Appendix C. Passenger Demand Assessment Report

Connolly Station Enhancement Options Study

National Transport Authority

Passenger Demand Assessment

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TBC

Connolly Station Enhancement Options Study

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Appendix A. Capacity Assessment Methodologies.

Executive Summary

This passenger capacity assessment of the main options for improving capacity at Connolly Station have employed a desktop assessment based on observed rail flows (annual one day census) and broadly factored to service group operational assumptions for each option. The calculations use standard rail industry approaches to assessing platform width requirements, stairs width and passageway width requirements.

The existing station layout is unlikely to cope with long term (foreseeable) peak passenger flows with growth derived from the NTA Dublin Regional Model for 2040. Platform congestion and ramp access congestion is forecast. The Option 3 design lengthens and widens the platform which will provide more capacity for the with management of passengers to utilise the whole length to reduce delays. However, there is limited ability to widen the ramp to the underpass so passive provision for a second access to be provided in the long term should be considered. For example; a footbridge between platform 5 and platform 6/7 further north than the current access.

The option 6 design removes the current underpass access to the island platform for through services. This results in the need for a very large new footbridge / transfer deck. That may be difficult to position with sufficient access around each side to the lift for wheelchair passengers. Platform 5/6 is also expected to be heavily used which brings a risk of congestion at the bottom of the footbridge impeding access and egress. Assuming that Platform 7 will not be used as the main through service platform standard bridge and stairway can be provided and the platform narrowed to standard to enable Platform 5/6 to be widened.

Option 8 design retains the existing underpass access to the island platform reducing the scale of footbridge / transfer deck required, if it is extended to platform 5. The designed platform widths and lengths match the forecast 2040 flows and overall this solution provides the best option for the passenger capacity requirements.

Given the potential congestion problems forecast and reliance on an assumption regarding option 8, it is strongly recommended that at the next stage of development pedestrian simulation modelling (eg Legion) is undertaken to check the designs taking account of passenger behaviour.

1. Introduction

This passenger demand assessment was undertaken to assess the pedestrian capacity implications of the options for improving train capacity at Connolly Station in Dublin.

1.1 Study Methodology

Station capacity planning guidelines in Ireland[1] provide for the safety of passengers and staff in line with the Railway Safety Act 2005. The general guidance specifies planning for the free movement of passengers in passageways and stairs, etc, for the foreseeable peak passenger use. Stairways, steps and ramps should have adequate width to avoid overcrowding and provide for access by people with disabilities. Platform widths should be adequate for the greatest number of passengers as any time. Some specific minimum standards are provided:

- Stairs at least 1.2m wide between handrails and not more than 2.4m between handrails.
- Ramps at least 2m wide.
- Lift run-off at least 2m.
- Stairs run-off to platform edge 5m, or barrier required.
- Single face platform not less than 2.5m wide.
- High speed platform not less than 3.0m wide.
- Island platform not less than 4.0m wide.
- High speed island platform not less than 6.0m wide.

However, in the absence of detailed guidance on the methodology for assessing free movement of passengers we have adopted the approach based on Fruin Levels which are the basis of assessment using detailed pedestrian simulation models used across the world. At this stage a desktop assessment of the three options - Option 3, Option 6 and Option 8 was undertaken. The sub-options relate to track capacity and train performance rather than passenger capacity.

1.2 Existing Passenger Demand and Trends

The National Transport Authority (NTA) publishes annual rail census information and has provided a detailed spreadsheet of Connolly station boarding and alighting data for 2017 for use in this study. Connolly Station is the busiest station in Ireland with 18,062 boardings and 18,927 alightings on the Census day in 2017. Flows at Connolly are 19% higher than the second ranked station (Pearse) and 66% higher than Heuston serving traffic from the west and southwest.

Figure 1.1 shows that Connolly Station flows declined between 2012 and 2014, during the recession, and demand has grown strongly since 2014 in line with the growth in the economy – shown in Figure 1.2.

There has been a 48% increase in passenger demand at Connolly between 2014 and 2017 aided by the introduction of services to Heuston in 2017 leading to a 19% increase in that year. Without Heuston flows the growth was 16% in 2017.

[1] CRR Guidelines – RSC-G-001-B, 2008 and CCE Departmental and Multi-disciplinary Standards I-DEP-0121

Figure 1.1: Connolly Station Flows 2012 – 2017 (Census Day). Source: NTA National Heavy Rail Census Report 2017.

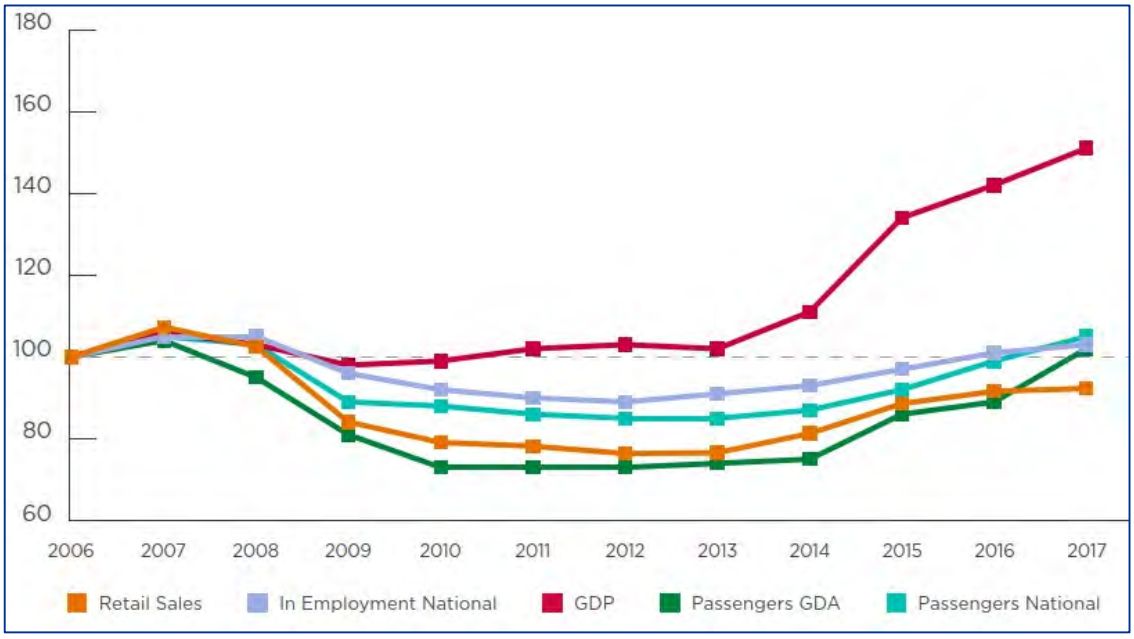

Figure 1.2: Rail Journeys in the GDA and Key Economic Indicators Indexed to 2006. Source, NTA Rail Census 2017

1.3 Future Passenger Demand at Connolly

To assess the "foreseeable peak passenger use" of the station, data for Connolly Station flows was extracted from the NTA Dublin Regional Transport Model which produced outputs from the 2012 base and the 2040 PLUTO tests. Figure 1.3 shows the AM and PM peak forecasts which produce a growth of 95% and 84% for the AM and PM peaks respectively. These forecasts represent annual compound growth factors of 2.4% AM peak and 2.2% PM peak. Whilst the growth forecasts appear low compared to recent trends the model contains committed schemes which may alter travel patterns in the city so are taken as the best evidence.

Passenger growth from 2017 to 2040 is estimated as 73% AM peak and 65% PM peak.

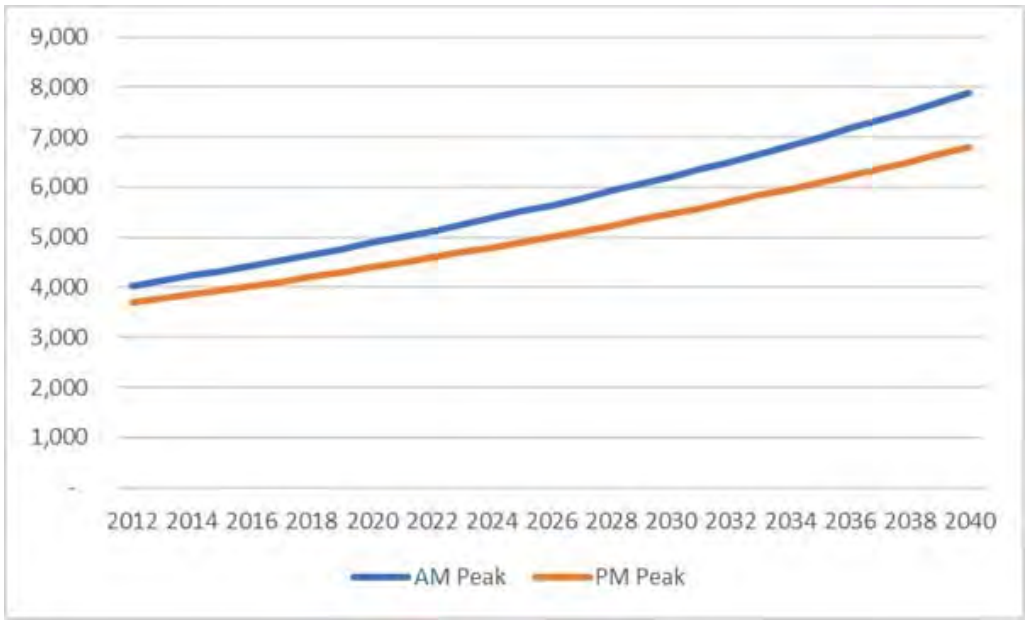

Figure 1.3: Forecast Connolly Station Flows 2012 – 2040 Source: NTA Regional Traffic (PLUTO) Model

The detailed spreadsheet of 2017 flows were used to estimate the peak hour flow (17% of all day flows) and that the highest peak hour flow is between 0800 and 0900.

2. Assessment of Options

2.1 Forecast Platform and Access Flows

The flows for each service group were allocated to each platform according to the assumptions in the operational effectiveness section of the detailed appraisal of options in the Connolly Station Enhancement Options Study, Option Appraisal report (sections 6.2.1, 6.2.5 and 6.2.11).

Option 3 retains the existing platform and access layout at the station. The platform flows were estimated from the normal service pattern and is summarised in Table 2.1. The assessment concentrates on the highest flows which relate to the through platforms and DART services. The underpass flow is also shown.

Platform	Daily Journeys 2017	Peak Hour Journeys 2017	Peak Hour Journeys 2040
Platform 6/7	15,441	2,625	4,541
Underpass flow		2,625	4,541
Platform 4/5	15,862	2,696	4,665
Platforms 1 to 3	5,686	967	1,672
Total	36,989		

Table 2 1: Option 3 Future Platform Flows and Underpass Flow

Option 6 provides a new platform (Platform 7) with an additional platform capable of through movements. Table 2.2 shows the forecast platform and connector flows. This option replaces the underpass with a new footbridge / transfer deck facility with two sections - connecting Platform 5/6 and Platform 7. This assumes that everyone using Platform 7 would transfer over the full bridge, rather than transferring to through services in platform 5/6.

Platform	Daily Journeys 2017	Peak Hour Journeys 2017	Peak Hour Journeys 2040
Platform 7	1,940	330	570
Footbridge Flow		330	570
Platform 5/6	13,502	2,295	3,971
Footbridge Flow		2,625	4,541
Platform 1 to 4	15,862	2,696	4,665
Total	36,989		

Table 2 2: Option 6 Future Platform Flows and Footbridge Flows

Option 8 retains Platforms 1 to 7 and provides a new north facing turnback platform (Platform 8). Table 2.3 shows the forecast flows including platform connections. A footbridge will connect to Platform 8 and also to Platforms 5 and 6/7. The design also retains the existing underpass between the concourse and Platform 6/7. It has been assumed that two thirds of Platform 6/7 users would use the underpass as it is closer to the main entrance.

Platform	Daily Journeys 2017	Peak Hour Journeys 2017	Peak Hour Journeys 2040
Platform 8	1,376	234	405
Footbridge Flow		234	405
Platform 6/7	14,065	2,391	4,137
Underpass Flow		1,578	2,730
Footbridge Flow		1,023	1,770
Platform 5	15,862	2,696	4,665
Platform 1 to 4	5,686	967	1,672
Total	36,989		

Table 2 3: Option 8 Future Platform Flows and Footbridge Flows

2.2 Capacity Assessment Option 3

The dimensions of the existing station were measured from the topographical survey CAD file;

- Platform 6/7 width at the end of the run off of the ramp access = 9.5m.
- Platform 6/7 Length = 230m.
- Platform 5 width at the middle of the platform = 13m.
- Platform 5 length = 217m.
- Ramp width = 2.4m.
- Ramp length = 34m
- Stairs width = 2 * 1.6m
- Escalator width = 1.2m

The stairs have 2*10 steps with midpoint landing.

There are three doorways between the concourse and access to the stairs each 1.6m wide.

The passenger capacity assessment (see calculation approach in Appendix A) concentrates on the stairs and platform dimensions using the 2040 design year flows and is summarised in Table 2.4. The measurements take account of the Option 3 design with platform extensions but shows that the platforms are forecast to be crowded, especially Platform 6/7. As the platform is narrower than required more of the platform length is likely to be used at this density, which could lead to congestion at the top of the ramp.

Element	Size Requirement	Size in Design
Platform 6/7	10.3m wide	9.5m
Platform 5	11.2m wide	13m (inc Platform 4)
Underpass / Ramp	3.6m wide	2.4m
Stairs	4.2m wide (2-way)	3.2m + escalator

Table 2 4: Option 3 Passenger Capacity Assessment

The ramp width leading to the underpass is currently 2.4m wide and unlikely to cope with peak flows in 2040. This is likely to lead to passenger congestion on the platform. The underpass itself is wider than the ramp as shown in Figure 2.1.

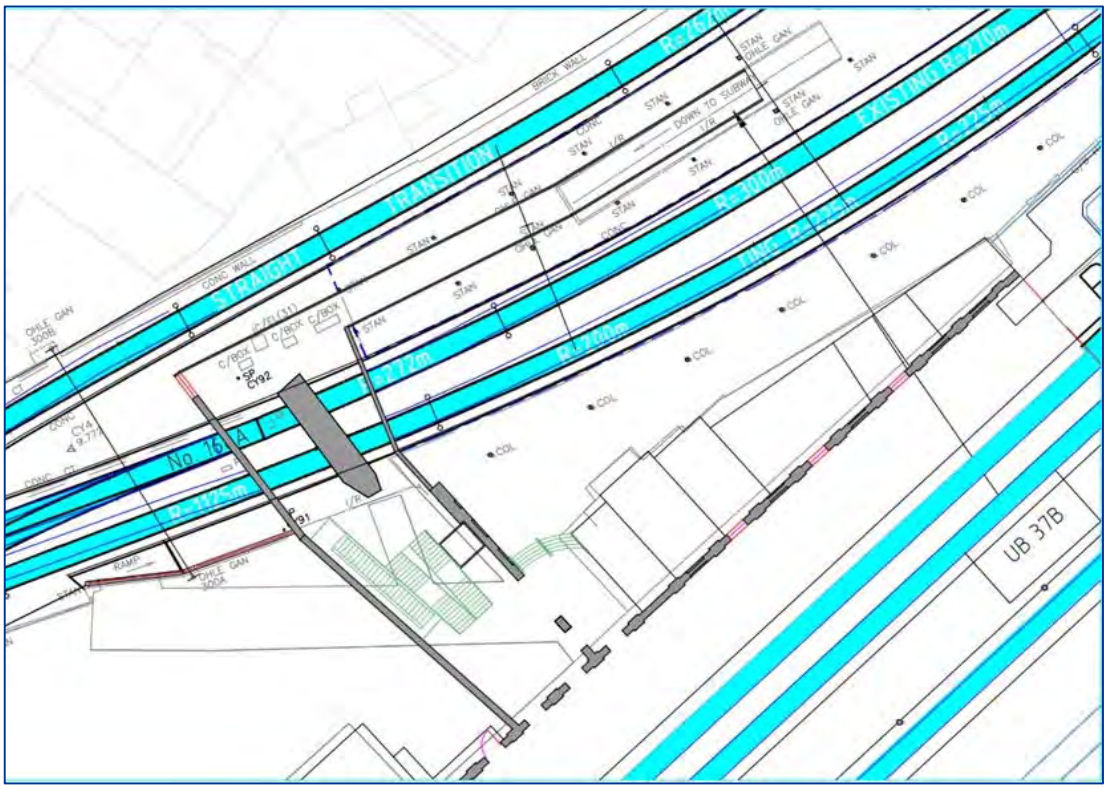

Figure 2.1: Current Access between Concourse and Platform 6/7.

