Waterman Moylan
Engineering Consultants

Flood Risk Assessment

Proposed Adamstown Boulevard Phase 1 Development at Lucan, Adamstown, South Dublin County Council.

April 2022

Waterman Moylan Consulting Engineers Limited
Block S, East Point Business Park, Alfie Byrne Road, Dublin 3
www.watermangroup.com

Waterman Moylan
Engineering Consultants

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This document has been prepared and checked in accordance with Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
1st	March '22	P Ingle	E Caulwell	DRAFT
2nd	April '22	P Ingle	E. Caulwell	Emma Caulwell

Comments

Disclaimer

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1. Introduction

This Flood Risk Assessment (FRA) has been prepared by Waterman Moylan in support of the proposed Development of **Phase 1 of the Adamstown Boulevard** tile (Development area 10) located in the Adamstown Strategic Development Zone (**ASDZ**), Co. Dublin. The subject ite is approximately 13 km west of Dublin and 2.5 km south of Lucan Village.

The Adamstown Boulevard Tile will consist of 2 № Phases. The total area of the subject lands is approximately 14.6 hectares. with Phase 1 approximately 10.14 hectares of this total area. The site is bound by the Aderrig Tile and Adamstown Way to the north and the future Adamstown Boulevard Phase 2 development to the east. Station Road bounds the site to the south, and farmlands border the west of the site.

This FRA has been carried out in accordance with the Department of Housing and Local Government (DEHLG) and the Office of Public Works (OPW) document *"The Planning Process and Flood Risk Management Guidelines for Planning Authorities"* published in November 2009. This Assessment identifies and sets out possible mitigation measures against potential risks of flooding from various sources. Sources of possible flooding include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical error.

This report provides an assessment of the subject site, Adamstown Boulevard **Phase 1**, for flood risk purposes only. It should be noted that the overall Adamstown Boulevard tile has been taken into consideration regarding the flood risk assessment, however this planning application is relevant to Phase 1 only. A plan illustrating the extent of the ASDZ can be seen in Figure 1-1 below.

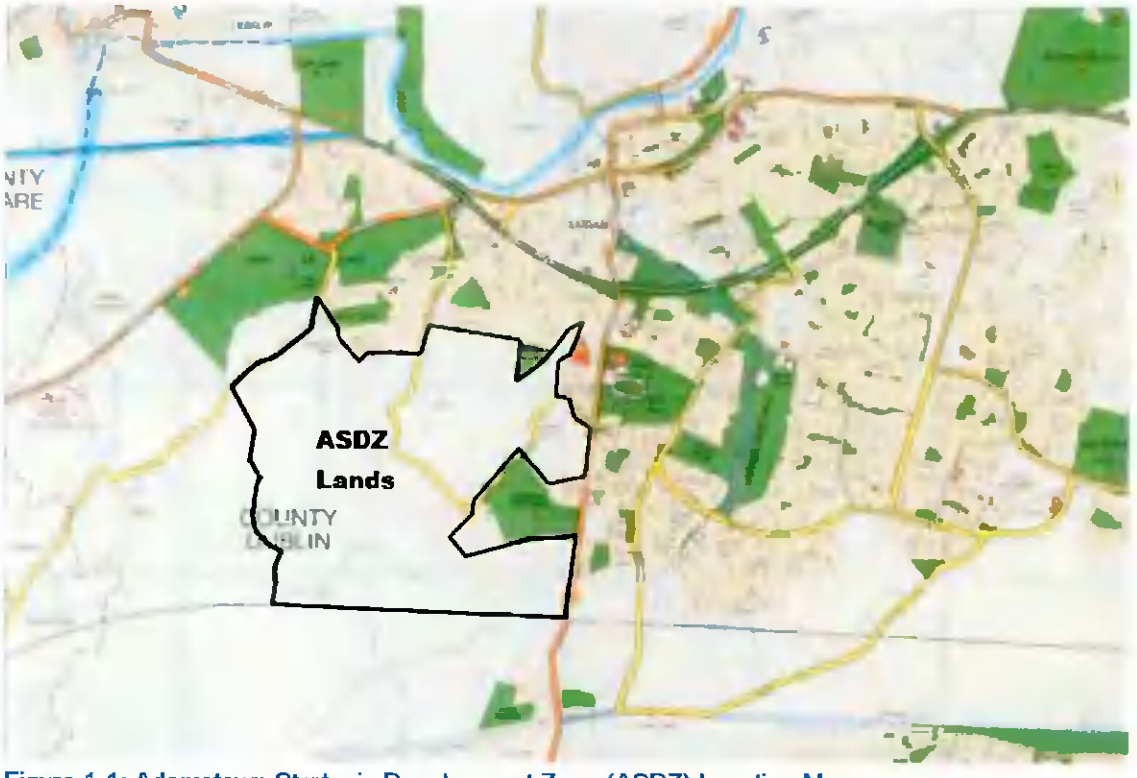


Figure 1-1: Adamstown Strategic Development Zone (ASDZ) Location Map

1.1 Site & Proposed Development Description

The current application site (10.14ha) is located within Development Area 10 – Adamstown Boulevard of the Adamstown SDZ Planning Scheme, 2014, as amended. Phase 1 of the Adamstown Boulevard development seeks Permission for 257no. terraced and semi-detached housing units ranging from 2 to 3-storeys in height; open space is proposed including a Pocket Park, and also a Linear Park which stretches from Adamstown Way to Station Road; all associated ancillary site development and landscape works, including internal roads and services, ESB Sub-Stations, landscaping and boundary treatment works. Outline Permission is also being sought for 166no. apartment units in a block ranging from 6 to 9-storeys in height which will deliver a range of unit types. All on a site of c.10.14Ha (including lands for Outline Permission).

The development is accessed from roads already approved and constructed. The existing Adamstown Way (permitted under Reg Ref SDZ06A/5) bounds the site to the north and 3 № access points are proposed onto this road. The Station Road (permitted under Reg Ref. SDZ04A/1) bounds the site to the south and 3 № access points are proposed onto this road. 1 № access point to the east of the site is proposed for future use into Phase 2 of the Boulevard and 1 № access point to the west of the site for the potential future development of the open lands.

The developer will construct all associated infrastructure to serve the development, which includes a network of foul, stormwater drains/ SuDS measures, as well as road infrastructure and watermain infrastructure.

The location of the proposed development, Adamstown Boulevard Phase 1, within the ASDZ and the overall Adamstown Boulevard tile can be seen in Figure 1-2.

