

SOCIAL HOUSING DEVELOPMENT RATHELLEN, FINISKLIN, CO. SLIGO

Hydrological Assessment Report



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Hydrological Assessment
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List of Abbreviations

AEP:	Annual Exceedance Probability
CFRAM:	Catchment Flood Risk Assessment and Management
EPA:	Environmental Protection Agency
FSR:	Flood Studies Report
HEFS:	High-End Future Scenario
ICPSS:	Irish Coastal Protection Strategy Study
MRFS:	Medium Range Future Scenario
OPW:	Office of Public Works

1 INTRODUCTION

RPS are the appointed Civil and Structural Engineering advisors for the proposed residential development at Finisklin, Co. Sligo. This project will deliver 39 houses and 24 apartments to Sligo County Council Planning Authority. The development will be sited over a land area of 2.46ha. **Figure 1.1** illustrates the location of this proposed development site at Sligo.

The red line boundary represents the revised extents of the site to be developed while the blue line boundary represents the extents of lands reserved for residential development by Sligo County Council. The lands included within the blue line boundary will be considered under this Hydrological Assessment Report.

As part of this development RPS has carried out a hydrological assessment of the proposed site. This assessment is required in order to obtain a planning permission for the proposed housing development project as set out in the Government's 2009 Planning System and Flood Risk Management Regulations (*hereafter referred to as the 2009 Planning Regulations*). The assessment involved a desktop study combined with a site visit. The study examines any flooding risks to the proposed site and also assesses any impacts of the proposed development on the existing flooding/hydrological regimes of the adjacent watercourses and lands.



Figure 1.1 Location of the proposed development at Rathellen, Finisklin, Sligo

2 THE SITE AND PROPOSED DEVELOPMENT

2.1 The Site and Existing Drainage System

The lands reserved for residential development by Sligo County Council covers a total area of 4.30ha (outlined in blue in **Figure 2.1**), which was purchased by Sligo Borough Council in 2002. It lies approximately 3 km from Sligo town centre in the townland of Finisklin. It is bounded by Finisklin Road on the north eastern and north western boundary, and the Sea Road along its western boundary. It is bounded by the IDA Finisklin Business & Technology Park to the south and east. The revised site boundary to be developed as part of the Social Housing PPP scheme (outlined in red) has an area of 2.516ha.

