



**MILLFIELD WORKS, GRANGFIELD ROAD,
STOCKTON-ON-TEES**
DRAINAGE ASSESSMENT
Final Report v1.0

June 2018

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Report Title: **Millfield Works, Grangefield Road, Stockton-on-Tees**
Drainage Assessment
Final Report v1.0

Client: T J Thomson and Son Ltd

Date of Issue: 14 June 2018

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1 INTRODUCTION

1.1 PURPOSE OF REPORT

Weetwood Services Ltd ('Weetwood') has been instructed by T J Thomson and Son Ltd to prepare a Drainage Assessment (DA) report to accompany an outline planning application for the proposed redevelopment of the Millfield Works, Stockton-on-Tees.

The assessment has been undertaken in accordance with the requirements of the National Planning Policy Framework (NPPF) and supporting Planning Practice Guidance (PPG).

The report should be read in conjunction with the Flood Risk Assessment report prepared by Weetwood which addresses flood risk for the proposed redevelopment (ref: 'Flood Risk Assessment – Millfield Works, Grangefield Road, Stockton-on-Tees; Final Report v1.0, June 2018').

1.2 STRUCTURE OF THE REPORT

The report is structured as follows:

- Section 1** Introduction and report structure
- Section 2** Presents national and local flood risk and drainage planning policy
- Section 3** Provides background information relating to the development site, the development proposals, ground conditions and existing site access arrangements
- Section 4** Assesses the effect of the proposed development on foul water infrastructure and determines a suitable point of connection for foul water from the proposed development
- Section 5** Addresses the effect of the proposed development on surface water runoff to ensure that surface water runoff is sustainably managed and flood risk is not increased elsewhere
- Section 6** Presents a summary of key findings and recommendations

2 PLANNING POLICY AND GUIDANCE

2.1 NATIONAL PLANNING POLICY

The aim of the NPPF is to ensure that flood risk is taken into account at all stages in the planning process and is appropriately addressed.

2.2 LOCAL PLANNING POLICY AND GUIDANCE

Stockton-on-Tees Borough Council's Publication Draft Local Plan (September 2017) was submitted to the Planning Inspectorate on 21 December 2017, and is currently under examination to determine whether the Local Plan is sound. The following policy is relevant in respect of drainage:

'Policy ENV4 – Reducing and Mitigating Flood Risk' states, in part:

- 1. Development proposals will be designed to ensure:*
 - a. They will be safe over the lifetime of the development, taking account of climate change;*
 - b. Flood risk is not increased elsewhere and will where possible, reduce flood risk overall;*
 - c. Foul and surface water flows are separated;*
 - d. Sustainable Drainage Systems (SuDS) are prioritised; and*
 - e. SuDS accord with the Tees Valley Authorities Local Standards for Sustainable Drainage (2015).*
- 2. Surface water runoff should be managed at source wherever possible and disposed of in the following hierarchy of preference sequence:*
 - a. To an infiltration or soakaway system; then,*
 - b. To a watercourse open or closed; then,*
 - c. To a sewer.*
- 3. Disposal to combined sewers should be the last resort once all other methods have been explored.*
- 4. For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event. For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.*
- 5. Within critical drainage areas or other areas identified as having particular flood risk issues the Council may:*
 - a. Support reduced runoff rates.*
 - b. Seek contributions, where appropriate, towards off-site enhancements directly related to flow paths from the development, to provide increased flood risk benefits to the site and surrounding areas.*
- 6. The incorporation of SuDS should be integral to the design process and be integrated with green infrastructure. Where SuDS are provided arrangements must be put in place for their whole life management and maintenance.*

7. *Through partnership working the Council will work to achieve the goals of the Stockton-on-Tees Local Flood Risk Management Strategy and Northumbria Catchment Flood Management Plan. This will include the implementation of schemes to reduce the risk of flooding to existing properties and infrastructure. Proposals which seek to mitigate flooding, create natural flood plans or seek to enhance and/or expand flood plains in appropriate locations will be permitted.*
8. *To reduce the risk of flooding the Council is working in partnership with the Environment Agency (EA) to deliver a Flood Alleviation Scheme on Lustrum Beck.*

2.3 REQUIREMENTS FOR SUSTAINABLE DRAINAGE SYSTEMS

Planning applications for major developments¹ are required² to provide Sustainable Drainage Systems (SuDS) for the management of surface water runoff, unless demonstrated to be inappropriate³ or disproportionately expensive.