The stairs requirement of 1 metre wider than the current staircase (2-way width) explains why an escalator has been provided to cope with peak direction flows. The escalator is likely to have a capacity of 100 passengers per minute which would cope with 85% of the forecast flows if all in one direction. Overall there is sufficient capacity in the underpass access stairs / escalator for the future year flows.

2.2.1 Conclusion

The existing station layout is unlikely to cope with long term (foreseeable) peak passenger flows with platform congestion and ramp access congestion forecast. The Option 3 design lengthens the platform which will provide more capacity enabling management of passengers to utilise the whole length. However, there is limited ability to widen the ramp to the underpass so passive provision for a second access to be provided in the long term should be considered. For example; a footbridge between platform 5 and platform 6/7 further north than the current access.

2.3 Capacity Assessment Option 6

Key dimensions taken from the engineering drawings are;

- Platform 5/6 width = 10.5m
- Platform 5/6 length = 182m
- Platform 7 width = 11.5m
- Platform 7 Length = 180m.

The passenger capacity assessment is shown in Table 2.5. Platform 7 is expected to have less trains per hour than the other through-platforms so the design shows plenty of capacity and could be reduced (assuming that it will not become the main through platform in future). Platform 5/6 is forecast to be heavily used and in 2040 will require a slightly wider platform than shown in the design. This assessment assumes 50% of the flow within 30% of the platform so it is likely that a longer length of the platform would have this level of density at the peak and, depending on the location of the stairs to the footbridge, could cause congestion for people accessing the platform which may need management.

The stairs to Platform 7 and the bridge to that platform can be standard width but the stairs to platforms 4 and 5/6 need to be much wider than standard and the bridge between also wider than standard. This will need careful design to ensure that there is sufficient width either side of the stairs to reach the lift without wheelchair passengers being too close to the platform edge.

Element	Size Requirement	Size in Design
Platform 7 width	1.6m	11.5m
Platform 5/6 width	11.3m	10.5m
Stairs width Platform 7	0.5m	Standard 1.2m
Stairs width Platform 5/6	3.7m	Suggest 4.0m with central handrail
Stairs width Platform 4	4.2m	Suggest 4.2 with central handrail
Bridge width Platform 7 to Platform 5/6	1.0m	Standard 1.2m
Bridge width Platform 5/6 to Platform 4	3.6m	Recommended 3.6m

Table 2 5: Option 6 Passenger Capacity Assessment

An alternate access arrangement with a new underpass and escalators to platforms 3 / 4, 5 / 6 and 7 has been proposed for this option. Table 2.6 shows the results highlighting that the escalators and underpass will provide for the 2040 flows. This assessment does not take account of the additional underpass and stairs to platforms 5 / 6 and 7, but the escalators to those platforms are forecast to cope with the flows. The heaviest used escalator will be to / from Platform 4 which has to handle the combined flows from the through platforms. It would be advisable to widen that access to provide a 2.0m staircase between the escalators for contingency planning and longer-term capacity.

Element	Size Requirement	Size in Design
Platform 7 width	1.6m	11.5m
Platform 5/6 width	11.3m	10.5m
Escalators Platform 7 up/ down	0.12 / 0.03	1 / 1
Escalators Platform 5/6 up/down	0.78 / 0.26	1 / 1
Underpass Width	1.1m	3m
Escalators Platform 4 up/down	0.28 / 0.90	1 / 1

Table 2 6: Option 6 Passenger Capacity Assessment – assuming new Underpass and Escalators

2.3.1 Conclusions

The option 6 design removes the current underpass access to the island platform for through services. This results in the need for a very large new footbridge / transfer deck. That may be difficult to position with sufficient access around each side to the lift for wheelchair passengers. Platform 5/6 is also expected to be heavily used which brings a risk of congestion at the bottom of the footbridge impeding access and egress. Assuming that Platform 7 will not be used as the main through service platform standard bridge and stairway can be provided and the platform narrowed to standard to enable Platform 5/6 to be widened. However, for operational flexibility it would be advisable to provide a higher capacity access to Platform 7.

An alternative design with a new underpass and escalators to platforms 4, 5 / 6 and 7 will provided sufficient capacity, if it can be achieved.

2.4 Capacity Assessment Option 8

Key dimensions taken from the engineering drawings are;

- Platform 4/5 width = 13m +
- Platform 5 length = 220m
- Platform 6/7 width = 10m
- Platform 6/7 length = 220m
- Platform 8 width = 3m
- Platform 8 Length = 174m

The passenger capacity assessment results are shown in Table 2.7. Platform 8 is expected to have less trains per hour than others and the space required is within the standard design. Platform 6/7 and Platform 5 will have substantial flows but the platform width requirements are within the design (in the case of Platform 5 assuming light use of Platform 4 at the northern end).

The relatively low use of Platform 8 means that a standard width footbridge and stairway will provide sufficient capacity. The provision of that footbridge also from Platform 6/7 to Platform 5 will provide a second means of access between the busy platforms and reduce use of the underpass to within capacity (assuming one third of passengers use the new footbridge). In addition, the footbridge and stairways width requirements are much lower than for option 6 and more realistic to provide within the width of the platforms.

Element	Size Requirement	Size in Design
Platform 8 width	1.2m	3m
Platform 6/7 width	9.8m	10m
Platform 5 width	10.1m	10.5m
Platform 8 footbridge stairs width	0.4m	Standard 1.2m
Platform 6/7 ramp width	2.4m	2.4m
Platform 6/7 underpass stairs width	2.5m	3.2m
Platform 6/7 footbridge stairs width	1.3m	Recommended standard 2.0m
Platform 5 footbridge stairs width	1.6m	Recommended standard 2.0m
Bridge Platform 8 to Platform 6/7 width	0.9m	Recommended standard 2.0m
Bridge Platform 6/7 to Platform 5 width	1.8m	Recommended standard 2.0m

Table 2 7: Option 8 Passenger Capacity Assessment

2.4.1 Conclusion

Option 8 design retains the existing underpass access to the island platform reducing the scale of footbridge / transfer deck required, if it is extended to platform 5. The designed platform widths and lengths match the forecast 2040 flows and overall this solution provides the best option for the passenger capacity requirements.

3. Conclusions and Recommendations

This capacity assessment has indicated potential congestion problems with option 3 – requiring a second access in the longer-term.

Option 6 removes the existing underpass and the footbridge requirements would be difficult to achieve within the platform widths whilst maintaining standards for passenger movement. An alternative option providing a new underpass and escalators to the through platforms will provide sufficient capacity if it is practical.

Option 8 retains the existing underpass and provided a second access to the main platforms and passenger flows fit with the capacity provided based on an assumption regarding the number of people who would choose the main and second accesses.

It is therefore recommended that any options taken forward are subjected to pedestrian simulation modelling (eg Legion) to ensure that passenger behaviour is taken into account in the detailed design.

Appendix A. Capacity Assessment Methodologies.

Platform Width

Capacity assessment using a space standard (i.e Fruin Level of Service C), of 0.8sqm per person applied to the busiest 30% of platform with 50% of boarding and alighting demand in the peak 15 minutes for the peak.

Stairs Width

Source: London Underground Station Planning Standards and Guidelines - Good Practice Guide (G-371A)

Observed flow and additional / reduced flow. Peak 15 mins flow converted to average minute and divided by 28 for the stairway width required.

Passageways

Source: London Underground Limited, Standard 2-03001-024, Station Planning.

Two-way passageway width = (Average peak minute flow / 40) + (2*0.3) m

Appendix D. Preferred Option Selection - Indicative Costs

CONNOLLY STATION INFRASTRUCTURE UPGRADE

Preferred Option Selection - Indicative Costs

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1st March 2019

CONNOLLY STATION INFRASTRUCTURE UPGRADE

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Executive Summary

Indicative costs were prepared for five options in relation to the adaptation of Connolly station and the associated rail infrastructure out to Newcomen Junction. These options were identified as potentially meeting the Client's requirements to achieve 30 trains per hour through Connolly station.

The indicative costs were prepared from outline design information provided by the design team, augmented where necessary by assumptions as to differentiator costs between the options. A detailed cost estimate will be developed for the preferred option.

This report is intended to provide details of the indicative costs used at the workshop to identify the preferred option.

A summary of the Costs associated with each option, subject to the contents of the CDAL (Cost Data Assumptions List) and Exclusions listed elsewhere in this report, are as follows:-

Connolly Station Detailed Options - Cost Summary (£ / € M's)		
	Cost GBP	***Cost***
Option 3	**£116.86**	**€134.39**
Option 6b	**£171.79**	**€197.56**
Option 6d	**£158.80**	**€186.62**
Option 8b	**£172.10**	**€197.91**
Option 8d	**£159.43**	**€183.34**

1. Introduction

Cost Estimates for five options were prepared based on outline design information provided by the Design Team. Each of the five options were considered independently to arrive at a total estimated construction cost.

The cost estimates prepared are intended only to provide a comparison of the likely costs associated with each option. Due to the limited amount of design information available, the total costs stated are indicative of the likely total cost only.

Where little or no information was available, reasonable allowances have been included as to the likely cost of some of the major cost components, based on the estimator's judgement.

For development of the cost estimate for the preferred option, additional design information will require to be developed.

2. Information Used

The Cost Estimate has been prepared using the following Information:-

Pway Drawings

Drawing Reference	OPTION 3 32110100-03-ETR-DG-001
	OPTION 6B -32110100-06-ETR-DG-002
	OPTION 6D 32110100-06-ETR-DG-003
	OPTION 8 B 32110100-08-ETR-DG-008
	OPTION 8 D 32110100-08-ETR-DG-009

Engineering Drawings

Drawing Reference	DROP LOCK SINGLE TRACK 2110100-3-ECV-DG-004-P01
	DROP LOCK DOUBLE TRACK 2110100-3-ECV-DG-005-P01
	PLATFORM LAYOUT OPTION 3 32110100-3-ECV-DG-001
	PLATFORM LAYOUT OPTION 6 32110100-6-ECV-DG-002
	PLATFORM LAYOUT OPTION 8 32110100-8-ECV-DG-003

Overhead Line Electrification Drawings

Drawing Reference	OLE LAYOUT OPTION 3 32110100-03-EOH-DG-001 P01
	OLE LAYOUT OPTION 6B 32110100-06B-EOH-DG-001 P01
	OLE LAYOUT OPTION 6D 32110100-06D-EOH-DG-001 P01
	OLE LAYOUT OPTION 8B 32110100-08B-EOH-DG-001 P01
	OLE LAYOUT OPTION 8D 32110100-08D-EOH-M2-001 P01

Signalling

A commentary on the likely parameters for the future design of signalling to be installed has been provided. It has not been possible to quantify and cost the likely future installation from this information. An allowance has been included in the cost plan estimates for each of the options based on the likely requirements determined from the line diagrams and using estimator's judgement.

Telecommunications

A commentary on the likely parameters for the future design of telecoms to be installed has been provided. It has not been possible to quantify and cost the likely future installation from this information. Again, allowance have been included in the cost plan estimates for each of the options based on the likely requirements determined from previous experience and using estimator's judgement.

Programme

No detailed programme information was available at this stage of the programme. Preliminaries costs have been based on likely percentage additions for work of this nature, established from similar previous projects.

3. Cost Estimate Summary

3.1 Basis of Costs

Where possible, the major elements of construction have been quantified. These quantities have been costed at rates derived from projects of a similar nature and where these have not been available, from pricing books or using the estimator's judgement.

Where known elements have no information upon which to base calculated costs, a reasonable allowance has been included based on the estimator's judgement. Where there is a clear difference in the cost between the options, this has been reflected in the allowances included.

Due to the lack of cost information available in relation to major rail infrastructure projects in the Republic of Ireland (ROI), the estimates have been based on rates applicable within the UK. Some general market research has been carried out in relation to the cost differences between the UK and ROI and it has been determined that major cost elements are generally 10% cheaper in the ROI than in the UK at present. This topic will require to be explored further for the preparation of the detailed cost estimate.

An allowance of 30% has been applied to all cost estimates in relation to preliminaries costs. Due to the absence of an outline programme, it has not been possible to differentiate between the options for this cost element. However, discussions during design team conference calls indicated that where one programme may take longer in comparison to another, the cost of Possessions vs closing the station may effectively neutralise or minimise any major difference in cost for this element. Consequently, the same percentage has been used for all options. It is not considered likely that any fluctuation in this percentage allowance would differentiate between the options.

Overheads and Profit (O&P)have been considered and some soft market research has indicated that the current levels of O&P in ROI and the UK are broadly similar. An allowance of 10% has been included as being a reasonable allowance for this cost element based on recent projects in the UK. It is not considered likely that any fluctuation in this percentage allowance would differentiate between the options.

An allowance of 10% has been applied to all options in respect of the cost of professional fees. Dependant on the requirements for the different options, it is considered that there may be some minor fluctuation in the level of professional fees required, however it is not considered likely that any such fluctuation would be a cost differentiator between the options. This cost element will require to be developed further for the detailed cost estimate.

Land Purchase Costs have been included for Option 8. In the absence of any specific expert local knowledge, a review of recent local land and building purchases has been carried out. From this information, an allowance has been included in respect of the likely costs associated with purchasing the additional land necessary to achieve the proposed scheme. Included within these figures is an allowance for the fact that the land will require to be the subject of Compulsory Purchase Orders.

3.2 Option Costs – Main Summary

The outputs from the options cost estimates, prepared on the basis of the above information, is summarised on the following table:-

Connolly Station - MASTER SUMMARY		Option 3		Option 6b		Option 6d		Option 8b		Option 8d
		Cost		*Cost*		*Cost*		*Cost*		*Cost*
1	*Track*									
1.1	Plain Line	£4,462,000		£6,672,000		£6,260,000		£6,952,000		£6,171,000
1.2	S&C	£6,760,000		£11,253,000		£10,670,000		£12,342,000		£11,198,000
1.3	Signalling	£28,335,000		£34,635,000		£33,435,000		£33,435,000		£32,535,000
1.4	OLE	£1,278,000		£1,593,000		£1,852,000		£1,371,000		£1,213,000
1.6	Telecoms	£379,000		£618,000		£618,000		£650,000		£650,000
1.5	Power Supply	£500,000		£500,000		£500,000		£500,000		£500,000
2	*Civils*									
2.1	Demolitions	£480,000		£1,389,000		£585,000		£991,000		£741,000
2.2	Bridges	£1,000,000		£5,566,000		£1,150,000		£5,566,000		£4,450,000
2.3	Retaining Structures	£752,000		£1,682,000		£986,000		£1,682,000		£986,000
2.4	Platforms	£5,473,000		£13,434,000		£13,434,000		£10,109,000		£10,109,000
2.5	Civils ad-hocs	£6,567,000		£5,105,000		£8,316,000		£6,084,000		£6,084,000
3	*Buildings*									
3.1	Demolitions	£342,000		£367,000		£367,000		£316,000		£316,000
3.2	Station Works	£11,375,000		£13,291,000		£12,801,000		£3,113,000		£3,113,000
	Sub Total	**£67,703,000**		**£96,105,000**		**£90,974,000**		**£83,111,000**		**£78,066,000**
4	Adjustment for ROI construction c	-10.0% -£3,937,000.00		-£6,147,000.00		-£5,754,000.00		-£4,968,000.00		-£4,554,000.00
	Sub Total	**£63,766,000**		**£89,958,000**		**£85,220,000**		**£78,143,000**		**£73,512,000**
5	General Preliminaries	30.0% £19,130,000.00		£26,988,000.00		£25,566,000.00		£23,443,000.00		£22,054,000.00
6	Overheads & Profit	10.0% £6,377,000.00		£8,996,000.00		£8,522,000.00		£7,815,000.00		£7,352,000.00
	Sub Total	**£89,273,000**		**£125,942,000**		**£119,308,000**		**£109,401,000**		**£102,918,000**
7	Professional Fees	10.0% £8,928,000.00		£12,595,000.00		£11,931,000.00		£10,941,000.00		£10,292,000.00
	Sub Total	**£98,201,000**		**£138,537,000**		**£131,239,000**		**£120,342,000**		**£113,210,000**
	Contingency & Construction Risk	19% £18,659,000.00	24%	£33,249,000.00	21%	£27,561,000.00	30%	£36,103,000.00	27%	£30,567,000.00
	Land Purchase Costs	£0		£0		£0		£15,646,000.00		£15,646,000.00
	Total Construction Costs GBP	**£116,860,000**		**£171,786,000**		**£158,800,000**		**£172,091,000**		**£159,423,000**

The above information has been summarised in the following table.

As stated above, the costs have been prepared in GBP (£'s).and the current exchange rate between the Euro and GBP has been used to provide the indicative costs in the Euro equivalent values.