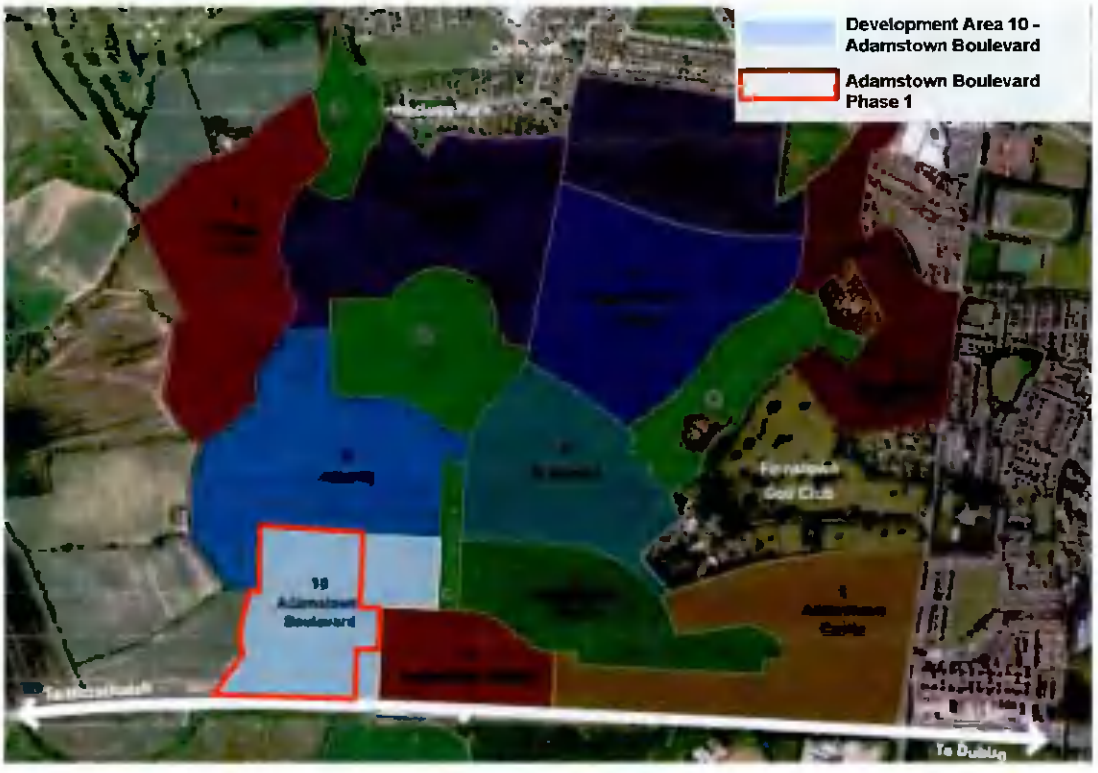


Figure 1-2: Location of Adamstown Boulevard Phase 1 within the ASDZ

The existing topography of the Adamstown Boulevard Phase 1 site is illustrated in Figure 1-3 below. An existing ditch traverses the site in the northwest corner of the lands. The site generally slopes from the south/southeast to the north with an overall elevation difference of 10m. A maximum ground elevation of 64.50m OD Malin

exists within the south-eastern portion of the subject site, and a minimum ground elevation of 54.50m OD Malin exists on the north side of the site. The site slopes north with an average slope of 1:36.

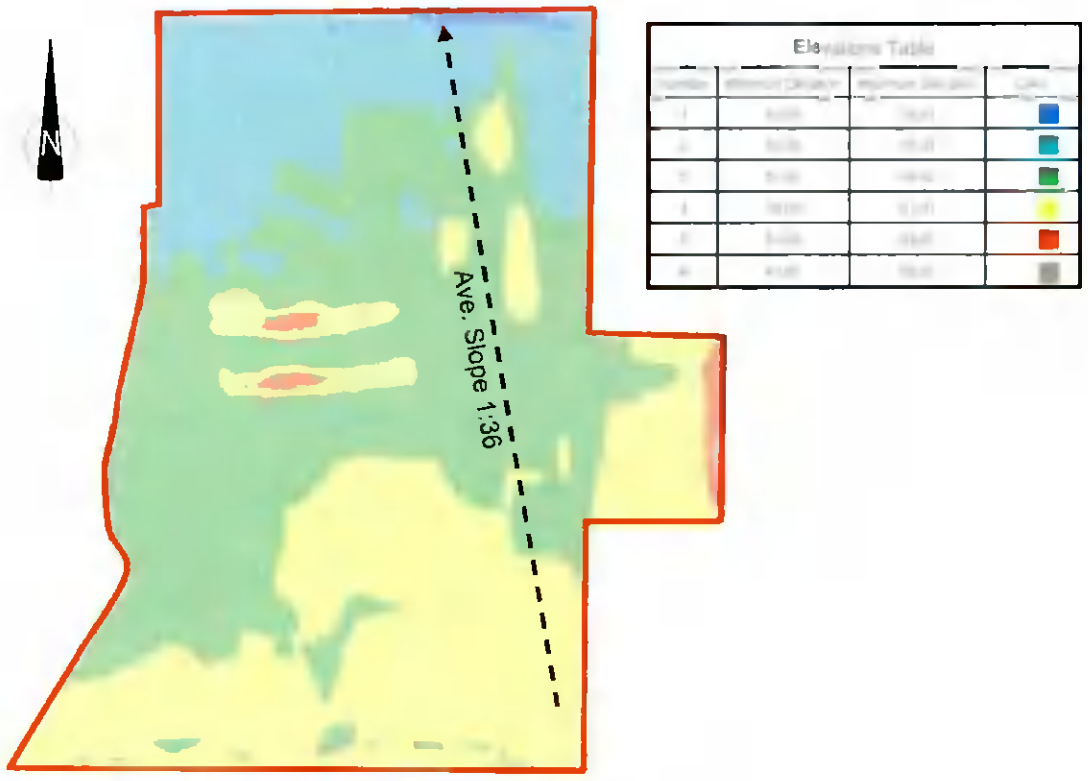


Figure 1-3: Survey Contours of Adamstown Boulevard Phase 1 Site

1.2 Background to the Report

This Flood Risk Assessment report follows the guidelines set out in the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009.

The components to be considered in the identification and assessment of flood risk are as per Table A1 of the above guidelines which have been summarised below:

- Tidal – flooding from high sea levels
- Fluvial – flooding from water courses
- Pluvial – flooding from rainfall / stormwater
- Ground Water – flooding from springs / raised ground water
- Human/mechanical error – flooding due to human or mechanical error

Each component will be investigated from a Source, Pathway and Receptor perspective. For an illustration which shows the sequencing and interaction of each of these components refer to Figure 1-3 below.

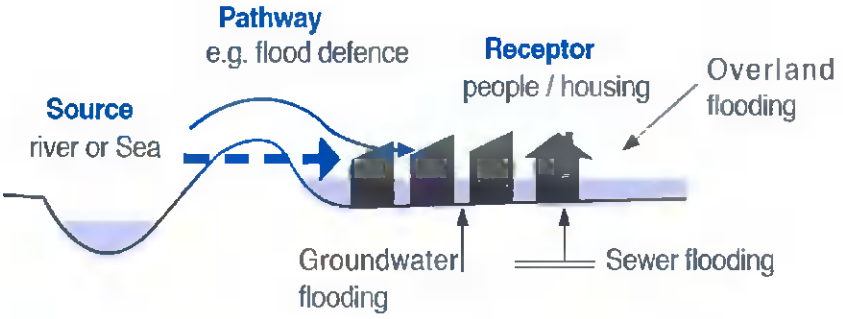


Figure 1-4: Source-Pathway-Receptor S-P-R Model

The aim of a flood risk assessment is to combine these components and map or describe the risks on a spatial scale, to analyse the consequences of each scenario and recommend mitigation measures if necessary.

1.3 Assessing the Overall Flood Risk

The overall risk of flooding to a development shall be determined by way of a 3x3 Risk Matrix, considering the likelihood of a flooding event occurring within a development and the consequences of such flooding.

1.3.1 Assessing Likelihood

The likelihood of flooding falls into the categories of low, moderate and high, which are described in the OPW Guidelines as follows:

Table 1-1: OPW Guidelines for Assessing Likelihood

Likelihood	Low	Moderate	High
Tidal	Probability < 0.1%	0.5% > probability > 0.1%	Probability > 0.5%
Fluvial	Probability < 0.1%	1.0% > probability > 0.1%	Probability > 1.0%
Pluvial	Probability < 0.1%	1.0% > probability > 0.1%	Probability > 1.0%

Note: Probability denotes likelihood of occurrence in a given year.

For ground water flooding and flooding from human/mechanical error, the limits of probability are not defined and therefore professional judgment is used. However, the likelihood of flooding is still categorized as low, moderate and high for these components.

1.3.2 Assessing Consequence

There is not a defined method used to quantify a value for the consequences of a flooding event. Therefore, in order to determine a value for the consequences of a flooding event. the elements likely to be adversely affected by such flooding will be assessed, with the likely damage being stated, and professional judgement will be used in order to determine a value for consequences. Consequences will also be categorized as low, moderate and high.

1.3.3 Assessing Risk

Based on the determined 'likelihood' and 'consequence' values of a flood event, the following 3x3 Risk Matrix will then be referenced to determine the overall risk of a flood event.

Table 1-2: 3x3 Risk Matrix

		CONSEQUENCE		
		LOW	MODERATE	HIGH
LIKELIHOOD	LOW	Extremely Low Risk	Low Risk	Moderate Risk
	MODERATE	Low Risk	Moderate Risk	High Risk
	HIGH	Moderate Risk	High Risk	Extremely High Risk

1.3.4 Flood Risk Management

After a risk has been assessed, flood risk management is the next stage. Flood risk management aims to minimize the risks to people, properties and the environment arising from flooding.

1.3.5 Residual Risk

The residual risk is the risk which remains after all risk avoidance, substitution and mitigation measures have been implemented.

