

**UNDERWATER ARCHAEOLOGICAL ASSESSMENT
METRO NORTH PROJECT**

**BROADMEADOW RIVER, LISSENHALL BRIDGE
BALHEARY DEMESNE/ LISSENHALL GREAT,
SWORDS, CO. DUBLIN
08D093, 08R311**

&

**WARD RIVER, BALHEARY BRIDGE
BALHEARY DEMESNE, SWORDS, CO. DUBLIN
08D092, 08R312**

Client: Railway Procurement Agency

THE ARCHAEOLOGICAL DIVING COMPANY LTD.

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EXECUTIVE SUMMARY

The Archaeological Diving Company Ltd (ADCO) was appointed by Irish Archaeological Consultancy Ltd (IAC), on behalf of the Railway Procurement Agency (RPA), to conduct non-disturbance underwater and riverside archaeological assessment of a 60m section of the Ward River, at Balheary Bridge, and a 60m section of Broadmeadow River, at Lissenhall Bridge, Swords, Co. Dublin. The archaeological assessment was conducted on 15th-18th December 2008; licence numbers 08D092, 08R311 (Ward River) and 08D093, 08R312 (Broadmeadow River). Two bridge structures had been identified in the EIS for the project, and the survey of these remains was the focus of the present study. Balheary Bridge (Feature 3) is a protected structure (RPS340, NIAH no. 1335018) and crosses the Ward River. Lissenhall Bridge (Feature 1) is a recorded monument and a Protected Structure (RMP: DU 011-081, RPS 341, NIAH no. 1335019) that crosses the Broadmeadow River. The archaeological assessment was undertaken in a systematic manner and included a detailed survey of the bridges, and riverbed and attendant bank structures at both river survey locations. The survey data was gathered and position-fixed using a Differential GPs unit and a Total Station EDM.

The survey concluded that Balheary Bridge and Lissenhall Bridge are part of the same continuous structure that was built across both the Broadmeadow and the Ward rivers. A detailed account of the existing bridge structures is presented in this report. The report also highlights an adjacent single-arched culvert (Feature 2) and several riverine features including, a weir location and associated walling (Feature 4), five sections of river revetment wall that are located upstream of Balheary Bridge (Feature 5), and a single-arched bridge structure located 91m west of Balheary Bridge (Feature 6). These features are of historic and architectural interest and, in common with Features 1-3, they retain an inherent archaeological significance.

This report recommends that no further archaeological pre-construction requirements are necessary prior to commencement of the proposed development. However, Archaeological monitoring, by a suitably qualified

archaeologist licensed to the Department of the Environment, Heritage and Local Government (DoEHLG), is recommended during all construction works associated with the project. This monitoring process should be conducted on all riverbed and landside ground disturbance activities, with the proviso to resolve fully any archaeological material that becomes apparent.

Recommendations are subject to the approval of the Department of the Environment, Heritage and Local Government (DoEHLG).

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1.0 INTRODUCTION

The Archaeological Diving Company Ltd (ADCO) was appointed by Irish Archaeological Consultancy Ltd (IAC), on behalf of the Railway Procurement Agency (RPA), to conduct a non-disturbance archaeological assessment of two waterways that are to be impacted by the proposed Metro North Project at Lissenhall Bridge (Broadmeadow River) and Balheary Bridge (Ward River). The Ward River flows northeastward through Balheary Demense before turning eastward and flowing east-north-east through the assessment area to conjoin with the Broadmeadow River at NGR 31885E, 248152N. Balheary Bridge, a two-arched bridge structure, crosses the Ward River at NGR 318744E, 248140N (centre-point). It is a Protected Structure and is noted in the National Inventory of Architectural Heritage (RPS 340, NIAH no. 1335018).¹ The Broadmeadow River is located 91m north of the Ward River and flows southeastward through Balheary Demense to its confluence with the Ward River within Lissenhall Great Td. Lissenhall Bridge, a five-arched bridge structure, crosses the Broadmeadow River at 318760E, 248245N (centre-point). It is a recorded monument and a Protected Structure (RMP: DU 011-081, RPS 341, NIAH no. 1335019). A bridge is first recorded in this location on the Down Survey map of 1656. The central section may retain structural evidence to suggest a late fifteenth-century construction. It may be the oldest surviving road bridge within a 10-mile radius of Dublin city.² Both river assessment areas are located adjacent to the N1 link-road, c.700m north of Swords, Co. Dublin (Figure 1).

The archaeological survey work was conducted under licence from the Department of the Environment, Heritage and Local Government (DoEHLG) as a non-disturbance underwater inspection and metal detection survey on 15th-18th December 2008; licence numbers 08D092, 08R311(Ward River) and 08D093, 08R312 (Broadmeadow River). The survey sought to provide a detailed account of the existing riverside environment at each location, supported by detailed survey data to record the historic features present. In addition, a detailed desktop study of relevant archaeological publications and related unpublished archives in the DoEHLG and the National Museum of Ireland (NMI) was undertaken to provide a comprehensive overview of the receiving environment; allowing all impacts arising from the proposed development to be fully assessed and a strategy for their resolution to be implemented.

¹Fingal County Development Plan 2005-2011.

² Peter O’Keeffe and Tom Simington, *Irish Stone Bridges: History and Heritage*, Irish Academic Press, Dublin 1991, pp 186-8.

The on-site archaeological assessment comprised of the systematic visual inspection and magnetometer survey of the riverbed and attend bank structures. A 100m section of the Ward River was surveyed, between NGR 318649E, 248114N and 318757E, 248141N, and a 70m section of Broadmeadow River was surveyed, between NGR 318724E, 248237N - 318786E, 248236N. The assessment was comprehensive and included a detailed survey of both Balheary Bridge and Lissenhall Bridge structures. In addition, a c.90m (north-south) x c.90m (east-west) area of parkland that forms the floodplain between the two rivers was field-walked (Figures 2-3). The results indicate that the Balheary and Lissenhall Bridges are part of the same continuous structure that was built across both river channels. For this reason, the two sets of archaeological licenses are being reported on in the one report.

2.0 PROPOSED DEVELOPMENT³

The Metro North alignment will use the existing Balheary Bridge for southbound Light Metro Vehicles (LMV) and a new bridge will be constructed to accommodate the northbound LMV (Figures 2 and 4). The new bridge (Ward Bridge) will cross the Ward River immediately west of Balheary Bridge; at a distance of between 0.20m (minimum) and 4m (maximum) from the existing bridge structure. The proposed Ward Bridge will be supported on piles inserted into the north and south banks of the river. These piles will be placed at a distance of 2-3m from the rivers edge.

The Metro North alignment will cross the Broadmeadow River via the existing Lissenhall Bridge structure (Figures 2 and 5). Bridge stabilization works will be undertaken to ensure its load-bearing capabilities and it is proposed that a 350mm thick concrete slab will be constructed across the upper surface of the structure. It is anticipated that the placement of this slab will assist in distributing the applied loading and waterproofing the structure. This work will require the undergrowth to be removed, any missing masonry to be replaced, and re-pointing of the entire bridge structure.

3.0 RECEIVING ENVIRONMENT

North Dublin retains a rich archaeological heritage that extends back in time to the earliest settlement evidence. The discovery of a working quarry for hand-axe production on nearby Lambay Island serves to highlight the maritime potential associated with the early settlement and focuses attention on the importance of waterways as vital means of communication. The growth of Swords during the middle

³ Based on information provided in the RPA Employers Brief, section 4.0 and 4.1, p.5.

ages calls particular attention to the survey area. The town's development was enriched with the appointment of John Comynn as Archbishop of Dublin in the thirteenth century, after which Swords flourished as the archiepiscopal manor, and Swords Castle remains one of the few surviving Episcopal castles in Ireland. The survey area lies just to the north of the medieval town, and was clearly on the main northern approaches to the settlement.

The assessment area is located c.1.3 km from the centre of Swords Town. The eastern limit of the area under assessment is delineated by a dual carriageway, built in the 1970s, that formed part of the N1 route from Dublin to Belfast. This carriageway removed vehicular traffic from Lissenhall and Balheary Bridges and these structures currently provide pedestrian access to a local amenity area. The N1 abuts the eastern side of Balheary Bridge and crosses Broadmeadow River approximately 30m downstream of Lissenhall Bridge. A two-arched concrete culvert abuts the downstream façade of the Balheary Bridge and a series of three poured-mass concrete culverts accommodate water-flow from the Broadmeadow River (Plates 1-2). On completion of the M1 motorway in the 1980s, the N1 roadway was turned into a link-road between Swords and the M1.

Cartographic Evidence

The Down Survey for Dublin compiled in 1656 shows a bridge across the Broadmeadow at the present day location of Lissenhall Bridge (Figure 4). The bridge is also shown on Herman Moll's map of 1714 and John Rocque's map of 1760 (Figures 6-7). Both the Ward River and Broadmeadow River remain largely unchanged from those watercourses depicted within Rocque's Map, the only significant difference being the presence of a small tributary that diverges southward from the Broadmeadow River c.90m upstream of Lissenhall Bridge. This watercourse flows under the roadway, at a point roughly mid-way between the two rivers, and later re-converges with them c.80 downstream of Lissenhall Bridge. Rocque's map depicts a single bridge structure crossing all three watercourses at this location. A 'Turnpike' is shown on the northern side of this bridge structure, indicating that the bridge was tolled.

The first turnpike road in Ireland was created in 1729 with an act of parliament passed to finance the repair of the road from Dublin to Kilcullen. This was followed by eighty similar schemes involving both the construction of new roads, often along straight alignments, and the financing of improvements on pre-existing roads. In

general, Irish turnpike roads were not a success, the relative dense network on non-turnpike routes ensured that traffic could easily evade tolls, and disappointing traffic levels meant that most turnpikes generated insufficient revenue for their upkeep.⁴

The Ordnance Survey First Edition map of 1837 also notes the presence of a turnpike at this location with a small building situated on the northern side of the river being annotated with the words '*Turnpike Gate Lodge*' (Figure 8). It is likely that the tolling of Lissenhall Bridge ceased in the latter half of the nineteenth-century and by the Third Edition mapping of 1906 all reference to a turnpike at this location has been removed.

The First Edition Mapping depicts significant changes to the eastern section of the Ward River, downstream of the river crossing (Figure 8). The Ward River is no longer shown flowing eastward to conjoin with the Broadmeadow downstream (c.80m east) of Lissenhall Bridge. Instead, the river meanders northward to a new confluence point, c.65m upstream from the original location and 15m east of Lissenhall Bridge. In addition, the aforementioned river tributary depicted on Rocque's map (1760) is no longer present and has been replaced by a narrow strip of woodland running north-south between the two rivers, adjacent to the western side of the roadway. An additional river alteration was noted with the presence of a curved section of waterway that measures c.100m and forms an artificial watercourse (possible mill-race) on the northern side of the Broadmeadow River, c.150m upstream of Lissenhall Bridge.

Two additional bridges are marked on the OS First Edition Map (Figure 8). The first, a minor bridge structure, is depicted crossing the Ward River approximately 92m upstream of the present day Balheary Bridge. This bridge facilitates a narrow roadway that runs in a northwest direction from a '*Gate Lodge*' situated 100m south of the Ward River to '*Balheary House*' located c.650m distant. The roadway crosses the Broadmeadow River c.280m upstream of Lissenhall Bridge where another minor bridge structure is located. These structures remain *in situ* today, the former bridge delineating the western limit of the assessment area along the Ward River.

⁴ Aalen, F. H. A., K. Whelan and M. Stout, (eds.) *Atlas of the Rural Irish landscape*, Cork University Press, Cork, 1997, p.208

By the OS Third Edition Map of 1906, Lissenhall Bridge is no longer illustrated as a single structure that crosses both the Broadmeadow and Ward Rivers, these crossing points having now been demarcated as '*Lissenhall Bridge*' and '*Balheary Bridge*' respectively (Figure 9). In addition, a number of topographic alterations to the area under assessment were noted within Second Edition mapping. The possible millrace located on the northern side of the Broadmeadow River has been removed, most likely in-filled, and an additional alteration to the easternmost section of the Ward River has taken place. This section of river is now depicted flowing eastward, rather than northward, for a distance of c.100m to its confluence with the Broadmeadow River. In addition, a degree of river straightening is evident along the Ward River and a Weir structure, situated immediately upstream of Balheary Bridge, is depicted.

Record of Monuments and Places⁵

The Record of Monuments & Places (RMP) is a list of archaeological sites known to the National Monuments Service with accompanying RMP Maps, based on OS 6" Sheets, which indicate the location of each recorded site. The RMP list is based on The Sites and Monuments Record files housed in the National Monuments Services offices. The Sites and Monuments Records (SMR) are lists with accompanying maps and files of all known or possible archaeological sites and monuments, predominately pre-1700AD in date, for all counties. These lists were, in many cases, initially based on cartographic, documentary and aerial photographic sources. The SMR (as revised in the light of available fieldwork) form the basis of the statutory RMP. The record is updated on a constant basis and focuses on monuments that predate 1700AD. Buildings belonging to the seventeenth-century and later are not well represented in their archive, although they are considered as archaeological sites today.

Only one site, Lissenhall Bridge, is listed in the RMP for the area under investigation (DU011-0081). A number of RMP sites are listed for the wider area and are listed in Table 1 below (Figure 10):

RMP Number:	Classification:	National Grid Reference:	Townland:	Proximity to Development:
DU011-081	Bridge; Lissenhall Bridge	318760E, 248245N	Balheary Demesne/ Lissenhall Great	0m
DU011-080	Ring-Ditch	317778E, 248245N	Holybanks	c.1km west
DU012-012001	Enclosure	319388E, 48436N	Lissenhall Great	c.450m northeast
DU012-012002	Field System	319503E, 248435N	Lissenhall Great	c.550m northeast

⁵ The RMP is maintained by the National Monument Section, Department of Environment, Heritage and Local Government (DoEHLG).

RMP Number:	Classification:	National Grid Reference:	Townland:	Proximity to Development:
DU012-015	Enclosure	319282E, 248063	Lissenhall Great	c.400m southeast
DU012-047	Tide Mill	319636E, 247631N	Lissenhall Great	c.1km southeast (not shown in Figure 10)
DU012-011	Holy Well	319104E, 248877N	Lissenhall Little	c.750m northeast
DU011-078	Enclosure	317686E, 248691N	Newtown (Balrothy East)	c.750m northeast
DU011-036	Earthwork	318797E, 247295N	Seatown West	c. 900m south (not shown in Figure 10)

Table 1: Known Archaeological sites located within the vicinity of the assessment area within Balheary Demesne.

National Inventory of Architectural Heritage

The National Inventory of Architectural Heritage (NIAH) is a county by county database that identifies, records, and evaluates the post-1700 architectural heritage of Ireland, uniformly and consistently as an aid to the protection and conservation of the nations built heritage. The NIAH surveys provide the basis for the recommendations of the Minister for the Environment, Heritage and Local Government to the planning authorities for the inclusion of particular structures in their Record of Protected Structures (RPS).

Both Lissenhall and Balheary bridge structures are listed in the NIAH inventory and are recorded as being of regional importance; NIAH numbers 11335019 and 11335018 respectively (Table 2). Balheary Bridge is dated to c.1850 and is noted as retaining architectural and technical interest. Lissenhall Bridge is dated to c.1769, incorporating possible fabric from a pre-1600 bridge. This structure is listed as retaining architectural, technical, and archaeological interest. Lissenhall Bridge is also registered as a Protected Structure (RPS 341), along with Balheary Bridge (RPS 340), in the County Development Plan.

NIAH Reg. No.	Date:	Categories of Special Interest:	Rating:	Original Use:	Description:
11335018: Balheary Bridge	1820-1880	Architectural Technical	Regional	Bridge	Double-arch ashlar granite road-bridge over river, c.1850
11335019: Lissenhall Bridge	1740-1780	Architectural Archaeological Technical	Regional	Bridge	Five-arch random rubble road-bridge over river, c.1760, with triangular cut waters to upstream side. Possibly incorporating fabric of pre-1600 bridge.

Table 2: Entries in the National Inventory of Architectural Heritage for Balheary Demesne.

Topographic Files

The National Museum of Ireland Topographical Files is the national archive of all known antiquities recorded by the National Museum. These files relate primarily to artefacts but also include references to monuments and also contain a unique archive of records of previous archaeological excavations. The Museum's files present an accurate catalogue of objects reported to that institution from 1928. There is a computerised database of finds from the 1980s onwards. The find-spots of artefacts can also be an important indication of the archaeological potential of the related or surrounding area.

A total of forty-five artefacts are listed in the NMI topographic files for the Swords area (Appendix 1). Forty-three of which have been recovered from Swords and the townlands of Swords Glebe, Newtown, and Seapoint. These artefacts range in date from the prehistoric through to late medieval period. Only two artefacts are listed for the townland of Lissenhall Great (Table 3). No artefacts are listed for Balheary Demesne or the area under assessment.

Artefact:	Find place:	Reg. No.	Description:
Flint waste	Lissenhall Great	1978:78	Recovered from scarp above shore road north side of Broadmeadow Estuary.
Flint waste	Lissenhall Great	1978:77	Recovered from scarp above shore road north side of Broadmeadow Estuary.

Table 3: National Museum of Ireland Topographic File entries for Lissenhall Great Td.

Excavations Bulletin

The *Excavations Bulletin* provides a published (yearly) summary of accounts of archaeological excavations undertaken throughout Ireland.⁶ Summaries may also be submitted for inter-tidal survey, underwater assessments, and the archaeological monitoring of marine dredging works.

Four sites were excavated within the townlands of Lissenhall Great/Lissenhall Little as part of the Northern Motorway/Airport – Balbriggan Bypass Scheme. These comprised the excavation of two earthworks sites within Lissenhall Great (99E0547, 2000:0322 & 99E0546, 2000:0321), a possible enclosure site (00E0953, 2000:0323) and a site comprising prehistoric pits, a hearth, and stake holes within Lissenhall Little (01E1074, 2001:444). No sites are listed in the *Excavations Bulletin* for Balheary Demesne or the sections of river under assessment. However, an excavation is listed

⁶ Isabel Bennett (ed.) *Excavations Bulletin: summary accounts of archaeological excavations in Ireland*, Wordwell.

for the River Ward, southeast of Swords (Windmill townland), c.2km from the current river assessment area (99E0554, 1999:275). The excavation, undertaken by the Underwater Archeological Unit, comprised the removal of six skeletons from an east-west orientated grave-cut located within an extensive midden along the northern riverbank. Pottery recovered from excavation indicates that the site dates to the late thirteenth to early fourteenth century. This dating was further strengthened by the presence of an Edward I silver penny, dating to the late 1280s.⁷

Conclusion

Balheary Bridge and Lissenhall Bridge retain both an architectural and archaeological significance and have provided the focus for the desktop study. Lissenhall Bridge is listed in the RMP (DU011-081), recorded in the NIAH (no. 1335019), and is listed as a protected structure (RPS 341). Balheary Bridge is also recorded in the NIAH (no. 1335018) and listed as a protected structure (RPS 340).

As previously shown the eighteenth and nineteenth-century maps of the area under assessment can be used to chart the topographic changes that have taken place within Balheary Demesne/ Lissenhall Great Townland. It is clear that the strip of land located between the Broadmeadow River and the Ward River has undergone substantive changes with the in-filling of a river tributary of the Broadmeadow and the reclamation of the river flood-plain; a change that is evident by First Edition OS Mapping. Moreover, the current desktop study attests to the presence of an *in situ* bridge structure at this location from at least the early part of the seventeenth-century and it has been suggested that the internal section of the existing Lissenhall Bridge could date from between 1450 and 1550.⁸ Furthermore, this long history of bridge activity may hint at earlier use of this crossing-location. Positioned upstream of Malahide Creek and 'The Strand' estuary, this area may have formed a useful crossing/fording-point from the prehistoric period onwards. Indeed, prehistoric activity in this area is evident with the recovery of flint and bronze artefacts from Swords and the higher land to the north of the Broadmeadow River. The length of human activity in the area, the history of bridges across the Broadmeadow and Ward Rivers, coupled with the proximity of the medieval township of Swords, has provided an inherent archaeological potential for the area under study; a potential that is highlighted by the excavation of a medieval midden and skeletal remains from the northern bank of the Ward River, c.2km upstream of the current assessment area.

⁷ Excavation Bulletin Entry 1999:275, Windmills Lands, River Ward Swords, Karl Brady and Connie Kelleher, Underwater Archaeological Unit, the Department of Environment, Heritage and Local Government, formerly Dúchas The Heritage Service, Licence Number 99E0554.

⁸ O'Keefe, Peter and Tom Simington, *Irish Stone Bridges: History and Heritage*, Irish Academic Press, Blackrock, 1991. pp.186-8

4.0 SURVEY METHODOLOGY

Archaeological assessment of the Broadmeadow River was undertaken across a 1092m² area, from the western side of the N1 to a point 40m upstream of Lissenhall Bridge, and included the systematic visual inspection of the riverbed and its attendant bank structures (Area 1, Figures 3, 11-12). Detailed descriptions were made of riverbed topography, bottom composition, and the existing river environment (Plate 3). In addition, a survey of Lissenhall Bridge was carried out and included a photomosaic/ drawn elevation of the upstream and downstream bridge façades (Figures 17-18), photographic and visual inspection of the internal face of the arch numbers 1-5, and underwater survey of the riverbed beneath arch numbers 1-3 where water depth was in excess of 0.50m (Plates 4-5). The area of parkland located between the two river survey locations was also field-walked to assess its archaeological potential (Area 2, Figures 3 and 19).

A series of river profiles were taken, mapping the topographic changes encountered across the riverbed at each river location (Figures 13-16, 20). A metal-detector survey was conducted across a 20m stretch of the River Ward (immediately upstream of Balheary Bridge) and a 50m stretch of the Broadmeadow River (25m either side of Lissenhall Bridge). All metal-detection hits were position-fixed using differential GPS and are recorded within Figures 12 and 19 (Plates 6-7).

Archaeological assessment of the Ward River was undertaken across a 1488m² area, from the downstream side of Balheary Bridge to a small bridge situated 91m upstream, and included the systematic visual inspection of the riverbed and its attendant bank structures (Area 3, Figure 3 and 19). Detailed descriptions were made of riverbed topography, bottom composition, and the existing river environment. In addition, detailed survey of Balheary Bridge was carried out and included: a photomosaic/ drawn elevation of the upstream façade (Figure 21), photographic and visual inspection of the downstream façade, photographic and visual inspection of the internal face of both archways, and an underwater survey of the riverbed beneath Balheary Bridge where water depth exceeded 0.50m.

A finds retrieval strategy dealing with conservation issues, cataloguing, and locational recording was in place to deal with any artefacts recovered during the river surveys. Position-fixing of all features encountered as part of the assessment was facilitated by the use of a hand-held GPS unit, a differential GPS unit, and Total Station survey (Plate 8-9).

A medium-high current was noted for both rivers and underwater visibility ranged between 0.50m-1m, depending on location within the river. A maximum water depth of 0.75m was encountered where riverbed scouring is taking place upstream of Balheary and Lissenhall Bridges. An average water temperature of 3° degrees was recorded for the rivers under assessment. A total of three archaeological dives were undertaken as part of the project and the longest dive was 57mins; bottom-time being limited due to the low water temperatures encountered during the survey. The accompanying dive-logs are tabulated in Appendix 3. The river survey was undertaken by a team of three maritime archaeologists, a certified surveyor, and a dive supervisor. The dive operations were carried out to HSA/HSE standards and in accordance with the Safety in Industry (Diving Operations) Regulations 1981, SI 422.

The assessment was conducted under Licence from the DoEHLG, over a four-day period between Monday 15th and Thursday 18th December 2008.

5.0 ARCHAEOLOGICAL ASSESSMENT

Surrounding Land-use

The Broadmeadow River flows eastward under Lissenhall Bridge, west of a large three-arched culvert associated with the N1 link-road (Plate 1). The northern side of the river is bounded by ploughed fields and a partially wooded, grass-covered, local amenity area lies to the south (Plate 10). A modern water pipe crosses the Broadmeadow River at NGR: 318724E, 248234N (30m upstream of Lissenhall Bridge) and the Ward River at NGR: 318724E, 248234N (22m upstream of Balheary Bridge).

Lissenhall and Balheary Bridges currently provide pedestrian access to the local amenity area. Prior to construction of the N1, these bridges accommodated road traffic for the R127. The pathway remains covered by tarmac and the central dashed white line from the R127 can still be seen (Plate 11). The remains of the R127 roadway can be traced to the south side of Balheary Bridge where it is truncated by the N1 link-road. The R127 roadway was raised above the adjoining parkland to the west, and a masonry wall delineates the roadway between Lissenhall Bridge and Balheary Bridge on this side. Infill and construction material from the N1 has been dumped along the pathway to the north of Lissenhall Bridge.

Riverbed Topography; Broadmeadow River

The Broadmeadow River measures 9m in average width and has an average water depth of 0.40m. A maximum river width of 18m was recorded along the downstream side of Lissehanll Bridge where the river shallows and broadens prior to flowing under a series of modern culverts. Two artificially raised bank structures delineate the northern and southern sides of the Broadmeadow River along the downstream (east) side of Lissenhall Bridge. The bank structures are c.5-6m in height, slope steeply at a c.50° degree angle, and are lined with low-lying vegetation that includes mixed grasses, ivy, nettles, gorse, and brambles (Figures 11, 13-16). The base of the northern bank is heavily eroded and a 1.3m high section of bank structure has been exposed by the river (Plate 12). This exposed section is composed of boulder clay, sub-rounded to angular gravel deposits, sub-rounded stones, soil deposits, rubble, and mixed building debris. The southern bank is less eroded with a 0.30m section of bank being exposed by the river. The southern bank is identical in composition to that of the northern bank; both structures forming artificially raised banks placed as part of the construction of the N1 dual carriageway. The northern bank, upstream (west) of Lissenhall Bridge, is of similar composition and profile to that of downstream sections. However, a 0.80 high bank forming a small, 4m wide, floodplain is located at the base of northern bank, along a c.20m section of river (Figures 13-16). Juvenile trees including sycamore and ash are located along the northern bank on either sides of Lissenhall Bridge.

The south bank, upstream (west) of Lissenhall Bridge, is less vegetated and has a lower profile than the other bank structures, measuring c.1.5m in height. It is almost vertical in profile and consists of a silty-clay deposit with frequent pebble and sub-rounded stone inclusions. As with the other riverbank areas it appears to be artificial in nature (Plate 13).

The riverbed, upstream of Lissenhall Bridge, gently undulates across its north-south extent and is composed of unsorted rounded pebbles, >0.4m x 0.04m in size, interspersed with angular to sub-angular river gravels, <5mm x 3mm in size. Water-flow is restricted to three of the five arches comprising Lissenhall Bridge, the two northernmost arches (Arch nos. 4 and 5) having undergone substantial siltation. This deposition of material is also evident along the upstream side of arch numbers 4 and 5. It is likely that the siltation has been caused by the presence of a low bank located along the northern side of the river. This bank, forming a small flood plain, has restricted the original watercourse by c.4m, effectively blocking water-flow to the

northernmost arch. It is likely to have formed from over-spill material from the raising of an artificial bank structure along the northern side of the river.

In contrast, a degree of riverbed scouring is taking place along the upstream side of the Lissehnall Bridge, across a 10m north-south section of riverbed running between the northern flood plain and southern bank structure. This scouring has dropped the river level by c.0.69m and has exposed a large section of poured mass-concrete placed to underpin the foundations of Lissehall Bridge. The concrete is visible extending from the base of the southern bank for a distance of 9.7m before disappearing into the riverbed, along the northern side of Arch number 2. Timber shuttering, running north-south between two iron I-beams, was encountered along the western extent of the concrete area (Figure 12). These elements represent the residue of a cofferdam placed to allow access to the bridge foundations and the placement of the concrete underpinning. A maximum water depth of 1.3m was recorded for this section of riverbed.

