dwellings} \times 4000 \text{ l/dwelling/d} = 3.8 \text{ l/s}$$

A 'Pre-development Enquiry' will be submitted to Southern Water to confirm capacity exists within the receiving public sewers.

A Section 106 application will be made to the Water Authority for consent to connect to the public sewer.

9 Water Neutrality Assessment

9.1 Introduction

This section aims to calculate the water demand for the proposed development and provide measures to ensure that the proposals will have no impact on Southern Water's existing potable water infrastructure.

9.2 Background

The proposed development is a retirement community of up to 72 units of accommodation and up to 10 starter homes with associated community facilities including a medical centre, on-site laundry and catering facilities.

9.3 Baseline Calculations

The water consumption rate for the existing situation is 0 litres/year as the site is undeveloped.

9.4 Proposal Demand

The accommodation schedule consists of 43 x 2 bed Class C2 units, 29 x 3 bed Class C2 units and 10 x 2 bed Class C3 affordable dwellings. Therefore, the baseline water consumption figures for the residential units have been calculated as follows:

53 x two bedroom dwellings:	53 x 1.88 occupants x 135 l/person	=	13,451 litres/day
29 x three bedroom dwellings:	29 x 2.47 occupants x 135 l/person	=	9,670 litres/day
	Total	=	23,121 litres/day
		=	8,439,165 litres/year

The medical centre, on-site laundry and catering facilities are shown to be 370m² in area on the outline development plan. The building floor plans for the communal facilities building are available in Appendix C. The water demand has been estimated based on assumptions and set out below:

Laundry

20m² laundry room

70 litres per machine per hour (taken from Table 2.10 of CIBSE Guide G)

Assuming 8 machines operating for 4 hours = 8 x 70 x 4 = 2,240 litres/day

Assuming 7 days a week = 365 x 2,240 = 817,600 litres/year

Medical Centre

Medical ward – 220 litres per bed (taken from Table 2.9 of CIBSE Guide G)

4 bed medical centre (two patient bedrooms and two nurse bedrooms = 220 x 4 = 880 litres/day

Assuming 5 days per week = 228,800 litres/year

Catering Facilities

27m² food preparation area

7 litres per meal (taken from Table 2.8 of CIBSE Guide G)

Assuming 100 meals per day = $100 \times 7 = 700$ litres/day

Assuming 6 days per week = $700 \times 312 = 218,400$ litres/year

Total = 3,820 litres/day

= 1,264,800 litres/year

The water demand calculations for the communal facilities building include employee water use.

Therefore, the proposed development requires a maximum of 26,941 litres/day or 9,703,965 litres/year.

9.5 Water Reduction Measures

Water efficient devices can be incorporated within the residential dwellings to reduce the water consumption to 75.8 litres/person/day. Calculations that demonstrate the water reduction measures are available within Appendix J. Using the local authority's occupancy data, the proposed developments total occupancy was calculated as 171.27. Therefore, the proposed dwellings will require 12,982 litres/day or 4,738,527 litres/year after introducing water efficient devices.

Rainwater harvesting has been considered but has not been incorporated into the calculations as it is not possible to achieve the 35-day drought capacity that is required by Horsham District Council. Supporting calculations that demonstrate that the drought capacity is not able to be provided are available within Appendix K.

Therefore, the volume of potable water required for the proposed development will be reduced to 16,802 litres/day or 6,003,327 litres/year.

9.6 Offsetting measures

Offsetting measures will be required to reduce water consumption on other land and property in order to achieve water neutrality. Local organisations, housing associations, businesses, churches and charities will be approached to explore options for water offsetting schemes. Typical options include:

- Donate/pay a fee to a housing association to retrofit their homes or existing businesses.
- Fixing leaks over and above planned work by water companies.
- Retrofitting school buildings or local hotels to improve water efficiency.
- Retrofitting water reuse schemes such as in public buildings or schools or private institutions like hotels in the area.

Water offsetting was considered to cover the remaining water demand of 20,162 litres/day, however, it was not possible to identify sufficient opportunities to offset the required water demand.

9.7 Groundwater Abstraction

A hydrogeological assessment was carried out by Stephen Buss Environmental Consulting in January 2024 to determine whether it is feasible to serve the potable water demand for the development from a private groundwater abstraction borehole. The report (available in full in Appendix H) concludes that:

- The effect of the proposed abstraction on the water balance of the Sussex North WRZ is negligible. All of the borehole yield will be from the Hythe Beds aquifer in the catchment of the River Adur.
- There is no interaction between the abstraction and groundwater in the Folkestone Formation aquifer: the “Wealden Greensand semi-confined aquifer”. The effect of the proposed abstraction on the water balance of the River Arun will be zero.
- There is no reasonable doubt that a borehole drilled to the recommended depth (see below), and completed correctly, will be able to yield in excess of 17.2 m³/day.
- It is recommended that the borehole be drilled at to the base of the Hythe Formation, and completed across its entire thickness. The base of the Hythe Formation is probably at a depth of c. 70 m. A pumping test should undertaken to verify the borehole yield.

A borehole was installed on site and a raw borehole sample was taken by Invicta Water Treatment on 05/08/24. The borehole was allowed to flow for some 2 hours prior to sampling. The water yield was recorded as 5.4 m³/h which is comfortably enough to serve the development. It is recommended to treat the abstracted water via:

- Filtration to 5 um
- UV disinfection
- Chlorination

Further details are available in the letter report which is available in Appendix I.

9.8 Conclusion

Whilst the development will not achieve water neutrality, a range of measures are proposed to reduce water demand including fitting water efficient devices and harvesting rainwater. The remaining water demand for the site will be served through a private water supply that sources water by abstracting groundwater and providing a private water treatment plant. The effect of the proposed abstraction on the water balance of the Sussex North WRZ is negligible.

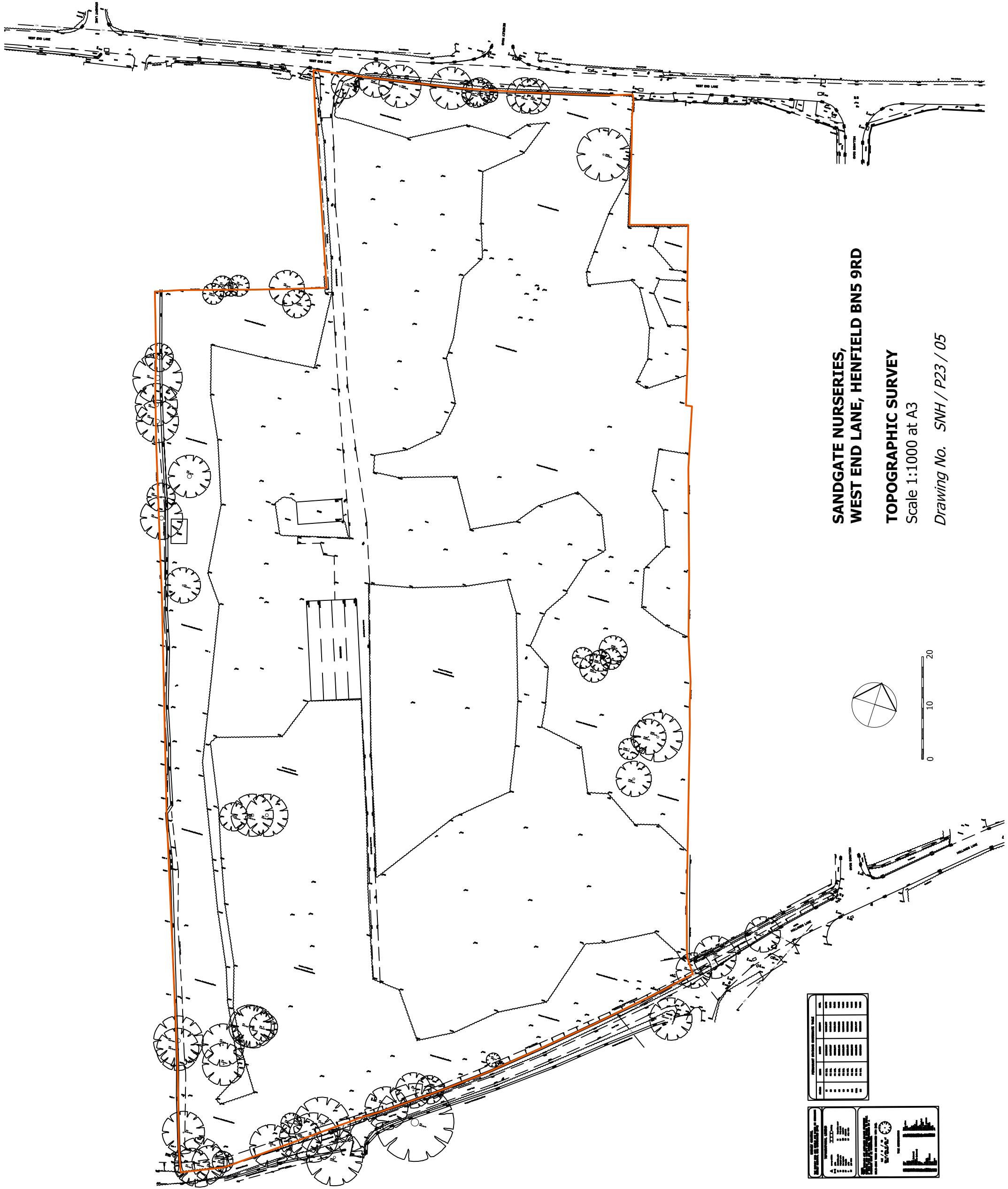
10 Conclusions

- The site is located off West End Lane, within West Sussex County Council and Horsham District Council. The full site address is Sandgate Nurseries, West End Lane, Henfield, Horsham, West Sussex, BN5 9UL. The OS grid reference is 520425 X, 116061 Y.
- The development proposals comprise of the erection of a continuing care retirement community of up to 72 units of accommodation and up to 10 starter homes with associated community facilities including a medical centre and on-site laundry and catering facilities, with access, infrastructure, open space, landscaping and associated works (all matters reserved except for access).
- The EA's flood map for planning shows that the site is located in Flood Zone 1 and is at very low risk of flooding (less than 0.1% annual probability of river or sea flooding).
- The development is considered to be at very low risk of flooding from groundwater, surface water, reservoirs and sewers.
- The surface water drainage strategy includes shallow permeable paving for all driveways. The remainder of the hardstanding areas will be attenuated by four Detention Basins, totalling 1,760m³ and discharging at a combined rate of 5.3 l/s for the 100 year plus 45% climate change event. Rainwater harvesting will also be incorporated and the use of hybrid systems that provide attenuation and rainwater harvesting will be incorporated at the detailed design stage.
- The surface water will discharge to an existing unnamed ordinary watercourse located approximately 320m down the unnamed road from the fork with Hollands Lane (N:520459, E:115604). The watercourse has an approximate base level of 2.60 mAOD and a bank level of approximately 3.40 mAOD. Ordinary Watercourse Consent will be acquired.
- The foul water drainage from the site is proposed to connect to the public foul water sewer located in Hollands Lane via gravity.

Appendix A

Topographical Survey



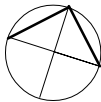


**SANDGATE NURSERIES,
WEST END LANE, HENFIELD BN5 9RD**

TOPOGRAPHIC SURVEY

Scale 1:1000 at A3

Drawing No. SNH / P23 / 05



0 10 20

NO.	DESCRIPTION	DATE
1	1:1000	10/10/04
2	1:1000	10/10/04
3	1:1000	10/10/04
4	1:1000	10/10/04
5	1:1000	10/10/04
6	1:1000	10/10/04
7	1:1000	10/10/04
8	1:1000	10/10/04
9	1:1000	10/10/04
10	1:1000	10/10/04
11	1:1000	10/10/04
12	1:1000	10/10/04
13	1:1000	10/10/04
14	1:1000	10/10/04
15	1:1000	10/10/04
16	1:1000	10/10/04
17	1:1000	10/10/04
18	1:1000	10/10/04
19	1:1000	10/10/04
20	1:1000	10/10/04

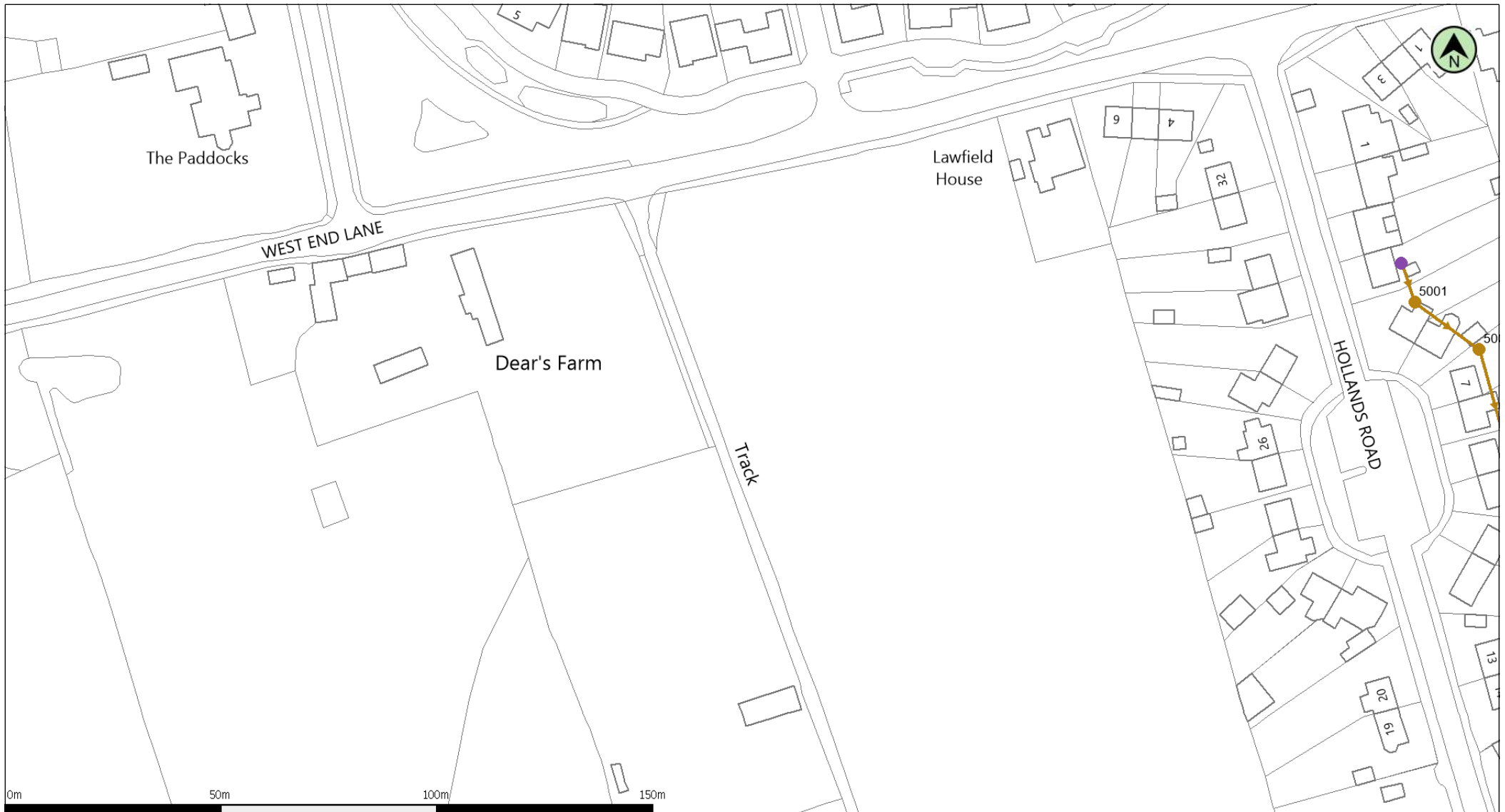
LEGEND	NOTES
1. All measurements are in meters.	2. All measurements are to the center of the road.
3. All measurements are to the center of the road.	4. All measurements are to the center of the road.
5. All measurements are to the center of the road.	6. All measurements are to the center of the road.
7. All measurements are to the center of the road.	8. All measurements are to the center of the road.
9. All measurements are to the center of the road.	10. All measurements are to the center of the road.
11. All measurements are to the center of the road.	12. All measurements are to the center of the road.
13. All measurements are to the center of the road.	14. All measurements are to the center of the road.
15. All measurements are to the center of the road.	16. All measurements are to the center of the road.
17. All measurements are to the center of the road.	18. All measurements are to the center of the road.
19. All measurements are to the center of the road.	20. All measurements are to the center of the road.

FORMER SANDGATE NURSERIES
HENFIELD

1:1000 at A3

Appendix B

Southern Water Sewer Records



(c) Crown copyright and database rights 2022 Ordnance Survey 100031673

Date: 18/08/22

Scale: 1:1250

Map Centre: 520408,116070

Data updated: 21/07/22

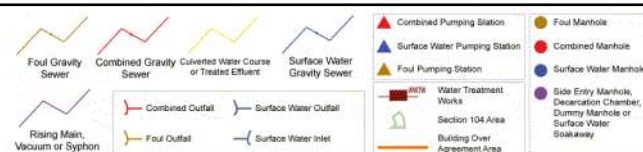
Our Ref: 929279 - 2

Wastewater Plan A4

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2022 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



nauvinen@pricemyers.com

30512 Sandgate Nur2



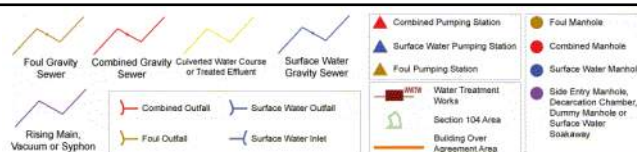


(c) Crown copyright and database rights 2022 Ordnance Survey 100031673 Date: 18/08/22 Scale: 1:1250 Map Centre: 520423,115883 Data updated: 21/07/22 Our Ref: 929279 - 1 Wastewater Plan A4

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2022 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



nauvinen@pricemyers.com

30512 Sandgate Nur1

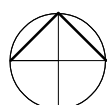


Appendix C

Proposed Development Plans



0 10 20 30



**SANDGATE NURSERIES,
WEST END LANE, HENFIELD BN5 9RD**

LOCATION PLAN

Scale 1:1250 at A3

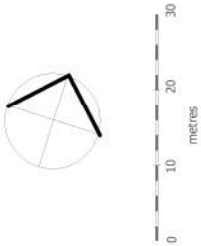
Drawing No. SNH / P23 / 01

**SANDGATE NURSERIES,
WEST END LANE, HENFIELD BN5 9RD**

PROPOSED SITE LAYOUT

Scale 1:1000 at A3

Drawing No. SNH / P23 / 02 Rev. B



SANDGATE NURSERIES,
WEST END LANE, HENFIELD BN5 9RD



PROPOSED FLOOR PLANS : SEMI DETACHED UNITS

Scale 1: 200 at A3

Drawing No. SNH / P23 / 04

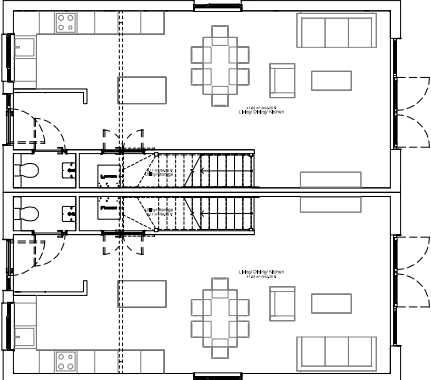
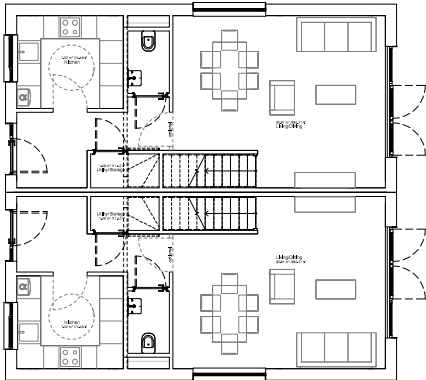
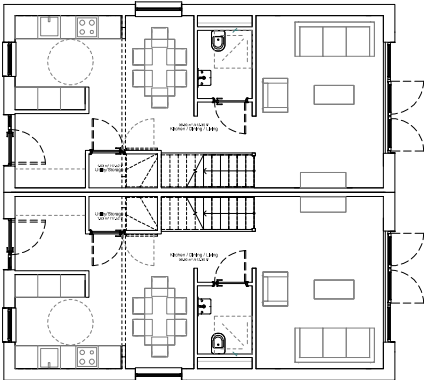
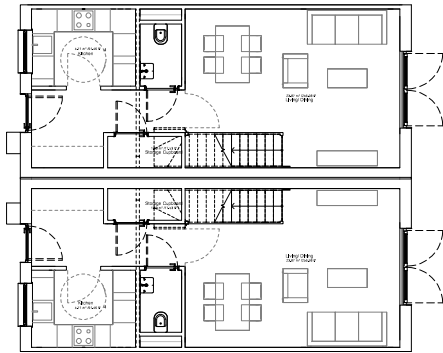
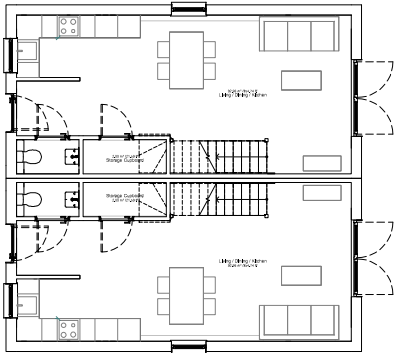
2Bedroom_3Person

2Bedroom_4Person

3Bedroom_4Person

3Bedroom_5Person

3Bedroom_5Person



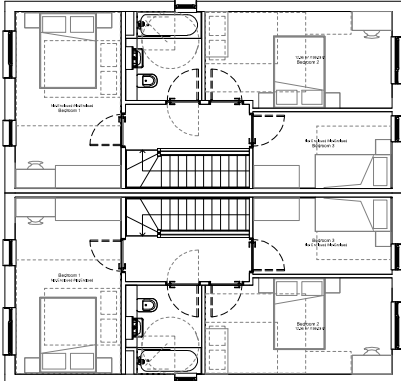
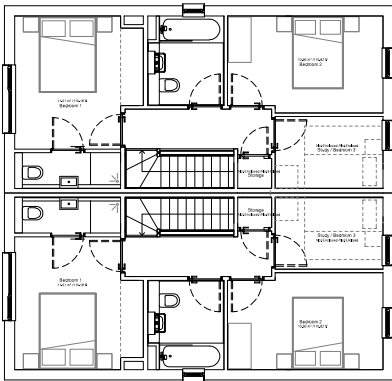
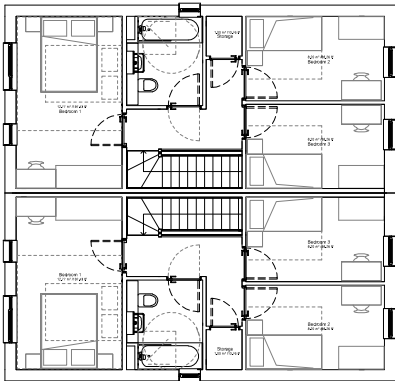
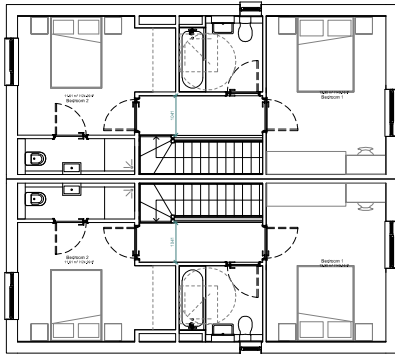
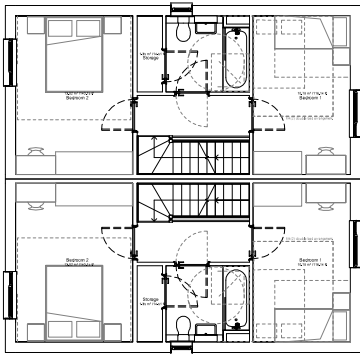
Ground floor plan

Ground floor plan

Ground floor plan

Ground floor plan

Ground floor plan



First floor plan

First floor plan

First floor plan

First floor plan

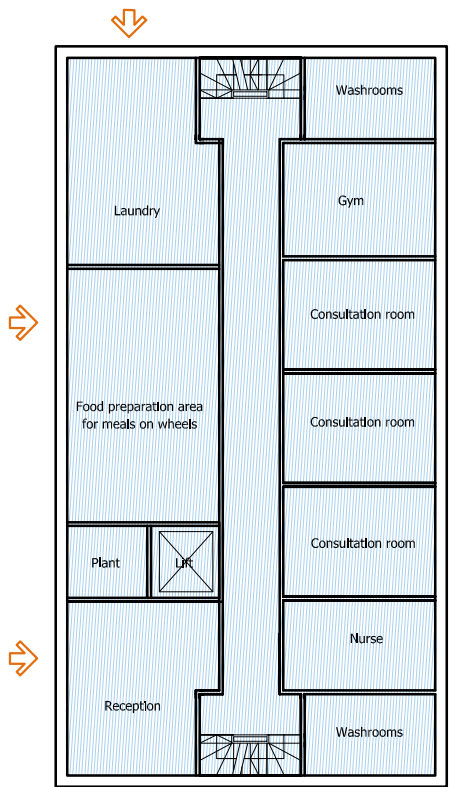
First floor plan

SANDGATE NURSERIES,
WEST END LANE, HENFIELD BN5 9RD

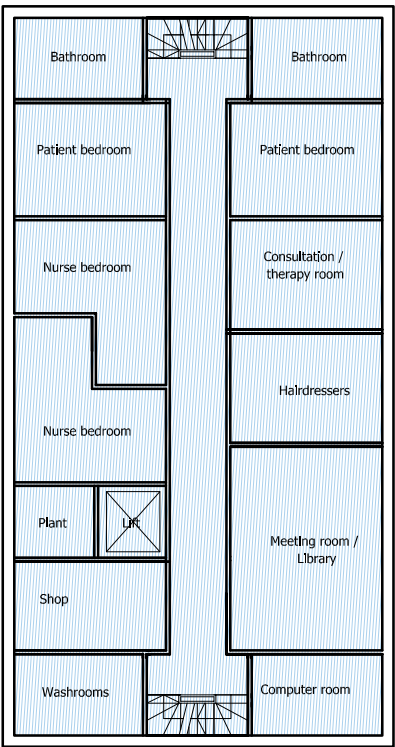
COMMUNAL FACILITIES BUILDING
FLOOR PLANS

Scale 1:200 at A3

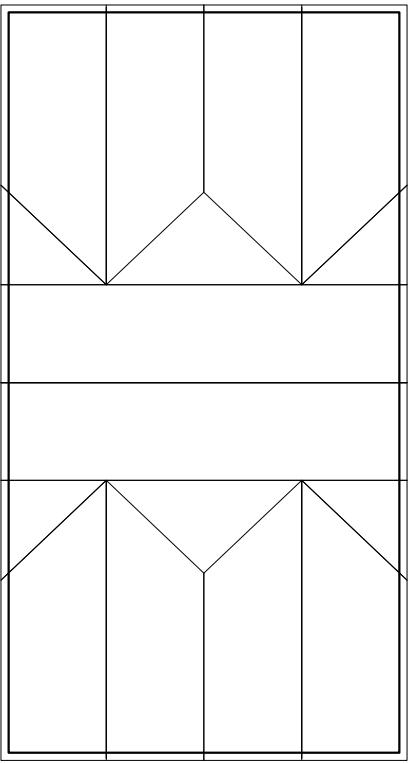
Drawing No. SNH / P23 / 06



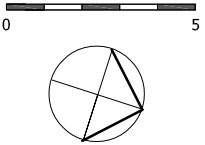
G R O U N D



F I R S T



R O O F



Appendix D

Greenfield Run-off Rates

Calculated by:	Harvey Doran
Site name:	30512
Site location:	Sandgate Nurseries

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	50.93002° N
Longitude:	0.28703° W
Reference:	2400064055
Date:	Jul 31 2023 11:16

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	1.815
-----------------------	-------

Methodology

Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Soil characteristics

	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	819	819
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default

Edited

Q_{BAR} (l/s):	6.27	6.27
1 in 1 year (l/s):	5.33	5.33
1 in 30 years (l/s):	14.41	14.41
1 in 100 year (l/s):	19.99	19.99
1 in 200 years (l/s):	23.43	23.43

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix E

Infiltration Test Results

Site : Sandgate Nurseries

Client : Solve Planning

Engineer: Land Science

Job Number
LS6786

Sheet
1 / 3

Location	Date	Level	Location
TP01	06/03/2023		

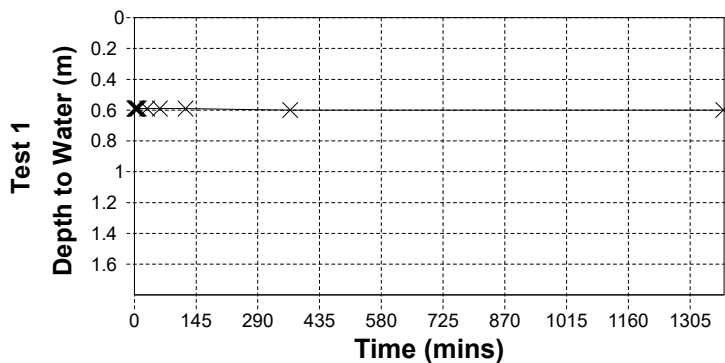
Pit Width (m)	0.40
Pit Depth (m)	1.80
Pit Length (m)	1.50

Soil type at test level
Groundwater
Drain discharge depth
Sidewall stability
Stone filled or open pit

	1
Effective depth (m)	1.21
Volume outflowing between 75% & 25% (m3)	
Mean surface area through which outflow occurs (m2)	
Time for outflow between 75% & 25% (min)	
SOIL INFILTRATION RATE (ms-1), f	Test Failed

Remarks

Elapsed time (mins)	Depth to Water Test 1
0	0.59
2	0.59
3	0.59
4	0.59
5	0.59
6	0.59
7	0.59
10	0.59
30	0.59
60	0.59
120	0.59
366	0.60
1383	0.60



Site : Sandgate Nurseries

Client : Solve Planning

Engineer: Land Science

Job Number
LS6786

Sheet
2 / 3

Location	Date	Level	Location
TP02	06/03/2023		

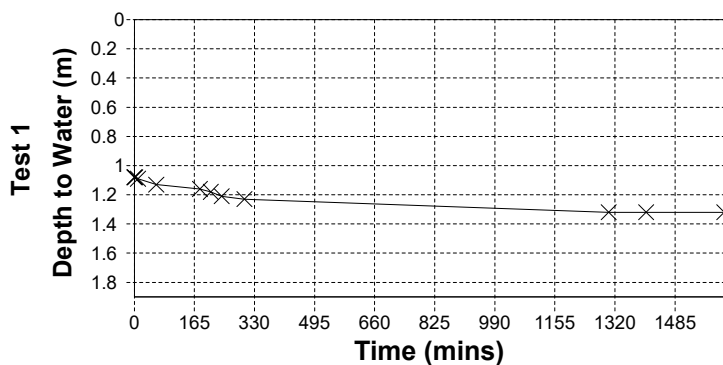
Pit Width (m)	0.40
Pit Depth (m)	1.90
Pit Length (m)	1.50

