Archaeological Monitoring of Geotechnical Site Investigations

Luas Broombridge (BXD)

Archaeological Licence Ref: 11E0459

for

on behalf of

Sept 2012

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EXECUTIVE SUMMARY

A programme of archaeological monitoring was undertaken during the excavation of 44 geotechnical site investigation trenches along the proposed route of Luas Broombridge (BXD) between 28 January and 6 June 2012 in accordance with Licence Number 11E0459. These works were undertaken by Edmond O'Donovan & Associates for IGSL Ltd. on behalf of the Railway Procurement Agency (RPA).

No archaeological stratigraphy was identified during the monitoring programme. There was no evidence, either structural or artefactual, of medieval or earlier activity. The earliest pottery-type recovered was a shard of North Devon Gravel Tempered Ware recovered from the Marlborough Street site investigations (insert trench number), which is ubiquitous in the 17th – 18th centuries.

Structural remains were examined in the Midland Great Western Railway cutting (ST19, ST17, ST18, ST16, ST14 and ST15) and within the grounds of St. Brendan's Hospital, ('Grangegorman'; ST01 and ST02). The latter were excavated abutting the boundary wall between the hospital complex and the Dublin Bus Phibsborough Depot. In all instances these remains dated from the late 18th and 19th century and were relatively modern.

No further archaeological work is required in connection with this programme of site investigations and the enclosed report should be viewed as final.

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1.0 Introduction

This report describes the results of archaeological monitoring of geotechnical site investigations carried out on the proposed route of Luas Broombridge (Figures 1-11).

As currently proposed, Luas Broombridge will be a twin track light rail system, which will serve a 5.6 km long corridor from the Luas Green Line at its current terminus (St. Stephen's Green) to the Iarnród Éireann Broombridge Station on the Maynooth railway line. The proposed scheme will link Dublin city centre to Phibsborough and Cabra via Broadstone and Grangegorman. Interchange with the Luas Red Line will be at the Abbey Street Stop and with the proposed Luas that runs from Lucan to the city centre, at Westmoreland and Trinity Stops. A total of 13 new stops are planned as part of the proposed scheme

The work was carried out for IGSL Ltd. on behalf of the Railway Procurement Agency (RPA), which is a statutory agency. The RPA was established as an Independent Statutory Body, by Ministerial Order on December 28th 2001 following the passing of the Transport (Railway Infrastructure) Act, 2001 to design and construct Railway Infrastructure.

The southern end of the Luas Broombridge is located within the centre of Dublin City and is located within the periphery of the historic town of Dublin. It is a registered area protected as a recorded monument under National Monuments Legislations (RMP Ref: DU018-020).

A total of 44 slit trenches (ST), bore-holes (BH) and test pits (TPs) excavated during the site investigations programme required archaeological monitoring. The excavation of the pits was carried out both mechanically (by mini-digger) and by hand; this facilitated the recording of the sections and profiles included in this report.

No archaeology stratigraphy was identified during the monitoring programme. There was no evidence, either structural or artefactual, of medieval or earlier activity. The earliest pottery-type recovered was a shard of North Devon Gravel Tempered Ware

recovered from the Marlborough Street / Place site investigations (ST039 and BH042), which is ubiquitous in the 17th – 18th centuries.

Structural remains were examined in the Midland Great Western Railway cutting (ST19, ST17, ST18, ST16, ST14 and ST15) and within the grounds of St. Brendan's Hospital, ('Grangegorman'; ST01 and ST02). The latter were excavated abutting the boundary wall between the hospital complex and the Dublin Bus Phibsborough Depot. In all instances these remains dated from the late 18th and 19th century and were relatively modern.

The archaeological monitoring was carried out by Edmond O'Donovan over a six month period from 28 January to 6 June 2012.

2.0 Historical and Archaeological Background

2.1 Introduction

The historical and archaeological background within this report has been set out to mirror the locations where the site investigations were positioned. The information in this section is not a complete history of Dublin, a more complete historical analysis is set out in the Luas Broombridge EIS document, however this section seeks to place the soils and structures described during the excavation of the site investigation trial pits (Section 3.0) in their local context, thus highlighting the site specific cultural heritage issues in those locations pertinent to the information uncovered as a result of the archaeological monitoring.

2.2 Dublin City Centre - College Green

College Green (Irish: *Faiche an Choláiste*) is a three-sided 'square' in the centre of Dublin. On its northern side is a building known today as the Bank of Ireland which until 1800 was Ireland's Parliament, known as Grattan's Parliament after Henry Grattan. To its east stands Trinity College Dublin. To its south stands a series of 19th century buildings that are mostly banks.

The area was once known as Hoggen Green from the Old Norse word *haugr* meaning mound. The cemetery at College Green consisted of several burial mounds, which are thought to have contained the remains of some of the Norse Kings of Dublin. The Norse *thing* (DU018-020132), an assembly and meeting-place, was located between Church Lane and Suffolk Street. It was still extant in the 17th century.

College Green is no longer a 'Green' and now exists as a street running from the front gates of Trinity College Dublin to pedestrian traffic lights close to The Central Bank in Dame Street at the junction of Trinity Street.

2.3 Dublin City Centre - All Hallows Priory

All Hallows (DU018-020044) was founded in 1166 by the King of Leinster, Dermot MacMurrough, in an area known as 'Hoggin Green', just outside the walled city of Dublin and now occupied by Trinity College Dublin. It was an Araosian (Augustinian) foundation, with canons regular. The priory was one of the most important, and over time became one of the wealthiest, religious establishments in the vicinity of Dublin, along with the Priory of St. John the Baptist (Thomas Street), the Priory of the Holy Trinity (Christ Church) and St. Mary's Abbey.

During the Reformation, as part of the Dissolution of the Monasteries, the priory was closed and in 1538 the buildings and lands were granted, for a Crown head rent of 4 pounds, 3 shillings and a halfpenny, to the Mayor and corporation of Dublin on behalf of the citizens.

2.4 Dublin City Centre - Trinity College Dublin

Archbishop Loftus asked the Mayor to grant the All Hallows lands, then generating a rent of only 20 pounds a year for the city, for the use of a college and when this was done, he employed Henry Ussher to appeal to Queen Elizabeth I of England for a charter for a college and a licence for the land, which was granted in December 1591. This new foundation became Trinity College, Dublin (DU018-020391) of which Archbishop Loftus became first Provost.

2.5 Dublin City Centre - Natural Features

The River Steyne or Stein ran along the western edge of the grounds of All Hallows, and one of two bridges over the small river was around the location of the current main entrance to Trinity College, with a watermill nearby (DU018-020099). The area was reclaimed from the River Liffey in the late medieval period, as this early suburb of Dublin developed. The Viking monument known as the long stone (DU018-020129) once stood at this location. It is thought to have marked the marshy ground on the edge of the Liffey to prevent ships running aground at high tide.

2.6 Dublin City Centre - Marlborough Street

Marlborough Street's name is in honour of the Duke of Marlborough, known for his victory at Blenheim during the 18th century. In the late 19th century it was for a time called Tyrone Street after Tyrone House (RPS 8155). The lower part of the street was at different times called Union Lane, Ferryboat Lane, and Union Street. Marlborough Place is a small side street and dates from the late 18th century. The land was reclaimed from the River Liffey estuary in the early post-medieval period with the expansion of the quay along the northern side of the Liffey from the 16th to the 18th century. The area was part of the 'Monto' distinct of the city, infamous for taverns and brothels in the 19th and early 20th century.

2.7 Dublin City Centre – Dominick Street

Until the beginning of the 18th century, the area in which Dominick Street lies was in open country at the edge of the Dublin 'City Liberty', as is illustrated on Brooking's Map of 1728. This area comprised part of a parcel of land in the possession of Sir Christopher Dominick who started to build in the area in 1720 and from whom the street derives its name.

Sir Christopher Dominick died in 1743 and a decade later his widow announced her intention "to let in lots for building…….all that new street called Dominick Street" where "sand may be raised out of the foundations for building work". Rocque's map (1756) is the first to show Dominick Street Lower and he represents it as extending between 'Great Britain Street' (now Parnell Street) and Dorset Street. The area was favoured by aristocrats and consequently, was an up-market residential location in the late 18th century. Sherrard's map of 1827 shows the presence of Lord Palmerston's as well as Lord Monck's estates to the immediate east of this street. Duncan's map (1821) shows both Dominick Street Lower and Upper and the presence of the Broadstone Branch of the Royal Canal at the northern limit of Dominick Street Upper.

The abolition of Parliament in 1801 with the Act of Union and the flight of aristocracy, coupled with the social decline in living standards in the city saw Dominick Street become a tenement residential area in the 19th century. Thom's Dublin Street Directory

of 1900 illustrates the extent of this change. By 1900, over 66% of the houses on Dominick Street Upper and between 33-66% of the houses on Dominick Street Lower were tenements. The growth of the north inner city as a working class residential area led to a significant increase in the density of population, where many large families were living in a single house. The census of Dublin in 1911 illustrates how an astonishing 835 people lived in 15 houses on Henrietta Street.

