Seafront Building and Civic Space at Seaview Terrace, Bettystown, County Meath

Flood Risk Assessment

Technical Report

June 2020

comhairle chontae na mí
meath county council

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Contract

This report describes work commissioned by Robin Lee on behalf of Robin Lee Architecture (RLA). Ben Murphy and Ross Bryant of JBA Consulting carried out this work.

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Purpose

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Abbreviations

AEP	Annual Exceedance Probability
CDP	County Development Plan
CFRAM	Catchment Flood Risk Assessment and Management
DoEHLG	Department of the Environment, Heritage and Local Government
EPA	Environmental Protection Agency
FRA	Flood Risk Assessment
GDSDS	Greater Dublin Strategic Drainage Strategy
GSI	Geological Survey of Ireland
OPW	Office of Public Works
PFRA	Preliminary Flood Risk Assessment
RFI	Request for Further Information
SFRA	Strategic Flood Risk Assessment

1 Introduction

1.1 Terms of reference

MPA Consulting Engineers have requested a flood risk assessment be undertaken to support a Meath County Council Part 8 planning application for a lifeguard station and community centre/library at Bettystown on the corner of Golf Links Road and Seaview Terrace.

The commission will ensure accordance with the Strategic Flood Risk Assessment (SFRA) of the County Development Plan (CDP) and the Planning System and Flood Risk Management Guidelines for Planning Authorities (DoEHLG & OPW, 2009).

JBA Consulting was appointed by MPA Consulting Engineers to prepare a Flood Risk Assessment (FRA) for a development in Bettystown, Co. Meath.

1.2 Flood Risk Assessment: Aims and Objectives

This study is being completed to inform the future development of the site as it relates to flood risk. It aims to identify, quantify and communicate to Planning Authority officials and other stakeholders the risk of flooding to land, property and people and the measures that would be recommended to manage the risk.

The objectives are to:

- Identify potential sources of flood risk;
- Confirm the level of flood risk and identify key hydraulic features;
- Assess the impact the proposed development has on flood risk;
- Develop appropriate flood risk mitigation and management measures which will allow for the long-term development of the site.

Recommendations for development have been provided in the context of the OPW / DoEHLG planning guidance, "The Planning System and Flood Risk Management". A review of the likely effects of climate change, and the long-term impacts this may have on existing development has also been undertaken.

1.3 Development Proposal

The client is applying for planning permission for a lifeguard station, public toilets and public library on a site on the corner of Golf Links Road and Seaview Terrace in Bettystown, Co.Meath. The proposed site layout is displayed in Figure 1-1.

The FRA provides an assessment of risk to the site, including recommendations for any flood mitigation that may be required.

1.4 Structure of report

Section 2 of this report gives an overview of the study location and associated watercourses. Section 3 contains background information and initial assessment of flood risk. Site-specific mitigation measures are outlined in Section 4. Conclusions are provided in Section 5.

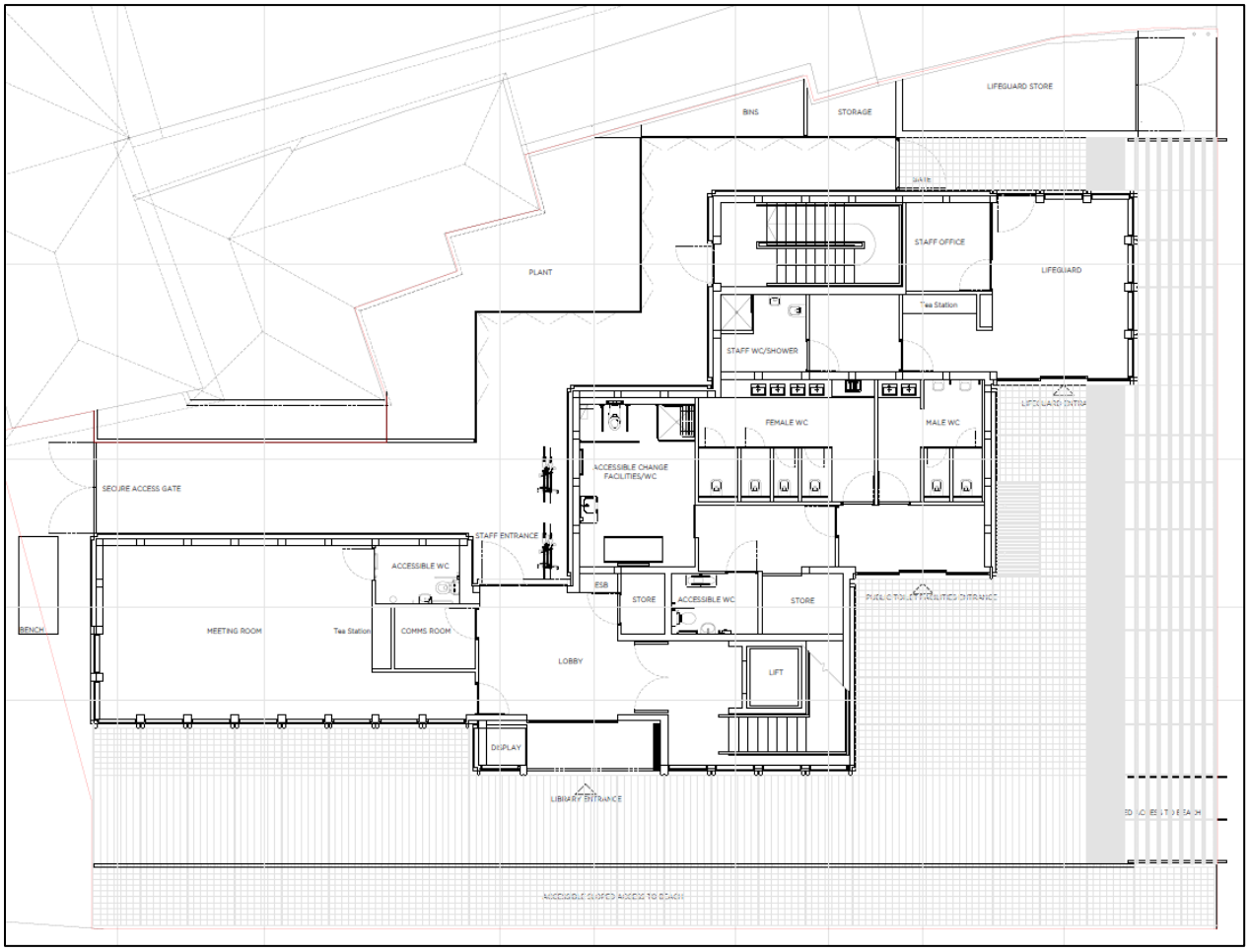


Figure 1-1: Proposed Site Layout

2 Site Background

This section describes the proposed development site including adjacent watercourses and the wider geographical area.