Soil type at test level
Groundwater
Drain discharge depth
Sidewall stability
Stone filled or open pit

	1
Effective depth (m)	0.82
Volume outflowing between 75% & 25% (m3)	
Mean surface area through which outflow occurs (m2)	
Time for outflow between 75% & 25% (min)	
SOIL INFILTRATION RATE (ms⁻¹), f	Test Failed

Remarks

Elapsed time (mins)	Depth to Water Test 1
0	1.08
1	1.08
2	1.08
10	1.09
60	1.13
180	1.16
210	1.18
240	1.21
302	1.23
1303	1.32
1406	1.32
1620	1.32



Site : Sandgate Nurseries

Client : Solve Planning

Engineer: Land Science

Job Number
LS6786

Sheet
3 / 3

Location	Date	Level	Location
TP03	06/03/2023		

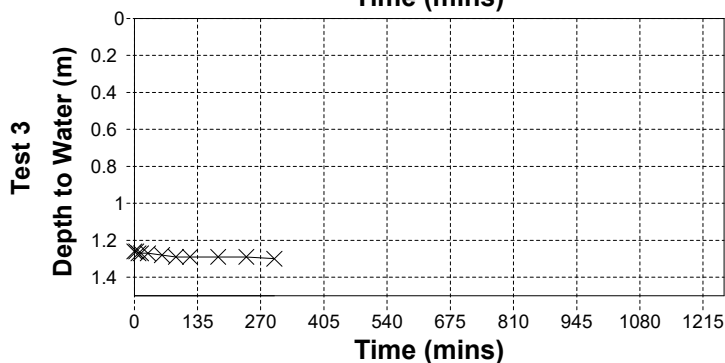
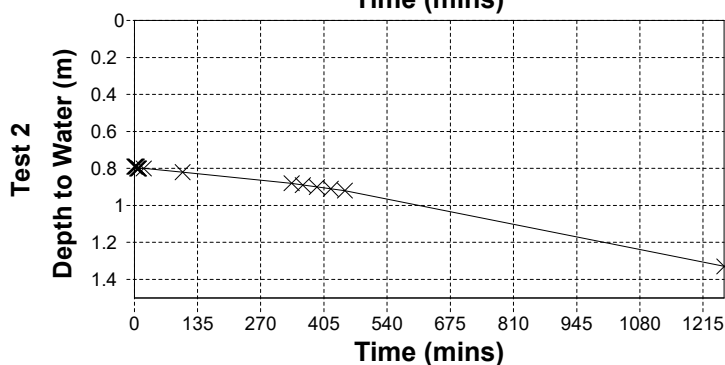
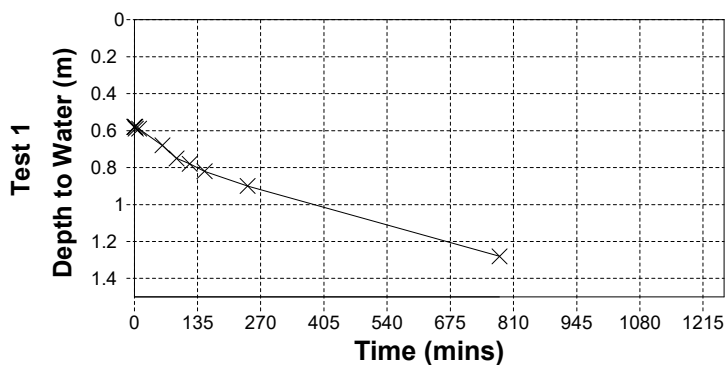
Pit Width (m)	0.40
Pit Depth (m)	1.50
Pit Length (m)	1.90

Soil type at test level
Groundwater
Drain discharge depth
Sidewall stability
Stone filled or open pit

	1	2	3
Effective depth (m)	0.92	0.71	0.24
Volume outflowing between 75% & 25% (m3)	0.35	0.27	
Mean surface area through which outflow occurs (m2)	2.88	2.39	1.31
Time for outflow between 75% & 25% (min)	623.84	701.34	
SOIL INFILTRATION RATE (ms-1), f	3.24E-6	2.68E-6	

Remarks

Elapsed time (mins)	Depth to Water Test 1	Depth to Water Test 2	Depth to Water Test 3
0	0.58	0.79	1.26
1	0.58	0.79	
2	0.58	0.79	
3	0.59	0.79	
4		0.79	1.26
5		0.79	
6		0.80	
7		0.80	
8		0.80	
9		0.80	1.27
10	0.59	0.80	
14			1.27
20		0.80	
29			1.27
59			1.28
60	0.68		
89			1.29
90	0.75		
103		0.82	
118	0.78		
119			1.29
150	0.82		
179			1.29
239			1.29
242	0.90		
299			1.30
336		0.88	
360		0.89	
390		0.90	
420		0.91	
450		0.92	
780	1.28		
1260		1.33	



Produced by the GEOTECHNICAL DATABASE SYStem (GEODASY) © all rights reserved

Produced by the GEOTECHNICAL DATABASE SYStem (GEODASY) © all rights reserved

[illegible]

Appendix F

Below Ground Drainage Layout



NOTES :

- This drawing is to be read in conjunction with all relevant Architect's, Engineer's and specialists' drawings and specifications.
- Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check that this drawing has been printed to the intended scale this bar should be 50mm long @ A1 or 25mm long @ A3.
- All new new surface water pipework routes to be confirmed with an arboriculturalist.
- Health & Safety :
All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules"

DRAINAGE KEY		DRAINAGE KEY	
S1			Permeable Paving
			Catchment 1
			Catchment 2
			Catchment 3
			Detention Basin
			Headwall

DRAINAGE LEGEND			
Site Boundary			
Existing Rising Main			
Existing Foul Sewer			
New SW Drain			
Root Protection Zone			

P04	25.04.24	TP	TS	Drain rerouted to avoid RPA
P03	09.08.23	TP	HD	Revised following infiltration testing
P02	20.04.23	TS	TS	Revised following infiltration testing
P01	27.01.23	SE	YA	Issued for Information
Rev	Date	Drawn	Eng	Amendment

SANDGATE NURSERIES
HENFIELD

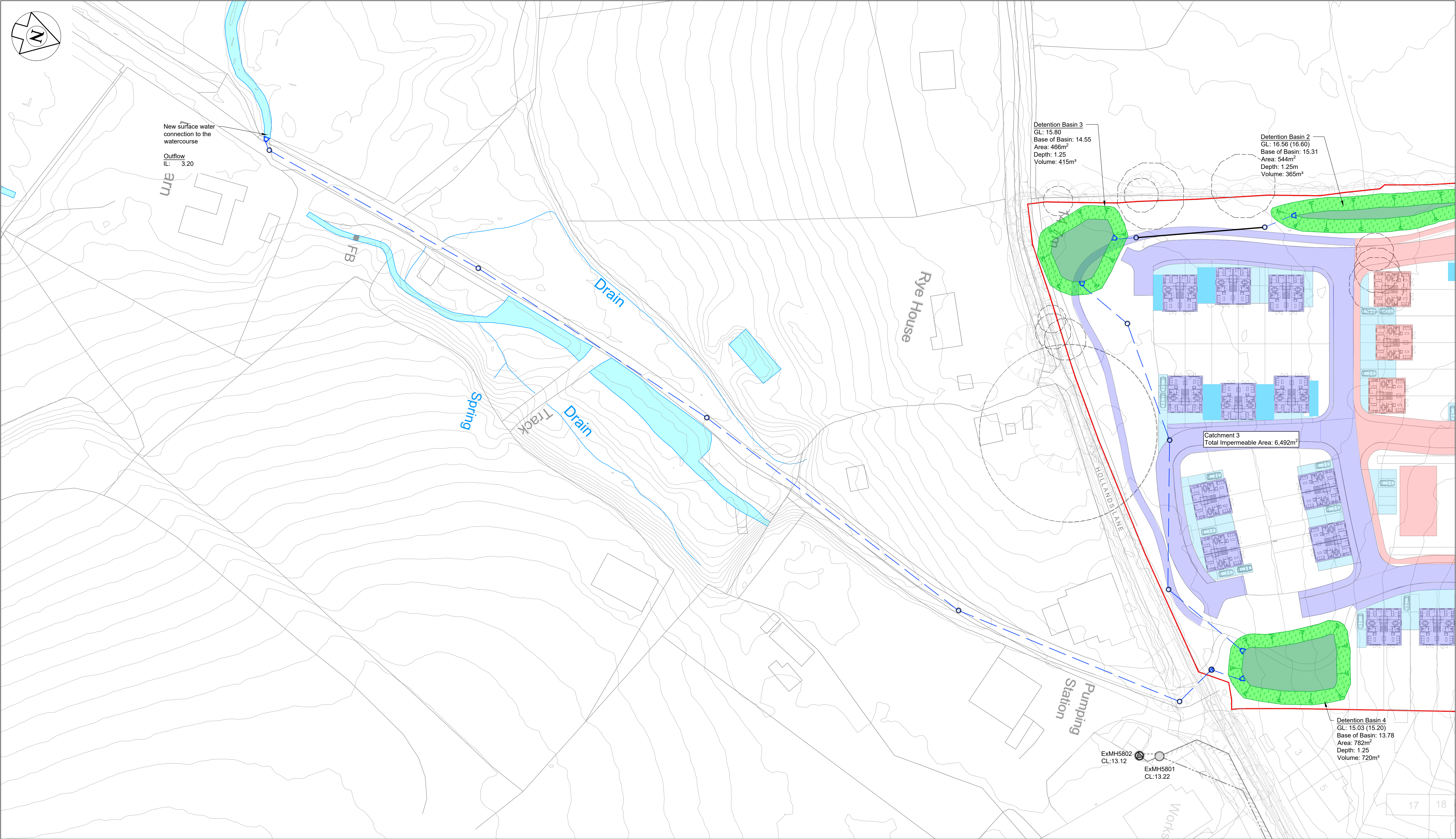
BELOW GROUND
DRAINAGE LAYOUT
SHEET 1

Status
FOR INFORMATION
NOT FOR CONSTRUCTION

Drawn	SE	Eng	YA
Scales	1:500 at A1	1:1000 at A3	
Drawing No	30512/6000	Rev	P04

PRICE &
MYERS

Consulting Engineers
37 Alfred Place
London
WC1E 7DP
020 7631 5128
mail@pricemyers.com
www.pricemyers.com



NOTES :

1. This drawing is to be read in conjunction with all relevant Architect's, Engineer's and specialists' drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check that this drawing has been printed to the intended scale this bar should be 50mm long @ A1 or 25mm long @ A3.
3. All new new surface water pipework routes to be confirmed with an arboriculturalist.
4. Health & Safety : All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".

DRAINAGE KEY		DRAINAGE KEY	
S1			Permeable Paving
			Catchment 1
			Catchment 2
			Catchment 3
			Detention Basin
			Headwall

DRAINAGE LEGEND			
Site Boundary			
Existing Rising Main			
Existing Foul Sewer			
New SW Drain			
Root Protection Zone			

P01	25.04.24	TP	HD	Drain rerouted to avoid RPA
P01	09.08.23	TP	HD	Revised following infiltration testing
Rev	Date	Drawn	Eng	Amendment

SANDGATE NURSERIES
HENFIELD

BELOW GROUND
DRAINAGE LAYOUT
SHEET 2

Status
FOR INFORMATION
NOT FOR CONSTRUCTION

Drawn	TP	Eng	HD
Scales	1:500 at A1	1:1000 at A3	
Drawing No	30512/6001		Rev
			P02

**PRICE &
MYERS**

Consulting Engineers
37 Alfred Place
London
WC1E 7DP
020 7631 5128
mail@pricemyers.com
www.pricemyers.com

Appendix G

Hydraulic Calculations

Price & Myers		Page 1
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole SItE-5.3ls-2yr.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Summary of Results for 2 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	13.645	0.145	4.3	170.5	O K
30 min Summer	13.691	0.191	4.7	223.9	O K
60 min Summer	13.740	0.240	4.9	281.9	O K
120 min Summer	13.834	0.334	5.2	392.0	O K
180 min Summer	13.889	0.389	5.2	457.2	O K
240 min Summer	13.925	0.425	5.3	499.4	O K
360 min Summer	13.965	0.465	5.3	546.4	O K
480 min Summer	13.987	0.487	5.3	572.2	O K
600 min Summer	13.999	0.499	5.3	586.2	O K
720 min Summer	14.004	0.504	5.3	592.2	O K
960 min Summer	14.003	0.503	5.3	591.5	O K
1440 min Summer	13.999	0.499	5.3	585.9	O K
2160 min Summer	13.989	0.489	5.3	575.0	O K
2880 min Summer	13.979	0.479	5.3	563.2	O K
4320 min Summer	13.964	0.464	5.3	545.3	O K
5760 min Summer	13.952	0.452	5.3	530.8	O K
15 min Winter	13.663	0.163	4.5	191.1	O K
30 min Winter	13.714	0.214	4.8	251.3	O K
60 min Winter	13.769	0.269	5.0	316.6	O K
120 min Winter	13.875	0.375	5.2	441.2	O K
180 min Winter	13.939	0.439	5.3	515.5	O K
240 min Winter	13.980	0.480	5.3	564.1	O K
360 min Winter	14.027	0.527	5.3	619.6	O K
480 min Winter	14.054	0.554	5.3	651.3	O K
600 min Winter	14.070	0.570	5.3	670.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	51.108	0.0	144.2	26
30 min Summer	33.809	0.0	195.2	41
60 min Summer	21.567	0.0	276.2	70
120 min Summer	15.291	0.0	395.2	128
180 min Summer	12.109	0.0	470.1	188
240 min Summer	10.099	0.0	522.4	246
360 min Summer	7.632	0.0	590.1	366
480 min Summer	6.205	0.0	636.4	484
600 min Summer	5.263	0.0	670.4	602
720 min Summer	4.587	0.0	695.7	720
960 min Summer	3.671	0.0	727.6	858
1440 min Summer	2.688	0.0	742.6	1100
2160 min Summer	1.987	0.0	957.3	1496
2880 min Summer	1.620	0.0	1037.7	1908
4320 min Summer	1.243	0.0	1178.3	2732
5760 min Summer	1.047	0.0	1361.1	3576
15 min Winter	51.108	0.0	163.3	26
30 min Winter	33.809	0.0	219.9	40
60 min Winter	21.567	0.0	310.6	68
120 min Winter	15.291	0.0	443.3	126
180 min Winter	12.109	0.0	526.5	184
240 min Winter	10.099	0.0	584.2	242
360 min Winter	7.632	0.0	657.8	358
480 min Winter	6.205	0.0	706.6	474
600 min Winter	5.263	0.0	740.5	588

Price & Myers		Page 2
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole SItE-5.3ls-2yr.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Summary of Results for 2 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
720 min Winter	14.079	0.579	5.3	679.9	O K
960 min Winter	14.081	0.581	5.3	683.2	O K
1440 min Winter	14.070	0.570	5.3	669.7	O K
2160 min Winter	14.054	0.554	5.3	651.3	O K
2880 min Winter	14.036	0.536	5.3	629.4	O K
4320 min Winter	14.002	0.502	5.3	589.5	O K
5760 min Winter	13.971	0.471	5.3	553.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
720 min Winter	4.587	0.0	763.0	702
960 min Winter	3.671	0.0	782.7	920
1440 min Winter	2.688	0.0	770.8	1186
2160 min Winter	1.987	0.0	1071.7	1628
2880 min Winter	1.620	0.0	1160.9	2084
4320 min Winter	1.243	0.0	1309.6	2988
5760 min Winter	1.047	0.0	1524.9	3856

Price & Myers		Page 3
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole Site-5.3ls-2yr.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 520350 115600 TQ 20350 15600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+45

Time Area Diagram

Total Area (ha) 1.815

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	0.605	4 8	0.605	8 12	0.605

Price & Myers		Page 4
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole Site-5.3ls-2yr.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 15.000

Tank or Pond Structure

Invert Level (m) 13.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1175.0	1.500	1175.0	1.501	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0101-5300-1500-5300	
Design Head (m)	1.500
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	13.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	5.3	Kick-Flo®	0.903	4.2
Flush-Flo™	0.442	5.3	Mean Flow over Head Range	-	4.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	0.800	4.7	2.000	6.1	4.000	8.4	7.000	10.9
0.200	4.7	1.000	4.4	2.200	6.3	4.500	8.9	7.500	11.3
0.300	5.1	1.200	4.8	2.400	6.6	5.000	9.3	8.000	11.7
0.400	5.2	1.400	5.1	2.600	6.8	5.500	9.8	8.500	12.0
0.500	5.2	1.600	5.5	3.000	7.3	6.000	10.2	9.000	12.3
0.600	5.2	1.800	5.8	3.500	7.9	6.500	10.6	9.500	12.7

Price & Myers		Page 1
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023	Designed by HD	
File Whole SITE-5.3ls-30yr.SRCX	Checked by TS	
Innovyze	Source Control 2018.1	

Summary of Results for 30 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	13.821	0.321	5.2	377.0	O K
30 min Summer	13.931	0.431	5.3	506.3	O K
60 min Summer	14.052	0.552	5.3	648.6	O K
120 min Summer	14.188	0.688	5.3	808.7	O K
180 min Summer	14.269	0.769	5.3	903.1	O K
240 min Summer	14.324	0.824	5.3	967.6	O K
360 min Summer	14.394	0.894	5.3	1050.4	O K
480 min Summer	14.435	0.935	5.3	1099.1	O K
600 min Summer	14.462	0.962	5.3	1129.8	O K
720 min Summer	14.478	0.978	5.3	1149.5	O K
960 min Summer	14.496	0.996	5.3	1170.1	O K
1440 min Summer	14.497	0.997	5.3	1171.0	O K
2160 min Summer	14.470	0.970	5.3	1139.3	O K
2880 min Summer	14.444	0.944	5.3	1109.6	O K
4320 min Summer	14.410	0.910	5.3	1068.7	O K
5760 min Summer	14.383	0.883	5.3	1037.2	O K
15 min Winter	13.860	0.360	5.2	422.8	O K
30 min Winter	13.983	0.483	5.3	567.9	O K
60 min Winter	14.120	0.620	5.3	728.1	O K
120 min Winter	14.274	0.774	5.3	909.1	O K
180 min Winter	14.366	0.866	5.3	1017.1	O K
240 min Winter	14.429	0.929	5.3	1091.7	O K
360 min Winter	14.510	1.010	5.3	1186.8	O K
480 min Winter	14.558	1.058	5.3	1242.6	O K
600 min Winter	14.588	1.088	5.3	1278.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	112.288	0.0	324.9	27
30 min Summer	75.603	0.0	407.0	41
60 min Summer	48.749	0.0	629.5	70
120 min Summer	30.755	0.0	776.5	130
180 min Summer	23.152	0.0	837.8	190
240 min Summer	18.796	0.0	849.8	250
360 min Summer	13.864	0.0	837.3	368
480 min Summer	11.083	0.0	816.7	488
600 min Summer	9.287	0.0	799.1	608
720 min Summer	8.025	0.0	784.0	726
960 min Summer	6.360	0.0	758.5	966
1440 min Summer	4.571	0.0	717.4	1442
2160 min Summer	3.302	0.0	1515.1	2056
2880 min Summer	2.640	0.0	1489.5	2392
4320 min Summer	1.958	0.0	1374.4	3160
5760 min Summer	1.604	0.0	2085.1	3976
15 min Winter	112.288	0.0	358.7	26
30 min Winter	75.603	0.0	426.3	41
60 min Winter	48.749	0.0	700.7	70
120 min Winter	30.755	0.0	837.3	128
180 min Winter	23.152	0.0	853.0	188
240 min Winter	18.796	0.0	839.1	246
360 min Winter	13.864	0.0	811.2	364
480 min Winter	11.083	0.0	791.7	480
600 min Winter	9.287	0.0	776.9	598

Price & Myers		Page 2
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole SItE-5.3ls-30yr.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Summary of Results for 30 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
720 min Winter	14.609	1.109	5.3	1303.0	O K
960 min Winter	14.632	1.132	5.3	1330.4	O K
1440 min Winter	14.641	1.141	5.3	1341.0	O K
2160 min Winter	14.623	1.123	5.3	1319.4	O K
2880 min Winter	14.592	1.092	5.3	1283.6	O K
4320 min Winter	14.547	1.047	5.3	1230.4	O K
5760 min Winter	14.510	1.010	5.3	1187.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
720 min Winter	8.025	0.0	764.9	714
960 min Winter	6.360	0.0	745.9	946
1440 min Winter	4.571	0.0	718.8	1402
2160 min Winter	3.302	0.0	1550.5	2060
2880 min Winter	2.640	0.0	1500.8	2680
4320 min Winter	1.958	0.0	1387.3	3336
5760 min Winter	1.604	0.0	2333.2	4280

Price & Myers		Page 3
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole Site-5.3ls-30yr.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 520350 115600 TQ 20350 15600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+45

Time Area Diagram

Total Area (ha) 1.815

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	0.605	4 8	0.605	8 12	0.605

Price & Myers		Page 4
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole Site-5.3ls-30yr.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 15.000

Tank or Pond Structure

Invert Level (m) 13.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1175.0	1.500	1175.0	1.501	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0101-5300-1500-5300	
Design Head (m)	1.500
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	13.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	5.3	Kick-Flo®	0.903	4.2
Flush-Flo™	0.442	5.3	Mean Flow over Head Range	-	4.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	0.800	4.7	2.000	6.1	4.000	8.4	7.000	10.9
0.200	4.7	1.000	4.4	2.200	6.3	4.500	8.9	7.500	11.3
0.300	5.1	1.200	4.8	2.400	6.6	5.000	9.3	8.000	11.7
0.400	5.2	1.400	5.1	2.600	6.8	5.500	9.8	8.500	12.0
0.500	5.2	1.600	5.5	3.000	7.3	6.000	10.2	9.000	12.3
0.600	5.2	1.800	5.8	3.500	7.9	6.500	10.6	9.500	12.7

Price & Myers		Page 1
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023	Designed by HD	
File Whole SITE-5.3ls-100.SRCX	Checked by TS	
Innovyze	Source Control 2018.1	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	13.906	0.406	5.2	476.6	O K
30 min Summer	14.050	0.550	5.3	645.8	O K
60 min Summer	14.209	0.709	5.3	832.7	O K
120 min Summer	14.368	0.868	5.3	1020.2	O K
180 min Summer	14.465	0.965	5.3	1134.1	O K
240 min Summer	14.534	1.034	5.3	1214.5	O K
360 min Summer	14.626	1.126	5.3	1322.9	O K
480 min Summer	14.685	1.185	5.3	1392.1	O K
600 min Summer	14.725	1.225	5.3	1439.3	Flood Risk
720 min Summer	14.753	1.253	5.3	1472.7	Flood Risk
960 min Summer	14.788	1.288	5.3	1513.4	Flood Risk
1440 min Summer	14.805	1.305	5.3	1533.3	Flood Risk
2160 min Summer	14.785	1.285	5.3	1509.6	Flood Risk
2880 min Summer	14.754	1.254	5.3	1473.0	Flood Risk
4320 min Summer	14.707	1.207	5.3	1418.0	Flood Risk
5760 min Summer	14.673	1.173	5.3	1378.0	O K
15 min Winter	13.955	0.455	5.3	534.3	O K
30 min Winter	14.116	0.616	5.3	724.3	O K
60 min Winter	14.295	0.795	5.3	934.5	O K
120 min Winter	14.476	0.976	5.3	1146.5	O K
180 min Winter	14.585	1.085	5.3	1274.5	O K
240 min Winter	14.662	1.162	5.3	1365.4	O K
360 min Winter	14.768	1.268	5.3	1489.5	Flood Risk
480 min Winter	14.836	1.336	5.3	1569.7	Flood Risk
600 min Winter	14.883	1.383	5.3	1625.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	141.636	0.0	392.3	27
30 min Summer	96.164	0.0	438.5	41
60 min Summer	62.307	0.0	785.7	72
120 min Summer	38.527	0.0	855.3	130
180 min Summer	28.787	0.0	835.5	190
240 min Summer	23.320	0.0	816.2	250
360 min Summer	17.228	0.0	790.6	370
480 min Summer	13.828	0.0	775.6	488
600 min Summer	11.628	0.0	766.0	608
720 min Summer	10.078	0.0	759.8	728
960 min Summer	8.020	0.0	753.7	966
1440 min Summer	5.772	0.0	751.4	1444
2160 min Summer	4.156	0.0	1557.2	2160
2880 min Summer	3.306	0.0	1504.6	2504
4320 min Summer	2.417	0.0	1403.3	3248
5760 min Summer	1.953	0.0	2532.6	4088
15 min Winter	141.636	0.0	417.8	27
30 min Winter	96.164	0.0	444.3	41
60 min Winter	62.307	0.0	844.2	70
120 min Winter	38.527	0.0	838.6	130
180 min Winter	28.787	0.0	812.6	188
240 min Winter	23.320	0.0	796.5	246
360 min Winter	17.228	0.0	780.7	364
480 min Winter	13.828	0.0	776.2	482
600 min Winter	11.628	0.0	777.9	598

Price & Myers		Page 2
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole SItE-5.3ls-100.SRCX	Designed by HD Checked by TS	
Innovyze Source Control 2018.1		

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
720 min Winter	14.918	1.418	5.3	1665.7	Flood Risk
960 min Winter	14.961	1.461	5.3	1716.9	Flood Risk
1440 min Winter	14.990	1.490	5.3	1750.7	Flood Risk
2160 min Winter	14.982	1.482	5.3	1741.9	Flood Risk
2880 min Winter	14.953	1.453	5.3	1707.8	Flood Risk
4320 min Winter	14.891	1.391	5.3	1633.9	Flood Risk
5760 min Winter	14.844	1.344	5.3	1578.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
720 min Winter	10.078	0.0	783.6	716
960 min Winter	8.020	0.0	793.5	948
1440 min Winter	5.772	0.0	793.2	1408
2160 min Winter	4.156	0.0	1576.0	2080
2880 min Winter	3.306	0.0	1538.3	2716
4320 min Winter	2.417	0.0	1488.3	3420
5760 min Winter	1.953	0.0	2827.6	4336

Price & Myers		Page 3
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole Site-5.3ls-100.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 520350 115600 TQ 20350 15600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+45

Time Area Diagram

Total Area (ha) 1.815

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
	(ha)		(ha)		(ha)
0	4 0.605	4	8 0.605	8	12 0.605

Price & Myers		Page 4
37 Alfred Place London WC1E 7DP	Sandgate Nurseries Henfield 30512	
Date 04/08/2023 File Whole Site-5.3ls-100.SRCX	Designed by HD Checked by TS	
Innovyze	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 15.000

Tank or Pond Structure

Invert Level (m) 13.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1175.0	1.500	1175.0	1.501	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0101-5300-1500-5300	
Design Head (m)	1.500
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	13.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	5.3	Kick-Flo®	0.903	4.2
Flush-Flo™	0.442	5.3	Mean Flow over Head Range	-	4.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	0.800	4.7	2.000	6.1	4.000	8.4	7.000	10.9
0.200	4.7	1.000	4.4	2.200	6.3	4.500	8.9	7.500	11.3
0.300	5.1	1.200	4.8	2.400	6.6	5.000	9.3	8.000	11.7
0.400	5.2	1.400	5.1	2.600	6.8	5.500	9.8	8.500	12.0
0.500	5.2	1.600	5.5	3.000	7.3	6.000	10.2	9.000	12.3
0.600	5.2	1.800	5.8	3.500	7.9	6.500	10.6	9.500	12.7

Appendix H

Hydrogeological Assessment

Stephen Buss Environmental Consulting

Horsham Borough Council
Parkside
Chart Way
Horsham
West Sussex RH12 1RL

4 January 2024

Document reference: 2024-100-002-001

Hydrogeological Assessment: Water Neutrality Statement for Sandgate Nurseries, Henfield

Dear Sirs

The following document was compiled to demonstrate that it is feasible that the proposed potable water use at the site at Sandgate Nurseries, Henfield can be water neutral.

BACKGROUND

Natural England (2022) believes that groundwater abstraction in the Sussex North water supply zone (SNWSZ) has a detrimental impact on the Arun Valley SAC, SPA and Ramsar site. The development site, like the whole of Horsham District, is in the SNWSZ. Hence to prevent further deterioration of the SAC, SPA and Ramsar site, Natural England insists that:

“For every new development, total water use in the Sussex North Water Supply Zone after the development must be equal to or less than the total water-use in the region before the new development.”

Hence each new development will need to demonstrate how that development will achieve no net increase in water consumption, by water efficiency measures, offsetting or, in the case of this proposal, not being reliant on groundwater resources that are used for public water supply in the SNWSZ

THE SITE

The site is off Sandgate Nurseries, West End Lane, Henfield, Horsham, West Sussex, BN5 9UL and the centre of the site is roughly at grid reference 520425E 116061N. A borehole supply has been proposed to provide potable water for the development. This site is close to the River Adur, which flows southwards past Henfield, at a distance of 1.5 km from the site.

The borehole will be sited to draw the water supply for the site from a source that is not hydrologically connected to the Sussex North water supply zone. Henfield is not in the catchment of the River Arun, which provides hydrological support to the Arun Valley SAC, SPA and Ramsar site.

All water to be abstracted is for potable uses. Price and Myers Ltd has estimated the potable water demand, after introducing water efficiency and smart metering devices at 17.2 m³/day or 6284 m³/year.

Stephen Buss Environmental Consulting Limited, registered in England and Wales no. 08595273

Registered office: 32 Port Hill Road, Shrewsbury SY3 8SA

www.hydro-geology.co.uk

01743 246977

steve@hydro-geology.co.uk

GEOLOGY

The local geological succession is presented in Table 1, along with brief lithological descriptions. Allen et al. (1997) describes the aquifer potential for the Lower Greensand sequence as follows:

“...the Folkestone and Hythe Formations can be considered as the major aquifers within the Lower Greensand Group of the Weald. The Sandgate Formation which separates them forms an inconsistent aquitard. Where present, the Bargate Beds can be included in the Hythe aquifer, and where the Marehill Clay is absent and the permeable layers of the Sandgate Formation are in continuity with the overlying Folkestone Formation, the younger parts of the Sandgate Formation can be included in the Folkestone aquifer. At depth, away from outcrop, where the Lower Greensand Group is undifferentiated, the sequence is believed to act as one aquifer.”

Outcrop at the Sandgate Nurseries site is mapped as “Lower Greensand Group – Silty Sandstone” whilst the Folkestone Formation outcrop is mapped separately to the east of the site, beneath part of Henfield (Figure 1). The British Geological Survey GeoIndex records two local borehole logs that can be used to assess the likely geology at the site:

- Borehole TQ11/NE6, which was previously constructed at Lidd Nurseries, about 440 m west of the Sandgate Nurseries site. The log records 19 m of Sandgate Formation clays, then 11 m of “Sandstone with hard veins” of the Hythe Beds (Appendix A). The borehole did not reach the Atherfield Clay below.
- Borehole TQ11/NW1 was constructed in 1976 at Nep Town about 630 m south-east of the Sandgate Nurseries site. The log records 6 m of Folkestone Formation and then sands, siltstones, mudstones and clays of the Sandgate Formation to 30 m, then sandstone of the Hythe Formation to 72 m depth.

Hence the aquifer beneath the Sandgate Nurseries site will be the Hythe Formation, probably between about 25 m and 70 m depth. The thickness of the Hythe Formation pinches out to the west, north and south of the site.