The poor living conditions in the tenements and consequent low rent led to widespread disrepair in the housing stock. Poor repair led to water ingress and subsequent structural failings. Episodic collapse of such tenement houses in the late 19th and early 20th century was not uncommon and often sadly associated with injury and death to the occupants of the houses. Dublin City Council (formerly Dublin Corporation) initiated a programme of demolition of Georgian houses from as early as 1900 up to the 1960's to address the poor accommodation issue for residents. This resulted in many former tenement buildings being demolished. The extent of the demolition is apparent around Dominick Street where relatively few Georgian buildings have survived.

2.8 Grangegorman

The site of St. Brendan's Hospital, generally referred to as Grangegorman lies outside the medieval walled town of Dublin, on the north side of the River Liffey. The grounds of the Hospital lie adjacent to known sites in the historic city of Dublin (DU018:020). The area to the south was known to have been settled in the Viking period. St. Mary's Abbey was founded under the auspices of the Hiberno-Norse in 1139 and controlled substantial lands on the north side of the Liffey, which extended to the south of Grangegorman. The parish church of St. Michan's lay to the southwest. This served the medieval suburb of the city that grew on the northern banks of the river along Church Street.

Grangegorman was one of three farms, the others being Glasnevin and Deansgrange, which belonged to the Augustinian Priory Church of the Holy Trinity in Christchurch Cathedral in Dublin (RPS 1520 and RMP DU 018-020270). Although no recorded archaeological sites (RMP sites) are located within the Grangegorman area, there is a site of significance along the southern boundary of the Grangegorman lands. 'Grange-

Gorman Manor House' (DU018:020565) is thought to be the site of the medieval farm buildings which give their name to Manor Street. The site of the manor house (DU018:020565) is currently occupied by the Stanhope Street Convent of the Irish Sisters of Charity. In 1559, the Manor House was conferred to Francis Asgard by Royal mandate. It may have been the location of the 'old store house' mentioned in the Civil Survey of 1654-56, and said to have had a great hall and several rooms. The lands surrounding this particular site were used for agricultural purposes as a farm in the medieval period. A building within the grounds of Grangegorman illustrated on John Rocque's map of 1760 may be a relict part of the old medieval manor house or other farm buildings that formed part of the land.

2.9 The Penitentiary and North Union Workhouse at Grangegorman

In the 18th and 19th centuries the care of the poor and sick in Dublin was left to private charity and the Government. Many centres sprang up around the city. Indeed Dublin was one of the most advanced cities in relation to public health care, with the erection of buildings on a massive scale such as the Royal Hospital, Kilmainham, the Cork Street Fever Hospital, and the Debtors Gaol. The lack of development in the Grangegorman area during this time meant that land was available for large scale projects and the suburban settings ensured that the land was well priced. At Grangegorman, three impressive structures were built independently of each other. Set back to back, without acknowledging the presence of one another, were the Richmond Lunatic Asylum (from 1814), Richmond Penitentiary (from 1812) and the North Dublin Union Workhouse of Industry (from 1773). The Penitentiary, designed by Francis Johnston, retains a full façade with a central pediment, cupola and wings. It was the public front of a semi-circular web of cell blocks, courtyards and common rooms. Corridors leading to a central 'eye' formerly divided the Asylum courtyard and the Penitentiary had concentric cell blocks enclosing exercise yards. Good behaviour merited movement from isolation at the periphery to common rooms, workshop and finally the main gate. Both had offices situated in a front block, forming an acceptable façade to street or garden. The same characteristics emerge time and again in the city's institutions; as elsewhere in Ireland,

they are marked by the symmetric presence of two chapels (Roman Catholic and Church of Ireland) rather than one.

The lands where the site investigation test trenches and boreholes were excavated within the Grangegorman complex consist of scrub woodland, where former buildings at the northern end of the North Union Workhouse and the eastern most end of the Richmond Penitentiary once stood. The area has been listed as one Dublin City Councils Strategic Development Redevelopment Areas (SDRA 8). The buildings where the site investigations were carried have been demolished. Upstanding remains of the Richmond Asylum, known as the Lower House remain (RPS 3289) and the southern range of buildings associated with the North Union Workhouse survives also.

2.10 Royal Canal and Ferns' Lock

The Royal Canal is a canal originally built for freight and passenger transportation from the River Liffey at Dublin to the River Shannon at Cloondara in Co. Longford. It fell into disrepair, but has since been restored for navigation. The full length of the canal was re-opened on 1 October 2010.

Work commenced in 1790 and lasted 27 years before finally reaching the Shannon in 1817, at a total cost of £1,421,954. The canal passes through Maynooth, Kilcock, Enfield, Mullingar and Ballymahon has a spur to Longford. The total length of the main navigation is 145 kilometres, and the system has 46 locks. At the Dublin end, the canal reaches the Liffey through a wide sequence of dock and locks at Spencer Dock, with a final sea lock to manage access to the river and sea. A canal harbour was constructed at Broadstone;this was in-filled c.1877 and the site is currently used as a car park to the fore of the Broadstone Depot. Recent archaeological investigations have identified that the canal walls are well preserved *c.*0.5m beneath the existing car-park (Doyle 2010)[1].

In 1843, while walking with his wife along the Royal Canal, Sir William Rowan Hamilton realised the formula for quaternions and carved his initial thoughts into a stone on the

[1] Doyle, T. 2010 *Luas Broombridge Advance Archaeological Testign at Broadstone, Assessment Report. Licence No. 10E0090*, Unpublished Report, Headland Archaeology Ltd for RPA

Brougham Bridge (Broombridge; RPS 909) over the canal. A plaque commemorating this act was erected on the bridge and is important internationally in the history of mathematics.

2.11 Broadstone Railway Station

In 1845 the Royal Canal was purchased by the Midland Great Western Railway (MGWR) Company for £298,059 with a view to using the land alongside the canal to construct a railway line to the west of Ireland.

Situated at the crest of Constitution Hill directly opposite King's Inns, is the Broadstone Terminal Building (RPS 2029) which served as the finishing point of the Midland and Great Western Railway. Designed by John Skipton Mulvany, the structure was built between 1841 and 1850, with the addition of the colonnade in 1861. Broadstone Station is constructed of granite in a neo- Egyptian style.

Broadstone Station was opened on 28 June 1847, closed to public traffic in 1937 and finally closed on 8 April 1961, having been used as the steam depot for Dublin between 1937 and this date.

With Galway projected to become the main port for transatlantic passenger traffic between Europe and North America, the MGWR successfully competed with its rival the Great Southern and Western Railway to reach it first. A special fourth class was introduced by the MGWR for poor migrants from the west going to Britain for work. The line, which branched out to serve Sligo, Westport, Achill and Clifden, was also used to transport large numbers of cattle. It was about this time that the majority of the houses surrounding the Broadstone Station in the area were constructed, as dwellings for workers on the railway. Most of the houses were built by the Artisan's Dwelling Company, which built many similar estates in Dublin and elsewhere, and houses of this type are now frequently described as Artisan cottages, regardless of their origin.

Joseph Howley was a member of the Irish Volunteers in Galway. He was shot dead by a special unit of the RIC known as the Igoe Gang at the station on December 4, 1920 during the Irish War of Independence.

The Broadstone Building is currently the headquarters of *Bus Éireann*, housing most of their administration and also one of their main garages. To the south, within the same property, lies the Dublin Bus Phibsborough Depot.

3.0 Archaeological Monitoring

3.1 Introduction

A total of 44 slit trenches (ST), bore-holes (BH) and test pits (TPs) requiring archaeological monitoring were excavated during the geotechnical site investigations programme (Table 1). These geotechnical investigations were carried out from College Street in Dublin City Centre through the MGWR railway cutting to Broombridge. A number of geotechnical investigations were also carried out within the lands of Grangegorman in order to investigate the nature of the boundary wall as present between Grangeorman and the Dublin Bus Phibsborough Depot. In all instances the investigative works commenced with the excavation of a hand dug test pit to determine the presence or absence of underlying utilities. Once this was determined pile rigs and other drilling equipment was employed as appropriate. This facilitated the recording of the sections and profiles included in this report.

