Our Case Number: ABP-317679-23

An Bord Pleanála

Development Application Unit
C/O The Manager
Government Offices
Newtown Road
Wexford
Co. Wexford
Y35 AP90

Date: 05 October 2023

Re: Ringsend to City Centre Core Bus Corridor Scheme.
Ringsend to City Centre, Co. Dublin.

Dear Sir / Madam,

An Bord Pleanála has received your recent submission in relation to the above-mentioned proposed road development and will take it into consideration in its determination of the matter.

Please note that the proposed road development shall not be carried out unless the Board has approved it or approved it with modifications.

The Board has also received an application for confirmation of a compulsory purchase order which relates to this proposed road development. The Board has absolute discretion to hold an oral hearing in respect of any application before it, in accordance with section 218 of the Planning and Development Act 2000, as amended. Accordingly, the Board will inform you in due course on this matter.The Board shall also make a decision on both applications at the same time.

If you have any queries in relation to this matter please contact the undersigned officer of the Board at laps@pleanala.ie

Please quote the above-mentioned An Bord Pleanála reference number in any correspondence or telephone contact with the Board.

Yours faithfully,

pp HL

Niamh Thornton
Executive Officer
Direct Line: 01-8737247

HA02A

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Facs	**Fax**	(01) 872 2684
Láithreán Gréasáin	**Website**	www.pleanala.ie
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64 Sráid Maoilbhríde
Baile Átha Cliath 1
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64 Marlborough Street
Dublin 1
D01 V902

Lauren Griffin

From: Lauren Griffin
Sent: Wednesday 4 October 2023 16:35
To: Manager.DAU@npws.gov.ie
Subject: RE: ABP-317679-23

Good evening Diarmuid,

The Board acknowledges receipt of your email; official acknowledgement of your submission will issue in due course.

Kind Regards,

Lauren Griffin

From: Housing Manager DAU <Manager.DAU@npws.gov.ie>
Sent: Tuesday, October 3, 2023 3:39 PM
To: LAPS <laps@pleanala.ie>
Cc: SIDS <sids@pleanala.ie>
Subject: ABP-317679-23

A Chara,

Please find attached Heritage Related recommendations for the above mentioned SID application.

Also noted for reference attached Appendix for Reference

Regards
Diarmuid

Diarmuid Buttimer
Executive Officer

An Roinn Tithíochta, Rialtais Áitiúil agus Oidhreachta
Department of Housing, Local Government and Heritage
Aonad na nIarratas ar Fhorbairt
Development Applications Unit
Oifigí an Rialtais
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Newtown Road, Wexford, County Wexford, Y35 AP90

—

Diarmuid.Buttimer@npws.gov.ie
Manager.DAU@npws.gov.ie

An Roinn Tithíochta,
Rialtais Áitiúil agus Oidhreachta
Department of Housing,
Local Government and Heritage

Your Ref: **ABP-317679-23**
Our Ref: **SID-DCC-2023-027**

3 October 2023

The Secretary
An Bord Pleanála
64 Marlborough Street
Dublin 1
D01 V902

Via email to laps@pleanala.ie

Re: Notification under the Planning and Development Act, 2000, as amended.

SID Application: National Transport Authority: National Transport Authority: Ringsend to City Centre

A chara

I refer to correspondence in connection with the above. Outlined below are heritage-related observations/recommendations coordinated by the Development Applications Unit under the stated headings

Archaeology

It is noted that the EIAR submitted as part of the planning application incorporates a desk-based Archaeological Impact Assessment which was carried out in relation to the proposed development by Courtney Deery Heritage Consultancy Ltd (EIAR Chapter 15; date July 2023). NMS has reviewed the EIAR and is broadly in agreement with the findings in relation to Archaeology and Cultural Heritage as set out therein.

Therefore, the Department of Housing, Local Government and Heritage advises that the following should be included as a condition of any grant of permission. Note these recommended conditions align with Sample Conditions C5 and C6 as set out in *OPR Practice Note PN03: Planning Conditions* (October 2022), with appropriate site-specific additions/adaptations based on the particular characteristics of this development and informed by the findings of the EIAR.

Archaeological Requirements:

1. All mitigation measures in relation to archaeology and cultural heritage as set out in Chapter 15 of the EIAR (Courtney Deery Heritage Consultancy Ltd; date July 2023) shall be implemented in full, except as may otherwise be required in order to comply with the conditions of this Order.

2. A Project Archaeologist shall be appointed to oversee and advise on all aspects of the scheme from design, through inception to completion.
3. The Construction Environment Management Plan (CEMP) shall include the location of any and all archaeological or cultural heritage constraints relevant to the proposed development as set out in Chapter 15 of the EIAR (Courtney Deery Heritage Consultancy Ltd; date July 2023) and by any subsequent archaeological investigations associated with the project. The CEMP shall clearly describe all identified likely archaeological impacts, both direct and indirect, and all mitigation measures to be employed to protect the archaeological or cultural heritage environment during all phases of site preparation and construction activity.
4. The planning authority and the Department shall be furnished with a final archaeological report describing the results of all archaeological monitoring and any archaeological investigative work/excavation required, following the completion of all archaeological work on site and any necessary post-excavation specialist analysis. All resulting and associated archaeological costs shall be borne by the developer.

Reason: To ensure the continued preservation (either *in situ* or by record) of places, caves, sites, features or other objects of archaeological interest.

Nature Conservation

Having considered the documentation supporting this application, and in particular the Environmental Impact Assessment Report (EIAR), the Department's main concern from a nature conservation perspective is the potential adverse effects the proposed development may have on otter during its construction and operational phases, and particularly on otter movements between the Liffey Estuary and Royal and Grand Canals. Mitigation measures to be incorporated into an Otter Conservation Plan are therefore suggested. Also in view of the apparent recent decline in the numbers of black guillemots nesting in the stretch of the Liffey Estuary between the Matt Talbot and Tom Clarke (East Link) Bridges, the Department considers it would be very desirable that as a biodiversity enhancement measure to be undertaken as part of the presently proposed project, black guillemot nest boxes should be installed in a stretch of the Liffey quays walls.

In the EIAR it is reported that while several sightings of otter were made during survey work undertaken in relation to the present project application, a dedicated survey in respect of the proposed River Dodder Public Transport Bridge (DPTOB) did not record any otter activity. It also notes that while an active otter holt had been identified in the quay wall at the pontoon serving the MV Cill Áirne Boat Restaurant immediately adjacent to the presently proposed scheme during an otter survey carried out for Dublin City Council by Macklin et al. in 2019, no evidence of otters was recorded within this holt when it was monitored on a fortnightly basis from October 2020 to April 2021 (though spraint was found on the pontoon).

However, otter spraint has been recorded for over ten years during irregular inspections by a staff member of the National Parks and Wildlife Service (NPWS) of this Department at the

head of the steps at the end of Sir John Rogerson's Quay immediately beside the site of the eastern end of the DPTOB. Most recently spraint was recorded at this location on the 11th of August and 29th of September 2023. Also an otter survey undertaken on behalf of Dublin City Council by Triturus Environmental Ltd. in January 2022 of the Royal Canal from Blanchardstown to the Liffey in connection with the proposed Royal Canal Greenway (a copy of which is attached as an Appendix to this submission) found the holt by the MV Cill Áirne to be active and identified three otter spraint sites as well in and around Spencer Dock, Another otter survey was carried out by Triturus in April 2022 of the Liffey-Dodder confluence to the Samuel Beckett Bridge and the Grand Canal Basin as a basis for the drawing up of an Otter Conservation Plan in connection with works by Waterways Ireland on the lock gates between the basin and the Liffey-Dodder confluence (the Conservation Plan is attached as a second Appendix to this submission). During this survey the holt by the MV Cill Áirne was also considered active and spraint was recorded at a number of places along the Liffey Estuary channel adjacent to the site of the currently proposed project including at the end of Sir John Rogerson's Quay. A second active otter holt was in addition identified circa 200 m east of the proposed DPTOB site in the rear private garden of the former Grand Canal Basin Master's House, accessed by otters up steps from the Dodder near the entrance to the Grand Canal Basin.

As referred to in the EIAR and also in the Natura Impact Statement (NIS) supporting the present application, otter is included in Annex II as well as Annex IV of the Habitats Directive (92/43/EEC) and these supporting documents consider the site of the project is potentially within the home range of male otter (via the Dodder) associated with the Wicklow Mountains Special Area of Conservation (SAC) for which the otter is a Qualifying Interest (QI). Otters survived in Dublin as in most of Ireland throughout the 20th century decline of the species in other European countries and to facilitate their continued presence in the city, and the connectivity of this population with other otter populations, it is important to maintain access to the Dodder, Royal Canal and Grand Canal from the Liffey. As reported in the Triturus survey of the Royal Canal, passage of otters between Spencer Dock forming the lowest level of the Royal Canal and the Liffey can only be possible when the tidal gates at the mouth of the dock are closed by their movement across road and quay (presumably at night). The proposed removal aside of the Scherser rolling lift bridges across the entrance of Spencer Dock to be replaced by a new road bridge as part of the presently proposed project would therefore potentially block off otter movements between the Liffey and Spencer Dock and the Royal Canal. A safer route for otter movements between the Liffey and Spencer Dock than the present situation could be provided by the modification of the mesh trash screen on the tidal gates into the docks as suggested on page 21 of the Triturus Royal Canal Otter Survey Report.

Though the construction of the DPTOB as part of the currently proposed project would potentially be a considerably lesser threat to the movement of otter, it will also be important to maintain routes for the free passage of otters between the Liffey, Dodder and the Grand Canal Basin as well as the holt to the rear of the former Grand Canal Basin Master's House during the construction of this bridge. From the evidence of spraint deposited at their head it

would appear that otters are mainly accessing the Grand Canal Basin from the Liffey-Dodder confluence by the steps up to Britain Quay to the west of the proposed DPTOB site.

Separately of any permission that may be granted by the Board in response to the present application, for any works to be carried out as part of the proposed project in the vicinity of the active holt near the MV Cill Áirne it will be necessary for the applicant to obtain a licence to derogate from the Habitats Directive from the NPWS of this Department to undertake such works.