The Hythe Formation aquifer is not part of the “Wealden Greensand semi-confined aquifer”, which is the main source of water for the Sussex North WSZ. This is the Folkestone Formation aquifer that is exploited by Southern Water’s Hardham boreholes about 17 km west of the site.

All potable water used in the development will be sent northwards for treatment at Henfield Waste Water Treatment Works (WWTW). The outfall from Henfield WWTW is on the Cutlers Brook, a tributary of the River Adur, at grid reference TQ2174917097, about 1.6 km north-east of Sandgate Nurseries site, and about 3.5 km upstream (Figure 2).

Given that it is reasonable to expect that that some proportion of the proposed abstraction’s yield will be sourced from the Adur catchment, the proposal is therefore likely to lead to a slight net gain in flow to the Arun catchment.

Table 1: Geological formations local to Henfield

Formations	Members	Lithology
Gault Formation		Mudrock
Folkestone Formation		Sand, with iron-pan deposits.
Sandgate Formation	Marehill Clay Member	Silty clay
	Pulborough Sandrock Member	Fine-grained sandstone
	Fittleworth Member	Complex sequence of clays, silts, sands
Hythe Formation		Fine-grained sands and sandstones
Atherfield Clay Formation		Mudrock
Weald Clay Formation		Mudrock

BOREHOLE YIELD AND SUSTAINABILITY

The target aquifer beneath the site is the Hythe Formation. Shand et al. (2003) summarise the hydrogeology from Allen et al. (1997) as follows.

“Groundwater flow in the Hythe Formation is predominantly intergranular where the sands are poorly cemented, but fracture flow dominates where the aquifer is more consolidated. The geometric mean of transmissivities from all parts of the Hythe Formation is 310 m²/day, with higher values (up to 1500 m²/day) being recorded where the aquifer is fractured. Transmissivities in the southern province of the study area tend to be quite high (around 1000 m²/day), whilst north towards Guildford they are thought to be lower, around 200 m²/day, because the sands are less well consolidated and flow is mainly intergranular.”

The log of borehole TQ11/NE6 records a pumping test at a rate of 78 m³/day which caused no drawdown after 8 hours. Most of the other wells in Henfield were completed in the Folkestone Formation and/or the Sandgate Formation and gave poor yields. But one borehole, TQ21/NW11, at Henfield Common about 1.3 km east of the site, exploited the confined Hythe Beds and yielded 59 m³/day with only 0.66 m drawdown after 8 hours.

These results indicate that the desired yield of 17.2 m³/day should easily be available from the proposed Sandgate Nurseries borehole.

Mean potential recharge to the River Ems catchment on the South Downs (for example) is about 398 mm/year (Buss, 2022) and for the North Downs is about 267 mm/year (Buss and Daily, 2010). Being about halfway between the South Downs and the North Downs, it might therefore be assumed that the potential recharge at Henfield is about halfway between the two values: 332 mm/year. If there was no runoff in the recharge area, the annual abstraction rate would be satisfied by the recharge passing through an area of 18 910 m², or a circle with radius 78 m.

GROUNDWATER QUALITY

There are no local examples of water quality in the Hythe Beds but Smock Alley Waterworks is completed in the Hythe Beds about 11 km west of Sandgate Nurseries (Appendix A). When the Smock Alley boreholes were sampled in 1948, water quality was fairly good and moderately hard, but not potable raw (Table 2). The water quality at the time slightly exceeded the drinking water standard for iron and approached the drinking water standard for ammonium.

Elsewhere in the Hythe Beds aquifer, there have been changes in groundwater quality since 1948. Most notably (Shand et al., 2003) there has been a rise in concentration of nitrate. However, the water chemistry required to keep iron dissolved tends to preclude high concentrations of nitrate.

Table 2: Water quality, Smock Alley Pumping Station, 1948

Determinand	Unit	Measurement	2024 drinking water standard
pH		7.4	
Ammoniacal nitrogen	mg N/l	0.345	0.39*
Albuminoid [organic] nitrogen	mg N/l	0.075	n/a
Nitrous (nitrite) nitrogen	mg N/l	0	0.15
Nitric (nitrate) nitrogen	mg N/l	4.0	11.3
Hardness, temporary	mg/l as CaCO ₃	197	n/a
Hardness, permanent	mg/l as CaCO ₃	63	n/a
Permanganate figure (chemical oxygen demand)	mg/l	0	n/a
Total [dissolved] solids	mg/l	340	n/a
Chloride	mg/l	26	250
Nitrate	mg NO ₃ /l	17.7	50
Iron	mg/l	0.36	0.2

* this standard for ammonium is not currently a statutory limit, but was previously.

CONCLUSIONS AND RECOMMENDATIONS

After review of available geological and hydrogeological data, the following conclusions may be made regarding design parameters for the borehole at the Sandgate Nurseries site:

- The effect of the proposed abstraction on the water balance of the Sussex North WRZ is negligible. All of the borehole yield will be from the Hythe Beds aquifer in the catchment of the River Adur. There is no interaction between the abstraction and groundwater in the Folkestone Formation aquifer: the “Wealden Greensand semi-confined aquifer”. The effect of the proposed abstraction on the water balance of the River Arun will be zero.
- There is no reasonable doubt that a borehole drilled to the recommended depth (see below), and completed correctly, will be able to yield in excess of 17.2 m³/day. The Hythe Formation is a good aquifer, that locally was able to supply 59 to 78 m³/day with little or no drawdown, and formerly maintained a public water supply abstraction of about 3000 m³/day near West Chilington Common.
- Water quality is probably good, and moderately hard. The iron concentration might be slightly above drinking water standard, and ammonium might be elevated.

It is recommended that the borehole be drilled at to the base of the Hythe Formation, and completed across its entire thickness. The base of the Hythe Formation is probably at a depth of c. 70 m. A pumping test should undertaken to verify the borehole yield.

Water treatment for removal of ammonium, iron and possibly manganese should be anticipated (to be confirmed by taking a water sample on borehole commissioning). Elevated iron and manganese concentrations can be readily dealt with by filtration. If iron is present then nitrate concentrations should not be high enough to require removal. Elevated concentrations of ammonium might need treatment by, for example, reverse osmosis or ion exchange.

In summary, a borehole can be installed at the Sandgate Nurseries site that is capable of sustainably yielding 17.2 m³/day. The abstracted water will probably need treatment, but suitable treatment methods are readily available.

Yours sincerely



Dr Stephen Buss MA MSc FGS CGeol
Owner / Principal Hydrogeologist



References

Allen, D.J., Brewerton, L.J., Coleby, L.M., Gibbs, B.R., Lewis, M.A., MacDonald, A.M., Wagstaff, S.J. and Williams, A.T. 1997. The physical properties of major aquifers in England and Wales. British Geological Survey Technical Report WD/97/34.

Buss, 2022. River Ems Flow Investigation, Phase 1 Baseline Report. Atkins report, for Portsmouth Water.

Buss, S.R. and Daily, P.J.J., 2010. London Basin Aquifer: Conceptual Model. ESI report reference 60121R1, for the Environment Agency.

Shand, P., Cobbing, J., Tyler-Whittle, R., Tooth, A.F. & Lancaster, A., 2003 Baseline Report Series 9: The Lower Greensand of southern England. British Geological Survey Report No. CR/03/273N

Hydrogeological Assessment: Water Neutrality Statement for Sandgate Nurseries, Henfield

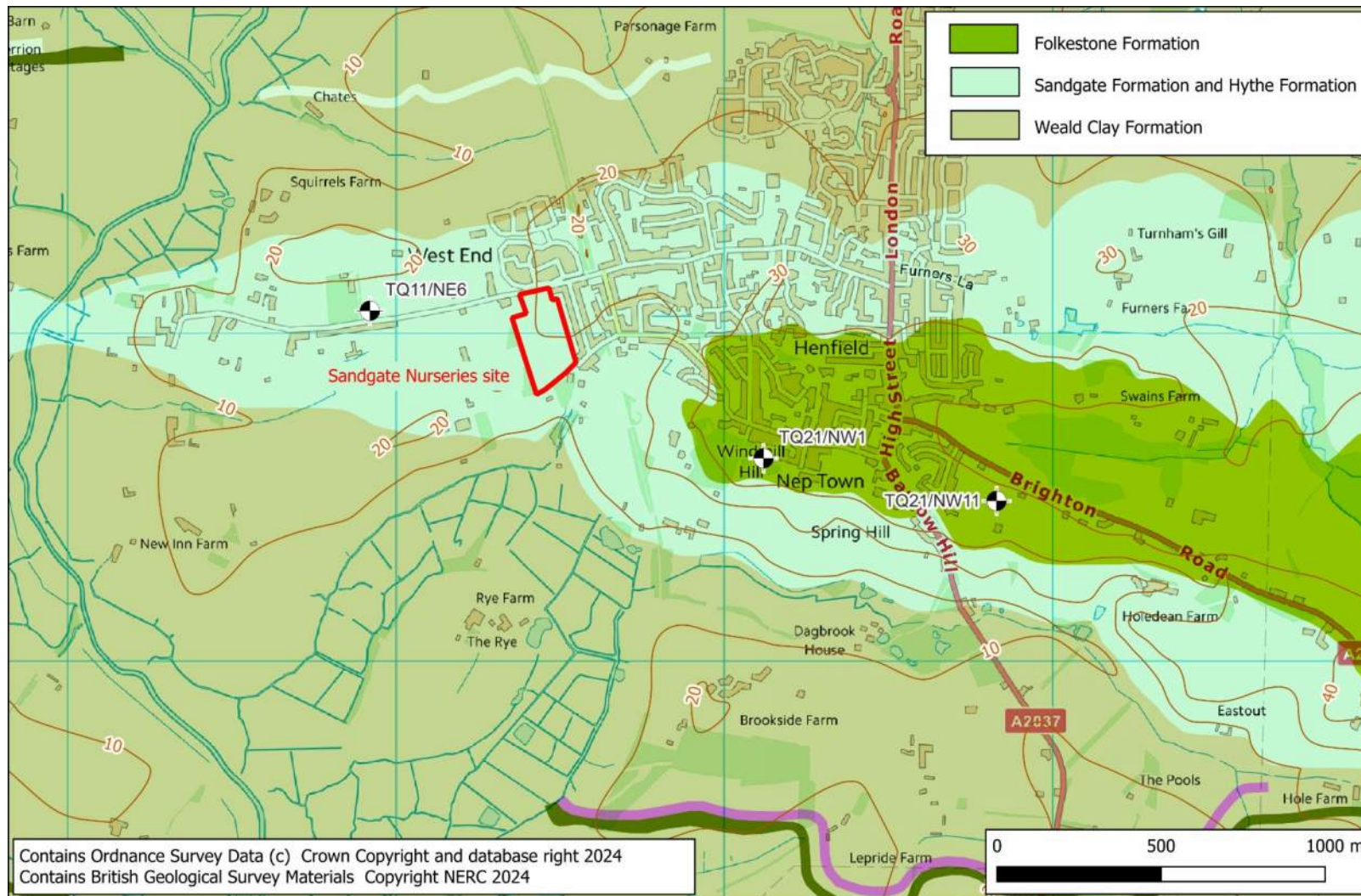


Figure 1: Bedrock geology and some local boreholes

Hydrogeological Assessment: Water Neutrality Statement for Sandgate Nurseries, Henfield

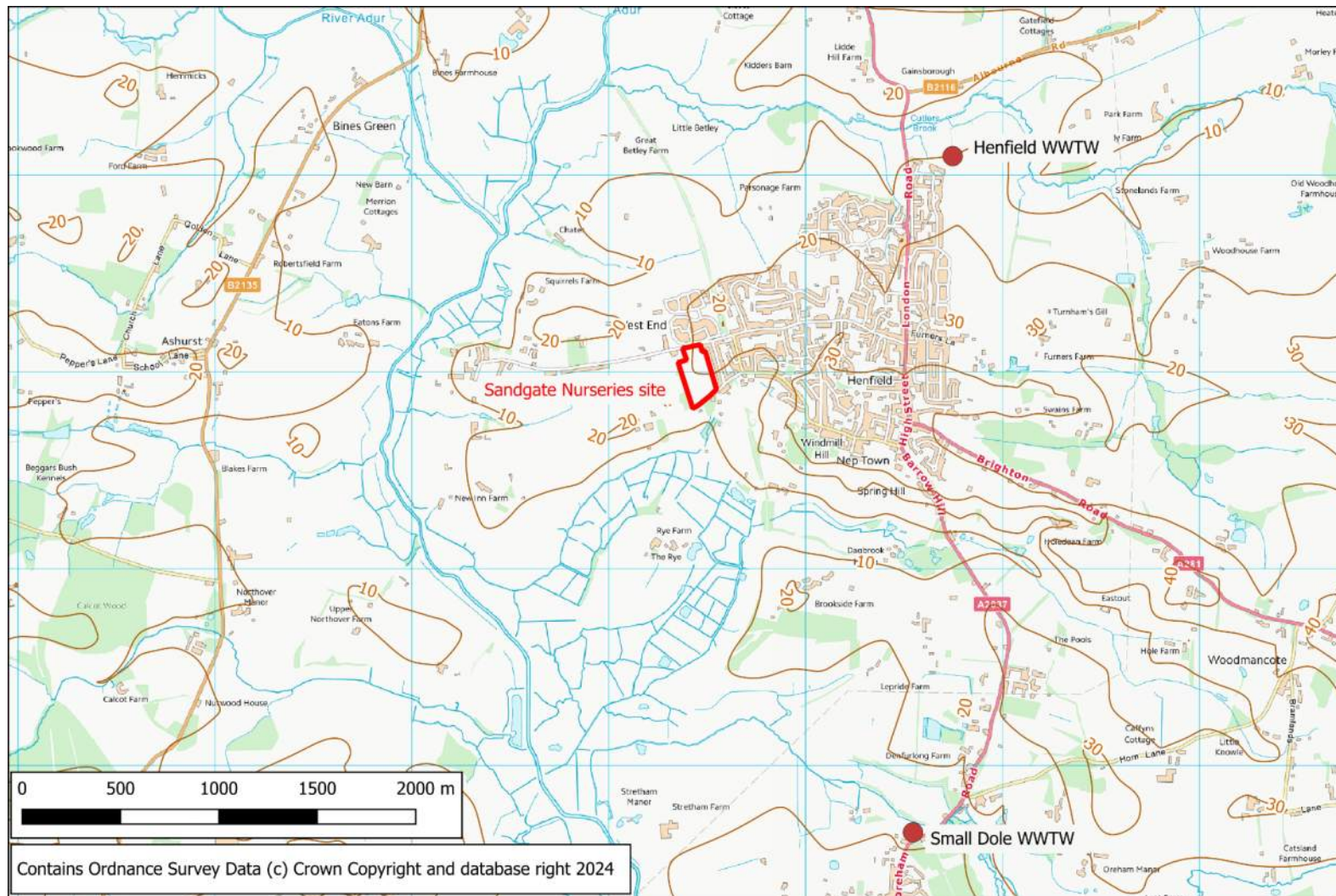


Figure 2: Local waste water treatment works (WWTW)

APPENDIX A: BOREHOLE LOGS

Presented as the following PDF files:

TQ11-NE6.pdf,

TQ21-NW1.pdf,

TQ21-NW11.pdf,

Smock Alley Waterworks log.pdf



RECORD OF WELL

At LIDD NURSERIES
WEST END LANE
Town or Village HENFIELD
County SUSSEX

For Survey use only Licence No. 16/12/10
1992,1607N.11283

318/445

EXACT SITE
OF WELL

Six-inch sheet SUSSEX (WEST) 38 SW Six-inch National Grid sheet

For C.A. RUSSELL & SONS State whether owner, tenant, builder, contractor, consultant, etc.:- OWNER

Address (if different from above) 21, BOUNDSTONE LANE, LANGING, SUSSEX

Level of ground surface above sea level (O.D.) +55 ft. from map If well top is not at ground level, state how far above: *
below: / / ft.

SHAFT.....ft.; diameter.....ft.; HEADINGS (please attach details—dimensions directions)

BORE.....ft.; diameter of bore: at top.....in.; at bottom.....in.

Full details of permanent lining tubes (position, length, diameter, plain, slotted etc.)

68ft. 6" PLAIN 8" CASING Open hole 68' 6" to 150'

Water struck at depths of 63ft. and onwards.....ft. below well top.

Rest level of water 11' 6" ft. above* well top. Suction at 20 ft. Yield on 8 hours* test
pumping at 730 galls. per HR with depression to 11' 6" ft. below well top.
(NO DEPRESSION)

Recovery to rest level in 0 mins.* Capacity of pump 2000 g.p.h. Date of measurements 6/11/6

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT: NOT YET DECIDED

Make and/or type.....Motive power.....

Capacity.....galls. per hour. Suction at.....ft. below well top.

Amount pumped.....galls. per day. Estimated consumption.....galls. per week.

Well made by DUKE & COCKENDELL LTD Date of sinking NOV. 1963

Information from....."

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

For Survey use only

Date Received 5.12.63

Section 6.....

Pumping test.....

Observ. well.....

Recorder.....

E.R. log.....

Site marked on

1" map 0 10

6" map 0 10 10 10
(use symbol)

Record forwarded



(For Survey use only)
GEOLOGICAL
CLASSIFICATION

NATURE OF STRATA

If measurements start below
ground surface, state how far ...

THICKNESS

Feet Inches
.. ..

DEPTH

Feet Inches

(m)

CLAY

22

22

6.71

STIFF BLUE CLAY

4

26

7.93

HARD SHALEY CLAY

14

40

12.19

STIFF BLUE CLAY WITH LAYERS OF

SHALE

23

63

19.20

(HYDRA)

SANDSTONE WITH HARD VEINS

37

100

30.48

Sandgate
Beds
63'

Hythe Beds
37'

M.H. + A.C.B.
1/12/72

L100
NUMERICS

Water Bn.
WD 313/445
1968
1' 318
1992.1607



RECORD OF WELL

At LIDD NURSERY
WEST END LANE
Town or Village HENFIELD
County SUSSEX

For Survey use only Licence No. 4/22/30
N. 11283

318/445

TQ 11/1

EXACT SITE
OF WELL

Six-inch sheet SUSSEX (WEST) 138 SW Six-inch National Grid sheet TQ 1992 1608
For G. A. RUSSEL & SONS State whether owner, tenant, builder,
contractor, consultant, etc. :— OWNER

Address (if different from above) 21, BOUNDSTONE LANE, LANCING, SUSSEX
Level of ground surface above sea level (O.D.) +0.55 from map If well top is not at ground level, state how far } above: *
below: / / ft.

DE
WHICHEVER IS
INAPPLICABLE

SHAFT ft. ; diameter ft. ; HEADINGS (please attach details—dimensions and directions)

BORE 100 ft. ; diameter of bore: at top 8 in. ; at bottom 8 in.

Full details of permanent lining tubes (position, length, diameter, plain, slotted etc.)

68ft 6" PLAIN 8" CASING Open hole 68' 6" to 100'

Water struck at depths of 63ft and onwards ft. below well top.

Rest level of water 11' 6" ft. ^{above*} below well top. Suction at 20 ft. Yield on 8 hours' * test
~~days~~

TEST
CONDITIONS

pumping at 730 galls. per HR. with depression to 11' 6" ft. below well top.
(NO DEPRESSION)

Recovery to rest level in 0 mins. * Capacity of pump 2000 g.p.h. Date of measurements 6/11/63
~~hours~~

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT: NOT YET DECIDED

NORMAL
CONDITIONS

Make and/or type Motive power

Capacity galls. per hour. Suction at ft. below well top.

Amount pumped galls. per day. Estimated consumption galls. per week.

Well made by DUKE & OGLENDEN LTD Date of sinking NOV. 1963

Information from " " "

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

For Survey use only

Date Received 5.12.63

Section 6

Pumping test

Observ. well

Recorder

E.R. log

Site marked on

1" map 0.10

6" map 0.10.12.63 ..
(use symbol)

Record forwarded

to

date

GEOLOGICAL SURVEY,
WATER DIVISION,
SOUTH KENSINGTON,
LONDON, S.W.7.

LOG OF STRATA OVERLEAF.

[illegible]

N. 11283.

copy to Geological Survey

318/445

MINISTRY OF HOUSING AND LOCAL GOVERNMENT

SECTION 14 OF THE WATER ACT 1945

1945 No. 11283

South Sussex Area (Conservation of Water) Order 1949

TQ1111

3

In this licence:-

(a) "the Minister" means the Minister of Housing and Local Government;

(b) a group of two letters and eight figures represents the map co-ordinates of the proposed position of the borehole which is the subject of this licence, estimated to the nearest ten metres on the grid of the national reference system used by the Ordnance Survey on its maps and plans.

The Minister, in exercise of his powers under section 14(6) of the Water Act 1945, hereby licenses Messrs. C. Russell and Sons to construct a borehole for the purpose of abstracting underground water at TQ19921607 *at* West End Lane, Newfield, Sussex, subject to the following conditions:-

1. The depth of the borehole shall not exceed 200 feet.
2. The capacity of the pump to be installed for abstracting water from the borehole shall not exceed 500 gallons per hour.
3. Except with the consent of the Minister and subject to any conditions attached thereto, given after like proceedings with respect to the publication and service of notices, and the making and hearing of objections, as apply to applications for licences under section 14(6) of the Water Act 1945 -
 - (a) during any (or each) period commencing on the 1st December and ending on the 30th June not more than 10,000 gallons of water shall be abstracted from the borehole in any period of 24 hours reckoned from midnight;
 - (b) during any (or each) period commencing on the 1st July and ending on the 30th November not more than 5,000 gallons of water shall be abstracted from the borehole in any period of 24 hours reckoned from midnight;
 - (c) no water shall be abstracted from the borehole after the 31st December 1950.
4. As soon as practicable a satisfactory water meter shall be installed to measure the abstraction from the borehole, and readings of the said meter shall be taken and recorded to show the quantity of water abstracted in any one day of 24 hours.
5. Any officer authorized for the purpose of section 14(12)(a) of the Water Act 1945 shall on request be permitted to inspect or transcribe records required to be kept by the last preceding condition and relating to any period not earlier than 5 years before the request is made.

/6.

U.S. UNDER THE WATER ACT 1945, IT IS AN OFFENCE PUNISHABLE BY FINE TO CONTRAVENE ANY CONDITION ATTACHED TO THIS LICENSE.

Sited by O on 6" Sheet 38 SW/4.

D.K.C.

318 TP11/1
445

6. If the borehole is not constructed within one year from the date of this licence, the licence shall cease to have effect.

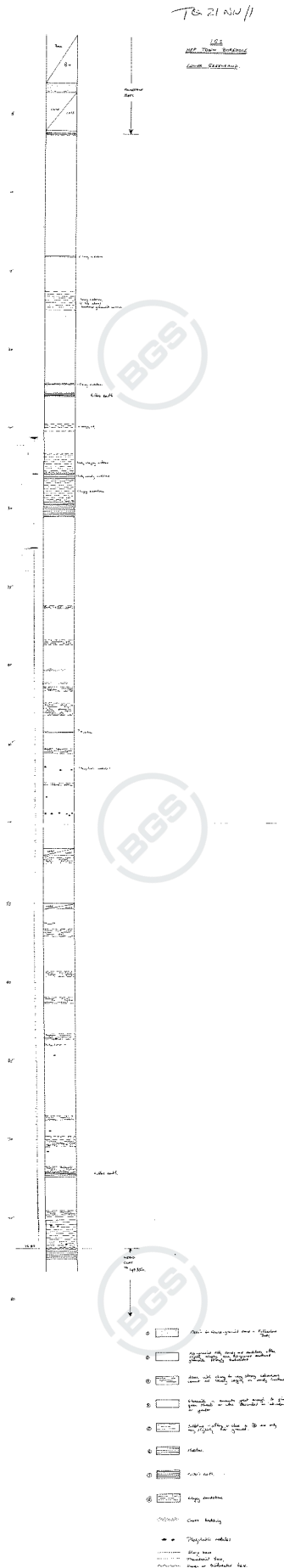
GIVEN under the Official Seal of the

Minister of Housing and Local Government

on 25th October 1961.

Assistant Secretary

MINISTRY OF HOUSING AND LOCAL GOVERNMENT.





BRITISH GEOLOGICAL SURVEY
RECORD OF SHAFT OR BOREHOLE

6-in or 1:10 000 Map Registration No.

TQ 21 NW - 1

Name and Number of Shaft or Borehole.

NEP TOWN

For whom made

I. G. S.

Town or Village

HENFIELD

County

SUSSEX

Exact site (reference to a fixed point on 1-in or 1:50 000 Map:

National Grid Reference

TQ 2112 1562

1-in or 1:50 000
New Series Map No.

BRIGHTON

318

Enter 'C' if
Confidential

Purpose for which made

RESEARCH

Ground level at ^{shaft}bore relative to O.D. _____ m. If not ground level give O.D. of beginning of ^{shaft}bore _____ m.

Made by

I. G. S.

Date of sinking Sept 1976

Information from

Examined by B YOUNG
R BOWIE
J HUDSON

Specimen Numbers and Additional Notes

Logged, between, 1977-1989.
Core Rest from, 145.10 - 149.35 m.
Specimen taken for straining 52.15 m.
LOWER GREENSAND TO 76.8 m.
WEALD CLAY TO 149.35 m.

Geological Classification	Description of Strata	Thickness metres	Depth metres
Folkstone Beds	<u>Rock b.t</u> medium - coarse yellow sands		3.05
	<u>Sand</u> medium - coarse generally subangular to sub-angular, some grains up to 2mm. Mostly dark yellow-orange (10 YR 6/6), with local patches of moderate brown (5YR 4/4) to moderate reddish- brown (10 R 4/6).	0.28	
	? Occasional traces of faint original laminar perhaps disturbed by network of very hard secondary iron - pan (concrete), dusky brown (5YR 2/2) sharp base		3.33
	<u>Sand</u> medium - coarse generally	0.33	

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

National Grid

Reference

TQ21NW/1

TQ 2112 1562

Page

2

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		3.33
	Subrounded to sub angular, soft, relatively incoherent, poorly to un-cemented. Occasional grains up to 1mm, occasional scattered dark grains (?) glauconite. Dark yellowish orange (10 YR 6/6) with streaks of moderate brown (5 YR 4/4) in Liesegang ring formations. Large 2cm, subhorizontal burrows. Infilled with sand of similar type to matrix. Occasional hard secondary iron pan in surrounding large 2cm burrows.		
	Very slightly clayey below c3.56m		3.66
	Core Loss	2.44	6.10
	Sand medium grained, poorly sorted un-cemented. Occasional grains up to 1mm. Very slightly clayey. Generally dark yellowish orange (10 YR 6/6) with patchy light brown (5 YR 5/6) mottling, no original lamination. Appears slightly bioturbated. Occasional pale grey clayey wisps and (?) disturbed laminar or burrow filling up to 2-3 mm thick. Some scattered dark grains (?) glauconite. Dark reddish brown (10 R 3/4) weak Fe pan up to 1cm thick ~ 1 cm from base.	0.17	
Base of Folkstone Beds.	sharp base. (?) bioturbated		6.27

N and Number of Shaft or Borehole:

NEP TOWN

6-in Map
Registration No.