Area	***Site Investigations Reference Number***	***Total***
MGWR Cutting	ST14, ST15, ST16, ST17, ST18 and ST19	6
Grangegorman / North Union Workhouse	ST001, ST002, ST003, ST004, ST005A, ST005, ST006, BH010 and BH030	9
Broadstone / Phibsborough Bus Stations	BX002, BH001, BH003, BH005, BH006, BH007, BH009 and BH031	8
Broombridge	BH032, ST033, TP02, TP05, TP06, TP07, TP08a, TP08, TP08, TP09, TP12 and TP14	12
Dominick Street	BH043, BH044, BH045, BH046 and BH047	5
Marlborough Street	ST039 and BH042	2
College Street	BH040 and BH041	2
Total		***44***

Table 1 - LUAS BXD - Archaeological Monitoring of Site Investigations

3.2 Site Investigations within the Midland Great Western Railway Cutting between Broadstone and Faussagh Road

3.2.1 The Site Investigations Test Pits

Six slit trenches (abbreviated ST, Table 1) were excavated on the bed of the old MGWR *(*Midland Great Western Railway) railway cutting adjacent to the western wall of the railway cutting (Figure 6). The trenches were excavated perpendicular to the line of the railway cutting and were all orientated northeast / southwest. The trenches were excavated on the 28/01/2012.

3.2.2 The Walls of the Railway Cutting

The wall that retains the side of the railway cutting is composed of ashlar dressed limestone calp blocks all faced and squared. The stones are rectangular and vary in size between 0.15m wide – 0.12m high and 0.45m wide -0.35m high. The wall is 20 courses high on average the course are between 0.3-0.4m high with each course composed of 1 to 3 blocks. The pointing has mostly fallen away, however in places the original pointing, consisting of a light brown cementatious mortar, survives. It appears that the mortar is largely washed out at the surface.

The base of the wall is bedded in a wet sandy soft lime /sand deposit laid upon a large stone plinth of composed from limestone calp. The plinth is cut away by a later sewer in several locations (ST15, ST16, ST17, ST18 and ST19). The base of the wall corresponds with the water table within the cutting. The wall is on average 5m high to the original ground level, with a further wall or parapet (2.6m high) above the existing old ground level. Occasional rectangular voids exist in the wall measuring 0.07m wide and 0.24m high. These allow water from the higher ground above the railway cutting to percolate through the structure to prevent pooling behind the retaining wall that would weaken its structure. The wall has failed and burst in a small number of locations where a rubble core is evident within the structure. This rubble core is bonded by a concrete like mortar.

3.2.3 ST14

The slit trench measured 3m deep, 3.10m long and was 4m wide at the top. It was 0.85m wide at the base. A deposit of fine silty grey clay mixed with Dublin black limestone fragments (calp), broken hand made brick, mixed with plastic, tin, modern bottle glass and other late 20th and 21st century objects, including plastic, was recorded in the trench. The deposit was uniform and was 3m deep. Water ingress occurred at the base of the trench where the wall plinth was recorded (see above).

3.2.4 ST15

The trench was 1.9m deep. It was 3.1m long and was 4m wide and the top. It was 0.85m wide at the base. An active clay sewer pipe was recorded at the base of the 0.4m east of the wall where upon excavation stopped.

3.2.5 ST16

The slit trench measured 1.9m deep, 2.9m long and was 2m wide. Diesel contamination in the trench, coupled with heavy water ingress hindered the excavation and recording of the soil profile. The water percolated rapidly into the trench 0.1m above the plinth that was again present at the base of the wall. A single fill was recorded in the slit trench consisting of fine silty grey clay mixed with Dublin black calp limestone fragments, broken hand made brick, mixed with plastic, tin, modern bottle glass and other late 20th century objects including plastic. There was some evidence for linear banding, although it was clear that plastic sheeting was located at the base of the excavated deposits where the water ingress was at its greatest.

3.2.6 ST17

The trench (ST17) measured 0.8m wide at the base and was excavated with battered edges so the trench was 2.8m wide at the top and was 2.8m long. A single modern fill was identified in the trench 2.3m deep to the base of the wall where the plinth was evident. The fill is entirely composed of fine silty grey clay mixed with Dublin black calp limestone fragments, broken hand made brick, mixed with plastic, tin, modern bottle glass and other late 20th century objects.

The wall plinth extends 0.17m out from the wall and was 0.07m deep. It appears to be set on the underlying bedrock through which the cutting was quarried. A clay sewer was identified 0.45m from the edge of the plinth at the base of the trench and was left *in situ* where excavation ceased.

3.2.7 ST18

The slit trench was 2.8m long, 0.95m wide and was 1.8m deep. The top width of the trench measured 4m. A double coursed plinth was recorded in this trench at the base of the wall. The first plinth extended 0.2m out from the wall and was 0.09m deep. The second plinth extended a further 0.13m beyond the first plinth and was 0.22m deep. The stepped foundation plinth was bonded by a loose wet friable cream/brown sandy mortar. The clay sewer pipe was located 0.4m from the outer edge of the plinth. The fill recorded in the trench consisted of a fine silty grey clay mixed with Dublin black calp limestone fragments, broken hand made brick, mixed with plastic, tin, modern bottle glass and other late 20th century objects.

3.2.8 ST19

The slit trench was 1.3m wide and 1.5m deep at wall and 0.5m deep at the north eastern lower end of the cutting. It was 2.8m long (Plate 1). The base of the trench narrowed to 0.8m wide.

0.00-1.20m The upper fill is entirely composed of fine silty grey clay mixed with Dublin black calp limestone fragments, broken hand made brick, mixed with plastic, tin, modern bottle glass and other late 20th century objects.

1.20-1.50m Grey clay mixed with limestone calp fragments, loose and wet with water ingress corresponding to the base of the ashlar stone wall adjacent to the west side of the slit trench. The base of the trench is cut away by a modern sewer that was left *in situ*.

1.50m+ Live clay pipe sewer

3.3 Site Investigations within Grangegorman to the rear of the Penitentiary and North Union Workhouse

3.3.1 The Site Investigations Test Pits

A total of 9 test pits in advance of Bore-Holes (abbreviated BH, Table 1) and slit trenches (abbreviated ST) were excavated within the former grounds of the Grangegorman Penitentiary and those of the North Union Workhouse (Figure 4). The site investigations were conducted between 10/02/2012 and 13/02/2012.

The test trenches were between 3m long and 3.5m deep, the bore-holes were preceded by test pits 1.2m deep. The slit trenches and test pits were excavated adjacent to the large retaining wall that divides these properties from the Dublin Bus Phibsborough Depot/Broadstone Building. The trenches were excavated perpendicular to the retaining wall and were roughly orientated east / west. The ground level on the Broadstone side of the retaining wall is c. 4m higher than the ground level within the former grounds of the Penitentiary and Workhouse, which reflects the substantial earthworks that were deposited at the site as part of the construction of the Broadstone Harbour.

3.3.2 ST01

The trench measured 2.4m long and 2m wide (Plate 2). A section through the western leaf of a double retaining wall was revealed in the slit trench (Plate 3). The profile in the trench uncovered the wall core between the two walls at its eastern end and the deposits on the western side of these structures (Plate 4). The inner (eastern) wall had a plinth 0.22m wide and 1.5m or 8 courses deep and it appeared that the foundations of this wall was considerably stepped (although these lie mostly buried behind the western wall (described below).

A deposit between the two retaining walls was recorded and it consisted of pure tan boulder clay (a deliberate filling deposits between the walls, acting as a buffer). The two walls were 0.7m apart. The outer (western) wall was 0.9m wide and was recorded below a thin layer of concrete measuring 0.2m deep at ground level. The western wall had

been demolished above ground level. The western wall was recorded up to 2.33m below the concrete. The ground level within the North Union Workhouse adjacent to the western wall consisted of deposits of a single loose deposit (at least 2.5m deep) of grey brown sandy gravelly clay.

The western wall (the primary boundary wall around the North Union Workhouse) was constructed prior to the construction of the retaining wall on its immediate eastern side. The Broadstone wall (the eastern wall) was constructed to take the weight of the substantial deposits clay that were built up on the Broadstone side to accommodate the construction of the Royal Canal Harbour. The eastern retaining wall was built with a series of buttresses at 5m intervals against the western wall. The voids between the buttresses were infilled with deposits of tan clay (described above) between the new retaining wall to the east and the earlier western wall that surrounded the North Union Workhouse.

3.3.3 ST02

The trench measured 2.4m long and 1m wide (north / south), areas to the north and south of the slit trench were investigated to ascertain the nature of the walls revealed in the trench (Plate 5).

A section through the western leaf of a double retaining wall was revealed in the slit trench and the profile was almost identical to that revealed in ST001A. It uncovered the wall core between the two walls and a deposit profile on the western side of these structures. The inner (eastern) wall had a plinth 0.14m wide and 0.8m or 4 courses deep and it appeared that their foundations were considerably stepped (although these lie buried behind the western wall (described below).

A deposit between the two retaining walls was recorded and it consisted of pure tan boulder clay (a deliberate filling deposits between the walls, acting as a buffer). The two walls were 0.89m apart. The outer (western) wall was 0.9m wide and was recorded immediately below the existing ground level. The western wall had been demolished above ground level. The western wall was recorded up to 0.8m deep and the recording

could not extend below this on account of the presence of a concrete manhole and sewer.