2. Tidal – Irish Sea

2.1 Sources

Tidal Flooding is caused by elevated sea levels or overtopping by wave action. The Irish Sea is approximately 18 km east of the subject site. The proposed development has a maximum ground elevation of 64.50m OD Malin exists within the south-eastern portion of the subject site, and a minimum ground elevation of 54.50m OD Malin exists on the north side of the site.

The Dublin Coastal Protection Project indicated that the 2002 high tide event reached 2.95 m OD Malin.

The lowest possible level of the proposed site is therefore 51.55m above the highest tide recorded in the Dublin Coastal area. The lowest building finished floor level within the subject site is 55.05m OD Malin and is therefore 52.10m above the highest tide.

2.2 Pathway

Given that the site is located 18 km west inland from the Irish Sea, the site levels exceed the highest ever recorded or projected tide in the area, and that there is no coastal flooding indicated on the OPW map, the risk from tidal flooding is considered EXTREMELY LOW and no flood mitigation measures need to be implemented.

3. Fluvial

3.1 Source

Fluvial flooding is caused by rivers, watercourses or ditches overflowing. The subject site is located within the Tobermaclugg Tributary Catchment area which contained the old Tobermaclugg Stream.

3.1.1 Historic Fluvial Source

The Tobermaclugg Stream existed as an above ground stream through the ASDZ before the development of the lands according to the ASDZ Scheme.

The *Catchment Flood Risk and Assessment Management* (CFRAM) map, for the Lucan to Chapelizod Extents (E09LUC_EXFCS_F0_02) dated October 2016, shown in Figure 3-1 below, has been consulted to establish historical flooding on site due to fluvial flooding. The flood map shows the historic Tobermaclugg Stream (above ground) and has not been updated since the undergrounding of the Stream, hence **incorrectly** indicates that flooding events occur to the north of the development.

The old Tobermaclugg Stream shown in Figure 3-1 no longer serves as a stream since replacement by undergrounded stormwater infrastructure, the segment of stream shown in the map in Aderrig 1 (see green bracket in Figure 3-1) is now undergrounded in a 1350mmØ pipe and a portion of the stream on the south of the subject site does not exist on site. The remnants of what is now an earth ditch still exists along the western edge and northwest portion of the subject site as illustrated in Figure 3-2. The CFRAM map is outdated and does not depict the current fluvial flood extent of the site accurately as previously explained to the SDCC Drainage Department and subsequently reviewed on site.

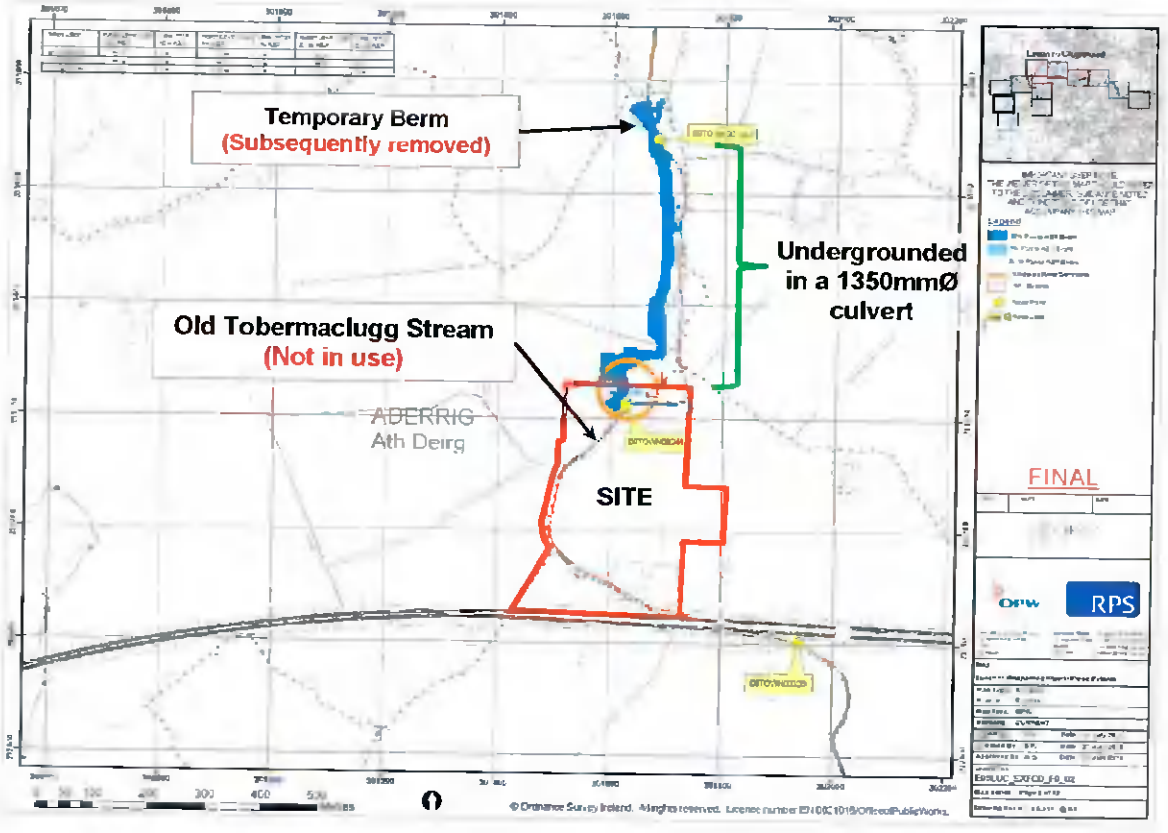


Figure 3-1: Outdated CFRAM 2016 Fluvial Flood Map (E09LUC_EXFCS_F0_02)

Evaluating the outdated CFRAM map further. it is noted that a small portion of the north of the site is reflected as being within the 10% Annual Exceedance Probability (AEP) (1 in 10 year) flood plain (see orange circle in Figure 3-1) and is therefore in Flood Zone A according to the available mapping. The remainder of the site is reflected as being outside of the 0.1% AEP (1in1000 year) flood plain as defined in section 2.23 of DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management published in November 2009.

However, this observation requires further investigation as these flooding events were influenced by 2 № factors, which have since been rectified, as described below:-

– manmade temporary works constructed during a previous project in the vicinity of the site between the years 2006-2009, and insufficient stormwater drainage infrastructure.

1) Factor № 1

- Temporary Berm

A manmade temporary berm was constructed during a previous project between the years 2006-2009 and was erroneously left in place following construction activities which caused ponding of water and the fluvial flows flooding the surrounding low-lying areas which can be seen in the flood map in Figure 3-1.

- Rectification

These temporary works have since been removed and the location of the removed historic berms has been reviewed on site with SDCC Drainage officials. The latest site visit took place on the 10th of March 2022 with Brian Harkin and Ronin Toft from the SDCC Drainage Department, Ian Swartz from GoodRock, and Penelope Ingle from Waterman Moylan present. It was verified on site that no berms nor resulting on-site flooding is present.

2) Factor № 2

- Surface Water Infrastructure

The surface water network within the ASDZ Scheme had not yet been upgraded to serve the lands which resulted in ponding of the fluvial floods without adequate infrastructure to drain the lands appropriately.

- Rectification

The network has been substantially upgraded since the issuing of the CFRAM map (2016) and the removal of the temporary berm to the north of the subject site. As discussed with SDCC Drainage (Mr Brian Harkin), there are a series of pipes that have been installed through the ASDZ which convey the 1 in 100-year stormwater run-off from the lands to the south of the ASDZ and are discussed in the following section.

3.1.2 Present Fluvial Source

Presently the old Tobermaclugg Stream is undergrounded with select locations being brought up to the surface in man-made designed water features. The location of these water features can be found in the Aderrig Phase 1 and Tobermaclugg Village Tiles (adjacent the Shackleton Drive **Lidl**), both north of the subject site. The Adamstown Boulevard is proposed to include a similar man-made water feature through the site, from south to north, as per the SDCC Strategic Development Zone (SDZ) guidelines.

Figure 3-2 shows a google map image (*sourced 2022-03-29*) of the existing land ditch (old Tobermaclugg Stream) which no longer serves as a stream and is currently dry. Further to the ditch in a currently dry state, a portion of the southern leg of the 'stream' is no longer present. It is proposed that this ditch be backfilled during construction as it no longer serves any purpose for the development lands.