SuDS aim to mimic natural drainage and can achieve multiple objectives such as removing pollutants from urban runoff at source, controlling surface water runoff from developments, and ensuring that flood risk is not increased downstream. Combining water management with green space can provide amenity and biodiversity enhancement.

In considering a development that includes a sustainable drainage system, the local planning authority will want to be satisfied that the proposed minimum standards of operation are appropriate and that there are clear arrangements in place for ongoing maintenance.

Non-statutory technical standards published by DEFRA⁴ state that surface water drainage systems must be designed so that:

- *Flooding does not occur on any part of the site for a 1 in 30 annual probability rainfall event, unless an area is designed to hold and/or convey water as part of the design;*
- *Flooding does not occur in any part of a building during a 1 in 100 annual probability event; and*
- *Flows resulting from rainfall in excess of a 1 in 100 annual probability rainfall event are managed in exceedance routes that minimise the risks to people and property, so far as is reasonably practicable.*
- *For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.*
- *Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be*

¹ Developments of 10 dwellings or more; or equivalent non-residential or mixed development (as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010)

² Written Statement (HCWS161) made by the Secretary of State for Communities and Local Government (Mr Eric Pickles) on 18 December 2014

³ Paragraph 082 (Reference ID: 7-082-20150323) of the Planning Practice Guidance outlines how a sustainable drainage system might be judged to be inappropriate

⁴ Non-Statutory Technical Standards for Sustainable Drainage Systems, Defra, March 2015

constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event

- *Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body, the runoff volume must be discharged at a rate that does not adversely affect flood risk.*
- *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.*
- *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.*
- *The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.*

2.4 CONSENTS

An Environmental Permit for Flood Risk Activities may be required from the Environment Agency (EA) for work:

- In, under, over or near a main river (including where the river is in a culvert)
- On or near a flood defence on a main river
- In the flood plain of a main river
- On or near a sea defence

Further information can be found at the gov.uk website⁵.

Land drainage consent may be required from the Lead Local Flood Authority or Internal Drainage Board for work to an Ordinary Watercourse. Undertaking activities controlled by local byelaws (made under the Water Resources Act 1991) also requires the relevant consent.

2.5 RELEVANT DOCUMENTS

The drainage assessment has been informed by the Tees Valley Authorities Local Standards for Sustainable Drainage (July 2015).

⁵ <https://www.gov.uk/guidance/flood-risk-activities-environmental-permitS>

3 SITE DETAILS AND PROPOSED DEVELOPMENT

3.1 SITE LOCATION

The former Millfield Works is located at Ordnance Survey National Grid Reference NZ 437 191, as shown in **Figure 1**.



Figure 1: Site Location

3.2 EXISTING AND PROPOSED DEVELOPMENT

The 19.9 ha site is occupied by a former scrap metal merchant and processing facility (the Millfield Works). The industrial warehouses and former railway lines utilised for the transportation of materials on and off site have recently been demolished/removed; the main office buildings are still erect. The northern boundary, western and southern parts of the site comprise of dense vegetation and trees.

The development proposals (**Appendix A**) entail the demolition of the remaining office buildings and the erection of up to 600 residential dwellings with means of site access. The extent of the development platform is shown on **Figure 1**; the vegetated areas to the west of the site will remain as existing.

The proposed primary access is off Grangefield Road via the existing works entrance, with two potential secondary access points (pedestrian, cycle and emergency vehicles only) off Riley Street and Britannia Road.

3.3 WATERBODIES IN THE VICINITY OF THE SITE

Lustrum Beck flows in a northerly direction through the western portion of the site. The beck flows into the River Tees approximately 3.5 km east of the site.

A culverted watercourse crosses the site in a northerly direction before outfalling via a public sewer to Lustrum Beck at Brown's Bridge. The alignment of the watercourse, as determined from drainage records, surveys and historical mapping, is shown on **Figure 2**. Historical mapping suggests that the watercourse was culverted to facilitate development of the site during the late 1800's (see **Section 5.1**).



