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Flood Risk Assessment & Drainage Strategy

Proposed Residential Development, Griffin Close, Frizington

Thomas Armstrong Construction and Home Group

Ref: K41128.FRA/001

Version	Date	Prepared By	Checked By	Approved By
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A	24th October 2024	C. Abram	T. Melhuish	T. Melhuish

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GLOSSARY OF TERMS

AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
BGL	Below Ground Level
BGS	British Geological Society
CC	Climate Change
DSM	Digital Surface Model
DTM	Digital Terrain Model
EA	Environment Agency
FEH	Flood Estimation Handbook
FFL	Finished Floor Level
FRA	Flood Risk Assessment
GIS	Geographical Information System
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
OS	Ordnance Survey
RGP	RG Parkins & Partners Ltd
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage System
UU	United Utilities

1. INTRODUCTION

1.1 BACKGROUND

This report has been prepared by R. G. Parkins & Partners Ltd (RGP) for Thomas Armstrong Construction and Home Group in support of their proposals to construct 17 new dwellings at a residential development located at Griffin Close, Frizington.

RGP has been appointed to undertake a Flood Risk Assessment and Foul and Surface Water Drainage Strategy to support a planning application that fulfils the requirements of the Local Planning Authority, Lead Local Flood Authority, Environment Agency and the Sewerage Undertaker.

The following report demonstrates the proposed development will not adversely affect flood risk elsewhere.

1.2 PLANNING POLICY

The NPPF [1] and its Planning Practice Guidance [2] states "a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in the future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use."

1.3 THE DEVELOPMENT IN THE CONTEXT OF PLANNING POLICY

Owing to the size of the development in terms of number of properties (17 no.), it is classed as major development (over 10 dwellings) in accordance with The Town and Country Planning Order 2015 [3].

The area covered by the application is 0.502 ha (hectares) and by reference to the Environment Agency Flood Map, the site lies entirely in Flood Zone 1.

Table 2 of the NPPF's Planning Practice Guidance [2] classifies each development into a vulnerability class, depending on the type of development, as outlined in Table 1.1.

The site is to be developed for a housing development; and is classified as 'More vulnerable'. 'More Vulnerable' development classes are deemed acceptable in terms of flood risk within Flood Zones 1, 2 and 3a but are not generally considered acceptable within Flood Zone 3b.

Table 1.1 Vulnerability Classification

Vulnerability Classification	Development
Essential Infrastructure	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. Essential utility infrastructure, which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. Wind turbines.
Highly Vulnerable	Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operation during flooding. Emergency dispersal points. Basement dwellings. Caravans, mobile homes, and park homes intended for permanent residential use. Installations requiring hazardous substances consent.
More Vulnerable	Hospitals. Residential institutions such as residential care homes, children's homes, prisons and hostels. Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs, and hotels. Non-residential uses for health services, nurseries, and education establishments. Landfill and sites used for waste management facilities for hazardous waste. Sites used for holiday or short let caravans and camping, subject to a specific warning and evacuation plan
Less Vulnerable	Police, ambulance, and fire stations which are NOT required to be operational during flooding. Buildings used for shops; financial, professional, and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distributions; non-residential institutions not included in the 'more vulnerable' class; and assemble and leisure. Land and buildings used for agriculture and forestry. Waste treatment (except landfill & hazardous waste facilities). Minerals working & processing (except for sand & gravel working). Water treatment works which do not need to remain operational during times of flood. Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
Water-Compatible Development	Flood control infrastructure. Water transmission infrastructure & pumping stations. Sewage transmission infrastructure & pumping stations. Sand & gravel working. Docks, marinas, and wharves. Navigation facilities. Ministry of Defence installations. Ship building, repairing & dismantling, dockside fish processing & refrigeration & compatible activities requiring a waterside location. Water based recreation (excluding sleeping accommodation). Lifeguard and coastguard stations. Amenity open space, nature conservation & biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. Essential ancillary sleeping or residential accommodation for staff required by uses in this category subject to a specific warning & evacuation plan.

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2. SITE CHARACTERISATION

2.1 SITE LOCATION

The site is located to the west of Frizington in Cumbria on a plot of land located to the immediate west of Griffin Close and to the north of Greenvale Court Road. The National Grid Co-Ordinates to the centre of the site are 303350E 5173600N (Figure 2.1).

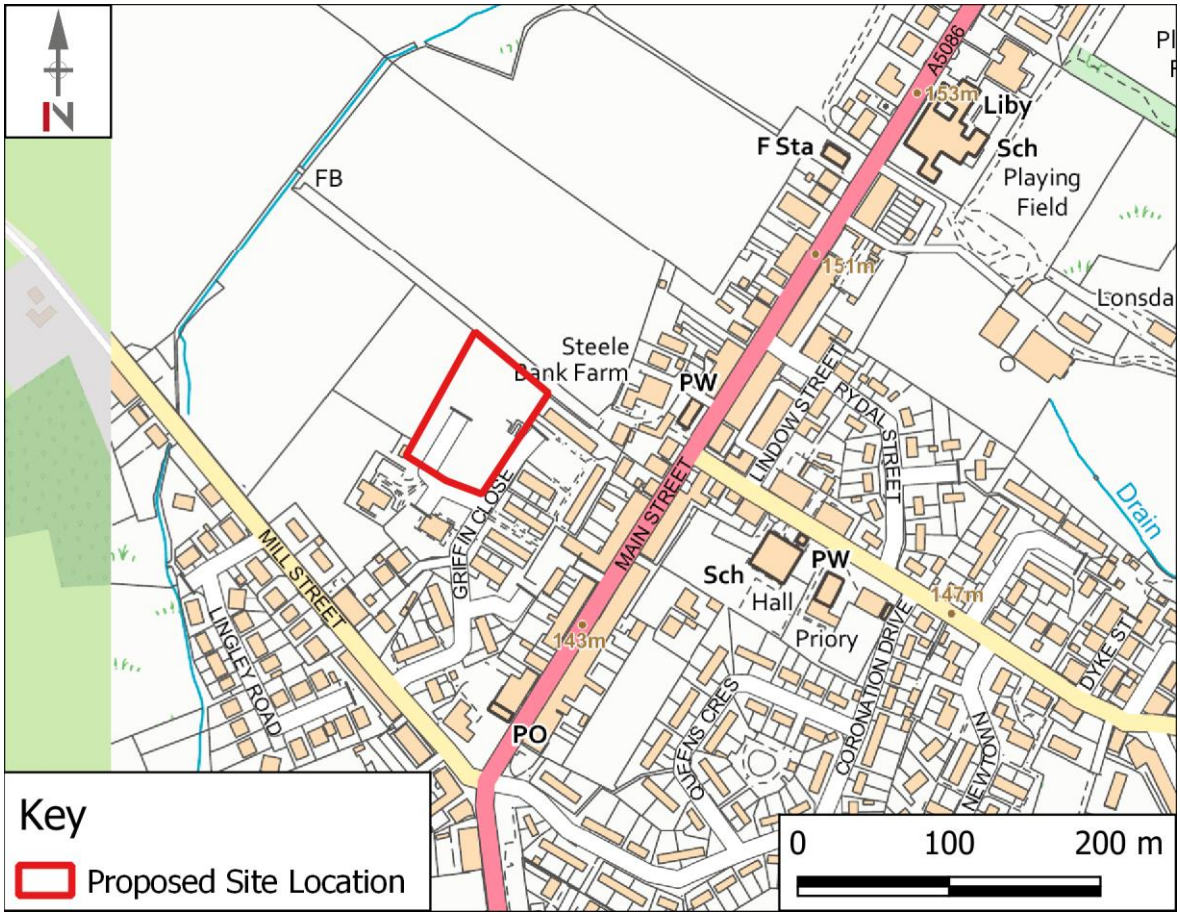


Figure 2.1 Site Location

2.2 SITE DESCRIPTION

The site covers an area of approximately 0.502 ha (5,016.5 m²). The site was formerly the location of the now demolished Greenvale Court sheltered accommodation complex, with some remnants of its former use such as hardstanding car park areas, abandoned drainage inspection chamber covers and retaining walls still visible in some areas. However the majority of the site at present is unused greenspace.

The site is bounded to the south by Greenvale Court Road, with Lindisfarne Residential Home and Griffin Close Medical Centre situated on the opposite side of this road. Griffin Close Road and residential area forms the eastern boundary. Agricultural land forms the neighbouring boundaries to the western and northern perimeters.

Topographically, the site is relatively level with a typical fall from east to west ranging from circa. 139.00 mAOD to 138.25 mAOD. Along the eastern boundary with Griffin Close the levels slope steeply up towards the existing road to an approx. higher level of around 140.5 mAOD.

Access to the site is by road via. Griffin Close with pedestrian access available down a set of steps located off Griffin Close.

2.3 GEOLOGY & HYDROGEOLOGY

British Geological Survey (BGS) [4] and Land Information Systems (LandIS) [5] mapping indicates the site is underlain by the geological sequences outlined in Table 2.1. The Defra Magic Maps [6] indicates the nearest Source Protection Zone is located c. 6.70 km to the south (Zone III Total Catchment).

The site is not located within a drinking water protected area or drinking water safeguard zone for surface water or groundwater.

The development site overlies a secondary aquifer with 'Medium' groundwater vulnerability and falls within an area classified as a 'Soluble Rock Risk'.

Table 2.1 Site Geological Summary

Geological Unit	Classification	Description	Aquifer Classification
Soil	Soilscape 18	Slowly permeable, seasonally wet, slightly acid but base rich loamy and clayey soils.	N/A
Drift	Till, Devensian	Diamicton – clay, silt, sands and gravel	Summary: Secondary (undifferentiated)
Solid	Pennine Middle Coal Measures Formation	Mudstone, siltstone and sandstone	Summary: Secondary A

2.4 HYDROLOGY

Reference to OS Mapping indicates the nearest open watercourse Lingla Beck lies approx. 210 m to the northwest. This watercourse is classified as 'Main River' and is therefore regulated by the Environment Agency.

2.5 EXISTING SEWERS

Reference to the United Utilities sewer records indicates the nearest public sewer to the site location is a foul sewer located in Griffin Close situated at a much higher level to the development that would not allow for a direct gravity connection. The nearest potential public sewer that would allow a connection from the development shown on the records is a combined sewer located towards the rear of 'The Laurels' residences south of the development site. However, the sewer records appear to be incomplete whereby this section of sewer (and others nearby) do not appear to be linked, warranting further investigation of the local sewer network.

Separate existing private foul and surface water drainage runs that serviced the former building are still present on the site with outfall chambers towards the southern boundary near the existing entrance having the potential to be utilised for the new development if suitable. CCTV drainage investigations have been undertaken as discussed below.

The neighbouring Medical Centre and Lindisfarne Residential Home buildings located to the south of the site on the remote side of Greenvale Court Road are known to have functioning drainage systems that appear to be routed in the same direction to the existing site drainage outfall routes.

2.6 DRAINAGE SURVEY INVESTIGATIONS

SK Drainage Solutions have carried out initial CCTV investigations on the existing site drainage in July 2022. This identified that the existing site drainage has separate surface and foul water networks that are routed off site under Greenvale Court Road for ultimate disposal.

The surface water outfall pipe was traced in the direction of the surgery where approximately 36m downstream the pipe was found to be fractured and in very poor condition preventing the passage of the crawler unit, the downstream connection point was not therefore able to be verified. In addition, access issues to potential connecting downstream manholes being located in third party land in an areas of dense vegetation prevented any further investigation.

The foul sewer run was traced all the way through to a manhole in the surgery car park and beyond this appeared to be routed towards the section of combined public sewer as shown on the sewer records towards the rear of 'The Laurels' access issues again prevented further investigation.

Further CCTV drainage investigations were carried out in April 2024 by SK Drainage Solutions of the wider sewer network outside of the site to try and establish the disposal route and connection points of the existing site drainage. Whilst missing sections of the sewer records were established in the Mill Street and Lingley Fields areas further away from the site, the overall disposal route and connection points of the existing site drainage was still not established due to the same access issues to manholes as incurred previously.

Access agreements were eventually secured with the landowner (Cumberland Council) to allow the clearance of obstructing vegetation to gain access to these manholes. This enabled jetting and clearing of both sewers to be undertaken with a final round of CCTV and drainage investigations undertaken by SK Drainage solutions in July 2024.

This verified that the existing 225mm dia. surface water drain from the development site continues in a north westerly direction along the boundary of the adjacent fields and is routed by a series of chambers to a larger 300mm diameter pipe that runs through private fields adjacent to the main road (Mill Road) for direct discharge to Lingla Beck.

The foul drainage run was traced from the development site all the way through to a connection point in Mill Road. This route appears to connect into the small section of public combined sewer indicated on the sewer records near 'The Laurels' residential area and clarifies the missing link

information confirming this is routed all the way thorough to Mill Road where it connects to the wider network for onward disposal.

For further information please refer to SK Drainage Solutions Report Reference SK-S 056-2024 included in Appendix D.

2.7 GROUND INVESTIGATION

A Phase 2 Ground Investigation report has been issued by GEO Environmental Engineering Ltd [17] in February 2023 which included intrusive ground investigations undertaken at the site between September and October 2022.

The below information regarding ground conditions are taken from this report.

Ground investigations comprised dynamic windowless sampling boreholes, rotary openholed boreholes, mechanically excavated trial pits and trenches. In situ geotechnical testing and chemical laboratory testing was also conducted.

Made ground was encountered across the site to depths of between c.0.40m and 6.60m bgl.

The made ground was noted as deepest across the northeastern part where it was recorded as topsoil overlying deep clay fill. The reason for such deep made ground is unclear at present and further works are recommended to confirm and delineate the extents of the fill material.

Made ground across the rest of the site, was typically 0.40m to 2.70m deep and comprised topsoil with occasional gravel of clinker, coal, slag and brick, overlying soft and firm sandy clay fill with gravel of clinker, coal, sandstone and brick. Occasional wood fragments, peat, topsoil and black organic silt inclusions were also noted. This was occasionally underlain by gravel of coarse dolomite.

The natural drift deposits typically comprised firm to stiff or stiff light brown and grey, silty sandy gravelly clay. A band of medium dense slightly clayey gravelly sand was also encountered between c.1.90m and c.3.00m bgl (WS01). The clay encountered directly beneath the made ground in borehole WS02 at c.5.50m bgl was noted as a very soft. A comment on the log suggests that this could be possible fill material.

Solid strata/bedrock was encountered in the rotary boreholes at depths of between c.2.90m and 6.60m bgl. The bedrock was described as light grey and reddish brown mudstone with occasional thin, hard siltstone and sandstone bands.

Up to three seams of coal were encountered in the rotary boreholes from depths of between 7.30m and 19.20m bgl. The seams appear to dip to the south west. These varied between 0.20m and 1.40m in thickness. The seams were noted as intact in the boreholes, which could potentially be representative of coal pillars if workings are present.

Three trenches were pulled across the area where a mine shaft is shown on The Coal Authority Plan. The trenches encountered made ground which was typically less than c.1.30m deep, however, a localised pocket of made ground extending to c.2.70m bgl was noted. This comprised

firm grey brown gravelly clay with occasional black organic. No direct evidence of a mine shaft was encountered.

The exploratory holes were typically dry during the intrusive ground investigation works. However, significant groundwater ingress was noted in one trial pit (TP03) at c.1.30m bgl. This was noted as perched water within the made ground and the flow was noted to cease quickly.

The rotary boreholes were drilled with water flush which masked any groundwater ingress. Groundwater monitoring of installations placed in the boreholes has been carried out on six occasions between September and December 2022.

Standing groundwater levels have been recorded between c.0.20m and c.1.00m bgl. Given the ground conditions, it is likely that the water has resulted from surface ingress which has been trapped/perched within the boreholes rather than a continuous groundwater table.

For further details refer to Geo Environmental Engineering Report No. GEO2023-5496.

2.8 COAL MINING INVESTIGATIONS

The initial intrusive ground investigations works did not positively identify any evidence of a mine shaft at the location indicated by Coal Authority records. However, boreholes in the north eastern part of the site encountered anomalies that could be associated with a mine shaft. As such, further works were recommended in this respect.

A Coal Authority License was therefore secured to enable investigation of the shallow mine workings and potential mine shaft identified.

Further intrusive works were undertaken that included a geophysical survey, trial trenching, excavations and supplementary rotary and dynamic super heavy probe boreholes to investigate for potential historic mine shaft and mine workings within the site locality.

This supplementary ground investigation confirmed the presence of coal seams and unrecorded mine workings across the northern part of the site as well as the presence of a column of soft clay extending at least 3.6m deep bgl which has been interpreted as an infilled mine shaft.

This discovery led to recommendations from the Geotechnical engineers to redesign the layout to accommodate the mine shaft by incorporating a ‘no-build’ exclusion zone 45 degrees from the intersection between the shaft and solid strata, which in this case was recorded as being 5m bgl leading to a minimum 5m exclusion zone from the outside perimeter of the shaft.

Remedial works are therefore recommended to stabilise the shaft and shallow unrecorded mine workings across the site.

For further information refer to Geo Environmental Engineering Report No. GEO2024-6310.

2.9 PERCOLATION TESTING

Percolation testing was undertaken concurrently with the above additional mine and ground investigation works and is included in the above referenced report.

Soil infiltration tests were completed on the 30th July 2024. The works comprised two trial pits (SA01 and SA02) to depths of between 2.00m and c.2.20m bgl. The trial pits encountered made ground to depths of between c.1.00m and c.1.70m bgl respectively. This comprised clayey gravel of dolomite, brick, timber and concrete in SA01 and reworked gravelly clay with brick, concrete and sandstone in SA02.

Both trial pits were partially filled with water from a mobile bowser and the water level was recorded frequently over a duration of c.5 hours. During the tests, the water in both trial pits dropped 4cm and 1cm respectively. The results suggest that the natural soils are practically impermeable (as would be expected given the presence of clay deposits) and the tests are considered as a fail.

Infiltration is therefore not considered a viable option for surface water drainage disposal at this site and a positive drainage solution should be progressed.

3. ASSESSMENT OF FLOOD RISK

3.1 BACKGROUND

The following risk assessment has been carried out in accordance with the National Planning Policy Framework [1] and its Planning Practice Guidance [2] on Flood Risk. The broad aim of the guidance is to reduce the number of people and properties within the natural and built environment at risk of flooding. To achieve this aim, planning authorities are required to ensure that flood risk is properly assessed during the initial planning stages.

Responsibility for this assessment lies with the developers and they must demonstrate:

- Whether the proposed development is likely to be affected by flooding.
- Whether the proposed development will increase flood risk in other parts of the hydrological catchment.
- That the measures proposed to deal with any flood risk are sustainable.

The developer must prove to the Local Planning Authority and the Environment Agency that the existing flood risk or the flood risk associated with the proposed development can be satisfactorily managed.

3.2 FLOOD RISK TERMINOLOGY

Flood risk considers both the probability and consequence of flooding.

Flood events are often described in terms of their probability of recurrence or probability of occurring in any one year. The threshold between a medium flood and a large flood is often regarded as the 1 in 100-year event. This is an event which statistical analysis suggests will occur on average once every hundred years. However, this does not mean that such an event will not occur more than once every hundred years. Table 9.1 shows the event return periods expressed in years and annual exceedance probabilities as a fraction and a percentage. For example, a 1 in 100-year event has a 1% probability of occurring in any one year, i.e. a 1 in 100 probability. A 1000-year event has a 0.1% probability of occurring in any one year, i.e. a 1 in 1000 probability.

Table 3.1 Flood Return Periods & Exceedance Probabilities

Return Period (years)	Annual Exceedance Probability (AEP)	
	Fraction	Percentage
2	0.5	50%
10	0.1	10%
25	0.04	4%
50	0.02	2%
100	0.01	1%
200	0.005	0.5%
500	0.002	0.2%
1000	0.001	0.1%

3.3 DATA COLLECTION

The following information was referred to for the Flood Risk Assessment:

- Environment Agency Flood Map for Planning covering the site and adjacent area.
- Environment Agency Surface Water Flood Risk Map
- Environment Agency Reservoir Flood Risk Map
- Environment Agency Historic Flood Map
- United Utilities sewer records
- British Geological Survey Groundwater Flooding Susceptibility Map
- Development layout plan
- Topographic survey

3.4 ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING

Figure 3.1 is an extract from the EA's Flood Map for Planning[6].

This has been reviewed to assess the level of flood risk to the area. The flood map shows areas that may be at risk of fluvial flooding in a 1% (1 in 100 year, dark blue) or 0.1% (1 in 1000 year, light blue) Annual Exceedance Probability (AEP) event. Alternatively, if the flood risk is tidal the flood map will show areas predicted to be at risk of flooding from the sea in a 0.5% AEP event (1 in 200 year, dark blue) or a 0.1% AEP event (1 in 1000 year, light blue).

The Flood Map shows the current best information on the extent of the extreme flooding from rivers or the sea that would occur without the presence of flood defences. The potential impact of climate change is not considered by the mapping.

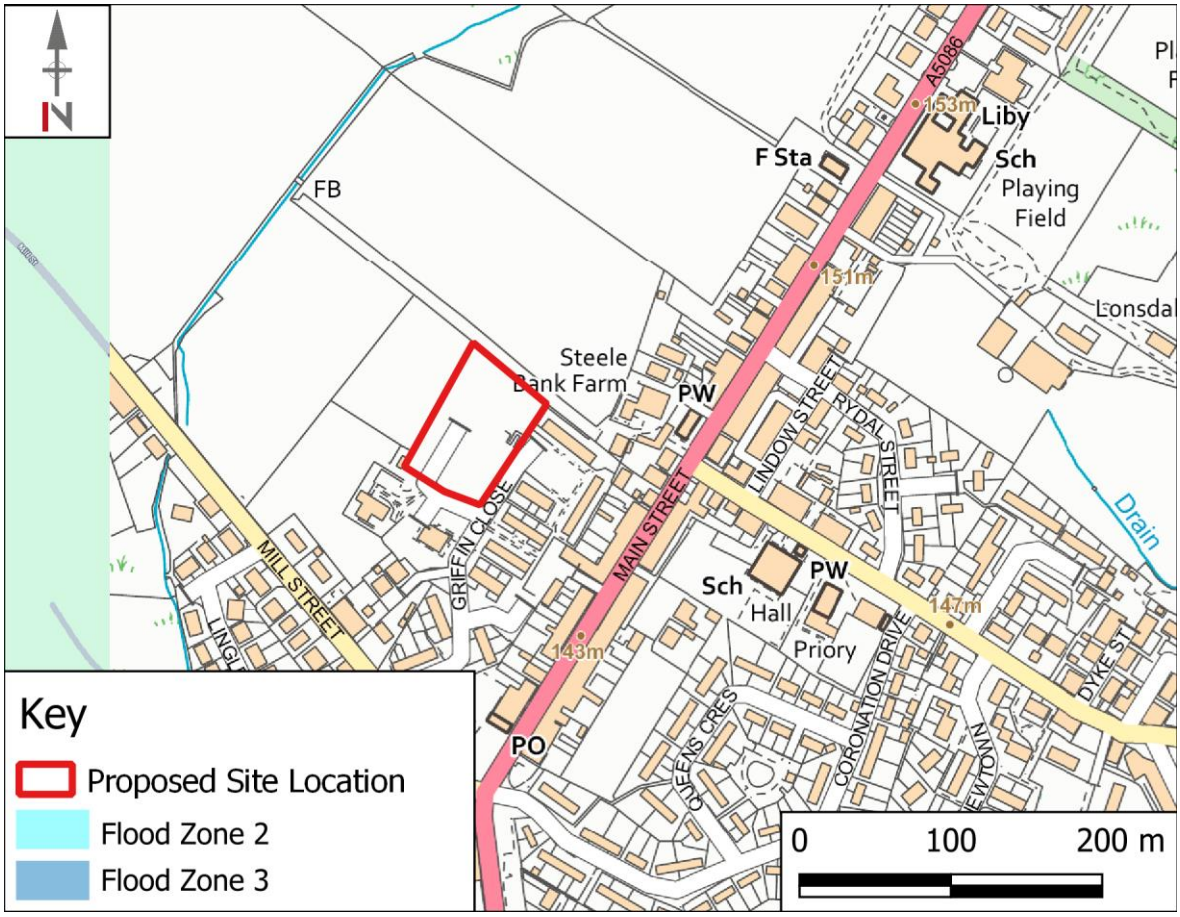


Figure 3.1 Environment Agency Flood Map for Planning

Reference to Figure 3.1 indicates the site lies entirely within Flood Zone 1 "Low Probability", land assessed as having a less than 0.1% annual probability of flooding (i.e. rivers, lake or sea) in any year by reference to the NPPF and is therefore not considered to be at risk of fluvial flooding.

3.5 SURFACE WATER FLOOD RISK

Surface water flooding is that which results from extreme rainfall rather than overflowing rivers. This type of flooding typically occurs when extreme rainfall causes water to run down slopes and collect in depressions in the landscape or where runoff is focussed into an area where drainage is insufficient. It can also cause erosion resulting in the partial or complete blockage of drains or culverts.

Figure 3.2 shows an extract from the EA Surface Water Flood Risk Map[6]. This has four risk classifications from very low probability (<0.1% AEP) to high probability (>3.3% AEP).

The EA surface water flood map indicates that a small, localised area within the proposed development boundary is shown in dark blue and at 'high' risk of surface water flooding with the risk of flooding being greater than 3.3% AEP.

It is unclear how up to date the surface water flood maps are, but as the surface water flooding area is contained to one localised area within the site it is likely attributable to runoff from hardstanding areas congregating in a localised depression. This does not align with the topographic

survey information obtained for the site which shows levels in this area gently and consistently sloping away towards the western boundary. It is likely this surface water flood mapping predates the demolition of the former assisted living complex and therefore cannot be relied upon for accuracy.

As any new development resulting in an increase in impermeable areas could cause additional run-off if not properly managed. It is therefore proposed to incorporate sufficient drainage features, SuDS measures and attenuation storage to mitigate this as part of the overall Drainage Strategy. This is discussed in further detail in Section 4.

Flooding via this mechanism is therefore not considered to be a risk for the proposed development.