2.1 Location and Topography

Commercial and residential land bounds the site location on the north, west and southern boundaries. Bettystown beach borders the site location to the east. Figure 2-1 shows the site location and surrounding area.

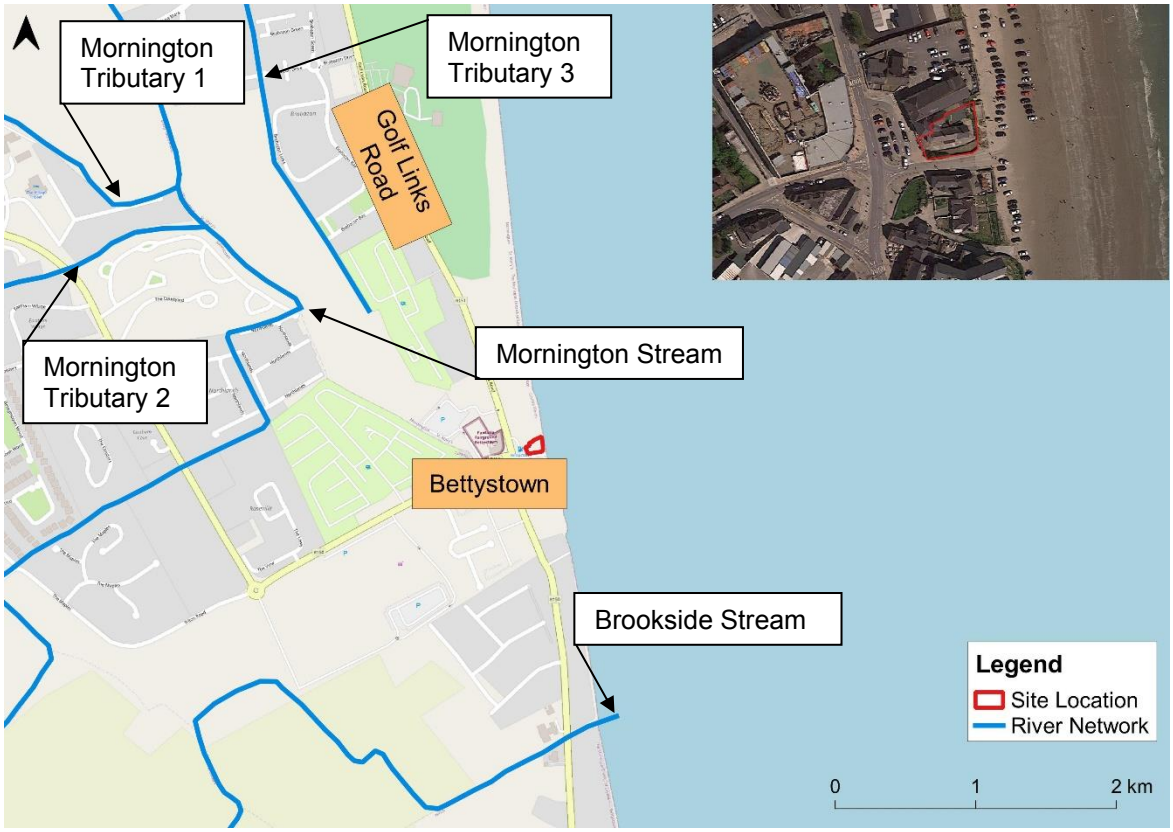


Figure 2-1: Site Location and watercourses (source: OSM and Google Satellite)

