



Flood Risk Assessment for Lindisfarne

Prepared for Natural England

19/09/2022

Prepared By:

Olivia Blackhurst
Graduate Civil/Structural Engineer
olivia.blackhurst@clancy.co.uk
0151 227 5300

Approved By:

Michael Dean
Chartered Structural Engineer
michael.dean@clancy.co.uk
0151 227 5300

Rev. 02

Clancy Consulting Limited
Old Hall Chambers
31 Old Hall Street
Liverpool
L3 9SY

enquiries@clancy.co.uk
www.clancy.co.uk

Report Reference: 4/8130

Version 02

Date originated: 6th September 2022

Prepared by: Clancy Consulting Limited
Old Hall Chambers
31 Old Hall Street
Liverpool
L3 9SY

REVISION LIST

REVISION	REASON FOR ISSUE	DATE OF ISSUE
01	Issued for Comment	6 th September 2022
02	Issued for Planning	19th September 2022

CAVEAT

This document has been prepared for the titled project, or named part thereof, and should not be relied upon or used for any other project or part as the case may be, without an independent check being made on it. Clancy Consulting shall not be liable for the consequences of using this document other than for the purpose for which it was commissioned, and any user and any other person using or relying on this document for such other purpose, agrees and will be such use or reliance be taken to confirm this agreement to indemnify Clancy Consulting for all loss or damage resulting therefrom.

TABLE OF CONTENTS

<u>1.</u>	<u>Introduction</u>	<u>4</u>
<u>2.</u>	<u>Report Structure</u>	<u>6</u>
<u>3.</u>	<u>Site Catchment Characteristics</u>	<u>7</u>
<u>4.</u>	<u>Flood Potential</u>	<u>9</u>
<u>5.</u>	<u>Drainage</u>	<u>15</u>
<u>6.</u>	<u>Flood Mitigation Measures</u>	<u>19</u>
<u>7.</u>	<u>Conclusions Ans Recommendations</u>	<u>22</u>
<u>8.</u>	<u>Flood Management Plan Advice</u>	<u>23</u>

1. **INTRODUCTION**

1.1. **General**

- 1.1.1. This report has been prepared on instruction received from Natural England and relates to the proposed development at their Lindisfarne Depot.
- 1.1.2. The proposed development comprises the construction of a single storey building which will include a laboratory, ancillary accommodation and associated facilities.
- 1.1.3. The development is to allow for Natural England to undertake research activities with facilities for short term university or educational bodies/ studies to further the understanding of the local habitat, as well as to provide welfare facilities to volunteer bodies who support Natural England with it's management of the environment.
- 1.1.4. This report sets out the results of a Flood Risk Assessment (FRA) required by the Lead Local Flood Authority in support of the planning application for this development.
- 1.1.5. This report is prepared solely for the benefit of the Client. This report may not be assigned without prior written permission from Clancy Consulting.

1.2. **Report Structure**

- 1.2.1. This FRA is considered to be compliant with the requirements set out in the National Planning Policy Framework 2021 and the associated online Planning Practice Guidance.
- 1.2.2. The methodology for this FRA has comprised of a desktop study.
- 1.2.3. Sources of information have included, but not limited to the following;
 - Environment Agency/ UK Government flood maps for rivers and sea flooding.
 - UK Government Flood Warning Information Service maps for surface water flooding and reservoir flooding.
 - Lead Local Flood Authority – Surface Water Policy
 - LLFA SuDS Guidance Council Specific Information.
 - Non-statutory technical standards for sustainable drainage systems.
 - Topographical Survey by Formby Surveys.
 - Utilities Survey by Formby Surveys.
 - Natural England Discretionary Advice
 - Architectural drawings by Firth Associates.
 - Phase 2 Geo-Environmental Ground Investigation by IGE Consulting (September 2022).

2. SITE CATCHMENT CHARACTERISTICS

2.1. History and Current Use

2.1.1. The development is located as detailed below.

OS X (Eastings)	406182
OS Y (Northings)	642614
Nat Grid	NU061426
Nearest Post Code	TD15 2PB
Lat (WGS84)	N55:40:37
Long (WGS84)	W1:54:06

Table 1 - Site Characteristics (Streetmap)



Figure 1 - Site Location (Google Maps)

2.1.2. The application site has an approximate development area of 0.064 hectares.

2.1.3. The current development area contains a large area of existing harstanding used as the access road off the main road and a compound for vehicular parking and storage of materials used as part of Natural England's operations. A smaller proportion of the area is overgrown vegetation located behind the existing steel frame building.