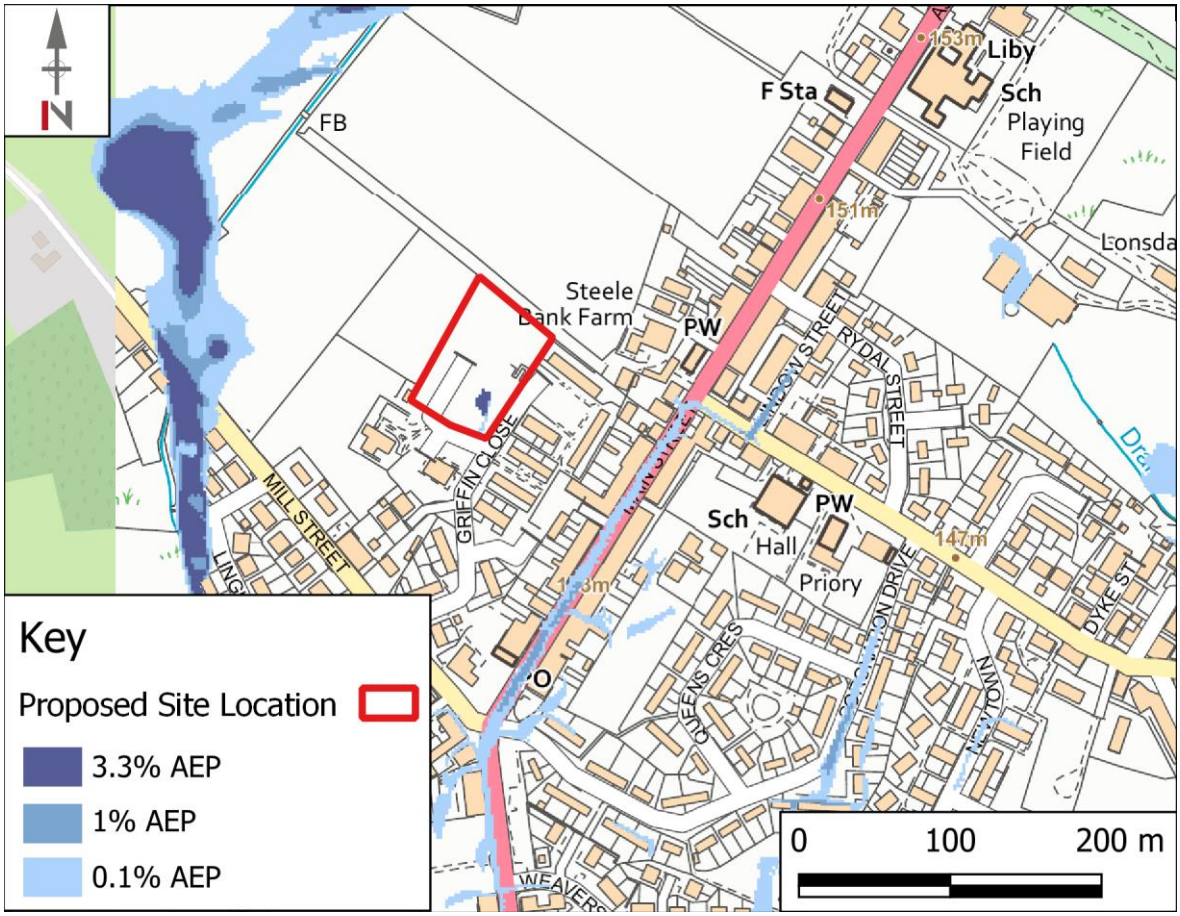


Figure 3.2 Environment Agency Surface Water Flood Map

It should be noted that EA guidance on the use of surface water flood maps states the following: *"Information Warnings: Risk of Flooding from Surface Water is not to be used at property level. If the Content is displayed in map form to others we recommend it should not be used with basemapping more detailed than 1:10,000 as the data is open to misinterpretation if used as a more detailed scale. Because of the way they have been produced and the fact that they are indicative, the maps are not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence."*

(https://www.data.gov.uk/dataset/d5ca01ec-e535-4d3f-adc0-089b4f03687d/risk-of-floodingfrom-surface-water-suitability)

3.6 GROUNDWATER FLOOD RISK

Groundwater flooding occurs when water levels in the ground rise above the ground surface. It is most likely to occur in low lying areas underlain by permeable drift and rocks.

As discussed in Section 2.7 the geotechnical testing undertaken at the site location found that there was no significant water ingress noted during the ground investigations other than that considered as trapped/perched water due to surface ingress.

Nevertheless, no below ground development is proposed in any case therefore groundwater would not pose a risk of flooding to the site.

3.7 FLOODING FROM RESERVOIRS, CANALS OR OTHER ARTIFICIAL SOURCES

No reservoirs canals or artificial structures are recorded as being within the vicinity of the site and the site is not considered at risk of flooding by these methods.

Flooding from these methods is usually based on a worst-case scenario of catastrophic failure of a dam or reservoir structure and therefore the likelihood of reservoir flooding etc. is, however considered to be much lower than other forms of flooding. Current reservoir regulation, which has been further enhanced by the Flood and Water Management Act, aims to make sure that all reservoirs are properly maintained and monitored to detect and repair any problem.

The proposed development site is not however shown to be affected in any case.

3.8 FLOODING FROM SEWERS

United Utilities (UU) do not provide information on flood risk from their assets and there have been no reports of flooding from this method. It is therefore concluded the site is not at risk of flooding from these sources as they should be properly maintained by the sewerage undertaker.

4. SURFACE WATER DRAINAGE STRATEGY & DESIGN

4.1 INTRODUCTION

The principal aim of the following drainage strategy is to design the development to avoid, reduce and delay the discharge of rainfall to public sewers and watercourses in order to protect watercourses and reduce the risk of localised flooding, pollution and other environmental damage.

In order to satisfy these criteria this surface water runoff assessment and drainage design has been undertaken in accordance with the following reports and guidance documents:

- SuDS Manual, CIRIA Report C753, 2015 [7]
- Code of Practice for Surface Water Management, BS8582:2013, November 2013[8]
- Rainfall Runoff Management for Developments, Defra/EA, SC030219, October 2013[9]
- Designing for Exceedance in Urban Drainage – Good Practice, CIRIA Report C635, 2006[10]
- Flood Estimation Handbook (FEH)[11]
- Flood Studies Report (FSR), Volume 1, Hydrological Studies, 1993[12]
- Flood Studies Supplementary Report No 14 (FSSR14), Review of Regional Growth Curves, 1983[13]
- Flood Estimation for Small Catchments, Marshall & Bayliss, Institute of Hydrology, Report No. 124 (IoH 124), 1994[14]
- Department for Environment, Food and Rural Affairs, Non-Statutory Technical Standards for Sustainable Drainage Systems, March 2015[15]

The following drainage strategy is based on the latest site layout plan by Architects Plus (Drawing No. 22031-02). Any alterations to the site plan resulting in changes to impermeable areas will require the drainage strategy to be revisited.

4.2 SURFACE WATER DISPOSAL

Surface water disposal has been considered in line with the hierarchy outlined in the SuDS Manual[7]. The approach considers infiltration drainage in preference to disposal to watercourse, in preference to discharge to sewer.

Cumberland Council as Lead Local Flood Authority prefer design in accordance with the Cumbria Design Guide which identifies the following hierarchy of techniques to be used:

- **Prevention**: Prevention of runoff by good site design and the reduction of impermeable areas.
- **Source Control**: Dealing with water where and when it falls (e.g. permeable paving).

- **Site Control**: Management of water in the local area (e.g. swales, detention basins).
- **Regional Control**: Management of runoff from sites (e.g. balancing ponds, wetlands).

4.2.1 DISCHARGE TO GROUND

Geotechnical testing undertaken at the site by GEO Environmental Engineering has indicated that the ground is not suitable to facilitate soakaway drainage. For further information refer to Section 2.9. Based on the historic coal mine workings and significant levels and variable depths of made ground encountered across the site, an infiltration drainage strategy is not considered appropriate due to the risk of inundation settlement of the made ground.

In addition, as the existing hardstanding areas of the site and former care home are/were positively drained on separate systems for conveyance for off-site disposal via existing sewers, this also indicates that soakaways are not a viable drainage solution.

4.2.2 DISCHARGE TO WATERCOURSE

Disposal to watercourse (Lingla Beck) has been discounted due to the fact it would require a long complex route through third party owned land and it is unclear as to whether the receiving beck levels are compatible with the development to allow a gravity fed connection. Significant lengths of new pipework would also need to be installed and agreements would have to be sought with potentially multiple third-party landowners to enable a route to be established.

4.2.3 DISCHARGE TO SURFACE WATER SEWER

It is therefore considered most appropriate to replicate the original surface water drainage disposal arrangement utilising the existing surface water drainage pipework for conveyance off site. There is a small section of pipework near the surgery that will need to be repaired/replaced.

4.3 ASSESSMENT OF SITE AREAS

To support the exploration of options for site drainage, the spatial extent of different types of proposed land cover on the site have been measured. Table 4.2 shows the measured proposed land cover areas.

Table 4.1 Land Cover Areas

Land Cover	Area		Percentage of total site area
	m²	Ha	
Total housing roof area	721.4	0.072	14%
Total parking and paved area	1091.7	0.109	22%
Total road area	1023.0	0.102	20%
Contributing garden & landscaped areas	1021.7	0.102	20%
Remaining garden & landscaped areas not contributing to the drainage network	1158.7	0.116	23%

To develop the detailed drainage design, only certain surfaces and areas will be positively drained into the surface water network. Positively drained areas include roof areas, car parking, access road

and footways. All other areas (principally gardens and landscaping) will either have a permeable surface or will have no positive drainage.

Having assessed the site proposals the landscaped and garden areas can however be split into two distinct areas, those considered to be disconnected from the development drainage (Plots 12-17 and green space on the western extent of the site falling away from the development) and those which could contribute some level of runoff to the drainage network i.e. garden/green areas that could contribute some level of runoff onto drained hardstanding areas (Plots 1-11 and the greenspace forming the sloping north eastern perimeter).

Table 4.3 summarises this and shows that the total catchment area which could contribute to the drained network as covering 77% of the overall site area with the remaining undrained areas making up the remaining 23%.

A surface water catchment plan is provided in Appendix A for reference.

Table 4.2 Summary of drained and undrained areas into surface water drainage system

Land Cover	Area		Percentage of total site area
	m²	Ha	
Total Contributing Catchment Drainage Area	3857.8	0.386	77%
Remaining permeable/undrained Area	1158.7	0.116	23%

Without attenuation-based SuDS, the proposed development would increase the Rate of Runoff from the developed areas of the site.

4.4 PRE-DEVELOPMENT RUNOFF ASSESSMENT

As the site covers an area of less than 200 ha the Greenfield calculations have been undertaken in accordance with methodology described in IoH 124[14]. For catchments of less than 50 ha the Greenfield runoff rate is scaled according to the size of the catchment in relation to a 50-hectare site. The calculation has been based on the entire site area of 0.52 ha.

Despite there being existing areas of hardstanding present on the site the entire site area has been classified as Greenfield for the purposes of deriving the runoff calculations. This approach is highly conservative as the peak runoff rate from the former care home would have been significantly higher than the greenfield runoff rate calculated.

Full details of the calculations and the methodology for deriving the Peak Rate of Runoff are in included in Appendix B, and a summary included in Table 4.1.

The proposed discharge rate matching the equivalent Greenfield QBAR runoff of 4.0 l/s is also a considerable improvement on the rate of discharge that would previously have occurred when the site was occupied by the assisted living development which was positively drained at an unrestricted brownfield rate. By direct comparison if we assume the former complex had impermeable areas of only 50% of the overall site area, the equivalent brownfield QBAR runoff rate can be calculated as 36.7 l/s demonstrating that a significant level of betterment is proposed.

Table 4.3 Pre-Development Greenfield Runoff Rates

Rate of Runoff (l/s)	
Event	**Greenfield**
Q1	3.5
QBAR	4.0
Q10	5.6
Q30	6.8
Q100	8.4
Q100 + 50% CC	12.6

4.5 RUNOFF CONTRIBUTION FROM PERMEABLE AREAS

A 40% contribution from affecting pervious / permeable areas should be allowed for within the calculations.

On this basis, of the 1021.7 m^2 of potentially contributing garden and landscaped catchment areas identified in Table 4.1, an additional 409 m^2 (40%) of this catchment has been accounted for as impermeable area in the drainage modelling.

Guidance by HR Wallingford stipulates a 30% contribution is the proposed default factor attributable to greenspace, the (40%) inclusion of this uplift from the potentially contributing greenspace and garden/landscaped areas of plots 1 to 11 at this site will result in highly conservative design.

4.6 SURFACE WATER DRAINAGE DESIGN PARAMETERS

The surface water drainage system has been designed on the following basis using the modified rational method and a generated rainfall profile:

4.6.1 CLIMATE CHANGE

Projections of future climate change indicate that more frequent short-duration, high intensity rainfall and more frequent periods of long-duration rainfall are likely to occur over the next few decades in the UK. These future changes will have implications for river flooding and for local flash flooding. These factors will lead to increased and new risks of flooding within the lifetime of planned developments.

The EA have provided a peak rainfall online map showing the anticipated changes in peak rainfall intensity across the UK. Climate change allowances are now provided on a catchment by catchment basis. The site falls within the South West Lakes catchment. Table 4.4 outlines the EA guidance for this catchment, for the anticipated design life of the proposed development.

In line with current guidance and for conservative design, a 50% allowance shall be used within this assessment.

Table 4.4 South West Lakes Management Catchment Peak Rainfall Allowances (1.0 AEP)

South West Lakes (1.0%AEP)	Central Allowance (%)	Upper End Allowance (%)
2050s	30	45
2070s	35	50

4.6.2 URBAN CREEP

BS 8582:2013[8] outlines best practice with regard to Urban Creep. Although not a statutory requirement, future increase in impermeable area due to extensions and introduction of impervious positively drained areas has been considered. An uplift of 10% on impermeable areas associated with plots only has been applied to the contributing area used for surface water drainage design.

4.6.3 PERCENTAGE IMPERMEABILITY (PIMP)

The percentage impermeability (PIMP) for all impermeable areas is modelled as 100%. The entirety of the impermeable areas is to be positively drained.

4.6.4 VOLUMETRIC RUNOFF COEFFICIENT (CV)

The volumetric runoff coefficient describes the volume of surface water which runs off an impermeable surface following losses due to infiltration, depression storage, initial wetting and evaporation. The coefficient is dimensionless. Default industry standard volumetric runoff coefficients are 0.75 for summer and 0.84 for winter and are used for design on the basis that a percentage of contributing green areas has been included in the site catchment calculations.

4.6.5 RAINFALL MODEL

The calculations use the REFH2 unit hydrograph methodology in line with best practice as outlined in the SuDS Manual[7]. The calculations use the most up to date available catchment descriptors (2022) provided by the Centre for Ecology and Hydrology Flood Estimation Handbook web service.

4.7 SURFACE WATER DRAINAGE DESIGN

The proposed surface water drainage network serving the entire developable area of the site has been modelled using Causeway Flow (results are included in Appendix B).

The drainage design has been sized to store a future 1% AEP event of critical duration without any flooding. Future climate change (50%) and urban creep (10% to housing roof areas only) and 40% uplift for contributing green spaces is accounted for within the calculations.

It is proposed that all impermeable site areas i.e. roof, driveway and road areas will ultimately drain via. gravity through a network of pipes and chambers either directly into or ‘offline’ via the flow control device to a single shared geocellular attenuation crate tank system located in the natural respective low point of the site to facilitate the drainage system.

Roof water, driveway and path runoff will connect directly into the surface water pipe network upstream of the attenuation systems, with inspection chambers utilised to route the new pipework

and allow for future inspection and maintenance. Proposed external levels will fall consistently to enable gravity connections to the drainage system.

Silt traps will be located upstream of the attenuation tank, which will provide surface water treatment and access for maintenance. Silt traps isolate silt and other particles by encouraging settlement into sumps, preventing ingress into the tank.

The attenuation tank will be founded at a suitable level providing a minimum depth of suitable cover whilst allowing for connection to the surface water network. The tank will be wrapped and sealed with an impermeable membrane to provide a water-tight structure.

The geocellular tank will be formed as a permanent feature under a shared private driveway/parking area to facilitate future access and maintenance requirements.

The attenuation tank will provide a minimum storage capacity of 215m^3 in order to service the development. A 1.2m deep x 7m wide x 27m long tank has been calculated to provide the required volumetric capacity.

A flow control chamber incorporating a Hydro-brake will be located downstream of the attenuation tank restricting discharge to the equivalent site greenfield runoff rate (QBAR) of 4.0 l/s, prior to discharge via the existing surface water drainage pipe connection and outfall route.

Hydro-brake design information is included in Appendix C for reference.

The access road and car parking areas will be constructed using conventional surfacing in the form of asphalt and block paving. The access road will be drained via. a series of highway gullies and/or channel drains into the proposed surface water drainage network.

Full details of the drainage proposals are shown on RGP drawings K41128-10, 12 & 13, included in Appendix A.

4.8 OTHER BENEFITS OF DEVELOPMENT

The development site in its current form is sparse vegetation, underlain by relatively impermeable soil, which provides little in the way of natural flood defence or attenuation to overland flows and stormwater runoff. The land in its current form also lacks any meaningful biodiversity or amenity value and provides limited benefits to the surrounding community.

The proposed development site will tie into the existing topography via careful design. Slopes, gardens and open space areas will be carefully landscaped using a variety of plants, shrubs and trees, providing a net gain in biodiversity and enhanced storage/protection against overland flows.

As such the existing hydraulic regime of the site will be modified whereby overland and subsurface flows will be intercepted, attenuated, and re-directed by below ground structures, positive drainage and service trenches.

Hydraulic gradients and velocities will be reduced, and the risk of downstream flooding would not be increased.

4.9 DESIGNING FOR LOCAL DRAINAGE SYSTEM FAILURE

In accordance with the general principles discussed in CIRIA Report C635 – Designing for Exceedance in Urban Drainage [10] the proposed surface water drainage, where practical, should be designed to ensure there is no increased risk of flooding to the proposed dwellings on the site or elsewhere as a result of extreme rainfall, lack of maintenance, blockages or other causes. These measures are discussed below.

4.9.1 BLOCKAGE & EXCEEDANCE

The sustainable drainage system has been designed to attenuate a 100-year design storm including a 50% allowance for climate change, with no flooding. The drainage system will also provide capacity for lower probability (greater design storm events) which are not critical duration.

Should flooding occur within any of the flow control devices, manholes or silt traps, exceedance flows would follow the road gradients, re-entering the network via capture from the proposed new road gullies.

In the highly unlikely event that exceedance flows were to bypass any of the proposed development drainage it is proposed to install a new double gully just outside the site boundary which could be formed as part of the new road entrance installation works to provide additional redundancy and ensure the interception and capture of any such flows generated in extreme events.

4.9.2 SURFACE STORAGE & EXTERNAL LEVELS

The site levels have been designed to offer additional surface water storage volume and conveyance of flood water should the SuDS and drainage system fail, flood or exceed capacity. Where appropriate, the kerb lines have been raised to channel surface water runoff back into the drainage system or onto the existing highway.

4.9.3 BUILDING LAYOUT & DETAIL

The finished floor levels to the new dwellings have been designed and situated to ensure that they are not at risk of flooding from overland flow. Finished floor levels will typically be set 150mm above external paved areas (whilst providing level access where needed). External footpaths typically fall away from the thresholds, ensuring that any flood water runs away from, rather than towards the dwellings. Threshold drains could be incorporated at level access points for additional redundancy.

4.9.4 DRAINAGE CONTINGENCY

The proposed surface water system will be designed to provide adequate storage volume against flooding for the Q100 event, including a 50% allowance to account for climate change. The drainage system will also provide capacity for lower probability (greater design storm events) which are not critical duration.

4.10 SURFACE WATER TREATMENT

The treatment of surface water is not a statutory requirement. Water quality remains a material consideration but there are no prescriptive standards to be imposed in terms of treatment train management. In the absence of a design standard, the SuDS manual has been used which outlines best practice.

Pollutants such as suspended solids, heavy metals and organic pollutants may be present in surface water runoff, the quantity and composition of the runoff is highly dependent upon site use. For housing developments, the pollutant load is very low. The SuDS Manual[7] outlines best practice with regards to treatment of surface water by SuDS components prior to discharge to the environment. SuDS components can be effective in reducing the amount of pollutants within the surface water discharged and therefore environmental impact of the development. SuDS components may be installed in series to form a treatment train to treat the runoff.

For the three categories of runoff areas served by the drainage system, roof areas, residential parking and residential roads, treatment is proposed by directing all surface water runoff via. a hydrodynamic vortex separator before discharge off site. Tables 4.5-4.7 summarise the pollution hazard and mitigation indices for this type of runoff and show that adequate treatment of surface water runoff is provided by the use of a hydrodynamic vortex separator (or similar device) which removes sediments, oils and floatables from the site stormwater runoff.

Table 4.5 Pollution Hazard & Mitigation Indices - Roof Areas

Indices	Suspended Solids	Metals	Hydrocarbons
Pollution Hazard	0.2	0.2	0.05
Pollution Mitigation	0.5	0.4	0.8
Treatment Suitability	**Adequate**	**Adequate**	**Adequate**

Table 4.6 Pollution Hazard & Mitigation Indices - Parking Areas

Indices	Suspended Solids	Metals	Hydrocarbons
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.5	0.4	0.8
Treatment Suitability	**Adequate**	**Adequate**	**Adequate**

Table 4.7 Pollution Hazard & Mitigation Indices - Road Areas

Indices	Suspended Solids	Metals	Hydrocarbons
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.5	0.4	0.8
Treatment Suitability	**Adequate**	**Adequate**	**Adequate**

4.11 OPERATIONS & MAINTENANCE RESPONSIBILITY

The drainage systems will be privately maintained by Home Group. A SuDS '*Operations & Maintenance Plan'* has been prepared by RGP detailing the requirements for future maintenance of the SuDS components.

5. FOUL WATER DRAINAGE STRATEGY

It is proposed that foul water from the new development shall be drained via gravity within the site for disposal via connection to an existing private foul sewer chamber located on the southern boundary.

This sewer is routed south under Greenvale Court Road and discharges into the public combined sewer to the rear of 'The Laurel' residences.

The new connections will be subject to formal application to UU under S106 agreements. Under Section 106 of The Water Industry Act 1991, '*the owner / occupier of any premises shall be entitled to have his drain or sewer communicate with the public sewer of any sewerage undertaker and thereby to discharge foul water and surface water from those premises or that private sewer*.' Unless '*the making of the communication would be prejudicial to the undertaker's sewerage system'*.

All private drainage will be constructed in accordance with The Building Regulations Approved Document Part H.

Foul water discharge calculations have been undertaken for the 17 no. dwellings in accordance with the Design and Construction Guidance for Foul and Surface Water Sewers [16], as shown in Table 5.1.

Once the existing foul disposal route has been verified a pre-development enquiry will be submitted to UU to determine acceptance in principle.

Table 5.1 Peak Foul Flow Rates

Sewerage Sector Design & Construction Guidance Clause B3.1	
Total Peak Load based on Number of Dwellings, 17 no. units @ 4000 l/day	68,000
Peak Flow Rate from Site (l/s)	0.78

The estimated total peak foul flow rate for the development is 0.78 litres/sec.

For further details, refer to the latest revision of the Drainage Layout Plan included in Appendix A (K41128-10).

6. CONCLUSIONS AND RECOMMENDATIONS

The proposed Flood Risk Assessment and Drainage Strategy can be summarised as follows:

- The site is located in Flood Zone 1 with a predicted annual probability of flooding from rivers or the sea of less than 0.1% AEP (1 in 1000).
- By reference to the National Planning Policy Framework [1] on Flood Risk, More Vulnerable development is acceptable within this flood zone.
- The site is not considered to be at significant risk of flooding from surface water, groundwater, reservoirs, canals, or any artificial structures.
- Ground investigations have confirmed that the underlying strata is not suitable for infiltration-based SuDS components.
- The watercourse located to the west of the site is not a suitable point of discharge due to third party land ownership and routing complications.
- It is proposed that surface water drainage shall be positively drainage and attenuated, using a geocellular tank system, with a hydro-brake flow control device restricting discharge to match the equivalent pre-development Greenfield QBAR rate of 4.0 l/s.
- Attenuated surface water disposal will be into the existing surface water system that served the original care home. A small section of this existing outfall pipework near the surgery will need to be repaired / renewed.
- Treatment of surface water runoff will be provided through a Hydrodynamic Vortex Separator if required.
- A SuDS Operations and Maintenance Plan has been prepared detailing future maintenance requirements of all sustainable drainage systems.
- Foul flows from the site shall discharge via gravity to the existing foul water drainage system that served the original care home, which discharges into the existing downstream UU public combined sewer. A pre-development wastewater enquiry will be submitted to UU.

7. REFERENCES

[1] Ministry of Housing, Communities and Local Government, National Planning Policy Framework, December 2023.

[2] Ministry of Housing, Communities and Local Government, Planning Practice Guidance to the National Planning Policy Framework, August 2023

[3] Defra/Environment Agency, The Town and Country Planning Order 2015, 2015 No.595, April 2015

[4] British Geological Survey, Geoindex: http://mapapps2.bgs.ac.uk/geoindex/home.html

[5] Land Information System (LANDIS)- Soilscapes viewer, http://www.landis.org.uk/soilscapes

[6] Defra Magic Maps, 2024 https://magic.defra.gov.uk/MagicMap.aspx .

[7] CIRIA, The SuDS Manual, Report C753, 2015.

[8] BS8582:2013, Code of Practice for Surface Water Management, November 2013.

[9] DEFRA/EA, Rainfall Runoff Management for Developments, SC030219, October 2013.

[10] CIRIA, Designing for Exceedance in Urban Drainage – Good Practice, Report C635, London, 2006.

[11] Centre for Ecology and Hydrology, Flood Estimation Handbook, Vols. 1 – 5 & FEH CD-ROM 3, 2009.

[12] Institute of Hydrology, Flood Studies Report, Volume 1, Hydrological Studies, 1993.

[13] Institute of Hydrology, Flood Studies Supplementary Report No 14 – Review of Regional Growth Curves, August 1983.

[14] Marshall & Bayliss, 1994. Flood Estimation for Small Catchments, Report No. 124 (IoH 124), Institute of Hydrology.