Figure 3-2: Portion of old Tobermaclugg Stream/Existing Dry Land Ditch On-Site

As mentioned, the original Stream has been undergrounded. This network consists of 1350mm Ø pipes with a 450mm Ø pipe that brings a restricted flow (approximately 100 ℓ/s) to the surface to now feed the proposed man-made water features through the SDZ in accordance with the Planning Scheme. Additionally, a 525mm Ø pipe was constructed through the proposed development to cater solely for the subject site's surface water run-off.

The as-built main surface water pipes are located below the proposed water feature and within Stream Road of the subject site, refer to the orange hatched area in Figure 3-2 for the general location of these pipes.

The indicative layout of the proposed man-made water feature can be seen in Figure 3-3 (please note this layout is indicative only) taken from the SDCC "Adamstown Strategic Development Zone, Planning Scheme, 2.0 Proposal for Development" document. Please refer to the Architects and Landscape Architects drawings submitted as part of this application for the final layouts and details of the proposed water feature.

There is no fluvial source of flooding on-site presently.

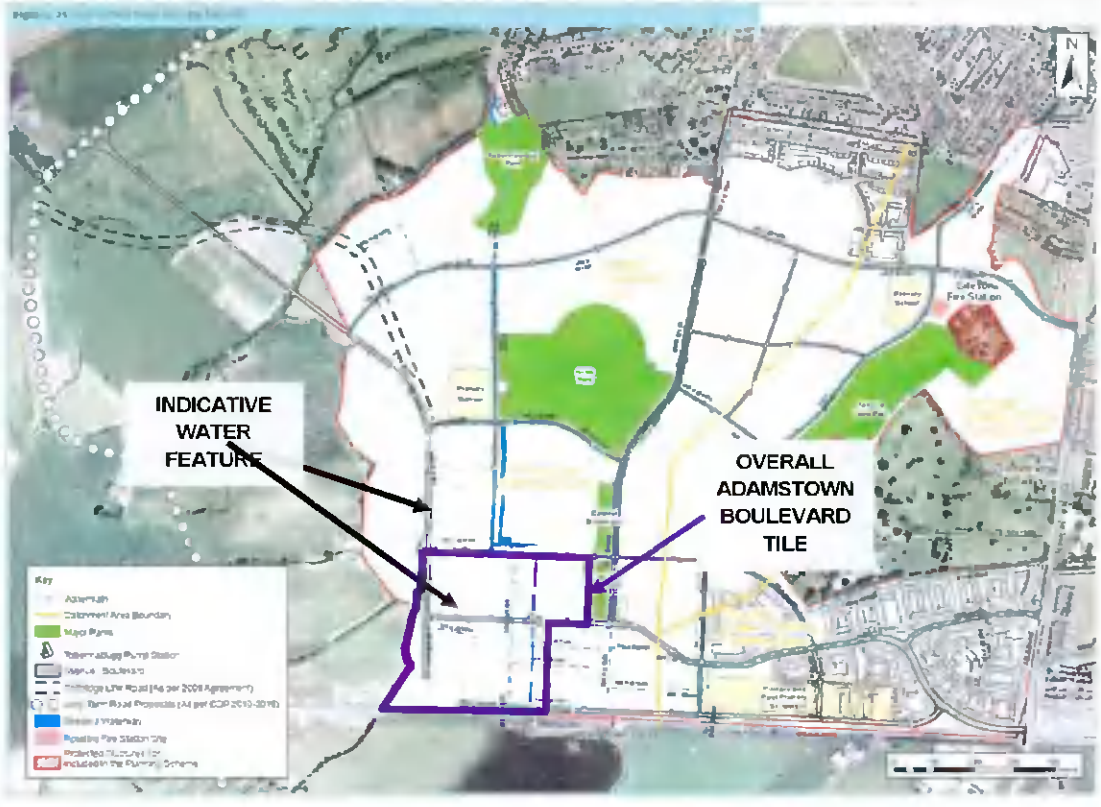


Figure 3-3: Indicative Layout of Proposed Water Feature within the SDZ

3.1.3 Ancillary Information

- Consolidated Surface Water Report

A detailed report consolidating all previous surface water reports (from 2005-2010) and the updated 2014 SDCC Adamstown SDZ Planning Scheme requirements into one master document issued by Waterman Moylan in 2017 has been included in this submission under a separate cover.

The document in question (see below) includes the overall surface water strategy for the ASDZ.

"Adamstown Strategic Development Zone Stormwater Drainage Engineering Assessment Report - Consolidated Review of Strategic Stormwater Drainage via the Tobermaclugg Stream and Backstown Stream (Dec 2017)"

- SDCC ASDZ Planning Scheme document

According to Section 2.5.9 of the Strategic Development Zone Planning Scheme (accessed on SDCC website):-

"The options for a stormwater drainage network within the Tobermaclugg catchment are a gravity-fed system of pipes ranging from 450-1,650mm in diameter that fully enclose the existing Tobermaclugg Stream, or a more open system that incorporate the Tobermaclugg Stream as a water feature fed by a series of pipes ranging from 450-1,200mm in diameter into a proposed network of public spaces. Both are considered acceptable, although the latter is preferred."

- SDCC ASDZ Planning Scheme (Amendment Report 2014) document

Section 2.5.9 was updated in 2014 (accessed on SDCC website):-

"In order to cater for up to a 100 year storm, the stream capacity of Tobermaclugg was supplemented by the construction of a 2400mm diameter surface water pipeline and attenuation pond. Dry weather and normal flows will continue to discharge into Tobermaclugg Stream".

The surface water pipe referenced above is located within the Lucan Golf Course, north of the subject site.

3.2 Pathway

The stream depicted in the flood map (Figure 3-1) no longer exists as a stream as it was diverted as part of the ASDZ design strategy and undergrounded. There is currently no existing pathway from this stream on site. The proposed water feature will contain water above ground but is to be restricted to a flow rate of 100 ℓ/s.

Taking the following into account:

1) The historical stormwater system and capacity for catering to higher fluvial flows has been substantially upsized post-publication of the flood maps referenced above;
2) The installation of the 450Ø and 1350Ø underground culverts was completed;
3) The old Tobermaclugg Stream which carried the majority of the fluvial flows has been diverted (and upsized) through newly designed systems (mentioned above).

There is **no existing** on-site flooding.

3.3 Receptor

The receptor for a fluvial flood event is the open space area and proposed park within the Phase 1 Adamstown Boulevard site and possibly surrounding roads infrastructure caused by potential flooding by the proposed water feature.

3.4 Likelihood

The likelihood of fluvial flooding is considered to be LOW as the water feature will have a minimal restricted flow of 100 ℓ/s through the development.

3.5 Consequences

The consequences of a flooding event would include minor damage to landscaped areas and possible flooding to internal roadways, thus the consequence is considered MODERATE.

3.6 Risk

Referencing the Risk Matrix in Section 1.3, with an extremely low likelihood and moderate consequence, the resulting risk is considered to be MODERATE, thus mitigation measures are required.

3.7 Mitigation Measures

Given that the risk of flooding for the site is considered moderate, mitigation measures are required.

Appropriate road levels have been designed throughout the site to ensure no cut off low points exist and to facilitate the overland stormwater run-off routes with roads at a minimum grade of 1/180. All dwellings will be set back from the edge of the water feature by at least 10m, as requested by the Drainage Department of SDCC. Where possible, the proposed finished floor levels are at least 150mm above the adjacent road levels with all thresholds falling away from the units to eliminate flood risk.

3.8 Residual Risk

Given the flood risk management features referenced above, the residual risk is assessed to be LOW.

4. Pluvial

4.1 Source

Pluvial flooding is from heavy rainfall and is often referred to as flooding from stormwater. Stormwater flooding can occur as a result of overland flow or ponding during periods of extreme prolonged rainfall.

4.2 Pathway & Receptors

During periods of extreme prolonged rainfall, pluvial flooding may occur through the following pathways and subsequent receptors:

Table 4-1: Pathways & Receptors

	Pathway	Receptor
1	Surcharging of the existing drainage system within the site.	Proposed development – residential dwellings, open spaces, and roads
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site.	Proposed development – residential dwellings and roads
3	Stormwater discharging from the subject site to the existing drainage network leading to downstream flooding.	Downstream lands and roads – proposed downstream dwellings and roads
4	Overland flooding from surrounding areas flowing onto the subject site.	Proposed development – residential dwellings and roads
5	Overland flooding from the subject site flowing onto surrounding areas.	Downstream lands and roads – proposed downstream dwellings and roads

Note the risk of pluvial flooding for each of the pathways discussed below has been assessed by referencing the Risk Matrix in Section 1.3 of this report.

