Hurricane Close, Sherburn-in-Elmet

Flood Risk Assessment and Drainage Strategy

June 2016

Waterco Ltd, Eden Court, Lon Parcwr Business Park, Ruthin, Denbighshire LL15 1NJ
Tel: 01824 702220 **Email:** enquiries@waterco.co.uk **Web:** www.waterco.co.uk

DOCUMENT VERIFICATION RECORD

CLIENT:	REC Ltd
SCHEME:	Proposed new build extension to the Kingspan building off Hurricane Close, Sherburn–in–Elmet – Flood Risk Assessment and Drainage Strategy
INSTRUCTION:	The instruction to carry out this Flood Risk Assessment & Drainage Strategy was received from Ms Sabine Sargeant of REC Ltd.

DOCUMENT REVIEW & APPROVAL

AUTHOR:	Jordan Jones BSc (Hons)
CHECKER:	Joshua Rigby BSc (Hons)
APPROVER:	Aled Williams BSc (Hons)

ISSUE HISTORY

ISSUE DATE	COMMENTS
15/06/2016	First issue

Contents

Appendices

Introduction

Waterco Consultants have been commissioned to undertake a Flood Risk Assessment (FRA) and Drainage Strategy to support the planning application in respect of a proposed new build extension to the Kingspan building off Hurricane Close, Sherburn–in–Elmet.

The purpose of this report is to outline the potential flood risk to the site, the impact of the proposed development on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate the identified flood risk. The report has been prepared in accordance with National Planning Practice Guidance (NPPG).

In accordance with NPPG a FRA is required as the development site is greater than 1ha.

From 6th April 2015, North Yorkshire County Council as a Lead Local Flood Authority (LLFA) is a statutory consultee for major planning applications in relation to surface water drainage, requiring that all planning applications are accompanied by a Sustainable Drainage Strategy. The aim of the Sustainable Drainage Strategy is to identify water management measures, including sustainable drainage systems (SuDS), to provide surface water runoff reduction and treatment.

Local Planning Policy

The Selby District Council Core Strategy Local Plan (October 2011), contains policies and proposals for the area. The following policy relates to flood risk and drainage;

Policy SP15: Sustainable Development and Climate Change

A. *Promoting Sustainable Development*

In preparing its Site Allocations and Development Management Local Plans, to achieve sustainable development, the Council will: …

d) Ensure that development in areas of flood risk is avoided wherever possible through the application of the sequential test and exception test; and ensure that where development must be located within areas of flood risk that it can be made safe without increasing flood risk elsewhere;

e) Support sustainable flood management measures such as water storage areas and schemes promoted through local surface water management plans to provide protection from flooding; and biodiversity and amenity improvements…

B. Design and Layout of Development

In order to ensure development contributes toward reducing carbon emissions and are resilient to the effects of climate change, schemes should where necessary or appropriate:

b) Incorporate sustainable design and construction techniques, including for example, solar water heating storage, green roofs and re-use and recycling of secondary aggregates and other building materials, and use of locally sourced materials;

c) Incorporate water-efficient design and sustainable drainage systems which promote groundwater recharge.

Local guidance documents including the Selby Level 1 Strategic Flood Risk Assessment (SFRA) (originally produced November 2007, updated October 2015) and the North Yorkshire County Council Preliminary Flood Risk Assessment (PFRA) (August 2011) have been reviewed to inform this report.

Consultation

Consultation has been undertaken with North Yorkshire County Council to determine if there are any site specific requirements for flood risk and drainage. A response is included in Appendix A. To summarise, the LLFA have no records of flooding at the site. A link was also provided to North Yorkshire County Council SuDS Design Guidance. The guidance in summary states:

- Major development must ensure SuDS are in place to manage surface water runoff, unless it can be demonstrated that they are inappropriate.
- Surface water runoff should be dealt with via a hierarchal approach; discharge to the ground (infiltration); discharge to a surface water body; discharge to a surface water sewer, highway drain or other drain; discharge to combined sewer.
- The drainage system should be designed so that flooding does not occur on site for the 1 in 30 year storm event, and that flooding should not affect the building during the 1 in 100 year plus climate change storm event.
- An allowance of 30% should be made to account for climate change.

The Shire Group of Internal Drainage Boards (IDB) were also contacted to establish any specific requirements for surface water discharge to watercourse. A response is included in Appendix A. To summarise, discharge to Green Dyke (watercourse) is acceptable in principle, provided that runoff

rates are restricted to greenfield rates or alternatively 1.4 l/s/ha. Consent from the IDB will also be required where works are proposed within 7 metres of Green Dyke.

Existing Conditions

The site covers an area of 3.44ha and is located adjacent to the Kingspan building off Hurricane Close, Sherburn–in–Elmet, Leeds, LS25 6PB (National Grid reference: 451230E 433327N). The existing site comprises of an access road and undeveloped land. A location plan and an aerial image are included in Appendix B.

The site is bordered by the existing factory building to the north and west, an attenuation pond and industrial buildings to the east and industrial land to the south. Access is provided off Aviation Road to the south-west and Enterprise Way to the north of the existing factory building.

Local Topography

Existing topographic levels have been derived from a 2m resolution Environment Agency (EA) composite 'Light Detection and Ranging' (LiDAR) Digital Terrain Model (DTM). An extract of the LiDAR data is included in Appendix C. The site is shown to be relatively level, varying from a high of 8.4 metres Above Ordnance Datum (m AOD) in the north to a low of 7.3m AOD in the west.

Local Drainage

Reference to an extract of the Yorkshire Water public sewer record (Appendix D) shows that there is a 375mm diameter public surface water sewer in Hurricane Close approximately 100m east of the site. The 375mm public surface water sewer flows east, away from the site. There is also a 225mm public foul water sewer in Hurricane Close approximately 100m east of the site and a public foul sewer located 60m south-east of the site.

A balancing pond is located in the eastern extent of the site. It is understood that the pond is utilised to attenuate surface water flows from the surrounding industrial estate, prior to being pumped into Green Dyke.

The proposed layout plan (Appendix C) identifies a 3 pipe underground culvert, which is assumed to contain Green Dyke, flowing eastward through the southern extent of the site.

Proposed Development

The proposed development is for a new build extension on the existing Kingspan building, new access roads and buildings associated with a proposed gasification power unit (boiler room, fuel store etc.). The proposed works cover an area of approximately 2.1ha. A proposed site layout plan is included in Appendix C.

Flood Zone Category

The Environment Agency (EA) 'Flood Map for Planning (Rivers and Sea)' included in Appendix E shows that the site is located within an area considered to be outside of the extreme flood extent (Flood Zone 1) meaning it has a less than 0.1% annual probability of flooding. As the site is located within Flood Zone 1, it is considered that this development passes the Sequential Test and the Exception Test does not need to be applied.

Sources of Flooding and Probability

Fluvial

There is an unnamed land drain located approximately 45m east of the site. This land drain becomes culverted and is assumed to join Green Dyke. Green Dyke is culverted under the site and is assumed to be contained within 3 pipes flowing east through the southern extent of the site. The nearest open section of Green Dyke is located approximately 70m east of the site.

EA Modelled Flood Level Data

Detailed modelled flood levels for Green Dyke have been obtained from the EA and are included in Appendix E. The modelled outputs have been taken from the Selby Dam Flood Mapping Study undertaken in 2008. The EA have confirmed that there is no flood history within the vicinity of the site.

A summary of the in-channel water levels for the node points immediately upstream and downstream of the site is provided in Table 1 overleaf. The node locations are shown on the EA 'Modelled Flood Level Node Point Location Map' included in Appendix E.

Table 1 – EA Estimated In-channel Water Levels for Green Dyke

	In-channel Water Levels (m AOD)							
Node	**1 in 5 (20%)**	**1 in 10 (10%)**	**1 in 25 (1%)**	**1 in 50 (2%)**	**1 in 75 (1.33%)**	**1 in 100 (1%)**	**1 in 101 (1%+CC)**	**1 in 1000 (0.1%)**
12213_MODEL_SELB144	6.32	6.32	6.33	6.33	6.34	6.34	6.34	6.35
12213_MODEL_SELB143	4.91	4.91	4.92	4.92	4.94	4.98	5.08	5.29

*CC – Climate Change

From a comparison of in-channel water levels and site levels, the site is not estimated to flood during all events, up to and including the extreme 0.1% Annual Exceedance Probability (AEP) event. The site is located a minimum of 0.95m above the 0.1% AEP flood level.

The site is located a minimum of 0.6m above the unnamed land drain. The EA 'Risk of Flooding from Surface Water' map (Appendix E) identifies the flood risk from surface water and small land drains. The map shows that the site is not at risk of flooding from the unnamed land drain.

The LLFA, SFRA and PFRA have no records of flooding at the site. The site is located within Flood Zone 1; an area considered to have the lowest probability of fluvial flooding (less than 0.1% annual probability) and it can therefore be concluded that the risk of fluvial flooding is low.

Tidal

The site is situated at a minimum of 7.3m AOD and is over 37km from the River Humber estuary. The site is therefore not at risk of tidal flooding.

Surface Water

Surface water flooding occurs when rainwater does not drain away through the normal drainage system or soak into the ground. It is usually associated with high intensity rainfall events, but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen or developed, resulting in overland flow and ponding in depressions in topography. Surface water flooding can occur anywhere without warning. However, flow paths can be determined by consideration of contours and relative levels.

The EA 'Risk of Flooding from Surface Water' map (Appendix E) shows that the majority of the site is at very low risk of surface water flooding, meaning it has a less than 0.1% annual probability of

flooding. Isolated topographical low points to the north and west of the site are identified at risk, however the flood extent is minimal.

The SFRA and PFRA contain no records of flooding at the site. There are no distinct flow routes which would direct any potential surface water flooding towards the site. It can therefore be concluded that the site is at low risk of surface water flooding.

Sewer Flooding

Flooding from sewers can occur when a sewer is overwhelmed by heavy rainfall, becomes blocked, is damaged, or is of inadequate capacity. Flooding is mostly applicable to combined and surface water sewers.

The Yorkshire Water sewer plan extract (Appendix D) shows that the nearest public sewers are a 375mm diameter public surface water sewer and a 225mm public foul water sewer in Hurricane Close, 100m to the east of the site, and a public foul sewer located 60m south-east of the site.

The SFRA and PFRA contain no records of sewer flooding at or near to the site. There are no distinct flow routes in this area which would direct any potential sewer flooding arising in Hurricane Close towards the site. It can therefore be concluded that the risk of sewer flooding is low.

Groundwater Flooding

Groundwater flooding occurs when water levels underneath the ground rise above normal levels. Prolonged heavy rainfall soaks into the ground and can cause the ground to become saturated. This results in rising groundwater levels which leads to flooding above ground.

The PFRA states ‘There is no substantial evidence of direct groundwater flooding in the majority of North Yorkshire.’ There are no records of groundwater flooding at or near to the site. It can therefore be concluded that the risk of groundwater flooding is low.

Artificial Sources of Flooding

There are no canals in the vicinity of the site. The EA ‘Risk of Flooding from Reservoirs’ map (Appendix E) shows that the site is not at risk of flooding from reservoirs.

There is a balancing pond located immediately east of the proposed building extension. The balancing pond is associated with the existing surface water drainage infrastructure. There are no

records of flooding on site as a result of the pond overtopping. The site is raised above the balancing pond. It can therefore be concluded that the risk of flooding from artificial sources is low.

Summary of Potential Flooding

It can be concluded that the site is at low risk of flooding from all sources and no mitigation measures are considered necessary.

The finished floor level of the proposed extension will likely be required to tie into the floor level of the existing building. Where practical, finished floor levels of all buildings should be set a minimum of 150mm above surrounding ground levels to comply with Building Regulations.

Surface Water Management

It is proposed to extend the existing building, create new access roads and erect outbuildings associated with a gasification power unit. The proposed development will therefore increase the impermeable area on site by 2.1ha.

In accordance with IDB requirements, runoff should be restricted to 1.4 l/s/ha of development where discharge to an IDB controlled watercourse is proposed. Therefore, for the 2.1ha area of additional hard standing, a runoff rate of 3 l/s should be applied.

In line with North Yorkshire County Council SuDS design guidance, attenuation should be provided for the 1 in 100 year plus 30% climate change (CC) storm event.