[15] Department for Environment, Food and Rural Affairs, Non-Statutory Technical Standards for Sustainable Drainage Systems, March 2015

[16] Water UK, Design and Construction Guidance for Foul & Surface Water Sewers Offered for Adoption Under the Code for Adoption Agreements for Water and Sewage Companies Operating Wholly or Mainly in England, Approved Version 2.0 March 2020

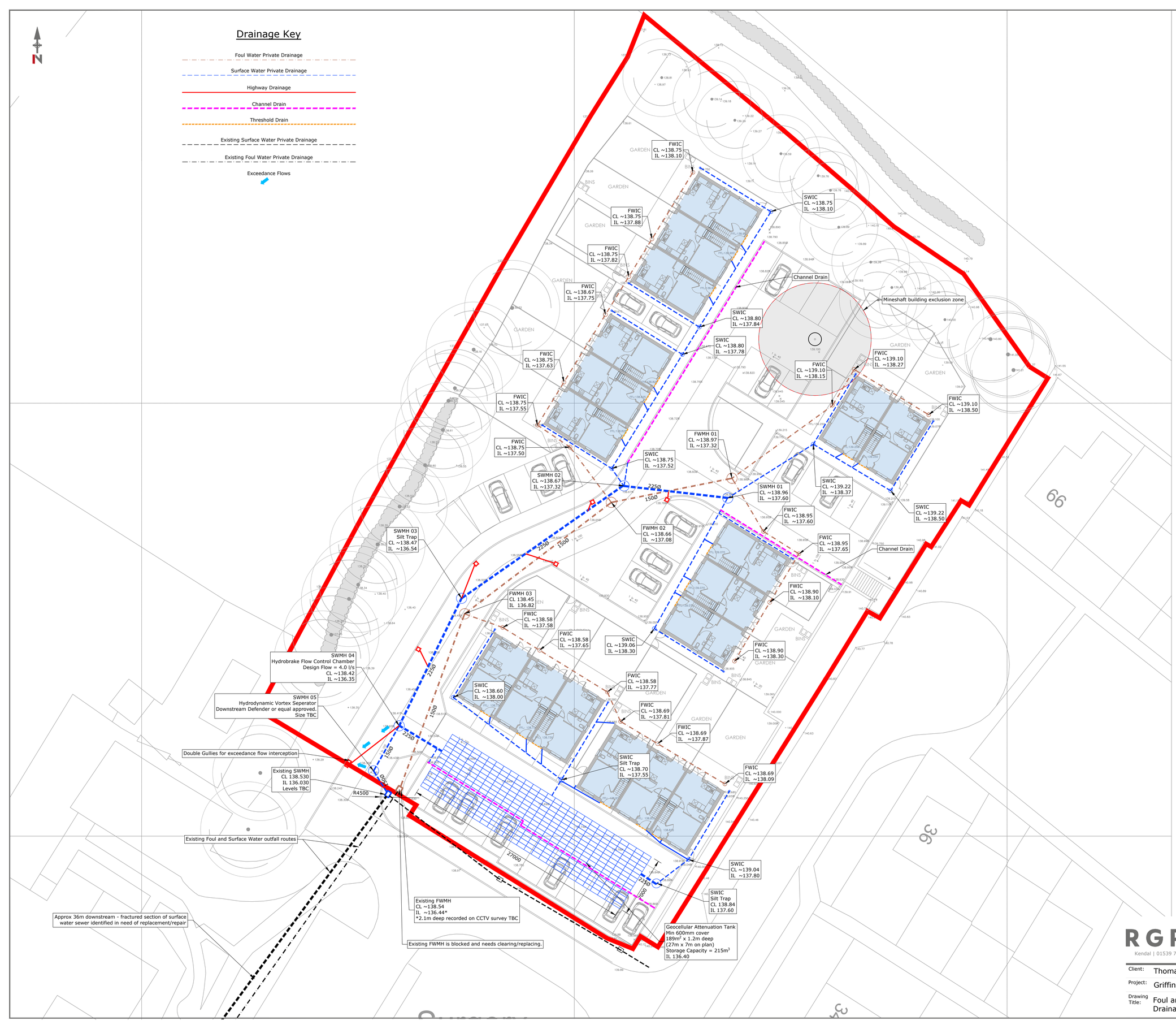
[17] GEO Environmental Engineering Ltd, February 2023. Phase II: Ground Investigation Report Proposed Residential Development of Land off Griffin Close, Frizington Cumbria. Report no. 2023-5496

APPENDIX A

DRAWINGS

Drainage Key

- Foul Water Private Drainage
- Surface Water Private Drainage
- Highway Drainage
- Channel Drain
- Threshold Drain
- Existing Surface Water Private Drainage
- Existing Foul Water Private Drainage
- Exceedance Flows



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Rev	Description	Date	Revised by	Checked by	Approved
B	Updated to suit layout amendments	24/10/24	CA	TM	TM
A	Drainage levels updated	13/08/24	CA	TM	TM

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS
Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong	Scale @ A1: 1:200	First Issue: 28/06/2024	Office of Origin: Kendal
Project:	Griffin Close, Frizington	Drawn by: CA	Checked by: TM	Approved:
Drawing Title:	Foul and Surface Water Drainage Layout	Project No: K41128	Drawing No: 10	Rev: B
		BIM No:		

KEY:

		DRAINAGE CONTRIBUTION
ROOF AREAS		- 0.08 Ha (incl. 10% urban creep uplift on roof areas)
ROAD/FOOTWAY AREAS		- 0.102 Ha
PARKING/PAVED AREAS		- 0.109 Ha
GARDEN/LANDSCAPE AREAS		- 0.041 Ha (40% contribution from gardens and greenspace)
TOTAL CATCHMENT		- 0.332 Ha

517400

517350

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Rev	Description	Date	Revised by	Checked by	Approved
A	Updated to suit layout alterations	18/10/24	CA	TM	TM

Issue Purpose: PLANNING

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Client:	Thomas Armstrong		
Project:	Griffin Close, Frizington		
Drawing Title:	Surface Water Catchment Plan		
Scale @ A1: 1:200	First Issue: 28/06/2024	Office of Origin: Kendal	
Drawn by: CA	Checked by: TM	Approved:	
Project No: K41128	Drawing No: 11	Rev: A	
BIM No:			

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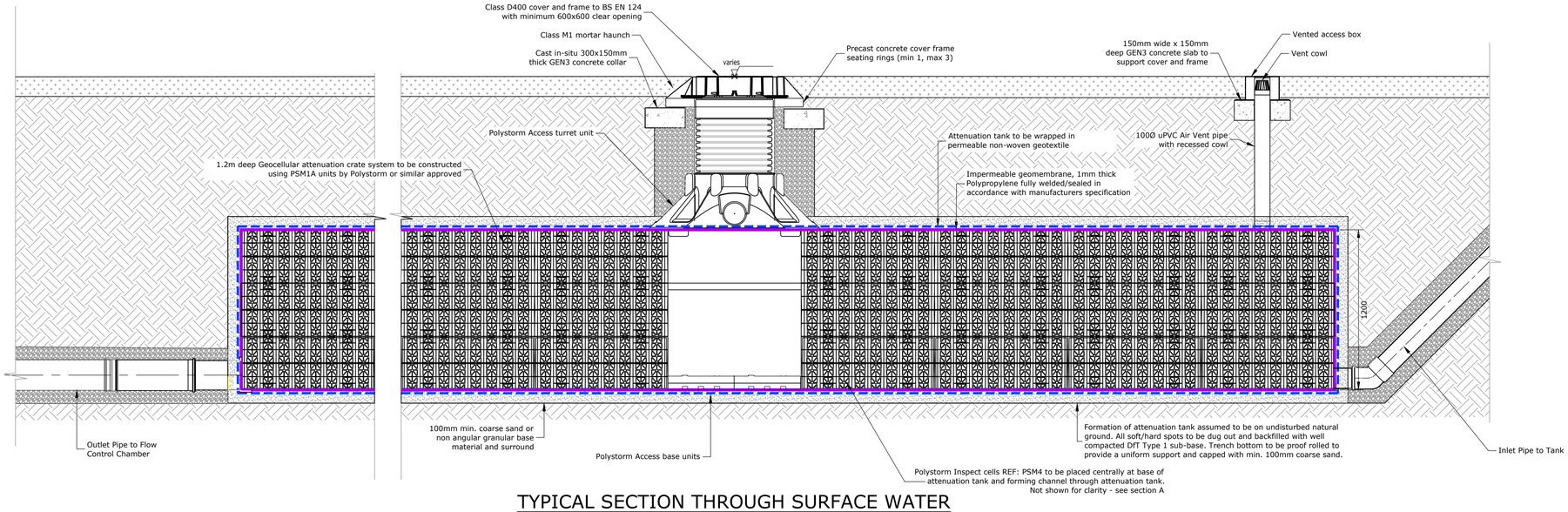
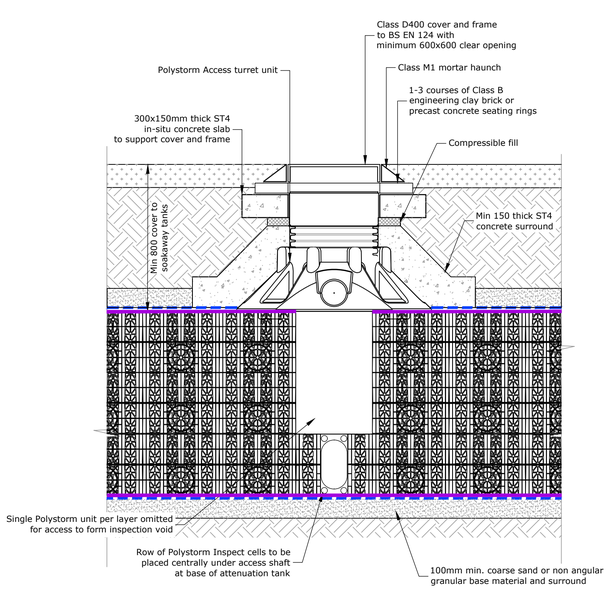


TYPICAL SECTION THROUGH SURFACE WATER DRAINAGE ATTENUATION TANK

SCALE 1:20



SECTION A-A THROUGH ACCESS TURRET

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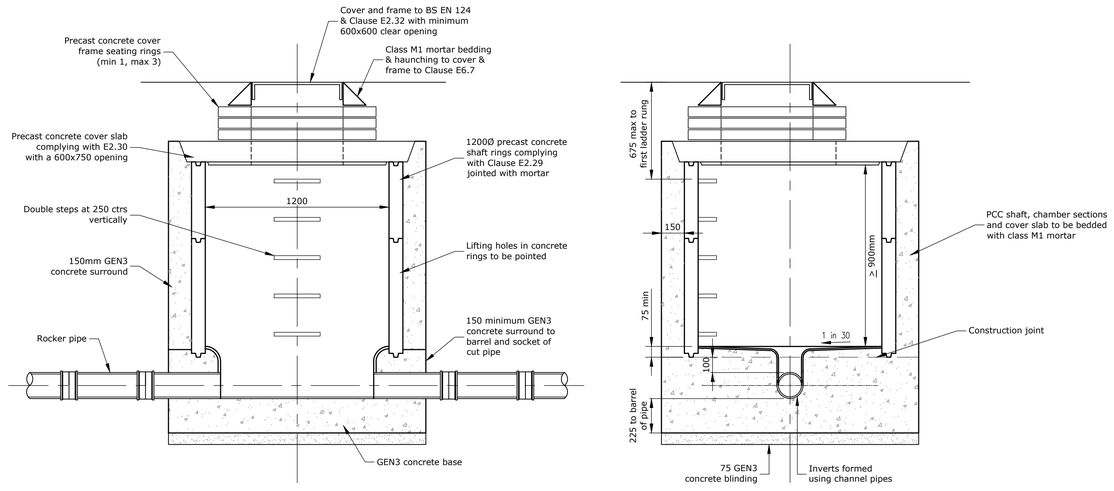
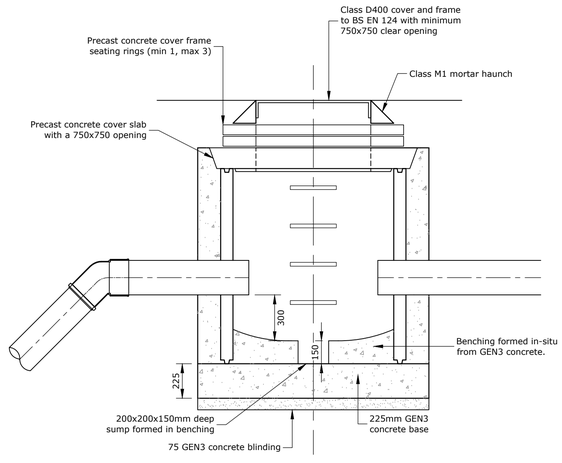


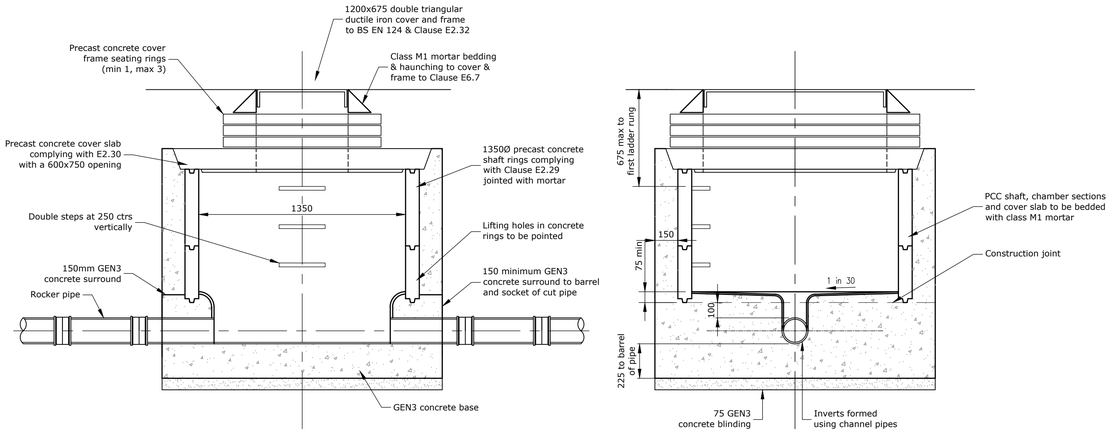
TYPICAL MANHOLE DETAIL - TYPE B DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE 1.5m TO 3m (1200Ø)

Scale 1:20



TYPICAL SILT TRAP MANHOLE

Scale 1:20



TYPICAL MANHOLE DETAIL - TYPE C DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE LESS THAN 1.5m (1350Ø) 450mm MAX PIPE DIAMETER

Scale 1:20

Rev	Description	Date	Revised by	Checked by	Approved
A	Details updated	24/10/24	CA	TM	TM

Issue Purpose: PLANNING

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R G PARKINS
Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong		
Project:	Griffin Close, Frizington		
Drawing Title:	Typical Drainage Construction Details Sheet 1 of 2		

Scale @ A1: 1:100	First Issue: 28/06/2024	Office of Origin: Kendal	
Drawn by: CA	Checked by: TM	Approved:	
Project No: K41128	Drawing No: 12	Rev: A	
BIM No:			

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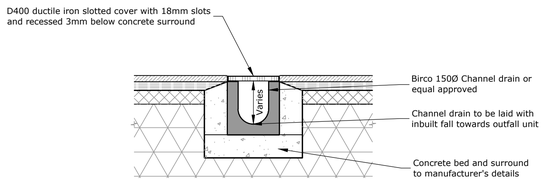
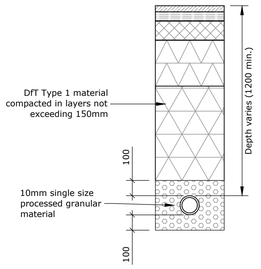
4. The Contractor is responsible for verifying all dimensions on site prior to commencing works.
5. Any specified proprietary products are to be installed in strict accordance with manufacturers guidelines. No specified product should be substituted without gaining approval from RG Parkins.

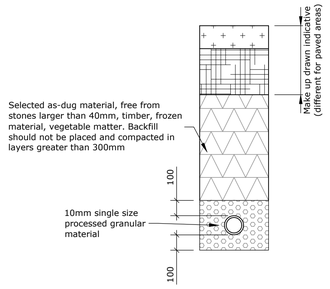
NOTE:
Channel to be installed strictly in accordance to manufacturers specification & details



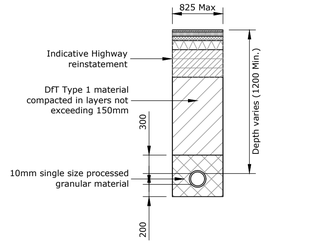
TYPICAL CHANNEL DRAIN DETAIL
SCALE 1:20



PIPE BEDDING FOR 100Ø/150Ø PIPES IN HARD LANDSCAPED AREAS
SCALE 1:20



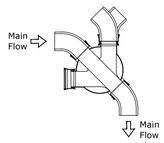
PIPE BEDDING FOR 100Ø/150Ø PIPES IN SOFT LANDSCAPED AREAS
SCALE 1:20



TYPE 7 EMBEDMENT CLASS S FOR 225Ø PIPE
SCALE 1:50

NOTE:
350Ø restricted access opening to be used where depth of chamber to soffit is >1.0m

TYPICAL PLAN



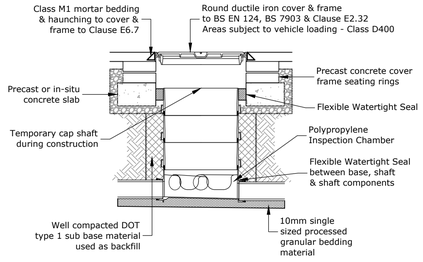
Where chambers are positioned on 90° corners always use the main channels by fitting a 45° bend on inlet & outlet

Bends of up to max 45° can be used on any inlet or the outlet

Short steep branch connections to be connected via a 45° inlet using a bend where necessary

Inlet stoppers to remain where connection not required

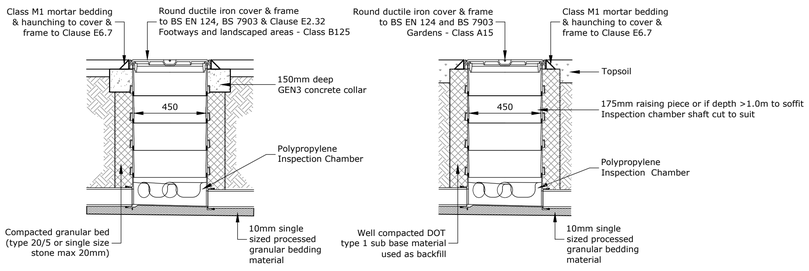
SITED IN DRIVEWAYS & FOOTWAYS



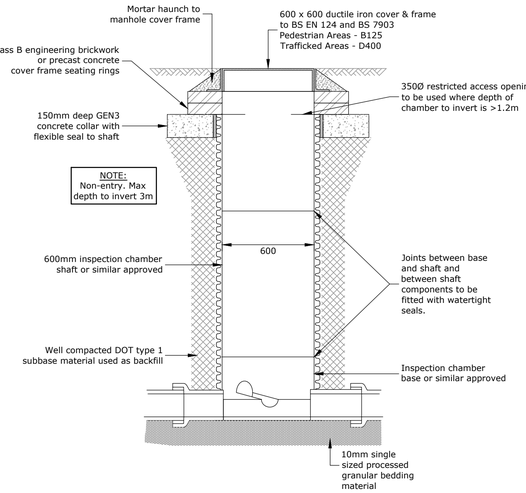
TYPICAL INSPECTION CHAMBER DETAIL (VEHICLE LOADING)
Scale 1:20

SITED IN DRIVEWAYS & FOOTWAYS

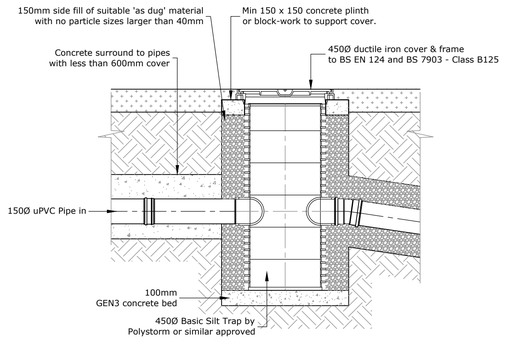
SITED IN GARDENS



TYPICAL INSPECTION CHAMBER DETAIL (LIGHT LOADING)
Scale 1:20



LARGE ACCESS CHAMBER DETAIL
Scale 1:20



TYPICAL 450Ø SILT TRAP
scale 1:20

Rev	Description	Date	Revised by	Checked by	Approved
A	Details updated	24/10/24	CA	TM	TM

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS
Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong		
Project:	Griffin Close, Frizington		
Drawing Title:	Typical Drainage Construction Details Sheet 2 of 2	BIM No:	

Scale @ A1:	First Issue:	Office of Origin:
1:20	28/06/2024	Kendal
Drawn by: CA	Checked by: TM	Approved:
Project No: K41128	Drawing No: 13	Rev: A

APPENDIX B

CALCULATIONS

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Wallingford Runoff Estimation	Job Number K41128	Page Number 1 of 4
	Calc by CA	Check by TM
Griffin Close Frizington	Date 15/10/2024	Revised A

DESIGN BASIS MEMORANDUM - PEAK RATE OF RUN-OFF CALCULATION

Design Brief

The following peak rate of run-off calculations have been undertaken to determine changes in peak flow resulting from the development of a greenfield or brownfield site. These calculations are for the **Peak Rate of Run-Off** requirements only.

Background Information & References

The site area **is less than** 200ha and the Greenfield (pre-development) calculation has been undertaken in accordance with methodology described by Marshall & Bayliss, Institute of Hydrology, Report No. 124, Flood Estimation for Small Catchments, 1994 (IoH 124).

In addition, the following references have been used in the preparation of these calculations:

- Interim Code of Practice for Sustainable Drainage Systems (SUDS), CIRIA, 2004
- CIRIA, The SUDS Manual, Report C753, 2015
- Designing for Exceedance in Urban Drainage - good practice, CIRIA Report C635, 2006
- Flood Estimation Handbook (FEH)
- Flood Studies Report (FSR), Volume 1, Hydrological Studies, 1993
- Flood Studies Supplementary Report No 2 (FSSR2), The Estimation of Low Return Period Floods
- Flood Studies Supplementary Report No 14 (FSSR14), Review of Regional Growth Curves, 1983
- Planning Practice guidance of the National Planning Policy Framework, Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights.

Results Summary

Rate of Run-Off (l/s)	
Event	**Greenfield**
Q1	3.5
QBAR	4.0
Q10	5.6
Q30	6.8
Q100	8.4
Q100 + 50% CC	12.6

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SITE AREAS (LAND COVER AREAS)

Existing Impermeable & Permeable Land Cover

Total Site Area: **0.50165** ha **5016.5** m²

Existing Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	ha	
Total impermeable area	0.0	0.000	0%
Remaining permeable area	5016.5	0.502	100%

Proposed Land Cover Areas

Land Cover	Area		Percentage of total site area
	m²	ha	
Total housing roof area	721.4	0.072	14%
Total parking and paved area	1091.7	0.109	22%
Total road area	1023.0	0.102	20%
Contributing Garden & landscaped areas	1021.7	0.102	20%
Disconnected Garden & landscaped areas	1158.7	0.116	23%

Proposed Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	ha	
Total contributing catchment area	3857.8	0.386	77%
Remaining permeable/undrained area	1158.7	0.116	23%

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Wallingford Runoff Estimation	Job Number K41128	Page Number 3 of 4
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ESTIMATION OF QBAR (RURAL) (GREENFIELD RUNOFF RATE)

IoH 124 based on research on small catchments < 25 km2

Method is based on regression analysis of response times
using catchments from 0.9 to 22.9 km^2

$QBAR_{rural}$ is mean annual flood on rural catchment
$QBAR_{rural}$ depends on SOIL, SAAR and AREA most significantly

$QBAR_{rural} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

For SOIL refer to FSR Vol 1, Section 4.2.3 and 4.2.6 and IoH 124

Contributing watershed area

Area, A	=	500000	m^2	insert 50 ha for EA
	=	0.500	km^2	small catchment method
	=	50.000	ha	

SAAR = **1352** mm — From FEH Web Service (point data)

Soil index based on soil type, SOIL

$$= \frac{(0.1S1+0.3S2+0.37S3+0.47S4+0.53S5)}{(S1+S2+S3+S4+S5)}$$

Where:				
	S1	=		%
	S2	=		%
	S3	=		%
	S4	=	**100**	%
	S5	=		%
			100	%

UK Suds website provides a value of 4 based on the equivalent Host value. This seems reasonable based on ground investigation.

So, SOIL = **0.47**

Note: for very small catchments it is far better to rely on local site investigation information.

$QBAR_{rural}$	=	0.521	m^3/s
	=	521.4	l/s

Small rural catchments less than 50 ha
The Environment Agency recommends that this method should be used for development sizes from 0 to 50 ha and should linearly interpolate the formula to 50 ha.

So, catchment size	=	**3858**	m^2	Excluding significant open space which would remain disconnected from the positive drainage system during flood events.
	=	0.004	km^2	
	=	0.386	ha	
$QBAR_{rural\ site}$	=	0.00402	m^3/s	
	=	**4.02**	l/s	

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Wallingford Runoff Estimation	Job Number K41128	Page Number 4 of 4
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GREENFIELD RETURN PERIOD ORDINATES

QBAR can be factored by the UK FSR regional growth curves for return periods <2 years and for all other return periods to obtain peak flow estimates for required return periods.

These regional growth curves are constant throughout a region, whatever the catchment type and size.

See Table 2.39 for region curve ordinates
Use FSSR2 Growth Curves to estimate Qbar

Reference- Pg 173-FSR V.1, ch 2.6.2

Region = **10**

Use Figure A1.1 to determine region

GREENFIELD RETURN PERIOD FLOW RATES

Return Period	Ordinate	Q (l/s)
1	0.87	3.50
2	0.93	3.74
5	1.19	4.79
10	1.38	5.55
25	1.64	6.60
30	1.7	6.84
50	1.85	7.44
100	2.08	8.37
200	2.32	9.33
500	2.73	10.98
1000	3.04	12.23

Ordinate from FSSR2

Interpolation taken from Figure 24.2 (pg 515) SuDS Manual

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	50	Minimum Backdrop Height (m)	0.200
CV	0.840	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.037	5.00	138.995	1200	303367.718	517389.055	1.395
2	0.050	5.00	138.675	1200	303356.019	517390.255	1.675
3	0.022	5.00	138.470	1200	303336.971	517377.463	1.929
4	0.022	5.00	138.425	1200	303329.763	517362.746	2.075
5			138.400	1200	303326.806	517357.538	2.200
6			138.530	1200	303328.480	517354.826	2.500
7	0.007	5.00	138.750	450	303372.713	517422.109	0.650
8	0.015	5.00	138.800	450	303364.450	517408.782	0.961
9	0.010	5.00	138.800	450	303362.488	517405.618	1.023
10	0.013	5.00	138.750	450	303354.322	517392.448	1.234
11	0.008	5.00	139.100	450	303386.554	517389.885	0.600
12	0.010	5.00	139.100	450	303377.606	517395.266	0.992
13	0.021	5.00	139.060	450	303359.241	517373.966	0.760
14	0.009	5.00	138.600	450	303336.002	517366.022	0.600
15	0.027	5.00	138.600	450	303349.286	517357.780	1.382
16			138.700	450	303347.404	517354.681	2.242
17	0.009	5.00	138.685	450	303367.914	517355.207	0.685
18	0.009	5.00	139.040	450	303363.184	517347.298	1.501
19	0.019	5.00	138.840	450	303359.463	517344.475	1.574
20	0.025		138.800	450	303357.691	517345.641	2.343
21	0.019	5.00	138.530	450	303334.699	517359.814	2.130

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.002	1	2	11.760	0.600	137.600	137.000	0.600	19.6	225	5.28	50.0
1.004	2	3	22.945	0.600	137.000	136.541	0.459	50.0	225	5.66	50.0
1.005	3	4	16.387	0.600	136.541	136.350	0.191	85.8	225	5.86	50.0
1.006	4	5	5.989	0.600	136.350	136.200	0.150	39.9	150	5.92	50.0
1.007	5	6	3.187	0.600	136.200	136.030	0.170	18.7	150	5.94	50.0
1.000	7	8	15.681	0.600	138.100	137.839	0.261	60.0	150	5.20	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
2.002	2.969	118.0	17.3	1.170	1.450	0.076	0.0
1.004	1.854	73.7	38.9	1.450	1.704	0.171	0.0
1.005	1.412	56.2	43.9	1.704	1.850	0.193	0.0
1.006	1.597	28.2	53.3	1.925	2.050	0.234	0.0
1.007	2.337	41.3	53.3	2.050	2.350	0.234	0.0
1.000	1.301	23.0	1.6	0.500	0.811	0.007	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.001	8	9	3.723	0.600	137.839	137.777	0.062	60.0	150	5.25	50.0
1.002	9	10	15.496	0.600	137.777	137.516	0.261	59.4	150	5.45	50.0
1.003	10	2	2.773	0.600	137.516	137.075	0.441	6.3	150	5.46	50.0
2.000	11	12	10.441	0.600	138.500	138.239	0.261	40.0	150	5.11	50.0
2.001	12	1	11.677	0.600	138.108	137.675	0.433	27.0	150	5.21	50.0
3.000	13	1	17.307	0.600	138.300	137.675	0.625	27.7	150	5.15	50.0
5.000	14	15	15.633	0.600	138.000	137.218	0.782	20.0	150	5.12	50.0
5.001	15	16	3.626	0.600	137.218	136.855	0.363	10.0	150	5.13	50.0
6.000	17	18	9.215	0.600	138.000	137.539	0.461	20.0	150	5.07	50.0
6.001	18	19	4.671	0.600	137.539	137.305	0.234	20.0	150	5.10	50.0
6.002	19	20	2.121	0.600	137.266	136.500	0.766	2.8	225	5.11	50.0
4.000	21	4	5.741	0.600	136.400	136.350	0.050	114.8	225	5.08	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.001	1.301	23.0	5.0	0.811	0.873	0.022	0.0
1.002	1.307	23.1	7.3	0.873	1.084	0.032	0.0
1.003	4.044	71.5	10.2	1.084	1.450	0.045	0.0
2.000	1.596	28.2	1.8	0.450	0.711	0.008	0.0
2.001	1.946	34.4	4.1	0.842	1.170	0.018	0.0
3.000	1.920	33.9	4.8	0.610	1.170	0.021	0.0
5.000	2.262	40.0	2.0	0.450	1.232	0.009	0.0
5.001	3.204	56.6	8.2	1.232	1.695	0.036	0.0
6.000	2.262	40.0	2.0	0.535	1.351	0.009	0.0
6.001	2.262	40.0	4.1	1.351	1.385	0.018	0.0
6.002	7.920	314.9	8.4	1.349	2.075	0.037	0.0
4.000	1.219	48.5	4.3	1.905	1.850	0.019	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.002	11.760	19.6	225	Circular	138.995	137.600	1.170	138.675	137.000	1.450
1.004	22.945	50.0	225	Circular	138.675	137.000	1.450	138.470	136.541	1.704
1.005	16.387	85.8	225	Circular	138.470	136.541	1.704	138.425	136.350	1.850
1.006	5.989	39.9	150	Circular	138.425	136.350	1.925	138.400	136.200	2.050
1.007	3.187	18.7	150	Circular	138.400	136.200	2.050	138.530	136.030	2.350
1.000	15.681	60.0	150	Circular	138.750	138.100	0.500	138.800	137.839	0.811
1.001	3.723	60.0	150	Circular	138.800	137.839	0.811	138.800	137.777	0.873
1.002	15.496	59.4	150	Circular	138.800	137.777	0.873	138.750	137.516	1.084