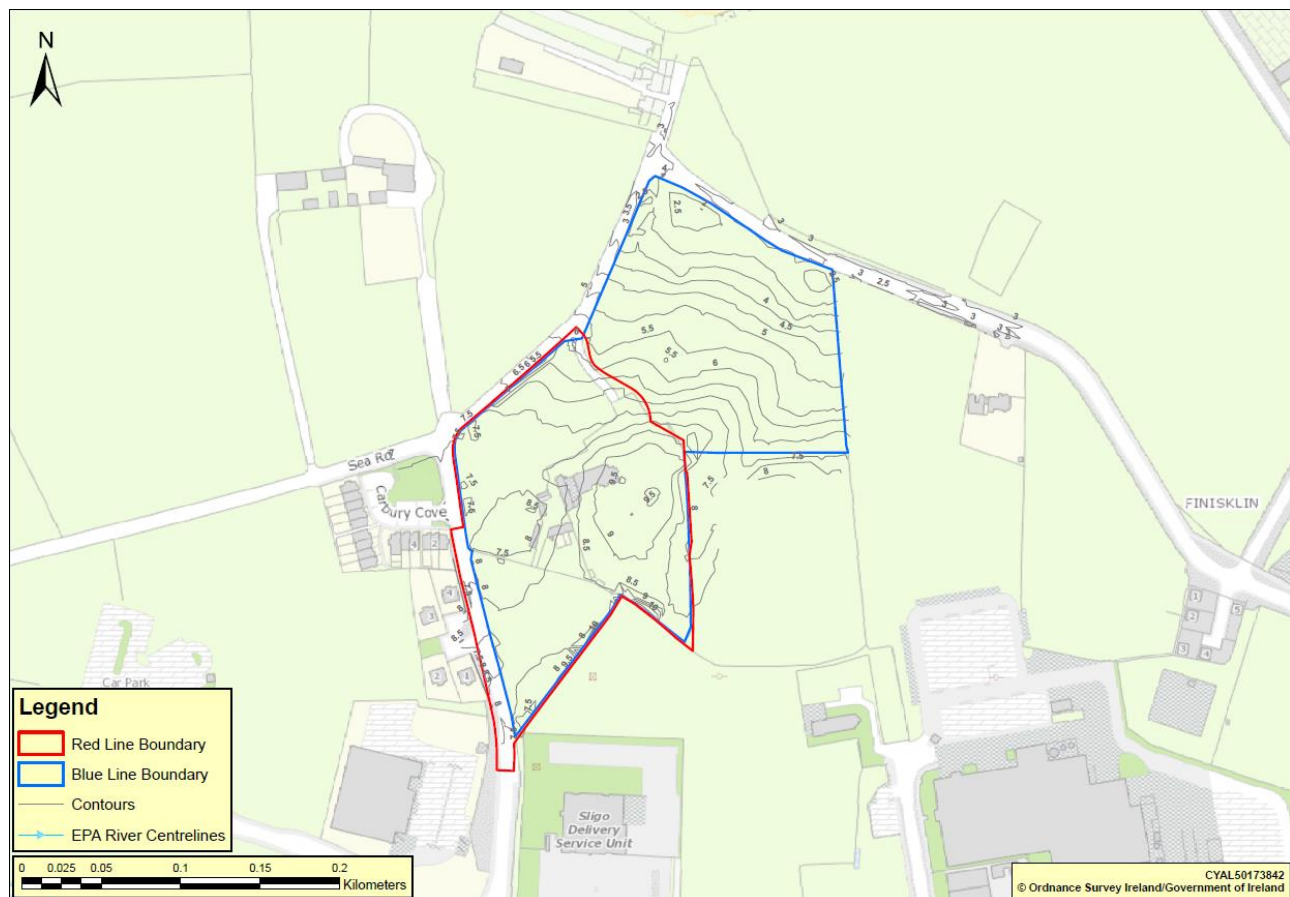


Figure 2.1 Proposed development site and existing drainage

The site is close to Sligo Estuary that leads to Sligo Bay (approximately 100m away from the shoreline). The estuary formally extended to sand marsh lands along Finisklin Road to the north east of the site. This coast land was reclaimed by land fill and used for many years as a Municipal Dump until its closure in the late 1980s. Further reclamation was carried out to form the site for Sligo's Main Drainage Treatment Plant, which lies to the north east of the site.

A topographical survey of the site was provided by Sligo County Council along with the project brief. The site is generally a level site, with levels ranging from 6.0mOD to 9.5mOD along the upper plateau within the site red line boundary. Further north of the proposed site red line boundary, the existing topography falls away from levels of 8.0mOD at the red line boundary to 2.2mOD to the North. Storm runoff from the site currently infiltrates to the ground and any excess runoff drains northward and eventually discharges into Sligo Estuary as overland flow (refer to **Figure 2.1** for site topographical information).

The entire site area falls under the 1975 Flood Studies Report classified soil type 2, suggesting high winter rain acceptance potential. Also, according to the Teagasc soil maps, the subject site's soil type comprises of deep well drained minerals (mainly acidic).

Geotechnical Investigation (GI) works undertaken during the period of July-August 2021 revealed the ground in the site to be predominantly consisting of stiff, brown, sandy gravelly clay with medium cobble content.

The sand is fine to coarse and gravel is fine to coarse, sub-angular to sub-rounded while cobbles are 63mm to 130mm dia, sub-rounded.

Rathellen House and site has been in private ownership until its purchase by Sligo Borough Council and the associated lands used as private garden, orchard, and for agricultural grazing, predominantly a greenfield site (see **Image 2.1** and **Image 2.2**).