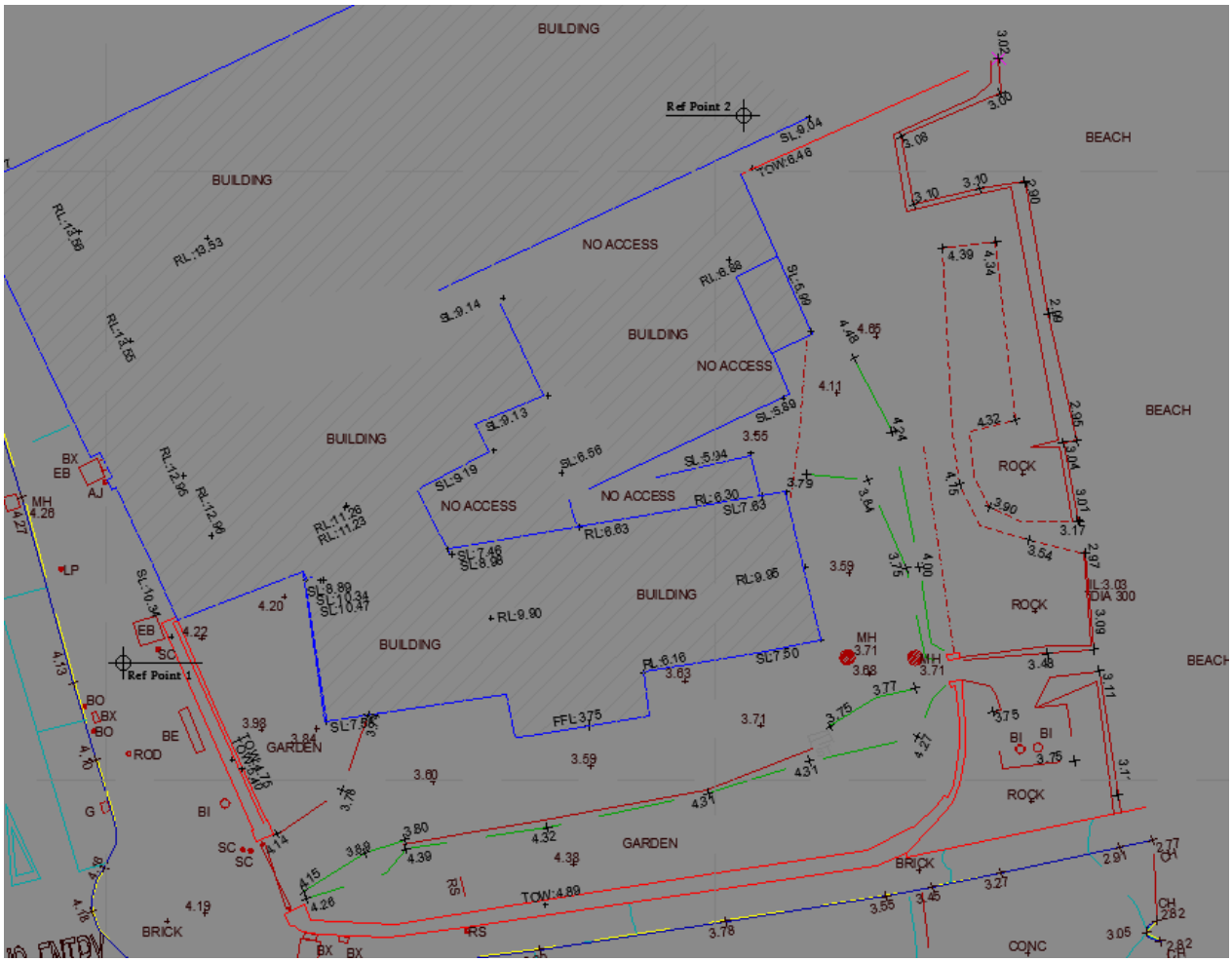


Figure 2-2: Topographic survey of site location

2.2 Topographic Survey

A topographic survey of the site was carried out by ABL surveyors. The site survey indicates the lowest level within the site boundary is 3.48m OD on the eastern boundary of the site. The pavement level on the western boundary of the site is 4.22m OD.

2.3 Watercourses

The Mornington Stream and its tributaries flow through Bettystown in a northerly direction, outfalling into the Boyne Estuary to the north in Mornington East. Brookside stream flows in an easterly direction through Bettystown and discharges directly into the Irish Sea, see Figure 2-1.

2.4 Site Geology

The groundwater and geological maps of the site provided by the Geological Survey of Ireland (GSI) have been studied. The underlying subsoil layer is made ground. There are no alluvium soils found across the site which could indicate historical fluvial flooding.

The underlying bedrock is identified as Tullyallen Formation which is classified as pale micritised grainstone-wackestone. There are no karst features or historic springs located at the site. The groundwater vulnerability for the site is classified as Low 'L', which indicates a depth to bedrock of greater than 10m. This suggests there is no indication of groundwater flooding at the site location.

Figure 2-3: Bettystown Soils (Source: GSI Database)

Figure 2-4: Bettystown Groundwater Vulnerability (Source: GSI Database)

2.5 Land Use Zoning (East Meath LAP 2014-2020)

The site is located within lands zoned as existing town centre use. The objective of this zoning is to protect, provide for and/or improve town and village centre facilities and uses. Figure 2-5 outlines zonings for the LAP area.

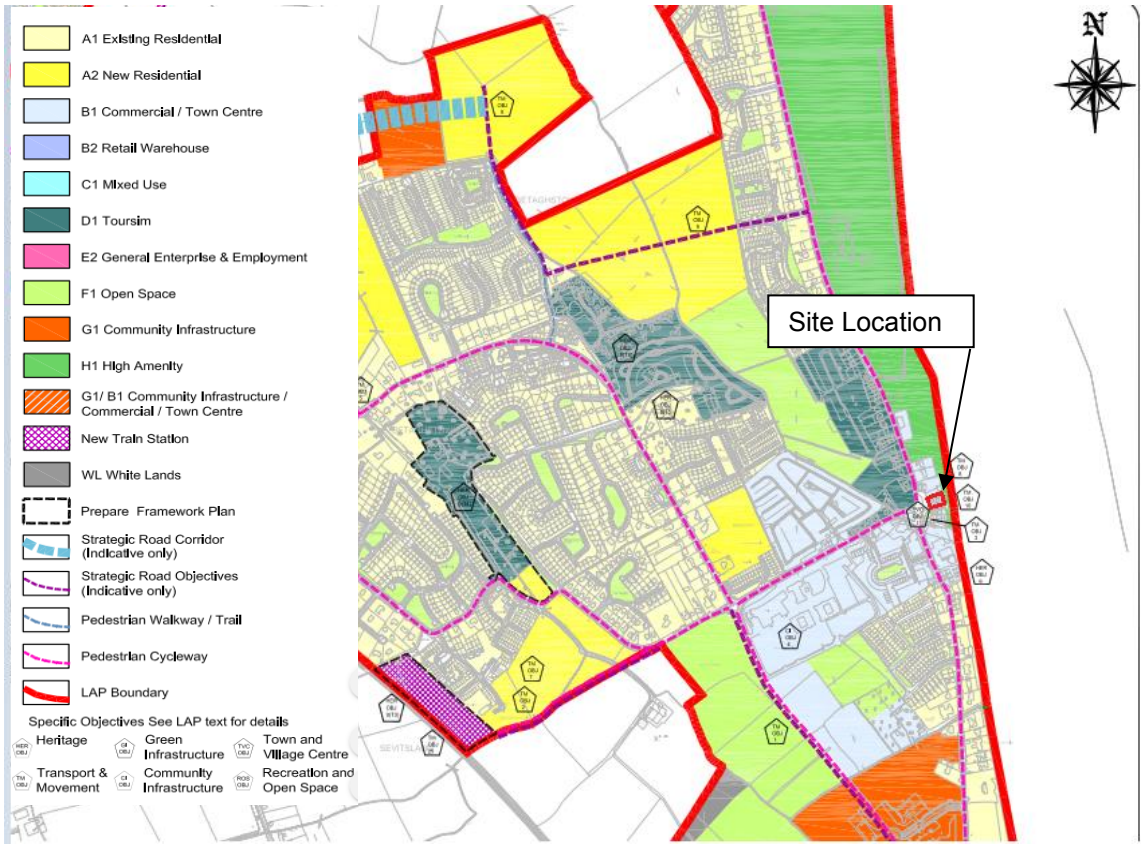


Figure 2-5: Land Use Zoning (Source: East Meath LAP 2014-2020)

3 Flood Risk Identification

An assessment of the potential and scale of flood risk at the site is conducted using historical and predictive information. This identifies any sources of potential flood risk to the site and reviews historic flood information. The findings from the flood risk identification stage of the assessment are provided in the following sections.