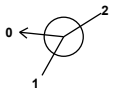
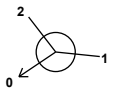
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.002	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.004	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.005	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.006	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.007	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.000	7	450	Manhole	Adoptable	8	450	Manhole	Adoptable
1.001	8	450	Manhole	Adoptable	9	450	Manhole	Adoptable
1.002	9	450	Manhole	Adoptable	10	450	Manhole	Adoptable

Pipeline Schedule

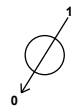
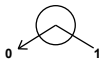
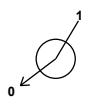
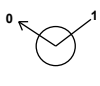
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.003	2.773	6.3	150	Circular	138.750	137.516	1.084	138.675	137.075	1.450
2.000	10.441	40.0	150	Circular	139.100	138.500	0.450	139.100	138.239	0.711
2.001	11.677	27.0	150	Circular	139.100	138.108	0.842	138.995	137.675	1.170
3.000	17.307	27.7	150	Circular	139.060	138.300	0.610	138.995	137.675	1.170
5.000	15.633	20.0	150	Circular	138.600	138.000	0.450	138.600	137.218	1.232
5.001	3.626	10.0	150	Circular	138.600	137.218	1.232	138.700	136.855	1.695
6.000	9.215	20.0	150	Circular	138.685	138.000	0.535	139.040	137.539	1.351
6.001	4.671	20.0	150	Circular	139.040	137.539	1.351	138.840	137.305	1.385
6.002	2.121	2.8	225	Circular	138.840	137.266	1.349	138.800	136.500	2.075
4.000	5.741	114.8	225	Circular	138.530	136.400	1.905	138.425	136.350	1.850

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.003	10	450	Manhole	Adoptable	2	1200	Manhole	Adoptable
2.000	11	450	Manhole	Adoptable	12	450	Manhole	Adoptable
2.001	12	450	Manhole	Adoptable	1	1200	Manhole	Adoptable
3.000	13	450	Manhole	Adoptable	1	1200	Manhole	Adoptable
5.000	14	450	Junction		15	450	Manhole	Adoptable
5.001	15	450	Manhole	Adoptable	16	450	Junction	
6.000	17	450	Manhole	Adoptable	18	450	Manhole	Adoptable
6.001	18	450	Manhole	Adoptable	19	450	Manhole	Adoptable
6.002	19	450	Manhole	Adoptable	20	450	Junction	
4.000	21	450	Junction		4	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
1	303367.718	517389.055	138.995	1.395	1200		1	3.000	137.675	150
							2	2.001	137.675	150
							0	2.002	137.600	225
2	303356.019	517390.255	138.675	1.675	1200		1	2.002	137.000	225
							2	1.003	137.075	150
							0	1.004	137.000	225
3	303336.971	517377.463	138.470	1.929	1200		1	1.004	136.541	225
							0	1.005	136.541	225
4	303329.763	517362.746	138.425	2.075	1200		1	4.000	136.350	225
							2	1.005	136.350	225
							0	1.006	136.350	150
5	303326.806	517357.538	138.400	2.200	1200		1	1.006	136.200	150
							0	1.007	136.200	150
6	303328.480	517354.826	138.530	2.500	1200		1	1.007	136.030	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
7	303372.713	517422.109	138.750	0.650	450	 0	1.000	138.100	150
8	303364.450	517408.782	138.800	0.961	450	 1 0	1.000 1.001	137.839 137.839	150 150
9	303362.488	517405.618	138.800	1.023	450	 1 0	1.001 1.002	137.777 137.777	150 150
10	303354.322	517392.448	138.750	1.234	450	 1 0	1.002 1.003	137.516 137.516	150 150
11	303386.554	517389.885	139.100	0.600	450	 0	2.000	138.500	150
12	303377.606	517395.266	139.100	0.992	450	 1 0	2.000 2.001	138.239 138.108	150 150
13	303359.241	517373.966	139.060	0.760	450	 0	3.000	138.300	150
14	303336.002	517366.022	138.600	0.600	450	 0	5.000	138.000	150
15	303349.286	517357.780	138.600	1.382	450	 1 0	5.000 5.001	137.218 137.218	150 150
16	303347.404	517354.681	138.700	2.242	450	 1	5.001	136.855	150
17	303367.914	517355.207	138.685	0.685	450	 0	6.000	138.000	150
18	303363.184	517347.298	139.040	1.501	450	 1 0	6.000 6.001	137.539 137.539	150 150
19	303359.463	517344.475	138.840	1.574	450	 1 0	6.001 6.002	137.305 137.266	150 225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
20	303357.691	517345.641	138.800	2.343	450	1	6.002	136.500	225
21	303334.699	517359.814	138.530	2.130	450	0	4.000	136.400	225

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Detailed	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m³/ha)	20.0		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	50	0	0

Node 4 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	136.350	Product Number	CTL-SHE-0091-4000-1250-4000
Design Depth (m)	1.250	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.0	Min Node Diameter (mm)	1200

Node 21 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Main Channel Length (m)	23.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	136.400	Main Channel Slope (1:X)	400.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.200

Inlets

20	16

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	189.0	0.0	1.200	189.0	0.0	1.201	0.0	0.0

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 98.62%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	20	138.310	0.710	44.5	1.1792	0.0000	SURCHARGED
30 minute summer	2	20	138.235	1.235	78.7	2.1347	0.0000	SURCHARGED
30 minute summer	3	20	137.638	1.097	87.0	1.4909	0.0000	SURCHARGED
480 minute winter	4	456	137.619	1.269	18.2	1.7043	0.0000	SURCHARGED
480 minute winter	5	456	136.235	0.035	4.0	0.0392	0.0000	OK
480 minute winter	6	456	136.062	0.032	4.0	0.0000	0.0000	OK
30 minute summer	7	20	138.417	0.317	4.1	0.1185	0.0000	SURCHARGED
30 minute summer	8	20	138.411	0.572	12.8	0.2696	0.0000	SURCHARGED
30 minute summer	9	20	138.396	0.619	16.5	0.2198	0.0000	SURCHARGED
30 minute summer	10	20	138.296	0.780	23.8	0.2887	0.0000	SURCHARGED
15 minute summer	11	10	138.544	0.043	4.8	0.0185	0.0000	OK
30 minute summer	12	20	138.345	0.237	10.6	0.0855	0.0000	SURCHARGED
30 minute summer	13	19	138.369	0.069	12.4	0.0492	0.0000	OK
15 minute summer	14	10	138.037	0.037	5.4	0.0112	0.0000	OK
480 minute winter	15	456	137.620	0.402	3.1	0.2210	0.0000	SURCHARGED
480 minute winter	16	456	137.619	1.162	3.1	0.0000	0.0000	OK
15 minute summer	17	10	138.037	0.037	5.4	0.0157	0.0000	OK
480 minute winter	18	456	137.620	0.081	1.6	0.0227	0.0000	OK
480 minute winter	19	456	137.620	0.354	3.2	0.1417	0.0000	SURCHARGED
480 minute winter	20	456	137.620	1.162	5.4	0.2476	0.0000	OK
480 minute winter	21	456	137.619	1.219	16.0	0.2170	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	1	2.002	2	35.8	1.270	0.303	0.4677	
30 minute summer	2	1.004	3	75.4	1.897	1.023	0.9125	
30 minute summer	3	1.005	4	85.5	2.149	1.522	0.6517	
480 minute winter	4	Hydro-Brake®	5	4.0				
480 minute winter	5	1.007	6	4.0	1.395	0.098	0.0092	155.0
30 minute summer	7	1.000	8	4.2	0.485	0.184	0.2761	
30 minute summer	8	1.001	9	12.3	0.958	0.536	0.0655	
30 minute summer	9	1.002	10	17.3	1.517	0.750	0.2728	
30 minute summer	10	1.003	2	22.8	2.479	0.319	0.0488	
15 minute summer	11	2.000	12	4.8	1.159	0.169	0.0429	
30 minute summer	12	2.001	1	10.4	1.594	0.304	0.2056	
30 minute summer	13	3.000	1	12.3	1.662	0.363	0.2209	
15 minute summer	14	5.000	15	5.4	0.948	0.135	0.0899	
480 minute winter	15	5.001	16	3.1	1.618	0.055	0.0638	
480 minute winter	16	Flow through pond	21	-3.9	0.010	-0.003	211.9699	
15 minute summer	17	6.000	18	5.4	1.097	0.135	0.0457	
480 minute winter	18	6.001	19	1.6	1.077	0.040	0.0639	
480 minute winter	19	6.002	20	3.2	1.699	0.010	0.0844	
480 minute winter	20	Flow through pond	21	-3.9	0.010	-0.003	211.9699	
480 minute winter	21	4.000	4	-14.4	-0.362	-0.297	0.2283	

DESIGN BASIS MEMORANDUM - SUSTAINABLE DRAINAGE TREATMENT OF SURFACE WATER

Design Brief

The following calculations outline the recommended treatment requirements for a sustaionable drainage system as outlined in the SuDS Manual 2015. The method used is the simple index approach outlined in section 26. The requirement for oil interceptors has been assessed in line with the now withdrawn Pollution Prevention Guidance document PPG3, produced by the Environment Agency. An oil interceptor is not required for the proposed development.

Treatment within SuDS components is affected by the flow rate and volume of water which passes through the component. It is not reasonable or practical to treat the entirety of the runoff for infrequent greater intensity design storms. In any case the majority of the pollutants are removed from surfaces by the more frequent rainfall events and in the first flush resulting from the initial runoff from the larger events.
and to a certain capacity.

The following references have been used in the preparation of these calculations:

- SUDS Manual, CIRIA Report C753, 2015
- Pollution Mitigation Indicies provided by Hydro International

Results Summary

Roof Area:

Treatment component 1 Hydo International Downstream Defender
Treatment component 2 None

Indices	Suspended Solids	Metals	Hydrocarbons
Pollution Hazard	0.2	0.2	0.05
Pollution Mitigation	0.5	0.4	0.8
Treatment Suitability	Adequate	Adequate	Adequate

Residential Parking:

Treatment component 1 Hydo International Downstream Defender
Treatment component 2 None

Indices	Suspended Solids	Metals	Hydrocarbons
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.5	0.4	0.8
Treatment Suitability	Adequate	Adequate	Adequate

Residential Roads

Treatment component 1 Hydo International Downstream Defender
Treatment component 2 None

Indices	Suspended Solids	Metals	Hydrocarbons
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.5	0.4	0.8
Treatment Suitability	Adequate	Adequate	Adequate

POLLUTION HAZARD INDEX

		Pollution Hazard Indices		
Source of Runoff	Pollution Hazard	Suspended Solids	Metals	carbons
Residential roofing	Very low	0.2	0.2	0.05

POLLUTION MITIGATION INDEX

The receiving water body shall be: Surface Water

		Pollution Mitigation Indices		
Suds Component		Suspended Solids	Metals	Hydro-carbons
1	Hydo International Downstream Defender	0.5	0.4	0.8
2	None	0	0	0
3	None	0	0	0
4	None	0	0	0
Total Pollution Mitigation Index		**0.5**	**0.4**	**0.8**

ASSESSMENT OF TREATMENT PROPOSAL

Indices	Suspended Solids	Metals	Hydro-carbons
Pollution Hazard	0.2	0.2	0.05
Pollution Mitigation	0.5	0.4	0.8
	Adequate	**Adequate**	**Adequate**

POLLUTION HAZARD INDEX

		Pollution Hazard Indices		
Source of Runoff	Pollution Hazard	Suspended Solids	Metals	carbons
Residential parking	Low	0.5	0.4	0.4

POLLUTION MITIGATION INDEX

The receiving water body shall be: Surface Water

		Pollution Mitigation Indices		
Suds Component		Suspended Solids	Metals	Hydro-carbons
1	Hydo International Downstream Defender	0.5	0.4	0.8
2	None	0	0	0
3	None	0	0	0
4	None	0	0	0
Total Pollution Mitigation Index		**0.5**	**0.4**	**0.8**

ASSESSMENT OF TREATMENT PROPOSAL

Indices	Suspended Solids	Metals	Hydro-carbons
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.5	0.4	0.8
	Adequate	**Adequate**	**Adequate**

POLLUTION HAZARD INDEX

		Pollution Hazard Indices		
Source of Runoff	Pollution Hazard	Suspended Solids	Metals	carbons
Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)	Low	0.5	0.4	0.4

POLLUTION MITIGATION INDEX

The receiving water body shall be: Surface Water

		Pollution Mitigation Indices		
Suds Component		Suspended Solids	Metals	Hydro-carbons
1	Hydo International Downstream Defender	0.5	0.4	0.8
2	None	0	0	0
3	None	0	0	0
4	None	0	0	0
Total Pollution Mitigation Index		**0.5**	**0.4**	**0.8**

ASSESSMENT OF TREATMENT PROPOSAL

Indices	Suspended Solids	Metals	Hydro-carbons
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.5	0.4	0.8
	Adequate	**Adequate**	**Adequate**

APPENDIX C

HYDRO-BRAKE DESIGN INFORMATION

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.250	4.000
Flush-Flo™	0.374	3.996
Kick-Flo®	0.770	3.200
Mean Flow		3.508

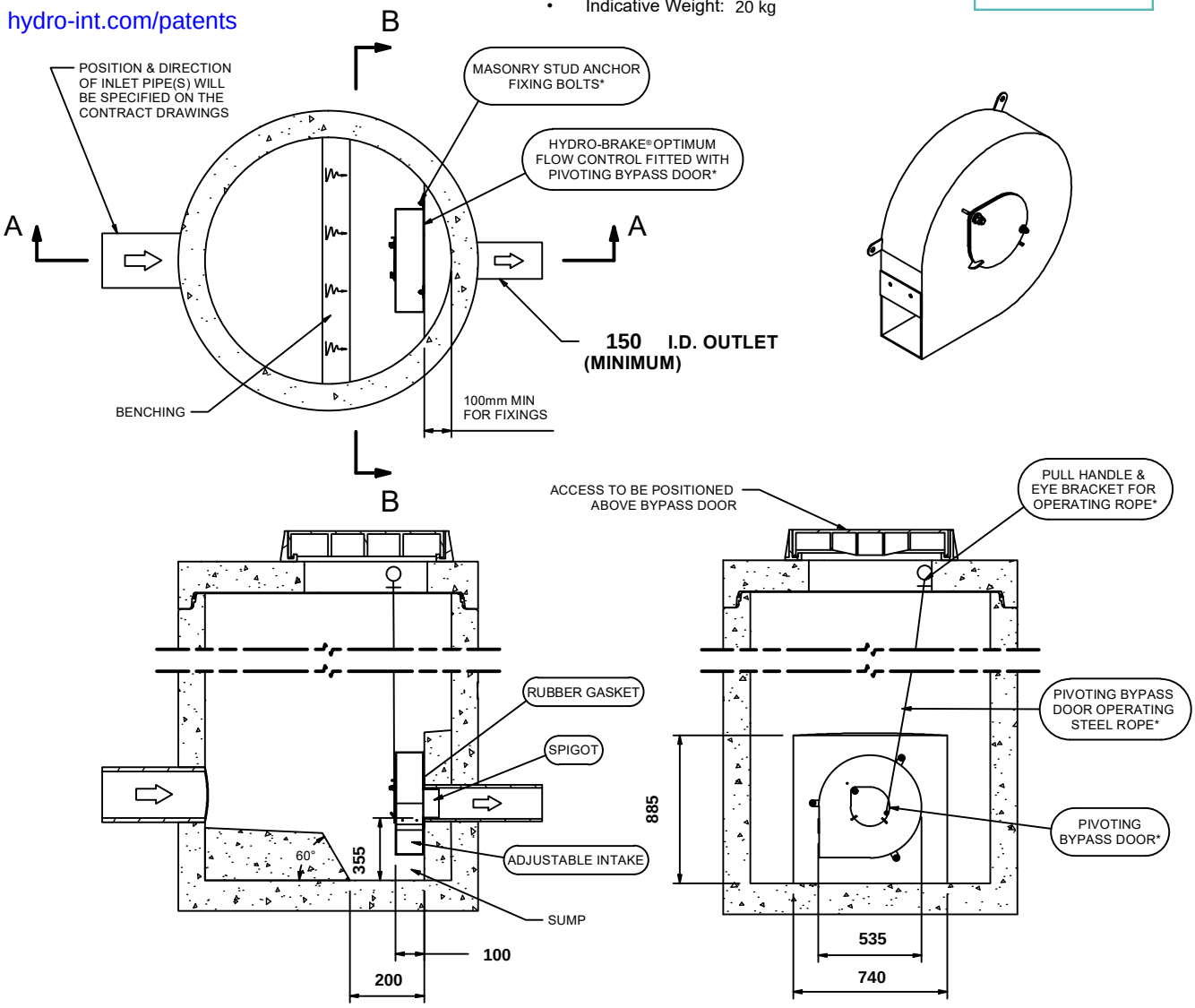
Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Variable flow rate post installation via adjustable inlet
- Indicative Weight: 20 kg

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

wrc approved PT/503/0422 Valid: 01/04/2022 - 31/03/2027

hydro-int.com/patents



SECTION A-A SECTION B-B

IMPORTANT: LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE

The head/flow characteristics of this SHE-0091-4000-1250-4000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International A CRH COMPANY

DATE	21/10/2024 13:37
SITE	Griffin Close
DESIGNER	Chris Abram
REF	K41128

SHE-0091-4000-1250-4000
Hydro-Brake® Optimum

 Hydro International Ltd • Unit 2, Rivermead Court • Kenn Business Park • Windmill Road • Kenn • Clevedon • BS21 6FT • Tel: 01275 878371 • www.hydro-int.com • Email: enquiries@hydro-int.com

chris.abram@rgparkins.com

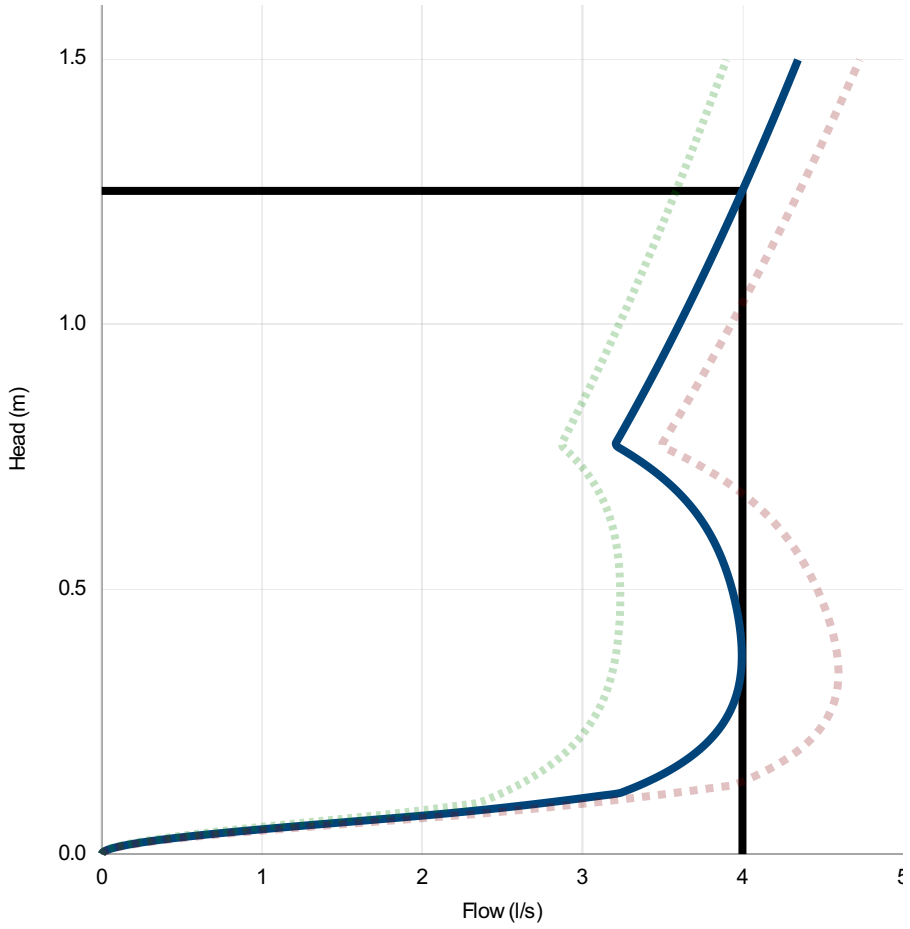
Technical Specification

	Original Setting		Minimum Setting		Maximum Setting	
Control Point	**Head (m)**	**Flow (l/s)**	**Head (m)**	**Flow (l/s)**	**Head (m)**	**Flow (l/s)**
Primary Design	1.250	4.000	1.250	3.585	1.250	4.356
Flush-Flo™	0.374	3.996	0.485	3.237	0.341	4.599
Kick-Flo®	0.770	3.200	0.770	2.864	0.769	3.488
Mean Flow		3.508		2.981		3.922

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

wrc approved™
PT/503/0422
Valid: 01/04/2022 - 31/03/2027

hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.043	0.865
0.086	2.466
0.129	3.354
0.172	3.623
0.216	3.797
0.259	3.904
0.302	3.964
0.345	3.991
0.388	3.995
0.431	3.982
0.474	3.956
0.517	3.918
0.560	3.866
0.603	3.797
0.647	3.702
0.690	3.573
0.733	3.399
0.776	3.211
0.819	3.292
0.862	3.370
0.905	3.446
0.948	3.521
0.991	3.593
1.034	3.665
1.078	3.734
1.121	3.802
1.164	3.869
1.207	3.934
1.250	3.999

DESIGN ADVICE

The head/flow characteristics of this SHE-0091-4000-1250-4000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

! **The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

Hydro International
A CRH COMPANY

DATE	21/10/2024 13:37
Site	Griffin Close
DESIGNER	Chris Abram
Ref	K41128

SHE-0091-4000-1250-4000

Hydro-Brake® Optimum

APPENDIX D

CCTV DRAINAGE INVESTIGATION REPORT

THOMAS ARMSTRONG CONSTRUCTION LTD
WORKINGTON ROAD • FLIMBY • MARYPORT • CA15 8AY

Job Ref. **SK - S 056-2024**
12/07/2024
MSCC5 Drain and Sewer Codes (SRM5 Scoring)

SK Drainage Solutions Ltd
31 Adams Road, Workington, Cumbria, CA14 3YS
Tel: 01900268189
office@skds.ltd

SK Drainage Solutions Ltd
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SK Drainage Solutions Ltd
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Report Overview

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Sewer Network Information	
Number of Sections	**16**
Total Length	**398.52 m**
Inspected Length	**398.38 m**
Not Inspected Length	**0.14 m**

Resources Collected
Inspection Photos **89**
Inspection Videos **16**
Site Drawings **0**
Site Photos **2**

Defects Found	
Structural	**15**
Service	**24**
Abandoned Survey(s)	**6**

Work Carried Out	
Pipeline(s) Surveyed	**16**
Pipeline(s) Pre Cleaned	**0**
Flow Control(s) Used	**0**

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Project Information

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Notes/Purpose of Survey

Survey of sections as per Parkins plan.

Client Details

Location	THOMAS ARMSTRONG CONSTRUCTION LTD	**Company Address**	WORKINGTON ROAD FLIMBY MARYPORT CA15 8AY
Contact Name			
Contact Tel.			
Contact Email	troy.melhuish@rgparkins.com		

Site Details

Company	GRIFFIN CLOSE / MILL STREET	**Address**	FRIZINGTON
Site Contact Name			
Site Contact Tel.			

Contractor Details

Company	SK Drainage Solutions Ltd	**Office Address**	31 Adams Road Workington Cumbria CA14 3YS
Office Contact Name	Steven Oakes		
Office Contact Tel.	01900268189		
Office Contact Email	office@skds.ltd		
Surveyor	B. Hughes		

Job Comments

PLEASE REFER TO SURVEYS FOR FURTHER INFORMATION

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Scoring Summary

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Stuctural Defects

Grade 3	Grade 4	Grade 5	Information
Best practice suggests consideration to be given to repair in the medium term.	Best practice suggests consideration to be given to repair to avoid potential collapse.	Best practice suggests this pipe is at risk of collapse at any time; urgent consideration should be given to repair to avoid collapse.	These summaries are based on the SRM grading from the WRC.

Section	PLR	Grade	Fault Description
1	NODE X	4	Displaced joints
3	2301 X	3	Fractures
4	2301C X	4	Multiple defects, made up of cracks , displaced joints & fractures
5	2301B X	4	Displaced joints
8	F , SURG MX	4	Displaced joints
13	FIELD MH 3X	3	Displaced joints
16	CORNER PREX	4	Multiple defects, made up of fractures & breaks

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Scoring Summary

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Service/Operational Defects

Grade 3	Grade 4	Grade 5	Information
Best practice suggests consideration to be given to maintenance activities in the medium term.	Best practice suggests consideration to be given to maintenance to avoid potential blockage.	Best practice suggests this pipe is at risk of backing up / causing flooding.	These summaries are based on the SRM grading from the WRC.

