
DRAINAGE STRATEGY

For

LAND OFF GELLIGAER ROAD CF46 6DN

REF : IR20134/DS1

NOVEMBER 2020

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Third							

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1. Introduction

Intrado Consulting Engineers have been appointed to provide a drainage strategy in support of a planning application at Land off Gelligaer Road, CF46 6DN.

This strategy is produced for the sole benefit of Joanne Creese from whom it was commissioned and has been prepared in response to their particular requirements and brief. This strategy may not be relied upon by any other party.

The Contracts (Rights of Third Parties) Act 1999 shall not apply to this report and the provisions of the said Act are expressly excluded from this report. This strategy may not be used for any purpose other than that for which it was commissioned.

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2. The Site

2.1 Site Location & Description

The proposals are for the construction of 4 houses on a parcel of land off Gelligaer Road. Treharris, CF46 6DN. The national grid reference for the site is 311131, 196638.

A site location plan is provided as Figure 2-1.

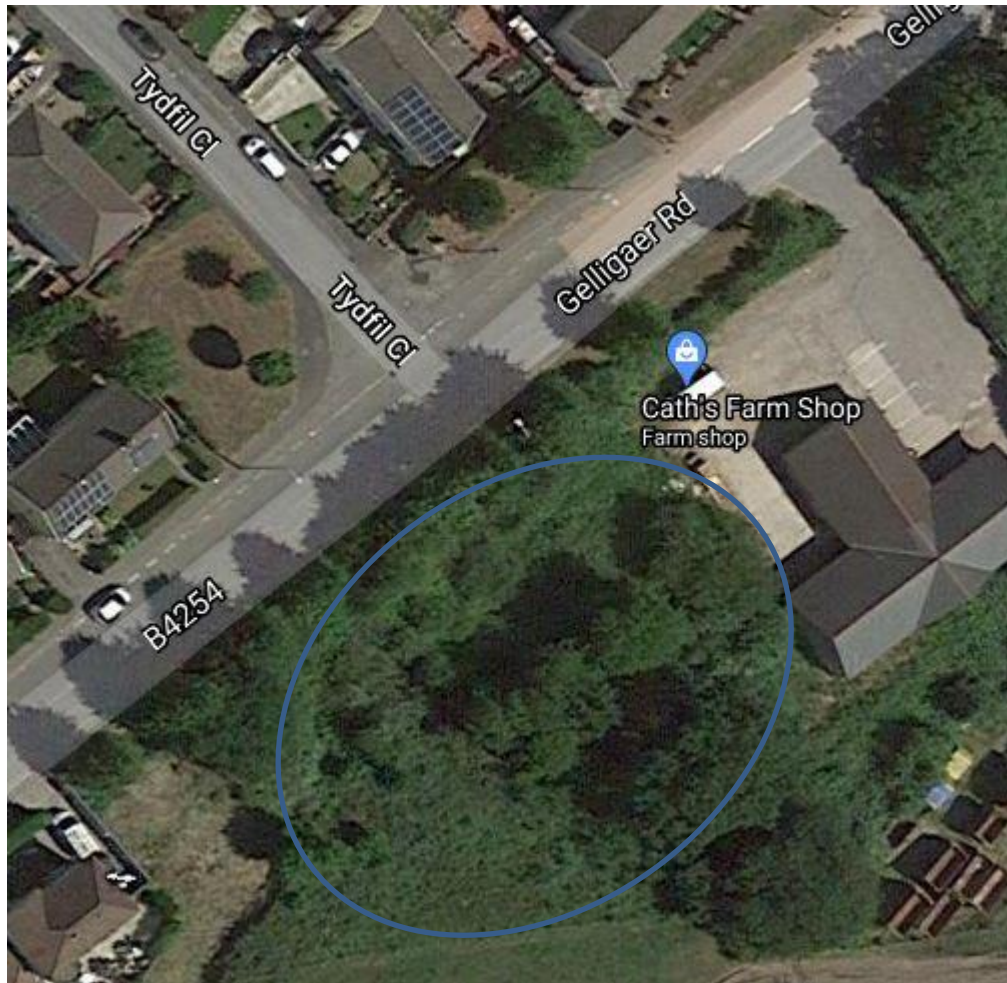


Figure 2-1 – Site Location

4. Proposed Drainage

a. Surface Water

The surface water run-off is to be managed through the use of Sustainable Drainage Systems (SuDS) integrated with the landscape strategy. The scheme will be subject to Schedule 3 of the Flood and Water Management Act 2010. To comply with this, the developer must follow the following guidelines:

- Water to be managed on or as close to the surface and source of the runoff as possible.
- Ensure pollution is prevented at source, not rely on the drainage system to treat it.
- Protect people from increased flood risk, and the environment from ecological changes in flow rates, patterns and sediment movement caused by the development
- Use a Management Train in series across a site rather than a single "end of pipe" feature, such as a pond, to serve the whole development
- SuDS should perform safely, reliably and effectively over the design life of the development. They must take into account the need for reasonable levels of maintenance
- Avoid the need for pumping where possible.
- Be affordable, taking into account both construction and long-term maintenance costs and the additional environmental and social benefits afforded by the system.

4.1 Surface Water Run-Off Destination

With reference to Schedule 3 the hierarchy of preferred disposal options are as Standard 1 which are as follows:

Priority Level 1 – Surface water is collected for reuse

Priority Level 2 - Surface water is infiltrated to the ground

Priority Level 3 - Surface water run-off is discharged to a surface water body

Priority Level 4 - Surface water run-off is discharged to a surface water sewer, highway drain, or another drainage system

Priority Level 5 - Surface water run-off is discharged to a surface water combined sewer.

Priority Level 1 – Collection for reuse

Rainwater has been discounted as the payback period on properties of this size is 51 years which is in excess of the lifetime of the unit. Refer to Appendix A for the calculation.

Priority Level 2 – Infiltration

A Site Investigation report has been carried out by Dr J Stewart Noake.

The possibility of constructing a soakaway at the site was investigated by Dr J Stewart Noake but discounted for the following reasons. A soakaway is 2m long by 1m wide and 2m deep and must have at least 1m of permeable material above the water table below for the water to drain into. This cannot be achieved at this site due to the potential for groundwater at the surface from the gully drainage as so was discounted.

In addition, the site development will entail making up the site level by some 2m with imported fill such as crusher run or quarry scalplings.

Priority Level 3 – Discharge to a surface water body.

There is an open ditch at the south-western end of the site and it is proposed to connect the surface water at this location.

Table 4-1 summarises the suitability of the disposal methods in the context of the site and the proposed development.

Surface water disposal method	Suitability Description	Method Suitable? (Y/N)
Priority Level 1 - Collection for reuse.	The use of recycled water at the site is very limited and it is not a viable solution.	N
Priority Level 2 - Infiltration to ground	The infiltration testing carried out Dr J Stewart Noakes advised infiltration is suitable.	N
Priority Level 3 – Discharge to a surface water body.	Proposed to connect the surface water ditch at the south-western end of the site	Y

Table 4-1 – Suitability of Surface Water Disposal Methods

It is therefore proposed to comply with standard S1 Priority Level 3.

4.2 Surface Water Run-Off Hydraulic Control

It is proposed to discharge the surface water from the development to the ditch at the south-western end of the site.

The drainage from the highway is to be kept separate from the development drainage. Currently a 150/200mm pipe discharges on to the site from a highway manhole and then flows overland. It is proposed to lay a new 225mm diameter pipe along the site boundary to allow the highway drainage to continue flowing through the site without causing any detriment to the residents.

The pipe will be 36.1m with a manhole after 17.8m to cater for the change in direction. The pipe will be laid from the current manhole invert level of 164.60 to the culvert at a level of 163.60 at a gradient of 1:36.1 giving a capacity of 86l/s.

In an aim to as far as practicably possible, prevent discharge from the site for the majority of rainfall events less than 5mm the drainage strategy uses infiltration trenches and raingardens.

It is proposed to manage the surface water run-off from the development via the following interception mechanisms as summarised in Table 4-3.

SuDS Management Train Mechanism	Application	Potential Suitable Suds Features
Source Control	For the interception of surface water run-off at the source of the roof and drives.	Raingardens and infiltration trenches.
Conveyance	To convey surface water run-off from 'Source Control' mechanisms to 'Site Control'	Raingardens and infiltration trenches.
Site Control	Provides the required surface water attenuation prior to controlled discharge to the culvert	Raingardens and infiltration trenches.

Table 4-3 Summary of Surface Water Management Strategy SuDS Options

Should a storm event occur which exceeds that of the 100 year storm event including for climate change, initially the surface water would hold on the surface of the garden and the drives. Once this volume has been exceeded the surface water will flow towards Gelligaer Road.

The Micro-drainage model for the surface water design can be found in Appendix D.

4.3 Water Quality

Standard S3 requires the design to minimise the potential pollution risk posed by the surface water to the receiving water body.

Table 4-4 sets out the Pollution Hazard Indices for land use in the proposed development as taken from Section 26 of The SuDS Manual the surface.

Land Use	Pollution Hazard Level	Pollution Hazard Indices		
		Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Individual Property Drives < 300 movements per day	Low	0.5	0.4	0.4
Residential Roofs	Very Low	0.2	0.2	0.05

Table 4-4 - Pollution Hazard Potential for Proposed Development

Type of SuDS component	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Raingarden	0.8	0.8	0.8

Table 4-5 - Mitigation Indices

The proposed drainage is required to demonstrate sufficient treatment capability to manage the specified Pollution Hazard Indices.

The Mitigation Indices are in Table 4-5.

The surface water at the front of the properties discharges to a raingarden. The drive flows into an ACO channel which discharges to the raingarden. It is not possible to use permeable paving to treat and store the surface water from the drive due to the foul sewer running through the drives. Welsh Water will not allow their apparatus to be within any SuDS features. A perforated pipe in the base of the raingarden directs the surface water to a carrier drain at the rear of the property.

The surface water from the rear downpipe discharges via a dish channel across the patio and into a raingarden.

The outflow from all raingardens is conveyed to a carrier drain to the existing culvert and discharged at a rate of 5.3 l/s controlled with an orifice plate.

The surface water from the highway and the overflow from Cathy's farm are connected to the culvert downstream of the orifice plate.

Due to the location of the raingardens a factor of safety of 5 has been applied to the design of the raingardens.

The SuDS Mitigation Indices provided by the proposed 'Source Control', 'Conveyance' and 'Site Control' measures for a discharge to surface waters have been compared against the Pollution Hazard Indices and are deemed sufficient.

The proposed drainage layout and construction details are in Appendix E

4.4 Amenity & Biodiversity

The drainage design has been carried out in conjunction with a landscaping scheme to ensure the SuDS scheme makes the best contribution to the development by maximising the benefits for amenity as well as for biodiversity, water quantity and quality.

Catherine Etchell Associates has been employed by the client to provide a Landscape Strategy and Planting Plan.

The proposed landscape design in co-ordination with the drainage proposals seeks to utilise the raingardens to offer opportunities for a variety of plant species associated with wetter soils. The consideration of these features together with the provision of wildflower seed within the garden areas will allow the residents to be able to benefit from a diverse planting mix and the benefits that will attract local wildlife.

The landscape areas will be subject to routine maintenance and aftercare visits to ensure that the long-term landscape character retains a pleasant setting for the local residents and its beneficial to the wildlife.

The SuDS management train will consist of the following:

- Discharge to raingardens. These areas will clean and filter out/absorb the pollutants and provide attenuation. Some of the run-off will also be lost in these areas due to up take by the vegetation and evaporating excess water into the atmosphere

5. Principal Operation and Maintenance Requirements

To comply with Standard S6 the following sections outline recommended maintenance requirements for the various aspects of the drainage system for the development.