3.1 Flood History

A number of sources of flood information were reviewed to establish any recorded flood history at, or near the site. This includes the OPW's website, www.floodmaps.ie and general internet searches

3.1.1 Floodmaps.ie

The OPW host a National Flood Hazard mapping website, www.floodmaps.ie, which highlights areas at risk of flooding through the collection of recorded data and observed flood events. The website has returned several results within the Bettystown area. The proposed development site was not believed to be affected during these events.

- Flood Event: Mornington/Bettystown - This area is prone to flooding from extreme high tides that occurred on 01/02/2002 and a combination of high tides and high rainfall that occurred on 06/11/2000. Properties were affected.
- Flood Event: Northlands Estate, Bettystown 24/10/2011 - Flooding on the Mornington River due to heavy rainfall and a blockage in the watercourse.
- Flood Event: Northlands Estate, Bettystown 26/09/2012 - Flooding on the Mornington River due to prolonged and heavy rainfall. Approximately 20 residential properties flooded. Farm land saturated in the area.

The site is located outside of benefiting lands shown in red in Figure 3-1. Benefiting lands are lands that were identified by the OPW that would benefit from land drainage schemes under the arterial drainage Act 1945.

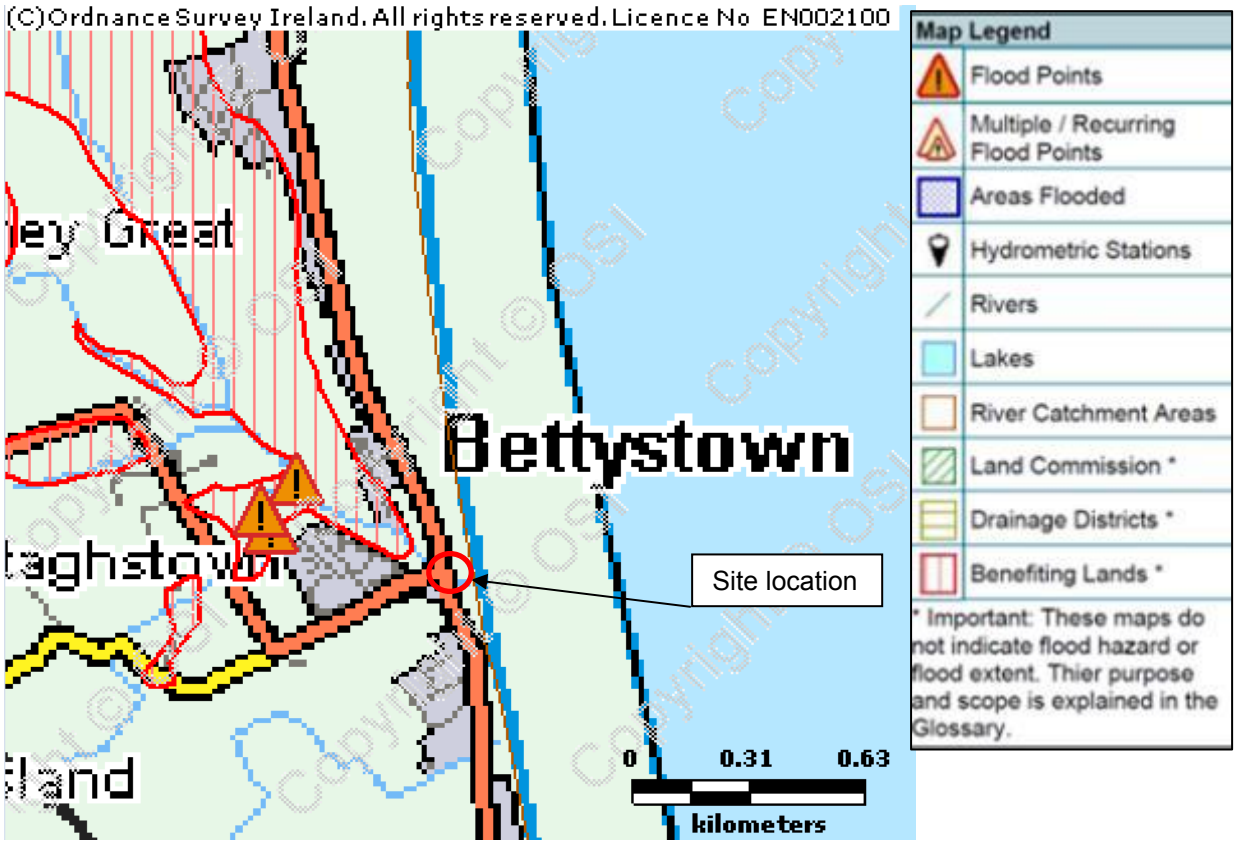


Figure 3-1: Historical Flooding (Source: floodmaps.ie)

3.1.2 Internet Search

An internet search was conducted to gather information about whether or not the site was affected by flooding previously and several results are present for the past flooding of Bettystown in 2002 and 2012. However, the site was not indicated as being affected in the reports.

3.2 Predictive Flooding

A number of predictive flood mapping and/or modelling studies have been carried out on the Mornington stream and its tributaries. The main studies to consider are:

1. OPW Preliminary Flood Risk Assessment (PFRA) (2011)

2. Meath County Council East Meath Local Area Plan (LAP) 2014-2020

3. Eastern Catchment Flood Risk Assessment and Management (CFRAM) study 2016

The level of detail presented by the studies listed above is high, however the Eastern CFRAM is the most recent and detailed assessment of flood extent. The Eastern CFRAM supersedes the fluvial and tidal flood outlines presented in the OPW PFRA and the Mornington District Surface Water and Flood Protection Scheme mapping, which was used within the East Meath LAP.