Concrete underpinning is also exposed along the base of Arch numbers 2 and 3, forming an artificial riverbed that extends downstream to a point c.3m east of Liessenhall Bridge (Figure 12). It is likely that consolidation measures were implemented across the foundations of Lissenhall Bridge in their entirety, and that poured mass-concrete also forms the riverbed underneath Arch numbers 3-5. This work is likely to be contemporary (1964) with similar measures observed at Balheary Bridge.

The riverbed, downstream of Lissenhall Bridge, is composed of deposits of well-sorted pebbles, >0.4m x 0.04m in size, and angular to sub-angular river gravels. A small island composed of water sorted pebbles, measuring 11m x 6m, is located in the centre of the river at this location (Plate 14). The majority of this low-lying island is covered during flood waters, only a small vegetated area to the southeast of the island remaining above water. Two fast-flowing channels are located either side of the river channel. These watercourses have, as previously mentioned, caused a degree of bankside erosion on either side of the river. Limited river debris was encountered as part of the riverbed survey. All objects encountered were of modern origin and included: a traffic cone, golf balls, a heavily eroded clay pipe fragment, and various ceramic fragments (blue & white ware, black-ware, transfer printed china, etc.).

Riverbed Topography; Ward River

The Ward River runs eastward through the survey area to flow through Balheary Bridge and a two-arched concrete culvert that abuts the bridge along its downstream façade (Plates 9 and 15). The river is delineated by two steep-sided bank structures (60° slope) measuring 1.3m in height (maximum) on the south side and 2m in height (maximum) on the north side of the river. These structures appear to have been artificially straightened, probably a twentieth-century alteration, and sections of revetment wall are present along the base of each bank. Both bank structures are tree-lined and covered with low-lying vegetation including mixed grasses, hawthorn, and bramble bushes. The river measures between 5m and 6.7m in width, with an average water depth of 0.35m. The riverbed is flat in profile and composed of small to medium sized sub-rounded pebbles and larger river cobbles (>0.05m x 0.08m). Some modern debris was encountered, scattered across the riverbed and included: fragments of red brick, bottles, bicycles parts, aluminium cans, etc. A piece of flint débitage was found on the south bank of the river at NGR: 318739E, 248136N (Plate 16, Figure 19). It was recovered protruding from a section of re-deposited bankside material and as such cannot be taken to be an *in situ* find. However, it does allude to the presence of prehistoric activity in the wider north Swords area. The flint artefact is triangular in shape, measuring 25mm in length, 15mm in width, and between 2mm-9mm in depth (find number 08D092:001). A small area of cortex indicates that it probably originally came from a rounded pebble.

A scour line is located 2m upstream of Balheary Bridge, running between the northern and southern banks. This river-scouring has dropped the riverbed by c.0.60m to expose a series of concrete slabs used as part of bridge consolidation works undertaken at Balheary Bridge. Poured mass-concrete has been used to underpin the bridge foundations and encase the in-water pier structure. This underpinning also extends across the base of both arches. Two vertically placed iron I-beams are located on either side of the river, immediately upstream of the western extent of the concrete underpinning. These iron piles are thought to have formed part of the upstream shuttering for a cofferdam that allowed access to the bridge foundations and placement of the aforementioned concrete underpinning. It is believed these consolidation measures were completed in the mid-part of the twentieth-century; the concrete encasing the in-water pier being inscribed with the initials of the workmen who undertook these measures along with a date of '1964'. This inscription is located on the northern side of the upstream section of the pier structure.

Visual Survey and Assessment

A total of six features of archaeological and historic interest were identified and recorded as part the archaeological assessment. These include: Feature 1 (Lissenhall Bridge), Feature 2 (Bridge Culvert), Feature 3 (Balheary Bridge), Feature 4 (Weir location and wall structures), Feature 5 (River revetment), and Feature 6 (Single-arched Bridge), see Figure 3:

Feature Number:	Classification:	National Grid Reference:	Proximity to Development:
Feature 1	Bridge; Lissenhall Bridge	318760E, 248245N	0m
Feature 2	Bridge Culvert; Lissenhall Bridge	318746E, 248190N	2-4m east
Feature 3	Bridge; Balheary Bridge/ Lissenhall Bridge	318744E, 248140N	0m
Feature 4	Weir location and wall structures	North Side: 318738E, 248138N South Side: 318739E, 241350N	0m
Feature 5	River revetment	North Side: 318696E, 248134N- 318725E, 248141N South side: 318698E, 248129N- 318718E, 248132N	10m west
Feature 6	Single-arched bridge	318647E, 248114N	80m west

Table 4: Features of archaeological or historic interest encountered as part of the assessment.

Feature 1: Lissenhall Bridge, RMP DU011-081, NIAH no. 1335019 (Figures 3, 11-18) Lissenhall Bridge comprises of a five-arched bridge structure crossing the River Broadmeadow at NGR: 318760E, 248245N, centre-point (Plates 17-18). The bridge measures 10.55m (34.6ft) in width (east-west) and 34m (111ft) in length (north-south). Two distinct build phases are visible for the structure and are interpreted as indicating a primary pre seventeenth-century construction that was extended on its upstream and downstream sides by bridge widening operations undertaken in the eighteenth-century.⁹ The abutment or transition points between the two build-phases are clearly visible, and in Arch nos. 2 and 3 the downstream section overlaps with the internal archway. The upstream section extends a maximum of 3.02m (9.9ft) to the west of the original build-phase, while the downstream section extends a maximum of 3.63m (11.9ft) to the east.

Phase 1: Internal Bridge Section (Figure 12).

⁹ The National Inventory of Architectural Heritage lists the bridge extensions to c.1760.

The internal bridge section measures 4m (13.12ft) in width and is present within all five of the bridge archways. This mid-section represents the original bridge-build (Phase 1) across the Broadmeadow River at this location. The construction interface between the mid-section and the later build-phases is visible in all of the bridge archways (Plates 19-38). This is most evident within Arch nos. 2 and 3 where the mid-section has a different arch-profile and height to the downstream bridge section (Plates 39-40). In addition, there is a contrast in the composition of intrados (arch-ceiling) between the two build phases; the mid-section not having been re-pointed using cement render. The intrados of the mid-section retains a surface covering of coarse, white coloured, mortar, with frequent river gravel, sub-rounded pebble, orange coloured brick fragments, cockle shell, and snail shell inclusions (Plate 41). Mortar of similar composition is located underneath the cement render on both the upstream and downstream bridge extensions. It is likely that this mortar was either applied on completion of the bridge widening endeavour or forms part of maintenance work carried out later in the eighteenth-century.

The arch-walls within Arch nos. 1, 4 and 5 are composed of irregular sized limestone blocks ranging in size from 0.25m x 0.20m – 0.45m x 0.27m. In contrast Arch nos. 2 and 3 contain five courses of dressed limestone blocks (Plates 42-43). The lowest course is composed of blocks measuring 0.42m length x 0.42m in width. The preceding three courses are composed of rectangular blocks measuring between 0.30m-0.95m in length and 0.26m in width. The topmost course is composed of rectangular blocks measuring up to 0.30m in length x 0.16m in width. A lintel has been placed across the topmost section of the arch-wall on both sides of the archway (Arch nos. 2-3). The lintels within Arch no. 2 are composed of a series of rectangular limestone blocks measuring 0.12m in width. These lintel blocks protrude 0.04m from the top of arch-walls and 0.17m from the base of arch-rings (Plate 44). The two lintels from Arch no. 3 differ in size and composition to that of those found in Arch no. 2 (Plate 45). They are composed of rectangular shale blocks measuring an average of 0.55m in length and 0.32m in width. The contrasting construction method between Arch nos. 2-3 and the remaining arches suggests that Arch nos. 2-3 are of later date than those that form the mid-section of Lissenhall Bridge; most likely representing bridge repair work undertaken sometime between the original build and construction of the bridge extensions. This intermediate repair work does not represent a distinct bridge build, rather a re-build of the Phase 1 arch-walls and, as such, has not been classified as separate build phase within this report.

The existing arch-walls and intrados forming the internal bridge section are in a medium to good state of preservation; the semi-circular profile of the arches being

maintained within Arch nos. 1, 2, 3 and 5. However, a degree of arch slippage has taken place along the intrados of the northern side of Arch no. 4. This has resulted in a bulging of the arch-ceiling that measures 2m in length x 1.7m in width (Plate 46).

Phase 2: Upstream Bridge Section (Figure 17)

The upstream side of Lissenhall Bridge is composed of five archways supported by four triangular-cut pier structures, two of which are located in the existing central flow-channel of the Broadmeadow River. There are four triangular cutwaters, with semi-pyramidal capping, built upon the upstream side of each of the pier structures (Plates 47-50). This bridge section represents part of a bridge widening endeavour and is contemporary with the downstream bridge extension.

The upstream bridge façade has been re-pointed using modern cement, obscuring much of the original stonework that forms the bridge parapet/spandrels. However, exposed sections of masonry show the use of good quality, roughly faced, irregular coursed limestone of varying size and shape (0.15m x 0.7m (min.) to 0.40m x 0.18m (max.)). The bridge parapet measures 1.46m in height (max.) and the spandrels measure 2.3m in width. Coping, in the form of large limestone blocks (average size: 0.90m length x 0.23m width), is present on the upstream side of the bridge structure. Poured cement has been used in places to consolidate the topmost section of the parapet.

Arch no. 1 (Plate 51-52) is in a relatively good state of preservation, the archway retaining its original shape. It measures 2.4m (7.87ft) in width/span (max.) and 2.4m (7.87ft) in height (max.). The archway is segmental in form and the arch-ring is composed of 32 (visible) arch stones of irregular shape. These stones measure between 0.35m - 0.47m in length, 0.7m - 0.12m in width, and 0.18m – 0.21m in depth. The keystone, whilst present, is not immediately apparent in the arch-ring construction, and is the same size/shape as the other arch stones. The skewbacks are only partially visible behind the cutwaters and do not appear to be trimmed to the correct angle; the first arch stones being adjusted to give the necessary arch tilt. Cement plastering has been used to reinforce the arch intrados (internal arch ceiling) and overlies an earlier lime mortar. The intrados is composed of shaped, rectangular, blocks of varying width and length (average size: 0.35m length x 0.12m width). The intrados runs eastwards for a distance of 2.95m (9.67ft) to join the internal bridge section (Phase 1) and 6.95m (22.8ft) to join the downstream bridge section (Phase 2). Two offset stones protrude from either side of the upstream section of Arch no. 1, these measure 0.22m in length and 0.12m width. They protrude 0.19m from the southern arch-wall, 0.42m above the bridge foundations.

The original arch-stones from the internal, Phase 1, build-section are not visible within in Arch no. 1 (Plate 53). However, they are partially visible in the other four arches and it would appear that the upstream and downstream sections of the bridge (build-Phase 2) abut to the internal bridge structure rather than being built into it (Plate 54).

Arch no. 2 (Plate 55-56) is in a good state of preservation, the archway retaining its original shape. The archway measures 3.6m (11.8ft) in width/span (max.) and 2.6m (8.53ft) in height (max.) and is larger than Arch no. 1 to the south and Arch nos. 3-5 to the north. The archway is segmental in form and the arch-ring is composed of 33 (visible) arch stones. The arch stones are more uniform in size than those used in the construction of Arch no. 1, and measure between 0.42m - 0.45m in length, 0.10m - 0.24m in width, and 0.18m – 0.22m in depth. The keystone is of similar type to that of Arch no.1. As with Arch no. 1 the first arch stones are adjusted to give the necessary arch tilt rather than the skewbacks. Cement plastering has been used to reinforce the arch intrados and overlies an earlier lime mortar. The intrados is composed of shaped, rectangular, blocks of varying width and length (average size: 0.35m length x 0.12m width). The intrados runs eastwards for a distance of 2.8m (9.1ft) to join the internal bridge section (Phase 1) and 6.72m (22ft) to join the downstream bridge section. A series of three offset stones protrude from either side of the upstream section of Arch no. 2. These stones protrude 0.12m from the arch-walls, 0.95m above the top of Piers 1-2, and measure between 0.18m - 0.20m in length and 0.14m- 0.16m in width.

Arch no. 3 (Plate 57-58) is in a medium state of preservation with marginal flattening visible along the northern side of the archway. The archway measures 3.6m (11.8ft) in width/span (max.) and 2.6m (8.53ft) in height (max.) and has identical dimensions to that of Arch no. 2. The archway is segmental in form and the arch-ring is composed of 30 (visible) arch stones. As with Arch no. 1, the arch stones are irregular in size and measure between 0.40m - 0.56m in length, 0.08m - 0.17m in width, and 0.17m – 0.22m in depth. No keystone is visible within the arch-ring. As found with the other arches, the first arch stones are adjusted to give the necessary arch tilt rather than the skewbacks. Cement plastering has been used to reinforce the arch intrados and overlies an earlier lime mortar. The intrados is composed of shaped, rectangular, blocks of varying width and length (average size: 0.20m length x 0.17m width). The intrados runs eastwards for a distance of 2.95m (9.67ft) to join the internal bridge section (Phase 1) and 6.95m (22.8ft) to join the downstream section (Phase 2). A series of three offset stones protrude from either side of the upstream section of Arch

no. 3 (Plate 49). These stones protrude 0.13m from the arch-wall and measure 0.25m in length and 0.11m in width.

Arch no. 4 (Plate 59-60) is in a medium state of preservation, the archway having flattened slightly along its apex. It measures 3.4m (11.15ft) in width/span (max.) and 2.4m (7.87ft) in height (max.). The archway is segmental in form and the arch-ring is composed of 24 (visible) arch stones. The arch stones are fairly uniform in size, measuring between 0.40m - 0.43m in length, 0.10m - 0.20m in width, and 0.18m - 0.22m in depth. The keystone, whilst present, is not immediately apparent in the arching construction, and is only slightly larger in size than other arch stones (measuring 0.45m length x 0.21m width). The skewbacks are only partially visible behind the cutwaters and do not appear to be trimmed to the correct angle; the first arch stones being adjusted to give the necessary arch tilt. Cement plastering has been used to reinforce the arch intrados and overlies an earlier lime mortar. The intrados is composed of shaped, rectangular, blocks of varying width and length (average size: 0.35m Length x 0.12m width). The intrados runs eastwards for a distance of 2.95m (9.67ft) to join the internal bridge section (Phase 1) and 6.95m (22.8ft) to join the downstream bridge section (Phase 2). In contrast to the Arch nos. 1-3, no offset stones protrude from either side of the archway.

Arch no. 5 (Plate 61-62) is in a poor state of preservation, the archway having flattened along its intrados. The arch measures 2.4m (7.87ft) in width/span (max.) and 2.4m (7.87ft) in height (max.). The archway is segmental in form and the arch-ring is composed of 32 (visible) arch stones. The arch stones are fairly uniform in size, measuring between 0.47m - 0.35m in length, 0.7m - 0.12m in width, and 0.18m - 0.21m in depth. No keystone is visible within the arch-ring. The skewbacks are only partially visible behind the cutwaters and do not appear to be trimmed to the correct angle; the first arch stones being adjusted to give the necessary arch tilt. Cement plastering has been used to reinforce the arch intrados and overlies an earlier lime mortar. The intrados is composed of shaped, rectangular, blocks of varying width and length (average size: 0.35m Length x 0.12m width). The intrados runs eastwards for a distance of 3.02m (9.9ft) to join the internal bridge section (Phase 1) and 6.74m (22.1ft) to join the downstream bridge section (Phase 2). As with Arch no. 4, no offset stones protrude from either side of the archway.

Phase 2: Downstream Bridge Section (Figure 18)

The downstream side of Lissenhall Bridge is contemporary with the upstream extension. Five archways are supported by four pier structures. The downstream piers are rectangular in shape and no downstream cutwaters are present.

The downstream bridge façade has been re-pointed using modern cement, obscuring much of the original stonework that forms the bridge parapet/spandrels. However, exposed sections of masonry show use of good quality, roughly faced, irregular coursed limestone of varying size and shape (0.30m x 0.16m (min.) to 0.77m x 0.25m (max.) for the bridge spandrels, with smaller, lower quality stonework used to construct the bridge parapet. The bridge parapet measures 1.46m in height (max.) and the spandrels measure 1.8m in width. Coping, in the form of large limestone blocks (average size: 1m length x 0.20m width), is present on southern half of the bridge parapet wall. The top of the parapet wall, along the northern half of the bridge, has undergone modern repair; being capped with a cement render. In addition, a section of the parapet wall, above Arch no. 3, has been repaired using cement blocks.

Arch no. 1 (Plate 63) is in a good state of preservation and retains its original semi-circular shape. The arch measures 2.4m (2.87ft) in width/span (max.) and 2.4m (7.87ft) in height (max.). The archway is segmental in form and the arch-ring is composed of 30 (visible) arch stones. In contrast to the upstream arch-rings, the downstream arches comprise neatly-faced masonry blocks of a more regular in size and shape. The arch stones measure 0.31m-0.32m in length, between 0.09m - 0.14m in width, and 0.20m – 0.24m in depth. Cement plastering has been used to reinforce the arch intrados and overlies an earlier mortar. The intrados is composed of shaped, rectangular, blocks of varying width and length (average size: 0.30m length x 0.14m width). The intrados runs westwards for a distance of 3.6m (11.81ft) to join the internal bridge section (Phase 1) and 7.6m (24.9ft) to meet the upstream (Phase 2) bridge section.

Arch no. 2 (Plate 64) is in a good state of preservation, retaining its original semi-circular shape. The arch measures 3.6m (11.8ft) in width/span (max.) 2.6m (8.53ft) in height (max.). The archway is segmental in form and the arch-ring is composed of 32 arch stones. The arch stones are fairly uniform in size, measuring 0.31m-0.33m in length, between 0.12m - 0.29m in width, and 0.20m – 0.25m in depth. Cement plastering has been used to reinforce the arch intrados and overlies an earlier lime mortar. The intrados is composed of shaped, rectangular, blocks of varying width and length (average size: 0.30m Length x 0.14m width). The intrados runs westwards for a distance of 3.6m (11.81ft) to join the internal bridge section (Phase 1) and 7.55m (24.77ft) to join the upstream bridge extension.

Arch no. 3 (Plate 65) is in a good state of preservation and retains its original semi-circular shape. The arch measures 3.6m (11.8ft) in width/span (max.) 2.6m (8.53ft) in height (max.). The archway is segmental in form and the arch-ring is composed of 32 arch stones. The arch stones are fairly uniform in size, measuring 0.32m-0.34m in length, between 0.15m - 0.21m in width, and 0.19m – 0.25m in depth. The keystone is visible and measures 0.34m length x 0.21m width. Cement plastering has been used to reinforce the arch intrados and overlies an earlier lime mortar. The intrados is composed of shaped, rectangular, blocks of varying width and length (average size: 0.30m length x 0.14m width). The intrados runs westwards for a distance of 3.56m (11.68ft) to join the internal bridge section (Phase 1) and 7.35m (24.1ft) to join the upstream extension.

Arch no. 4 (Plate 66) is in a good state of preservation and retains its original semi-circular shape. The arch measures 3.4m (11.15ft) in width/span (max.) and 2.4m (7.87ft) in height (max.). The archway is segmental in form and the arch-ring is composed of 32 arch stones. The arch stones are fairly uniform in size, measuring 0.32m-0.33m in length, between 0.08m - 0.20m in width, and 0.18m – 0.24m in depth. Cement plastering has been used to reinforce the arch intrados and an earlier lime mortar. The intrados is composed of shaped, rectangular, blocks of varying width and length (average size: 0.30m length x 0.14m width). The intrados runs westwards for a distance of 3.41m (11.18ft) to join the internal bridge section (Phase 1) and 7.2m (22.96ft) to join the upstream extension.

Arch no. 5 (Plate 67) is in a good state of preservation and retains its original semi-circular shape. The arch measures 2.4m (2.87ft) in width/span (max.) and 2.4m (7.87ft) in height (max.). The archway is segmental in form and the arch-ring is composed of 30 (visible) arch stones. The arch stones measure 0.31m-0.32m in length, between 0.09m - 0.14m in width, and 0.20m – 0.24m in depth. Cement plastering has been used to reinforce the arch intrados and an earlier lime mortar. The intrados is composed of shaped, rectangular, blocks of varying width and length (average size: 0.30m length x 0.14m width). The intrados runs westwards for a distance of 3.33m (10.92ft) to join the internal bridge section (Phase 1) and 7.05m (23ft) to join the upstream extension.

Phase2: Upstream Bridge Cutwaters

There are four triangular shaped cutwaters present along the upstream side of Lissehnall Bridge (Plates 47-50). No cutwaters are present along the downstream side. These cutwaters measure between 2.2m (7.2ft) in width (max.) and Cutwater nos. 1, 3, and 4 have a uniform height of 2.8m (9.1ft). Cutwater no. 2 measures 3.1m

(10ft) in height. The cutwater structures are composed of irregular sized limestone and ashlar blocks measuring between 0.10m - 0.25m in length and 0.07m – 0.18m in width. Modern cement render has been liberally applied to all surfaces of these structures. The four cutwaters are bridge features contemporary with the Phase 2 extension, the semi-pyramidal capping of each cutwater being faced on the arises with tailor-made-cut-stone slabs which have a banded support plinth.¹⁰ A triangular shaped pier protrudes 0.23m from the base of each cutwater.

Bridge Footings/Pier Structures

Inspection of these bridge elements was not possible due to the modern concrete consolidation measures present (Plate 68). The bridge footings and pier structures being covered by poured mass concrete. While the exact dimensions, composition, and build quality of the bridge foundations cannot be assessed, it is likely that the pier structures are composed of a cut-stone facing with a heavily mortared internal rubble core.¹¹ The bridge footings and pier structures protrude a maximum of 0.23m from the base of the arch-walls. The western (upstream) end of each pier structure is triangular in shape and the eastern (downstream) ends are rectangular in shape.

Conclusion

Visual inspection has identified that Lissenhall Bridge comprises two phases of bridge construction. The initial build-phase is of pre-seventeenth century date and forms part of a series of bridge arches that crossed the wide floodplain formed by the Ward River, the Broadmeadow River, and a small tributary located between the two watercourses. It is likely that these arches formed a single, continuous structure known as Lissenhall Bridge. This structure was later extended in the eighteenth-century (on both its eastern and western sides) to form the single continuous structure; as depicted on Rocque's map of 1760 and labelled as Lissenhall Bridge on the First Edition Mapping 1837 (Figures 7-8). The upstream and downstream, Phase 2, sections of Lissenhall Bridge correspond to this later bridge widening endeavour.

Impact from proposed works

Lissenhall Bridge is a protected structure (PRS 314) and listed in the RMP (DU011-081). It is understood that a direct impact to the bridge will take place as part of the

¹⁰ O'Keefe, Peter and Tom Simington, *Irish Stone Bridges: History and Heritage*, Irish Academic Press, Blackrock, 1991. pp.186-8

¹¹ Comparison made with techniques employed for the construction of in-water piers from archaeological excavations undertaken by ADCO Ltd at John's Bridge, Kilkenny, River Nore Flood Alleviation Scheme, 2001-2002 (Licence number: 01E036) and the archaeological survey and excavation of Old Navan Road Bridge, River Tolka Flood Alleviation Scheme, 2006 (licence numbers: 05D026Ext. and 06E092).

development, a load-bearing pre-cast concrete causeway being placed along the upper surface of the structure to accommodate the proposed scheme. This will also provide additional waterproofing for the structure. As part of this proposed work the undergrowth will be removed, any missing masonry will be replaced, and entire bridge structure will be re-pointed. Lissenhall Bridge has been fully-recorded and no further archaeological mitigation measures are deemed necessary prior to commencement of the construction phase of the project. However, it is anticipated that an architectural conservation assessment will take place prior to commencement of the proposed scheme.¹² In addition, it is recommended that archaeological monitoring of all construction works on/ around Lissenhall Bridge is undertaken during the construction phase.

Feature 2: Single-arched Culvert (Figures 3, 19)

A single arched-culvert is located 43m south of Lissenhall Bridge (Feature 1) and 44m north of Balheary Bridge (Feature 3), roughly halfway between the two structures at NGR: 318748E, 248189N (Plate 69). The culvert was built to accommodate a tributary of the Broadmeadow River. This tributary is visible on the Rocque's Map of 1760 but has been in-filled by the OS First Editing Mapping of 1837 (Figures 7-8).

The eastern half of the culvert structure has been backfilled, presumably as part of the re-landscaping of the eastern side of R127 following the construction of the N1 dual-carriageway. The western arch-ring remains exposed, while the arch walls have been in-filled; the archway being exposed 1.4m from the existing ground-level. The surface of the roadway is located c.1.55m above the apex of the arch. The arch-ring is semi-circular in shape, is segmental in form with 32m arch stones, and measures 2.4m (7.87ft) in width. These arch stones measure between 0.35m - 0.42m in length, 0.7m - 0.12m in width, and 0.18m – 0.21m in depth. The western side of the culvert arch has both similar construction characteristics and dimensions to that of Arch nos. 1 and 5 from Lissenhall Bridge (Feature 1). Moreover, a series of offset stones are located within the archway, a build characteristic also present within the Lissenhall Bridge structure. Three offset stones protrude from the northern arch-wall, with two further stones protruding from the southern wall. They are irregular in size with the largest stone measuring 0.35m in length x 0.10m in width and protrude up to 0.12m from the arch-wall.

¹² As outlined in the Metro North *Archaeological Strategy* Document, p.13.

The arch intrados has been rendered using a cement mortar and extends eastwards for a distances of 2.4m (7.87ft) to a transition-point with an earlier culvert-arch (Plate 70). The intrados of the earlier structure is rendered with a white coloured lime mortar that matches the mortar found within the mid-sections of Lissenhall Bridge. This intrados extends eastward for 0.9m to meet an earth and rubble wall comprising of back-fill material. By extrapolating a line between the eastern and western limits of Lissenhall Bridge, coupled with a line extended from the build-phase transition points, it is possible to calculate the east-west extent of the buried section of this structure. It is anticipated that internal arch section measures 4m in width and that the eastern section of arch measures 2.8m in width (9.18ft); giving the structure and overall width of 9.2m (30.18ft).

Conclusion

Two build-phases are visible within the exposed section of Feature 2. These correspond to the original Phase 1 construction and the Phase 2 extension of Lissenhall Bridge. In addition, the build characteristics and dimensions of Feature 2 match those encountered across Arch nos. 1 and 5 from Lissenhall Bridge (Feature 1). Therefore, as identified at Lissenhall Bridge, this culvert comprises a mid-section and two bridge extensions that are thought to be contemporary with those of Feature 1; forming part of the single structure that is depicted on Rocque's Map of 1760.

Impact from proposed works

A direct impact to this structure is anticipated as part of the proposed Metro North Project. Feature 2 has been fully-recorded and no further archaeological mitigation measures are deemed necessary prior to commencement of the construction phase of the project. As previously discussed this feature contains a mid-section of possible pre seventeenth-century date (build-Phase 1) and as such it is recommended that an architectural conservation assessment should be undertaken prior to commencement of the proposed development. This recommendation would correspond with the requirements outlined for Lissenhall Bridge (Feature 1) in the Archaeological Strategy for the Metro North. In addition, it is recommended that archaeological monitoring of all construction works on/ around Feature 2 is undertaken during the construction phase.

Feature 3: Balheary Bridge, NIAH: 11335018 (Figures 3, 19-21)

Balheary Bridge comprises of a two-arched bridge structure crossing the Ward River at NGR: 318744E, 248140N, centre-point (Plate 71). The bridge measures 10.55m

(34.6ft) in width (east-west) and 11.2m (36.7ft) in length (north-south). Three distinct build-phases are visible for the structure and are interpreted as indicating a primary pre seventeenth-century construction (Phase 1) that was extended on its downstream side in the mid-1700s (Phase 2) and its upstream side c.1850 (Phase 3).¹³ The abutment or transition points between the three build phases and are clearly visible. The upstream section extends a maximum of 3.8m (12.4ft) to the west of the original build-phase, while the downstream section extends a maximum of 2.88m (9.44ft) to the east. A modern, two-arched, culvert abuts the downstream (Phase 2) side of the bridge.