Image 2.1 View of site from Finisklin Road looking west



Image 2.2 View of site from Sea Road looking east

In the Sligo Development Plan (2017-2023), the subject site was zoned R2 – Residential low / medium density with a range of 20-34 DPH (see **Figure 2.2**). The cross hatching on the zoning map indicates that the site is in the Strategic Land Reserve (SLR), however sites for the provision of social housing are exempt from the SLR.

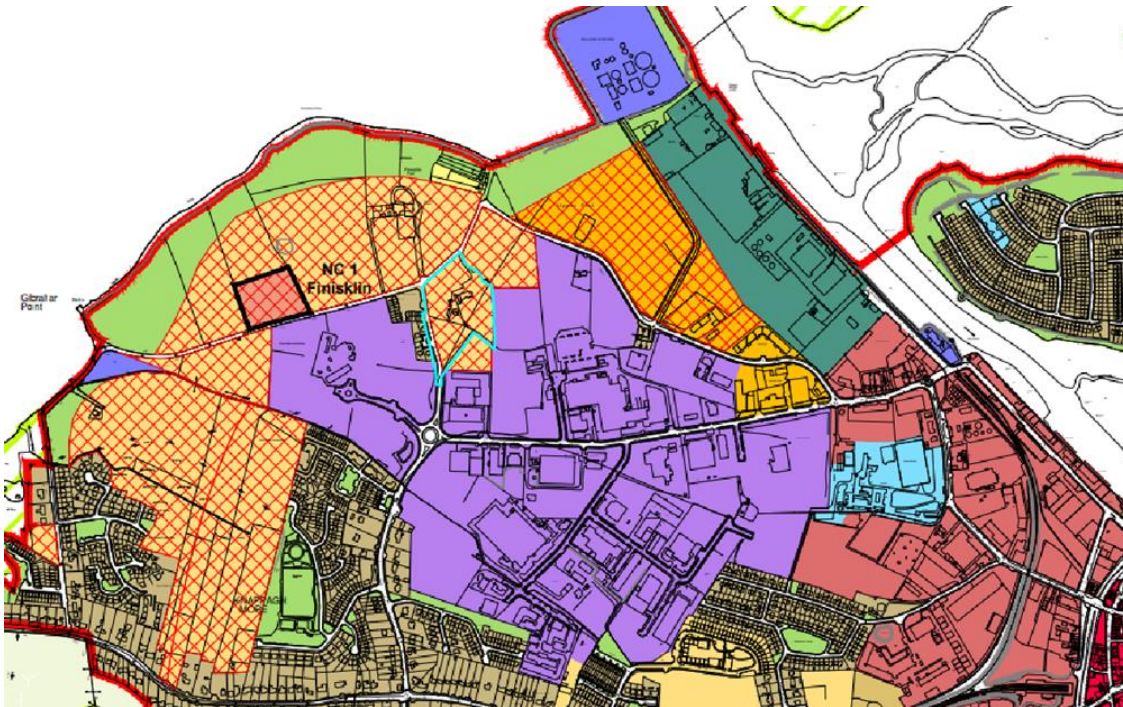


Figure 2.2 Sligo Development Plan (2017-2023), Land Use Zoning Map

2.2 Proposed Development

The proposed development includes 39 houses ranging from two to five bed and 24 apartments ranging from one and two bed sited over a land area of 2.516 ha encompassing a little over half the total Sligo County Council site, and also includes associated access roads, car parking area and other utility services. The finished floor levels across the site vary from a minimum of 8.0mOD at Block 2 at the western boundary of the site to a maximum of 9.5mOD at Block 4 at the eastern boundary of the site. **Figure 2.3** shows the proposed development layout plan. A detailed layout plan of the proposed development is also included in **Appendix A**.