Attenuation Storage

In order to achieve a discharge rate of 3 l/s, attenuation storage will be required. An attenuation storage estimate has been provided using MicroDrainage and is included in Appendix F. An estimated storage volume of 1824m³ will be required for the 1 in 100 year plus 30% CC event. The attenuation volume is based on a flow rate of 3 l/s, pond / tank storage, hydro-brake flow control and an impermeable drainage area of 2.1ha which includes the proposed extension, new access roads and buildings associated with the proposed gasification unit.

The attenuation volume is for indicative purposes only and should be verified during the detailed drainage design.

Discharge Method

Paragraph 080 of the NPPG: Flood Risk and Coastal Change sets out the following hierarchy of drainage options: into the ground (infiltration); to a surface water body; to a surface water sewer, highway drain or another drainage system; to a combined sewer.

Infiltration

The first consideration for the disposal of surface water is infiltration techniques (soakaways and permeable surfaces). BGS mapping indicates that the site is underlain by superficial deposits consisting of the Hemingbrough Glaciolacustrine Formation (clay, silt, sand). This is shown to be further underlain by bedrock deposits consisting of the Roxby Formation (mudstone and siltstone with subordinate sandstone). The Cranfield University 'Soilscapes' map indicates that the site is underlain by 'slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils' with 'impeded drainage'.

Based on the underlying geology, the use of infiltration techniques does not appear suitable. In addition, due to the significant area of hard standing to be drained, the use of soakaways may not be practical.

Watercourse

Where soakaways are not suitable a connection to watercourse is the next consideration. The nearest watercourse is Green Dyke, which is culverted through the site. A connection to Green Dyke appears to be a feasible option.

Modelled flood levels provided by the EA indicate that the 1 in 100 year plus climate change flood level for the Green Dyke, immediately downstream of the site is 5.08m AOD. The outfall to Green Dyke should be above this level. A pumped solution may be required for the proposed development (subject to depth of attenuation storage). Surface water discharge to Green Dyke via a new connection should be restricted to 3 l/s.

An alternative option is to discharge to Green Dyke via the existing pumped connection. This would require enlarging the existing attenuation pond. The increase in pond size would be determined by the existing discharge (pumped) rate.

Sewer

A connection to the public sewer system will not be required as a connection to Green Dyke is a feasible option.

Sustainable Drainage Systems

Attenuation storage should be provided in the form of Sustainable Drainage Systems (SuDS) where practical. The following SuDS options have been considered:

Soakaways

As described above, due to the significant area of hard standing to be drained, the use of soakaways may not be practical.

Swales, detention basins and ponds

Sufficient space is available on site to utilise a pond, basin or swale as an above ground attenuation feature. However, an open surface water attenuation feature such as a pond presents a safety risk; the hazards and appropriate mitigation should be considered at the detailed design stage.

There is an existing balancing pond located to the east of the proposed extension. This pond could be enlarged to accommodate the additional attenuation volume. Alternatively, a separate pond could be constructed adjacent to the proposed access road, or adjacent to the existing pond to accommodate the additional volume.

Rainwater Harvesting

The attenuation benefits provided through the use of rainwater harvesting are considered to be limited, and would only be realised when the tanks were not full. However, rainwater harvesting techniques could be incorporated within the final design.

Green Roofs

The proposed development plans do not identify green roofs for the proposed extension and outbuildings.

Porous / Permeable Paving

The use of permeable paving on the access road will not be a suitable option for the site given the heavy goods vehicles that will utilise the road frequently.

Underground Attenuation Tanks

Storage could be provided within a below ground attenuation tank located in open space adjacent to the proposed access road or existing pond, or within oversized pipes beneath the access road.

Concept Surface Water Drainage Scheme

Surface water runoff should be discharged to Green Dyke at a controlled rate of 3 l/s. A total attenuation volume of 1824m³ will be required to achieve the discharge rate. The attenuation volume could be provided within a pond or a below ground attenuation tank located adjacent to the existing access road or existing pond.

The proposed surface water drainage scheme will ensure no increase in runoff over the lifetime of the development.

Exceedance Event

Storage will be provided for the 1 in 100 year plus 30% CC event. Storm events in excess of the 1 in 100 year plus 30% CC event should be permitted to produce shallow depth flooding within the access road and / or landscaped areas.

Pumped Solution

Where a pumped solution is required, storage will be required to accommodate for the event of power or plant failure. In accordance with Sewers for Adoption 7th edition, 123m^3 of attenuation is required for every 10,000m^2 of impermeable drainage area. This equates to a volume of 259m^3 for the proposed 2.1ha impermeable area on site. This storage volume can be accommodated within the storage provided to accommodate the 1 in 100 year plus 30% CC event (1824m^3).

Provision of standby pumps, an automated pump exercise regime and a pump failure alarm system would limit the risk of pump failure.

Surface Water Treatment

In accordance with the CIRIA C753 publication 'The SuDS Manual' (2015), industrial roofs are classified as having a 'low' pollution hazard level, whereas highly frequented lorry approaches are classified as having a 'high' pollution level. Table 2 below shows the pollution hazard indices for each land use.

Table 2 – Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Other roofs	Low	0.3*	0.2	0.05
Sites with heavy pollution (e.g. highly frequented lorry approached to industrial estates)	High	0.8	0.8	0.9

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.2

** Indices values range from 0-1.*

Runoff from the roofs and the access roads could be discharged via a pond. Table 3 below demonstrates that a pond provides partial surface water treatment.

Table 3 – SuDS Mitigation Indices

	Mitigation Indices		
Type of SuDS	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Pond	0.7	0.7	0.5

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.3

A pond alone does not provide sufficient surface water treatment. Therefore, a suitable hydrodynamic separator will be required to provide treatment prior to discharge to the pond. This will also be required where an attenuation tank is utilised for attenuation storage.

Maintenance

Maintenance of drainage features such soakaways, a pond and / or an underground attenuation tank will be the responsibility of the site owner.

Maintenance of ponds includes:

- Monthly inspection of inlets, outlets, banks and pipe work for damage and / or erosion
- Removal of sediment, litter and debris
- Regular cutting of vegetation

Maintenance of underground attenuation tanks and oversized pipes includes:

- Removal of sediment from silt traps / separators

Other Considerations

Correspondence from the IDB (included in Appendix A) states that 'No obstructions within 7 metres of the edge of a watercourse are permitted without Consent from the Board.' Where the developer proposes to discharge surface water into Green Dyke, further consent will be required from the IDB.

Conclusions

The proposal is for a new build extension to the existing Kingspan building, new access roads and the erection of buildings associated with a gasification unit.

The site is located within Flood Zone 1 on the Environment Agency (EA) 'Flood Map for Planning (Rivers and Sea)' – an area considered to have the lowest probability of fluvial and tidal flooding. A comparison of the modelled flood levels provided by the EA and the local topography shows that the site is located 0.95m above the extreme 0.1% AEP fluvial flood level.

The risk from all other sources has been assessed and the flood risk to the site is considered to be low.

The proposed development will introduce hard standing in the form of buildings and roads. In order to ensure the increase in surface water runoff generated by the introduction of hard standing will not increase flood risk elsewhere, flow control will be used and attenuation provided on site for storm events up to and including the 1 in 100 year plus 30% climate change event.

All methods of surface water discharge have been assessed. Discharge of surface water to Green Dyke appears to be a feasible option. Discharge to Green Dyke via a new connection should be restricted to 3 l/s as agreed with the IDB.

Attenuation will be required on site in order to restrict surface water discharge to 3 l/s. Attenuation could be provided within the existing balancing pond, a new balancing pond or a below ground attenuation tank. Sufficient space for an attenuation feature is available adjacent to the proposed access road, or alternatively adjacent to the existing pond. A pumped solution may be required for surface water drainage subject to the depth of an attenuation storage feature.

The site owner will be responsible for the maintenance of the surface water drainage system.

Treatment of surface water will be provided in the form of a suitably sized separator.

Recommendations

1. Submit this Flood Risk Assessment and Drainage Strategy to the Planning Authority in support of the outline Planning Application;
2. Verify the attenuation volumes included in this report when undertaking detailed drainage design.

Appendix A – Council and IDB Correspondence

Jordan Jones

From: Stuart Edwards <Stuart.Edwards@northyorks.gov.uk> on behalf of llfa <llfa@northyorks.gov.uk>
Sent: 16 May 2016 13:37
To: Jordan Jones
Subject: RE: w10071 - Kingspan, Sherburn - in - Elmet - council email

Categories: Information received

Jordan,

We have no records of flooding at that location. For information please find below a link to our SuDS Design Guidance:

http://www.northyorks.gov.uk/media/30769/North-Yorkshire-County-Council-SuDS-design-guidance/pdf/SuDS_design_guidance.pdf

For further information I believe that the site lies within the drainage district of the Shire Group of IDBs who will have restrictions on discharge rates to their watercourses, link to their website below:

http://www.shiregroup-idbs.gov.uk/

Regards

Stuart Edwards BEng(Hons) MCIWEM MCIWM
SuDS and Development Control Officer

Flood Risk Management
Business & Environmental Services
North Yorkshire County Council
County Hall
Northallerton
North Yorkshire
DL7 8AD

Tel. 01609 533216

From: Jordan Jones [mailto:jordan.jones@waterco.co.uk]
Sent: 13 May 2016 08:51
To: floodriskmanagement
Subject: w10071 - Kingspan, Sherburn - in - Elmet - council email

FAO: Flood Risk Management

Extension south of an existing building off Hurricane Close, Sherburn – in – Elmet, Leeds, LS25 6PB. Grid reference: 451212E 433340N.

Dear Sir / Madam,

I am currently preparing a Flood Risk Assessment and Drainage Strategy at the above address. We are seeking Lead Local Flood Authority comments in regards to flood risk and surface water drainage.

The proposal is for an extension to a building at the above address. I attach a red boundary plan for reference.

Environment Agency mapping shows the site to be at risk of surface water flooding. Please can you advise if you have any records of historical flooding at this site. It should be noted that through development, rainwater will be directed into the sites drainage system (which will attenuate up to the 1 in 100 plus climate change event), thereby preventing overland flows forming and surface water flooding at the site. Please can you also advise on the amount for climate change to attenuate for.

We propose to discharge surface water via soakaways. Where infiltration is not feasible, we propose to discharge surface water to Green Dyke, restricting to greenfield rates.

Attenuation will be provided in the form of SuDS. Please can you advise if you have any specific Council guidance or hierarchy on the use of SuDS.

If you have any questions or require any further details please don't hesitate to contact me.

Kind Regards,

Jordan Jones

T: 01824 702220 | **E:** jordan.jones@waterco.co.uk | **W:** www.waterco.co.uk

Waterco consultants

Specialists of choice for water, drainage and flood risk

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If you receive an automatic response stating that the recipient is away from the office and you wish to request information under either the Freedom of Information Act, the Data Protection Act or the Environmental Information Regulations please forward your request by e-mail to the Information Governance Team (infogov@northyorks.gov.uk) who will process your request.

North Yorkshire County Council.

Jordan Jones

From: Shire Group Planning <planning@shiregroup-idbs.gov.uk>
Sent: 24 May 2016 15:23
To: Jordan Jones
Subject: RE: w10071 - Kingspan, Sherburn - in - Elmet - council email
Attachments: Consent Application Form.doc; 173-2016- SAIIDB- 24May16.pdf

Categories: Information received

Good afternoon

Please find attached our notes regarding surface water discharge into Green Dyke at restricted greenfield rates. The site area does lie within the Selby Area IDB, so before works are to commence you will be required to fill out a consent form and return it to us with any relevant documentation. There is a consent application form fee of £50 which will need to be payable to Selby Area IDB.

I attach our notes and consent form for your information. For further notes, please visit our website or e-mail us.

Therefore, in principle if you follow our consent form procedure, surface water discharge into soakaways and a restricted rate into the dyke would be acceptable by the IDB.

Kind Regards

Naomi Wright (Admin)
(on behalf of the Shire Group of IDBs)

From: Jordan Jones [mailto:jordan.jones@waterco.co.uk]
Sent: 16 May 2016 15:45
To: Information (ShireGroup) <info@shiregroup-idbs.gov.uk>
Subject: w10071 - Kingspan, Sherburn - in - Elmet - council email

Extension south of an existing building off Hurricane Close, Sherburn – in – Elmet, Leeds, LS25 6PB. Grid reference: 451212E 433340N

Dear Sir / Madam,

I have been advised by the Lead Local Flood Authority to contact you in relation to a proposed extension at the above site. I attach a red boundary plan for reference.