Each of the 5 № pathways will be assessed individually in Sections 4.4 to 4.8 of this report.

4.3 Overview – Existing Stormwater Drainage

The site is located in the Tobermaclugg Tributary stormwater catchment area of the ASDZ. According to the ASDZ Planning Scheme 2014 Amendment (see 2.5.5), most of the SDZ (65%) is within the Western Catchment of the ASDZ, is drained to a large stormwater outfall and attenuation pond (5000m^3 capacity) to the northeast of Lucan Golf Course on the Backstown / Tobermaclugg Stream. The Adamstown Boulevard Development Tile falls within this Stormwater Catchment.

4.3.1 Existing Drainage Infrastructure on Site

The existing stormwater infrastructure that serves the Adamstown Boulevard Phase 1 site includes: -

- 1350mm Ø stormwater main transverse the site from south to north in Stream Road;
- 450mm Ø stormwater pipe with Syphon structures on the northern half of the site (along Stream Road) for a potential water feature;
- 900mm Ø stormwater pipe within Adamstown Way (north of the site); and,
- 525mm Ø stormwater main which transverses the site from south to north in Stream Road.

The 1350mmØ pipe's purpose is to accommodate stormwater from the lands to the south of the Boulevard and underground the old Tobermaclugg Stream, and hence will not be made use of for the subject site's stormwater discharge. It is proposed to discharge the site's stormwater runoff to the existing 525mm Ø and 900mm Ø pipes which upsize into a 1200mm Ø stormwater outfall within the Linear Park of the Aderrig Phase 1 development north of the subject site.

Refer to Figure 4-1 which shows the proposed developments existing surface water infrastructure and for which the site will connect into, the arrows indicate the direction of flow. The site drains in a northeast direction.

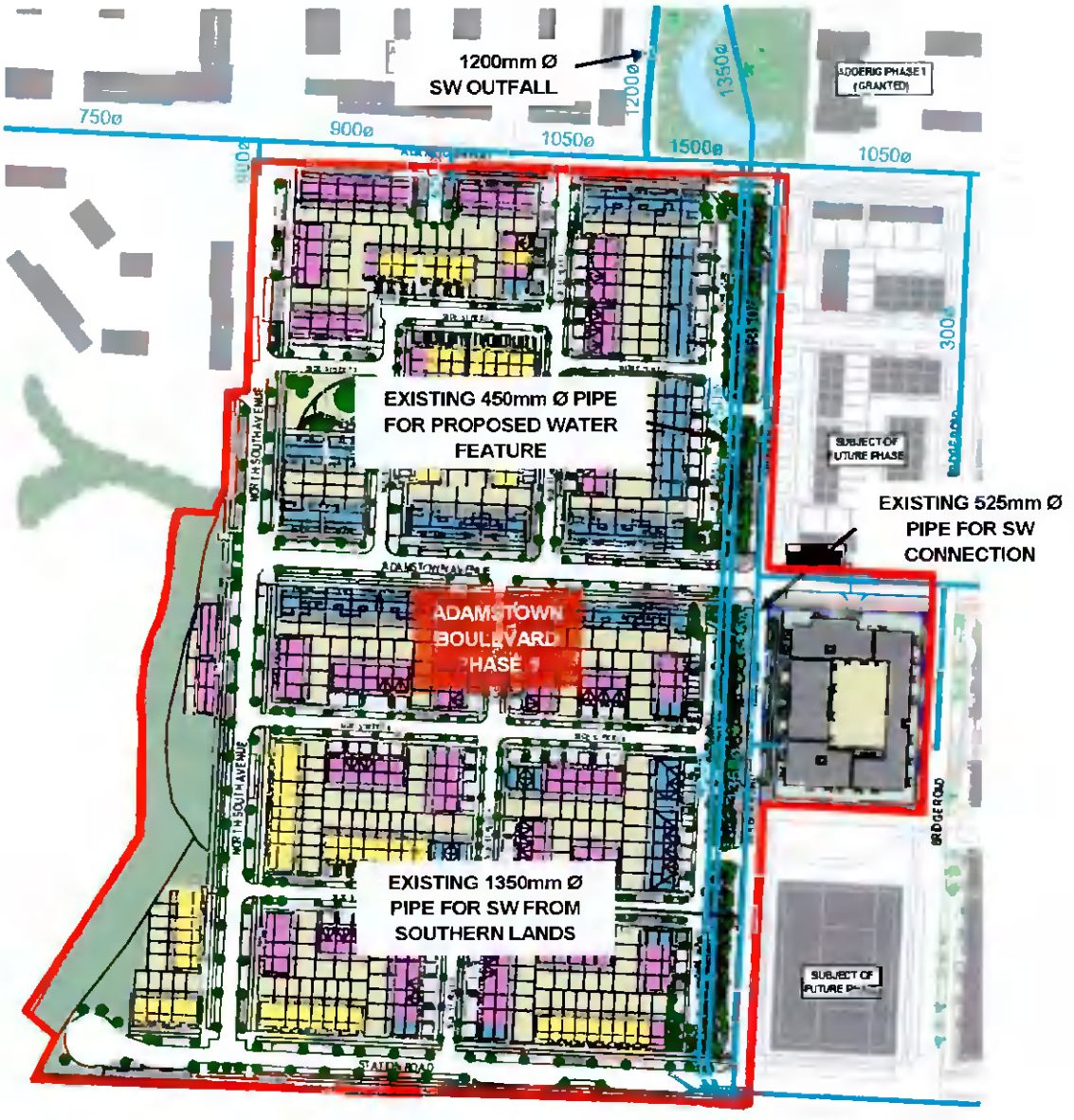


Figure 4-1: Existing Stormwater Drainage within Adamstown Boulevard Phase 1

4.3.2 Existing Surrounding Drainage Infrastructure

The surrounding surface water infrastructure within the vicinity of the site is shown in Figure 4-2 below (blue lines). Figure 4-2 is an extract from the Waterman Moylan Drawing 17-113-SK121B which shows the 3 № ASDZ stormwater Catchments and overall stormwater infrastructure.

The Lucan Golf Course and attenuation pond are further downstream (north), the details of which can be seen in Figure 4-3.