Figure 2: Location of Waterbodies

3.4 GROUND CONDITIONS

A geoenvironmental appraisal report⁶ of the site issued in September 2017 indicates that the site is underlain by made ground to a depth of 6.5 metres below ground level (m bgl) underlain by Glaciolacustrine clays to 10.0 m bgl.

According to British Geological Survey (BGS) mapping, ground conditions at the site comprise of clay and silt (Glaciolacustrine Deposits, Devensian) underlain by Sandstone (Sherwood Sandstone Group).

⁶ Geoenvironmental Appraisal Report of Former Millfield Works, Stockton-on-Tees, Sirius Geotechnical and Environmental Ltd, Report C7333, September 2017

3.5 SITE LEVELS

A topographic survey of the site is provided in **Appendix B**. The survey data and LiDAR data have been utilised to develop a digital terrain model (DTM) of the site and wider area respectively (as illustrated in **Figure 3** and **Figure 4**).

The DTM indicates that elevation levels are highest in the north-eastern, eastern and central portions of the site, with levels sloping down towards the north, south and west. Site levels generally range between approximately 10.4 – 14.3 metres Above Ordnance Datum (m AOD); levels within the western portion of the site range between 4.7 – 22.1 m AOD. Levels adjacent to the northern boundary of the site steeply slope down to approximately 7.5 m AOD.