We propose to discharge surface water via soakaways. Where infiltration is not feasible, we propose to discharge surface water to Green Dyke, restricting to greenfield rates.

Please can you advise if this is acceptable.

If you have any questions, or require any additional information then please do not hesitate to contact me.

Kind regards,

Jordan Jones

T: 01824 702220 | **E:** jordan.jones@waterco.co.uk | **W:** www.waterco.co.uk

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Regards

Stuart Edwards BEng(Hons) MCIWEM MCIWM
SuDS and Development Control Officer

Flood Risk Management
Business & Environmental Services
North Yorkshire County Council
County Hall
Northallerton
North Yorkshire
DL7 8AD

Tel. 01609 533216

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We propose to discharge surface water via soakaways. Where infiltration is not feasible, we propose to discharge surface water to Green Dyke, restricting to greenfield rates.

Attenuation will be provided in the form of SuDS. Please can you advise if you have any specific Council guidance or hierarchy on the use of SuDS.

If you have any questions or require any further details please don't hesitate to contact me.

Kind Regards,

Jordan Jones

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The first message in this conversation was sent internally from within the JBA organisation

CONSULTEE PLANNING APPLICATION RESPONSE

Application Number	Pre-Application Advice
Case Officer	(Selby District Council)
Proposal	Extension south of an existing building
Applicant:	Jordan Jones
Address	Hurricane Close, Sherburn -in -Elmet, leeds
Date of Reply	24 May 2016
Engineer to the Board/Officer	Paul Jones (Shire Group of IDB's)
On behalf of	Selby Area IDB

The above application lies within the IDB district and indicates that:

The impermeable area to the site will increase, the applicant proposes to drain surface water discharge into soakaways and at a restricted rate into Green Dyke.

The IDB as a Consultee give the following comments/recommendations:

Detailed plans of the proposed surface water discharge have not been submitted.

If the surface water were to be disposed of via a soakaway system, the Board would have no objection in principle but would advise that the ground conditions in this area may not be suitable for soakaway drainage. It is therefore essential that percolation tests are undertaken to establish if the ground conditions are suitable for soakaway drainage throughout the year.

If surface water is to be directed to a mains sewer system the Board would again have no objection in principle, providing that the Water Authority are satisfied that the existing system will accept this additional flow.

If the surface water is to be discharged to any watercourse within the Drainage District, Consent from the Board would be required in addition to Planning Permission, and would be restricted to 1.4 litres per second per hectare or greenfield runoff.

No obstructions within 7 metres of the edge of a watercourse are permitted without Consent from the Board.

Advice/recommendations:

We would advise that CONSENT required from the IDB is made a CONDITION of any Planning DECISION.

ANY surface water discharge into ANY watercourses in, on, under or near the site requires CONSENT from the Drainage Board.

For further application information, consent form & guidance visit:

www.shiregroup-idbs.gov.uk, Select "IDB", then select "Selby", and select "Planning, Consent & Byelaws".

For direct enquiries e-mail: planning@shiregroup-idbs.gov.uk

APPLICATION FOR WORKS IN DRAINAGE DISTRICT

LAND DRAINAGE ACT 1991 SECTION 23
AND DRAINAGE BOARD BYELAWS

IMPORTANT NOTICE
Please ensure that the form is completed accurately and in full to avoid any delays in processing. **If you have any queries, please do not hesitate to contact the Engineer on the details below.**

1. APPLICANT DETAILS

NAME (individual, organisation or company)	
NAME OF CONTACT	
POSTAL ADDRESS	**POSTCODE**
TELEPHONE NUMBER	
OUT OF HOURS NUMBER	
EMAIL	

2. AGENTS DETAILS

NAME		**PROFESSION**	
ADDRESS		**CONTACT**	
		TELEPHONE NO.	
POSTCODE		**EMAIL**	

3. LOCATION OF WORKS

LOCATION OF PROPOSED WORKS	
NAME OF IDB DISTRICT	
NAME OF WATERCOURSE (if known)	
DISTRICT / PARISH COUNCIL	
NATIONAL GRID REFERENCE	

4. APPLICANTS INTEREST IN THE LAND

(If you are not the owner of the land, please provide the name and address of the owner and confirmation you have their permission to enter onto the land to complete the works).

5. DESCRIPTION AND PURPOSE OF PROPOSED WORKS

NUMBER OF STRUCTURES

6. SUPPORTING DOCUMENTS

(Please provide a description and reference number of all relevant plans, sections, or other supporting documents that you are submitting with the application).

7. IS THIS APPLICATION FOR PERMANENT OR TEMPORARY WORKS, OR BOTH?

(State Permanent / Temporary / Both)	
PROPOSED START DATE OF WORKS	
EXPECTED DURATION OF WORKS	

8. DO THE PROPOSED WORKS INVOLVE OR AFFECT THE FOLLOWING?

THE DISCHARGE OF TRADE EFFLUENT OR SURFACE WATER	**YES**	**NO**
THE ABSTRACTION (REMOVAL) OF WATER	**YES**	**NO**
THE IMPOUNDING (HOLDING BACK) OF A WATERCOURSE	**YES**	**NO**

**** DELETE AS APPLICABLE ****

9. IF YOU HAVE BEEN GIVEN PLANNING PERMISSION FOR THE PROPOSED WORKS PLEASE COMPLTE THIS SECTION

PLANNING AUTHORITY	
APPLICATION NO.	
APPROVAL DATE	

10. NAME AND CONTACT DETAILS OF PERSON OR ORGANISATION RESPONSIBLE FOR MAINTAINING THE WORKS

DURING CONSTRUCTION	
ON COMPLETION	

ENVIRONMENTAL CONSIDERATIONS
FOR LAND DRAINAGE CONSENTS

The Board is required to consider the environmental implications of all works in the district which require its consent under the Land Drainage Act 1991 (as amended). The applicant is required to demonstrate the environmental impact of the proposals is negligible or can be mitigated against.

A number of species of animals and plants are protected under the Wildlife and Countryside Act 1981 (as amended). Water voles, otters, badgers and bats are known to inhabit watercourses and have varying degrees of protection under legislation. Other species may also be present in the area. The applicant is required to demonstrate that the proposed works are not likely to adversely impact on protected species and/or protected habitats. A surveyor opinion, by a suitably qualified individual, with mitigation proposals where appropriate will suffice in most cases.

Works which may affect sites of national or international wildlife importance require further measures to be taken. Such works may be remote from the site and the area of influence must be determined by the Board. The Board is required to obtain the assent of English Nature to such works which is independent of any consent/assent the applicant may be required to obtain. In such cases the period required by the Board to determine an application is extended to 8 weeks for national sites and 16 weeks for international sites. The Board will endeavour to determine application as soon as possible but is dependent upon the responses from English Nature.

11. EFFECTS ON THE ENVIRONMENT

(Please provide brief details of the effect the proposed works will have on the environment together with any proposals for improvements you will make or action you will take to compensate for the effects).

12. DECLARATION

I/WE (insert name) | |

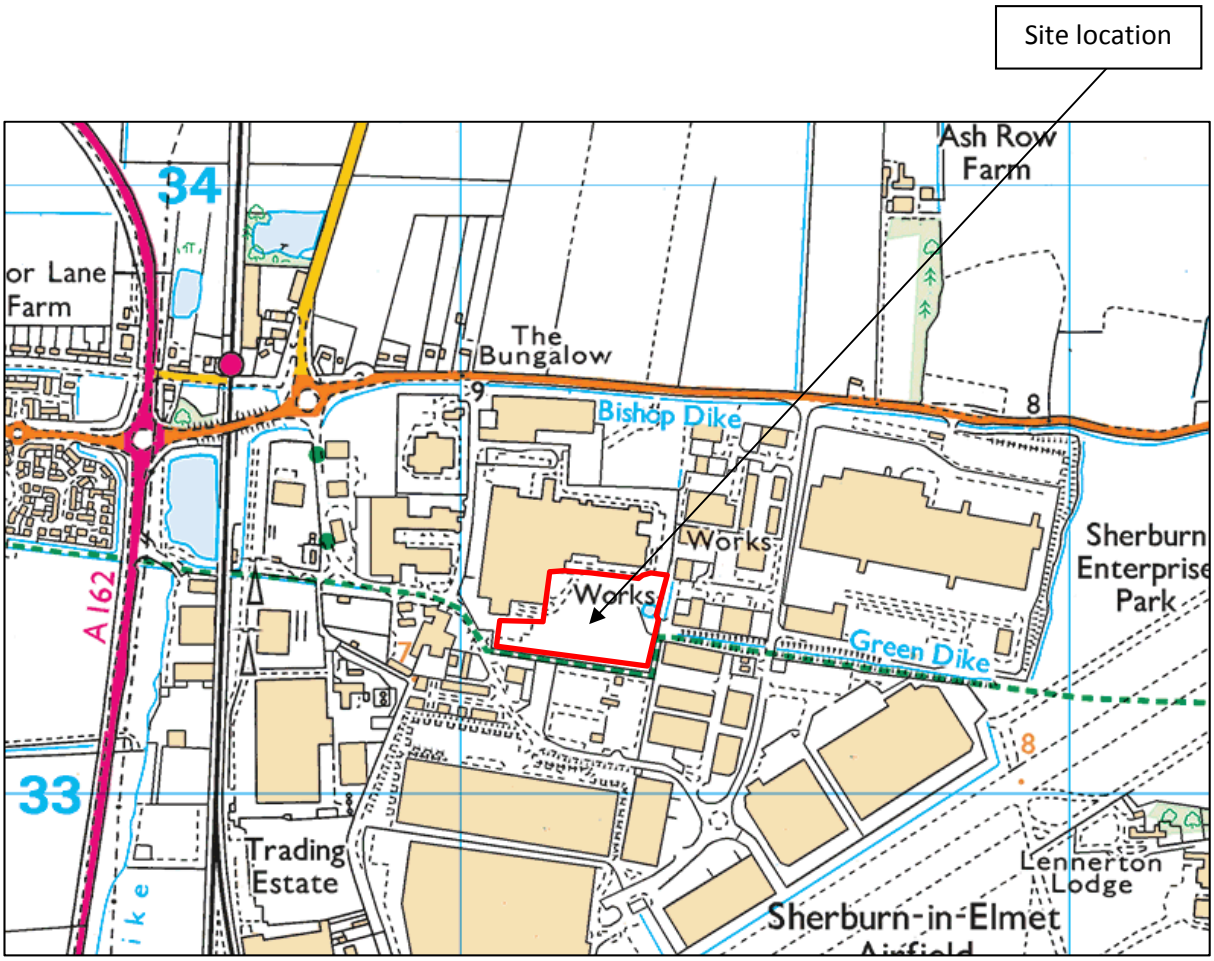
1. Apply for consent under the provisions of Section 23 of the Land Drainage Act 1991 and Drainage Board Bye-Laws to carry out works as described in this Application and on the attached plan(s).
2. Declare that as far as I know and believe, the information in this application and any supporting document is full, accurate and true. I understand that this application may be refused, or approval withdrawn, if I give false or incomplete information.
3. Declare that I do not know of or suspect any other facts or information which would or might affect the granting of or conditions which might be imposed on the consent.
4. Confirm that I/We have the right to carry out the works and have obtained consent or approval as necessary.
5. Confirm that I/We will notify the Drainage Board of any future changes in the information given in this application which might be material to the consent.
6. Accept that the period of two months specified in Section 23 of the Land Drainage Act 1991 for deciding the application will not start until the Drainage Board is satisfied that it has all the necessary information.

