

Forth Replacement Crossing

Queensferry Junction Technical Assessment Summary Report

May 2010

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1 Introduction

Towards the end of 2008, the developing preliminary design for the Forth Replacement Crossing (FRC) indicated the requirement for a junction located directly to the south of South Queensferry. The intended purpose of the junction was to provide access from the proposed mainline to South Queensferry and the surrounding environs and to permit access to the Forth Road Bridge for public transport. As the design for the FRC project evolved in early 2009, the refinement of existing strategies necessitated a review of the proposed junction arrangements.

The need for the review was further emphasised by feedback from the Public Exhibitions undertaken in January 2009 and consultation with the Local Authorities and Community Councils. The feedback from the Public Exhibitions is collated in a separate report titled 'Public Information Exhibitions: Feedback and Outcome Report', published in June 2009.

As a consequence of this review, the junction was repositioned to the west of Queensferry as shown in Figure 1 below:

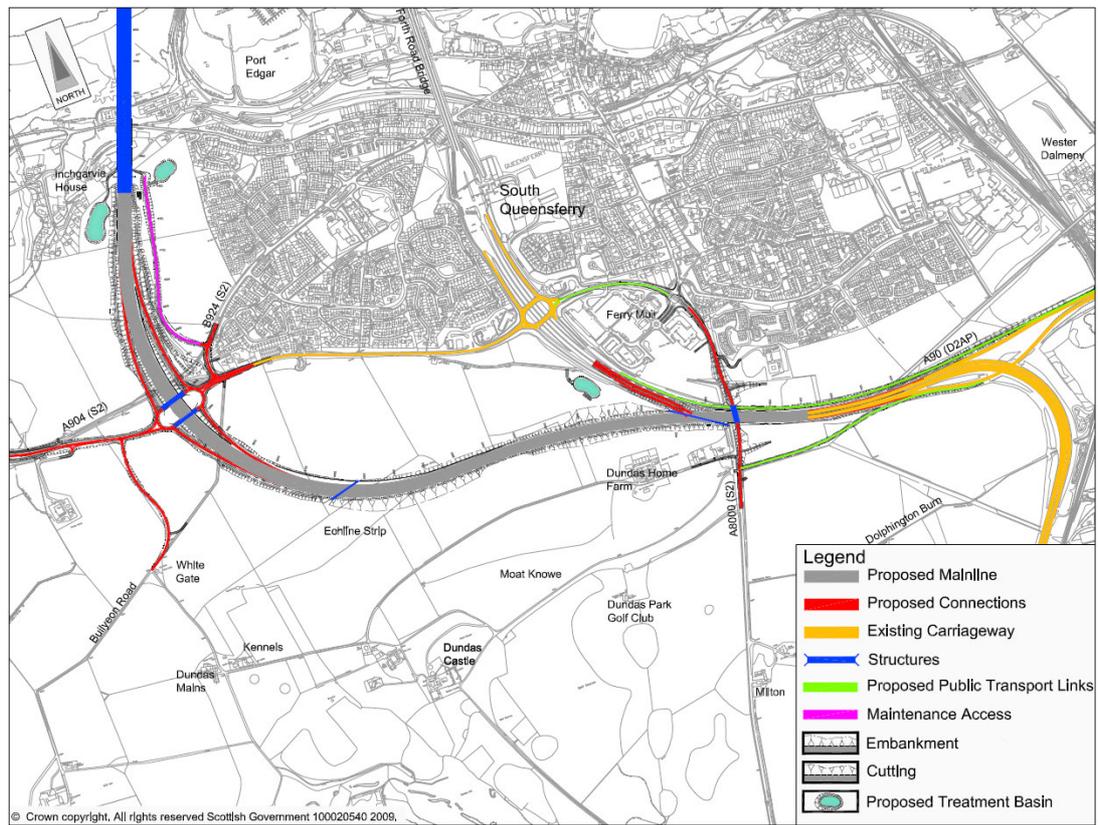


Figure 1: Proposed Queensferry Junction

1.1 Purpose of the Technical Assessment Summary Report

The purpose of this report is to summarise the technical assessment work that has been undertaken to inform and confirm the decision to reposition Queensferry Junction to the west of South Queensferry.