3.3.4 ST03

The trench measured 2.7m deep, 0.7m wide and was 2.1m long. It was located along the eastern boundary wall of the Broadstone Bus Station and to the north of the North Union Workhouse and to the east of the Grangegorman Penitentiary, where the following profile was recorded:

0.00-0.65m Topsoil, brown silty clay and stone and modern plastic

0.65-1.35m Sandy silty clay, 75% mortar, stone and red brick 25% clay

1.35-1.80m+ Bands of sandy silty clay above a clay sewer pipe (not excavated further)

3.3.5 ST04

The trench measured 2.65m deep, 0.70m wide and was 1.6m long, where the following soil profile was recorded:

0.00-0.15m Modern accumulations of organic silt and decayed vegetation

0.15-0.35m Concrete

0.35-0.55m Fine silty organic peaty soil

0.55-2.70m Uniform fill consisting of brown sandy gravelly clay with few large stones and occasional red bricks, the fill was finer that the fill from other trenches adjacent to it

2.70m+ Stony grey / brown clay and stone (natural)

3.3.6 ST05A

The trench measured 1.75m long and was 2m wide, where the following soil profile was recorded:

0.00-0.90m Black grey silty clay including red brick and very modern late 20th century objects as were identified in ST006

0.90-1.40m Tan / grey red brick rubble demolition layer as per the deposit identified in ST006

1.40-1.80m+ Grey / brown silty clay including red brick with sulfurous iron slag (similar to the deposits in ST006)

3.3.7 ST05

The trench was 3.5m deep, 1.5m wide and was 2.5m long. It was located adjacent to the dividing wall between the two properties (as described above), where the following soil profile was recorded:

0.00-0.70m Black grey silty clay (topsoil) including red brick and very modern late 20th century objects as were identified in ST006 and ST005A

0.70-1.10m Brown mortar sand mixed with red brick rubble demolition (similar to the deposit sequence in ST005A)

1.10-2.30m Band of mortar flecked brown / grey silty clay mixed with red brick, limestone calp blocks, old galvanized buckets, ash *etc.* (20th century)

2.3-3.5m+ Silty brown / black gravelly clay fill, including red brick and other modern inclusions

3.3.8 ST06

The trench was 2m wide, 2.4m long and was excavated to a depth of 3.4m deep (Plate 6). The slit trench was located against the old boundary wall, where the following soil profiles was recorded:

0.00-0.70m Loose dry crumbly sandy silty grey clay, late 21st century deposited including demolished 18th and 19th century rubble (Limestone calp and granite)

0.70-1.40m Sand / mortar and red brick fragment mixed with light brown clay and loose deposited of demolished buildings including limestone calp masonry fragments

1.40-3.40m Grey brown silty clay and red brick deposits mixed with sulfurous iron slag and other banded deposits

3.40m+ Boulders

3.3.9 MGI/BX/BH010

The following soil profile was recorded in the trench:

0.00-0.20m Reinforced concrete

0.20-0.41m Crushed stone (foundation for the concrete)

0.41-1.20m+ Gravel (60%) and sand (40%), including small red brick fragments

3.3.10 MGI/BX/BH030

The following soil profile was recorded in the trench:

0.00-0.20m Concrete

0.20-0.40m Gravel / hard core (modern late 20th / 21st century)

0.40-1.30m+ Stiff compact tan boulder clay, tan stony natural, some large stones up to 0.3m in diameter and many smaller stones (0.05m in diameter)

3.4 Site Investigations within the Broadstone and Phibsborough Bus Depots

3.4.1 Introduction

Eight Boreholes (abbreviated BH, table1) including a Geo-Bore S core were monitored within the Bus Stations (Figure 4 and 5). The investigations involved monitoring small hand dug test pits measuring 0.8m x 0.8m square down to at least 1.20m below the existing ground surface.

3.4.2 ENV/BX/003

This rotary Geo-Bore S core was located centrally on the Dublin Bus Phibsborough Depot yard on the site of the now in-filled Broadstone Harbour. The upper section of the site investigation was revealed in a test pit recorded in advance of the core to a depth of 0.5m (Plate 7), the second section was revealed by a shell and augur investigation to 2.5m and the remainder was revealed in the Geo-Bore core extracted from the location (Plate 8).

Test Pit

0.00-0.07m Interlocking concrete paving bricks

0.07-0.14m Sand

0.14-0.50m Gravelly clay heavily stained and soaked in diesel / hydrocarbons. The pit filled with a pool of 'oil', excavation

0.50-2.50m Sandy clay mortar stone red brick black grey sticky and wet (strong smell of hydrocarbons), oyster shell

Insertion of the Casing for the Geo-Bore

2.50-3.00m Brown re-deposited gravelly boulder clay

Geo-Bore (Run 1)

3.00-4.60m (0.65m recovery from 1.6m of drilling) the void in the core reflects the fact that the upper deposit at that level was a fine silt, sand or gravel that washed out of the core on account of its loose consistency

4.00-4.40m Limestone clap (masonry fragments) mixed with hard concrete like mortar with white gravel inclusions

4.40-4.60m Compact grey gravelly clay, silty to touch, including an 18th / 19th century clay pipe stem (fill)

Geo-Bore (Run 2)

4.60-6.10m (total recovery of the core)

4.60-4.65m Compact grey gravelly clay, silty to touch, the deposit continued from run 1 (fill)

4.65-4.70m Dark brown / black silty clay including tiny red brick fragments (old topsoil or sod horizon?), oyster and mussel shell fragments

4.70-5.70m Compact grey mottled stony clay, gravelly gritty inclusions with 3cm diameter limestone pebbles (natural?)

5.70-6.10m Brown and grey mottled clay with gravel and limestone inclusions, 3cm diameter limestone pebbles (natural?), some rootlets in the top of the layer

Geo-Bore (Run 3)

6.10-7.60m (total recovery of the core)

6.10-6.50m Brown and grey mottled clay with gravel and limestone inclusions, 3cm diameter limestone pebbles (natural?), the deposit continued from run 2

6.50-7.60m Hard black boulder clay (natural), gradual transition from the brown boulder clay to the black boulder clay suggests the layer between 5.7-6.5m is a natural post glacial deposit

Geo-Bore (Run 4)

7.60-9.10m (total recovery of the core)

7.60-9.10m+ Hard black boulder clay (natural), the deposit continues from the basal layer in Run 3

*Interpretation of the Fill in the Geo-Bore S Core (*ENV/BX/003*)*

The core methodology (Geo-Bore S) is not suited to retrieving fine silty material. A significant void in the core was identified in the core between 3-4m below the existing ground level. This is highly likely to reflect the fact that the material *in situ* at that level consists of fine silty material. This would be consistent with the deposits (silt) that would be expected to be recovered from a backfilled canal.

A small fragment of a clay pipe stem was recovered from the deposits of grey gravelly silt between 4.4-4.6m, this deposit may also be canal fill. A thin deposit (0.05m) of dark brown / black silty clay including tiny red brick fragments was recovered from below the silt. This maybe the base fill of the canal. However, two further deposits of clay.

Two deposits of brown boulder clay are identified in the core between 5.7-6.5m below present ground level. Typical cross sections of the boulder clay in Dublin identify brown natural boulder clay (soft and malleable) overlying the 'Dublin Black Boulder Clay' which is extremely hard and compact. It is likely that the brown boulder clay identified between 5.7-6.5m is natural, although, there remains a possibility that it reflects deliberate dumping / deposition associated with the construction of the canal and earthworks associated with such engineering works.

3.4.3 ENV/BX/001

This bore-hole was located along the western boundary to the open car park area outside the gates into the Dublin Bus and Bus Eireann stations, where the following soil profiles were recorded:

0.00-0.05m Asphalt

0.05-0.20m Hardcore

0.20-0.35m Large angular limestone blocks *c.* 0.15-0.25m in diameter and hardcore

0.35-0.60m Grey dry gravelly clay, small fragments of red brick

0.60-1.20m+ Soft silty grey clay, slate and stone, high gravel content, moist at the base

3.4.4 ENV/BX/002

The following soil profile was recorded at ENV/BX/002 (Plate 9):

0.00-0.05m Tarmac

0.05-0.40m Hardcore / crushed stone / lean mix

0.40-1.20m+ Plastic brown gravelly clay, small fragments of red brick and limestone calp, tiny fragment of a clay pipe stem at the base of the trench

3.4.5 MGI/BX/BH005

The following soil profile was recorded at BH005 (Plate 10):

0.00-0.15m Concrete and rebar

0.15-0.70m Banded layers of crushed concrete

0.70-1.30m+ Compact dry sticky clay including gravel (fill) + pantile

3.4.6 MGI/BX/BH/RC006

This bore-hole was located adjacent to and to the south of BH009 close to the rear of the garage located on Church Street, where the following soil profile was recorded:

0.00-0.12m Two layers of asphalt

0.12-0.30m Crushed stone fill and red brick (old and modern)

0.30-0.55m Limestone blocks *c.* 0.25m, gravel, clay and red brick

0.55-1.20m+ Brown gravelly clay, mortar, crushed red brick and small to medium angular limestone clap stones (0.2-0.1m in diameter).

