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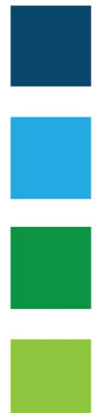
CONSULTING ENGINEERS

BUILT ON KNOWLEDGE



Clifden Town Centre Public Realm Enhancement, Clifden, Co. Galway

Flood Risk Assessment



Clifden Town Centre Public Realm Enhancement, Clifden, Co. Galway

Flood Risk Assessment

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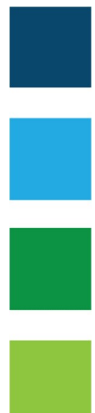


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1.0 INTRODUCTION

TOBIN Consulting Engineers were appointed by Galway County Council to undertake the detailed design, tender and construction of the Clifden Town Centre Public Realm Enhancement, including a Flood Risk Assessment (FRA) of the enhancement areas (see Figure 1-1 and Figure 1-2) at Clifden Town Centre, Harbour Park and Beach Road Quay, Clifden, Co. Galway.

The Public Realm Enhancement Areas are located in Clifden, on the northern banks of the outlet of the Owenglin River at Clifden Bay. Harbour Park has existing ground levels ranging from approximately 3.03mOD at the southern boundary with Clifden Bay, to approximately 11.18mOD at the north eastern corner of the subject site. Beach Road Quay has existing ground levels ranging from approximately 3.24mOD in the centre of the site adjacent to Clifden Bay, to approximately 4.69mOD at southern boundary with Clifden Bay. Clifden Town Centre has existing ground levels ranging from 17.66mOD at the south eastern corner of the town centre, to approximately 30.40mOD on Market Street. A topographic survey of the Public Realm Enhancement Areas is provided in Appendix 1.

The purpose of this report is to identify, quantify, and communicate the risks of flooding, if any, to the proposed project.

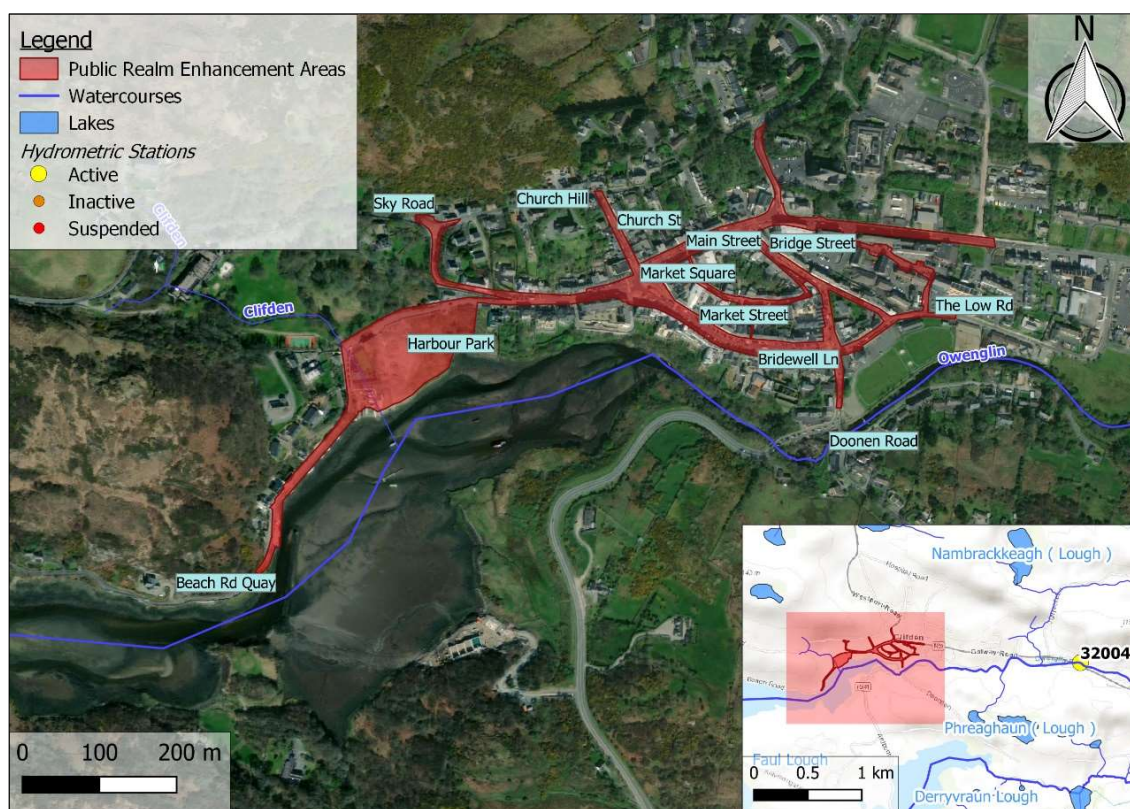


Figure 1-1 Site Location

The proposed public realm enhancement scheme includes three distinct but interconnected projects at the Town Centre, Harbour Park and Beach Road Quay; see Figure 1-2. Enhancement works include the provision of outdoor seating, landscaping, public lighting, parking, drainage works, and vehicular and pedestrian route improvements.