Connolly Station Detailed Options - Cost Summary (£ / € M's)		
	Cost GBP	***Cost***
Option 3	**£116.86**	**€134.39**
Option 6b	**£171.79**	**€197.56**
Option 6d	**£158.80**	**€186.62**
Option 8b	**£172.10**	**€197.91**
Option 8d	**£159.43**	**€183.34**

3.3 Risk

Allowances in respect of construction risks have been made for each of the options in the above costs.

A draft Risk Register was circulated to the Design Team for comment. This document identified some of the risks associated with the construction activities. Any comments received were considered and included in the Risk Register.

A risk scoring matrix was developed and each of the risks were considered and allocated a risk cost which was used to determine the differentiating risks between the options. This exercise was intended only to demonstrate the differing level of risks between the various options and does not represent the overall risks to the project to be considered as part of the detailed cost estimate. This cost element will require significant further development for the detailed cost estimate.

The risk scoring matrix used is as follows:-

Project: Connolly Station Infrastructure Adaptation- Scoring Matrix

Scoring matrix to be set according to size of the project, and agreed with Senior Construction Manager
Below is an example of scoring matrix for a project of c. £1 mill cost and 1-year timescale.

THREAT

	LIKELIHOOD of adverse impact			COST IMPACT *Increase in total project cost*		*Increase in whole project schedule*	
5. Very High	Almost Certain	91%	100%	£ 3,000k	or more	4 weeks	or more
4. High	Probable	61%	90%	£ 1,500k	£ 3,000k	3 weeks	4 weeks
3. Medium	Possible	31%	60%	£ 1,000k	£ 1,500k	2 weeks	3 weeks
2. Low	Unlikely	11%	30%	£ 800k	£ 1,000k	1 weeks	2 weeks
1. Very Low	Remote	0%	10%	£ 500k	£ 800k	1 day	1 weeks

HEAT MAP

Almost Certain	8	15	22	24	25
Probable	7	14	19	20	23
Possible	5	9	16	18	21
Unlikely	3	4	10	13	17
Remote	1	2	6	11	12
	Very Low	Low	Medium	High	Very High

The risks considered for each of the options and the risk costs attached to each are detailed on the following pages. Note that this information will require to be significantly augmented and developed for the preferred option cost estimate : -

Option 3

General Mandatory Risk Data							Current Risk Ranking							Mitigation Plan Details (Only to be populated where Risks for Red or Y	
Unique Identifier	Risk, Opportunity	Description			Risk / Opportunity Owner	Movement	Assessment (Qualitative)				Highest Initial Risk Rating	Risk Score	Responce Strategy	Action Planned To Reduce Risk Or Enhance An Opportunity	Agreed Mitigation Plan Cost
							Probability		Schedule Impact	Cost Impact			Risk / Opportunity		
		As a result of (Definite Cause)	,(uncertain event) may occur	Which may lead to (effect on objectives)			%age	In Words	In Words	In Words				Scope Details	
1	Risk	Failure to obtain permission to re-locate Maintenance Shed	Delay to commencement of the work	Cost escalation/completion delayed	NTA	No Change	50%	Possible	High	Medium	Medium	16	Accept	Early IR Involvement and discussion on re-location measures	800
2	Risk	Existing platforms in poorer condition than anticipated resulting in additional demolition and replacement	Additional time on site	Cost escalation/completion delayed	NTA	No Change	60%	Possible	High	High	Medium	18	Accept	Extensive survey work required to identify any issues with existing platforms	1000
3	Risk	Existing structure requires more strengthening than anticipated to suit new platform configuratrion	Following additional survey work, existing structure requires more strengthening than anticipated	Additional costs and additional time to design	NTA	No Change	75%	Possible	High	Very High	Medium	21	Accept	Extensive survey work required to identify any issues with existing platforms	1000
4	Risk	Innovative design for drop lock	Delay to design and construction process due to unforseen design matters	Delay and additional costs	NTA	No Change	50%	Unlikely	Medium	Medium	Medium	10	Accept	Extensive research and design work prior to procurement required	800
5	Risk	Construction of new bridge at Ossory Road	Existing canal construction being found to be unsuitable for construction of new dual track bridge	Substantial additional canal strengthening works required prior to cvonstruction of new bridge	NTA	No Change	50%	Possible	Medium	Medium	Medium	16	Accept	Early condition surveys to be carried out	1000
6							0%					-		**Total**	**4600**

Option 6b

OPTION 6b

General Mandatory Risk Data							Current Risk Ranking							Mitigation Plan Details (Only to be populated where Risks for Red or Y	
Unique Identifier	Risk, Opportunity	Description			Risk / Opportunity Owner	Movement	Assessment (Qualitative)				Highest Initial Risk Rating	Risk Score	Responce Strategy	Action Planned To Reduce Risk Or Enhance An Opportunity	Agreed Mitigation Plan Cost
							Probability		Schedule Impact	Cost Impact			Risk / Opportunity		
		As a result of (Definite Cause)	,(uncertain event) may occur	Which may lead to (effect on objectives)			%age	In Words	In Words	In Words				Scope Details	
1	Risk	Failure to obtain permission to re-locate Maintenance Shed	Delay to commencment of the work	Cost escalation/completion delayed	NTA	No Change	50%	Possible	High	Medium	Medium	16	Accept	Early consultation with highways authorities	1500
2	Risk	Existing platforms in poorer condition than anticipated resulting in additional demolition and replacement	Additional time on site	Cost escalation/completion delayed	NTA	No Change	60%	Possible	High	High	Medium	18	Accept	Early condition surveys to be carried out	3000
3	Risk	Existing structure requires more strengthening than anticipated to suit new platform configuratrion	Following additional survey work, existing structure requires more strengthening than anticipated	Additional costs and additional time to design	NTA	No Change	75%	Possible	High	Very High	Medium	21	Accept	Early ground investigation works to be carried out	3000
4	Risk	Innovative design for drop lock	Delay to design and construction process due to unforseen design matters	Delay and additional costs	NTA	No Change	50%	Unlikely	Medium	Medium	Medium	10	Accept	Early condition surveys to be carried out	800
5	Risk	Demolition and re-construction of North Strand Bridge	Failure to obtain approval to re-route traffic during construction period	Constraints on demolition and construction being partial and phased	NTA	No Change	50%	Possible	High	High	High	18	Accept	Early condition surveys to be carried out	3000
6	Risk	Construction of new bridge at Ossory Road	Existing canal construction being found to be unsuitable for construction of new dual track bridge	Substantial additional canal strengthening works required prior to cvonstruction of new bridge	NTA	No Change	50%	Possible	Medium	Medium	Medium	16	Accept	Early ground investigation works to be carried out	1500
7	Risk	Dualling of track from Newcomen - ground conditions not as expected / suitable for rail track	Existing ground conditions found to be unsuitalbe for new track layout	Additional ground stabilistation works prior to laying of new track	NTA	No Change	75%	Possible	Medium	Medium	Medium	16	Accept	Early ground investigation works to be carried out	1500
8	Risk	Additional strengthening works required to existing Bridge structures to cater for new works	Unexpected additional strengthening works required to existing structures to support new deck infills	Additional design time and construction costs	NTA	No Change	75%	Possible	High	High	High	18	Accept	Early ground investigation works to be carried out	1500
9	Risk	Suitability of existing structure to incorporate additional overbridges and lift pits	Unexpected additional strengthening works required to existing structures to support new deck infills	Additional design time and construction costs	NTA	No Change	75%	Probable	Medium	Medium	Medium	19	Accept	Early condition surveys to be carried out	3000
												-		**Total**	**18800**

Option 8b

OPTION 8b

General Mandatory Risk Data							Current Risk Ranking							Mitigation Plan Details (Only to be populated where Risks for Red or Y	
Unique Identifier	Risk, Opportunity	Description			Risk / Opportunity Owner	Movement	Assessment (Qualitative)				Highest Initial Risk Rating	Risk Score	Responce Strategy	Action Planned To Reduce Risk Or Enhance An Opportunity	Agreed Mitigation Plan Cost (£K)
							Probability		Schedule Impact	Cost Impact			Risk / Opportunity		
		As a result of (Definite Cause)	,(uncertain event) may occur	,Which may lead to (effect on objectives)			%age	In Words	In Words	In Words				Scope Details	
1	Risk	Failure to obtain permission to re-locate Maintenance Shed	Delay to commencment of the work	Cost escalation/completion delayed	NTA	No Change	50%	Possible	High	Medium	Medium	16	Accept	Early consultation with highways authorities	1500
2	Risk	Existing platforms in poorer condition than anticipated resulting in additional demolition and replacement	Additional time on site	Cost escalation/completion delayed	NTA	No Change	60%	Possible	High	High	Medium	18	Accept	Early condition surveys to be carried out	3000
3	Risk	Existing structure requires more strengthening than anticipated to suit new platform configurartion	Following additional survey work, existing structure requires more strengthening than anticipated	Additional costs and additional time to design	NTA	No Change	75%	Possible	High	Very High	Medium	21	Accept	Early ground investigation works to be carried out	3000
4	Risk	Innovative design for drop lock	Delay to design and construction process due to unforseen design matters	Delay and additional costs	NTA	No Change	50%	Unlikely	Medium	Medium	Medium	10	Accept	Early condition surveys to be carried out	800
5	Risk	Demolition and re-construction of North Strand Bridge	Failure to obtain approval to re-route traffic during construction period	Constraints on demolition and construction being partial and phased	NTA	No Change	50%	Possible	High	High	High	18	Accept	Early condition surveys to be carried out	3000
6	Risk	Construction of new bridge at Ossory Road	Existing canal construction being found to be unsuitable for construction of new dual track bridge	Substantial additional canal strengthening works required prior to cvonstruction of new bridge	NTA	No Change	50%	Possible	Medium	Medium	Medium	16	Accept	Early ground investigation works to be carried out	1500
7	Risk	Dualling of track from Newcomen - ground conditions not as expected / suitable for rail track	Existing ground conditions found to be unsuitalbe for new track layout	Additional ground stabilistation works prior to laying of new track	NTA	No Change	75%	Possible	Medium	Medium	Medium	16	Accept	Early ground investigation works to be carried out	1500
8	Risk	Additional strengthening works required to existing Bridge structures to cater for new works	Unexpected additional strengthening works required to existing structures to support new deck infills	Additional design time and construction costs	NTA	No Change	75%	Possible	High	High	High	18	Accept	Early ground investigation works to be carried out	1500
9	Risk	Suitability of existing structure to incorporate additional overbridges and lift pits	Unexpected additional strengthening works required to existing structures to support new deck infills	Additional design time and construction costs	NTA	No Change	75%	Probable	Medium	Medium	Medium	19	Accept	Early condition surveys to be carried out	3000
10	Risk	Failure to CPO derelict house requiring demolition; Failure to CPO Car park area required for platform extension; Failure to obtain approval to demolish section of IR building	Currently unknown if it will be possible to CPO required land and if IR will agree to demolition of portion of building	Significant delays to progress and substantial additional land acquisition costs	NTA	No Change	80%	Probable	High	Medium	High	20	Accept	Early consultation and negotiation	3000
11	Risk	Unknown condition of existing arches leading to higher design and construction costs	Extenson of existing arches into car park to support platform extension may require excessive additional structural works	Additional design time and construction costs	NTA	No Change	75%	Possible	Medium	Medium	Medium	16	Accept	Early condition surveys to be carried out	1000
12	Risk	Work at heights over public areas for platform 8 extension works	Danger to public outwith the curtiledge of the site	Additional protective measures required	NTA	No Change	100%	Almost Certain	Low	Low	Medium	15	Accept	Ensure additional protective measures are in place	1000
14	Risk	Infilling void on bridge at throat	Major engineering activities over public highway	Danger to public and possibility of damage to structure of bridge	NTA	No Change	50%	Possible	Medium	Medium	Medium	16	Accept	Possibility of introducing temporary supporting structure and/or crash deck	1250
15												-		Total	23550

Option 8d

OPTION 8d

General Mandatory Risk Data							Current Risk Ranking							Mitigation Plan Details (Only to be populated where Risks for Red or Y	
Unique Identifier	Risk, Opportunity	Description			Risk / Opportunity Owner	Movement	Assessment (Qualitative)				Highest Initial Risk Rating	Risk Score	Responce Strategy	Action Planned To Reduce Risk Or Enhance An Opportunity	Agreed Mitigation
							Probability		Schedule Impact	Cost Impact			Risk / Opportunity		
		As a result of (Definite Cause)	,(uncertain event) may occur	,Which may lead to (effect on objectives)			%age	In Words	In Words	In Words				Scope Details	
1	Risk	Failure to obtain permission to re-locate Maintenance Shed	Delay to commencment of the work	Cost escalation/completion delayed	NTA	No Change	50%	Possible	High	Medium	Medium	16	Accept	Early consultation with highways authorities	1500
2	Risk	Existing platforms in poorer condition than anticipated resulting in additional demolition and replacement	Additional time on site	Cost escalation/completion delayed	NTA	No Change	60%	Possible	High	High	Medium	18	Accept	Early condition surveys to be carried out	3000
3	Risk	Existing structure requires more strengthening than anticipated to suit new platform configuratrion	Following additional survey work, existing structure requires more strengthening than anticipated	Additional costs and additional time to design	NTA	No Change	75%	Possible	High	Very High	Medium	21	Accept	Early ground investigation works to be carried out	3000
4	Risk	Innovative design for drop lock	Delay to design and construction process due to unforseen design matters	Delay and additional costs	NTA	No Change	50%	Unlikely	Medium	Medium	Medium	10	Accept	Early condition surveys to be carried out	800
5	Risk	Construction of new bridge at Ossory Road	Existing canal construction being found to be unsuitable for construction of new dual track bridge	Substantial additional canal strengthening works required prior to cvonstruction of new bridge	NTA	No Change	50%	Possible	Medium	Medium	Medium	16	Accept	Early ground investigation works to be carried out	1500
6	Risk	Additional strengthening works required to existing Bridge structures to cater for new works	Unexpected additional strengthening works required to existing structures to support new deck infills	Additional design time and construction costs	NTA	No Change	75%	Possible	High	Very High	Medium	21	Accept	Early ground investigation works to be carried out	1500
7	Risk	Suitability of existing structure to incorporate additional overbridges and lift pits	Unexpected additional strengthening works required to existing structures to support new deck infills	Additional design time and construction costs	NTA	No Change	75%	Probable	Medium	Medium	Medium	19	Accept	Early condition surveys to be carried out	3000
8	Risk	Failure to CPO derelict house requiring demolition; Failure to CPO Car park area required for platform extension; Failure to obtain approval to demolish section of IR building	Currently unknown if it will be possible to CPO required land and if IR will agree to demolition of portion of building	Significant delays to progress and substantial additional land acquisition costs	NTA	No Change	80%	Probable	Very High	High	High	23	Accept	Early consultation and negotiation	2000
9	Risk	Unknown condition of existing arches leading to higher design and construction costs	Extension of existing arches into car park to support platform extension may require excessive additional structural works	Additional design time and construction costs	NTA	No Change	75%	Possible	Medium	Medium	Medium	16	Accept	Early condition surveys to be carried out	1000
10	Risk	Work at heights over public areas for platform 8 extension works	Danger to public outwith the curtiledge of the site	Additional protective measures required	NTA	No Change	100%	Almost Certain	Low	Low	Medium	15	Accept	Ensure additional protective measures are in place	1000
11	Risk	Infilling void on bridge at throat	Major engineering activities over public highway	Danger to public and possibility of damage to structure of bridge	NTA	No Change	50%	Possible	Medium	Medium	Medium	16	Accept	Possibility of introducing temporary supporting structure and/or crash deck	1250
12												-		Total	18050

3.4 Assumptions

The assumptions that have been made when compiling the option cost estimates are detailed in the following table:-

COST DATA ASSUMPTIONS LIST - OPTION 3			
The following assumptions have been made in the preparation of the costs contained in this report			
	Item	**Description**	**Assumption**
TRACK			
1	Scope of work	Extent of existing and new track is not clear from drawings provided	Assumed that all track shown red on Pway drawings is new
2	Scope of work	Extent of track to be lifted is not clear	Assumed that track to be lifted as shown on the detailed information provided for Option 6b is common to all options
3	Scope of work	Maintenance lines at South East	Assumed that all of these lines will be completed prior to station upgrade works commencing. Arbitrary line struck between completion of maintenance lines and commencement of station track upgrade - no information available
4	Signalling	No quantification possible	Assumed that there are no abnormal costs associated with the signalling for this project. In the absence of detailed information, a general allowance based on similar projects has been included
TELECOMS			
1	Scope of Work	No definition provided	Assumed that LLPA will link back to existing system. One extension to system per platform has been assumed
2	CIS Scope of Work	No definition provided	costs are based on rate per m2 from similar projects. Assumed there are no abnormal costs associated with this item
3	CCTV installation Scope of Work	No definition provided	Assumed that the existing CCTV system will be suitable for extension to suit the new platform layouts. No allowance made for upgrading existing system.
POWER SUPPLY			
1	Scope of Work	No definition provided	General allowance made for extending and upgrading current provision
2	Scope of Work	No definition provided	It has been assumed that outwith the general allowance included, there will be no requirement for major power infrastructure upgrading works to be carried out i.e. no new sub-station or extensive HV cabling to be provided

CIVILS			
1	Scope of Work	Existing platforms	Assumed all existing platforms are to be demolished and removed offsite
2	Scope of Work	Excavation	Assumed no existing materials are being reused
3	Scope of Work	Demolition	Assumes the railway bridge - over canal is to be demolished
4	Scope of Work	Demolition	Assumes the lift bridge over canal is to be demolished
5	Scope of Work	Bridges	We have made an allowance for structural alterations and strengthening to existing arches
6	Scope of Work	Bridges	We have made an allowance for building the new railway bridge - over canal
7	Scope of Work	Bridges	We have made an allowance for a temporary bridge to accommodate existing services
8	Scope of Work	Newcomen Junction	Assumed vehicles diverted elsewhere during bridge replacement works
9	Scope of Work	Newcomen Junction	Assumed canal closed during construction works
10	Scope of Work	Newcomen Junction	Assumed crash deck/catch nets or similar to prevent debris falling into the canal
11	Scope of Work	Newcomen Junction	No details on the pumping units - all aspects have been assumed
12	Scope of Work	Newcomen Junction	Assumed no existing materials are being reused
13	Scope of Work	Newcomen Junction	Assumed dredging will be required to lower water level
14	Scope of Work	Newcomen Junction	Temporary bridge required to maintain existing services over the canal during road bridge replacement works
15	Scope of Work	Existing utilities	In the absence of any information we have included an allowance of £750,000 for dealing with existing utilities
16	Scope of Work	New platforms	The platforms are assumed to be of a typical front wall construction. • 665 x 1100mm solid concrete blockwork walls with cope. • Concrete strip foundations 1100 x 470mm. • Concrete support. • Between walls it is assumed that that it will be filled with 6N material. • Typical platform make up; 50mm dense bitumen base and 25mm bitumen wearing. course.