2.1.4. Along the West boundary there is a small brook which flows North before entering the primary South Low which ultimately flows out into the North Sea.

2.1.5. Along the North and East boundaries, the ground does ramp up to approximately 6 – 6.5m. This is adjacent to the High Speed Rail Line.

2.1.6. Topographical information provided by Formby Surveys indicates that a fall of 1200mm from North to South with the East to West direction fairly flat.

2.1.7. Where the actual building is proposed to be located, the land is fairly flat with a nominal fall East to West in the direction of the watercourse located on the West boundary.

2.1.8. The vast majority of the development is within a Flood Zone One – the lowest flood risk category. However, a very small proportion of the development – the North East corner, is located in a Flood Zone Two. This has been calculated to be in the region of 56 square metres of the development area (640 square metres)



Figure 2 – Flood Zone Characterisation
(GOV.UK)

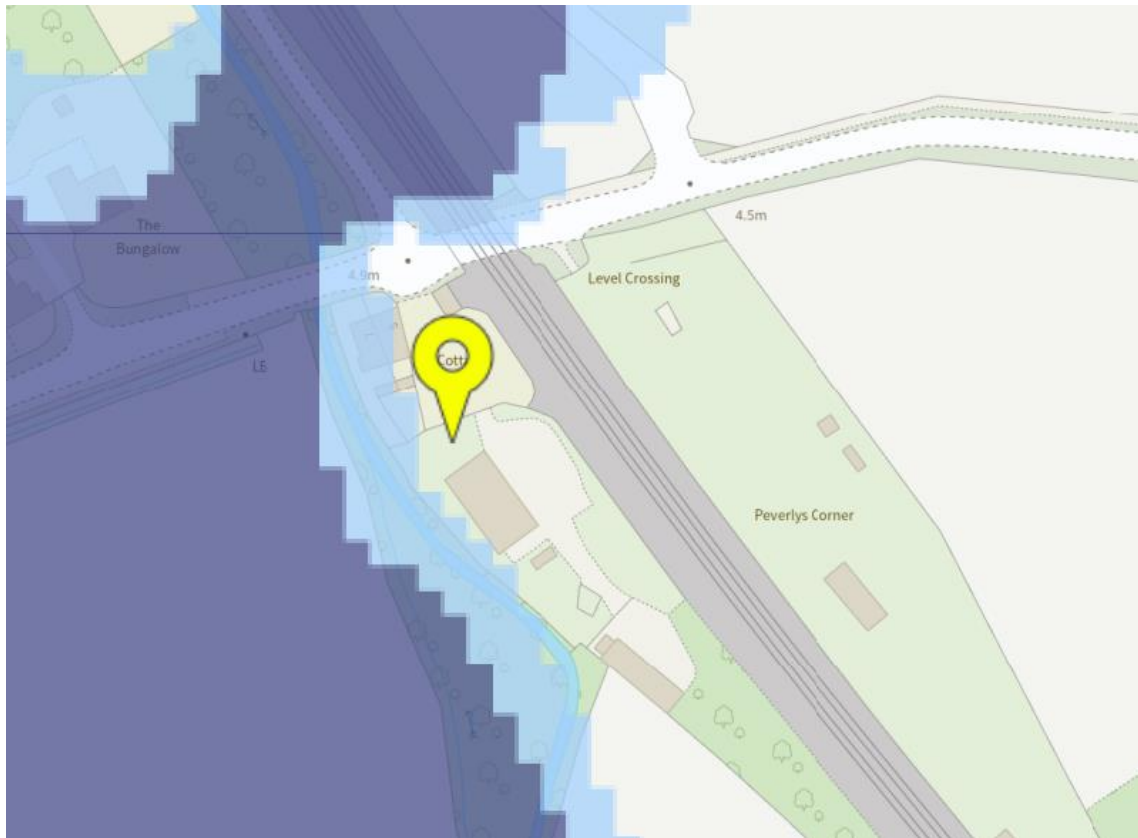


Figure 3 – Flood Zone Closeup showing small area in FZ2. (GOV.UK)