The drainage design has considered the construction of the drainage elements, they can all be constructed by a competent contractor with minimal risk in terms of health & Safety.

5.1 Underground Piped Systems

A recommend operation and maintenance plan for the piped drainage network is summarised in Table 5-1

Maintenance Schedule	Required Action	Minimum Frequency
Regular maintenance	Ensure drainage intakes are clear or debris/silt	Monthly (or as required)
Occasional Maintenance	Clear gully pots	6 monthly
	Jet clean sewer lines, gully tails and kerb channels to remove grease, grit, sediment and other debris to ensure conveyance capacity is not compromised	Every 2 years
	Clear perforated pipework of blockages	As required.
Intermittent Maintenance	CCTV survey of sewer lines to identify any defects/sign of performance degradation such as: Cracked/deteriorating pipes; Leaking joints/seals at manholes; High water line showing regular high stage in pipes (sign of lack of capacity or downstream constraint); and Suspected infiltration or exfiltration.	Every 2 – 5 years
Remedial Actions	Repair defects using suitable methods. Effective temporary repairs may be sufficient in short term until scheduled, capital improvements can be made.	As required
Monitoring	Record areas of surface ponding/intake bypassing/ surcharging (photos, inundated areas, depths) during extreme storm events and investigate the reasoning for this post-storm.	As required

Table 5-1 - Typical Pipe System Operation and Maintenance Requirements

5.2 Raingarden

The proposed drainage scheme will utilise a raingarden as a mechanism for collection, treatment and attenuation of surface water run-off. The anticipated maintenance and management for the raingarden s associated with the surface water drainage system is outlined in Table 5-2.

Maintenance Schedule	Required Action	Minimum Frequency
Regular inspection	Inspect infiltration surfaces for silting and ponding. Record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular Maintenance	Reseed area of poor vegetation growth, after plant types to better suit conditions, if required	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional Maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial Actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

Table 5-2 Typical Raingarden Operation & Maintenance Requirements

6. Conclusion

Intrado has been appointed to develop a Flood Risk Assessment and Surface Water Drainage Strategy to manage surface water run-off resulting from the proposed planning application for of 4 houses on a parcel of land off Gelligaer Road. Treharris, CF46 6DN.

The potential sources of flood risk at the site have been confirmed with the conclusion that the flood risk to the site was predominantly very low and warrant no further consideration or specific mitigation measures to be applied.

Currently a highway drain discharges on to the site. Due to poor infiltration this caused the site to be waterlogged. A ditch has been formed to direct the highway drainage to the culvert. It is proposed to lay a 225mm pipe from the highway manhole to the culvert to maintain the flow and not pose any risk to the residents.

Technical information provided in this report on behalf of the Applicant seeks to demonstrate that a robust and sustainable drainage strategy has been prepared for the site, including residual events. It is proposed that the surface water run-off arising from the development discharges the existing culvert.

The surface water drainage strategy presented in this report demonstrates that adequate SuDS space provision is afforded within the development and that the proposed scheme is feasible and compliant to appropriate best practice and regulatory requirements and can be maintained in accordance with best practise. It is considered that the proposals ensure the safe management and maintenance of surface water run-off.

Appendix A

Raincatcher Calculation



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Calculator

RainCatcher's Rainwater Harvesting Systems Calculator

This calculator shows you the tank size you will require and the savings you can expect from your rainwater harvesting system.



Part 1: Annual Rainwater Yield

Roof area (m²):

Roof type: ▼

Location: ▼

Part 2 - Annual Water Demand

Number of occupants:

Type of building: ▼

Daily Water Consumption per person (Litres):
 ▼

System implemented for:

WC: ☒

Washing Machine: ☐

Garden Use/External Irrigation : ☒

Part 3: Potential Saving

Water supply unit cost (£/m³):

Part 4 - Estimated payback period

Full system (Tank, Pump & Filter) price (£):

Installation Cost (£)

Avg. annual rainfall (mm):	1091.00
Annual Water Yield (L):	83952.45
Annual water demand (L):	118260.00
Annual non-potable water saving (%):	70.99
Annual Saving (£):	115.85
Minimum rainwater storage (L):	5037.15
Payback period (years):	38.84

This is a guide only based on the simplified approach seen in the QCF BPEC certified course content. [Get in touch](#) today to receive a full specification.

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Appendix B

Mining Risk Assessment & Geology Report

Client: Joanne Creese

Project: Proposed housing development

Location: Land off Gelligaer Road, Trelewis

Drone image dated 10/9/2020



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Date: September 2020

Dr. J Stewart Noake
Engineering Geologist
and
Mining Consultant

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**Ms Joanne Creese
'Gwynfa'
Penywaun Farm
Heol Fawr
Nelson
CF46 6PL**

Date: September 2020

Dear Madam,

Proposed development on land off Gelligaer Road, Trelewis;

Mining Risk Assessment & Geotechnical Report

Terms of reference

This report has been produced for Ms Joanne Creese and concerns the suitability of a plot of land off Gelligaer Road, Trelewis for the construction of some new detached houses given that the possibility of shallow mine workings and uncertain soils have been identified at the site.

This report also contains a Mining Risk Assessment.

Information Available

Information for this report has been obtained from several site visits between May 2013 and September 2020, the excavation of four trial pits, The Tithe Map dated 1810, the Old County Map Editions for Monmouth sheet XIX dated 1875 1898, 1918, the 1938, 1948, 1960 and modern National Grid Series maps, Geological sheet ST 19 NW, Google images dated 1945, 2001, 2004, 2006, 2010, 2013, 2016, 2018 and 2020, online information and mining abandonment plans including SWR 3079, from British Coal's Mansfield Abandoned Mines Records Office, the memoirs of the Geological Survey for the Country around Newport dated 1909 and 1969 and the country around Pontypridd and Maesteg (1903 & 1964) and local archive material including a list of all Collieries that worked in the area by Mr. R.A. Lawrence, a local historian.

In addition, several reports have been prepared by the author in the area over the last 40 years and these have also been consulted as well as the author's own voluminous archives.

This report should be read with reference to the accompanying plans, diagrams and photographs.

General

The site (Fig.1 and front cover) is located at National Grid Reference ST111967 at an elevation of some 155m AOD and lies to the south-east of Gelligaer Road, Trelewis. This is a greenfield site that is presently overgrown with brambles and scrub and lies some 1 - 1.5m below the level of the adjacent road (Front cover inset). It is bounded to the north-west by

Gelligaer Road, to the south-west by an adjacent recently constructed property, to the north-east by Cath's Farm Shop and a field to the south-east.

Historical records (Figs 2, 3, 4 & 5) show the site as undeveloped on the Tithe, 1875, 1898, 1918, 1938, 1948 and 1951 editions, the 1945 aerial photograph and all subsequent Google images up to 2020 and the drone image on the front cover. The adjacent building to the south-west has been recently constructed and was also investigated by the author. A new housing estate has recently been constructed to the north-east of the site.

A watercourse is shown on all of the map editions with 'rises' being added on the 1914 - 1948 editions, nothing is again indicated on the 1960 edition and 'issues' being shown on the 1990 edition. This is described in detail later in the section entitled 'Hydrology and Hydrogeology'.

Geology

Solid geology

The site is underlain by strata of Carboniferous Age belonging to the Grovesend Beds above the Mynyddislwyn Seam, which crops well to the west (Fig.2) beyond a faulted contact. These strata, which are not exposed at the site, comprise a sequence of mainly coarse grained and very thickly bedded, very wide spaced jointed, extremely strong gritstones overlying mudstones and siltstones associated with the Mynyddislwyn Seam and lie in a faulted trough on the south-western side of the Gelligaer Fault and north-eastern side of the Llanfabon Fault with a very gentle dip to the north into the Blackwood Syncline. The seam itself comprises a 1.5m thickness of coking quality coal and lies at a depth of some 40m below the site.

These strata have been faulted on NW and NE axes with the major Gelligaer Fault lying well to the north-east of the site and the parallel Llanfabon Fault well to the west so that the site lies in a faulted trough. There are several minor faults recorded below the site in the Mynyddislwyn Seam workings beneath the site.

Superficial deposits

These strata are in turn indicated as overlain by a layer of glacial sand and gravel soils deposited in an extensive late glacial lake with Glacial till lower down the hillside by the Geological Survey (Fig. 2). In the event, all four trial pits proved a different sequence to that predicted by the Geological Survey with only glacial till underlying the site with a variable layer of colluvium above.

The soils at the site were investigated by logging the available natural exposures nearby and the excavation of four trial pits. In the event, all four trial pits proved an identical sequence of organic topsoil up to 0.4m thick overlying an orangey brown, soft becoming firm, silty clay, which is a colluvial soil or head deposit down to a depth of 0.9m. Both of these types of soil are unsuitable as a founding stratum and will have to be stripped from below any new foundations.

The underlying soil down to a maximum recorded depth of 1.2m was found to comprise a greyish-green with orange mottling towards the top, soft to firm becoming stiff, silty sand with rounded gravel, cobbles and boulders which is a glacial till. This is an ideal founding stratum and this is discussed further in the following section entitled 'Foundations'.

Foundations

The site investigation has shown that the existing site level is 1 - 1.5m below road level. In order to develop the site, the off road parking area and egress from the site will have to be at road

level which will entail making the site up to road level. This will also be necessary to establish service connections to the proposed property.

The site investigation also showed a variable thickness up to some 0.9m of organic topsoil and colluvium at the site which are both unsuitable as a founding stratum and will have to be stripped from below any new foundations. The underlying soils were found to comprise a firm glacial till which is strong in engineering terms and will adequately support traditional strip type foundations.

In order to develop the site, it will be necessary to strip the whole of the upper unsuitable soil layers and to remove them from the site. The site level should then be made up to road formation level with imported clean, inert granular fill such as crusher run or quarry scalplings. As this material is a virgin quarry product, it is exempt from contaminant testing. This material should be compacted in 150mm layers with a minimum of five passes of a ten tonne vibrating roller to construct an engineering plinth. The new building may then be safely constructed on a lightweight raft or modified raft design with a ground bearing slab. An allowable bearing capacity of 50kPa would be appropriate.

As this is a coalfield area, there is the continual risk of the emission of coalfield gases such as methane, which is a natural process. In order to prevent the build up of such gases and indeed any gases including the extremely remote possibility of radon, an impermeable polythene barrier should be placed below all new concrete foundation areas.

Hydrology and Hydrogeology

As mentioned in the General section above, there is a watercourse shown on the early map editions with 'rises' indicated at the northern end adjacent to the road and it was decided to investigate this with trial pit TP 1. There is a 200mm diameter pipe feeding the gully drainage from the road onto the site and the cover to the manhole cover adjacent to the road was lifted to inspect this as it is the only source of water entering the site.

In the event, a 200mm diameter pipe was found to be leading from a recently constructed manhole cover adjacent to the highway (TP 1). In the event, two road gully feeds were found in the chamber. One from the north-east and the other from the south-west that is known to be blocked from a camera survey. This means that there is only a short road gully feed to the overflow pipe leading to the site.

Trial pit TP 1 was excavated across the line of the watercourse to determine the amount of alluvium present and the results are presented in the records of TP 1. In the event, no alluvium was encountered nor was there any signs of the watercourse being active, nor was there any signs of 'rises' as indicated on the earlier maps. This includes the period from 2013 - 2020 when the site was being monitored for the earlier property development.

The investigation proved the presence of organic topsoil infilling the line of the watercourse as shown in the photograph accompanying TP 1 where the natural succession of colluvium down to glacial till was encountered. There is no way that the glacial till below the site can be the source of groundwater as it is effectively impermeable. This was taken to indicate that the watercourse had not flowed significantly in recent times.

