

The background is a vibrant red color. It features several abstract geometric shapes: a large white circle with a blue border in the upper right; a smaller white circle with a blue border in the lower left; a large teal shape with a white border in the bottom right; and various other shapes in blue, green, and white scattered throughout the corners and edges.

Appendix N

Flood Risk Assessment



Site Specific Flood Risk Assessment Lucan to City Centre

Bus Connects Dublin Core Bus Corridor
Infrastructure Works

September 2022

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1 Introduction

1.1 Background

Mott MacDonald/AECOM has been appointed by the National Transport Authority (NTA) to undertake a Stage 1 Flood Risk Assessment (FRA) as part of the planning application process for the Core Bus Corridor (CBC) BusConnects Dublin Programme. This FRA will assess the flood risk for Route 06; Lucan to the City Centre.

The Stage 1 FRA is a high-level study of the scheme to identify flood risks to the project and any potential flooding issues arising due to the project. This report will inform the planning process and identify whether a further Stage 2 FRA is required.

The BusConnects Dublin Programme is a plan to transform Dublin's bus system, with the Core Bus Corridor (CBC) project providing 230km of dedicated bus lanes and 200km of cycle tracks on sixteen of the busiest bus corridors in and out of the city centre. This project is fundamental to addressing the congestion issues in the Dublin region with the population due to grow by 25% by 2040, bringing it to almost 1.55million.

In June 2018 the National Transport Authority (NTA) published the Core Bus Corridors Project Report. The report was a discussion document outlining proposals for the delivery of a CBC network across Dublin. The aim of the Proposed Project is to transform the bus system to provide better services to more people.

The 'Lucan to City Centre CBC' is identified as forming part of the radial Core Bus Network designated as 'Route 06'. The BusConnects radial CBC network is shown in Figure 1.

This FRA has been undertaken in accordance with the 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DoEHLG), herein referred to as 'The Guidelines'.

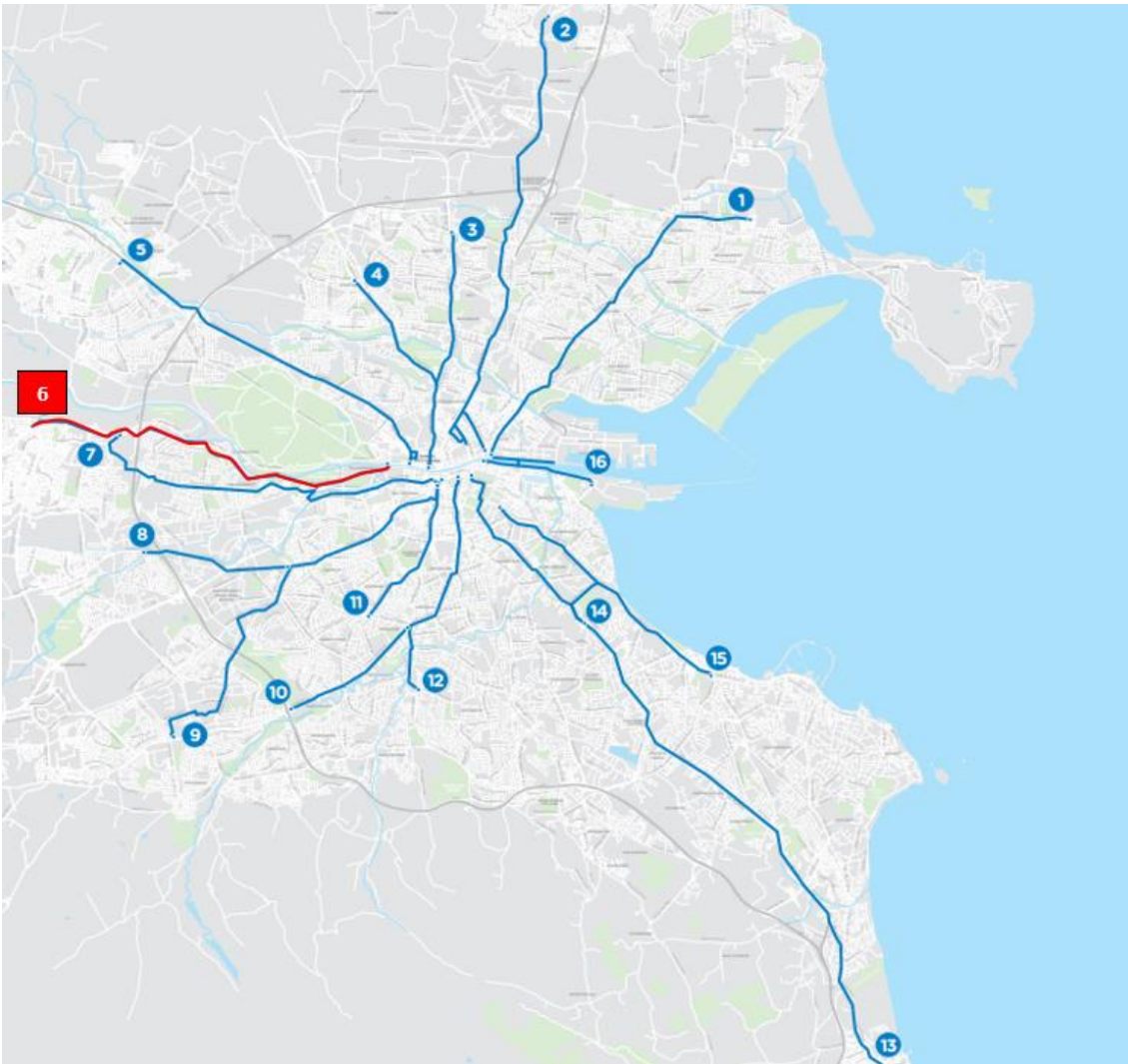


Figure 1: BusConnects CBC Network (CBC Route 06)

1.2 Scope of Assessment

The Flood Risk Assessment (FRA) will include the following:

- Confirmation of the sources of flooding which may affect the site;
- A qualitative assessment of the risk of flooding to the site and to adjacent sites as a result of construction of the proposed development,
- Review of the availability and adequacy of existing information,
- Identification of possible measures which could mitigate the flood risk to acceptable levels, and;
- Areas for further investigation (Stage 2 FRA) if required.

1.3 Summary of Data Used

Data regarding flood risk relevant to the proposed development and surrounding area has been obtained from the following sources;

- Review of Dublin City Development Plan (<http://www.dublincity.ie/main-menu-services-planning-city-development-plan/dublin-city-development-plan-2016-2022>)

- Irish Coastal Protection Strategy Study (ICPSS);
- Preliminary Flood Risk Assessment (PFRA) Mapping produced by the OPW (www.floodinfo.ie);
- Flood history of the site from the OPW National Flood Hazard Mapping website (www.floodinfo.ie);
- Guidelines for Planning Authorities on 'The Planning System and Flood Risk Management' published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DEHLG);
- Topographical information received for site surveys,

All Ordnance Datum (OD) levels referred to in this report are to Malin Head Ordnance Datum unless otherwise stated.

1.4 Route Overview

The Lucan to City Centre Core Bus Corridor (CBC) commences at Junction 3 on the N4 and it is routed via the N4 as far as Junction 7 (M50), and via the R148 along the Chapelizod Bypass, Con Colbert Road and St John's Road West as far as Frank Sherwin Bridge, where it will join the prevailing traffic management regime on the South Quays.

1.4.1 N4 Junction 3 to M50 Junction (Junction 7) – N4 Lucan Road

It is proposed to commence this CBC at Junction 3 on the N4 Lucan Road. The existing lane arrangement on the Ballyowen Road bridge over the N4 is to be amended to include the provision of cycle lanes in both directions in lieu of the right turning lane for the N4 westbound on slip. At the Ballyowen Road junction with Lucan Road the existing layout is to be modified to remove the left turn slip lanes.

On the N4 it is proposed to maintain the existing city centre bound bus lane. Over the full length of this section of the corridor a segregated two-way cycletrack is proposed on the northern side of the N4. In the vicinity of the Hermitage Golf Club land acquisition will be required to provide this cycle track which will connect to the existing foot/cycle bridge over the N4 adjacent to the Mount Andrew estate.

Eastwards of this location the two-way cycle track continues on the north side of the N4 and will require some additional land acquisition from the Hermitage Clinic lands. The two-way cycle track then runs along the eastbound off slip at Junction 2. From here the segregated two-way cycle track runs along the southside of the Old Lucan Road before connecting to the foot/cycle bridge that crosses the M50. The Old Lucan Road will be narrowed, and traffic calmed.

The latest proposals include a significant improvement to the bus stop provision in the vicinity of the Liffey Valley Shopping Centre. The bus stops themselves are moved some 150m further west, segregated from the adjacent N4 carriageway and increased in length. To better serve the increased bus stop capacity a new footbridge is proposed adjacent to the new bus stop locations, some 200m further west from the existing footbridge. The position of this new bridge aligns with the proposed public transport interchange within the Liffey Valley Shopping Centre. The relocation of the bus stops allows for an increased weaving length for all eastbound traffic approaching the M50 interchange and for all westbound traffic exiting the M50 interchange.

At the M50 junction, it is proposed to include a continuous bus lane with two general traffic lanes in both directions through the junction.

1.4.2 M50 Junction (Junction 7) to R148 Con Colbert Road – Chapelizod Bypass

Between the M50 Junction and Kennelsfort Road junction, a continuous bus lane, two general traffic lanes and a merging lane for traffic from the M50 are proposed on the city centre bound route. On the westbound carriageway of the R148 west of Kennelsfort Road the proposed lane arrangement maintains two lanes for general traffic, with a continuous bus lane.

A segregated two-way cycle track is proposed to run along the north side of the Old Lucan Road between the foot/cycle bridge crossing the M50, through Palmerstown village to the start of the Chapelizod bypass. There is also a proposed segregated two-way cycle facility along the east side of Kennelsfort Road Lower.

At the R148 signalised junction with the Old Lucan Road / the Oval a new westbound, bus only, right turn lane is provided on the R148 to facilitate bus services serving Palmerstown village. In addition, new bus stops are provided on the Old Lucan Road to serve Mill Lane / Stewarts Hospital. Between Kennelsfort Road Junction and the junction with the Oval, the existing bus stops will be upgraded with bus laybys provided.

On the Chapelizod bypass new bus stops are proposed at the bridge over Chapelizod Hill Road, with access ramps and steps provided to make use of the existing Chapelizod Hill Road underpass.

1.4.3 Con Colbert Road to Frank Sherwin Bridge – St. John's Road West

At the junction between the R148 Con Colbert Road and Memorial Road an eastbound right turning lane is proposed to facilitate the changes to Memorial Road included in Liffey Valley CBC. As a consequence of this additional turning lane the existing pedestrian crossing facility would be moved to the east side of the junction.

At the South Circular Road junction, a short right turn lane on South Circular Road is provided in the northbound direction.

Between the Heuston South Quarter Development junction and the Frank Sherwin Bridge one bus lane and one single general traffic lane is proposed in each direction. The latest proposals include a significant improvement to the bus stop provision in the vicinity of Heuston Station with the introduction of bus laybys and increased passenger waiting areas.

2 The Planning Context

The following policy documents are relevant to the assessment of the proposed development:

- The National Planning Guidelines, referred herein as ‘the Guidelines’, published by the OPW and the Department of the Environment, Heritage and Local Government in November 2009 entitled ‘The Planning System and Flood Risk Management: Guidelines for Planning Authorities’ are particularly pertinent and are discussed in Section 2.1.
- In terms of planning policy context, the provisions contained in the Dublin City Development 2016 - 2022 are relevant.

2.1 The Planning System and Flood Risk Management Guidelines for Planning Authorities

In November 2009, the Department of Environment, Heritage and Local Government and the Office of Public works jointly published a Guidance Document for Planning Authorities entitled “The Planning System and Flood Risk Management”.

The Guidelines are issued under Section 28 of the Planning and Development Act 2000 and Planning Authorities. Therefore, An Bord Pleanála are required to implement these Guidelines in carrying out their functions under the Planning Acts.

The aim of the guidelines is to ensure that flood risk is neither created nor increased by inappropriate development.

The guidelines require the planning system to avoid development in areas at risk of flooding, unless they can be justified on wider sustainability grounds, where the risk can be reduced or managed to an acceptable level.

They require the adoption of a Sequential Approach to Flood Risk Management following the steps of Avoidance of flood risk, Substitution with less vulnerable uses, Justification and Mitigation of flood risk. The Guidelines require the incorporation of Flood Risk Assessment into the process of making decisions on planning applications and planning appeals.

Fundamental to The Guidelines, is the introduction of flood risk zoning and the classifications of different types of development having regard to their vulnerability to flooding.

The management of flood risk is now a key element of any development proposal in an area of potential flood risk and should therefore be addressed as early as possible in the site master planning stage.

2.1.1 Definition of Flood Zones

Flood zones are geographical areas within which the likelihood of flooding is in a particular range.

There are three types of flood zones defined in the Guidelines as follows:

Table 1: Definition of Flood Zone Categories

Zone Category	Description
Flood Zone A	Probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding).
Flood Zone B	Probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 and 0.5% or 1 in 200 for coastal flooding); and
Flood Zone C	Probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

2.1.2 Definition of Vulnerability Classification of Flooding

The Guidelines classify different land uses and types of development as highly vulnerable, less vulnerable and water-compatible to flooding. The vulnerability classification is influenced primarily by the ability to manage the safety of people in flood events and the long-term implications for recovery of the function and structure of buildings. The following Table 2 summarises the Vulnerability Classes defined in the Guidelines and provides a sample of the most common type of development applicable to each class.

The project will be providing primary transport and is therefore considered essential infrastructure. It is therefore classed as Highly Vulnerable Development.

Table 2: Definition of Vulnerability Classes

Vulnerability Class	Land use and types of development which include:
Highly Vulnerable Development	Includes Garda, ambulance and fire stations, hospitals, schools, residential dwellings, residential institutions, essential infrastructure, such as primary transport and utilities distribution and SEVESO and IPPC sites, etc.
Less Vulnerable Development	Includes retail, leisure, warehousing, commercial, industrial and non-residential institutions, etc.
Water Compatible Development	Includes Flood Control Infrastructure, docks, marinas, wharves, navigation facilities, water-based recreation facilities, amenity open spaces and outdoor sport and recreation facilities

2.1.3 Sequential Approach and Justification Test

The Guidelines outline the sequential approach that is to be applied to all levels of the planning process. This approach should also be used in the design and layout of a development and the broad philosophy is shown in Figure 2. In general, development in areas with a high risk of flooding should be avoided as per the sequential approach.