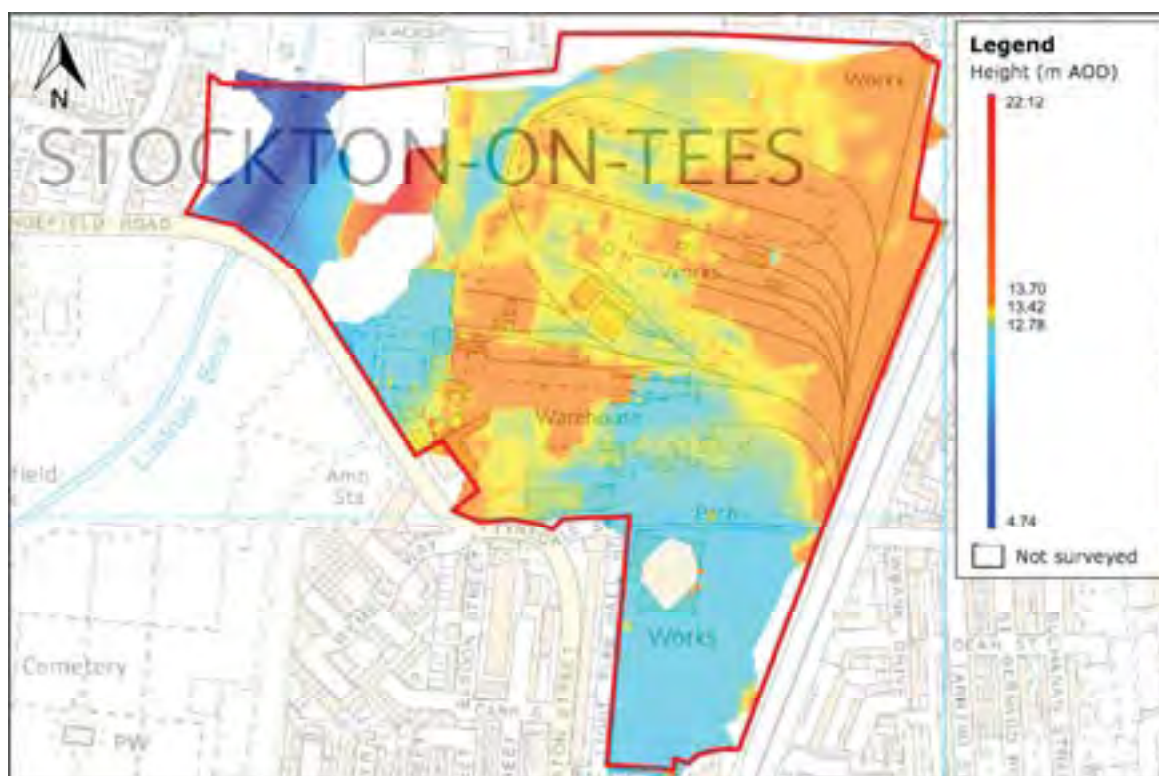


Figure 3: Digital Terrain Model

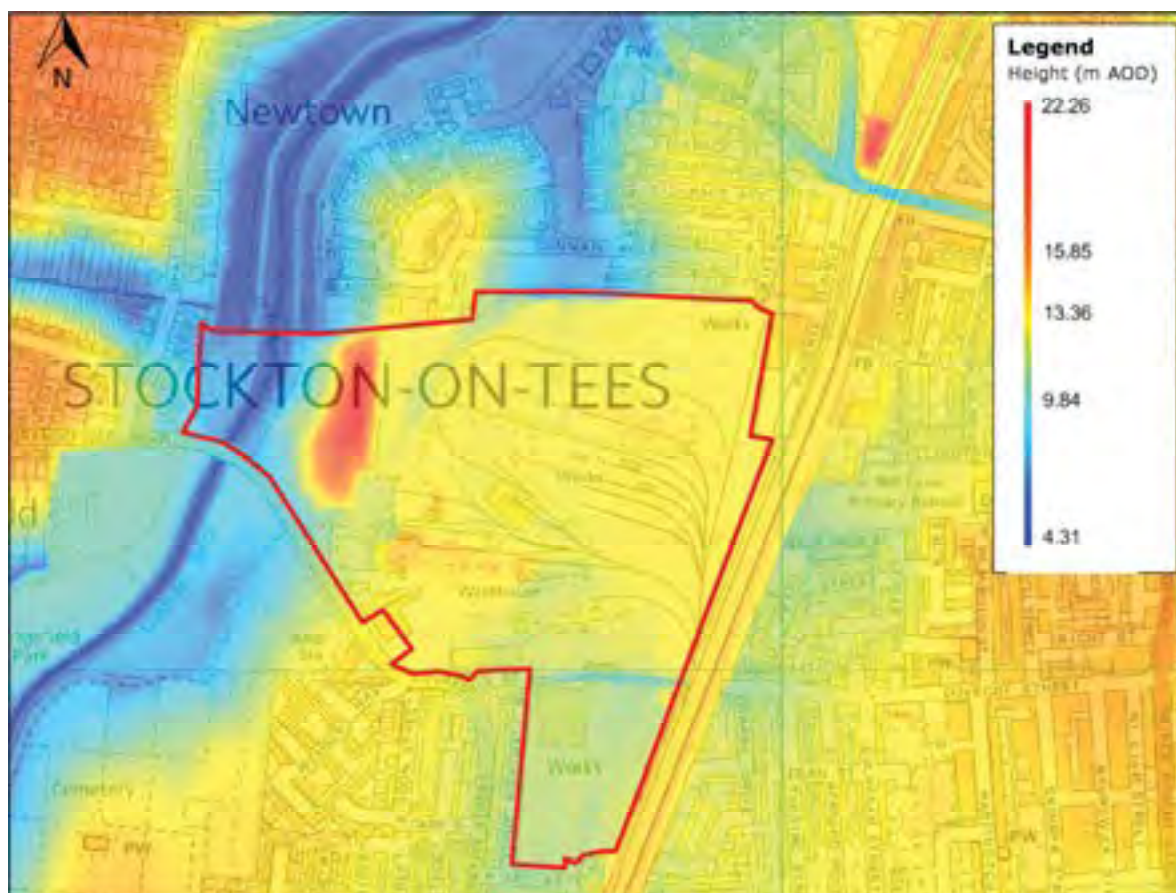


Figure 4: Digital Terrain Model from EA LiDAR

4 FOUL WATER ASSESSMENT

4.1 EXISTING WASTEWATER INFRASTRUCTURE

NWL records (see **Appendix C** and extract in **Figure 5**) indicate that there is a 525 mm and a 1200 x 800 mm diameter public combined sewer on-site to the west of Lustrum Beck.

The records indicate that the immediate area surrounding the site is served by a combined sewer network.

4.2 EXISTING TRADE EFFLUENT LICENCE

Millfield Works holds a trade effluent licence for the discharge of trade effluent to the public combined sewer in Grangefield Road at a maximum rate of 30 l/s. Based on NWL records and an on-site drainage survey (see **Appendix D**), effluent from the existing site is expected to be disposed of at or between manholes 5001, 5002 and 4101 (see **Figure 5**).