The black guillemot, a species Amber Listed and considered a species of conservation concern listed in 'Birds of Conservation Concern in Ireland 2020-2026 by Gilbert et al. (2021) as referenced in the EIAR, has nested along the quay walls along the Liffey Estuary for approximately the last twenty years. As also noted in the EIAR the population of black guillemots nesting along the Liffey Estuary has been surveyed for the Dublin Port Company annually since 2013, and these surveys show that the number of black guillemot nests in the section of the Liffey between the Matt Talbot Memorial Bridge and the Tom Clarke East Link Bridge peaked at 14 in 2014 before declining to 3 nests in 2019. Only a single nesting pair was recorded in the surveys carried out in connection with the present project application. Much of the decline of the nesting black guillemot population in this part of the estuary is attributable to the disappearance of a colony of these birds nesting in the Liffey north quay wall below where it is proposed to construct the Custom House Quay Boardwalk as part of the presently proposed project. Circa five pairs of black guillemots, possibly more, were nesting in this section of quay wall around 2014-2014, but nesting had ceased here completely by around 2021, most likely due to the extension of pontoons and increased disturbance in this area, and possible also due to the removal of holes in the quay walls where the birds nested. As a biodiversity enhancement measure and to bring back nesting black guillemots to this stretch of the Liffey the Department considers it would be desirable to install ten permanent black guillemot nest boxes in the section of the Liffey north quay wall next downstream to the section of the quay wall where it is proposed to install the Custom House Quay Boardwalk.

Recommendations

In the light of the above the Department recommends that any planning permission granted in response to the present SID application should be subject to the following conditions:

1. That prior to the commencement of works on this project the applicant shall submit to the planning authority for its written agreement an Otter Conservation Plan to include measures to maintain the presence of otter in the vicinity of the proposed development project and particularly preserve routes for the movement of otter in the course of works on this project and subsequently between the River Liffey Estuary and Spencer Dock and the Royal Canal and between the Liffey-Dodder confluence and the Grand Canal Basin. The plan shall also set out measures to minimise disturbance to otter breeding and resting places during the project's construction

phase and include the provision of artificial holts to form new refuges for this species to compensate for the increased human disturbance of otter likely during the development's operational phase, and set out a program for the monitoring by otter specialists of the presence of otter in nearby sections of the Liffey Estuary, the River Dodder, the Royal Canal and Grand Canal Basin before, during and after the proposed works.

Reason: To conserve a species, namely otter, which is subject to a system of strict protection under the Habitats Directive (92/43/EEC) and is a QI species for the Wicklow Mountains SAC, which is potentially in the home range of male otter occurring in the vicinity of the proposed project.

2. That prior to the commencement works on the proposed project the design and location of permanent black guillemot nest boxes to be installed in its vicinity shall be submitted to the planning authority for its written agreement, these proposals to include the installation of ten such nest boxes in the north wall of the Liffey quays downstream of the proposed Custom House Quay Boardwalk.

Reason: To enhance local biodiversity by providing nest sites for a species of conservation concern, namely the black guillemot, which has recently declined as a nesting species in the section of the Liffey Estuary adjacent to the site of the proposed project.

Attached Apendix on the Grand Canal Basin Management Plan included

You are requested to send any further communications to this Department's Development Applications Unit (DAU) at manager.dau@npws.gov.ie :

Is mise le meas,

Diarmuid Buttimer
Development Applications Unit
Administration

Grand Canal Basin Otter Survey and Otter Conservation Management Plan

Prepared by Triturus Environmental Ltd. for Waterways Ireland

October 2022

Please cite as:

Triturus (2022). Grand Canal Basin otter survey and conservation management plan. Report prepared by Triturus Environmental Ltd. for Waterways Ireland. October 2022.

Table of contents

1. Introduction

1.1 Project background

Triturus Environmental Ltd. were commissioned by Waterways Ireland to undertake an otter (*Lutra lutra*) survey and Otter Conservation Management Plan for the species in the Grand Canal Basin (Grand Canal Dock) in Ringsend, Dublin City. The study area also included the adjoining habitats in the estuaries of the River Dodder and Liffey (**Figure 2.1**). The baseline survey identified the most important areas for otters in the vicinity of the proposed works. This was based on an assessments of sign distribution in addition to observations on general aquatic and fisheries habitats. The distribution of otter signs acted as an indicator regarding areas of canal and aquatic habitat used by otters, inclusive of potential breeding and resting areas (i.e. holts and couches). Notably the plan was also required considering proposed restoration and upgrade works to Camden Lock, which separates Grand Canal Basin from the River Liffey estuary as part of a planning decision order (see project planning context below). It would also deliver management and conservation recommendations for otter in the wider context of the Grand Canal Basin area, which has been highlighted to Waterways Ireland previously by National Parks and Wildlife Service (NPWS).

1.2 Planning context

The areas immediately around the locks (cut stone steps on both sides) are known to be used by otter as key passage routes between the Grand Canal Basin and the Liffey and Dodder (Waterways Ireland and NPWS, pers. comm(s)). Given the known importance of the proposed works area and adjoining habitats for otter, a condition of planning (Decision Order No. P2290, Application No. DSDZ 3781/20 26012021) requires that an Otter Conservation Plan be developed and implemented for the proposed lock upgrade works. The purpose of the plan is "*to protect the aquatic environment and flora and fauna from pollution arising from the proposed works and to ensure the continued presence of a population of a species afforded strict protection under the Habitats Directive (92/43/EEC), namely otter, in the Grand Canal Basin during the course of the proposed development works and into the future*". The condition states, "*That before the commencement of works on site the applicant shall agree a Grand Canal Basin Otter Conservation Plan with the National Parks and Wildlife Service, and DCC Parks, Biodiversity and Landscape Services and submitted for the written agreement of the planning authority*".

1.3 Legislative protection & conservation status

The Eurasian otter (*Lutra lutra*) is a species of conservation concern and high priority having suffered major declines in its range and population throughout Europe since the 1950s. It is classified as 'near threatened' by the IUCN Red List with a decreasing population trend and, as such, is listed in Appendix I of CITES, Appendix II of the Bern Convention (Council of Europe, 1979) and Annexes II and IV of the EC Habitats Directive (92/43/EEC).

Otters, along with their breeding and resting places, are also protected under provisions of the Irish Wildlife Acts 1976-2021. Otters have additional protection because of their inclusion in Annex II and Annex IV of the Habitats Directive 92/43/EEC, which is transposed into Irish law by the European Union (Birds and Natural Habitats) Regulations 2011-2021.

The protection of otters is outlined in Article 51(1) and (2):

Protection of fauna referred to in the First Schedule;

51.(1) *The Minister shall take the requisite measures to establish a system of strict protection for the fauna consisting of the species referred to in Part 1 of the First Schedule.*

51.(2) *Notwithstanding any consent, statutory or otherwise, given to a person by a public authority or held by a person, except in accordance with a license granted by the Minister under Regulation 54, a person who in respect of the species referred to in Part 1 of the First Schedule (listed below). Items (b) and (d) may be considered most relevant to developments.*

- ***(a)*** *deliberately captures or kills any specimen of these species in the wild,*
- ***(b)*** *deliberately disturbs these species particularly during the period of breeding, rearing, hibernation and migration,*
- ***(c)*** *deliberately takes or destroys eggs of those species from the wild,*
- ***(d)*** *damages or destroys a breeding site or resting place of such an animal, or*
- ***(e)*** *keeps, transports, sells, exchanges, offers for sale or offers for exchange any specimen of these species taken in the wild, other than those taken legally as referred to in Article 12(2) of the Habitats Directive, shall be guilty of an offence.*

According to the NPWS (2021), *'it should also be noted that in the case of Regulation 51(d) any action resulting in damage to, or destruction of, a breeding or resting place of an animal may constitute an offence unless a derogation licence has been granted and this action does not need to be deliberate'*. Furthermore, *'breeding and resting places are protected even when the animals are not using them, once there is a high probability that they will return'* (CJEU Case C-477/19) (NPWS, 2021). Regulation 51(d) therefore places a strict responsibility of due diligence on anyone proposing to carry out an 'action or project' that can 'damage or destroy' the breeding place of Annex IV species.

In an Irish context, according to the most recent Article 17 reporting (NPWS, 2019), otter conservation status has improved, with the species now evaluated as being of 'Favourable' conservation status. Otters were considered to be previously 'Near Threatened' (Marnell, 2009) based on a 20-25% decline between 1980 and 2005 (Bailey & Rochford, 2006). However, the current conservation status is now of 'Least Concern' (Marnell et al., 2019).

1.4 Biodiversity policy within Dublin City

The Draft Dublin City Biodiversity Action Plan 2021-2025 (DCC, 2021) is the third such plan produced by Dublin City Council and follows on from the 2015-2020 and 2008-2012 plans. The Draft Biodiversity Action Plan (BAP) is based on 18 no. objectives across six themes that focus the outcomes for biodiversity conservation required across the city.

The Draft BAP specifies a number of actions specific to otter management and conservation. In this respect, the current report and associated management recommendations will help to achieve the following actions and meet the core objectives of the BAP;

- **Action 4.7:** Implement the recommendations of the Dublin City Otter Survey (Macklin et al., 2019)
- **Action 4.8:** Update the Dublin City Otter Survey (Macklin et al., 2019) and expand to include Dublin canals

Furthermore, the following actions are also of relevance to otter and their achievement will be assisted through this current survey and subsequent management recommendations;

- **Action 8.2:** Develop and implement river restoration measures for all rivers in Dublin City, including continuing measures for the River Tolka and new initiatives for the Santry and Camac Rivers
- **Action 8.3:** Gather evidence-based data and develop a wildlife corridors strategy for Dublin
- **Action 8.5:** Implement measures to support migratory fish and their life cycles, particularly Atlantic salmon, eel, and lamprey
- **Action 11.4:** To incorporate Inland Fisheries Ireland's guidance on Planning for Watercourses in the Urban Environment into plans and projects

1.5 Study area description

The Grand Canal Basin covers a total surface area of c. 9ha, inclusive of Grand Canal Dock (inner basin) and the two remaining derelict graving docks on the eastern side of the main basin. The Grand Canal is some 130km long and links the River Liffey in Dublin City with the River Shannon in Co. Offaly. The canal flows westwards from Dublin. Though originally constructed for transport of goods (work was completed in 1804), the Grand Canal was closed to typical navigation in 1960. The present-day canal serves as a highly valuable recreational amenity site and regionally-important ecological corridor. The entire length of the Grand Canal is designated as a proposed Natural Heritage Area (pNHA) (site code: 002104) (NPWS, 1995).