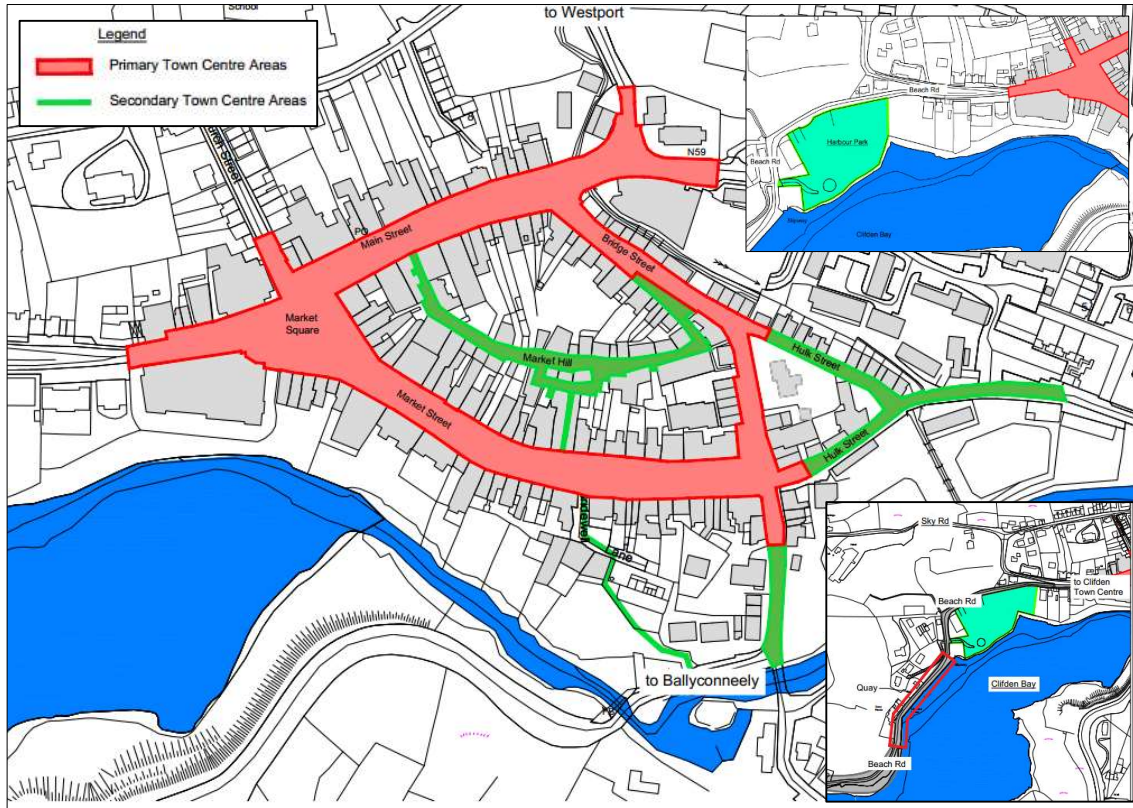


Figure 1-2 Proposed Public Realm Enhancement Projects

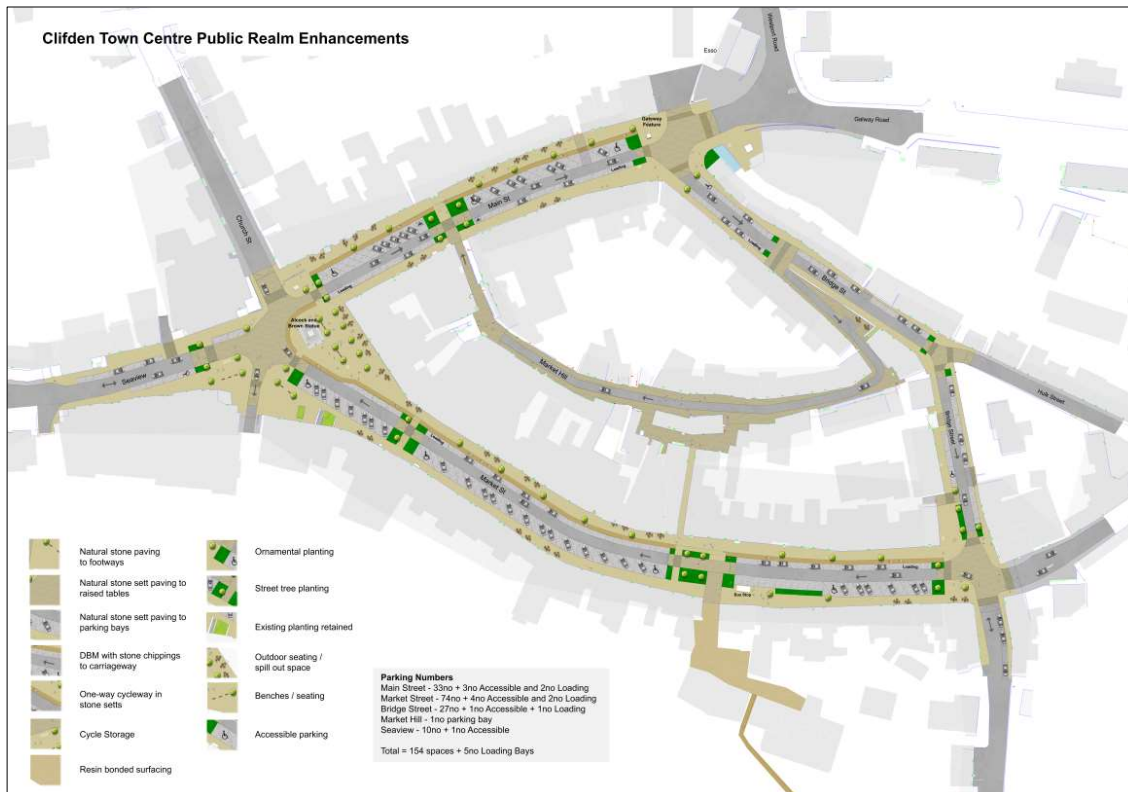


Figure 1-3 Proposed Clifden Town Centre Enhancements

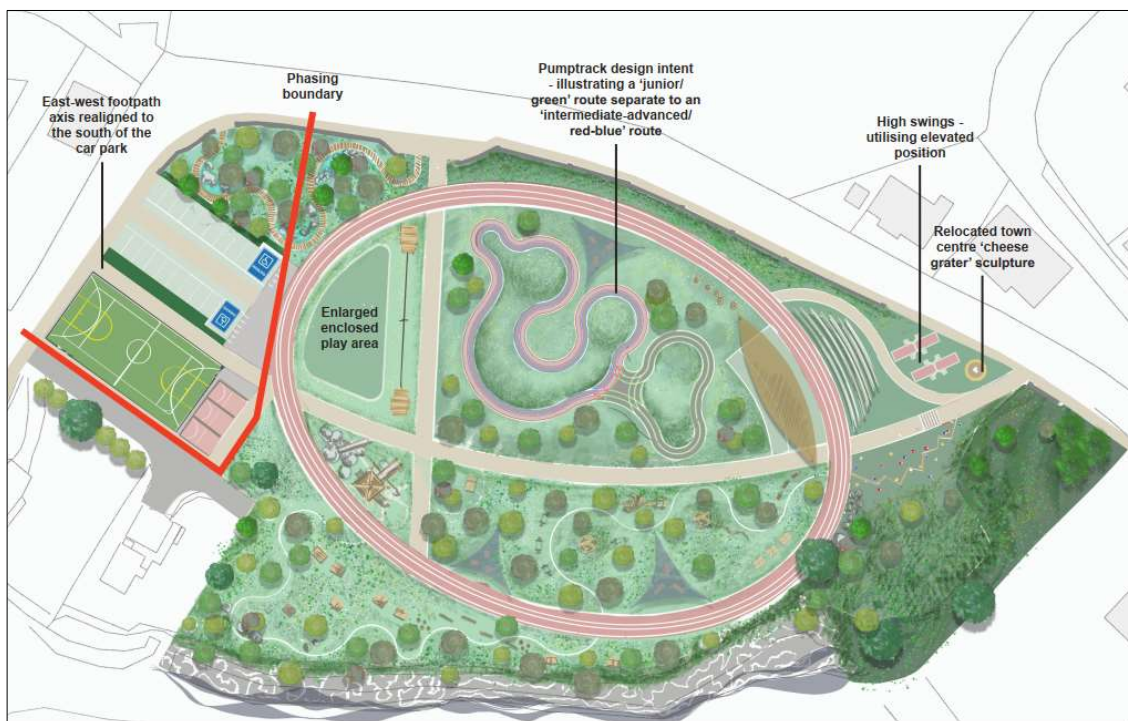


Figure 1-4 Proposed Harbour Park Enhancements

2.0 FLOOD RISK MANAGEMENT GUIDANCE

This Stage 2 Flood Risk Assessment was carried out in accordance with the following flood risk management guidance documents:

- The Planning System and Flood Risk Management Guidelines for Planning Authorities
- Flood Risk Management Climate Change Sectoral Adaptation Plan
- Galway County Development Plan
- Clifden Small Growth Town

2.1 The Planning System and Flood Risk Management Guidelines

The Planning System and Flood Risk Management Guidelines for Planning Authorities (PSFRM Guidelines) were published in 2009 by the Office of Public Works (OPW) and Department of the Environment, Heritage and Local Government (DoEHLG). Their aim is to ensure that flood risk is considered in development proposals and the assessment of planning applications.

2.1.1 Flood Zones and Vulnerability Classes

The PSFRM Guidelines discuss flood risk in terms of flood zones A, B, and C, which correspond to areas of high, medium, or low probability of flooding, respectively. The extents of each flood zone are based on the Annual Exceedance Probability (AEP) of various flood events.

The PSFRM Guidelines also categorise different types of development into three vulnerability classes based on their sensitivity to flooding. Outdoor developments (such as the works proposed as part of the proposed urban enhancement scheme) are considered “water compatible”.

Table 2-1 shows a decision matrix that indicates which types of development are appropriate in each flood zone and when the Justification Test (see Section 2.1.2) must be satisfied. The annual exceedance probabilities used to define each flood zone are also provided.

Table 2-1 Decision Matrix for Determining the Appropriateness of a Development

Flood Zone (Probability)	Annual Exceedance Probability (AEP)	Development Appropriateness		
		Highly Vulnerable	Less Vulnerable	Water Compatible
A (High)	<u>Fluvial & Pluvial Flooding</u> More frequent than 1% AEP	Justification Test	Justification Test	Appropriate
	<u>Coastal Flooding</u> More frequent than 0.5% AEP			
B (Medium)	<u>Fluvial & Pluvial Flooding</u> 0.1% to 1% AEP	Justification Test	Appropriate	Appropriate
	<u>Coastal Flooding</u> 0.1% to 0.5% AEP			
C (Low)	<u>Fluvial, Pluvial & Coastal Flooding</u> Less frequent than 0.1% AEP	Appropriate	Appropriate	Appropriate

2.1.2 The Justification Test

Any proposed development being considered in an inappropriate flood zone (as determined by Table 2-1) must satisfy the criteria of the Justification Test outlined in Figure 2-1 (taken from the PSFRM Guidelines).

Box 5.1 Justification Test for development management (to be submitted by the applicant)

When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied:

1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.
2. The proposal has been subject to an appropriate flood risk assessment that demonstrates:
 - (i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;
 - (ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;
 - (iii) The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and
 - (iv) The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: See section 5.27 in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.

Refer to section 5.28 in relation to minor and infill developments.

Figure 2-1 Criteria of the Justification Test

2.2 The Flood Risk Management Climate Change Adaptation Plan

The Flood Risk Management Climate Change Sectoral Adaptation Plan was published in 2019 under the National Adaptation Framework and Climate Action Plan. This plan outlines the OPW's approach to climate change adaptation in terms of flood risk management.

This approach is based on a current understanding of the potential impacts of climate change on flooding and flood risk. Research has shown that climate change is likely to worsen flooding through more extreme rainfall patterns, more severe river flows, and rising mean sea levels.

To account for these changes, the Adaptation Plan presents two future flood risk scenarios to consider when assessing flood risk:

- Mid-Range Future Scenario (MRFS)
- High-End Future Scenario (HEFS)

Table 2-2 indicates the allowances that should be added to estimates of extreme rainfall depths, peak flood flows, and mean sea levels for the future scenarios.

Table 2-2 Climate Change Adaptation Allowances for Future Flood Risk Scenarios

Parameter	Mid-Range Future Scenario (MRFS)	High-End Future Scenario (HEFS)
Extreme Rainfall Depths	+ 20%	+ 30%
Peak River Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 0.5 m	+ 1 m

2.3 Galway County Development Plan 2022-2028

The current Galway County Development Plan provides a strategic framework for planning and sustainable development in Co. Galway for 2022 to 2028. Chapter 14 outlines Galway County Council's strategy for the management of Climate Change, Energy and Renewable Resource, with Sections 14.6.2 outlining County Policies for effective flood risk management, setting out the following key objectives:

FL 1 Flood Risk Assessment and Management

It is the policy objective of Galway County Council to support, in co-operation with the OPW, the implementation of the EU Flood Risk Directive (2007/60/EC), the Flood Risk Regulations (SI No. 122 of 2010) and the DEHLG/OPW publication The Planning System and Flood Risk Management Guidelines (2009) (and any updated/superseding legislation or policy guidance) and Department Circular PL2/2014 or any updated / superseding version.

FL 2 Flood Risk Management and Assessment

Comply with the requirements of the DoEHLG/OPW The Planning System and Flood Risk Management Guidelines for Planning Authorities and its accompanying Technical Appendices Document 2009 (including any updated/superseding documents).

This will include the following:

- a) Avoid, reduce and/or mitigate, as appropriate in accordance with the Guidelines;
- b) Development proposals in areas where there is an identified or potential risk of flooding or that could give rise to a risk of flooding elsewhere will be required to carry out a Site Specific Flood Risk Assessment, and justification test where appropriate, in accordance with the provisions of The Planning System and Flood Risk Management Guidelines 2009 (or any superseding document); Any flood risk assessment should include an assessment of the potential impacts of climate change, such as an increase in the extent or probability of flooding, and any associated measures necessary to address these impacts;
- c) Development that would be subject to an inappropriate risk of flooding or that would cause or exacerbate such a risk at other locations shall not normally be permitted;
- d) Galway County Council shall work with other bodies and organisations, as appropriate, to help protect critical infrastructure, including water and wastewater, within the County, from risk of flooding.