Phase 1: Internal Bridge Section (Figure 19).

The internal bridge section measures 4m (13.12ft) in width and is present within both archways. This mid-section represents the original bridge-build (Phase 1) across the Ward River at this location. The construction interface between the mid-section and the later build-phases is visible within both bridge archways and is most evident between build-phase 1 and 3 of the structure; the mid-section having a different arch-profile and height to the upstream bridge section (Plates 72-75). In addition, there is a contrast in the composition of intrados (arch-ceiling) between the two build phases; the mid-section not having been re-pointed using cement render. The intrados of the mid-section retains a surface covering of coarse, white coloured, mortar, with frequent river gravel, sub-rounded pebble, orange coloured brick fragments, cockle shell, and snail shell inclusions (Plate 76). Mortar of similar composition is located underneath the cement render on both the upstream and downstream bridge extensions. It is likely that this mortar was either applied on completion of the bridge widening endeavour or forms part of maintenance work carried out later in the eighteenth-century. This application of mortar and cement render across the arch intrados is identical to the pattern identified for both Lissenhall Bridge (Feature 1) and the adjacent single-arched culvert (Feature 2).

The existing arch-walls and intrados forming the internal bridge section are in a medium to good state of preservation; the semi-circular profile of the arches being maintained. The arch-walls within both archways are composed of irregular sized limestone blocks ranging in size from 0.25m x 0.20m – 0.45m x 0.27m. The upstream section (Phase 3) undercuts the arch-walls within both Arch nos. 1 and 2, large dressed sandstone blocks being interlaced with the smaller stones that form the arch-walls across the mid-section (Plate 77-78). The fact that the arch-walls from the upstream bridge extension are built-into, rather than abutting those from the mid-

¹³ The National Inventory of Architectural Heritage lists the upstream side of Balheary Bridge to be between 1820-1880, NIAH number 113350:18.

section, suggests there was damage to/ collapse of masonry from the upstream side of the Phase 1 structure. It is likely that the original upstream bridge extension, a contemporary construction to that of the downstream (Phase 2) extension, became unstable or partially collapsed; this extension being removed and replaced with the current, Phase 3, structure. In addition, it is clear that during the collapse event or subsequent removal of the Phase 2 extension, the Phase 1 structure was undermined, making its necessary to interlace the two structures across the their base sections.

Phase 2: Downstream Bridge Section (Figure 17)

The downstream (west) side of Balheary Bridge is contemporary with the Phase 2 bridge extensions at Lissenhall Bridge. A modern culvert abuts the downstream side of the structure and obscures much of the façade, including the bridge parapet and spandrels (Plates 79-80). However, inspection of the visible bridge areas reveals a façade that is identical in construction to that presented on the downstream side of Lissenhall Bridge (Feature 1). The bridge façade has been re-pointed using modern cement and exposed sections of masonry show use of good quality, roughly faced, irregular coursed limestone of varying size and shape 0.30m x 0.16m (min.) to 0.77m x 0.25m (max.). The downstream piers are partially visible and have rectangular ends. No downstream cutwaters are present.

Arch nos. 1 and 2 are in a good state of preservation and retain their original semi-circular shape. They measures 2.4m (7.87ft) in width/span (max.) and 2.2m (7.21ft) in height (max.). Both archways are segmental in form with 13 arch stones visible for Arch no.1 and 14 arch stones for Arch no. 2. It is likely that c.30 arch stones comprise both arch-rings as a whole. The arches comprises neatly-faced masonry blocks of a regular size and shape with arch stones measuring between 0.31m-0.32m in length, 0.09m - 0.14m in width, and 0.20m – 0.24m in depth. Cement plastering has been used to reinforce the arch intrados and overlies an earlier mortar. The arch ceilings are composed of shaped, rectangular, blocks of varying width and length (average size: 0.30m Length x 0.14m width). These intrados run westwards for a distance of 2.64m (8.66ft) to join the internal bridge section (Phase 1) and 6.88m (22.55ft) to meet the upstream bridge (Phase 3) section.

Phase 3: Upstream Bridge Section (Figure 21).

The upstream (east) side of Balheary Bridge represents a nineteenth-century replacement of the original (Phase 2) bridge extension at this location. The upstream section of bridge comprises of two archways, a semicircular cutwater, and two rectangular pillars that protrude from the façade. Granite blocks have been used to

cap the structure and construct the arch-rings, haunch, central cutwater, and flanking pillars. Limestone blocks have been used to face the spandrel, parapet, arch-walls, and arch intrados. A triangular-cut pier structure, encased in modern concrete, is located between Arch nos. 1 and 2. A semi-circular cutwater, with semi-pyramidal capping, has been built upon the aforementioned pier structure (Plate 81). The cutwater structure measures 1.5m (4.9ft) in height x 1m (3.28ft) in width and is composed of four courses of neatly cut granite blocks. The lowest course comprises of two rectangular blocks measuring 0.50m in length and 0.17m in width. The remaining courses are composed of larger blocks measuring 0.50m in length and 0.29m in width. The cutwater-capping is composed of a single granite block, cut into a semi-pyramidal shape, measuring 0.43 in height (max.) x 1.2m in width.

The two rectangular pillars, flanking the northern and southern sides of Arch no. 1 and Arch no. 2, measure 3.4m (21.9ft) in height x 1.6m (5.2ft) in width and protrude a maximum of 0.12m (at pillar base) from the rest of the bridge façade. They are constructed of granite blocks measuring a uniform width of 0.28m. These blocks vary in length between 0.68m and 0.30m.

The bridge façade comprises of eighteen courses of cut-stone masonry. The first four courses form the haunch, located on either side of the two arches, and are composed of rectangular granite blocks measuring 0.28m in width and 0.50m in length. The following eight courses comprise the bridge spandrels and are composed of limestone blocks. These blocks, largely rectangular in shape, are more irregular in size than the granite blocks and measure between 0.91m – 0.43 in length. The stones in each course-line are of uniform width; however, the width of each course varies between 0.43m – 0.17m. The next two courses form a stepped, decorative rail running horizontally between the two pillars; directly above the apex of the two arch-rings. These courses are composed of neatly cut/ shaped granite blocks measuring up to 0.90m in length. The lower course measures 0.18m in width and is chamfered along its upper edge (c.0.05m chamfer). The upper course measures 0.26m in width and is also chamfered along its upper face (c.0.05m chamfer).

The bridge parapet is composed of three courses of rectangular limestone blocks measuring between 0.32m – 0.76m in length and 0.14m – 0.16m in width. Granite coping has been used to cap the parapet. The coping stones measures between 0.70m – 0.80m in length and has a uniform width of 0.14m. A large, rectangular, granite block measuring 0.82m length x 0.47m width is located mid-point along the north-south extent of the parapet façade.

Arch nos. 1 and 2 are in a very good state of preservation and retain their original semi-circular shape. They measure 2.4m (7.87ft) in width/span (max.) and 2.2m (7.21ft) in height (max.). Both archways are segmental in form and comprise of 15 neatly-faced, wedged shaped, granite blocks. The arch-rings have a uniform width of 0.35m and the arch stones measure 0.35m in width along the top of the arch-ring, 0.22m along the base. The arch-ring measures 0.60m in depth. Cement plastering has been used to reinforce the arch intrados and overlies an earlier mortar. The arch ceilings are composed of shaped, rectangular, blocks of varying width and length. These intrados run westwards for a distance of 3.8m (12.4ft) to join the internal bridge section (Phase 1) and 7.8m (25.5ft) to meet the downstream bridge (Phase 2) section.

Bridge Footings/Pier Structures

As encountered at Lissenhall Bridge (Feature 1), inspection of these bridge elements at Balheary Bridge was not possible due to the modern concrete consolidation measures present. The bridge footings and pier structures being covered by poured mass concrete. While the exact dimensions, composition, and build quality of the bridge foundations cannot be assessed, it is likely that the pier structures are composed of a cut-stone facing with a heavily mortared internal rubble core.¹⁴ The bridge footings and pier structures protrude a maximum of 0.16m from the base of the arch-walls. The western (upstream) end of each pier structure is triangular in shape and the eastern (downstream) ends are rectangular in shape.

Conclusion

Visual inspection has identified that Balheary Bridge comprises three phases of bridge construction. The initial build-phase is of pre-seventeenth century date and forms part of a series of bridge arches that crossed the wide floodplain formed by the Ward River, the Broadmeadow River, and a small tributary located between the two watercourses. It is likely that these arches formed a single, continuous structure known as Lissenhall Bridge. This structure was later extended in the eighteenth-century, on both its eastern and western sides; to form the single continuous structure, as depicted on Rocque's map of 1760 and labelled as Lissenhall Bridge on the First Edition Mapping 1837 (Figures 7-8). The downstream, Phase 2, section of Balheary Bridge corresponds to this later bridge widening endeavour. The upstream side of Balheary Bridge was constructed in the nineteenth-century (c.1850) and

¹⁴ Comparison made with techniques employed for the construction of in-water piers from archaeological excavations undertaken by ADCO Ltd at John's Bridge, Kilkenny, River Nore Flood Alleviation Scheme, 2001-2002 (Licence number: 01E036) and the archaeological survey and excavation of Old Navan Road Bridge, River Tolka Flood Alleviation Scheme, 2006 (licence numbers: 05D026Ext. and 06E092).

represents the third phase of bridge building at this location. It is likely to have been constructed in response to the collapse or partial collapse of the upstream (Phase 2) bridge extension and it is following this nineteenth-century addition that the three bridge phases are collectively named Balheary Bridge. This, in name, partitioned the extended structure that formed Lissenhall Bridge; Balheary Bridge and Lissenhall Bridge now being clearly marked as separate structures on the OS Third Edition mapping of 1906 (Figure 9).

Impact from proposed works

A direct impact to Balheary Bridge is anticipated as part of the Metro North Project. It is proposed to use the existing Balheary Bridge for southbound Light Metro Vehicles and to construct a new bridge across the Ward River, immediately west of Balheary Bridge; at a distance of between 0.20m (minimum) and 4m (maximum) from the existing bridge structure. However, it is understood that neither of these proposed works will affect the historic or archaeological fabric of the existing bridge structure. Balheary Bridge has been fully-recorded and no further archaeological mitigation measures are deemed necessary prior to commencement of the construction phase of the project. However, given that the internal section of Balheary Bridge is thought to form part of a single structure (build-Phase 1), running between Features 1-3, it is recommended that an architectural conservation assessment should be undertaken prior to commencement of the proposed development. This recommendation would correspond with the requirements outlined for Lissenhall Bridge (Feature 1) in the Archaeological Strategy for the Metro North. In addition, it is recommended that archaeological monitoring of all construction works on/ around Balheary Bridge is undertaken during the construction phase.

Feature 4: Weir location and wall structures (Figure 3, 19)

A weir is marked on the OS Third Edition Map of 1906, c.3m upstream (west) of Balheary Bridge. The in-water elements of this structure are no longer present, having been removed sometime in the in the twentieth-century (possibly during the bridge consolidation works undertaken in 1960s). This feature is not marked on the First Edition map of 1837, suggesting that the structure was of late nineteenth-century date. However, two masonry walls forming part of, or associated with, the weir structure remain. These structures are located on either side of the Ward River, running parallel (north-south) to Balheary Bridge (c.3m upstream of the bridge). The northern section of walling is located at NGR: 318738E, 248143N (southern end) and measures 0.45m in width; it is upstanding 0.72m from the riverbed (Plate 82). The northern end of the structure is covered by the adjacent riverbank, leaving only a

0.55m section exposed. A small pile of stones, measuring 0.5m x 0.4m in extent, is located on the western side of this wall section. These stones are likely to form part of a river revetment wall (Feature 5) located on either side of the Ward River, upstream of Feature 4. A section of the revetment wall appears to have been removed to facilitate construction of the weir and its associated wall sections. The southern wall section is located at NGR: 318739E, 24135N (northern end) measures 0.40m in width and is upstanding 0.65m from the riverbed. It extends 2.1m south and is attached to another section of wall, running perpendicular to the bridge (Plate 83). This wall runs east-west from Balheary Bridge for a distance of 3m to terminate at NGR: 318738E, 248133N. A similar section of wall is located on the northern side of the river, disappearing into the bank structure along its eastern extent.

Conclusion

Feature 4 comprises of four sections of limestone walling associated with a late nineteenth to early twentieth-century weir structure that was located c.3m upstream of Balheary Bridge. The structures are of relatively modern origin and are of historic, rather than archaeological, interest. The weir structure depicted on the OS Third Edition mapping has been completely removed and there is no indication of any foundations associated with this structure being present.

Impact from proposed works

A potential impact to Feature 4 is anticipated with the construction of the proposed Ward Bridge on the upstream side of Balheary Bridge. Feature 4 has been recorded and no further archaeological mitigation measures are deemed necessary prior to commencement of the construction phase of the project. However, should additional structural components associated with Feature 4 be uncovered during the construction process, further archaeological recording may be required. Archaeological monitoring of all riverbed/ground disturbances associated with the construction of the Ward Bridge should be undertaken by a suitably qualified archaeologist licensed to the DoEHLG.

Feature 5: River Revetment (Figure 3, 19)

This feature comprises of two sections of dry-stone revetment wall located at the base of the existing bank structures on either side of the Ward River (Plates 84-85). Originally two revetment walls would have run east-west along the both sides of the river from Balheary Bridge to a point c.90m upstream (west). However, these structures have been truncated by later constructions and are now visible in two

sections on the north side, and three sections on the south side of the river (Sections 1-5). These sections all measure 0.30m in width, up-stand to a height of between 0.70m and 0.95m from the riverbed, and are composed of angular stones (limestone and quartzite) of irregular size and shape (average size: 0.15m length x 0.12m width). A cement render has been applied to the revetment walls, most likely applied as part of the maintenance work undertaken at Balheary Bridge.

Section 1, is located on the northern side of the river and measures 28m in length, running between NGR: 318752E, 248229N and NGR: 318743E, 248164N (Plates 84-85). Section 2 is located c.4m downstream from Section 1, and measures 3m in length, running between NGR: 3187722E, 248140N and NGR: 318725E, 248141N. Section 3 is located on the southern side of the river and measures 12m in length, running between NGR: 318699E, 248128N and NGR: 318711E, 248131N. Sections 4 and 5 are located downstream of Section 3. Section 4 measures 5.3m and runs between NGR: 318712E, 248131N and NGR: 318718E, 248132N. Section 5 measures 1.3m and is truncated by a drainage pipe to the west and Feature 4 to the east (NGR: 318738E, 248135N, centre-point).

Conclusion

The five sections of revetment wall are the residue of river-channelling undertaken in late nineteenth/ early twentieth-century. The OS Third Edition map shows a straightening of a c.90m stretch of the river channel between Balheary Bridge and the upstream single single-arch bridge (Feature 6). The revetments are truncated on both sides of the waterway by the construction of a weir and associated walling located c.3m upstream of Balheary Bridge (Feature 4). The structures, while thought to pre-date Feature 4, are also of relatively modern origin and retain an historic interest rather than any archaeological significance.

Impact from proposed works

A potential direct impact to the eastern ends of the two revetment walls are anticipated with the construction of the proposed Ward Bridge on the upstream side of Balheary Bridge. These structure been recorded and no further archaeological mitigation measures are deemed necessary with regard to Feature 5 prior to commencement of the construction phase of the project.

Feature 6: Single arched Bridge (Figure 3)

This feature comprises a single-arched bridge located 92m upstream (west) of Balheary Bridge at NGR: 318648E, 248113N (Plates 86-87). The bridge is marked on the OS First Edition map of 1837, giving the structure a late eighteenth or early nineteenth-century date. The bridge measures 8m in length and 4m in width. The bridge façade is constructed using neatly cut, rectangular, limestone blocks measuring between 0.30m - 0.41m in length. The limestone blocks vary in width from 0.13 - 0.18m depending on the masonry course. The bridge parapet measures 0.68m in height and has undergone extensive modern repair. The arch is of three-centred arch form and composed of 20 neatly cut/ faced arch stones. This arch style is used to reduce road-gradients with increased arch spans. It originated in Italy in the sixteenth-century and became common in Ireland in the eighteenth and nineteenth-centuries.¹⁵ The arch stones are almost square in shape, measuring 0.33m in length x 0.32m in width. A larger keystone is present and measures 0.41m in length x 0.32m in width. The arch measures 4.1m (13.4ft) in width and 1.9m (6.23ft) in height above the bridge footings. The structure is in a good state of preservation and has its bridge footings underpinned using concrete. This bridge maintenance work is contemporary with that undertaken at Lissenhall Bridge and Balheary Bridge in the 1960s.

Conclusion

Feature 6 represents a single build-phase pedestrian bridge structure, constructed in the late nineteenth to early nineteenth-century. The structure is of historic and architectural importance, but does not retain any archaeological significance.

Impact from proposed works

This feature is located 92m west of the proposed Ward River impact area and no further archaeological mitigation measures are required at this site.

Metal-detection Survey (Figures 12 and 19)

A metal-detector survey was undertaken across a 50m stretch of the Broadmeadow River. A relatively low ratio of hits was encountered as part of the survey. The majority of the targets, twenty-four in total, remained buried within the river gravels and these were position-fixed using the differential GPS unit (Figure 12). All exposed targets proved to be of modern origin and included: beer cans, re-bar, corrugate iron fragments, engine parts, etc. The high water velocities present for this stretch of river, coupled with the presence of concrete consolidation works covering the natural

¹⁵ O'Keefe, Peter and Tom Simington, *Irish Stone Bridges: History and Heritage*, Irish Academic Press, Blackrock, pp.88

riverbed beneath Lissenhall Bridge, has lead to this low hit ratio; any portable objects being carried to catchment areas further downstream. Metal-detection was also undertaken across the northern and southern bank structures on the downstream side of Lissenhall Bridge. These structures yielded a concentrated hit ratio of 1 target every 1m². This higher hit ratio is most likely due the artificial nature of these structures, a large amount of modern debris being present within them.

Similar metal-detection characteristics were encountered for the Ward River riverbed survey area. Metal-detection was undertaken across a 20m stretch of riverbed, upstream of Balheary Bridge, and a total of seventeen targets were encountered. All targets remained buried and were position-fixed using a GPS unit (Figure 19). As with the Broadmeadow River, the high water velocities present for this stretch of river, coupled with the presence of the concrete consolidation works covering the natural riverbed beneath Balheary Bridge, has also resulted in low hit ratio for this survey area. In contrast, a greater concentration of metal-detection targets was present within adjacent bank structures and a hit ratio of 1 target every 1-2m² was encountered.

Mortar Sampling

A series of locations suitable for removal of mortar samples for detailed analysis were identified from within Features 1-3. *In situ* visual inspection of the arch intrados within each structure has shown similar composition/properties of the aggregate and binder components of the mortar used, suggesting they are contemporary with second build-phase or later maintenance work undertaken in the eighteenth-century. It is anticipated that examination of mortar samples will provide a possible origin for each mortar type and allow cross-referencing with other sample of know date. In addition, it is anticipated that an older mortar is present beneath the aforementioned mortar layer; located within the Phase 1 sections of structures 1-3. Comparison of mortar samples from these sections may shed further light on the relationship between the Phase 1 build-phases. All samples should be visually examined by microscope/ stereomicroscope and fragments selected for petrographic analysis.

Discussion

The current assessment has provided the opportunity to present a detailed account of the existing bridge structures that comprise Lissenhall Bridge (Feature 1), its adjacent single-arched culvert (Feature 2) and Balheary Bridge (Feature 3). The assessment has also documented any additional riverine features (Features 4-6) and the existing river environment at the Broadmeadow and Ward Rivers. While all

features identified are of historic or architectural interest, Features 1-3 also retain an inherent archaeological significance and have provided the main focus for the assessment. Lissenhall Bridge (Feature 1) is listed in the RMP (DU011-081), recorded in the NIAH (no. 1335019), and is listed as a protected structure (RPS341). Balheary Bridge (Feature 2) is also recorded in the NIAH (no. 1335018) and listed as a protected structure (RPS 340).

Both the physical and cartographic evidence suggests that Liessenhall Bridge (Feature 1) formed a single structure that crossed both a tributary of the Broadmeadow River and the Ward River, in addition to the Broadmeadow River. John Rocque's map of county Dublin (1760) clearly depicts a single structure as described, and the visual inspection has confirmed the presence of an earlier build-phase, Phase 1, at Lissenhall Bridge (Feature 1), the single-arched culvert (Feature 2), and Balheary Bridge (Feature 3).

The initial build phase (Phase 1) forms the mid-section of each structure comprising Features 1-3. These mid-sections are aligned with each other on a north-south axis and display a similar construction methodology throughout. Later build-phases abut the eastern (downstream) and western (upstream) side of each structure. It has previously been noted that the middle section of Feature 1 (present-day Lissenhall Bridge) is thought to date to the pre seventeenth-century; a date that can be extrapolated to encompass the mid-sections of the adjacent Culvert (Feature 2) and Balheary Bridge (Feature 3).¹⁶ Due to the pre seventeenth-century build-phase within Feature 1, Lissenhall Bridge has been listed in the Record of Monuments and Places (DU011-081) and is provided statutory protection under the National Monuments Acts 1930-2004. The current assessment has identified this pre-1600s build-phase (Phase 1) within Features 1 and 2. As such, it is anticipated that these features will be afforded the same protection as Feature 1, encompassing the existing RMP monument DU011-081.

It is also clear that the mid-eighteen-century build-phase (Phase 2), forming the bridge extensions at Features 1-2 and the downstream extension at Feature 3, was part of a single structure as depicted on Rocque's map of 1760 and labelled as Lissenhall Bridge on the First Edition Mapping 1837. A third build-phase is present at Balheary Bridge (Feature 3), the upstream bridge extension being constructed in the

¹⁶ O'Keefe, Peter and Tom Simington note that the characteristics of the middle section of Lissenhall Bridge suggest that it is of pre-1600 date. In addition, the National Inventory of Architectural Heritage (Entry number: 1335019) lists Lissenhall Bridge as having a pre-1600 core.

nineteenth-century (c.1850) in response to the collapse or partial collapse of the upstream (Phase 2) bridge extension that preceded it. It is following the construction of this Phase 3 bridge extension that a segregation of the extended structure that formed Lissenhall Bridge takes place; Balheary Bridge and Lissenhall Bridge now being clearly marked as separate structures on the OS Third Edition mapping of 1906.

6.0 PROPOSED IMPACTS

It is proposed that the Metro North alignment will cross the Broadmeadow River via the existing Lissenhall Bridge structure (Feature 2). The existing Balheary Bridge (Feature 3) will be used for southbound Light Metro Vehicles (LMV) and a new bridge will be constructed to accommodate the northbound LMV. The new bridge (Ward Bridge) will cross the Ward River immediately west of Balheary Bridge; at a distance of between 0.20m (minimum) and 4m (maximum) from the existing bridge structure. The proposed Ward Bridge will be supported on piles inserted into the north and south banks of the river. These piles will be placed at a distance of 2-3m from the rivers edge.

The current archaeological assessment has sought to fully record the exposed extents of all material, structures or deposits of historical and archaeological significance located within the proposed river impact areas. All riverbed areas impacted by the proposed development have been systematically inspected and no upstanding features, deposits, or features of archaeological significance were encountered. Further pre-disturbance investigation of these areas is not deemed necessary prior to commencement of the development.

It is anticipated that direct impacts (low magnitude) will take place to Features 1-3 (Lissenhall Bridge, its adjacent Culvert, and Balheary Bridge). In addition, a potential direct impact is anticipated for Feature 4 (Weir location and wall structures) by the construction of the Ward Bridge, upstream of Balheary Bridge (Feature 3). However, this feature has been fully recorded and does not retain any archaeological significance. Features 5 (River revetment walls) and 6 (Single-arched bridge) will remain unaffected by the proposed development. It is anticipated that further archaeological mitigation relating to Features 4-6 is not required prior to commencement of the development. It is recommended, in line with the requirements of the Archaeological Strategy for the Metro North, that an architectural conservation

assessment is undertaken at Features 1-3. This assessment should be undertaken prior to commencement of the construction phase of the development. It is also anticipated that construction phase monitoring will be necessary at Features 1-3, to record the process and ensure that impacts to these structures are minimised.

7.0 RECOMMENDATIONS

Pre-construction Measures

No further pre-construction measures are recommended with regard to Features 4-6. However, a programme of mortar sampling and analysis is recommended for Features 1-3 to further establish the relationship between each structure, and to provide additional information on their individual and collective build-phases. All samples should be visually examined by a mortar specialist and the results absorbed into an archaeological report that addresses the principal issues highlighted. In addition, a conservation architect's report is recommended for Features 1-3; as outlined in the Archaeological Strategy for the proposed Metro North Project.¹⁷

Construction Phase Measures

ARCHAEOLOGICAL MONITORING. Archaeological Monitoring is recommended for all bankside and riverbed disturbance works associated with this scheme. This monitoring should be conducted under licence to the DoEHLG by a suitably qualified archaeologist with previous experience of river-based development projects.

It is also recommended that all invasive elements of the proposed construction work associated with Features 1-3 be monitored. This archaeological work should be undertaken with the proviso for full excavation of any archaeologically significant material uncovered at this time.

RETAINING AN ARCHAEOLOGIST/S. An archaeologist should be retained for the duration of the relevant works.

THE TIME SCALE for the construction phase should be made available to the archaeologist, with information on where and when ground disturbances and dredging will take place.

¹⁷ Metro North, *Archaeological Strategy*, Railway Procurement Agency Document.

DISCOVERY OF ARCHAEOLOGICAL MATERIAL. In the event that archaeological features/artefacts are discovered during construction monitoring, construction works in the affected area shall stop immediately and the archaeological site shall be fenced off and findings shall be immediately reported to the Project Archaeologist.

ARCHAEOLOGICAL MATERIAL. Should archaeological material be identified during the construction works the DoEHLG may seek preservation by avoidance (i.e. the preservation of material *in situ*) or preservation by record (i.e. archaeological excavation). The extent and duration of any excavation would be a matter for discussion between the client and the licensing authorities.

MACHINERY TRAFFIC during construction must be restricted as to avoid any of the selected sites and their environs.

SPOIL should not be dumped on any of the selected sites or their environs.

PLEASE NOTE: All of the above recommendations are based on the information supplied for the Metro North project. Should any alteration occur, further assessment maybe required.

PLEASE NOTE: Recommendations are subject to the approval of the Department of the Environment, Heritage and Local Government.

8.0 ACKNOWLEDGEMENTS

Thanks are extended to Maria Fitzgerald (Project Archaeologist) and Brian Hession, (Contracts Manager) Railway Procurement Agency, and Conor Gormley (Project Manager) Irish Archaeological Consultancy Ltd. The survey team included Rex Bangerter (Maritime Archaeologist), Graeme Laidlaw (Archaeologist), Edward Pollard (Maritime Archaeologist and project licence-holder), Brian MacAllister (Dive Supervisor), and Oscar Ryan (Archaeological Surveyor). This report was written by Rex Bangerter (Archaeological Director) and edited by Bangerter and Dr. Niall Brady, Project Manager.

Appendix 1: Artefact Entries from the Topographic Files at the National Museum of Ireland listed for the townlands surrounding the river assessment areas.