Accordingly, it is recommended that the 200mm diameter pipe be extended across the site to its southern margin in a suitable bedded stone surround wrapped in terram or similar to permit the flow to continue, should it ever be re-established. This can then be buried beneath the proposed

infilling of the site as a whole and connected to the open ditch coursing along the south-western side of the site.

Groundwater was not encountered in any of the trial pits nor was there any sign of any transient phreatic surface staining.

Raising the site level will also effectively prevent the possibility of future flooding.

It is considered that neither surface nor groundwater are an obvious problem at the site.

Site run off drainage/soakaway

The site is lower than the surrounding area and as such has a very restricted catchment. At present, the site is fed by a 200m diameter pipe that imports road gully drainage which it is proposed to pipe across the site as described above to connect with the open ditch at the south-western end of the site.

The possibility of constructing a soakaway at the site was investigated but discounted for the following reasons. A soakaway is 2m long by 1m wide and 2m deep and must have at least 1m of permeable material above the water table below for the water to drain into. This cannot be achieved at this site due to the potential for groundwater at the surface from the gully drainage as so was discounted.

In addition, the site development will entail making up the site level by some 2m with imported fill such as crusher run or quarry scalplings.

As it is illegal to construct a soakaway in fill materials, then the roof and hardstanding drainage from the site after development will have to be fed into the open drainage ditch in the south-west.

Mining

There are no recorded or suspected mine entries beneath or within influencing distance of the site (Fig. 2 and insets).

The shallowest recorded Coal Seam below the site is Mynyddislwyn Seam and the mining abandonment plans indicate that it has been completely worked out beneath the site and lies at a depth of some 40m. These workings were essentially completed by the turn of the Nineteenth century from Llancaich Colliery to the east. It is considered that these workings in the Mynyddislwyn Seam are at sufficient depth not to pose a threat to the proposed new development.

Mining in the deeper seams were in the Brithdir Seam but mainly in the underlying Main Productive Coal Measures and were prosecuted from Trelewis Deep Navigation (Ocean) Colliery which closed in 1990 to the west and Penallta Colliery to the east at depths in excess of 500m, the last workings being from Penallta Colliery in the Meadow Vein in 1990. All subsidence strains associated with these workings are normally completed within one month of extraction and will now have ceased as that colliery closed in 1990 having been opened in 1906 by the Powell Duffryn Steam Coal Company.

Mining Risk Analysis

This investigation has shown the site to be clear of all recorded mine entries.

The shallowest recorded workings below the site lie at a depth of some 40m and were

completed by the end of the Nineteenth Century. All deeper mining in the main productive measures and overlying Brithdir Seam were completed before 1990 when both the Trelewis Deep Navigation and the Penallta collieries finally closed.

It is thus considered that the risk to the proposed development from previous mining activity is zero.

Conclusions

The site is underlain by strata of Carboniferous Age belonging to the Grovesend Beds above the Mynyddislwyn Seam and are not exposed at the site.

These strata are in turn overlain by glacial soils which are a strong in engineering terms.

It is recommended that the site be stripped of unsuitable surface organic soils and then filled with quarry scalplings or crusher run to formation level sufficient to establish service connections and enable site access at road level. The property may then be safely constructed on a lightweight or modified raft type foundation.

A 200mm diameter pipe has been identified as feeding road gully drainage onto the site. It is recommended that this be extended beneath the proposed development in a terram surrounded pipe bedded in suitable coarse granular material to the open ditch at the south western end of the site. This will then be buried beneath the proposed filled site.

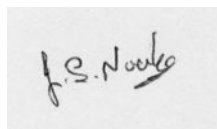
No threat has been identified for either surface or ground water and the development of the site will effectively prevent the risk of flooding.

After development by filling, the site will be unsuitable for a soakaway and surface drainage will have to be accommodated within the existing open ditch watercourse at the southern end of the site.

No threat has been identified from previous mining activity. It is considered that the risk to the proposed development from previous mining activity is zero.

The conclusions in this report are based on a review of the information available. There may be local conditions at the site that could affect the development such as high seasonal local groundwater conditions or local pockets of weak soils or fill although this is considered extremely unlikely. Should such conditions come to light during the site development, then the conclusions of this report should be reviewed and appropriate measures adopted.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'J.S. Noake', is written over a light grey rectangular background.

Dr. J. S. Noake BSc, PhD, FGS. C. Geol.

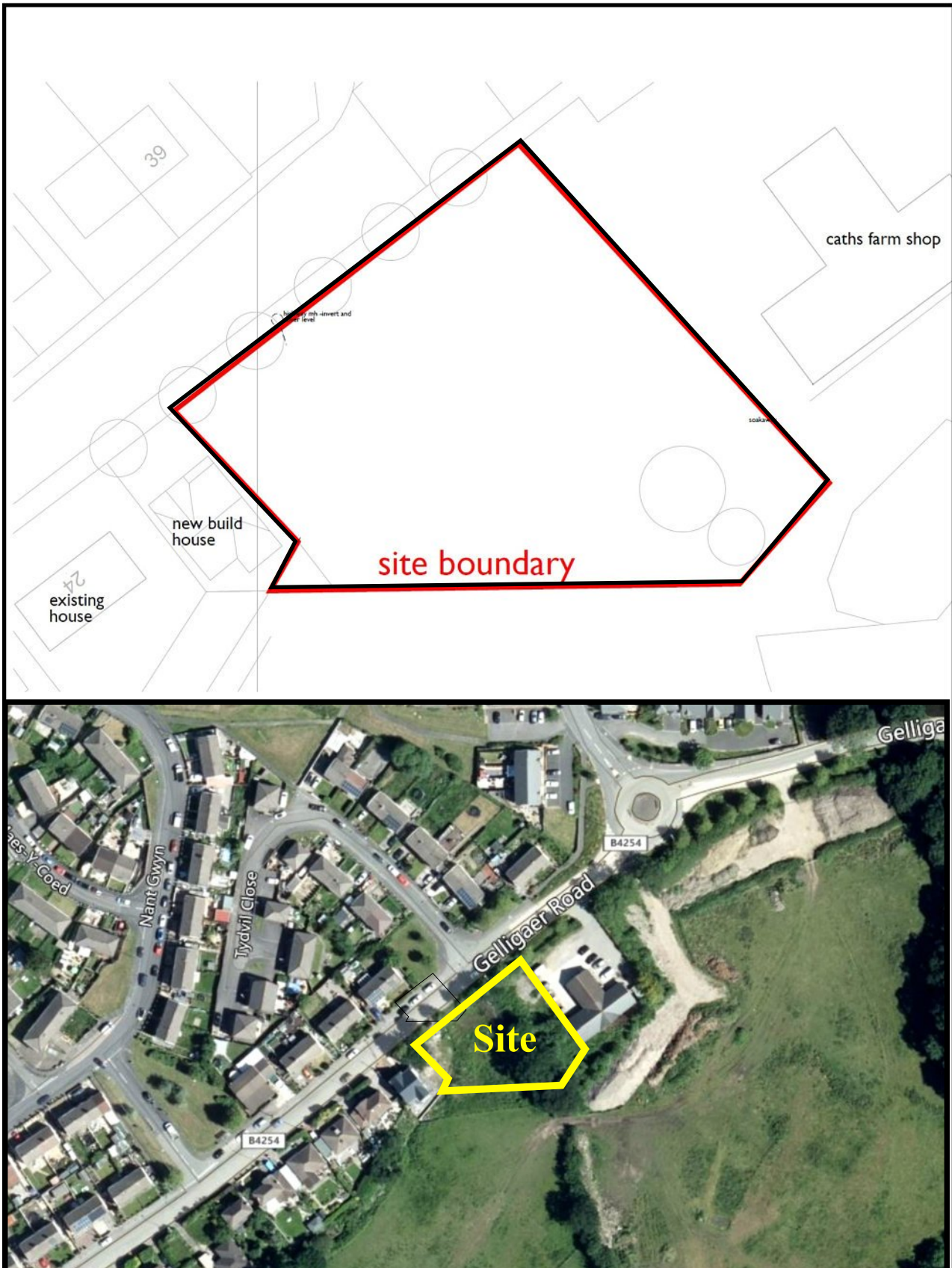


Fig. 1

**Proposed development off
Gelligaer Road, Trelewis;
Location plan**

Scale as shown

Dr J S Noake September 2020



Fig. 2 Proposed development off Gelligaer Road, Trelewis;
Geological plan with mining details (inset)

Scale as shown

Dr J S Noake September 2020

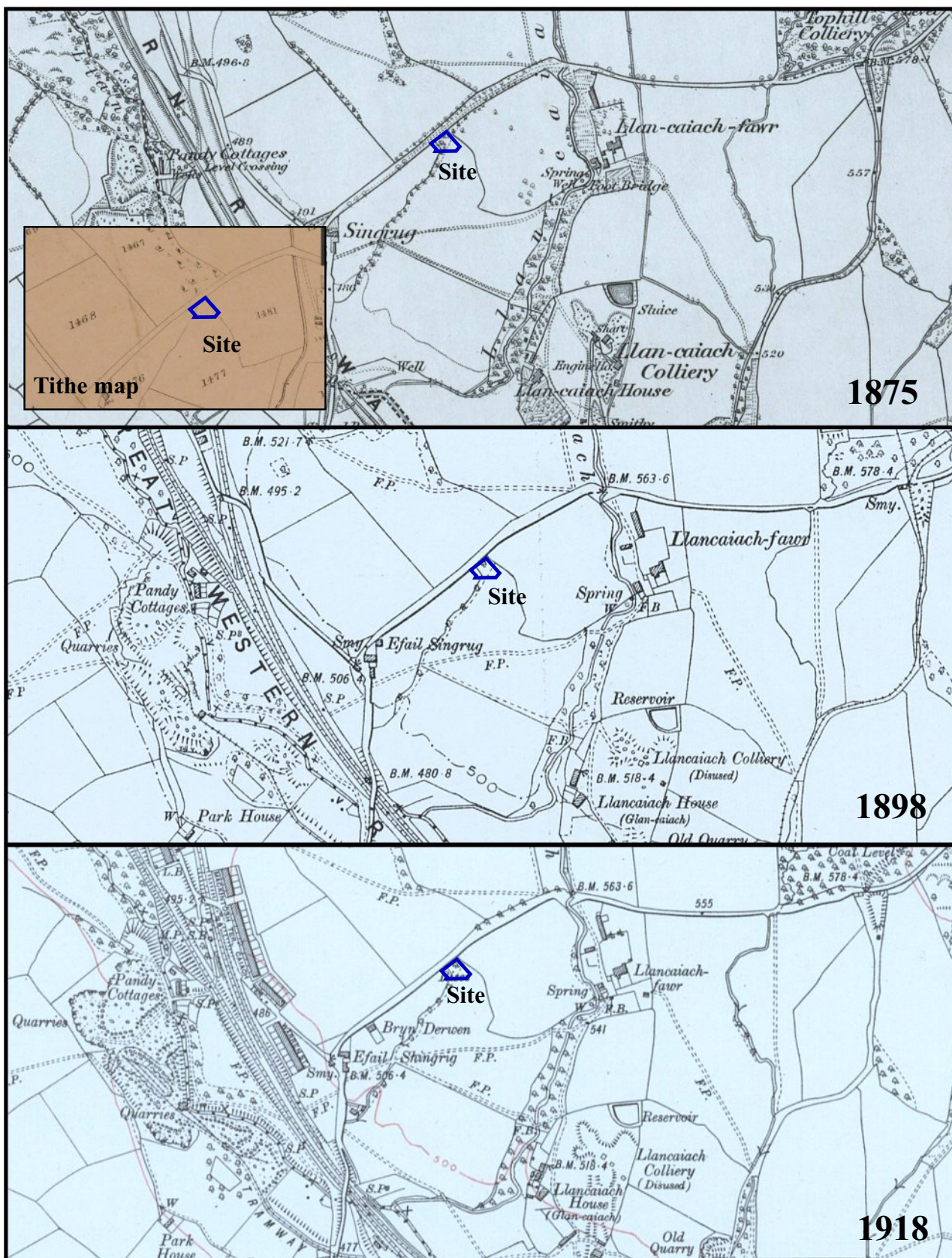


Fig. 3

Proposed development off Gelligaer Road, Trelewis; Historical plans Tithe, 1875, 1898 & 1918