FL 3 Principles of the Flood Risk Management and Guidelines

The Planning Authority shall implement the key principles of flood risk management set out in the Flood Risk Management Guidelines as follows:

- a) Avoid development that will be at risk of flooding or that will increase the flooding risk elsewhere, where possible;
- b) Substitute less vulnerable uses, where avoidance is not possible; and
- c) Mitigate and manage the risk, where avoidance and substitution are not possible. Development should only be permitted in areas at risk of flooding when there are no alternative, reasonable sites available in areas at lower risk that also meet the objectives of proper planning and sustainable development. Vulnerable development in areas which have the highest flood risk should be avoided and/or

only considered in exceptional circumstances (through a prescribed Justification Test) if adequate land or sites are not available in areas which have lower flood risk.

FL 4 Flood Relief Schemes

The Planning Authority shall support and co-operate with the Office of Public Works (OPW) in the delivery of Flood Relief Schemes.

FL 5 Catchment Planning

The Planning Authority will support the OPW'S CFRAM Programme and catchment-based Flood Planning Groups, especially where catchments go beyond the Council's administrative boundary, in the development and implementation of catchment-based strategies for the management of flood risk - including those relating to storage and conveyance.

FL 6 Surface Water Drainage and Sustainable Drainage Systems (SuDs)

Maintain and enhance, as appropriate, the existing surface water drainage system in the County. Ensure that new developments are adequately serviced with surface water drainage infrastructure and promote the use of Sustainable Drainage Systems in all new developments. Surface water run-off from development sites will be limited to predevelopment levels and planning applications for new developments will be required to provide details of surface water drainage and sustainable drainage systems proposals.

FL 7 Protection of Waterbodies and Watercourses

Protect waterbodies and watercourses within the County from inappropriate development, including rivers, streams, associated undeveloped riparian strips, wetlands and natural floodplains. This will include protection buffers in riverine, wetland and coastal areas as appropriate.

FL 8 Flood Risk Assessment for Planning Applications and CFRAMS

Protect Flood Zone A and Flood Zone B from inappropriate development and direct developments/land uses into the appropriate Flood Zone in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities 2009 (or any superseding document) and the guidance contained in Development Management Standard 68.

Site-specific Flood Risk Assessment (FRA) is required for all planning applications in areas at elevated risk of flooding, even for developments appropriate to the particular flood zone. The detail of these site-specific FRAs will depend on the level of risk and scale of development. A detailed site-specific FRA should quantify the risks, the effects of selected mitigation and the management of any residual risks. The Planning Authority shall have regard to the results of any CFRAM Studies in the assessment of planning applications.

Development proposals will need to be accompanied by a Development Management Justification Test in addition to the site-specific Flood Risk Assessment. Where only a small proportion of a site is at risk of flooding, the sequential approach shall be applied in site planning, in order to seek to ensure that no encroachment onto or loss of the flood plain occurs and/or that only water compatible development such as Open Space would

be permitted for the lands which are identified as being at risk of flooding within that site. In Flood Zone C, where the probability of flooding is low (less than 0.1%, Flood Zone C), site-specific Flood Risk Assessment may be required and the developer should satisfy themselves that the probability of flooding is appropriate to the development being proposed.

In addition to the County Plan SFRA datasets (including the Flood Zones, CFRAMS mapping, historical and predictive groundwater mapping, predictive pluvial mapping and historical flood risk indicator mapping, such as the Benefitting Lands mapping), new and emerging datasets (such as the OPW's National Fluvial Mapping that will supersede existing PFRA fluvial mapping for catchments greater than 5km²) must be consulted by prospective applicants for developments and will be made available to lower-tier Development Management processed in the Council.

Applications for developments in coastal areas and associated assessments shall also consider wave overtopping and coastal erosion.

FL 9 SFRA of Lower Tier Plans

Lower tier plans shall undertake SFRA (Strategic Flood Risk Assessment) in compliance with the Flood Risk Management Guidelines.

FL 10 SFRA/ FRA and Climate Change

SFRAs and site-specific FRAs shall provide information on the implications of climate change with regard to flood risk in relevant locations. The 2009 OPW Draft Guidance on Assessment of Potential Future Scenarios for Flood Risk Management (or any superseding document) shall be consulted with to this effect.

FL 11 FRA and Environmental Impact Assessment (EIA)

Flood risk may constitute a significant environmental effect of a development proposal that in certain circumstances may trigger a sub-threshold EIA. FRA should therefore be an integral part of any EIA undertaken for projects within the County.

FL 12 SFRA of Lower Tier Plans

It is a policy objective of the Planning Authority to consult, where necessary, with Inland Fisheries Ireland, the National Parks and Wildlife Service and other relevant agencies in the construction of flood alleviation measures in County Galway.

FL 13 CFRAM

It is a policy objective of the Planning Authority to take account of and incorporate into local planning policy and decision making, including possible future variations to this plan, CFRAM measures that may be published in the future, including planned investment measures for managing and reducing flood risk.

FL 14 Flood Vulnerable Zones

It is Council policy objective to ensure that applications pertaining to existing developments in flood vulnerable zones provide details of structural and non-structural risk management measures to include, but not be limited to specifications of the

following - floor levels, internal layout, flood resilient construction, flood resistant construction, emergency response planning, access and egress during flood events.

FL 15 Flood Risk Management

Ensure each flood risk management activity is examined to determine actions required to embed and provide for effective climate change adaptation as set out in the OPW Climate Change Sectoral Adaptation Plan for Flood Risk Management applicable at the time.

FL 16 Benefitting Land

Applications for development on land identified as benefitting land may be prone to flooding, and as such site-specific flood risk assessments may be required in these areas.

FL 17 Consultation with OPW

Consult with the OPW in relation to proposed developments in the vicinity of drainage channels and rivers for which the OPW are responsible and retain a strip on either side of such channels where required, to facilitate maintenance access thereto. In addition, promote the sustainable management and uses of water bodies and avoid culverting or realignment of these features.

FL 18 SFRA of Lower Tier Plans

Where a development/land use is proposed within any area subject to this objective the development proposal will need to be accompanied by a detailed hydrological assessment and robust SUDS design which demonstrates the capacity to withstand potential flood events to maintain water quality and avoid potential effects to ecological features.

- Any development proposals should be considered with caution and will be required to comply with The Planning System and Flood Risk Management Guidelines for Planning Authorities/Circular PL2/2014 & the associated Development Management Justification Test.
- Climate Change should be duly considered in any development proposal
- Protect the riparian zones of watercourse systems throughout the plan area through a general 10 metre protection buffer from rivers within the plan area as measured from the near riverbank, (this distance may be increased and decreased on a site by site basis, as appropriate).
- Any development proposals submitted for this site will require a detailed ecological report (s), carried out by suitably qualified personnel for the purposes of informing Appropriate Assessment Screening by Galway County Council, the competent authority.
- The relevant lands will be outlined and flagged with a symbol on the land use zoning map and on the GIS system of Galway County Council so that staff and the public are aware of the special conditions/constraints attached.
- A briefing will be provided to relevant staff within Galway County Council on the special conditions and constraints on relevant lands.

2.3.1 Clifden Small Growth Town

The town of Clifden has been identified in Volume 2 of the Galway CDP as a Small Growth Town. This volume of the report sets out the vision and zoning policy objectives for the identified towns.

Zoning and Flood Plans have been prepared for the identified towns, including Clifden. The mapping for Clifden is shown in Figure 2-2 below.

Harbour Park and Beach Road Quay are identified as being located in Flood Zone A by the flood mapping.

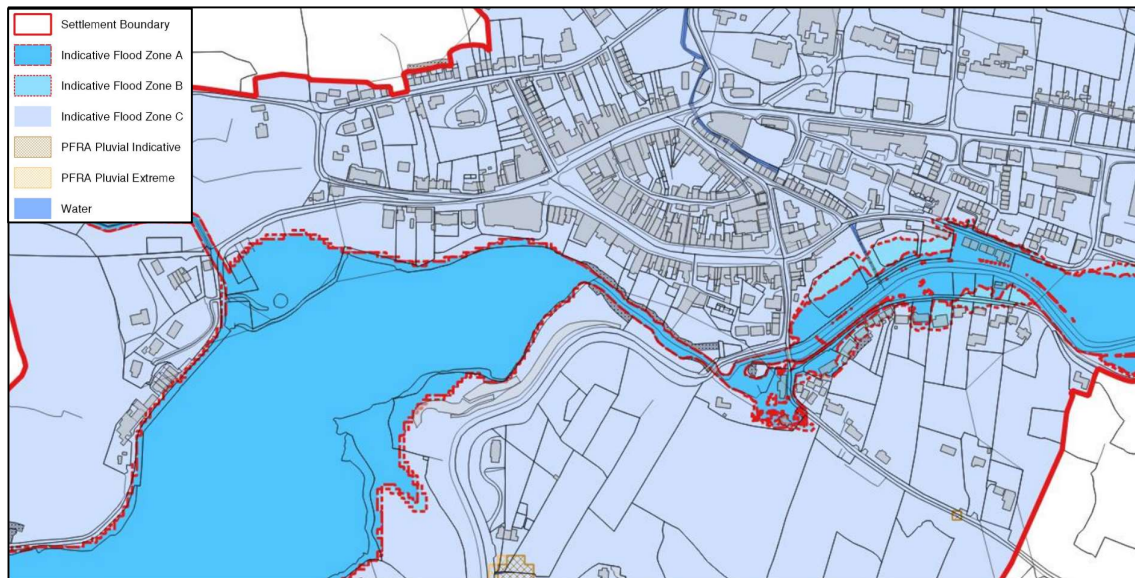


Figure 2-2 Proposed Public Realm Enhancement Projects

3.0 INITIAL FLOOD RISK ASSESSMENT

3.1 Past Flood Events

The OPW's National Flood Information Portal¹ provides past flood event mapping with records of flooding reports, meeting minutes, photos, and/or hydrometric data.