Figure 2.3 Sligo PPP Social Housing proposed development layout plan

3 SITE FLOOD HISTORY AND FLOOD DATA

3.1 Site Flood History

The following sources of records have been collected and reviewed to identify any existing flood risk to the proposed development site area and its vicinity:

- 6" & 25" historical maps for the Sligo Area,
- Historic flood maps and reports from (www.floodmaps.ie),
- OPW Flood Plans & Flood Maps Info (<https://www.floodinfo.ie>),
- EPA Maps (<https://gis.epa.ie/EPAMaps/>),
- OPW and EPA Hydrometric Data (<http://www.opw.ie/hydro/index.asp?mpg=main.asp>; <http://hydronet.epa.ie/hydronet.html>),
- The National Preliminary Flood Risk Assessment (PFRA) – Overview Report & Indicative Flood Maps (OPW, March 2012, www.cfram.ie),
- Western CFRAM Study Reports (www.floodinfo.ie),
- Met Eireann rainfall records (www.meteireann.ie),
- Sligo Development Plan (2017 – 2023)
- Marine Institute for Tidal Records, 2008 – 2013)
- Irish Coastal Protection Strategy Study Report– North West Coast (OPW, November 2013)

The historical 6 inch and 25 inch maps do not show any flood prone areas within the subject site boundary. However, the OPW flood maps show a flood prone area at the northwest corner of the blue line boundary (see **Figure 4.1**). This low-lying northwest part of the site and the adjacent road were flooded on 18th November 2009. Prolonged intense rainfall caused accumulation of surface runoff at the low-lying northwest corner of the site.

Due to its close proximity to Sligo Estuary and reclaimed marshy lands immediately north of Finisklin road combined with the presence of permeable mineral subsoils within the site area, it is likely that there would be some active hydraulic connectivity between the tide level and site ground water level. This should be verified through concurrent monitoring groundwater and tide levels in the area. Potential mitigation in the demonstration of hydraulic connectivity would be to maintain finished floor levels, foundation levels and subsurface attenuation/percolation areas above the predicted tidal flood levels.

3.2 Rainfall, Water Level and Flow Records

Rainfall records for the Sligo area have been collected from Met-Eireann. The observed long-term average annual rainfall at Sligo Airport is 1,150 mm.

The OPW, EPA and Marine Institute were contacted for water levels and flow records for Sligo Estuary.

Water Level records (2003 - present) of the Garavogue River at Sligo New Bridge gauging station (35012) were obtained from EPA. The observed maximum water level at New Bridge was 3.844 mOD, recorded on 6th December 2015. Water levels at this gauge are both tidally and fluvially affected.

Tidal Records of Sligo Estuary at Rosses Point (35060) were available for the period of 2008 to 2013. These records were obtained from Marine Institute. The observed maximum tide level at Rosses Point in Sligo Bay, during the 2008-2013 recorded period was 2.454 mOD, recorded on 15th December 2012.

Unfortunately, observed tidal data is not available for Rosses Point Tidal Gauge (35060) during the period 2013-2017 to confirm if the flood event at New Bridge gauging station (35012) in 2015 was as a result of a fluvial-tidal combined event.

Sligo County Council Water Services Division informed RPS that coastal flooding occurred in 2013/2014. There is no observed tidal data available for Rosses Point Tidal Gauge (35060) during this period. The extents of flooding have not been mapped and so the significance/extremity/return period of this flood event could not be established.

4 HYDROLOGICAL ASSESSMENT AND FLOOD RISK

4.1 Surface Water Flood Risk

As discussed in the previous section, much of the subject site area is not at flooding risk and did not flood in the past, apart from some low-lying lands towards the north. Accumulated surface runoff from the surrounding area causes some flooding at this low-lying area before it drains slowly through infiltration and also as overland flows into the Sligo Estuary. Road runoff drains via storm sewer network constructed under the Sligo Main Drainage Scheme.

The Western CFRAM study results did not show any fluvial flooding at subject site; however, it showed some coastal flooding outside the site boundary to the north-east at the Far Finisklin Road, particularly during the 0.5% AEP and 0.1% AEP coastal events. No flood prone area was identified within the subject site during the 10% AEP tidal event in this study (see **Figure 4.1**).

In this Western CFRAM study, the Irish Coastal Protection Strategy Study (ICPSS, OPW, 2013) predicted / estimated tide levels were used. **Table 4.1** below shows estimated extreme water levels (combined tide and surge) in the nearest vicinity of the subject site in Sligo Bay (at ICPSS computation node no. NW6). **Figure 4.2** shows the location of this computation node NW6.