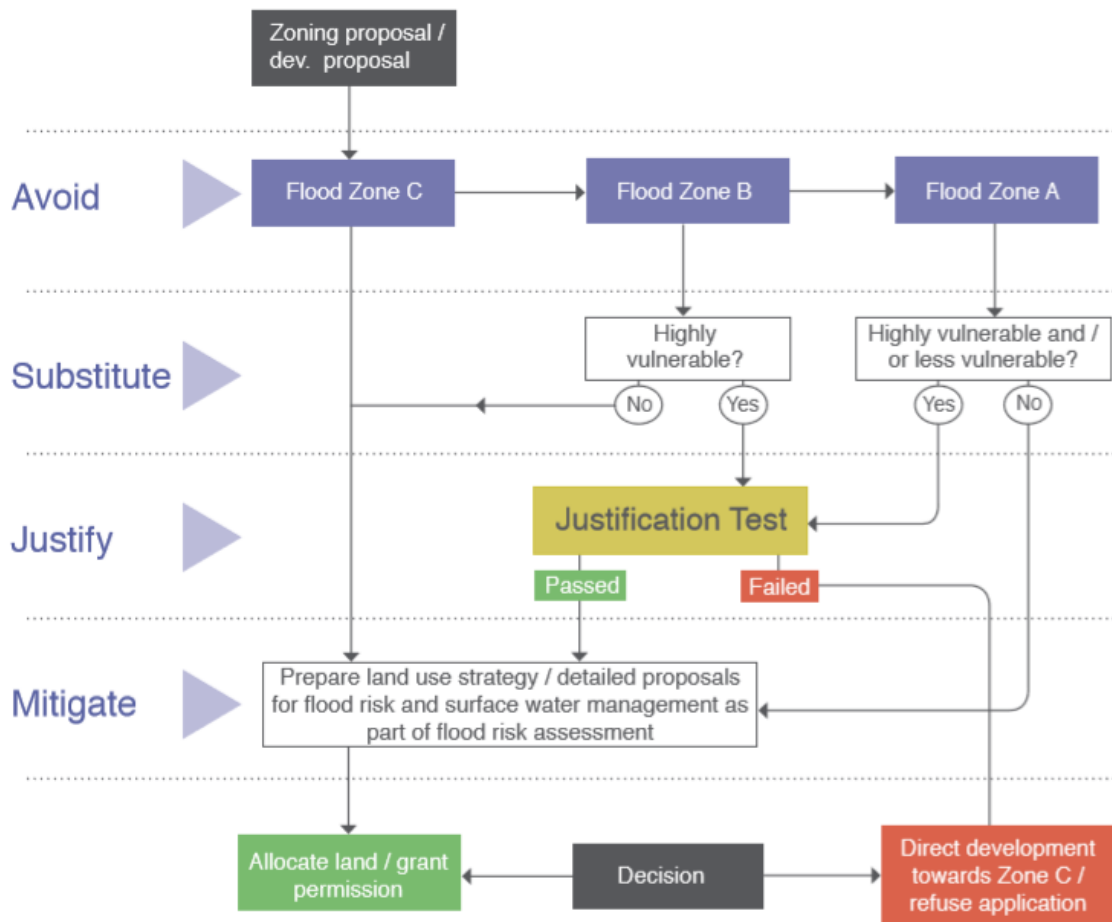


Figure 2: Sequential Approach (reproduced from the Guidelines)

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of developments that are being considered in areas of moderate or high flood risk. The test comprises the following two processes.

- The first is the Plan-making Justification Test and is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- The second is the Development Management Justification Test and is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

Table 3 illustrates the different types of Vulnerability Class appropriate to each zone and indicates where the Justification Test is required.

Table 3: Vulnerability Class per Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable	Justification Test	Justification Test	Appropriate
Less Vulnerable	Justification Test	Appropriate	Appropriate
Water Compatible	Appropriate	Appropriate	Appropriate

2.2 Dublin City Development Plan 2016-2022

The Dublin City Development Plan 2016-2022 was adopted by Dublin City Council on 23rd September 2016 and came into effect on 21st October 2016. The Plan sets out policies and objectives to create a sustainable and vibrant city at the heart of the Greater Dublin Region and guides how and where development will take place in the city over the next 6 years.

Section 9.5.3 of the plan deals with Flood Management and outlines the key policies and objectives of Dublin City Council in relation to flood risk. The plan presents a number of Dublin City Council 'Strategic Infrastructure' (SI) policies that state that it is their policy to:

- **SI8:** To mitigate the effects of floods and droughts, subject to Environmental Assessment.
- **SI9:** To assist the Office of Public Works in developing catchment-based Flood Risk Management Plans for rivers, coastlines and estuaries in the Dublin city area and have regard to their provisions/recommendations.
- **SI10:** To have regard to the Guidelines for Planning Authorities on the Planning System and Flood Risk Management and Technical Appendices, November 2009, published by the Department of the Environment, Community, and Local Government as may be revised/updated when assessing planning applications and in the preparation of plans both statutory and non-statutory.
- **SI11:** To put in place adequate measures to protect the integrity of the existing Flood Defence Infrastructure in Dublin City Council's ownership and identified in the Strategic Flood Risk Assessment and to ensure that the new developments do not have the effect of reducing the effectiveness or integrity of any existing or new flood defence infrastructure and that flood defence infrastructure has regard also to nature conservation and amenity issues.
- **SI12:** To implement and comply fully with the recommendations of the Strategic Flood Risk Assessment prepared as part of the Dublin City Development Plan.
- **SI13:** Development of basements or any above ground buildings for residential use below the estimated flood levels for Zone A or Zone B will not be permitted.
- **SI14:** To protect the Dublin City coastline from flooding as far as reasonably practicable, by implementing the recommendations of the Dublin Coastal Flood Protection Project and the Dublin Safer Project.
- **SI15:** To minimise the risk of pluvial (intense rainfall) flooding in the city as far as is reasonably practicable and not to allow any development which would increase this risk.

- **SI16:** To minimise the flood risk in Dublin City from all other sources of flooding, including fluvial, reservoirs and dams and the piped water system.
- **SI17:** To require an environmental assessment of all proposed flood protection or flood alleviation works.

Section 9.5.3 of the development plan also outlines the following objectives in relation to Flood Risk Management. The plan presents a number of Dublin City Council 'Strategic Infrastructure Objectives' (SIO) objectives that state that it is there objectives for:

- **SI08:** All development proposals shall carry out, to an appropriate level of detail, a Site-Specific Flood Risk Assessment (SSFRA) that shall demonstrate compliance with:
 - The Planning System and Flood Risk Management, Guidelines for Planning Authorities, Department of the Environment, Community and Local Government, November 2009, as may be revised/updated and the Strategic Flood Risk Assessment (SFRA) as prepared by this Development Plan.
 - The site-specific flood risk assessment (SSFRA) shall pay particular emphasis to residual flood risks, site-specific mitigation measures, flood-resilient design and construction, and any necessary management measures (the SFRA and Appendix B4 of the above-mentioned national guidelines refer). Attention shall be given in the site-specific flood risk assessment to building design and creating a successful interface with the public realm through good design that addresses flood concerns but also maintains appealing functional streetscapes. All potential sources of flood risk must be addressed in the SSFRA.
- **SI09:** Proposals which may be classed as 'minor development', for example small-scale infill, small extensions to houses or the rebuilding of houses or paving of front gardens to existing houses, most changes of use and small-scale extensions to existing commercial and industrial enterprises in Flood Zone A or B, should be assessed in accordance with the Guidelines for Planning Authorities on the Planning System and Flood Risk Management & Technical Appendices, November 2009 as may be revised/updated, with specific reference to Section 5.28 and in relation to the specific requirements of the Strategic Flood Risk Assessment. The policy shall be not to increase the risk of flooding and to ensure risk to the development is managed.
- **SI010:** That recommendations and flood maps arising from the Fingal-East Meath CFRAM Study, the Dodder CFRAM Study and the Eastern CFRAM Study are taken into account in relation to the preparation of statutory plans and development proposals. This will include undertaking a review of the Strategic Flood Risk Assessment for Dublin city following the publication of the Final Eastern CFRAM Study, currently being produced by the OPW.
- **SI011:** To work with neighbouring Local Authorities when developing cross-boundary flood management work programmes and when considering cross-boundary development.
- **SI012:** To 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 Dublin City Council climate change adaption policy and in the OPW Climate Change Sectorial Adaptation Plan Flood Risk Management applicable at the time.

2.3 Dublin Strategic Flood Risk Assessment

A Regional Flood Risk Assessment (RFRA) was carried out for the Regional Planning Guidelines (RPG) for the Greater Dublin Area 2010-2022. Chapter 9 of the RFRA sets out the key policy with regards to avoiding and managing flood risk within the Greater Dublin Area (GDA). The Guidelines set out a number of strategic recommendations including:

- **FR1:** New development should be avoided in areas at risk of significant flooding. Alongside this, the Regional Flood Risk Appraisal recognises the need for continuing investment and development within the urban centres of flood vulnerable designated growth towns and the City and for this to take place in tandem with the completion of CFRAM Studies and investment in comprehensive flood protection and management.
- **FR2:** Development and Local Area Plans should include a Strategic Flood Risk Assessment and all future zoning of land for development in areas at risk of flooding should follow the sequential approach set out in the Departmental Guidance on Flood Risk Management. All Flood Risk Assessments and CFRAM studies should take place in coordination and consultation with adjoining local authorities and regions and in coordination with the relevant River Basin Management Plans.
- **FR3:** Local authorities should take the opportunities presented to optimise improvements in biodiversity and amenity when including policies and actions in development plans/local area plans (such as flood plain protection and SuDS) for existing and future developments.
- **FR4:** Plans and projects associated with flood risk management that have the potential to negatively impact on Natura 2000 sites will be subject to a Habitats Directive Assessment (HDA) according to Article 6 of the habitats directive and in accordance with best practice and guidance.

3 Flood Mechanisms and Historic Flooding at the Site

3.1 Potential Flood Risk Sources to the Site

The potential sources of flooding to the subject site can be categorised as follows:

- Fluvial (river) Flooding a of watercourse occurs when the capacity a river is exceeded during periods of intense rainfall.
- Tidal Flooding is the temporary inundation of low-lying areas, during exceptionally high tide events.
- Pluvial Flooding/Urban Drainage occurs when the capacity of the local urban drainage network is exceeded during periods of intense rainfall. At these times, water can collect at low points in the topography and cause flooding.
- Groundwater Flooding can occur during lengthy periods of heavy rainfall, typically during late winter/early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause long periods of flooding.

3.2 Historic Flood Data

Reports and maps from the OPW's Flood Hazard Mapping website (www.floodinfo.ie) have been examined as part of this flood risk assessment. Figure 3 presents the flood record for the site and its immediate vicinity. It can be seen that there are no historic flood events have occurred on or adjacent to the Proposed Scheme.

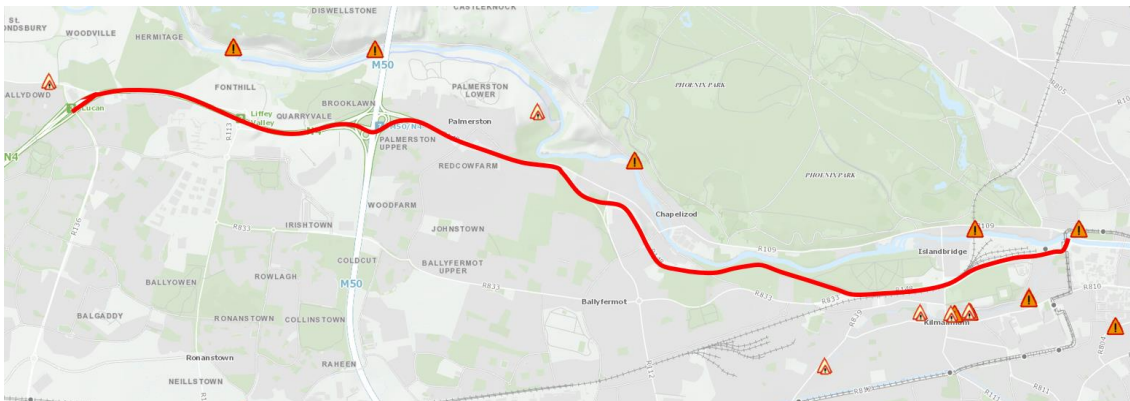


Figure 3: Historic Flood Events

4 Existing Flood Risk

4.1 Fluvial Flooding

Fluvial flood extent maps from the Eastern CFRAMS are displayed in Figure 4, Figure 5, Figure 6, Figure 7, Figure 8, Figure 9 and Figure 10 (with the proposed route highlighted in red). The predicted fluvial flood extents for three return period events are presented on the map (for the 1 in 10, 200 and 1000-year fluvial flood extents).

As shown in Figure 4, Figure 5, Figure 6, Figure 7, Figure 8, and Figure 9 the proposed route falls outside of all designated flood zones.

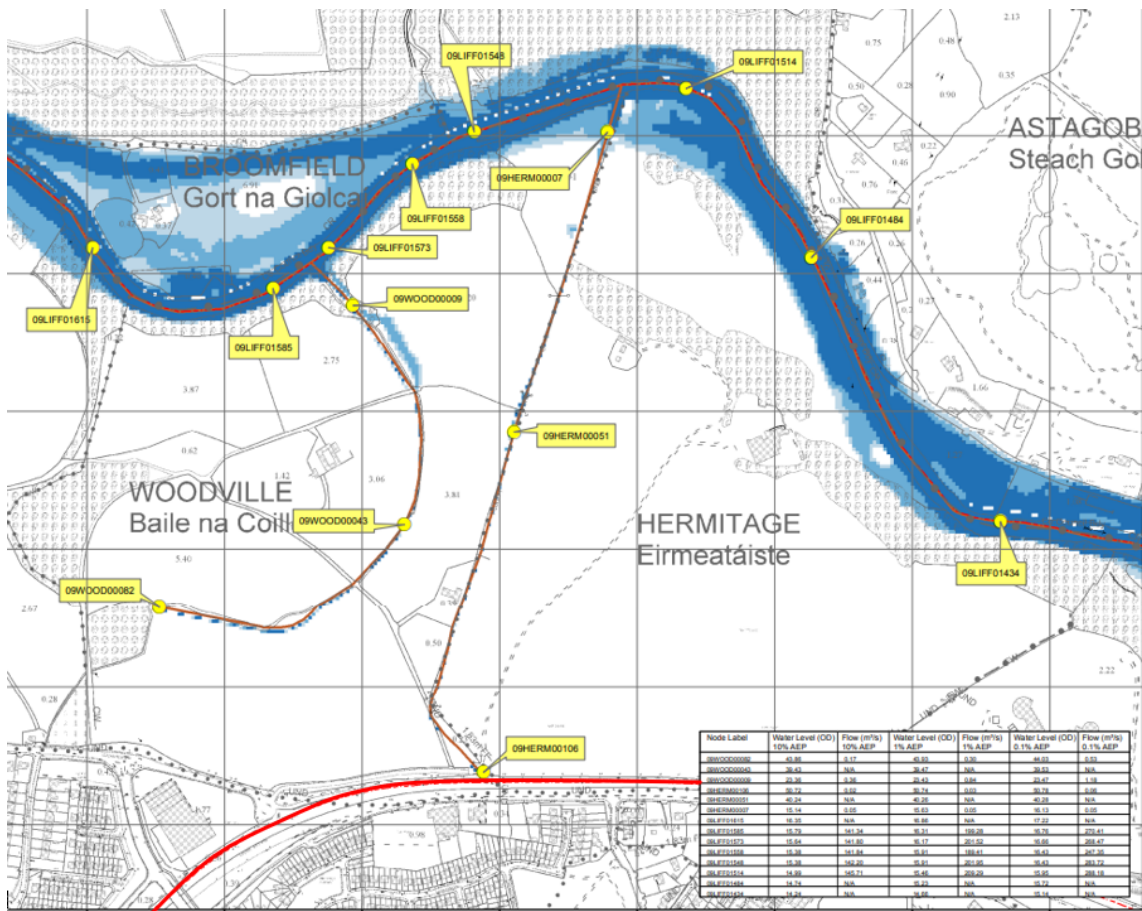


Figure 4: CFRAM Fluvial Flood Map (Lucan)