Based on the flood map shown in Figure 3-1, Clifden has a history of flooding and several areas of recurring events have been reported in the vicinity of the public realm enhancement projects.

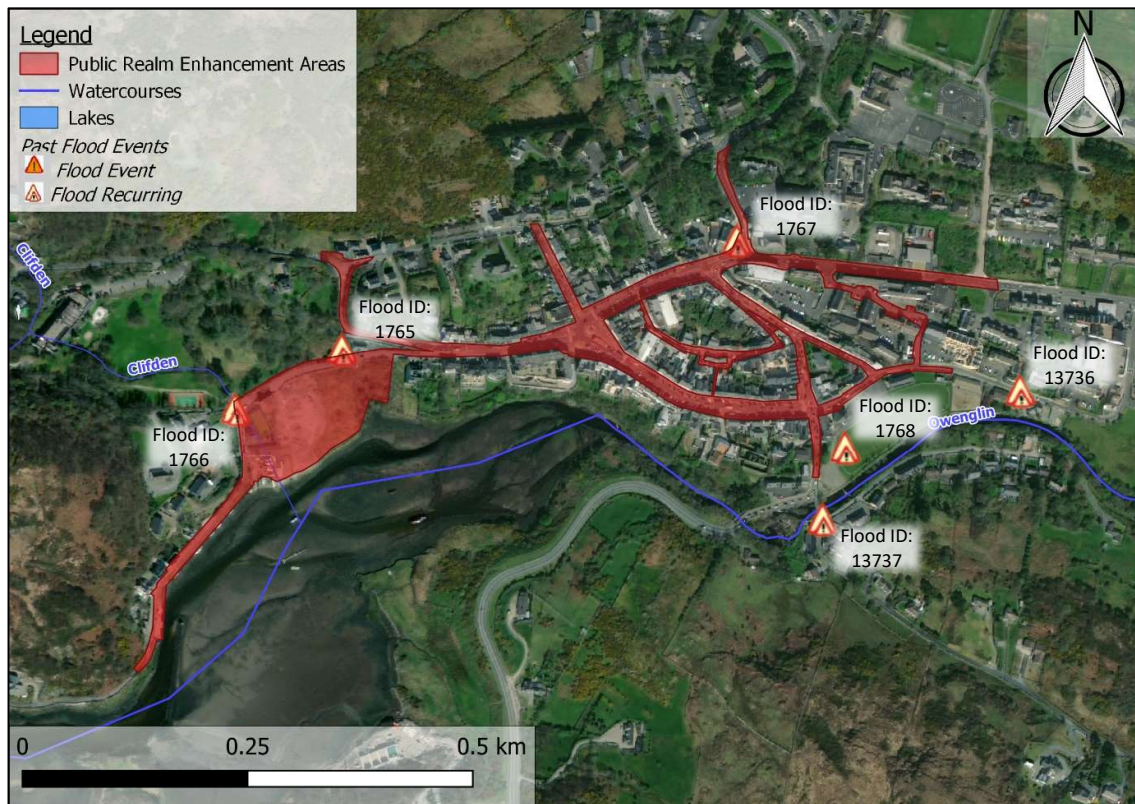


Figure 3-1 OPW Flood Map of Past Flood Events

Meeting minutes from a meeting with the Clifden Area Engineer on 27th April 2005² lists several locations subject to recurring flooding. These include the following:

- Flood ID 1765 Clifden— Flooding occurs due to water flowing off high ground after heavy rain every year.
- Flood ID 1766 Clifden— Flooding occurs due to runoff from C10 and river overflowing its banks after heavy rain every year.
- Flood ID 1767 Westport Road, Clifden— Flooding occurs after river/stream overflows its banks and surface water runoff from the town. Council have undertaken remedial work and no flooding has occurred since this work has been completed.

¹ floodinfo.ie

² Galway County Council Oral Report – Clifden Area Engineer (27th April 2005)

-
- Flood ID 1768, Showgrounds, Clifden— Flooding occurs when river overflows its banks after heavy rain. Surface water drainage was upgraded by the council 5 years ago and no flooding has occurred since.

More recently, Flood Event Reports were prepared for 2nd September 2020 flooding at Low Road (Flood ID 13736)³ and Riverside (Flood ID 13737)³, attributing flooding to high intensity rainfall and surging in the Owenglin River. Flood levels were measured at 14.06mOD at No. 6 Low Road Cottages, and 14.2mOD at the Clifden Showgrounds. Previous flood events were experienced in September 2015 and 2016.

³ OPW Flood Event Report, Flooding at Low Road Clifden 02nd September 2020

3.2 OPW Preliminary Flood Risk Assessment (PFRA) Study

In 2009, the OPW produced a series of maps to assist in the development of a broad-scale FRA throughout Ireland. These maps were produced from several sources.

The OPW's National Preliminary Flood Risk Assessment (PFRA) Overview Report from March 2012 noted that *"the flood extents shown on these maps are based on broad-scale simple analysis and may not be accurate for a specific location"*⁴.

Limitations on potential sources of error associated with the PFRA maps include:

- Assumed channel capacity (due to absence of channel survey information)
- Absence of flood defences and other drainage improvements and channel structures (bridges, weirs, culverts)
- Local errors in the national Digital Terrain Model (DTM)

Figure 3-2 provides an overview of the fluvial, coastal, pluvial, and groundwater indicative flood extents in the vicinity of the project areas.

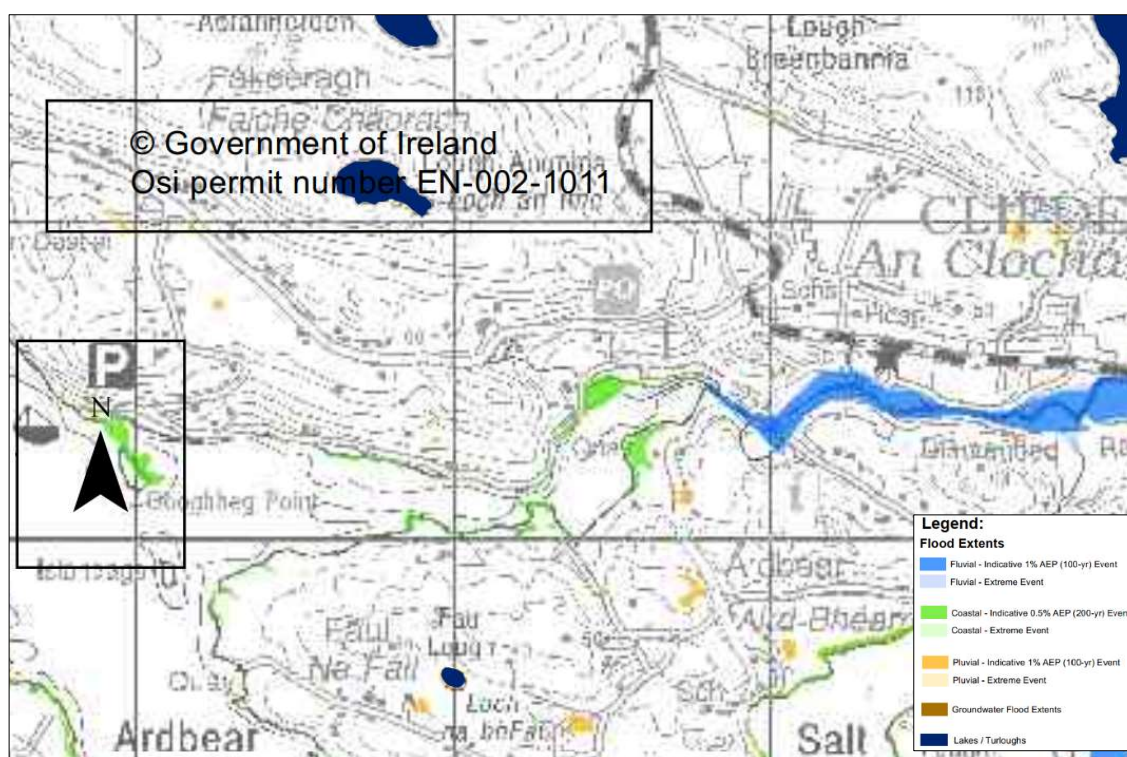


Figure 3-2 Indicative Flood Mapping [extract from PFRA Map 241]

Improved hydraulic modelling was carried out through the Catchment Flood Risk Assessment and Management Study (CFRAM) in 2015 (discussed in Section 3.3) and is considered more accurate than the PFRA study as it utilised surveyed river geometry.

⁴ The National Preliminary Flood Risk Assessment (PFRA) Overview Report, OPW (March 2012)

3.3 Catchment Flood Risk Assessment and Management Study

In 2015, the OPW produced flood maps¹ as part of the Catchment Flood Risk Assessment and Management (CFRAM) Study. The flood extents in these maps are based on detailed modelling of Areas for Further Assessment identified by the National Preliminary Flood Risk Assessment.

CFRAM mapping of the existing 100-Year and 1000-Year fluvial flood extents, presented in Figure 3-3, indicates the proposed public enhancement works at the Town Centre are located north of the predicted fluvial flood extents.