The Grand Canal is known to support a range of fish species including pike (*Esox lucius*), perch (*Perca fluviatilis*), roach (*Rutilus rutilus*), rudd (*Scardinius erythropthalmus*), bream (*Abramis brama*), roach x bream hybrids, common carp (*Cyprinus carpio*), three-spined stickleback (*Gasterosteus aculeatus*), tench (*Tinca tinca*) and European eel (*Anguilla anguilla*) (McLoone, 2011; Tierney et al., 1999). These provide a good prey resource for otter. Isolated populations of brook lamprey (*Lampetra planeri*) are also known from the Grand Canal (e.g. 7th lock, Caffrey et al., 2006; 5th lock, MKO, 2019). The Grand Canal Basin, effectively separated from the main line of the Grand Canal via a series of locks, is known to support a range of fish species including roach, perch and European eel (Des Chew, IFI, pers. comm.). Annex II white-clawed crayfish (*Austropotamobius pallipes*), a valuable prey item of otters, are known from the Grand Canal but no records are available east of the M50. Otters are widespread along the Grand Canal, including within the Grand Canal Basin and adjoining River Liffey and River Dodder estuaries (Macklin et al., 2019; Eco Serve, 2011; NPWS & NBDC data).

The Grand Canal Basin (Liffey and Dublin Bay) (river waterbody code: IE_09_AWB_GCB) was of moderate WFD status in the 2013-2018 period and is considered 'at risk' of not achieving good ecological status. In contrast, the Grand Canal Main Line (Liffey and Dublin Bay) (IE_09_AWB_GCMLE) was of good WFD status in the same period and is considered 'not at risk' of achieving good ecological status. In terms of adjoining habitats, the Liffey Estuary Lower (transitional waterbody) was of good

WFD status in the 2013-2018 period, with the transitional waterbodies risk currently under review. The adjoining tidal reaches of the River Dodder (river waterbody Dodder_050) was of moderate WFD status in the 2013-2018 period and is considered 'at risk' of not achieving good ecological status.

2. Methodology

2.1 Desktop review of otter records

A desktop review of published and unpublished data for the Grand Canal and connected habitats (e.g. River Liffey and River Dodder estuaries) was undertaken in respect of otter. Data pertaining to otters held by the National Biodiversity Data Centre (NBDC) was also reviewed.

2.2 Otter sign surveys

Walkover and boat-based otter surveys of the Grand Canal Basin and adjoining habitats were undertaken on Monday 11th April 2022. The survey area comprised the Grand Canal Basin (both inner and outer basins) and approx. 0.5km linear length of the Grand Canal (main line) between McCartney Bridge and the basin (**Figure 2.1**). Additionally, 0.9km of the River Liffey estuary and the lowermost 0.5km of the River Dodder were also surveyed (by boat) (**Figure 2.1**).

The survey was completed during dry, mild, bright and settled conditions, which ensured that a good representation of habitat marked by otter could be recorded in the field, including territorial marking or marking of feeding areas. The survey also deliberately coincided with a prolonged dry period to not only ensure safe site access but also that the extent of otter signs (spraint, smears etc.) washed away due to recent precipitation was minimised.

Each otter sign was logged by type, location (handheld GPS), condition and approximate age for later interpretation to distinguish differences in habitat use and activity. Spraints were subjectively assessed as either fresh (recent), mixed-age (recent and older spraints, typically indicative of a regular sprainting site) or old (spraint breaking down and not recently deposited). Furthermore, indicative counts of spraint (i.e. number of individual spraints) and the number of sprainting sites (often separate clusters in one area) were noted. This helped indicate the frequency of otter marking, which can clarify levels of activity in particular areas, inclusive of breeding (holt) and resting (couch) areas.

2.3 Total corridor otter survey (TCOS) methodology

The survey broadly followed the best practice survey methodology for otter as recommended by Lenton et al. (1980), Chanin (2003) and Bailey & Rochford (2006). However, methodology differed in that the entire waterline was surveyed rather than the standard 500-600m sections from accessible points (e.g. bridges). The novel survey technique, known as a total corridor otter survey (TCOS) (Macklin et al., 2019), encompassed the entire riparian zone and in-channel (boat-based) surveys within the survey area.

Total corridor survey methodology typically involves the use of two (or more) surveyors working independently (in tandem) along each respective bank of an individual watercourse (where practical). This also facilitates one to work from a more elevated position (e.g. bank top) with one surveying (with appropriate PPE such as a dry suit or chest waders) from within the channel/boat, thus greatly increasing the likelihood of otter sign detection. This is especially true of more cryptic signs such as holts that are often located in undercut banks and under tree root systems. These areas are often out of the view of traditional bank-based surveys. Surveyors can alternate between the channel and each

bank depending on surveyor knowledge and experience of preferential areas of habitat likely to be used by otter.

2.4 Biosecurity

A strict biosecurity protocol including the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation.

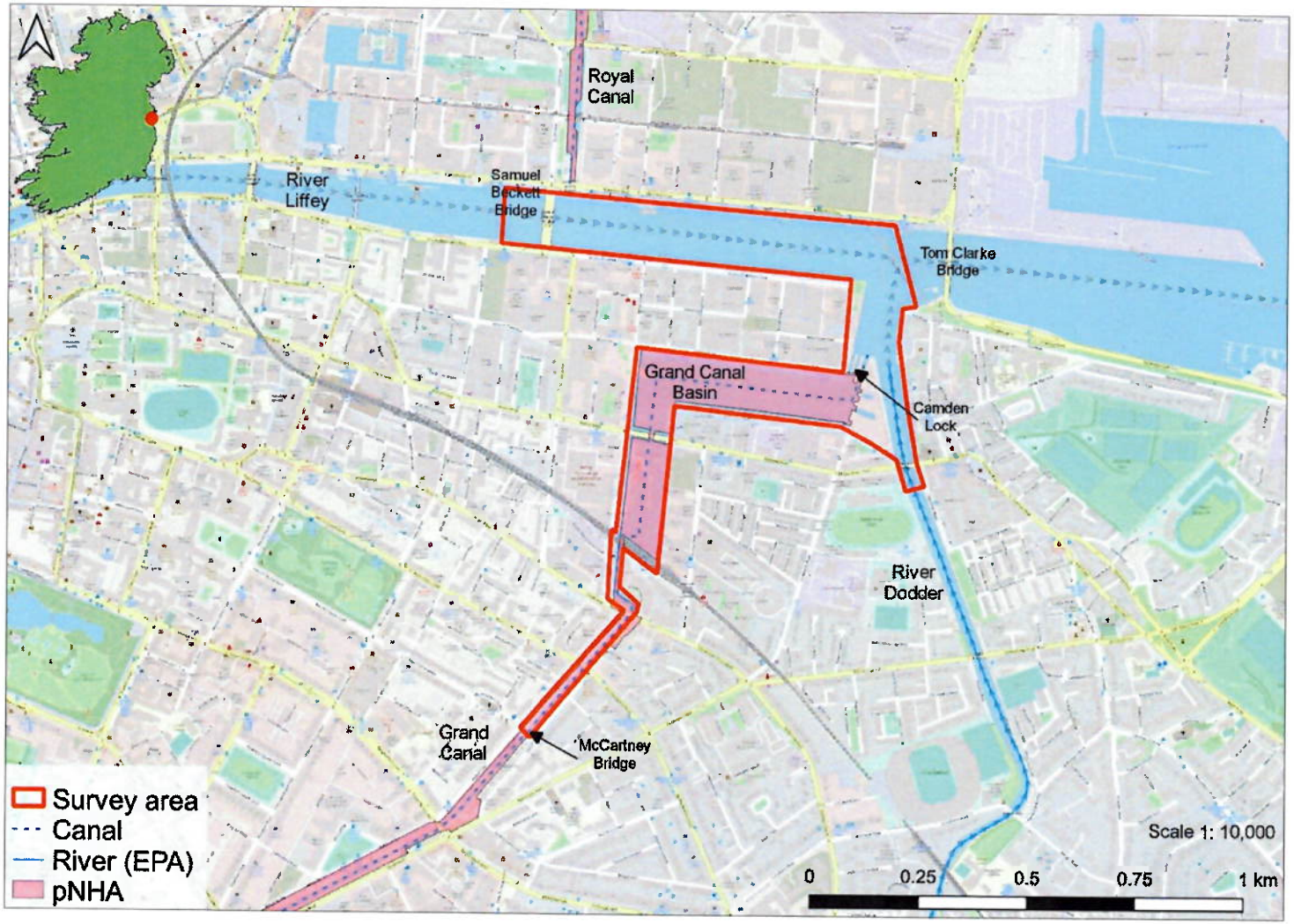

Figure 2.1 Overview of the Grand Canal Basin otter survey area, April 2022

3. Results

3.1 Desktop review of otter records

A desktop review revealed a low number of otter records within and in the vicinity of the survey area. During ecological surveys undertaken in September 2011, an otter spraint was recorded on the eastern bank of the inner Grand Canal Basin (ITM 717354, 733717) (EcoServe, 2011). A live otter sighting was recorded in 2015 in Grand Canal Basin near the Grand Canal Dock rail bridge, with live sighting of two animals also recorded on the River Liffey Estuary at the East Link toll bridge (Tom Clarke Bridge) (NBDC data). A sighting of a live otter with video footage was captured by Nina McGowan during 2020 on the jetty opposite the Coffey/ Jones engineering building in Grand Canal Harbour. No otter signs were recorded in the vicinity of Grand Canal Basin during ecological surveys in 2018 (MKO, 2019). Several regular otter spraint sites and an active holt were previously recorded by Triturus in the River Liffey estuary in the vicinity of the Grand Canal Basin in the 2018-2019 period (Macklin et al., 2019).

3.2 Otter records

A total of *n*=34 otter signs were recorded within the survey area during the current April 2022 survey (**Table 3.1; Figures 3.1 & 3.2; Appendix A**). Site images are presented in **Appendix B**. Signs were well distributed throughout the survey area, with approximately half located within Grand Canal Basin and the other signs identified along the River Liffey (*n*=9 in total) and River Dodder estuaries (*n*=6 in total). Only a low number of signs (*n*=3) were located along the Grand Canal (main line) between the Grand Canal Dock rail bridge and McCartney Bridge.

Spraint sites (*n*=28) accounted for the majority of all signs recorded. A total of *n*=2 active holts were identified during the survey (based on the presence of fresh spraint in the vicinity of the respective entrances). A newly excavated holt (with trail to the River Dodder) was identified in a walled private garden near Camden Lock. A second active holt was located in the quay wall of the River Liffey near the MV Cill Airne (a known holt site; Macklin et al., 2019).