2.2. Development Proposals

- 2.2.1. A single storey frame building will be constructed in the North West corner of the development.
- 2.2.2. The proposed development comprises the construction of a single storey building which will include a laboratory, ancillary accommodation and associated facilities.
- 2.2.3. The development is to allow for Natural England to undertake research activities with facilities for short term university or educational bodies/ studies to further the understanding of the local habitat, as well as to provide welfare facilities to volunteer bodies who support Natural England with it's management of the environment.
- 2.2.4. The architectural package of drawings show the roof to be of 'green construction' and has an approximate area of 110 square metres.
- 2.2.5. An area of car parking will be formed along the East boundary. This will be constructed with a permeable surface to replicate the current arrangement as far as practicable. Storage for the volume generated can be held within the subbase below the car park and released at a controlled rate into the watercourse.
- 2.2.6. Existing external levels will be maintained as far as is practicable (approximately 5.400m AOD) with the internal ground floor level set 200mm higher than this (5.600m AOD).

3. FLOOD POTENTIAL

3.1. Development Proposal

- 3.1.1. The proposal consists of offices and other educational rooms appropriate to it's use with a small proportion of overnight accommodation. Table 2 of the NPPF flood risk vulnerability classification indicates residential areas are classified as 'More Vulnerable' developments and offices and similar are classified as 'Less Vulnerable'.
- 3.1.2. Following review of Table 3 of the NPPF, developments within Flood Zones One and Two with either a vulnerable class of more or less both indicate the development to be appropriate and no exception tests are required to be undertaken.

3.2. Potential for Flooding

- 3.2.1. There are six potential sources of flooding at the site which will be addressed in more detail in this report, i.e.
- (i) Flooding from rivers or the Sea.
 - (ii) Flooding from Surface Water run-off
 - (iii) Flooding from the surcharging of drains or sewers on or around the development.
 - (iv) Flooding due to high groundwater levels.
 - (v) Flooding from Reservoirs.
 - (vi) Flooding from canals

3.3. Existing Historical Flooding Information

- 3.3.1. No historical flood records have been identified within or in the vicinity of the development.

3.4. Existing Structures Likely to Affect Local Hydraulics

- 3.4.1. The watercourse which runs North passes below a road. If this culvert was to become blocked, there is a increase in risk of flooding to the development, although the neighbouring topography would suggest this would run into the farmer's fields to the West first.

3.5. Flood Risk Probabilities

i. Flooding from Rivers (Fluvial)