SIGNED	
ON BEHALF OF	
DATED	

SUBMISSION

1. Please return this form, together with one copy of a plan sufficient to show clearly the location of the proposed works, one copy of plans and sections showing details of the proposed works to a scale appropriate to the nature of the works, and any relevant supporting documents.
2. Submissions may be in electronic or paper format.
3. Electronic submissions should be e-mailed to: **Consents@shiregroup-idbs.gov.uk**
4. Paper submissions should be posted to: **Shire Group, Epsom House, Chase Park, Redhouse Interchange, Doncaster, DN6 7FE.**
5. We cannot charge for application for consent in relation to the Board Byelaws. However, **for applications under Section 23 of the Land Drainage Act 1991** payment of the **£50.00 fee** to cover the cost of the application may be made by card, via one of our Financial Officers on 01302 337798, or by sending a cheque **made payable to the relevant Drainage Board.**

Appendix B – Location Plan & Aerial Image



Location Plan

(Source: Streetmap)

Aerial Image

(Source: Google Earth)

Appendix C – Proposed Development Plan & LiDAR Extract

new access road

Acc.
35m x
10m

Turbine / Offices,
35m x 20m

site car parking

5 no loading bays

Boiler, 85m x 20m

Fuel Store, 55m x 20m

stack

gatehouse

new access road

new access road

see site boundary fence

3 Pipe Underground Culvert

new access road

Balancing Ponds

Surface water drainage to pond

new access road

Warehouse

see sketch

GAS HEATER

GAS HEATER

Works Office

QC LABORATORY

SWITCH ROOM

Boiler House

COMPRESSOR ROOM

CHEMICAL STORAGE OFFICE

Dangerous Gases

HV Switch Room

GAS SUPPLY METER

NEW WATER TANK 300m3

WATER TANK 400m3

Pump House

0 5 10 15 20 25 30 40 50

METRES

Revision	By	Date	

supercraft STRUCTURES LIMITED

Shobdon Airfield,
Shobdon, Nr Leominster, Herefordshire. HR6 9NR

Tel: 01568 708456 / 708114 Fax: 01568708212
Email: dave@supercraftltd.co.uk

Client

Job Title

Industrial Building

Site

Kingspan Imnsulations Ltd
Pembridge
Herefordshire

Drawing Title

PROPOSED SITE PLAN

Drawn DGM Checked by dgm

Date June 2016

Scale 1:500 at A0

DRAWING No. 26478 / 3

REVISION

new access road

Acc,
35m x
15m

Turbine / Offices,
32m x 20m

site car parking

3 no loading bays

gatehouse

gate

new access road

Boiler, 85m x 20m

stack

Fuel Store, 55m x 20m

weighbridge

new access road

new site boundary fence

3 Pipe Underground Culvert

new access road

142126-overall extension

fire exit

fire exit

fire exit

doorway

fire exit

roof lights

29990 partial

57710 overall

fire exit

doorway

29810 partial

roof lights

fire exit

fire exit

fire exit

doorway

fire exit

doorway

fire exit

Balancing Ponds

retaining wall, with fence and armco barrier

new access road

Mole

Three Three Bays Approx 7340mm Centres

LV Bus Bar (At Roof Level)

QC LABORATORY

Gas Heater

SWITCH ROOM

TRANSFORMER

Works Office

Gas Pipe (7.5m to Underside)

LV Cable (At Roof Level)

Gas Pipe (8.5m to Underside)

LV Cable (At Roof Level)

LV Cable (At Roof Level)

Gas Pipe (8.5m to Underside)

GAS HEATER

Revision	By	Date

supercraft STRUCTURES LIMITED

Shobdon Airfield,
Shobdon, Nr Leominster, Herefordshire. HR6 9NR

Tel: 01568 708456 / 708114 Fax: 01568708212
Email: dave@supercraftltd.co.uk

Client

Job Title
Industrial Building

Site
Kingspan tmmsulations Ltd
Pembridge
Herefordshire

Drawing Title
SITE PLAN OF PROPOSAL.

Drawn DGM Checked by dgm
Date June 2016
Scale 1:250 at A0

DRAWING No. 26478 / 5 REVISION

Works

ENTERPR

HURRICANE CL

SPITFIRE W

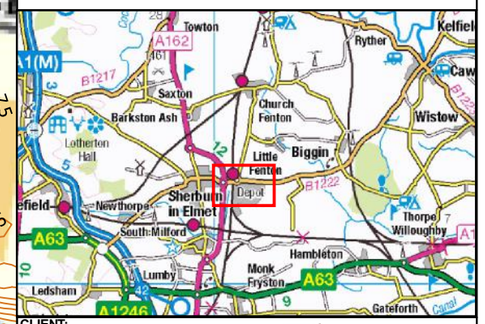
ORDFISH WAY

SEAFOX COURT

LEGEND

- SPOT HEIGHT
- BOUNDARY
- CONTOUR

ALL LEVELS GIVEN TO METRES ABOVE ORDNANCE DATUM (m AOD)



CLIENT:

REC
DELIVERING SOLUTIONS

waterco consultants

SCHEME:

HURRICANE CLOSE SHERBURN-IN-ELMET

PLOT TITLE:

SITE LEVELS

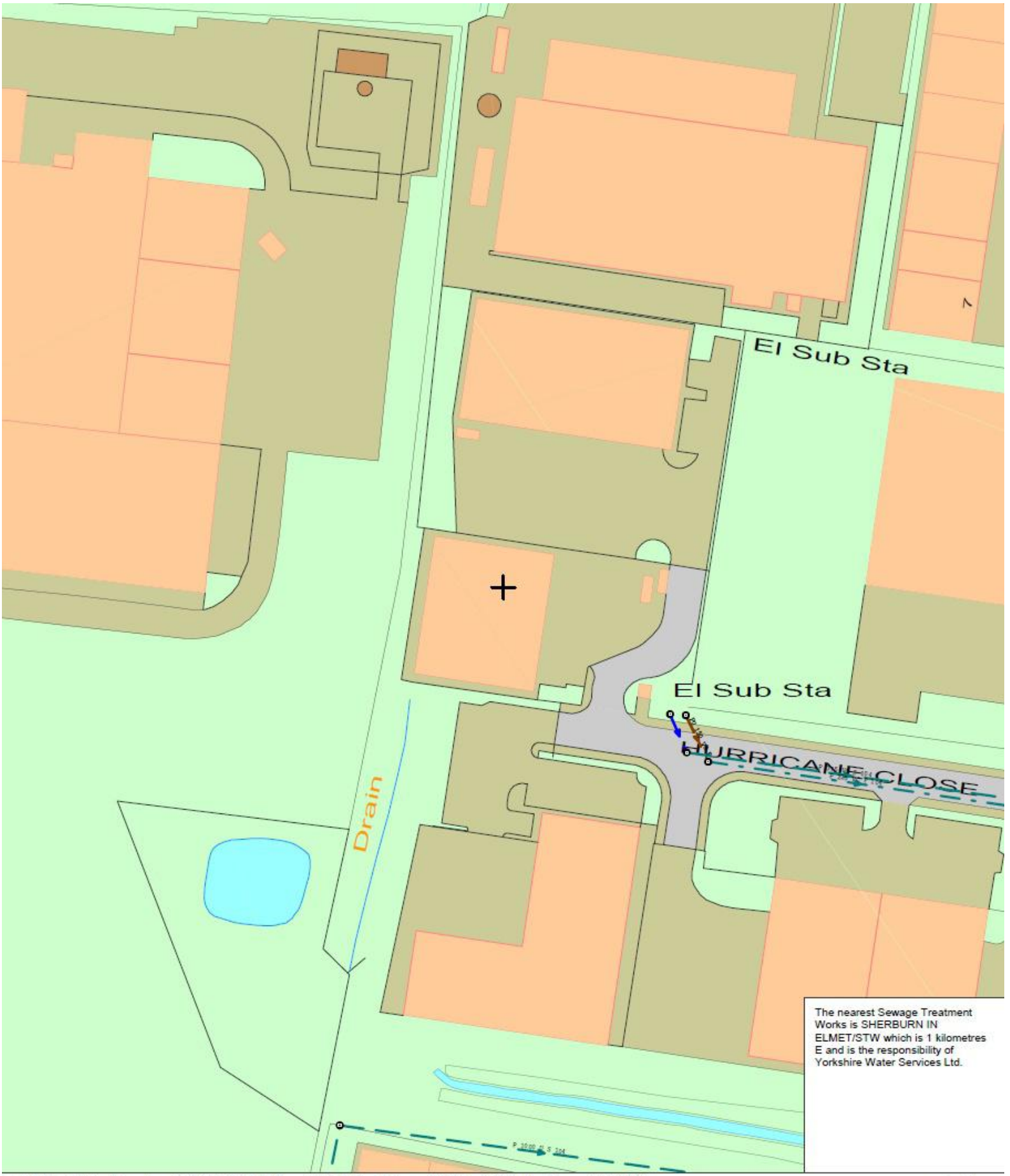
PLOT STATUS:

ISSUE

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
JJ	JR	AW	1:1500 (unless otherwise stated)

DATE:	PLOT NAME:	REV:
15-06-2016	w10071-SITE LEVELS	A

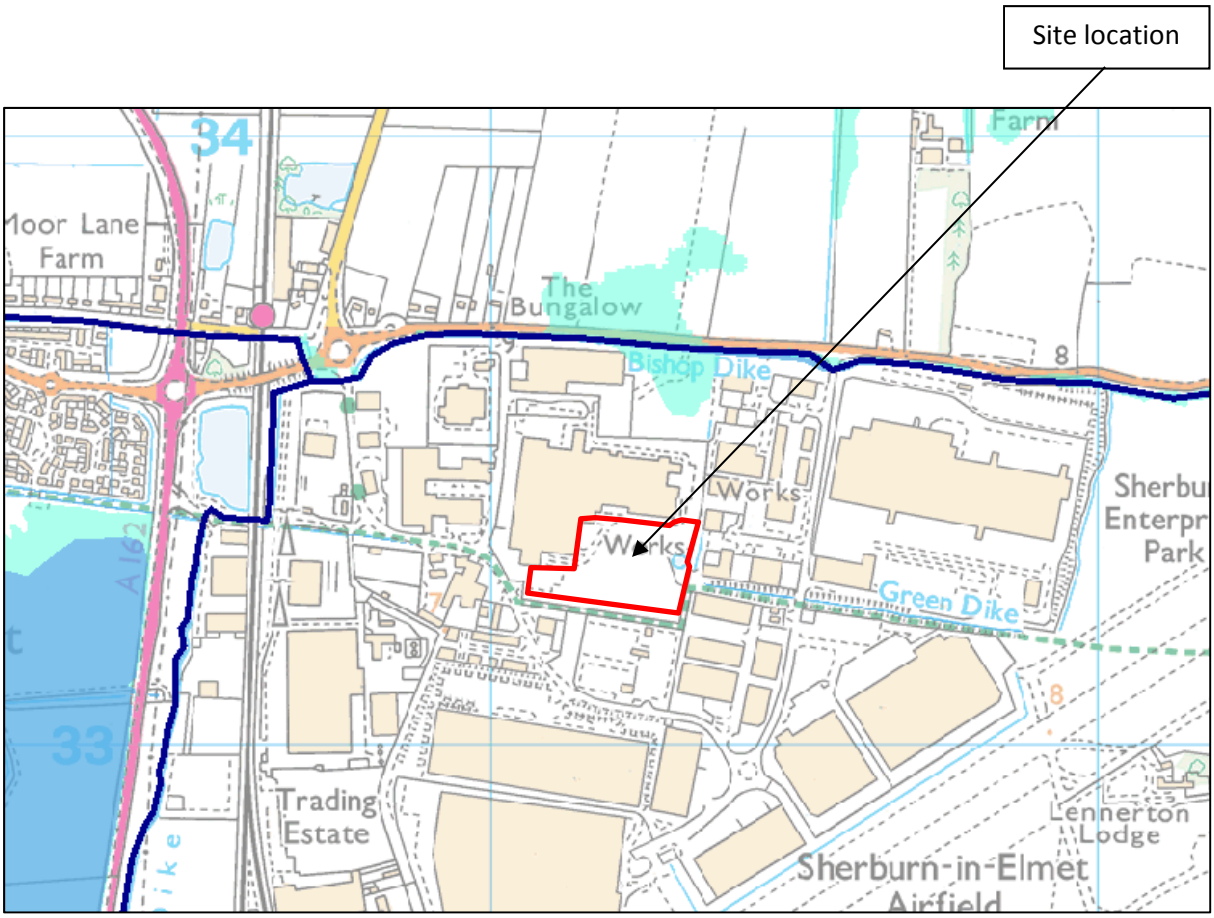
Appendix D – Yorkshire Water Sewer Plan Extract



The nearest Sewage Treatment Works is SHERBURN IN ELMET/STW which is 1 kilometres E and is the responsibility of Yorkshire Water Services Ltd.