3.2.1 OPW Preliminary Flood Risk Assessment

The preliminary Flood Risk Assessment (PFRA) is a requirement of the EU Flood Directive (2007/60/EC). One of the PFRA deliverables is flood probability mapping for various sources: pluvial (surface water), groundwater, fluvial and tidal. The PFRA is a preliminary or 'indicative' assessment and analysis has been undertaken to identify areas potentially prone to flooding. The OPW PFRA study has largely been superseded by the FEM CFRAM programme.

3.2.2 East Meath Local Area Plan (LAP) 2014-2020

A Strategic Flood Risk Assessment (SFRA) was prepared to accompany the 2014-2020 Local Area Plan for East Meath, covering the areas of Bettystown, Laytown, Mornington East, Donacarney and

Mornington. This entailed a flood risk assessment of the area in conjunction with reproduction of flood mapping from the Mornington scheme.

A flood risk management plan was developed to assist with the Plan and its zoning objectives. As required by the Planning Guidelines, the Flood Zones presented in the LAP do not take into account the presence of flood protection structures and highlight the residual risk behind the defences as hatched areas.

The Flood Mapping produced for the SFRA does not identify flood risk to the site.

3.2.3 Eastern CFRAM Flood Risk Assessment Study (Eastern CFRAM)

The Eastern CFRAM study is the most detailed mapping undertaken in the Dublin/Meath region. It commenced in June 2011 with final flood maps issued during 2016. The Eastern CFRAM involves detailed hydraulic modelling of rivers and their tributaries. Following the detailed hydraulic modelling, flood maps were produced for the 10%, 1% and 0.1% AEP flood events.

Figure 3-2 shows the fluvial flood mapping for Bettystown. The site is predominantly located outside of the recognised flood extents.

The coastal flood mapping in the area was also reviewed from the Eastern CFRAM Study. Figure 3-3 identifies there is flood risk to the site for the 0.5% AEP event in the south east corner of the site.

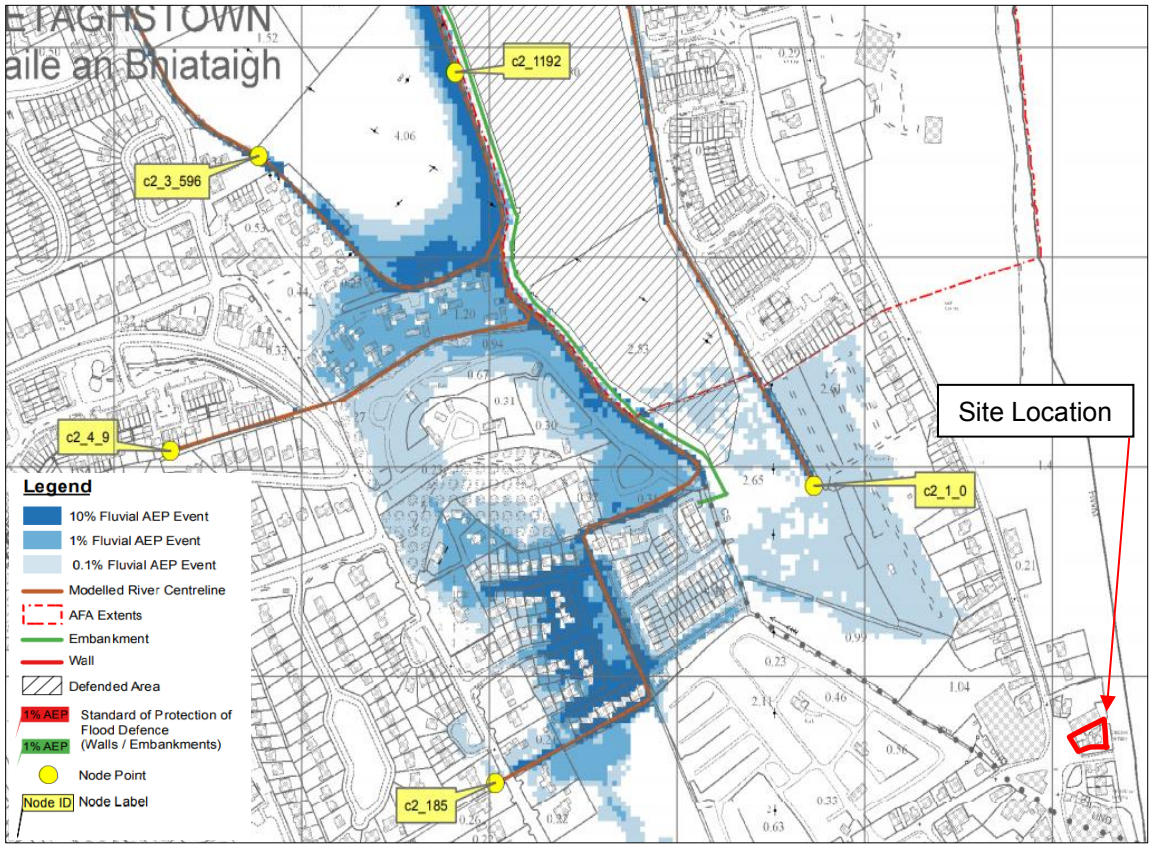
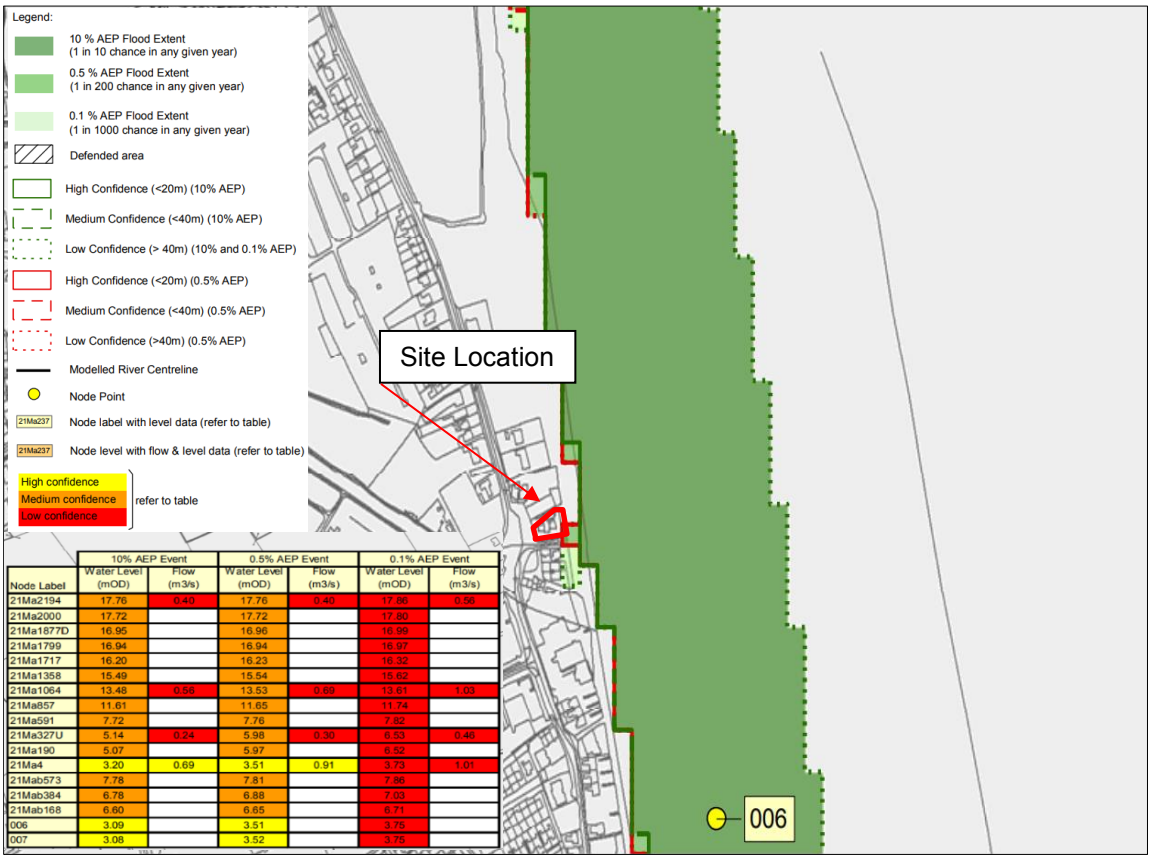