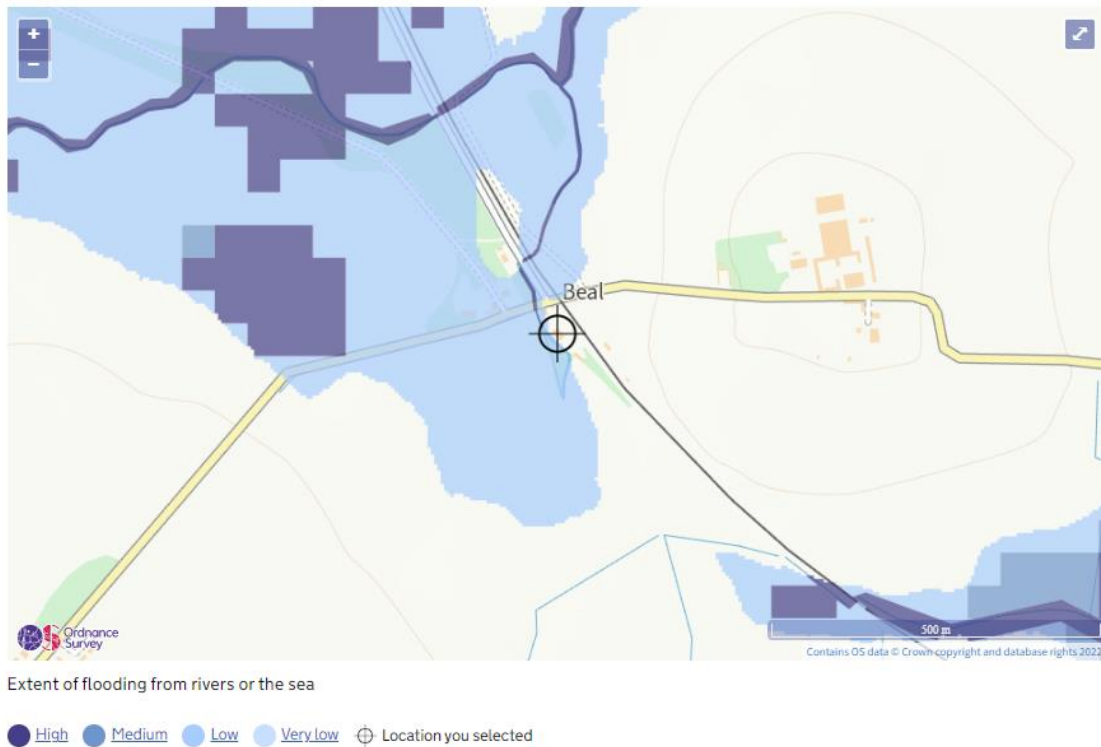


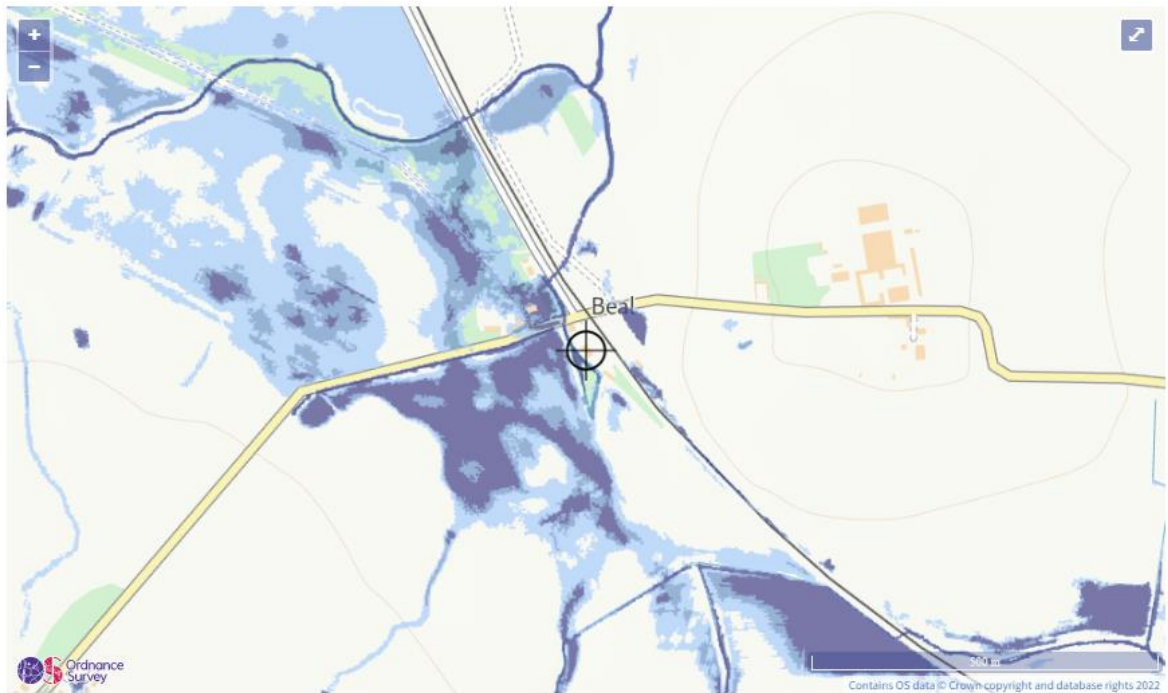
Figure 4 - Extent of Flooding from Rivers or the Sea (Environment Agency)

3.5.1. Flooding to the development from Rivers or the Sea is indicated in Figure 4. It can be seen that the development is at very low risk from fluvial flooding.

3.5.2. The watercourse to the West boundary appears to drain into the adjacent farmers fields if it were to flood.

The risk of fluvial or tidal flooding at this development is very low.

ii. **Flooding from Surface Water Run-off**



Extent of flooding from surface water

High
 Medium
 Low
 Very low
 Location you selected

Figure 5 - Extent of Flooding from Surface Water (Environment Agency)

- 3.5.3. During periods of heavy rainfall, the capacity of the sewers and drainage systems can be exceeded, surcharging of manholes and gullies (or other forms of outfall) can occur and surface water overland flow can occur.
- 3.5.4. The Environment Agency flood maps for surface water (Figure 5) have been consulted for this area and the risk is considered to be very low.
- 3.5.5. There is a potential to increase flood risk due to the increased impermeable areas and changes in proposed levels. Consideration has been made to reduce the impact of the increase in impermeable area with the use of a green roof.
- 3.5.6. The drainage system for the development will be designed in strict accordance with the Lead Local Flood Authorities' requirements with greenfield rates of controlled runoff coming off the development and design in accordance with the relevant storm events to either result in no flooding (1 in 30 year storm event) or that

all flood waters are held on site away from properties and not allowed to enter neighbouring land/ property (1 in 100 year storm event plus 40% climate change).