A couch (resting area) was identified under a retaining wall and felled tree along the Grand Canal Circular line Level 1 (GCCL) at Clanwilliam Terrace. A second couch site was also identified in the quay wall near Charlotte's Quay in the Grand Canal Outer Basin. Single examples of (anal) jelly and otter prints were also recorded during the survey.

The April 2022 otter sign database is provided in **Appendix A**, with miscellaneous site images presented in **Appendix B**.

Table 3.1 Summary of the otter signs recorded in the Grand Canal Basin survey area, April 2022

Otter sign	Total no.
Spraint site	28
Holt (active)	2
Couch	2
Jelly	1
Prints	1
Total	**34**

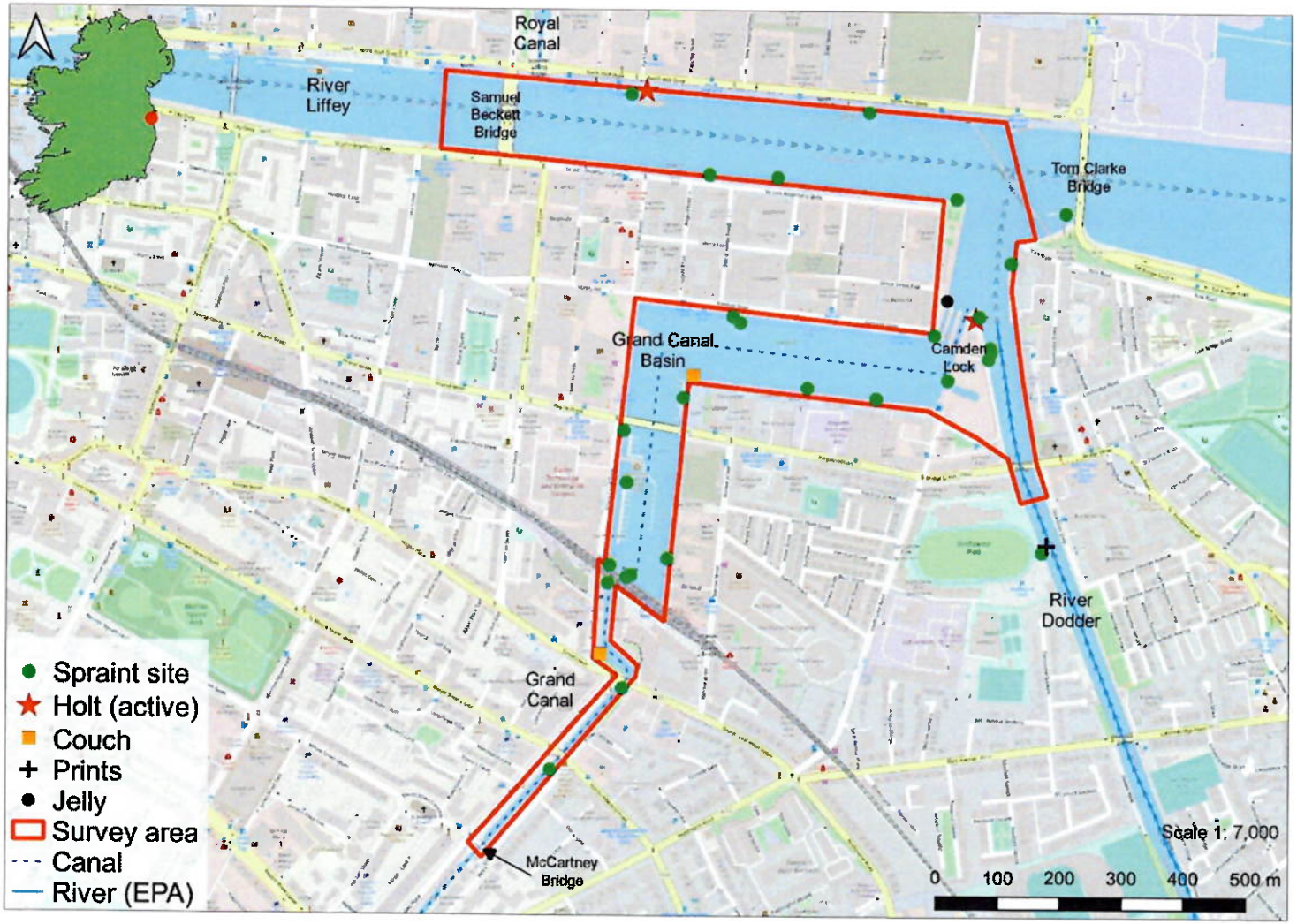

Figure 3.1 Overview of the otter signs recorded within the Grand Canal Basin survey area, April 2022

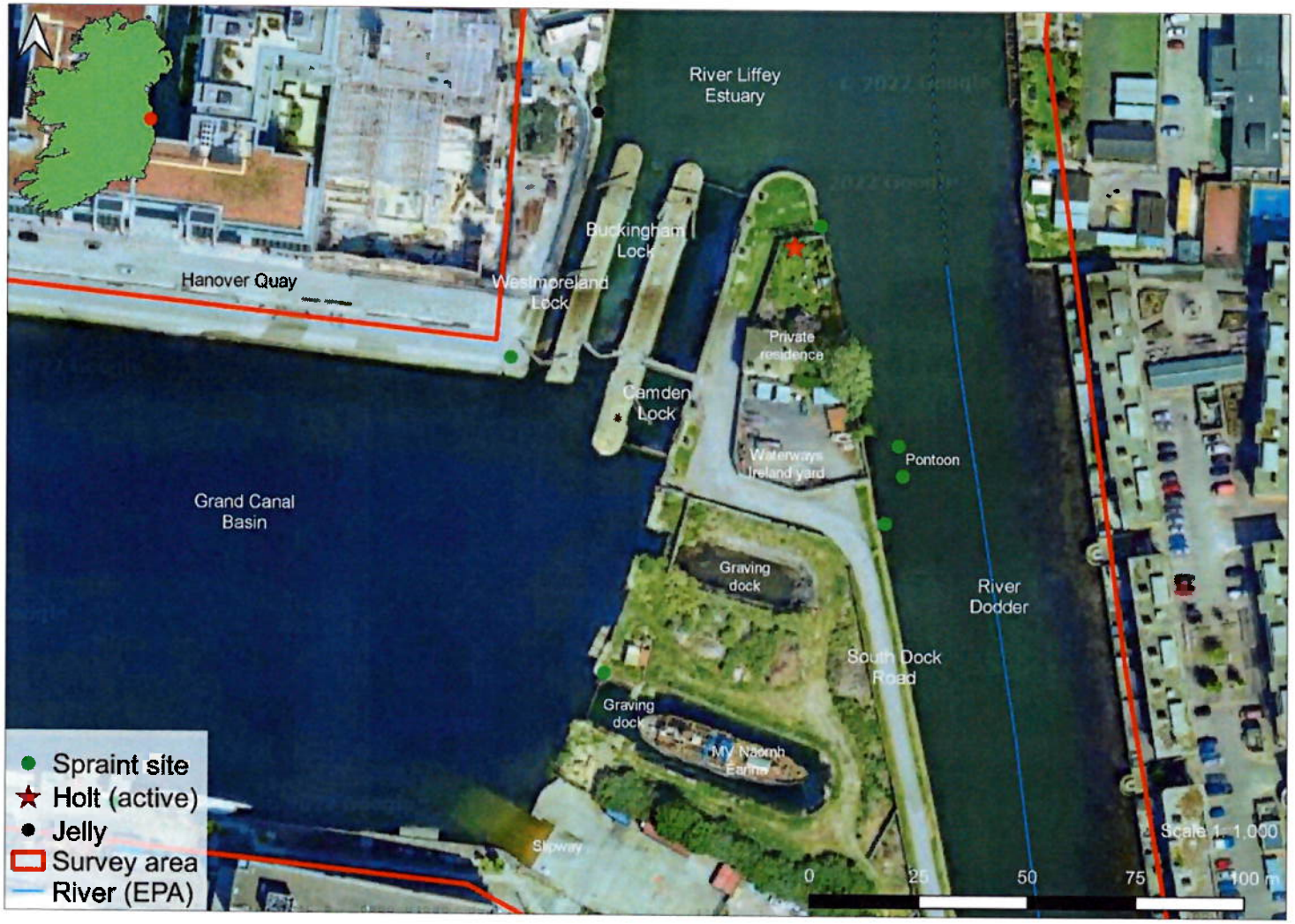

Figure 3.2 Location of otter signs in the immediate vicinity of the proposed Camden Lock works area, April 2022

4. Discussion

Our comprehensive approach, utilising boat-based total corridor otter survey (TCOS) methodology, has facilitated the identification of the most important areas for otters within and adjoining Grand Canal Basin. Evidently, otters utilise Grand Canal Basin as a foraging, commuting and resting area on a regular basis, with an active holt identified in close proximity to the proposed works at Camden Lock.

Overall habitat quality in terms of potential foraging opportunities, water quality and holting prospects appears to play a large role in otter distribution across the wider Dublin City area (Brazier & Macklin, 2020; Macklin et al., 2019). Although contemporary data on prey resources and water quality were beyond the scope of this study, their importance in supporting otter populations are well known. Superficially, those areas of habitat with healthier fish stocks (main prey base for otter) and less anthropogenic pressures appeared to support more regular otter usage, as inferred from sign distribution. The drivers of otter sign distribution are discussed below, with management recommendations for otter preservation and conservation outlined in section 5.

4.1 Otter sign distribution

This survey recorded a total of *n*=34 otter signs within and adjoining Grand Canal Basin **(Appendix A)** and this data significantly improves the knowledge of urban otter along the Grand Canal and connecting habitats.