3.4.7 MGI/BX/BH/RC007

The following soil profile was recorded at BH007:

0.00-0.20m Concrete and rebar

0.20-0.40m Banded layers of hardcore

0.40-0.80m Loose sandy black gravelly clay

0.80-1.05m Compact sandy / gravelly black clay, no inclusions

1.05-1.25m+ Mortar layer, mixed with red brick and limestone calp (demolished wall?)

3.4.8 MGI/BX/BH/RC009

This bore-hole was moved to this location as an additional hole adjacent to the steps of Broadstone Building, the new location is 10m from the Broadstone Building, where the following soil profile was recorded:

0.00-0.05m Asphalt

0.05-0.15m Hardcore / crushed stone

0.15-0.50m Crushed stone mixed with a grey gravelly / sandy clay

0.50-1.20m+ Brown dry gravelly clay, small fragments of red brick and stone, moist at the base

3.4.9 MGI/BX/BH031

0.00-0.17m Tarmac

0.17-0.30m Crushed stone and clay

0.30- 0.95m Concrete, red brick and timber mixed with crushed stone

0.95-1.30m+ Compact grey brown boulder clay becoming a stiff grey brown boulder clay, some angular stone (0.10m in diameter)

3.5 Site Investigations at Broombridge

3.5.1 Introduction

Twelve test pits were archaeologically monitored in advance of Bore-holes, Slit Trenches and Environmental Test Pits (abbreviated BH, ST and TP, see Table 1) were excavated at the Broombridge end of the scheme (Figure 7, 8, 9, 10 and 11). These trenches were dug along the banks of the Royal Canal as it runs west overlooking Broombridge Station to the north east. The pits were excavated between 29/03/12 and 03/04/12. The trenches were located in the embankment to the north of the old MGWR Railway line and on the old line itself.

3.5.2 MGI/BX/BH/RC032

The following soil profile was recorded:

0.00-0.70m Harcore (old track surface)

0.70-1.00m Black fine grey silty clay fill (more silt like)

1.00-1.20m+ Grey compact soft silty clay with angular limestones *c*. 0.30m long, the clay had a putty like consistency (natural?)

3.5.3 ST033

The slit trench was moved 5m to avoid a deep pool dug to prevent vehicular access. The trench was excavated adjacent to the factory wall that bounds the southern side of the site and the boundary of the new proposed Luas line. The trench was excavated adjacent to a concrete wall, where the following soil profile was recorded:

0.00-0.50m Fine black silty ash stained clay

0.50-0.71m Brown silty clay fill, located adjacent to the concrete wall foundation

0.71-1.80m+ Tan sticky clay, including limestones, *c.* 0.05m (natural)

3.5.4 TP02

The following soil profile was recorded:

0.00-0.64m Bands of grey clay mixed with deposits of ash and slag, the tip lines within the deposit indicate that the material was dumped from the south and fell down an existing open bank to the north

0.64-1.50m Burnt metal slag

1.50-3.00m+ Grey / tan silty gravelly clay (natural)

3.5.5 TP05

The following soil profile was recorded:

0.00-0.40m Black topsoil

0.40-1.40m Tan / grey clay and limestone silty gravelly clay compact wet clay

1.80-3.00m Mixed wet grey gravelly clay and 19th century brick

3.00m+ Natural (tan) boulder clay (?)

3.5.6 TP06

The following soil profile was recorded:

0.00-0.10m Scraw and topsoil

0.10-0.98m Grey / black friable gravelly clay with ashy silt at the southern end

1.98-3.00m+ Tan grey soft boulder clay, harder at base (natural)

3.5.7 TP07

The trench was 2m long, 0.5m wide and 3m deep, where the following soil profile was recorded:

0.00-0.10m Scraw and topsoil

0.10-0.30m Brown grey silty clay (topsoil)

0.30-3.00m Stony grey natural clay

3.00m+ Black boulder clay

3.5.8 TP08

The trench was 0.40m wide, 1.50m long and 1.50m deep, where the following soil profile was recorded:

0.00-0.20m Black / brown silty topsoil with scraw

0.20-1.50m Grey / brown boulder clay and limestone (natural ?)

1.10-1.60m+ Gravel with cockle shell, inclusion of fine gravel

3.5.9 TP08a

Located 11m to the east of TP 8. The profile was identical to that recorded in TP 8, both in terms of water level and content

3.5.10 TP08

The trench was 0.40m wide, 1.60m long and 3.00m deep, where the following soil profile was recorded:

0.00-1.20m Grey / brown compact gravelly clay

1.20-2.00m Moist organic silty brown friable clay and orange brick

2.00-3.00m+ Bands of compact grey gravelly clay with organic lenses

3.5.11 TP09

The trench was located adjacent to late 19th century railway buildings illustrated on the (c.) 1890 25 inch edition Ordnance Survey maps. The walls which were exposed on the

western and south side of the trench were built from bright red brick, mortared in grey concrete like / hard mortar up to 20 courses high. The structures have been completely covered by subsequent dumping / deposits of clay at the site, where the following soil profile was recorded:

0.00-0.30m Topsoil and scraw

0.30-1.44m Compact tan clay (re-deposited boulder clay)

1.44-2.05m Friable diesel stained clay

2.05m+ Concrete / hard mortar floor, the base of the trench was lined in concrete or very hard mortar and with a crushed metal tank lining the base of the trench surrounded by a matrix of friable clay

3.5.12 TP12

A large number of bottles dating from the early 20th century were recovered from between 0.3m to 3m deep in the test pit. These bottles included marked glassware, such as a 'rectangular sectioned Glasgow 20th century Camp Coffee jar', a clear octagonal J. C. ENO'S Effervescing Fruit Salt jar and brown beer bottles from 144-145 Stand Road labeled as 'M'O Meara' and a 'Kirker & Co. Ltd.' beer bottle from Belfast. The following soil profile was recorded in the trench:

0.00-0.30m Topsoil including plastic inclusions

0.30-1.50m Banded grey / brown sandy gravelly clay

1.50-3.00m Grey black gravelly silt with horizontal banding, the lowest deposit has seven bands of cinders coal and ash deposited horizontally (300mm deep)

3.00m+ Brown clay (natural ?)

3.5.13 TP14

The following soil profile was recorded in the trench:

0.00-1.10m Brown / friable loose clay, very modern late 20th century

inclusions

1.10-1.60m Organic loose fill (peat like consistency) old railway sleepers

1.60-3.00m Black grey gravelly clay fill, loose stone inclusions

3.6 Site Investigations on College Street

3.6.1 Introduction

Two test pits were excavated in advance of two shell and augur bore-hole excavations on the pedestrian islands at College Street on the 22/05/2012 (Figure 2). The first pit was excavated at the junction of College Green and College Street, adjacent to the disused Victorian public toilets on the Thomas Moore pedestrian island. The second pit was excavated on the pedestrian island between College Street and Pearse Street at the Longstone monument.

3.6.2 MGI/BX/BH040

The following soil profile was recorded in the pit:

0.00-0.06m Concrete paving

0.06-0.20m Sand

0.20-0.45m Sand clay and concrete and brick fragments

0.45-1.50m+ Brown dry friable silty gravelly clay mixed with red brick fragments and mortar and limestone fragments (18^{th} / 19^{th} century deposit)

3.6.3 MGI/BX/BH041

The following soil profile was recorded in the pit:

0.00-0.06m Concrete paving

0.06-0.35m Concrete dust and fill, grey broken limestone fragments

0.35-0.70m Dry brown silty gravelly clay mixed with red brick and tarmac

0.70-1.50m+ Brown moist silty gravelly clay, red bricks, mortar flecks (very wet at base), 18th / 19th century in date

3.7 Site Investigations on Marlborough Place / Street

3.7.1 Introduction

A bore-hole and slit trench were excavated on Marlborough Place and on Marlborough Street (Figure 1). The trial pit in advance of the construction of the bore-hole was excavated on the 23/05/2012 on the street. The slit trench was excavated on the 06/06/2012 on the footpath.

3.7.2 MGI/BX/BH042 (Marlborough Place)

The following soil profile was recorded in the pit:

0.00-0.17m Two layers of concrete

0.17-0.43m Modern gravelly clay including cobbles

0.43-0.65m Brown gravelly clay, including animal bone, pottery (North Devon Gravel Tempered Ware 17-18th century)

0.65-0.80m Mortar deposit, sandy brown sand and limestone fragments

0.80-0.92m Cobbled surface, the cobbles were *c*.0.12m in diameter, the cobbles were set on the deposit described below

0.92-1.15m+ Dry brown / sandy clay gravel, including limestone fragments (fill)

3.7.3 ST039 (Marlborough Street)

The trench measured 0.79m long, 0.42m wide with an L-shaped square extension measuring 0.42m. A modern concrete wall oriented east / west supporting the upstanding gable wall of the existing building (No. 1 Sackville Place) on the street was uncovered in the trench. The wall was located 0.28m below the existing footpath,

covered by concrete and modern mortar and crushed stone filling. The pit was excavated to a depth of 0.50m below present ground level and 0.22m of the south face of the wall was exposed in the pit. This exposed section of wall was constructed from concrete re-enforced with steel rebar.