			• 400mm wide concrete tactile slabs to run the length of the platform.
17	Scope of Work	New platforms	Where the new platforms are to constructed between gap in the existing arched, we have assumed there will a new concrete slab supported on concrete beams on either side.
18	Scope of Work	New platforms	Lighting poles are assumed to be 15m centres.
19	Scope of Work	New platforms	Passenger information screens are assumed to be at 15m centres.
20	Scope of Work	New platforms	We have assumed any existing platforms will be re-surfaced.
BUILDINGS			
1	Scope of Work	Existing maintenance shed	Assumed existing maintenance shed has to be demolished and rebuilt
STATION WORKS			
1	Demolitions	Maintenance shed	Assumed that maintenance shed has to be demolished and re-located for this option
2	New Work	Platform Infrastructure	Assumed that no alterations are being made to existing infrastructure beyond platform adaptations. No allowance is made for new ticket barriers, ticket machines, escalators, lifts, stairs etc.
3	Scope of Work	New platforms	It is assumed new canopy's to platform 4/5 & 6/7
METHODOLGY			
1	Method of work	Sequence of construction	It is assumed that this work can be carried out as a phased construction utilising Possessions as required

COST DATA ASSUMPTIONS LIST - OPTION 6b			
The following assumptions have been made in the preparation of the costs contained in this report			
	Item	**Description**	**Assumption**
TRACK			
1	Scope of work	Extent of existing and new track is not clear from drawings provided	Assumed that all track shown red on Pway drawings is new
2	Scope of work	Extent of track to be lifted is not clear	Assumed that track to be lifted as shown on the detailed information provided for Option 6b is common to all options
3	Scope of work	Maintenance lines at South East	Assumed that all of these lines will be completed prior to station upgrade works commencing. Arbitrary line struck between completion of maintenance lines and commencement of station track upgrade - no information available

4	Scope of work	Maintenance shed	Assumed Maintenance shed has to be demolished and re-built
5	Signalling	No quantification possible	Assumed that there are no abnormal costs associated with the signalling for this project. In the absence of detailed information, a general allowance based on similar projects has been included
TELECOMS			
1	Scope of Work	No definition provided	Assumed that LLPA will link back to existing system. One extension to system per platform has been assumed
2	CIS Scope of Work	No definition provided	costs are based on rate per m2 from similar projects. Assumed there are no abnormal costs associated with this item
3	CCTV installation Scope of Work	No definition provided	Assumed that the existing CCTV system will be suitable for extension to suit the new platform layouts. No allowance made for upgrading existing system.
POWER SUPPLY			
1	Scope of Work	No definition provided	General allowance made for extending and upgrading current provision
2	Scope of Work	No definition provided	It has been assumed that outwith the general allowance included, there will be no requirement for major power infrastructure upgrading works to be carried out i.e. no new sub-station or extensive HV cabling to be provided
CIVILS			
1	Scope of Work	Existing platforms	Assumed all existing platforms are to be demolished and removed offsite
2	Scope of Work	Excavation	Assumed no existing materials are being reused
4	Scope of Work	Demolition	Assumes the lift bridge over canal is to be demolished
5	Scope of Work	Bridges	We have made an allowance for structural alterations and strengthening to existing arches
6	Scope of Work	Bridges	We have made an allowance for building the new railway bridge - over canal
7	Scope of Work	Bridges	We have made an allowance for a temporary bridge to accommodate existing services
8	Scope of Work	Newcomen Junction	Vehicles diverted elsewhere during bridge replacement works
9	Scope of Work	Newcomen Junction	Canal closed during construction works
10	Scope of Work	Newcomen Junction	Assumed crash deck/catch nets or similar to prevent debris falling into the canal

11	Scope of Work	Newcomen Junction	No details on the pumping units - all aspects have been assumed
12	Scope of Work	Newcomen Junction	Assumed no existing materials are being reused
13	Scope of Work	Newcomen Junction	Assumed dredging will be required to lower water level
14	Scope of Work	Newcomen Junction	Temporary bridge required to maintain existing services over the canal during road bridge replacement works
15	Scope of Work	Existing utilities	In the absence of any information we have included an allowance of £750,000 for dealing with existing utilities
16	Scope of Work	New platforms	The platforms are assumed to be of a typical front wall construction. • 665 x 1100mm solid concrete blockwork walls with cope. • Concrete strip foundations 1100 x 470mm. • Concrete support. • Between walls it is assumed that that it will be filled with 6N material. • Typical platform make up; 50mm dense bitumen base and 25mm bitumen wearing. course. • 400mm wide concrete tactile slabs to run the length of the platform.
17	Scope of Work	New platforms	Where the new platforms are to constructed between gap in the existing arched, we have assumed there will a new concrete slab supported on concrete beams on either side.
18	Scope of Work	New platforms	Lighting poles are assumed to be 15m centres.
19	Scope of Work	New platforms	Passenger information screens are assumed to be at 15m centres.
20	Scope of Work	New platforms	We have assumed any existing platforms will be re-surfaced.
BUILDINGS			
1	Scope of Work	Existing maintenance shed	Assumes existing maintenance shed is to remain
2	Scope of Work	Existing Offices on platform 4	Assumes a section of the station offices will be demolished and a new structural external wall built.
STATION WORKS			
1	Scope of Work	Footbridges	Assumes there will be no requirement for escalators, ticket barriers or ticket machines.
2	Scope of Work	Existing maintenance shed	Assumes existing maintenance shed is to be demolished and re-built

3	Scope of Work	New canopy's platforms	It is assumed new canopy's to platform 4/5 & 6/7
METHODOLGY			
1	Method of work	Sequence of construction	It is assumed that this Option will require the entire closure of Connolly station for a period of time

COST DATA ASSUMPTIONS LIST - OPTION 6d			
The following assumptions have been made in the preparation of the costs contained in this report			
	Item	**Description**	**Assumption**
TRACK			
1	Scope of work	Extent of existing and new track is not clear from drawings provided	Assumed that all track shown red on Pway drawings is new
2	Scope of work	Extent of track to be lifted is not clear	Assumed that track to be lifted as shown on the detailed information provided for Option 6b is common to all options
3	Scope of work	Maintenance lines at South East	Assumed that all of these lines will be completed prior to station upgrade works commencing. Arbitrary line struck between completion of maintenance lines and commencement of station track upgrade - no information available
4	Scope of work	Maintenance shed	Assumed Maintenance shed has to be demolished and re-built
5	Signalling	No quantification possible	Assumed that there are no abnormal costs associated with the signalling for this project. In the absence of detailed information, a general allowance based on similar projects has been included
TELECOMS			
1	Scope of Work	No definition provided	Assumed that LLPA will link back to existing system. One extension to system per platform has been assumed
2	CIS Scope of Work	No definition provided	costs are based on rate per m2 from similar projects. Assumed there are no abnormal costs associated with this item
3	CCTV installation Scope of Work	No definition provided	Assumed that the existing CCTV system will be suitable for extension to suit the new platform layouts. No allowance made for upgrading existing system.
POWER SUPPLY			
1	Scope of Work	No definition provided	General allowance made for extending and upgrading current provision
2	Scope of Work	No definition provided	It has been assumed that outwith the general allowance included, there will be no requirement for major power infrastructure upgrading works to be

			carried out i.e. no new sub-station or extensive HV cabling to be provided
CIVILS			
1	Scope of Work	Existing platforms	Assumed all existing platforms are to be demolished and removed offsite
2	Scope of Work	Excavation	Assumed no existing materials are being reused
3	Scope of Work	Bridges	We have made an allowance for structural alterations and strengthening to existing arches
4	Scope of Work	Newcomen Junction	Assumed the canal will be closed during construction works
5	Scope of Work	Newcomen Junction	Assumed crash deck/catch nets or similar to prevent debris falling into the canal
6	Scope of Work	Newcomen Junction	No details on the pumping units - all aspects have been assumed
7	Scope of Work	Newcomen Junction	Assumed no existing materials are being reused
8	Scope of Work	Newcomen Junction	Assumed dredging will be required to lower water level
9	Scope of Work	Existing utilities	In the absence of any information we have included an allowance of £750,000 for dealing with existing utilities
10	Scope of Work	New platforms	The platforms are assumed to be of a typical front wall construction. • 665 x 1100mm solid concrete blockwork walls with cope. • Concrete strip foundations 1100 x 470mm. • Concrete support. • Between walls it is assumed that that it will be filled with 6N material. • Typical platform make up; 50mm dense bitumen base and 25mm bitumen wearing. course. • 400mm wide concrete tactile slabs to run the length of the platform.
11	Scope of Work	New platforms	Where the new platforms are to constructed between gap in the existing arched, we have assumed there will a new concrete slab supported on concrete beams on either side.
12	Scope of Work	New platforms	Lighting poles are assumed to be 15m centres.
13	Scope of Work	New platforms	Passenger information screens are assumed to be at 15m centres.

14	Scope of Work	New platforms	We have assumed any existing platforms will be re-surfaced.
BUILDINGS			
1	Scope of Work	Existing maintenance shed	Assumed existing maintenance shed is to be demolished and re-built
2	Scope of Work	Existing Offices on platform 4	Assumed a section of the station offices will be demolished and a new structural external wall built.
STATION WORKS			
1	Scope of Work	Footbridges	Assumes there will be no requirement for escalators, ticket barriers or ticket machines.
2	Scope of Work	Existing maintenance shed	Assumes existing maintenance shed is to remain
3	Scope of Work	New canopy's platforms	It is assumed new canopy's to platform 4/5 & 6/7
METHODOLGY			
1	Method of work	Sequence of construction	It is assumed that this Option will require the entire closure of Connolly station for a period of time

COST DATA ASSUMPTIONS LIST - OPTION 8b			
The following assumptions have been made in the preparation of the costs contained in this report			
	Item	**Description**	**Assumption**
TRACK			
1	Scope of work	Extent of existing and new track is not clear from drawings provided	Assumed that all track shown red on Pway drawings is new
2	Scope of work	Extent of track to be lifted is not clear	Assumed that track to be lifted as shown on the detailed information provided for Option 6b is common to all options
3	Scope of work	Maintenance lines at South East	Assumed that all of these lines will be completed prior to station upgrade works commencing. Arbitrary line struck between completion of maintenance lines and commencement of station track upgrade - no information available
4	Signalling	No quantification possible	Assumed that there are no abnormal costs associated with the signalling for this project. In the absence of detailed information, a general allowance based on similar projects has been included
TELECOMS			
1	Scope of Work	No definition provided	Assumed that LLPA will link back to existing system. One extension to system per platform has been assumed
2	CIS Scope of Work	No definition provided	costs are based on rate per m2 from similar projects. Assumed there are no abnormal costs associated with this item

3	CCTV installation Scope of Work	No definition provided	Assumed that the existing CCTV system will be suitable for extension to suit the new platform layouts. No allowance made for upgrading existing system.
POWER SUPPLY			
1	Scope of Work	No definition provided	General allowance made for extending and upgrading current provision
2	Scope of Work	No definition provided	It has been assumed that outwith the general allowance included, there will be no requirement for major power infrastructure upgrading works to be carried out i.e. no new sub-station or extensive HV cabling to be provided
CIVILS			
1	Scope of Work	Existing platforms	Assumed all existing platforms are to be demolished and removed offsite
2	Scope of Work	Excavation	Assumed no existing materials are being reused
3	Scope of Work	Demolition	Assumed the railway bridge - over canal is to be demolished
4	Scope of Work	Demolition	Assumed the lift bridge over canal is to be demolished
5	Scope of Work	Bridges	We have made an allowance for structural alterations and strengthening to existing arches
6	Scope of Work	Bridges	We have made an allowance for building the new railway bridge - over canal
7	Scope of Work	Bridges	We have made an allowance for a temporary bridge to accommodate existing services
8	Scope of Work	Newcomen Junction	Assumed vehicles diverted elsewhere during bridge replacement works
9	Scope of Work	Newcomen Junction	Assumed canal closed during construction works
10	Scope of Work	Newcomen Junction	Assumed crash deck/catch nets or similar to prevent debris falling into the canal
11	Scope of Work	Newcomen Junction	No details on the pumping units - all aspects have been assumed
12	Scope of Work	Newcomen Junction	Assumed no existing materials are being reused
13	Scope of Work	Newcomen Junction	Assumed dredging will be required to lower water level
14	Scope of Work	Newcomen Junction	Temporary bridge required to maintain existing services over the canal during road bridge replacement works
15	Scope of Work	Existing utilities	In the absence of any information we have included an allowance of £750,000 for dealing with existing utilities

16	Scope of Work	New platforms	The platforms are assumed to be of a typical front wall construction. • 665 x 1100mm solid concrete blockwork walls with cope. • Concrete strip foundations 1100 x 470mm. • Concrete support. • Between walls it is assumed that that it will be filled with 6N material. • Typical platform make up; 50mm dense bitumen base and 25mm bitumen wearing. course. • 400mm wide concrete tactile slabs to run the length of the platform.
17	Scope of Work	New platforms	Where the new platforms are to constructed between gap in the existing arched, we have assumed there will a new concrete slab supported on concrete beams on either side.
18	Scope of Work	New platforms	Lighting poles are assumed to be 15m centres.
19	Scope of Work	New platforms	Passenger information screens are assumed to be at 15m centres.
20	Scope of Work	New platforms	Where the new platforms are to constructed between gap in the existing arched, we have assumed there will a new concrete slab supported on concrete beams on either side.
21	Scope of Work	New platforms	footbridge to extend from Platform 1 -8; 4no lifts and 5no stair cases.
22	Scope of Work	New platforms	It is assumed new canopy's to platform 4/5, 6/7 & 8
23	Scope of Work	New platforms	Construction of platform 8. • To enable the construction of platform 8 we have assumed that new brickwork columns will be constructed at 5 meter centres. • We have assumed that existing plate girder underbridge will be demolished and new retaining wall will be built. The arches and behind the retaining wall will be backfilled. • We assumed that the • We have made an allowance for piling for the brickwork arches.
24	Scope of Work	New platforms	We have allowed for the courtyard to the garages to be bridged with a concrete deck; allowance of 100m2.