This report is similar in format to that used in the initial Route Corridor Options Review, as published in March 2009. The assessment work summarised in this report was based on the information that was available at that time, and covered design criteria, traffic including public transport, environment and cost.

The original junction position and layout is shown in Figure 1 of Appendix A (Option 1), and the key issues identified relating to this junction were:

- Design constraints (departures/relaxations);
- Cost;
- Noise and air quality;
- Visual impact associated with embankment height;
- Sustainability associated with cut/fill balance of embankment;
- Landscape and cultural heritage;
- Drainage and utilities; and
- Land use flexibility.

The assessment results are presented in the form of tables highlighting the benefits/disbenefits with regards to the above list and are scored as green, amber and red with regards to relative impact, with green being the highest score followed by amber and then red.

The assessment was undertaken in two phases as set out below.

1.2 Phase 1

To address the issues raised above, Option 1 was reviewed and refined. This refined layout, identified as Option 2 (refer to Figure 2 of Appendix A), incorporated the following:

- Reversing the vertical design of the mainline such that the gyratory is located above the A90 mainline;
- Removal of the high load route requirement at the overbridge, such that high loads would possibly be routed up and down the slip roads; and
- The introduction of relaxations and departures.

Option 1 and Option 2 were then assessed using the criteria set out above. The results of this Phase 1 assessment are provided in Section 2 of this report.

The original junction layout, Option 1, was considered the optimum solution for progressing to Phase 2 of the assessment as, although there were many areas where the scores were similar, Option 1 scored higher overall in Design, Environment and Cost.

1.3 Phase 2

Following the Phase 1 assessment, the possible introduction of Public Transport (PT) links was considered. The introduction of these separate PT links permitted greater flexibility in the positioning of the Queensferry Junction in relation to the public transport corridor over the Forth Road Bridge. This phase of the assessment therefore considered three options as follows:

- Option 1: The optimum solution from Phase 1.
- Option 1 with PT: The optimum solution from Phase 1 including, optimised public transport corridor provision. This option is shown in Figure 4 of Appendix A.
- Option 3: Junction located to the west of South Queensferry, at the A904, including optimised public transport corridor provision. This option is shown in Figure 3 of Appendix A.

The assessment was undertaken in a similar manner to Phase 1. It should however be noted that with the more significant variations in design and the inclusion of public transport corridors, it was necessary to expand upon the level of assessment to include:

- Junction operation;
- Public transport service;
- Traffic impact and volume of traffic on the A904; and
- Proximity of the roundabout on the A904;

The comparison tables of the Phase 2 assessment are provided in Section 3 of this report.

Option 3 was considered to be the optimum solution. Although there were many areas where the assessment criteria were similar, Option 3 scored higher overall in Design, Traffic Performance, Public Transport and Cost. In the case of the Environment, Option 3 scored slightly higher in the areas of landscape, visual impact, noise, air quality and sustainability.

2 Phase 1 Assessment

The following table shows the findings from Phase 1 of the assessment.