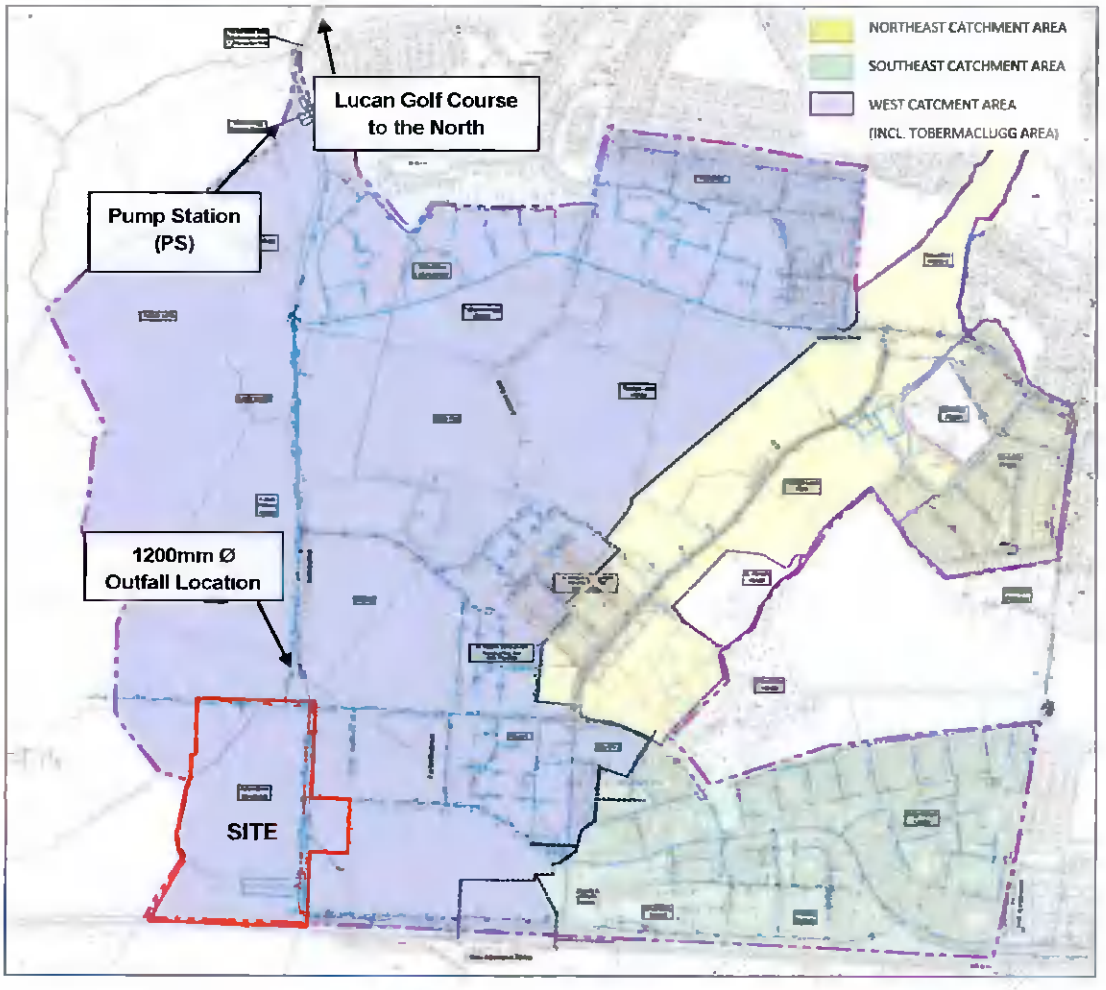


Figure 4-2 Adamstown Overall Stormwater Drainage Infrastructure

The Lucan Golf Course and surrounding landmarks north of the subject site can be seen in Figure 4-3, the figure includes a plan view of the attenuation pond area, with a capacity of 5000m^3, for the Western Catchment of the ASDZ (65% of ASDZ). In accordance with the ASDZ Stormwater Strategy, Adamstown Boulevard Phase 1 will attenuate all stormwater drainage to this attenuation pond and no on-site attenuation storage is required.

Refer to Appendix A for an A3 sized drawing of 17-113-SK121B.

Figure 4-3: Location of the Western Catchment's 5000m³ attenuation pond.

4.4 Surcharging from the Site's Existing Drainage System

The existing site's drainage system was installed for future development of the lands, no drainage of the site into this surface water network currently occurs. The site is mostly greenfield.

No further investigation of pluvial flooding from the site's existing drainage system is required.

4.5 Surcharging from the Existing Surrounding Drainage System

4.5.1 Likelihood

The existing surrounding drainage system has been sized to accommodate the 1in100-year storm event for stormwater. Therefore, it is considered that there is a LOW likelihood of flooding as a result of surcharging from the existing surrounding drainage system.

4.5.2 Consequences

The consequence of flooding from surcharging of the existing surrounding drainage system will be minor damage to landscaped areas and surrounding roads infrastructure. The consequences of a pluvial flood event are therefore assessed to be MODERATE.

4.5.3 Risk

Referencing the Risk Matrix in Section 1.3 of this report for a flood event with a low likelihood and moderate consequence of flooding the site from the existing surrounding drainage network, the resultant risk is assessed to be MODERATE.

4.5.4 Mitigation Measures

Given that the risk of flooding for the site is considered moderate, mitigation measures are required.

These will include appropriate flood routing through the development and raised finished floor levels relative to the adjoining roads and ensuring no localised low points within the roads exist. Where possible, the proposed finished floor levels are at least 150mm above the adjacent road levels with all thresholds falling away from the units to eliminate flood risk.

4.5.5 Residual Risk

Given the flood risk management features referenced above, the residual risk is assessed to be LOW.

4.6 Stormwater Discharge from the Subject Site

4.6.1 Likelihood

Due to the increase in hard standing area as a result of the proposed development, there is an increase in the likelihood of stormwater discharge from the site leading to consequential increased runoff within the subject site and downstream of the site.

The green space amenity area will include the proposed water feature for the development. This water feature will be restricted to a flow of 100ℓ/s (extremely low) through the green space.

Therefore, the likelihood of flooding from stormwater discharge from the subject site is considered MODERATE.

4.6.2 Consequences

In an event of stormwater discharging from the subject site the consequence of flooding would result in flood damage to surrounding roads and landscaped areas. The consequences of such flooding are assessed to be MODERATE.

4.6.3 Risk

Referencing the Risk Matrix in Section 1.3 of this report for a flood event with a moderate likelihood and the moderate consequences of flooding the development and downstream of the development due to discharging of stormwater from the site, the resultant risk is considered to be MODERATE and flood risk management will be required to be implemented.

4.6.4 Mitigation Measures

Appropriate SuDS devices are proposed throughout the site. This will ensure stormwater discharging from the development can be reduced in volume and velocity thereby reducing the risk of damage by managing and substantially lowering the stormwater discharge.

Refer to Appendix B for the overland flood routing map for the subject site.

Given the proposed extent of green space, SuDS, and appropriate flood routing of the site, the flood risk of stormwater discharge from the subject site is considered to be reduced substantially.

4.6.5 Residual Risk

Given the flood risk management features referenced above, the residual risk is assessed to be LOW.

4.7 Overland Flooding from Surrounding Areas

4.7.1 Likelihood

The existing and proposed surrounding road network has been designed to ensure flood routing of stormwater along the internal and main road networks.

The surrounding development has cut-off and diverted the stormwater runoff from the lands south of the ASDZ and the bulk of the original stream flow through the ASDZ has been undergrounded. This network has been designed to accommodate the 1in100-year flood event.

Furthermore, according to the historical flooding map produced by the OPW's online National Flood hazard Mapping database no floods have been recorded within or surrounding the site. A map showing all flood events within proximity of the subject site is provided below in Figure 4-4.

The likelihood of the development flooding from overland surrounding areas stormwater run-off is considered to be LOW.

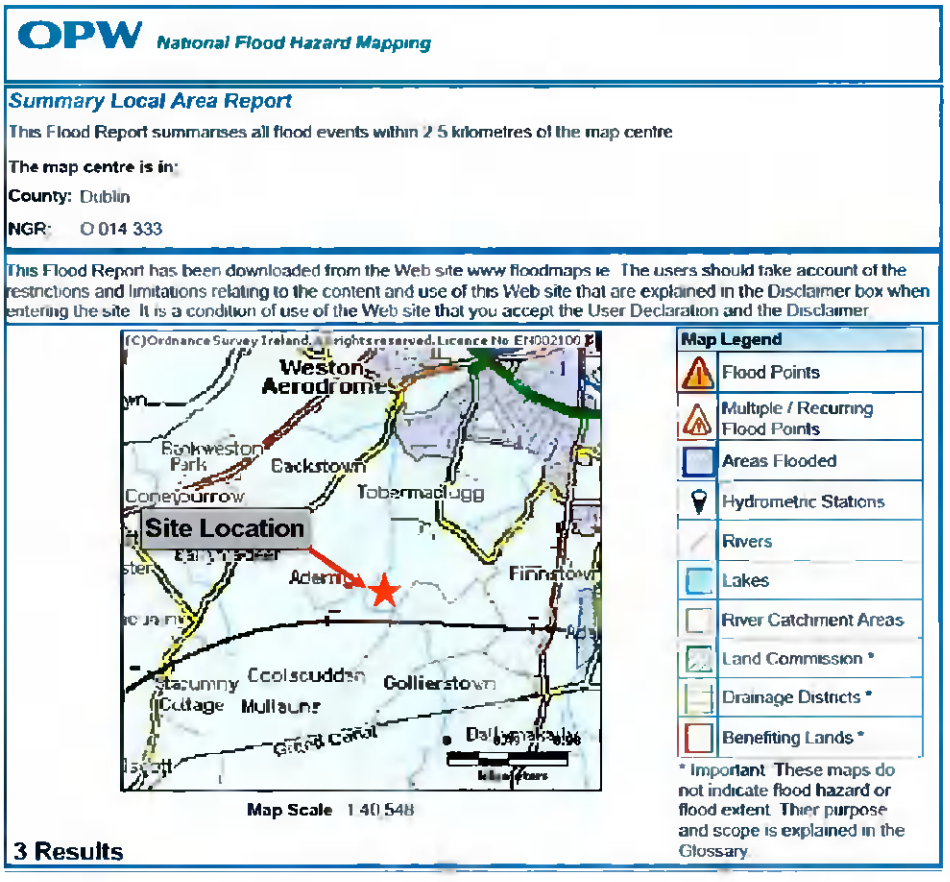


Figure 4-4: OPW National Flood Hazard Mapping

4.7.2 Consequence

The consequence of overland flooding from the surrounding area would result in moderate damage to roads, landscaped area and dwellings. The consequences of this flooding event are therefore assessed to be MODERATE.