TQ21NW/1

Page

National Grid
Reference

TQ 2112 1562

3

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		6.27
	Clay very silty, sandy material bioturbated, pale brown (5 YR 5/2). Sub vertical and sub horizontal burrows up to 7mm wide infilled with sand from above. Becoming progressively silty and sandier downwards, passing rapidly down to	0.12	
	Sand fine, silty, scattered with mica grains. Intensely bioturbated. pale yellowish brown (10 YR 6/2) - (10 YR 7/2). 2mm burrows with sandy-clayey infill. to 6.80m. Relatively dark yellow brown (10 YR 4/2). Clayey burrow + trails fillings up to 5mm. Clay wisps becoming less common downwards, much disturbed by burrowing. Colour of sand becoming dark- yellowish orange (10 YR 6/6) and clay wisps dusky brown (5 YR 2/2) below 6.72m. Clay burrow linings becoming more numerous and olive black (5 Y 2/1) below 6.85m. Reddish massive pyrite nodules ~ 2cm at 7.00m. Scattered glauconite below 6.90m. Passing down rapidly to	0.63	6.39
	Silt very clayey, olive black (5 Y 2/1) bioturbated, scattered mica grains	0.02	7.02
			7.04

Name and Number of Shaft or Borehole: NEP TOWN	6-in Map Registration No. TQ21NW1	Page 4
	National Grid Reference TQ 2112 1562	

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		7.04
	Sand fine grained, silty, un- cemented. Scattered mica and some glauconite. Generally olive grey (5Y4/1). Intensity bioturbated. little or no original structure. Dark clayey wisps, burrow fillings and disturbed laminae in paler sand matrix. Colour becoming slightly paler below 7.25m with patchy dark yellow orange (10YR6/6) mostly between 7.30 - 7.50m. Costs of bivalves at 7.73 + 7.78 + 8.1m, together with sub-horizontal burrows up to 7mm filled with glauconite rich sediment. Pyrite below 7.60m. Large diameter burrows up to 2cm. relatively common below 7.85m. Large 3cm sub-vertical branching burrow at ~ 8.10m. m filled with dark grey silty sand, also 2mm diameter burrows filled with pale sand. Laminae rather more disturbed below 9.10m. Laminae relatively clear in lowest 1cm. Sharp base	2.46	
	Sand fine grained silty compact uncemented, dusky yellow brown (10YR 2/2) olive grey (5Y 3/2) mottled. Intensity bioturbated (?)	0.12	9.50

Name and Number of Shaft or Borehole: NEP TOWN	6-in Map Registration No. TQ21NW/1	Page 5
	National Grid Reference TQ 2112 1562	

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		9.50
	glaucanite and white mica. Narrow (<1mm) vertical fissures apparently filled with yellowish medium- coarse sand passing down to		9.62
	Sand (similar to above previous unit). Fine grained scattered white mica, some scattered glaucanite. Generally olive grey (5Y4/1). Intensely bioturbated, traces of original lamination. Dark clayey wisps, burrows fillings and disturbed laminae in pale sandy matrix. Branching clayey lined burrows up to 5mm diameter below 10.00m. Bivalve casts (destroyed by handling) at 10.20m. Vertical dark grey clay filled burrows up to 5mm diameter and up to 2cm long below 10.00m. Small 3mm diameter nesting burrows lined with very pale clean grey sand common at 10.40m and occasionally below. Small bivalve casts at ~ 10.40m. passing down gradually to	1.48	11.10
	Sand fine grained, unconsolidated, friable, silty, slightly	0.77	

Name and Number of Shaft or Borehole: NEP TOWN	6-in Map Registration No. TQ21NW11	Page 6
	National Grid Reference TQ 2112 1562	

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		11.10
	clayey, greyish olive (10Y5/2). Traces of original lamination. Some scattered glauconite grains, much like above lithology, though rather more glauconitic. Scattered white mica grains. Much protubated and burrowed, anastomosing branching burrows up to 1 cm diameter, 5 mm deep. Interbedded with olive black silty clay. The whole sediment smells slightly of pyrite. passing down rapidly to		11.87
	Sand fine grained silty, clayey, olive grey (5Y 3/2) Immediately becoming olive black (5Y 2/1). Scattered white mica. Much protubated and burrowed, less distinct than above. Faint trace of original lamination. Occasional rough ovoid porous pyrite nodules up to 1.5 cm. passing down to	0.20	12.07
	Sand fine sand, silty, uncemented, fine, friable, slightly clayey, scattered glauconite grains. greyish olive (10Y5/2) white mica 11.10 - 11.87m. Traces of original lamination.	0.26	

Name and Number of Shaft or Borehole: NEP TOWN	6-in Map Registration No. TQ21NW/1	Page 7
	National Grid Reference TQ 2112 1562	

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		12.07
	though heavily protubated Some clay filled anastomosing burrows, some seen to branch up to 5mm diameter with in places cut 1cm into clear sand. Unit Large 2cm diameter roughly cylindrical, vertical pores of pyritic nodules (?) Glaucconite grains embedded in pyrite. Pyrite fill 4cm long. Sediment smells of pyrite Glaucconite becomes abundant downwards. pores down to		12.33
	Sand fine grained, clayey firm, relatively friable (Firmest than above) Scattered glaucconite more abundant than above. Generally dark olive grey (SY 3/1). Faint traces of original lamination. Heavily protubated and burrowed. Many of these lined and filled with olive black (SY 2/1) silty clay. 2cm diameter at ~ 12.35m. Indication of bivalve casts ~ 12.35m. Sediment colour olive grey (SY 4/2) between 12.76 - 12.84m, 13.07 - 13.11m, 13.50 - 13.54m. Olive black clay lined burrows abundant between 12.52 -	0.74	

Name and Number of Shaft or Borehole: NEP TOWN	6-in Map Registration No. TQ21NW 11	Page 8
	National Grid Reference TQ 2112 1562	

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		12.33
	12.57m rather less marked between 12.90 - 12.93m. Occasional burrows up to 2cm diameter, filled with sediment similar to matrix. Scattered massive pyrite nodules up to 2cm diameter. Very poor indication of the bivalves at 13.68m. Ovoid - massive pyrite nodules (4cm) at 13.74m passing down rapidly to		14.07
	Clay very sandy, silty, olive black (SY 2/1), massive heavily bioturbated. Burrows up to ~ 1cm infilled with sediment from above. This unit resembles. Rather thicker development of more clay rich bands - described above at 12.76, 13.07m etc. ? some scattered glauconite ? pyrite, scattered white mica. Some 1cm diameter pyritised burrow fillings. passing down rapidly to	0.06	14.13
	<u>Sand</u> (as at 12.33m) fine grained, silty, clayey firm, relatively friable. Scattered glauconite - less abundant than at 12.33m. dark olive gray (SY 3/1) little trace of original lamination. Heavily bioturbated. Numerous anastomosing	0.14	

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

National Grid

Reference

TQ21NW11

TQ 2112 1562

Page

9

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		14.13
	boreholes up to 3cm diameter filled with olive black (SY 2/1) silty clay. Rough ovoid massive 2cm pyrite nodules at 14.16m passing down rapidly to		14.27
	Sand, fine grained, silty, firm, uncemented, friable, olive gray (SY 4/2). No original laminae visible. Heavily bioturbated as above. A few prominent clay filled boreholes. Smells slightly of pyrite passing down rapidly to	0.15	14.42
	Sand as above with return of anastomosing clay lined boreholes as 14.13m. Some of boreholes up to 1cm diameter. Some 2cm boreholes filled with very pale clean sand between 14.42 - 14.50m. Rather straighter oblique boreholes between 14.68 - 14.74m. Colours becoming rather darker below 14.75m. Oblique fissures / joints from 15.00 - 15.20m. Rather firm below 15.00m and very firm and compact below 16.00m. Sediment smells slightly of pyrite	1.88	

Name and Number of Shaft or Borehole: NEP. TOWN	6-in Map Registration No. TQ21NW/1	Page 10
	National Grid Reference TQ 2112 1562	

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		14.42
	'Chondrites' style burrows in coarsely burrowed sediment at 16.15m Bivalve casts at 16.20m passing down to		16.30
	Siltstone very sandy and clay. Olive black (SY 2/1) clay, wisps and burrow linings. Compact, relatively hard and firm, though friable - mud like above. Scattered white mica. Much scattered glauconite giving rock a greenish streak when cut or scraped. Olive grey (SY 3/2) to olive black (SY 2/1). Little trace of original laminae, intensity disturbed. Chondrites type burrows very abundant between 16.50 - 16.60m. Few sand filled burrows up to 1cm diameter. Relatively well preserved bivalves at 16.30m. Vertical or nearly vertical fining from 16.30 - 16.60m, 16.90 - 17.15m. Glauconite content increasing downwards, colour becoming darker. Large (1cm) diameter, horizontal burrows common at 17.50m. Clay lined burrows and stretched surfaces at 17.20m passing down to	1.20	17.50

Name and Number of Shaft or Borehole: NEP TOWN	6-in Map Registration No. TQ21NW/1	Page 11
	National Grid Reference TQ2112 1562	

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		17.50
	Sandstone very fine grained, silty, slightly clayey. Fine though friable. Greyish olive (10Y4/2) much scattered glauconite. Rock shows distinct greenish streak. Some scattered white mica. No trace of original lamination. Intensely bioturbated and burrowed. Some clay lined burrows 2-3 mm in diameter. Clay wisps. passing down to	0.25	
	Sands fine grained, silty, clayey greyish olive green (5Y4/2) much scattered glauconite. Distinct greenish streak. Some scattered white mica No original lamination. Intensely bioturbated, numerous anastomosing burrows and tracks lined with olive black (5Y2/1) silty clay. Some of burrows up to 1cm diameter very rich in olive black clay between 17.93 - 17.96m with some 2mm diameter pyritised burrow fillings. Occasional small pyrite nodules. Sediment has (?) faint small of pyrite. Clay lined burrows between become more membranous below 18.91. Traces of original lamination below 19.30m though still heavily bioturbated.	1.95	17.75

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

TQ 21NW/1

Page

National Grid

Reference

TQ 2112 1562

12

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		17.75
	passing down to		19.60
	Sand very fine grained silty, clayey, much scattered glauconite. Relatively soft and friable olive black (SY 2/1) No original lamination. Intensely bioturbated. Very many chestonoring burrows filled with olive black (SY 2/1) clay up to 1cm diameters. Shaly concentric fill. 2 cm sub rounded pyrite nodules at 19.76m. passing down to	0.18	19.78
	Sand fine grained, silty, clayey, soft, friable (very similar to 17.75m) much scattered glauconite. greyish olive green (SY 3/4) to olive black (SY 2/1). Scattered white mica. (?) faint trace of original lamination. Intensely bioturbated. Many chestonoring burrows lined with olive black (SY 2/1) clay up to 7mm diameters. Burrows rather less numerous between 20.30 - 20.60m. Vertical fissure from 21.27 - 21.45m, 21.50 - 22.00m. Sediment smacks slightly of pyrite.	2.36	

IGS 1602 2000 4/76

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

TQ 21NW/1

Page

National Grid

Reference

TQ 2112 1562

13

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		19.78
	poorly preserved to value at 21.18m		
	passing down rapidly to		22.14
	Clay very silty, sandy olive black (5Y 2/1), compact, firm, friable, glauconitic, intensely bioturbated Sand filled burrows from overlying unit, common up to 1-2 cm diameter	0.10	
	passing down rapidly to		22.24
	Sand very fine grained, silty, slightly clayey, soft, friable, greyish olive (10Y 4/2) much scattered glauconite, some scattered white mica Heavily bioturbated. Some (?) faint trace of original bedding	0.48	
	Olive black (5Y 2/1) anastomosing clay lined burrows and trails up to 1cm diameter common, some sand filled burrows up to 1-1.5 cm diameter and very thin clay lining		
	Core unbroken below 22.50m Following log based on examination of intact core only		
	passing down to		22.72
	Mudstone Compact, massive	0.23	

Name and Number of Shaft or Borehole: NEP TOWN	6-in Map Registration No. TQ 21NW	Page 14
	National Grid Reference TQ 2112 1562	

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		22-72
	waxy. Relatively hard resembling Fullers Earth silty sandy initially becoming relative pure below 22-90m. Olive grey (SY 3/2) with slightly olive brown (SY 5/6 - SY 4/6), mottled. Sand filled burrows from overlying sediment, common down to 22-90m. Numerous slickensides below 22-90m, colour becoming predominantly olive brown (SY 5/6 - SY 4/6) below 22-90m. (?) sharp base		22-95
	Sand very fine grained, silty, slightly clayey, soft, unconsolidated, friable generally grey olive (SY 5/2) to light olive grey (SY 5/2) (to SY 4/2 when dry) Scattered glauconite grains less abundant than above mudstone. Scattered white mica Top 2m penetrated by small 2-3mm diameter burrows filled with clay from above Traces of original bedding especially below 23-80m. Intensely bioturbated. Numerous anastomosing burrows 2-3mm diameters, lined and filled with olive grey black (SY 2/1) silty clay.	1-80	

Name and Number of Shaft or Borehole: NEP TOWN	6-in Map Registration No. TQ 21NW / 1	Page 15
	National Grid Reference TQ 2112 1562	

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		22.95
	Core broken below 23.72		
	2cm ovoid nodules of massive pyrite at 23.83m		
	5 x 2cm flattened ovoid massive pyrite nodules at ~ 24.40m		
	Clay lined burrows rather more numerous below 24.00m		
	4cm diameter silty clay nodules or disturbed burrow fill at 24.60m		24.75
	passing down to		
	Sand very clayey, silty, compact, firm, friable olive grey (SY 3/2). Very slight traces of original lamination. Intensely bioturbated. Some scattered glauconite (rock does not show green streaks). Scattered white mica. Numerous disturbed laminae and (?) worm fillings of olive black (SY 2/1) clay, occasionally showing slickensides.	0.35	
	passing down to		25.10
	Sand Very fine grained, silty, firm, friable. Some scattered glauconite, a little white mica. Olive grey (SY 4/2). Little trace of original lamination. Intensely bioturbated, numerous anastomosing burrows up to 3mm diameter.	0.40	

Name and Number of Shaft or Borehole: NEP TOWN	6-in Map Registration No. TQ 21NW 11	Page 16
	National Grid Reference TQ 2112 1562	

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		25.10
	Lined and filled with olive black (SY 2/1) silty clay passing down to		25.50
	Sand very similar to above, very fine grained, very silty, very clayey. Fine compact relatively friable. Olive grey (SY 3/2) to light olive grey (SY 5/2).	1.00	
	(?) Some scattered glauconite and white mica, rather more abundant than before, little trace of original lamination. Intensely bioturbated. Very many anastomosing burrows, many lined and filled with olive black (SY 2/1) clay. Poorly preserved bivalve at cost at 25.58m. Sub-rounded 3cm diameter flattened massive pyrite nodules at 25.70m. Sediment sands very slightly of pyrite. Very small (2mm) white calc. shell fragment at 26.65m. and small bivalve casts at 25.28, 25.30m. Small creamish-white calc. shelly fragments common between 25.32 - 25.43m, with occasional small 1.5cm roughly ovoid massive pyrite nodules. Small shell fragments at 26.50m. passing down to		26.50

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

National Grid

Reference

TQ21NW/1

TQ.2112 1562.

Page

17.

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		26.50
	Siltstone relatively coarse very sandy, clayey, olive grey (SY 3/2).	1.20	
	Faint traces of original lamination. Intensity bistratified. Olive black (SY 2/1) clay burrows lining and distributed laminar.		
	(?) some scattered glauconite and white mica.		
	Scattered common shell debris Roughly void massive pyrite nodules at 26.75m.		
	Large relatively well preserved bivalves at 26.78m. Some oblique preserved between 26.50 - 26.78m.		
	Becoming more sandy between 27.05 - 27.13m with fine sand (?) 1m wide 2-3 cm diameter horizontal (?) Onolaccan burrows.		
	Vertical fissure 27.25-27.40m. Numerous sub-horizontal fissures and streaked surfaces between 27.40 - 27.43m.		
	Large relatively well preserved bivalves at 27.70m.		
	passing down to		27.70
	Mudstone very silty, sandy, compact, firm, tough, olive black (SY 2/1).	0.60	
	No glauconite seen. Scattered white mica.		

Name and Number of Shaft or Borehole: NEPTOWN	6-in Map Registration No. TQ21NW/1	Page 18
	National Grid Reference TQ.2112 1562	

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		27.70.
	Partly preserved lamination bioturbated. fine silt filled burrows mostly sub-horizontal, up to 2mm diameter and disturbed. Silt laminae. Some large sub-horizontal burrows up to 1.5 cm diameter (? crustacean burrows), filled with very fine slightly glaucous silty sand at 27.82. Occasional small pockets (?) barrow fillings Very small (2mm) whitish-a cream calc. shell fragment at 27.82m. Scattered very small (1-2mm) shelly fragments between 28.00 - Passing down to		28.30
	Siltstone clayey, sandy, firm, traces of original lamination, bioturbated, slightly calcareous. Scattered glaucous. Sand & disturbed burrows and laminae. olive grey (5Y3/1). Slight smell of pyrite. Large brachia fragment at 28.33m. Numerous silty-sandy glaucous lamination and (?) disturbed burrow fillings between 28.70 - 28.50m. Shell debris relatively common at 28.38m. Irregular pyrite nodules at 28.63m. Large brachia (2) at	1.27	

Name and Number of Shaft or Borehole: NEP TOWN	6-in Map Registration No. TQ21NW/1	Page 19
	National Grid Reference 70.2112 1562	

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		28.30
	28.68 m. in life position at 28.88 m. Rather more friable from 28.68 - 28.72 m. Small shells and shell debris common between 28.80 - 29.00 (Many shells (?) immature (?) juveniles.) In small clusters. Bioturbation more intense below 29.20 m. passing down to		29.57
	Core returned unbroken below 29.57 m.		
	Mudstone silty, massive, compact. dark olive gray. (SY 3.11) Traces of original lamination Bioturbation. Silt wisps and lenses, (?) burrow fillings. Some scattered white mica, blocky, to sub-conchoidal fracture, becoming less silty downwards passing to		29.70
	Mudstone Compact, massive, silty at top. Olive gray (SY 4.11), little sign of original lamination Bioturbated (?) Slightly soapy, feel becoming much less silty downwards and between ~ 29.90 - more soapy with rather compact waxy texture. Very homogeneous of Fullers Earth. Between 30.00 m. core breaking very readily on drying to crudely rectangular blocks	0.85	

Fullers
Earth (?)

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

TQ21NW/1

Page

National Grid

Reference

TQ 2112 1562

20

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		29.70
	Occasional slickensided surfaces below ~30.20m. Sharp base.		30.55
	Sandstone Very fine grained, very silty and clayey, compact massive, firm, friable, strongly glauconitic. Olive gray (SY4/1) to greenish gray (SY43/1) Slightly calcareous. Scattered white mica. Less calcareous below 32.50m. Traces of original lamination disturbed. Burrows and burrow linings of olive black (SY2/1) clay. Large bivalve at 30.68m. occasional shell fragments and (?) complete ones seen. Top (?) penetrated by burrows filled with overlying mudstone burrows (?) penetrate 2-3cms. Core broken below 31.09m. oblique fissures below 31.20-31.40m. 31.60-31.70m. Large bivalves (?) not in life position at 31.24-31.30, 31.22, 31.42, 31.47, 31.50m. Crushed large bivalve fragments at 31.60m and occasionally below 32.50m die out ~ 32.00m. Vertical fissure 31.90-32.35m. Glauconite much more abundant below 32.00m.	3.64	

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

TQ21NW1

Page

National Grid

Reference

TQ 2112 1562

21

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		30.55
	Disseminated crystal pyrite (?) in burrows at 32.26, 32.30m. Large bivalves below ~ 32.55m. Some high angle oblique fractures between 32.50-33.50m. Becoming less firm and more friable between 33.50- 33.62m. Discontinuous disturbed clay laminae (?) and relatively more abundant below 33.00m. Sub-horizontal Prominent glauconite, rich burrows fills 2-3mm diameter passing down to		34.19
	Sandstone very fine grained very similar to above strongly calcareous, fine, becoming hard on drying. greenish grey (59Y5/1) Original lamination present though strongly disturbed. Very thin dark black (5Y2/1) clay laminae. Scattered glauconite common some scattered white mica. Occasional large shell fragments up to 2cm. Sub vertical fissure 34.26-34.45m. and between 34.60-35.00m. Large ~ 1cm diameter burrows filled with silty material, similar to matrix. at 34.67, 35.40, 35.50m. large bivalves at 35.28m. Becoming rather less hard below ~ 34.75m and very	1.46	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

Page

NEP TOWN

TQ21NW/1

National Grid Reference

52112 11562

22

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		34.19
	closely resembling lithology above.		
	Becoming harder 35.30m +		
	passing to		35.65
	Sandstone very fine grained	0.55	
	silty, firm compact. Some		
	scattered glauconite, less than		
	above. Scattered white mica.		
	Slightly calcareous. Numerous		
	discontinuous clay laminae and		
	burrows (1-2mm diameter)		
	Relatively intensely bioturbated.		
	yellowish grey-light olive grey		
	(SY 6/1 - SY 8/1). Clay burrows		
	fillings of olive beads (SY 2/1)		
	clay. Some large up to 2cm.		
	diameter burrows, filled with		
	similar material to matrix.		
	Small shell fragments.		
	Original laminae much less		
	distinct between 36.06m.		
	passing down to		36.20
	Sandstone very fine grained	0.17	
	silty, compact, hard, blocky.		
	fracture, strongly calcareous		
	Some scattered glauconite		
	and white mica.		
	No sign of original lamination		
	Intensely bioturbated. Some		
	clay filled burrows up to		
	2mm. diameter. Discontinuous		
	clay laminae, disturbed by		
	compaction.		
	olive grey (SY 5/1)		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW / 1

Page

National Grid Reference

TQ 2112 5762.

23

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		36.20
	Large bivalve at 36.30m		
	-upto. 3cm. long. 1cm. diameter		
	vertical burrow filled with		
	sand identical to matrix.		
	Local with glauconitic sand		
	passing down to		36.37
	Sandstone fine grained, rather	2.00	
	clayey, silty, firm, compact		
	Some scattered glauconite		
	a little white mica.		
	Strongly calcareous.		
	Original lamination well preserved.		
	Similar to lithology at 35.65m		
	(rather more clay).		
	Numberous discontinuous		
	clay laminae and burrow fillings		
	Relatively intensely bioturbated.		
	olive grey (5Y 4/1) to light		
	olive grey (5Y 6/1).		
	Small bivalve at 36.40m.		
	large bivalve at 36.78m.		
	sub vertical fissure from 36.50-		
	37.50m., 37.70-38.37m.		
	becoming rather harder below		
	36.60m.		
	Sand filled burrows up to		
	1cm diameter below 36.70m		
	Large 2cm diameter burrow		
	with concentric fill at 36.87m		
	relatively common below		
	37.20m		
	Small (2cm). Crystalline		
	pyrite nodules at 37.17m		
	with acicular crystals in.		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW/1

Page

National Grid Reference

TQ.212 5162

24

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		36.37
	cavities.		
	(?) chitinous shell fragment at 37.60m.		
	Softer and relatively more friable below 37.70m.		
	passing down to		38.57
	Sandstone very fine grained, silty, compact, massive, hard, blocky fracture (very similar to sandstone at 36.20m but to sediment immediately above.	0.34	
	strongly calcareous. Some shell fragments.		
	A little scattered glauconite		
	Little trace of original lamination		
	Strongly bioturbated. Burrows up to 1cm. filled with sand.		
	identical to matrix.		
	Olive grey (5Y4/1 - 5Y5/1)		
	Some olive black (5Y2/1)		
	discontinuous very thin clay laminae and burrow fillings		
	Clay laminae disturbed by compaction		
	passing to clay to		38.71
	Sandstone Very fine grained, silty, compact, massive, hard - not as hard as above. A little scattered white mica and glauconite	2.64	
	Relative well preserved original lamination. Or tensely bioturbated		
	- a few oblique sand filled		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

Page

NEP TOWN

TQ21NW/1

National Grid Reference

TQ 2112 5162

25

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		38.71
	up to 2mm. and filled with clay.		
	Scattered shell fragments generally < 1mm. but up to 2mm.		
	Generally light olive grey (SY6/1) - (SY7/1)		
	Members olive black (SY2/1) to olive grey (SY3/1)		
	discontinuous - clay rich laminae.		
	Sub horizontal pyritised burrow 5mm. diameter		
	extending across core at 38.75m and 5mm. diameter		
	sub-horizontal pyritised burrows at 39.10m.		
	Large bivalve at 39.10m.		
	Large bivalve and fragments at 39.17m, also at 39.94m		
	Sub vertical fissures at 39.70 - 39.88m.		
	Bivalve fragments common below 39.50m.		
	Some scattered glauconite below 39.50m, being rather more abundant below 40.00 - 40.10.		
	2-3 mm. diameter sub-horizontal pyritised burrow at 40.14m		
	(?) traces of low angle cross bedding at 40.30m and between 41.00 - 41.07m.		
	Olive black, very hard strongly calcareous nodules		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

Page

NEP TOWN

TQ21NW/1

National Grid Reference

TQ 2112 5162

26

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		38.71
	2-3 cm. diameter at 40.10m		
	(?) calcareous burrow fill at 40.67m		
	Sub vertical fissure 41.25-41.35m (end to 41.50m).		
	passing down to		41.35
	Sandstone very fine grained, silty, compact, massive, hard to very hard, hackly fracture. (Very similar to sandstone at 38.77m. Occasional glauconite grains. Strongly calcareous. Some lustre mottling. Scattered very fine shell debris generally < 1mm. light olive grey (5Y 2/1) Little sign of original bedding. Strongly bioturbated. Occasional olive black (5Y 2/1) discontinuous very thin clay laminae and burrow linings. (?) Some pyrite - smells slightly of pyrite when struck. passing down to	0.28	
	Sandstone very fine grained, silty, compact, firm, strongly calcareous, traces of original lamination. Strongly bioturbated. light olive grey (5Y 6/1) Mottled olive black (5Y 2/1) clay. No. of discontinuous disturbed laminae and burrow infillings	0.75	
			41.63

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

Page

NEP TOWN

National Grid Reference

TQ. 2112 5162.

27.

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		41.63
	Very occasional scattered glauca glauconite. Rare scattered very small shell fragments.		
	Some sub-horizontal clay-filled burrows up to 3mm diameter, some wider 1-2 cm, burrows filled with sediment identical to matrix, a few burrows filled with very hard cement. Locally slight small of pyrite when struck.		
	Sub-vertical fissure from 41.43 - 42.30m		
	large 3mm diameter flattened horizontal (?) crustacean burrow at 42.25m passing down to		42.38
	Sandstone very fine grained, silty, compact, massive, hard becoming very hard (very similar to above but harder) below 42.50m with fine sparry calcite cement, strongly calcareous coarse sparry calcite cement locally visible at 42.39m (?) a little scattered glauconite. Rare white mica grains. Some very small < 1mm. shelly fragments - locally common. No trace of original lamination. Very strongly bioturbated. Light olive grey (5Y 6/1)	0.80	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

Page

National Grid Reference

28

NEP. TOWN

TQ 2112 5162

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		42.38
	to light grey (N7) relatively numerous olive black (5Y 2/1) (?) discontinuous disturbed clay laminae and burrows, fillings up to 2mm diameter (horizontal- vertical). Sub-horizontal burrows fill up to 1.5cm diameter with outer clay lining and concentric fill of sand identical to matrix. Smells slightly of pyrite when struck. Massive pyrite partly infilling or replacing burrows filling at 42.95m. passing down to		43.18
	Sandstone much like above but with rather more clay laminae. very fine grained, silty, very much. like sandstone at 41.63m. Strongly calcareous, fine, compact, loosely friable. (?) a little scattered glauconite and white mica. Traces of original lamination with some very large diameter sub-horizontal burrows (up to 1.5 ^{cm}). Material similar to matrix. Light olive grey (5Y 6/1) to yellowish grey (5Y 8/1), numerous olive black (5Y 2/1) disturbed discontinuous clay laminae and burrow fillings - clay filled	1.02	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

NEP TOWN

6-in or 1:10 000 Map Registration No.

TQ21NW 11

National Grid Reference

TQ 2112 5162

Page

29

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		43.18.
	barrenes up to 2-3 mm.		
	Some scattered ? steel fragments		
	< 1 mm.		
	1-2 mm diameter sand filled		
	barrenes filled with clay		
	common below 43.50 and		
	43.70 m.		
	Sub-vertical fissures from		
	43.20 m.		
	Large 3cm diameter flattened		
	horizontal barrenes filled		
	with olive grey (SY4/1)		
	clayey sand (?) crustacean		
	barrenes, slight concentric		
	fill at 44.00 m.		
	Schists 2-3mm diameter		
	pyritised barrenes fill at		
	44.17 m.		
	(?) Sharp base - not seen.		44.20
	Below may represent a large		
	caved block. - casing down to		
	44.10 m.		
	Mudstone massive, very	0.05	
	slightly silty, olive grey		
	(SY4/1), blocky to sub-		
	conchoidal fracture. Scaly feel,		
	resembles fuller earth, strongly		
	resembles mudstone at 29.70m		
	and may be a fault be a casing		
	(?) Sharp base - not seen.		44.25
	Sandstone (as above) Very fine	1.05	
	grained, silty, compact, locally friable		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

NEP TOWN

6-in or 1:10 000 Map Registration No.

TQ 21 NW 11

National Grid Reference

TQ 2112 5162

Page

30

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		44.25
	strongly calcareous. generally olive grey (SY 6/1) Traces of original lamination, strongly bioturbated. Numerous olive black (SY 2/1). Clay burrow fills and discontinuous disturbed laminae. Some large 2-2.5cm sub-horizontal to vertical up to 4 cm long burrows with concentric fill of sand identical to matrix, at and below 44.45m. Shows strong development of calcareous cement (?) a few scattered glauconite grains, very small and (?) Immature bivalve at 44.45m. Very rapid passage - contact seems to be oblique, cutting all other structures		45.22-45.30
	Sandstone Very fine grained, silty, compact, very hard, very strongly calcareous. Sparry calcite cement visible. No trace of original lamination. Strongly bioturbated (?) Slightly foetid smell when struck. Light-olive grey (SY 6/1) to light grey (N7). A few scattered glauconite grains. Small scattered shell fragments. < 1mm. Some olive black (SY 2/1) discontinuous disturbed clay laminae and burrow linings - difficult to see in freshly broken	0.23	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW/1

Page

National Grid Reference

TQ 2112 5162

31

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		45.30
	material (?) worked by caliche cement.		
	High angle oblique fissure at 45.26m - 45.50m.		
	rapid passage to		45.53
	Sandstone Very fine grained, silty, compact, firm, strongly calcareous. Traces of original bedding. Strongly bioturbated. Generally olive grey (SY5/1). A few scattered glauconite grains, a little white mica. Numerous olive black (SY2/1) disturbed discontinuous clay laminae and brown fillings. Few clearer burrows. In places becoming cleaner downwards with sub-horizontal burrows up to 2cm diameter with concentric fill of sand identical to matrix. Oblique fissure 46.00-46.10m. Large burrows 1-2m. fills at 46.33m and below. Very hard, strongly calcareous cement. Relatively soft and friable between 47.30-47.40m (?) due to drilling. Small sub-rounded (?) phosphatic nodules or burrow fill up to 1cm at 46.44 + 46.66m. Rock loosely streaks of pyrite when struck passing down rapidly to	1.92	
			47.45

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW/1

Page

National Grid Reference

TQ 2112 5162

32

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		47.45
	Sandstone very fine grained, silty, compact, very hard, very strongly calcareous.	0.18	
	light olive grey (SY 7/1)		
	A little scattered glauconite and a few very small (<1mm) shell fragments, plus white mica.		
	Little sign of original lamination. Strongly bioturbated. Some olive black (SY 2/1) discontinuous disturbed clay laminae and burrow fills, details difficult to discern in freshly broken material.		
	passing down very gradually to contact, oblique across core		
	vertical fissures 47.43-47.70m		
	Slight fractid small when struck		47.57-47.63
	Sandstone Very fine grained, silty, firm, compact, locally friable, strongly calcareous.	4.45	
	A few scattered glauconite grains. Traces of original lamination. Strongly bioturbated olive grey (SY 4/1 - SY 5/1)		
	Numerous disturbed discontinuous olive black (SY 2/1) thin clay laminae and burrow linings. Some sand filled burrows up to 1cm. Tubercle crystals pyrite nodules 2.5cm diameter at 47.78m.		
	Several sub-horizontal fissures between 47.82-47.98m		
	Core rather flattened between 48.15-48.49m		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW11

Page

National Grid Reference

TQ 2112 5162

33

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		47.63
	Large 5cm diameter olive black (SY 2/1) and dark yellowish brown (10YR 4/2) (?) phosphatic and pyritic burrow fill at 48.33 m. Several fillings of oblique burrows 1cm diameter and up to 7cm long with very well developed calcareous cement below 48.60m. Dark brown (?) phosphatic (? also pyritic) nodules as burrow fills up to 2cm diameter relatively common apparently associated with large diameter (1cm) and filled burrows (concentric filling) between 49.23-49.50m. Some nodules show glauconite outer coating.		
	Large bivalve at 49.37 and 49.43m.		
	Oblique fissure 49.35-49.36m		
	Massive pyrite nodules at 50.25m. horizontal burrow fill 2.5cm, 8cm long.		
	Small shell fragment 4mm across, ribbed bivalve at 50.29 and 50.33m.		
	Whole sediment smells very slightly of pyrite when struck.		
	Loss of Core 51.50-51.96m.		
	Sandstone as above panning rapidly down to		52.08
	Sandstone Very fine grained	0.39	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

NEP TOWN

6-in or 1:10 000 Map Registration No.

TQ 21NW/1

National Grid Reference

TQ 2112 5162

Page

34

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		52.08
	silty, compact, very hard, heavy, strongly calcareous.		
	Light olive grey (SY 6/1) to light grey (N7).		
	A little scattered glauconite		
	A few scattered very small < 1mm shell fragments and a few scattered white mica grains.		
	Little sign of original lamination		
	Relatively strongly bioturbated		
	Foetial smell when struck		
	Olive black (SY 2/1) clay		
	burrows fills up to 2mm diameter and some discontinuous disturbed clay lamination.		
	passing down to		52.47
	Sandstone Very fine grained, silty, compact, firm, locally friable, calcareous.	4.15	
	Generally light olive grey (SY 6/1), traces of original lamination, strongly bioturbated		
	Numerous olive black (SY 2/1) clay rich laminae and burrows filling and linings, disturbed and discontinuous.		
	A little scattered glauconite and a few grains of white mica.		
	Some clay filled burrows up to 2cm and sand filled burrows up to 1cm.		
	Small (1-2 cm) gypsum		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW/1

Page

National Grid Reference

TQ 2112 5162

35

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		52.47
	(selenite) crystals on sub-horizontal fracture or joint surface at 52.70 m.		
	Numerous vertical or oblique fissures between 52.80 and 53.10 m.		
	Patchy very hard calcareous cement developed (?) in long (2 cm) diameter horizontal burrows at c 53.16 m.		
	Locally streaks of pyrite when struck.		
	Large bivalves and (?) pyritised bone / wood fragment at 53.88 m.		
	Large bivalve ? Perna at with wide 1.5 cm horizontal burrows with light olive-brown (SY 5/6) ? phosphatic sandy fill, hard calcareous central burrow fill at 54.15 m.		
	Cone Loss 55.00 - 55.35 m.		
	Sandstone as above, cone badly broken between 55.50 - 55.87 m.		
	Some vertical and sub vertical fissures between 56.00 - 56.58 m.		
	Patch of hard calcareous cement sandstone 5 cm thick at 56.23 m, extending half way across core.		
	pening rapidly to		56.62

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW 11

Page

National Grid Reference

TQ 2112 5162

36

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		56.62
	<u>Sandstone</u> Very fine grained, silty, compact, very hard, heavy, strongly calcareous. Little sign of original lamination. Strongly bioturbated. Olive grey (SY 4/1) (SY 5/1). A few scattered glauconitic grains. Numerous olive black (SY 2/1) disturbed discontinuous clay laminae and burrow fills. Many sand filled burrows up to 1 cm. diameter. Foetid smell when struck. Passing rapidly down to oblique contact.	0.52	57.07-57.14
	<u>Sandstone</u> very fine grained, silty, compact, firm, calcareous. Faint traces of original lamination. Olive grey (SY 4/1 - SY 5/1). (?) very occasional glauconitic grains and shell fragments < 1 mm. Strongly bioturbated. Numerous olive black (SY 2/1) clay rich discontinuous disturbed laminae and burrow fillings. Dark brown (?) phosphate burrow fill 1 cm. diameter at 57.39 and 57.61 m. Poorly preserved ribbed brachio at 57.95 m.	2.18	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

NCP. TOWN

6-in or 1:10 000 Map Registration No.