Scale as shown

Dr J S Noake September 2020

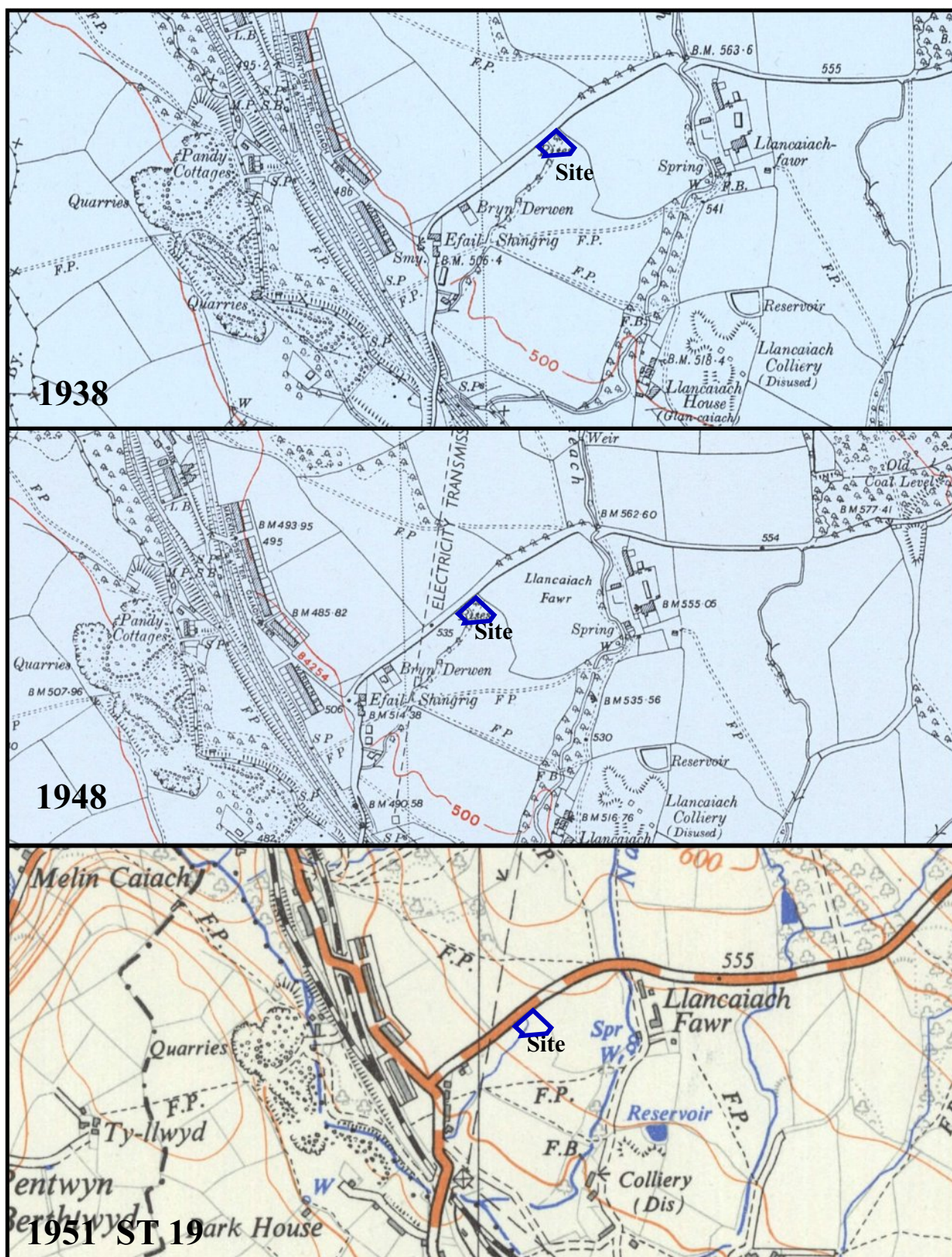


Fig. 4

Proposed development off Gelligaer Road, Trelewis; Historical plans 1938, 1948 & 1951

Scale as shown

Dr J S Noake September 2020

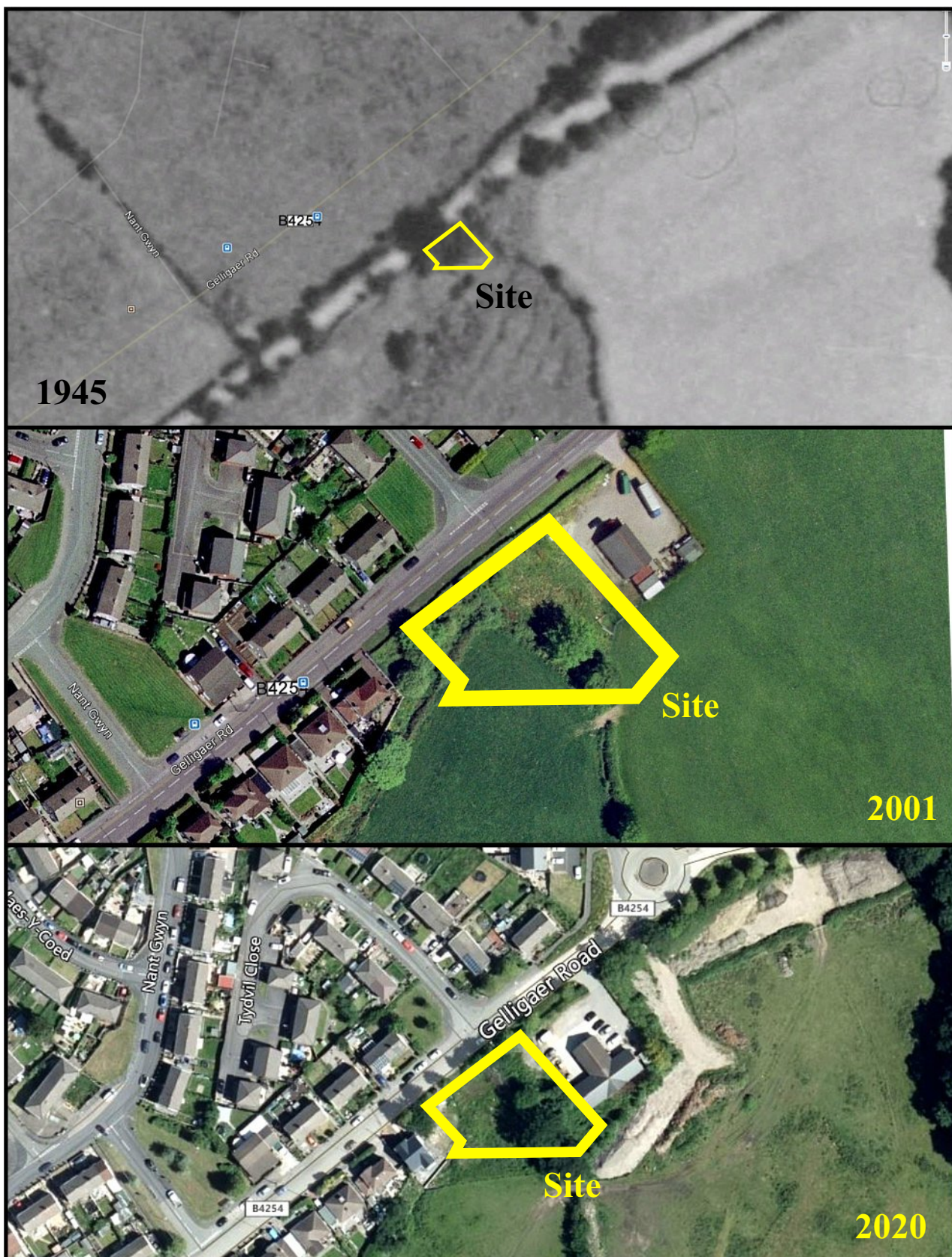
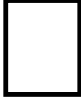
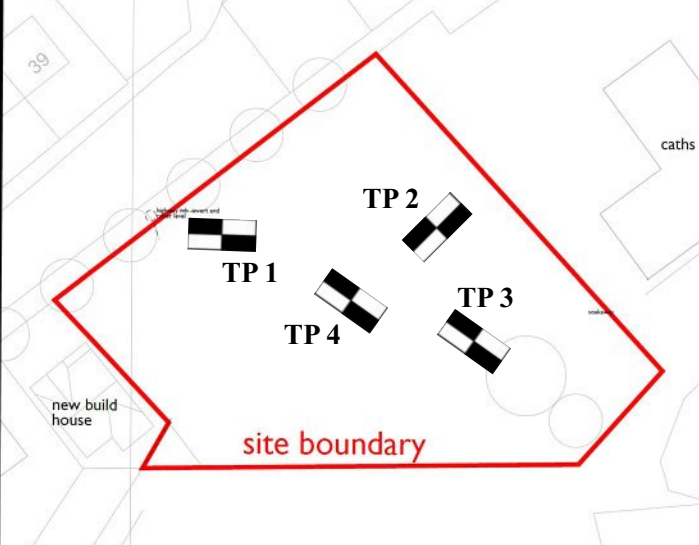
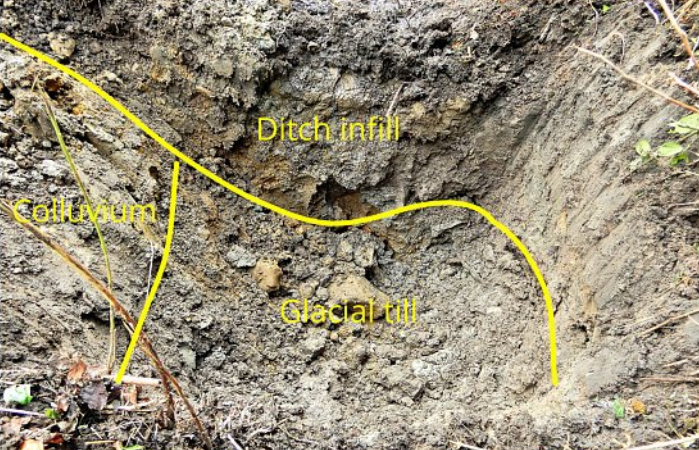