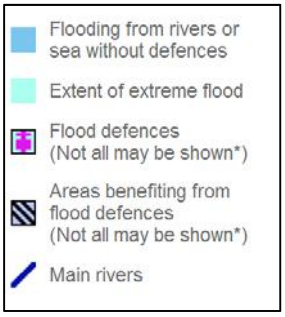
Public Waste Water Network 09/01/2014 09:49:09 OS Grid Coordinates: 451256 : 433241 Map Name : SE5133SW websterh

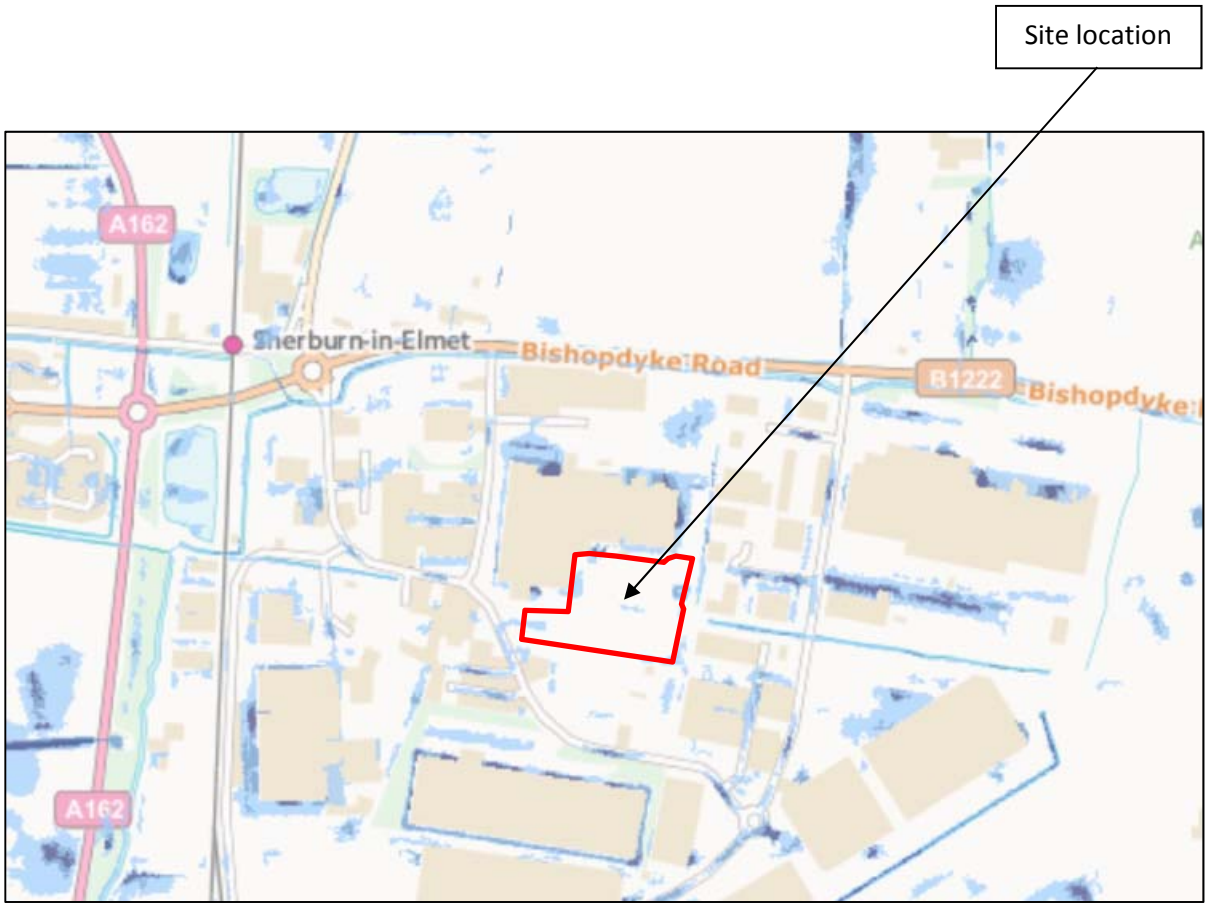
Appendix E – Environment Agency Flood Maps and Data



Environment Agency Flood Map for Planning (Rivers and Sea)

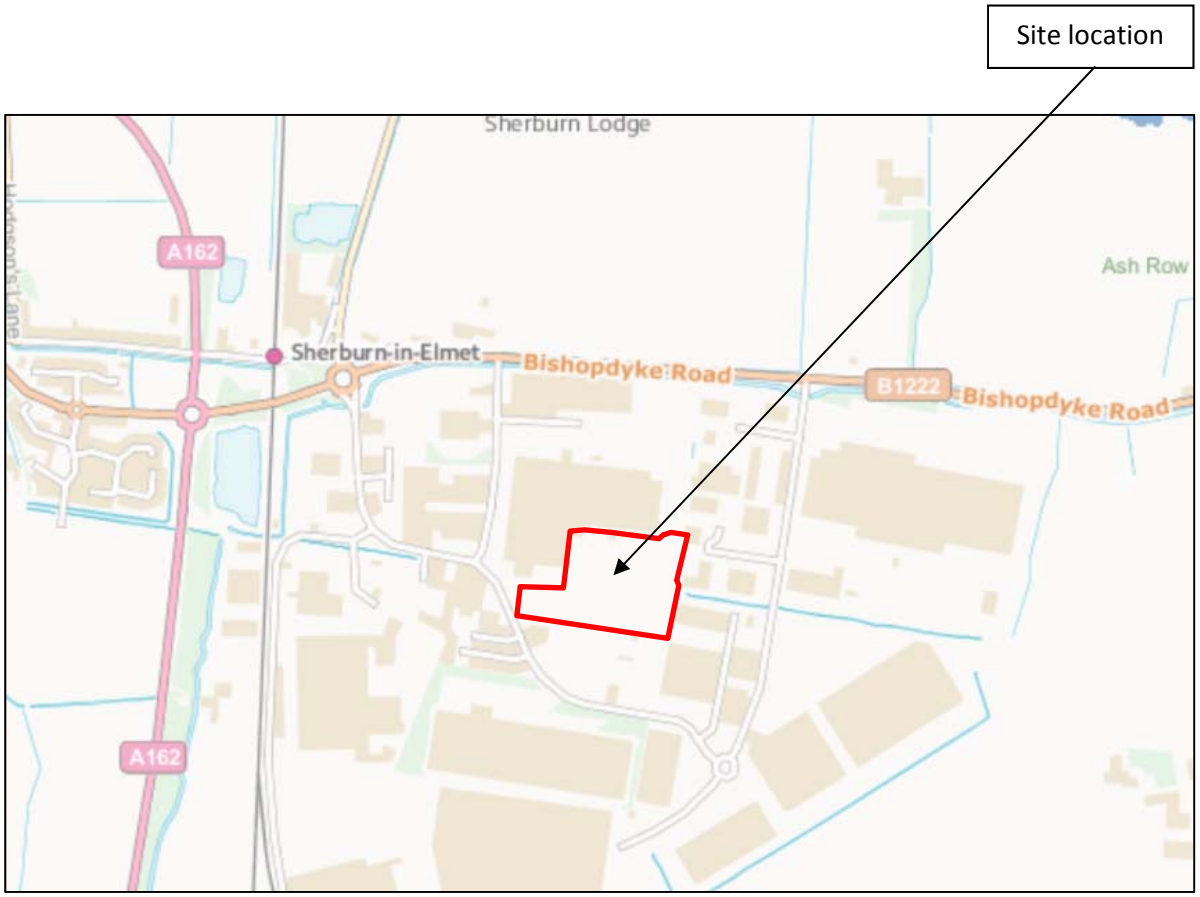
(June 2016)





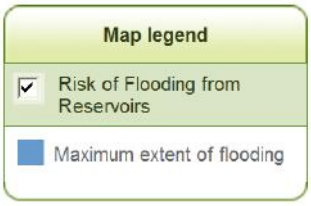
Environment Agency Risk of Flooding from Surface Water

(June 2016)

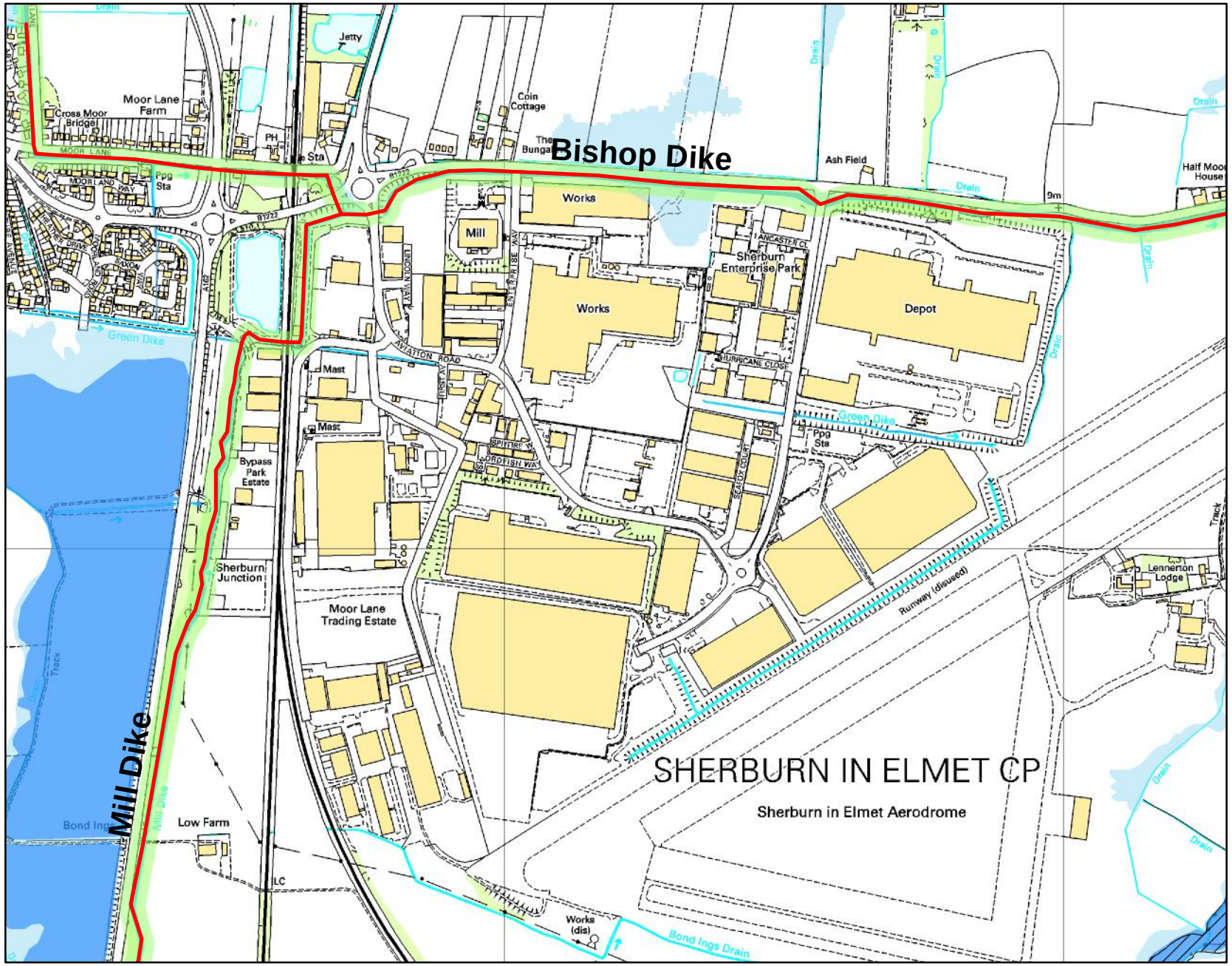


Environment Agency Risk of Flooding from Reservoirs

(June 2016)



Detailed FRA map centred on Sherburn in Elmet. [RFI/2016/13043]