TQ 21NW/1

National Grid Reference

TQ 2112 5162

Page

37

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		57.14
	vertical fissures from 58.00 to 59.30m. Oblique fissures from 59.00 - 59.20m. passing down rapidly to		59.32
	Sandstone Very fine grained, silty, compact, massive, hard heavy, strongly calcareous. (?) traces of original lamination. Strongly bioturbated. Olive grey (SY 4/1 - SY 5/1) Occasional scattered white mica and glauconite grains. Scattered small < 1mm shell fragments, numerous olive black (SY 2/1) clay rich, discontinuous disturbed laminae and burrow fillings. Ribbed bivalve at 59.36m. Small ? immature ribbed bivalve at 59.41m. Fossil pyritic small when struck passing rapidly to	0.30	59.62
	Sandstone Very fine grained, clayey, silty, fine, compact, calcareous. Traces of original lamination. Strongly bioturbated. A few scattered glauconite grains and white mica. Generally olive grey (SY 4/1 - SY 5/1), numerous olive black (SY 2/1) clay rich laminae and burrow fillings, discontinuous and disturbed	0.83	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW/1

Page

National Grid Reference

TQ 2112 5162

38

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		59.62
	Some sand filled burrows (fill very similar to matrix) up to 1 cm diameter, locally sand filled burrows relatively strongly cemented.		
	Sub vertical fissure 59.75-59.96m Light olive brown (SY 5/6) stained (?) phosphatic (?) burrow fill c 1.5 cm diameter at 60.18m Success burrows at 60.20m Soilment smells of pyrite when struck. passing rapidly to		60.45
	Sandstone Very fine grained, silty, compact, massive, hard, heavy, strongly calcareous, spongy calcite. Some traces of original lamination. Strongly bioturbated. Olive grey (SY 4/1 - SY 5/1) to light grey (NT) Some scattered very small < 1 mm shell fragments. (?) a few scattered glauconite grains Numerous olive black (SY 2/1) discontinuous disturbed clay rich laminae and burrow fillings. Brown (?) phosphatic burrows 5 mm diameter at 61.14m. Smells of pyrite when struck passing down rapidly to	0.93	61.38

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW / 1

Page

National Grid Reference

TQ 2112 5162

39

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		61.38.
	Sandstone Very fine grained, silty, rather clayey, friable (?) due to drilling, calcareous. Traces of original lamination strongly protuberated. Generally olive grey (5Y 4/1) numerous olive black (5Y 2/1) discontinuous and disturbed clay-rich laminae and burrow fillings. Some burrows up to 1cm diameter. Sub horizontal, shows development of hard calcareous cement.	1.57	
	Numberous vertical fissures between 61.50-62.92m. Vertical fissuring very pronounced between 62.50m with core splitting readily along vertical fissures down to 62.92m. Very small (1-2mm) bivalve fragments at 62.95m passing down to		62.95
	Sandstone fine grained, silty, scattered glauconite, calcareous, firm, Olive grey (5Y 5/1) to light olive grey (5Y 6/1). Strongly protuberated. No sign of original lamination. Numerous olive black (5Y 2/1) discontinuous disturbed thin clay rich laminae and burrow fills. Some vertical clay filled burrows up to 1cm, very patchy	0.35	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW 11

Page

National Grid Reference

TQ 2112 5162

40

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		62.95
	development of very strong calcareous cement, irregular, vague, very hard calcitic nodules up to at least 10cm diameter.		
	Brown (?) phosphatic burrows fill or nodules at 63.10m.		
	Oblique fissure and slickensided surfaces in places with green glauconite coating. Surfaces coated with < 1mm thick crystalline calcite at 63.07-63.16m.		
	Wide (10cm) diameter branching oblique burrows between 63.20 -		
	poning down to		63.30
	Sandstone Very fine grained, very strong, calcareous cement. very hard and heavy.	0.38	
	Scattered glauconite grains, greenish grey (594 6/1)		
	No trace of original lamination		
	Large 1cm diameter burrows		
	Oblique and vertical, much disturbed by solution and cementation, filled with olive black (542/1) clay rich sediment, all with calcitic cement.		
	Small gastropod at 63.50m		
	Dusky yellow (546/4) nodules, olive brown to olive grey (543/2) rounded phosphatic		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

Page

TQ 21NW/1

National Grid Reference

TQ 2112 5162

41

NET TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		63.30
	nodules at 63.52m		
	Very prominent vertical open fissures. Thin <1mm skin of crystalline calcite.		
	passing down to		63.68
	Sandstone. Very fine grained, silty, compact, firm, calcareous. Traces of original lamination (?) a few scattered glauconite grains. Strongly bioturbated. Some scattered very small <1mm shell debris. Generally olive grey (5Y 4/1) Numerous olive black (5Y 2/1) discontinuous disturbed thin clay rich laminar and burrows with rather indefinite boundaries. Very hard band with abundant dense calcite cement extremely abundant from 63.91-64.02m, in this band becomes greenish grey (5Y 6/1) with a little scattered glauconite visible. Small bivalve at 65.38m. Vertical fissure from 64.10-64.90m and 65.00-65.43m. Soft brown (?) phosphatic nodules (2cm diameter) or burrows filled at 64.65m. Locally smells very slightly of pyrite when struck. Solid core breaking easily	4.80	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW 11

Page

National Grid Reference

TQ 212 5162

42

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		63.68
	along vertical fissures 65.43 - 65.76 m. Core much broken.		
	along fissures 65.76 - 66.95 m		
	? some pyritized sickenstedt joint surfaces between 66.70 - 66.95 m. Vertical fissures 66.95 - 67.50 m.		
	(?) Phosphatized burrow 1 cm. diameter at 66.90 m.		
	Oblique fissure 68.06 - 68.48 m		
	(?) disturbed zone leading between 68.06 - 68.08 m.		
	(?) panning down to 68.48.		68.48
	Sandstone Very fine grained, silty, compact, massive, hard, stringy calcareous. Traces of original lamination moderately to stringy bioturbated olive grey (5Y5/1). Some scattered very fine (<1 mm) shelly debris. Numerous olive black (5Y2/1) discontinuous, disturbed clay rich laminae and burrow fillings. Vertical and sub-vertical fissures with very thin calcite coating and traces of horizontal sickenstedt between 68.50 - 68.72 m. passing down to	0.27	
	Sandstone Very fine grained, silty, firm, compact, calcareous	0.99	68.75

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

Page

National Grid Reference

NEP TOWN

TQ 2112 5162

43

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		68.75
	Traces of original lamination, moderately to strongly bioturbated. Generally olive grey (SY4/1). Numerous olive black (SY2/1) discontinuous disturbed clay rich laminae and burrow fillings, with material identical to matrix. Some sand filled burrows up to 1.5cm diameter, with concentric fill (?) a little scattered glauconite. Some scattered very fine <1mm. shell debris. Vertical fissures splitting readily along vertical planes below 69.50m. One much broken between 68.75-69.50m. Large poorly preserved (?) bivalve and 1cm. diameter brown. (?) phosphatic nodules at 69.40m. Oblique fissure from 69.70-69.74m. passing down to		69.74
	Sandstone very fine grained, silty, compact, massive, hard, heavy, strongly calcareous. Some scattered fine shell debris. Little sign of original lamination, strongly bioturbated. Generally olive grey (SY4/1) to light grey (N7).	0.11	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW / 31

Page

National Grid Reference

TQ 2112 5162 .

44

NEP. TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		69.74
	Numerous olive black (SY 2/1) discontinuous clay rich mounds and burrow fills (?) in part disturbed laminae passing down to		69.85
	<u>Sandstone</u> very fine grained, silty, compact, massive, calcareous very much like that at 68.75 m. (?) a little scattered glauconite. Some scattered very fine shell debris (<1mm). Olive gray (SY 5/1) to light gray (N7)	0.15	70.00
	<u>Sandstone</u> Very fine grained compact, massive, hard, heavy, strongly calcareous. A little scattered very fine (<1mm) shelly debris. Rare glauconite grains occasional faint traces of original lamination, strongly bioturbated. Generally olive gray (SY 5/1) to light gray (N7) numerous olive black (SY 2/1) discontinuous disturbed clay rich laminae and burrow fillings. Clay filled burrows 2-3 mm. Burrows up to filled burrows ~ 1mm diameter, light-olive gray (SY 5/2) yellowish gray (SY 7/2)	0.45	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW11

Page

National Grid Reference

TQ 2112 5162

45

NEP. TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		
	Gravel up to 1 cm filled with sand identical to matrix Some sand filled burrows ~ 1 mm diameter details of individual burrows generally difficult to distinguish. Ovoid phosphatic nodules at 70.20 m and 70.35 m. Vertical finings with trace of horizontal slickensides and cryptal. gypsum effusion seen at 70.20 - 70.40 m. Shells of pyrite when struck in places strongly panning down to		
	<u>Sandstone</u> Very fine grained, silty, massive, compact, calcareous locally faint traces of original lamination, strongly bioturbated. Generally olive grey (5Y 4/1) Numerous olive black (5Y 2/1) clay rich discontinuous disturbed laminae and burrow fillings. Ducky yellow (5Y 6/4) to yellowish grey (5Y 7/2). Few olivine greenish brown up to 1 cm diameter, sub-vertical to vertical. Nodules up to 1 cm diameter at 70.77 m. (?) A few scattered glauconite grains and a few scattered <1 mm shell fragments bearing	1.25	70.45

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

Page

TQ 21NW 11

National Grid Reference

TQ 2112 5162

45

NEP. TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		70.45
	relatively abundant below		
	71.60m. Vertical to sub-		
	vertical fissures, with in places		
	very thin olive black (SY 2/3)		
	clay coating in places,		
	showing polished surfaces		
	with horizontal stichmarking		
	Cone much broken below.		
	70-86 m. apparently down		
	numerous vertical and sub-		
	vertical fissures.		
	Large bivalve fragment at 71.06m		
	passing down to		71-70
	Sandstone Very fine grained,	0.34	
	silty compact, massive, harder		
	than above, though not as hard		
	as other hard beds. Strongly		
	calcareous.		
	Scattered fine shell debris (1mm		
	relatively abundant		
	olive grey (SY 4/1) to light grey		
	(N7).		
	Traces of original lamination.		
	Strongly bioturbated. Numerous		
	olive black (SY 2/1) discontinuous		
	disturbed clay laminae and		
	burrow linings and fillings.		
	Some complex breccias filled		
	with sand, similar to matrix.		
	and up to 1cm. diameter		
	prominent at 71.90m.		
	Very small (?) immature		
	bivalve at $\approx$ 71.85m		
	Several very prominent vertical		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW/1

Page

National Grid Reference

TQ2112 5162

47.

NEP. TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		71.70.
	finer, often open with $\approx 1\text{mm}$ void. Some horizontal subhorizontal surfaces with streaks of crystalline calcite in places (Core much broken below 72.00m. Becoming very clayey in lowest 2cm.		
	passing rapidly down to		72.04
	Mudstone Compact, massive, very silty and sandy. Rather blocky, earthy fracture, subhorizontal surfaces. (Core very broken) (loose, resembles Fuller's Earth. calcareous. Olive black (SY2/1) No evidence of original lamination seen. (?) Disturbed (?) sand in burrows.		
	passing down to		72.16
	Mudstone Compact, massive, very silty, locally slightly calcareous, soapy feel, blocky, earthy fracture, Very closely resembles fuller's Earth. Dark greenish grey (SY4/1) (Core very broken) Few blocks larger than 5cm. Breaks with smooth angular blocks on drying. Becoming very slightly paler	0.22	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW 11

Page

National Grid Reference

TQ 2112 5162

48

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		72.16
	more waxy and friable below		
	72.36m Numerous horizontal		
	lentic surfaces.		
	A few discontinuous silt laminae		
	up to 1mm below 72.36m		
	Scattered grains of glauconite.		
	Sharp base (?) rippled		72.38
	Sandstone Very fine grained, silty		
	compact, firm, slightly clayey.		
	Calcareous.		
	Traces of original lamination,		
	becoming clearer below 72.90m		
	with less intense cross-bedding		
	Generally olive grey (5Y 4/1)		
	Numerous olive black		
	(5Y 2/1) discontinuous disturbed		
	laminae and burrow fillings.		
	A few scattered grains of		
	shell debris < 1mm. and		
	glauconite		
	Prominent vertical fissures.		
	Some horizontal slickensides		
	clay covered surfaces to		
	joints.		
	Large poorly preserved (?)		
	brachio at 73.35m		
	passing down to		74.50
	Sandstone Very fine grained,	0.25	
	silty, compact, massive,		
	harder than above, calcareous.		
	Very like sandstone at 71.70m.		
	Scattered grains of fine shell		
	debris. (< 1mm) and (?)		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW 1

Page

National Grid Reference

TQ 2112 5162

49.

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		74.50
	'Forams'		
	Traces of original lamination.		
	Moderately bioturbated.		
	Clay-rich laminae.		
	Vertical to sub vertical		
	fossils common, occasionally		
	open with <1mm void.		
	Locally smells of pyrite		
	when struck.		
	passing down to		74.75
	Siltstone Sandy, clayey,	2.10	
	very like above, but not so		
	hard, compact, firm, calcareous.		
	Scattered very fine shell		
	debris, and (?) forams		
	Some traces of original		
	lamination, moderately to		
	strongly bioturbated. Numerous		
	very prominent complex (?)		
	deformed sand filled burrows		
	up to 5mm diameter between		
	74.75 - 75.89m.		
	Olive grey (SY 4/1)		
	Relatively numerous		
	olive black (SY 2/1)		
	discontinuous disturbed		
	clay rich laminae and		
	burrows fills.		
	(?) belemnite or scaphopod at		
	74.90m.		
	(?) bivalve at 74.95m and 76.03m.		
	Small 1cm. platy, nodules at		
	75.34m. Flattened ovoid platy		
	nodules 4cm x 1cm at 75.36m.		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW 11

Page

National Grid Reference

TQ 2112 5162

50

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		74.75
	yellowish grey (SY 7/2) inter layer grading in to olive grey (SY 3/2)		
	prominent oblique fissures 75.50m. 75.70m.		
	Fine sand, in disturbed, burrows and laminae.		
	Becoming rather more sandy and clear laminations below 75.50m.		
	1.5cm diameter horizontal burrow filled with very fine sand		
	extending across core at 75.82m.		
	5mm diameter pyritised horizontal burrows extending across core at 76.04m.		
	Turned out gasteropod at 76.24m.		
	Very intensely burrowed, up to 1cm diameter 76.33 - 76.39m.		
	Massive pyrite nodules up to 2cm at 76.40m.		
	Poorly preserved large bivalve at 76.45m.		
	Yellowish grey (SY 7/2) clay grade incipient nodules (?) plus 2cm thick extends across core at 76.50m. A few sub horizontal 1mm diameter burrows filled with similar material.		
	Olive black (SY 2/1) 1cm diameter phosphatic nodules with a little pyrite at 76.55m.		
	Vertical fissure from 76.50m.		
	Fragment of (?) large ribbed bivalve at 76.69m.		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

Page

National Grid Reference

NEP TOWN

TQ 21NW/1

TQ 2112 5162

51

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		74.75
LOWER GREEN SAND	Bivalve and fish scales at 76.75m., with 1.5 cm. pyrite nodules. Sharp base, much disturbed by burrowing. Burrows filled with sandy silt up to 2cm diameter penetrate up to 14 cm into underlying unit.		76.80
WEALD CLAY	Mudstone massive, compact, homogeneous Dark greenish grey (SY 4/1) Occasional ostracods, mainly as casts, initially portings rich in ostracods with lots below 77.35m. Very slightly calcareous locally (?) due to ostracods. Pyritised vertical burrows 5 cm diameter, 3 cm long at 76.96 m. Core much sheared by drilling between 76.80-76.90 m. Numerous horizontal lenticular surfaces between 76.23-76.29m giving rather friable texture. Portings very rich in ostracods and fish scales and spines at 77.24 m. Large bivalve with ostracods at 77.48 m. Very poor core 77.50-77.70m.	0.70	77.50

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

NEP TOWN

6-in or 1:10 000 Map Registration No.

TQ 21NW 11

National Grid Reference

TQ 2112 5162

Page

S2

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		77.50
	Mudstone massive, compact, fairly hard, biturbated, earthy fracture light olive grey (SY 6/1) Scattered ostracods and fish scales. (Core very poor and much broken - blocks, bounded by slickensided surfaces)	0.16	
	Mudstone compact. Little sign of laminae, coarsely finit. Very scattered isolated ostracods and small fragments of fish. Occasional pyritised. Vertical and horizontal burrows up to 1 mm diameter. The disturbed silt laminae apparently panning down to	0.10	77.66
	Mudstone silty, well laminated, silt in laminae up to 2 mm thick, becoming more abundant downwards. Generally moderately biturbated. Strongly biturbated with loss of laminae between 77.80-77.84 m. Generally olive grey (SY 3/1) with very light grey (NS) silt laminae. Less biturbation in lower 1 cm. Sharp channelled base.	0.10	77.76
	Siltstone well laminated,	0.05	77.86

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW/1

Page

National Grid Reference

TQ 2112 5162

53

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		77.86
	clayey at top. Very light grey (N8). A few burrows up to 2 mm. Some micro faulting. Sharp channelled base.		77.91
	Mudstone Poorly laminated, olive grey (5Y 2/1), locally with patchy greenish grey (5GY 6/1) between 78.00-78.05m. Occasional 2-3mm. silt laminae. A few fish scales in a cluster at 78.18m. Rather friable and (?) disturbed by drilling to 78.20m, more compact between 78.20 and base. Scattered ostracods, passing down to	0.36	78.27
	Mudstone Very silty, compact, relatively hard, traces of original lamination. Disturbed Light olive grey (5Y 6/1) Scattered ostracods common, becoming more abundant downwards. Ostracods (?) concentrated in horizontal burrow fill lam. diameter at 78.35m. passing down to	0.08	78.35
	Mudstone Compact, poorly laminated, relatively friable. Olive black (5Y 2/1) Occasional very thin silt	1.23	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW/1

Page

National Grid Reference

TQ 2112 5162 .

54

NET TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		78.35
	Laminae (<1mm) and thin partings of ostracods with tests, locally a few fish fragments.		
	A few discontinuous silt laminae up to 2mm thick at 78.50m. Horizontal distrib surfaces common between 78.53-78.57m.		
	Ostracods die out below 78.50m.		
	Colour becoming olive grey (544/1) below 78.65m.		
	Silt laminae becoming more numerous below 78.75m.		
	Colour becoming olive grey (545/1) below 79.00m. and medium grey (N5).		
	Ostracod rich partings below 79.35m.		
	Bivalve (?) in life position at 79.50m		
	Discontinuous horizontal laminae (5mm) composed of ostracod debris with a few fish fragments below 79.45m.		
	passing down to		79.58
	Mudstone generally medium grey (N6) Numerous well marked silt laminae up to 2mm thick very light grey (N8), becoming 4mm thick near base.	0.42	
	Disturbance in some silt laminae, with locally silt filled burrows up to 2mm diameter		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

NET TOWN

6-in or 1:10 000 Map Registration No.

TQ 21 NW 11

Page

National Grid Reference

TQ 2112 5162

55

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		79.58.
	Micro faulting - reverse fault in thick silt laminae up to 1cm thick at 79.83m. Lamination destroyed by slumping and denudating phenomena. ls give relatively homogeneous mudstone in regular beds from 79.89-79.92m. passing down to		80.00.
	Mudstone dark greenish grey (SGY 3/1), poorly fissile. A few thin (< 1mm) silt laminae. Numerous horizontal listric surfaces to 80.18m making rock rather friable, becoming firm and more massive and very slightly pater. In colour below 80.18m. Fish fragments at 80.20m. Thin parting of ostracods and some fine fish debris at 80.24m. passing down to	0.29.	80.29.
	Mudstone Compact, relatively massive, dark greenish grey (SGY 4/1), occasional partings of ostracods with. tests and a few fish fragments with. locally a few pale brown (?) faecal pellets, some horizontal listric surfaces initially becoming more compact below 80.28m. with faint lamination	0.47	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

NEP TOWN

6-in or 1:10 000 Map Registration No.

TQ21NW / 1

National Grid Reference

TQ 2112 5162

Page

56

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		
	and scattered ostracods in addition to ostracod rich partings, blocky fracture. Initially becoming relatively more fine below 80.40 m.		
	Small crushed gastropods with ostracods and fish scales in partings below 80.47 m.		
	Horizontal electric surfaces between ~ 80.50 - 80.55 m.		
	Ostracods and shelly debris in places to fill flattened horizontal burrows up to 2 cm.		
	Poorly preserved large bivalves in partings at 80.65 m with ostracods and fish debris.		
	Large bivalves and small gastropods, fish spines and ostracods in parting at 80.68 m. (bivalves as single valve concave upwards)		
	A few silt laminae at 80.74 m, passing down to		80.76
	Mudstone relatively fine, lamination becoming clearer downwards. Greenish black. (5 c, 2/1). (rather disturbed by drilling)	0.10	
	Small (up to 2 mm) ovoid brownish (?) faecal pellets, associated with fish debris at 80.84 m, from 80.80 - 80.85 m.		
	A few horizontal and oblique		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW/1

Page

National Grid Reference

TQ 2112 5362

57

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		80.76
	lustrous surfaces, 2 mm diameter		
	(?) oblique pyritised burrows		
	at 80.85 m		
	pening down to		80.87
	Mudstone laminated	0.40	
	dark greenish grey (59Y4/1)		
	Thin partings of ostracods		
	and tests and fish debris		
	with some small (up to		
	1 mm) pale brown (?) faecal		
	beetles.		
	Partings generally only		
	1 ostracod thick.		
	Discontinuous ostracod		
	partings at 80.95 m, 5 mm		
	thick (?) infilling small		
	channel ~ 7 cm. across		
	3 mm thick ostracod parting		
	across core at 80.96 m		
	Some horizontal lustrous surfaces		
	between 81.10 - 81.12 m		
	Ostracods (?) filling 1 cm		
	wide horizontal burrows		
	extending across core at		
	81.13		
	Some large fish scales and		
	spines up to 1 cm at 81.15 m		
	(?) small bivalves at 81.25 m		
	4 mm layer of dark soft		
	mudstone at base with fish		
	debris and pyrite.		
	Sharp base		81.27
	Mudstone Silty, relatively	0.23	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW/1

Page

National Grid Reference

TQ 2112 5162

58

NET TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		81.27
	Mudstone friable, medium dark grey (N4). Numerous laminae up to 1 mm thick of very light grey (N8) to yellowish grey (5Y 8/1) silt laminae often much disturbed by bioturbation and (?) in places clumping. Numerous 2 mm. diameter branching or (?) intersecting silt filled horizontal burrows very clearly seen at 81.40 m. Small (up to 5 mm) argillite films at 81.32 m. sharp base		81.50
	Mudstone silty, laminated, medium grey (N5) to olive grey (5Y 5/1) silt laminae becoming more numerous downwards and become ^{very} silty in lower 5 cm. A few silt filled horizontal-oblique burrows up to ~ 2 mm diameter, silty laminae at 81.57 m, shows numerous parallel (?) oblique or early tension cracks with very narrow filling of grey silty clay sharp base - (?) channelled	0.02	81.52
	Mudstone Silty laminated (very like above) Medium grey, (N5) to olive grey (5Y 5/1) silt laminae becoming more numerous downwards, with centricular 1 cm thick rays	0.03	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW 11

Page

National Grid Reference

TQ 2112 5162

59

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		81.52
	Silty lens at base some parallel (?) tension cracks or silt filled burrows at 1-2mm diameter. A few small burrows. Fish scale at 81.54m. Sharp base (?) channelled.		81.55
	(These two units resemble very small scale string upwards rhythms)		
	Mudstone Silty, compact, generally olive grey (545/1) strongly burrowed. Oblique to horizontal (light olive grey 546/1) silt filled burrows up to 2mm diameter clearly seen on outside of core - very small lens obvious on fresh surface Sharp base		81.58
	Mudstone laminated silty medium dark grey (N4), some thin 1mm very light grey (N8) silt laminae in plane shining. (?) micro fault. Relatively numerous horizontal listric surface to 81.62m (core all rather disturbed by drilling) little bioturbation of any. pending rapidly down to	0.12	81.70
	Mudstone Compact, fairly hard	0.41	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW/1

Page

National Grid Reference

TQ 2112 5162

60

NET TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		81.70
	Sub concoidal fracture in top 2cm, becoming finer below.		
	Greenish grey (5Y 5/1) Non-brown oblique burrows up to 2mm wide filled with dark olive grey (5Y 3/1) clay to 81.80m. Apparently to have been disturbed by compaction. A few very thin, very discontinuous silt laminae. A few small 1-2mm diameter silt filled burrows below 81.80m, becoming more common downwards. Very silty, laminae up to 1cm. Thick disturbed by burrowing at 82.03. Very silty in laminae 5cm with relatively little disturbance. The lower 5cm a little contorted (?) due to compaction. Sharp base		82.11
	Mudstone Compact, relatively massive, olive black (5Y 2/1) to dark grey (N3). A few 1-2mm silt filled sub-horizontal burrows. Some scattered ostracods below 82.30m. Ostracod shell fragments with a little fine fish debris at 82.35m + 82.40m. Becoming rather pale coloured	0.33	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW/1

Page

National Grid Reference

TQ 2112 5162

61

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		82.11
	Below 82.41m.		
	Passing down very rapidly to		82.44
	Clay Ironstone compact, massive, very hard, olive grey (5Y 6/1) faint trace of original lamination, from 82.51-82.53m. A few fish scales at 82.46m passing down rapidly to	0.18	
	Mudstone Poorly laminated, medium dark grey (N4) to dark olive grey (5Y 2/1). Relatively fine, some scattered ostracods fish fragments and small (2-1cm) faecal pellets.	0.11	
	Sharp bioturbated base		82.73
	Mudstone silty, laminated, relatively fine, medium grey (N5) to olive grey (5Y 5/1). Discontinuous, 1mm thick, very light grey (N5) silt laminae. Slight bioturbation - a few small horizontal silt filled burrows passing down to.	0.09	
	Mudstone Poorly laminated, relatively fine, dark olive grey (5Y 5/1) with faint darker mottling (?) bioturbation. A few very thin	0.21	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

NEP TOWN

6-in or 1:10 000 Map Registration No.

TQ 21NW 11

National Grid Reference

TQ 2112 5162

Page

62

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		82.82
	Very light grey (N8) discontinuous silt laminae, (fewer than above)		
	passing down to		83.03
	Mudstone Poorly laminated, relatively friable. Dark olive grey (543/1)	0.07	
	passing down to		83.10
	Mudstone Compact, massive relatively hard, Olive grey (544/1). Numerous shadowy wisps of olive black (542/1) oblique clay filled burrows (?) disturbed by compaction.	0.09	
	(?) Sharp base or rapid passage (base not seen)		83.19
	Mudstone Compact, massive, olive black (542/1). A few small scattered fish fragments and small (?) faecal pellets. Horizontal lenticular surfaces 83.38m and 83.41-83.42m.	0.24	
	(?) passing down to (base not seen)		83.43
	Mudstone Compact, poorly laminated, olive grey (544/1) olive black (542/1) oblique shadowing clay burrow fillings up to 1mm, (?) disturbed by compaction. A few very thin discontinuous silt laminae	0.20	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21NW 11

Page

National Grid Reference

TQ 2112 5.162

63

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		83.43
	and silt filled burrows up to 2mm. rapidly passing down to		83.63
	Mudstone Silty, laminated fine, slightly bioturbated. Generally dark olive grey (543/1), with prominent very light grey (N8) silt laminae up to 3mm. Some of laminae discontinuous and lenticular and some much disturbed by burrowing becoming rather more strongly bioturbated below 83.86m. Sharp base	0.27	83.90
	Mudstone compact, poorly laminated, olive black (542/1). A very few silt laminae at $\approx$ 84.07m. A little scattered fine fish debris some $\approx$ 1mm. Brown (?) faecal pellets. Some oblique or horizontal lenticular surfaces. passing down to	0.23	84.13
	Mudstone compact, massive. Olive grey (545/1). Relatively hard, earthy fracture. Some olive black (542/1) sub horizontal compacted clay filled burrows, scattered ostracods. Parting of ostracods	0.07	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TA 21NW/1

Page

National Grid Reference

TA 2112 5162

64

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		84.13
	and fresh debris at 83.15m.		
	passing down to		84.20
	Mudstone poorly laminated,	0.71	
	becoming better with rather		
	more numerous very thin		
	silt laminae downwards		
	to 84.40.		
	Olive grey (545/1), patchy		
	olive black (542/1) to		
	greenish black (592/1)		
	mottling (?) disturbed		
	bioturbation.		
	Locally a few very thin		
	silt laminae		
	Silt laminae die out		
	below 84.40, with		
	colour becoming dark		
	olive grey (543/1)		
	Many horizontal listric		
	surfaces 84.68, making		
	rock relatively friable		84.91.
	bed.		
	(partly re logged, see below)		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

Page

TQ 21NW/1

National Grid Reference

64

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		84.20
	Mudstone, olive grey (5Y 5/1) slightly silty, lentic, with many horizontal lentic surfaces down to 84.79. 60°+ slickensided fractures 84.80-84.90. Fish. frags. Smoother and slightly darker with some bioturbation, slightly micaceous, some fine debris	0.71	84.91
	Mudstone. yellowish brown (10YR 5/2) slightly silty with fine pale silt laminae. Fish debris at 84.91. Some bioturbation with darker burrow fills (2mm). Lentic with numerous slickensided surfaces 84.95-85.01	0.10	85.01
	Mudstone olive grey (5Y 4/1) silty with fine pale silt, partings; Bioturbated. Hard. Intensely bioturbated below. 85.20. Some yellow staining? rootlets at top. Micaceous with some fine plant debris. Some very silty bands at base. Darker and less silty at base	0.39	85.40
	Mudstone Siltstone, very light grey (N8) finely micaceous and bioturbated with very fine? ferruginous oolites or mineralisation		
	passing down to	0.07	85.47
	Mudstone, silty, pale yellow-brown to olive grey bioturbated finely micaceous. Burrows up to 2mm. Passing down to:	0.06	85.53
	Mudstone: olive grey, slightly silty and finely micaceous with fine pale silt horizontal laminae. Some pyrite trails particularly c. 85.65		

IGS 1805 3000 12/76

Sample sent to Pet.