Figure 3-2: Eastern CFRAM Fluvial Flood Extent Map



Node Label	10% AEP Event		0.5% AEP Event		0.1% AEP Event	
	Water Level (mOD)	Flow (m3/s)	Water Level (mOD)	Flow (m3/s)	Water Level (mOD)	Flow (m3/s)
21Ma2194	17.76	0.40	17.76	0.40	17.86	0.56
21Ma2000	17.72		17.72		17.80	
21Ma1877D	16.95		16.96		16.99	
21Ma1799	16.94		16.94		16.97	
21Ma1717	16.20		16.23		16.32	
21Ma1358	15.49		15.54		15.62	
21Ma1064	13.48	0.56	13.53	0.69	13.61	1.03
21Ma857	11.61		11.65		11.74	
21Ma591	7.72		7.76		7.82	
21Ma327U	5.14	0.24	5.98	0.30	6.53	0.46
21Ma190	5.07		5.97		6.52	
21Ma4	3.20	0.69	3.51	0.91	3.73	1.01
21Mab573	7.78		7.81		7.86	
21Mab384	6.78		6.88		7.03	
21Mab168	6.60		6.65		6.71	
006	3.09		3.51		3.75	
007	3.08		3.52		3.75	

Figure 3-3: Eastern CFRAM Coastal Flood Event Map

The modelled coastal flood levels for the nearest nodes to the site (006 and 21Ma4) are presented in Table 3-1.

Table 3-1: CFRAM Modelled Tidal Flood Levels

Node Label	10% AEP	0.5% AEP	0.1% AEP
	Water Level (mOD)	Water Level (mOD)	Water Level (mOD)
006	3.09	3.51	3.75

3.3 Sources of Flooding

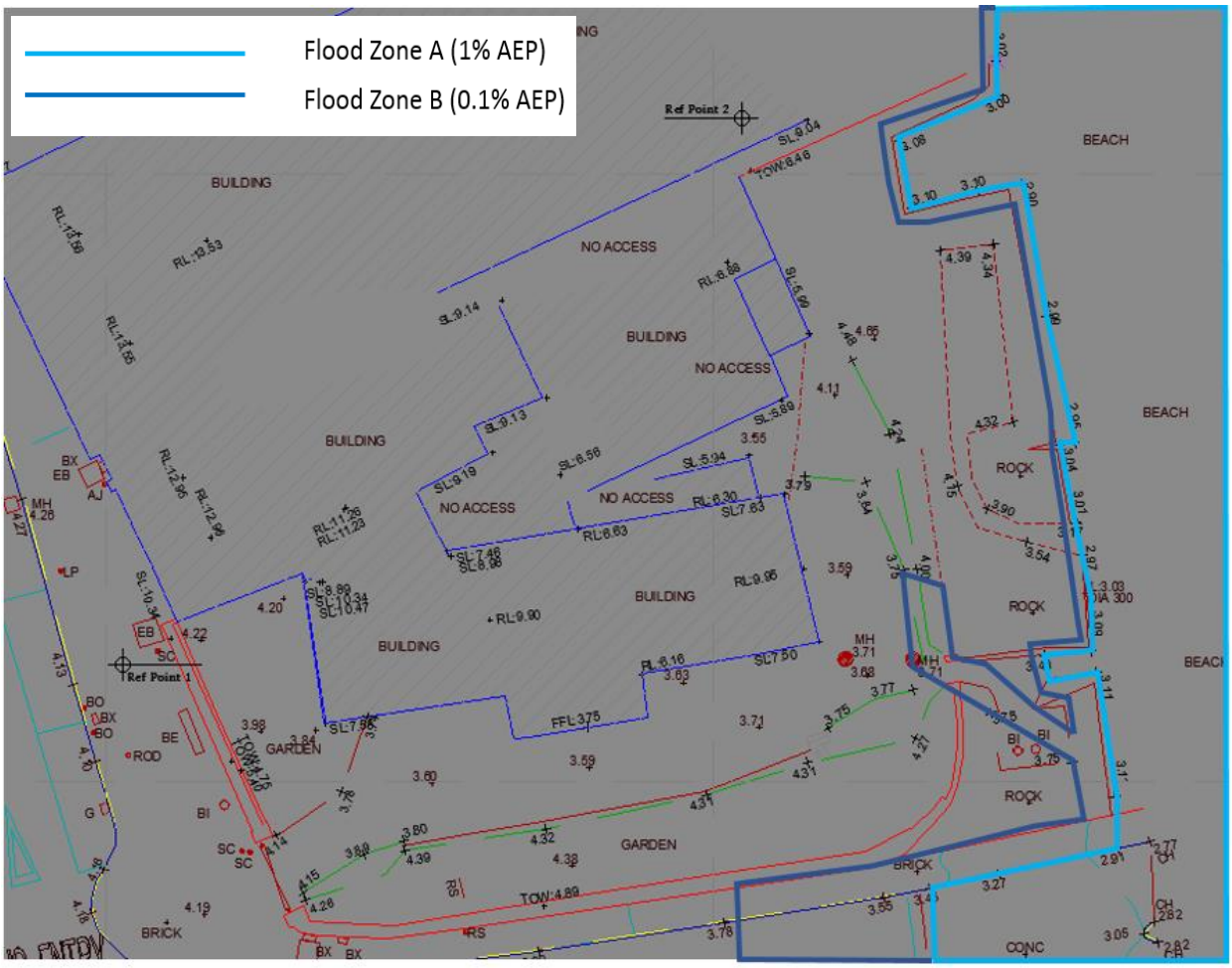
The initial stage of a Flood Risk Assessment requires the identification and consideration of probable sources of flooding. Following the initial phase of this Flood Risk Assessment, it is possible to summarise the level of potential risk posed by each source of flooding. The flood sources are described below.