Signs were well distributed throughout the survey area, with approximately half located within Grand Canal Basin and the other signs identified along the River Liffey estuary (*n*=9 in total), River Dodder estuary (*n*=6) and Grand Canal Circular line[1] (*n*=2). Spraint sites (*n*=28) accounted for the majority of all signs recorded, with a strong marking preference observed with quay steps and mooring pontoons. This marking behaviour was considered a result of the paucity of suitable marking sites within the wider survey area (a common characteristic of urban waterways). Generally, spraint sites were located in those areas of lowest relative disturbance, i.e. poor or no human accessibility, such as bridge ledges, quay steps and mooring pontoons. This was true even in those survey sections which were exposed to high or very high levels of human-related disturbance. Such areas are preferentially marked by otter in urban environments (Macklin et al., 2019; Brazier & Macklin, 2020). The deposition of spraint and other marking behaviour (e.g. scent marking via urination) is known to serve a variety of territorial and communicative functions in otter populations (Sittenthaler et al., 2020; Remonti et al., 2011; Kean et al., 2011; Kruuk, 1992). Sign marking is routinely associated with prominent features such as large instream boulders, tree root systems, bridge ledges, grassy hummocks and holts, as well as at key foraging sites (Almeida et al., 2012). Spraint sites have also been associated with specific tree limbs such as crack willow (*Salix fragilis* agg.) (Macklin and Brazier in prep.). However, when suitable sign marking features be scarce or unavailable, or exposed to high levels of disturbance (such as in Grand Canal Basin and along the Grand Canal Circular line) otter signs will consequently becomes more scarce. This does not imply the absence of otter, rather habitat less appropriate to otter marking but as otter marking has important communicative functions it may have unforeseen ecological implications for local populations. The preservation of quayside steps, pontoons, ledges and areas less accessible to humans are desirable attributes for otter conservation in built up urban areas.

[1] GC Circular Line runs from Suir Road Bridge to Lock 1 Clanwilliam Place

Two active holts were identified during the survey (based on the presence of fresh spraint at or in the vicinity of the respective entrances). A newly excavated holt was identified in a private walled garden (low human disturbance levels) near Camden Lock, adjacent to the proposed works area. A trail was present leading from the holt through a hole in the garden's stone wall to quay steps on the River Dodder. These steps were a regular sprainting site. A second active holt was located in the quay wall of the River Liffey near the MV Cill Airne restaurant. This is a known holt site, recorded during the Dublin City otter survey (Macklin et al., 2019). A couch (resting area) was identified under an overhanging retaining wall and felled tree along the Grand Canal main line at Clanwilliam Terrace. This area had been purported as a holt during previous surveys (Waterways Ireland, pers. comm.). A second couch site (also a very regular spraint site) was also identified on old steps in the quay wall near Charlotte's Quay.

Despite some habitat suitability and good foraging opportunities, there were only a low number of otter signs (*n*=2) recorded between Macquay's Bridge (lock C1) and McCartney Bridge (lock C3) (**Figure 3.1**). This was considered to reflect high levels of human-related disturbance, a paucity of suitable marking sites and barriers to otter passage in this area (see section 4.2).

4.2 Barriers to otter passage

The mapping of otter sign distribution in the vicinity of Grand Canal Basin has illuminated potential issues with otter passage between connecting habitats, notably between the Basin and the Grand Canal main line. Whilst a low number (*n*=2) of otter spraint sites were recorded along the Grand Canal between locks C1 (Macquay's Bridge) and lock C3 (McCartney Bridge), the Lock C1 and C2 structures represent barriers to frequent otter movement given the large difference in water levels between the locks and an absence of associated steps or ledges (see **Plate 4.1**). The presence of these lock barriers to the free passage of otter requires animals to cross footpaths and roadways to circumnavigate the lock structures. Otter ledges/ladders could contribute to improved otter passage in these areas (see Management recommendations below).

Additionally, the triumvirate of canal locks at Westmoreland Lock, Buckingham Lock and Camden Lock (i.e. proposed works area) at the confluence of Grand Canal Basin and the River Liffey Estuary also present restrictions to otter movement (e.g. **Plate 4.2**). However, otter sign distribution in the vicinity would suggest that animals are able to move between Grand Canal Basin and estuarine habitat via a set of quay steps on the River Dodder (next to the old Grand Canal Docks sign) and traversing the open ground immediately east of Camden Lock (near Waterways Ireland yard). There is also opportunity for otters to move between the estuary and Grand Canal Basin via quay steps north of Westmoreland Lock (at Brewdog Outpost Dublin) along Hanover Quay. However, this access route was blocked to otters during the survey due to ongoing construction and associated temporary site fencing (**Plate 4.3**).

Plate 4.1 The Grand Canal at lock C1 (Macquay's Bridge) presents a significant barrier to otter movement given an absence of steps or ledges and a fall of approx. 1.8m

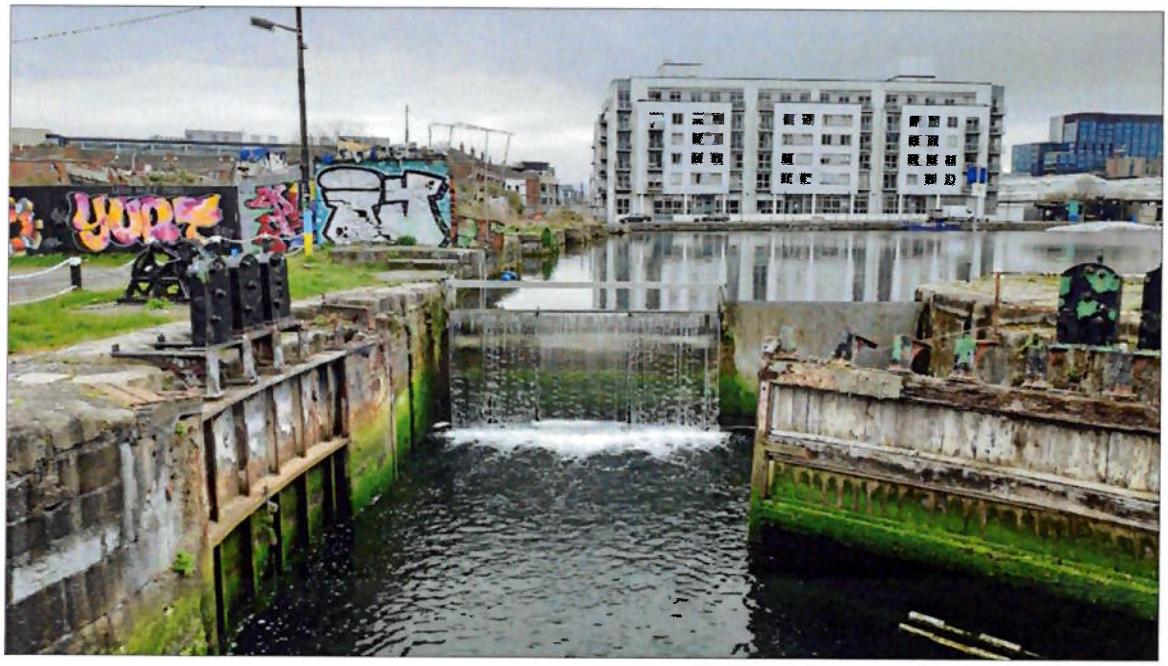

Plate 4.2 The existing Camden Lock structure (with Grand Canal Basin in background) is considered to restrict the free passage of otter at the spill over given a high fall in levels and an absence of steps or ledges. Alternatively, otters are known to use the quayside steps to navigate across land to the Grand Canal Basin.

Plate 4.3 The potential otter commuting route along Westmoreland Lock/Hanover Quay was blocked via temporary construction fencing at the time of survey

Plate 4.4 The quay steps on the River Dodder estuary which appear to be the main commuting/access route for otters moving between estuarine habitat and the Grand Canal Basin

Plate 4.5 Active otter holt identified in private garden adjacent to Camden Lock (with trail leading to hole in the wall)

Plate 4.6 A hole in the wall allows otter passage from the Dodder quay steps to the otter holt located within the private garden adjacent to Camden Lock

5. Management recommendations

5.1 Otter habitat creation (artificial holts)

There are a low number of suitable areas for natural otter holt excavation within the vicinity of Grand Canal Basin and connecting canal and riverine habitats, primarily due to urban encroachment and high levels of human-related disturbance. Therefore, management of the Grand Canal Basin for otter should consider the installation of artificial otter holts (**Plate 5.1**) in suitable areas of lower disturbance habitat. The most optimal location would currently be in the vicinity of the graving docks (east side of the outer Basin) (**Figure 5.1).** However, considerable development plans are in preparation for this area which may render this location unsuitable due to anticipated levels of disturbance. Despite existing suitability for otter breeding and resting areas, and evidence of regular mammal activity in this heavily scrubbed area, no definitive holts or couches (or other mammal dens/setts) were identified in this area during the current survey. Nevertheless, it represents one of the lowest disturbance area in the vicinity of the Basin and proposed works. Otter breeding areas (holts) are especially sensitive to direct human disturbance (Mason & Macdonald, 2009), with otter reproductive success known to be higher in less disturbed habitats; hence their preferential fidelity for low-disturbance areas (Scorpio et al., 2016; Ruiz-Olmo et al., 2011; Loy et at., 2009; Kruuk, 2006).

The concrete platform at the Grand Canal Tunnel stormwater outfall (adjacent to Grand Canal Dock station within the inner Basin) would also be very suitable for artificial holt installation (**Figure 5.1**). On consultation with the NPWS (Terry Doherty, NPWS, pers. comm.) this area was agreed as a good prospective area for artificial holt construction. The area is evidently used as a highly regular sprainting site and, whilst located adjacent to high levels of human disturbance, is inaccessible to humans except via watercraft. Whilst the outfall has been targeted for removal under the proposed Grand Canal Storm Water Outfall Extension Project[2], part of the concrete wall/structure could be retained (**Plate 5.2**). This area could then serve as a sprainting site, a breeding site (artificial holt) and an area of enhanced biodiversity through aquatic planting (as proposed under the North Lotts and Grand Canal Dock SDZ Planning Scheme (Scott Cawley, 2015) (see below). Artificial otter holts should be constructed and installed in conjunction with suitably qualified otter specialists. These could be constructed using the double box structure design of Triturus Environmental Ltd. with natural wood limbs on the roof structure to improve naturalness (**Plate 5.1**) or by using a log holt structure (**Plate 5.3**).