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ 21 NW 1

Page

65

National Grid Reference

NEP. TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		85.53
	and occasional carbonaceous debris Passing to: Some more fossil bands.	0.25	85.78
	Mudstone dark yellowish brown (10YR4/2) finely micaceous slightly silty. A few small burrows with pale silt infill. Faint laminations. Vertical plane with numerous slickensided surfaces. ? penicontemporaneous Passing to	0.17	85.95
	Mudstone greenish grey (5Y5/1) slightly silty finely micaceous. Some pale silt laminae and darker grey smooth mudstone laminae fossil at base.	0.07	86.02
	Mudstone light greenish grey smooth hard slightly silty bioturbated. Dark smooth mudstone at base with fine pale laminae	0.03	86.07
	Mudstone ^{olive} dark grey with bands of ferruginous sand. Broken @ 86.07 - 10 and 86.19 - 86.22. Bioturb- ated	0.16	86.23
	Mudstone Olive grey (5Y4/2) smooth slightly silty slightly lenticled bedded and fossil at top. 50° Fracture. 86.30 - 86.35. Bioturbated with burrows 2mm. Some pale silt-laminar	0.17	86.40
	Mudstone grayish olive 10Y5/2 to light olive grey 5Y/52. Smooth hard slightly silty and micaceous. Fine near vertical fracture in parallel 2mm apart.	0.32	86.72

✓VSD

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW/1

Page

66

National Grid Reference

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		86.72
↘ 30°	Mudstone, olive grey, smooth lentic fractured with slickensided surfaces. 30° Silt laminae and partings. Finely micaceous.	0.08	86.80
	Mudstone, dark greenish grey (5GY 4/1) smooth lentic and fissile at top slightly silty; some silty partings. Common fine debris. Bioturbated. Irregular slickensided surfaces.	0.18	86.98
↘ 45°	Mudstone, dark yellowish brown, 10YR 4/2 with bioturbated with burrows infilled with greenish grey mudstone from above up to 3mm. Some hor. in top 10 cm. Some horizontal fine silt laminae. Some pyrite trails. Fracture ~45° 87.18-87.23. Silt partings 87.24. Some carbonaceous debris. Iron staining.	0.54	87.52
	Mudstone as above but light olive grey (5Y 5/2) Finely laminated. Some bioturboidal structures. Becoming darker and more silty at base.	0.48	88.00
↘ 60°	Mudstone, smooth mottled fractured with numerous slickensided fractures. 60° Olive grey (5Y 4/1) ↑? High in Montmerillonite (greasy). Bioturbated. Numerous lentic surfaces (to dark greenish grey (5GY 4/1)).		88.17
	Mudstone Light olive grey silty finely laminated with silt laminae (horiz) Fractured with slickensided surfaces.		

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW11

Page

National Grid Reference

67

Geological Classification	Description of Strata	Thickness metres	Depth metres
Mudst 88.41	Brought Forward		88.17
80°	Bioturbated. Pencontemperans fracturing + slickensides		
88.72	High angle fault 80° 88.41 - 88.72	0.55	88.72
Siltst	Siltstone, yellowish grey (5Y8/1) with muddy laminae + partings, micaceous Bioturbated. Becoming muddier below 88		
	88.80. Passing to	0.13	88.85
	Mudstone, silty, light olive grey (5Y6/1) bioturbated with pale silt laminae + patches Regular 20° fractures. Burrows and trails Some higher angle slickensided fractures Passing to	0.12	88.97
	Mudstone. dark yellowish brown (10YR4/2) bioturbated. passing to.	0.03	89.00
	Ironstone. muddy, fairly fine, micaceous with fine iron mineralisation throughout Bioturbated. Becoming more muddy below 89.20	0.28	89.28
	Mudstone yellowish brown, with pale silt laminae passing to 10YR 4 1/2 fine	0.07	89.35
	Mudstone. hard. yellowish brown (10YR 5/2) bioturbated. Some pale greenish grey silt patches passing to.	0.13	89.48
150°	Mudstone greenish grey (5G7.6/1) slightly silty, bioturbated. Numerous 50° fractures with slickensides some darker grey layers highly laminated with fine silt. and some darker laminae	0.77	

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW11

Page

68

National Grid Reference

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward Some carbonaceous specks. Becoming more olive grey below 89.90. Occasional listric structures + surfaces. Burrows up to 4mm. Becoming browner below at base		89.48
	Mudstone dark yellowish-brown 10YR 4/2 silty, bioturbated. Some dark grey bands. Pseudotemporaneous. pressure structures. Passing down to	0.15	90.25
	Mudstone v. silty with ? iron oolites or sand. Yellowish grey (5Y 7/2) Passing down to:	0.05	90.40
	Mudstone dark yellowish brown. 10YR 4/2 slightly silty with hory laminae some silt laminae + pods. Bioturbated. Some fractures with rough slickensiding. Slightly listric. Becoming greenish passing to	0.03	90.45
	Mudstone silty, greenish grey 5GY 6/1 with fine horizontal silt laminae. Bioturbated burrows up to 4mm. Some carbonaceous debris. Some darker grey bands. Becoming darker with disturbed laminae and fractured at base. Occasional listric surfaces	0.35	90.53
	Siltstone yellowish grey (5Y 8/1) irregular 30° fracture 90.90-90.98 passing to	0.10	90.88
	Mudstone olive grey (5Y 4/1) fine laminated with pale silt. Fractured low angle with some slickensides. Small lenses	0.09	↓



↘ 60°

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

NEP TOWN

6-in or 1:10 000 Map Registration No.

TQ21NW/1

National Grid Reference

Page

69

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Minor Brought Forward		90.98
	Bed of silt slump structures and distorted + broken bedding. Slickensided junction		91.07
	Mudstone, light olive grey 5Y 5/2 silty brownish in part with irregular some pale silt lenses. Becoming more silty below 91.20 with some laminae	0.29	
	Fracture 30° 91.24 - 91.28. Some ? trails Irregular ? Erosion surface.		91.36
	Mudstone		
	Siltstone light olive grey 5Y 6/4 above with light olive grey silt 5Y 6/4 with some bioturbation and fine laminae with minor slump structures etc.	0.09	
			91.45
	Mudstone olive grey 5Y 4/1. Smooth ? high montmorillonite expanding clays becoming greener and lustrous below 91.60 becoming dark greenish grey.	0.37	
	5Y 4/1 Below 91.70 Some silt pods carbonaceous debris and fish debris		
	Passing down to Fractures with slickensides		91.82
	Mudstone greenish grey, pyritic	0.16	
	toollets ? some pale silt pods + laminae		
	Bioclasted burrows 3mm Becoming siltier at base		91.98
	Siltstone yellowish grey to light olive grey, laminated siltstone with silty mudstone. Some trails passing to. Sharp junction with.	0.23	
			92.21

↘ 30°
↘ 50°

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW11

Page

National Grid Reference

70

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		92.21
	Mudstone: dark greenish grey smooth slightly silty, high in ? montmorillonite (expanding clays) very fractured and listric. Some fish fragments. ? disturbed by drilling. Sharp junction with	0.24	92.45
	Mudstone, light olive grey 5Y5/2. slightly silty, with fine silt laminae. Bioturbated with burrows up to 3mm with dark greenish grey mudstone infill from above. some pinkish coloration. Some listric surfaces with slickensides passing to S.	0.15	92.60
460	Mudstone: as above. Some slightly fine carbonaceous debris. Irregular 60° joints with some slickensides. Some silt bands up to 10mm. at 92.70. Fine silt laminae and partings. Bioturbated. Some darker olive grey mud clasts with fine carbonaceous debris below. 93.00. Finely bioturbated, some wood fragments becoming darker towards base.	0.77	93.37
	Mudstone, light olive grey 5Y6/2 slightly harder and more silty than above very finely laminated with grey mudstone 93.47-93.49. Common iron staining below down to 93.60 and stripy grey 93.70 some iron pyrite. Becoming darker and olive grey below. 93.70 with sortorted laminae. Low angle 20° junction with.	0.45	93.82

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW1

Page

National Grid Reference

71

NEP TOWN

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		93.82
44.05 high mount waxy.	Mudstone dark greenish grey 567 4/1 lustrous with numerous slickensided surfaces with parallel 300 fractures Common fish debris some parts phosphatised	0.21	94.03
	Mudstone olive grey slightly silty with pale silt laminae and partings Bioturbated with burrows infilled with greenish grey mudstone from above in top 5 cm Some fish debris Fine trails some pyritised Silty at base	0.19	94.22
43 Δ 30°	Mudstone dark greenish grey 567 4/1 as above very fractured and slickensided ~ 30° common fish debris and ostracods passing to	0.21	94.43
	Iron stone, dark yellowish brown 1072 4/2 dense heavy hard with fine sandstone irregular beds	0.09	94.52
	Mudstone light olive grey 576/2 silty with fine silt laminations Bioturbated burrows 1 mm and up to 2 mm Some parallel jointing with slickensides (tectonic) ~ 45° Some fine carbonaceous debris Becoming very silty at base and iron stained Sharp base	0.36	94.88
	Mudstone dark greenish grey 567 4/1 as above Silt laminae and fine fish debris and carbonaceous debris Bioturbated	0.12	95.00
	Mudstone olive grey 574/1 very lustrous friable with slickensides Some fish scales	0.10	95.10

IGS 1805 3000 12/76

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

Page

NEP TOWN

National Grid Reference

72

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		95.10
	Mudstone dark greenish grey, 5G74/1 very fractured with slickensides (blocky) Some fish scales. Fractured by Broken up by drilling below. 95.20	0.35	95.45
	Mudstone light greenish grey 5G76/1 Silty with fine silt laminae. Some iron staining and pink patches. Scattered fine carbonaceous debris. Silty at base.	0.43	95.83
	Mudstone dark greenish grey 5G74/1 Silty in places. Lentic becoming more olive grey with common ostracods and fish scales throughout. Dark greenish grey with numerous slickensides and lentic surfaces. and very fractured at base.	0.27	96.10
	Passing to		
	Mudstone greenish grey with numerous darker burrows at top. becoming greenish- yellowish grey 5Y8/1 below. 96.15 with some iron stained burrows. Very silty. Parallel jointing (tectonic) at 96.25. Bioturbated throughout. with iron mineralisation in some burrow fills Becoming silty at base. passing to:	0.50	96.60
	Mudstone greyish olive 10Y4/2 with fine silt laminae. Bioturbated throughout Siltstone band 96.74 with irregular base. Irregular mudstone band below.	0.16	96.76
	Siltstone yellowish grey, muddy		96.80

IGS 1805 8000 12/76

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW11

National Grid Reference

Page

73

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		96.80
	Mudstone: greenish grey 5G46/1		
	hard silty, slightly micaceous Horizontal		
	Slackensided surface joint surface 96.85	0.17	96.87
	Mudstone: greenish grey 5G46/1		
	Silty, bidimbed, very fine shattered		
	and greyish olive 1074/2 below 96.95		
	to 96.99 with numerous slickensides		
	Some 45° fractures Some phosphatic		
	fish debris. Strong parallel structural		
lineation	fabrics Fossils and listric 96.7.03		
	97.06 becoming more greenish blue		
	97.15 some carbonaceous material.		
	becoming silty below 97.18 passing to	0.33	97.20
	Mudstone greenish grey 5G46/1 silty		
	with fine silt laminae and pods		
	Bedded Horizontal bedding		
	Some yellow iron staining	0.31	97.51
	Mudstone: dark greenish grey 5G44/1		
	slightly silty, smooth waxy		
	with fish scales and debris. Underside junction	0.23	97.74
			97.73
	Mudstone: greenish grey 5G45/1		
	listric slickensided surfaces		
	Silty with silt laminae and pods		
	bidimbed, Parallel structural lineation		
	iron staining. Becoming very silty		
	below 98 Sharp junction		98.16
	Mudstone: dark greenish grey 5G46/1	0.62	
	Fractured 45° and slickensided		
	Listric smooth. Some fish scales		
	debris and ostracods		

IGS 1805 9000 12/76

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW/1

Page

National Grid Reference

74

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		
	Very listric fractured 98.70-98.74		98.74
	Mudstone. greenish grey 5675/1	0.51	
	slightly silty, with silt pods + laminae. bioturbated. Shuckenshided curved joints to near vertical 98.80. Silty band 98.90. (3cm). Becoming harder pale and micaceous below 99.00 passing to		99.25
	Mudstone. olive grey 545/1 - 546/1	0.35	
	bioturbated slightly silty, some silt filled burrows and fine laminae. some shuckenshided surfaces and pressure structures		99.60
	Mudstone. Light olive to olive grey mottled 545/1 - 544/2	0.75	
	slightly silty, with some silt, patches. Bioturbated Very listric shuckenshided (100.25 - 100.35) and fractured passing to		100.35
	Mudstone light olive grey 545/1	0.25	
	silty, bioturbated with silt filled burrows some fractures 45°. Finely laminated		100.60
	Mudstone dark greenish grey 5674/1	0.25	
	smooth fine fractured fine		100.85
	Mudstone pale olive 10452 silty	0.52	
	with fine silt laminae and pods, bioturbated with silt filled burrows. Some structural 'deavage'. Some iron staining with iron stained burrow fills at top		101.47

Institute of Geological Sciences

Name and Number of Shaft or Borehole:

6-in or 1:10 000 Map Registration No.

TQ21NW/1

National Grid Reference

Page

75

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward		101.47
	Mudstone, greenish grey. some 50Y5/1 smooth slightly silty, some silt laminae at top. Some fish debris. ? Fish jaw 101.65. Some laminae with abundant fish debris and ostracods 102.15 and burrow burrows with fish debris 102.20 sharp junction	0.77	
	Silt Mudstone very silty yellowish grey 5Y 8/1 Bioturbated	0.8	102.32
	Mudstone greenish grey as above. little numerous slickensides. Some are fish debris	0.17	102.49
	Mudstone silty yellowish grey mottled greenish v. bioturbated. Some pyroclastic burrows	0.06	102.55
	as above. Mudstone greenish grey brownish at top, some fish debris. Fine laminae of fish debris and ostracods at 103.05 and scattered ostracods above throughout. Some slickensided surfaces	0.58.	103.13
	Mudstone yellowish grey very silty finely laminated - 45° slickensided surfaces with ? iron staining becoming more silty and some greenish grey passing to	0.27	103.40
	Mudstone. greenish grey 50Y5/1 more above. very friable and fractured and fissure	0.40	103.80

Observations
ostracods at
beginning of
cycle?

Name and Number of Shaft or Borehole:

● NEP TOWN

6-in Map

Registration No.

TQ21NW/1

Page

National Grid

Reference

76

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		103.80
	Mudstone greenish grey (5G 1/1) silty with fine silt wraps and partings with common fish debris. Some larger fish scales. Becoming lighter and mottled below 108.80 with some carbonaceous debris. Passing down to	5.20	
	Mudstone pinkish fawn (10YR 6/2) irregular to elongate patches of greenish colour. Faint wispy stringers of greenish material. These patches die out at 109.15m	0.35	109.00
	Mudstone greyish fawn (5Y 6/2) homogeneous from 110.0m harder. Patches of pale cream fleck material	0.75	109.35
	Mudstone grey-yellow (10Y 6/2) slightly silty. Pale cream fleaky material. Isolated (?) fish scales. Rare muddy, lentic bedding planes, dip 3-4°.	0.10	110.10
	Mudstone greyish (5GY 4/1) homogeneous. At 110.3 winged shiny surface. Sharp contact	0.17	110.20
	Shaly Mudstone greenish-grey, mottled at times and rough lentic surfaces. Variation from fine papery partings, rough to smooth. Some laminae soft and crumbly. Gradational to:- Mudstone	0.68	110.37
	Mudstone grey-cream laminal	0.10	111.05

Name and Number of Shaft or Borehole: NEP TOWN		6-in Map Registration No. TQ21NW/1	Page 77
		National Grid Reference	
GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		111.05
	fine laminae (1-4mm) with some flaser type bedding.		111.15
	Mudstone yellow-cream, patchy colouration (10Y 7/2) with more grey areas. Rough textured silty laminae, with slight reduction in colouration. Sharp contact.	0.10	111.25
	Mudstone grey-cream, patchy colouration with some fine paler laminae. Broken texture with listric surfaces. Colour (10Y 7/1 - 10Y 4/1) gradational to :-	0.10	111.35
	Silty Mudstone greenish-grey (10.5R 5/1). Mostly broken crumbly; listric partings. Irregular laminae of pale cream.	0.25	111.60
	Mudstone greyish (10Y 5/1) A lot of rubble. Homogeneous, smooth. Listric surfaces. Gradational to :-	0.55	112.15
	Mudstone pinkish grey, with patches of greenish grey. Rock becoming more pale tan with depth (10YR 6/2 - 10.5Y 7/1 - 10YR 6/2). Greenish grey patches spread through rock or more concentrated near weak joints. From 112.15 - 112.35 iron stained patches. Rock	1.05	

Name and Number of Shaft or Borehole:

NEP Town

6-in Map

Registration No.

TQ21NW/1

Page

National Grid

Reference

78

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		112.15
	Very broken. From 112.95-113.0m irregular masses of brown granular (?) concrete . Rare fish scales siderite.		113.20
	Mudstone pale olive-grey (5Y 6/1) with some laminae more pinkish. Wavy-migh. listric surfaces. From 113.38 - 113.45 nodular zone (rubble) of diffuse purple-green masses Below 113.45 cream patches.	0.45	113.65
	From 113.55 tiny cream laminae, slightly wavy bedding.		113.65
	Shaly Mudstone grey-olive grey. (5.5Y 6/1). Fine flaky partings at time. Minor listric surfaces. At 114.35-114.40m mudstone with iron stained patches. Cream mudstone laminae up to 0.8cm.	0.90	114.55
	Mudstone olive grey (5.5Y 7/1) with pale cream patches. Nodular between 114.55-114.73, 114.83-114.85, 114.96-115.00, 115.28-115.33m, 115.70-115.80m. At 114.80m wedge shaped bedding with siltstone and (?) iron rich sediment. From 114.95- 115.25 isolated iron stained patches. From 115.35-115.50 mottled greens on broken surfaces. Minor development of listric surfaces. Towards bottom laminae of pale cream (0.05- 0.1 cm). Some reduction spots. Horizontal tubulated	1.50	

IGS 1602 2000 4/76

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

TQ21NW/1

Page

National Grid

Reference

79

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		114.55
	particularly from 115.15 - 115.28 m. Harder to describe base.		116.05
	Mudstone, greenish grey with diffuse patches of cream. Harder, more massive, isolated iron stained patches. Small scattered fish scales. Dirty partings. At becoming silty with depth on some faces.	1.57	117.63
	Mudstone (top part rubble) Mottled brown - olive green. Structureless. From 118.95 irregular patches of grey - yellow green (SY 6/2). At times quite silty. gradational to:-	1.17	118.80
	Siltstone. Mottled grey - fawn - greenish hue (SY 6/1) gradational to:-	0.60	119.40
	Sandstone fine grained, green - grey with irregular patches of deep green (SY 6/1) (SY 5/2) Minor iron stained patches. Full of tiny rounded purple - brown grains gradational to:-	0.43	119.83
	Siltstone. fine grained, at times. green - grey with irregular patches of deep green. Surface of core indicates a nodular structure. A number of rough joint planes at steep angles to core (50 - 65°)	0.42	

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

National Grid

Reference

TQ21NW1

Page

80

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		119.83
	Irregular brownish patches gradational to:-		120.35
	Siltstone - mudstone yellow-green grey (SY 6/2), with irregular brownish zones. Nodular horizons and beds, - ill. defined on broken surfaces. From 121.2 - 121.65m prominent zone down core of deep brown (10YR 4/2) siltstone. Irregular boundary. Throughout patchy colouration. gradational boundary to:-	1.55	121.90
	Silty Sandstone patchy cream grey to pale green with areas of darker colour (SY 6/1 - SY 5/2) Irregular wavy and patches of silty material, probably some of mudstone. Horizons of turbated beds. Diffuse horizons with more medium grained rock.	1.87	123.77
	Clay rubble	0.08	123.85
	Sandstone grey-black. Irregular masses of the darker material, Hard with (?) high % of quartz.	0.05	123.90
	Mudstone, some rubble, enclosed pebble yellow-green SY 6/2 with pale cream patches	0.10	124.00
	Siltstone greenish-cream. In fine laminae. Steep dip ~45°. A joint at ~50°. Irregular muddy partings towards top	0.10	124.10

IGS 1602 2000 4/76

Name and Number of Shaft or Borehole:

NCP TOWN

6-in Map

Registration No.

TQ21NW/1

Page

81

National Grid

Reference

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		124.10
	Siltstone pale yellow-greenish grey (SY 8/1)	0.17	124.27
	Shale greenish-grey friable	0.03	124.30
	Siltstone some muddy content pale greenish grey (SY 7/1) with irregular patches of more creamish material often in tiny laminae (0.5-2.0mm) Muddy laminae up to 0.5cm horizontal	0.55	124.85
	Siltstone - Mudstone patches of greenish grey becoming interbedded between deep reddish orange patches of this rock with greenish grey rock (SY 7/1 - 10R 4/4) from top to 125.2m steady increase in reddish orange in irregular partly diffuse patches, becoming partly bedded with depth 100v joint planes and some listric surfaces. At base laminae of greyish rock between reddish. Some penconglomeratic faults. At 125.20-125.22m irregular shaped part of medium grained sandstone. From 125.22-125.95m intense reddening, patches of deep orange, fluvial stringers of grey rock. Horizontal bedding. From 125.95m bed of reddish	1.50	

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

National Grid

Reference

TQ21NW/1

Page

82

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		124.85
	rock. upto 1-3 cm thick. Narrow fleecy bedding. becoming more laminated with depth. some patches of orange. More friable with depth.		126.35
	Silty Mudstone pale grey. (NT) with darker bands. Quite hard. Very diffuse bedding. From 126.5 - 126.85m. nodular appearance on one face. Bands with no nodular structure. Towards base. diffuse pale reddish brown patches. from 126.85 massive homogeneous grey with lips of pale rock.	1.00	127.35
	Silty Mudstone, greenish grey. (SYV 6/1). Soft and crumbly.	0.20	127.55
	Silty Mudstone patchy areas of orange brown (SYR 5/4) and greenish grey (10446/2) More greyish with depth. Randomly attraction at times with sharp edges against zones of greenish-grey rock. Soft. crumbly. Rubble from 128.17- 128.37m.	0.90	128.45
	Mudstone silty at times greenish grey (SYV 5/1) Softish and somewhat crumbly at times. Laminated bedded. Sparse cream laminae 1-2mm Horizontal bedding.	0.50	128.95

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

National Grid

Reference

TQ 21NW/1

Page

83

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		128.95
	Siltstone greenish gray, with irregular patches of deep brown iron staining, diffuse areas with blue tinge.	0.15	129.10
	Silty shale some siltstone horizons. Greenish gray, with tinges of blue and yellowish gray in diffuse patches. Shaly partings to very crumbly. Steep junction (65°) with:-	0.75	129.25
	Silty shale medium yellowish brown (10 YR 5/2) with patchy wisps of grey, orange, greenish grey crumbly and fissile at times, over 0.10 m transitional to:-	0.50	129.75
	Silty shale gray-yellow-green (5.5Y 6/2) crumbly fissile at times, a lot of rubble.	0.35	130.10
	Fault Zone rubble, sheared rock with harder blocks of siltstones	0.10	130.20
	Mudstone greenish gray (5.5Y 5/1) streaks of bluish gray. Poor laminated bedding. Weak vertical joints. At 130.30m shells and at 130.36m bank of tiny shells. Shaly mudstone from 130.43-130.55m. Below isolated rounded patches of iron staining.	0.90	

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

TQ 21NW/1

Page

National Grid

Reference

84

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		130.20
	Scattered fish scales and accumulations of tiny shells. At 131.0m. numerous shells.		131.10
	Clay, cream white soft, mottled gradational boundary to:-	0.10	131.20
	Siltstone whitish patchy areas of pale gray with depth more greyish.	0.15	131.35
	Silty Shale greyish. Shiny surfaces, poor crumbly partings. At 131.42-131.47m medium cream mudstone. Numerous beds (1-3") of harder mudstone. Minor listric surfaces, some parting planes wavy.	0.75	132.10
	Mudstone greenish gray, all bedding planes crowded with tiny shells.	0.20	132.30
	Mudstone, greyish with masses and irregular shaped nodules of pinkish brown, cream brown iron staining.	0.10	132.40
	Shale-Mudstone greenish grey laminae of fine to shaly partings others less so.	0.25	132.55
	Mudstone greenish olive grey (5.94 5/2) hard, no bedding planes. On broken surfaces	0.55	

IGS 1602 2000 4/76

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

TQ21NW/1

Page

National Grid

Reference

85

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		132.40
	fossil. shell accumulations some fish scales		132.95
	Shaly <u>limestone</u> grey fine laminae or fine partings		133.22
	Mudstone greenish grey some fractures clay accumulations of tiny shells	0.11	133.43
	Shale greenish grey (59Y 6/1), soft fine, crumbly isolated mudstone clasts	0.27	133.70
	Mudstone whitish cream (5Y 7/1) mottled in pale or darker patches, fine laminae bedding. Quite tough.	0.15	133.85
	Shale greenish grey (59Y 6/1), soft fine, crumbly,	0.55	134.40
	Mudstone and shale mostly rubble. grey-greenish grey at top narrow laminae with iron enrichment. Some lenticular surfaces and (?) shearing.	1.65	136.05
	Mudstone, greenish grey, cream grey, darker bands and irregular areas. Shale partings, disturbed. Rough broken surfaces. Some rubble	0.45	136.50
	Shale greenish grey fine - crumbly	0.25	136.75

Name and Number of Shaft or Borehole:

NEP 70NN

6-in Map

Registration No.

TQ21NW/1

Page

National Grid

Reference

86

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		136.75
	Silty Mudstone yellowish grey (SY 7/1) with darker areas. mottled on some surfaces.	0.45	137.20
	Mudstone - silty ^{grey} tan yellow (SY 6/1) with more greyish horizons. Irregular coloration. Minor stickensided joints. Some rubble.	0.47	137.67
	Mudstone greyish cream pale coloration. Hard massive.	0.15	137.82
	Mudstone - Shale greyish grey (SY 5/1) with bands of pale creamish green grey, bluish grey. Beds and laminae of mudstone (2-4 cm). Listric surfaces and stickensided joints. Some partings nodular. Rare fish scales. Towards base blocky fracture, increases brownish hue.	1.18	139.00
	Mudstone - Shale brownish yellow grey (10YR 7/2) patches of cream grey. Rough fracture, common listric surfaces. gradational to:-	0.60	139.60
	Mudstone brownish-pinkish grey (10YR 7/2) increase of pink hue with depth. Greenish vein like masses	1.30	

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

TQ21NW/1

National Grid

Reference

Page

87

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		139.60
	towards the top wisps of medium blue. Pellets with iron stained halo (139.90-140.00m)		
	At 140.3m (?) bedding plane greenish-grey rough. tips of hard material		
	gradational to:-		140.90
	Siltstone cream-yellow (SY 7/2). From 140.05m. increasing % of mudstone partings and laminae	0.23	
	gradational to:-		140.13
	Mudstone - shale greenish grey, becomes more shaly with depth. joints planes - dirty, steep - 60-70°	0.32	
			141.45
	Siltstone, muddy, cream-yellow (SY 7/2). Fine laminated bedding.	0.17	
			141.62
	Mudstone - Shale, interbedded greenish grey (SY 6/1) and brownish grey (SYR 6/1) mudstone to 141.72 then a disturbed zone with laminae, folds and irregular masses of brownish grey - greenish grey and later / Mechanized surfaces. From 141.85m brownish grey with greenish stringers and wisps. Low angled joints. From 142.03 mostly tabular Dip ~ 5-7°	0.54	
			142.16
	Mudstone, reddish grey (SYR 5/1)	0.34	

Name and Number of Shaft or Borehole:

NEP TOWN

6-in Map

Registration No.

TQ21NW/1

Page

National Grid

Reference

88

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS	DEPTH
		METRES	METRES
	Brought Forward		142.16
	reddish brown (10 YR 6/2) greenish brown (5 Y 6/2) At top flaggy reddish grey mudstone grading to greenish grey. Sharp irregular junction associated with dyke like masses into reddish brown rock. Rock grades into greenish brown - greenish rock. Gradational boundary:-		142.50
	Mudstone reddish grey with patches of greenish grey with depth to all greenish. Isolated laminae (1-2mm) of cream mudstone dip $\approx 25^\circ$. Joint at base. dip $\approx 45^\circ$.	0.20	142.70
	Mudstone pinkish grey (10 YR 6/2) with laminae of greenish grey rock laminae (1-4mm). Dip 12-13°. Laminated bedding.	0.25	142.95
	Shaly mudstone brownish- greenish grey. patchy coloration. Soft crumbly with narrow fine bedding and steep angled parting planes. Disturbed laminae of harder lithologies. With depth partings increase in density and increase in dip 75-90°. Flaring of shale laminae into incipient joint planes. Steep laminae of deep reddish mudstone parallel to (?) bedding/shear planes.	2.15	145.10
Loss of core below this depth Bore hole reached. 149.35 m.			



RECORD OF WELL

At Mill Field
The Community, Hatfield
Town or Village Hatfield
County Summers

For Survey use only Licence No. TQ21NW 11/22/20

2183.1549 N. 106m

318
444

EXACT SITE
OF WELL

Six-inch sheet 38.5W/E Six-inch National Grid sheet

For C. C. White & Son State whether owner, tenant, builder, contractor, consultant, etc.:—

Address (if different from above)

Level of ground surface above sea level (O.D.) +105 from map If well top is not at ground level, state how far above: *
+33 m ft. below: ft.

SHAFT ft.; diameter ft.; HEADINGS (please attach details—dimensions and directions)

BORE 260 ft.; diameter of bore: at top 6 in.; at bottom 1 1/2 in.

Full details of permanent lining tubes (position, length, diameter, plain, slotted etc.):

Plain 6" diameter to 89' 6" 4 1/2" 89' 6" to 106' 8" and
Open Hole 175' - 200' perforated 106' 8" to 175 ft.

Water struck at depths of 21 91 123 ft. below well top.

Rest level of water 74 ft. above* well top. Suction at 100 ft. Yield on 6 hours* test days

pumping at 540 galls. per 1 min with depression to 81 ft. below well top.