Artefact:	Find place:	NMI Reg. No.	Description:
Flint waste	Lissenhall Great	1978:78	Scarp above shore road north side of Broadmeadow Estuary.
Flint waste	Lissenhall Great	1978:77	Scarp above shore road north side of Broadmeadow Estuary.
Flint waste	Seapoint	1978:76	Ploughed field north side of Broadmeadow Estuary, brown flint débitage.
Flint waste	Seapoint	1978:75	Ploughed field north side of Broadmeadow Estuary, brown flint débitage.
Iron spearhead	Garden soil at Seapoint or Templehill	1999:213	-----
Circular copper alloy button	Newtown	1995:160	Site of 18 th -century house 'Springvale'. Front decorated with a recessed central boss surrounded by a ring of small pellets. Detail of rear obscured by corrosion/concretions.
Copper alloy axehead with side flanges and stop-ridge	Newtown	1962:259	Found in surface soil of ploughed field. The butt end has been broken or cut off in antiquity. Length 9.2cm, width at cutting edge 6.7cm, at butt 2.5cm, max thickness (including flanges) 2.2cm.
Portion of a stone lamp	Newtown	1956:182	Found near the site of a ring fort.
Jet/lignite bracelet fragment	Newtown	1955:41	Picked up on an earthen mound surrounded by bank. Diameter of 3cm internally and 3.6cm externally. The section is a rounded triangle, 1cm wide at the base (i.e. the inside of the bracelet or that portion resting against the flesh) and 6mm high from mid-base to apex.
Copper axehead	Newtown	1928:2	Near Ferguson's House, Newtown, Glencullen near Ballyedmonduff.
Bronze Vessel	Swords	R:181	Found in a quarry.
Socketed bronze spearhead	Swords	1998:48	Dark green patina, rubbed in places. Leaf-shaped blade with bevelled edges. Circular socket extending well into the blade. Pair of circular peg-holes in the socket, placed opposite one another.
Axehead: Bronze palstave, unlooped	Swords	1939:17	Bronze palstave, finely patinated all over. Ornamented with raised ribs on the apron and casting seams treated decoratively on narrow sides. Length 9.2cm, width at butt 2.2cm, width at cutting edge 4.5cm, thickness across pocket 3cm.
Flat Bronze Axehead	Swords	1939:16	Bevelled narrow edges with possible trace of cable ornament. Widely splayed cutting edge, length 13.8cm, width at butt 3.3cm, thickness 8mm, cutting edge width 8.5cm.
Flanged bronze axehead	Swords	1916:14	Harbison Type Derryniggin (undecorated). Harbison P (1968) The axes of the early bronze age in Ireland. Prahistorische Bronzefunde 9 (1). Munich.
Bronze axehead	Swords	1916:41	Found in 1838.
Bronze palstave	Swords	1916:39	Bronze Palstave with shoe stop type. Ransay, G. 1989. Middle Bronze Age weapons in Ireland PhD Thesis, Queen's University, Belfast.

Medieval bronze tripod ewer	Swords	4969:W57	Has an anthropomorphic spout. Lewis, Brownsword and Pitt Class: Group Bb. Lewis, J.M. Brownsword, R. and E.E. H. Pitt 1987. Medieval bronze tripod ewers from Wales', Medieval Archaeology (31), 80-93.
Flat bronze axehead	Swords	E92:335	Butt end cut off or blunt. Rectangular cross-section expanded cutting-edge. Pocked surface. Length 7.2cm, width 5cm, thickness 6mm.
Flint fragment	Swords Glebe	1978:12	Disturbed soil at west side of graveyard, yellowish waste flint.
Flint fragment	Swords Glebe	1978:11	Disturbed soil at west side of graveyard, yellowish waste flint.
50 fragments of Pottery, one glazed pot, 2 unworked chip flint	Swords Glebe	1974:10	Site of new vicarage, ancient monastic site foundation spoil. Pottery miscellaneous quartz-gritted clay, base and body sherds made of coarse micaceous wheel-thrown fabric.
Unglazed potsherds	Swords Glebe	1973:72-88, 67	E.C. monastic site and medieval church, base body sherd, fine wheel-thrown micaceous ware grey in the case of a dull reddish brown on both the inner and outer surfaces.
Base-wall sherd of medieval cooking pot	Swords Glebe	1973:67	Dark grey fairly coarse micaceous wheel thrown ware. Outer surface bears a carbonised deposit – medieval cooking pot.
Sherds of green glazed ware	Swords Glebe	1973:68-71, 60-66	E.C. monastic site and medieval church, portion of pot leg/handle. Dull reddish-brown fine hard wheel-thrown ware. Outer surface has a thick mottled green glaze or a brown glaze.
Whetstone portion	Swords Glebe	1973:59	E.C. monastic site and medieval church, rectangular in outline and cross-section, all original surfaces are worn, one broad face bears two deep approximately parallel grooves. Max length 7cm, max width 5.6cm, max thickness 3.1cm.
Glass bead	Swords Glebe	1969:57	Found c. 30 yards from Swords Round Tower, spherical with narrow straight perforation 1.2mm in diameter. Has been subjected to heat. Diameter of bead is 1.6cm.
Lump of melted green enamel	Swords Glebe	1969:56	Found c. 30 yards from Swords Round Tower. Length 1.7cm, width 1.4cm, thickness 1cm.
Blue glass bead	Swords Glebe	1969:55	Found c. 30 yards from Swords Round Tower. Length 1cm, diameter 9mm.
Biconical opaque blue glass bead	Swords Glebe	1969:54	Found c. 30 yards from Swords Round Tower. Each conical surface bears spiral ribbing. Diameter 1.5cm, thickness 8mm.
Blue glass bead, white and yellow inlay	Swords Glebe	1969:53	Found c. 30 yards from Swords Round Tower. Perforated along the longer axis. At either end of the perforation was apparently subrounded by a raised rib of applied yellow glass. The blue central portion of the bead is inlaid with two running waves. Length 1.6cm, diameter 1.2cm.
Portion of brass buckle	Swords Glebe	1969:52	Found c. 30 yards from Swords Round Tower, sub-rectangular shape, d-shape cross section. Length 3.6cm, width 2.5cm, thickness 3mm.
Copper alloy metal object	Swords Glebe	1969:51	Found c. 30 yards from Swords Round Tower. Long slender piece of metal, round pointed at either end and of concave-

			convex cross-section. The concave surface is partly filled with a grey hard metal. Length 15.3cm, width 1.1cm, thickness 4.5mm.
Two lead fragments	Swords Glebe	1969:50	Found c. 30 yards from Swords Round Tower. Been subjected to heat, lengths 4.5 and 3.7cm, both 1cm in width.
Small tanged iron knife	Swords Glebe	1969:49	Found c. 30 yards from Swords Round Tower, 1.4cm long, length 7.9cm, width 1.5cm and thickness 5mm.
Tanged iron knife	Swords Glebe	1969:48	Found c. 30 yards from Swords Round Tower, length 10.65cm, length of tang fragment 1.5cm, thickness 4mm.
Bone pin perforated	Swords Glebe	1969:47	Found c. 30 yards from Swords Round Tower, partly worked, irregularly shaped, perforated head. Cross-section varies from circular to oval approaching the head, length 7.4cm, max width of head 1cm, thickness 5mm.
Decorated bone fragment	Swords Glebe	1969:46	Found c. 30 yards from Swords Round Tower, flat strip of bone, polished and ornamented with two parallel rows of dot and circle ornament.
Half-farthing	Swords Glebe	1969:45	Found c. 30 yards from Swords Round Tower, 'Patrick of Henry VI', date of 1460, diameter 1.35cm.
Farthing, Charles I	Swords Glebe	1969:44	Found c. 30 yards from Swords Round Tower, diameter 1.6cm, 1626-35 in date.
Brass mount	Swords Glebe	1969:43	Found c. 30 yards from Swords Round Tower, oval shape and concavo-convex cross-section. Length 5.1cm, width 4cm and thickness 2mm.
Bronze finger ring	Swords Glebe	1969:42	Found c. 30 yards from Swords Round Tower, unornamented, D-shaped in cross-section.
Bronze pin	Swords Glebe	1969:41	Found c. 30 yards from Swords Round Tower, circular cross-section but the lower 3cm nearest the point is rectangular. Ornament on the flat head consists of two incised lines and circular impressions.
Bronze pin	Swords Glebe	1969:40	Found c. 30 yards from Swords Round Tower, slightly pointed domed shaped head that may have been incised with X-designs. Length 9.2cm, max diameter of stem 3.5mm
Sheela-na-gig	Swords Glebe	1945:18	Female figure carved on a pillar which acted as a gate post at Drynam House. The figure was 67x28cm. The pillar was 148cm in height. The figure had a standing posture with one leg raised in a jig like stance. Small breasts, broad neck and face with features worn away. Gesture of hands towards the lower abdomen.

Appendix 2: Excavations Bulletin entries for townlands surrounding Swords.

<p>Dublin 1999:275 WINDMILL LANDS, RIVER WARD, SWORDS Medieval burials 99E0554</p> <p>In October 1999 the Underwater Unit of Dúchas undertook a rescue excavation following a report from Fingal County Council that a possible human skull was protruding from a riverbank in Swords, Co. Dublin. An intra-riverine inspection verified that the human skull lay within an extensive midden that was exposed for at least 40m along the riverbank. The midden (which consisted mainly of charcoal, shells, animal bone and the human skull) had become exposed during recent flooding of the Ward Valley. Upon removal of the skull, it was apparent that the articulated remains of the skeleton were present within the midden deposit. It was therefore necessary to open a 2m-by-2m cutting to recover the remains of the skeleton. The site is in the flood-plain of the River Ward valley to the south of Swords in the townland of Windmill Lands.</p> <p>The site produced a number of phases, with the upper levels being quite disturbed and containing a variety of pottery types ranging from transfer print ware and Frechen ware to medieval pottery including Leinster cooking ware and Dublin-type ware. The first undisturbed medieval phase produced both burials and domestic finds. The articulated remains of two individuals were discovered. One of the skeletons was that of a newborn infant, while the other consisted of the upper right long bones and part of the right pelvis of a mature adult. This stratum also produced animal bone remains, metal objects including iron nails, two belt-buckles and two possible socketed arrowheads, and medieval pottery.</p> <p>The second phase of activity appears to have been associated with some form of nearby settlement as the stratum consisted primarily of the dumping of domestic material. A significant amount of animal bone (cattle, sheep and horse) and medieval pottery including Leinster cooking ware and Dublin-type ware was present. Other finds included mortar and slate, a large quantity of iron nails and an Edward I silver penny. No human remains were recovered from this phase of activity.</p> <p>The lowest stratum consisted of the midden and the human skull that were originally visible in the riverbank. The midden rested on natural riverine deposits and consisted of large quantities of charcoal, animal bone and shell, including periwinkles, oysters, scallops, mussels and limpets. Excavation of this midden layer revealed three further burials. These individuals had been placed one on top of the other, most likely at the same time. A young female adult was uncovered slightly flexed, with pillow-stones placed around her head. This burial was orientated east-west and was placed more or less on top of an extended older female, whose skull had already been removed from the riverbank. The upper part of the older female had been placed on and had subsequently crushed an infant, who had been the primary interment. The infant remains were orientated in a north-west/south-east direction. The foot bones of another adult were retrieved from the edge of the cutting, and it is likely that the remainder of this skeleton has been long lost to the River Ward. The burials generally tended towards an east-west orientation. However, it is possible that some degree of haste was involved, as it would appear that the bodies were thrown rather than placed with any degree of time and ritual.</p> <p>The pottery recovered indicates that the site dates to the late 13th and early 14th centuries. This dating is further strengthened by the presence of the Edward I silver penny, which dates to the late 1280s. The dating of the site is not unusual given its location within the medieval borough of Swords. In total, the remains of six skeletons were excavated. Post-excavation work is ongoing.</p> <p>Karl Brady and Connie Kelleher, Underwater Archaeological Unit, Dúchas The Heritage Service, 51 St Stephen's Green, Dublin 2.</p>
<p>Dublin 2000:0321 SITE 5, LISSENHALL GREAT Earthwork 319428 248445 99E0546</p> <p>The site was defined as a possible enclosure from aerial photographs. The possible location of the feature was on the top of an east-west-facing low ridge. Because the field had been ploughed it was not possible to identify the feature above ground. Only about one-third of the feature was to have been affected by the road construction. During the investigation three hand-dug cuttings were opened.</p>

Cutting 1, on the north-western slope of the ridge, measured 4m x 2m. The topsoil measured 0.37m and overlay subsoil. Two patches of modern lime were cut into the natural. The cutting contained nothing of archaeological significance. Cutting 2, on the top of the ridge 7m to the east of Cutting 1, measured 8m x 2m and contained nothing of archaeological significance. Cutting 3, located 6.5m to the east of Cutting 2 on the south-eastern slope of the ridge, measured 4m x 2m and contained nothing of archaeological significance.

Editor's note: The summary of this excavation, which was carried out during 1999, arrived too late for publication in the bulletin of that year

Patricia Lynch, 112 Cianlea, Swords, Co. Dublin, for Valerie J. Keeley Ltd, Brehon House, Kilkenny Road, Castlecomer, Co. Kilkenny.

Dublin

2000:0322

SITE 6, LISSENHALL GREAT

Earthwork

319185 247817

99E0547

This site was identified as a possible earthwork on the first edition OS map. There were no surface indications of the earthwork, and it is possible that its remains were incorporated into the garden walls/boundaries of the nearby estate, Lissenhall House. Four hand-dug cuttings measuring 3m x 3m were sited on the very low, east-west ridge within the road-take.

Cutting 1 was to the east of the slope. Topsoil measured 0.4–0.5m and overlay the natural subsoil. The cutting contained a modern field drain cut into the subsoil but nothing of archaeological significance.

Nothing of significance was found in the other cuttings, Cutting 2, c. 6.5m north-west of Cutting 1, Cutting 3, c. 50m north-west of Cutting 1, and Cutting 4, c. 65m to the west of Cutting 1.

Editor's note: The summary of this excavation, which was carried out during 1999, arrived too late for publication in the bulletin of that year.

Patricia Lynch, 112 Cianlea, Swords, Co. Dublin, for Valerie J. Keeley Ltd, Brehon House, Kilkenny Road, Castlecomer, Co. Kilkenny.

Dublin

2000:0323

LISSENHALL LITTLE

Enclosure?

319126 249686

00E0953

This report describes the investigations carried out at Lissenhall Little, Co. Dublin, prior to the construction of the Northern Motorway/Airport– Balbriggan bypass. The site, initially identified in the environmental impact study as Site 4 (Keeley 1994), was described as a possible enclosure identified by aerial photography. This assessment report and later borehole monitoring by Hilary Opie recommended that archaeological investigations should be conducted to ascertain the nature and extent of the potential site (Keeley 1998).

The site, which is to be directly affected by the motorway construction, was located approximately surrounding the north and west top of the highest hill in the locality. When originally inspected the ground was under scrub but at the time of this investigation was under wheat, and some undulations were identifiable in the topography. Also visible were linear areas that contained long grass along with the wheat crop.

During the investigations, eight cuttings were opened, sited at the base, along the side and on the top of the possible feature. Cuttings 1 and 2 were at the north-eastern foot of the hill; Cuttings 3, 7 and 8 were on the northern side of the hill; Cuttings 4 and 5 were on the top of the hill; and Cutting 6 was on the eastern slope of the hill. All measured 8m x 2m. No features of archaeological significance were identified during the testing.

References

Keeley, V.J. 1994 Archaeological report on the line of the proposed Northern Route Phase 2. Unpublished.

Keeley, V.J. 1998 Archaeological bore hole monitoring: Northern Motorway Airport to Balbriggan By-Pass, Co. Fingal. Unpublished.

Patricia Lynch, 112 Cianlea, Swords, for Valerie J. Keeley Ltd, Brehon House, Kilkenny Road, Castlecomer, Co. Kilkenny.

Dublin

2001:444

Airport/Balbriggan Bypass, Site 2, Lissenhall Little

Pits, hearth, stake-holes

01E1074

This site was found during the monitoring of topsoil-stripping for the Airport/Balbriggan bypass. It measured 34m north-south by 20m on the southern side and 10m on the northern. Post-excavation work has not been completed for the site so full interpretation is not possible. Three areas of activity were identified: one in the northern area, the second in the west and an area in the south. All features were cut into the natural subsoil.

In the eastern part of the northern area were two plough-furrows and several possible post-holes. No pattern could be discerned. Some 6m to the west of this group were two circular features, C10 and C45. C10 was a circular pit, 0.5m by 0.6m and 0.12m deep. Its fill was charcoal-rich with some burnt stone. C45 was a tear-shaped pit, 0.36m by 0.39m at maximum and 0.1m deep. It had two fills, the primary fill and a burnt, charcoal-rich deposit.

The second area of activity was concentrated around a hearth. It measured 1.93m by 2.19m by 0.34m deep and had three different fills. There was obvious scorching of the natural subsoil at the base of the feature. It seemed to have been used regularly. A line of stake-holes ran in a north-north-easterly direction 4m to the west of the hearth and curved to the south-east at its southern end. They may have supported a windbreak since the prevailing wind would have come from that direction.

The third area of activity was in the south-eastern corner of the site. The remains of eight shallow stake-holes were closely grouped to the north of an irregular pit or post-hole feature. Their function cannot be determined at present.

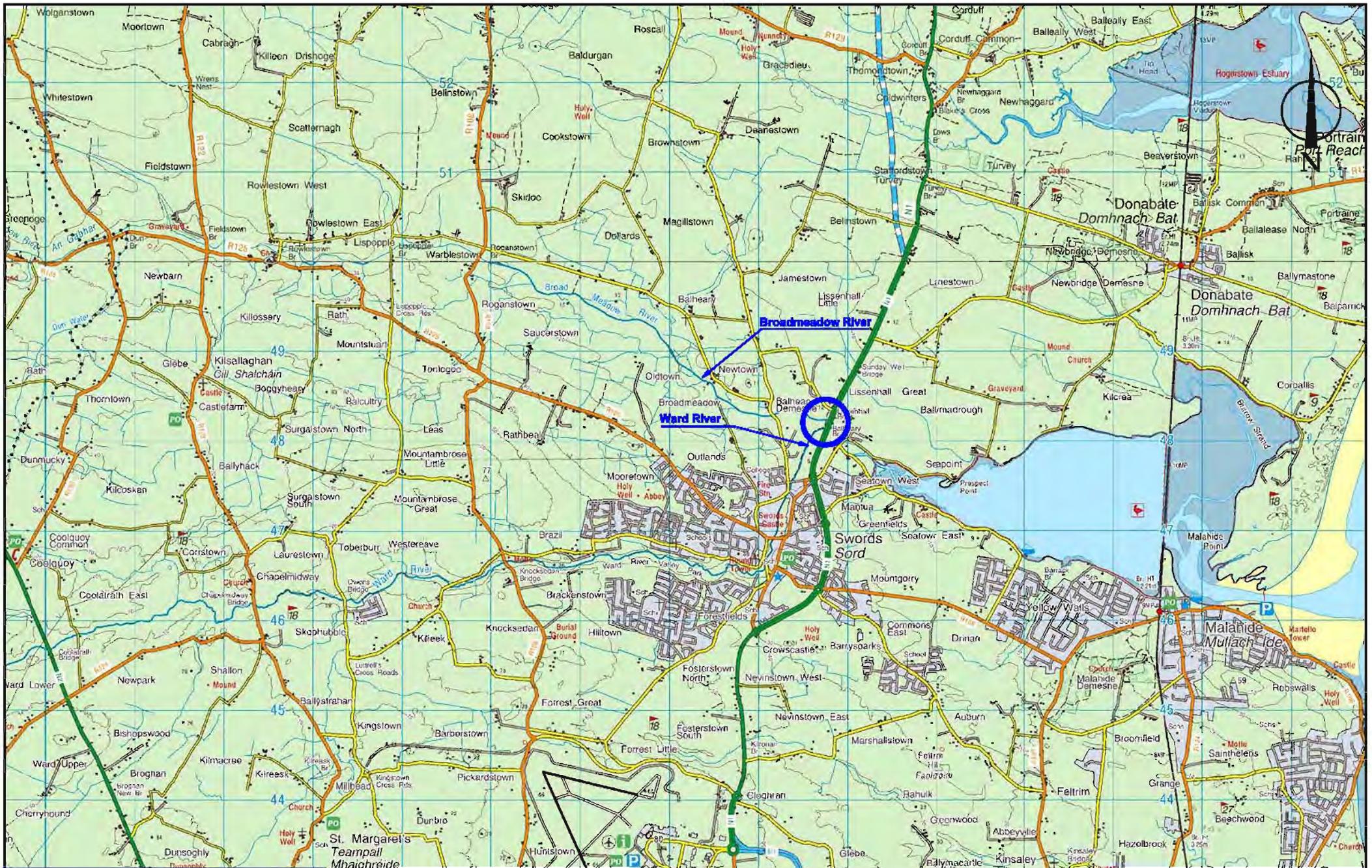
Soil samples were taken for environmental analysis. Finds included flint nodules (struck and unstruck), some flint flakes, medieval pottery sherds and a few sherds of prehistoric pottery. Further interpretation will be carried out on receipt of specialists' reports.

Fiona Reilly, Wood Road, Cratloekeel, Co. Clare, for Valerie J. Keeley Ltd.

Appendix 3: Tabulated Dive Logs from the Underwater Assessment.

Diver Number:	001	
Date:	16.12.08	
Dive Location:	Broadmeadow River, upstream and downstream of Lissenhall Bridge	
Vessel/Installations:	n/a	
Type of Dive:	HSE Scuba	
H/P Main Gas: 220 Bar	Reduced to:	8 Bar
B/O: 220 Bar	S/B Diver Gas:	230 Bar
Diver:Rex Bangerter	S/B Diver:	Edward Pollard
L/S: 13hrs 20mins	A/S:	14hrs 17mins
Bottom Time: 57mins	Max Depth:	1.3m
Table used: n/a	Diver Supervisor: Brian McAllister	
Diver Number:	002	
Date:	16.12.08	
Dive Location:	Broadmeadow River, upstream and downstream of Lissenhall Bridge	
Vessel/Installations:	n/a	
Type of Dive:	HSE Scuba	
H/P Main Gas: 200 Bar	Reduced to:	8 Bar
B/O: 200 Bar	S/B Diver Gas:	230 Bar
Diver:Rex Bangerter	S/B Diver:	Edward Pollard
L/S: 14hrs 56mins	A/S:	15hrs 43mins
Bottom Time: 48mins	Max Depth:	1.2m
Table used: n/a	Diver Supervisor: Brian McAllister	
Diver Number:	002	
Date:	17.12.08	
Dive Location:	Broadmeadow River, upstream and downstream of Lissenhall Bridge	
Vessel/Installations:	n/a	
Type of Dive:	HSE Scuba	
H/P Main Gas: 230 Bar	Reduced to:	8 Bar
B/O: 230 Bar	S/B Diver Gas:	230 Bar

Diver: Edward Pollard	S/B Diver: Rex Bangerter
L/S: 14hrs 56mins	A/S: 15hrs 32mins
Bottom Time: 36mins	Max Depth: 1.2m
Table used: n/a	Diver Supervisor: Brian McAllister



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Notes:
 ○ ADCO Survey Area
 Source: Ordnance Survey Ireland

Job/Exc No.
 080082,
 080083,

Date
 11.02.09

Compiled by
 R.Bangerter

Scale
 N.T.S

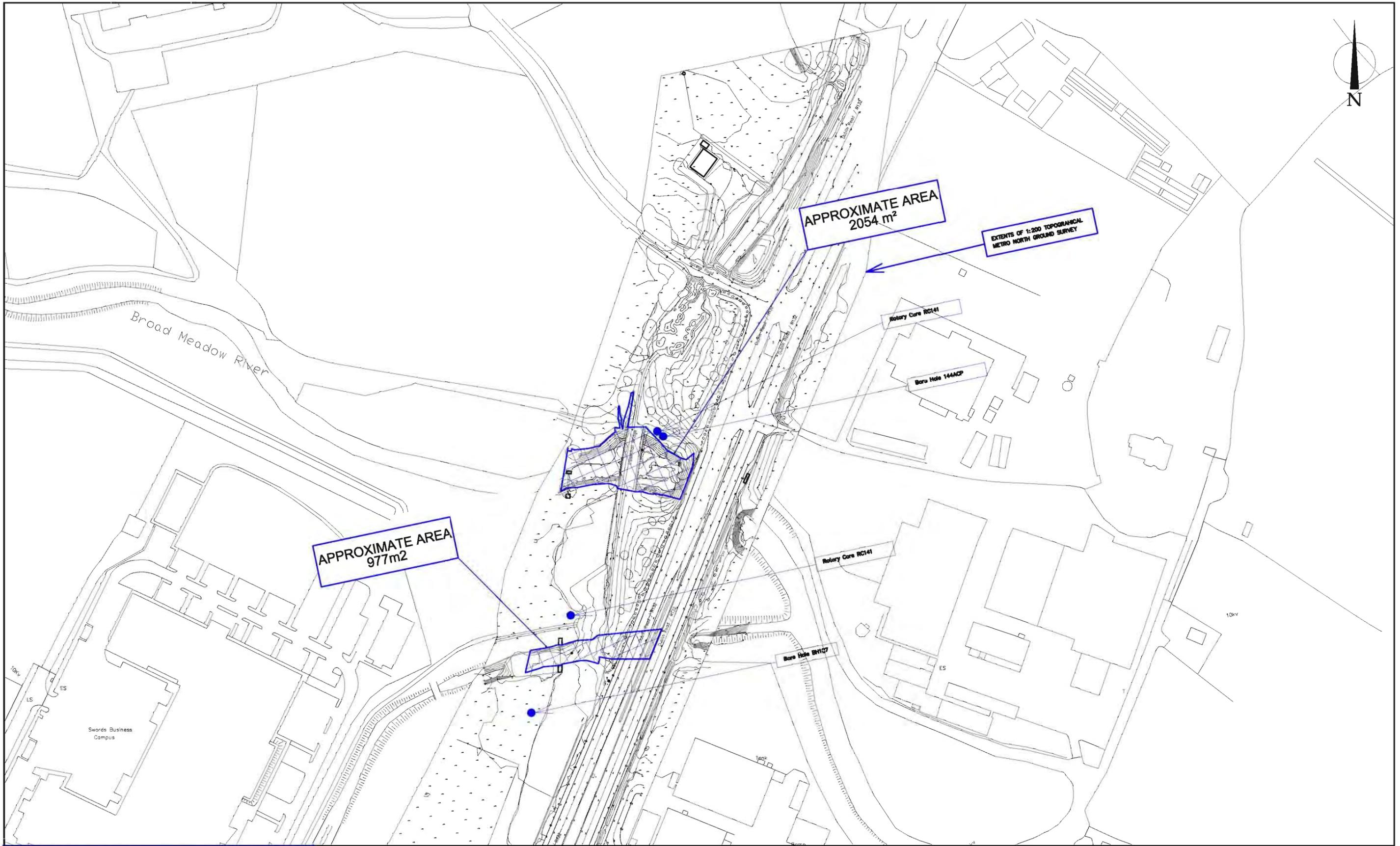
CAD reference
 RPA-Swords

Drawing No.
 Figure 1

Client
 Railway Procurement Agency

Project
 Metro North- Broadmeadow River and Ward
 River Archaeological Survey.

Title
 Figure 1- Extract from OS 1:50,000 Discovery
 Series Mapping showing location of River
 Assessment Areas at Lissenhall Bridge and
 Balheary Bridge.