Section	PLR	Grade	Fault Description
1	NODE X	3	Displaced joints
4	2301C X	3	Multiple defects, made up of roots , displaced joints , fractures & cracks
5	2301B X	3	Displaced joints
7	MH 56 X	4	Deposits
8	F , SURG MX	3	Multiple defects, made up of deposits & displaced joints
11	FIELD MH CX	3	Deposits
13	FIELD MH 3X	5	Multiple defects, made up of displaced joints & obstacles
14	S, SURG MHX	4	Deposits

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Scoring Summary

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Abandoned Surveys

Section	PLR	Fault Description
1	NODE X	Survey Abandoned
2	NODE X	Survey Abandoned
7	MH 56 X	Survey Abandoned
13	FIELD MH 3X	Survey Abandoned
14	S, SURG MHX	Survey Abandoned
16	CORNER PREX	Survey Abandoned

SK Drainage Solutions Ltd
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Site Photographs

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Other Site Photos

sw uncovered mh back up to surgery mh

Other Site Photos

300MM SW OUTFALL INTO BECK

SK Drainage Solutions Ltd
31 Adams Road, Workington, Cumbria, CA14 3YS
Tel: 01900268189
office@skds.ltd

CCTV Inspection - Section No. 1 - 2301 to NODE

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**NODE X**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**09/04/2024**
Time	**10:45 - 10:48**
Weather	**2 - Heavy Rain**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Upstream**	**3.80**	**3.80**

Start Node
Ref: **2301**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Combined**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **150**
Unit Length: -

End Node
Ref: **NODE**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference 2301	00:00:00	S1C1	0
0.00	WL	Water level 0% height/diameter	00:00:00	S1C2	0
1.72	JD	Joint displaced 15mm	00:00:20	S1C3	40 / 2
3.12	JD	Joint displaced 20mm	00:00:36	S1C4	80 / 2
3.80	SA	Survey abandoned - Remark: CRAWLER UNABLE TO PASS JDM	00:00:59	S1C5	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	2	80	31.58	120	4	Structural Defects	Construction Observations
Operational	2	2	1.05	4	3	Service/Operational Defects	Miscellaneous Observations

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Pictures - Section No. 1 - 2301 to NODE

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S1C1

00:00:00 - 0.00 m
Start node type, manhole, reference 2301

S1C2

00:00:00 - 0.00 m
Water level 0% height/diameter

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Pictures - Section No. 1 - 2301 to NODE

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S1C3

00:00:20 - 1.72 m
Joint displaced 15mm

S1C4

00:00:36 - 3.12 m
Joint displaced 20mm

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Pictures - Section No. 1 - 2301 to NODE

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S1C5

00:00:59 - 3.80 m
Survey abandoned - Remark: CRAWLER UNABLE TO PASS JDM

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Overview - Section No. 1 - 2301 to NODE

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**3.8 m**
Inspected Length	**3.8 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **5**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**2**
Service/Operational	**2**
Survey Abandoned	**Yes**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
NODE X	**Upstream**	**2301**	**NODE**	**Vitrified clay**	**150 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference 2301
0	WL	Water level 0% height/diameter
1.72	JD	Joint displaced 15mm
3.12	JD	Joint displaced 20mm
3.8	SA	Survey abandoned - Remark: CRAWLER UNABLE TO PASS JDM

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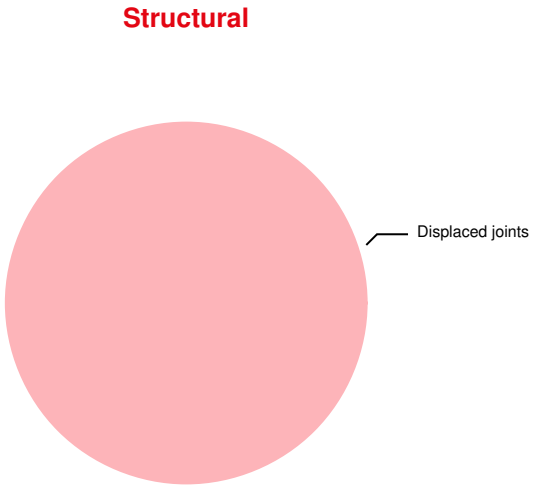
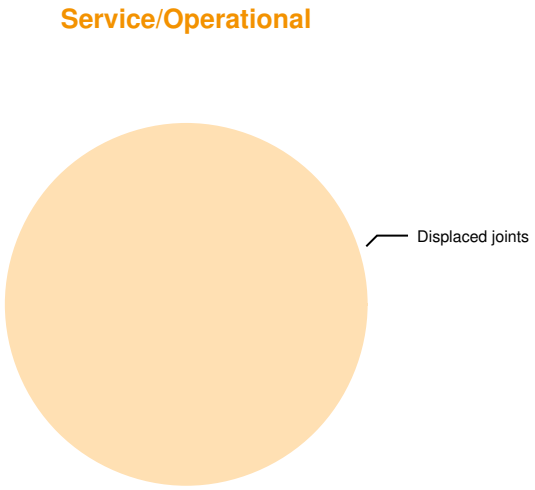
Damage Overview - Section No. 1 - 2301 to NODE

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity
Displaced joints	2



Service/Operational Defects	Quantity
Displaced joints	2



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CCTV Inspection - Section No. 2 - 2301 to NODE

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**NODE X**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**09/04/2024**
Time	**10:50 - 11:09**
Weather	**2 - Heavy Rain**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Upstream**	**37.07**	**37.07**

Start Node
Ref: **2301**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Combined**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **150**
Unit Length: -

End Node
Ref: **NODE**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference 2301	00:00:00	S2C1	0
0.00	WL	Water level 10% height/diameter	00:00:00	S2C2	0
35.90	REM	MH LOCATED IN FIELD	00:01:54	S2C3	0
37.07	SA	Survey abandoned - Remark: UNABLE TO PUSH ROUND MH FINISH 2301A	00:02:49	S2C4	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	0	0	0.00	0	1	Structural Defects	Construction Observations
Operational	0	0	0.00	0	1	Service/Operational Defects	Miscellaneous Observations

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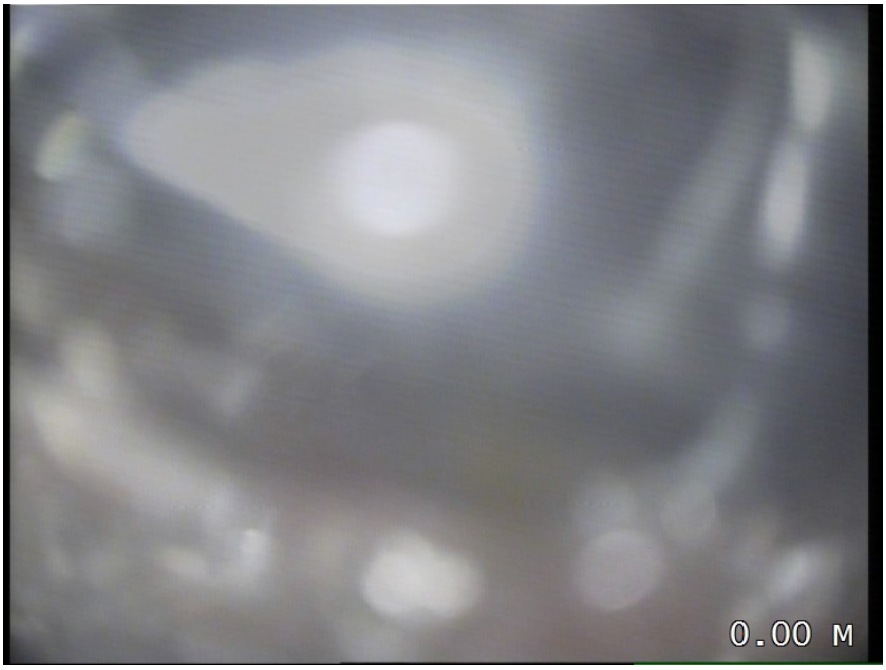
Pictures - Section No. 2 - 2301 to NODE

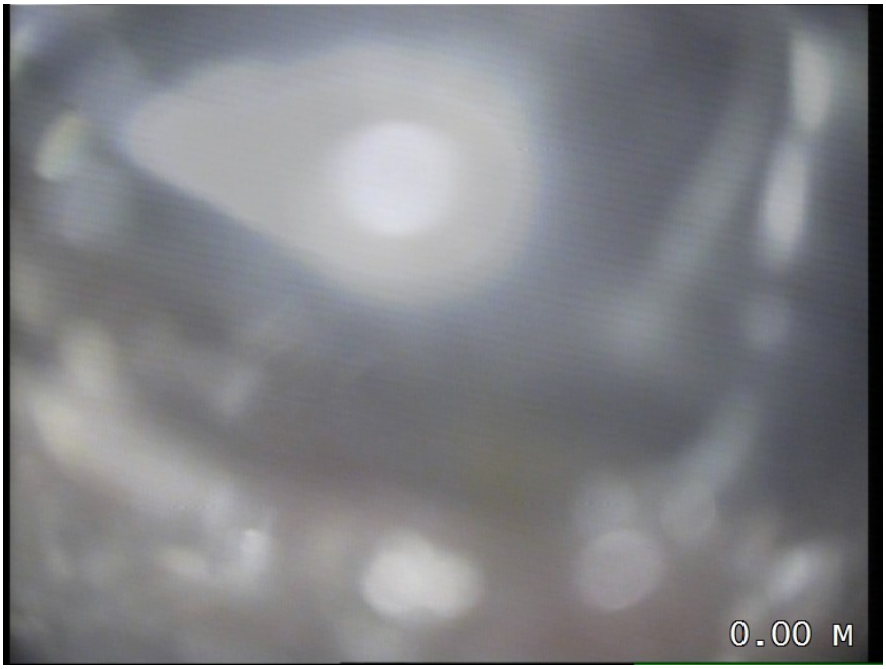
Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S2C1



00:00:00 - 0.00 m
Start node type, manhole, reference 2301

S2C2



00:00:00 - 0.00 m
Water level 10% height/diameter

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Pictures - Section No. 2 - 2301 to NODE

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S2C4

00:02:49 - 37.07 m
Survey abandoned - Remark: UNABLE TO PUSH ROUND MH FINISH 2301A

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Overview - Section No. 2 - 2301 to NODE

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**37.07 m**
Inspected Length	**37.07 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **4**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**0**
Service/Operational	**0**
Survey Abandoned	**Yes**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
NODE X	**Upstream**	**2301**	**NODE**	**Vitrified clay**	**150 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference 2301
0	WL	Water level 10% height/diameter
35.9	REM	MH LOCATED IN FIELD
37.07	SA	Survey abandoned - Remark: UNABLE TO PUSH ROUND MH FINISH 2301A

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Damage Overview - Section No. 2 - 2301 to NODE

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity

There were no structural defects recorded

Service/Operational Defects	Quantity

There were no service/operational defects recorded

SK Drainage Solutions Ltd
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CCTV Inspection - Section No. 3 - 2301 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**2301 X**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**09/04/2024**
Time	**11:10 - 11:27**
Weather	**2 - Heavy Rain**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Downstream**	**24.02**	**23.88**

Start Node
Ref: **2301**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Combined**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **150**
Unit Length: -

End Node
Ref: **OUTFALL**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference 2301	00:00:00	S3C1	0
0.00	WL	Water level 10% height/diameter	00:00:00	S3C2	0
0.10	FL	Fracture longitudinal at 9 o'clock - Remark: Possibly been a manhole	00:00:14	S3C3	40 / 1
0.48	LL	Line of drain/sewer deviates left	00:00:19	S3C4	0
8.86	CUW(S1)	Loss of vision, camera under water, Start	00:01:08	S3C5	0
11.67	CUW(F1)	Loss of vision, camera under water, Finished	00:01:21	S3C6	0
16.69	CUW(S2)	Loss of vision, camera under water, Start	00:01:40	S3C7	0
19.81	CUW(F2)	Loss of vision, camera under water, Finished	00:02:04	S3C8	0
22.38	CUW(S3)	Loss of vision, camera under water, Start	00:02:14	S3C9	0
23.60	CUW(F3)	Loss of vision, camera under water, Finished	00:02:21	S3C10	0
23.88	MHF	Finish node type, manhole, reference 2301B	00:02:46	S3C11	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	1	40	1.68	40	3	Structural Defects	Construction Observations
Operational	1	1	0.04	1	2	Service/Operational Defects	Miscellaneous Observations

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Pictures - Section No. 3 - 2301 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S3C1

00:00:00 - 0.00 m
Start node type, manhole, reference 2301

S3C2

00:00:00 - 0.00 m
Water level 10% height/diameter

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Pictures - Section No. 3 - 2301 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S3C3

00:00:14 - 0.10 m
Fracture longitudinal at 9 o'clock - Remark: Possibly been a manhole

S3C4

00:00:19 - 0.48 m
Line of drain/sewer deviates left

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Pictures - Section No. 3 - 2301 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S3C5

00:01:08 - 8.86 m
Loss of vision, camera under water, Start

S3C6

00:01:21 - 11.67 m
Loss of vision, camera under water, Finished

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Pictures - Section No. 3 - 2301 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S3C7

00:01:40 - 16.69 m
Loss of vision, camera under water, Start

S3C8

00:02:04 - 19.81 m
Loss of vision, camera under water, Finished

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Pictures - Section No. 3 - 2301 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S3C9

00:02:14 - 22.38 m
Loss of vision, camera under water, Start

S3C10

00:02:21 - 23.60 m
Loss of vision, camera under water, Finished

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Pictures - Section No. 3 - 2301 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S3C11

00:02:46 - 23.88 m
Finish node type, manhole, reference 2301B

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Overview - Section No. 3 - 2301 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**24.02 m**
Inspected Length	**23.88 m**
Not Inspected Length	**0.14 m**

Resources Collected
Inspection Photos **11**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**1**
Service/Operational	**1**
Survey Abandoned	**No**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
2301 X	**Downstream**	**2301**	**OUTFALL**	**Vitrified clay**	**150 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference 2301
0	WL	Water level 10% height/diameter
0.1	FL	Fracture longitudinal at 9 o'clock - Remark: Possibly been a manhole
0.48	LL	Line of drain/sewer deviates left
8.86	CUW	Loss of vision, camera under water, Start
11.67	CUW	Loss of vision, camera under water, Finished
16.69	CUW	Loss of vision, camera under water, Start
19.81	CUW	Loss of vision, camera under water, Finished
22.38	CUW	Loss of vision, camera under water, Start
23.6	CUW	Loss of vision, camera under water, Finished
23.88	MHF	Finish node type, manhole, reference 2301B

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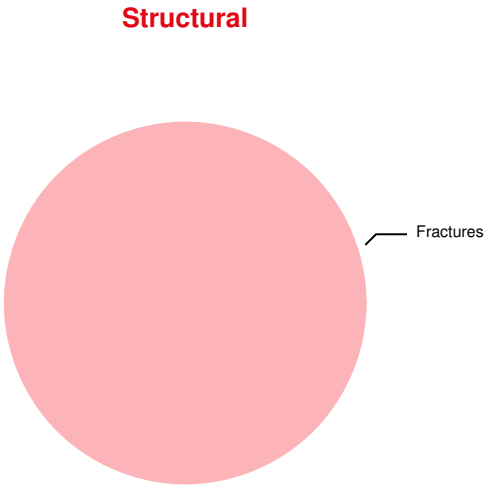
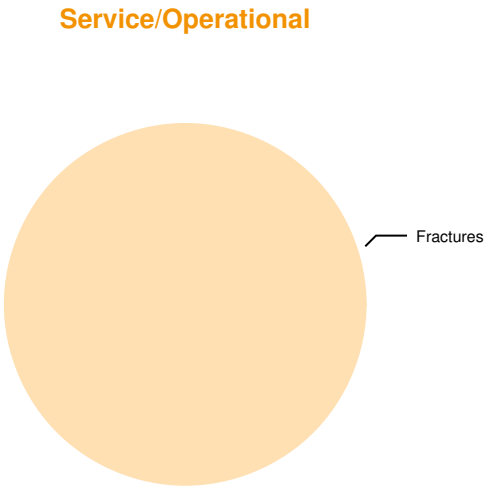
Damage Overview - Section No. 3 - 2301 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity
Fractures	1



Service/Operational Defects	Quantity
Fractures	1



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CCTV Inspection - Section No. 4 - 2301C to 2301B

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**2301C X**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**09/04/2024**
Time	**11:52 - 11:53**
Weather	**2 - Heavy Rain**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Downstream**	**13.69**	**13.69**

Start Node
Ref: **2301C**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Combined**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **150**
Unit Length: -

End Node
Ref: **2301B**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference 2301C	00:00:00	S4C1	0
0.00	WL	Water level 0% height/diameter	00:00:00	S4C2	0
0.29	CC	Crack circumferential from 7 to 10 o'clock	00:00:05	S4C3	10 / 1
0.98	RMJ	Roots mass 10% cross-sectional area loss at joint	00:00:09	S4C4	4
1.52	RMJ	Roots mass 15% cross-sectional area loss at joint	00:00:12	S4C5	4
7.55	JD	Joint displaced 25mm	00:00:40	S4C6	80 / 2
8.45	FM	Fracture multiple from 4 to 11 o'clock	00:00:45	S4C7	80 / 1
8.79	FL	Fracture longitudinal at 9 o'clock	00:00:46	S4C8	40 / 1
13.69	MHF	Finish node type, manhole, reference 2301B	00:01:08	S4C9	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	4	80	15.34	210	4	Structural Defects	Construction Observations
Operational	6	4	0.95	13	3	Service/Operational Defects	Miscellaneous Observations

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Pictures - Section No. 4 - 2301C to 2301B

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S4C1

00:00:00 - 0.00 m
Start node type, manhole, reference 2301C

S4C2

00:00:00 - 0.00 m
Water level 0% height/diameter

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Pictures - Section No. 4 - 2301C to 2301B

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S4C3

00:00:05 - 0.29 m
Crack circumferential from 7 to 10 o'clock

S4C4

00:00:09 - 0.98 m
Roots mass 10% cross-sectional area loss at joint

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Pictures - Section No. 4 - 2301C to 2301B

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S4C5

00:00:12 - 1.52 m
Roots mass 15% cross-sectional area loss at joint

S4C6

00:00:40 - 7.55 m
Joint displaced 25mm

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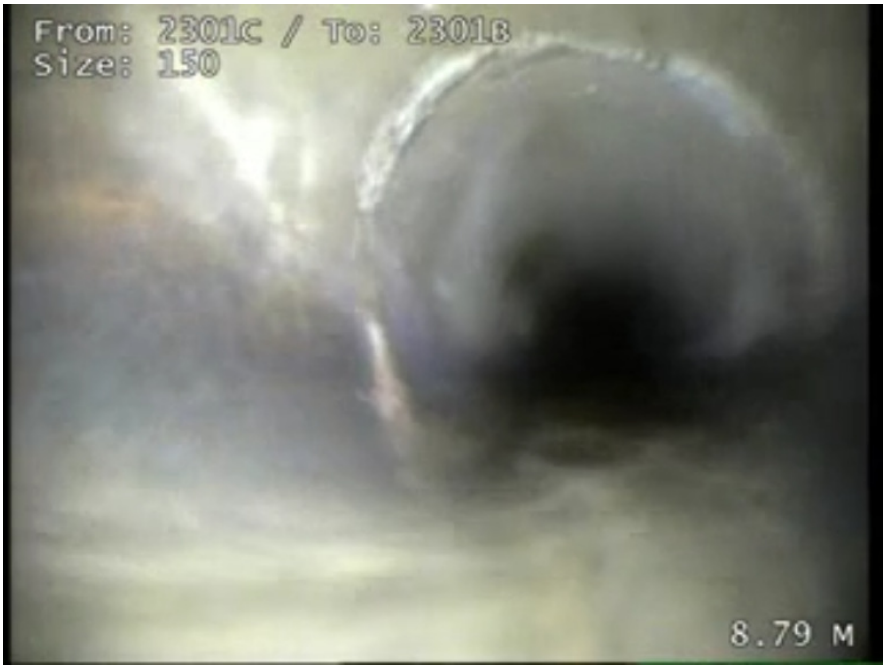
Pictures - Section No. 4 - 2301C to 2301B

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S4C7

00:00:45 - 8.45 m
Fracture multiple from 4 to 11 o'clock

S4C8



00:00:46 - 8.79 m
Fracture longitudinal at 9 o'clock

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Pictures - Section No. 4 - 2301C to 2301B

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S4C9

00:01:08 - 13.69 m
Finish node type, manhole, reference 2301B

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Overview - Section No. 4 - 2301C to 2301B

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**13.69 m**
Inspected Length	**13.69 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **9**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**4**
Service/Operational	**6**
Survey Abandoned	**No**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
2301C X	**Downstream**	**2301C**	**2301B**	**Vitrified clay**	**150 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference 2301C
0	WL	Water level 0% height/diameter
0.29	CC	Crack circumferential from 7 to 10 o'clock
0.98	RMJ	Roots mass 10% cross-sectional area loss at joint
1.52	RMJ	Roots mass 15% cross-sectional area loss at joint
7.55	JD	Joint displaced 25mm
8.45	FM	Fracture multiple from 4 to 11 o'clock
8.79	FL	Fracture longitudinal at 9 o'clock
13.69	MHF	Finish node type, manhole, reference 2301B

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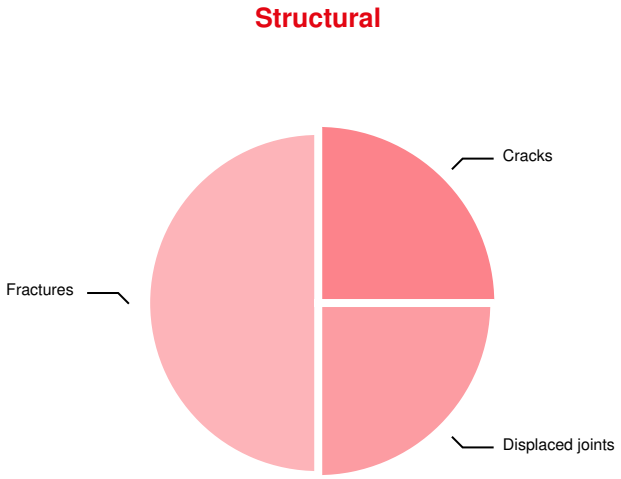
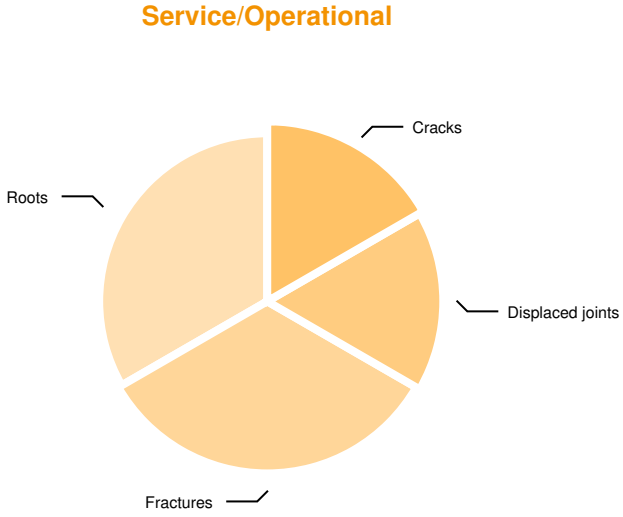
Damage Overview - Section No. 4 - 2301C to 2301B

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity
Fractures	2
Displaced joints	1
Cracks	1



Service/Operational Defects	Quantity
Roots	2
Fractures	2
Displaced joints	1
Cracks	1



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Tel: 01900268189
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CCTV Inspection - Section No. 5 - 2301B to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**2301B X**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**09/04/2024**
Time	**11:58 - 12:06**
Weather	**2 - Heavy Rain**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Downstream**	**30.86**	**30.86**

Start Node
Ref: **2301B**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Combined**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **150**
Unit Length: -

End Node
Ref: **OUTFALL**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference 2301B	00:00:00	S5C1	0
0.00	WL	Water level 15% height/diameter	00:00:00	S5C2	0
8.57	JD	Joint displaced 20mm	00:00:27	S5C3	80 / 2
11.74	CUW	Loss of vision, camera under water	00:00:39	S5C4	0
24.83	REM	Manhole noted in the distance	00:02:00	S5C5	0
30.86	MHF	Finish node type, manhole, reference 2301D	00:03:50	S5C6	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	1	80	2.59	80	4	Structural Defects	Construction Observations
Operational	1	2	0.06	2	3	Service/Operational Defects	Miscellaneous Observations

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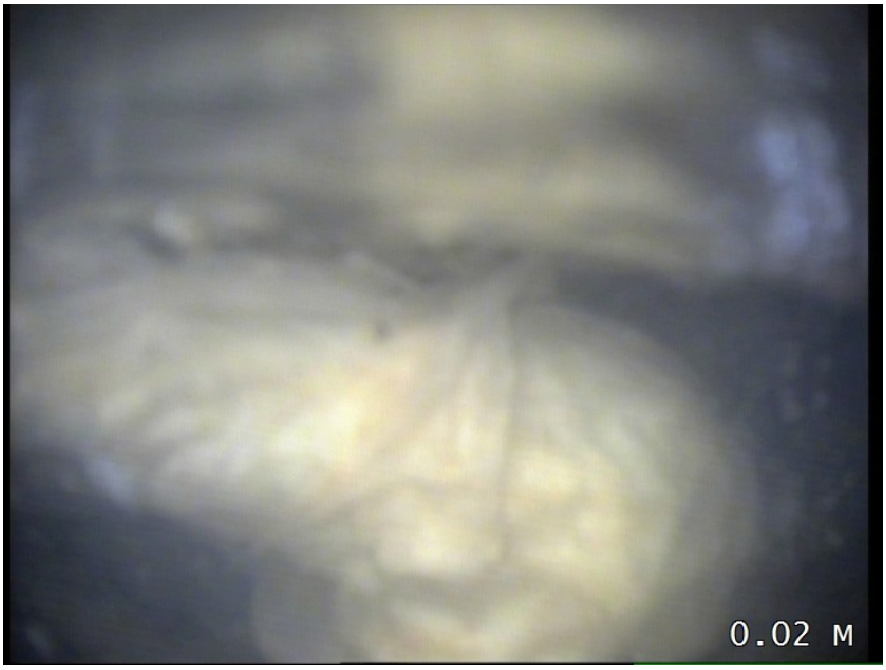
Pictures - Section No. 5 - 2301B to OUTFALL

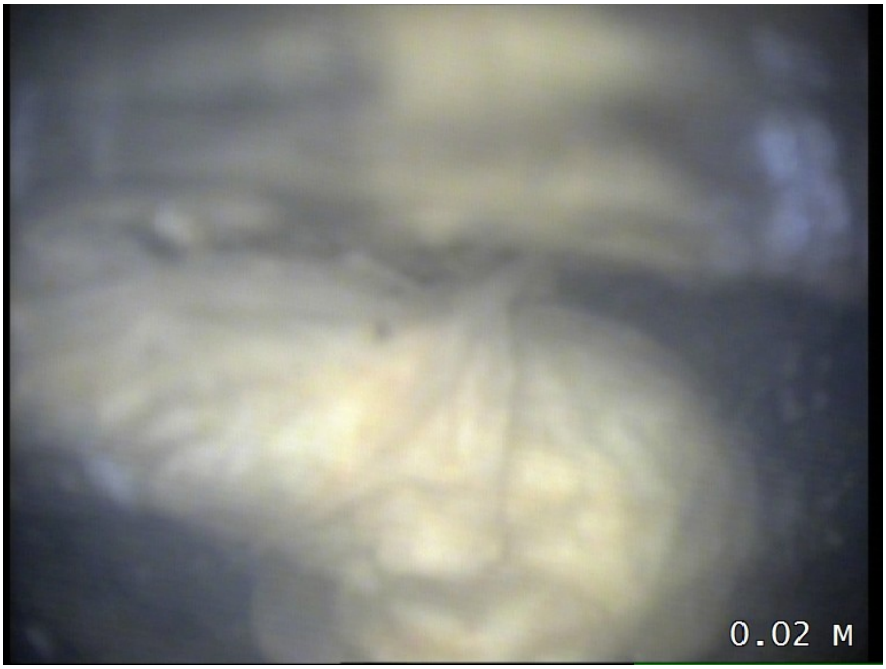
Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S5C1



00:00:00 - 0.00 m
Start node type, manhole, reference 2301B

S5C2



00:00:00 - 0.00 m
Water level 15% height/diameter

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Pictures - Section No. 5 - 2301B to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S5C3

00:00:27 - 8.57 m
Joint displaced 20mm

S5C4

00:00:39 - 11.74 m
Loss of vision, camera under water

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Pictures - Section No. 5 - 2301B to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S5C6

00:03:50 - 30.86 m
Finish node type, manhole, reference 2301D

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Overview - Section No. 5 - 2301B to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**30.86 m**
Inspected Length	**30.86 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **6**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**1**
Service/Operational	**1**
Survey Abandoned	**No**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
2301B X	**Downstream**	**2301B**	**OUTFALL**	**Vitrified clay**	**150 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference 2301B
0	WL	Water level 15% height/diameter
8.57	JD	Joint displaced 20mm
11.74	CUW	Loss of vision, camera under water
24.83	REM	Manhole noted in the distance
30.86	MHF	Finish node type, manhole, reference 2301D

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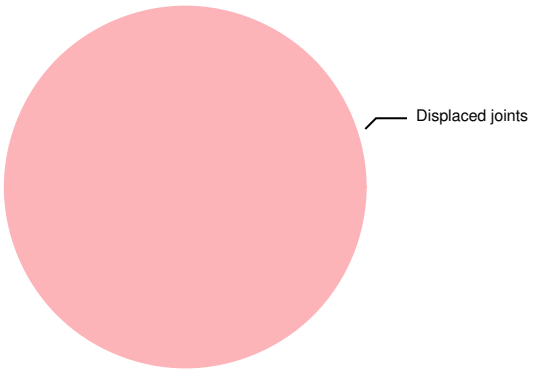
Damage Overview - Section No. 5 - 2301B to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