Recovery to rest level in mins* Capacity of pump g.p.h. Date of measurements

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:

Make and/or type NOT YET INSTALLED Motive power

Capacity galls. per hour Suction at ft. below well top

Amount pumped galls. per day Estimated consumption galls. per week

Well made by Duke & Ochenden Ltd Date of sinking 8.10.63

Information from " " " "

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

For Survey use only

Date Received 26.11.63

Section 6

Pumping test

Observ. well

Recorder

E.R. log

Site marked on

1" map 0 10

Master 6" map 0 63/10/43
(use symbol)

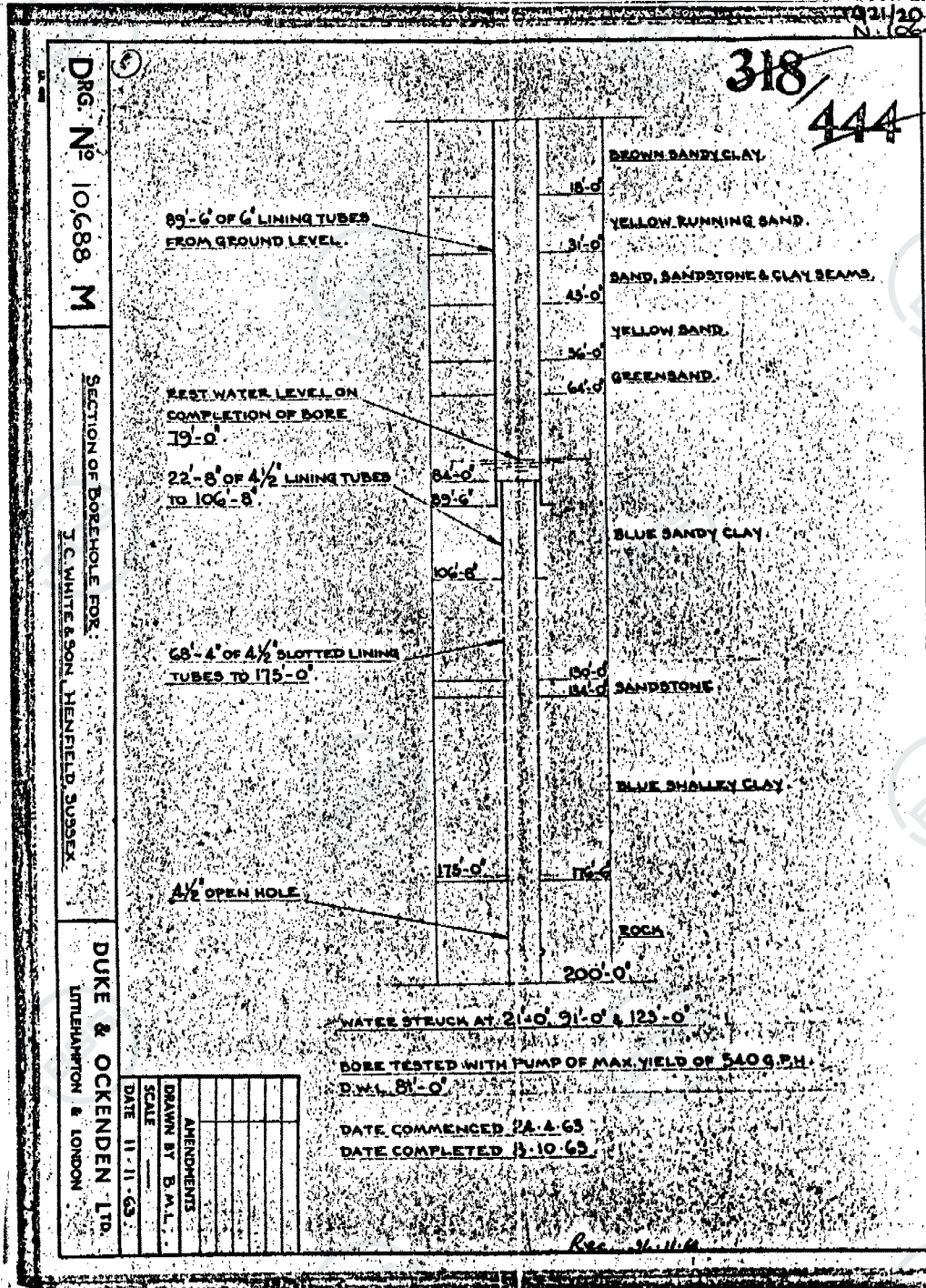
M.H. & ACB
1/12/72

TQ21NW11

TQ21/20

② (For Survey use only) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA If measurements start below ground surface, state how far ...	THICKNESS		DEPTH	
		Feet Inches		Feet Inches	
Fo	Brown sandy clay			9	2.74
	Brown sand, traces of clay			18	5.49
	Running sand			31	9.45
	Sand, sandstone & clay seams			42	12.81
	Yellow sand			56	17.07
	Green sand, traces of blue clay			64	19.51
	Blue sandy clay			68	20.73
	Blue sandy & silty clay			80	24.38
	Blue clay with green sand			95	28.96
	Blue sandy clay			118	35.97
SaB	Stiff blue clay & sand traces			130	39.42
	Sandstone			132	40.23
	Sandstone & shaley clay			137	41.74
	Shaley clay			139	42.37
	Blue shaley clay			150	45.72
	Clay with shales			156	47.55
	Silty clay			160	48.97
	Shaley clay & small gravel			167	50.90
	Shaley clay			174	53.04
	Shaley clay & sandstone			176	53.11
Hh	Red formation			200	60.96
MM/MSB 1/12/72					

TQ 21 NW 11





RECORD OF WELL

At Mill Field
The Common, Hatfield
Town or Village Hatfield
County Summers

For Survey use only Licence No. W/22/29
N. 10640

318 / 444

TQ21/20

EXACT SITE
OF WELL

Six-inch sheet 38.5W/E Six-inch National Grid sheet
For J. C. White & Son State whether owner, tenant, builder, contractor, consultant, etc. Owner

• DELETE
WHICHEVER IS
INAPPLICABLE

Address (if different from above)
Level of ground surface above sea level (O.D.) +C105 fm map If well top is not at ground level, state how far above: *
below:ft.

SHAFTft.; diameterft.; HEADINGS (please attach details—dimensions and directions)

BORE 200ft.; diameter of bore: at top 6in.; at bottom 4 1/2in.

Full details of permanent lining tubes (position, length, diameter, plain, slotted etc.)

Main 6" surface to 89' 6" 4 1/2" 84' 15" 175' plain to 106' 8" and
Open Hole 175' - 200' retreated 106' 8" to 175' ft.

Water struck at depths of 21' 91' 123'ft. below well top.

Rest level of water 79ft. ^{above*} below well top. Suction at 100ft. Yield on 8 hours' test
pumping at 540galls. per hour with depression to 81ft. below well top.

TEST
CONDITIONS

Recovery to rest level inmins.* hours Capacity of pumpg.p.h. Date of measurements

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:

Make and/or type NOT YET INSTALLED Motive power

Capacitygalls. per hour. Suction atft. below well top.

Amount pumpedgalls. per day. Estimated consumptiongalls. per week.

Well made by Duke & Ockenden Ltd Date of sinking 8.10.63

Information from " " " "

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

For Survey use only

Date Received 26.11.60

Section 6

Pumping test

Observ. well

Recorder

E.R. log

Site marked on

1" map 0

Master 6" map 0 13/12/63

(use symbol)

Record forwarded

to

date

GEOLOGICAL SURVEY,
WATER DIVISION,
SOUTH KENSINGTON,
LONDON, S.W.7.

LOG OF STRATA OVERLEAF attached



(For Survey use only)
GEOLOGICAL
CLASSIFICATION

NATURE OF STRATA

If measurements start below
ground surface, state how far ...

THICKNESS

Feet Inches

DEPTH

Feet Inches

Folkestone
Beds
64'

Sandgate
Beds

112' 6"

Hythe Beds
23' 6"

Brown sandy clay
Brown sand, traces of clay
Running sand
Sand, sandstone + clay seams
Yellow sand
Greensand, traces of blue clay
Blue sandy clay
Blue sandy + silty clay
Blue clay with green sand
Blue sandy clay
Stiff blue clay + sand traces
Sandstone
Sandstone + shaley clay
Shaley clay
Blue shaley clay
Clay with + shale
Silty clay
Shaley clay + small gravel
Shaley clay
Shaley clay + sandstone
Rock formation

9

18

31

43

56

64

68

80

95

118

130

132

137

139

150

156

160

167

174

176

200

M.H. & A.C.B.
1/12/72

N. 10640

318 TP 21/20
4444

DRG. N° 10,688 M

SECTION OF BOREHOLE FOR:

J. C. WHITE & SON, HENFIELD, SUSSEX.

DUKE & OCKENDEN LTD.

LITTLEHAMPTON & LONDON

89'-6" OF 6" LINING TUBES
FROM GROUND LEVEL.

REST WATER LEVEL ON
COMPLETION OF BORE
79'-0"

22'-8" OF 4 1/2" LINING TUBES
TO 106'-8"

68'-4" OF 4 1/2" SLOTTED LINING
TUBES TO 175'-0"

4 1/2" OPEN HOLE.

BROWN SANDY CLAY.

YELLOW RUNNING SAND.

SAND, SANDSTONE & CLAY SEAMS.

YELLOW SAND.

GREENSAND.

BLUE SANDY CLAY.

SANDSTONE.

BLUE SHALLEY CLAY.

ROCK.

WATER STRUCK AT 21'-0", 91'-0" & 123'-0"

BORE TESTED WITH PUMP OF MAX. YIELD OF 540 G.P.H.
D.W.L. 81'-0"

DATE COMMENCED 24.4.63

DATE COMPLETED 8.10.63.

Rec. 26.11.68

AMENDMENTS	DRAWN BY B.M.L.	SCALE	DATE
			11.11.63

10

Geological Survey.

N. 10640.
318/444

MINISTRY OF HOUSING AND LOCAL GOVERNMENT

Section 14 of the Water Act, 1945
Licence No. 17/L/22/22

TQ 21/20

South Sussex Area (Conservation of Water) Order, 1949

In this licence:-

- (a) "the Minister" means the Minister of Housing and Local Government;
- (b) a group of two letters and eight figures represents the map co-ordinates of the proposed position of the borehole which is the subject of this licence, estimated to the nearest ten metres on the grid of the national reference system used by the Ordnance Survey on its maps and plans.

The Minister, in exercise of his powers under section 14(6) of the Water Act, 1945, hereby licenses Mr. J. B. White, Mill Field, The Common, Henfield, Sussex, to construct a borehole for the purpose of abstracting underground water at TQ21821549 in Mill Field, The Common, Henfield, Sussex, subject to the following conditions:-

1. The depth of the borehole shall not exceed 100 feet.
2. The capacity of the pump to be installed for abstracting water from the borehole shall not exceed 500 gallons per hour.
3. Except with the consent of the Minister, and subject to any conditions attached thereto, given after like proceedings with respect to the publication and service of notices, and the making and hearing of objections, as apply to applications for licences under section 14(6) of the Water Act, 1945 -
 - (a) no water shall be abstracted from the borehole during the period commencing on the 1st August and ending on the 31st March;
 - (b) during the period commencing on the 1st April and ending on the 31st July not more than 10,000 gallons of water shall be abstracted from the borehole in any period of 24 hours reckoned from midnight nor shall a greater total quantity of water than 640,000 gallons be so abstracted during the said period;
 - (c) no water shall be abstracted from the borehole after the 31st July, 1967.
4. As soon as practicable a satisfactory meter shall be installed to measure the abstraction from the borehole, and readings of the said meter shall be taken and recorded to show the quantity of water abstracted in any one day of 24 hours.
5. Any officer authorized for the purpose of section 14(12)(a) of the Water Act, 1945 shall on request be permitted to inspect or transcribe records required to be kept by the last preceding condition and relating to any period not earlier than five years before the request is made.
6. If the borehole is not constructed within one year from the date of this licence, the licence shall cease to have effect.

GIVEN under the Official Seal of

the Minister of Housing and
Local Government this

day of June 1962.

H. J. RYAN

Assistant Secretary

Ministry of Housing and Local Government

N.B. UNDER THE WATER ACT, 1945 IT IS AN OFFENCE PUNISHABLE BY FINE TO
CONTRAVENE ANY CONDITION ATTACHED TO THIS LICENCE.

DKO.

Sited on 6" Sassa 38 SW/12

geological survey

318 N. 10640
1/22/22
444
TQ21/20

WH/REAS:

(1) The Minister of Housing and Local Government on 26th June, 1962 licensed the construction of a borehole at TQ21821549 in Mill Field, The Common, Henfield, Sussex and condition 3 of the licence provided that except with the consent of the Minister, and subject to any conditions attached thereto, given after like proceedings with respect to the publication and service of notices and the making and hearing of objections as apply to applications for licences under Section 14(6) of the Water Act 1945 -

- (a) no water shall be abstracted from the borehole during the period commencing on 1st August and ending on 31st March;
- (b) during the period commencing 1st April and ending on 31st July not more than 10,000 gallons of water shall be abstracted from the borehole in any period of 24 hours reckoned from midnight nor shall a greater total quantity of water than 640,000 gallons be so abstracted during the said period.
- (c) no water shall be abstracted from the borehole after 31st July, 1967.

(2) Application has been made to the Minister for his consent to the abstraction of water from the said borehole as aforesaid during the period commencing on 1st May and ending on 31st August instead of during the period commencing on 1st April and ending on 31st July and, being satisfied that such procedure as is referred to in the foregoing recital has been observed, he has decided to grant the application.

NOW THEREFORE, in pursuance of condition 3 of the said licence, the Minister hereby consents to the abstraction from the said borehole of not more than 10,000 gallons of water in any one day of 24 hours, reckoned from midnight, during the period commencing on 1st May and ending on 31st August and not more than a total quantity of 640,000 gallons of water during the said period. Provided that no water shall be abstracted from the borehole -

- (a) during the period commencing on 1st September and ending on 30th April and,
- (b) after the 31st August, 1967.

GIVEN under the Official Seal of the

MINISTER OF HOUSING AND LOCAL

GOVERNMENT on 17th June, 1963.

(Signed) H. J. RYAN
Assistant Secretary

(L.S.)

Ministry of Housing and Local
Government

8 x 0.

copy for geological Survey.

N. 10640.

318 TQ21/20

444

MINISTRY OF HOUSING AND LOCAL GOVERNMENT

SECTION 14 OF THE WATER ACT 1945

LICENCE NO. HO/L/22/22

see 1/22/22

South Sussex Area (Conservation of Water) Order 1949

In this licence:-

- (a) "the Minister" means the Minister of Housing and Local Government;
- (b) a group of two letters and eight figures represents the map co-ordinates of the proposed position of the borehole which is the subject of this licence, estimated to the nearest ten metres on the grid of the national reference system used by the Ordnance Survey on its maps and plans.

The Minister, in exercise of his powers under section 14(6) of the Water Act 1945 hereby licences Mr. J. H. White to extend an existing borehole for the purpose of abstracting underground water at T.21821949 in Hill Field, The Ouseon, Hovefield, Sussex, subject to the following conditions:-

1. The depth of the borehole when extended shall not exceed 220 feet.
2. The capacity of the pump to be installed for abstracting water from the borehole shall not exceed 500 gallons per hour.
3. Except with the consent of the Minister and subject to any conditions attached thereto given after like proceedings with respect to the publication and service of notices, and the making and hearing of objections, as apply to applications for licences under section 14(6) of the Water Act 1945:-
 - a) no water shall be abstracted from the borehole during the period commencing on 1st September and ending on 30th April;
 - b) during the period commencing on 1st May and ending on 31st August not more than 10,000 gallons of water shall be abstracted from the borehole in any period of 24 hours reckoned from midnight nor shall a greater total quantity of water than 640,000 gallons be so abstracted during the said period;
 - c) no water shall be abstracted from the borehole after 31st August 1967.
4. As soon as practicable a satisfactory meter shall be installed to measure the abstraction from the borehole, and readings of the said meter shall be taken and recorded to show the quantity of water abstracted in any one day of 24 hours.
5. Any officer authorized for the purpose of section 14(12)(a) of the Water Act 1945 shall on request be permitted to inspect or transcribe records required to be kept by the last preceding condition and relating to any period not earlier than five years before the request is made.
6. If the work is not carried out within one year from the date of this licence, the licence shall cease to have effect.

GIVEN under the Official Seal of the

Minister of Housing and Local Government

on 17th October 1963.

M. J. EVAN

Assistant Secretary

Ministry of Housing and Local Government

N.B. UNDER THE WATER ACT 1945 IT IS AN OFFENCE PUNISHABLE BY FINE TO CONTRAVENE ANY CONDITION ATTACHED TO THIS LICENCE.

Sited on 6" Sheet. 38 SW/8.

Duke & Ockenden.



BGS ID: 570262 : BGS Reference: TQ01NE24/A
British National Grid (27700) : 509020,117020

Institute of Geological Sciences
RECORD OF SHAFT OR BOREHOLE

6-inch or 1:10 000 Map Registration No.

TQ 01 NE/24a

Name and Number of Shaft or Borehole:

Smock Alley Waterworks No. 1 (W.D. 317/264A)

For whom made Charltonbury ROC

Town or Village West Chilton County Sursex

Exact site (reference to a fixed point on 1-in or 1:50 000 Map)

National Grid Reference

0920 1702

1-in or 1:50 000
New Series Map No.

Enter 'C' if
Confidential

317

Purpose for which made Water supply

Purpose for which made _____

Ground level at ^{shaft} relative to O.D. e-31 m. If not ground level give O.D. of beginning of ^{shaft} _{bore} _____ m.

Made by G. Stow Date of sinking Dec. 1939

Information from

Examined by

Specimen Numbers and Additional Notes

[illegible]

IGS 2489 (1789) 10 000 2/79

TQ 01 NE / 24

GEORGE STOW & CO., LTD.

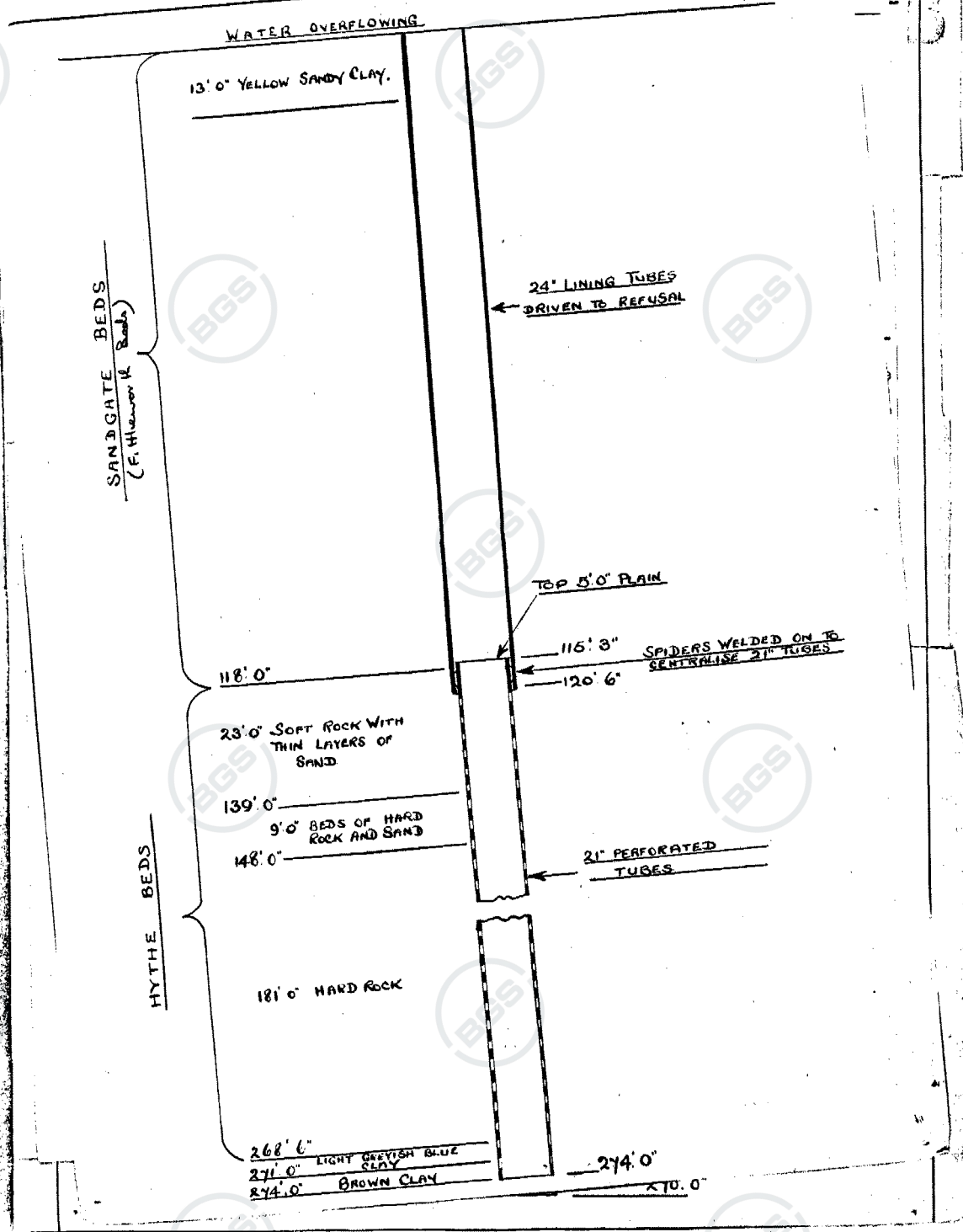
WATERWORKS ENGINEERS

MILL STREET — SLOUGH, BUCKS.

SKETCH No 23/H. CHANCTONBURY R.D.C. SMOCK ALLEY.

DATE: 19/8/41.

NO 1 BOREHOLE





TQ 01 NE / 24 b.

A description of the Strata pierced should be given as follows:-

		Thickness of each Stratum		Total depths from the surface	
		Feet	Inches	Feet	Inches
Sand-	(Blue sandy clay with small bands of rock ...	82	-	82	- 24.99
gate	(Dark greenish sandy clay with bands of rock ...	21	-	103	- 31.39
Beds (F.M. level Geds.)	(Dark greenish sandy clay with grit ...	6	6	109	6 33.37
	(Rock	50	6	160	- 48.97
Hythe	(Hard rock	42	6	202	6 61.42
Beds.	(Rock	53	6	265	- 80.77
160'	(Hard rock	4	-	269	- 81.99
Ather-	(Grey Sandy clay	1	-	270	- 82.30
field (clay.					
Weald	(Brown clay	4	-	274	- 83.52
Clay					

A Section to scale showing the size of the well or boring, strata pierced, rest level of water, and other particulars, should also be forwarded to the Ministry.

D 68200-1 1000 D/a 2272 3/38 R.P.W.



RECORD OF WELL (SHAFT OR BORE)

At Smockalley Waterworks (No. 1 bore)

Town or Village West Chillington

County Sussex Six-inch quarter sheet 36 SE.

For Chanctonbury R.D.C.

Exact site of well See plan.

O.D. basement floor level = 92.100 TQ 0920 1702

Level of ground surface above sea-level (O.D.) 92.100 feet.

Is well-top at ground level? Yes If not, state how far above ; — feet.
below ; — feet.

Shaft — ft., diameter — ft. Details of headings —

Bore 274 ft.; diameter of bore: at top 24 ins.; at bottom 21 ins.

Lengths, diameters, perforations, etc., of lining tubes 120'6" x 24" from surface ;

15'89" x 21" from 115'3" to 274'0" (perforated 120'6" to 274').

Water struck at depths, below well-top, of (feet) —

TEST DETAILS overflowing at 5000-6000 gph.
Rest-level of water above well-top. Suction at — ft. Yield on — hours' days'
Month — pumping — gallons per — (max. capacity of pump — g.p.h.),
Year — with depression of — feet. Recovery to — in — mins. hours.

WORKING CONDITIONS
Rest-level of water in — (month), — (year), — ft. above well-top.
Highest — in — (month), — (year), — ft. above well-top.
Lowest — in — (month), — (year), — ft. above well-top.
Suction at — ft. Rate of pumping — galls. per — for — hours per day.
with average depression of — ft. Recovery to — in — mins. hours.

Quality of water (attach copy of analysis if available) —

Well made by G. Stow Date of well Dec. 1939.

Information from Chanctonbury R.D.C.

ADDITIONAL NOTES.

Full pumping tests not carried out - (see attached note.)

Yield 24,000 gph. P.W.L. 68' below surface (Sept. 1941).

" 22,000 gph. (Dec. 1939). - see 317/184.

Water overflowing, depressed to 90' down, pumping 22,000 gph. for 14 days. 9/1/40 (see file 629).

W6/N.W. Sussex (Sussex) Water Board/14/10/50 :- I confirm that:-
On sinking No 1 bore overflowed at surface prior to pumping.
In 1948 the R.W.L. was 71 feet from basement floor level.
This level is 92 feet.

LOG OF STRATA OVERLEAF.

GEOLOGICAL SURVEY AND MUSEUM,
SOUTH KENSINGTON,
LONDON, S.W.7.

Date received.	G.S.M. Office File No.	1" N.S. Map No.	1" O.S. Map No.	Site marked (use symbol) on 1" Map. on 6" Map.	
<u>23/9/41</u>		<u>317</u>		☐	☐

P.T.O.



(For Survey use only) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA If measurements start below ground surface, state how far... ..	THICKNESS		DEPTH	
		Feet	Inches	Feet	Inches
2 Sandgate Beds. 118'	Yellow sandy Clay	13	0	13	0
	?	105	0	118	0
Hythe Beds. 150'6" Athyfield clay ? 2 1/2' Weald clay ? 3' MH 1/2/73	Soft Rock with thin layers of Sand	21	0	139	0
	Beds of Hard Rock & Sand	9	0	148	0
	? (Hard rock at 181'0")	120	6	268	6
	Light greyish Blue Clay	2	6	271	0
	Brown Clay	3	0	274	0
Inf. from NW. Series w/Beds lettered J.1-63 (Sect 7. Stars) Nuthouse / Smock Alley B/H water - pH of 7.30, hardness 280-350 ppm, free CO ₂ 34, iron 0.27-0.42.					



To be furnished in Triplicate.

WELLS AND BOREHOLES

Information to be supplied to the Ministry of Health

Name of District Chanctonbury Rural District

If the District is a Rural District, name of
Contributory Place concerned

Level of surface of ground above Ordnance Datum 100 ft.

Depth and diameter of shaft or boring, or of each 33" dia. 118 ft. deep
30" " 114'3" to 274'

Depth or depths at which water was found Water overflowed when
Hythe Beds were struck.

Yield of water in gallons per diem, as ascertained by
continuous pumping during days or
otherwise

Level of water above Ordnance Datum at commencement of pumping

Level of water above Ordnance Datum at cessation of pumping

Time taken for water to return to original rest level
after pumping ceased

A tabulated Statement should be sent showing the
quantity of water pumped in each 24 hours during the
duration of the test together with the level of the
water above Ordnance Datum at the end of each day. If
there should be any stoppage, the reason and duration
should be stated.

Distances of the well or borehole from any other known
wells or boreholes in the neighbourhood 40 ft. from Smockally
borehole No. 1

Quality. (Copies of chemical and bacteriological
analyses should be annexed. Information as to the
mineral constituents of the water is desirable) Attached hereto.

A 6" to the mile Ordnance map showing (in red) the precise
situation of the well or borehole

Date of completion of well or borehole 8th May 1940.

Well or borehole sunk by Messrs. George Stow & Co. Ltd., Slough.
per EDWARD SANDERSON & PARTNERS

Signed [Signature]

Date 4 March 1941

Normally the pumping test should be continuous over a period of 14 days.
This form should be signed by the Engineer for the proposed works.

P.T.O.