Environment Agency

Scale 1:10,000

N

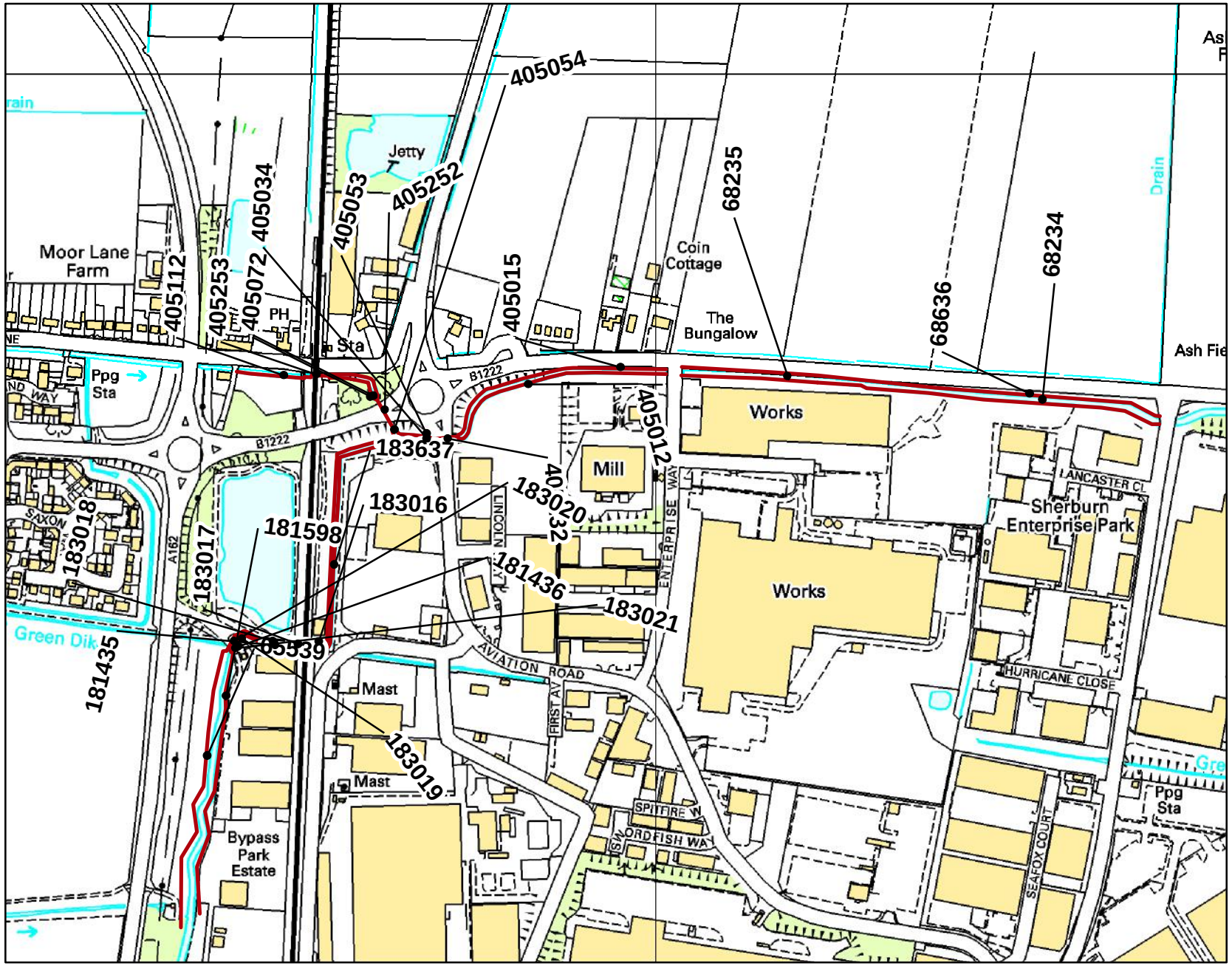
Please note that the supplied map is not considered by the Environment Agency to constitute a flood risk assessment on its own and may not be accepted by local planning authorities for that purpose. Using an inappropriate scale can in some instances result in a different indication of whether a particular point is within a flood zone.

Legend

- Bank Top E-Planning Tool
- Areas Benefiting
- Flood Zone 3
- Flood Zone 2
- Main River

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Flood Defence Asset Location Map centred on Sherburn in Elmet. [RFI/2016/13043]



Environment Agency

Scale 1:7,500

N

Please note that the supplied map is not considered by the Environment Agency to constitute a flood risk assessment on its own and may not be accepted by local planning authorities for that purpose. Using an inappropriate scale can in some instances result in a different indication of whether a particular point is within a flood zone.

Legend

NAFRA_DEFENCE

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Mapping & Data Response to RFI/2016/13043 – Building off Hurricane Close, Sherburn in Elmet, Leeds, LS25 6PB

Flood Map

We have provided you with a map which shows areas of land that we believe to be at risk of flooding from rivers and does not cover other sources of flooding such as local drainage, surface water or groundwater. These areas do not take into account defences as water can overtop or they can fail in extreme conditions.

- **Flood Zone 2 -** This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) in any year

- **Flood Zone 3 -** This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) in any year

Bank Top ePlanning Tool

Bank Top ePlanning Tool is required as a result of recently changed statutory consultation requirements for Local Planning Authorities (LPA) as set out in the "Town and Country Planning (General Development Procedure) (Amendment) (No2) (England) Order 2006. Local Authorities have the responsibility to consult the Environment Agency on any new development falling within 20 metres of the top of the bank of a Main River. The Bank Top Tool allows the LPA to determine if new development falls within these areas and triggers the consultation.'

Areas benefiting from flood defences - areas that benefit from the flood defences shown, in the event of a river flood with a 1% (1 in 100) chance of happening each year, or a flood from the sea with a 0.5% (1 in 200) chance of happening each year. If the defences were not there, these areas would flood.

Please see the PDF **'DetailedFRAMap'** for the location of watercourses in the vicinity of the site.

Model Data

According to our records there are Modelled Flood Levels in the vicinity of the site on the Selby Dam. The Levels are taken from the Selby Dam Flood Mapping Study (2008).

Please see the PDF '**ModelledFloodLevels'.** The PDF **'ModelledFloodLevelNodePointLocationMap'** shows the location where the Levels were taken from.

The Levels are given in Metres above Ordnance Datum
The Flows are given in Cubic metres per second

Updated Flood Map for Surface Water

This shows areas where surface water only would be expected to flow or pond in England & Wales. It is shown on our website as the Risk of Flooding from Surface Water map. It supersedes earlier Environment Agency national scale maps, the Areas Susceptible to Surface Water Flooding (2008/9) and Flood Map for Surface Water (2010). All land in England and Wales will be within 'one' of a possible 'four' categories. The four categories shown on the map are:

- **High** - This area has a chance of flooding greater than 1 in 30 in any given year (annual probability of flooding 3.3%)
- **Medium** - This area has a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%) in any given year
- **Low** - This area has a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) in any given year
- **Very low** - This area has a chance of flooding of less than 1 in 1000 (0.1%) in any given year

Historic information

According to our records there is No Flood History in the vicinity of the site.

Asset information

Please see the PDF **'Flood Defence Asset Location Map'** for the location of the nearest Flood Defences. Further information is given in the table below.

ASSET_ID	DESIGN_SOP	AIMS_SUB_TYPE	ASSET_MAINTAINER	BANK	LENGTH	ACTUAL_DCL	ACTUAL_UCL	AIMS_TYPE	PROTECTION_TYPE	DESCRIPTION	OVERALL_CONDITION
405053		high_ground	private	left	43.78	None Given	None Given	defence	fluvial	High Ground (Natural Channel)	3
405034		high_ground	private	right	36.36	None Given	None Given	defence	fluvial	High Ground(Natural Channel)	3
405232		simple_culvert	environment_agency		30.3	None Given	None Given	channel	fluvial	Simple Culvert (Concrete box culvert under road). Concrete headwall and wingwall.	1
405015		high_ground	private	left	264.18	None Given	None Given	defence	fluvial	High Ground (Natural Channel)	3
405012		high_ground	private	right	261.71	None Given	None Given	defence	fluvial	HIgh Ground	3
68235		high_ground	private	right	150.68	None Given	None Given	defence	fluvial	Concrete clad channel side into high ground.	2
68636		high_ground	private	left	534.19	None Given	None Given	defence	fluvial	Dyke channel leading to high ground	3
68234		high_ground	private	right	383.48	None Given	None Given	defence	fluvial	Dyke channel leading to high ground.	3
65539	50	high_ground	internal_drainage_board	left	319.94	None Given	None Given	defence	fluvial	Maintained Channel	2
181598	50	high_ground	internal_drainage_board	right	293.86	None Given	None Given	defence	fluvial	Maintained Channel	3
183020	50	high_ground	internal_drainage_board	left	19.07	None Given	None Given	defence	fluvial	Maintained Channel	2
183021	50	simple_culvert	internal_drainage_board		7.96	None Given	None Given	channel	fluvial	Road Culvert	3
181436	50	high_ground	internal_drainage_board	right	22.85	None Given	None Given	defence	fluvial	Maintained Channel	3
183018	50	high_ground	internal_drainage_board	left	71.58	None Given	None Given	defence	fluvial	Maintained Channel	2
183019	50	simple_culvert	internal_drainage_board		8.52	None Given	None Given	channel	fluvial	Road Culvert	2
405112		high_ground	private	right	83.76	None Given	None Given	defence	fluvial	High Ground (Natural Channel)	3
181435	50	high_ground	internal_drainage_board	right	61.63	None Given	None Given	defence	fluvial	Maintained Channel	3
183017	50	simple_culvert	internal_drainage_board		17.57	None Given	None Given	channel	fluvial	Culverted Channel	4
405253		simple_culvert	environment_agency		20.32	None Given	None Given	channel	fluvial	Simple Culvert (Concrete box culvert under road), concrete headwall and wingwalls.	1
183637	50	high_ground	internal_drainage_board	right	297.33	None Given	None Given	defence	fluvial	Mainatained Channel	2
183016	50	high_ground	internal_drainage_board	left	293.04	None Given	None Given	defence	fluvial	Mainatained Channel	3
405072		high_ground	private	right	65.83	None Given	None Given	defence	fluvial	High Ground (Natural Channel)	3
405092		high_ground	private	left	70.7	None Given	None Given	defence	fluvial	High Ground (Natural Channel)	3
405252		simple_culvert	environment_agency		37.18	None Given	None Given	channel	fluvial	Simple Culvert (Box culvert under road),concrete headwall and wingwall.	1
405054		high_ground	private	right	9.11	None Given	None Given	defence	fluvial	High Ground (Natural Channel)	3

Risk of Flooding – Environment Agency Defences
The risk of flooding is reduced by the presence of flood defences that we maintain, but there is still a residual risk of flooding if these were to breach or be overtopped by a flood greater than that for which they were designed.

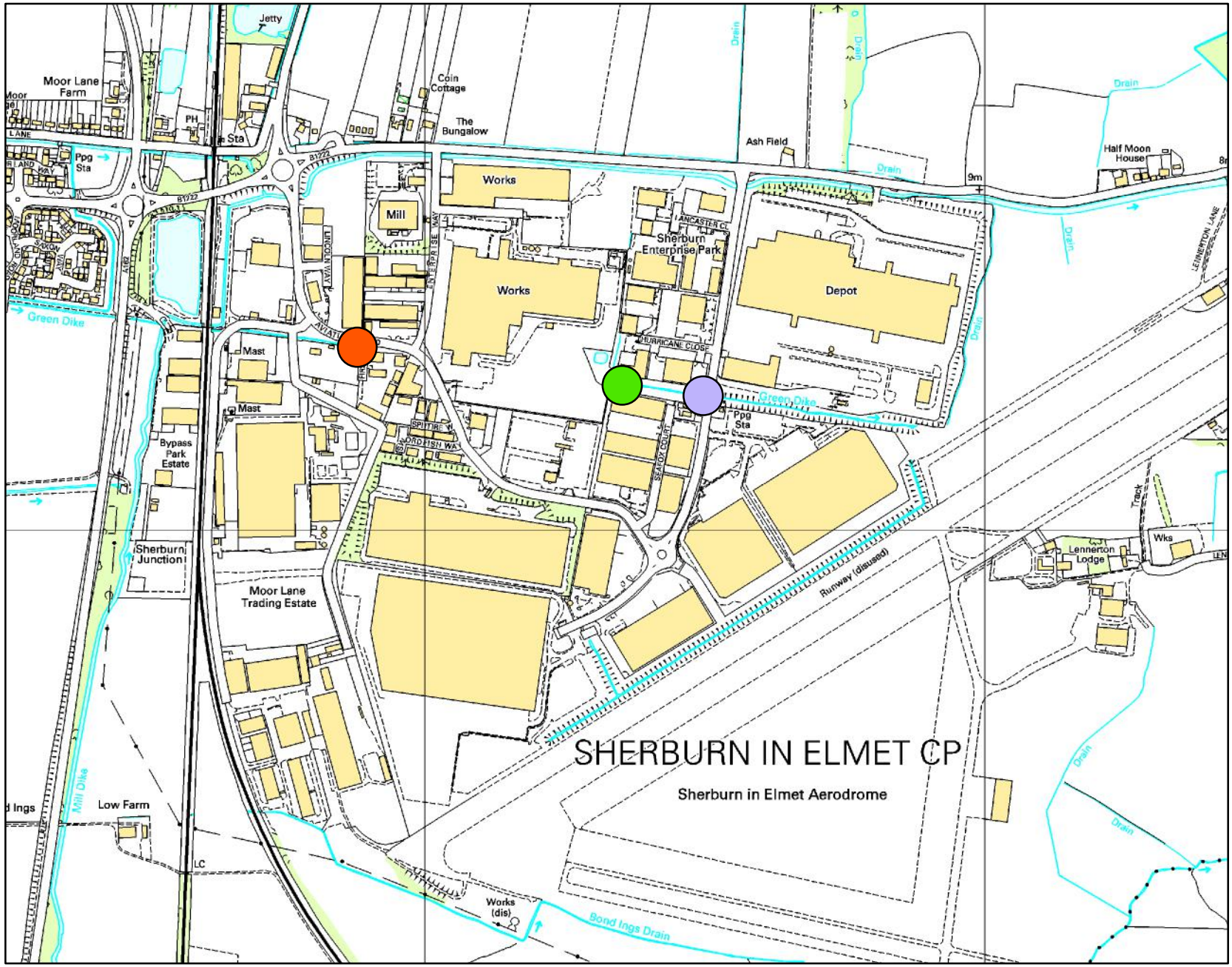
Risk of Flooding – Privately Maintained Defences
We do not maintain any of those defences. However we undertake regular risk based visual inspections. We do not hold design levels and have no height information on these defences or structures.