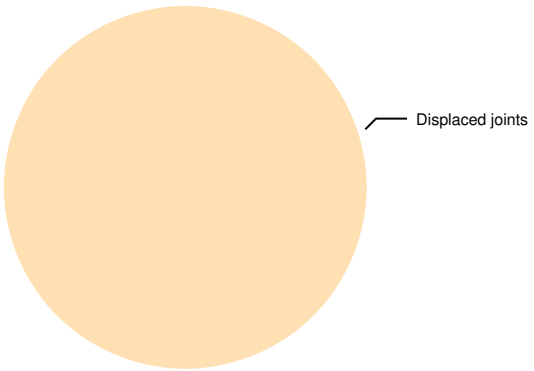
Structural Defect	Quantity
Displaced joints	1

Structural



Service/Operational Defects	Quantity
Displaced joints	1

Service/Operational



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CCTV Inspection - Section No. 6 - F , SURG MH to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**F , SURG MX**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**09/04/2024**
Time	**12:49 - 13:11**
Weather	**2 - Heavy Rain**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Downstream**	**15.00**	**15.00**

Start Node
Ref: **F , SURG MH**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Foul**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **100**
Unit Length: -

End Node
Ref: **OUTFALL**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference F , SURG MH	00:00:00	S6C1	0
0.00	WL	Water level 5% height/diameter	00:00:00	S6C2	0
14.24	JN	Junction at 6 o'clock, diameter 100mm - Remark: Back Drop Connection to manhole	00:00:40	S6C3	0
15.00	MHF	Finish node type, manhole, reference OUTFALL	00:00:50	S6C4	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	0	0	0.00	0	1	Structural Defects	Construction Observations
Operational	0	0	0.00	0	1	Service/Operational Defects	Miscellaneous Observations

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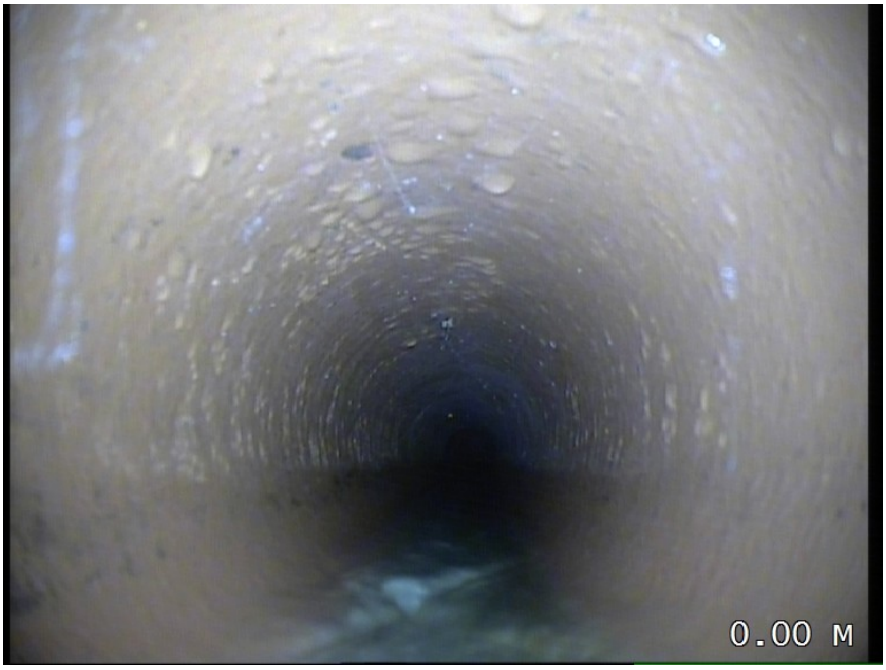
Pictures - Section No. 6 - F , SURG MH to OUTFALL

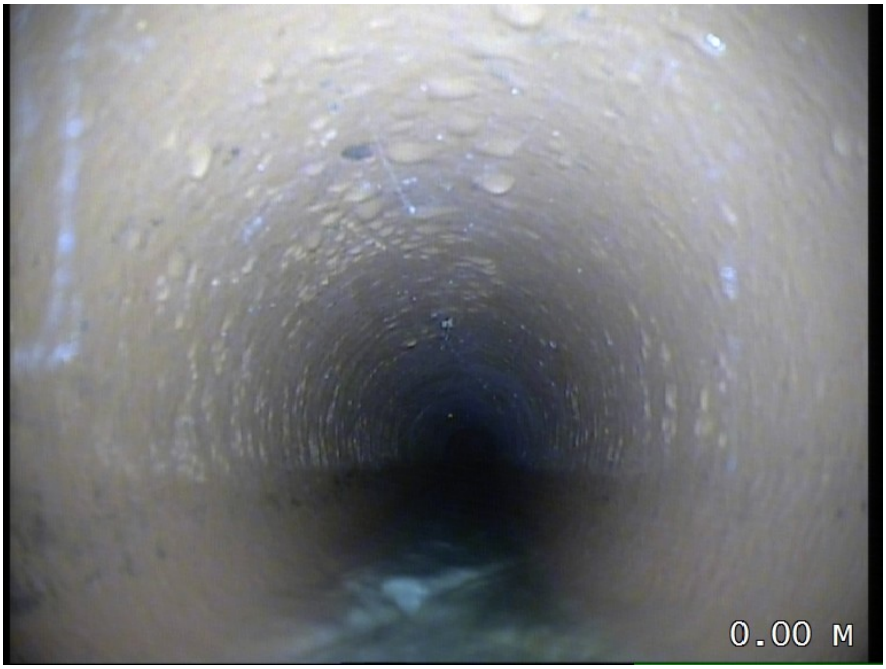
Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S6C1



00:00:00 - 0.00 m
Start node type, manhole, reference F , SURG MH

S6C2



00:00:00 - 0.00 m
Water level 5% height/diameter

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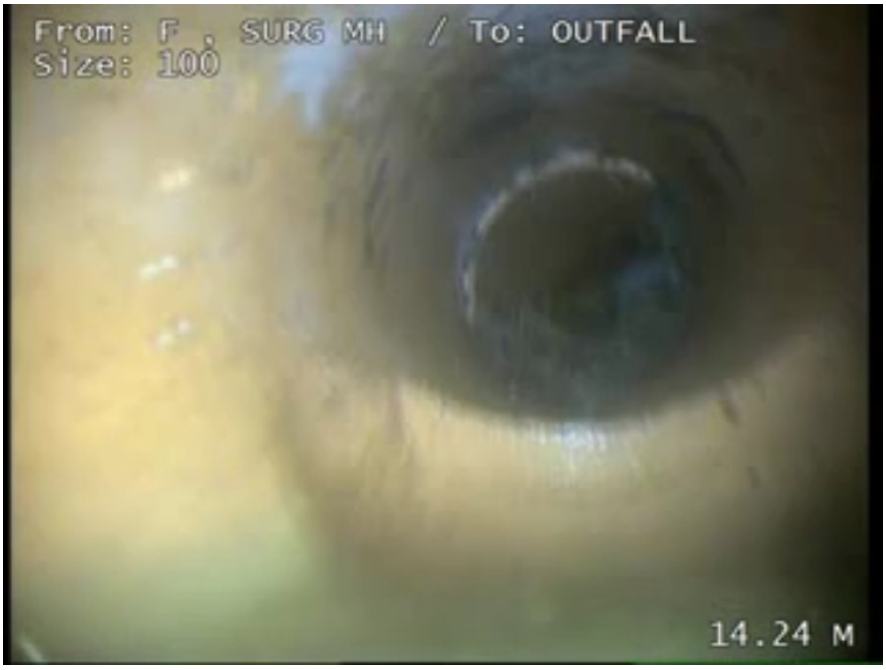
Pictures - Section No. 6 - F , SURG MH to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S6C3



00:00:40 - 14.24 m
Junction at 6 o'clock, diameter 100mm - Remark: Back Drop Connection to manhole

S6C4

00:00:50 - 15.00 m
Finish node type, manhole, reference OUTFALL

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Overview - Section No. 6 - F , SURG MH to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**15 m**
Inspected Length	**15 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **4**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**0**
Service/Operational	**0**
Survey Abandoned	**No**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
F , SURG MX	**Downstream**	**F , SURG MH**	**OUTFALL**	**Vitrified clay**	**100 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference F , SURG MH
0	WL	Water level 5% height/diameter
14.24	JN	Junction at 6 o'clock, diameter 100mm - Remark: Back Drop Connection to manhole
15	MHF	Finish node type, manhole, reference OUTFALL

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Damage Overview - Section No. 6 - F , SURG MH to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity

There were no structural defects recorded

Service/Operational Defects	Quantity

There were no service/operational defects recorded

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CCTV Inspection - Section No. 7 - MH 56 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**MH 56 X**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**09/04/2024**
Time	**13:33 - 13:39**
Weather	**2 - Heavy Rain**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Downstream**	**13.10**	**13.10**

Start Node
Ref: **MH 56**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Foul**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **100**
Unit Length: -

End Node
Ref: **OUTFALL**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference MH 56	00:00:00	S7C1	0
0.00	WL	Water level 0% height/diameter	00:00:00	S7C2	0
0.10	REM	Joins another run	00:00:02	S7C3	0
1.55	LL	Line of drain/sewer deviates left	00:01:14	S7C4	0
11.71	DEX	Other settled deposits 30% cross-sectional area loss - Remark: Waste	00:02:16	S7C5	5
13.10	SA	Survey abandoned - Remark: Unable to pass waste	00:02:37	S7C6	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	0	0	0.00	0	1	Structural Defects	Construction Observations
Operational	1	5	0.38	5	4	Service/Operational Defects	Miscellaneous Observations

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Pictures - Section No. 7 - MH 56 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S7C1

00:00:00 - 0.00 m
Start node type, manhole, reference MH 56

S7C2

00:00:00 - 0.00 m
Water level 0% height/diameter

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Pictures - Section No. 7 - MH 56 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S7C4

00:01:14 - 1.55 m
Line of drain/sewer deviates left

S7C5

00:02:16 - 11.71 m
Other settled deposits 30% cross-sectional area loss - Remark: Waste

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Pictures - Section No. 7 - MH 56 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S7C6

00:02:37 - 13.10 m
Survey abandoned - Remark: Unable to pass waste

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Overview - Section No. 7 - MH 56 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**13.1 m**
Inspected Length	**13.1 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **6**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**0**
Service/Operational	**1**
Survey Abandoned	**Yes**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
MH 56 X	**Downstream**	**MH 56**	**OUTFALL**	**Vitrified clay**	**100 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference MH 56
0	WL	Water level 0% height/diameter
0.1	REM	Joins another run
1.55	LL	Line of drain/sewer deviates left
11.71	DEX	Other settled deposits 30% cross-sectional area loss - Remark: Waste
13.1	SA	Survey abandoned - Remark: Unable to pass waste

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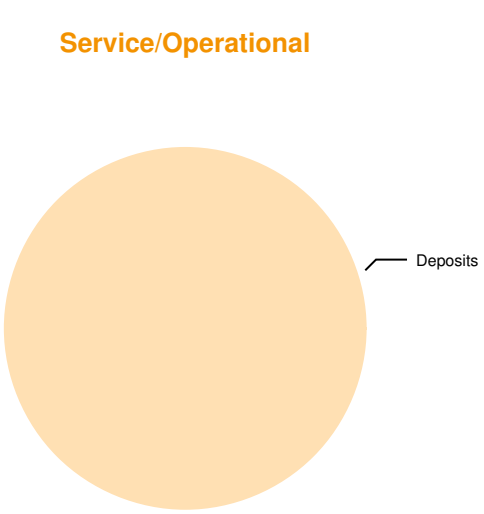
Damage Overview - Section No. 7 - MH 56 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity

There were no structural defects recorded

Service/Operational Defects	Quantity
Deposits	1



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CCTV Inspection - Section No. 8 - F , SURG MH (EXPOSED) to FIELD MH

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**F , SURG MX**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**03/07/2024**
Time	**10:28 - 10:33**
Weather	**2 - Heavy Rain**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Downstream**	**19.40**	**19.40**

Start Node
Ref: **F , SURG MH (EXPOSED)**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Foul**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **100**
Unit Length: -

End Node
Ref: **FIELD MH**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference F , SURG MH (EXPOSED)	00:00:00	S8C1	0
0.00	WL	Water level 0% height/diameter	00:00:00	S8C2	0
0.36	DEZ(S1)	Other attached deposits from 6 to 9 o'clock 5% cross-sectional area loss - Remark CONCRETE, Start	00:00:05	S8C3	1
2.05	JD	Joint displaced 20mm	00:00:39	S8C4	80 / 2
2.95	DEZ(F1)	Other attached deposits from 6 to 9 o'clock 5% cross-sectional area loss - Remark CONCRETE, Finished	00:01:03	S8C5	1
5.88	JD	Joint displaced 10mm	00:01:32	S8C6	40 / 2
13.24	JD	Joint displaced 10mm	00:02:22	S8C7	40 / 2
19.40	MHF	Finish node type, manhole, reference FIELD MH	00:02:58	S8C8	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	3	80	8.25	160	4	Structural Defects	Construction Observations
Operational	6	3	0.46	9	3	Service/Operational Defects	Miscellaneous Observations

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Pictures - Section No. 8 - F , SURG MH (EXPOSED) to FIELD MH

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S8C1

00:00:00 - 0.00 m
Start node type, manhole, reference F , SURG MH (EXPOSED)

S8C2

00:00:00 - 0.00 m
Water level 0% height/diameter

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Pictures - Section No. 8 - F , SURG MH (EXPOSED) to FIELD MH

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S8C3

00:00:05 - 0.36 m
Other attached deposits from 6 to 9 o'clock 5% cross-sectional area loss - Remark CONCRETE, Start

S8C4

00:00:39 - 2.05 m
Joint displaced 20mm

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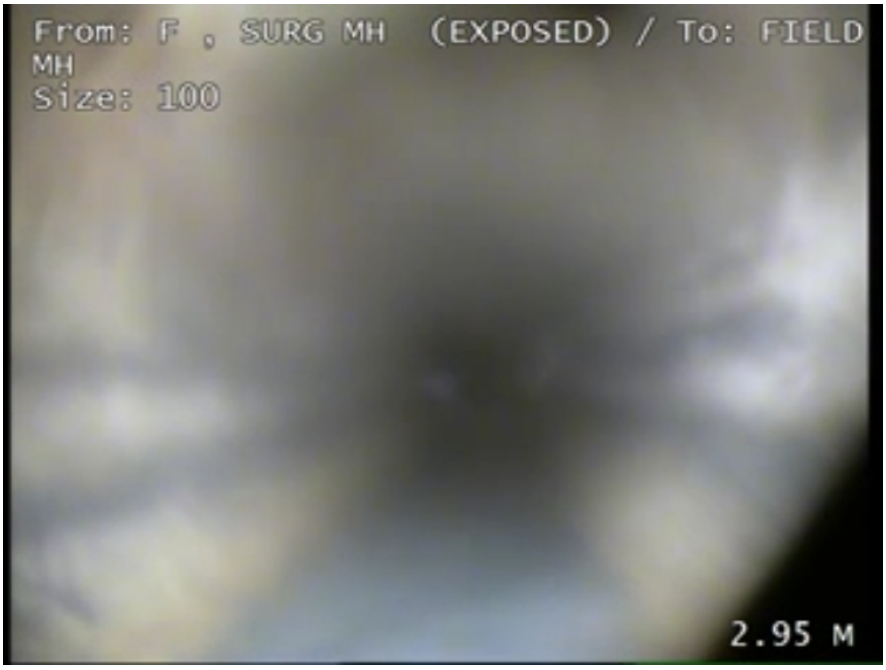
Pictures - Section No. 8 - F , SURG MH (EXPOSED) to FIELD MH

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S8C5



00:01:03 - 2.95 m
Other attached deposits from 6 to 9 o'clock 5% cross-sectional area loss - Remark CONCRETE, Finished

S8C6

00:01:32 - 5.88 m
Joint displaced 10mm

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Pictures - Section No. 8 - F , SURG MH (EXPOSED) to FIELD MH

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S8C7

00:02:22 - 13.24 m
Joint displaced 10mm

S8C8

00:02:58 - 19.40 m
Finish node type, manhole, reference FIELD MH

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Overview - Section No. 8 - F , SURG MH (EXPOSED) to FIELD MH

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**19.4 m**
Inspected Length	**19.4 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **8**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**3**
Service/Operational	**5**
Survey Abandoned	**No**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
F , SURG MX	**Downstream**	**F , SURG MH (EXPOSED)**	**FIELD MH**	**Vitrified clay**	**100 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference F , SURG MH (EXPOSED)
0	WL	Water level 0% height/diameter
0.36	DEZ	Other attached deposits from 6 to 9 o'clock 5% cross-sectional area loss - Remark CONCRETE, Start
2.05	JD	Joint displaced 20mm
2.95	DEZ	Other attached deposits from 6 to 9 o'clock 5% cross-sectional area loss - Remark CONCRETE, Finished
5.88	JD	Joint displaced 10mm
13.24	JD	Joint displaced 10mm
19.4	MHF	Finish node type, manhole, reference FIELD MH

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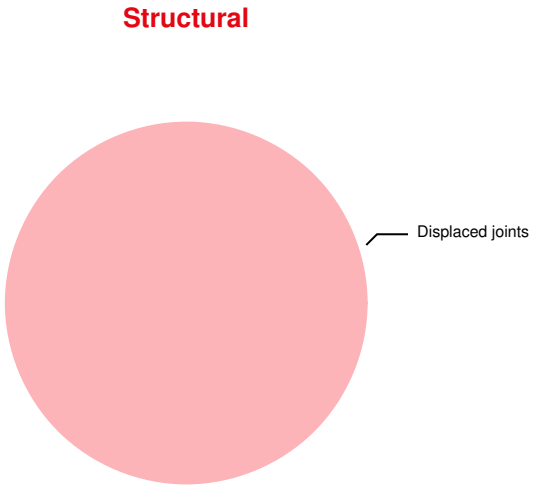
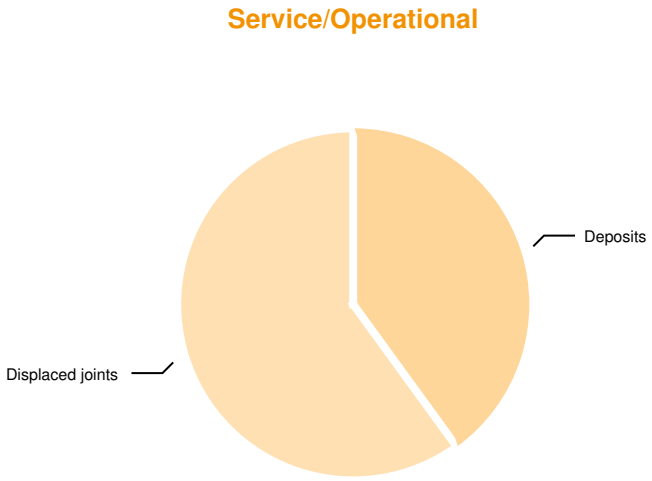
Damage Overview - Section No. 8 - F , SURG MH (EXPOSED) to FIELD MH

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity
Displaced joints	3



Service/Operational Defects	Quantity
Displaced joints	3
Deposits	2



SK Drainage Solutions Ltd
31 Adams Road, Workington, Cumbria, CA14 3YS
Tel: 01900268189
office@skds.ltd

CCTV Inspection - Section No. 9 - FIELD MH to FIELD MH CORNER

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**FIELD MH X**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**03/07/2024**
Time	**10:36 - 10:40**
Weather	**2 - Heavy Rain**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Downstream**	**17.48**	**17.48**

Start Node
Ref: **FIELD MH**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Foul**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **100**
Unit Length: -

End Node
Ref: **FIELD MH CORNER**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference FIELD MH	00:00:00	S9C1	0
0.00	WL	Water level 0% height/diameter	00:00:00	S9C2	0
17.48	MHF	Finish node type, manhole, reference FIELD MH CORNER	00:03:06	S9C3	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	0	0	0.00	0	1	Structural Defects	Construction Observations
Operational	0	0	0.00	0	1	Service/Operational Defects	Miscellaneous Observations

SK Drainage Solutions Ltd
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office@skds.ltd

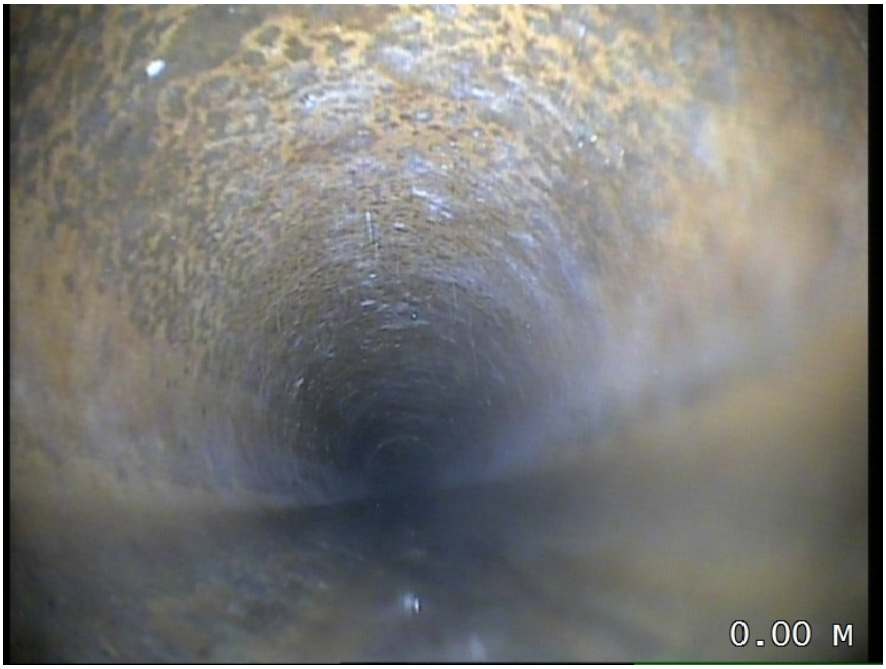
Pictures - Section No. 9 - FIELD MH to FIELD MH CORNER

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S9C1

00:00:00 - 0.00 m
Start node type, manhole, reference FIELD MH

S9C2



00:00:00 - 0.00 m
Water level 0% height/diameter

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Pictures - Section No. 9 - FIELD MH to FIELD MH CORNER

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S9C3

00:03:06 - 17.48 m
Finish node type, manhole, reference FIELD MH CORNER

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Tel: 01900268189
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Overview - Section No. 9 - FIELD MH to FIELD MH CORNER

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**17.48 m**
Inspected Length	**17.48 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **3**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**0**
Service/Operational	**0**
Survey Abandoned	**No**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
FIELD MH X	**Downstream**	**FIELD MH**	**FIELD MH CORNER**	**Vitrified clay**	**100 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference FIELD MH
0	WL	Water level 0% height/diameter
17.48	MHF	Finish node type, manhole, reference FIELD MH CORNER

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Damage Overview - Section No. 9 - FIELD MH to FIELD MH CORNER

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity

There were no structural defects recorded

Service/Operational Defects	Quantity

There were no service/operational defects recorded

SK Drainage Solutions Ltd
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Tel: 01900268189
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CCTV Inspection - Section No. 10 - S , SURG MH (EXPOSED) to FIELD MH CORNER

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**S , SURG MX**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**03/07/2024**
Time	**11:14 - 11:21**
Weather	**1 - Dry**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	N	-	**Downstream**	**35.82**	**35.82**

Start Node

Ref: **S , SURG MH (EXPOSED)**

Depth	Coordinates
-	-

Drain/Sewer

Sewer Use: **Surface water**

Sewer Type: -

Criticality	Year
-	-

Pipe

Material: **Vitrified clay**

Lining Type: -

Lining Material: -

Shape: -

Diameter: **225**

Unit Length: -

End Node

Ref: **FIELD MH CORNER**

Depth	Coordinates
-	-

0.00	MH	Start node type, manhole, reference S , SURG MH (EXPOSED)	00:00:00	S10C1	0
0.00	WL	Water level 0% height/diameter	00:00:00	S10C2	0
35.82	MHF	Finish node type, manhole, reference MH IN CORNER	00:03:17	S10C3	0
35.82	REM	MH IN CORNER REPLICATING FOUL LINE	00:03:18	S10C4	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	0	0	0.00	0	1	Structural Defects	Construction Observations
Operational	0	0	0.00	0	1	Service/Operational Defects	Miscellaneous Observations

SK Drainage Solutions Ltd
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office@skds.ltd

Pictures - Section No. 10 - S , SURG MH (EXPOSED) to FIELD MH CORNER

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S10C1

00:00:00 - 0.00 m
Start node type, manhole, reference S , SURG MH (EXPOSED)

S10C2

00:00:00 - 0.00 m
Water level 0% height/diameter

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Pictures - Section No. 10 - S , SURG MH (EXPOSED) to FIELD MH CORNER

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S10C3

00:03:17 - 35.82 m
Finish node type, manhole, reference MH IN CORNER

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Tel: 01900268189
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Overview - Section No. 10 - S , SURG MH (EXPOSED) to FIELD MH CORNER

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**35.82 m**
Inspected Length	**35.82 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **4**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**0**
Service/Operational	**0**
Survey Abandoned	**No**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
S , SURG MX	**Downstream**	**S , SURG MH (EXPOSED)**	**FIELD MH CORNER**	**Vitrified clay**	**225 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference S , SURG MH (EXPOSED)
0	WL	Water level 0% height/diameter
35.82	MHF	Finish node type, manhole, reference MH IN CORNER
35.82	REM	MH IN CORNER REPLICATING FOUL LINE

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Damage Overview - Section No. 10 - S , SURG MH (EXPOSED) to FIELD MH CORNER

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity

There were no structural defects recorded

Service/Operational Defects	Quantity

There were no service/operational defects recorded

SK Drainage Solutions Ltd
31 Adams Road, Workington, Cumbria, CA14 3YS
Tel: 01900268189
office@skds.ltd

CCTV Inspection - Section No. 11 - FIELD MH CORNER SW to FIELD MH 2

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**FIELD MH CX**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**03/07/2024**
Time	**11:36 - 11:45**
Weather	**1 - Dry**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Downstream**	**56.19**	**56.19**

Start Node
Ref: **FIELD MH CORNER SW**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Surface water**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **225**
Unit Length: -

End Node
Ref: **FIELD MH 2**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference FIELD MH CORNER SW	00:00:00	S11C1	0
0.00	WL	Water level 0% height/diameter	00:00:00	S11C2	0
2.41	DEEJ	Attached deposits, encrustation from 3 to 12 o'clock 10% cross-sectional area loss at joint	00:02:00	S11C3	2
4.27	DEEJ	Attached deposits, encrustation from 1 to 12 o'clock 15% cross-sectional area loss at joint	00:02:14	S11C4	2
56.19	MHF	Finish node type, manhole, reference MH ON CORNER OF FIELD AGAIN FOLLOWING THE FOUL	00:06:55	S11C5	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	0	0	0.00	0	1	Structural Defects	Construction Observations
Operational	2	2	0.07	4	3	Service/Operational Defects	Miscellaneous Observations

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Pictures - Section No. 11 - FIELD MH CORNER SW to FIELD MH 2

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S11C1

00:00:00 - 0.00 m
Start node type, manhole, reference FIELD MH CORNER SW

S11C2

00:00:00 - 0.00 m
Water level 0% height/diameter

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Pictures - Section No. 11 - FIELD MH CORNER SW to FIELD MH 2

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S11C3

00:02:00 - 2.41 m
Attached deposits, encrustation from 3 to 12 o'clock 10% cross-sectional area loss at joint