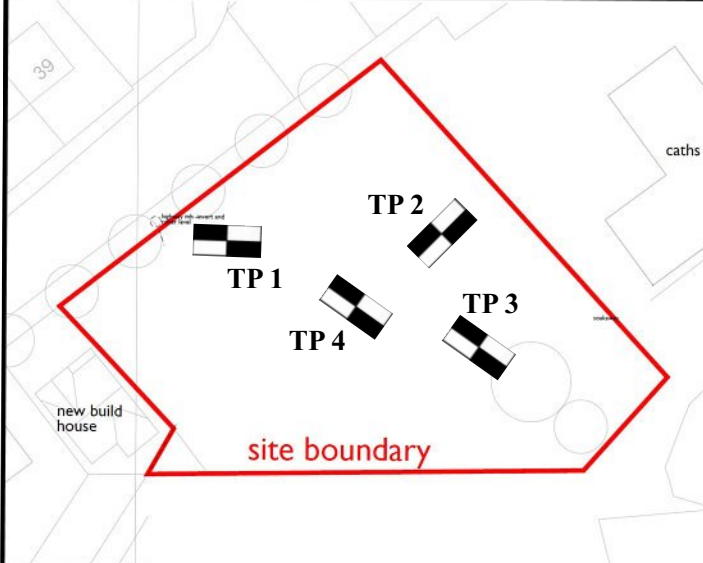
Fig. 5

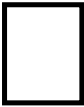
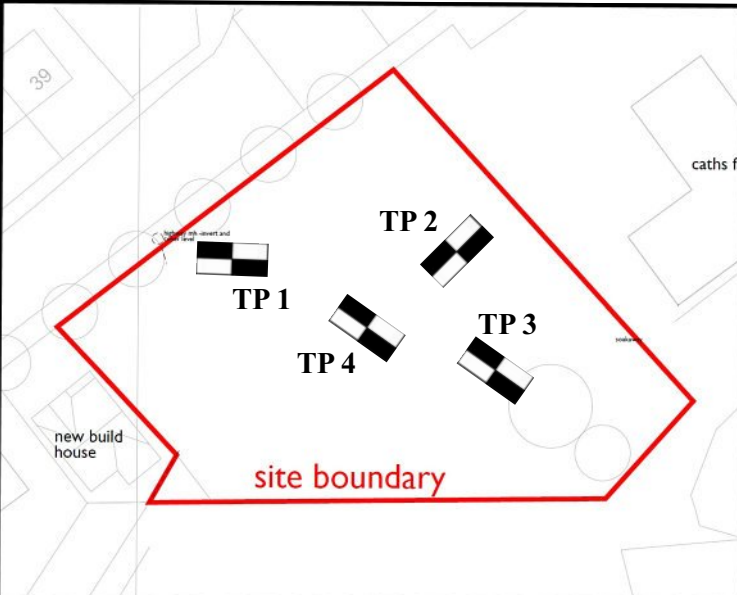
**Proposed development off
Gelligaer Road, Trelewis;
Google images 1945, 2001 & 2020**

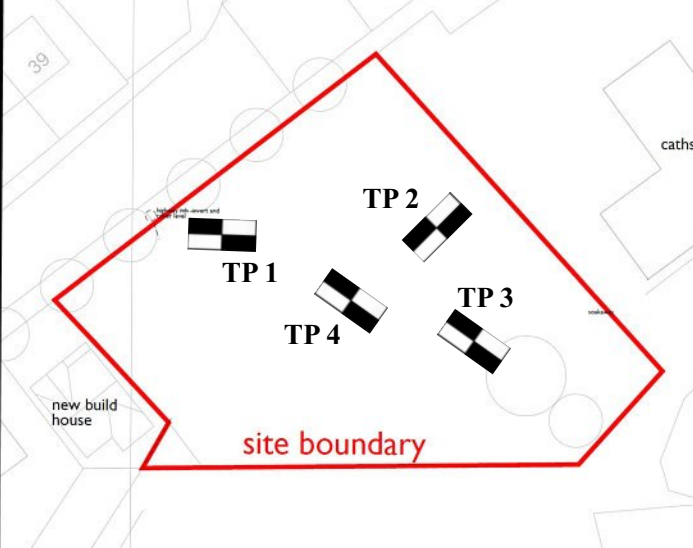
Scale as shown

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CLIENT: Joanne Creese SITE: Land off Gelligaer Road, Trelewis Method of excavation: Machine Contractor: Steve Rees Elevation: 155m AOD Date: 10th September 2020 National Grid Reference: ST111967	Record of Trial Pit TP 1
	Plan (not to scale) 1m N090 degrees  1.5m
Details	Description
	0.00 - 0.20m increasing to 0.70m within the ditch. Black silty very organic silty sand; Organic topsoil. 0.20 - 0.90m Orangish-brown, soft becoming firm, sandy, silty clay: Colluvium. 0.90 - 1.20. Grey and green with orange mottling at the top, firm silty sand with rounded gravel, cobbles and boulders; Glacial till.
	
Water: Dry	Remarks: Old drainage ditch.
Samples/Test: None	
Logged by: JSN Date: 10/9/2020	Scale as shown

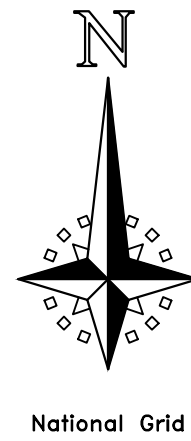
CLIENT: Joanne Creese SITE: Land off Gelligaer Road, Trelewis Method of excavation: Machine Contractor: Steve Rees Elevation: 155m AOD Date: 10th September 2020 National Grid Reference: ST111967	Record of Trial Pit TP 2 Plan (not to scale) 1m  N040 degrees 1.5m
Details	Description
 	0.00 - 0.20m Black silty very organic silty sand; Organic topsoil. 0.20 - 0.50m Orangish-brown, soft becoming firm, sandy, silty clay: Colluvium. 0.50 - 1.20. Grey and green with orange mottling at the top, firm silty sand with rounded gravel, cobbles and boulders; Glacial till.
Water: Dry	Remarks:
Samples/Test: None	
Logged by: JSN Date: 10/9/2020	Scale as shown

CLIENT: Joanne Creese SITE: Land off Gelligaer Road, Trelewis Method of excavation: Machine Contractor: Steve Rees Elevation: 155m AOD Date: 10th September 2020 National Grid Reference: ST111967	Record of Trial Pit TP 3 Plan (not to scale) 1m N130 degrees  1.5m
Details	Description
	0.00 - 0.20m Black silty very organic silty sand; Organic topsoil. 0.20 - 0.90m Orangish-brown, soft becoming firm, sandy, silty clay: Colluvium. 0.90 - 1.20. Grey and green with orange mottling at the top, firm silty sand with rounded gravel, cobbles and boulders; Glacial till.
	
Water: Dry	Remarks:
Samples/Test: None	
Logged by: JSN	Scale as shown

CLIENT: Joanne Creese SITE: Land off Gelligaer Road, Trelewis Method of excavation: Machine Contractor: Steve Rees Elevation: 155m AOD Date: 10th September 2020 National Grid Reference: ST111967	Record of Trial Pit TP 4 Plan (not to scale) 1m  N130 degrees 1.5m
Details	Description
	0.00 - 0.20m Black silty very organic silty sand; Organic topsoil. 0.20 - 0.30m Orangish-brown, soft becoming firm, sandy, silty clay: Colluvium. 0.30 - 0.50. Grey and green with orange mottling at the top, firm silty sand with rounded gravel, cobbles and boulders; Glacial till.
	
Water: Dry	Remarks:
Samples/Test: None	
Logged by: JSN	Scale as shown

Appendix C

Topographical Survey

[illegible]

Appendix D

Greenfield Run Off Rates

Storm Rates

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 310750 196400 ST 10750 96400
Data Type	Catchment
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	6.400	0.043	150.0	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	18.400	0.123	149.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	9.800	0.065	150.8	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	10.700	0.195	55.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	6.400	0.043	150.0	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	18.400	0.123	150.0	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	10.900	0.073	150.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	49.44	5.13	165.450	0.006	0.0	0.0	0.0	0.82	14.5	0.8
1.001	48.17	5.50	165.407	0.006	0.0	0.0	0.0	0.82	14.5	0.8
1.002	47.53	5.70	165.284	0.012	0.0	0.0	0.0	0.82	14.4	1.5
1.003	47.12	5.84	165.219	0.021	0.0	0.0	0.0	1.36	24.0	2.7
2.000	49.44	5.13	165.190	0.006	0.0	0.0	0.0	0.82	14.5	0.8
2.001	48.17	5.51	165.147	0.012	0.0	0.0	0.0	0.82	14.5	1.6
1.004	46.45	6.06	165.025	0.042	0.0	0.0	0.0	0.82	14.5	5.3

INTRADO

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.005	1.200	0.098	12.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	6.400	0.043	150.0	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	18.400	0.123	149.6	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.006	10.600	0.071	149.3	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.007	1.200	0.008	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.000	6.400	0.043	150.0	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	180.000	1.200	150.0	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.008	5.000	0.033	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.005	46.43	6.06	164.952	0.042	0.0	0.0	0.0	2.89	51.1	5.3
3.000	49.44	5.13	165.020	0.006	0.0	0.0	0.0	0.82	14.5	0.8
3.001	48.17	5.50	164.977	0.012	0.0	0.0	0.0	0.82	14.5	1.6
1.006	45.80	6.28	164.854	0.064	0.0	0.0	0.0	0.82	14.5	7.9
1.007	45.73	6.30	164.783	0.064	0.0	0.0	0.0	0.82	14.5	7.9
4.000	49.44	5.13	164.860	0.006	0.0	0.0	0.0	0.82	14.5	0.8
4.001	39.77	8.80	164.817	0.011	0.0	0.0	0.0	0.82	14.5	1.2
1.008	39.56	8.90	163.617	0.075	0.0	0.0	0.0	0.82	14.5	8.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
BIO 1	166.200	0.750	Open Manhole	1200	1.000	165.450	150				
S2	166.200	0.793	Open Manhole	1200	1.001	165.407	150	1.000	165.407	150	
S3	166.200	0.916	Open Manhole	1200	1.002	165.284	150	1.001	165.284	150	
S4	165.980	0.761	Open Manhole	1200	1.003	165.219	150	1.002	165.219	150	
BIO 2	166.036	0.846	Open Manhole	1200	2.000	165.190	150				
S5	166.036	0.889	Open Manhole	1200	2.001	165.147	150	2.000	165.147	150	
S6	165.820	0.795	Open Manhole	1200	1.004	165.025	150	1.003	165.025	150	
								2.001	165.025	150	
S7	165.850	0.898	Open Manhole	1200	1.005	164.952	150	1.004	164.952	150	
BIO 3	165.870	0.850	Open Manhole	1200	3.000	165.020	150				
S8	165.660	0.683	Open Manhole	1200	3.001	164.977	150	3.000	164.977	150	
S9	165.660	0.806	Open Manhole	1200	1.006	164.854	150	1.005	164.854	150	
								3.001	164.854	150	
S10	165.680	0.897	Open Manhole	1200	1.007	164.783	150	1.006	164.783	150	
BIO 4	165.710	0.850	Open Manhole	1200	4.000	164.860	150				
S11	165.710	0.893	Open Manhole	1200	4.001	164.817	150	4.000	164.817	150	
13	165.660	2.043	Open Manhole	1200	1.008	163.617	150	1.007	164.775	150	1158
								4.001	163.617	150	
Culvert	165.660	2.076	Open Manhole	0		OUTFALL		1.008	163.584	150	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	BIO 1	166.200	165.450	0.600	Open Manhole	1200
1.001	o	150	S2	166.200	165.407	0.643	Open Manhole	1200
1.002	o	150	S3	166.200	165.284	0.766	Open Manhole	1200
1.003	o	150	S4	165.980	165.219	0.611	Open Manhole	1200
2.000	o	150	BIO 2	166.036	165.190	0.696	Open Manhole	1200
2.001	o	150	S5	166.036	165.147	0.739	Open Manhole	1200
1.004	o	150	S6	165.820	165.025	0.645	Open Manhole	1200
1.005	o	150	S7	165.850	164.952	0.748	Open Manhole	1200
3.000	o	150	BIO 3	165.870	165.020	0.700	Open Manhole	1200
3.001	o	150	S8	165.660	164.977	0.533	Open Manhole	1200
1.006	o	150	S9	165.660	164.854	0.656	Open Manhole	1200
1.007	o	150	S10	165.680	164.783	0.747	Open Manhole	1200
4.000	o	150	BIO 4	165.710	164.860	0.700	Open Manhole	1200
4.001	o	150	S11	165.710	164.817	0.743	Open Manhole	1200
1.008	o	150	13	165.660	163.617	1.893	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	6.400	150.0	S2	166.200	165.407	0.643	Open Manhole	1200
1.001	18.400	149.6	S3	166.200	165.284	0.766	Open Manhole	1200
1.002	9.800	150.8	S4	165.980	165.219	0.611	Open Manhole	1200
1.003	10.700	55.0	S6	165.820	165.025	0.645	Open Manhole	1200
2.000	6.400	150.0	S5	166.036	165.147	0.739	Open Manhole	1200
2.001	18.400	150.0	S6	165.820	165.025	0.645	Open Manhole	1200
1.004	10.900	150.0	S7	165.850	164.952	0.748	Open Manhole	1200
1.005	1.200	12.3	S9	165.660	164.854	0.656	Open Manhole	1200
3.000	6.400	150.0	S8	165.660	164.977	0.533	Open Manhole	1200
3.001	18.400	149.6	S9	165.660	164.854	0.656	Open Manhole	1200
1.006	10.600	149.3	S10	165.680	164.783	0.747	Open Manhole	1200
1.007	1.200	150.0	13	165.660	164.775	0.735	Open Manhole	1200
4.000	6.400	150.0	S11	165.710	164.817	0.743	Open Manhole	1200
4.001	180.000	150.0	13	165.660	163.617	1.893	Open Manhole	1200
1.008	5.000	150.0	Culvert	165.660	163.584	1.926	Open Manhole	0