4.3 FOUL LOADING ESTIMATE

The projected foul flow from 600 dwellings has been calculated to be 27.8 l/s based on a domestic water consumption of 4000 litres/dwelling/day (from Sewers for Adoption 7th Edition, as stipulated by Northumbrian Water).

4.4 POINT OF CONNECTION

NWL has confirmed, by way of letter dated 3 May 2018 (see **Appendix E**) that there is existing capacity in the local foul sewerage network to receive and treat foul flows from the proposed development⁷. In addition, foul water can discharge without restriction into the 225 mm diameter combined sewer along Grangefield Road at manhole 5001.

Based on NWL records, a gravity connection is expected to be feasible given the depth of the 225 mm diameter combined sewer and its proximity to the site. This would be confirmed at the detailed design stage.

4.5 OFF-SITE INFRASTRUCTURE REINFORCEMENT

NWL has confirmed that no off-site reinforcement of the sewer network or receiving wastewater treatment works is required to facilitate the proposed development.

4.6 DIVERSIONS, EASEMENTS & RIGHTS OF WAY

According to the public sewer maps, no public foul water infrastructure is located within the development platform. As such, there should be no constraints to the proposed development due to diversionary works or easements.

⁷ Enquiries to Northumbrian Water Ltd have been based on the original development proposals of up to 500 residential dwellings