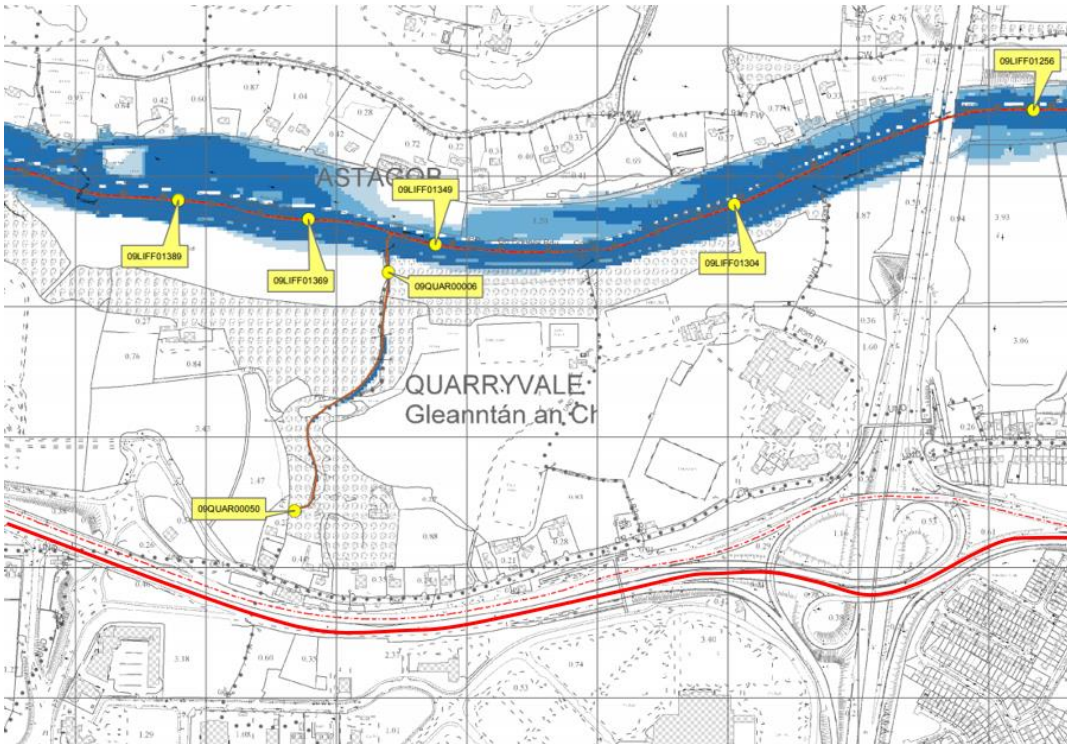


Figure 5: CFRAM Fluvial Flood Map (near Fonthill)

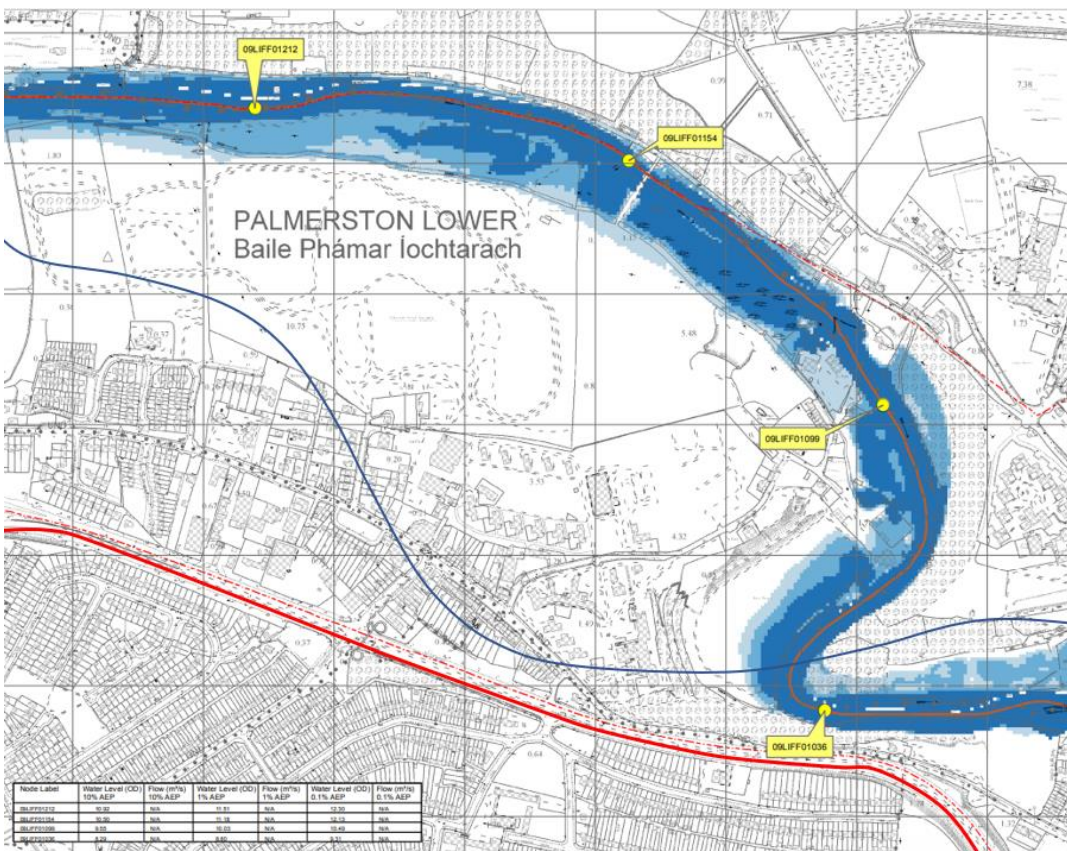


Figure 6: CFRAM Fluvial Flood Map (near Palmerston)

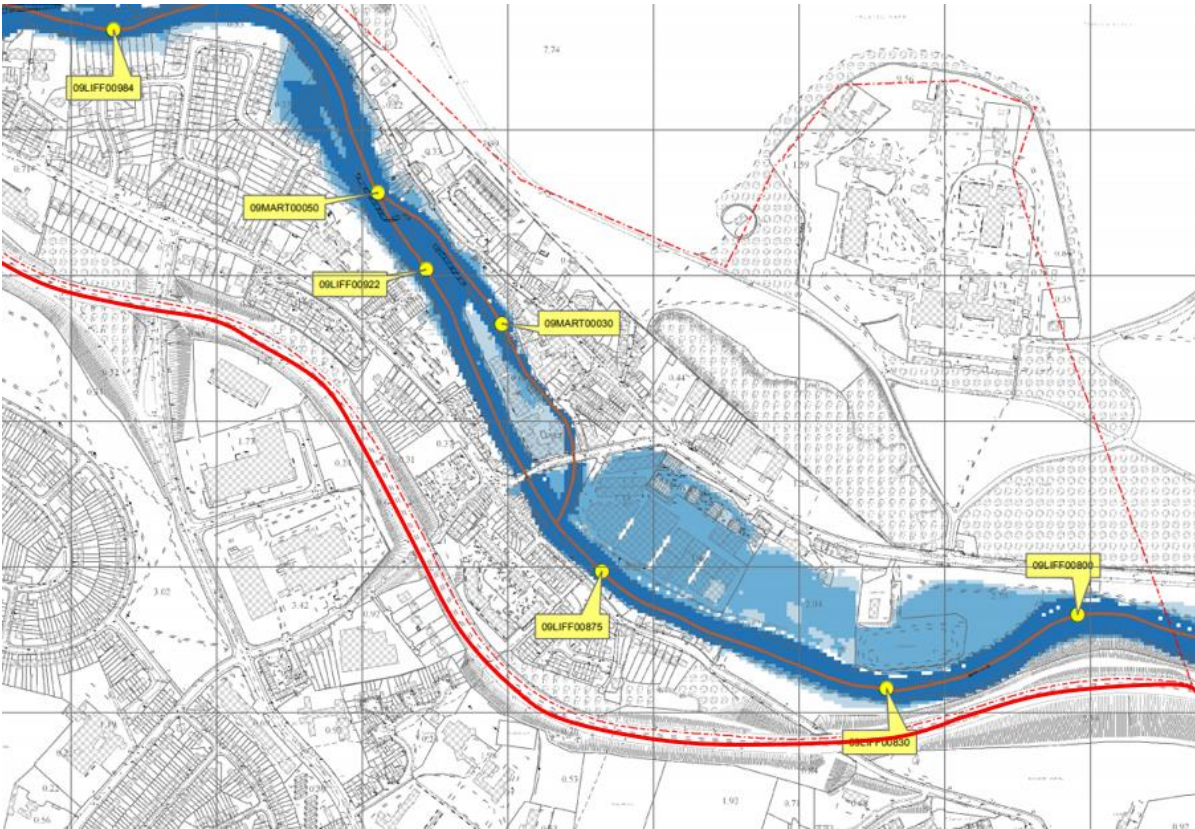


Figure 7: CFRAM Fluvial Flood Map (near Chapelizod)

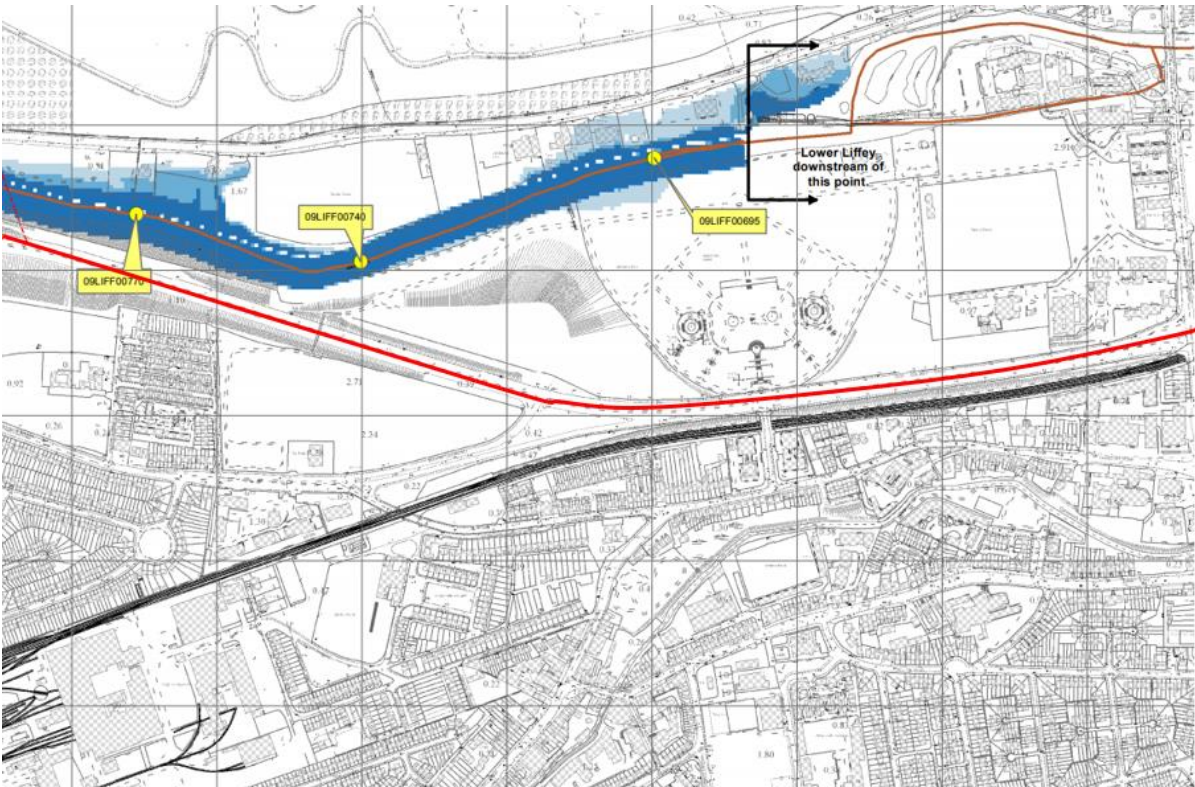


Figure 8: CFRAM Fluvial Flood Map (Kilmainham)

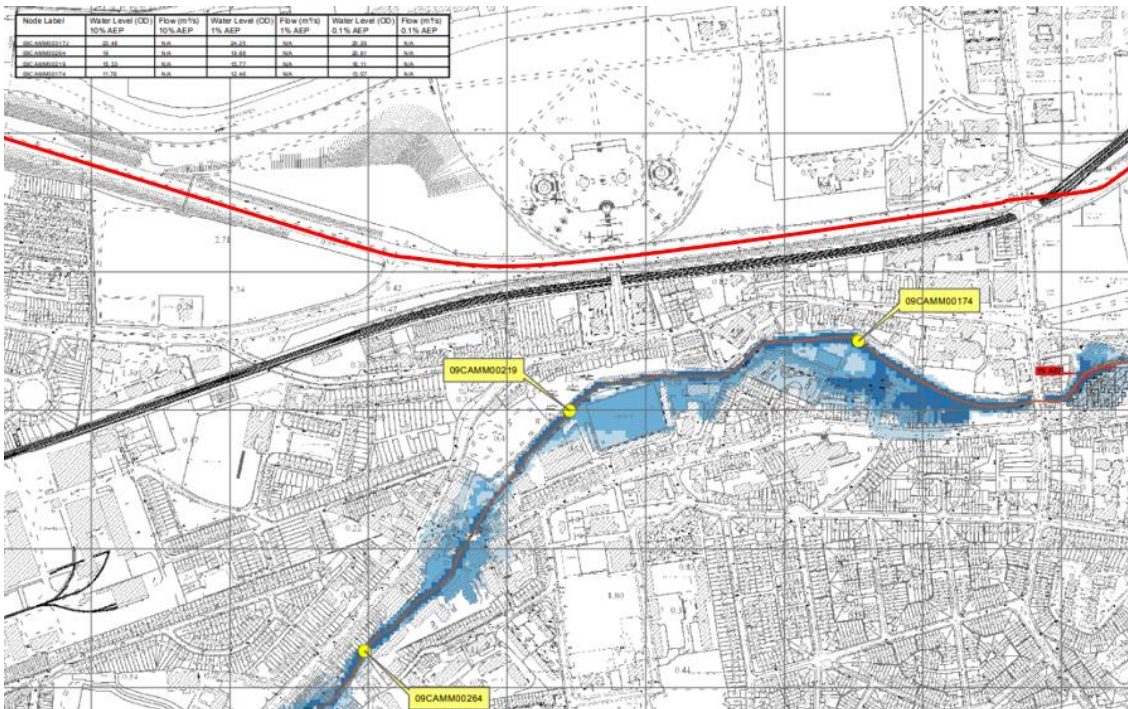


Figure 9: CFRAM Fluvial Flood Map (Kilmainham)

As shown in Figure 10, a section of the proposed route falls within Flood Zone B (Fluvial 0.1% AEP Fluvial Event). This figure includes the modelled water levels for the nodes displayed along the River Camac. The closest node to the site, approx. 75m from the Proposed Scheme, is 09Camm000271. The estimated water levels at this location are indicated in Table 4. The route level of the proposed route at this location varies from approx. 4m – 5m.