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Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall C. Level Name (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	Culvert	165.660	163.584	0.000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	7
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 310750 196400 ST 10750 96400
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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<u>Online Controls for Storm</u> <u>Orifice Manhole: 13, DS/PN: 1.008, Volume (m³): 5.5</u> Diameter (m) 0.044 Discharge Coefficient 0.600 Invert Level (m) 163.617		
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Storage Structures for Storm

Bio-Retention Area Manhole: BIO 1, DS/PN: 1.000

Invert Level (m) 165.450 Infiltration Coefficient Side (m/hr) 0.00000
 Porosity 1.00 Safety Factor 5.0
 Infiltration Coefficient Base (m/hr) 0.00000

Depth (m)	Area (m ²)	Perimeter (m)	Depth (m)	Area (m ²)	Perimeter (m)
0.000	3.3	25.500	0.201	11.1	25.500
0.200	3.3	25.500	0.600	11.1	25.500

Bio-Retention Area Manhole: S4, DS/PN: 1.003

Invert Level (m) 165.146 Infiltration Coefficient Side (m/hr) 0.00000
 Porosity 1.00 Safety Factor 5.0
 Infiltration Coefficient Base (m/hr) 0.00000

Depth (m)	Area (m ²)	Perimeter (m)	Depth (m)	Area (m ²)	Perimeter (m)
0.000	2.4	12.500	0.201	8.0	12.500
0.200	2.4	12.500	0.750	8.0	12.500

Bio-Retention Area Manhole: BIO 2, DS/PN: 2.000

Invert Level (m) 165.290 Infiltration Coefficient Side (m/hr) 0.00000
 Porosity 1.00 Safety Factor 5.0
 Infiltration Coefficient Base (m/hr) 0.00000

Depth (m)	Area (m ²)	Perimeter (m)	Depth (m)	Area (m ²)	Perimeter (m)
0.000	3.3	25.500	0.201	11.1	25.500
0.200	3.3	25.500	0.600	11.1	25.500

Bio-Retention Area Manhole: S7, DS/PN: 1.005

Invert Level (m) 164.952 Infiltration Coefficient Side (m/hr) 0.00000
 Porosity 1.00 Safety Factor 5.0
 Infiltration Coefficient Base (m/hr) 0.00000

Depth (m)	Area (m ²)	Perimeter (m)	Depth (m)	Area (m ²)	Perimeter (m)
0.000	2.4	12.500	0.201	8.0	12.500
0.200	2.4	12.500	0.750	8.0	12.500

Bio-Retention Area Manhole: BIO 3, DS/PN: 3.000

Invert Level (m) 165.120 Infiltration Coefficient Side (m/hr) 0.00000
 Porosity 1.00 Safety Factor 5.0
 Infiltration Coefficient Base (m/hr) 0.00000

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Bio-Retention Area Manhole: BIO 3, DS/PN: 3.000

Depth (m)	Area (m ²)	Perimeter (m)	Depth (m)	Area (m ²)	Perimeter (m)
0.000	3.3	25.500	0.201	11.1	25.500
0.200	3.3	25.500	0.750	11.0	25.500

Bio-Retention Area Manhole: S10, DS/PN: 1.007

Invert Level (m) 164.784
 Porosity 1.00
 Infiltration Coefficient Base (m/hr) 0.00000

Infiltration Coefficient Side (m/hr) 0.00000
 Safety Factor 5.0

Depth (m)	Area (m ²)	Perimeter (m)	Depth (m)	Area (m ²)	Perimeter (m)
0.000	2.4	12.500	0.201	8.0	12.500
0.200	2.4	12.500	0.750	8.0	12.500

Bio-Retention Area Manhole: BIO 4, DS/PN: 4.000

Invert Level (m) 164.960
 Porosity 1.00
 Infiltration Coefficient Base (m/hr) 0.00000

Infiltration Coefficient Side (m/hr) 0.00000
 Safety Factor 5.0

Depth (m)	Area (m ²)	Perimeter (m)	Depth (m)	Area (m ²)	Perimeter (m)
0.000	3.3	25.500	0.201	11.1	25.500
0.200	3.3	25.500	0.750	11.1	25.500

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)

for Storm

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 2.000

Hot Start Level (mm) 0

Inlet Coefficient 0.800

Manhole Headloss Coeff (Global) 0.500

Flow per Person per Day (l/per/day) 0.000

Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0

Number of Storage Structures 7

Number of Online Controls 1

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH

FEH Rainfall Version 2013

Site Location GB 310750 196400 ST 10750 96400

Data Type Catchment

Cv (Summer) 0.750

Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

DVD Status OFF

Analysis Timestep Fine

Inertia Status OFF

DTS Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Period(s) (years) 2, 30, 100

Climate Change (%) 0, 0, 40

	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level
									(m)
1.000	BIO 1	15 Winter	2	+0%					165.474
1.001	S2	15 Winter	2	+0%					165.430
1.002	S3	15 Winter	2	+0%					165.317
1.003	S4	15 Winter	2	+0%	100/30 Winter				165.252
2.000	BIO 2	15 Winter	2	+0%	100/30 Summer				165.216
2.001	S5	15 Winter	2	+0%	100/15 Summer				165.181
1.004	S6	15 Winter	2	+0%	100/15 Summer				165.087
1.005	S7	15 Winter	2	+0%	30/30 Winter				165.002
3.000	BIO 3	15 Winter	2	+0%	100/15 Summer				165.046
3.001	S8	15 Winter	2	+0%	30/60 Winter				165.011
1.006	S9	15 Winter	2	+0%	30/15 Summer				164.934
1.007	S10	15 Winter	2	+0%	30/15 Summer				164.871
4.000	BIO 4	15 Winter	2	+0%	30/30 Summer				164.886
4.001	S11	15 Winter	2	+0%	30/15 Winter				164.849
1.008	13	120 Summer	2	+0%	2/15 Summer				164.439

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INTRADO		Page 10
Castle House 63-69 Cardiff Road CF15 7RD	IR20134	
Date 16/11/2020 File STORM OCTOBER 2021.MDX	Designed by Design Checked by	
XP Solutions	Network 2020.1.3	

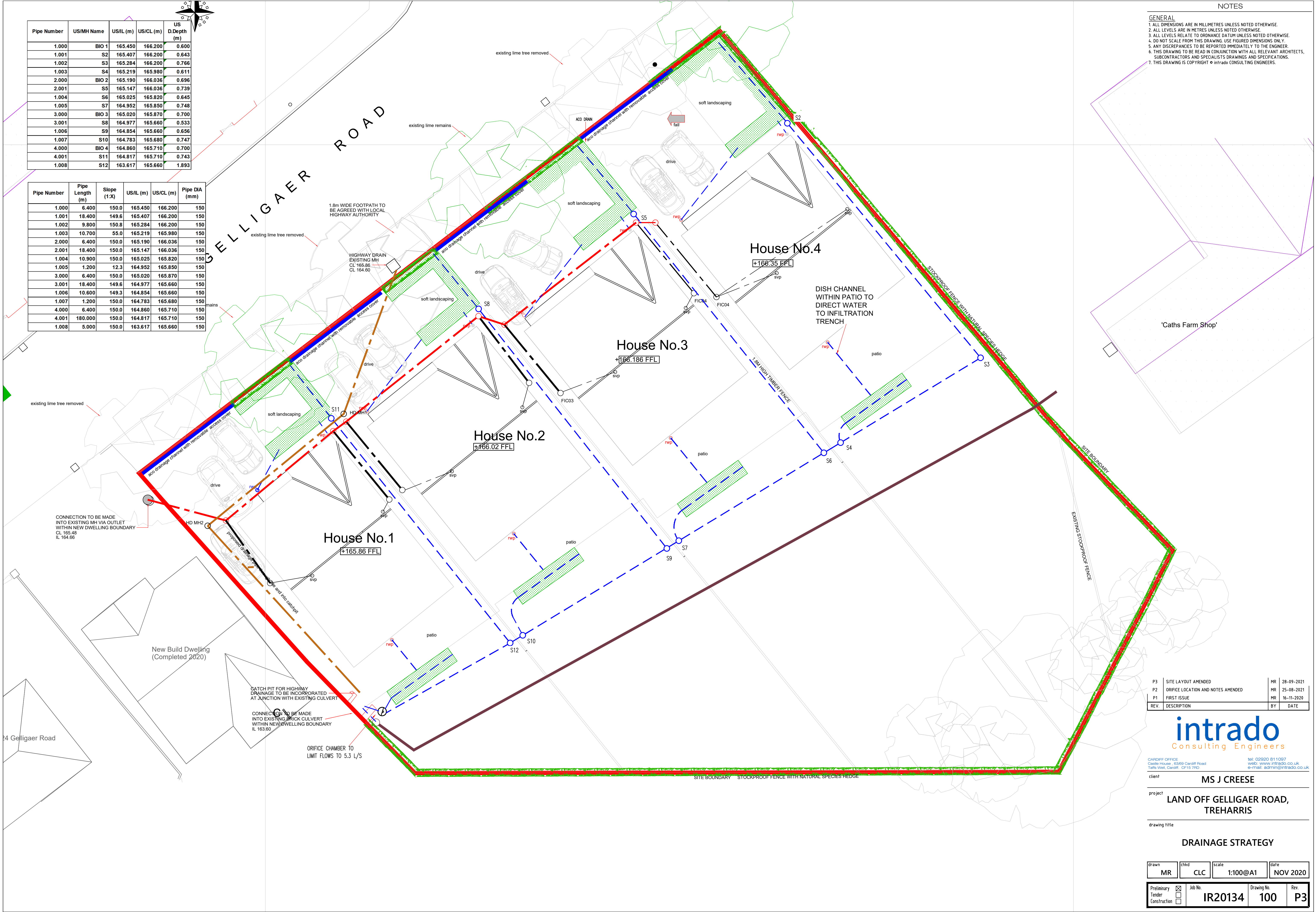
2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Surcharged		Flooded		Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)				
1.000	BIO 1	-0.126	0.000	0.06		7	0.7	OK	
1.001	S2	-0.127	0.000	0.05			0.7	OK	
1.002	S3	-0.117	0.000	0.11			1.4	OK	
1.003	S4	-0.117	0.000	0.11			2.3	OK	
2.000	BIO 2	-0.124	0.000	0.07		6	0.8	OK	
2.001	S5	-0.116	0.000	0.11			1.5	OK	
1.004	S6	-0.087	0.000	0.36			4.7	OK	
1.005	S7	-0.100	0.000	0.24		8	4.7	OK	
3.000	BIO 3	-0.124	0.000	0.07		6	0.8	OK	
3.001	S8	-0.117	0.000	0.11			1.5	OK	
1.006	S9	-0.070	0.000	0.54			7.0	OK	
1.007	S10	-0.062	0.000	0.63		8	6.9	OK	
4.000	BIO 4	-0.124	0.000	0.07		6	0.8	OK	
4.001	S11	-0.119	0.000	0.07			1.1	OK	
1.008	13	0.672	0.000	0.32			3.6	SURCHARGED	