4.7.3 Risk

Referencing the Risk Matrix in Section 1.3 of this report for a flood event with a low likelihood and the moderate consequences of overland flooding from surrounding areas, the resultant risk is MODERATE and flood risk management will be required to be implemented.

4.7.4 Mitigation Measures

Raised finished floor levels, the elimination of localised cut off low points on the designed roads and overland flood routing have been adopted to mitigate the potential risk of flooding.

Refer to Appendix A which depicts the overall flood routing for the ASDZ, and Appendix B which depicts the flood routing for the subject site.

4.7.5 Residual Risk

Given the flood risk management features referenced above, the residual risk is assessed to be LOW.

4.8 Overland Flooding from the Subject Site

4.8.1 Likelihood

Due to the increase in hard standing area as a result of the proposed development, there is an increase in the likelihood of overland flooding from the site leading to flooding within the subject site and downstream of the site, thus the likelihood of such flooding is considered MODERATE.

4.8.2 Consequence

The consequence of stormwater discharging from the subject site would be damage to the surrounding roads and landscaped areas. Therefore, the consequence of such flooding is assessed to be MODERATE.

4.8.3 Risk

Referencing the Risk Matrix in Section 1.3 of this report for a flood event with a moderate likelihood and the moderate consequences of overland flooding from the subject site, the resultant risk is MODERATE.

4.8.4 Mitigation Measures

It is proposed to include extensive SuDS measures around the site which will assist in the capturing and slowing of the stormwater run-off. Carefully designed flood routes are proposed from the development, discharging overland flow to the north.

4.8.1 Residual Risk

Considering the above mitigation measures and the stream diversion which is now undergrounded and the infrastructure upgraded to cater for the development in the 1in100 year flood event and along with the permeable area of the open spaces proposed, the residual risk of overland flooding from the site is considered to be LOW.

5. Ground Water

5.1 Source

During periods of prolonged rainfall, the groundwater can seep to above ground level.

5.2 Pathway

During periods of prolonged rainfall there is a possibility that the groundwater level could rise. This may result in ground water seeping above the ground surface.

5.3 Receptor

The receptors would be the proposed open spaces.

5.4 Likelihood

The SFRA for South Dublin County Council Development Plan 2016 to 2022 shows that ground water flooding is not a risk for South Dublin County Council (ref paragraph 5.8.3). However, it is possible for ground water to rise and cause potential flooding on site during prolonged wet periods. Therefore, the likelihood of ground water flooding occurring at the proposed development is assessed to be LOW.

5.5 Consequence

The consequence of ground water flooding would be some minor temporary seepage of ground water through the landscaping areas. Therefore, the consequences of ground water flooding occurring at the proposed development is assessed to be LOW.

5.6 Risk

Referencing the Risk Matrix in Section 1.3 of this report for a flood event of a low likelihood with low consequences, it is deemed that the risk from ground water flooding on the proposed development is EXTREMELY LOW.

5.7 Flood Risk Management

Given that the flood risk of ground water flooding is EXTREMELY LOW and the proposed development is water compatible, no further flood risk management measures are deemed necessary.

6. Human / Mechanical Errors

6.1 Source

The existing surrounding stormwater sewer network is the source of possible flooding if the system were to block.

6.2 Pathway

If the proposed drainage system blocks this could lead to possible flooding within the open spaces, landscaped areas and roads.

6.3 Receptor

The receptors are the landscape areas, Water Feature/Stream and roads.

6.4 Likelihood

There is a MODERATE likelihood of flooding on the subject site if the stormwater network was to block.

6.5 Consequence

The stormwater network would surcharge and overflow through manhole lids on roads and landscape area and to the Water Feature/Stream. It is therefore assessed that the consequences of such flooding are MODERATE.

6.6 Risk

Referencing the Risk Matrix in Section 1.3 of this report for a flood event of a moderate likelihood with low consequences, it is deemed that the risk of overland flooding from human/mechanical error flooding on the proposed development is MODERATE.

6.7 Flood Risk Management

Regular inspection of the proposed and existing drainage network will reduce the risk of overland flooding from human/mechanical error.

Raised finished floor levels, appropriate adjacent road levels, no isolated low points and overland flood routing have been adopted to mitigate the potential risk of flooding.

Refer to Appendix B for the flood routing map pertaining to Adamstown Boulevard Phase 1.

6.8 Residual Risk

As a result of the flood risk management outlined above, there is a LOW residual risk of overland flooding from human/mechanical error.

7. Conclusions and Recommendations

The subject site has been analysed for risks from tidal flooding, fluvial flooding from the Tobermaclugg and surrounding old agricultural ditches, pluvial flooding, groundwater and drainage system failures due to human error or mechanical system failure.

Table 7-1 below presents the various residual flood risks involved. As the flood risk from all sources can be mitigated, with all residual risk seen as low, the proposed development is considered acceptable in terms of flood risk.

Table 7-1: Summary of the Flood Risks from each flooding type

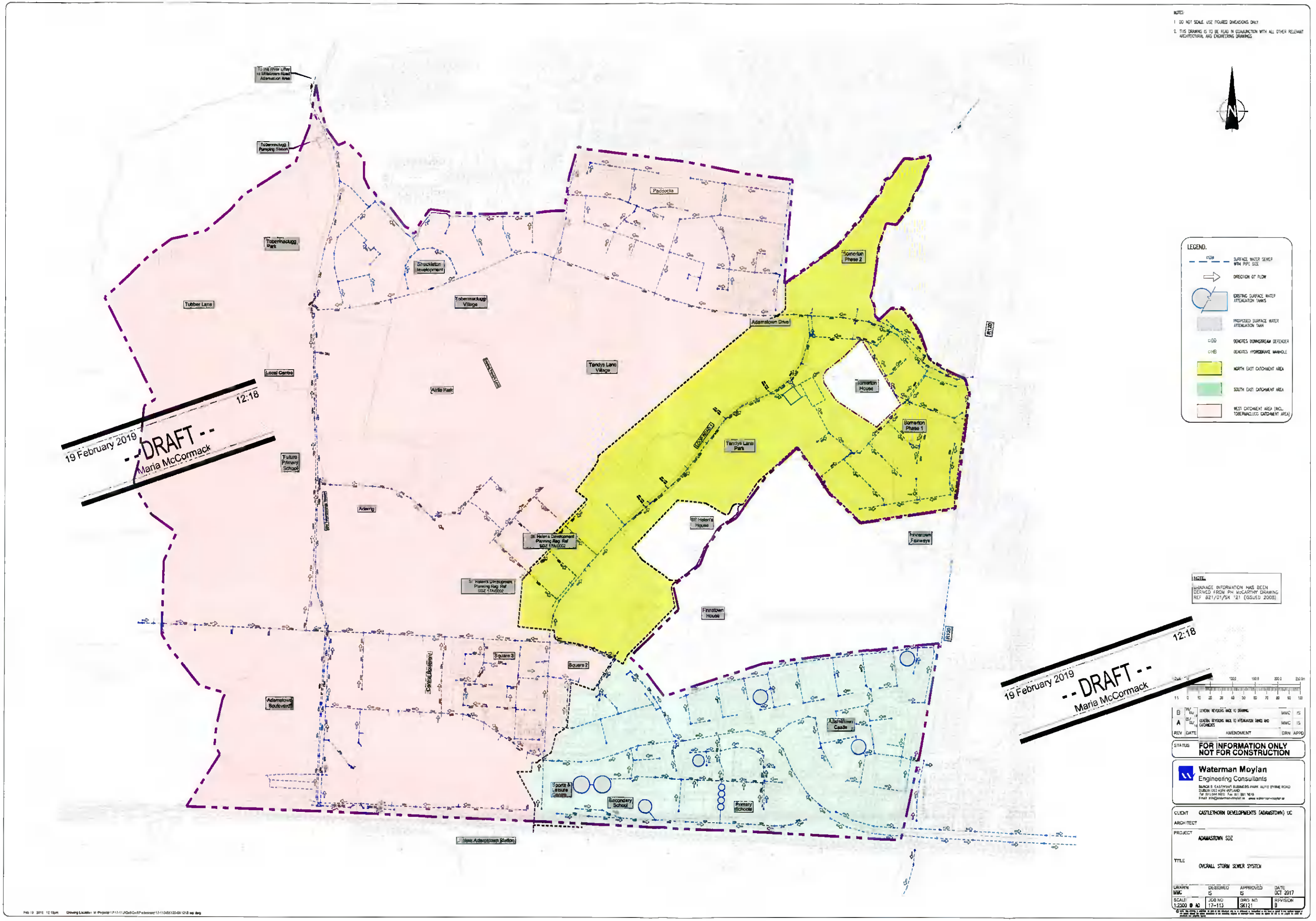
Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	None	Proposed Development	n/a	n/a	n/a	none	**N/A**
Fluvial	Overland & system surcharge from the proposed water feature	**Proposed Development**	Low	**Moderate**	**Moderate**	Buildings set back by at least 10m from edge of water feature. Raised FFL's & appropriate flood routing	**LOW**
Pluvial	Private and Public Drainage Network	Proposed Development	**Moderate**	**Moderate**	**Moderate**	SuDS measures, flood routing & raised FFL's	**LOW**
Ground Water	Ground	Proposed Development	Low	Low	**Extremely Low**	n/a	**EXTREMELY LOW**
Human / Mechanical Error	Drainage network	Proposed Development	**Moderate**	**Moderate**	**Moderate**	Maintenance of sewer system	**LOW**