Table 4.1 ICPSS predicted extreme water levels (combined tide & surge) (Node - NW6)

Scenario	ANNUAL EXCEEDANCE PROBABILITY (AEP)							
	50%	20%	10%	5%	2%	1%	0.50%	0.10%
Present Day (PD)	2.5	2.64	2.73	2.82	2.94	3.03	3.12	3.33
MRFS (PD+0.5m)	3	3.14	3.23	3.32	3.44	3.53	3.62	3.83
HEFS (PD+1.0m)	3.5	3.64	3.73	3.82	3.94	4.03	4.12	4.33

The predicted 0.5% AEP (1 in 200 year) and 0.1% AEP (1 in 1000 year) extreme water levels in the vicinity of the site are 3.12 mOD and 3.33 mOD (Malin) respectively for the present-day condition. For the Medium-Range and High-End Future Climatic Scenarios (MRFS & HEFS), the estimated 0.5% AEP water levels are 3.62 mOD and 4.12 mOD respectively. Based on the existing land elevations, these predicted flood levels suggest that the approximately 0.53 to 0.68 ha land areas, located north north-eastern from the subject site, would flood if these extreme tidal events would occur. Average flood depth could be in the order of 1.0 m, with a maximum flood depth of up to 2.1 m in the case of HEFS. The results though suggest very minimal flooding for the present-day scenario (3.12 mOD).