Table 4: Modelled flood levels along River Camac

Node	1 in 10-year event (10%AEP)	1 in 100-year event (1%AEP)	1 in 1000-year event (0.1%AEP)
09Camm000271	3.29mOD	4.37mOD	6.09mOD

The Dublin City Development Plan SFRA suggests that there is a fluvial flood risk as the River Liffey is tidally influenced. Below are some noteworthy comments from the Dublin City Development Plan SFRA for the area shown in Figure 10:

- All surface water within this area is to be managed and provisions shall be made for a 1-year high tide event occurring concurrently with a 1 in 100-year rainfall event,
- Some of this area has existing Quay Walls to ground level but their design standards and capacity for flood defence is unknown,
- Moderate to high sensitivity to climate change. The river in this location has combined fluvial and tidal influences which could result in greater increases in water level than elsewhere, increases in river levels could have significant consequences if quay walls are overtopped more frequently, there is little difference between the extents of Flood Zone A and Flood Zone B in most locations,
- All surface water within this area is to be managed and provisions shall be made for a 1-year high tide event assuming a 100-year rainfall event,

- The flood extents indicate flow paths coming directly out of the river channel and directly out of the tidal region, some are through quay walls and underground chambers and pipelines near quay walls.
- Sea level rise will have an impact on water levels at the downstream end,
- This portion of the Camac Catchments is susceptible to pluvial flooding from intense rainfall events,
- Flood extents indicate flow paths coming directly out of the river channel. Pluvial flooding may increase flooding risk if it occurs during high river flows.

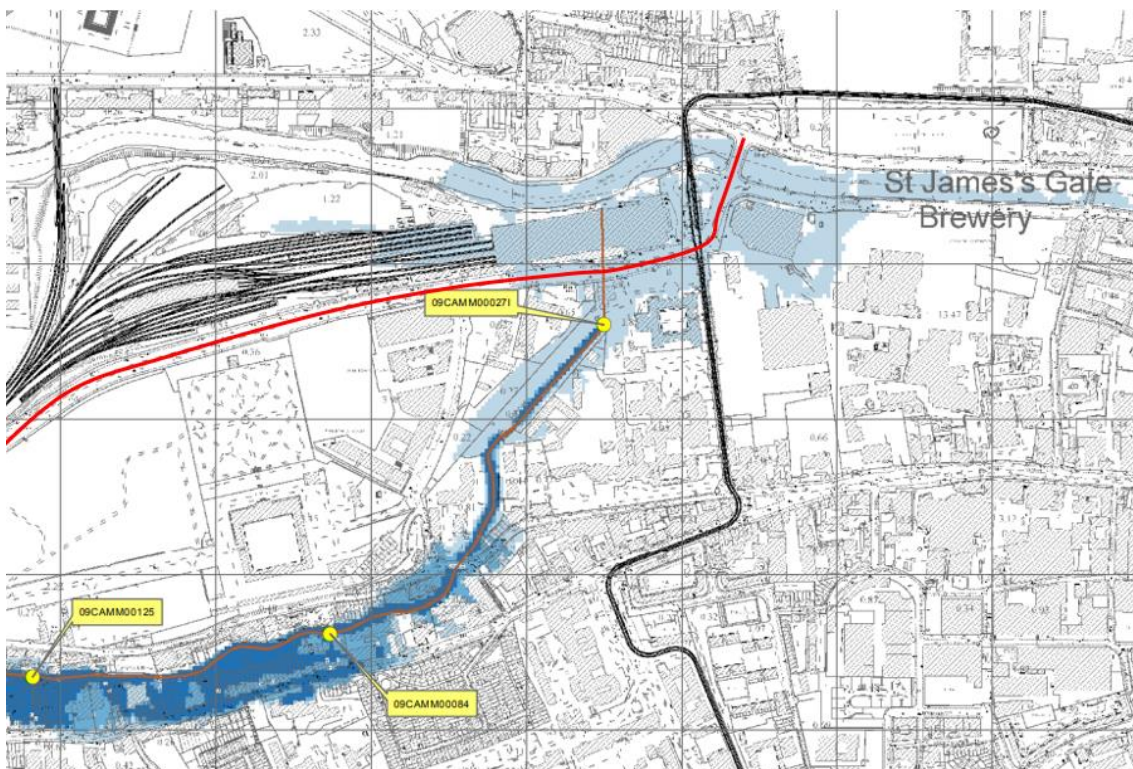


Figure 10: CFRAM Fluvial Flood Map (Heuston)

4.2 Tidal Flood Risk

The proposed route is not within the extents of the CFRAM study for coastal flood risk. Additionally, the proposed route is removed from coastal boundaries. Therefore, no tidal/ coastal flood risk exists along the proposed route. However, it should be noted, as described in Section 4.1 above, the fluvial flood risk at Heuston is compounded but the tidally influenced River Liffey.

4.3 Pluvial Flooding/ Urban Drainage

Pluvial flooding occurs when extreme rainfall overwhelms drainage systems or soil infiltration capacity, causing excess rainwater to pond above ground at low point in the topography.

The risk of pluvial flooding has been assessed by the flood maps produced as part of the Preliminary Flood Risk Assessment (PRFA) by Office of Public Works (OPW) as shown in Figure 11.

It is noted that the initial 3.4km (approx.) of the Proposed Scheme is located outside of the rainfall flood extents mapping, thus the pluvial flood risk for this section of the scheme was not assessed.

The 10% AEP Pluvial Flood Risk Map indicates that there is a significant percentage of the route which is identified as being at risk of flooding following a 1 in 10-year rainfall event. There are multiple locations where there is a continuous section of the scheme which is indicated as being flooded on the OPW Flood Maps.

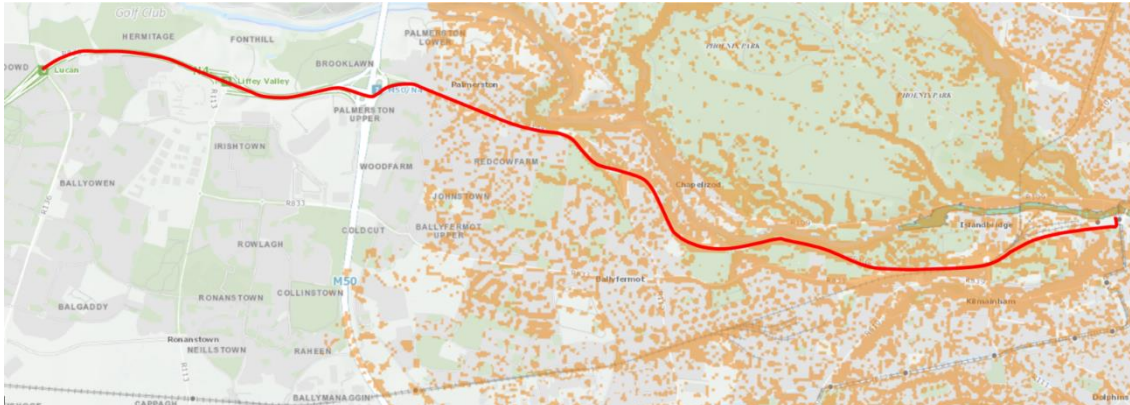


Figure 11: Extract from OPW PFRA Pluvial Flood Maps - 10% AEP Pluvial Flood Risk

There are multiple locations on the R148 where there is a continuous section of scheme flooded due to 10% AEP Pluvial Event.

As noted above, the Dublin City Development Plan SFRA requires stormwater to be managed with different provisions along the proposed. Site 17 of the Dublin City Development Plan SFRA indicates fluvial flooding of the Proposed Scheme and states that this portion of the Camac Catchments is susceptible to pluvial flooding from intense rainfall events.

The pluvial flood depth map along the Proposed Scheme was reviewed. These maps are available in PDF from the floodinfo.ie website¹. These maps estimate the flood depth for a flood event of a particular probability. The depths are mapped over square grids of 25m or 12.5m. The depths across these grids is mapped as constant, however, the depths within the grid square may vary. From these maps it was determined that there is potential for pluvial flooding along the Proposed Scheme.

Figure 12 shows the proposed route (in yellow) overlaid on the pluvial flood depth map for the area for a 10% AEP event. There are multiple sections along the route which are flooded. Generally, these are scattered areas of flooding. However, a significant section of the Con Colbert Road is highlight in purple, indicating flood depths of up to 2m and greater.

News articles from 22 November 2017 state that “2 lanes are closed on the Chapelizod bypass outbound at Con Colbert Road due to floods”.

¹ Flood Maps. Available at: <https://www.floodinfo.ie/map/floodmaps/>

groundwater it is not expected that this risk will increase to the site or surrounding areas due to the construction of the scheme.

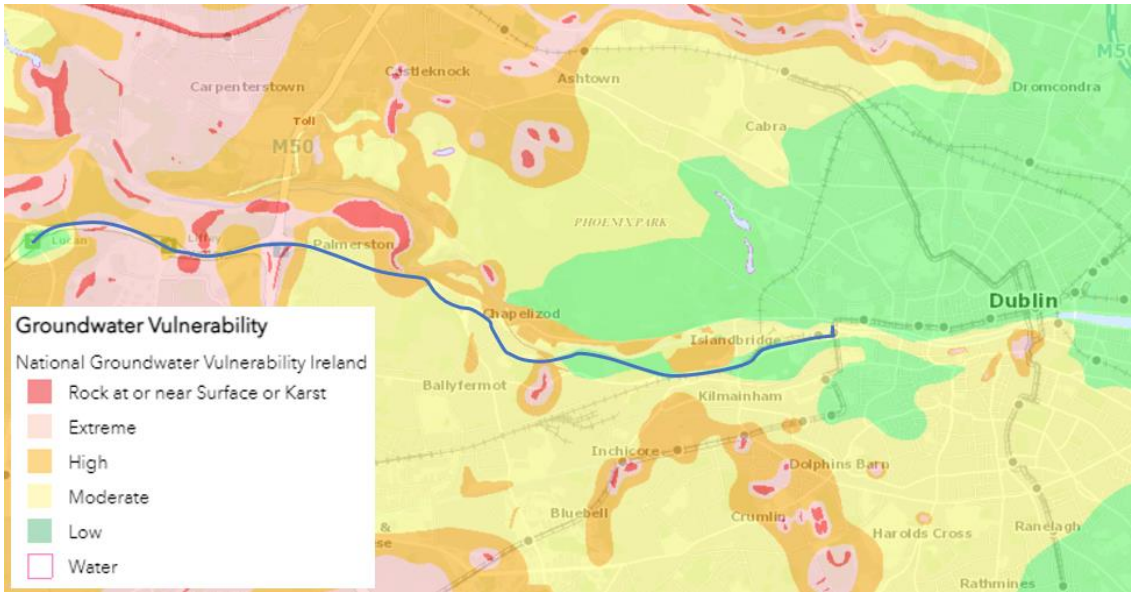


Figure 13: GSI Groundwater Vulnerability Mapping

4.5 Summary of Existing Flooding

The risk of flooding to the existing site from fluvial, tidal, pluvial and groundwater sources has been assessed and is summarised as follows:

- The proposed route from Lucan to City Centre has varying levels of flood risk along the route. The section of the route at Heuston is in the 1 in 1000-year fluvial flood extent and is therefore located within Flood Zone B – medium risk.
- The risk of pluvial flooding to the site is currently medium to high.
- The risk of groundwater flooding to the site is considered medium to high.

5 Application of “The Planning System and Flood Risk Management” Guideline

5.1 Flood Zones

The site is located within Flood Zone B at Hueston (1 in 1000 fluvial flood extents).

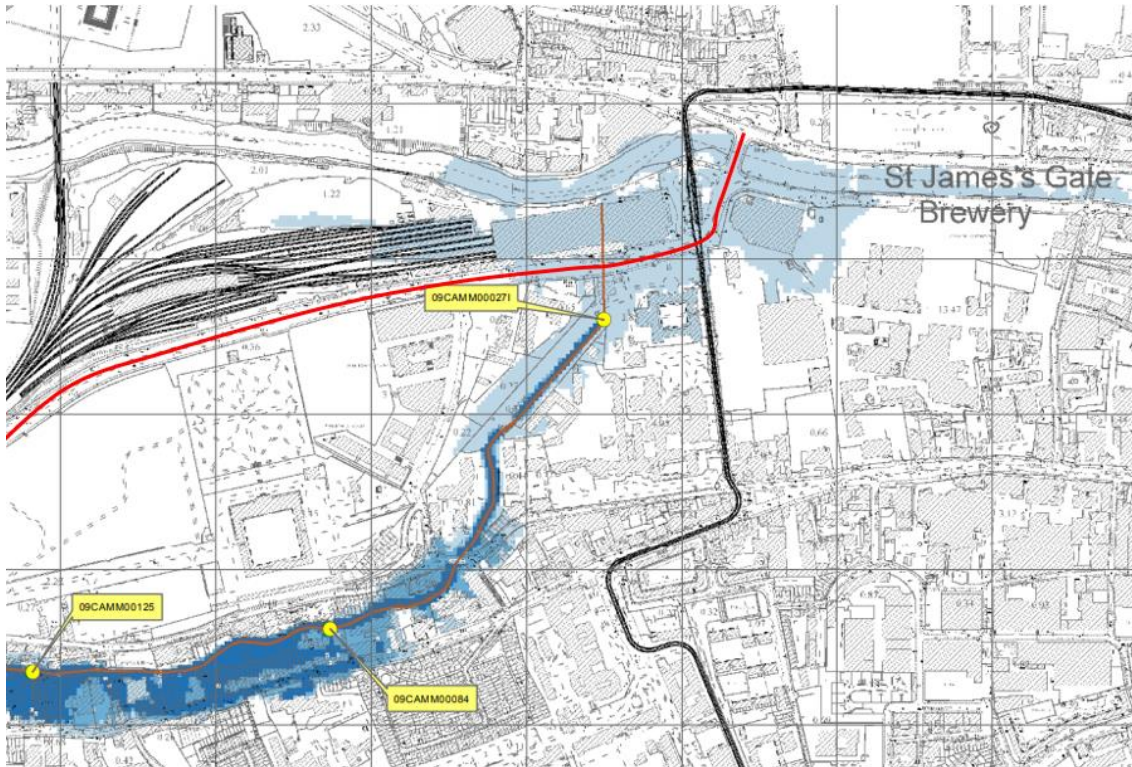


Figure 14: CFRAM Fluvial Flood Map (Hueston)

5.2 Vulnerability Classification

As per Table 2, it is considered the proposed development is classified as a ‘highly vulnerable development’ as per the vulnerability classification.

As the proposed development is a “highly vulnerable development” a Justification Test is required for those sections of the route which are within Flood Zone A and Flood Zone B.