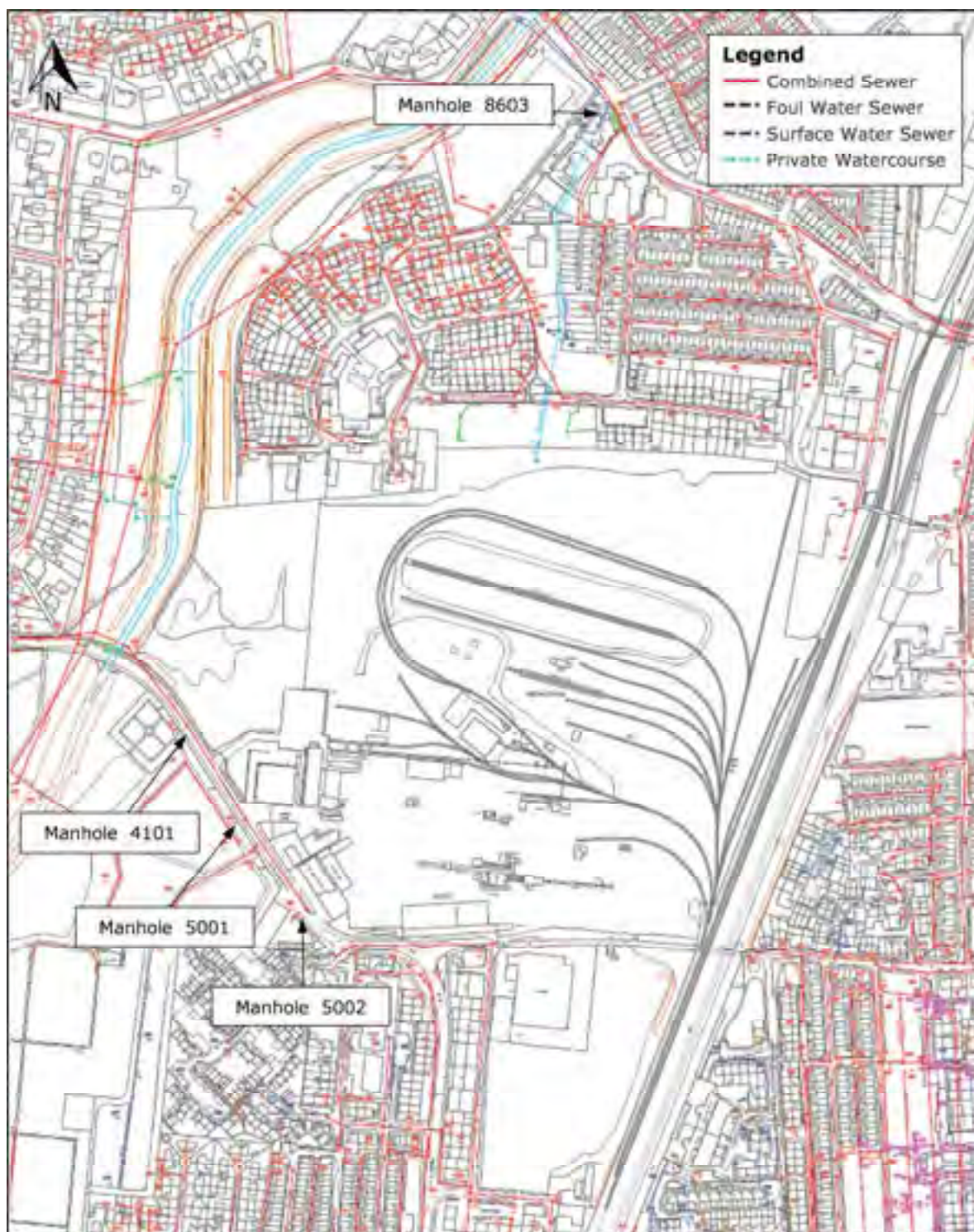


Figure 5: Existing Sewerage Infrastructure

5 SURFACE WATER MANAGEMENT

5.1 SURFACE WATER DRAINAGE AT THE EXISTING SITE

Historical mapping in 1857 indicates the presence of a spring fed watercourse originating towards the south of the site and flowing in a northerly direction. Mapping in 1893 indicates the presence of a steel works (the Moor Steel and Iron Works) on-site with the watercourse originating from the north of the site. Based on this, it is presumed that the watercourse was culverted to facilitate the construction of the new works in the early 1870's.

Drainage surveys undertaken in 1983 and amended in 2001 (see **Appendix D**) and in May 2018 (refer **Appendix F**) indicate that the watercourse is still culverted through the site, commencing from a point in the central southern part of the site as shown on **Figure 1**. The watercourse does not appear to receive any flow from outside of the site boundary and only takes flow from site runoff.

Northumbrian Water Limited (NWL) records (see **Appendix C**) indicate that a culverted watercourse extends along its historical course in a northerly direction before outfalling into Lustrum Beck at Brown's Bridge via a public surface water sewer.

The 2018 drainage survey indicates that the historic culvert has been extended from its original point of origin towards the southern portion of the site in order to facilitate surface water drainage in the southern part of the site.

The 2018 survey further indicates that the culvert is 450 mm in diameter from the south of the site at MH11 (see **Appendix F**) to MH8603 (see **Figure 5**).

The 1983 drainage survey also indicates that surface water runoff within the south-western portion of the site is disposed of via the public combined sewer in Grangefield Road at manholes 5001, 5002 and 4101 (see **Figure 5**).

The drainage surveys indicate that approximately 3.65 ha of impermeable areas are positively drained; surface water runoff from approximately 2.5 ha impermeable surfaces discharge to the watercourse, and 1.15 ha impermeable surfaces discharge to the combined sewer. There are no on-site surface water attenuation storage facilities and surface water runoff discharges to the watercourse and combined sewer at unrestricted rates.

5.2 SURFACE WATER DRAINAGE AT THE REDEVELOPED SITE

5.2.1 Disposal of Surface Water

In accordance with the PPG⁸, surface water runoff should be disposed of according to the following hierarchy: Into the ground (infiltration); To a surface water body; To a surface water sewer, highway drain, or another drainage system; To a combined sewer.

As discussed in **Section 3.4**, the site is underlain by up to 6.5 m of made ground underlain by Glaciolacustrine clays up to 10.0 m bgl. As such, disposal of surface water runoff by way of infiltration is not assessed to be appropriate.

⁸ Paragraph 080, Reference ID: 7-080-20150323

It is therefore proposed to direct all surface water runoff from impermeable surfaces of the redeveloped site to the on-site watercourse. Runoff from the south-western portion of the site will thus be removed from the public combined sewer.

5.2.2 Post Development Impermeable Area

The development platform has an area of approximately 17.0 ha. The post development percentage of impermeable surfaces at the site has been conservatively estimated to be 10.2 ha (60%). This includes an additional 10% to allow for urban creep.

5.2.3 Peak Flow Control

It is proposed to restrict surface water runoff from impermeable surfaces at the redeveloped site to Q_{bar} (3.7 l/s/ha).

The greenfield runoff rate for the site has been calculated using the ICP SUDS method within MicroDrainage (**Table 1**). Details of the input parameters and the output results are provided in **Appendix G**.