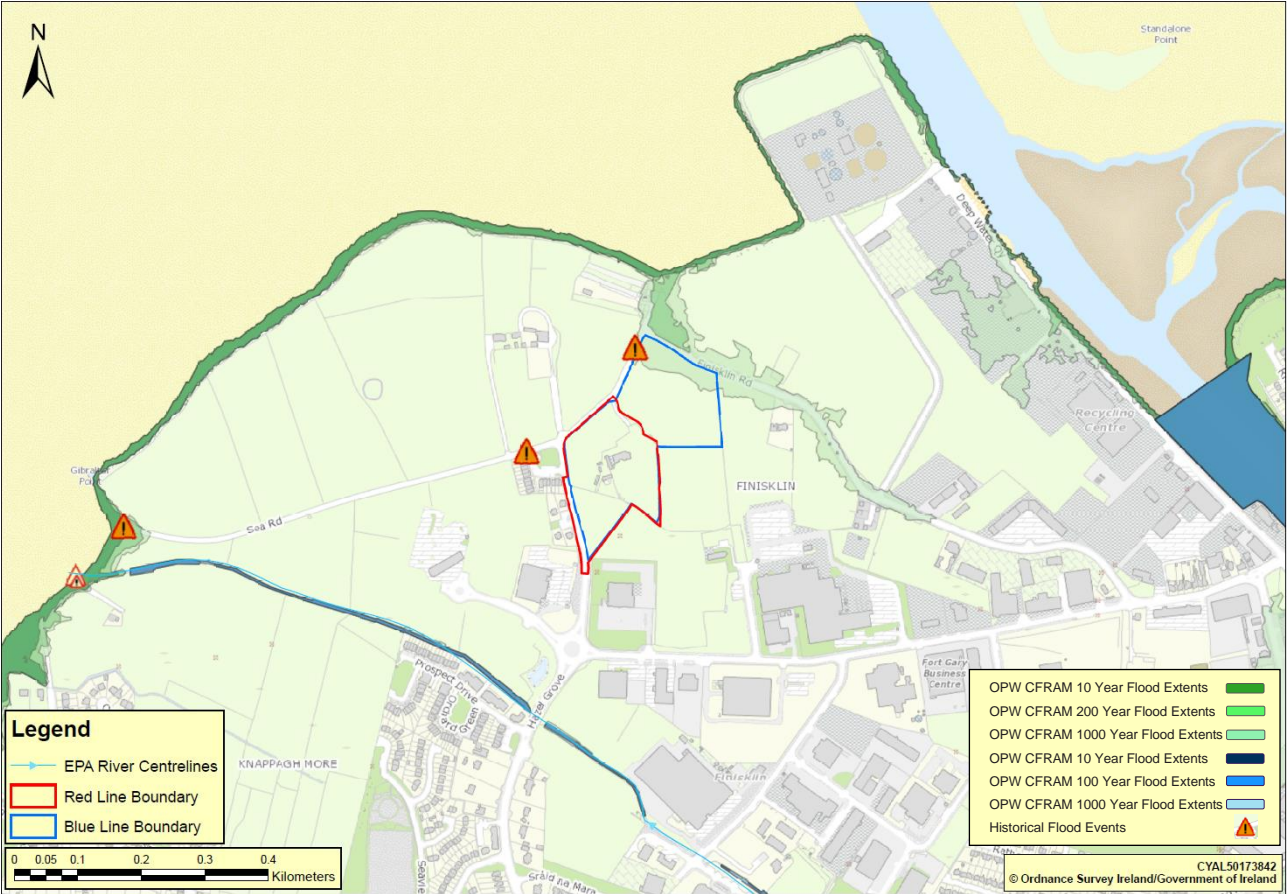


Figure 4.1 CFRAM Flood Extents and Hazard Maps

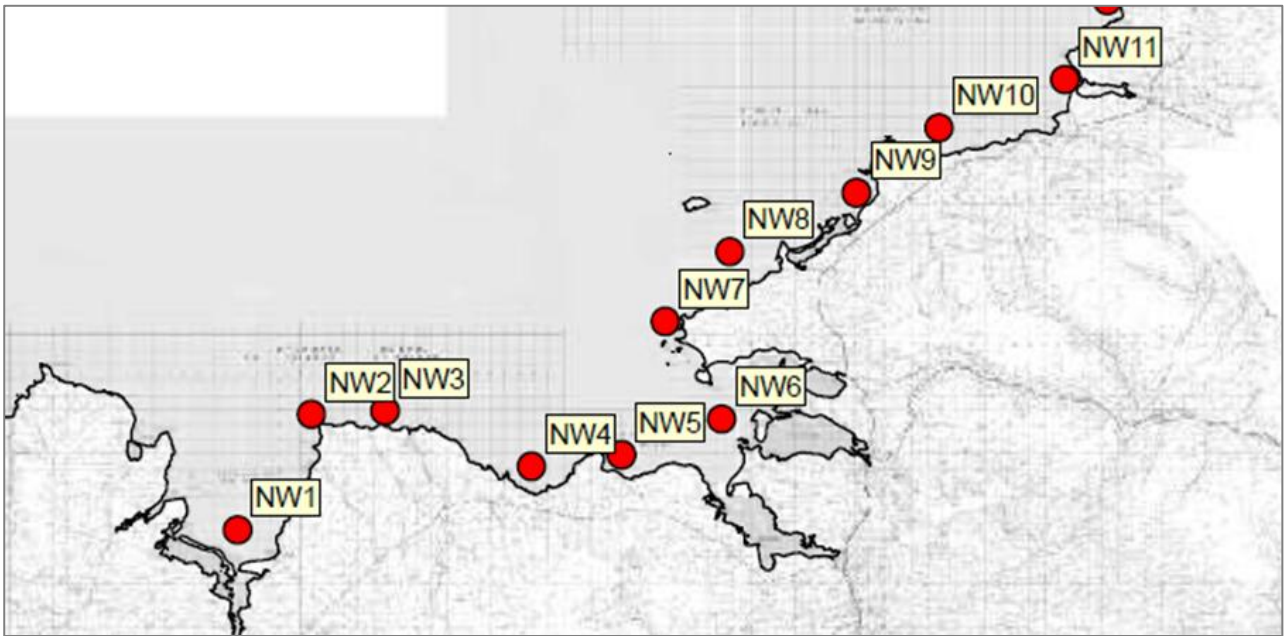


Figure 4.2 ICPSS extreme sea levels estimation nodes along the North-West coast of Ireland