3.3.1 Fluvial

All available sources of flooding have been researched as part of the FRA and the findings confirm that the site is at low probability of fluvial flooding.

3.3.2 Tidal/Coastal

Having reviewed the detailed topographic survey and comparing the CFRAM modelled tidal flood levels, the majority of the site is in Flood Zone C. The south east corner of the site is located in Flood Zone B



3.3.3 Pluvial/Surface Water

Pluvial flooding is the result of rainfall-generated overland flows that arise before run-off can enter a watercourse or sewer. It is particularly sensitive to increases in hard-standing ground/urbanised areas and is usually associated with rainfall events of high intensity. A number of sources have been researched such as floodmaps.ie. Based on review of the available information there is no recorded pluvial flooding at the site or immediate surrounding area.

Opportunities for improvements in management of surface water should be incorporated into the drainage design. Specific mitigation measures are proposed in Section 4.

3.3.4 Groundwater

Groundwater flooding results from high sub-surface water levels that impact upper levels of the soil strata and overland areas that are usually dry. The GSI groundwater vulnerability for the site is classified 'low' which indicates a groundwater depth of below 10m. Review of the gsi.ie web-portal confirms that no karst features are located in the area surrounding the site.

In summary, there is no known risk of groundwater flooding in this area and has been screened out at this stage.

4 Flood Risk Assessment and Mitigation

4.1 Flood Risk

Having reviewed the available sources of flooding information outlined in Section 3, there is no identified historic flooding within the site but there are recorded events within the surrounding area.

This FRA confirms that the site is deemed to be at low risk of flooding from a tidal event, with the majority of the site within Flood Zone C. The south east corner of the site is within Flood Zone B.

The building footprint is located appropriately within Flood Zone C, this is in accordance with the sequential approach as set out by the Planning System and Flood Risk Management Guidelines. As such the Justification Test is not applicable.

4.2 Flood Risk Mitigation

In response to the risk identified from coastal flooding, mitigation measures are required to minimise the flooding onsite and are outlined below.

4.2.1 Site Layout & Finished Floor Levels (FFL)

Finished Floor Levels for the development are recommended to be set at 4.31m OD which provides a 300mm freeboard above the 0.5% AEP event plus 0.5m climate change.. The ground floor, designed to be water compatible consists of an entrance lobby, a lifeguard station, changing rooms, toilets and a community meeting room. The first floor which consists of the library, offices and toilets have an FFL of >6mOD, well above flood levels.

Building materials on the ground floor should be resilient to impacts of flooding. This can be achieved by using wall and floor materials such as ceramic tiling that can be cleaned and dried relatively easily, provided that the substrate materials (e.g. blockwork) are also resilient. All electricals associated with the ground floor should be raised to a minimum level 4.75mOD, to provide greater freeboard.

All Electrical and Mechanical plant located below 4.75mOD shall be flood resilient or shall be protected against flooding.

Electrical components will not be located at a low level in the lift shaft and a sump at the base of the lift shaft of $1m^3$ to allow for a submersible sump pump should be introduced.

Incoming services ducts and penetrations through the floor slab and up to minimum level of 4.75mOD in the proposed development shall be sealed.

4.2.2 Access and Emergency Plan

In order to offer mitigation against the residual risk of a tidal surge during return periods exceeding the design event, the facility requires a robust Emergency Plan that ensures the safe management of the facility in the event of a tidal surge. The plan should be agreed with the Planning Authority in advance of the occupation of the proposed development.

Whilst floor levels of the development are suitably raised the access and egress to the building could be impacted by sea spray and wind and this would represent a risk to persons using the facility. As seen in Figure 3-3, the coastal levels are not expected to inundate access points but the sea spray/wave action could result in some inundation of the beach facing development. As such the applicant should employ the services of a competent consultant (prior to detailed design) to investigate the possible implications of Coastal wave action on the proposed development and should incorporate suitable compensatory measures in the detailed design of this proposed development to counteract same.

The flood emergency response recommendations are outlined below. A full plan should be drafted for the site once the planning permission is approved. The response includes staged structure, which relates to the escalation of the flooding situation.

The stages are:

- Receipt of tidal surge warning or OPW warning to Council to trigger an evacuation

- Stage 1 - Continue to monitor the situation and receive updates on the potential surge severity. Be prepared to restrict public access to the building and review on-site staffing levels.
- Stage 2 - Facility shut down - At predetermined threshold trigger levels the facility should be fully evacuated and shut down.
- Stage 3 - Recovery; repair, cleaning, debriefing, review emergency plan.

4.2.3 Foul & Surface Water Management

A surface water system will be incorporated within the development design. The proposed surface water system will manage surface water run-off from the site and must be designed in agreement with Meath County Council Drainage Engineers.

All Foul Sewer chambers at Ground level in this development shall be sealed to a specification to be agreed with Irish Water.