5.3 Justification Test

The Justification Test is comprised of two processes:

1. The first is the Plan-making Justification Test (described in Chapter 4 of ‘The Planning System and Flood Risk Management’ guidelines) and is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
2. The second is the Development Management Justification Test (described in Chapter 5 of ‘The Planning System and Flood Risk Management’ guidelines) and is used at the

planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

5.4 Plan-making Justification Test

A Plan-Making Justification test forms part of the Strategic Flood Risk Assessment. The Strategic Development Zone (SDZ) Planning Scheme as approved notes that all proposed developments must include a site-specific flood risk assessment (SSFRA). It is further confirmed that the SSFRA is not required to carry out a justification test, given that this exercise has already been carried out as part of the adopted SDZ Planning Scheme.

5.5 Development Management Plan Justification Test

Box 5.1 of the Justification Test in the Planning Guidelines requires two criteria to be met:

- The subject lands have been zoned or otherwise designated for the particular use of form of development in an operative development plan, which has been adopted or varied taking account of these guidelines.
- 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

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.

5.5.1 Development Management Plan Justification Test – Item 1

With regards to Item 1, we consider that this criterion has been met as follows:

- The subject lands have been zoned or otherwise designated for the particular use of form of development in an operative development plan, which has been adopted or varied taking account of these guidelines.

As shown in Figure 15, the site is identified as a Proposed BRT (Bus Rapid Transport) route within zoning map set J of the Dublin City Development Plan 2016 – 2022.



Figure 15: Dublin City Development Plan 2016-2022 – Map J Strategic Transport and Parking Areas

5.5.2 Development Management Plan Justification Test – Item 2

With regards to Item 2, we consider that these criteria have been met as follows:

- The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk.

As flood areas identified are existing roadways, it is not proposed to alter the extents of hardstanding area or raise the road level in these areas. Therefore, development of the Bus Connects route in this area will not increase flood risk elsewhere. This area meets the criteria for Part 2(i).

- The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonable possible.

Many areas along the route which are within a predicted flood extents zone are existing roads and will not increase flood risk compared to the existing scenario.

Any new roads, cycleways etc. constructed as part of the scheme will include appropriate mitigation measures to reduce the risk of flooding included at detailed design stage. As outlined in Section 4.3 pluvial flood risk will be mitigated by the incorporation of SuDS features into the drainage system where necessary. This will reduce the risk of ponding and surface water collecting at localised low points.

The mitigation measures proposed will minimise the flood risk to people, property, the economy, and the environment.

It is therefore considered that the proposed development satisfies the criteria of Part 2(ii) of the Development Management Justification Test.

- 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.

The measures ensure that residual risks to the area and/or development will 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.

Therefore, it is considered that the proposed development satisfies the criteria of Part 2(iii) of the development management Justification Test.

- 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 scheme has been designed to the highest standards and creates a connection of Bus services along core routes of Dublin. Measures to address the flood risk have been incorporated into the design without compromising the streetscape and functioning of the development.

Therefore, it is considered that the proposed development satisfies the criteria of Part 2 (iv) of the development management Justification Test.

5.6 Justification Test Conclusion

The scheme satisfies the requirements of the Plan Making Justification Test and the requirements of Development Management Justification Test.

6 Conclusion

This site-specific flood risk assessment for the Proposed Scheme has been undertaken in accordance with the requirements of “The Planning System and Flood Risk Management Guidelines for Planning Authorities”.

No past flood events have been identified along or near the Proposed Scheme.

The eastern (city centre) end of the Proposed Scheme runs adjacent to the coastal boundaries of the River Liffey (which is tidally influenced). As per the Dublin City Development Plan 2016-2022 Strategic Flood Risk Assessment Vol 7, an area of the Proposed Scheme is located within Flood Zone B.

There is an area of the Proposed Scheme where there is a significant risk of pluvial flooding. This is located along the R148 at Con Colbert Road. The risk of pluvial flooding along most of the proposed route is considered to be high.

The above risks exist in the current scenario and will be reduced as a result of the Proposed Scheme, as where new surface water sewers are being proposed along the development, these networks shall be designed to provide attenuation for return period of up to 30 years where possible. This would be an improvement on the existing historical drainage network infrastructure and will reduce the overall risk of pluvial flooding. New drainage infrastructure will be provided including SuDS such as rain gardens, swales, and tree pits where possible. These SuDS features will provide source control measures and reduce the risk of pluvial flooding.

The groundwater vulnerability varies along the proposed development route. As most of the proposed development is on existing roads with no known flooding specifically from groundwater, it is expected that this risk will not increase as a result of the Proposed Scheme. To accurately assess the site-specific risk of groundwater flooding, a pre-construction geotechnical site investigation will be carried out as part of the final design in order to confirm groundwater conditions along the Proposed Scheme.

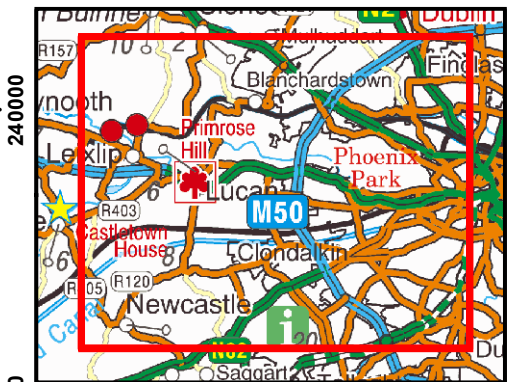
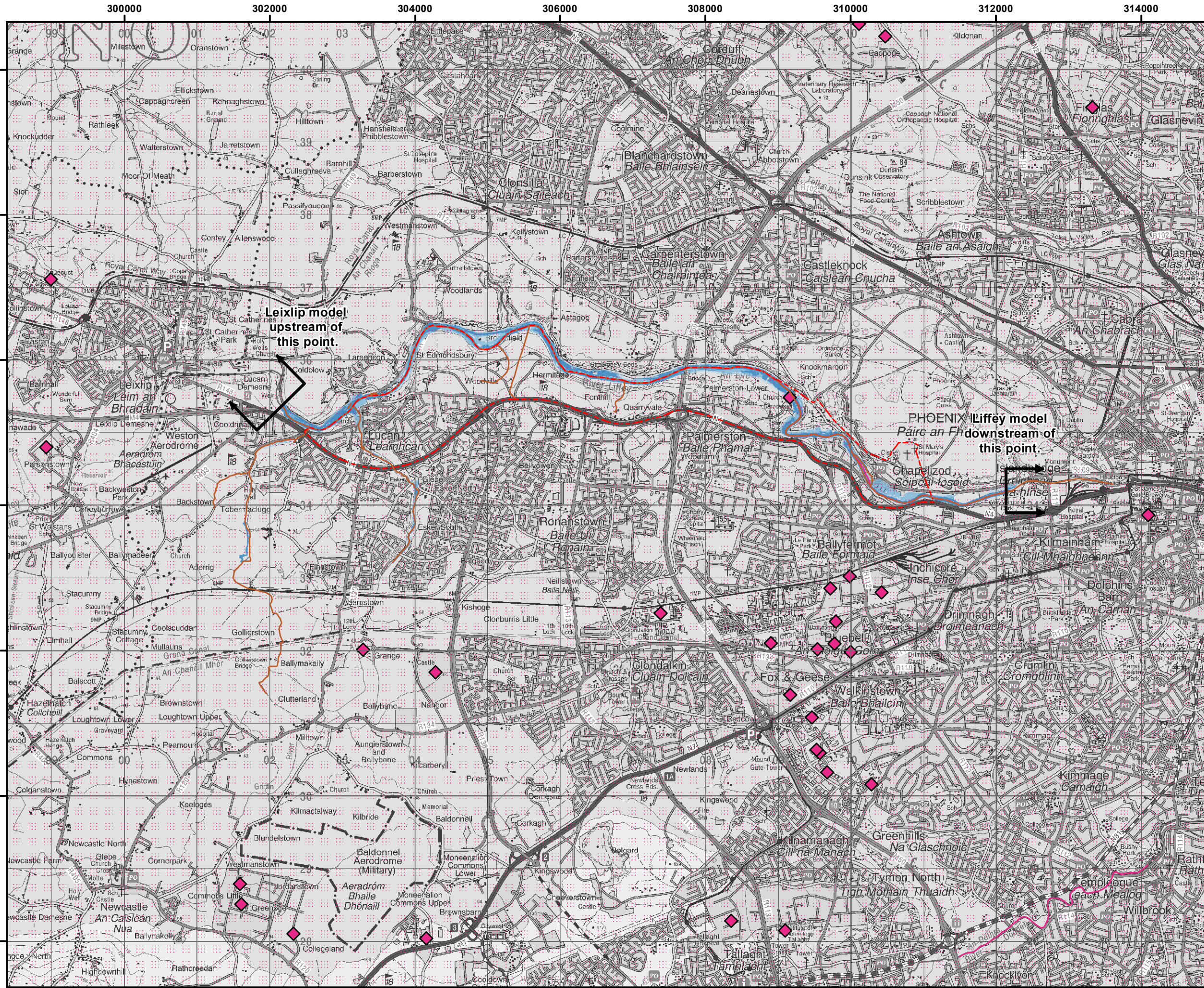
With the exception of the areas outlined above, the rest of the route does not fall within any flood extents, and therefore categorised as a Vulnerability Class Flood Zone C development.

Finally, the Proposed Scheme is categorised by the Guidelines as a ‘highly vulnerable development’ and is required to pass the justification test if any part of the development is located within Flood Zone A or Flood Zone B. The Plan Making Justification Test and Development Management Justification have been assessed and passed in Chapter 5 of this report and further investigation of the flood risk in the form of a Stage 2 FRA is not required.

Appendices

Drawings

- Lucan to Chapelizod Risk to Environment Map - GENERAL RISK – ENVIRONMENT Page 1 of 1
- Lucan to Chapelizod Fluvial Flood Extents Sheet 8 to Sheet 12
- Liffey Fluvial Flood Extents Sheet 1
- Camac Fluvial Flood Extents Sheet 24
- Liffey Tidal Flood Extents Sheet 1 & Sheet 2



IMPORTANT USER NOTE:
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- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
 - IED Sites
 - Designated for Drinking Water Abstraction
 - Designated for Drinking Water Abstraction
 - Recreational Waters
 - SAC Water Dependent
 - SAC Water Dependent
 - SPA Water Dependent
 - Modelled River Centreline
 - AFA Extent

FINAL

REV:	NOTE:	DATE:



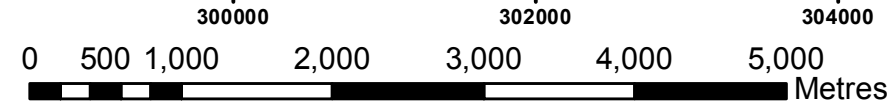
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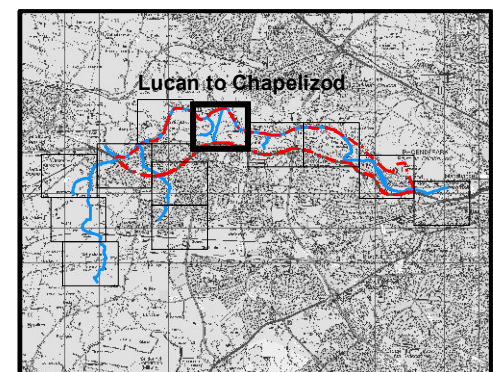
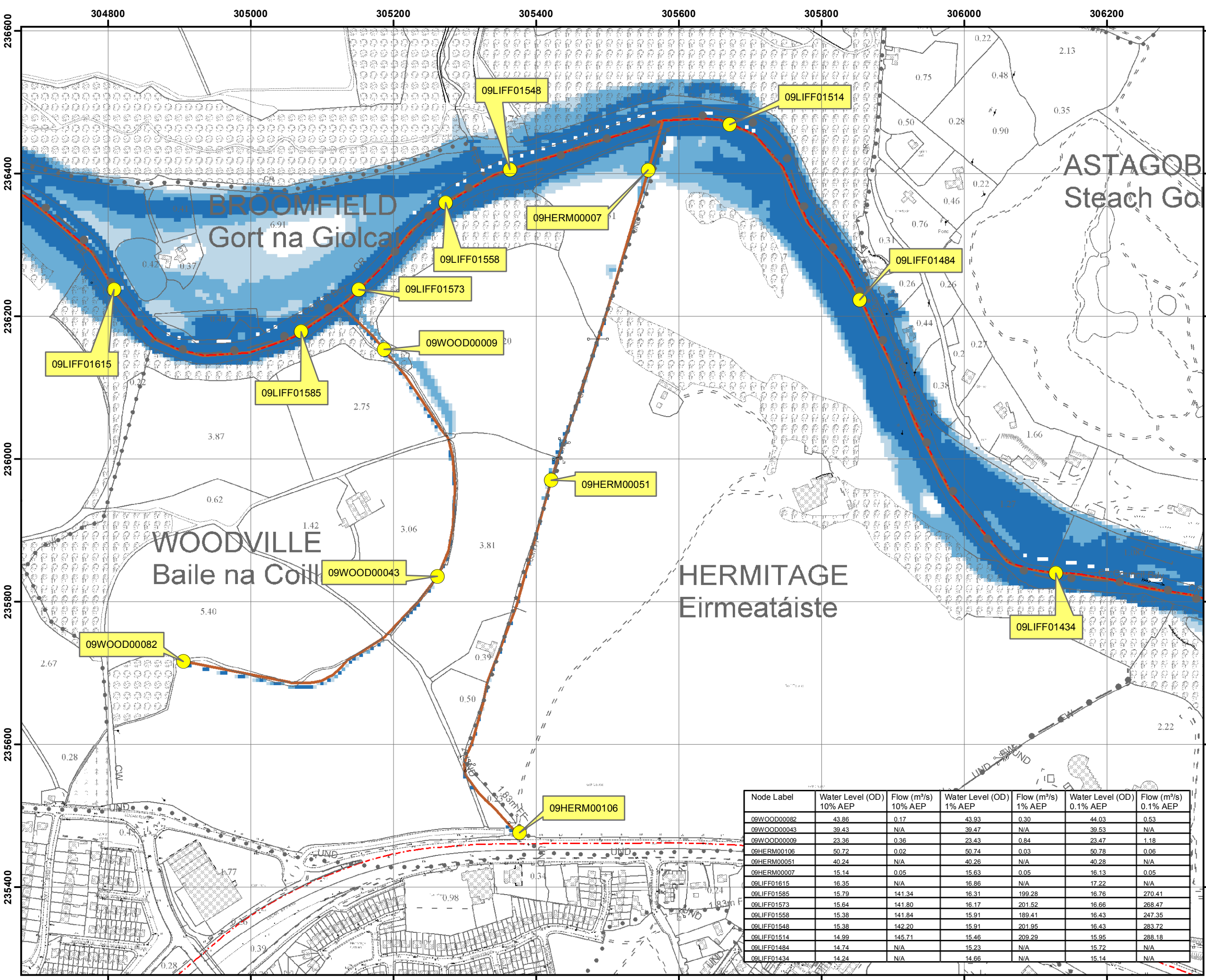
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E ireland@rpsgroup.com

Map:
Lucan to Chapelizod Risk to Environment Map

Map Type: GENERAL RISK - ENVIRONMENT
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By: C.C. Date: 28 July 2016
Checked By: S.P. Date: 28 July 2016
Approved By: G.G. Date: 28 July 2016
Drawing No.: E09LUC_RVFCDF0_01
Map Series: Page 1 of 1
Drawing Scale: 1:50,000 @ A3