INTRADO		Page 1																
Castle House 63-69 Cardiff Road CF15 7RD	IR20134 Land off Gelligaer Road																	
Date 13/11/2020 08:10 File	Designed by Clare Checked by																	
XP Solutions																		
Source Control 2020.1																		
<u>FEH Mean Annual Flood</u> Input <table> <tr> <td>QMED Method</td> <td>2008</td> </tr> <tr> <td>Site Location GB 310750 196400 ST 10750 96400</td> <td></td> </tr> <tr> <td>Area (ha)</td> <td>0.178</td> </tr> <tr> <td>SAAR (mm)</td> <td>1480</td> </tr> <tr> <td>URBEXT (1990)</td> <td>0.0233</td> </tr> <tr> <td>SPRHOST</td> <td>40.800</td> </tr> <tr> <td>BFIHOST</td> <td>0.454</td> </tr> <tr> <td>FARL</td> <td>1.000</td> </tr> </table> Results QMED Rural (l/s) 5.7 QMED Urban (l/s) 5.8			QMED Method	2008	Site Location GB 310750 196400 ST 10750 96400		Area (ha)	0.178	SAAR (mm)	1480	URBEXT (1990)	0.0233	SPRHOST	40.800	BFIHOST	0.454	FARL	1.000
QMED Method	2008																	
Site Location GB 310750 196400 ST 10750 96400																		
Area (ha)	0.178																	
SAAR (mm)	1480																	
URBEXT (1990)	0.0233																	
SPRHOST	40.800																	
BFIHOST	0.454																	
FARL	1.000																	
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Appendix E

Drainage Drawings



Pipe Number	US/MH Name	US/IL (m)	US/CL (m)	US D.Depth (m)
1.000	BIO 1	165.450	166.200	0.800
1.001	S2	165.407	166.200	0.843
1.002	S3	165.284	166.200	0.766
1.003	S4	165.219	165.980	0.811
2.000	BIO 2	165.190	166.036	0.896
2.001	S5	165.147	166.036	0.739
1.004	S6	165.025	165.820	0.845
1.005	S7	164.952	165.850	0.748
3.000	BIO 3	165.020	165.870	0.700
3.001	S8	164.977	165.660	0.533
1.006	S9	164.854	165.660	0.656
1.007	S10	164.783	165.680	0.747
4.000	BIO 4	164.860	165.710	0.700
4.001	S11	164.817	165.710	0.743
1.008	S12	163.617	165.660	1.893

Pipe Number	Pipe Length (m)	Slope (1:X)	US/IL (m)	US/CL (m)	Pipe DIA (mm)
1.000	6.400	150.0	165.450	166.200	150
1.001	18.400	149.6	165.407	166.200	150
1.002	9.800	150.8	165.284	166.200	150
1.003	10.700	55.0	165.219	165.980	150
2.000	6.400	150.0	165.190	166.036	150
2.001	18.400	150.0	165.147	166.036	150
1.004	10.900	150.0	165.025	165.820	150
1.005	1.200	12.3	164.952	165.850	150
3.000	6.400	150.0	165.020	165.870	150
3.001	18.400	149.6	164.977	165.660	150
1.006	10.600	149.3	164.854	165.660	150
1.007	1.200	150.0	164.783	165.680	150
4.000	6.400	150.0	164.860	165.710	150
4.001	180.000	150.0	164.817	165.710	150
1.008	5.000	150.0	163.617	165.660	150

- NOTES
- GENERAL
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
 2. ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
 3. ALL LEVELS RELATE TO ORDNANCE DATUM UNLESS NOTED OTHERWISE.
 4. DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS ONLY.
 5. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
 6. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
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P3	SITE LAYOUT AMENDED	MR	28-09-2021
P2	ORIFICE LOCATION AND NOTES AMENDED	MR	25-08-2021
P1	FIRST ISSUE	MR	16-11-2020
REV.	DESCRIPTION	BY	DATE

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client

MS J CREESE

project

LAND OFF GELLIGAER ROAD,
TREHARRIS

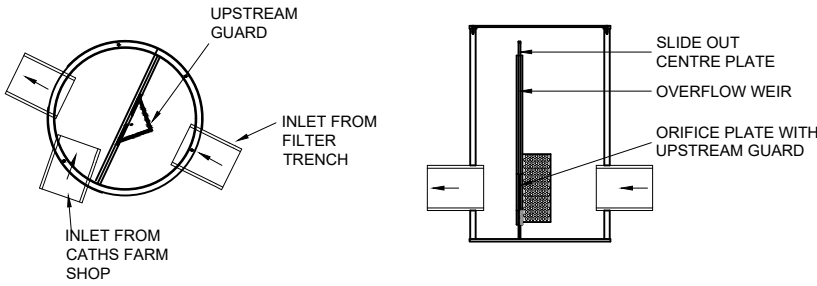
drawing title

DRAINAGE STRATEGY

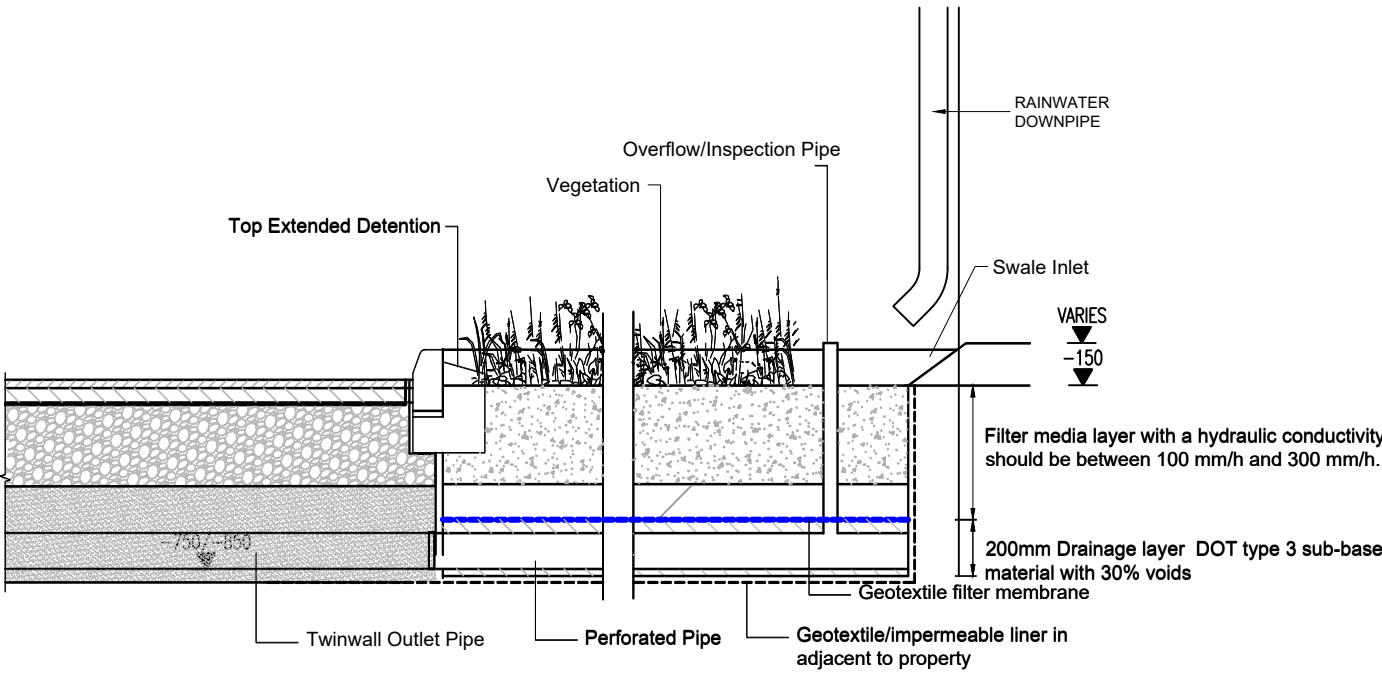
drawn	MR	chkd	CLC	scale	1:100@A1	date	NOV 2020
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Preliminary	☒	Job No.	IR20134	Drawing No.	100	Rev.	P3
Tender	☐						
Construction	☐						

- GENERAL
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CONTROLFLOW CHAMBER



SCHEMATIC SECTION THROUGH RAINGARDEN

P3	FILTER TRENCH REMOVED	HR	18-10-2021
P2	ORIFICE CONTROL AMENDED	HR	25-08-2021
P1	FIRST ISSUE	HR	16-11-2020
REV.	DESCRIPTION	BY	DATE

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project **LAND OFF GELLIGAER ROAD,
TREHARRIS**

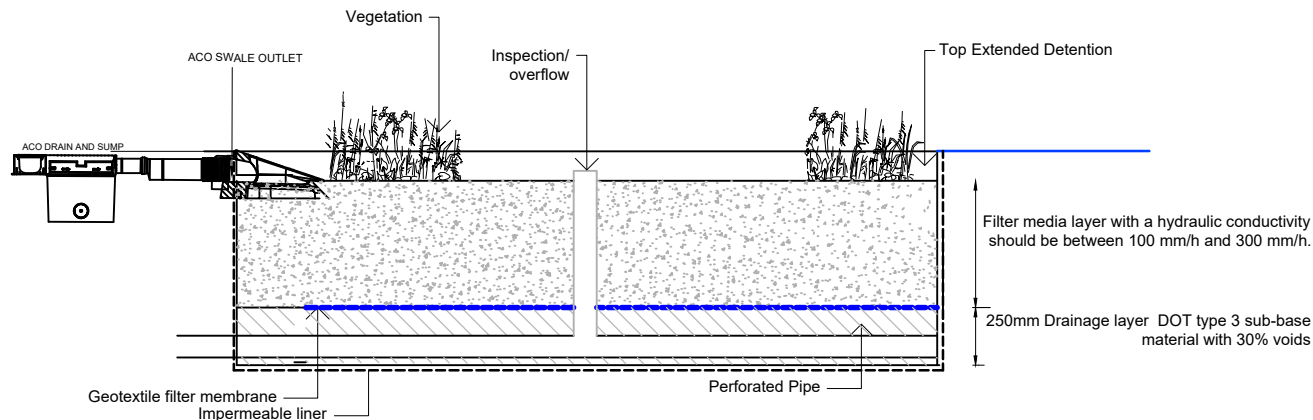
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DRAINAGE STRATEGY DETAILS