Table 1: Greenfield Runoff Rate

Annual probability of rainfall event	Greenfield Runoff Rate (l/s/ha)
1 in 1	3.2
Q_{bar}	3.7
1 in 30	6.4
1 in 100	7.6

5.2.4 Managing Surface Water within the Development

Attenuation storage will be provided to restrict surface water runoff generated across the proposed roof and hardstanding surfaces.

The attenuation storage facility has been modelled using the Detailed Design module of MicroDrainage Source Control (**Appendix H**). The required storage volume has been sized to store the 1 in 100 annual probability rainfall event including a 20% increase in rainfall intensity in order to allow for climate change in accordance with EA guidance⁹.

Assuming a peak discharge rate of 62.9 l/s (i.e. 3.7 l/s/ha), a storage volume of approximately 4,700 m³ would be required. The storage could be accommodated within a 1.3 m depth detention basin (including a 0.3 m freeboard and a side slope of 1 in 3) with a surface area of approximately 5,300 m².

The estimated volume does not take into account storage that would be provided within the on-site surface water conveyance system. As such, the estimated storage volume is indicative and conservative and expected to reduce when the drainage scheme is refined at the discharge of conditions / reserved matters stage.

⁹ Flood Risk Assessments: climate change allowances (<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>)

In practice the storage is likely to be provided in a number of storage facilities. The potential for alternative and/or additional SuDS features (for example, permeable paving, filter drains, filter strips, swales, detention basins and retention basins) and the sizing and location of the storage facilities will be confirmed at the discharge of condition / reserved matters stage.

In accordance with the EA's climate change guidance, a sensitivity analysis has been undertaken using a 40% increase in rainfall intensity in order to allow for uncertainty with respect to climate change (**Appendix I**). An approximate additional volume of 970 m³ would be required during this event; this would be contained within the freeboard of the detention basin with no surface flooding.

5.2.5 Pollution Control

Detention basins can provide water quality benefits via the settlement of pollutants in still or slow moving water, adsorption by the soil, and biological activity. The potential for additional SuDS features to be utilised at the site would be investigated further at the detailed design stage.

5.2.6 Exceedence Routes

Flows resulting from rainfall in excess of the 1 in 100 plus climate change annual probability rainfall event will be managed in exceedence routes. It is assumed that as the development proposals progress, the design of the site would ensure flood flows are directed towards carriageways, with the site being profiled to ensure that flood flows are directed away from built development.

5.2.7 Volume Control

The SuDS Manual (Section 24.10.1 pg 533/534) states that where infiltration is not suitable/feasible, any extra volume generated by the development should be released at a very low rate e.g. 2 l/s/ha and the 1 in 100 annual probability greenfield allowable runoff rate reduced to take account of this extra discharge.

An alternative approach to managing the extra runoff volumes from extreme events separately from the main drainage system is to release all runoff (above the 1 in 1 event) from the site at a maximum rate of 2 l/s/ha or Q_{bar} , whichever is the higher value.

It is proposed to restrict the rate at which surface water is discharged from the site to Q_{bar} . As such, the proposed development would be expected to reduce the risk of flooding downstream.

5.3 MAINTENANCE OF SUDS

SuDS elements within the curtilage of residential dwellings would be the responsibility of the owner of the property.

Surface water pipes built to adoptable standards (Sewers for Adoption 7th Edition) may be offered for adoption by NWL. Detention basins and other SuDS features may be maintained by a management company. An indicative maintenance schedule for a detention basin is provided in **Table 2**.

Table 2: Indicative SuDS Maintenance Schedule

Schedule	Action	Frequency
Detention Basin		
Regular maintenance	Litter and debris removal	Monthly, or as required
	Grass cutting – meadow grass in and around basin	Bi-annually (spring and autumn)
	Manage other vegetation and remove nuisance plants	Monthly for 3 months, then as required
	Tidy all dead growth before start of growing season	Annually
	Inspect inlets/outlets for blockages and clear if required	Monthly
	Inspect banksides for physical damage	Monthly
Occasional maintenance	Re-seed areas of poor vegetation growth	Annually, or as required
	Prune and trim trees and remove cuttings	Biennial, or as required
	Remove sediment from basin	Every 5 years, or as required
Remedial actions	Repair erosion or other damage	As required
	Re-level uneven surfaces and reinstate design levels	As required
	Repair inlets/outlets	As required

6 SUMMARY AND RECOMMENDATIONS

This drainage assessment has been prepared on behalf of T J Thomson and Son Ltd and relates to the proposed redevelopment of the Millfield Works, Stockton-on-Tees.