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Notes
 Source: Railway Procurement Agency

Job/Exc No.
 08D092,
 08D093

Compiled by
 R.Bangerter

CAD reference
 RPA-Swords

Client
 Railway Procurement Agency

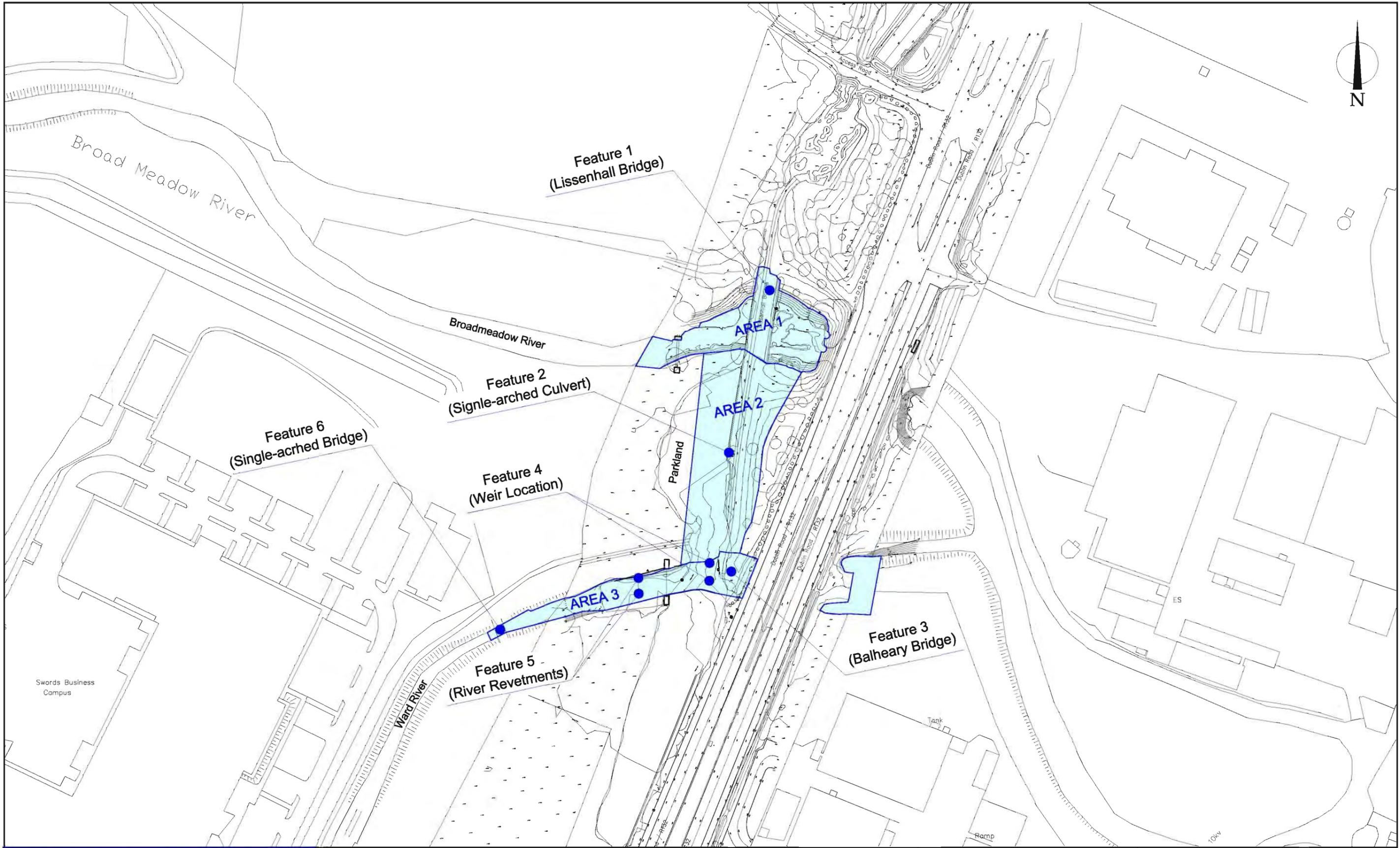
Date
 30.02.09

Scale
 1:2000

Drawing No.
 Figure 2

Project
 Metro North- Broadmeadow River and Ward
 River Archaeological Survey.

Title
 Figure 2- Extract from Project Drawings
 showing riverbed areas requiring assesment
 along the Boradmeadow and Ward Rivers.



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 Tel. 056 4440236 email: info@adco-ie.com

Notes
 Source: Figure adapted from Project Drawing supplied by Railway Procurement Agency

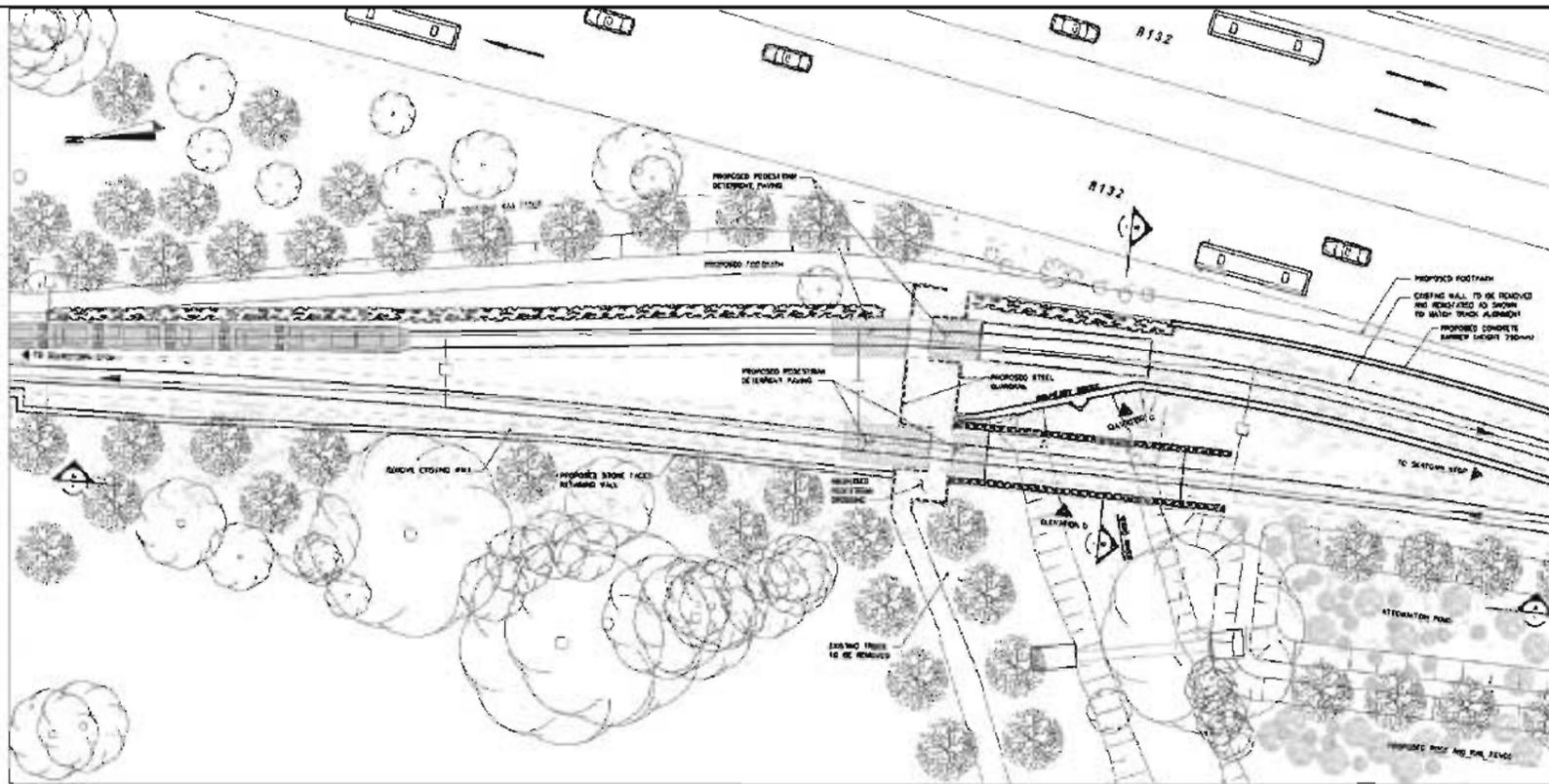
Job/Exc No.
 08D092, 08D093
Date
 30.02.09

Compiled by
 R.Bangerter
Scale
 1:1500

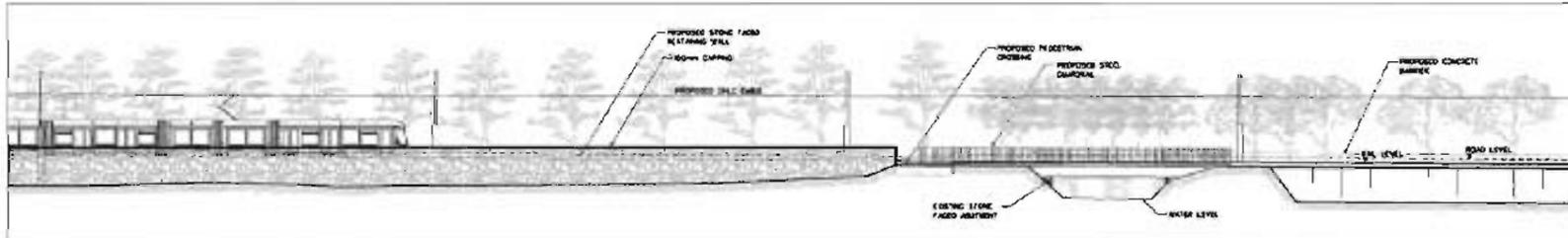
CAD reference
 RPA-Swords
Drawing No.
 Figure 3

Client
 Railway Procurement Agency
Project
 Metro North- Broadmeadow River and Ward River Archaeological Survey.

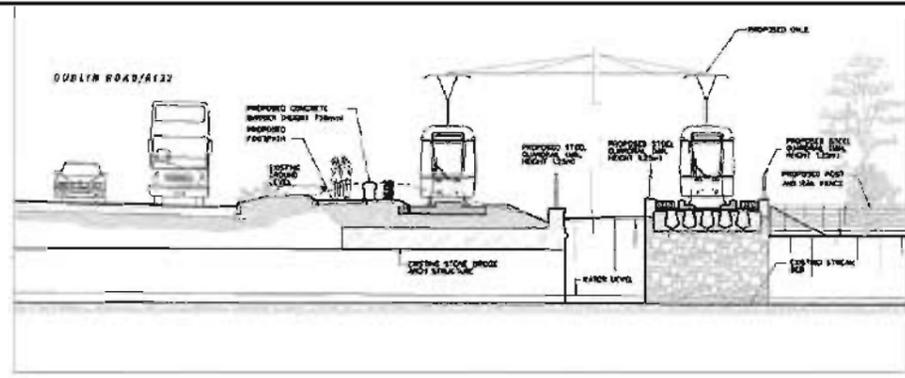
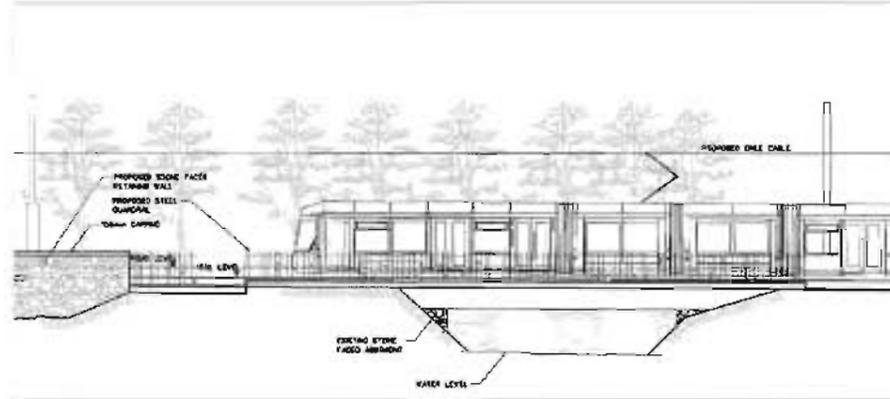
Title
 Figure 3- OS Background Mapping showing ADCO Assessment Areas (Areas 1-3) and location of Features identified as part of the assessment (Features 1-6).



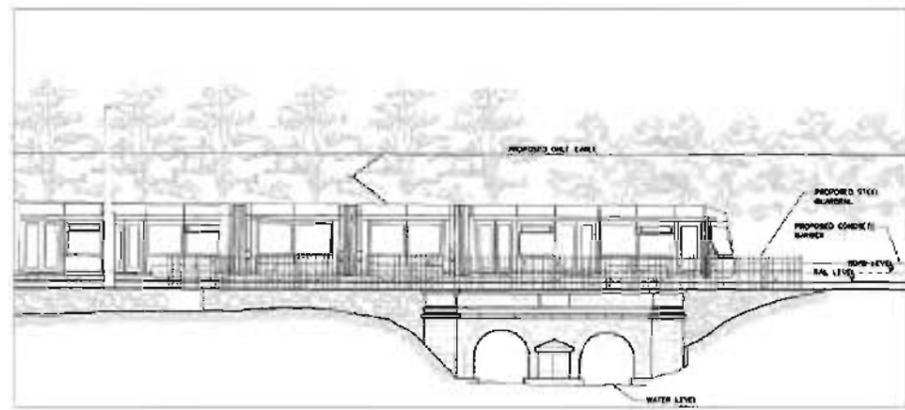
PLAN
SCALE 1:500



STRAIGHTENED ELEVATION A-A
SCALE 1:200



BALHEARY BRIDGE & WARD RIVER BRIDGE (SECTION B-B)
SCALE 1:100



BALHEARY BRIDGE (ELEVATION C)
SCALE 1:100

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Notes
Source: RPA
Project Drawing Number: MN-BR 101 F-G2

Job/Exc No.
08D092,
08D093

Date
17.02.09

Compiled by
R.Bangarter

Scale
N.T.S.

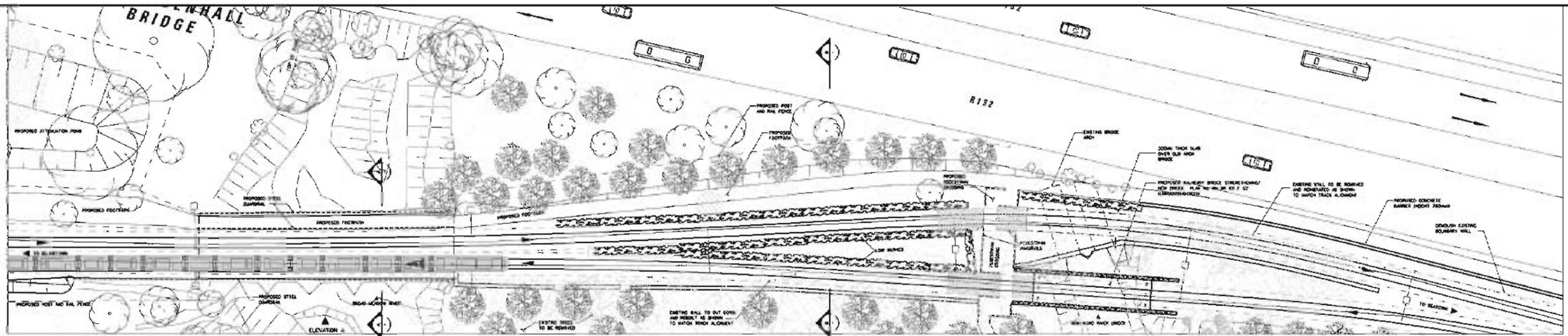
CAD reference
RPA-Swords

Drawing No.
Figure 4

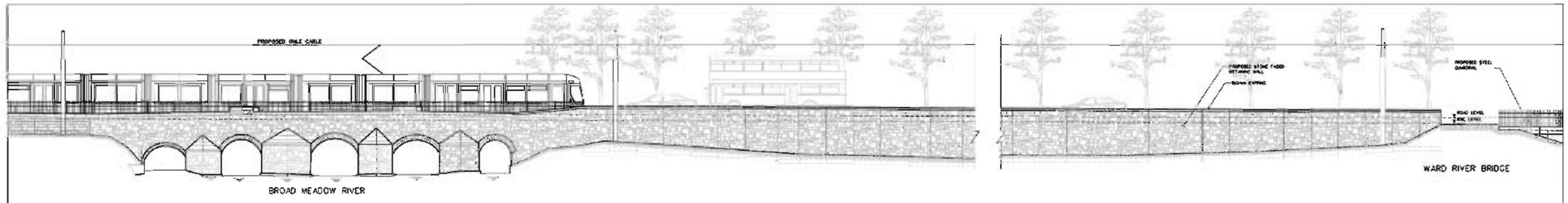
Client
Railway Procurement Agency

Project
Metro North- Broadmeadow River and Ward River Archaeological Survey.

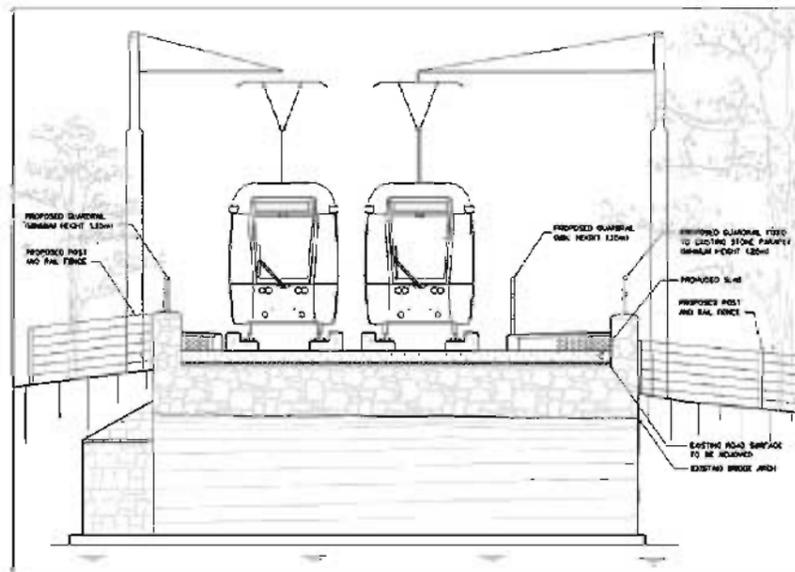
Title
Figure 4- Project Drawing showing proposed development at the Ward River and Balheary Bridge.



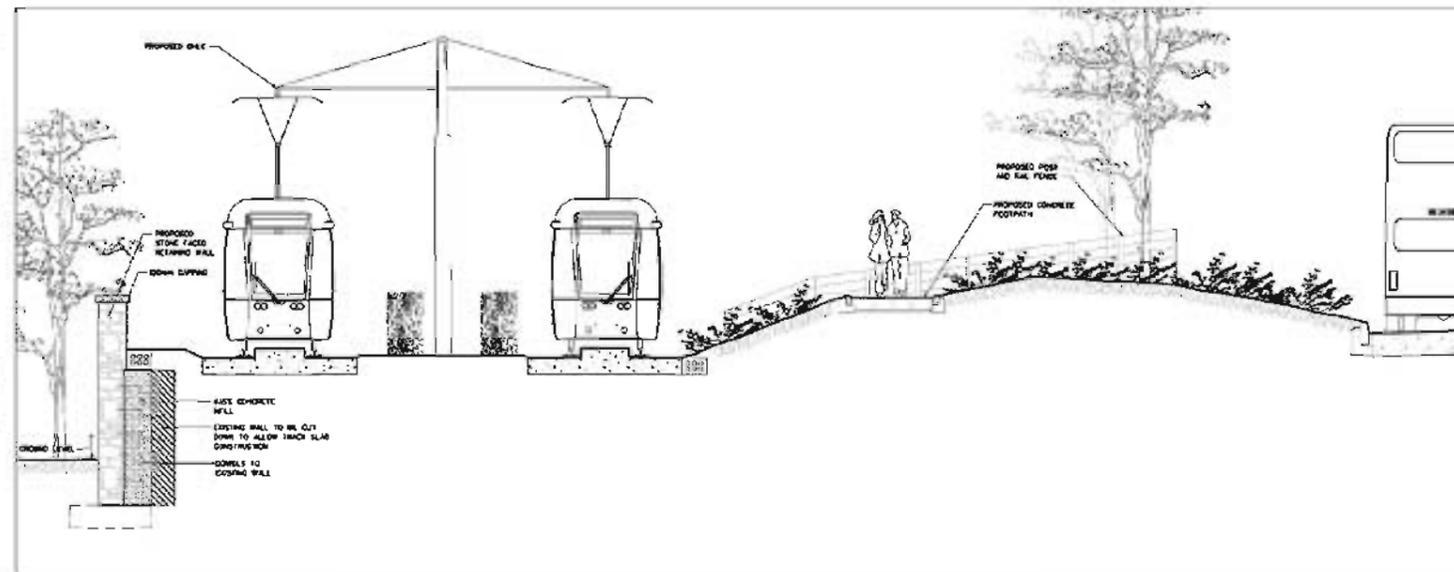
PLAN
SCALE: 1/500



LISSENHALL BRIDGE ELEVATION A
SCALE: 1/500



SECTION A-A
SCALE: 1/500



SECTION B-B
SCALE: 1/500

REFERENCE RELATED DRAWINGS FOR 1:500 PLAN DRAWING SET

KEY MAP - METRO NORTH

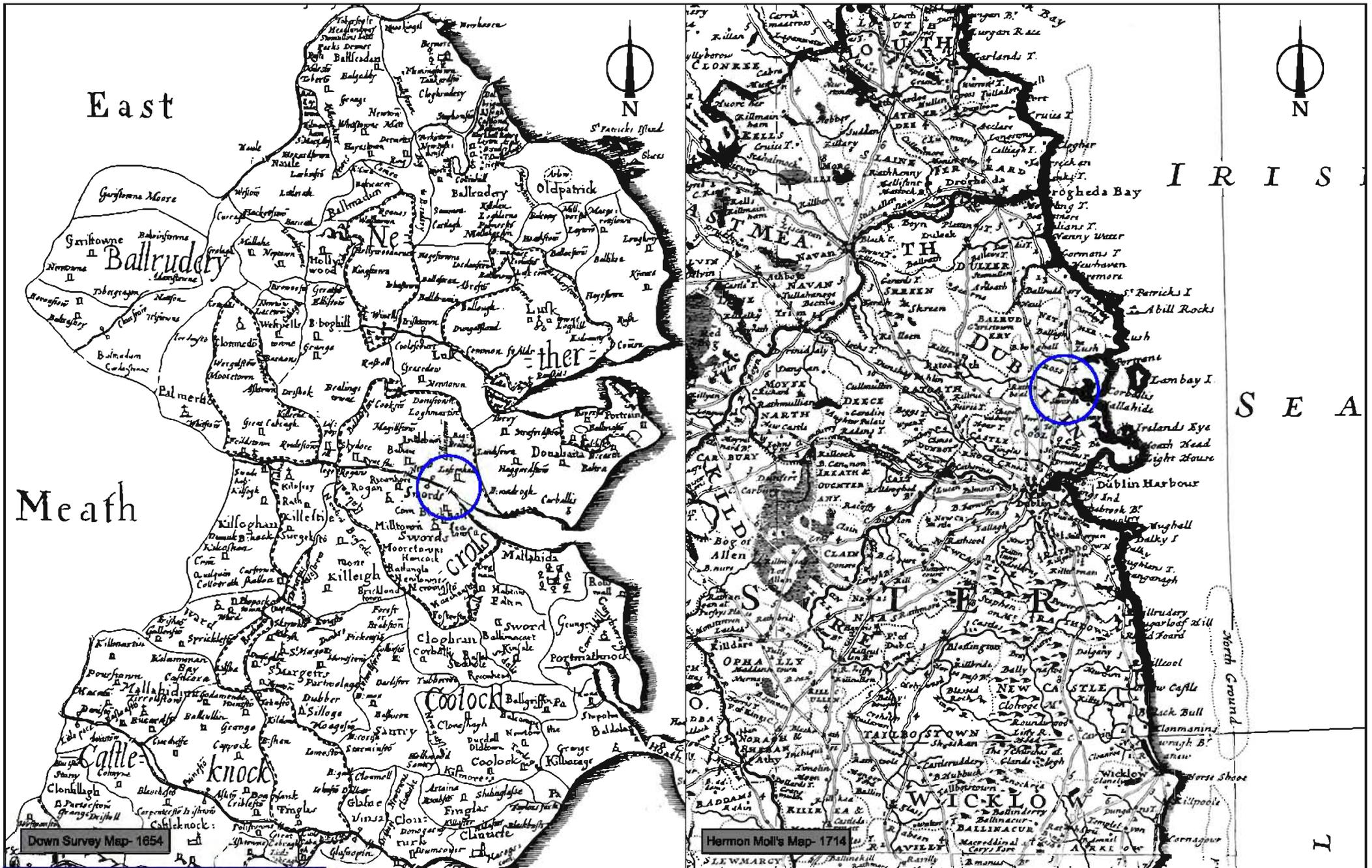
RPA **METRO**

RAILWAY WORKS
LINE MN - STRUCTURES
LISSENHALL BRIDGE

PROJECT NO. 08D092	DATE: 17.02.09	SCALE: 1:500	REVISED: 17.02.09
101	MN-BR 101 F-01	RAIL ORDER	

Notes Source: RPA Project Drawing Number: MN-BR 101 F-G2	Job/Exc No. 08D092, 08D093	Compiled by R. Bangarter	CAD reference RPA-Swords	Client Railway Procurement Agency	Title Figure 5- Project Drawing showing proposed development at the Broadmeadow River and Lisshenhall Bridge.
	Date 17.02.09	Scale N.T.S.	Drawing No. Figure 5	Project Metro North- Broadmeadow River and Ward River Archaeological Survey.	

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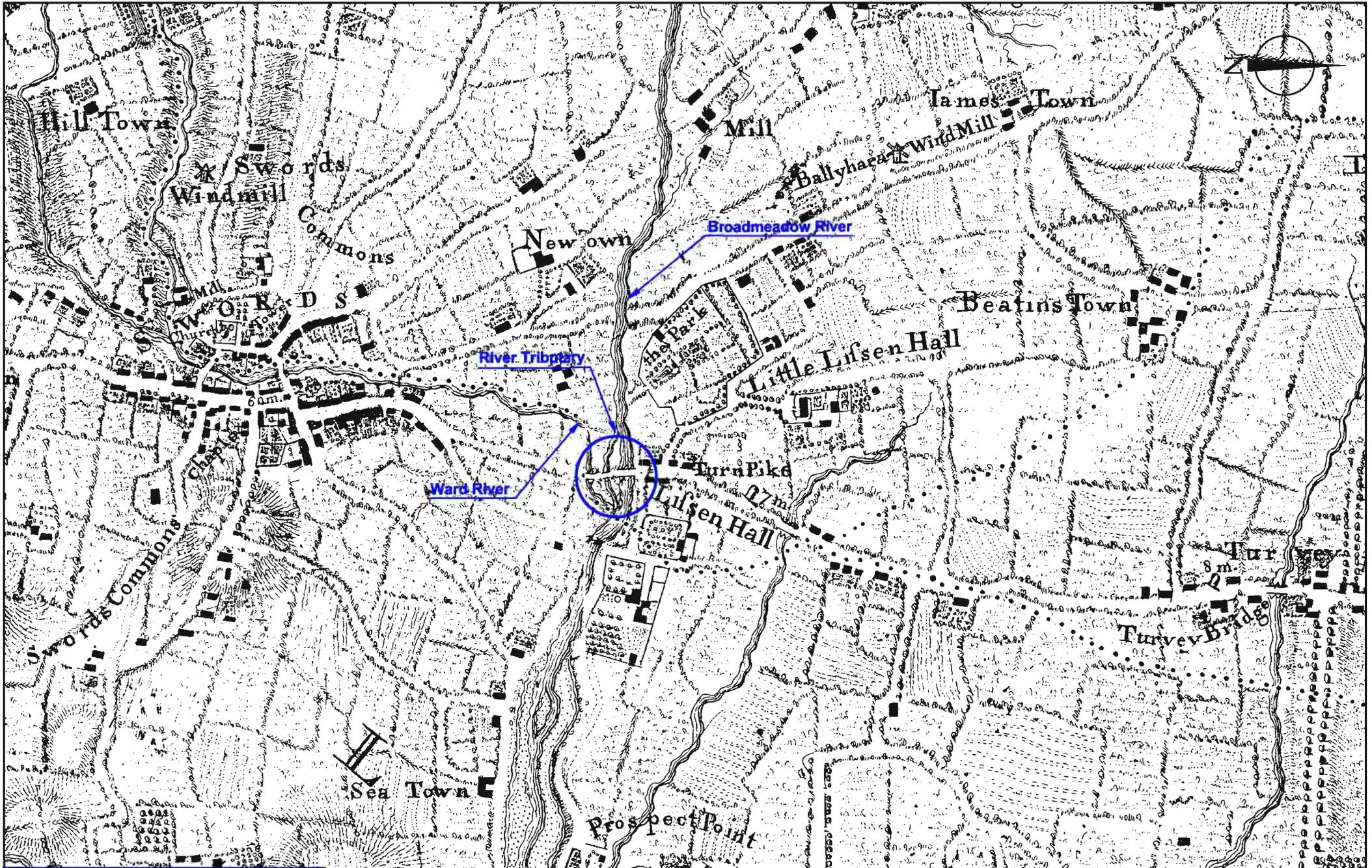


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Notes
 ○ Location of Bridge crossing River Broadmeadow

Job/Exc No. 08D082, 08D083,	Compiled by R.Bangertor	CAD reference RPA-Swords	Client Railway Procurement Agency
Date 28.02.09	Scale N.T.S	Drawing No. Figure 8	Project Metro North- Broadmeadow River and Ward River Archaeological Survey.