25	Scope of Work	New platforms	We have allowed for new ventilation to the courtyard/ garages; allowance of 100m2.
BUILDINGS			
1	Scope of Work	Existing maintenance shed	Assumes existing maintenance shed demolished and rebuilt
2	Scope of Work	"Post Office" building	Assumes the back on Irish rail offices is to be demolished and new structural wall built
3	Scope of Work	Burnt out House	Assumes the house is to be demolished
STATION WORKS			
1	Scope of Work	Station works	Assumes there will be no requirement for escalators, ticket barriers or ticket machines.
2	Scope of Work	Existing maintenance shed	Assumes existing maintenance shed is to remain
3	Scope of Work	New canopy's platforms	It is assumed new canopy's to platform 4/5 & 6/7
LAND PURCHASE			
1	Purchase of Derelict House at Throat	Derelict house at the location of the throat will require to be demolished to allow the throat to be extended	Assumed that this will be the subject of a Compulsory Purchase Order
2	Purchase of Car Park adjacent to the arches	The car park spaces at the arches will require to be purchased to facilitate the construction of the structural supports for the bridge extension	Assumed that this will be the subject of a Compulsory Purchase Order
3	Purchase of "Post Office" building	The building known as the "Post Office" building will require to be purchased in order that the gable nearest the railway can be demolished and re-built further from the railway to facilitate the extension of the throat	Assumed that this will be the subject of a Compulsory Purchase Order
4	Purchase of "garages" building	Garages located in the arched below the tracks	Assumed that this land is owned by the client. No allowances have been made for decanting tenants or providing tenants with new accommodation.
METHODOLGY			
1	Method of work	Sequence of construction	It is assumed that this work can be carried out as a phased construction utilising Possessions as required

COST DATA ASSUMPTIONS LIST - OPTION 8d

The following assumptions have been made in the preparation of the costs contained in this report			
	Item	**Description**	**Assumption**
TRACK			
1	Scope of work	Extent of existing and new track is not clear from drawings provided	Assumed that all track shown red on Pway drawings is new
2	Scope of work	Extent of track to be lifted is not clear	Assumed that track to be lifted as shown on the detailed information provided for Option 6b is common to all options
3	Scope of work	Maintenance lines at South East	Assumed that all of these lines will be completed prior to station upgrade works commencing. Arbitrary line struck between completion of maintenance lines and commencement of station track upgrade - no information available
4	Signalling	No quantification possible	Assumed that there are no abnormal costs associated with the signalling for this project. In the absence of detailed information, a general allowance based on similar projects has been included
TELECOMS			
1	Scope of Work	No definition provided	Assumed that LLPA will link back to existing system. One extension to system per platform has been assumed
2	CIS Scope of Work	No definition provided	costs are based on rate per m2 from similar projects. Assumed there are no abnormal costs associated with this item
3	CCTV installation Scope of Work	No definition provided	Assumed that the existing CCTV system will be suitable for extension to suit the new platform layouts. No allowance made for upgrading existing system.
POWER SUPPLY			
1	Scope of Work	No definition provided	General allowance made for extending and upgrading current provision
2	Scope of Work	No definition provided	It has been assumed that outwith the general allowance included, there will be no requirement for major power infrastructure upgrading works to be carried out i.e. no new sub-station or extensive HV cabling to be provided
CIVILS			
1	Scope of Work	Existing platforms	Assumed all existing platforms are to be demolished and removed offsite
2	Scope of Work	Excavation	Assumed no existing materials are being reused
3	Scope of Work	Bridges	We have made an allowance for structural alterations and strengthening to existing arches

4	Scope of Work	Newcomen Junction	Assumed vehicles diverted elsewhere during bridge replacement works
5	Scope of Work	Newcomen Junction	Assumed canal closed during construction works
6	Scope of Work	Newcomen Junction	Assumed crash deck/catch nets or similar to prevent debris falling into the canal
7	Scope of Work	Newcomen Junction	No details on the pumping units - all aspects have been assumed
8	Scope of Work	Newcomen Junction	Assumed no existing materials are being reused
9	Scope of Work	Newcomen Junction	Assumed dredging will be required to lower water level
10	Scope of Work	Newcomen Junction	Temporary bridge required to maintain existing services over the canal during road bridge replacement works
11	Scope of Work	Existing utilities	In the absence of any information we have included an allowance of £750,000 for dealing with existing utilities
12	Scope of Work	New platforms	The platforms are assumed to be of a typical front wall construction. • 665 x 1100mm solid concrete blockwork walls with cope. • Concrete strip foundations 1100 x 470mm. • Concrete support. • Between walls it is assumed that that it will be filled with 6N material. • Typical platform make up; 50mm dense bitumen base and 25mm bitumen wearing. course. • 400mm wide concrete tactile slabs to run the length of the platform.
13	Scope of Work	New platforms	Where the new platforms are to constructed between gap in the existing arched, we have assumed there will a new concrete slab supported on concrete beams on either side.
14	Scope of Work	New platforms	Lighting poles are assumed to be 15m centres.
15	Scope of Work	New platforms	Passenger information screens are assumed to be at 15m centres.
16	Scope of Work	New platforms	Where the new platforms are to constructed between gap in the existing arched, we have assumed there will a new concrete slab supported on concrete beams on either side.
17	Scope of Work	New platforms	footbridge to extend from Platform 1 -8; 4no lifts and 5no stair cases.

18	Scope of Work	New platforms	It is assumed new canopy's to platform 4/5, 6/7 & 8
19	Scope of Work	New platforms	Construction of platform 8. • To enable the construction of platform 8 we have assumed that new brickwork columns will be constructed at 5 meter centres. • We have assumed that existing plate girder underbridge will be demolished and new retaining wall will be built. The arches and behind the retaining wall will be backfilled. • We assumed that the • We have made an allowance for piling for the brickwork arches.
20	Scope of Work	New platforms	We have allowed for the courtyard to the garages to be bridged with a concrete deck; allowance of 100m2.
21	Scope of Work	New platforms	We have allowed for new ventilation to the courtyard/ garages; allowance of 100m2.
BUILDINGS			
1	Scope of Work	Existing maintenance shed	Assumes existing maintenance shed demolished and rebuilt
2	Scope of Work	"Post Office" building	Assumes the back on Irish rail offices is to be demolished and new structural wall built
3	Scope of Work	Burnt out House	Assumes the house is to be demolished
STATION WORKS			
1	Scope of Work	Station works	Assumes there will be no requirement for escalators, ticket barriers or ticket machines.
2	Scope of Work	Existing maintenance shed	Assumes existing maintenance shed is to remain
3	Scope of Work	New canopy's platforms	It is assumed new canopy's to platform 4/5 & 6/7
LAND PURCHASE			
1	Purchase of Derelict House at Throat	Derelict house at the location of the throat will require to be demolished to allow the throat to be extended	Assumed that this will be the subject of a Compulsory Purchase Order
2	Purchase of Car Park adjacent to the arches	The car park spaces at the arches will require to be purchased to facilitate the construction of the structural supports for the bridge extension	Assumed that this will be the subject of a Compulsory Purchase Order

3	Purchase of "Post Office" building	The building known as the "Post Office" building will require to be purchased in order that the gable nearest the railway can be demolished and re-built further from the railway to facilitate the extension of the throat	Assumed that this will be the subject of a Compulsory Purchase Order
4	Purchase of "garages" building	Garages located in the arched below the tracks	Assumed that this land is owned by the client. No allowances have been made for decanting tenants or providing tenants with new accommodation.
METHODOLGY			
1	Method of work	Sequence of construction	It is assumed that this work can be carried out as a phased construction utilising Possessions as required

3.5 Exclusions

The following table lists the specific exclusions from the option cost estimates

EXCLUSIONS

The following Items are EXCLUDED from the reported costs

Item	Element	Description
1	VAT	No allowance is made in the costs for VAT
2	Power Infrastructure	No allowance is made for any local electrical power infrastructure upgrades by Statutory Authorities required as a result of the station infrastructure upgrade works
3	Inflation	Costs are based on a commencement in 1Q 2019 no allowance has been made for inflationary effects beyond these allowances
4	Re-location costs	No allowance has been made for any costs associated with relocating staff/equipment from existing premises either to new premises or to alternative existing premises
5	Re-location costs	Where an option includes for the construction of a new facility, no costs are included in respect of either the transfer of or purchase of new loose furniture, fittings or equipment
6	Re-location costs	The cost of re-locating any plant machinery or equipment from any of the existing facilities to be vacated to a new location is excluded
7	Rates, Taxes and Insurance	The costs associated with any additional rates, taxes or insurance as a result of relocating to alternative premises is specifically excluded
8	Traffic Management	The cost of any traffic management measures required in relation to the closure of roads, footpaths or car parks is excluded
9	Legal Costs	No allowance has been made for any costs associated with legal fees, conveyancing etc.
10	Land Acquisition	With the exception of the requirements specific to Option 8b and 8d, No allowance has been made for any costs associated with Land Acquisition
11	Archaeological works	No allowance has been included in respect of any work associated with Archaeological findings or dealing with uncovered munitions
12	Contaminated land	No allowance has been included for constructing on or remediating any contaminated land which may be uncovered.
13	Ordinance	No allowance has been included in respect of dealing with any unexploded ordinance which may be uncovered
14	Finance costs	No allowance has been made in respect of financing costs

EXCLUSIONS

The following Items are EXCLUDED from the reported costs

Item	Element	Description
15	Planning / Building / Local Authority Approvals	No allowance has been made in respect of any costs associated with obtaining construction approval e.g. Planning Charges, Building Control fees Planning Consultation costs, Road Closure requests etc.
16	Ecological mitigation measures	No allowance has been made in respect of any costs in respect of any ecological mitigation measures which may prove necessary
17	Rail infrastructure outwith the scope of the project	No allowance has been included in respect of any enabling work which may be required to other sections of the rail infrastructure to facilitate the proposals at Connolly Station / Newcomen Junction (e.g. Glasnevin)
18	Existing Station Facilities	The cost of any upgrading required to the existing station facilities beyond that necessary for the platform and trail re-alignments is specifically excluded
19	Landowner Interface issues	No allowance has been made for any costs associated with interfaces with adjacent landowners
20	Third Party costs	No allowance has been included for costs in respect of payments to third parties e.g. access consents etc.

3.6 Class of Estimate

The classification of the above estimate in relation to the Jacobs SOP 211 is a Class 4 estimate with confidence levels of **-30%** and **+40%**. The classification table is shown below:-

	Primary Characteristics	*Secondary Characteristics*			
ESTIMATE CLASS	**LEVEL OF PROJECT DEFINITION** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**AACE EXPECTED ACCURACY RANGE** Typical variation in low and high ranges (a)	**JACOBS EXPECTED OVERALL ACCURACY RANGE**
Class 5 (Order of Magnitude)	**0% to 2%**	Concept Screening	Capacity Factored, Parametric Models, Judgement or Analogy	**L: -20% to -50% H: +30% to +100%**	**- 50% to + 50%**
Class 4 (Preliminary)	**1% to 15%**	Study or Feasibility	Equipment Factored or Parametric Models	**L: -15% to -30% H: +20% to +50%**	**- 30% to + 40%**
Class 3 (Early Budget)	**10% to 40%**	Budget, Authorisation or Control	Semi-detailed Unit Costs with Assembly Level Line Items	**L: -10% to -20% H: +10% to +30%**	**- 20% to + 30%**
Class 2 (Budget/Control)	**30% to 70%**	Control or Bid/Tender	Detailed Unit Cost with Forced Detailed Takeoff	**L: -5% to -15% H: +5% to +20%**	**- 10% to + 15%**
Class 1 (Definitive/ Construction)	**50% to 100%**	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Takeoff	**L: -3% to -10% H: +3% to +15%**	**- 5% to + 5%**

Appendix E. Environmental Assessment of Potential Options

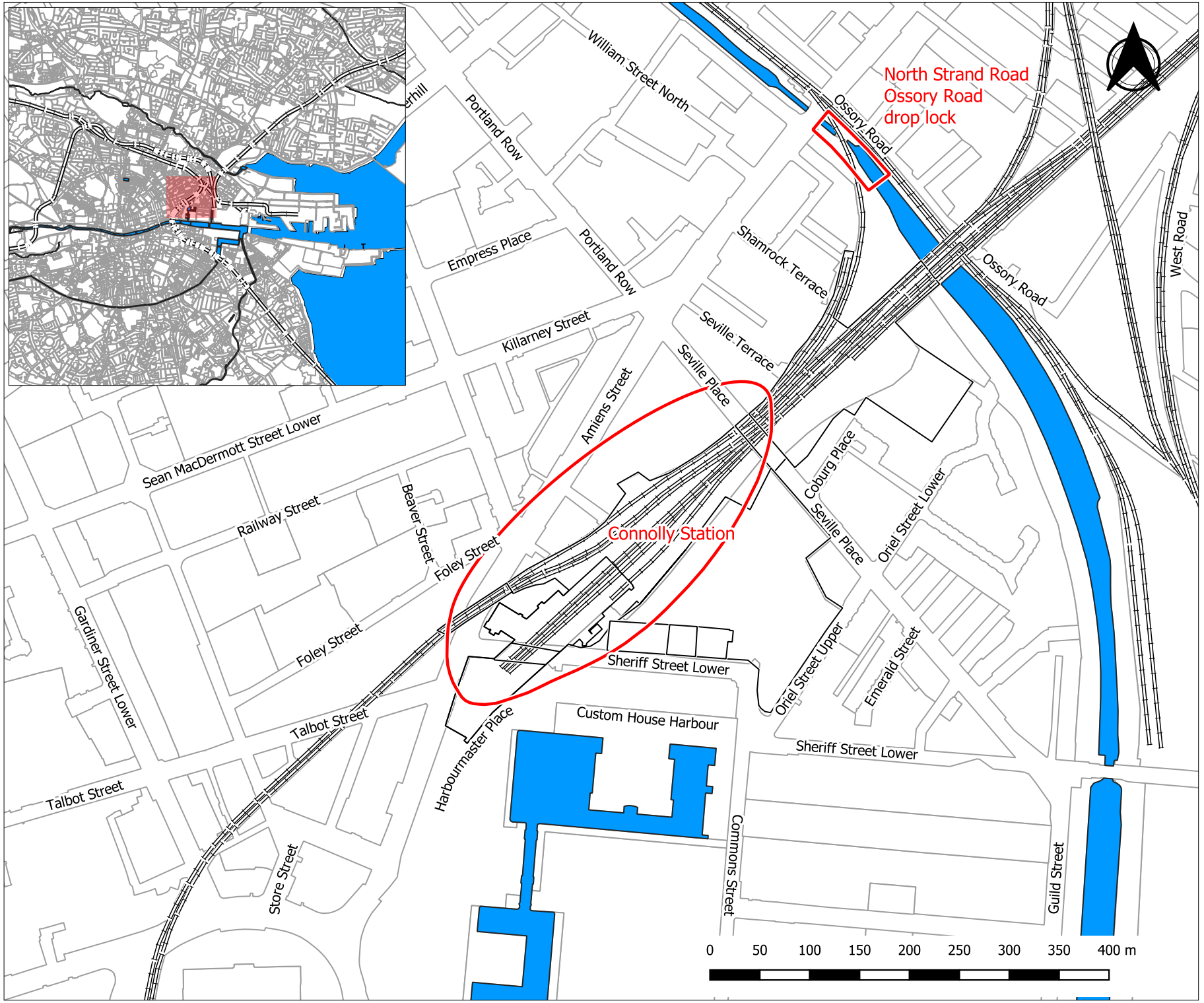

FIGURE 1

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

- Rail Line
- Assessment Area
- Water
- Connolly Station

NOTES

Background mapping: Open Street Maps & DCC Development Plan
: https://data.smartdublin.ie/dataset/development-plans-