4.2 Groundwater Flooding

Further to the above-mentioned surface water flooding, the historical and potential future groundwater flooding risks within the study area were also investigated. The winter of 2015/2016 saw the most extensive groundwater flooding ever witnessed in Ireland. Homes were flooded or cut off, roads submerged, and agriculture disrupted by karst derived groundwater flooding, with some affected areas remaining inundated for months. Geological Survey Ireland prepared historical and predictive flood maps across Ireland (particularly for the limestone karstic regions) under the GWFlood Project (2016-2019). The predictive groundwater flood map presents the probabilistic flood extents for locations of recurrent karst groundwater flooding. It consists of a series of stacked polygons at each site representing the flood extent for three specific AEP's (10%, 1%, and 0.1% respectively). This GSI prepared predictive flood maps show no groundwater flooding within the subject site area.

Due to its close proximity to Sligo Estuary and reclaimed marshy lands immediately north of Finisklin road combined with the presence of permeable mineral subsoils within the site area, it is likely that there would be some active hydraulic connectivity between the tide level and site ground water level. This should be verified through concurrent monitoring groundwater and tide levels in the area. Potential mitigation in the demonstration of hydraulic connectivity would be to maintain finished floor levels, foundation levels and subsurface attenuation/percolation areas above the predicted tidal flood levels.

4.3 Hydrological Impact Assessment

The above assessments suggest that during the design 0.5% AEP event (HEFS), flood level in the vicinity of the site could rise up to a maximum level of 4.12 mOD (Malin). Based on a freeboard allowance of 0.3m, the proposed buildings' finished floor level (FFL) should be set at a minimum level of 4.42 mOD. This suggests that proposed minimum FFL of 8.0m OD would be adequate. Any increase in flood level in the vicinity of the site due to raising of site area, particularly at the north north-western parts of the site, is expected to be very minimal, given its close proximity to Sligo Estuary.

Any additional site surface runoff (excess to the pre-development greenfield runoff) will be managed within the site using SUDS including constructing adequate attenuation system. The attenuation system should be designed to attenuate storm flows to 1% AEP storm flow event inclusive of climate change to the existing greenfield runoff rates. Consideration shall also be given to storage of storm runoff volumes during period of zero discharge during high tides. In this way, any increase in flooding risk to any adjacent properties / roads the, from the post-development stage site surface runoff will be minimised and avoided. The formation level for the proposed subsurface attenuation/percolation area should be constructed 300mm above the predicted tidal flood level (0.5%HEFS) to mitigate against buoyancy forces should there be a determination of groundwater/tidal water level connectivity.

5 FLOOD ZONE MAPPING AND JUSTIFICATION TEST

The flood zones are defined on the basis of the probability of flooding from rivers and the sea. The different flood zones recommended in the 2009 Planning Guidelines are:

- i. Flood Zone A: is at highest risk and has a 1% chance of flooding in any one year from rivers and a 0.5% chance of flooding from the sea.
- ii. (Flood Zone B: is at moderate risk of flooding from rivers and the sea and its outer limit is defined by a 0.1% chance of flooding in any one year.
- iii. Flood Zone C: is the low risk area, with a less than 0.1% chance of flooding from rivers, estuaries, or the sea in any one year.

From the flood extent maps associated the design flood level (0.5% AEP) prepared for the subject site area under the Western CFRAM study shows, it can be seen that the proposed development site area falls under Flood Zone C while a portion of the lands to the north fall under Flood Zone B (**Figure 4.1**). Based on this and since the site was zoned as R2-Residential in the Sligo Development Plan (2017-2023), the subject site deemed to be appropriate for the proposed Social Housing Development.