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- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Node Point
 - Node ID Node Label

FINAL

REV:	NOTE:	DATE:
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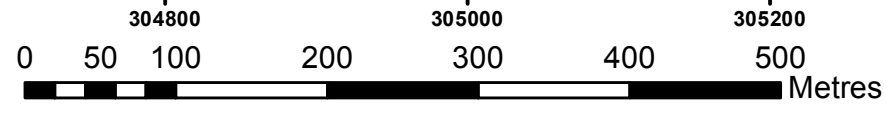


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 E ireland@rpsgroup.com

Node Label	10% AEP		1% AEP		0.1% AEP	
	Water Level (OD)	Flow (m³/s)	Water Level (OD)	Flow (m³/s)	Water Level (OD)	Flow (m³/s)
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09WOOD00043	39.43	N/A	39.47	N/A	39.53	N/A
09WOOD00009	23.36	0.36	23.43	0.84	23.47	1.18
09HERM00106	50.72	0.02	50.74	0.03	50.78	0.06
09HERM00051	40.24	N/A	40.26	N/A	40.28	N/A
09HERM00007	15.14	0.05	15.63	0.05	16.13	0.05
09LIFF01615	16.35	N/A	16.86	N/A	17.22	N/A
09LIFF01585	15.79	141.34	16.31	199.28	16.76	270.41
09LIFF01573	15.64	141.80	16.17	201.52	16.66	268.47
09LIFF01558	15.38	141.84	15.91	189.41	16.43	247.35
09LIFF01548	15.38	142.20	15.91	201.95	16.43	283.72
09LIFF01514	14.99	145.71	15.46	209.29	15.95	288.18
09LIFF01484	14.74	N/A	15.23	N/A	15.72	N/A
09LIFF01434	14.24	N/A	14.66	N/A	15.14	N/A



Map:
 Lucan to Chapelizod Fluvial Flood Extents

Map Type: EXTENT

Source: FLUVIAL

Map Area: HPW

Scenario: CURRENT

Drawn By: C.C. **Date:** 27 July 2016

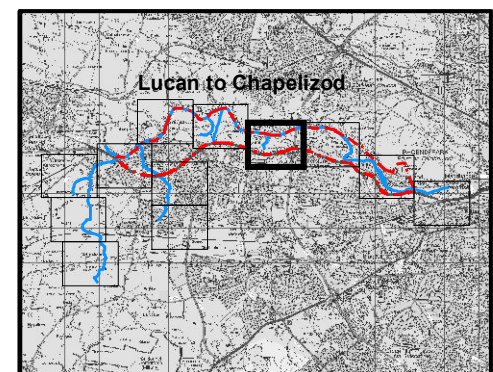
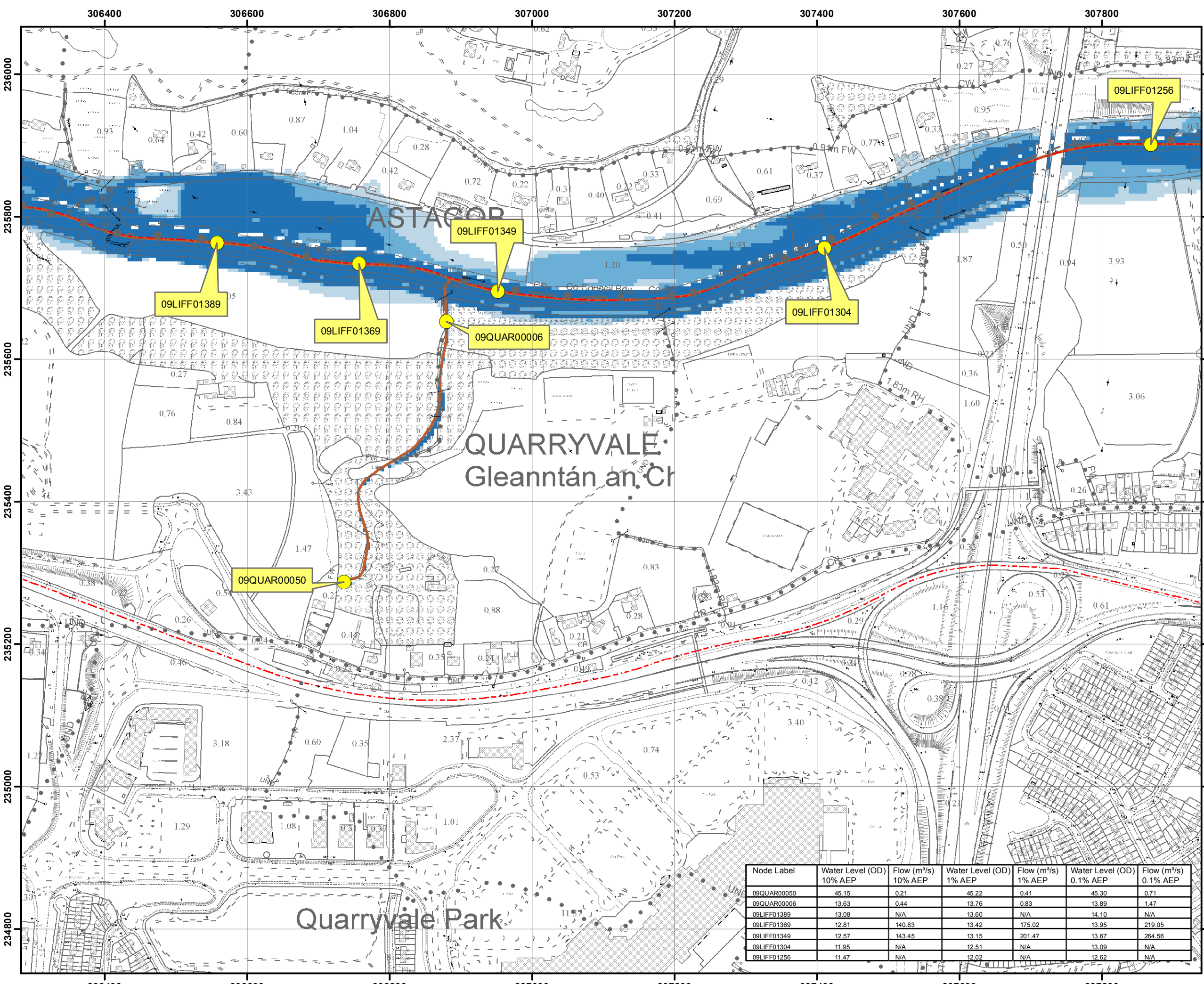
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Approved By: G.G. **Date:** 27 July 2016

Drawing No.:
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Map Series: Page 8 of 12

Drawing Scale: 1:5,000 @ A3



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- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Node Point
 - Node ID Node Label

FINAL

REV:	NOTE:	DATE:
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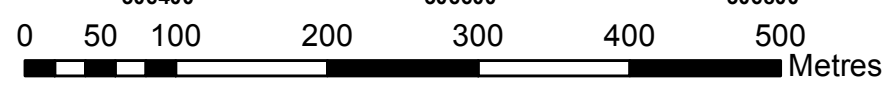
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Óifig na hOibreacha Poiblí
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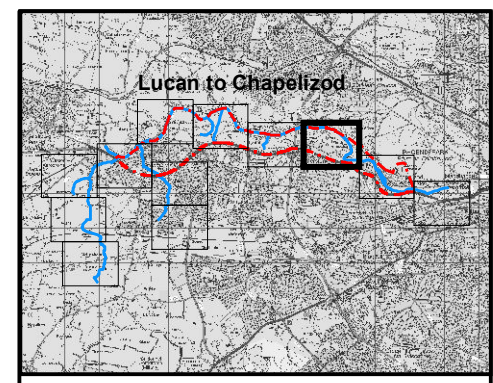
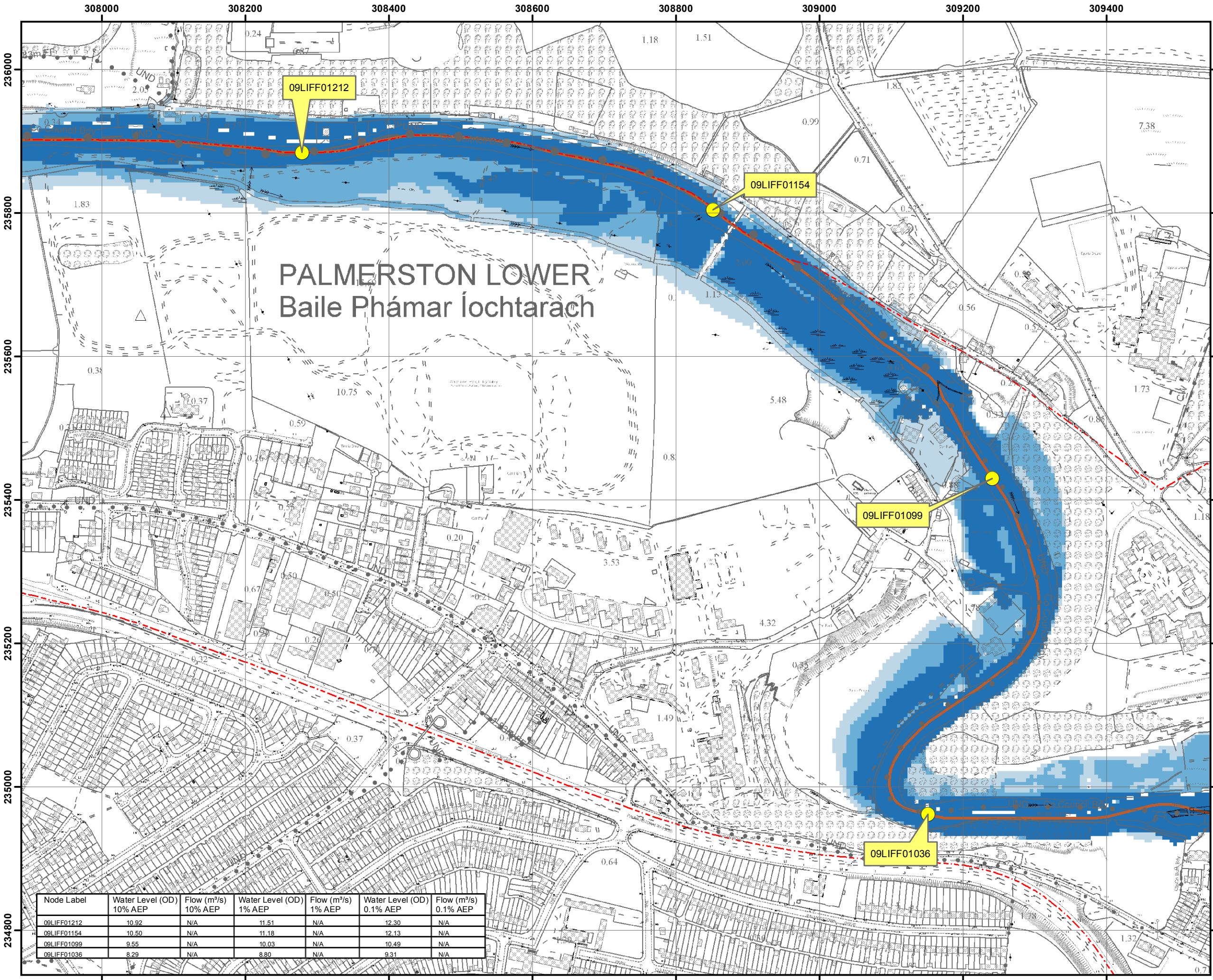
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Node Label	Water Level (OD)		Flow (m ³ /s)		Water Level (OD)		Flow (m ³ /s)	
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09QUAR00006	13.63	0.44	13.76	0.83	13.89	1.47		
09LIFF01389	13.08	N/A	13.60	N/A	14.10	N/A		
09LIFF01369	12.81	140.83	13.42	175.02	13.95	219.05		
09LIFF01349	12.57	143.45	13.15	201.47	13.67	264.56		
09LIFF01304	11.95	N/A	12.51	N/A	13.09	N/A		
09LIFF01256	11.47	N/A	12.02	N/A	12.62	N/A		

Map:	
Lucan to Chapelizod Fluvial Flood Extents	
Map Type:	EXTENT
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By:	C.C. Date : 27 July 2016
Checked By:	S.P. Date : 27 July 2016
Approved By:	G.G. Date : 27 July 2016
Drawing No. :	
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Drawing Scale : 1:5,000 @ A3	





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- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Node Point
 - Node ID
 - Node Label

PALMERSTON LOWER Baile Phámar Íochtarach

FINAL

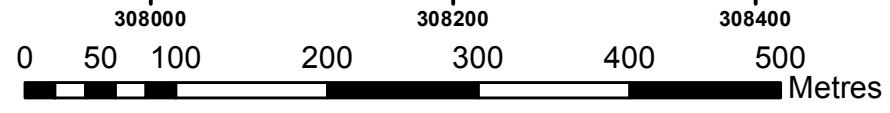
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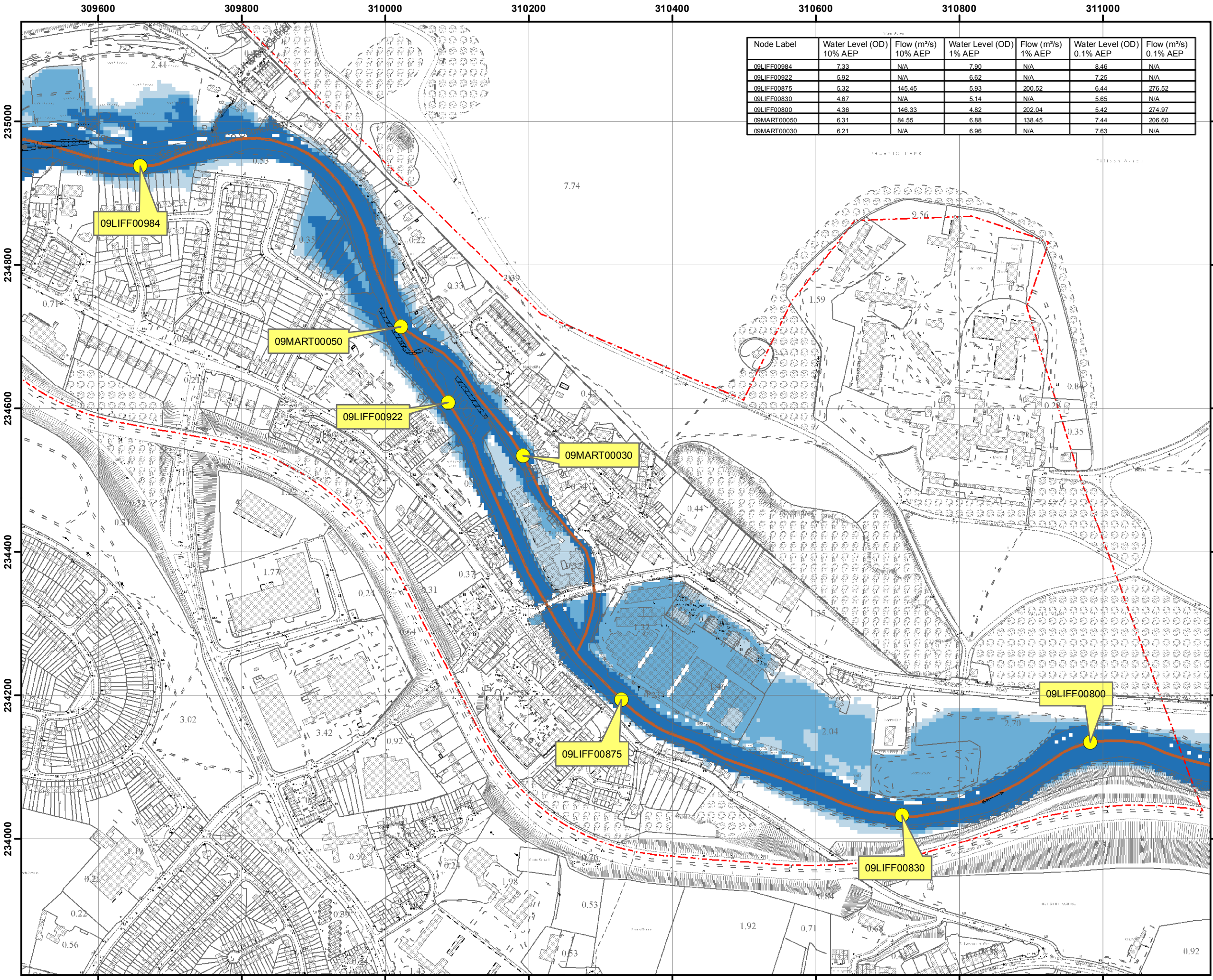
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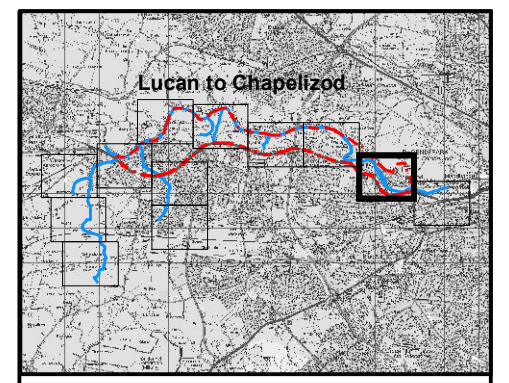
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09LIFF01154	10.50	N/A	11.18	N/A	12.13	N/A
09LIFF01099	9.55	N/A	10.03	N/A	10.49	N/A
09LIFF01036	8.29	N/A	8.80	N/A	9.31	N/A