S11C4

00:02:14 - 4.27 m
Attached deposits, encrustation from 1 to 12 o'clock 15% cross-sectional area loss at joint

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Tel: 01900268189
office@skds.ltd

Pictures - Section No. 11 - FIELD MH CORNER SW to FIELD MH 2

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S11C5

00:06:55 - 56.19 m
Finish node type, manhole, reference MH ON CORNER OF FIELD AGAIN FOLLOWING THE FOUL

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Tel: 01900268189
office@skds.ltd

Overview - Section No. 11 - FIELD MH CORNER SW to FIELD MH 2

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**56.19 m**
Inspected Length	**56.19 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **5**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**0**
Service/Operational	**2**
Survey Abandoned	**No**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
FIELD MH CX	**Downstream**	**FIELD MH CORNER SW**	**FIELD MH 2**	**Vitrified clay**	**225 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference FIELD MH CORNER SW
0	WL	Water level 0% height/diameter
2.41	DEEJ	Attached deposits, encrustation from 3 to 12 o'clock 10% cross-sectional area loss at joint
4.27	DEEJ	Attached deposits, encrustation from 1 to 12 o'clock 15% cross-sectional area loss at joint
56.19	MHF	Finish node type, manhole, reference MH ON CORNER OF FIELD AGAIN FOLLOWING THE FOUL

SK Drainage Solutions Ltd
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Tel: 01900268189
office@skds.ltd

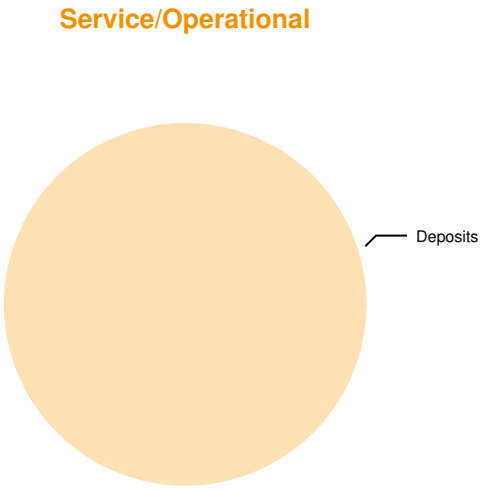
Damage Overview - Section No. 11 - FIELD MH CORNER SW to FIELD MH 2

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity

There were no structural defects recorded

Service/Operational Defects	Quantity
Deposits	2



SK Drainage Solutions Ltd
31 Adams Road, Workington, Cumbria, CA14 3YS
Tel: 01900268189
office@skds.ltd

CCTV Inspection - Section No. 12 - FIELD MH 2 to FIELD MH 3

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**FIELD MH 2X**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**03/07/2024**
Time	**11:46 - 12:59**
Weather	**1 - Dry**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Downstream**	**27.88**	**27.88**

Start Node
Ref: **FIELD MH 2**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Surface water**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **225**
Unit Length: -

End Node
Ref: **FIELD MH 3**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference FIELD MH 2	00:00:00	S12C1	0
0.00	WL	Water level 0% height/diameter	00:00:00	S12C2	0
27.88	MHF	Finish node type, manhole, reference OUTFALL	00:07:28	S12C3	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	0	0	0.00	0	1	Structural Defects	Construction Observations
Operational	0	0	0.00	0	1	Service/Operational Defects	Miscellaneous Observations

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Pictures - Section No. 12 - FIELD MH 2 to FIELD MH 3

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S12C1

00:00:00 - 0.00 m
Start node type, manhole, reference FIELD MH 2

S12C2

00:00:00 - 0.00 m
Water level 0% height/diameter

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Pictures - Section No. 12 - FIELD MH 2 to FIELD MH 3

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S12C3

00:07:28 - 27.88 m
Finish node type, manhole, reference OUTFALL

SK Drainage Solutions Ltd
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Tel: 01900268189
office@skds.ltd

Overview - Section No. 12 - FIELD MH 2 to FIELD MH 3

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**27.88 m**
Inspected Length	**27.88 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **3**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**0**
Service/Operational	**0**
Survey Abandoned	**No**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
FIELD MH 2X	**Downstream**	**FIELD MH 2**	**FIELD MH 3**	**Vitrified clay**	**225 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference FIELD MH 2
0	WL	Water level 0% height/diameter
27.88	MHF	Finish node type, manhole, reference OUTFALL

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Damage Overview - Section No. 12 - FIELD MH 2 to FIELD MH 3

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity

There were no structural defects recorded

Service/Operational Defects	Quantity

There were no service/operational defects recorded

SK Drainage Solutions Ltd
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Tel: 01900268189
office@skds.ltd

CCTV Inspection - Section No. 13 - FIELD MH 3 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**FIELD MH 3X**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**03/07/2024**
Time	**13:18 - 16:10**
Weather	**1 - Dry**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Downstream**	**15.71**	**15.71**

Start Node
Ref: **FIELD MH 3**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Surface water**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **300**
Unit Length: -

End Node
Ref: **OUTFALL**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference FIELD MH 3	00:00:00	S13C1	0
0.00	WL	Water level 0% height/diameter	00:00:00	S13C2	0
11.22	JN	Junction at 9 o'clock, diameter 150mm	00:00:50	S13C3	0
11.56	OBIJ	Other obstacles protruding through wall at 4 o'clock 20% cross-sectional area loss at joint	00:00:55	S13C4	10
14.10	CN	Connection other than junction at 3 o'clock, diameter 150mm - Remark: FRACTURES AROUND THE CONNECTION	00:01:22	S13C5	0
15.71	JD	Joint displaced 30mm	00:01:52	S13C6	40 / 2
15.71	SA	Survey abandoned - Remark: UNABLE TO PROCEED DEBRIS AND DEFECT	00:02:15	S13C7	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	1	40	2.55	40	3	Structural Defects	Construction Observations
Operational	2	10	0.76	12	5	Service/Operational Defects	Miscellaneous Observations

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Pictures - Section No. 13 - FIELD MH 3 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S13C1

00:00:00 - 0.00 m
Start node type, manhole, reference FIELD MH 3

S13C2

00:00:00 - 0.00 m
Water level 0% height/diameter

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Pictures - Section No. 13 - FIELD MH 3 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S13C3

00:00:50 - 11.22 m
Junction at 9 o'clock, diameter 150mm

S13C4

00:00:55 - 11.56 m
Other obstacles protruding through wall at 4 o'clock 20% cross-sectional area loss at joint

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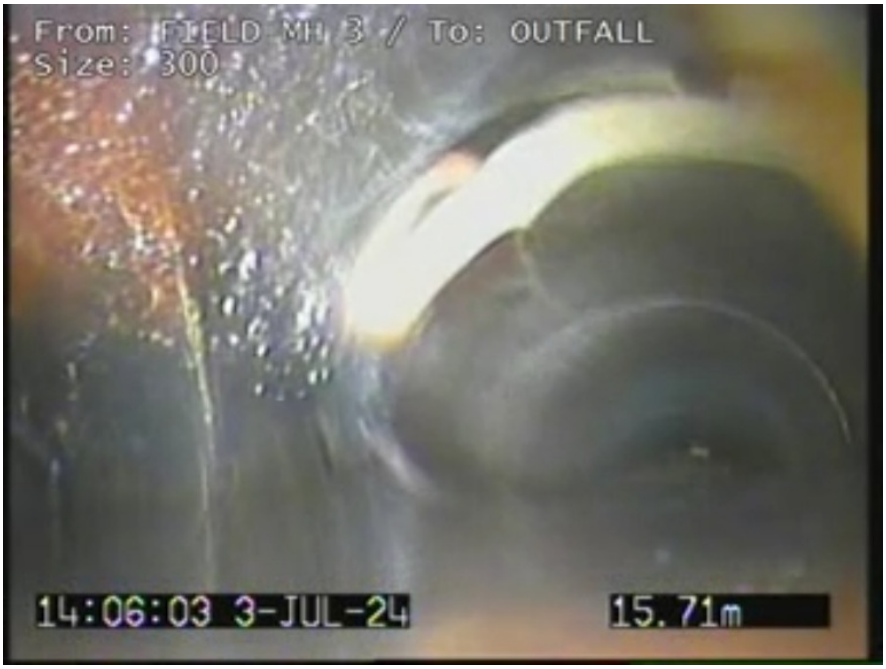
Pictures - Section No. 13 - FIELD MH 3 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S13C5

00:01:22 - 14.10 m
Connection other than junction at 3 o'clock, diameter 150mm - Remark: FRACTURES AROUND THE CONNECTION

S13C6



00:01:52 - 15.71 m
Joint displaced 30mm

SK Drainage Solutions Ltd
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Tel: 01900268189
office@skds.ltd

Pictures - Section No. 13 - FIELD MH 3 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S13C7

00:02:15 - 15.71 m
Survey abandoned - Remark: UNABLE TO PROCEED DEBRIS AND DEFECT

SK Drainage Solutions Ltd
31 Adams Road, Workington, Cumbria, CA14 3YS
Tel: 01900268189
office@skds.ltd

Overview - Section No. 13 - FIELD MH 3 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**15.71 m**
Inspected Length	**15.71 m**
Not Inspected Length	**0 m**

Resources Collected	
Inspection Photos	**7**
Inspection Videos	**1**
Manhole Photos	**0**

Defects Found	
Structural	**1**
Service/Operational	**2**
Survey Abandoned	**Yes**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
FIELD MH 3X	**Downstream**	**FIELD MH 3**	**OUTFALL**	**Vitrified clay**	**300 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference FIELD MH 3
0	WL	Water level 0% height/diameter
11.22	JN	Junction at 9 o'clock, diameter 150mm
11.56	OBIJ	Other obstacles protruding through wall at 4 o'clock 20% cross-sectional area loss at joint
14.1	CN	Connection other than junction at 3 o'clock, diameter 150mm - Remark: FRACTURES AROUND THE CONNECTION
15.71	JD	Joint displaced 30mm
15.71	SA	Survey abandoned - Remark: UNABLE TO PROCEED DEBRIS AND DEFECT

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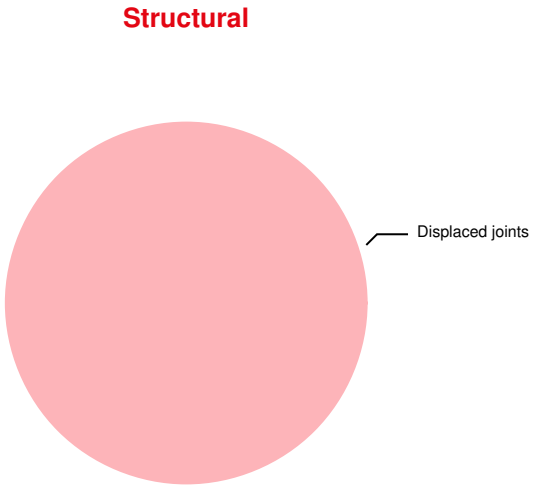
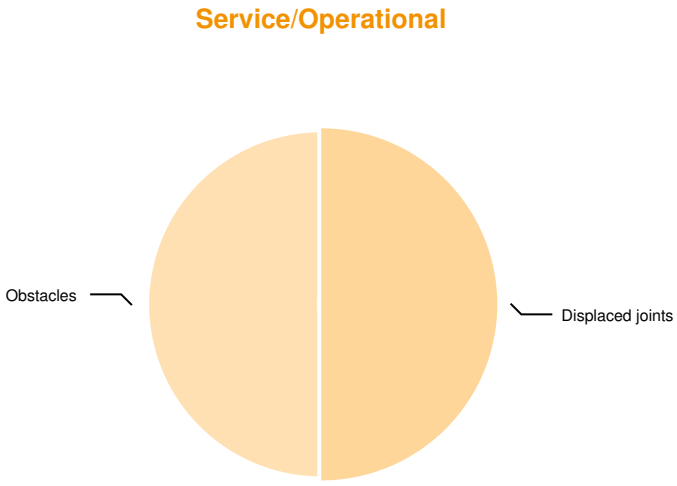
Damage Overview - Section No. 13 - FIELD MH 3 to OUTFALL

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity
Displaced joints	1



Service/Operational Defects	Quantity
Obstacles	1
Displaced joints	1



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Tel: 01900268189
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CCTV Inspection - Section No. 14 - S, SURG MH to S , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**S, SURG MHX**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**03/07/2024**
Time	**16:22 - 16:24**
Weather	**1 - Dry**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	**N**	-	**Downstream**	**8.45**	**8.45**

Start Node
Ref: **S, SURG MH**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Surface water**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **100**
Unit Length: -

End Node
Ref: **S , SURG MH (EXPOSED)**
Depth: - | Coordinates: -

Position (m)	Code	Observation	Video Ref	Photo Ref	Score
0.00	MH	Start node type, manhole, reference S, SURG MH	00:00:00	S14C1	0
0.00	WL	Water level 0% height/diameter	00:00:00	S14C2	0
4.21	DEZ(S1)	Other attached deposits from 4 to 8 o'clock 25% cross-sectional area loss - Remark CEMENT, Start	00:00:22	S14C3	5
8.45	DEZ(F1)	Other attached deposits from 4 to 8 o'clock 25% cross-sectional area loss - Remark CEMENT, Finished	00:01:17	S14C4	5
8.45	SA	Survey abandoned - Remark: DEBRIS	00:01:17	S14C5	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	0	0	0.00	0	1	Structural Defects	Construction Observations
Operational	5	5	2.96	25	4	Service/Operational Defects	Miscellaneous Observations

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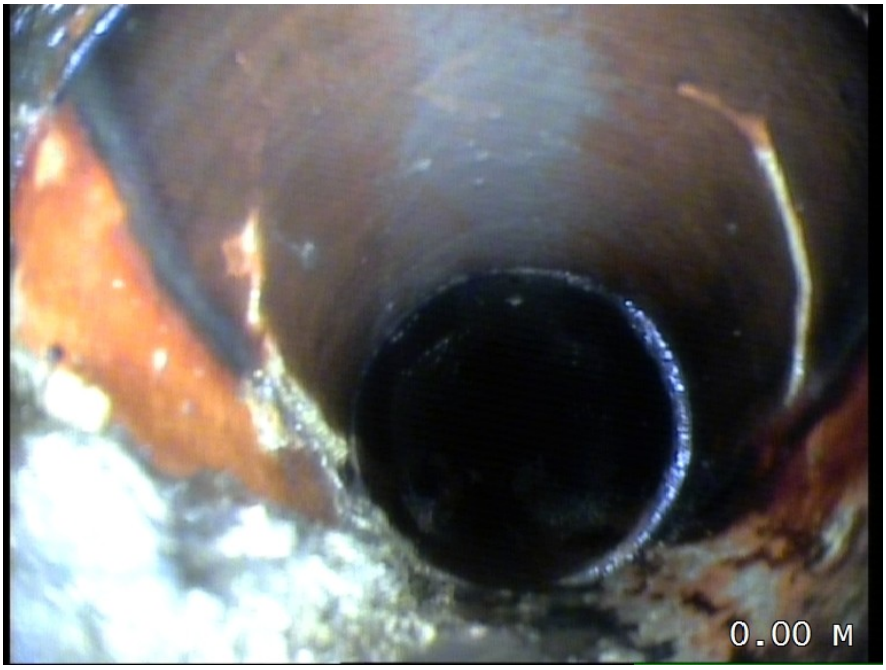
Pictures - Section No. 14 - S, SURG MH to S , SURG MH (EXPOSED)

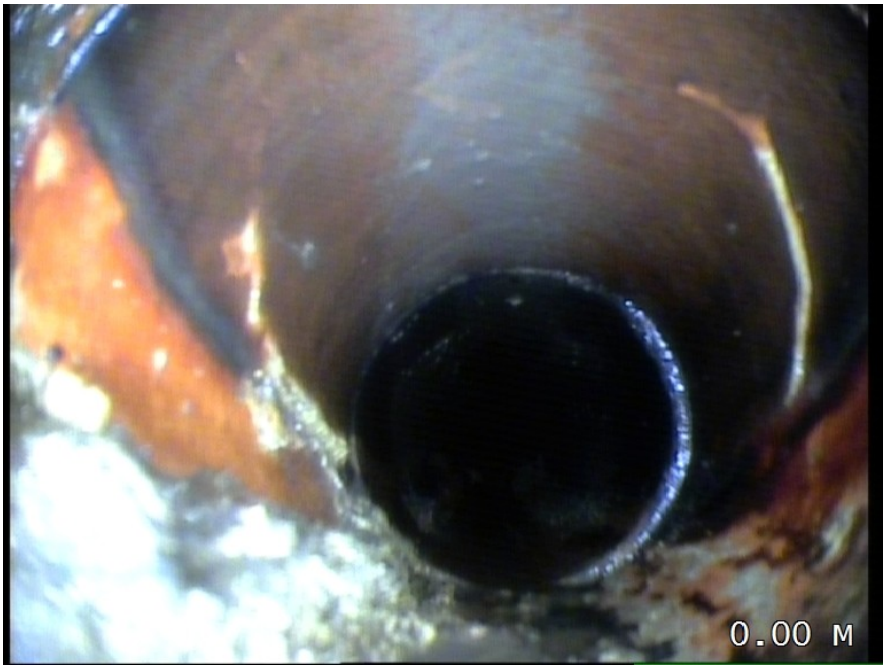
Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S14C1



00:00:00 - 0.00 m
Start node type, manhole, reference S, SURG MH

S14C2



00:00:00 - 0.00 m
Water level 0% height/diameter

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Pictures - Section No. 14 - S, SURG MH to S , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S14C3

00:00:22 - 4.21 m
Other attached deposits from 4 to 8 o'clock 25% cross-sectional area loss - Remark CEMENT, Start

S14C4

00:01:17 - 8.45 m
Other attached deposits from 4 to 8 o'clock 25% cross-sectional area loss - Remark CEMENT, Finished

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Pictures - Section No. 14 - S, SURG MH to S , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S14C5

00:01:17 - 8.45 m
Survey abandoned - Remark: DEBRIS

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Overview - Section No. 14 - S, SURG MH to S , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**8.45 m**
Inspected Length	**8.45 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **5**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**0**
Service/Operational	**2**
Survey Abandoned	**Yes**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
S, SURG MHX	**Downstream**	**S, SURG MH**	**S , SURG MH (EXPOSED)**	**Vitrified clay**	**100 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference S, SURG MH
0	WL	Water level 0% height/diameter
4.21	DEZ	Other attached deposits from 4 to 8 o'clock 25% cross-sectional area loss - Remark CEMENT, Start
8.45	DEZ	Other attached deposits from 4 to 8 o'clock 25% cross-sectional area loss - Remark CEMENT, Finished
8.45	SA	Survey abandoned - Remark: DEBRIS

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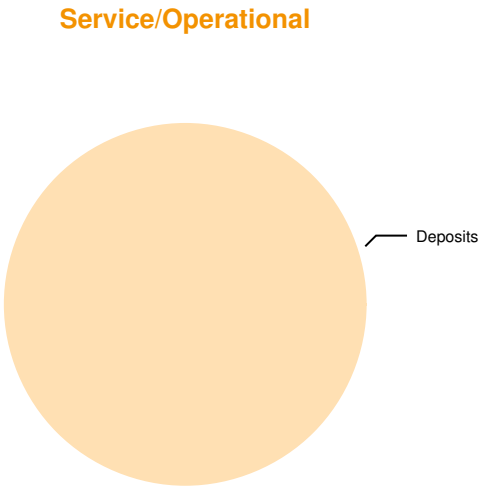
Damage Overview - Section No. 14 - S, SURG MH to S , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity

There were no structural defects recorded

Service/Operational Defects	Quantity
Deposits	2



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CCTV Inspection - Section No. 15 - CORNER PREP SITE FW to F , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**CORNER PREX**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**09/07/2024**
Time	**15:06 - 15:11**
Weather	**1 - Dry**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	N	-	**Downstream**	**43.71**	**43.71**

Start Node

Ref: **CORNER PREP SITE FW**

Depth	Coordinates
-	-

Drain/Sewer

Sewer Use: **Foul**

Sewer Type: -

Criticality	Year
-	-

Pipe

Material: **Vitrified clay**

Lining Type: -

Lining Material: -

Shape: -

Diameter: **150**

Unit Length: -

End Node

Ref: **F , SURG MH (EXPOSED)**

Depth	Coordinates
-	-

0.00	MH	Start node type, manhole, reference CORNER PREP SITE FW	00:00:00	S15C1	0
0.00	WL	Water level 0% height/diameter	00:00:00	S15C2	0
43.71	MHF	Finish node type, manhole, reference F , SURG MH (EXPOSED)	00:04:12	S15C3	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	0	0	0.00	0	1	Structural Defects	Construction Observations
Operational	0	0	0.00	0	1	Service/Operational Defects	Miscellaneous Observations

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Pictures - Section No. 15 - CORNER PREP SITE FW to F , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S15C1

00:00:00 - 0.00 m
Start node type, manhole, reference CORNER PREP SITE FW

S15C2

00:00:00 - 0.00 m
Water level 0% height/diameter

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Pictures - Section No. 15 - CORNER PREP SITE FW to F , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S15C3

00:04:12 - 43.71 m
Finish node type, manhole, reference F , SURG MH (EXPOSED)

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Overview - Section No. 15 - CORNER PREP SITE FW to F , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**43.71 m**
Inspected Length	**43.71 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **3**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**0**
Service/Operational	**0**
Survey Abandoned	**No**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
CORNER PREX	**Downstream**	**CORNER PREP SITE FW**	**F , SURG MH (EXPOSED)**	**Vitrified clay**	**150 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference CORNER PREP SITE FW
0	WL	Water level 0% height/diameter
43.71	MHF	Finish node type, manhole, reference F , SURG MH (EXPOSED)

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Damage Overview - Section No. 15 - CORNER PREP SITE FW to F , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity

There were no structural defects recorded

Service/Operational Defects	Quantity

There were no service/operational defects recorded

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CCTV Inspection - Section No. 16 - CORNER PREP SITE SW to S , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Info	
Contractor's Job Ref.	**SK - S 056-2024**
Pipeline Length Ref.	**CORNER PREX**
Drainage Area	
Division/District	

Location	
Street Name	
Town or Village	
Location Type	
Land Ownership	

Factors	
Date	**09/07/2024**
Time	**15:20 - 15:26**
Weather	**1 - Dry**
Temp.	

Surveyor Details	
Name of Surveyor	Camera System
B. Hughes	**VJ7B51U7GO**

Survey Details					
Purpose of Inspection	Pre Cleaned	Flow Control	Direction	Expected Length	Inspected Length
-	N	-	**Downstream**	**36.34**	**36.34**

Start Node
Ref: **CORNER PREP SITE SW**
Depth: - | Coordinates: -

Drain/Sewer
Sewer Use: **Surface water**
Sewer Type: -
Criticality: - | Year: -

Pipe
Material: **Vitrified clay**
Lining Type: -
Lining Material: -
Shape: -
Diameter: **225**
Unit Length: -

End Node
Ref: **S , SURG MH (EXPOSED)**
Depth: - | Coordinates: -

0.00	MH	Start node type, manhole, reference CORNER PREP SITE SW	00:00:00	S16C1	0
0.00	WL	Water level 0% height/diameter	00:00:00	S16C2	0
29.84	FM	Fracture multiple from 9 to 3 o'clock	00:02:33	S16C3	80 / 1
33.54	FM	Fracture multiple from 12 to 12 o'clock	00:02:57	S16C4	80 / 1
35.39	B	Broken pipe from 12 to 12 o'clock	00:03:11	S16C5	80
36.34	SA	Survey abandoned - Remark: APROX 5M FROM MH EXPOSED ON CORNER OF SURGERY SITE	00:03:32	S16C6	0

General Remarks

Defect	Quantity	Peak	Mean	Total	Grade	Key	
Structural	3	80	6.60	240	4	Structural Defects	Construction Observations
Operational	2	1	0.06	2	2	Service/Operational Defects	Miscellaneous Observations

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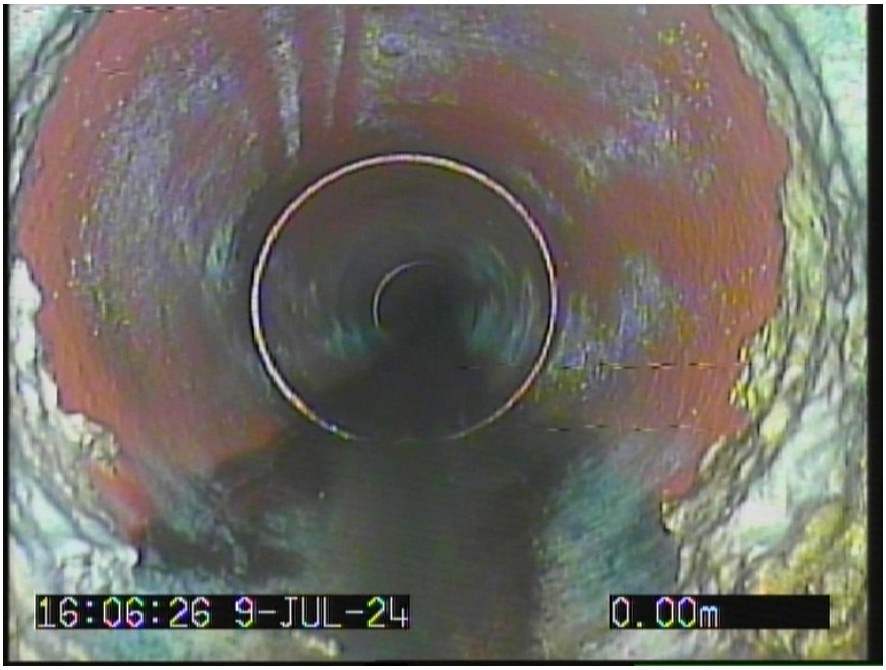
Pictures - Section No. 16 - CORNER PREP SITE SW to S , SURG MH (EXPOSED)

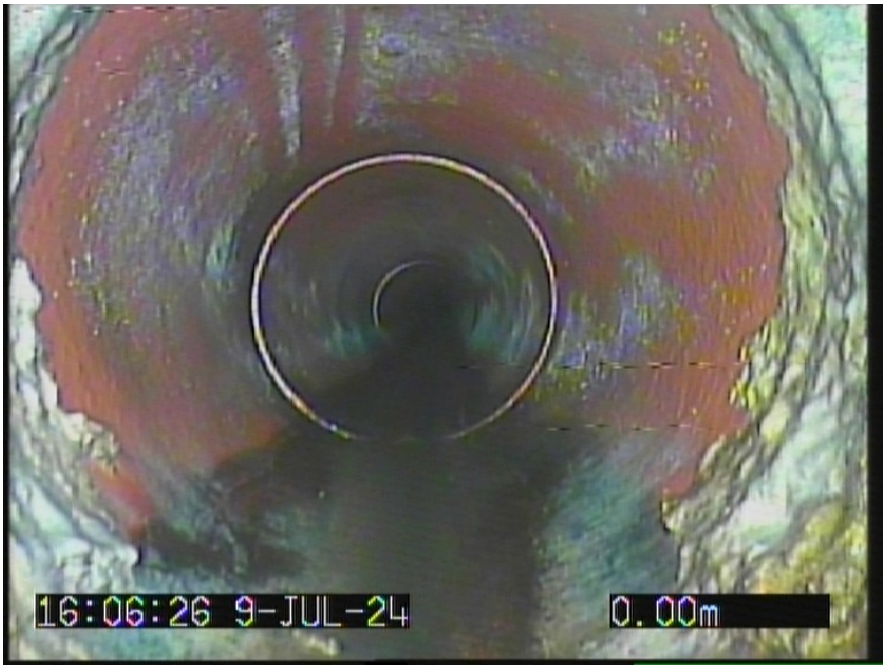
Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S16C1



00:00:00 - 0.00 m
Start node type, manhole, reference CORNER PREP SITE SW

S16C2



00:00:00 - 0.00 m
Water level 0% height/diameter

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Pictures - Section No. 16 - CORNER PREP SITE SW to S , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S16C3