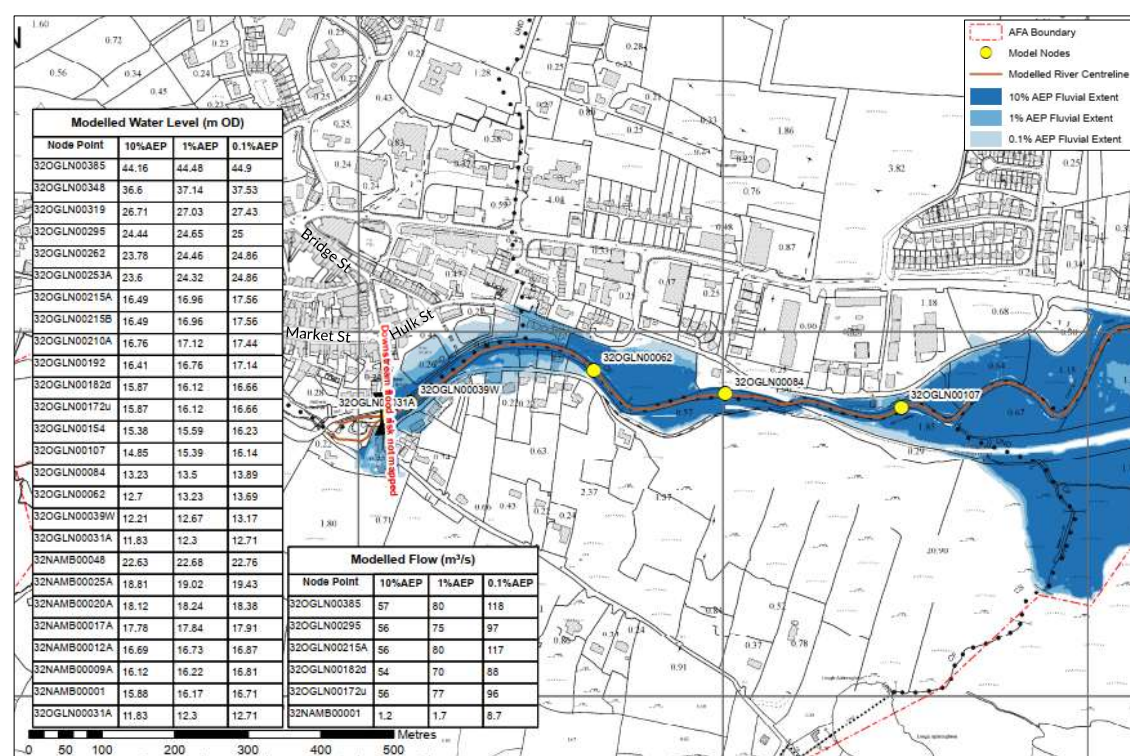


Figure 3-3 Western CFRAM Existing Fluvial Flood Extents⁵

Based on this updated CFRAM mapping, the Town Centre is located within Flood Zone C, outside of the 0.1% AEP fluvial flood extent. The CFRAM study estimates water levels at Low Road for the current 1% and 0.1% AEP events of 13.23mOD and 13.69mOD, respectively, and at the downstream outlet with Clifden Bay of 12.3mOD and 12.71mOD. Existing ground elevations at the public enhancement areas in the vicinity of the CFRAM fluvial extents range from 14.05mOD to 17.97mOD.

The Western CFRAM Study also included an assessment of the likely impact of climate change on flood risk in the area. The flood extents for a Mid-Range Future Scenario (MRFS) are shown in Figure 3-4, showing Secondary Town Centre Areas Hulk Street and Doonen Road may be liable to the 0.1% AEP fluvial flood event.

⁵ Western CFRAM Study Map No: W32CFD_EXFCD_F3_01 (December 2017)

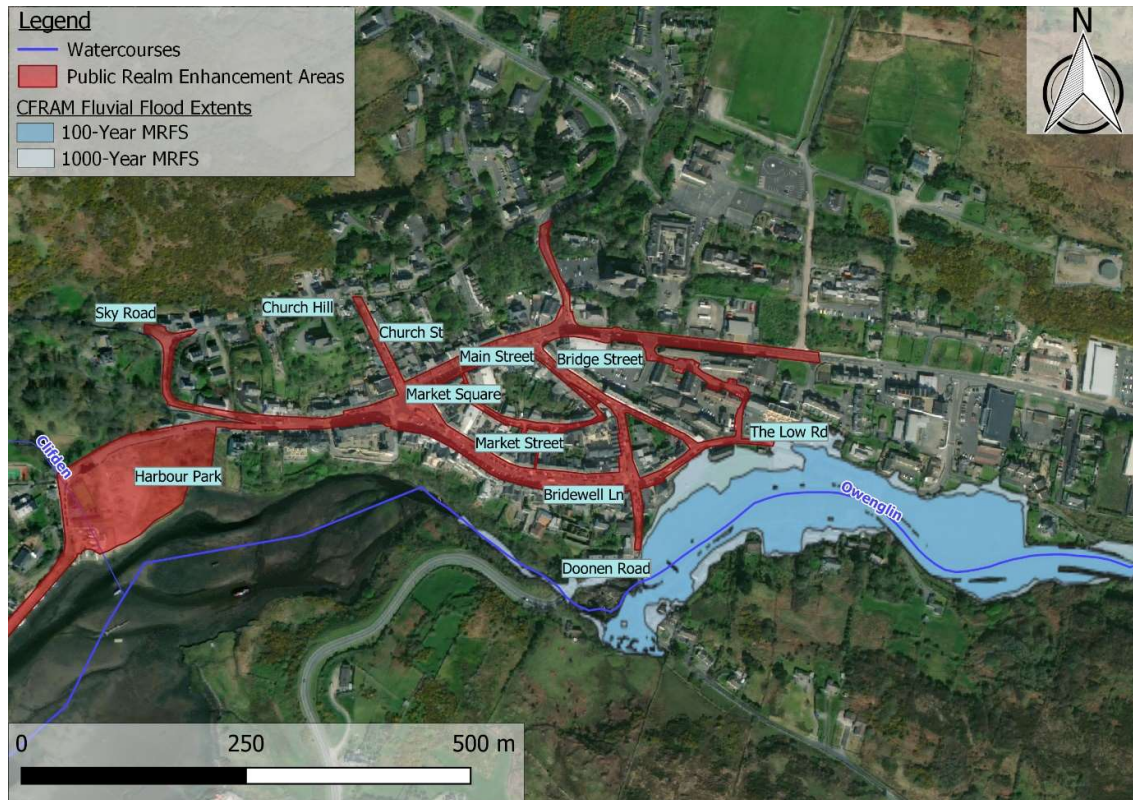


Figure 3-4 Western CFRAM MRFS Fluvial Flood Extents

3.4 Irish Coastal Protection Strategy Study (ICPSS)

As part of the Irish Coastal Protection Strategy Study (ICPSS), RPS performed detailed hydraulic modelling of tidal flooding along the Irish Coast. The study produced 'predictive' flood maps which provide predicted coastal flood extents for a future scenario 'design' flood event.

The flood extent mapping (Figure 3-5) indicates Harbour Park and Beach Road Quay may be liable to coastal flooding during a 0.5%AEP coastal flood event, and are therefore located in coastal Flood Zone A. The Town Centre is located outside the predicted areas of coastal flooding.

For the MRFS, the study predicted 200-year and 1000-year water levels of 3.87mOD and 4.10mOD respectively [reference Point W29]⁶. The ICPSS mapping shows that the Harbour Park area is liable to flooding during the 1 in 200-year and 1 in 1,000-year coastal flood events.

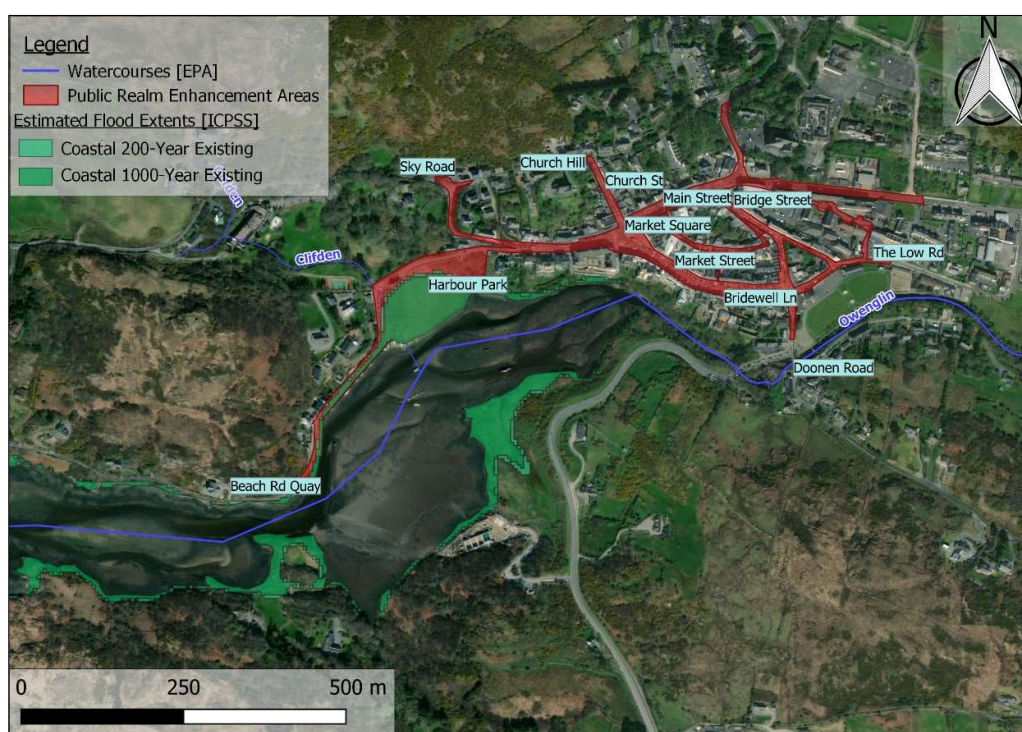


Figure 3-5 ICPSS Flood Mapping in vicinity of subject site

As per the ICPSS, "The maps have been produced at a strategic level to provide an overview of coastal flood hazard and risk in Ireland, and minor or local features may not have been included in their preparation. A DTM is used to generate the maps, which is a 'bare earth' model of the ground surface with the digital removal of man-made and natural landscape features such as vegetation, buildings, bridges and embankments. The mapping process can show some of these man-made features, such as bridges and embankments, as flooded on the flood maps, when in reality they do not flood".