The report should be read in conjunction with the Flood Risk Assessment report prepared by Weetwood which addresses flood risk for the proposed development (ref: 'Flood Risk Assessment – Millfield Works, Grangefield Road, Stockton-on-Tees; Final Report v1.0, June 2018').

A summary of the principal findings and proposals is provided below.

Foul Water

- The peak foul flow rate from the proposed development has been estimated to be 27.8 l/s⁷.
- Northumbrian Water Limited has confirmed that there is capacity in the local foul sewerage network to receive and treat foul flows from the proposed development⁷ and has stated that foul water can discharge into the 225 mm diameter combined sewer along Grangefield Road.

Surface Water

- Surface water runoff from the site currently drains unrestricted to the culverted watercourse that crosses the site and to the public combined sewer in Grangefield Road.
- Disposal of surface water by infiltration is assessed to be impracticable due to ground conditions. It is therefore proposed to dispose of surface water to the on-site culverted watercourse. Runoff will be removed from the public combined sewer.
- The surface water drainage strategy proposes that surface water runoff from impermeable surfaces at the redeveloped site will be restricted to Q_{bar} (3.7 l/s/ha).
- For the purposes of this assessment, it is assumed that the attenuation storage would be provided above ground e.g. by a single detention basin.
- In practice, it is likely that storage would be provided by a number of facilities.
- It is recommended that the culverted watercourse is cleared and cleaned, followed by a condition survey prior to the commencement of development.
- Details of the surface water drainage system are to be confirmed at the discharge of conditions / reserved matters stage.

This Drainage Assessment has demonstrated that surface water from impermeable surfaces and foul water from the developed site can be managed without conflicting with the requirements of the NPPF and accompanying PPG.

APPENDIX A:

Development Proposals



0 5 10 20
m

North/south spine road to align with route of existing culvert (approximate routing based on available information shown dotted and to be determined following further intrusive pre-construction investigations and subsequent infrastructure drainage design development).

emergency access

primary access

Extra Care / Concierge Plus over-55s Apartment Building 60no. apartments @ 61+m2 gfa with ground floor services.

- Blue square: 60 no. over-55s apartments @ 61+m2 gfa with ground floor services.
- Green square: 60 no. over-55s apartments @ 61+m2 gfa with ground floor services.
- Purple square: 60 no. over-55s apartments @ 61+m2 gfa with ground floor services.
- Yellow square: 60 no. over-55s apartments @ 61+m2 gfa with ground floor services.
- Light blue square: 60 no. over-55s apartments @ 61+m2 gfa with ground floor services.
- Light green square: 60 no. over-55s apartments @ 61+m2 gfa with ground floor services.
- Light purple square: 60 no. over-55s apartments @ 61+m2 gfa with ground floor services.
- Light yellow square: 60 no. over-55s apartments @ 61+m2 gfa with ground floor services.
- Light cyan square: 60 no. over-55s apartments @ 61+m2 gfa with ground floor services.

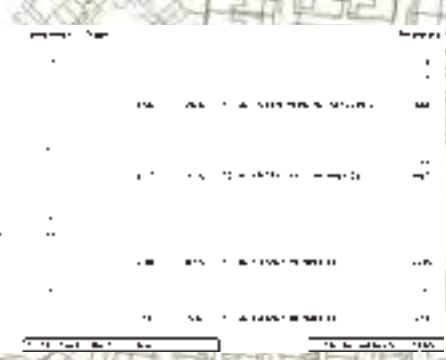
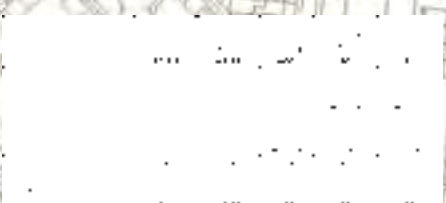
phase 2
phase 1

phase 2
phase 1

phase 1
phase 3

secondary access

phase 1
phase 3



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APPENDIX B:

Topographic Survey



APPENDIX C:

Northumbrian Water Ltd Sewer Records