00:02:33 - 29.84 m
Fracture multiple from 9 to 3 o'clock

S16C4

00:02:57 - 33.54 m
Fracture multiple from 12 to 12 o'clock

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Pictures - Section No. 16 - CORNER PREP SITE SW to S , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

S16C5

00:03:11 - 35.39 m
Broken pipe from 12 to 12 o'clock

S16C6

00:03:32 - 36.34 m
Survey abandoned - Remark: APROX 5M FROM MH EXPOSED ON CORNER OF SURGERY SITE

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Overview - Section No. 16 - CORNER PREP SITE SW to S , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Information	
Total Length	**36.34 m**
Inspected Length	**36.34 m**
Not Inspected Length	**0 m**

Resources Collected
Inspection Photos **6**
Inspection Videos **1**
Manhole Photos **0**

Defects Found	
Structural	**3**
Service/Operational	**2**
Survey Abandoned	**Yes**

Work Carried Out	
Pipeline Surveyed	**Yes**
Pipeline Pre Cleaned	**No**
Flow Control Used	**No**

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height
CORNER PREX	**Downstream**	**CORNER PREP SITE SW**	**S , SURG MH (EXPOSED)**	**Vitrified clay**	**225 mm**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference CORNER PREP SITE SW
0	WL	Water level 0% height/diameter
29.84	FM	Fracture multiple from 9 to 3 o'clock
33.54	FM	Fracture multiple from 12 to 12 o'clock
35.39	B	Broken pipe from 12 to 12 o'clock
36.34	SA	Survey abandoned - Remark: APROX 5M FROM MH EXPOSED ON CORNER OF SURGERY SITE

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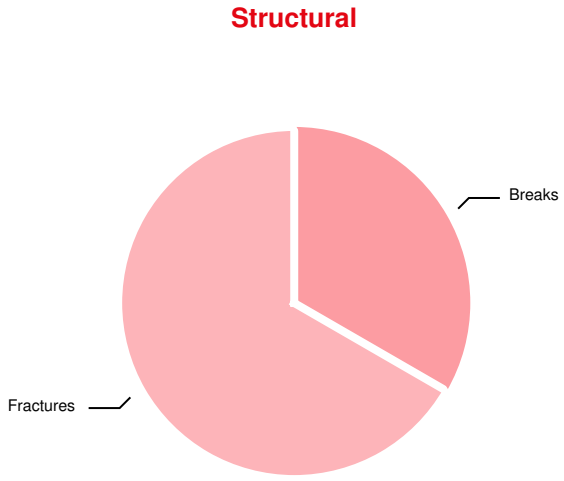
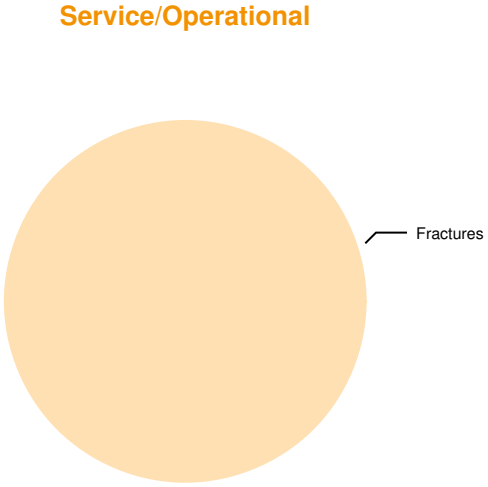
Damage Overview - Section No. 16 - CORNER PREP SITE SW to S , SURG MH (EXPOSED)

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity
Fractures	2
Breaks	1



Service/Operational Defects	Quantity
Fractures	2



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Summary - All Sections

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Sewer Network Information	
Number of Sections	**16**
Total Length	**398.52 m**
Inspected Length	**398.38 m**
Not Inspected Length	**0.13999999999999 m**

Resources Collected
Inspection Photos **89**
Inspection Videos **16**
Manhole Photos **0**
Abandoned Surveys **6**

Section Breakdowns / Data Collections

1 - 3 / 16

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length / Total Length
NODE X	**Upstream**	**2301**	**NODE**	**Vitrified clay**	**150 mm**	**3.8m / 3.8m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference 2301
0	WL	Water level 0% height/diameter
1.72	JD	Joint displaced 15mm
3.12	JD	Joint displaced 20mm
3.8	SA	Survey abandoned - Remark: CRAWLER UNABLE TO PASS JDM

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length / Total Length
NODE X	**Upstream**	**2301**	**NODE**	**Vitrified clay**	**150 mm**	**37.07m / 37.07m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference 2301
0	WL	Water level 10% height/diameter
35.9	REM	MH LOCATED IN FIELD
37.07	SA	Survey abandoned - Remark: UNABLE TO PUSH ROUND MH FINISH 2301A

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length / Total Length
2301 X	**Downstream**	**2301**	**OUTFALL**	**Vitrified clay**	**150 mm**	**23.88m / 24.02m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference 2301
0	WL	Water level 10% height/diameter
0.1	FL	Fracture longitudinal at 9 o'clock - Remark: Possibly been a manhole
0.48	LL	Line of drain/sewer deviates left

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Summary - All Sections

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Breakdowns / Data Collections ...3 - 4 / 16

Meas. from MH (m)	Code	Observation
8.86	CUW	Loss of vision, camera under water, Start
11.67	CUW	Loss of vision, camera under water, Finished
16.69	CUW	Loss of vision, camera under water, Start
19.81	CUW	Loss of vision, camera under water, Finished
22.38	CUW	Loss of vision, camera under water, Start
23.6	CUW	Loss of vision, camera under water, Finished
23.88	MHF	Finish node type, manhole, reference 2301B

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length	13.69m
2301C X	**Downstream**	**2301C**	**2301B**	**Vitrified clay**	**150 mm**	Total Length	**13.69m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference 2301C
0	WL	Water level 0% height/diameter
0.29	CC	Crack circumferential from 7 to 10 o'clock
0.98	RMJ	Roots mass 10% cross-sectional area loss at joint
1.52	RMJ	Roots mass 15% cross-sectional area loss at joint
7.55	JD	Joint displaced 25mm
8.45	FM	Fracture multiple from 4 to 11 o'clock
8.79	FL	Fracture longitudinal at 9 o'clock
13.69	MHF	Finish node type, manhole, reference 2301B

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Summary - All Sections

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Breakdowns / Data Collections 5 - 7 / 16

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length	Total Length
2301B X	**Downstream**	**2301B**	**OUTFALL**	**Vitrified clay**	**150 mm**	**30.86m**	**30.86m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference 2301B
0	WL	Water level 15% height/diameter
8.57	JD	Joint displaced 20mm
11.74	CUW	Loss of vision, camera under water
24.83	REM	Manhole noted in the distance
30.86	MHF	Finish node type, manhole, reference 2301D

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length	Total Length
F , SURG MX	**Downstream**	**F , SURG MH**	**OUTFALL**	**Vitrified clay**	**100 mm**	**15m**	**15m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference F , SURG MH
0	WL	Water level 5% height/diameter
14.24	JN	Junction at 6 o'clock, diameter 100mm - Remark: Back Drop Connection to manhole
15	MHF	Finish node type, manhole, reference OUTFALL

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length	Total Length
MH 56 X	**Downstream**	**MH 56**	**OUTFALL**	**Vitrified clay**	**100 mm**	**13.1m**	**13.1m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference MH 56
0	WL	Water level 0% height/diameter
0.1	REM	Joins another run
1.55	LL	Line of drain/sewer deviates left
11.71	DEX	Other settled deposits 30% cross-sectional area loss - Remark: Waste
13.1	SA	Survey abandoned - Remark: Unable to pass waste

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Summary - All Sections

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Breakdowns / Data Collections 8 - 10 / 16

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length / Total Length
F , SURG MX	**Downstream**	**F , SURG MH (EXPOSED)**	**FIELD MH**	**Vitrified clay**	**100 mm**	**19.4m / 19.4m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference F , SURG MH (EXPOSED)
0	WL	Water level 0% height/diameter
0.36	DEZ	Other attached deposits from 6 to 9 o'clock 5% cross-sectional area loss - Remark CONCRETE, Start
2.05	JD	Joint displaced 20mm
2.95	DEZ	Other attached deposits from 6 to 9 o'clock 5% cross-sectional area loss - Remark CONCRETE, Finished
5.88	JD	Joint displaced 10mm
13.24	JD	Joint displaced 10mm
19.4	MHF	Finish node type, manhole, reference FIELD MH

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length / Total Length
FIELD MH X	**Downstream**	**FIELD MH**	**FIELD MH CORNER**	**Vitrified clay**	**100 mm**	**17.48m / 17.48m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference FIELD MH
0	WL	Water level 0% height/diameter
17.48	MHF	Finish node type, manhole, reference FIELD MH CORNER

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length / Total Length
S , SURG MX	**Downstream**	**S , SURG MH (EXPOSED)**	**FIELD MH CORNER**	**Vitrified clay**	**225 mm**	**35.82m / 35.82m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference S , SURG MH (EXPOSED)
0	WL	Water level 0% height/diameter
35.82	MHF	Finish node type, manhole, reference MH IN CORNER
35.82	REM	MH IN CORNER REPLICATING FOUL LINE

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Summary - All Sections

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Breakdowns / Data Collections 11 - 13 / 16

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length	Total Length
FIELD MH CX	**Downstream**	**FIELD MH CORNER SW**	**FIELD MH 2**	**Vitrified clay**	**225 mm**	**56.19m**	**56.19m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference FIELD MH CORNER SW
0	WL	Water level 0% height/diameter
2.41	DEEJ	Attached deposits, encrustation from 3 to 12 o'clock 10% cross-sectional area loss at joint
4.27	DEEJ	Attached deposits, encrustation from 1 to 12 o'clock 15% cross-sectional area loss at joint
56.19	MHF	Finish node type, manhole, reference MH ON CORNER OF FIELD AGAIN FOLLOWING THE FOUL

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length	Total Length
FIELD MH 2X	**Downstream**	**FIELD MH 2**	**FIELD MH 3**	**Vitrified clay**	**225 mm**	**27.88m**	**27.88m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference FIELD MH 2
0	WL	Water level 0% height/diameter
27.88	MHF	Finish node type, manhole, reference OUTFALL

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length	Total Length
FIELD MH 3X	**Downstream**	**FIELD MH 3**	**OUTFALL**	**Vitrified clay**	**300 mm**	**15.71m**	**15.71m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference FIELD MH 3
0	WL	Water level 0% height/diameter
11.22	JN	Junction at 9 o'clock, diameter 150mm
11.56	OBIJ	Other obstacles protruding through wall at 4 o'clock 20% cross-sectional area loss at joint
14.1	CN	Connection other than junction at 3 o'clock, diameter 150mm - Remark: FRACTURES AROUND THE CONNECTION
15.71	JD	Joint displaced 30mm
15.71	SA	Survey abandoned - Remark: UNABLE TO PROCEED DEBRIS AND DEFECT

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Summary - All Sections

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Section Breakdowns / Data Collections 14 - 16 / 16

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length	Total Length
S, SURG MHX	**Downstream**	**S, SURG MH**	**S , SURG MH (EXPOSED)**	**Vitrified clay**	**100 mm**	**8.45m**	**8.45m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference S, SURG MH
0	WL	Water level 0% height/diameter
4.21	DEZ	Other attached deposits from 4 to 8 o'clock 25% cross-sectional area loss - Remark CEMENT, Start
8.45	DEZ	Other attached deposits from 4 to 8 o'clock 25% cross-sectional area loss - Remark CEMENT, Finished
8.45	SA	Survey abandoned - Remark: DEBRIS

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length	Total Length
CORNER PREX	**Downstream**	**CORNER PREP SITE FW**	**F , SURG MH (EXPOSED)**	**Vitrified clay**	**150 mm**	**43.71m**	**43.71m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference CORNER PREP SITE FW
0	WL	Water level 0% height/diameter
43.71	MHF	Finish node type, manhole, reference F , SURG MH (EXPOSED)

Pipeline Length Ref.	Direction	Upstream Node	Downstream Node	Pipe Material	Dia/Height	Inspected Length	Total Length
CORNER PREX	**Downstream**	**CORNER PREP SITE SW**	**S , SURG MH (EXPOSED)**	**Vitrified clay**	**225 mm**	**36.34m**	**36.34m**

Meas. from MH (m)	Code	Observation
0	MH	Start node type, manhole, reference CORNER PREP SITE SW
0	WL	Water level 0% height/diameter
29.84	FM	Fracture multiple from 9 to 3 o'clock
33.54	FM	Fracture multiple from 12 to 12 o'clock
35.39	B	Broken pipe from 12 to 12 o'clock
36.34	SA	Survey abandoned - Remark: APROX 5M FROM MH EXPOSED ON CORNER OF SURGERY SITE

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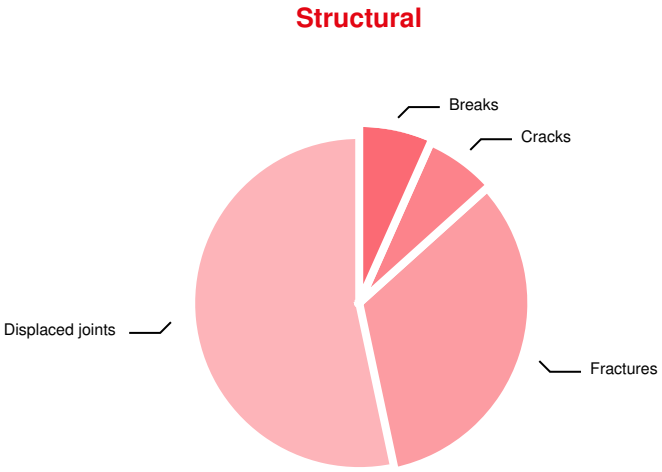
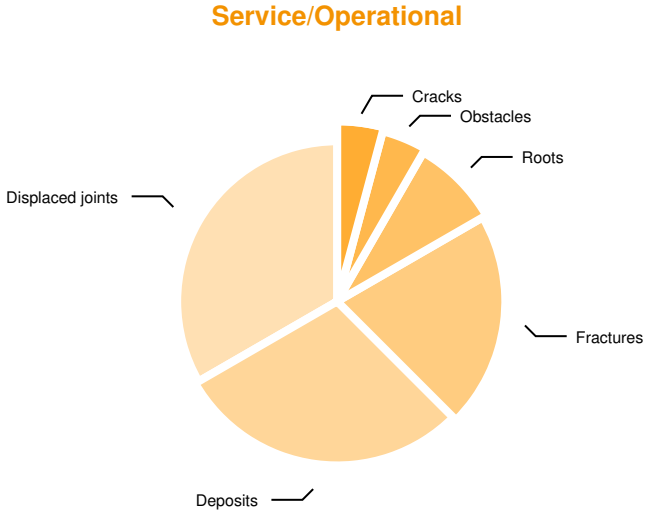
Damage Overview - All Sections

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Structural Defect	Quantity
Displaced joints	8
Fractures	5
Cracks	1
Breaks	1



Service/Operational Defects	Quantity
Displaced joints	8
Deposits	7
Fractures	5
Roots	2
Obstacles	1
Cracks	1



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Inspection Summary

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Node		Section		Expected	Defects							
From	To	Height (mm)	Length (m)	Length (m)	JD	F	C	R	DE	OB	B	Total
2301	NODE	150	3.80	3.80	2	0	0	0	0	0	0	2
2301	NODE	150	37.07	37.07	0	0	0	1	0	0	0	1
2301	OUTFALL	150	23.88	24.02	0	1	6	0	0	0	0	7
2301C	2301B	150	13.69	13.69	1	2	1	2	0	0	0	6
2301B	OUTFALL	150	30.86	30.86	1	0	1	1	0	0	0	3
F , SURG MH	OUTFALL	100	15.00	15.00	0	0	0	0	0	0	0	0
MH 56	OUTFALL	100	13.10	13.10	0	0	0	1	1	0	0	2
F , SURG MH (...	FIELD MH	100	19.40	19.40	3	0	0	0	2	0	0	5
FIELD MH	FIELD MH CO...	100	17.48	17.48	0	0	0	0	0	0	0	0
S , SURG MH (...	FIELD MH CO...	225	35.82	35.82	0	0	0	1	0	0	0	1
FIELD MH CO...	FIELD MH 2	225	56.19	56.19	0	0	0	0	2	0	0	2
FIELD MH 2	FIELD MH 3	225	27.88	27.88	0	0	0	0	0	0	0	0
FIELD MH 3	OUTFALL	300	15.71	15.71	1	0	1	0	0	1	0	3
S, SURG MH	S , SURG MH (...	100	8.45	8.45	0	0	0	0	2	0	0	2
CORNER PRE...	F , SURG MH (...	150	43.71	43.71	0	0	0	0	0	0	0	0
CORNER PRE...	S , SURG MH (...	225	36.34	36.34	0	2	0	0	0	0	1	3
Total			398.38	398.52	8	5	9	6	7	1	1	37

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Remarks Summary

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Job Details and Remarks

Total distance inspected	Engineer	Number of Surveys	Number of Grade 4/5 Surveys
60.8	**B. Hughes**	**16**	**16**

PLEASE REFER TO SURVEYS FOR FURTHER INFORMATION

Survey 1 - 2301 to NODE (09/04/2024)

Pipe Length: **3.80m**
Inspection Length: **3.80m**
Structural Grade: **4**
Service Grade: **0**
Material: **Vitrified clay**
Pipe Size: **150mm**
Use: **Combined**

Survey abandoned as the camera could not pass the displaced joint.

Survey 2 - 2301 to NODE (09/04/2024)

Pipe Length: **37.07m**
Inspection Length: **37.07m**
Structural Grade: **0**
Service Grade: **0**
Material: **Vitrified clay**
Pipe Size: **150mm**
Use: **Combined**

Camera under water due to flow. Manhole located at 35.9m in a field.

Survey 3 - 2301 to OUTFALL (09/04/2024)

Pipe Length: **24.02m**
Inspection Length: **23.88m**
Structural Grade: **3**
Service Grade: **0**
Material: **Vitrified clay**
Pipe Size: **150mm**
Use: **Combined**

This section has areas of standing water. The fracture at the start could be a repair to a manhole.

Survey 4 - 2301C to 2301B (09/04/2024)

Pipe Length: **13.69m**
Inspection Length: **13.69m**
Structural Grade: **4**
Service Grade: **3**
Material: **Vitrified clay**
Pipe Size: **150mm**
Use: **Combined**

Root ingress noted at 0.98 and 1.52m.Joint displaced 7.55m, 0.29m. Fractured at 8.45m.

Survey 5 - 2301B to OUTFALL (09/04/2024)

Pipe Length: **30.86m**
Inspection Length: **30.86m**
Structural Grade: **4**
Service Grade: **0**
Material: **Vitrified clay**
Pipe Size: **150mm**
Use: **Combined**

Camera under water most of the way due to the flow. Displaced joint noted at 8.57m. Manhole noted at 24.83m.

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Remarks Summary

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Survey 6 - F , SURG MH to OUTFALL (09/04/2024)

Pipe Length: **15.00m**
Inspection Length: **15.00m**
Structural Grade: **0**
Service Grade: **0**
Material: **Vitrified clay**
Pipe Size: **100mm**
Use: **Foul**

Back drop connection to the manhole.

Survey 7 - MH 56 to OUTFALL (09/04/2024)

Pipe Length: **13.10m**
Inspection Length: **13.10m**
Structural Grade: **0**
Service Grade: **4**
Material: **Vitrified clay**
Pipe Size: **100mm**
Use: **Foul**

Survey abandoned due to amount of waste in the pipe run.

Survey 8 - F , SURG MH (EXPOSED) to FIELD MH (03/07/2024)

Pipe Length: **19.40m**
Inspection Length: **19.40m**
Structural Grade: **4**
Service Grade: **2**
Material: **Vitrified clay**
Pipe Size: **100mm**
Use: **Foul**

CONCRETE AT THE START. FEW DISPLACED JOINTS

Survey 9 - FIELD MH to FIELD MH CORNER (03/07/2024)

Pipe Length: **17.48m**
Inspection Length: **17.48m**
Structural Grade: **0**
Service Grade: **0**
Material: **Vitrified clay**
Pipe Size: **100mm**
Use: **Foul**

OK

Survey 10 - S , SURG MH (EXPOSED) to FIELD MH CORNER (03/07/2024)

Pipe Length: **35.82m**
Inspection Length: **35.82m**
Structural Grade: **0**
Service Grade: **0**
Material: **Vitrified clay**
Pipe Size: **225mm**
Use: **Surface water**

WOULD BENEFIT FROM A CLEAN WITH A JET VAC

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Remarks Summary

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Survey 11 - FIELD MH CORNER SW to FIELD MH 2 (03/07/2024)

Pipe Length: **56.19m**
Inspection Length: **56.19m**
Structural Grade: **0**
Service Grade: **3**
Material: **Vitrified clay**
Pipe Size: **225mm**
Use: **Surface water**

ENCRUSTATION AT THE JOINTS AT 2.41M AND 4.27M.

Survey 12 - FIELD MH 2 to FIELD MH 3 (03/07/2024)

Pipe Length: **27.88m**
Inspection Length: **27.88m**
Structural Grade: **0**
Service Grade: **0**
Material: **Vitrified clay**
Pipe Size: **225mm**
Use: **Surface water**

APPEARS OK

Survey 13 - FIELD MH 3 to OUTFALL (03/07/2024)

Pipe Length: **15.71m**
Inspection Length: **15.71m**
Structural Grade: **3**
Service Grade: **5**
Material: **Vitrified clay**
Pipe Size: **300mm**
Use: **Surface water**

NEEDS A CLEAN IN ORDER TO SURVEY FURTHER

Survey 14 - S, SURG MH to S , SURG MH (EXPOSED) (03/07/2024)

Pipe Length: **8.45m**
Inspection Length: **8.45m**
Structural Grade: **0**
Service Grade: **4**
Material: **Vitrified clay**
Pipe Size: **100mm**
Use: **Surface water**

DEBRIS PREVENTED PROGRESS

Survey 15 - CORNER PREP SITE FW to F , SURG MH (EXPOSED) (09/07/2024)

Pipe Length: **43.71m**
Inspection Length: **43.71m**
Structural Grade: **0**
Service Grade: **0**
Material: **Vitrified clay**
Pipe Size: **150mm**
Use: **Foul**

OK

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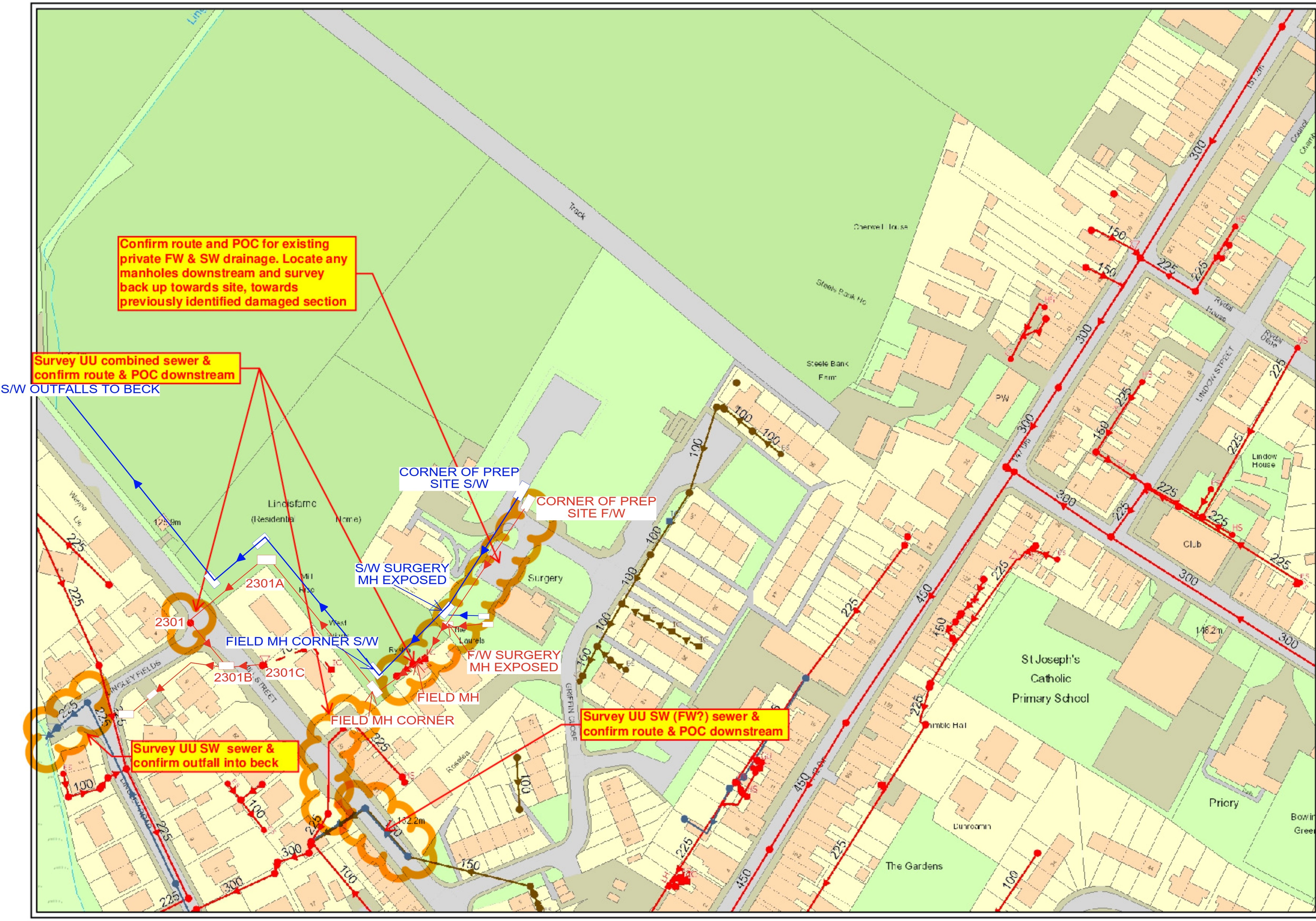
Remarks Summary

Client - **THOMAS ARMSTRONG CONSTRUCTION LTD**

Survey 16 - CORNER PREP SITE SW to S , SURG MH (EXPOSED) (09/07/2024)

Pipe Length: **36.34m**
Inspection Length: **36.34m**
Structural Grade: **4**
Service Grade: **0**
Material: **Vitrified clay**
Pipe Size: **225mm**
Use: **Surface water**

UNABLE TO PASS DEFECTS


Confirm route and POC for existing private FW & SW drainage. Locate any manholes downstream and survey back up towards site, towards previously identified damaged section
Survey UU combined sewer & confirm route & POC downstream
S/W OUTFALLS TO BECK
CORNER OF PREP SITE S/W
CORNER OF PREP SITE F/W
S/W SURGERY MH EXPOSED
2301A
2301
FIELD MH CORNER S/W
F/W SURGERY MH EXPOSED
2301B
2301C
FIELD MH
FIELD MH CORNER
Survey UU SW (FW?) sewer & confirm route & POC downstream
Survey UU SW sewer & confirm outfall into beck
Lindisfarne
(Residential Home)
Track
Surgery
Club
St Joseph's
Catholic
Primary School
Priory
The Gardens
Lindow House
LINDOW STREET
GRIFFIN CLOSE
Steele Bank
Farm
Lindow House

United Utilities Maps for SafeDig

Date :	12/12/2023 16:17:50
Centre X:	303384
Centre Y:	517369
Scale :	1250
UserName:	RGP4RK1NS

Extract from maps of United Utilities' Underground Assets

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private service pipes may be shown by a blue broken line. United Utilities Water will not accept liability for any damage caused by the actual position being different from those shown.

United Utilities
Water for the North West