		Option 1 without PT (As per *Figure 1)		Option 2 without PT (As per *Figure 2)	
Criteria	Issue	Comment	Score	Comment	Score
Design	Embankment Height and Earthworks Balance	<ul style="list-style-type: none"> Maximum embankment height = 12.3m Level AOD at maximum height = 63.9 Approximate Mainline Chainage = 2615 Cut / Fill Balance = 345k / 590k m³ 	Green	<ul style="list-style-type: none"> Maximum embankment height = 14m Level AOD at maximum height = 67.7 Approximate Mainline Chainage = 2780 Cut / Fill Balance = 200k / 645k m³ 	Red
	Alignment	<p>The mainline connects the Forth Replacement Crossing to the existing A90 just south of Echline Junction as an extension of the existing A90. The alignment continues westward on embankment, crossing over the strategic pipeline in two locations and Queensferry Junction, before dropping into cutting, to pass under the A904, sweeping through 90 degrees with a 720m radius curve northwards, passing west of Queensferry and connecting into the approach viaducts.</p> <p>The proposed grade-separated junction (Queensferry Junction) is located under the mainline to the south of South Queensferry, between the two strategic pipeline crossings. The level of this junction is dictated by the clearance required above the strategic pipeline and drainage requirements, which in turn controls the height of the mainline embankment over the junction.</p>	Amber	<p>The mainline connects the Forth Replacement Crossing to the existing A90 just south of Echline Junction as an extension of the existing A90. The alignment continues westward on embankment, crossing over the strategic pipeline in two locations, before dropping into cutting, to pass under the A904, sweeping through 90 degrees with a 720m radius curve northwards, passing west of Queensferry and connecting into the approach viaducts.</p> <p>The proposed grade-separated junction (Queensferry Junction) is located over the mainline to the south of South Queensferry, between the two strategic pipeline crossings. The level of this junction is dictated by level of the mainline which is dictated by the clearance required above the strategic pipeline and drainage requirements, which in turn controls the height of the junction over the mainline.</p>	Amber
	Drainage	<p>Low point is at the junction gyratory. Deep carrier pipes are used to drain from this point back to Dolphington Burn. The A904 link road will drain into the A904 existing drainage system. The dualled section of the A904 between Echline and the A904 will drain into the A904 existing drainage. The realigned Builyeon and B924 roads will tie into existing or the mainline drainage. The mainline to the west of the junction drains to a basin near Linn Mill on the west side of the mainline.</p> <p>Issues:</p> <ul style="list-style-type: none"> Deep carrier pipe back to Dolphington Burn Difficulty with draining dualled A904 and link road as they cannot drain to Dolphington and have to tie into the existing A904 drainage. Issues with draining pre-earthworks on south of mainline however the intention is to drain to Ferry Burn. 	Amber	<p>Low point is on the mainline, east of the junction. Deep carrier pipes are used to drain from this point back to Dolphington Burn. The A904 link road will drain into the A904 existing drainage system. The dualled section of the A904 between Echline and the A904 will drain into the A904 existing drainage. The realigned Builyeon and B924 roads will tie into existing or the mainline drainage. The mainline to the west of the junction drains to a basin near Linn Mill on the west side of the mainline.</p> <p>Issues:</p> <ul style="list-style-type: none"> Deep carrier pipe back to Dolphington Burn Difficulty with draining dualled A904 and link road as they cannot drain to Dolphington and have to tie into the existing A904 drainage. Issues with draining pre-earthworks on south of mainline however the intention is to drain to Ferry Burn. 	Amber
	Standards	<p>There are nine Departures from Standard associated with the mainline and junction geometry and 14 associated with the various side road realignments.</p> <p>Departures and Relaxations are listed below. Departures are in bold. All chainages are approximate.</p> <p>Mainline:</p> <p><u>Weaving Length</u> Mainline northbound – Ch 1460 – 2130m L_{act} = 670m (2000m required)</p> <p>Mainline southbound – Ch 2250m - 1130m L_{act} = 1120m (2000m required)</p> <p><u>Horizontal Alignment</u> Ch 1490m - 1565.215m, Radius = 965.5m, Desirable Minimum = 1020m Ch 2721.998m - 3995.847m, Radius = 720m, Desirable Minimum = 1020m</p>	Amber	<p>There are nine Departures from Standard associated with the mainline and junction geometry and 14 associated with the various side road realignments.</p> <p>Departures and Relaxations are listed below. Departures are in bold. All chainages are approximate.</p> <p><u>Weaving Length</u> Mainline northbound – Ch 1460 – 2130m L_{act} = 670m (2000m required)</p> <p>Mainline southbound – Ch 2250m - 1130m L_{act} = 1120m (2000m required)</p> <p><u>Horizontal Alignment</u> Ch 1490m - 1565.215m, Radius = 965.5m, Desirable Minimum = 1020m Ch 2721.998m - 3995.847m, Radius = 720m, Desirable Minimum = 1020m</p> <p><u>Vertical Alignment</u> None</p>	Amber