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Lucan to Chapelizod Fluvial Flood Extents	
Map Type:	EXTENT
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By:	C.C. Date: 27 July 2016
Checked By:	S.P. Date: 27 July 2016
Approved By:	G.G. Date: 27 July 2016
Drawing No.:	
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Map Series: Page 10 of 12	
Drawing Scale: 1:5,000 @ A3	



Node Label	10% AEP		1% AEP		0.1% AEP	
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09LIFF00922	5.92	N/A	6.62	N/A	7.25	N/A
09LIFF00875	5.32	145.45	5.93	200.52	6.44	276.52
09LIFF00830	4.67	N/A	5.14	N/A	5.65	N/A
09LIFF00800	4.36	146.33	4.82	202.04	5.42	274.97
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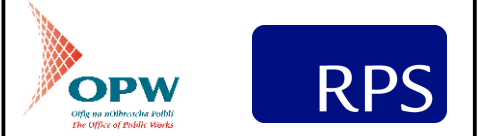


IMPORTANT USER NOTE:
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- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Node Point
 - Node ID

FINAL

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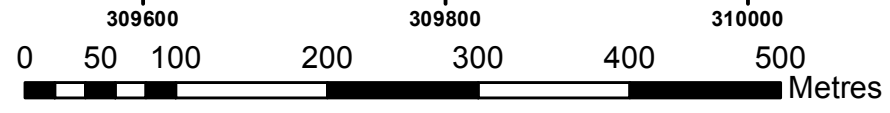


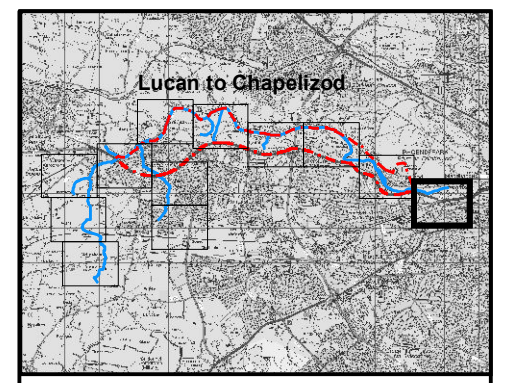
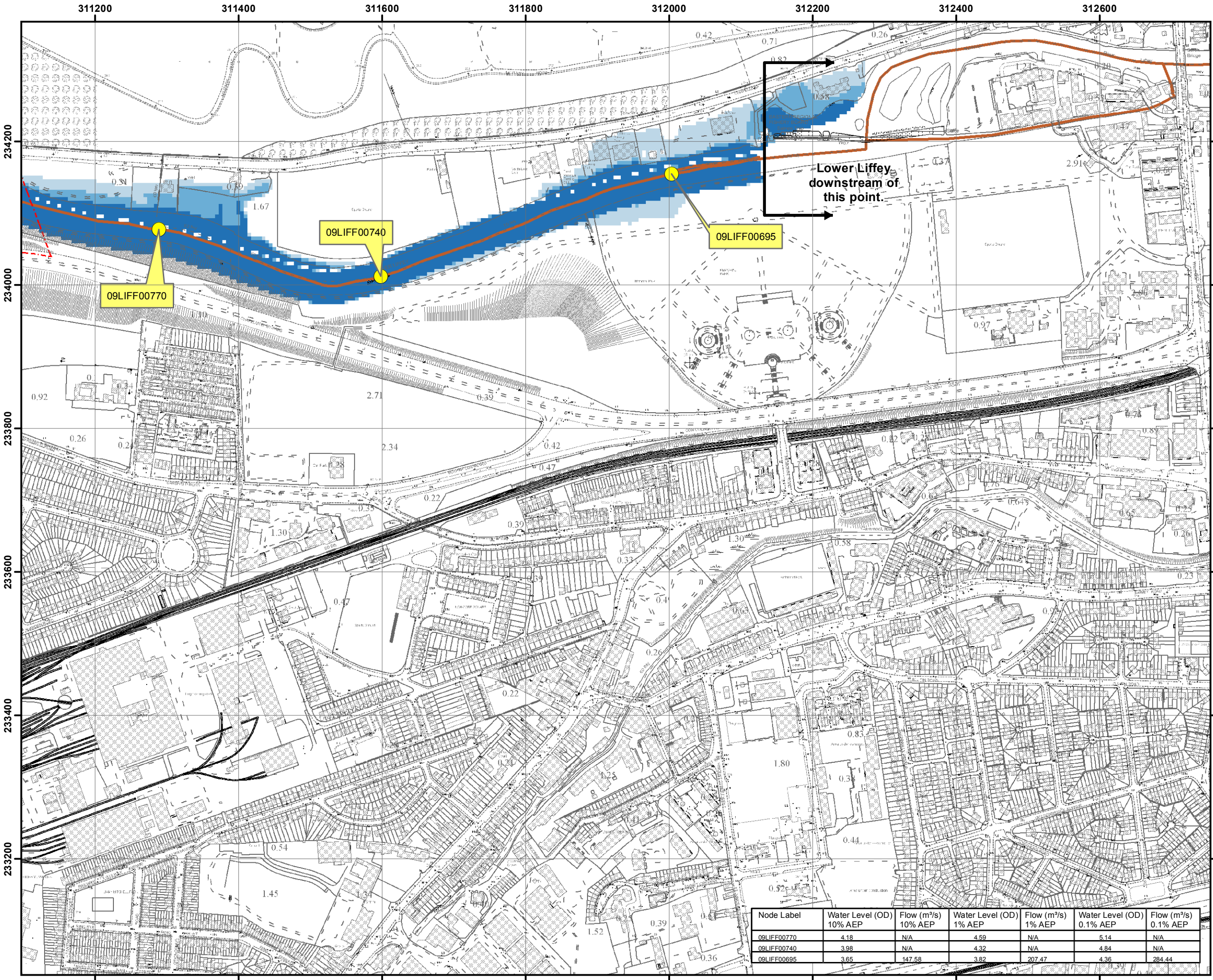
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Map: Lucan to Chapelizod Fluvial Flood Extents	
Map Type: EXTENT	
Source: FLUVIAL	
Map Area: HPW	
Scenario: CURRENT	
Drawn By: C.C.	Date: 27 July 2016
Checked By: S.P.	Date: 27 July 2016
Approved By: G.G.	Date: 27 July 2016
Drawing No.: E09LUC_EXFCD_F0_11	
Map Series: Page 11 of 12	
Drawing Scale: 1:5,000 @ A3	





IMPORTANT USER NOTE:
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- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Node Point
 - Node ID Node Label

FINAL

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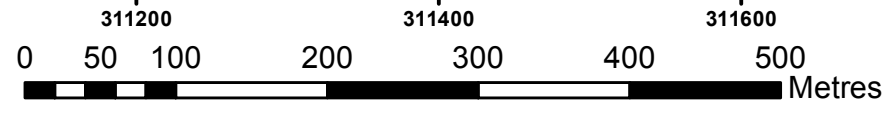
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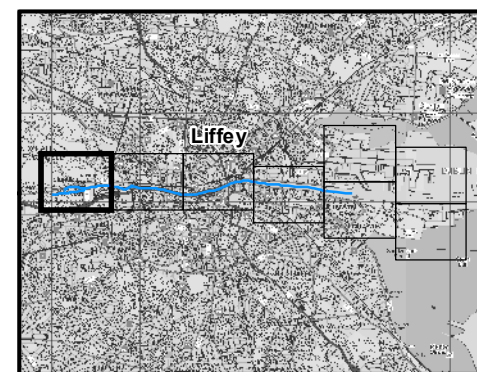
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Map:	
Lucan to Chapelizod Fluvial Flood Extents	
Map Type: EXTENT	
Source: FLUVIAL	
Map Area: HPW	
Scenario: CURRENT	
Drawn By : C.C.	Date : 27 July 2016
Checked By : S.P.	Date : 27 July 2016
Approved By : G.G.	Date : 27 July 2016
Drawing No. :	
E09LUC_EXFCD_F0_12	
Map Series : Page 12 of 12	
Drawing Scale : 1:5,000 @ A3	

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09LIFF00740	3.98	N/A	4.32	N/A	4.84	N/A	N/A	
09LIFF00695	3.65	147.58	3.82	207.47	4.36	284.44		



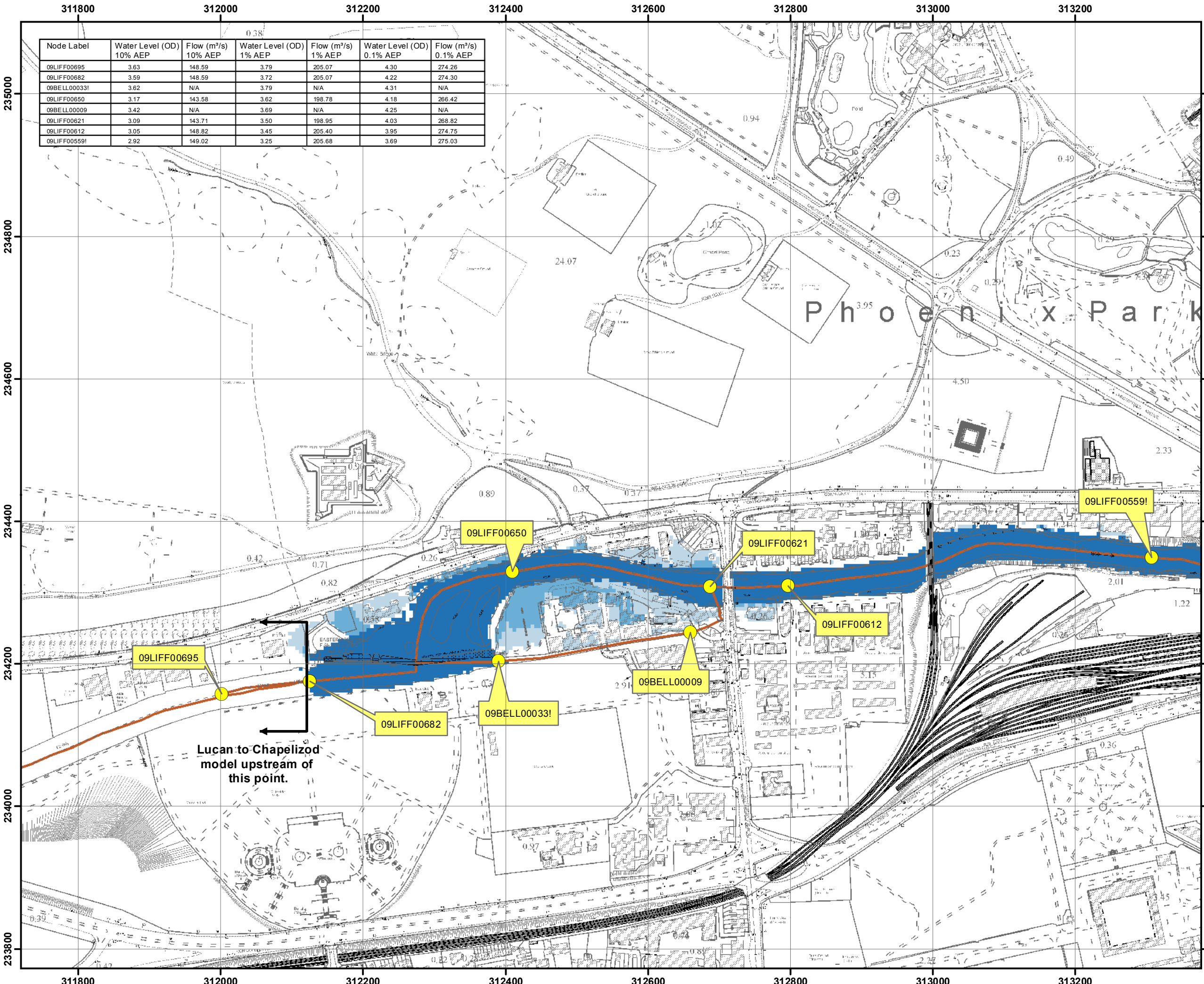
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09LIFF00682	3.59	148.59	3.72	205.07	4.22	274.30
09BELL00033!	3.62	N/A	3.79	N/A	4.31	N/A
09LIFF00650	3.17	143.58	3.62	198.78	4.18	266.42
09BELL00009	3.42	N/A	3.69	N/A	4.25	N/A
09LIFF00621	3.09	143.71	3.50	198.95	4.03	268.82
09LIFF00612	3.05	148.82	3.45	205.40	3.95	274.75
09LIFF00559!	2.92	149.02	3.25	205.68	3.69	275.03



IMPORTANT USER NOTE:
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Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- AFA Extents
- Node Point
- Node ID



09LIFF00695
09LIFF00682
09BELL00033!
09LIFF00650
09LIFF00621
09LIFF00612
09BELL00009
09LIFF00559!