⁶ Irish Coastal Protection Strategy Study- Phase IV, West Coast Flood Extent Map, Figure No. W / RA / EXT / MRFS / 30 (April 2012)

3.5 Geological Survey Ireland Mapping

The Geological Survey Ireland (GSI) provides mapping⁷ with data related to Ireland's subsurface. Based on the map shown in Figure 3-6, there are no karst features (caves, springs, turloughs, etc.) in the vicinity of the subject site, with the nearest karst feature located more than 40km west.

As shown in Figure 3-6, as part of their recent GW Flood project, the GSI has not identified any lands in Clifden as liable to groundwater flooding.

Older hydraulic modelling completed by HR Wallingford as part of the PFRA project (see Figure 3-2) did not indicate any groundwater flooding in the vicinity of the subject site.

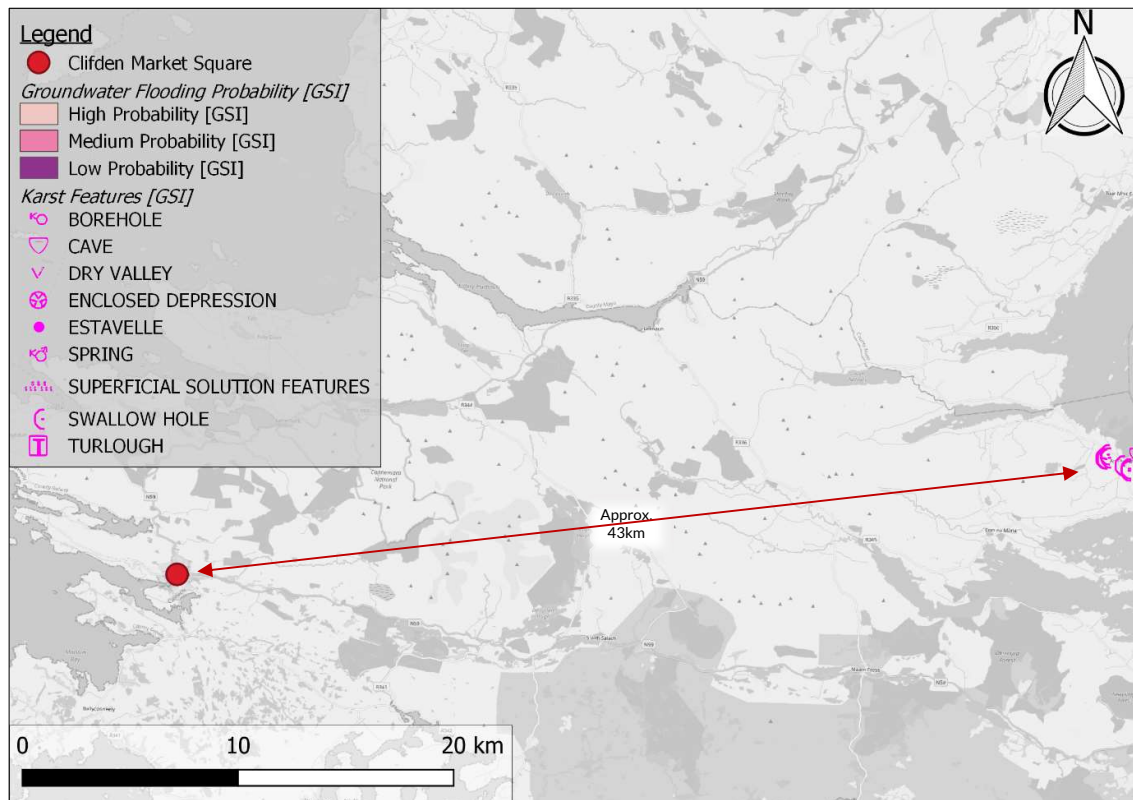


Figure 3-6 GSI Mapping of Karst Features and Indicative Groundwater Flood Mapping

⁷ <https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx>

3.6 National Parks & Wildlife Services Designated Sites

The National Parks & Wildlife Service (NPWS) is responsible for the designation of prime wildlife conservation areas in the country, in line with the EU Habitats Directive⁸. Special Protection Areas (SPAs) are designated under the EU Birds Directive (2009/147/EC) for the protection of listed rare and vulnerable species, regularly occurring migratory species, and wetlands, while Special Areas of Conservation (SACs) protect significant Irish habitats and species.

As shown in Figure 3-7, the subject site is located adjacent to the Twelve Bens/Garraun Complex SAC (002031), which encompasses 13 qualifying interests, including a priority habitat under the Habitats Directives⁹.

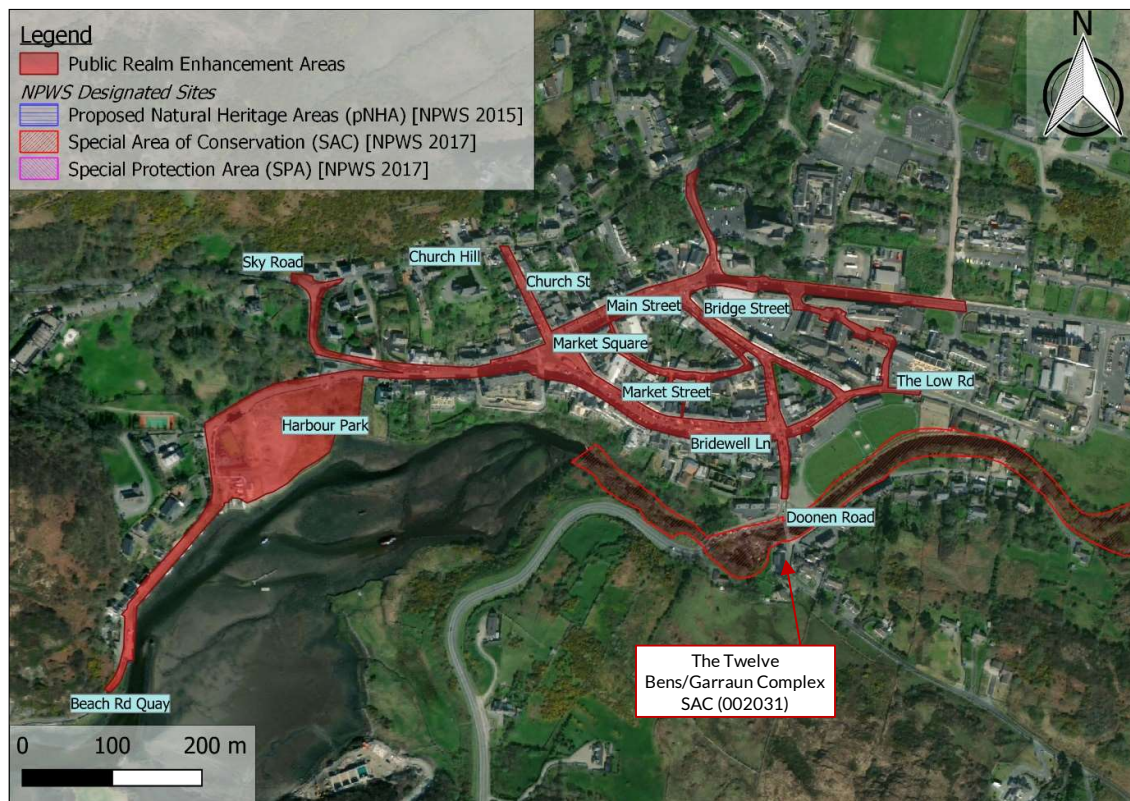


Figure 3-7 National Parks & Wildlife Services Designated Sites

⁸ <https://www.npws.ie/protected-sites>

⁹ NPWS (2017) Conservation Objectives: The Twelve Bens/Garraun Complex SAC 002031. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

3.7 Local Consultation

Following an initial client meeting it was noted that “[t]here seems to be flash flooding occurring in the Harbour Park (specifically the playground) area with most of the surface water flow coming from the top of Beach Road (from the town), could be issues with blocked drainage pipes upstream or inadequate pipe sizes.”

Figure 3-8 below outlines the area of Beach Road where the flooding occurs. The road is damaged in the vicinity.



Figure 3-8 Beach Road culvert crossing

A GPR-Utility survey was carried out in August 2022 to determine the utilities in the subject site. A review of the report was undertaken to determine the drainage infrastructure in the vicinity of the area of flash flooding.

There is a manhole located on Beach Road. There are 4 no. pipes that converge at the manhole. All 4 pipes are stormwater culverts. They are all PVC pipes and vary in diameter.