		Option 1 without PT (As per *Figure 1)		Option 2 without PT (As per *Figure 2)	
Criteria	Issue	Comment	Score	Comment	Score
		<p>Ch 2845 to 2615, SSD =f 237m – within the immediate approach to junction. Ch 1980 to 1845, SSD = 242m</p> <p><u>Merge / Diverge Layouts</u> A904 to FRC NB Merge Layout Type A Taper Merge Provided Type F Lane Gain at Ghost Island Required</p> <p>FRC SB to A904 Diverge Layout Type A Taper Diverge Provided Type C Ghost Island Required</p> <p>A8000 Ch 118 to 150, K crest is 17, desirable minimum 100 Ch 24 to 85, K sag is 13, absolute minimum 26 Ch 0 to 150, ,SSD of 84m, desirable minimum 215 Ch 91, junction visibility of 120m n/b, desirable minimum of 215m Ch 50, junction visibility of 160m n/b, desirable minimum of 215m Ch 0 to 150m, cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges Ch 54 to 127, horizontal curve with no elimination of adverse camber or transition, required 3.5% superelevation and transitions. Ch 425, no transition provided where required. Ch 90 and 390, maximum gradient of 8.8%, desirable maximum gradient of 8.0%</p> <p>A904 Cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges Ch 13, no transition provided where required. Ch 535, junction visibility of 90m e/b, desirable minimum of 160m</p> <p>Builyeon Rd Cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges</p> <p>B924 Ch 38 & 92, no transitions provided where required.</p> <p>In conclusion the Departures required for both options are similar in extent and severity.</p>		<p><u>Merge / Diverge Layouts</u> A904 to FRC NB Merge Layout Type A Taper Merge Provided Type F Lane Gain at Ghost Island Required</p> <p>FRC SB to A904 Diverge Layout Type A Taper Diverge Provided Type C Ghost Island Required</p> <p>A8000 Ch 118 to 150, K crest is 17, desirable minimum 100 Ch 24 to 85, K sag is 13, absolute minimum 26 Ch 0 to 150, ,SSD of 84m, desirable minimum 215 Ch 91, junction visibility of 120m n/b, desirable minimum of 215m Ch 50, junction visibility of 160m n/b, desirable minimum of 215m Ch 0 to 150m, cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges Ch 54 to 127, horizontal curve with no elimination of adverse camber or transition, required 3.5% superelevation and transitions. Ch 425, no transition provided where required. Ch 90 and 390, maximum gradient of 8.8%, desirable maximum gradient of 8.0%</p> <p>A904 Cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges Ch 13, no transition provided where required. Ch 535, junction visibility of 90m e/b, desirable minimum of 160m</p> <p>Builyeon Rd Cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges</p> <p>B924 Ch 38 & 92, no transitions provided where required.</p> <p>In conclusion the Departures required for both options are similar in extent and severity.</p>	
	Local network connection	Connects to the A904 via a dualled section of carriageway from Queensferry Junction to a new roundabout on the A904. The A904 will be dualled between the new roundabout and Echline junction to enable resilience if the FRC is closed. Builyeon Road will be realigned to the west of the mainline alignment. A8000 will be realigned to the east of its current location to enable offline construction of the new overbridge.	Amber	Connects to the A904 via a dualled section of carriageway from Queensferry Junction to a new roundabout on the A904. The A904 will be dualled between the new roundabout and Echline junction to enable resilience if the FRC is closed. Builyeon Road will be realigned to the west of the mainline alignment. A8000 will be realigned to the east of its current location to enable offline construction of the new overbridge.	Amber
	Utilities	There are 3 required crossings of the strategic pipeline, which requires to be protected and would also require a false cutting / high containment barrier on the mainline as it runs parallel to the alignment closer than 50m.	Amber	There are 3 required crossings of the strategic pipeline, which requires to be protected and would also require a false cutting / high containment barrier on the mainline as it runs parallel to the alignment closer than 50m.	Amber
Environmental	Land Use:	<ul style="list-style-type: none"> Primarily impacting upon Green Belt. Goes through Echline strip, and extending into Countryside (maintenance access to the west of South Queensferry). Maintenance access would impact on development land for Open Space and Housing (Springfield Housing and Environmental Improvements) Agricultural impact expected as fields would be bisected by A904 Roundabout Link and Builyeon Road Re-alignment. Note: Businesses located along A904 (BP, Premier Inn and McDonalds), also Scotstoun House near A8000 – potential minor land take impacts although no land take info available. 	Amber (Medium)	<ul style="list-style-type: none"> Primarily impacting upon Green Belt. Goes through Echline strip, and extending into Countryside (maintenance access to the west of South Queensferry). Maintenance access would impact on Open Space (Springfield Housing and Environmental Improvements) No residential properties demolished Agricultural impact expected as fields would be bisected by A904 Roundabout Link and Builyeon Road Re-alignment. Note: Businesses located along A904 (BP, Premier Inn and Mc Donalds), also Scotstoun House near A8000 – potential minor land take impacts although no land take info available. 	Amber (Medium)
	Geology, contaminated land and ground water.	Contaminated land: <ul style="list-style-type: none"> No major contamination issues-mainly routed through Greenfield sites. Low flow elevated methane identified approx. 200m from route. 	Amber (Low)	Contaminated land: <ul style="list-style-type: none"> No major contamination issues-mainly routed through Greenfield sites. Low flow elevated methane identified approx. 200m from route 	Amber (Low)
	Water environment:	<ul style="list-style-type: none"> No watercourses crossed. 	Amber (Low)	<ul style="list-style-type: none"> No watercourses crossed. 	Amber (Low)
	Ecology and nature	Designated sites <ul style="list-style-type: none"> Will impact upon northern edge of Dundas Estate Listed Wildlife Site (LWS) as well as 	Amber (Low)	Designated sites: <ul style="list-style-type: none"> Will impact upon northern edge of Dundas Estate LWS as well as Dundas 	Amber (Low)