Lucan to Chapelizod model upstream of this point.

FINAL

REV:	NOTE:	DATE:
01	Amendments to Flood Extents.	05/12/16



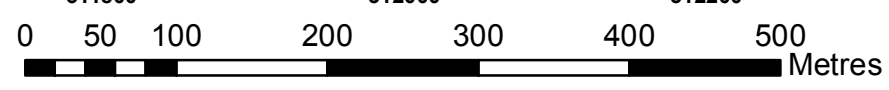
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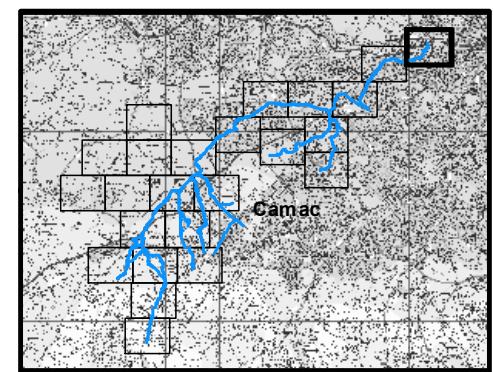
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Map:	
Liffey Fluvial Flood Extents	
Map Type: EXTENT	
Source: FLUVIAL	
Map Area: HPW	
Scenario: CURRENT	
Drawn By : C.C.	Date : 9 May 2017
Checked By : A.S.	Date : 9 May 2017
Approved By : S.P.	Date : 9 May 2017

Drawing No. :
E09LIF_EXFCD_F1_01
Map Series : Page 1 of 8
Drawing Scale : 1:5,000 @ A3



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09Camm00084	6.88	N/A	7.68	N/A	8.49	N/A
09Camm000271	3.29	32.00	4.37	50.7	6.09	88.70
09Camm00125	9.61	N/A	10.18	N/A	10.93	N/A



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Embankment
 - Wall
 - Defended Area
 - 1% AEP Standard of Protection of Flood Defence (Walls / Embankments)
 - 0.1% AEP Standard of Protection of Flood Defence (Walls / Embankments)
 - Node Point
 - Node ID Node Label

FINAL

REV: 01	NOTE: SOP label updated (Pg 21) Removal of Def. Area (Pg 21)	DATE: 13/11/2017
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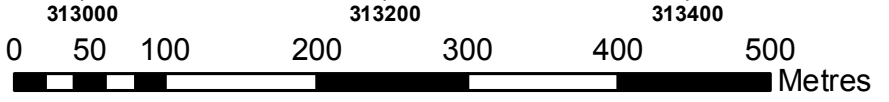


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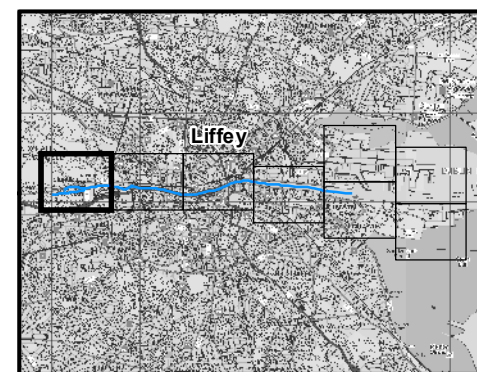
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Map: Camac Fluvial Flood Extents
Map Type: EXTENT
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By: C.McG. Date: 13 November 2017
Checked By: A.S. Date: 13 November 2017
Approved By: S.P. Date: 13 November 2017
Drawing No.: E09CAM_EXFCD_F1_24
Map Series: Page 24 of 24
Drawing Scale: 1:5,000 @A3



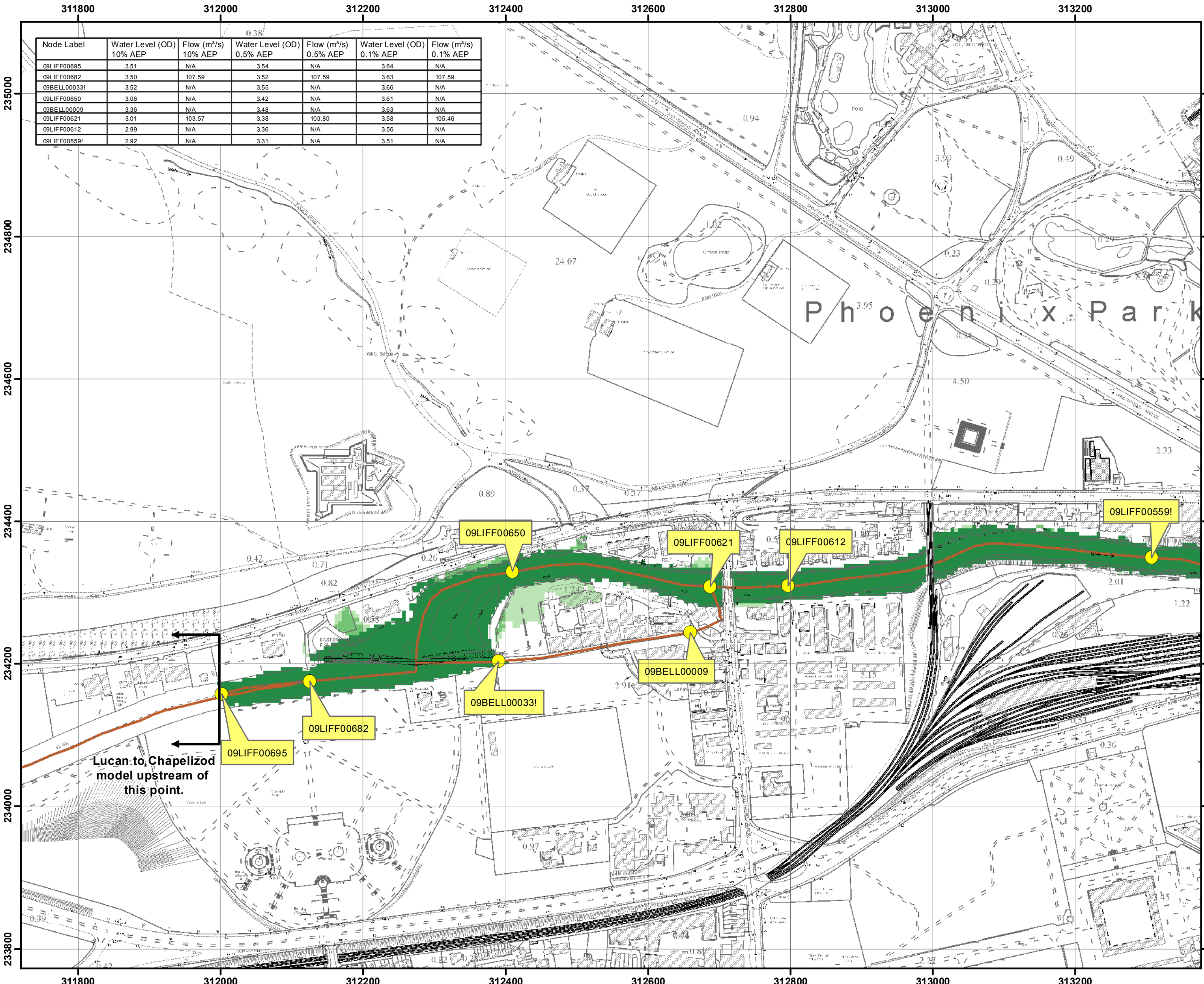
Node Label	Water Level (OD)		Flow (m ³ /s)		Water Level (OD)		Flow (m ³ /s)	
	10% AEP	0.5% AEP	10% AEP	0.5% AEP	0.5% AEP	0.1% AEP	0.5% AEP	0.1% AEP
09LIFF00695	3.51	N/A	3.54	N/A	3.64	N/A	N/A	N/A
09LIFF00682	3.50	107.59	3.52	107.59	3.63	107.59	N/A	N/A
09BELL00033!	3.52	N/A	3.55	N/A	3.66	N/A	N/A	N/A
09LIFF00650	3.06	N/A	3.42	N/A	3.61	N/A	N/A	N/A
09BELL00009	3.36	N/A	3.48	N/A	3.63	N/A	N/A	N/A
09LIFF00621	3.01	103.57	3.38	103.80	3.58	105.46	N/A	N/A
09LIFF00612	2.99	N/A	3.36	N/A	3.56	N/A	N/A	N/A
09LIFF00559!	2.92	N/A	3.31	N/A	3.51	N/A	N/A	N/A



IMPORTANT USER NOTE:
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Legend

- 10% Tidal AEP Event
- 0.5% Tidal AEP Event
- 0.1% Tidal AEP Event
- Modelled River Centreline
- AFA Extents
- Node Point
- Node ID Node Label



FINAL

REV:	NOTE:	DATE:
01	Amendments to Flood Extents.	05/12/16

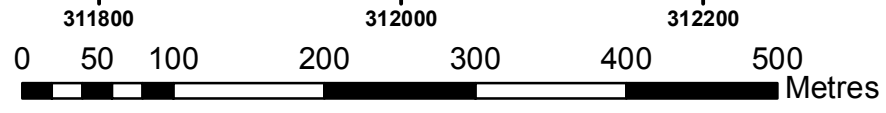


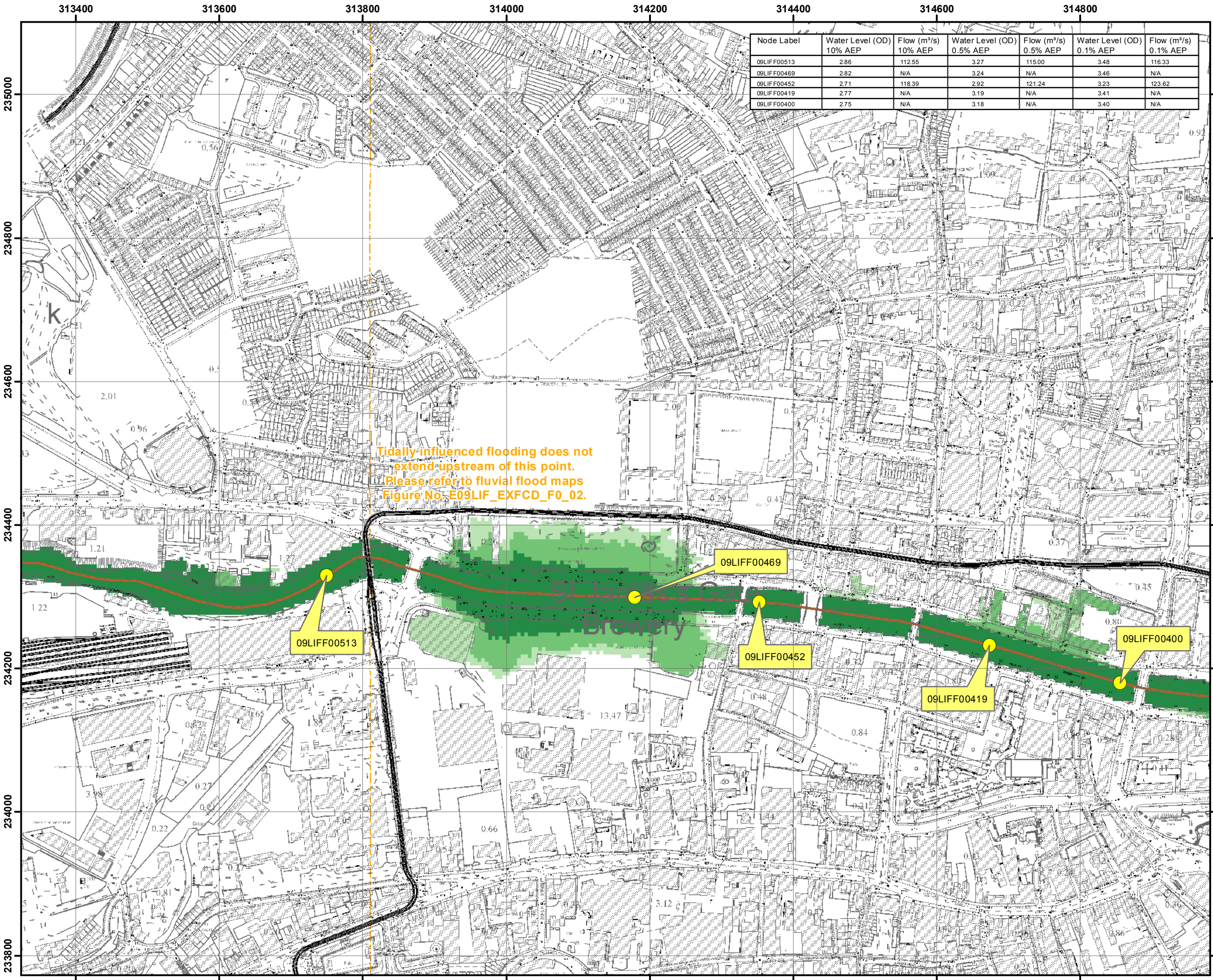
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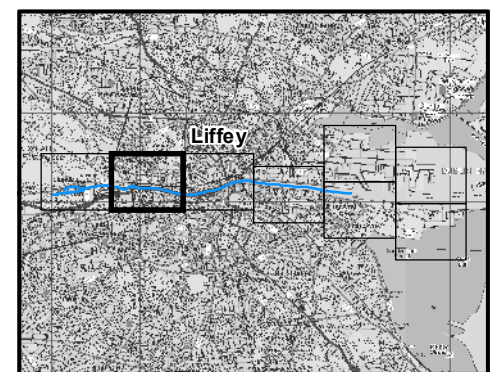
Map:	Liffey Tidal Flood Extents
Map Type:	EXTENT
Source:	TIDAL
Map Area:	COASTAL
Scenario:	CURRENT
Drawn By:	C.C. Date : 9 May 2017
Checked By:	A.S. Date : 9 May 2017
Approved By:	S.P. Date : 9 May 2017
Drawing No.:	E09LIF_EXCCD_F1_01
Map Series:	Page 1 of 8
Drawing Scale:	1:5,000 @ A3





Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 0.5% AEP	Flow (m³/s) 0.5% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09LIFF00513	2.86	112.55	3.27	115.00	3.48	116.33
09LIFF00469	2.82	N/A	3.24	N/A	3.46	N/A
09LIFF00452	2.71	118.39	2.92	121.24	3.23	123.62
09LIF F00419	2.77	N/A	3.19	N/A	3.41	N/A
09LIFF00400	2.75	N/A	3.18	N/A	3.40	N/A

Tidally influenced flooding does not extend upstream of this point. Please refer to fluvial flood maps Figure No. E09LIF_EXFCD_F0_02.



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Tidal AEP Event
- 0.5% Tidal AEP Event
- 0.1% Tidal AEP Event
- Modelled River Centreline
- AFA Extents
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:
01	Amendments to Flood Extents.	05/12/16



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Map: Liffey Tidal Flood Extents
Map Type: EXTENT
Source: TIDAL
Map Area: COASTAL
Scenario: CURRENT
Drawn By: C.C. Date: 9 May 2017
Checked By: A.S. Date: 9 May 2017
Approved By: S.P. Date: 9 May 2017
Drawing No.: E09LIF_EXCCD_F1_02
Map Series: Page 2 of 8
Drawing Scale: 1:5,000 @ A3