A 600mm diameter culvert comes from a north-westerly direction. There are 2 no. 300mm culverts that come from the south and north-east. There is a 225mm diameter culvert that comes from a north-easterly direction. They all outfall from a 600mm PVC culvert. The culvert flows in a north-easterly direction for 20m before entering another manhole. It then changes direction and flows in a south-easterly direction for 20m before entering another manhole. The flow discharges via 2 no. 300mm culverts. They then enter a manhole and flow in a southerly direction to discharge into the adjacent Clifden Bay via a non-return valve.

4.0 DETAILED FLOOD RISK ASSESSMENT

With reference to the PSFRM Guidelines, the proposed outdoor urban enhancement works are classified as “water compatible” in terms of sensitivity to flooding. As such, the proposed Public Realm Enhancements Projects may be constructed in any Flood Zone (A, B or C). The proposed public realm enhancement scheme includes three distinct but interconnected projects at the Town Centre, Harbour Park and Beach Road Quay; see Figure 1-2.

4.1 Fluvial Flooding

The public realm enhancement works are located within Clifden, on the northern banks of the Owenglin River and Clifden Bay. The Town Centre is located adjacent to the outlet of the Owenglin River, and therefore may be liable to fluvial flooding.

Based on the results of OPW modelling (PFRA, CFRAM) and the Clifden LAP SFRA, the Town Centre public realm enhancement areas are located within Flood Zone C, outside the predicted 0.1% AEP fluvial flood extents. Under a Mid-Range Future Scenario (MRFS) for climate change, Secondary Town Centre Areas Hulk Street and Doonen Road may be liable to the 0.1% AEP fluvial flood event (see Figure 3-3, Figure 3-4).

Harbour Park is bisected by the minor Clifden Stream (see Figure 1-1), with reports of recurring annual flooding to the north attributed to runoff from the C10 and the Clifden Stream overflowing its banks after heavy rain each year. OPW and Clifden LAP SFRA mapping is not available for this minor watercourse.

Works within the subject site, and within the floodplain will predominantly consist of the upgrading of surfacing materials and reconfiguring parking areas and public spaces, with most engineering works below ground. The public realm improvements will not involve major level changes and will improve site drainage, and therefore will not exacerbate flood risk elsewhere.

Therefore, it is estimated that risk of fluvial flooding associated with the proposed scheme is minimal.

4.2 Pluvial Flooding

Based on the indicative pluvial flood mapping presented in the OPW Preliminary Flood Risk Assessment, it is estimated that the subject site is not at risk from pluvial flooding during an extreme 0.1% AEP pluvial flood event (see Figure 3-2).

Local consultation: “There seems to be flash flooding occurring in the Harbour Park (specifically the playground) area with most of the surface water flow coming from the top of Beach Road (from the town), could be issues with blocked drainage pipes upstream or inadequate pipe sizes.” A review of the GPR Survey showed that there are a number of culverts that converge in the one location without an adequate outfall. This causes the manhole to surcharge and causes the flash flooding during periods of heavy rain. This drainage issue will be addressed by the design team as the project progresses.

The proposed urban enhancement scheme includes the provision of drainage works, including a drainage investigation of existing infrastructure and design of a new drainage system suitable to public spaces used by pedestrians and cyclists and the aesthetic nature of the area.

Surface water arising at the site will be managed by a dedicated stormwater drainage system in accordance with Sustainable Drainage Systems (SuDS) principles.

The landscaping and topography of the developed site will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with an extreme flood event or a scenario where the stormwater drainage system becomes blocked.

Therefore, it is estimated that risk of pluvial flooding associated with the proposed development is minimal.

4.3 Groundwater Flooding

Based on a review of Geological Survey Ireland (GSI) subsurface mapping of karst features, historic and predicted groundwater flooding in the area (Figure 3-6), and the PFRA study (Figure 3-2), there is no evidence to suggest liability to groundwater flooding at the proposed development site.

4.4 Coastal Flooding

Based on the results of OPW modelling (PFRA, ICPSS) and the Clifden LAP SFRA, the Harbour Park and Beach Road Quay public realm enhancement areas are located within Flood Zone A, within the predicted 0.5% AEP coastal flood extents, (see Figure 3-5). For the MRFS, the study predicted 200-year and 1000-year water levels of 3.87mOD and 4.10mOD respectively.

The Town Centre is located outside the predicted areas of coastal flooding. The Harbour Park site is identified as being liable to flooding during a 0.5%AEP coastal flood event, and are therefore located in coastal Flood Zone A. However, the proposed development in this location is water compatible therefore the flood risk associated with this development is minimal.

Works within the subject site, and within the floodplain will predominantly consist of the upgrading of surfacing materials and reconfiguring parking areas and public spaces, with most engineering works below ground. The public realm improvements will not involve major level changes and will improve site drainage, and therefore will not exacerbate flood risk elsewhere.

4.5 The Justification Test

With reference to the PSFRM Guidelines, the proposed outdoor urban enhancement works are classified as “water compatible” in terms of sensitivity to flooding.

Based on the findings of this Flood Risk Assessment, the Town Centre areas are primarily located in Flood Zone A, i.e. there is less than a 0.1% Annual Exceedance Probability (AEP) of pluvial/fluvial/groundwater flooding, and less than a 0.5% AEP of coastal flooding; however Harbour Park and Beach Road Quay are located within Flood Zone A, and may be liable to coastal flooding in an 0.1% AEP extreme event.

As the Planning System and Flood Risk Management Guidelines consider water compatible developments appropriate in any flood zone (Flood Zone A, B, C), the Justification Test does not need to be applied.

5.0 CONCLUSIONS

TOBIN Consulting Engineers were appointed by Galway County Council to undertake the detailed design, tender and construction of this public realm enhancement project at Clifden Town Centre, Harbour Park, and Beach Road Quay, Clifden, Co. Galway.

The proposed urban enhancement scheme includes the provision of outdoor amenities and upgrades, considered “water compatible” in terms of their sensitivity to flooding under the Planning System and Flood Risk Management (PSFRM) Guidelines (OPW/DoEHLG, 2009). The proposed works are therefore considered appropriate in any flood zone (Flood Zone A, B or C).

Coastal Flooding:

Based on the results of OPW modelling (PFRA, ICPSS) and the Clifden LAP SFRA, the Harbour Park and Beach Road Quay public realm enhancement areas are located within Flood Zone A, within the predicted 0.5% AEP coastal flood extents.

The public realm improvements are considered “water compatible” in terms of their sensitivity to flooding, and are not predicted to impact flood risk elsewhere; therefore, it is estimated that risk of coastal flooding associated with the proposed scheme is minimal.

Fluvial Flooding:

The Public Realm Enhancement Areas are located in Clifden, on the northern banks of the outlet of the Owenglin River at Clifden Bay.

Based on the results of hydraulic modelling carried out as part of the OPW’s CFRAM programme, and flood mapping produced as part of the Clifden LAP SFRA, the Town Centre public realm enhancement areas are located within Flood Zone C, outside the predicted 0.1% AEP fluvial flood extents. Under a Mid-Range Future Scenario (MRFS) for climate change, Secondary Town Centre Areas Hulk Street and Doonen Road may be liable to the 0.1% AEP fluvial flood event.

A minor stream is delineated by the EPA as draining south across Beach Road to Harbour Park, before outletting to Clifden Bay, with reports of the watercourse overflowing its banks after heavy rain, indicating Harbour Park may be liable to fluvial flooding.

The public realm improvements are considered “water compatible” in terms of their sensitivity to flooding, and are not predicted to impact flood risk elsewhere; therefore, it is estimated that risk of fluvial flooding associated with the proposed scheme is minimal.

Pluvial Flooding:

Based on the indicative pluvial flood mapping presented in the OPW Preliminary Flood Risk Assessment, it is estimated that the subject site is not at risk from pluvial flooding.

Galway County Council reported an area of flash flooding on Beach Road which is adjacent to the Harbour Park site. This is as a result of poor drainage in the area. This issue will be addressed by the design team as the project progresses.

The proposed urban enhancement scheme includes the provision of drainage works, including a drainage investigation of existing infrastructure and design of a new drainage system in accordance with Sustainable Drainage Systems (SuDS) principles.

The landscaping and topography of the site will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with extreme flooding or blockage of the stormwater drainage system, minimizing the potential for pluvial, fluvial, groundwater and coastal flooding.

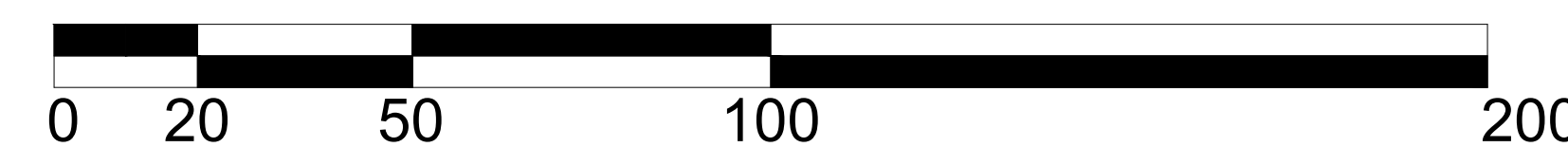
Groundwater Flooding:

There is no evidence to suggest groundwater as a potential source of flood risk to the proposed development site.

Based on the findings of this Flood Risk Assessment, the subject site is appropriately located in Flood Zones A and C in accordance with the Planning System and Flood Risk Management Guidelines.