Asset Condition Ratings
The performance of a flood defence asset is recorded as the condition of the asset. Our asset inspectors subjectively assess the conditions of assets (during visual inspection site visits) with reference to a national standard template. Each asset is given a rating between one and five with one being very good condition and five being very poor. A condition rating of 3, or 'fair' is the minimal acceptable standard for a critical asset, such as a defence wall that protects properties. We are striving to improve all assets below 'fair' to an acceptable standard.

Asset inspections are done on average every six months, although some critical assets are assessed on a more regular basis. It is possible that adjacent assets are inspected on different dates, which may result in two assets of a similar state of repair having different condition ratings.

Condition ratings of assets may also be affected by the time of year the surveys are conducted, as vegetation may obscure the asset in the summer months, or accessibility may be an issue during winter months. These factors would not usually affect the recorded condition rating of an asset unless the asset is on a borderline between two ratings.

Modelled Flood Level Node Point Location Map centred on Sherburn in Elmet. [RFI/2016/13043]



Environment Agency

Scale 1:10,000

N

Please note that the supplied map is not considered by the Environment Agency to constitute a flood risk assessment on its own and may not be accepted by local planning authorities for that purpose. Using an inappropriate scale can in some instances result in a different indication of whether a particular point is within a flood zone.

Legend

NodePoints_point

- <all other values>

NODEPOINTN

- 12213_MODEL_SELB141
- 12213_MODEL_SELB143
- 12213_MODEL_SELB144

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

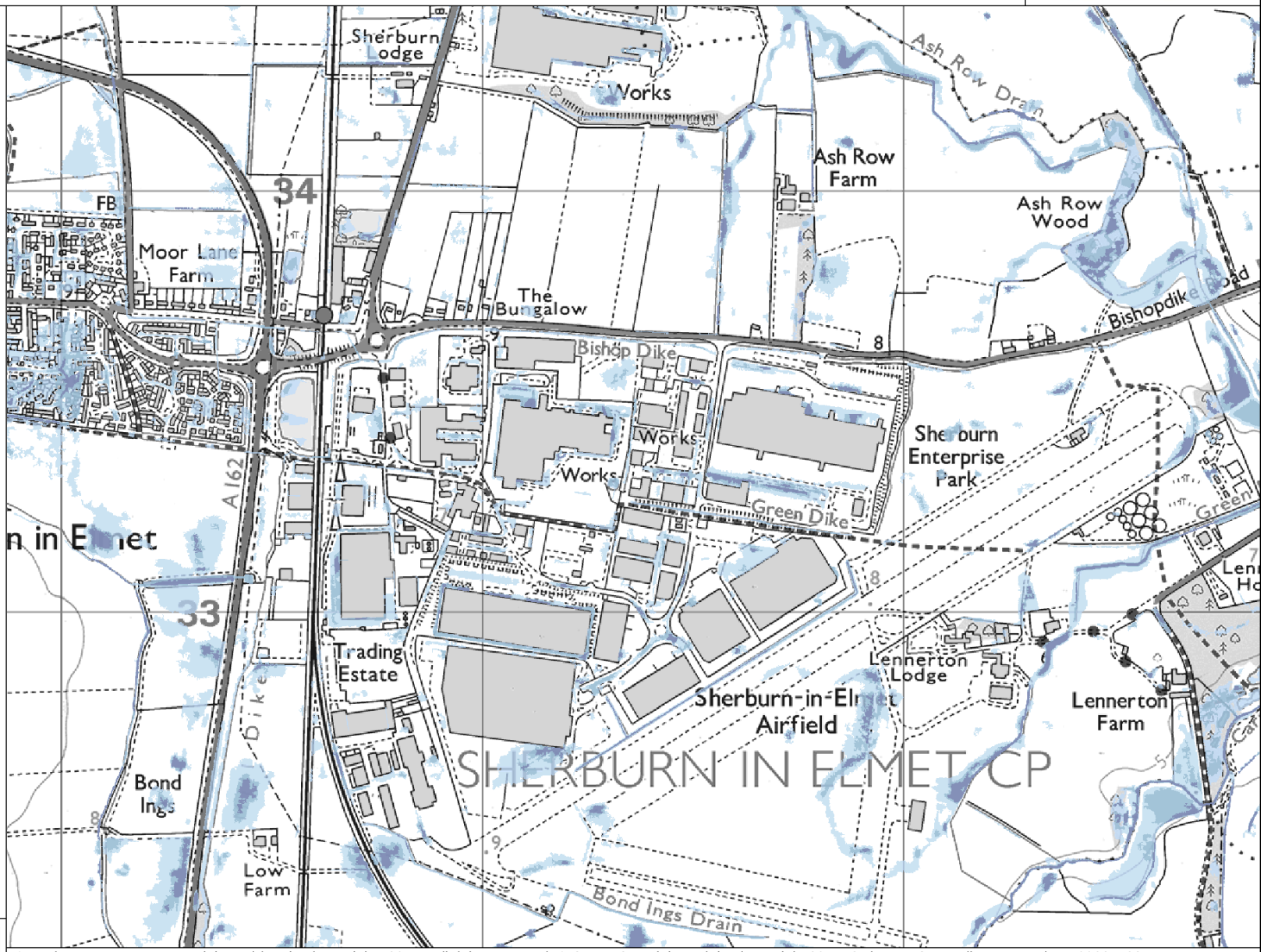
NodePointName	ModelledFloodGroupCode	ReturnPeriod	LevelValue	FlowValue
Model_SELB141	EA122130052	5	4.41	0.25
Model_SELB141	EA122130052	10	4.6	0.25
Model_SELB141	EA122130052	25	4.72	0.26
Model_SELB141	EA122130052	50	4.84	0.25
Model_SELB141	EA122130052	75	4.91	0.24
Model_SELB141	EA122130052	100	4.96	0.24
Model_SELB141	EA122130052	101	5.07	0.25
Model_SELB141	EA122130052	1000	5.29	0.24
Model_SELB143	EA122130052	5	4.91	0.25
Model_SELB143	EA122130052	10	4.91	0.25
Model_SELB143	EA122130052	25	4.92	0.26
Model_SELB143	EA122130052	50	4.92	0.26
Model_SELB143	EA122130052	75	4.94	0.24
Model_SELB143	EA122130052	100	4.98	0.24
Model_SELB143	EA122130052	101	5.08	0.25
Model_SELB143	EA122130052	1000	5.29	0.24
Model_SELB144	EA122130052	5	6.32	0.25
Model_SELB144	EA122130052	10	6.32	0.25
Model_SELB144	EA122130052	25	6.33	0.26
Model_SELB144	EA122130052	50	6.33	0.26
Model_SELB144	EA122130052	75	6.34	0.27
Model_SELB144	EA122130052	100	6.34	0.27
Model_SELB144	EA122130052	101	6.34	0.27
Model_SELB144	EA122130052	1000	6.35	0.29

Easimap

Environment Agency

Legend

- uFMfSW (2013) – 1 in 30 chance rain
- uFMfSW (2013) – 1 in 100 chance rain
- uFMfSW (2013) – 1 in 1000 chance rain



0 130 260 390 m.

N W E S

Appendix F – MicroDrainage Storage Estimates

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.264	0.264	3.0	482.5	O K
30 min Summer	9.349	0.349	3.0	638.0	O K
60 min Summer	9.439	0.439	3.0	803.3	O K
120 min Summer	9.533	0.533	3.0	975.2	O K
180 min Summer	9.588	0.588	3.0	1075.8	O K
240 min Summer	9.626	0.626	3.0	1145.2	O K
360 min Summer	9.677	0.677	3.0	1239.6	O K
480 min Summer	9.715	0.715	3.0	1308.4	Flood Risk
600 min Summer	9.743	0.743	3.0	1360.5	Flood Risk
720 min Summer	9.766	0.766	3.0	1401.7	Flood Risk
960 min Summer	9.799	0.799	3.0	1462.9	Flood Risk
1440 min Summer	9.839	0.839	3.0	1536.0	Flood Risk
2160 min Summer	9.866	0.866	3.0	1584.1	Flood Risk
2880 min Summer	9.872	0.872	3.0	1595.1	Flood Risk
4320 min Summer	9.855	0.855	3.0	1564.2	Flood Risk
5760 min Summer	9.829	0.829	3.0	1517.9	Flood Risk
7200 min Summer	9.804	0.804	3.0	1472.1	Flood Risk
8640 min Summer	9.780	0.780	3.0	1427.0	Flood Risk
10080 min Summer	9.756	0.756	3.0	1383.2	Flood Risk
15 min Winter	9.295	0.295	3.0	540.7	O K
30 min Winter	9.391	0.391	3.0	715.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	119.440	0.0	246.2	27
30 min Summer	79.076	0.0	253.0	42
60 min Summer	49.937	0.0	502.9	72
120 min Summer	30.490	0.0	493.9	132
180 min Summer	22.544	0.0	478.4	192
240 min Summer	18.087	0.0	461.5	250
360 min Summer	13.181	0.0	439.5	370
480 min Summer	10.536	0.0	427.7	490
600 min Summer	8.849	0.0	421.9	610
720 min Summer	7.669	0.0	420.1	730
960 min Summer	6.114	0.0	423.1	968
1440 min Summer	4.436	0.0	424.3	1446
2160 min Summer	3.212	0.0	855.5	2164
2880 min Summer	2.552	0.0	848.5	2884
4320 min Summer	1.843	0.0	825.5	4196
5760 min Summer	1.461	0.0	1715.9	4840
7200 min Summer	1.219	0.0	1648.2	5560
8640 min Summer	1.052	0.0	1578.0	6320
10080 min Summer	0.928	0.0	1508.9	7160
15 min Winter	119.440	0.0	250.6	27
30 min Winter	79.076	0.0	253.1	41

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.492	0.492	3.0	900.6	O K
120 min Winter	9.598	0.598	3.0	1094.3	O K
180 min Winter	9.660	0.660	3.0	1208.1	O K
240 min Winter	9.703	0.703	3.0	1286.2	Flood Risk
360 min Winter	9.761	0.761	3.0	1392.8	Flood Risk
480 min Winter	9.804	0.804	3.0	1471.0	Flood Risk
600 min Winter	9.836	0.836	3.0	1530.8	Flood Risk
720 min Winter	9.862	0.862	3.0	1578.4	Flood Risk
960 min Winter	9.902	0.902	3.0	1649.8	Flood Risk
1440 min Winter	9.950	0.950	3.0	1738.0	Flood Risk
2160 min Winter	9.984	0.984	3.0	1801.6	Flood Risk
2880 min Winter	9.997	0.997	3.0	1823.8	Flood Risk
4320 min Winter	9.988	0.988	3.0	1808.8	Flood Risk
5760 min Winter	9.960	0.960	3.0	1756.3	Flood Risk
7200 min Winter	9.926	0.926	3.0	1694.9	Flood Risk
8640 min Winter	9.896	0.896	3.0	1640.2	Flood Risk
10080 min Winter	9.865	0.865	3.0	1583.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	49.937	0.0	501.9	72
120 min Winter	30.490	0.0	478.3	130
180 min Winter	22.544	0.0	452.8	188
240 min Winter	18.087	0.0	439.6	248
360 min Winter	13.181	0.0	429.5	366
480 min Winter	10.536	0.0	430.6	484
600 min Winter	8.849	0.0	436.7	602
720 min Winter	7.669	0.0	441.1	720
960 min Winter	6.114	0.0	446.0	954
1440 min Winter	4.436	0.0	446.2	1424
2160 min Winter	3.212	0.0	897.3	2120
2880 min Winter	2.552	0.0	896.1	2800
4320 min Winter	1.843	0.0	870.1	4148
5760 min Winter	1.461	0.0	1749.4	5368
7200 min Winter	1.219	0.0	1698.3	5832
8640 min Winter	1.052	0.0	1652.1	6672
10080 min Winter	0.928	0.0	1608.3	7664