APPENDICES

A. Drawing 17-113-SK121B ~ ASDZ Overall Storm Sewer System

NOTES:

1. DO NOT SCALE. USE FIGURED DIMENSIONS ONLY.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTURAL AND ENGINEERING DRAWINGS



LEGEND.

- SURFACE WATER SEWER WITH PIPE SIZE
- DIRECTION OF FLOW
- EXISTING SURFACE WATER ATTENUATION TANKS
- PROPOSED SURFACE WATER ATTENUATION TANK
- DD DENOTES DOWNSTREAM DEFENDER
- MH DENOTES HYDROBRAKE MANHOLE
- NORTH EAST CATCHMENT AREA
- SOUTH EAST CATCHMENT AREA
- WEST CATCHMENT AREA (INCL. TOBERMACLUGG CATCHMENT AREA)

NOTE:
DRAINAGE INFORMATION HAS BEEN DERIVED FROM PH McCARTHY DRAWING REF. 821/01/SK 121 (ISSUED 2008)

19 February 2019 12:18
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REV	DATE	AMENDMENT	DRN	APPD
B	19/02/19	SEWER REVISIONS MADE TO DRAWING	MMC	IS
A	08/02/19	SEWER REVISIONS MADE TO ATTENUATION TANKS AND CATCHMENTS	MMC	IS

STATUS: FOR INFORMATION ONLY NOT FOR CONSTRUCTION

Waterman Moylan
Engineering Consultants
BLOCK S EASTPOINT BUSINESS PARK ALFIE BYRNE ROAD DUBLIN D03 H294 IRELAND
Tel (01) 644 9500 Fax (01) 660 1619
Email info@watermanmoylan.ie www.watermanmoylan.ie

CLIENT: CASTLETHORN DEVELOPMENTS (ADAMSTOWN) UC
ARCHITECT:
PROJECT: ADAMSTOWN SDZ
TITLE: OVERALL STORM SEWER SYSTEM

DRAWN	DESIGNED	APPROVED	DATE
MMC	IS	IS	OCT 2017

SCALE	JOB NO	DRG NO	REVISION
1:2500 @ A0	17-113	SK121	B

19 February 2019 12:18
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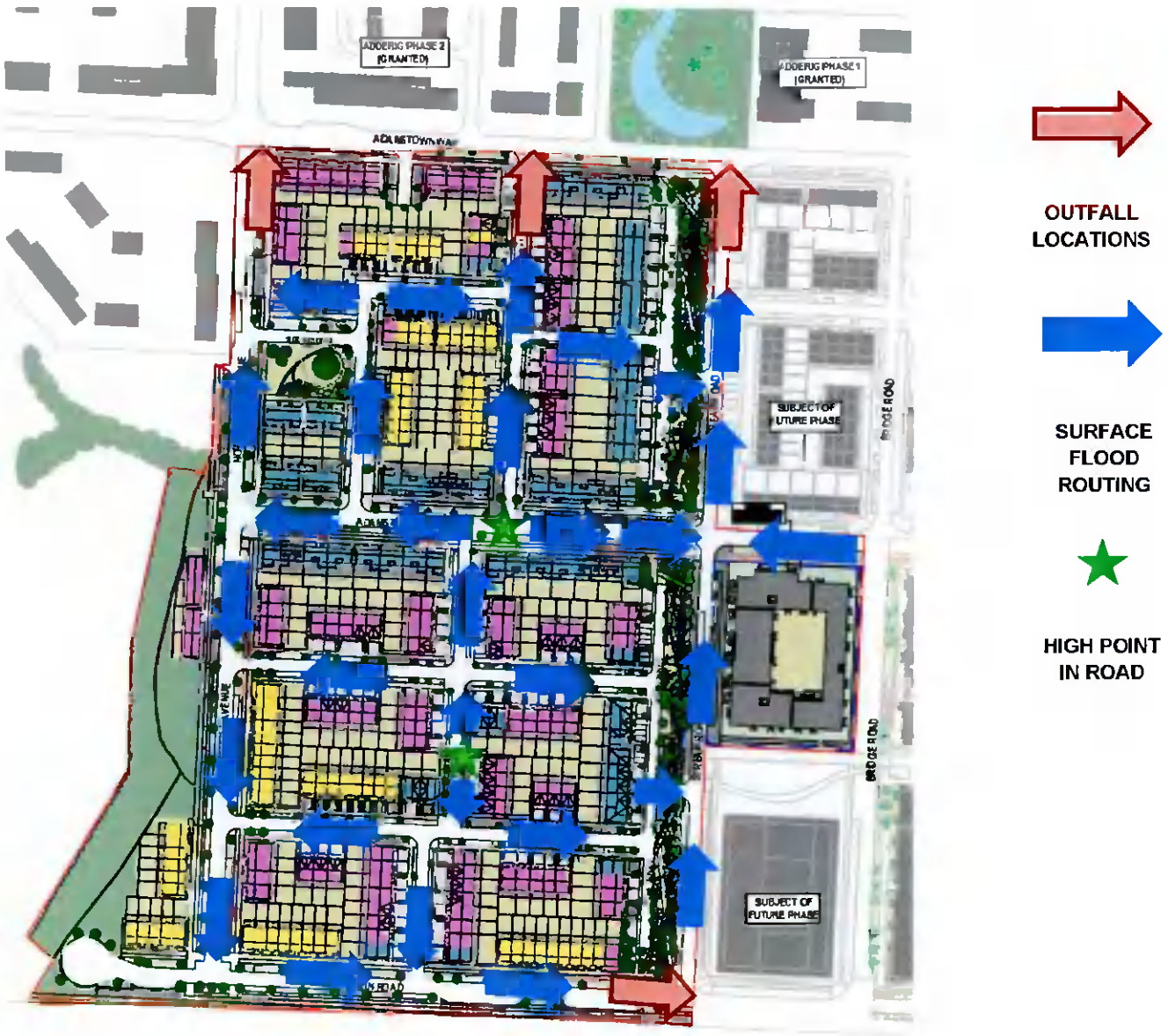
Feb 19 2019 12:18pm Drawing Location: M:\Projects\17-113\Civil\Cad\Preliminary\17-113-SK120-SK121.sip.dwg

B. Adamstown Boulevard Phase 1 Overland Flood Routing Map



Appendix B
Flood Risk Assessment
Project Number: 21.074
Document Reference: 21-074r.002

UK and Ireland Office Locations