- 3.5.7. The design will utilise source control by introducing a green roof with surplus either stored for irrigation or allowed to drain into the brook as currently happens.
- 3.5.8. The foul and surface water systems will be kept separate before entering their associated public foul/surface water sewers.
- 3.5.9. The proposal attempts to maintain the levels of the current topography as far as practical.

iii. Flooding from the surcharging of drains or sewers on or around the site.

- 3.5.10. There are a number of highway gullies on the neighbouring roads which are likely to discharge either into these sewers or at some point into a water course downstream.
- 3.5.11. A cleaning and maintenance regime is outlined within the Drainage Strategy for the development drainage and this details recommendations to ensure the surface water system remains operational during normal times and post storm conditions.
- 3.5.12. The public infrastructure will be managed by either the Lead Local Flood Authority and/ or the local Water Authority. It will be a civic duty of a resident or manager of the drainage system to report to these bodies when local public infrastructure is blocked so this can be logged and made good to reduce the future risk of flooding.
- 3.5.13. In these instances, surface water flooding from poorly maintained private sewers has the potential to accumulate at these properties.

The risk of surface water flooding from surcharged sewers and gullies at this site is medium.

iv. Groundwater Flooding

- 3.5.14. No groundwater strikes were recorded in the Site Investigation Report.
- 3.5.15. Based on this, the ground water level is below the proposed levels of the development and so, the proposed development is at a very low risk of flooding from Groundwater. Precautions may be required for the construction of foundations, but this would be part of the standard procedures for a construction project of this scale.

The risk of groundwater flooding at this site is low.

v. Flooding from Reservoirs

- 3.5.16. Artificial sources of flooding are potentially from man-made structures and infrastructure. The Environment Agency have modelled the potential effect of flooding from failures in retaining structures containing reservoirs and this is shown in Figure 6.
- 3.5.17. It should be noted that reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs are inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the Environment Agency ensure that reservoirs are inspected regularly, and essential safety work is carried out.