Title
 Figure 8- Extract from Dwon Survey of 1654
 and Hermon Moll's Mapping of 1714 showing
 Lissenhall Bridge.



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Notes

○ Approximate location of ADCO Survey Area
Source: John Roque's Dublin County Maps 1760.

Job/Exc No.
08D092,
08D093.

Compiled by
R.Bangertor

CAD reference
RPA-Swords

Client
Railway Procurement Agency

Title
Figure 7- Extract from John Roque's mapping
of County Dublin (1760) showing approximate
location of ADCO Assessment Area.

Date
11.02.09

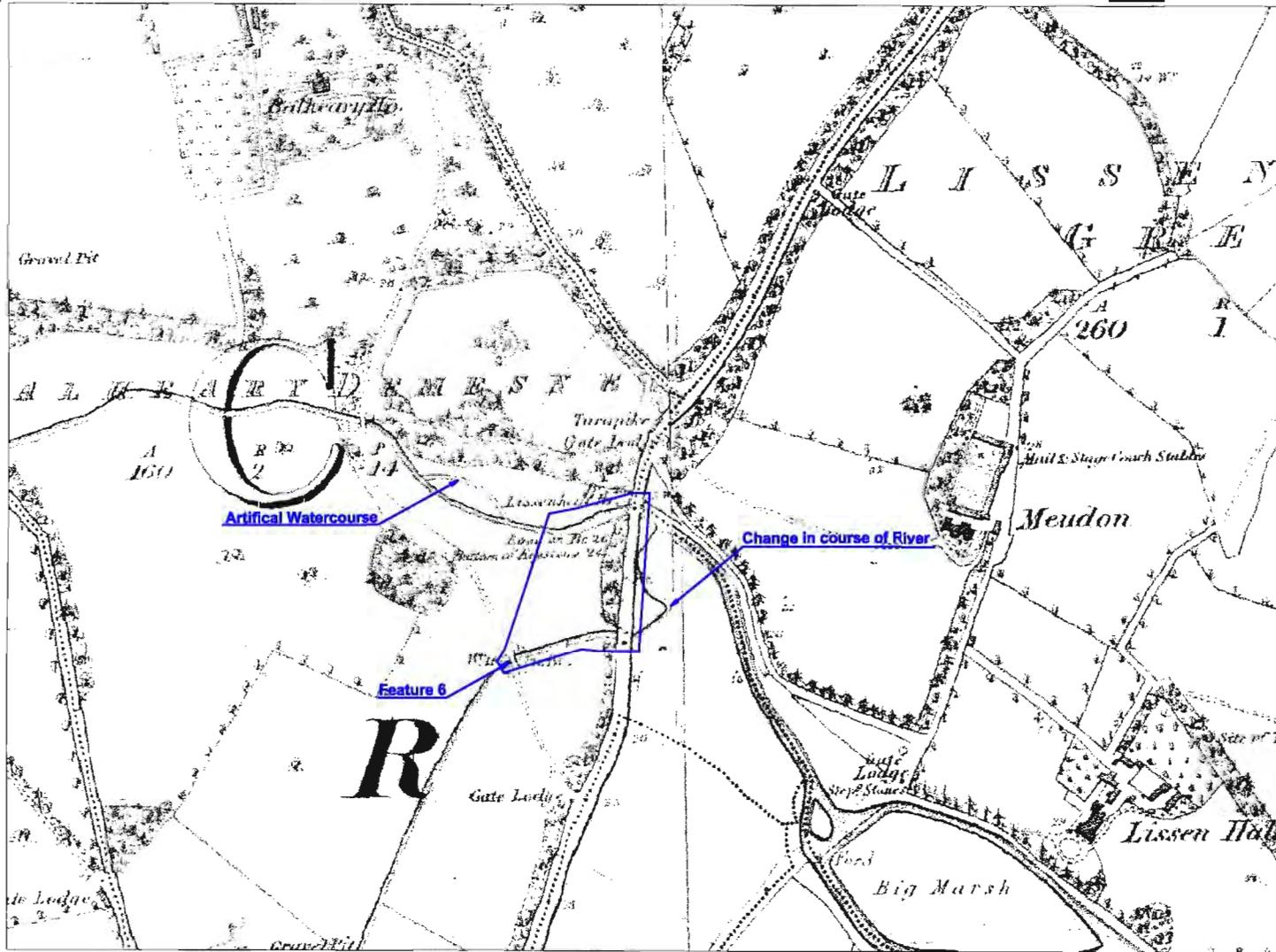
Scale
N.T.S

Drawing No.
Figure 7

Project
Metro North- Broadmeadow River and Ward
River Archaeological Survey.

Surveyed 1837
 Revised 1837
 Levelled

Historic Map



ITM CENTRE PT COORDS

718692,748317

DESCRIPTION

MAP SHEETS

6 inchBE1
 DN011 DN012



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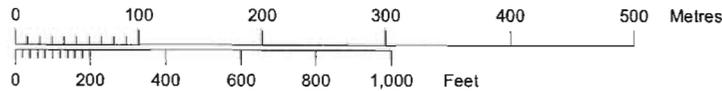
Gach oidear a' cosnaimh. Ní oideadh aon chuid
 den fhiosrachán seo a chlo péir a' stairgeadh nó
 a' thairgeadh nó a' thairgeadh nó a' thairgeadh
 a' thairgeadh nó a' thairgeadh nó a' thairgeadh
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 áiríonn seo agus áiríonn a' thairgeadh sí.
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Scale:- 1:5,000
 Scála:- 1:5,000



Plot Ref. No. 9004240_1_1
 Plot Date 11-FEB-2009

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Notes

ADCO Survey Area

Source: Ordnance Survey Ireland, Historic Maps

Job/Exc No.
 08D092,
 08D093,

Date
 11.02.09

Compiled by
 R.Bangertor

Scale
 As Shown

CAD reference
 RPA-Swords

Drawing No.
 Figure 8

Client
 Railway Procurement Agency

Project
 Metro North- Broadmeadow River and Ward
 River Archaeological Survey.

Title
 Figure 8- Extract from OS First Edition Mapping
 (1837) showing location and extent of ADCO
 Assessment Area.

Surveyed 1906
Revised 1906
Levelled

Historic Map



71810
748747

718275
748747

ITM CENTRE PT. COORDS

718692,748317

DESCRIPTION

MAP SHEETS

25 inchBE1
DN011-08 DN012-05



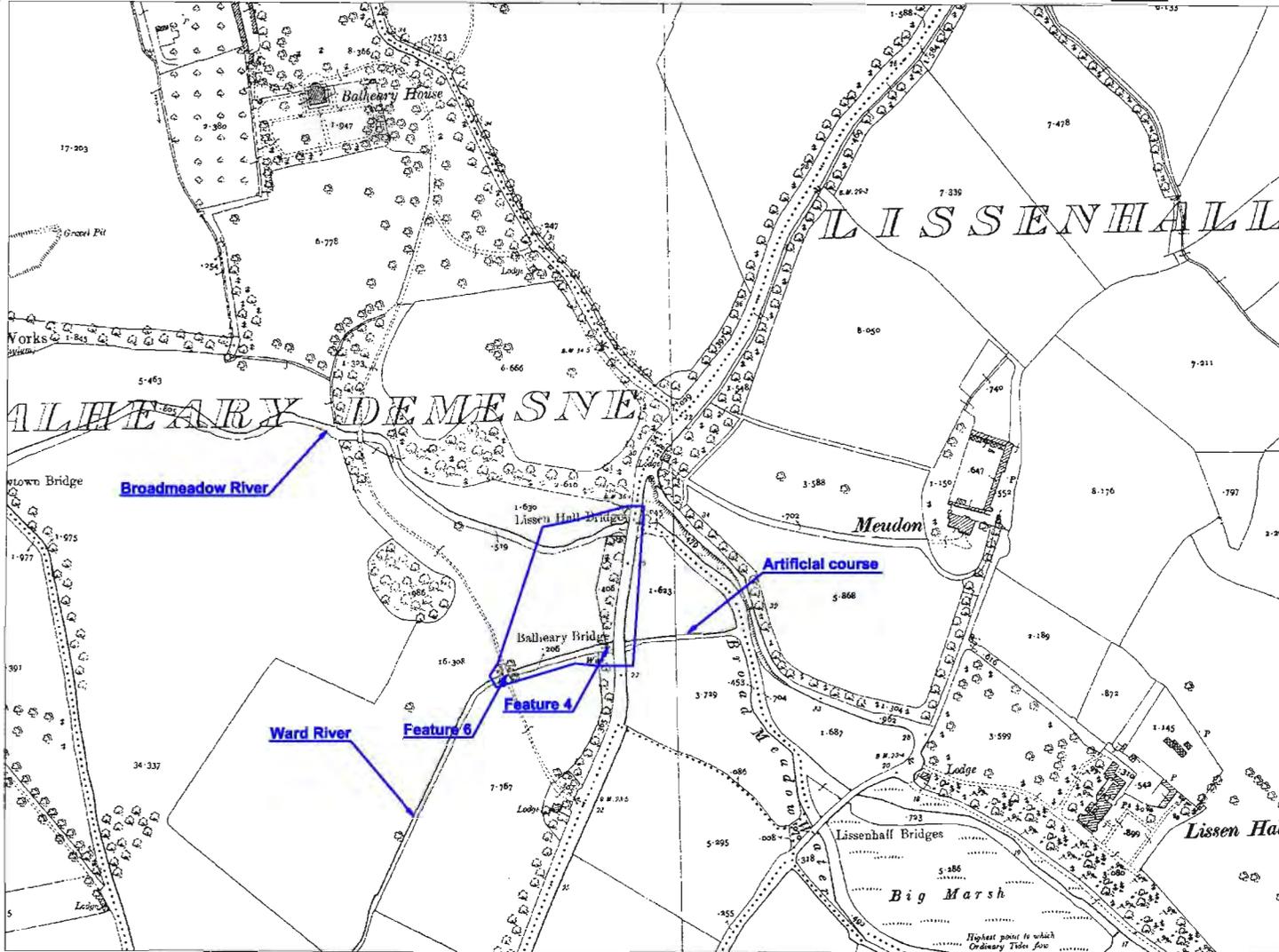
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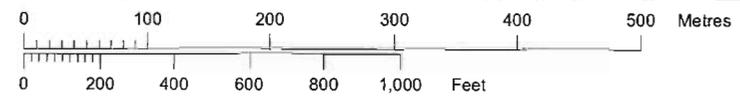
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718275
747887



Scale:- 1:5,000
Scála:- 1:5,000



Plot Ref. No. 9004240_2_1
Plot Date 11-FEB-2009

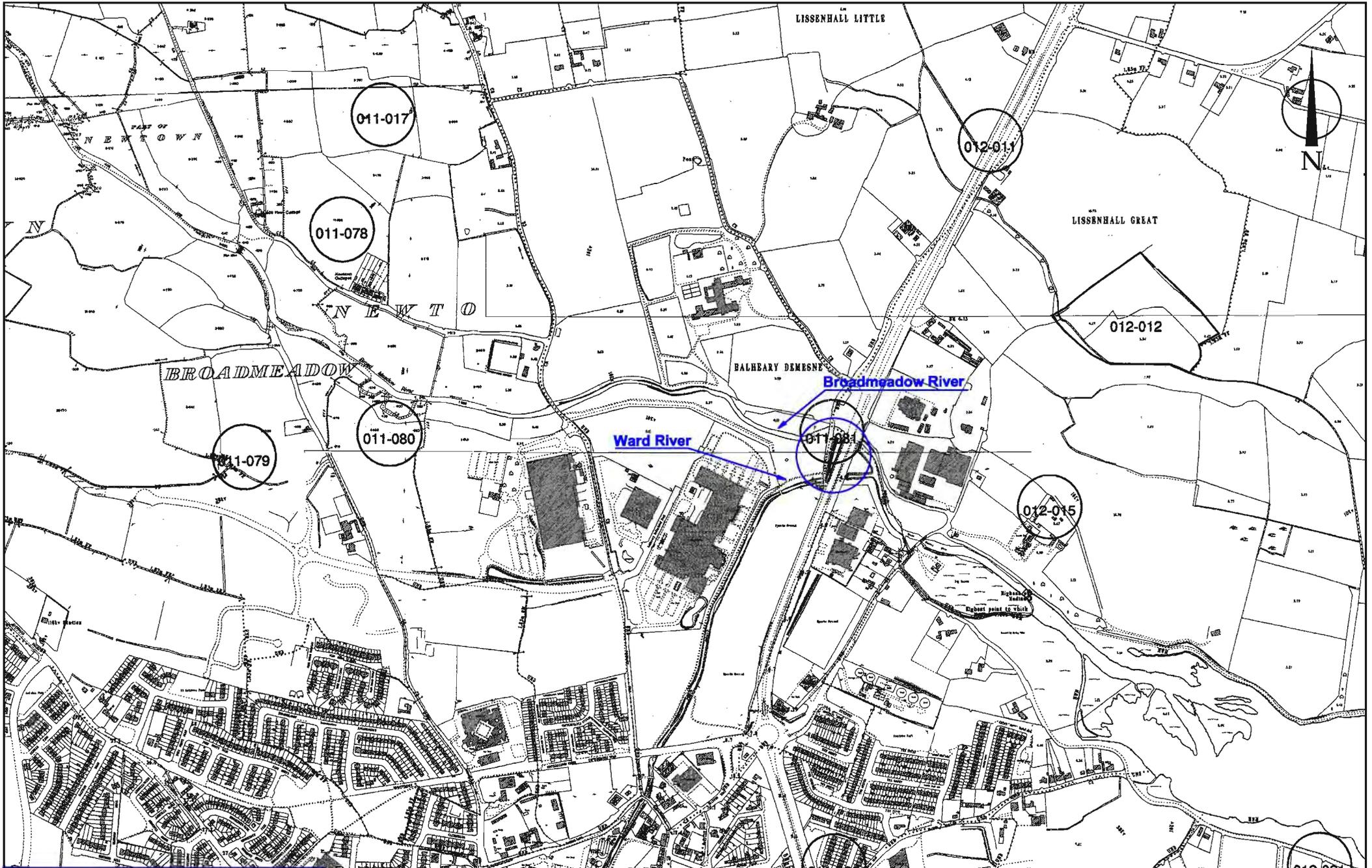
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Notes
ADCO Survey Area
Source: Ordnance Survey Ireland, Historic Maps

Job/Exc No. 08D092, 08D093.	Compiled by R.Bangenter	CAD reference RPA-Swords
Date 11.02.09	Scale As Shown	Drawing No. Figure 9

Client Railway Procurement Agency
Project Metro North- Broadmeadow River and Ward River Archaeological Survey.

Title
Figure 9- Extract from OS Third Edition Mapping (1906) showing location and extent of ADCO Assessment Area.



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Notes

○ ADCO Survey Area

Source: Record of Monuments and Places Archive

Job/Exc No.
08D092,
08D093.

Compiled by
R.Bangerter

CAD reference
RPA-Swords

Client
Railway Procurement Agency

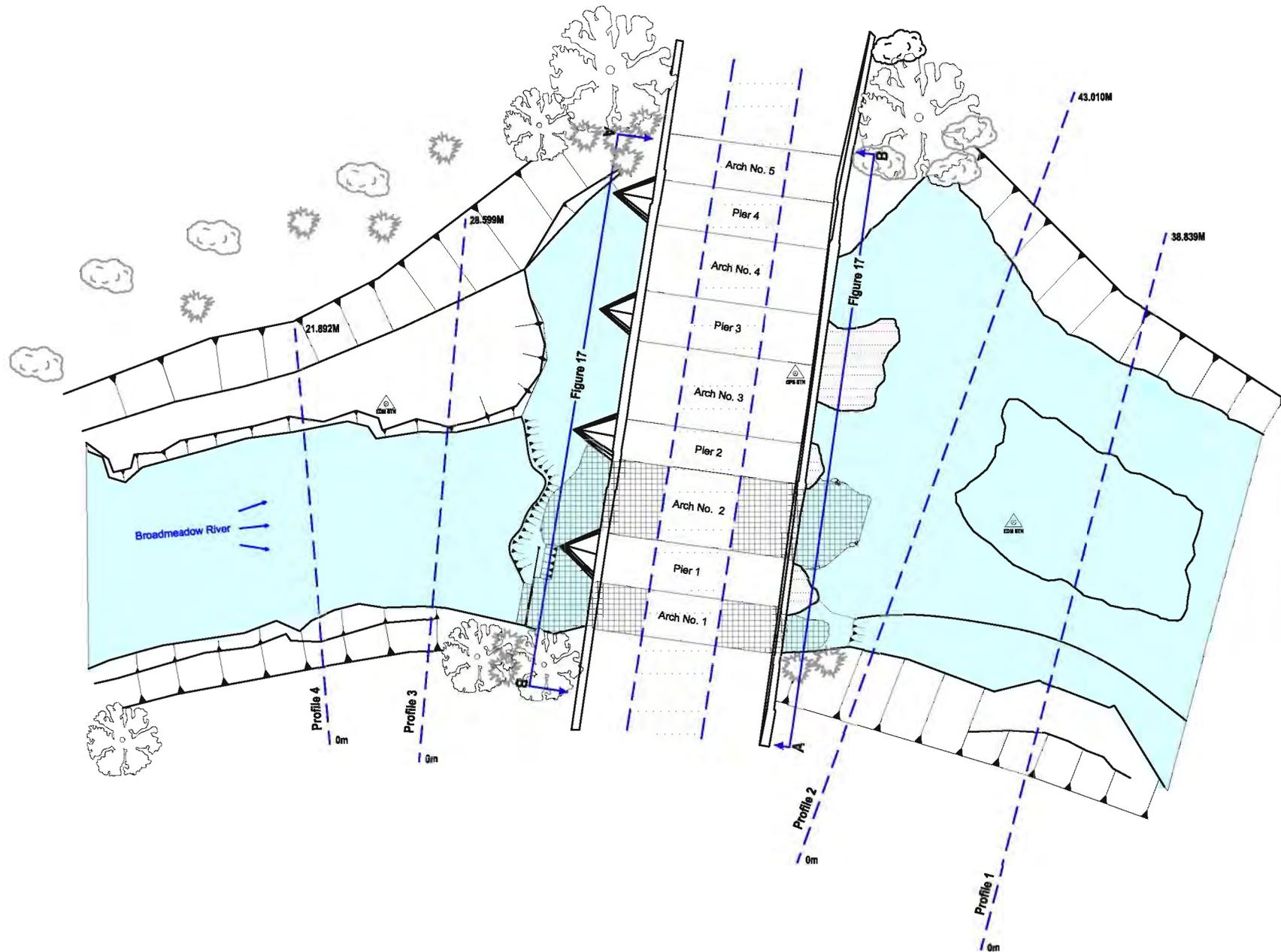
Date
11.02.09

Scale
N.T.S

Drawing No.
Figure 10

Project
Metro North- Broadmeadow River and Ward
River Archaeological Survey.

Title
Figure 10- Extract from OS 6" RMP
Archaeological Mapping showing location of
ADCO Assessment Area.



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Notes

ADCO Survey Area

[See Figures 13-16 for River Profiles across the Broadmeadow River]

Job/Exc No.
08D092,
08D093,

Date
17.02.09

Compiled by
R.Bangertner

Scale
1:300

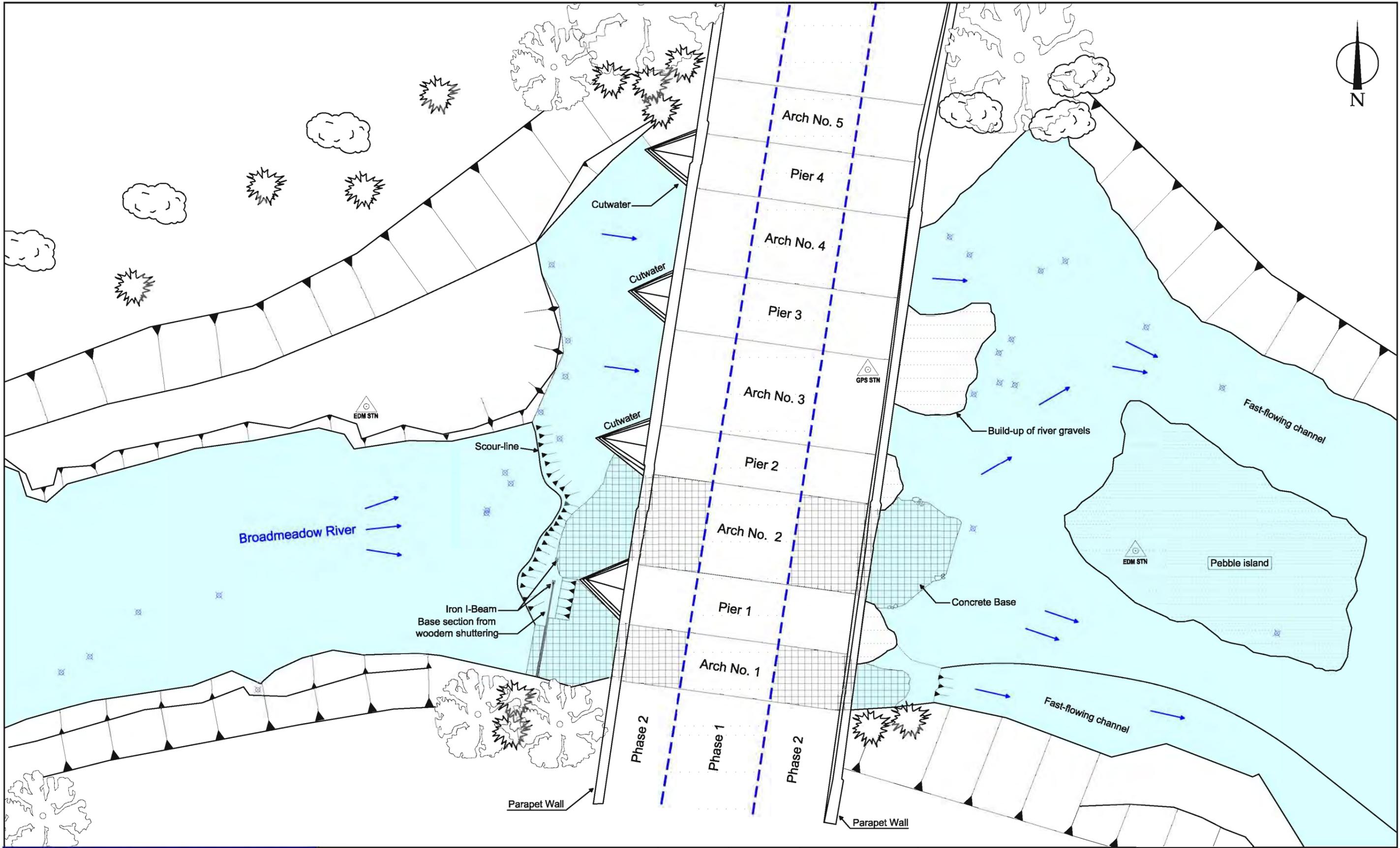
CAD reference
RPA-Swords

Drawing No.
Figure 11

Client
Railway Procurement Agency

Project
Metro North- Broadmeadow River and Ward
River Archaeological Survey.

Title
Figure 11- Plan of Lissenhall Bridge showing
ADCO Assessment Area, location of River
Profiles 1-4, and location of the upsteraam and
downstream bridge elavations [Figures 17-18].



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Notes
 Data gathered by O.Ryan and R.Bangerter

- Phase 1 bridge structure
- Phase 2 bridge structure
- Metal-detection target
- Concrete underpinning of bridge foundations

Job/Exc No.
 08D092,
 08D093

Date
 17.02.09

Compiled by
 R.Bangerter

Scale
 1:150

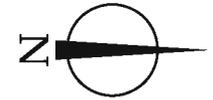
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 RPA-Swords

Drawing No.
 Figure 12

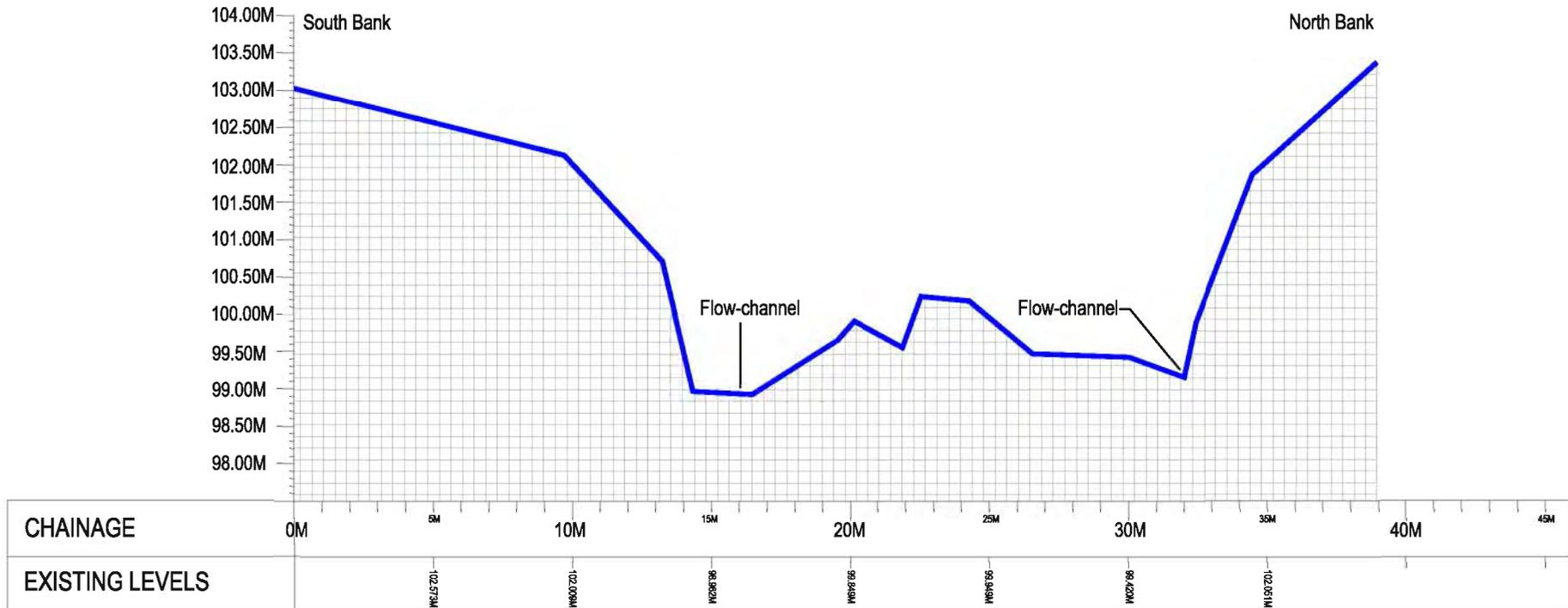
Client
 Railway Procurement Agency

Project
 Metro North- Broadmeadow River and Ward
 River Archaeological Survey.