[2]https://www.dublincity.ie/residential/environment/water-and-wastewater/drainage-services/drainage-projects/grand-canal-storm-water-outfall-extension

Plate 5.1 Example of a double-chambered artificial otter holt designed and installed by Triturus Environmental Ltd. on the Glashaboy River, Co. Cork in 2021 (left: box structure, right: natural log roof) Macklin, R. (2022)

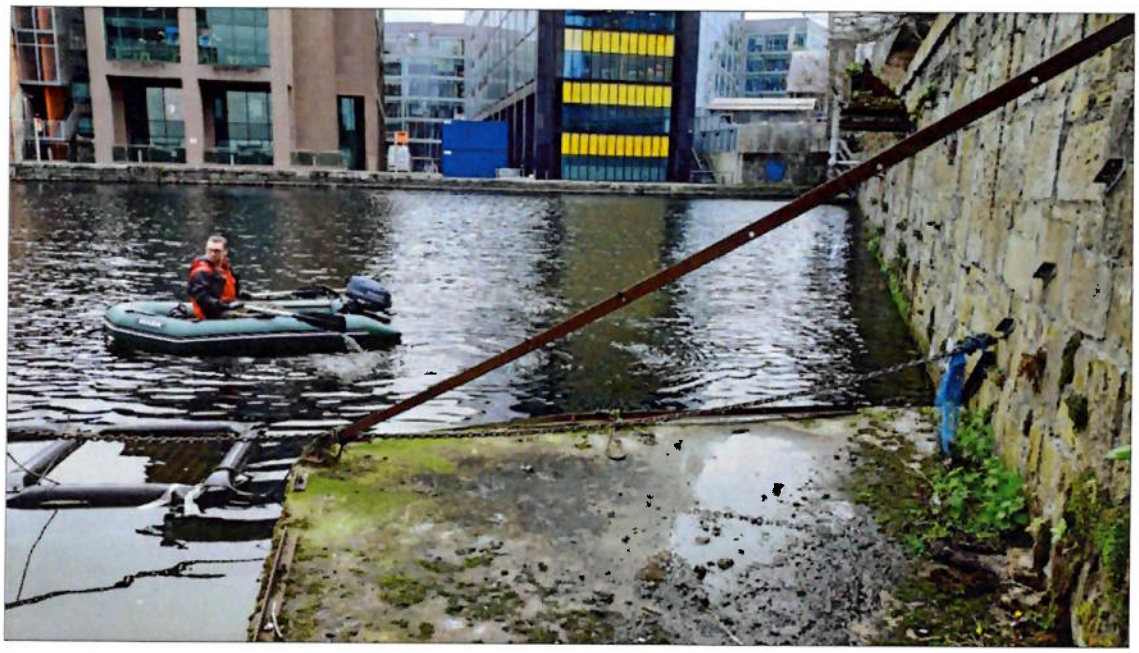

Plate 5.2 The concrete platform at the existing Grand Canal Tunnel discharge outfall could be retained after proposed upgrade works given its use as a regular sprainting site and suitability as an artificial holt site. Note remnants of floating vegetation islands/mats in left foreground.

Plate 5.3 Example of a log holt structure that is used regularly by otter on the Glashaboy River, Macklin, R. (2022)

5.2 Otter habitat enhancement

5.2.1 Riparian planting

Whilst macrophyte (aquatic plant) species such as Nuttall's pondweed (*Elodea nuttallii*), spiked water-milfoil (*Myriophyllum spicatum*) and rigid hornwort (*Ceratophyllum demersum*) are present in the Grand Canal Basin, growth is limited due to prohibitive depths and shading. As proposed under the North Lotts and Grand Canal Dock SDZ Planning Scheme (Scott Cawley, 2015), future management of Grand Canal Basin should incorporate the planting of both macrophytes and terrestrial riparian species such as iris (*Iris psuedacorus*) and purple loosestrife (*Lythrum salicaria*). Due to a paucity of suitable areas (due to urban encroachment, quay walls and deep margins), this would primarily be achieved via the installation of floating planters/islands. However, there are limited areas which would be suitable for direct planting of macrophytes such as yellow water lily (*Nuphar lutea*), reed canary grass (*Phalaris arundinacea*), common reed (*Phragmites australis*) and sedges. Examples of such areas would be the shallow silted margin along Grand Canal Docks station and the margins of the outer Basin adjoining the graving docks (**Figure 5.1**). The planting or selected marginal areas and the installation of floating islands would greatly benefit the overall biodiversity of the Basin and enhance otter foraging opportunities while also providing seclusion and couch (resting) areas. Floating structures and moorings often act as fish attracting devices and thus have both above water and below water benefits. Appropriate harvesting of plants (e.g. reeds) would also help to improve water quality within the Basin through the removal of nutrients. Planting of adjoining estuarine habitats (floating reedbeds) on the River Liffey and River Dodder with suitable species such as sea rush (*Juncus maritimus*) is also recommended (as per Scott Cawley, 2015). The species planted should be tailored according to planting location. Considerations such as light, salinity, nutrients and biodiversity gains are important for the planting mix and as such a site-specific landscaping plan is recommended with input from aquatic and terrestrial botanical specialists. It is acknowledged that previous attempts made by Waterways Ireland to install floating vegetated islands (**Plate 5.2**) failed due to a combination of predation of the vegetation by wildlife and human vandalism. The use of a more robust bespoke plant design affixed to the bed of the canal using anchored recycled plastic boxes with geotextile to support emergent reedbeds in the Inner Basin adjoining the Grand Canal Tunnel outfall would be an optimal location. Here the shallower water and situation away from more heavy boat wash (e.g. as with outer basin) would encourage establishment and longer term survival. Given the high potential net biodiversity benefits of such vegetation features, it its recommended that efforts to successfully establish vegetation islands within the Grand Canal Basin are made again.

5.2.2 Fisheries management (otter prey resources)

Whilst the Grand Canal Basin supports a fish population dominated by coarse fish species such as roach (*Rutilus rutilus*), perch (*Perca fluviatilis*) and pike (*Esox Lucius*), densities of fish are not considered high (Des Chew, IFI, pers. comm.). However, the Basin is known to also support considerable numbers of European eel (*Anguilla anguilla*) which are likely to be a staple food source for otter in this area (Eamonn Horgan, WI pers. comm.) Low coarse fish densities are likely due to limited spawning opportunities (high average depth and lack of suitable substrata), the presence of

invasive zebra mussels[3] (*Dreissena polymorpha*) and also known water quality issues. Therefore, the management and enhancement of fish stocks should be considered in an attempt to improve otter foraging opportunities within the Basin (and to a lesser extent, the adjoining Grand Canal main line). An improvement in fish stocks could be achieved via both supplemental stocking (with suitable fish species and appropriate fish health screening, in conjunction with Inland Fisheries Ireland and the Marine Institute) and fisheries habitat enhancement measures such as the installation of spawning substrata (e.g. riparian planting, vegetated floating islands and perhaps very locally littoral planting). Spawning substrata would help facilitate a self-sustaining fish population while the option of supplementary stocking should also be explored following the augmentation of existing fish spawning opportunities that would also have wider biodiversity gains. Macrophytes and emergent herbaceous vegetation would also attract invertebrates which are also the prey items of otter, birds and bats. This would also serve to improve the recreational value of Grand Canal Basin in terms of its angling value, thus tying in with proposals outlined as part of the North Lotts and Grand Canal Dock SDZ Planning Scheme (Scott Cawley, 2015).

In lieu of targeted (and costly) netting surveys of fish populations, DNA metabarcoding should be repeated every 3 years to clarify the status of fish stocks within the Basin and adjoining canal habitat, given the known importance of such prey resources for otter persistence. Metabarcoding would provide a cost-effective qualitative evaluation of fish diversity and relative abundance based on DNA concentrations in water. Comparative inter annual sampling would help establish changes in fish relative abundance and composition. Otters are food-limited and prey availability is a crucial factor in determining mortality and breeding success (Ruiz-Olmo & Jiménez, 2009; Ruiz-Olmo et al., 2002). Knowledge of the fish prey base would therefore be very important in understanding potential reductions in prey availability overtime.

5.2.3 Water quality

Water quality issues have long been acknowledged in Grand Canal Basin[1,4], with regular microbial contamination noted after heavy rainfall events due to the existing storm water and drainage network design. The Grand Canal Basin (Liffey and Dublin Bay) (river waterbody code: IE_09_AWB_GCB) was of moderate WFD status in the 2013-2018 period, and is considered 'at risk' of not achieving good ecological status. The existing Grand Canal Truck Combined Surface Water (CSO) sewer discharges storm and foul water to the (inner) Grand Canal Basin and has been targeted for upgrade works under the Grand Canal Storm Water Outfall Extension Project. An improvement in water quality would benefit all biodiversity of the Basin, including otter and their prey resources (e.g. fish and macro-invertebrates).

[3] Zebra mussels are invasive bivalve molluscs which filter feed on phytoplankton and zooplankton populations, thus impacting fish recruitment through reduced prey resources

[4] https://dublininquirer.com/2020/06/17/poor-water-quality-in-grand-canal-dock-may-pose-a-health-risk-to-the-public