3.8 Site Investigations on Dominick Street

3.8.1 Introduction

Five site investigation test pits were archaeologically monitored in advance of the insertion of Shell and Augur Boreholes (abbreviated BH, see Table 1) on Dominick Street (Figure 3). The work was carried out between the 6th of May and the 5th of June 2012. The test pits were opened through the existing road surface and measured on average 0.75m long and wide and were up to 1.20m deep.

3.8.2 MGI/BX/BH043

The pit was opened at the South end of Dominick Street at the Parnell Street junction, where the following soil profile was recorded:

0.00-0.06m Tarmac

0.06- 0.25m Asphalt

0.25-0.44m Concrete

0.44-0.50m Hardcore (crushed stone and rubble concrete)

0.50-0.90m Brown dry gravelly clay, charcoal, animal bone, small fragments of red brick (18th or 19th century fill material)

0.90-1.40m+ Brown / orange stained sticky damp gravelly clay and limestone (natural?)

3.8.3 MGI/BX/BH044

The following soil profile was recorded in the pit:

0.00-0.09m Tarmac

0.09-0.25m Concrete

0.25-0.35m Concrete (2nd layer of concrete)

0.35-0.45m Lean mix (dry concrete / gravel) and crushed stone and concrete fragments

0.45-1.25m Demolished building rubble, crushed red brick, orange and yellow brick, slate, mortar and sand mixed with 10% clay

1.25-2.25m Void with a brick base (soft decayed brick at base), likely to be a culvert

3.8.4 MGI/BX/BH045

The following soil profile was recorded in the pit:

0.00-0.07m Tarmac

0.07-0.25m Second layer of tarmac

0.25-0.35 Hard core mixed with gravelly clay

0.35-0.80m Crushed bed brick mixed with mortar and compacted with clay

0.80-1.50m+ Loose red brick, mortar, sand gravel (deposits of demolition rubble) mixed with 18th / early 19th century non imperial hand made bricks

3.8.5 MGI/BX/BH046

An old electricity cable (mid 20th century) was located at southern end of the pit orientated east /west, as a consequence the size of the pit was reduced to fit in between the cable and a gas service to the south. The pit measured 0.6m x 0.9m (north / south), where the following soil profile was recorded:

0.00-0.07m Tarmac over asphalt

0.07-0.10m Tar

0.10-0.30m Cobbled layer, the cobbles measured 0.15m deep, 0.12m round and consisted of limestone water rolled stones between *c*. 0.08m

to 0.12m in diameter, tightly packed set above and into a compact gravelly grey clay 18th / 19th century in date

0.30-1.25m+ Soft brown sandy damp gravelly clay fill, fragments of red brick (large and small), mortar, sand, animal bone and charcoal

3.8.6 MGI/BX/BH047

The pit measured 0.75m x 0.75m, a wall or coal bunker was located on the eastern side of the pit, where the following soil profile was recorded:

0.00-0.09m Tarmac

0.20-0.75m Concrete

0.75-1.20m Mixed grey brown gravelly clay and modern concrete inclusions

1.20-1.50m+ Sticky brown tan mottled clay (natural?), small limestone inclusions, could be a re-deposited clay

4.0 CONCLUSIONS

4.1 Summary of archaeological findings

Archaeological monitoring of the excavation of 44 geotechnical investigative pits along the proposed route of Luas Broombridge did not uncover any significant archaeological features, deposits or artefacts.

The trenches excavated within the former grounds of St Brendan's Hospital in Grangegorman were excavated against the original walls that formed the boundary around the institutions at the site dating from the late 18th century (See Section 2.8 and 2.9). The trenches excavated within the MGWR railway cutting were adjacent to the impressive masonry walls that line the cutting dating from *c*. 1846 (See Section 2.11).

The boreholes excavated on the site of the Broadstone Harbour identified the potential base of the harbour at a depth of 4.4-4.6m below the present ground level.

Plate 1 ST 19, MGWR

Plate 2 ST 01, Grangegorman

Plate 3 Grangegorman Boundary Wall

Plate 4 Grangegorman Boundary Wall

Plate 5 ST 02, Grangegorman

Plate 6 ST 06, Grangegorman

Plate 7 BX 03, Broadstone

Plate 8 BX 03, Broadstone

Plate 9 BX 02, Broadstone

Plate 10 BH 05, Broadstone

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North

Cable Percussion Location
Cable Percussion/Rotary Location
Slit Trench Locations
Dynamic Probe Locations
Trial Pit Locations
Rotary Corehole Locations
BH11 RC11 Metro North Boreholes

IGSL Limited
SITE INVESTIGATION & GEOTECHNICAL SPECIALISTS

Rev	By	Date	Description
A	CK	26/06	Layout Plan

Project:	Luas Broombridge BXD
Component:	Ground Investigation
Title:	Location Plan

Designed:	CK	Date:	21/06	File Name:	16122
Drawn:	GD	Date:	21/06	Original Scale:	1/1000 @A3
Checked:	CK	Date:	21/06	Date:	25/06/2012

Drawing No: 16121-000-001

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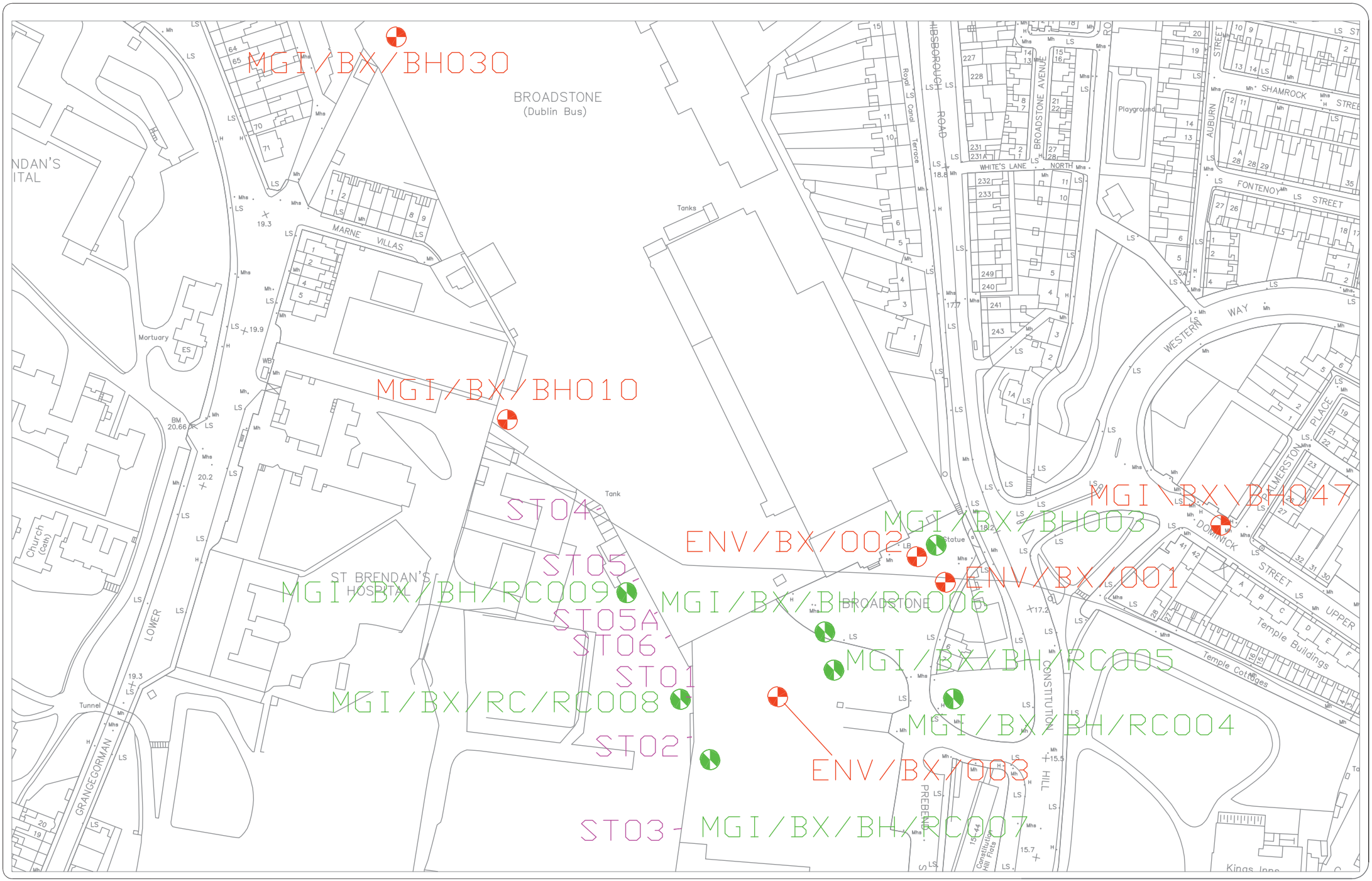