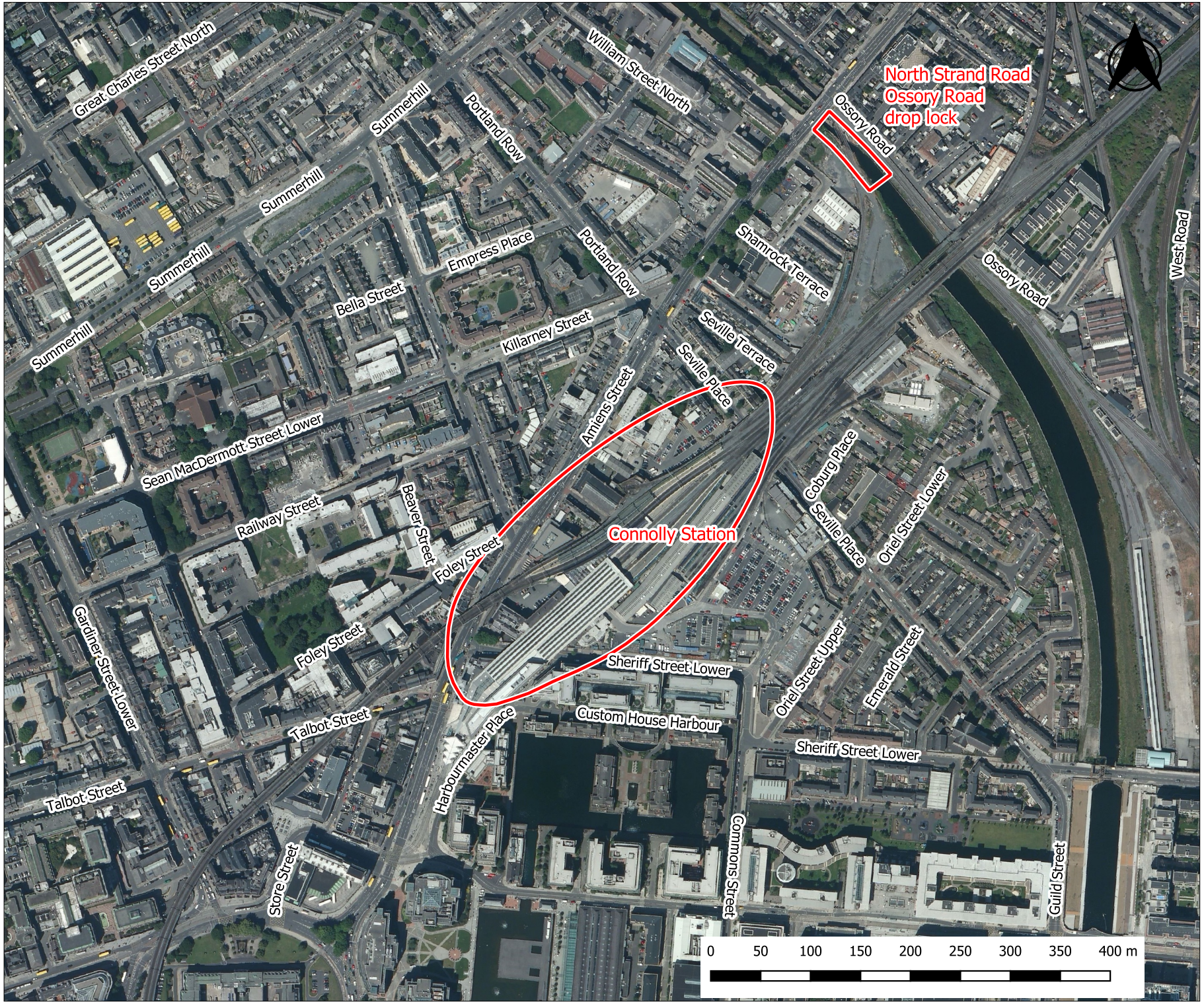

FIGURE 2

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS
BING IMAGES

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

Assessment Area

NOTES

Background mapping: Open Street Maps & BING satellite Images

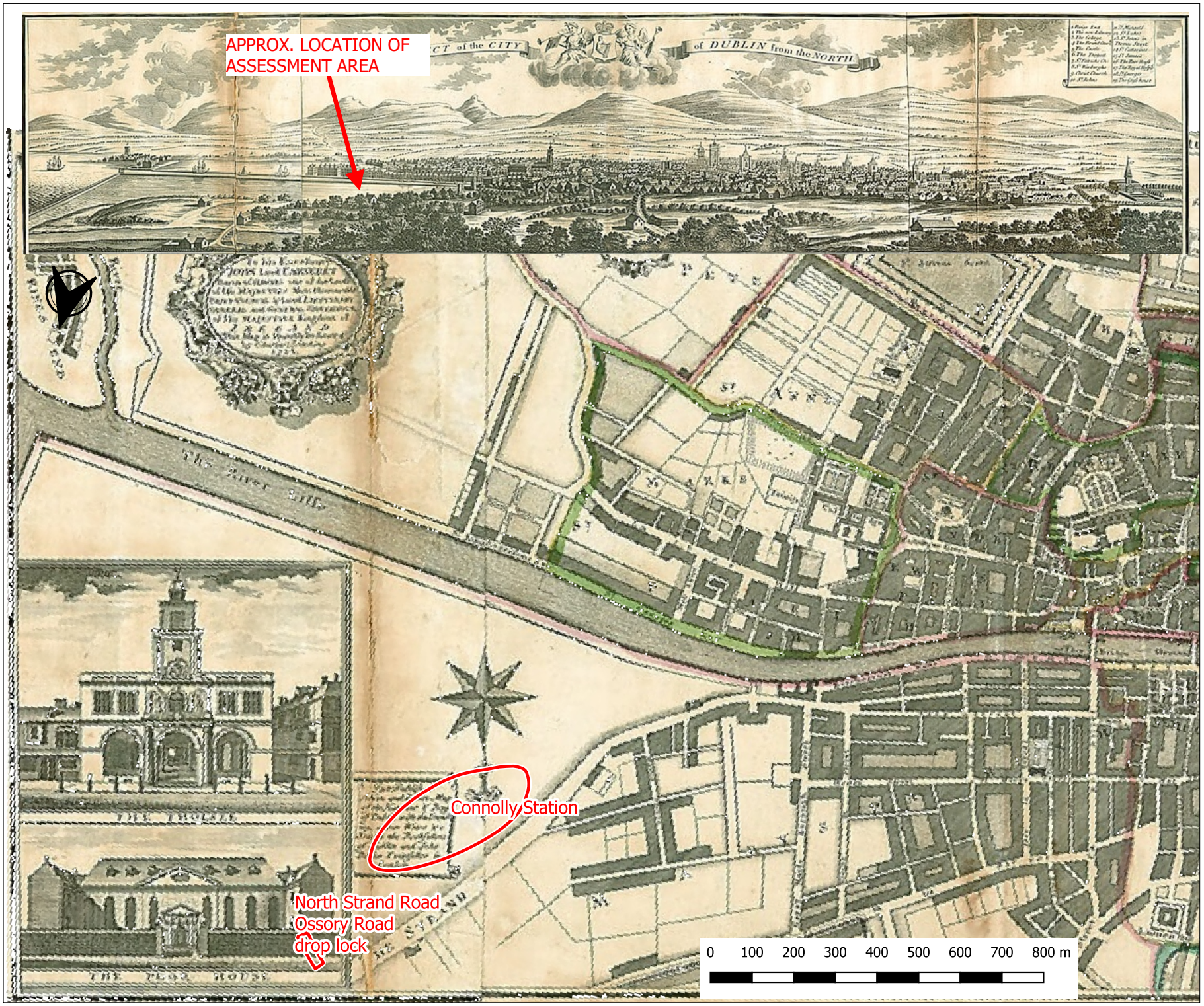

FIGURE 3

CONNOLLY STATION ENHANCEMENT OPTIONS STUDY
EXTRACT OF BROOKING'S A MAP OF DUBLIN 1728

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

Works Areas

Assessment Area

NOTES

Background mapping: Extract of Charles Brooking's 'A map of the city and suburbs of Dublin', 1728, available at https://www.iberlibro.com/servlet/

FIGURE 4

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS
ROCQUE'S MAP OF DUBLIN 1756

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

Assessment Area

NOTES

Background mapping: Rocque, J. 1756. An Exact Survey of the City and Suburbs of Dublin. [Online]. Available at: https://iiif.lib.harvard.edu/manifests/view/ids:10135315

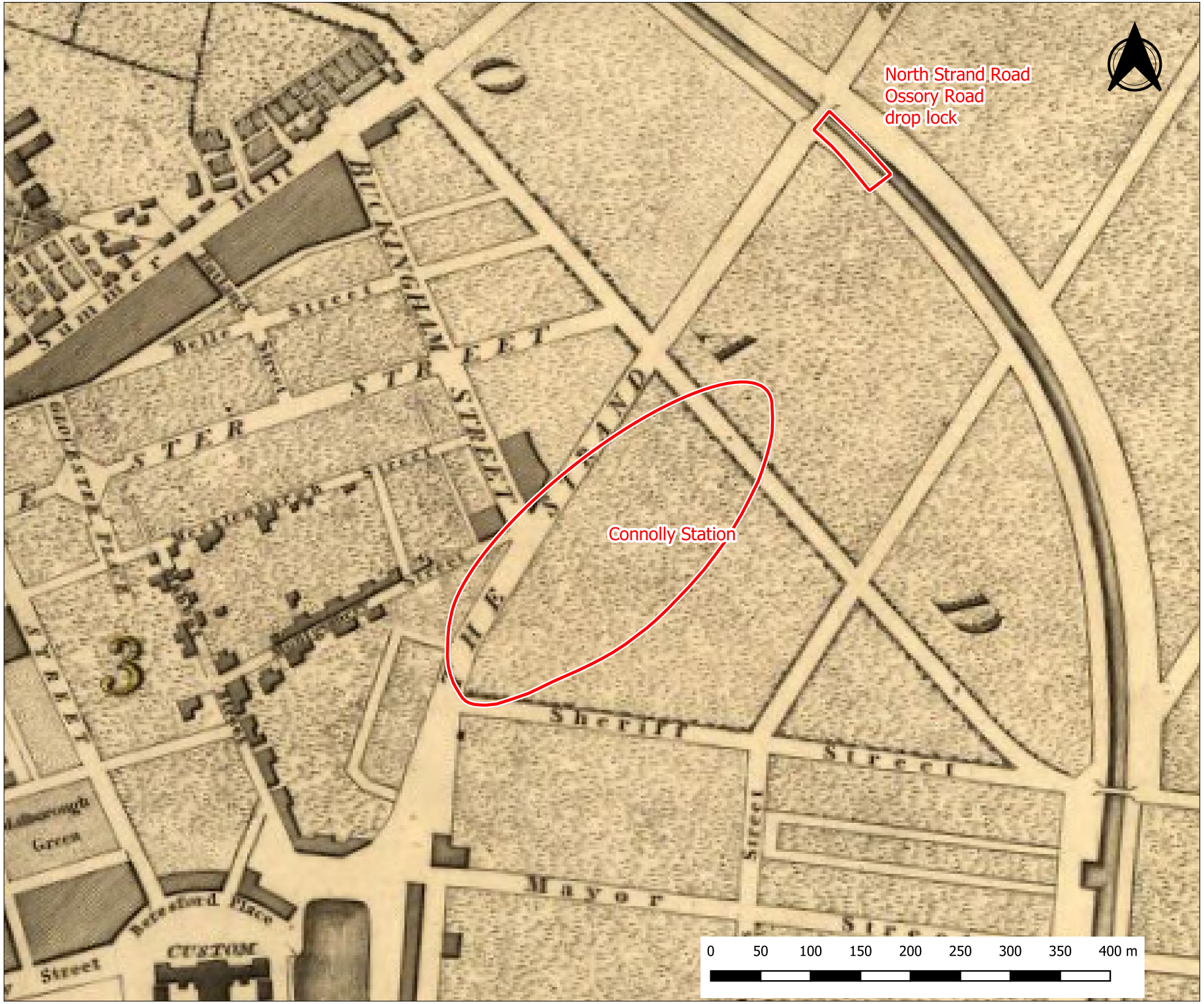

FIGURE 5

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS
FADEN'S MAP OF DUBLIN 1797

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

Assessment Area

NOTES

Background mapping: Faden, W. et al. 1797. A plan of the city of Dublin : as surveyed for the use of the division[a]l justices ... 1797. image, London : Sold by W. Allen & J. Archer. [Online]. Available at: https://www.loc.gov/item/2004626017/ [Accessed 5 March 2019].

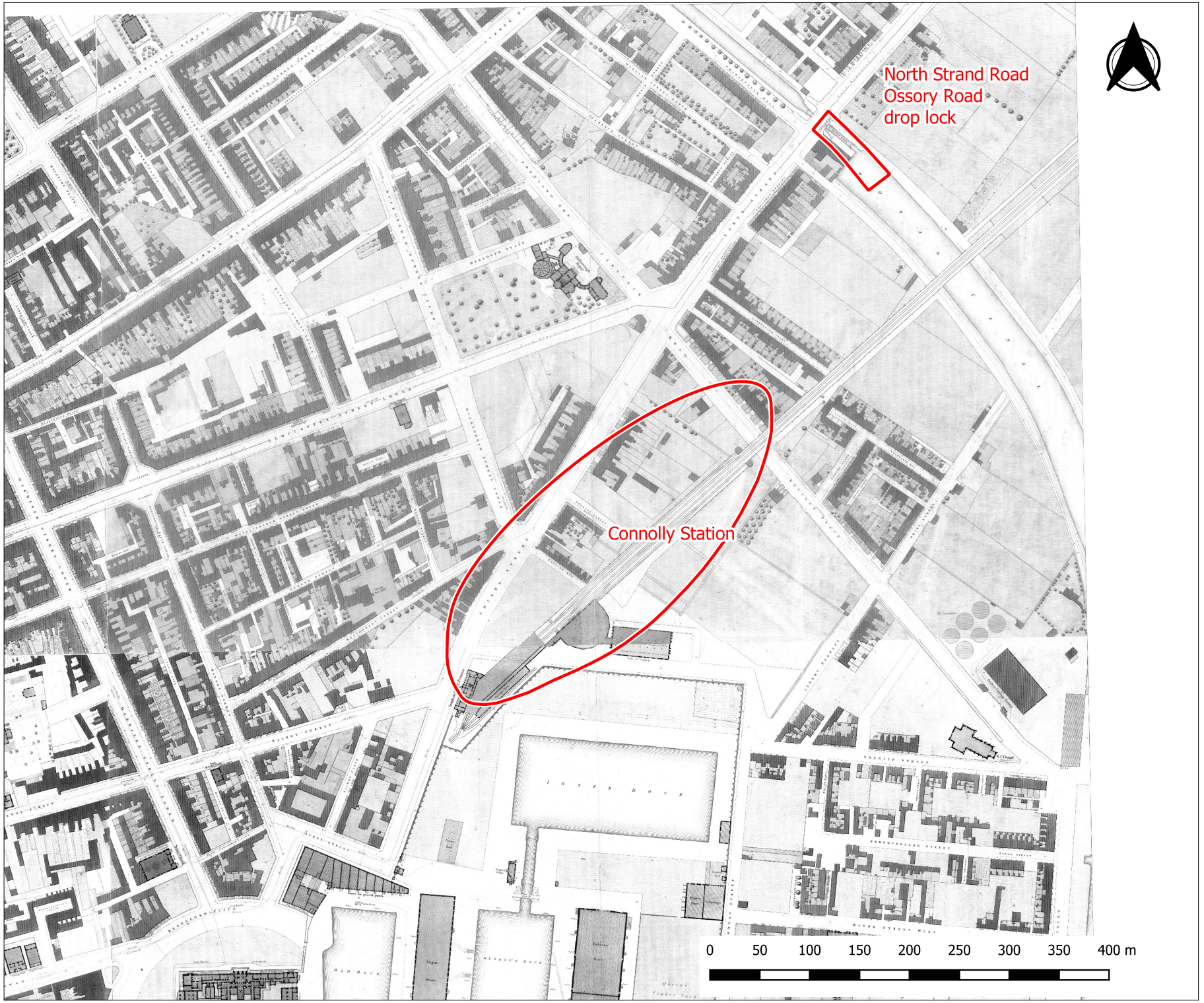

FIGURE 6

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS
ORDNANCE SURVEY OF IRELAND
TOWN PLAN (1:1056)
SURVEYED 1838,
PUBLISHED 1847

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

Assessment Area

NOTES

Background mapping: Ordnance Survey of Ireland. 1847. Town Plan 1:1056, City of Dublin: sheets 8, 9, 14, 15 (surveyed 1838). Dublin, Ireland : Ordnance Survey of Ireland.