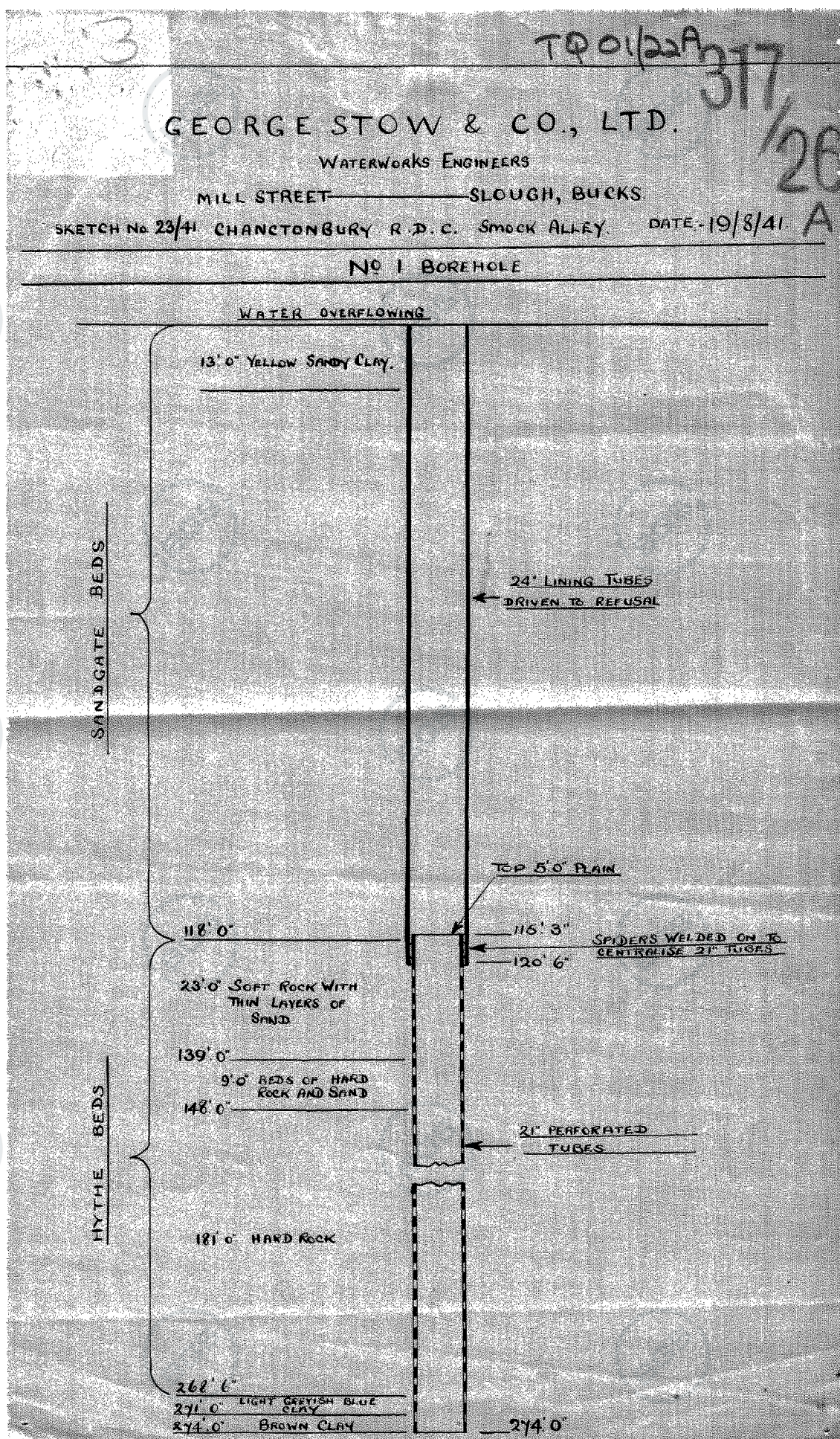


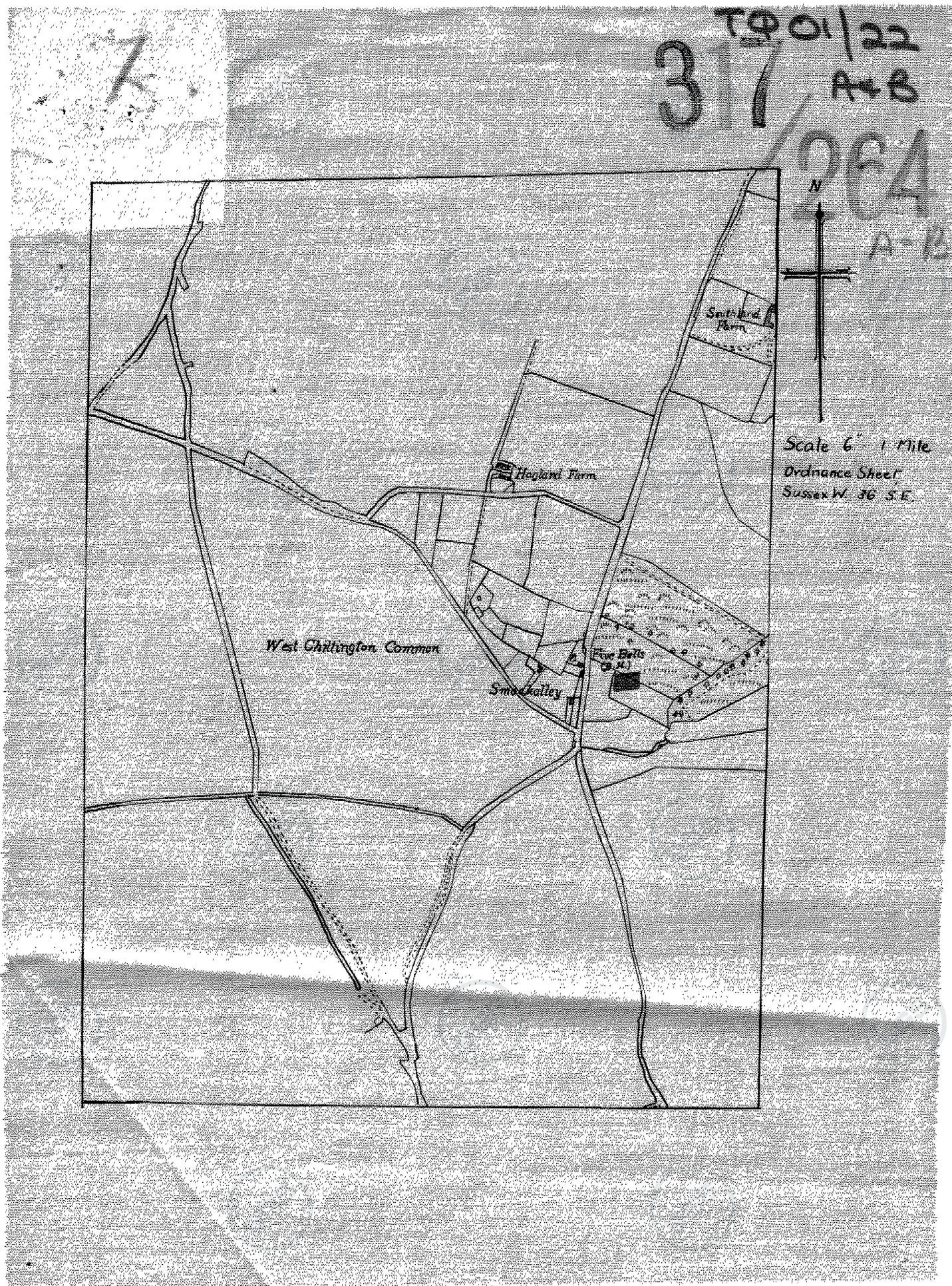
5

A description of the Strata pierced should be given as follows:-

	Thickness of each Stratum		Total depths from the surface	
	Feet	Inches	Feet	Inches
Sand- (Blue sandy clay (with small bands (of rock ...	82	-	82	-
gate (Dark greenish sandy (clay with bands of Beds (rock	21	-	103	-
(Dark greenish sandy (clay with grit ...	6	6	109	6
(Rock	50	6	160	-
Hythe (Hard rock	42	6	202	6
Beds. (Rock	53	6	265	-
160' (Hard rock	4	-	269	-
Ather- (Grey Sandy clay	1	-	270	-
field (clay.		-		-
Weald (Brown clay	4	-	274	-
Clay (				

A Section to scale showing the size of the well or boring, strata pierced, rest level of water, and other particulars, should also be forwarded to the Ministry.





Snock Alley. Both bores on this site were put down by Messrs. George Stow & Co. Ltd., details of which are shown on the attached tracings. Full pumping tests were not carried out on account of the urgent necessity to connect the supply to the mains system with temporary pumping plant, but it is noteworthy that No. 1, the 24", provides 24,000 gallons per hour at 68' pumping level, while No. 2, (33"), provides 37,000 gallons per hour at 88' pumping level, when working on normal pumping duty, which for the past six months has been continuous running.

It is also interesting to note that water was over-flowing at surface previous to pumping at a rate of between 5,000 and 6,000 gallons per hour.

The site plan is indicated on the enclosed tracing from Sheet No. Sussex (West) 36. S.E.

Yours faithfully,

Rest of letter
on 317/159.

Water Engineer
Chancetownbury R.D.C.
19/9/41.

Encl.

TQ 01/22A.B

317

264

A.B



ANALYSIS OF SAMPLE OF WATER FROM WELL, BOREHOLE, ADIT OR
OTHER WORK IN THE STATE IN WHICH IT IS ABSTRACTED

Date of taking sample..... 29th June 1948

(a) Physical Examination

Temperature at source..... °C.

Colour Slightly yellowish

Appearance Slight deposit of ferruginous matter.

Taste

Smell None

(d) Other determinations to be carried out at the analyst's
discretion or at the Minister's request, depending upon
indications obtained and on general characteristics of
waters of the district, e.g., manganese, fluorine, etc.

..... parts per million*
..... " " "
..... " " "

Please quote in all
correspondence the
Geological Survey
Reference Number

TQ01/22A+3 NE24
314/264

Parts per million*

(b) General Chemical Examination

Reaction, pH

7.4

Free Carbon dioxide, as CO₂

Ammoniacal Nitrogen, as N

Albuminoid Nitrogen, as N

Nitrous Nitrogen, as N

Nitric Nitrogen, as N

Hardness (state test used) Clark's Soap Test

as CaCO₃—

Temporary

Permanent

Permanganate figure (4 hours, 80°F.) as O

Alkalinity, as CaCO₃

Total Solids

0.345

0.075

Nil

4.0

197

63

Nil

340

(c) Mineral Analysis

Calcium, as Ca

Magnesium, as Mg

Sodium, as Na

Carbonate, as CO₃

Chloride, as Cl

Sulphate, as SO₄

Nitrate, as NO₃

Iron

26

17.7

0.36

* Analyses expressed in parts per million are desired ; if they are expressed in any other units the appropriate alteration should be made.



THIRD SCHEDULE

RETURN OF ANALYSIS OF UNDERGROUND WATER
UNDER WATER ABSTRACTION REGULATIONS, 1947.

TQ01/22AKR

Name and address of person making return

(e) *Bacteriological Analyses*, if available,
should be attached to this form.

Full address of premises in which well,
borehole, adit or other work is
situated if different from above

SMOCK ALLEY PUMPING STATION

Name and address of analyst

R.F. WRIGHT . B.Sc.
The Analytical Laboratory
Wraybury
1 Offham Road
Lewes

(6038) Wt.45888 8/48 Gp.697 G.B.&Co.Ltd.



C O - Y.
11132 5132

TQ01/22 A+B

517/264

THE PUBLIC ANALYST'S LABORATORY
WRAYSBURY, OFFHAM ROAD
LEWES
SUSSEX

REPORT upon a sample of water forwarded by Mr. E. S. Brockway. Sanitary
Inspector. Storrington on the 29th June, 1948.

Sample labelled: Smock Alley Pumping Station.

The water on arrival had the following characteristics:

Colour— Slightly yellowish
Smell— None

Sediment— A slight deposit of ferruginous matter

RECEIVED BY CLERK
- 9 JUL 1948
ACKD.....

Chemical Analysis afforded the following:—

	Grains per Gallon	Parts per Million
Total solids (dried at 100° C)	23.8	
Solids (after ignition)	19.2	
Chlorine	1.8	
Ammonia (free)		.420
Ammonia (albuminoid)		.090
Oxygen taken from permanganate in $\frac{1}{2}$ hour	Nil	
Oxygen " " 4 hours	Nil	
Nitrogen as Nitrates and Nitrites	.28	
Nitrites	Nil	
Hardness (total)	18.2	
Hardness (after boiling)	4.4	
Phosphates	Nil	
Metallic impurity	.025	
PH. ... 7.4		

BACTERIOLOGICAL EXAMINATION.

The organisms per ml. which grow on Nutrient Agar in three days at 22° C. under
aerobic conditions and were then visible to the naked eye as colonies numbered 3

On Agar at blood temperature and under aerobic conditions 2
colonies were noticed after two day's incubation.

Probable number of Coli-Aerogenes organisms in 100 ml. of the original water 0

I.T.O

Appendix I

Groundwater Analysis and Treatment Design

Invicta Water Treatment

89 Castle Drive

Horley

Surrey RH6 9DD

T. 01293 781077

Mobile. 07970 154529

Email. sales@invictawatertreatment.co.uk

www.invictawatertreatment.co.uk

Chris Green

Littleworth Properties Limited

3c High Street

Esher

Surrey KT10 9RL

By email: chris.green@team-green.co.uk

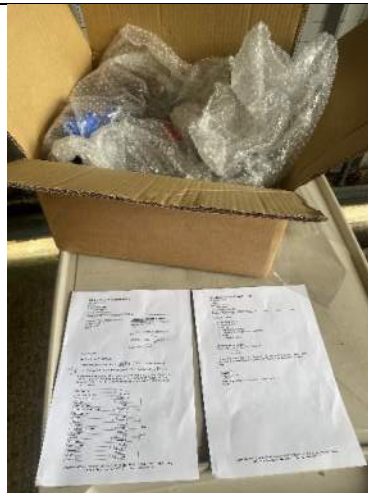
03/09/24

Dear Mr Green,

Re: Private Water Supply at Sandgate Nurseries Site – Raw Borehole Water Analysis (to date and inferences); Proposed Design and Compliance with PWS Regs 2016 Amended 2018 – Rev A

Further to the request that a raw borehole sample was taken by an accredited UKAS PWS Sampler, I can confirm that this was performed on 05/08/24 by Stefan Massingham. The borehole was allowed to flow for some 2 hours prior to sampling. It has been frequently flushed and allowed to develop during drilling prior to sampling. Visually, the water was turbid and grey in colour.

The samples were taken in accordance with DWI requirements (based on Group A & B Schedules PWS Regs 2016), with the correct bottles supplied by the UKAS Accredited lab, SE Water Scientific Services (SEWSS). and then duly transported to the lab thereafter, at the required transit temperatures (between 2°C and 8°C). Additional determinands were tested based on previous HDC requirements.



Signed acceptance of IWT Order by SEWSS

Invicta Water Treatment

89 Castle Drive

Horley

Surrey RH6 9DD

T. 01293 781077

Mobile. 07970 154529

Email. sales@invictawatertreatment.co.uk

www.invictawatertreatment.co.uk

Determinands to Date	Sample Number 1287680-3 Interim, 03/09/24
Alkalinity, mg/l	257.0
Ammonium (Ammonia and Ammonium ions), mg/l	0.081
Chloride, mg/l	33.50
Nitrate, mg/l	<0.9
Nitrite, mg/l	<0.004
Nitrite/nitrate, mg/l	0.000
Sulphate, mg/l	77.2
Total Hardness, mg/l	107.3
Odour – Qualitative	None
Odour – Quantitative	0
Colony Count 3 days at 22°C, cfu/ml	>300
Colony Count 2 days @ 37°C, cfu/ml	>300
E coli, mpn/100 ml	0
Total Coliforms, mpn/100 ml	3
Pseudomonas aeruginosa, cfu/100 ml	Competing growth, indicative count 0
Clostridium perfringens (including spore), cfu/100 ml	0
Enterococci, cfu/100 ml	0
Colour, mg/l Pt/Co	<2
Conductivity, uS/cm	569
Hydrogen ion, pH	7.5
Turbidity, NTU	2.770
Bromate, ug/l	<0.8
Antimony, ug/l	<0.2
Arsenic, ug/l	<1.0
Selenium, ug/l	1.5
Boron, mg/l	<0.040
Calcium, mg/l	105.3
Magnesium, mg/l	4.8
Sodium, mg/l	18.7
Fluoride, mg/l	0.121
Benzo(a)pyrene, ug/l	<0.003
Benzo(1,12)perylene, ug/l	<0.003
Benzo(11,12)fluoranthene, ug/l	<0.003
Benzo(3,4)fluoranthene, ug/l	<0.003
Indeno(1,2,3-cd)pyrene, ug/l	<0.003
PAH Total, ug/l	0.000
1,1,1 Trichloroethane, ug/l	<0.60
1,2-Dichloroethane, ug/l	<0.12
Benzene, ug/l	<0.02
Dibromochloromethane, ug/l	<0.50

Invicta Water Treatment

89 Castle Drive

Horley

Surrey RH6 9DD

T. 01293 781077

Mobile. 07970 154529

Email. sales@invictawatertreatment.co.uk

www.invictawatertreatment.co.uk

Dichlorobromomethane, ug/l	<0.43
Tetrachloroethene	<0.15
Tetrachloroethene/Trichloroethene- SUM, ug/l	0.00
Tetrachloromethane, ug/l	<0.11
Total Trihalomethane, ug/l	0.00
Tribromomethane, ug/l	<0.60
Trichloroethene, ug/l	<0.10
Trichloromethane, ug/l	<0.50
Aluminium, ug/l	<6.1
Copper, mg/l	<0.009
Iron, ug/l	325.5
Iron (free), ug/l	<7.3
Lead, mg/l	<0.9
Manganese, ug/l	41.1
Nickel, ug/l	4.1
Cadmium, ug/l	<0.12
Chromium, ug/l	0.8
Calc Pesticides – Total Substances	0.000
Aldrin, ug/l	<0.007
Dichlobenil, ug/l	<0.004
Heptachlor, ug/l	<0.009
Heptachlor Epoxide, ug/l	<0.005
Propyzamide, ug/l	<0.005
Tri-allate, ug/l	<0.005
2,4,5-T, ug/l	<0.007
2,4-D, ug/l	<0.007
Bentazone, ug/l	<0.007
Bromoxynil, ug/l	<0.007
Dicamba, ug/l	<0.020
Dichlorprop, ug/l	<0.003
Fluroxypyr, ug/l	<0.008
MCPA, ug/l	<0.008
MCPB, ug/l	<0.008
Mecoprop(MCPP), ug/l	<0.005
Triclopyr, ug/l	<0.015
Epichlorohydrin, ug/l	<0.1
Atrazine, ug/l	<0.002
Carbendazim, ug/l	<0.001
Carbetamide, ug/l	<0.002
Chlorotoluron, ug/l	<0.003
Diuron, ug/l	<0.004
Epoxiconazole, ug/l	<0.003
Flutriafol, ug/l	<0.003

Invicta Water Treatment

89 Castle Drive

Horley

Surrey RH6 9DD

T. 01293 781077

Mobile. 07970 154529

Email. sales@invictawatertreatment.co.uk

www.invictawatertreatment.co.uk

Isoproturon, ug/l	<0.003
Linuron, ug/l	<0.003
Oxadixyl, ug/l	<0.003
Pendimethalin, ug/l	<0.007
Prometryn, ug/l	<0.002
Simazine, ug/l	<0.003
Terbutryn, ug/l	<0.002
Trietazine, ug/l	<0.004
Mercury, ug/l	<0.04
% transmission	92.7
UV Abs (10 mm) @ 254 nm unfiltered, abs_unit	0.033
Bicarbonate Alkalinity, mg/l	256.17
Total Phosphate, ug/l	178
Total Organic Carbon, mg/l	1.2
Silica, mg/l	8.79
Suspended Solids, mg/l	6.4
Filtered Turbidity 0.45 um, NTU	0.0053
Filtered Aluminium 0.45 um, ug/l	<6.1

Treatment Prognosis

Based on the failures to date, the water treatment system will need to remove excess:

- iron (325.5 ug/l, maximum 200.0 ug/l)
- turbidity (2.770 NTU, maximum 1.000 NTU)
- suspended solids
- Bacteria – failures for Coliforms and general bacteria

The recommended treatment will be:

- Filtration to 5 um
- UV disinfection
- Chlorination

We propose the following equipment design:

- Borehole pump feeding
- Automatic backwashable media filter for sediment removal to 5 um or lower feeding
- 5 um security sediment filter for any stray particulate matter
- UV disinfection chamber with UV sensor for spore forming micro-organisms
- Automatic proportional chlorine dosing to provide disinfection residual to all points of use
- 30,000 litre treated water tank with level controls
- Booster pumps (duty/standby/assist)
- 5 um sediment filter
- Control panel with tank level indicators and pH/chlorine residual monitoring
- PVC rigid solvent weld pipework, MDPE pipework

Invicta Water Treatment

89 Castle Drive

Horley

Surrey RH6 9DD

T. 01293 781077

Mobile. 07970 154529

Email. sales@invictawatertreatment.co.uk

www.invictawatertreatment.co.uk

- High strength chlorination of all filtration pipework prior to use
- UKAS sampling of treated water as per PWS Regs

The total volume of treated water required is 17,216 litres per day. No EA abstraction licence is required as the volume is less than the 20,000 litre per day threshold. The yield is some 5.4 m³/h, so there is plenty of scope for future development, if required, subject to licence approval.

The filtration equipment is modular in nature and so upgrades are quite straight forward. The treated water will meet the PWS Regs requirements.

Compliance

With reference to the PWS Regs 2016 and amended 2018, this supply will be classified as Reg 9. We have allowed for a DWI risk assessment on the completed system by David Clapham (RIAMS independent consultant) along with the required sampling by a UKAS accredited sampler. We understand, under PWS Regs section 6 & 7, the duties of the council. We look for the council to provide clarity on this.

Ongoing Maintenance & Sampling

The water treatment system will require maintenance. We will provide a bespoke O&M manual, with specific procedures for your system along with the manufacturer's documentation. We will issue a line drawing of the water treatment process and provide hands-on training during the commissioning phase. Critical spares will be left on site and these are: spare UV lamp, quartz sleeve and sediment filters.

Regarding headings 3,4,5 in HDC Water Neutrality Compliance requirements. Please note 3 and 4 will be detailed at contract phase in the O&M manual. The manual will also cover recording. We have other applications/systems passed based on the same wording as in this report. With regard to recording: the designated maintenance contractor/owner/agent looking after the system will take necessary samples and record in the site log book, which forms part of the O&M manual. Until the system is commissioned, we cannot say which determinands need to be tracked but it is highly likely it is those which have failed and highlighted below. Specific SOPs, contained in the O&M, will be written once the system has been commissioned and will cover inspection, cleaning and maintenance. We will comply with PWS Regs 2016 amended 2018.

Sampling the raw borehole as well as the treated water is important to understand how the ground water is changing over time and how it reacts to weather events. We will only test pertinent process determinands and those required under the Schedules (see PWS Regs). If the council requires regulatory samples, we assume we will be instructed accordingly.

Invicta Water Treatment

89 Castle Drive

Horley

Surrey RH6 9DD

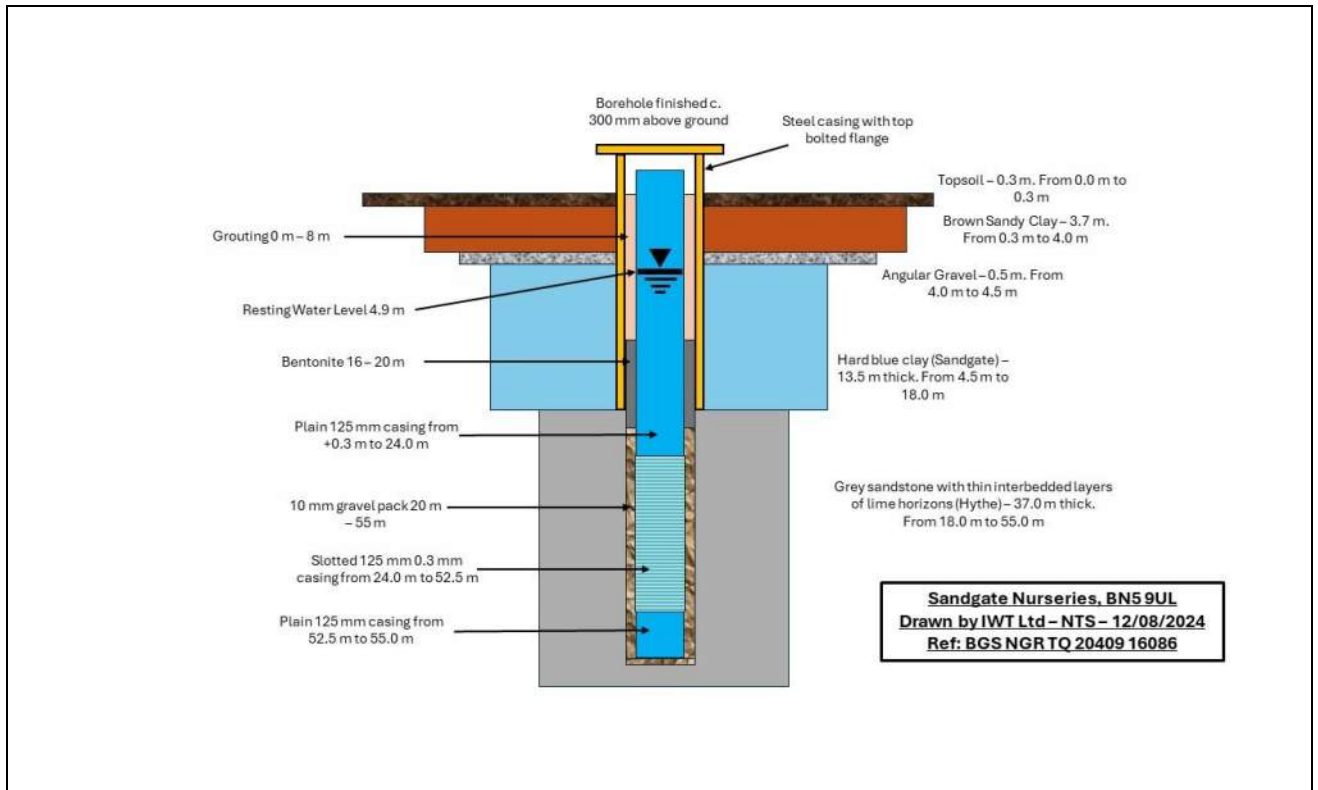
T. 01293 781077

Mobile. 07970 154529

Email. sales@invictawatertreatment.co.uk

www.invictawatertreatment.co.uk

Borehole Design As Drilled On Site



The borehole has been drilled as per the drill log attached to the email and as below (page 1 of log). The borehole produces water from the grey sands/sandstone and red clay. The borehole has been finished above ground. There are no known sewage systems or ground contamination sources nearby.

Invicta Water Treatment

89 Castle Drive

Horley

Surrey RH6 9DD

T. 01293 781077

Mobile. 07970 154529

Email. sales@invictawatertreatment.co.uk

www.invictawatertreatment.co.uk

WR39a Borehole record form

Borehole record form



British
Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL



Environment
Agency

Water Resources Act 1991 (as amended by the Water Act 2003)

A Site details

Borehole drilled for Littleworth Properties Ltd
Location Sandgate Nurseries, West End Lane, Henfield West Sussex, BN5 9UL
NGR (ten digits) 1Q 2040R 16086 Please attach site plan
Ground level (if known) 20 metres Above Ordnance Datum
Drilling company OT Drilling Ltd
Date drilling commenced 22/07/2024 (DD/MM/YYYY) Completed 05/08/2024 (DD/MM/YYYY)

B Construction details

Borehole datum (if not ground level) GL metres (m). Please tick if this is above ☐ or below ☐ ground level.
(point from which all measurements of depth are taken, for example, flange, edge of chamber)

Borehole drilled diameter 200 mm from 0 to 55 m/depth
1 mm from 1 to 1 m/depth
1 mm from 1 to 1 m/depth
1 mm from 1 to 1 m/depth

Casing material Mild Steel diameter 219 mm from +0.0 to 18.0 m/depth
and type (for example, if plain steel, plastic slotted). Please record permanent casing details, not temporary casing.

Casing material UPVC Plain diameter 125 mm from +0.0 to 24.0 m/depth

Casing material UPVC Slotted 0.3mm diameter 125 mm from 24.0 to 52.5 m/depth

Casing material 125 mm from 1 to 1 m/depth

Grouting details 50mm gravel placed in annulus around screen. Bentonite pellet grout placed 20-16m

Water struck at 1. 18.0 m (depth below datum - m(bd)) 2. 1 m (mbd)
3. 1 m (mbd) 4. 1 m (mbd)

C Test pumping summary (Please supply full details on form WR39)

Test pumping datum GL m. Please tick if this is above ☒ or below ☐ ground level.
(if different from borehole datum)

Pump suction depth 42 mbd

Water level (start of test) 4.8 mbd

Water level (end of test) 4.9 mbd

Type of test (for example, bailer, step, constant rate)
constant

Pumping rate 5.4 m³/hour ☒ or litres/second ☐. Please tick as appropriate.
for 1 days, 2 hours, 0 mins

Recovery to 4.8 mbd in 1 days, 0 hours, 0 mins
(from end of pumping)

Date(s) of measurements Pump started 05/08/2024 (DD/MM/YYYY)

Pump stopped 05/08/2024 (DD/MM/YYYY)

Please supply chemical analysis if available. If you have included this please tick this box ☐

WR39a Version 2, February 2011

page 1 of 3

Page 1 of 3 – see email attachments for full document

Summary

Invicta Water Treatment Limited registered office: Cheeld Wheeler & Co, Redhill Chambers, 2D High Street, Redhill, Surrey, RH1 1 RJ. Registration No. 4571271. VAT No. 920 2302 82

Invicta Water Treatment

89 Castle Drive

Horley

Surrey RH6 9DD

T. 01293 781077

Mobile. 07970 154529

Email. sales@invictawatertreatment.co.uk www.invictawatertreatment.co.uk

We trust that there is enough information herein for HDC. Please keep us informed of your progress. HDC can contact me directly if they wish.

Please feel free to call 07970 154529 if you need any parts of the report clarified.

Regards

Stefan Massingham BSc (Hons Chem.) MSc (Cran) MWMSoc

Director - Invicta Water Treatment Limited

Qualified UKAS Private Water Supply Sampler

[Recent Projects with Photos - Click Here](#)

Disclaimer

Liability: This document contains information and may contain conclusions and recommendations. Every effort has been made to ensure that the information is accurate and that the opinions expressed are sound. However, Invicta Water Treatment Limited cannot be made liable for any errors or omissions or for any losses or consequential losses resulting from decisions based on the information.

Appendix J

Water Efficiency Calculations

Installation Type	Unit of Measure	Capacity/Flow rate (1)	Use Factor (2)	Fixed use (litres/person/day) (3)	Litres/person/day = [(1)x(2)] + (3) (4)
WC (single flush)	Flush Volume (litres)		4.42	0.00	0
WC (dual flush)	Full flush Volume (litres)	6	1.46	0.00	8.76
	Part flush Volume (litres)	3	2.96	0.00	8.88
WC (multiple fittings)	Average effective flushing Volume (litres)		4.42	0.00	0
Taps (excluding kitchen/utility room taps)	Flow rate (litres/min)	1.00	1.58	1.58	3.16
Bath (where shower also present)	Capacity to overflow(litres)	125.00	0.11	0.00	13.75
Shower (where bath also present)	Flow Rate(litres / minute)	4.00	4.37	0.00	17.48
Bath Only	Capacity to overflow(litres)		0.50	0.00	0
Shower Only	Flow Rate (litres/minute)		5.60	0.00	0
Kitchen/Utility room sink taps	Flow rate (litres/minute)	1.80	0.44	10.36	11.15
Washing Machine	(Litres/kg dry load)	5.60	2.1	0.00	11.76
Dishwasher	(Litres/place setting)	0.80	3.6	0.00	2.88
Waste disposal unit	(Litres/use)	☐ Present	3.08	0.00	0
Water Softener	(Litres/person/day)		1.00	0.00	0
	(5)	Total Calculated use (litres/person/day) = SUM(column 4)			77.82
	(6)	Contribution from greywater (litres/person/day)			0
	(7)	Contribution from rainwater (litres/person/day)			0
	(8)	Normalisation factor			0.91
	(9)	Total internal water consumption = [(5)-(6)-(7)]x(8) (litres/person/day)			70.82
	(10)	External water use			5.0
	(11)	Total water consumption (Building Regulation 17.K) = (9)+(10)(litres/person/day)			75.8

Installation Type	Make/Model (mandatory)	Litres/Person/Day
WC (dual flush)	Polo Close-coupled Cistern - 6/3 Litre	17.64
Taps	Basin/Pillar Tap Flow Limiter 1 Litre Per Minute	3.16
Baths (shower(s) present)	Duravit No.1 1700mm Single Ended Rectangular Built In Bath	13.75
Showers (bath(s) present)	Bristan ECO SHW 04	17.48
Kitchen Taps	Kreen Pull Out Kitchen Faucet	11.15
Washing Machines	LG V3 FAV309SNE	11.76
Dishwasher	Samsung Series 6 DW60M6040BB/EU Full-size	2.88



©Water Research Centre Limited 2025

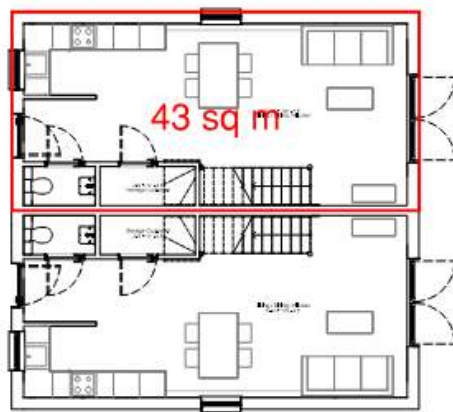
[Terms and Conditions](#)
[System Requirements](#)

Appendix K

Rainwater Harvesting Calculations

Calculation for a rainwater harvesting tank in the rear garden of a dwelling based on a 2 bedroom, 3 person dwelling, as shown below:

2Bedroom_3Person



Ground floor plan

Surface water collection area = 43m²

Yield coefficient & hydraulic filter efficiency = 0.9 (based on a pitched roof with tiles)

Rainfall = 819 mm/year

Number of occupants = 3

Daily collectable rainwater = $43 \times 0.9 \times 819 / 365 = 86.8$ litres

Yearly collectable rainwater = 31,682

Horsham District Council require 35 day drought capacity

Demand for recycled rainwater = 29.4 litres/person/day

Daily household demand for recycled rainwater = 88.2 litres/day

Yearly household demand for recycled rainwater = 32,193 litres

Demand is greater than collectable rainwater. Therefore, the rainwater harvesting tank does not meet the 35 day drought capacity and can't be relied upon for water neutrality calculations.