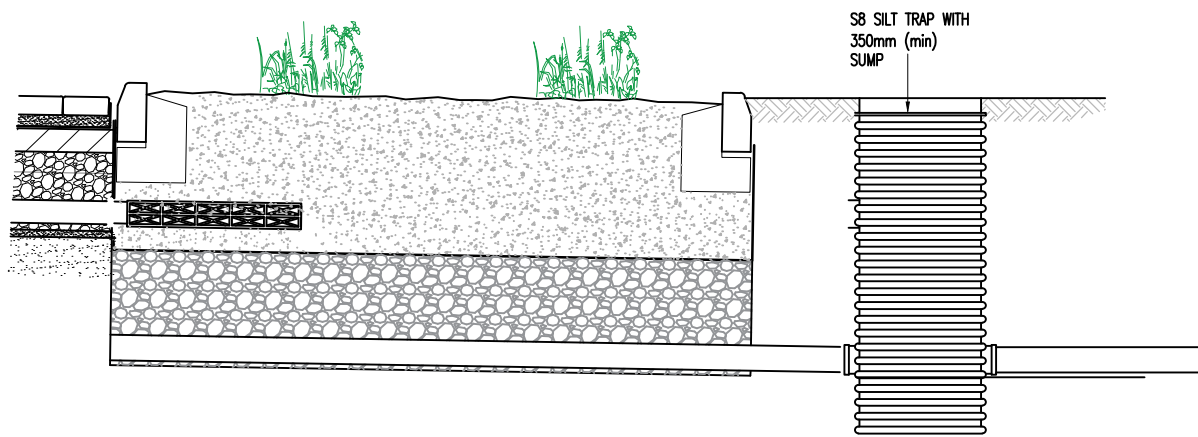
drawn	chd	scale	date
MR	CLC	1:100@A1	NOV 2020

Preliminary	Job No.	Drawing No.	Rev.
Tender	IR20134	101	P3
Construction			

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ACO TO BIO RETENTION



RWP TO BIO RETENTION

P1	FIRST ISSUE	CLC	16/10/2021
REV.	DESCRIPTION	BY	DATE

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project **LAND OFF GELLIGAER ROAD,
TREHARRIS**

drawing title

DRAINAGE STRATEGY DETAILS

drawn	chd	scale	date
MR	CLC	1:100@A1	OCT 2021

Preliminary	Job No.	Drawing No.	Rev.
Tender	IR20134	102	P1
Construction			

Appendix F

Landscape Details

• Tree locations are subject to confirmation of engineering and foundation details. Foundations to be piled with ground beams and shall comply with guidelines set by structural engineering consultants, and shall accord with the current NHBC Standards 'Building near Trees' and shall accommodate immediate and future impact of tree or shrubs on buildings and their foundations.

• Any proposed substitutions, whether species, cultivar, pot size or other specification, must be approved by landscape architect prior to planting;

• Any significant layout changes necessitating revised details (such as new retaining walls casting shade on planting beds) should be reported to the landscape architect;

• All Nursery Stock to comply with BS3936 Part 1:1992 and all subsequent amendments;

• All Landscape operations to comply with BS4428:1989 and all subsequent amendments;

• The landscape contractor to make him/herself aware of any underground services prior to planting.

• Any poor site or soil preparation or conditions, such as excess kerb haunchings, to be reported to site manager for remediation prior to planting.

• No substitutions are to be made without prior approval of the Local Authority

SOILS
• Topsoil and subsoil to be stored in separate, non-overlapping mounds and topsoil should be stripped from any areas used for subsoil storage. The minimum amount of compaction should be applied when forming soil storage mounds, they should not be driven across. Topsoil mounds should be no greater than 2m in height and subsoil mounds should be no higher than 3m;

• The imported soils for tree and shrub planting will comprise sandy loams as per BS 3882:2015 and BS 8601:2013, of slightly acid pH on placement and with excellent drainage and aeration properties. Details of the soils to be imported (certification in accordance with BS 3882:2015 and BS 8601:2013) and the soil scientist's interpretive report evidencing fitness for purpose, will be made available to the LPA. Soil scientist to advise if ripping is required underneath tree pit.

• Refer to Engineer details for SUDS construction and soil profiles;

• The protection of topsoil and subsoil for planting areas should accord with the Construction Code for the Sustainable Use of Soils on Construction Sites (DEFRA, 2009), BS 3882:2015 and BS 8545:2014;

• Great care must be taken to preserve soil quality and integrity;

• All ground modelling to be to smooth and flowing contours new soil edge to be feathered to marry into adjacent levels;

• All planting and grass areas to be cultivated, with prior ripping where necessary to relieve compaction caused by tracking;

• Planting areas to be spread with imported free draining topsoil to a depth of 300mm for planting beds, above subsoil; soils allowed to settle prior to planting or seeding.

• Soil profiles to be 300mm topsoil over 600mm subsoil for all areas of tree planting/mixed tree and shrub planting, including provision for a minimum 10 cubic metres of root available soil (11m²) for each new tree. Shrubs only and mixed shrub and grass/herbaceous to receive 300mm topsoil over 300mm subsoil and grass only 150mm topsoil over 150mm subsoil.

TREE PITS
• Tree pits to be excavated to minimum 1m x 1m x depth of rootball. In sloping ground, maintain horizontal bases and vertical sides with no less than minimum depth throughout. If compacted, break up bottoms of pits to a depth with a fork and scarify sides;

• All tree pits to be back filled with 600mm subsoil followed by 300mm topsoil;

• Rootballed trees to be anchored underground with Greenleaf Rootball Fixing System and planted with Greenleaf 'Root Rain Urban' watering pipes, fitted according to manufacturer's instructions;

• Tree supply, planting and aftercare must accord with BS 8545:2014.

• No tree will be planted until it has been found to be compliant with Table 1, p.21, BS 8545:2014 – this will be established via inspections on delivery

• All non-biodegradable wrappings, cages etc. to be completely removed on planting. Biodegradable wrappings also to be removed, but may, where root-ball collapse is a concern, be cut and peeled back to no less than one-third root-ball height, and pelled back wrapping removed not folded in;

• All same-species trees to be similar height, form and habit;

• All trees in grass to be planted in mulched edged bed. Tree mulch circles to be a **minimum 1.5m radius** and 50mm depth tapered to 25mm over the root-ball surface; underplanted with bulbs as specified below;

• All planting beds adjacent grass areas and tree pits in grass to be edged with half moon edging tool to separate mulch from grass by forming neat and vertical edges;

• All planting beds but not tree pits to receive peat-free compost during cultivations at a rate of 1m³ to 20m² and slow release fertiliser (e.g. Ficote 140) at rate of 25g/plant; beds to be thoroughly watered following planting and before mulching;

• Bareroot/containerised trees to be staked with short double stakes a maximum of one quarter the height of the tree above ground, and fixed with Greenleaf biodegradable hessian ties;

• All planting beds to receive Green-tech mycorrhizal Root Grow (granules for general planting and root dip for bare root planting), applied according to manufacturer recommendations;

• Mulch to be dark brown mixed conifer bark of particle size 8-35mm and pH range 5.0-7.0 to BS PAS 100:2005; mulch to be laid to 75mm (settled) depth.

HEDGES
• Hedges to be planted in 800mm wide bed, 500mm from kerb

WILDFLOWER GRASSLAND
• For new wildflower areas and remedial areas: Wildflower grass seed is to be Emorsgate EW1 Woodland Mix sown at 4g/m² for shady areas. All to be sown in suitable conditions onto shallowly cultivated subsoil using shake-aerator; spread with 10-15mm layer of compost, worked into the top layer and watered in (to ensure some nitrogen but low phosphorus)

Spacing	ID	No.	Latin Name	Scheduled Size	
as shown	Acam	17	Acer campestre	1+1, 60-80cm	BR, 3 breaks
TREE	BaF-18/20	3	Betula albosinensis 'Fascination'	18-20cm	Rootballed
8/m2	BSil	102	Bergenia 'Silberlicht'	30-40, 5L	Full pot
6/m2	BSil-1	65	Bergenia 'Silberlicht'	30-40, 3L	Full pot
as shown	Ca-1	66	Corylus avellana	1+2, 80–100cm	BR
3/linm	CaSV	98	Cornus alba 'Sibirica Variegata'	40-60cm, 3L or BR	3 breaks in lower third
as shown	Cm-BR	132	Crataegus monogyna	1+2, 80–100cm	BR
5/m2	DCK	40	Dryopteris affinis 'Cristata The King'	30-40cm, 2L	Full pot
SPEC	Fj	4	Fatsia japonica	60-80cm, 10L	5 breaks in lower third
5/m2	GmWN	51	Geranium macrorrhizum 'White Ness'	30-40cm, 5L	Full pot
4/m2	HAm	51	Hydrangea 'Ammarin'	60-80cm, 3L	5 breaks in lower third
6/m2	Ho	40	Helleborus x hybridus	20-30cm, 3L	Full pot
as shown	Lp	17	Lonicera periclymenum	60-90cm, 3L	min 2 breaks, cane removed on planting
4/m2	Ma	82	Mahonia aquifolium 'Apollo'	20-30cm, 3L	main leader, well branched
4/m2	PoD	12	Physocarpus opulifolius 'Diabolo'	40-60cm, 3L	3 breaks in lower third
as shown	Rca	33	Rosa canina	1+2, 80–100cm	BR, 5 breaks in lower third
4/m2	SR	34	Skimmia 'Reevesiana'	30-40cm, 5L	5breaks in lower third
as shown	Vo	66	Viburnum opulus	1+2, 80-100cm	BR

Landscape, Biodiversity & Amenity Strategy

The landscape proposals will provide an attractive setting to the proposed housing and integrate the development into the surrounding community.

Planting includes a mix of flowering and evergreen perennial and shrubs as well as wildflower grassland, to improve biodiversity and bring wildlife into back gardens. A native hedge proposed around the site boundary mitigates for loss of existing vegetation and provides a wildlife corridor around the site.

Surface water and roof water will be captured and drained towards the rain gardens Water here will be temporarily stored and then will drain into pipes to be transported further down the drainage chain.

Attenuation area planting will further enhance biodiversity, and planting here will be specified to tolerate the aspect (sun/shade) and the drainage (wet/dry/mesic).

For SUDS details, refer to Intrado Strategy

For Ecology, refer to BeEcological Ltd report

For Arboricultural Survey of lime trees, refer to Cardiff Treescapes Initial Arboricultural Report

legend

- ornamental shrub beds
- amenity turf and / or seed e.g. 'Shademaster'
- proposed rain garden hedge planted in 0.8m width bed, in single rows, at 500mm from kerb
- proposed rain gardens with free draining soils, no mulch
- proposed native hedge
- ground levels underneath trees and existing vegetation to be retained; no turfing; wildflower seed suitable for shade and remedial works
- existing trees and vegetation retained, with Root Protection Area in orange
- existing trees removed

Driveways and drains under existing lime trees constructed utilising no-dig methodology as per arboricultural report recommendations

Elsewhere, ground levels underneath all tree canopies and within the Root Protection Areas are to remain unchanged.

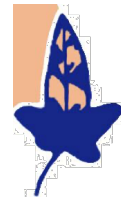
Rain gardens enhance biodiversity, and planting here is specified to tolerate the aspect (sun/shade) and the drainage (wet/dry/mesic). Hedges suited to tree shade and mesic conditions provide privacy to front gardens at back to highway

Retaining existing tree avenue (in part) balances the height of the houses, softening the streetscene and improving microclimate.

Perennial and shrub planting includes high proportion of flowering and scented species to to attract pollinators

Ground levels and vegetation underneath all tree canopies and within the Root Protection Areas are to remain unchanged. Remedial seeding with wildflower mix specified; no turfing

Native hedgerow provides ecological connectivity and mitigates for loss of vegetation; hedge to include hazel, hawthorn and honeysuckle of benefit to many native species



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Parc Beddw • Libanus • Brecon • LD3 8NN

job title
Land adjacent
Cath's Farm Shop
client
Mr Chris Reilly

drawing title
Landscape Strategy &
Planting Plan

scale • 1:250 at A1
date • October 2021
drawn • CE
drawing number • 542.01
revision • –