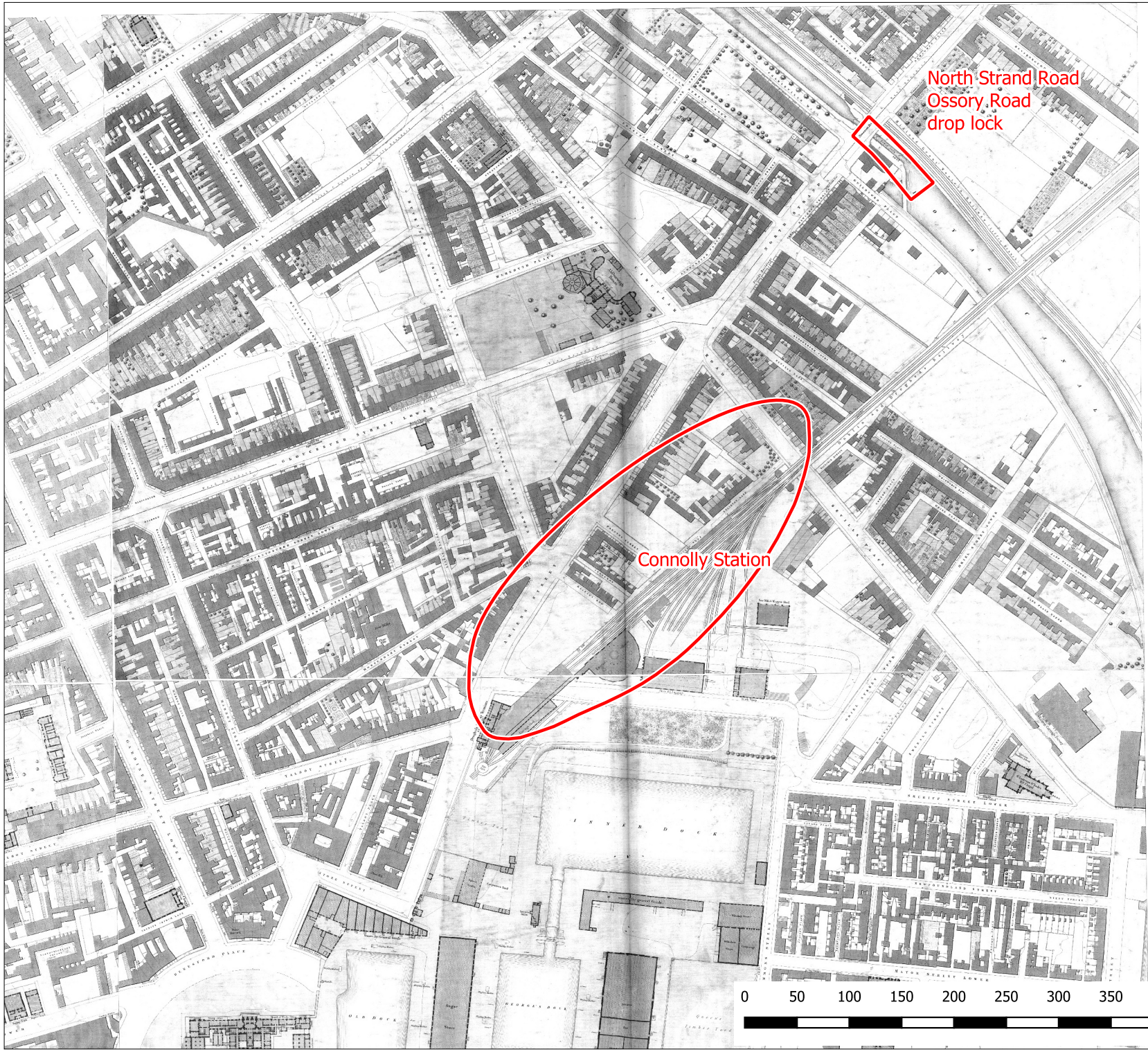

FIGURE 7

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS
ORDNANCE SURVEY OF IRELAND
TOWN PLAN (1:1056)
ENGRAVED 1864

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

Assessment Area

NOTES

Background mapping: Ordnance Survey of Ireland. 1864. Town Plan 1:1056, City of Dublin: sheet 8, 9, 14, 15. 2nd ed. Dublin, Ireland : Ordnance Survey of Ireland.

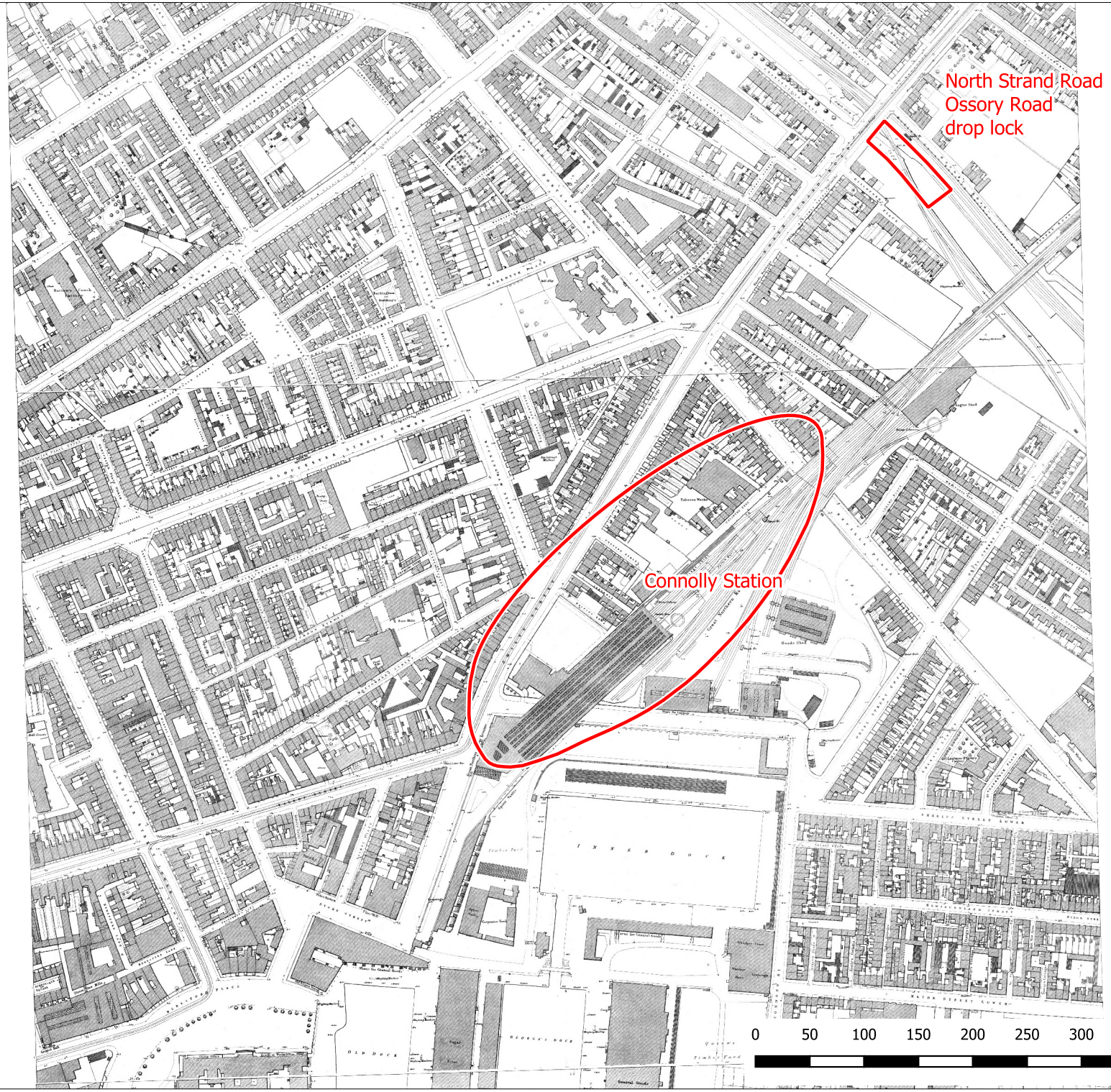

FIGURE 8

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS
ORDNANCE SURVEY OF IRELAND
TOWN PLAN (1:1056)
ENGRAVED 1888

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

Assessment Area

NOTES

Background mapping: Ordnance Survey of Ireland. 1888. Town Plan 1:1056, City of Dublin: sheet 38, 48, 58. 3rd ed. Dublin, Ireland : Ordnance Survey of Ireland.

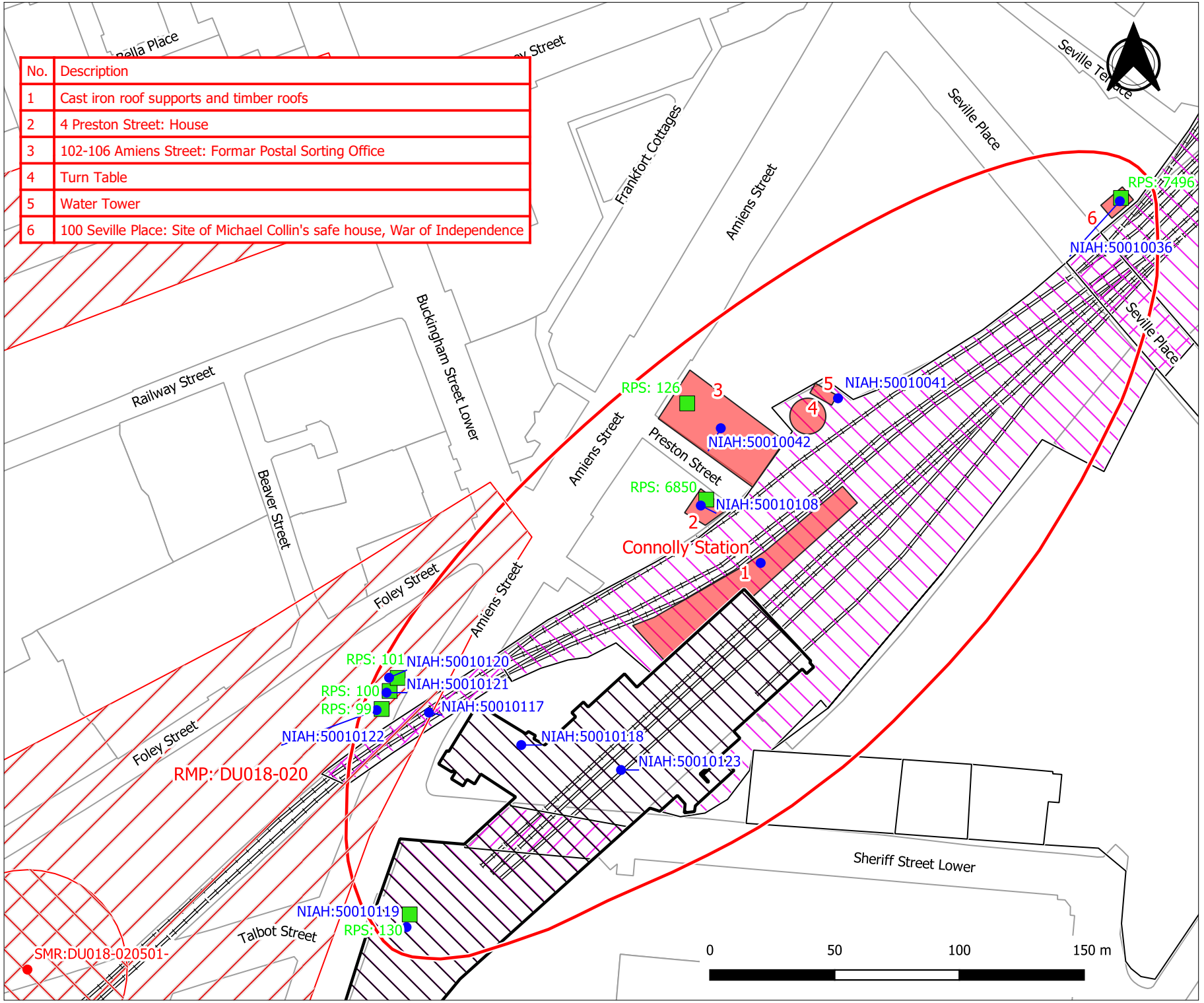

FIGURE 9

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS
CONNOLLY STATION AREA
RECORDED ARCHAEOLOGY
AND ARCHITECTURE

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

- Assessment Area
- Features
- Brick Arches
- Bridge
- Connolly Station
- NIAH
- RPS
- SMR Zone
- SMR
- RMP DU018-20

NOTES

Background mapping: Street names from Open Street Maps; RMP, RPS and street outline from Dublin City Council: https://data.smartdublin.ie/dataset/development-plans-dublin-city. SMR and NIAH from www.archaeology.ie.

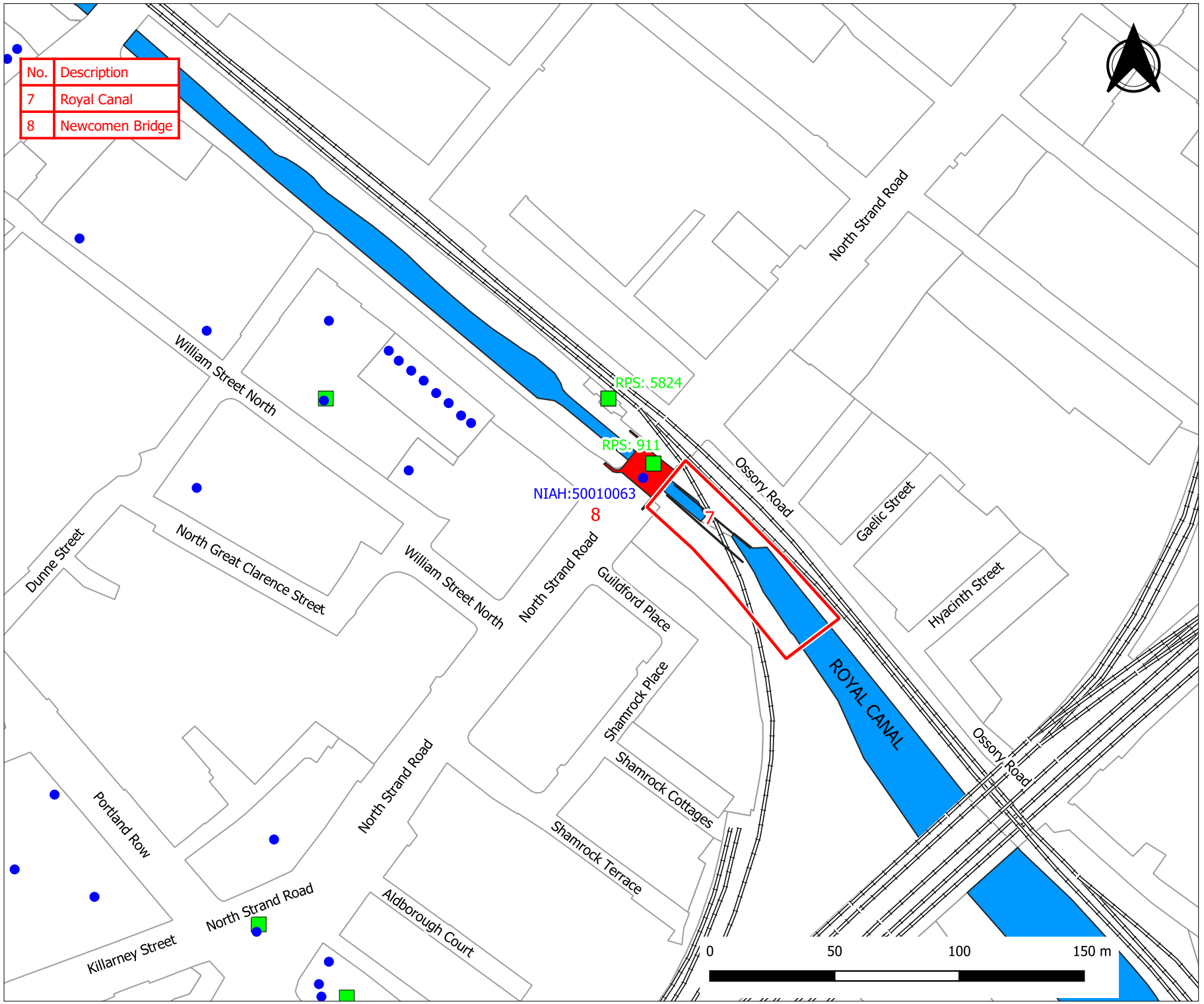

FIGURE 10

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS
NEWCOMEN BRIDGE/ OSSORY ROAD DROP LOCK AREA
RECORDED ARCHAEOLOGY AND ARCHITECTURE

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

- Assessment Area
- Features
- Brick Arches
- Bridge
- NIAH
- RPS

NOTES

Background mapping: Street names from Open Street Maps; RMP, RPS and street outline from Dublin City Council: https://data.smartdublin.ie/dataset/development-plans-dublin-city. NIAH from www.archaeology.ie.