Title
 Figure 12- Plan showing in-water observations, metal-detection target locations, and Bridge Phasing (Build-phases 1-2) at Lissenhall Bridge (Feature 1).



Broadmeadow River Profile Number 1



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Notes
 Profile survey data gathered by: O. Ryan

Job/Exc No.
 08D094,
 08R310,

Compiled by
 R.Bangertel/
 O. Ryan

CAD reference
 RPA-Swords

Client
 Railway Procurement Agency

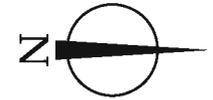
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Scale
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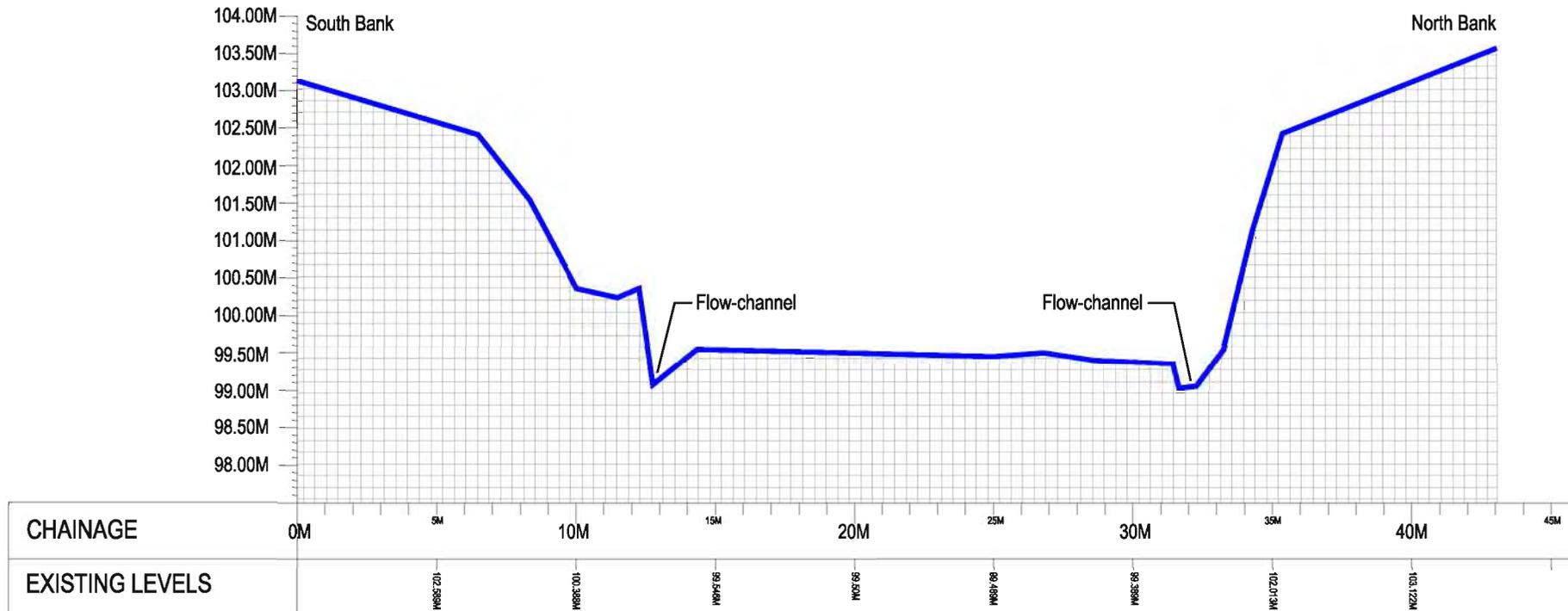
Drawing No.
 Figure 13

Project
 Metro North- Broadmeadow River and Ward
 River Archaeological Survey.

Title
 Figure 13- Profile Number 1; profile taken
 across Boradmeadow River along downstream
 side of Lissenhall Bridge [see Figure 11 for
 profile locations].



Broadmeadow River Profile Number 2



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Notes
 Profile survey data gathered by: O. Ryan

Job/Exc No.
 08D094,
 08R310,

Compiled by
 R.Bangert/
 O. Ryan

CAD reference
 RPA-Swords

Client
 Railway Procurement Agency

Date
 28.02.09

Scale
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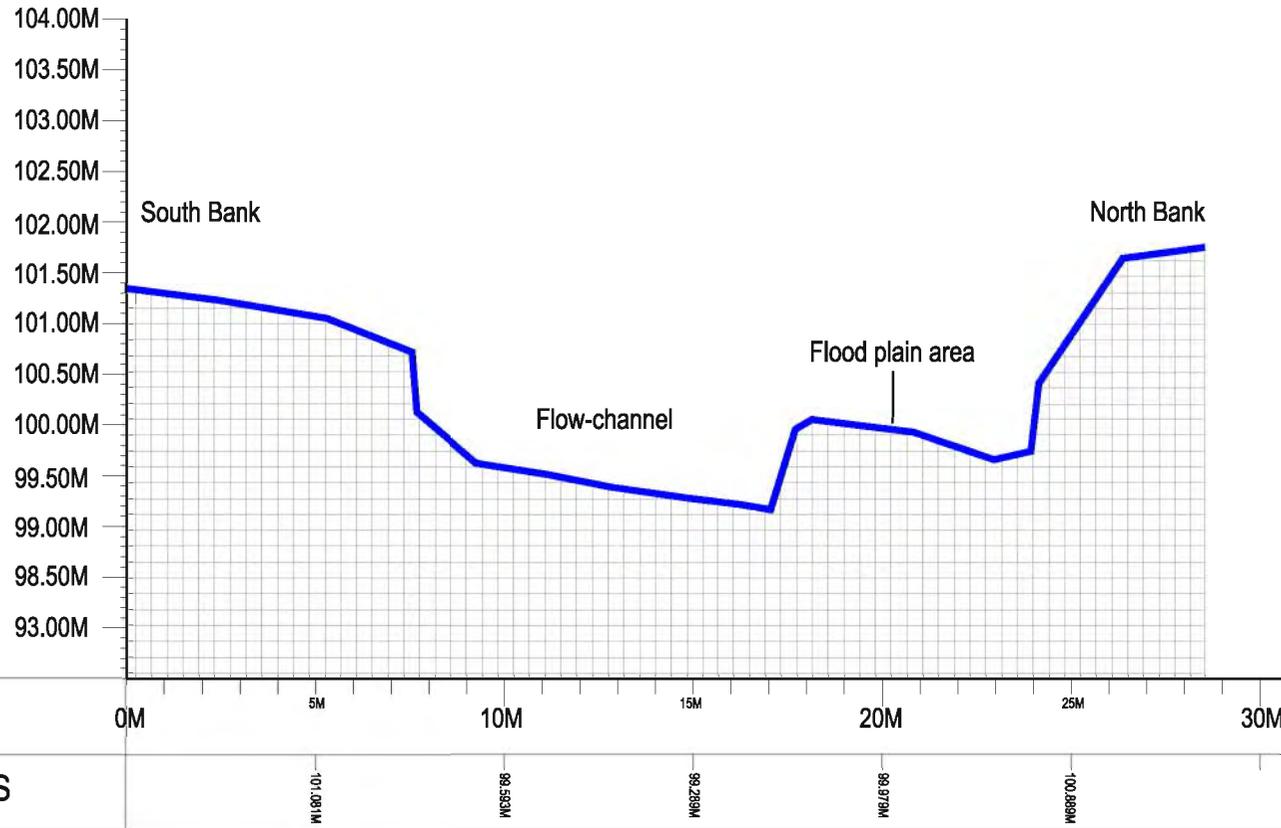
Drawing No.
 Figure 14

Project
 Metro North- Broadmeadow River and Ward
 River Archaeological Survey.

Title
 Figure 14- Profile Number 2; profile taken
 across Broadmeadow River along downstream
 side of Lissenhall Bridge [see Figure 11 for
 profile locations].



Broadmeadow River Profile Number 3



CHAINAGE	0M	5M	10M	15M	20M	25M	30M
EXISTING LEVELS		101.001M	99.595M	99.258M	99.979M	100.898M	

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Notes
 Profile survey data gathered by: O. Ryan

Job/Exc No.
 08D094,
 08R310,

Compiled by
 R.Bangerter/
 O. Ryan

CAD reference
 RPA-Swords

Client
 Railway Procurement Agency

Date
 28.02.09

Scale
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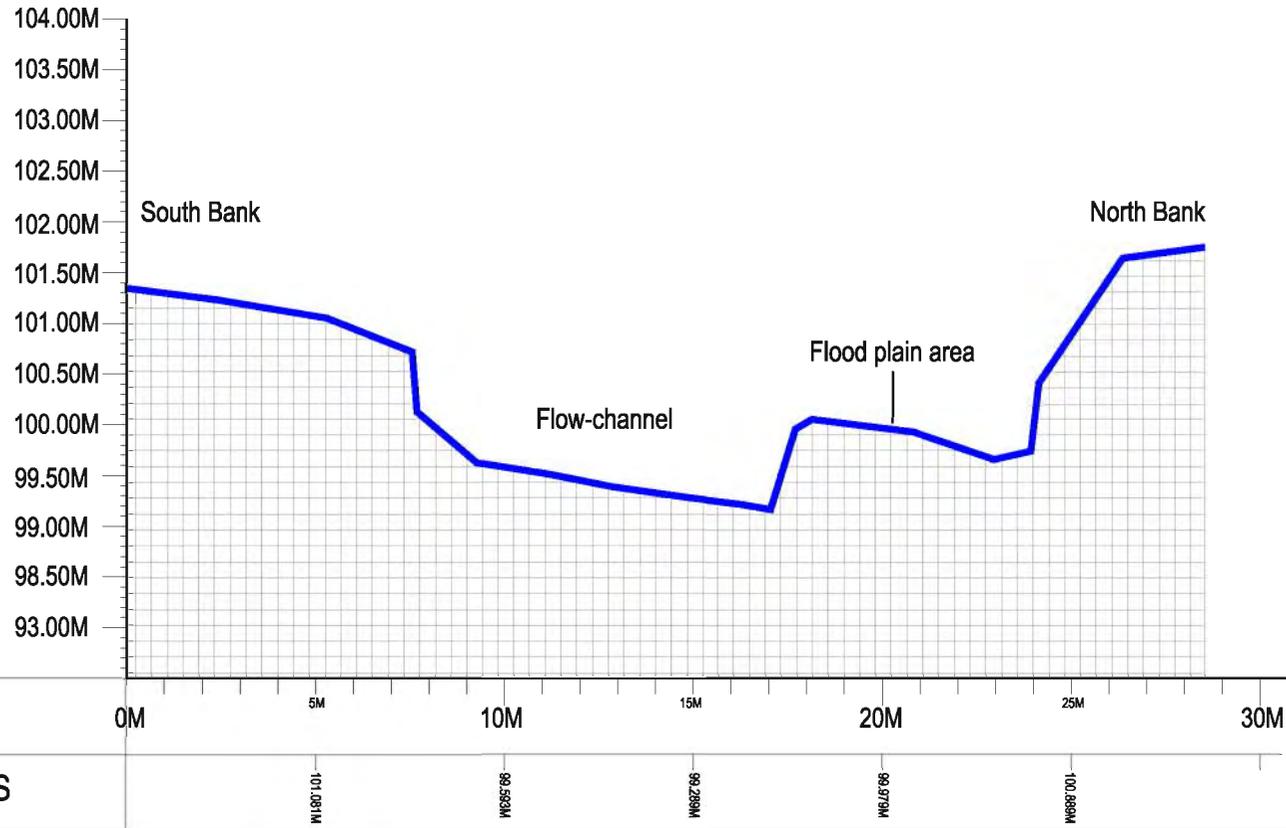
Drawing No.
 Figure 15

Project
 Metro North- Broadmeadow River and Ward
 River Archaeological Survey.

Title
 Figure 15- Profile Number 3; profile taken
 across Boradmeadow River along downstream
 side of Lissenhall Bridge [see Figure 11 for
 profile locations].



Broadmeadow River Profile Number 3



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Notes
 Profile survey data gathered by: O. Ryan

Job/Exc No.
 08D094,
 08R310,

Compiled by
 R.Bangert/
 O. Ryan

CAD reference
 RPA-Swords

Client
 Railway Procurement Agency

Date
 28.02.09

Scale
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Drawing No.
 Figure 16

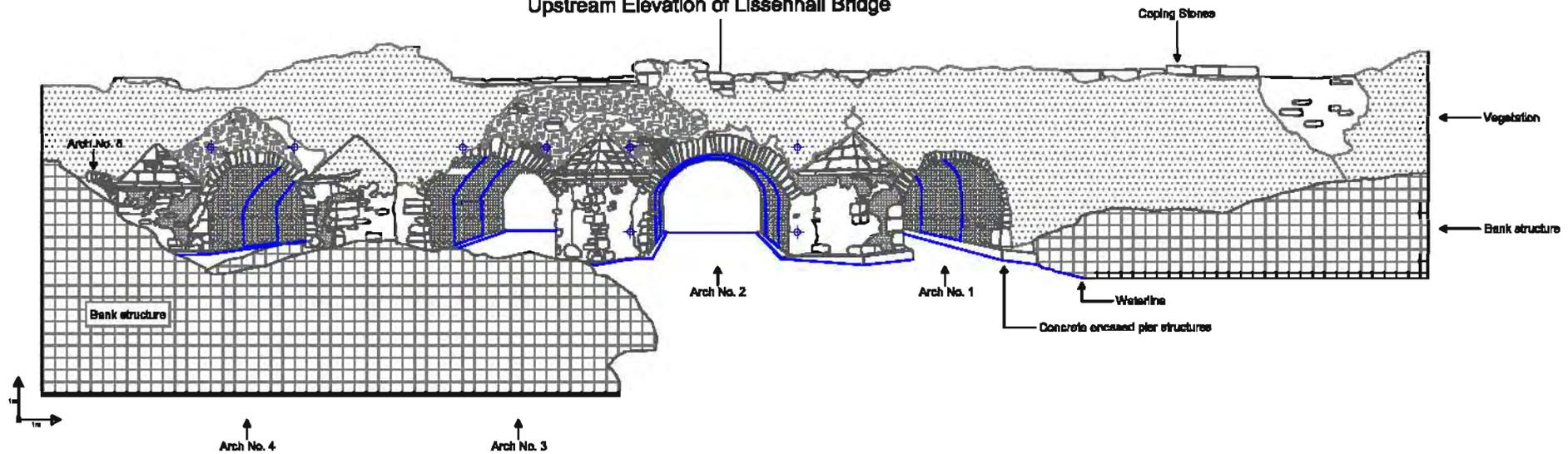
Project
 Metro North- Broadmeadow River and Ward
 River Archaeological Survey.

Title
 Figure 16- Profile Number 3; profile taken
 across Boradmeadow River along downstream
 side of Lissenhall Bridge [see Figure 11 for
 profile locations].

Upstream Photomosaic Elevation of Lissenhall Bridge



Upstream Elevation of Lissenhall Bridge



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Notes
 Survey Datum Point
 Bridge Section Marker
 Phase 1 Bridge Structure
 Concrete Rander

Job/Exc No.
 08D062,
 08D063
 Date
 16.02.09

Compiled by
 R.Bengert
 Scale
 1:150

CAD references
 RPA-Swords
 Drawing No.
 Figure 17

Client
 Railway Procurement Agency

Project
 Metro North- Broadmeadow River and Ward
 River Archaeological Survey.

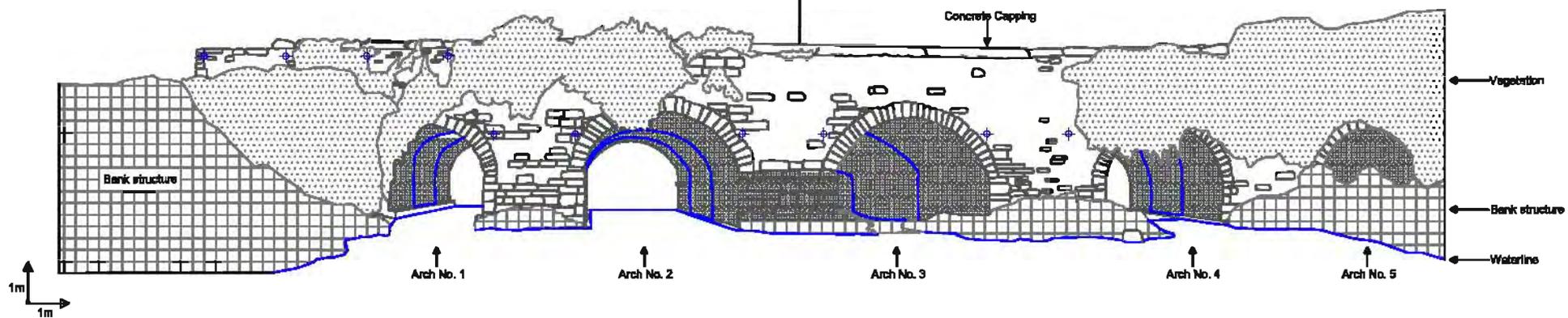
Title
 Figure 17- Photomosaic and Drawn
 Elevation of Upstream side of Lissenhall
 Bridge (Feature 1).



Downstream Photomosaic elevation of Lissenhall Bridge



Downstream Elevation of Lissenhall Bridge



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 Tel. 056 4440236 email: info@adco-ia.com

Notes
 Survey Datum Point
 Bridge Section Marker
 Phase 1 Bridge Structure

Job/Exc No.
08D082,
08D083
Date
13.02.09

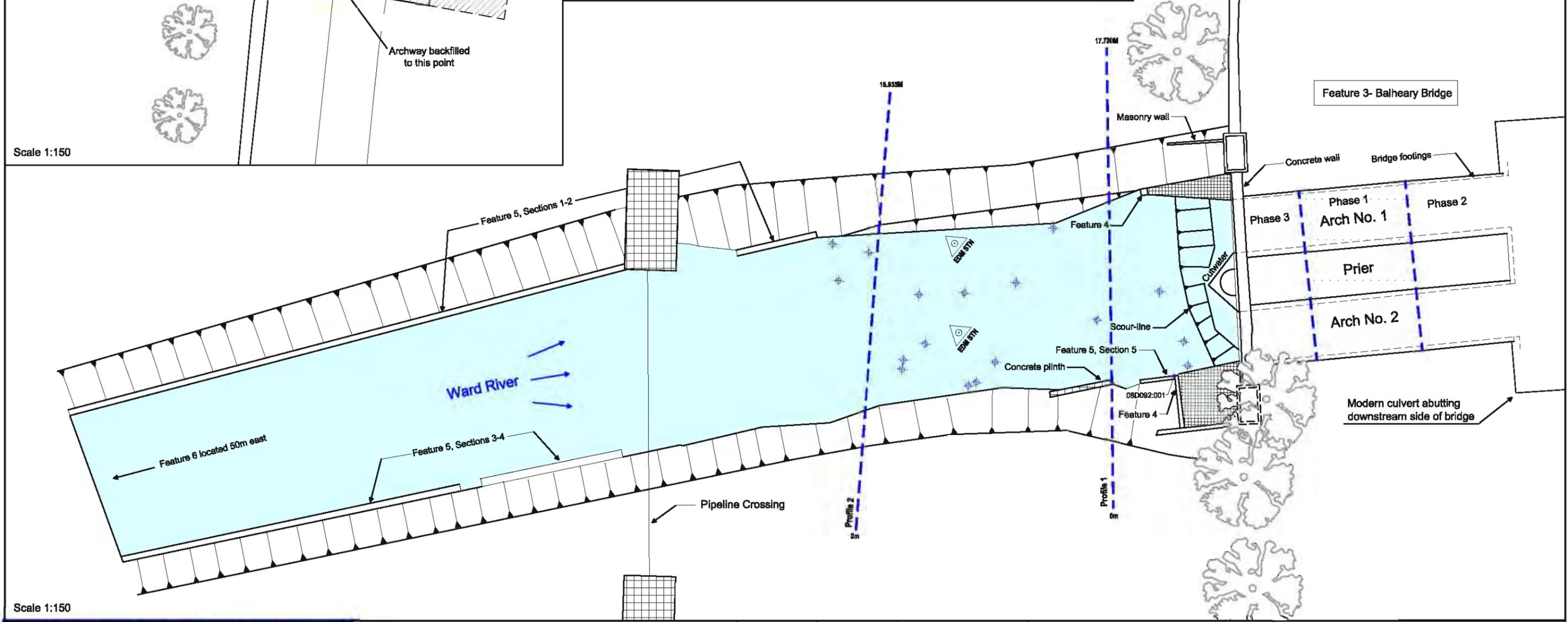
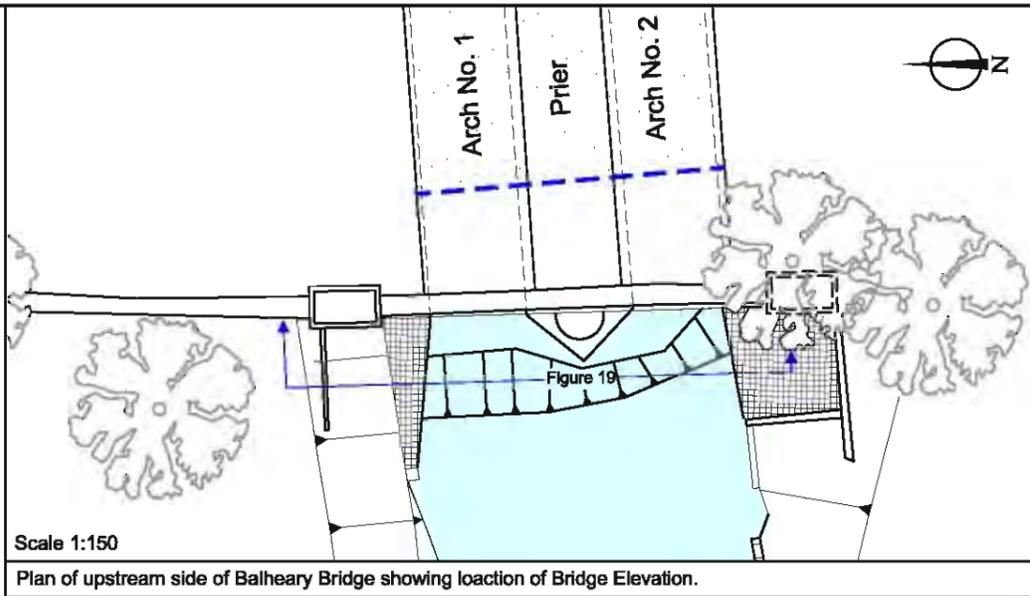
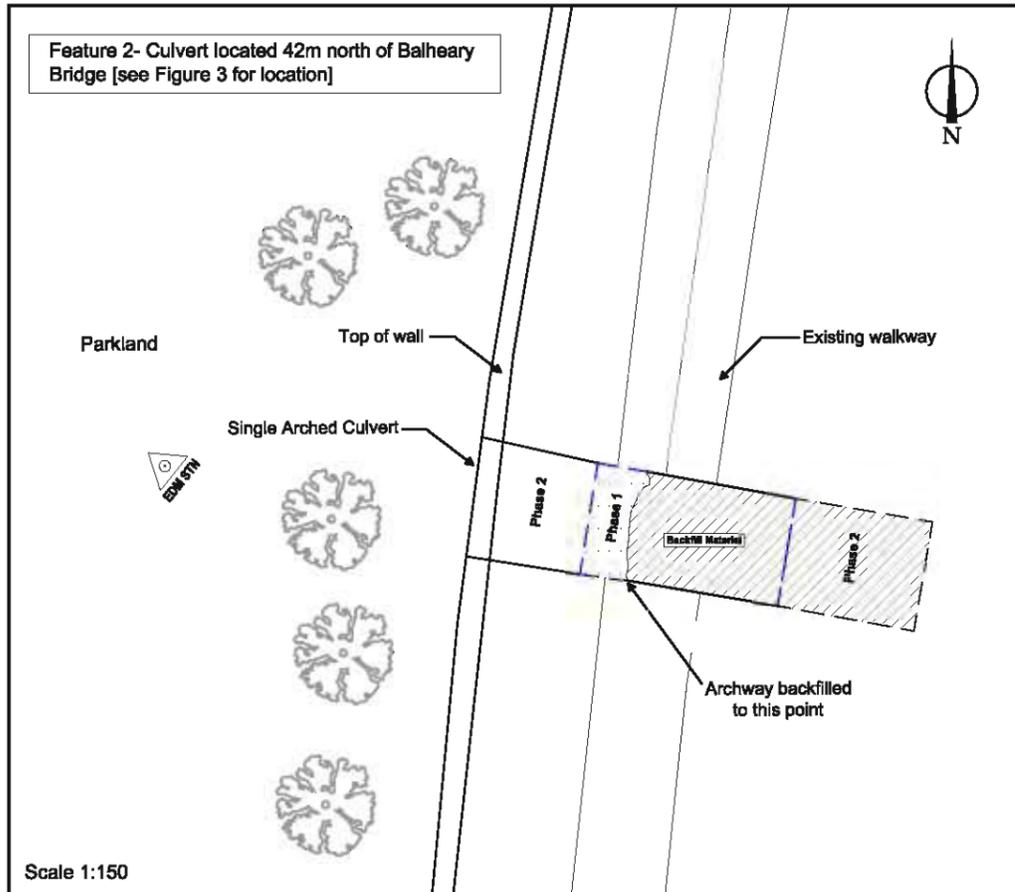
Compiled by
R.Bangarier
Scale
1:150

CAD reference
RPA-Swords
Drawing No.
Figure 18

Client
Railway Procurement Agency

Project
Metro North- Broadmeadow River and Ward
River Archaeological Survey.

Title
Figure 18- Photomosaic and Drawn
Elevation of downstream side of Lissenhall
Bridge (Feature 1).



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Notes
 Data gathered by O.Ryan and R.Bangertner

Phase 1 bridge structure Metal-detection target

Concrete underpinning of bridge foundations

Job/Exc No.
 08D092,
 08D093

Date
 17.02.09

Compiled by
 R.Bangertner

Scale
 1:150

CAD reference
 RPA-Swords

Drawing No.
 Figure 19

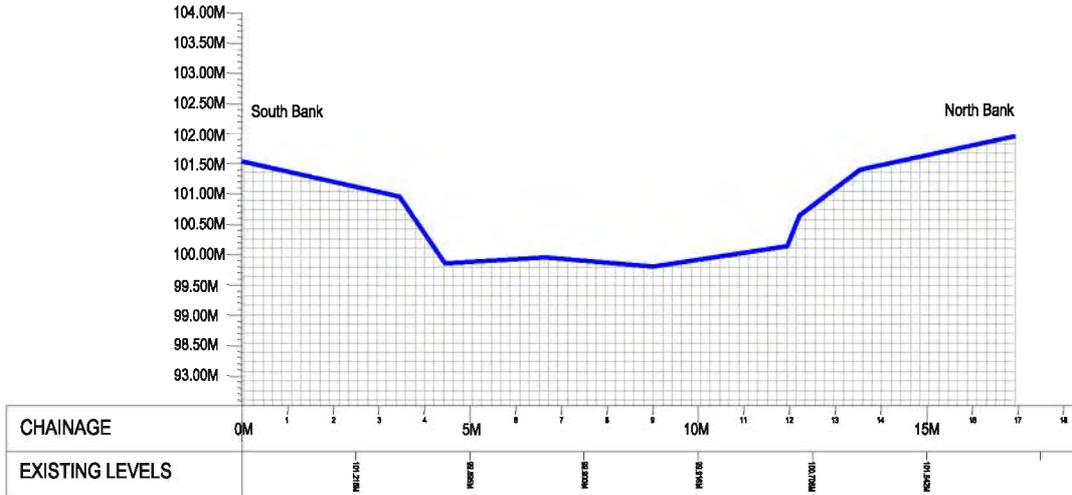
Client
 Railway Procurement Agency

Project
 Metro North- Broadmeadow River and Ward River Archaeological Survey.