Appendix 1

Topographic Survey



SCALE BAR 1:1000

Legend

Street Furniture and Services

- [illegible]

Natural Features

-
- LEGEND:**
- 20.00 **BOTTOM OF BANK**
 - 10.00 **CANOPY VEGETATION LINE DEM**
 - 20.00 **RED LEVEL**
 - 10.00 **CANOPY VEGETATION LINE**
 - 10.00 **IMPERVIOUS CANOPY**
 - 10.00 **HEDGE CENTRE/HEDGE CANOPY/PLANTATION**
 - **BREAKLINE**
 - **WATER EDGE**
 - 10.00 **ARCH CLEFT**
 - 10.00 **BOX CLEFT**
 - 10.00 **INVERT LEVEL**
 - 10.00 **WATER LEVEL**
 - 10.00 **Spot Height**
 - 10.00 **Tree Coniferous**
 - 10.00 **Tree Deciduous**

Built Features, Roads and Road Markings

- | | | | |
|--|---|--|-----------------------------|
| | REINCH | | BUILDING OUTLINE |
| | BUILDING OUTLINE DM | | PILAR |
| | SAKE | | FIELD SIGN |
| | AJUTEX | | ROOF LEVEL |
| | PIAPUAT LEVEL | | TOP OF FENCE |
| | TOP OF WALL | | BIKE |
| | UNDERGROUND MARKING DM | | SCAFFOLD FACE |
| | CHANGING DEAN LINE | | AREA BOTTLENECK TOP WALL DM |
| | OVERHANGING ROOF CANOPY | | WHITE LINE |
| | WHITE LINE DASHED | | YELLOW LINE DASHED |
| | ROAD MARKING (EDGE/TRACE)/STAIRING WALL | | ROAD MARKING |

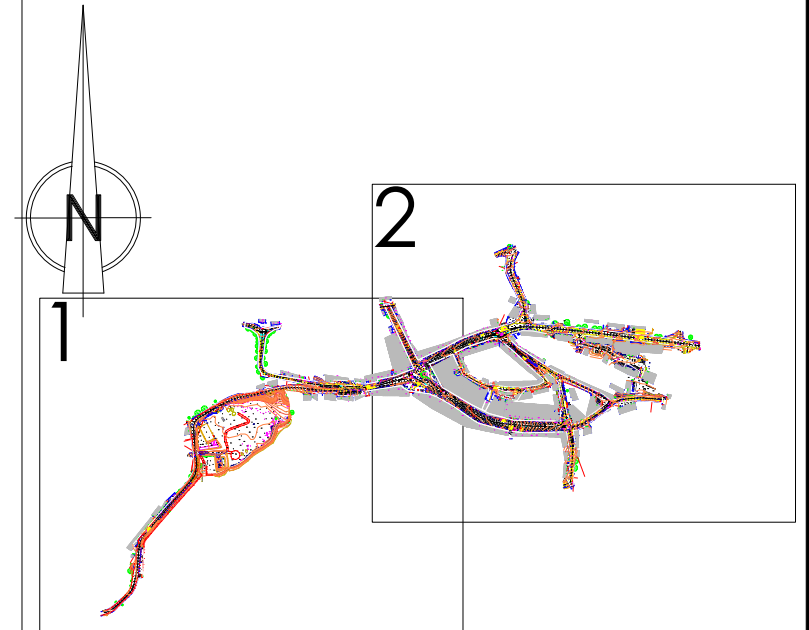
Railway Features

- STORAGE BOX
 STRAL PANEL
 BUILDING OUTLINE
 SLEEPER CONCRETE
 SWITCH ROD
 SLEEPER WOODEN
 RAILWAY MAIN TRACK
 CABLE
 LUBRICATOR
 10-24 MILE POST
 NAC RODS MARKER POST LABELLED

Survey Features

- BENCHMARK
 SURVEY STATION CHECK
 CONTROL STATION POINT

Sheet Layout



C	Extra features added	DR	26/04/22
B	Extra features added	DR	11/04/22
A	ORIGINAL DRAFT	DR	30/03/22
REV:	DESCRIPTION:	BY:	DATE:
REV/STATUS:			



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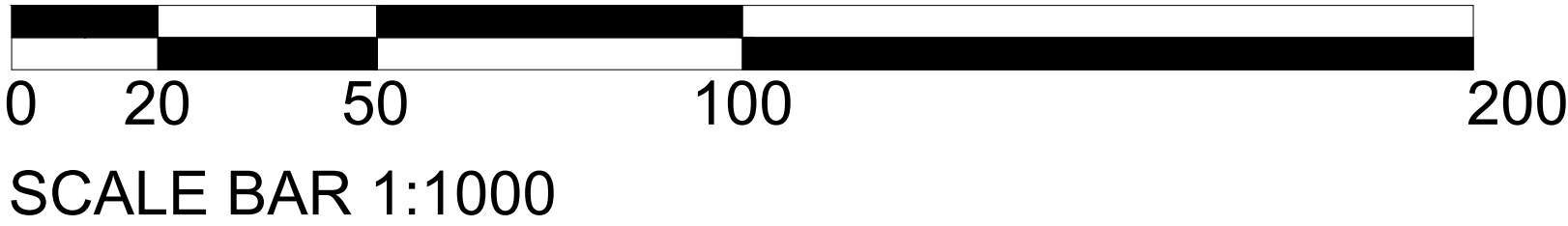
CLIENT	Galway County Council
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PROJECT	Topographical Survey
---------	----------------------

SITE: CLIFDEN
County Galway

GRID:	GRIDSYS:ITM
	Height Datum: OSGM15/ Malinhead

SCALE AT A1: 1:1000	DATE: 26/04/22	DRAWN: DR	CHECKED: CM
PROJECT NO: 2072	DRAWING NO: 2072_I_3D_Rev2		SHEET: 1 OF 2



Legend

Street Furniture and Services

AIR VALVE REC COVER	BASINMENT ACCESS COVER	BN SQUARE
BUS SHELTER	BT INSPECTION COVER	CABLE GIRD
CABLE TELEVISION INSPECTION COVER	CCTV INSPECTION COVER	BRICK INSPECTION COVER
CONTROL PANEL	DB CONTROL BOX	FREE HOKANT COVER
STAY INSPECTION COVER	DB INSPECTION COVER	INSPECTION COVER SQUARE
BORD GAS COVER OR PANEL	GULLY COVER	STOP VALVE REC COVER
MANHOLE SQUARE COVER	INSPECTION COVER	STOP VALVE REC COVER
ELECTRICITY INSPECTION COVER	INSPECTION COVER	STOP VALVE REC COVER
VERGAS MEDIA INSPECTION COVER	WATER METER SQUARE COVER	STOP VALVE REC COVER
AIR VALVE COVER	BORE HOLE	STOP VALVE REC COVER
ROAD	EARTH ROD COVER	STOP VALVE REC COVER
ELECTRICITY POLE	INSPECTION COVER	STOP VALVE REC COVER
GAS STOP VALVE ROUND COVER	INSPECTION COVER	STOP VALVE REC COVER
LAMP POST	MANHOLE ROUND COVER	STOP VALVE REC COVER
PARKING METER	POLE	STOP VALVE REC COVER
SON	STAY	STOP VALVE REC COVER
TRAFFIC LIGHT	TELEGRAPHY POLE	STOP VALVE REC COVER
WATER STOP VALVE COVER	DUCT LINE	STOP VALVE REC COVER
OVERHEAD CABLE	FENCE BARBED WIRE	STOP VALVE REC COVER
HAND RAIL	OVERHEAD CABLE	STOP VALVE REC COVER

Natural Features

BOTTOM OF BANK	RED LEVEL	BREAKLINE
CANOPY VEGETATION LINE DIM	CANOPY VEGETATION LINE	WATER EDGE
TOP OF BANK	HOUSE CONCRETEHOUSE CANOPY/PURIFICATION	
ARCH CULVERT	SPOT HEIGHT	TREE DECIDUOUS
BOX CULVERT	TREE CONIFEROUS	
INVERT LEVEL	WATER LEVEL	

Built Features, Roads and Road Markings

BENCH	BUILDING OUTLINE RECT	BUILDING OUTLINE
BUILDING OUTLINE DIM	CONCRETE CANYON SHED	PILLAR
LINE	YELLOW BOX	WELL SIGN
APEX	SCOTT LEVEL	FLOOR LEVEL
PARAMET LEVEL	ROADWAY LEVEL	TOP OF FENCE
TOP OF WALL	BRIDGE DECK/RAIL SD	CONCRETE SURFACE
BKE LAINE/ROAD MARKING DIM	SURFACE CHANGE	KEEL BOTTOM/WEB TOP WALL DIM
CHANNEL DRAIN LINE	STOP SIGN	WALL LINE SOLID
OVERHEAD/ROOF CANOPY	YELLOW LINE SOLID	YELLOW LINE DASHED
WIRE LINE CLOTHED	ROAD DYNAMIC (ELECTRICITY/RETAINING WALL)	ROAD MARKING

Railway Features

STORAGE BOX	STRAIL PANEL	BUILDING OUTLINE
SUPPLY CABLES	SUPPLY WOODSH	SUPPLY WOODSH
RAILWAY DRG TRACK	CABLE	LIBERATOR
WALL POST	WALLER POST LABELLED	

Survey Features

BENCH NAME	SURVEY STATION CHECK	CONTROL STATION POINT
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Sheet Layout

C	Extra features added	DR	26/04/22
B	Extra features added	DR	11/04/22
A	ORIGINAL DRAFT	DR	30/03/22
REV:	DESCRIPTION:	BY:	DATE:
REV/STATUS:			

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CLIENT	Galway County Council		
PROJECT	Topographical Survey		
SITE:	CLIFDEN County Galway		
GRID:	GRIDSYS:ETM Height Datum: OSGM15/ Malinhead		
SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:1000	26/04/22	DR	CM
PROJECT NO:	DRAWING NO:	SHEET:	
2072	2072_T_3D_Rev2	2 OF 2	

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