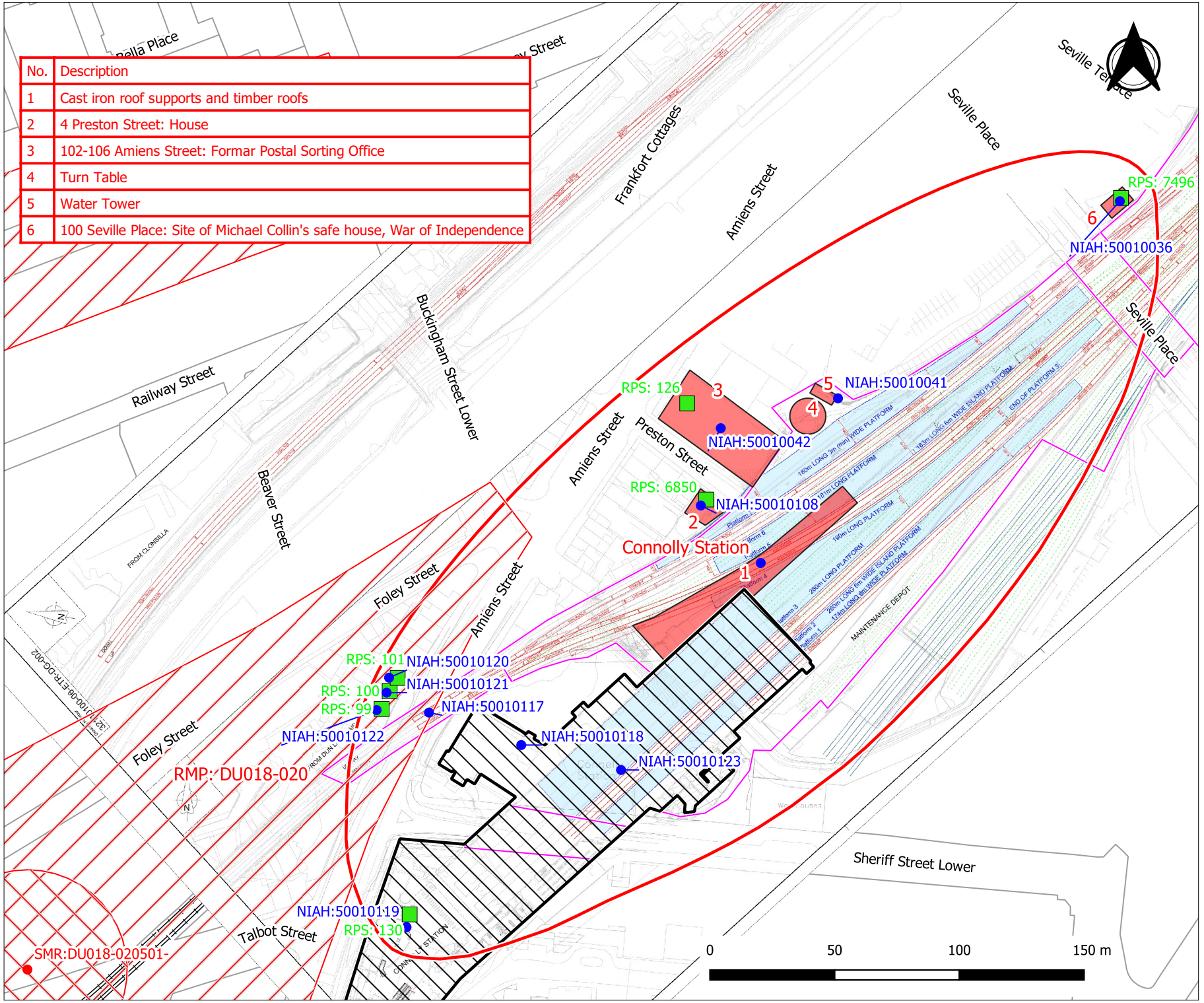

FIGURE 11

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS
CONNOLLY STATION AREA
OPTION 6B

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

- Assessment Area
- Features
- Brick Arches
- Connolly Station
- NIAH
- RPS
- SMR Zone
- SMR
- RMP DU018-20

NOTES

Background mapping: Street names from Open Street Maps; RMP, RPS and street outline from Dublin City Council: https://data.smartdublin.ie/dataset/development-plans-dublin-city. SMR and NIAH from www.archaeology.ie.

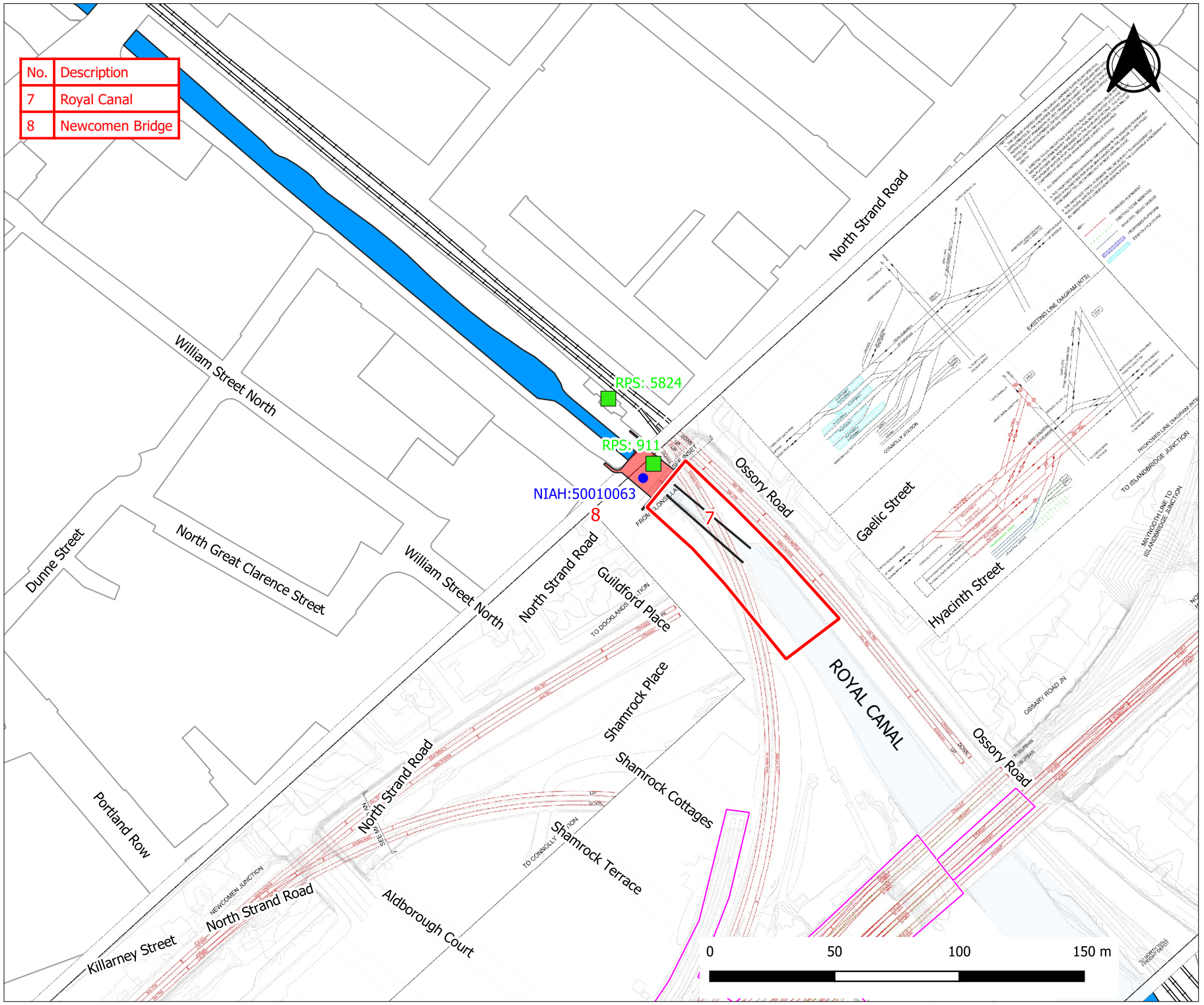

FIGURE 12

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS
NEWCOMEN BRIDGE/ OSSORY
ROAD DROP LOCK AREA
OPTION 6B

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

- Assessment Area
- Features
- Brick Arches
- NIAH
- RPS

NOTES

Background mapping: Street names from Open Street Maps; RMP, RPS and street outline from Dublin City Council: https://data.smartdublin.ie/dataset/development-plans-dublin-city. NIAH from www.archaeology.ie.

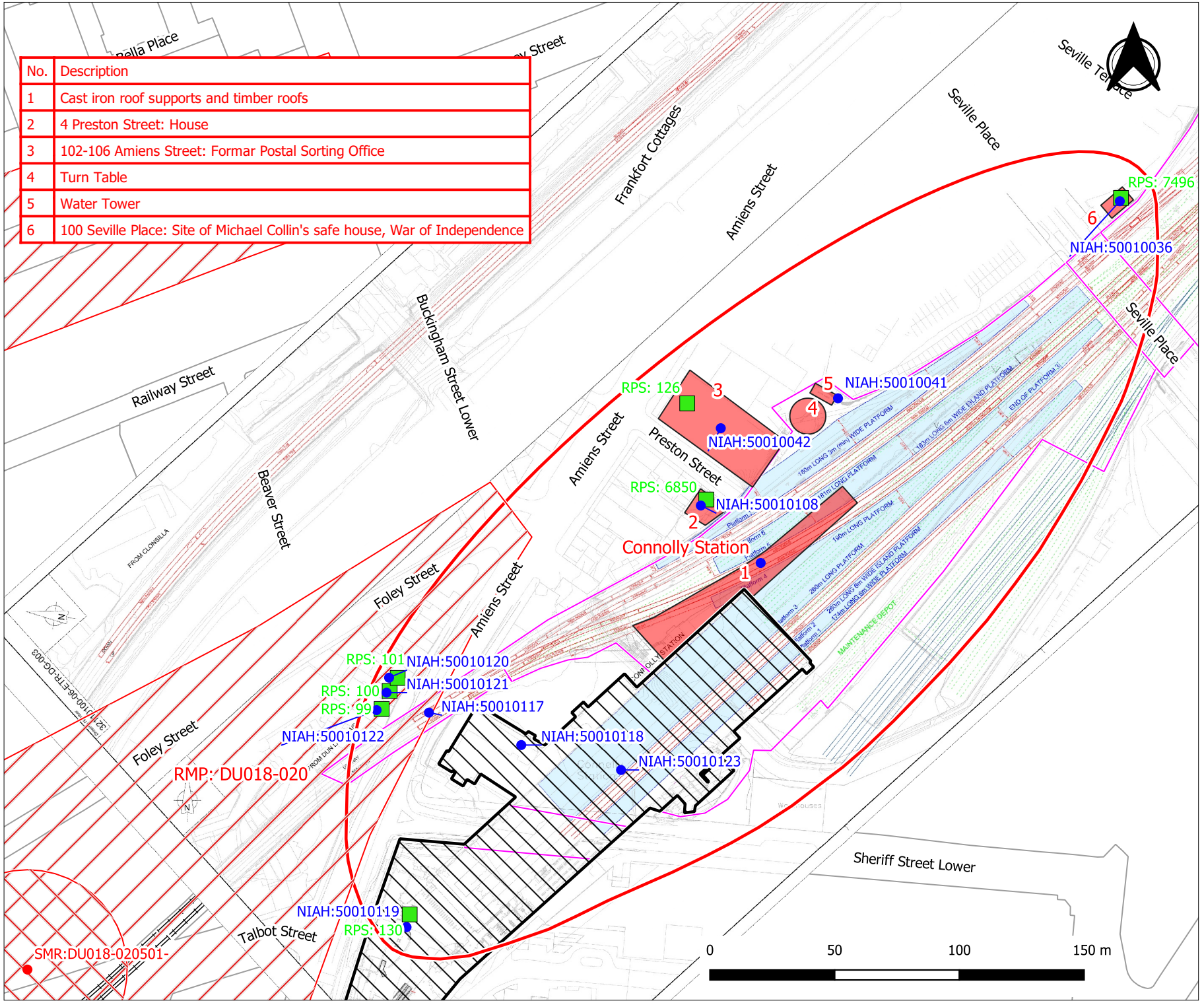

FIGURE 13

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS
CONNOLLY STATION AREA
OPTION 6D

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

- Assessment Area
- Features
- Brick Arches
- Connolly Station
- NIAH
- RPS
- SMR Zone
- SMR
- RMP DU018-20

NOTES

Background mapping: Street names from Open Street Maps; RMP, RPS and street outline from Dublin City Council: https://data.smartdublin.ie/dataset/development-plans-dublin-city. SMR and NIAH from www.archaeology.ie.

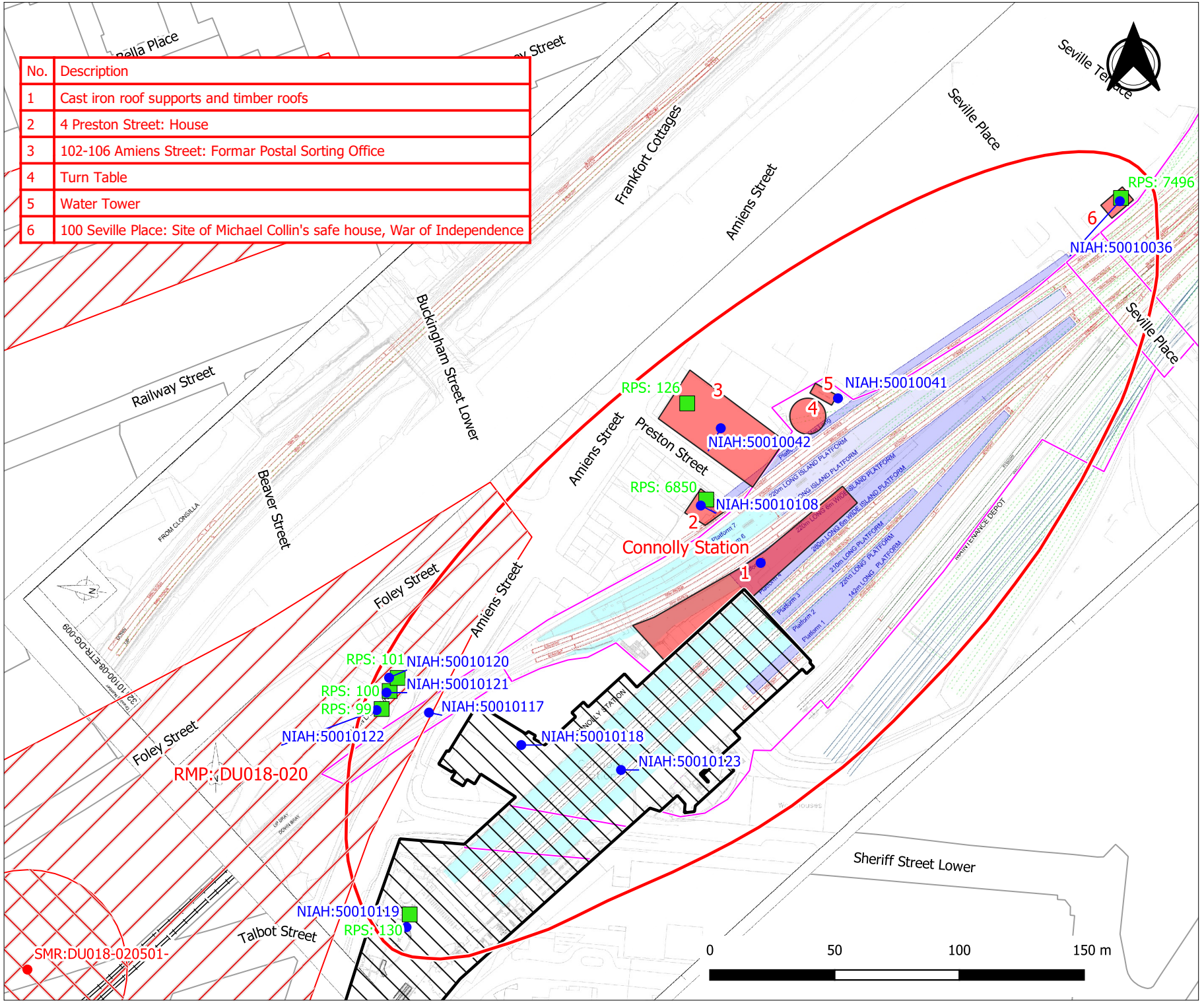

FIGURE 14

CONNOLLY STATION
ENHANCEMENT OPTIONS STUDY
ASSESSMENT AREAS
CONNOLLY STATION AREA
OPTION 8D

AMS Ref. Number: J2014
Jacobs Ref. Number: 32110100

Legend

- Assessment Area
- Features
- Brick Arches
- Connolly Station
- NIAH
- RPS
- SMR Zone
- SMR
- RMP DU018-20

NOTES

Background mapping: Street names from Open Street Maps; RMP, RPS and street outline from Dublin City Council: https://data.smartdublin.ie/dataset/development-plans-dublin-city. SMR and NIAH from www.archaeology.ie.