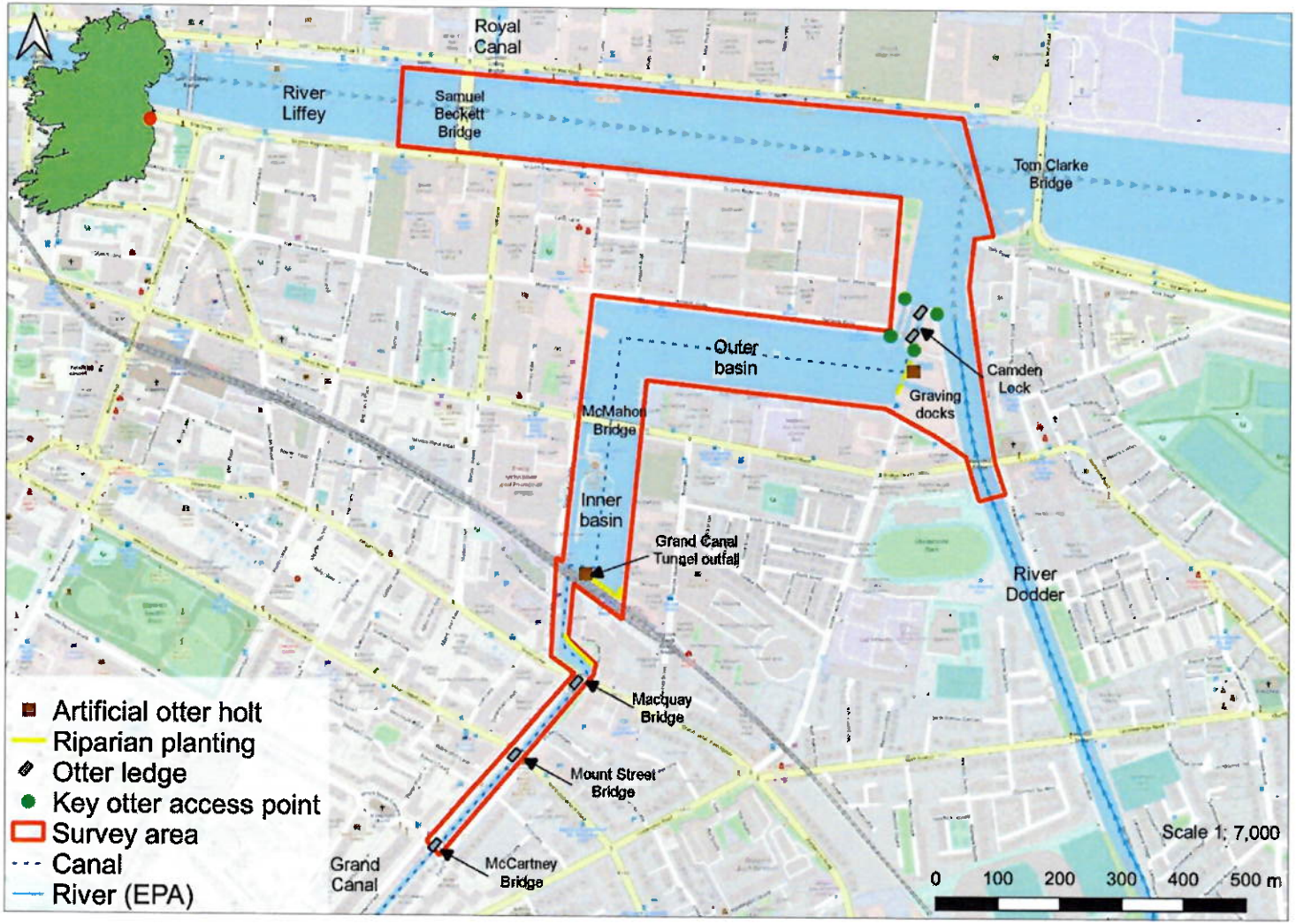

Figure 5.1 Location of recommended otter management measures in the vicinity of Grand Canal Basin

5.3 General mitigation measures to protect otter

The otter data collated during this survey has significantly expanded the knowledge and baseline of the species within and adjoining Grand Canal Basin. The data will inform mitigation measures to protect otters and their habitat in light of the proposed upgrade works to Camden Lock, as well as other future developments in vicinity of the Basin. The management and mitigation measures proposed in this plan should be cognisant of and be implemented in harmony with the North Lotts and Grand Canal Dock SDZ Planning Scheme and other development works, e.g. the proposed Grand Canal Storm Water Outfall Extension Project.

5.3.1 Avoidance of breeding area

Of particular note is the identification of an active otter holt in a private garden adjacent to Camden Lock. Otters, along with their breeding and resting places, are protected under provisions of the Irish Wildlife Acts 1976-2021. Therefore, as proposed works will likely disturb this area (given close proximity), a derogation licence will be required from the National Parks and Wildlife Service (NPWS) in advance of works. The avoidance of undisturbed areas supporting the breeding and resting areas of otters can be achieved by the consideration of alternatives, avoidance by project design (changing the design of a structure to retain areas used by species), altering the way in which activities or works are undertaken and or using appropriate methods or machinery to avoid impacts (NPWS, 2021).

In this regard, temporary fencing of the area between the River Dodder quay steps and the hole in the wall providing access to the identified garden holt adjacent to Camden Lock should be adopted. Fencing should be solid galvanised steel fencing (i.e. not mesh) to ensure better disturbance shielding during works. Furthermore, a fenced-off pathway for otter between this location and Grand Canal Basin Basin should be seriously considered during construction. The same recommendations would also apply to future works and future development plans for the Grand Canal Basin area. Future development and designs for the area should include for protection of this important otter habitat and passage route(s).

5.3.2 Improved otter passage

The key future consideration for otter conservation in the Grand Canal Basin environs should be given to the maintenance of current available otter passage and the provision of improved otter passage along the Grand Canal corridor by way of otter-accessible ledges, steps and or ladders at locks C1, C2, C3 and Camden Lock which currently represent barriers to otters (**Figure 5.1**). Video and photographic evidence of urban Eurasian otters climbing vertical ladders to navigate similar structures is available online[5] (**Plate 5.3**) and thus the installation of a simple rail ladder at each lock (adjoining one of the bottom lock gates) may be sufficient to facilitate improved otter passage, where space constraints exist. However, more traditional passage mitigation measures such as 300-500mm wide bolt-on steel plate or HDPE ledges/shelves would likely prove more effective (e.g. **Plate 5.4, Plate 5.5**), where their installation would not impede watercraft navigation through the lock structure. For example, such a bolt on ledge could be installed (along one side) under Macquay's Bridge (Lock C1), ramping upwards (in a stepped fashion) to the ground adjoining the bottom lock gates without impeding watercraft or

[5] https://www.deadlinenews.co.uk/2021/10/19/adorable-images-show-otter-climbing-up-ladders-in-shetland/

the functionality of the lock. The design and installation of otter passage should be in consultation with otter specialists and follow best practice (e.g. TII, 2015; NIEA, 2011, NRA, 2006; OPW, 2006, Highways Agency, 1999). Channel width restrictions under the bridge(s) in this case may not allow for the installation of a 500m wide ledge as recommended for otter passage in Ireland (NRA, 2006), i.e. a narrower ledge would be required. Available Navigation width to be determined by Waterways Ireland, which will inform the suitability of installing Otter ledges at these locations.

The continuity of aquatic habitats likely favours otter success in a variety of ways (Scorpio et al., 2016). Whilst the heavily-urbanised and disturbed nature of the lower Grand Canal levels invariably have reduced value for otter, such areas do support the species (as inferred by sign marking). Even areas of canal with little inherent value are important to enable lateral and longitudinal otter colonisation, by allowing otters to commute between better habitats along riparian corridors (Van Looy et al., 2014).

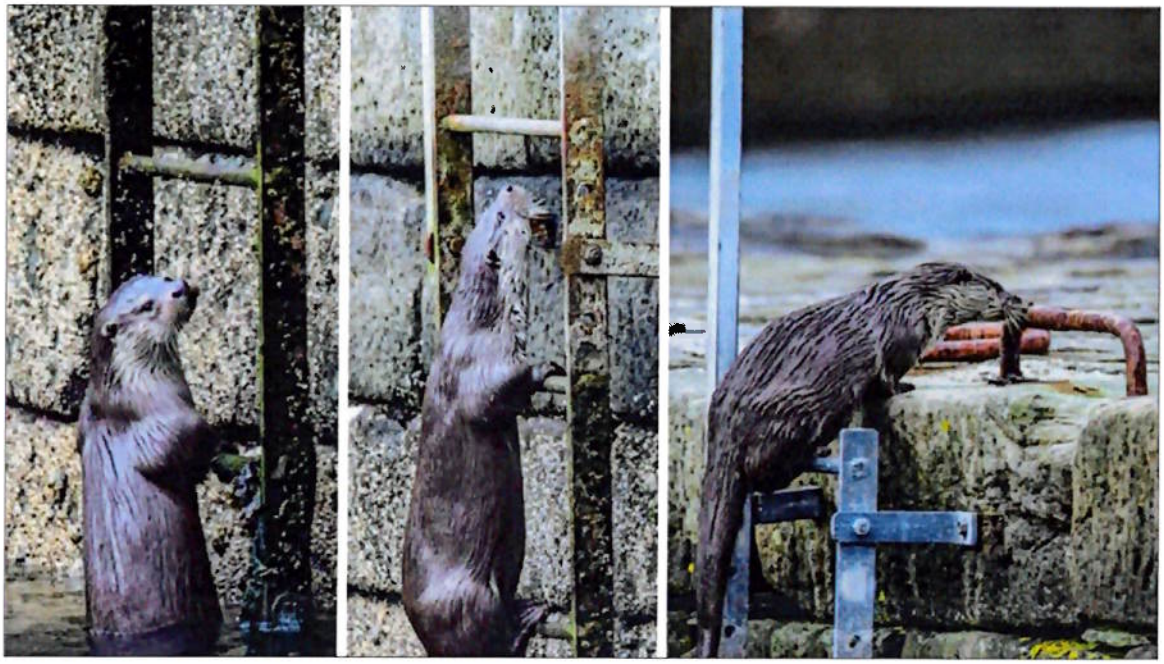

Plate 5.3 Sequence of Eurasian otter climbing a quayside ladder in Scotland (© Gary Buchan/Deadline News)

Plate 5.4 Example of best practice bolt-on steel mammal shelf/ledge for otter passage under culverts (source: Landmarc Environmental Engineering, UK)

Plate 5.5 Another example of bolt-on mammal shelf/ledge for otter passage at a large road culvert (source: Althon, UK)

5.3.3 Maintenance of unrestricted otter passage

Given the height and scale of Westmoreland, Buckingham and Camden locks, a low number of quay side steps (**Figure 5.1**) provide the only access route for otters between Grand Canal basin and adjoining estuarine habitats. These access routes should be maintained with unrestricted access for otters during and after proposed works. Furthermore, pathways between these access points should not be blocked during construction by temporary security fencing (as per Hanover Quay in April 2022; **Plate 4.3**). In the same respect future development within all areas of the wider Grand canal Basin should provide unrestricted access to otter along known commuting routes.

5.3.4 Maintenance of buffer zones & poorer-access areas

Future development should consider the provision of 10m marginal buffer zone of the Grand Canal and Basin as a vital area for otter passage and marking for otter given the identified importance of this riparian corridor in the current study and also in the Dublin City Otter Survey (Macklin et al. 2019). Key stakeholders (i.e. Waterways Ireland, Dublin City Council, NPWS) should be consulted ahead of any development works to mitigate impacts to otter commuting routes and known otter breeding and resting areas.

Poorer access areas (hard to access areas for humans/dogs etc.) should be maintained for otter and development of these areas should be carefully considered given these areas have high value for otter and other protected mammal species such as badger, e.g. graving docks. These areas could be enhanced via native species treeline/hedgerow planting to improve their overall biodiversity value and further restrict human access. Currently these areas are heavily scrubbed over and often support non-native species that could be replaced with species of higher biodiversity value. This approach would also compliment the installation of artificial otter holt(s) in such areas.

5.3.5 Include Grand Canal Basin in future Dublin City otter surveys

A key recommendation of the Dublin City otter survey (Macklin et al., 2019) was to repeat the city-wide survey every 3-5 years. This would help to monitor otter populations and identify new breeding and resting areas over time, ensuring impacts due to development are effectively mitigated. Based on the results of the current survey, it is recommended that the Grand Canal Basin survey area should form part of any repeat city-wide survey effort.