6 CONCLUSIONS AND RECOMMENDATIONS

- 1 Much of the proposed site area does not have any record of flooding in the past. During the November 2009 prolonged rainfall event, the low-lying north-western corner of the site was flooded due to accumulation of surface water runoff before it drained slowly through infiltration, via road drainage network and also as overland flows to Sligo Estuary. Sligo County Council Water Services Division informed RPS that coastal flooding occurred in 2013/2014. There is no observed tidal data available for Rosses Point Tidal Gauge (35060) during this period. The extents of flooding have not been mapped and so the significance/extremity/return period of this flood event could not be established.
- 2 Flood extent maps for the design flood level (0.5% AEP) prepared for the subject site area under the Western CFRAM study shows that the proposed site development area (red line boundary) falls under Flood Zone C. A very small north north-western portion of the lands within the blue line boundary falls under the Flood Zone B (estimated to be approximately 16% of the entire blue line area). Based on this and since the site land is zoned as R2-Residential in the Sligo Development Plan (2017-2023), the subject site (red line boundary) is deemed to be appropriate for the proposed Social Housing Development.
- 3 The above assessments suggest that during the design 0.5% AEP event (HEFS), flood level in the vicinity of the site could rise up to a maximum level of 4.12 mOD (Malin). Based on a freeboard allowance of 0.3m, the proposed buildings' finished floor level (FFL) should be set at a minimum level of 4.42 mOD. This suggests that proposed minimum FFL of 4.5 mOD would be adequate. The finished site level could be set at 1% AEP MRFS levels of 3.53 mOD, allowing some temporary flooding only on the site. Any increase in flood level in the vicinity of the site due to raising of site area, particularly at the north north-western parts of the site, is expected to be very minimal, given its close proximity to Sligo Estuary.
- 4 Any additional site surface runoff (excess to the pre-development greenfield runoff) will be managed within the site using SUDS measures including constructing adequate attenuation system. The attenuation system should be designed to attenuate storm flows to 1% AEP storm flow event inclusive of climate change to the existing greenfield runoff rates. This ensures that runoff from the site will not be increased as a result of the proposed development.
- 5 It is recommended that any likely active hydraulic connection between the groundwater level within the site area and the tide levels in Sligo Estuary be investigated through installation of a groundwater borehole at the site and also a tide gauge in Sligo Estuary. Continuous groundwater monitoring at the site was unavailable at the time of writing this report, so hydraulic connectivity could not be established nor ruled out.
- 6 Potential mitigation in the demonstration of hydraulic connectivity between tidal and groundwater levels would be to maintain finished floor levels, foundation levels and subsurface attenuation/percolation areas above the predicted tidal flood levels.

REFERENCES

1. Natural Environmental Research Council (NERC) (1975) "Flood Studies Report" Vols 1 to 5, London.
2. A.M. Cawley and C. Cunnane (2003) "Comments on estimation of Greenfield runoff rates", Irish National Hydrology Seminar, 2003.

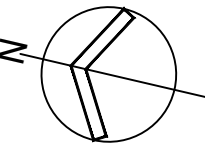
Appendix A

Layout Plan of the Proposed Development

Notes:
Do not scale from this drawing.
Use figured dimensions only.
All errors and omissions to be reported to the Architect.
This drawing to be read in conjunction with relevant consultant's drawings.
All dimensions are in millimetres and all levels are in meters to match Datum unless otherwise noted.
Contractor Design responsibility
It is noted that there are many elements within the works that require contractor design, and will be subject to certification as part of BCAR - see Preliminary Inspection Plan for clarity on certification required.
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Site Plan Legend

Part 10 Planning Application



LEGEND: SITE PLAN

- Part 10 Planning Application
- Asphalt to carriageways generally
 - Concrete flag paving to street edge (outside boundary), brick paving otherwise
 - Raised road with coloured pavours for vehicular loading
 - Buff coloured tarmac
 - Soft landscaping see Landscape Architecture plan for details (boundary planting / front curtilage planting)
 - Public open space to landscape architect's detail
 - Existing trees with root protection zone to be retained
 - Existing site features to be removed
 - Proposed landscaping levels
 - Proposed ground floor slab level
 - Proposed ESB substation
 - Proposed EV switch room location
 - Proposed house type reference and number
 - Universally accessible unit

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P-01	Issue for Pre-Planning	19-11-2021	NB
P-00	Issue to client	16-07-2021	NC

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SLIGO COUNTY COUNCIL

Title:
Finisklin Proposed Site Layout

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1 Site Layout Plan
Scale: 1:500