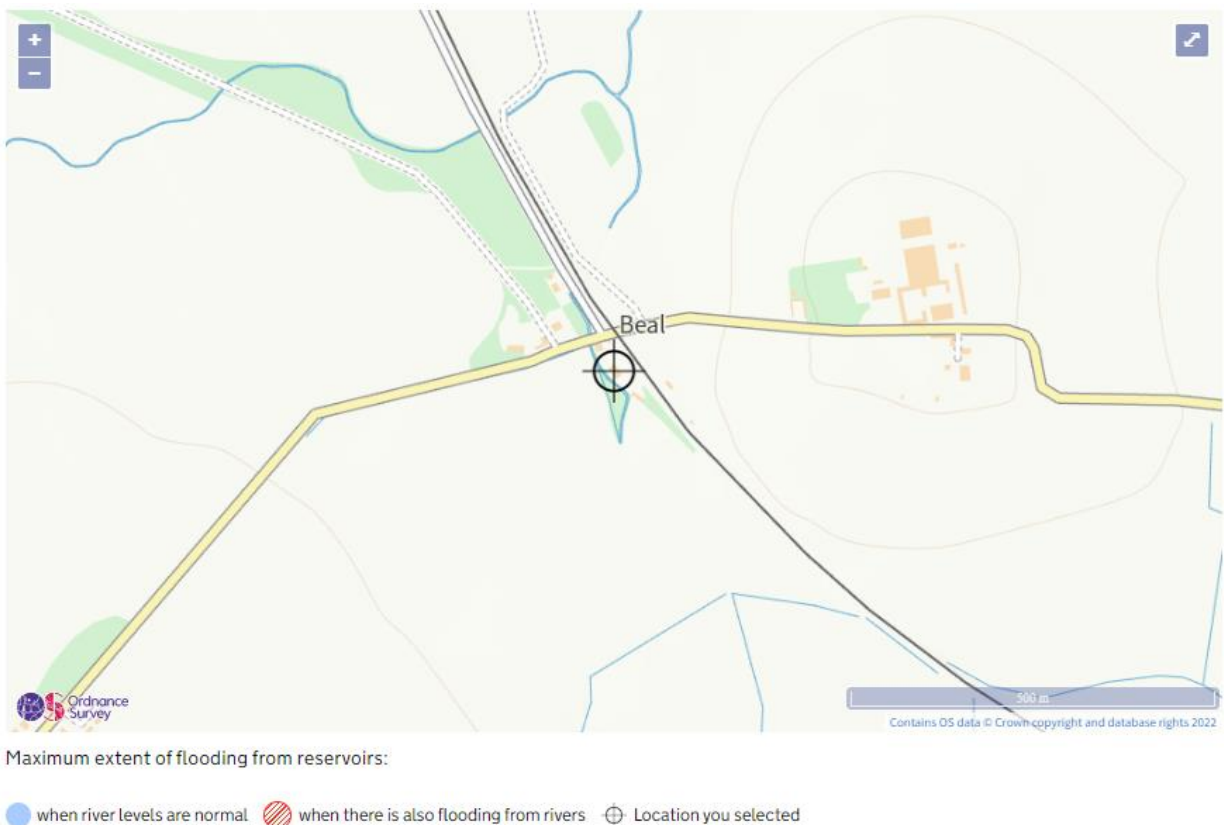


Figure 5 - Flood Risk from Reservoirs (Environment Agency)

The risk of flooding from reservoirs at this site is low.

vi. Flooding from Canals

- 3.5.18. There are no canals located within a 200m vicinity of the site.

The risk of flooding from canals at this site is low.

3.6. Impact of Development on Fluvial Morphology

- 3.6.1. The development will not alter any flow regimes which will have an adverse effect on the fluvial morphology of the area.

4. DRAINAGE

4.1. Existing Drainage

- 4.1.1. There is limited information available as to the presence of existing private drainage on the development.
- 4.1.2. The utilities survey undertaken shows rainwater being collected off the roof of the main building and discharging into the watercourse.
- 4.1.3. Foulwater appears to collect and enter into a septic tank – although it does not appear this has been serviced in a number of years despite the site being used daily.

4.2. Proposed Sustainable Drainage Systems (SuDS.)

- 4.2.1. Any new drainage for the development should be designed in accordance with the non-statutory technical guidance for the design of sustainable drainage systems.

4.3. Surface Water Disposal Hierarchy

- 4.3.1. The disposal of surface water should be considered in the following order of priority;
 1. Discharge to be used on site.
 2. Infiltration into the subsoil via soakaways or permeable paving.
 3. Discharge to a water course or the sea.
 4. Discharge to a surface water sewer.
 5. Discharge to a combined sewer.
- 4.3.2. If it is not possible to use discharge on site or discharge to a soakaway, then surface water should be controlled with the use of Sustainable Drainage Systems (SuDS) and considered using the SuDS Hierarchy.

Most Sustainable	SUDS technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
	Living roofs	✓	✓	✓
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices - soakaways - infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains - gravelled areas - solid paving blocks - porous paviers	✓	✓	
Least Sustainable	Tanked systems - over-sized pipes/tanks - storms cells	✓		

Figure 8 - SuDS Hierarchy (Environment Agency Thames Region, 2006 SuDS A Practical Guide)

4.4. Disposal Strategy

4.4.1. Use on Site

There is a potential for any surplus runoff from the green roof to be stored and used for irrigation purposes.

4.4.2. Infiltration

The ground investigation report appears to indicate the site is underlain by silty, sandy clays which will by their nature have minimal filtration properties.

In addition, the ground investigation has identified potential contaminants in the ground – likely to be from the past history of the site as a railway sidings. Filtration has the potential to carry contaminants into the groundwater.

Infiltration is not recommended based on the above.

4.4.3. Discharge to a Water Course

There is a small open water course along the West boundary which appears to be where surface water currently discharges to.

It would be the intention to take the discharge from the new building into this watercourse.

Further investigations would be required to assess the feasibility of discharging into this. At this stage, due to the size and limited information this would have to be used in conjunction with a primary source of draining the site.

4.4.4. Discharge to a Surface Water Sewer

There are no surface water sewers within the vicinity of the development that would not entail crossing third party land.

There are likely to be highway drains in the adopted highway but local authorities do not usually accept discharge from private developments and often they do not have adequate capacity to take the additional discharge of the increased risk of liability from flooding.

4.4.5. Combined Sewer

It is not proposed to combine the surface water with the foul and collect this in the septic tank or any upgrading of the foul system.