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.383	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 2.168

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.723	4	8	0.723	8	12	0.723

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1830.0	1.000	1830.0

Hydro-Brake Optimum® Outflow Control

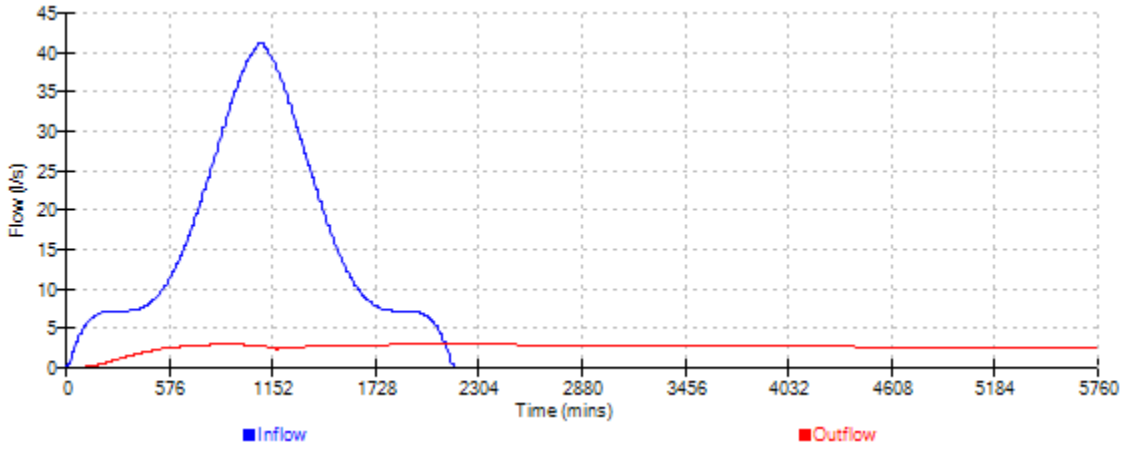
Unit Reference	MD-SHE-0082-3000-1000-3000
Design Head (m)	1.000
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	82
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

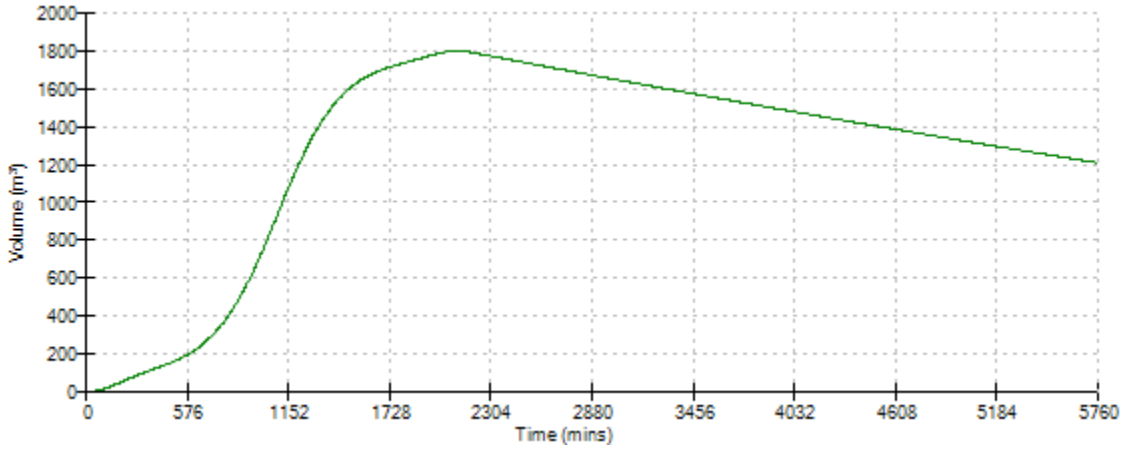
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.0
Flush-Flo™	0.299	3.0
Kick-Flo®	0.621	2.4
Mean Flow over Head Range	-	2.6

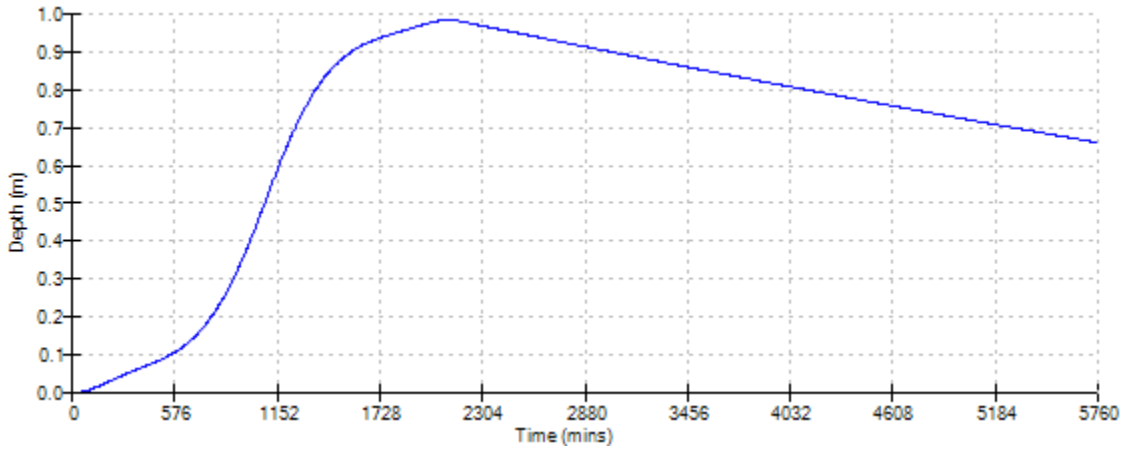
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	1.200	3.2	3.000	5.0	7.000	7.4
0.200	2.9	1.400	3.5	3.500	5.3	7.500	7.7
0.300	3.0	1.600	3.7	4.000	5.7	8.000	7.9
0.400	2.9	1.800	3.9	4.500	6.0	8.500	8.1
0.500	2.8	2.000	4.1	5.000	6.3	9.000	8.3
0.600	2.5	2.200	4.3	5.500	6.6	9.500	8.6
0.800	2.7	2.400	4.5	6.000	6.9		
1.000	3.0	2.600	4.7	6.500	7.2		

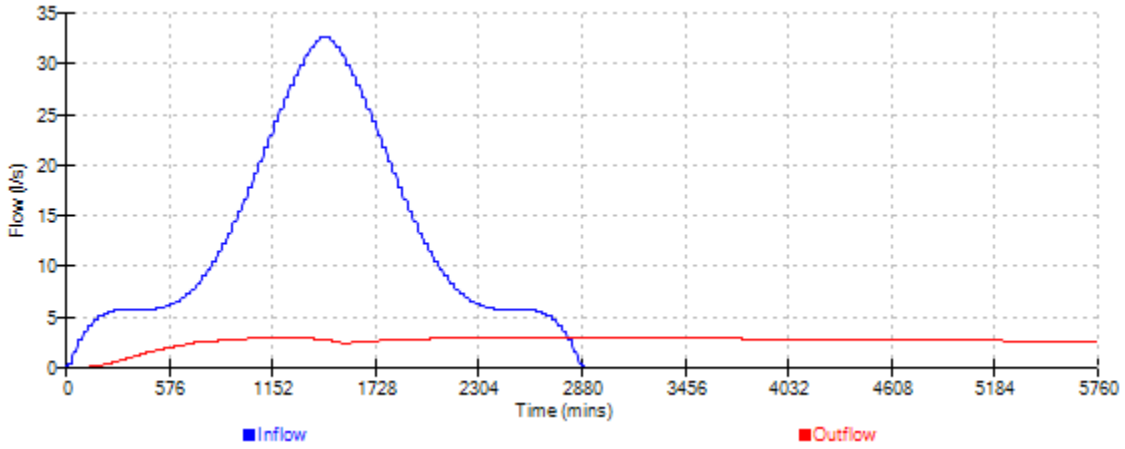
Event: 2160 min Winter

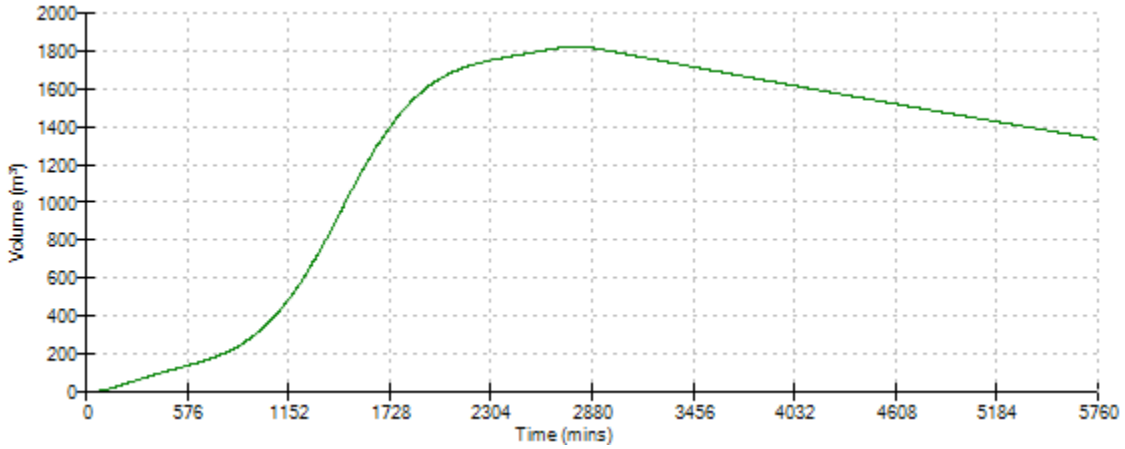


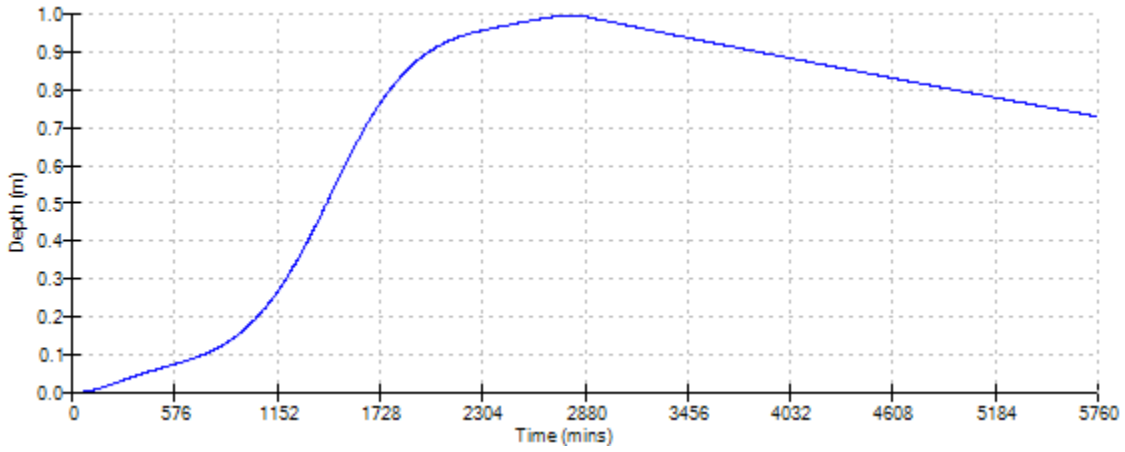




Event: 2880 min Winter







Event: 4320 min Winter