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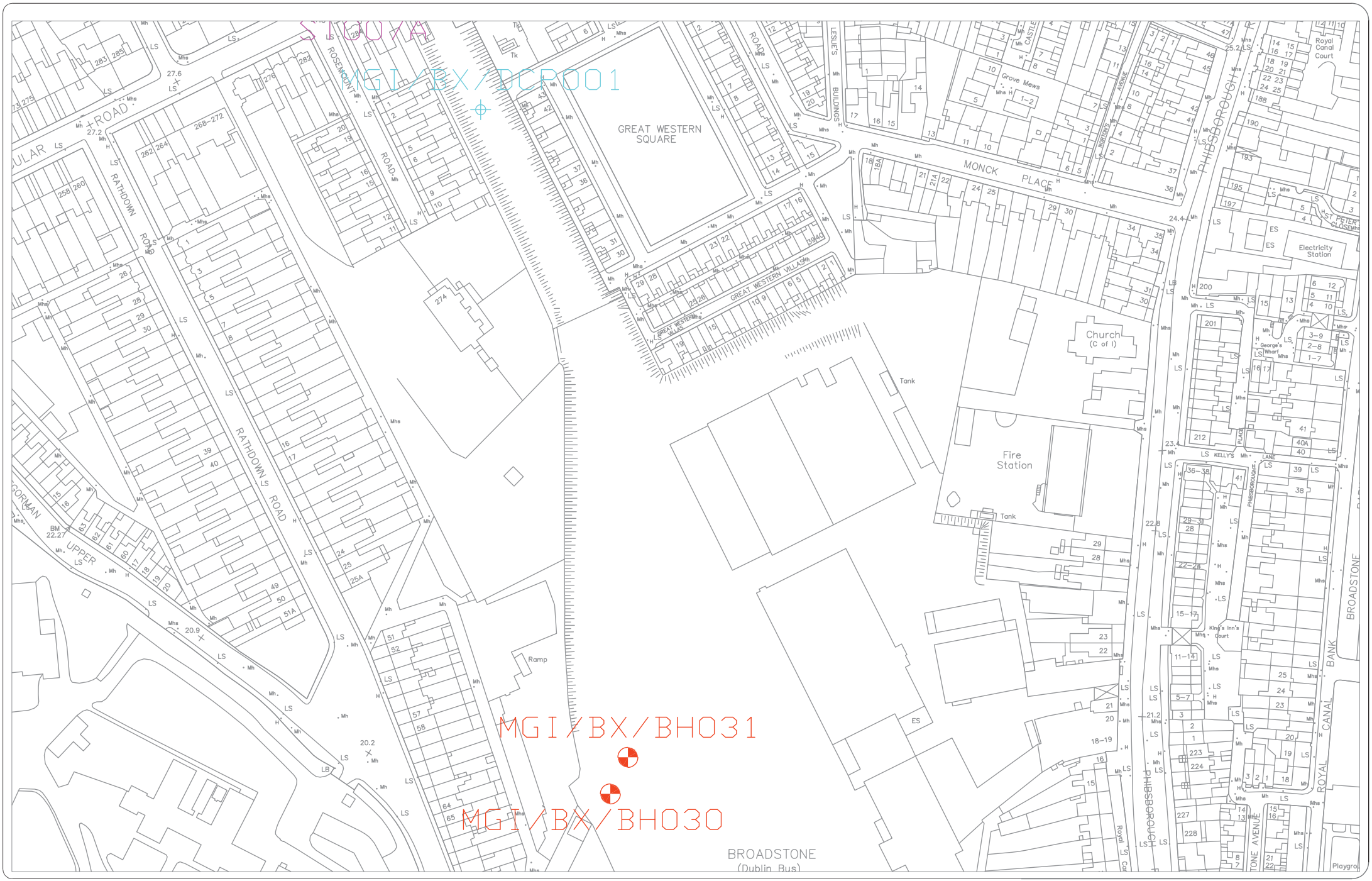

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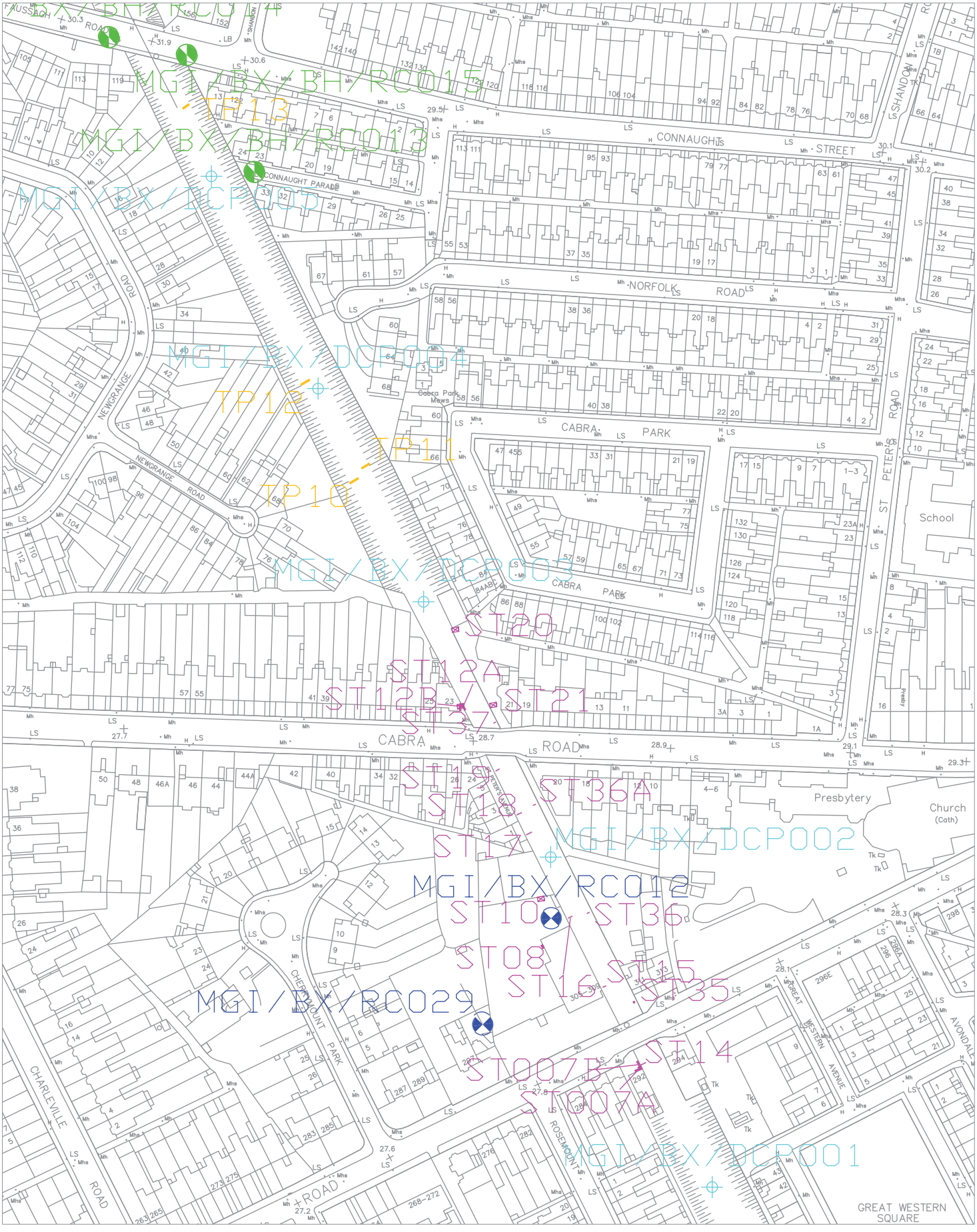

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Checked: CK	Date: 21/06	Date: 25/06/2012			

North

Cable Percussion Location

Cable Percussion/Rotary Location

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Dynamic Probe Locations

Trial Pit Locations

Rotary Corehole Locations

BH11 RC11 Metro North Boreholes

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Rev	By	Date	Description
A	CK	26/06	Layout Plan

Project:	Luas Broombridge BXD				
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Checked: CK	Date: 21/06	Date: 25/06/2012			