5. FLOOD MITIGATION MEASURES

5.1. Fluvial/ Tidal Flood Mitigation

- 5.1.1. The architect has proposed that the ground floor level of the building will be raised 200mm higher than the current ground levels of the development.
- 5.1.2. It is typical for floor levels to be raised 600mm above known flood levels with the 600mm considered 'freeboard' above the peak flood level. However, given the vast majority of the development is contained with Flood Zone One and a nominal area (56m² out of a total 640m²) is contained in Flood Zone Two, the increase of 200mm is proposed to offer a nominal freeboard for a development which is not proposed to be used at all times.
- 5.1.3. At the time of writing, no flood levels have been provided by any of the bodies contacted but there is not believed to be a history of river flooding on the development.
- 5.1.4. The risk from tidal flooding following mitigation can be considered generally low for the habitable areas of the development as the ground floor levels as it appears levels are set above or at the minimum required levels.

5.2. Surface Water Flooding Mitigation

- 5.2.1. It is recommended that proposed external ground levels across the development should fall away from the proposed buildings in a manner which does not create low points where water may pond unintentionally. This will ensure the any surface water will not flow towards the proposed buildings.
- 5.2.2. The drainage network will be designed in strict accordance with the LLFA requirements.
- 5.2.3. Providing the above measures are implemented on the development, flooding risk from surface water is therefore considered low post development.

5.3. Surface Water Flooding due to surcharged sewers or gullies Mitigation

- 5.3.1. All new development drainage will be designed in accordance with the FRA, Lead Local Flood Authority requirements and best practice.
- 5.3.2. Based on the nature of the development, a lifespan in excess of 60 years is anticipated. Therefore, the potential climate change allowance for 2070-2115 ranges between 30% for the central allowance and 40% for the upper end allowance. The upper limit will be considered now.
- 5.3.3. In following the hierarchy of drainage solutions, consideration has been given firstly to the discharge of surface water runoff by sustainable method of infiltration, through to discharge into a sewer. These options are discussed in Section 4.

5.3.4. To minimise localised flooding within the development, the drainage design should ensure that gullies, drainage channels and drains are all suitably sized to accommodate peak storm flows. Additionally, all inlet features should include suitably sized sumps to catch silts and should be subject to documented maintenance and cleansing regime.

5.3.5. A cleaning and maintenance regime should be adopted and adhered to with outline details found in the drainage strategy.

5.4. Groundwater Flood Mitigation

5.4.1. Groundwater flooding tends to last over a number of weeks or months rather than hours or days. Groundwater flooding does not generally pose a significant risk to life due to the slow rate at which the water level rises. However, it can cause significant risk to property.

5.4.2. The development is considered to be at a low risk of groundwater flooding as no groundwater was encountered upto at least 6m below ground level during the site investigations.

5.4.3. Finished floor levels are set above ground water levels.

5.4.4. External ground levels across the development generally fall away from the proposed buildings and ensure that the creation of low points is avoided (other than those used intentionally for drainage features) in order that in the unlikely event of groundwater flooding, the flood water is safely routed away from the buildings.

5.4.5. Providing the above mitigation measures are imposed, the risk from groundwater flooding would therefore be considered to be low post development.

5.5. Flood Mitigation Generally

5.5.1. Flood water exceedance routes should be identified, both on and off site.

5.5.2. For any sustainable drainage systems employed in the development, an appropriate management and maintenance plan for the sustainable drainage system for the lifetime of the development should be submitted and should include;

- Any arrangements for adoption by an appropriate public body or statutory undertake, management and maintenance by a Resident's Management Company.
- Arrangements concerning appropriate funding mechanisms for its ongoing maintenance of all elements of the sustainable drainage systems (i.e. inspections, regular maintenance).
- Means of access for maintenance and easements where applicable.

5.5.3. The Environment Agency Floodline Warnings Direct is a free service that provides warnings by phone, text or email. Property owners and commercial unit managers can register to receive notifications. This will enable people to prepare for flooding and evacuate the building if necessary.

5.5.4. The development should be designed in accordance with guidance given in BS 85500:2015 - Flood resistant and resilient construction. Guide to improving the flood performance of buildings. This document

can be used to help improve the resistance and resilience of buildings against flooding with the use of suitable materials and construction techniques.

5.5.5. For example, materials that are to be used up to first floor could be resilient to water.

5.5.6. The proposed ground floor of the building will be set at 200mm above current ground levels.

5.5.7. External levels should be locally 'ramped' upwards adjacent to the entrance doors from the surrounding external levels.

5.5.8. The introduction of thresholds drains are proposed to each of the entrance doors to the buildings residential and commercial doors.