5.3.6 Population genetics study

The Dublin City Otter survey (Macklin et al., 2019) also recommended that a population genetics study be undertaken on otters in the wider Dublin City area. A genetics study will help to clarify the numbers of otters in Dublin City, including Grand Canal Basin. This data would inform management in both canal and riverine watercourses. The completion of such a study would also help to achieve **Action 4.7** and **Action 4.8** (see section 1.3 of this report) of the Draft Dublin City Biodiversity Action Plan 2021-2025 (DCC, 2021). A genetics study should be repeated over time (every 5 years) in an attempt to monitor otter numbers and population demographics and further identify risks to the conservation of the species. This approach would also help to elucidate the efficacy of implemented otter management measures.

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7. Appendix A – otter signs database

Table 6.1 Summary of the *n*=34 otter signs recorded in the Grand Canal Basin survey area, April 2022. Breeding and resting areas highlighted in bold.

Sign ID	Watercourse	Location	Survey section	Sign	Spraint site (no. spraints)	Sign age	Marking feature	Notes	ITM x	ITM y
GCB_001	Grand Canal	Mount Street Bridge/Lock C2		Spraint	1 (2)	Fresh	Lock	Fresh spraint site on top of lock under balance beam, eastern bank	717172	733344
GCB_002	Grand Canal	Macquay's Bridge/Lock C1		Spraint	2 (5)	Mixed	Lock	Regular spraint site on top of lock, downstream side of lock gate, eastern bank	717288	733477
GCB_003	**Grand Canal Basin**	**Clanwilliam Terrace**		**Couch**	**1 (10+)**	**Mixed**	**Bank undercut**	**Couch with regular spraint site under concrete wall undercut where old tree had been removed. Not a holt as had been previously suspected (used by rats only)**	**717252**	**733531**
GCB_004	Grand Canal Basin	Grand Canal Dock station bridge		Spraint	3 (20+)	Mixed	Bridge	Regular spraint site on southern extent of same bridge ledge	717264	733647
GCB_005	Grand Canal Basin	Grand Canal Dock station bridge		Spraint	6 (20+)	Mixed	Bridge	Very regular spraint site with multiple piles on ledge under northern extent of bridge	717267	733676
GCB_006	Grand Canal Basin	Grand Canal Dock station		Spraint	3 (10)	Mixed	Concrete platform	Very regular spraint site on western corner of same concrete platform as above. Adjacent to UCD box	717294	733657
GCB_007	Grand Canal Basin	Grand Canal Dock station		Spraint	1 (4)	Mixed	Concrete platform	Regular spraint site on eastern corner of concrete platform along rail line. Fish remain with what appeared to be bird bones in spraint	717301	733660
GCB_008	Grand Canal Basin	Grand Canal Dock apartments		Spraint	1 (4)	Mixed	Steps	On steps under apartments	717360	733687
GCB_009	Grand Canal Basin	Dock near Grand Canal Quay		Spraint	1 (3)	Mixed	Mooring cleat	Regular spraint site on mooring cleat & rope on dock/pontoon near Waterways Ireland office	717294	733810
GCB_010	Grand Canal Basin	The Art of Coffee, Grand Canal Quay		Spraint	1 (1)	Very fresh	Steps	Very fresh spraint on steps	717289	733894
GCB_011	Grand Canal Basin	Charlotte Quay		Spraint	1 (6)	Mixed	Mooring cleat	Regular spraint site on mooring cleat & rope on dock/pontoon	717385	733948
GCB_012	**Grand Canal Basin**	**Charlotte Quay**		**Couch**	**3 (40+)**	**Mixed**	**Steps**	**Couch & very regular spraint site in quay undercut beside Millennium Tower apartments. Some spraint very fresh**	**717401**	**733984**
GCB_013	Grand Canal Basin	Hanover Quay		Spraint	1 (1)	Old	Pontoon	Second old spraint site on same metal pontoon	717466	734081
GCB_014	Grand Canal Basin	Hanover Quay		Spraint	1 (4)	Old	Mooring rope	Old spraint site on rope on metal pontoon	717478	734071
GCB_015	Grand Canal Basin	Grand Canal Dock		Spraint	1 (1)	Fresh	Quay wall	Spraint site in quay wall/old culvert	717588	733965

Sign ID	Watercourse	Location	Survey section	Sign	Spraint site (no. spraints)	Sign age	Marking feature	Notes	ITM x	ITM y
GCB_016	Grand Canal Basin	Grand Canal Wharf		Spraint	2 (2)	Mixed	Boat ramp	Spraint site on old boat ramp beside South Dock Road	717699	733948
GCB_017	Grand Canal Basin	Grand Canal Dock		Spraint	1 (2)	Mixed	Quay wall	Mixed age spraint site on top of quay wall beside MV Naomh Éanna dry dock	717813	733979
GCB_018	Grand Canal Basin	Hanover Quay/Westmoreland Lock		Spraint	2 (4)	Mixed	Steps	Regular spraint site on steps at Westmoreland Lock	717791	734052
GCB_019	River Dodder	Grand Canal Street Upper		Spraint	1 (3)	Mixed	Steps	Regular spraint site at top of steps to River Dodder, adjacent to otter holt in garden	717863	734083
GCB_020	**River Dodder**	**Grand Canal Street Upper**		**Holt (active)**			**Garden**	**Active otter holt in private garden with trail through hole in the wall to above steps**	**717857**	**734078**
GCB_021	River Dodder	South Dock Road		Spraint	1 (4)	Mixed	Pontoon	Second regular spraint site on downstream side of same pontoon	717881	734032
GCB_022	River Dodder	South Dock Road		Spraint	1 (6)	Mixed	Pontoon	Regular spraint site on disused mid-channel pontoon and mooring rope	717882	734025
GCB_023	River Dodder	South Dock Road		Spraint	1 (1)	Fresh	Quay wall	Spraint in old culvert entrance in quay wall	717878	734014
GCB_024	River Dodder	Shelbourne Park Greyhound Stadium		Prints		Fresh	Intertidal mud	Abundant prints along low water mark, west bank of river	717973	733711
GCB_025	River Dodder	Shelbourne Park Greyhound Stadium		Spraint	1 (1)	Old	Grassy promontory	Old spraint on top of grassy embankment with slide to water & strong smell of urine	717966	733700
GCB_026	River Liffey	Britain Quay		Jelly		Fresh	Steps	Fresh anal jelly on top of steps beside Brewdog	717811	734109
GCB_027	River Liffey	Britain Quay		Spraint	1 (1)	Old	Steps	Old spraint on steps	717826	734274
GCB_028	River Liffey	Sir John Rogerson's Quay		Spraint	1 (8)	Mixed	Pontoon	Regular spraint site on pontoon	717538	734307
GCB_029	River Liffey	Sir John Rogerson's Quay		Spraint	1 (3)	Mixed	Steps	Spraint site on steps with anal jelly	717426	734311
GCB_030	River Liffey	MV Cill Airne		Spraint	3 (40+)	Mixed	Pontoon	Very regular spraint site on Liffey Ferry pontoon at MV Cill Airne. Previously recorded spraint site near holt in quay wall	717299	734441
GCB_031	**River Liffey**	**MV Cill Airne**		**Holt (active)**			**Quay wall**	**Previously recorded (Macklin et al., 2019) holt in quay wall at MV Cill Airne floating restaurant**	**717323**	**734446**
GCB_032	River Liffey	North Wall Quay		Spraint	1 (10+)	Mixed	Mooring cleat	Mixed age spraint site on pontoon cleat & rope	717686	734413

Sign ID	Watercourse	Location	Survey section	Sign	Spraint site (no. spraints)	Sign age	Marking feature	Notes	ITM x	ITM y
GCB_033	River Liffey	St. Patrick's Rowing Club		Spraint	1 (8)	Mixed	Pontoon	Regular spraint site on corner of rowing club pontoon near boulder revetment	718002	734251
GCB_034	River Liffey	Thorncastle Street		Spraint	1 (3)	Mixed	Steps	Spraint site on disused steps underneath apartments	717914	734170

*** Conservation value:** Otters, along with their breeding and resting places (i.e. holts and couches), are protected under provisions of the Irish Wildlife Act 1976-2021. Otters are also listed under Annex II and IV of the Habitats Directive [92/42/EEC].

8. Appendix B – miscellaneous survey images

Plate 8.1 Lock C3 (McCartney Bridge) on the Grand Canal – a barrier to otter passage

Plate 8.2 Lock C2 (Mount Street Bridge) – another barrier to linear otter passage along the Grand Canal

Plate 8.3 Otter spraint site recorded on the C1 lock structure (Macquay's Bridge)

Plate 8.4 Surveying by boat at Grand Canal main (circular line) at Clanwilliam Terrace

Plate 8.5 Location of otter couch under retaining wall at Clanwilliam Terrace

Plate 8.6 One of several regular spraint sites underneath Grand Canal Station rail bridge

Plate 8.7 The inner basin of Grand Canal Basin viewed from the west bank near Grand Canal Quay (Grand Canal Tunnel outfall visible in right midground)

Plate 8.8 Regular spraint site on the concrete platform of the Grand Canal Tunnel outfall

Plate 8.9 Sprainting site on step underneath balcony of Grand Canal Dock apartments (step in centre of image)

Plate 8.10 Otter spraint on quay steps adjacent to The Art of Coffee

Plate 8.11 View of Waterways Ireland office and Boland Mills, inner Basin

Plate 8.12 Couch and very regular spraint site on old covered steps at Charlottes Quay (facing towards Grand Canal Square)

Plate 8.13 Inspecting an spraint site in quay wall via boat at Grand Canal Dock

Plate 8.14 Low disturbance area of ground at the graving docks adjacent to the Naomh Éanna – an area with suitability for artificial otter holt installation

Plate 8.15 View of Camden Lock (right), Buckingham Lock (centre) and Westmoreland Lock (left) from the graving docks

Plate 8.16 The existing Camden Lock presents an impassable barrier to otter

Plate 8.17 View from Camden Lock to the River Liffey estuary

Plate 8.18 River Dodder estuary facing upstream to Ringsend Bridge

Plate 8.19 Disused pontoon on the River Dodder – a regular sprainting site for otter

Plate 8.20 Fresh otter prints were abundant along the intertidal zone of the River Dodder near Shelbourne Park

Plate 8.21 View of River Liffey Estuary near Samuel Beckett Bridge

Plate 8.22 Regular spraint site on River Liffey mooring cleat along North Wall Quay

Plate 8.23 Inspecting known otter holt for spraint at the MV Cill Airne on the River Liffey estuary

Plate 8.24 View of River Liffey and Dodder estuaries, looking across to Grand Canal Docks from Three Locks Square