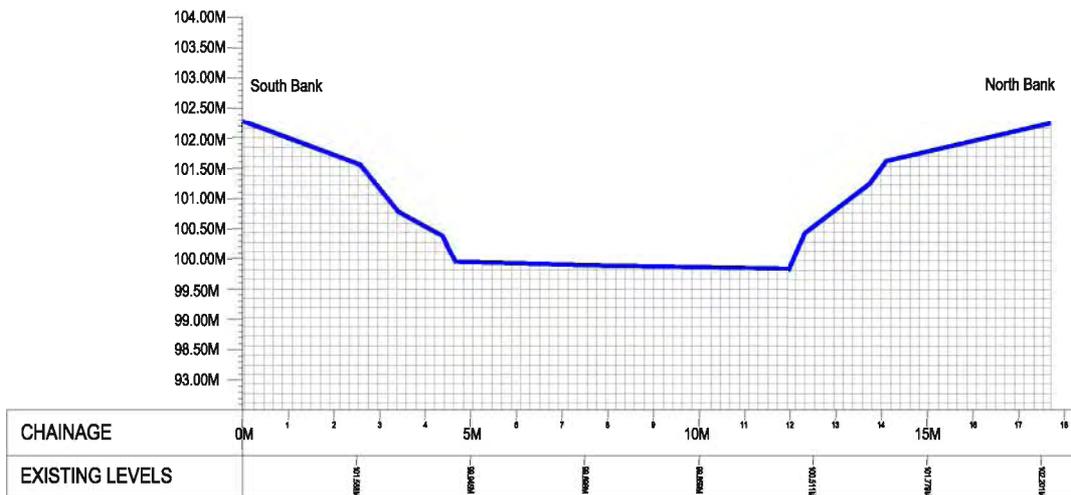
Title
 Figure 19- Plan showing location of Features 2-6, metal-detection target locations, and Bridge Phasing (Build-phases 1-3). [see Figure 21 for bridge elevation]



Ward River Profile Number 2



Ward River Profile Number 1



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Notes
 Profile survey data gathered by O.Ryan

Title
 Figure 20- River Profiles numbers 1-2, profiles taken across Ward River along upstream side of Balheary Bridge.

Client
 Railway Procurement Agency

Project
 Metro North- Broadmeadow River and Ward River Archaeological Survey

Job/Exc No.
 08D092, 08D093

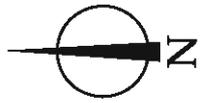
Compiled by
 R.Bangertner

CAD reference
 RPA-Swords

Date
 28.02.09

Scale
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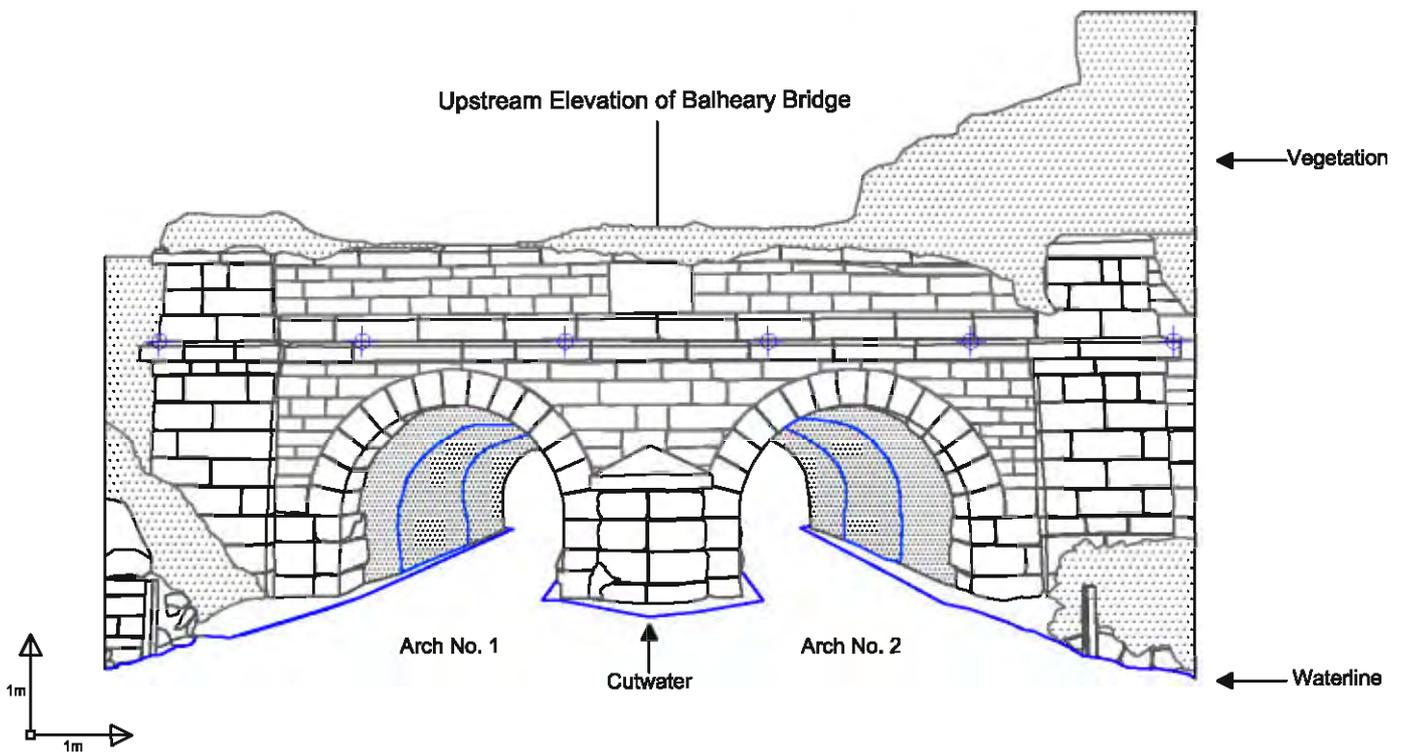
Drawing No.
 Figure 20



Upstream Photographic Elevation of Balheary Bridge



Upstream Elevation of Balheary Bridge



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DIVING COMPANY LTD.**
Tel. 056 4440236 email: info@adco-ie.com

Client
Railway Procurement Agency

Notes

-  Survey Datum Point
-  Bridge Section Marker
-  Phase 1 Bridge Structure
-  Limestone Blocks
-  Vegetation
-  Granite Blocks

Title
Figure 21- Photomosaic and Drawn
Elevation of Upstream side (Build-phase 3)
of Balheary Bridge (Feature 3).

[see Figure 19 for location]

Project
Metro North- Broadmeadow & Ward River Archaeological Survey

Job/Exc No.
08D092, 08D093

Compiled by
Rex Bangarter

CAD reference
RPA-Swords

Date
12.02.09

Scale
1:75

Drawing No.
Figure 21



Plate 1: East-facing view of downstream side of Lissenhall Bridge showing pebble island and three-arched culvert that accommodates the N1 Link-Road (1m horizontal and 2m vertical scale).



Plate 2: West-facing view of the two-arched culvert that accommodates the N1 Link-Road located on the downstream side of Balheary Bridge (1m scale).



Plate 3: Working-shot of bridge recording along the upstream side of Arch No. 2, Lissenhall Bridge.



Plate 4: Working-shot of diver undertaking riverbed survey along upstream side of Lissenhall Bridge, Broadmeadow River. Note: diver tethered to counteract against river-flow.



Plate 5: Working-shot of diver undertaking riverbed survey along downstream side of Lissenhall Bridge, northern flow-channel of Broadmeadow River. Note: diver tethered to counteract against river-flow.



Plate 6: Working-shot of metal-detector and Station survey in progress along the downstream side of Lissenhall Bridge (Feature 1), Broadmeadow River.



Plate 7: Working-shot of metal-detector survey undertaken across upstream side of Balheary Bridge, Ward River.



Plate 8: Working-shot of metal-detector survey and Total Station survey undertaken along downstream side of Lissenhall Bridge (Feature 1), Broadmeadow River.



Plate 9: Working-shot of Total Station survey undertaken along upstream side of Balheary Bridge (Feature 3), Ward River.



Plate 10: West-facing view of the Broadmeadow River along the downstream side of Lissenhall Bridge. Note: parkland bounds the south side of the river at this location.



Plate 11: North-facing view of upper surface of Lissenhall Bridge (Feature 1) showing residue of tarmacadam from the R127 (1m scale).



Plate 12: North-facing view of bankside erosion taking place along the base of the northern bank structure, downstream side of Lissenhall Bridge, Broadmeadow River (2m scale).



Plate 13: South-facing view of southern bank structure located along the upstream side of Lissenhall Bridge, Broadmeadow River (2m scale).



Plate 14: West-facing view of the Broadmeadow River and downstream (east) side of Lissenhall Bridge (Feature 1).



Plate 15: East-facing view of upstream (west) side of Balheary Bridge, Feature 3, Build-phase 3 (1m vertical and 2m horizontal scale).



Plate 16: Detail shot of flint artefact recovered from south bank of the Ward River, find number 08D092:01. Find measures 25mm in length, 15mm in width, and between 2mm-9mm in depth.



Plate 17: West-facing view of downstream side of Lissenhall Bridge, Feature 1, Build-phase 2 (1m vertical and 2m horizontal scale).



Plate 18: Northeast-facing view of upstream side of Lissenhall Bridge, Feature 1, Build-phase 2 (1m scale).



Plate 19: Transition-point between mid-section (Phase 1) and upstream section (Phase 2), south side of **Arch no. 1** (1m scale).



Plate 20: Transition-point between mid-section (Phase 1) and upstream section (Phase 2), north side of **Arch no. 1** (1m scale).



Plate 21: Transition-point between mid-section (Phase 1) and upstream section (Phase 2), south side of **Arch no. 2** (1m scale).



Plate 22: Transition-point between mid-section (Phase 1) and upstream section (Phase 2), north side of **Arch no. 2** (1m scale).



Plate 23: Transition-point between mid-section (Phase 1) and upstream section (Phase 2), south side of **Arch no. 3** (1m scale).



Plate 24: Transition-point between mid-section (Phase 1) and upstream section (Phase 2), north side of **Arch no. 3** (1m scale).

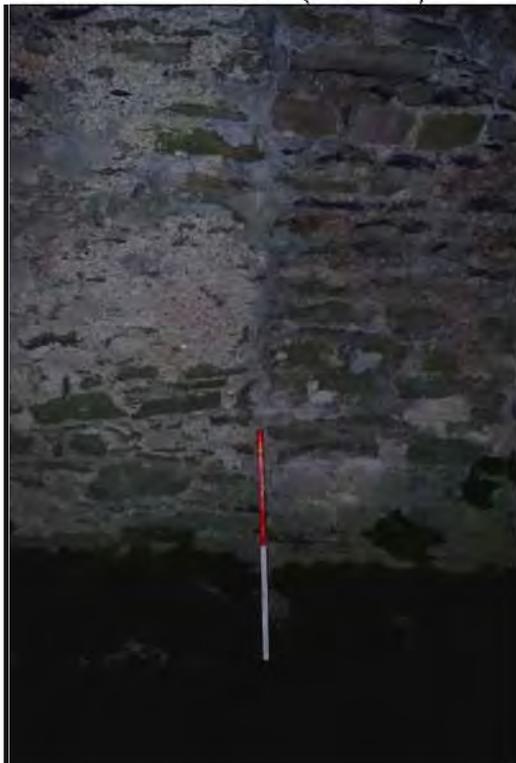


Plate 25: Transition-point between mid-section (Phase 1) and upstream section (Phase 2), south side of **Arch no. 4** (1m scale).



Plate 26: Transition-point between mid-section (Phase 1) and upstream section (Phase 2), north side of **Arch no. 4** (1m scale).



Plate 27: Transition-point between mid-section (Phase 1) and upstream section (Phase 2), south side of **Arch no. 5** (1m scale).

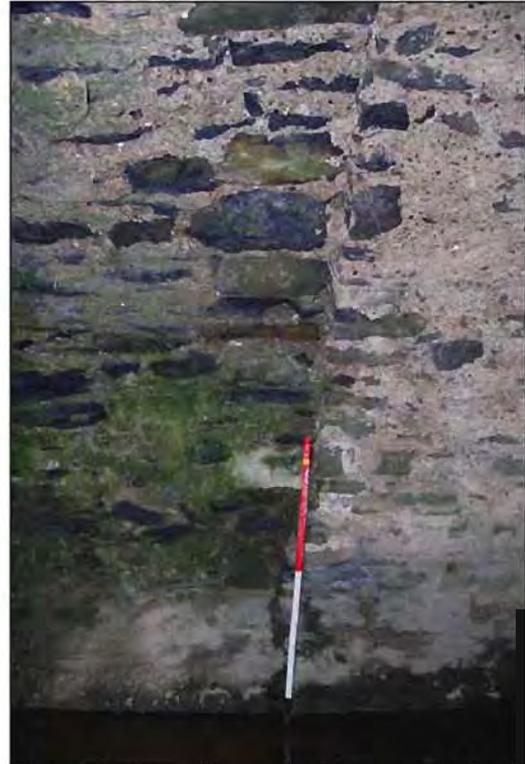


Plate 28: Transition-point between mid-section (Phase 1) and upstream section (Phase 2), north side of **Arch no. 5** (1m scale).



Plate 29: Transition-point between mid-section (Phase 1) and downstream section (Phase 2), south side of **Arch no. 1** (1m scale).

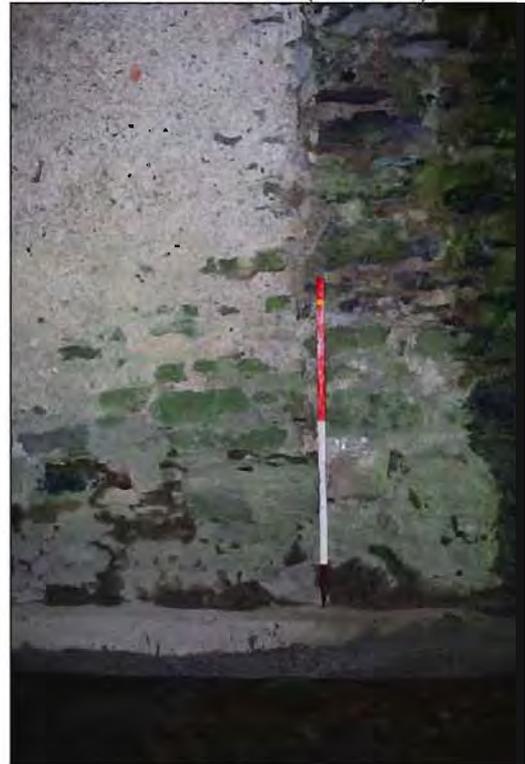


Plate 30: Transition-point between mid-section (Phase 1) and downstream section (Phase 2), north side of **Arch no. 1** (1m scale).



Plate 31: Transition-point between mid-section (Phase 1) and downstream section (Phase 2), south side of **Arch no. 2** (1m scale).



Plate 32: Transition-point between mid-section (Phase 1) and downstream section (Phase 2), north side of **Arch no. 2** (1m scale).



Plate 33: Transition-point between mid-section (Phase 1) and downstream section (Phase 2), south side of **Arch no. 3** (1m scale).



Plate 34: Transition-point between mid-section (Phase 1) and downstream section (Phase 2), north side of **Arch no. 3** (1m scale).



Plate 35: Transition-point between mid-section (Phase 1) and downstream section (Phase 2), south side of Arch no. 4 (1m scale).



Plate 36: Transition-point between mid-section (Phase 1) and downstream section (Phase 2), north side of Arch no. 4 (1m scale).

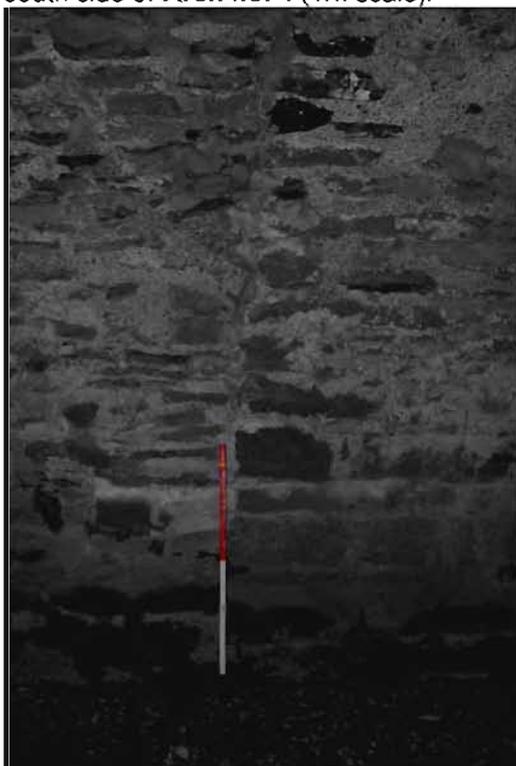


Plate 37: Transition-point between mid-section (Phase 1) and downstream section (Phase 2), south side of Arch no. 5 (1m scale).



Plate 38: Transition-point between mid-section (Phase 1) and downstream section (Phase 2), north side of Arch no. 5 (1m scale).



Plate 39: West-facing view of arch-walls and intrados from **Arch no. 2**, Lissenhall Bridge, Feature 1 (1m scale).



Plate 40: West-facing view of arch-walls and intrados from **Arch no. 3**, Lissenhall Bridge, Feature 1 (1m scale).



Plate 41: Detail shot of coarse mortar covering the intrados of the mid-section of Lissenhall Bridge. (10cm scale).



Plate 42: South-facing view of arch wall from the re-built mid-section, south side of Arch no. 2, Lissenhall Bridge, Feature 1 (1m scale).



Plate 43: North-facing view of arch wall from the re-built mid-section, north side of Arch no. 2, Lissenhall Bridge, Feature 1 (1m scale).



Plate 44: West-facing view across lintel forming at top of arch-wall on south side of the mid-section of Arch no. 2, Lissenhall Bridge, Feature 1 (10cm scale).



Plate 45: North-facing view across lintel forming at top of arch-wall on north side of the mid-section of **Arch no. 2**, Lissenhall Bridge, Feature 1 (10cm scale).



Plate 46: West-facing view of intrados on north side of **Arch no. 4**, showing bulge located across the arch-ceiling of the phase 1 mid-section, Lissenhall Bridge, Feature 1 (1m scale).



Plate 47: East northeast-facing view of Cutwater No. 1, located between Arch nos. 1 and 2, Lissehanll Bridge, Feature 1 (1m scale).



Plate 48: East-facing view of Cutwater No. 2, located between Arch nos. 2 and 3, Lissehanll Bridge, Feature 1 (1m scale).



Plate 49: East-facing view of Cutwater no. 3, located between Arch nos. 3 and 4, Lissehanll Bridge, Feature 1 (1m scale).



Plate 50: Northeast-facing view of south side of Cutwater no. 4, located between Arch nos. 3 and 4, Lissehanll Bridge, Feature 1 (1m scale).



Plate 51: East-facing view of Arch no. 1, upstream side of Lissenhall Bridge, Feature 1 (2m scale).



Plate 52: West-facing view across arch-ceiling (intrados) of Arch no. 1, Lissenhall Bridge (Feature 1). Note: differing composition of intrados and concrete underpinning of bridge footings (1m scale).



Plate 53: Detail shot of intrados transition-point between the upstream section (Phase 2) and the middle section (Phase 1) from **Arch no. 1**, Lissenhall Bridge, Feature 1 (10cm scale).

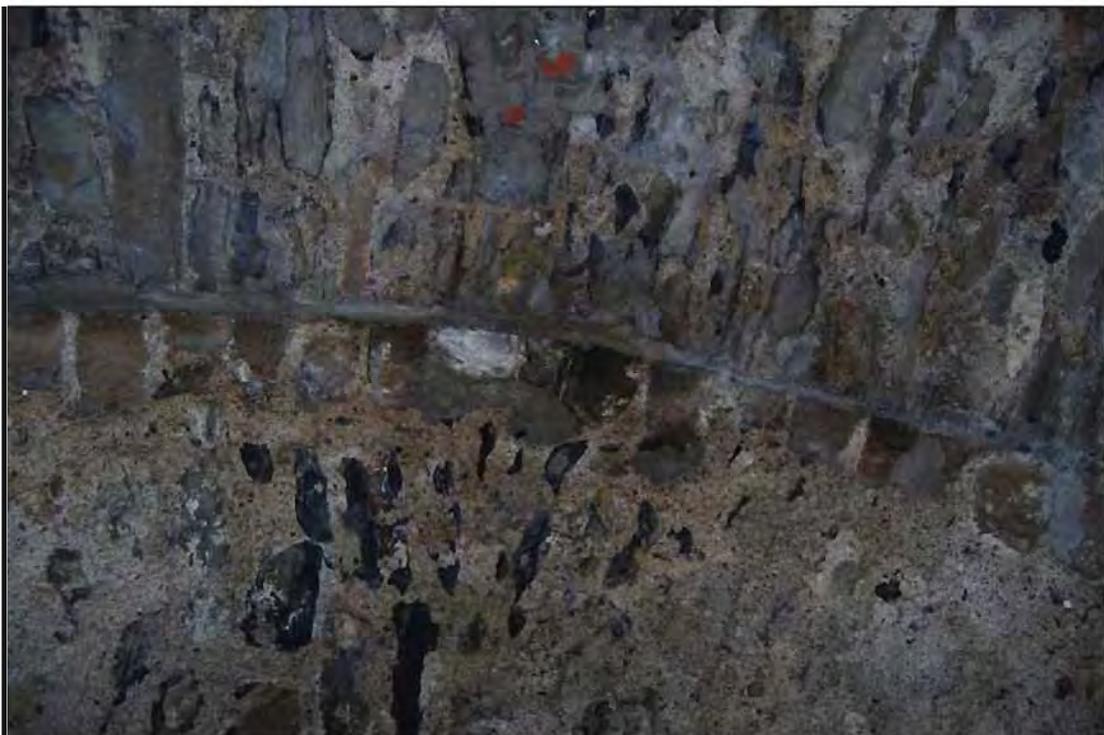


Plate 54: Detail shot of intrados transition-point between the middle section (Phase 1) and the downstream section (Phase 2) within **Arch no. 2**, Lissenhall Bridge (Feature 1).



Plate 55: East-facing view of Arch no. 2, upstream side of Lissenhall Bridge, Feature 1 (2m scale).



Plate 56: West-facing view across arch-ceiling (intrados) of Arch no. 2, Lissenhall Bridge (Feature 1). Note: differing composition of intrados and protruding arch-stones from downstream side of mid-section (1m scale).



Plate 57: East-facing view of Arch no. 3, upstream side of Lissenhall Bridge, Feature 1 (2m scale).



Plate 58: Southwest-facing view across arch-ceiling (intrados) of Arch no. 3, Lissenhall Bridge (Feature 1). Note: differing composition of intrados and protruding arch-stones from downstream side of mid-section (1m scale).



Plate 59: East-facing view of Arch no. 4, upstream side of Lissenhall Bridge, Feature 1 (2m scale).



Plate 60: West-facing view across arch-ceiling (intrados) of Arch no. 4, Lissenhall Bridge, Feature 1, (1m scale).



Plate 61: East-facing view of Arch no. 5, upstream side of Lissenhall Bridge, Feature 1 (2m scale).



Plate 62: Southwest-facing view across arch-ceiling (intrados) of Arch no. 5, Lissenhall Bridge, Feature 1, (1m scale).



Plate 63: West-facing view of **Arch no. 1**, downstream side of Lissenhall Bridge, Feature 1 (2m scale).



Plate 64: West-facing view of **Arch no. 2**, downstream side of Lissenhall Bridge, Feature 1 (2m scale).



Plate 65: West-facing view of **Arch no. 3**, downstream side of Lissenhall Bridge, Feature 1 (2m scale).



Plate 66: West-facing view of **Arch no. 4**, downstream side of Lissenhall Bridge, Feature 1 (2m scale).



Plate 67: West-facing view of **Arch no. 5**, downstream side of Lissenhall Bridge, Feature 1 (2m scale).



Plate 68: Southeast-facing view of concrete encased bridge footings located along the base of **Arch no. 1**, upstream side of Lissenhall Bridge, Feature 1 (1m scale).



Plate 69: East-facing view of the single-arched culvert comprising Feature 2, located approximately mid-point between Lissenhall Bridge, Feature 1, and Balheary Bridge, Feature 3 (1m vertical and 2m horizontal scale).



Plate 70: Southeast-facing view of the transition-point, on southern side of the arch, between the western section (Phase 2) and middle section (Phase 1) from Feature 2 (1m scale).



Plate 71: East-facing shot showing upstream (Phase 3) side of Balheary Bridge, Feature 3. Note: Total Station survey at this location in progress.



Plate 72: Transition-point between mid-section (Phase 1) and upstream section (Phase 3), north side of Arch no. 1 (1m scale).



Plate 73: Transition-point between mid-section (Phase 1) and downstream section (Phase 2), north side of Arch no. 1 (1m scale).



Plate 74: Transition-point between mid-section (Phase 1) and upstream section (Phase 3), north side of Arch no. 2 (1m scale).



Plate 75: Transition-point between mid-section (Phase 1) and downstream section (Phase 2), north side of Arch no. 2 (1m scale).



Plate 76: Detail shot of mortar located across intrados of middle section (Phase 1) of Arch nos. 1 and 2 from Balheary Bridge (Feature 3).



Plate 77: East-facing view through **Arch no. 1** showing transition between the upstream (Phase 3) and middle section (Phase 1) at Balheary Bridge, Feature 3 (1m scale).



Plate 78: East-facing view through **Arch no. 2** showing transition between the upstream (Phase 3) and middle section (Phase 1) at Balheary Bridge, Feature 3 (1m scale).



Plate 79: West-facing view of **Arch no. 1** on downstream side of Balheary Bridge, Feature 3 (1m scale). Shot take from within adjoining concrete culvert.



Plate 80: West-facing view of **Arch no. 2** on downstream side of Balheary Bridge, Feature 3 (1m scale). Shot take from within adjoining concrete culvert.



Plate 81: North-facing view of semi-circular cutwater located between Arch nos. 1 and 2 on upstream side of Balheary Bridge, Feature 3 (1m scale). Note: concrete underpinning of bridge structure.



Plate 82: North-facing view showing concrete underpinning of upstream side of Balheary Bridge and section of masonry wall (Feature 4) located to right of picture, on north side of the Ward River (1m scale).



Plate 83: South-facing view of masonry wall, part of Feature 4, abutting upstream side of Balheary Bridge located to right of picture, on south side of the Ward River (1m scale).



Plate 84: Northeast-facing view of Ward River showing location of revetment wall (Feature 5, Section 1) located along north side of the river (1m vertical and 2m horizontal scale).



Plate 85: North-facing detail shot of revetment wall (Feature 5, Section 1) located along north side of the river (1m vertical and 2m horizontal scale).



Plate 86: West-facing view of downstream side of a single-arched bridge (Feature 6) located 92m upstream of Balheary Bridge (1m scale).



Plate 87: Southwest-facing view of southern side of a single-arched bridge (Feature 6) located 92m upstream of Balheary Bridge (1m vertical and 2m horizontal scale).