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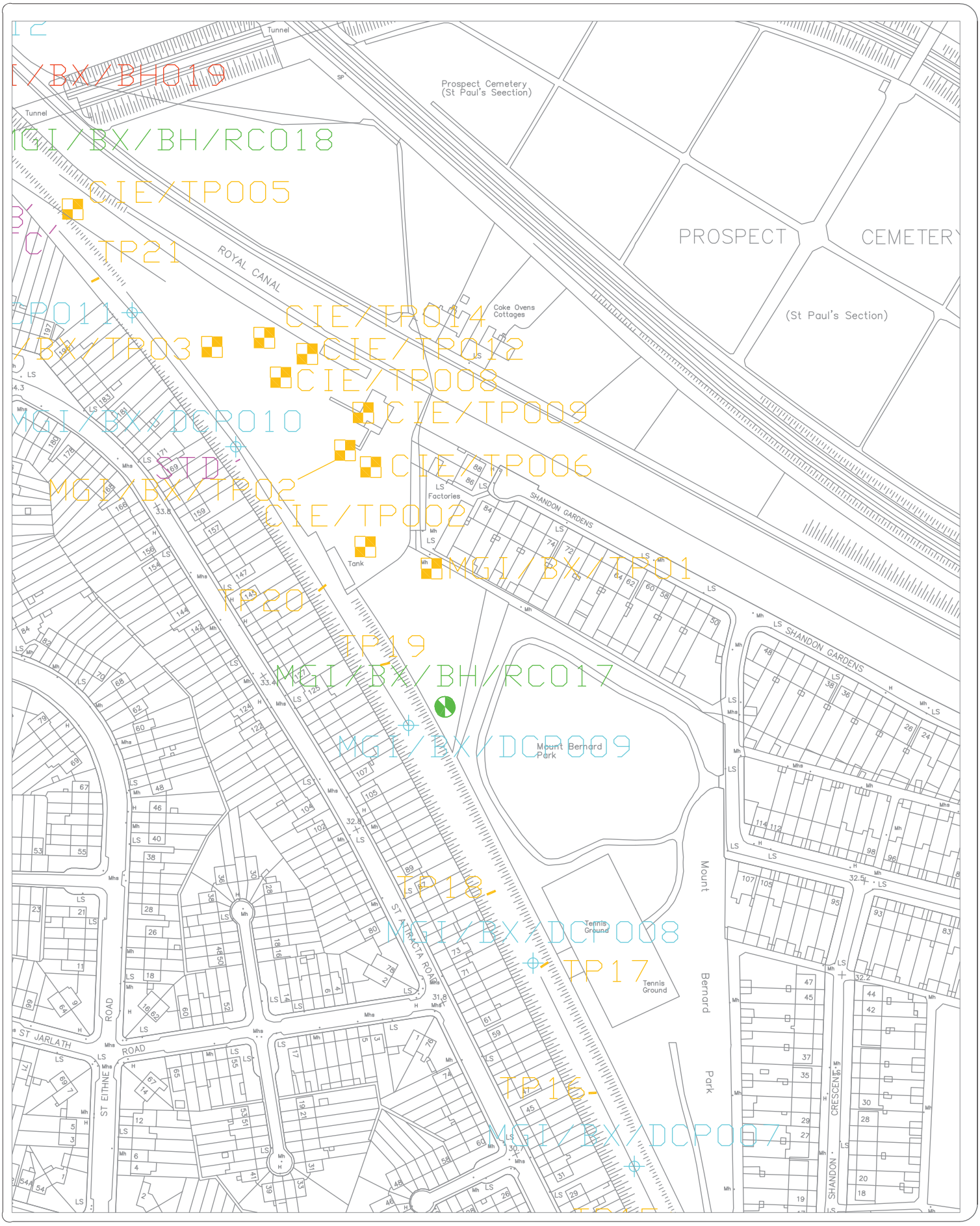

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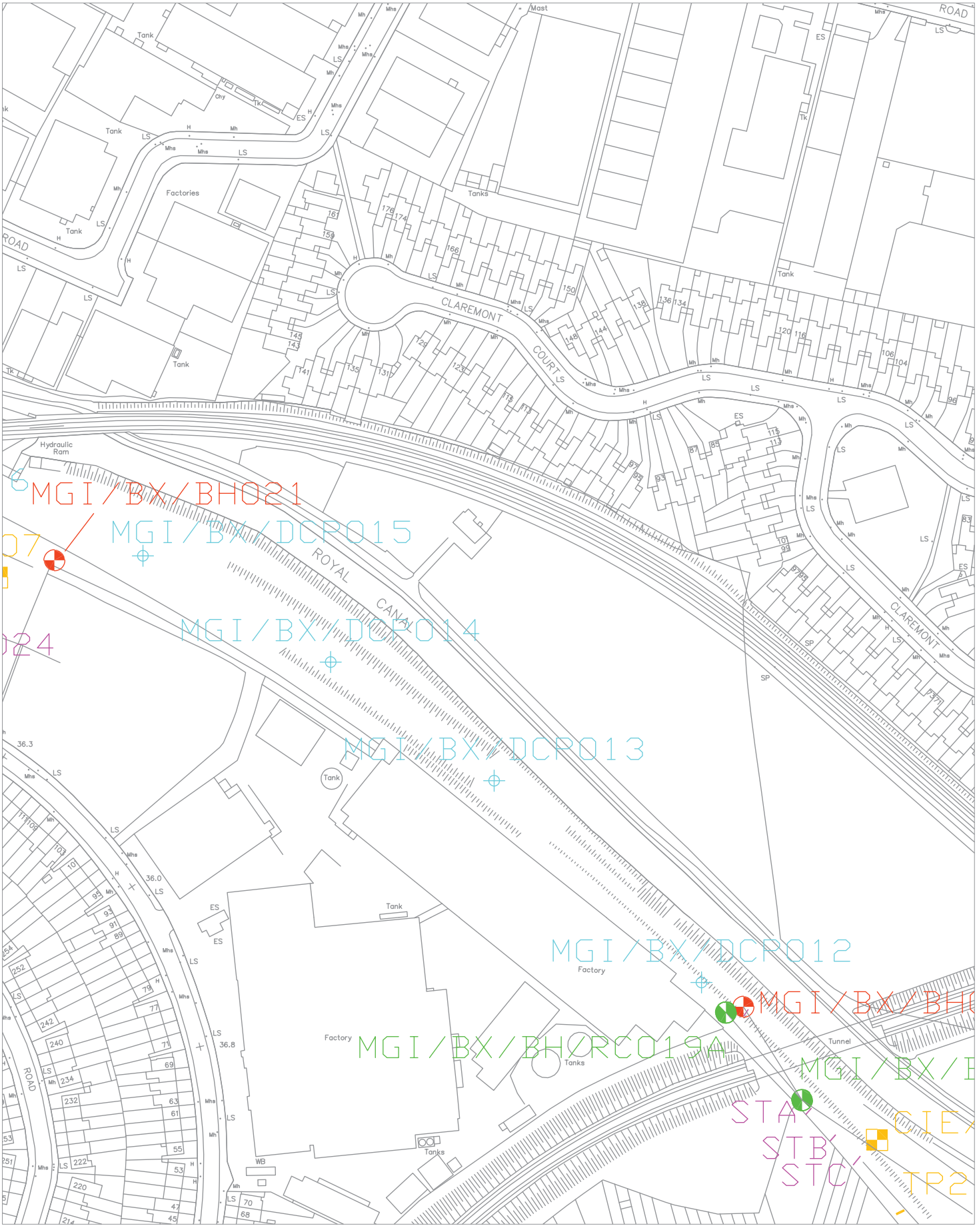
SITE INVESTIGATION & GEOTECHNICAL SPECIALISTS



Rev	By	Date	Description
A	CK	26/06	Layout Plan

Project:	Luas Broombridge BXD				
Component:	Ground Investigation				
Title:	Location Plan				
Designed: CK	Date: 21/06	File Name: 14381	Drawing No:		
Drawn: GD	Date: 21/06	Original Scale: 1/1500 @A3	16121-000-009		
Checked: CK	Date: 21/06	Date: 25/06/2012			

North

Cable Percussion Location
Cable Percussion/Rotary Location
Slit Trench Locations
Dynamic Probe Locations
Trial Pit Locations
Rotary Corehole Locations
BH11 / RC11 Metro North Boreholes

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North

Cable Percussion Location
Cable Percussion/Rotary Location
Slit Trench Locations
Dynamic Probe Locations
Trial Pit Locations
Rotary Corehole Locations
BH11 / RC11 Metro North Boreholes

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Rev	By	Date	Description
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Project:	Luas Broombridge BXD
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Designed:	CK	Date:	21/06	File Name:	14381
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Checked:	CK	Date:	21/06	Date:	25/06/2012

Drawing No: 16121-000-010

North

Cable Percussion Location
Cable Percussion/Rotary Location
Slit Trench Locations
Dynamic Probe Locations
Trial Pit Locations
Rotary Corehole Locations
BH11 / RC11 Metro North Boreholes
Trial Pit / Infiltration Location

IGSL Limited
SITE INVESTIGATION & GEOTECHNICAL SPECIALISTS

Rev	By	Date	Description
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Project:	Luas Broombridge BXD
Component:	Ground Investigation
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Drawing No: 16121-000-011