5.5.9. Assuming that the proposed drainage system is designed to provide adequate capacity, and that the private and adopted sewers will be maintained by their adopted authority, it can be assumed risk of flood from blockage or overloading is minimal.

6. **CONCLUSIONS AND RECOMMENDATIONS**

- 6.1. This report gives details of the Flood Risk Assessment, which has been carried out in relation to the proposed development of Natural England Lindisfarne.
- 6.2. The development is predominantly within a low risk of surface water flooding as defined by the Environment Agency. The risk of flooding from rivers, seas and surface water is generally very low subject to suitable design and maintenance of the proposed drainage systems.
- 6.3. The proposed development has been designed to take flood risk into account where possible.
- 6.4. The drainage network will be designed in strict accordance with the LLFA requirements. The outline proposal is to use the green roof as source control to slow the flow and volume of surface water down with the remainder discharged into the existing open watercourse. This is the current drainage strategy used by the adjacent impermeable roofed building.
- 6.5. The car park will have a permeable surface to replicate the current arrangement with the subbase below the car park designed to hold storm water and discharge into the watercourse at a controlled rate.
- 6.6. Ground floor levels will be set 200mm higher than current ground levels given the vast majority of the building will remain in Less Vulnerable Classification.
- 6.7. This Flood Risk Assessment has demonstrated that the development is generally at low risk from all forms of flooding applicable to this development and would not increase the risk of flooding elsewhere.
- 6.8. A flood management plan can be developed and included within the Operation and Maintenance Manual for the drainage on site as part of the handover of the finished project.
- 6.9. The development provides the opportunity to reduce flood risk overall with the use of sustainable drainage systems to attenuate surface water run-off from the site.
- 6.10. The Drainage Strategy for the development is a separate document which can be read alongside this Flood Risk Assessment.

7. FLOOD MANAGEMENT PLAN ADVICE

- 7.1. The Health and Safety File which will be required under the Construction, Design and Management Regulations, will contain a section on flood management. This document will have all operation and maintenance manuals for any drainage systems.
- 7.2. The Development managers will need to be made aware of flood warning procedures. A flood management plan should be developed. This chapter provides guidance on the contents for the management plan. Reference can also be made with the EA advice at <http://apps.environment-agency.gov.uk/flood/151256.aspx>
- 7.3. The property is within an area covered by the Environment Agency's Flood Line Warnings Direct. This is a free service and provides flood warnings by telephone, mobile, email, text and fax. The managers can sign up on-line <https://www.gov.uk/sign-up-for-flood-warnings>
- 7.4. Flood advice will be provided at different levels:-

FLOOD WATCH

Flooding of low-lying land and roads is expected.

What to do:

- Monitor local news and weather forecasts.
- Be aware of water levels near you.
- Be prepared to act on your flood plan.
- Charge mobile phones.

FLOOD WARNING

Act Now! Flooding is expected.

What to do:

- Move students, staff, valuables and important documents to safety.
- Turn off gas, electricity and water supplies if safe to do so.
- Be prepared to evacuate.
- Act on your flood plan.

SEVERE FLOOD WARNING

Act Now! Severe flooding is expected with extreme danger to life and property.

What to do:

- Collect things you need for evacuation.
- Turn off gas, electricity and water supplies if safe to do so.
- Stay in a high place with a means of escape.
- Avoid electricity sources.
- Avoid walking or driving through flood water.
- If in danger, call 999 immediately.
- Listen to emergency services.
- Act on your flood plan.

ALL CLEAR

No further flooding is expected. Water levels will start to go down.

What to do:

- Keep listening to weather reports.
- Only return to evacuated buildings if you are told it is safe.
- Beware sharp objects and pollution in flood water.
- If your property or belongings are damaged, contact your insurance company. Ask their advice before starting to clean up.

All managers / residents should be made aware of the health risk associated with contaminated flood water. Water should not be waded through or touched if at all possible.

7.5. Prepare a flood kit of essential items.

First aid kit and supplies

Details of all important contact numbers

Water proof clothing for use by key staff

7.6. Ensure that there are clear instructions on how to turn off electric, water mains and gas supplies if appropriate.

7.7. A plan is also required for the return to the site after a flood.

A safety inspection should be carried out by park managers to ensure that there is no dangerous debris or displaced manhole covers etc.

Structures should be inspected to ensure that there is no structural damage. Power should only be reinstated by professional electricians.

Flood water clean-up operations should only be undertaken with suitable personal protective equipment to avoid contact with sewerage and contamination.