4.3 Residual Risk

Residual risks are defined as risks that remain after all risk avoidance, substitution and mitigation measures have been taken. The flood risk assessment identifies the following as the main sources of residual risk to the proposed development:

- Climate Change
- Failure of on-site surface water attenuation system

In accordance with the OPW guidelines, it is necessary to assess the risk associated with climate change, which under the medium range future scenario (MRFS) corresponds with an increase of 0.5m in tidal levels. FFLs have been set 300mm above the MFRS scenario and risk is appropriately managed.

Failure of the storm water system could include exceedance or blockage of the surface water gullies. Should this occur the direct runoff should be directed to flow towards the beach by use of preferential slope, where this is not possible then the flood resilient ground floor finishes (see Section 4.2.1) will manage the risk.

5 Conclusion

JBA Consulting has undertaken a Flood Risk Assessment for the proposed development on the corner of Golf Links Road and Seaview Terrace in Bettystown, Co.Meath.

From reviewing the available sources of flooding, the site has been shown to reside in Flood Zone C. The south east corner of the site is located in Flood Zone B, since the proposed use is less vulnerable and the building footprint is in Flood Zone C the Justification Test does not apply. There are no instances of historic flooding on site but there are recorded events in the surrounding area. Bettystown beach is located immediately east of the site and the 0.5% AEP flood event, (1 in 200 year) inundates the south eastern corner of the site.

Residual risks have been identified as potential impacts of climate change and stormwater system exceedance. The proposed mitigation measures for the development adequately protect against potential flooding.

Risk to the site is managed by raising floor levels to a minimum of 4.31mOD which will provide mitigation for up to and including the 0.5% coastal AEP flood level, with an allowance for climate change and freeboard of 300mm.

An emergency plan is put in place which includes staged structure, which relates to the escalation of the flooding situation.

As a result of the mitigation details discussed above, it is concluded that the development proposal is in compliance with the core principles of the Planning System and Flood Risk Management Guidelines and has been subject to a commensurate assessment of risk.

Appendices

A Understanding Flood Risk

Flood risk is generally accepted to be a combination of the likelihood (or probability) of flooding and the potential consequences arising. Flood risk can be expressed in terms of the following relationship:

Flood Risk = Probability of Flooding x Consequences of Flooding

A.1 Probability of Flooding

The likelihood or probability of a flood event (whether tidal or fluvial) is classified by its Annual Exceedance Probability (AEP) or return period (in years). A 1% AEP flood has a 1 in 100 chance of occurring in any given year.

In this report, flood frequency will primarily be expressed in terms of AEP, which is the inverse of the return period, as shown in the table below and explained above. This can be helpful when presenting results to members of the public who may associate the concept of return period with a regular occurrence rather than an average recurrence interval, and is the terminology which will be used throughout this report.

Return period (years)	Annual exceedance probability (%)
2	50
10	10
50	2
100	1
200	0.5
1000	0.1

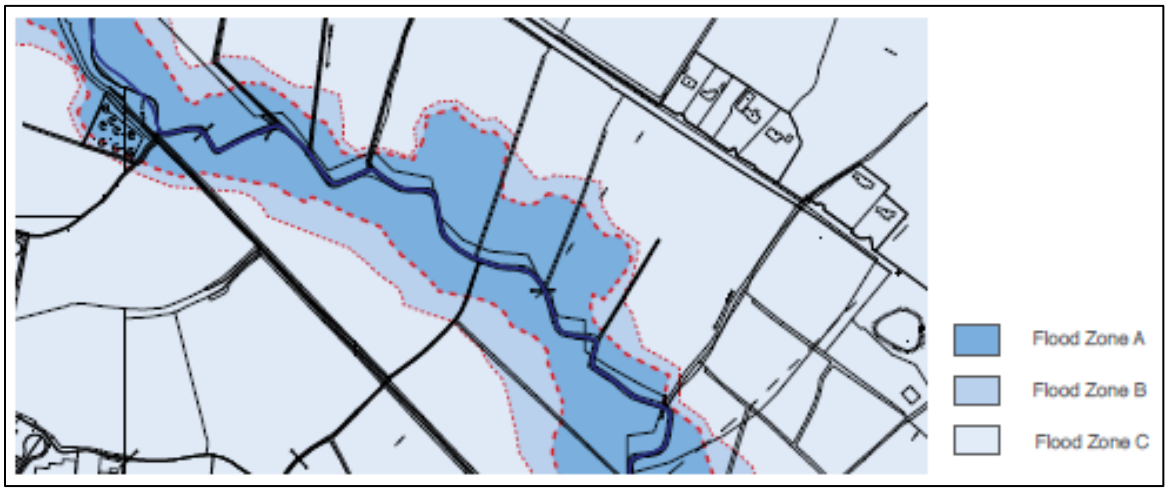
Conversion between return periods and annual exceedance probabilities

A.2 Flood Zones

Flood Zones are geographical areas illustrating the probability of flooding. For the purposes of the Planning Guidelines, there are 3 types or levels of flood zones, A, B and C.

Zone	Description
Flood Zone A	Where the probability of flooding is highest; greater than 1% (1 in 100) from river flooding or 0.5% (1 in 200) for coastal/tidal flooding.
Flood Zone B	Moderate probability of flooding; between 1% and 0.1% from rivers and between 0.5% and 0.1% from coastal/tidal.
Flood Zone C	Lowest probability of flooding; less than 0.1% from both rivers and coastal/tidal.

It is important to note that the definition of the flood zones is based on an undefended scenario and does not take into account the presence of flood protection structures such as flood walls or embankments. This is to allow for the fact that there is a residual risk of flooding behind the defences due to overtopping or breach and that there may be no guarantee that the defences will be maintained in perpetuity.



Indicative Flood Zones (OPW & DoEHLG 2009)

A.3 Consequence of Flooding

Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation measures etc.).

The 'Planning System and Flood Risk Management' provides three vulnerability categories, based on the type of development, which are detailed in Table 3.1 of the Guidelines, and are summarised as:

- Highly vulnerable, including residential properties, essential infrastructure and emergency service facilities;
- Less vulnerable, such as retail and commercial and local transport infrastructure;
- Water compatible, including open space, outdoor recreation and associated essential infrastructure, such as changing rooms.

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