		Option 1 without PT (As per *Figure 1)		Option 2 without PT (As per *Figure 2)	
Criteria	Issue	Comment	Score	Comment	Score
	conservation:	<p>Dundas Hill/Barrencraig Wood SINC.</p> <p>Habitats</p> <ul style="list-style-type: none"> Primary impact will be on amenity grassland and poor semi-improved grassland, but will also impact on mixed plantation woodland of Echline Strip. Minor impact on species poor hedges and dry-stone walls. Small area of amenity grassland to be lost to west of South Queensferry for maintenance road. <p>Protected Species:</p> <ul style="list-style-type: none"> Potential impact on 4 unconfirmed bat tree roosts. Potential impact on 1 main badger sett and 2 outlier setts. 		<p>Hill/Barrencraig Wood SINC.</p> <p>Habitats:</p> <ul style="list-style-type: none"> Primary impact will be on amenity grassland and poor semi-improved grassland, but will also impact on mixed plantation woodland of Echline Strip. Minor impact on species poor hedges and dry-stone walls. Small area of amenity grassland to be lost to west of South Queensferry for maintenance road. <p>Protected Species:</p> <ul style="list-style-type: none"> Potential impact on 4 unconfirmed bat tree roosts. Potential impact on 1 main badger sett and 2 outlier setts. 	
	Landscape:	<p><u>Positive features:</u></p> <ul style="list-style-type: none"> Junction located within a dip with views backed by rising landform and woodland in Dundas Estate Mitigation planting would be in character with Dundas Estate shelterbelts/Echline Strip <p><u>Negative features:</u></p> <ul style="list-style-type: none"> High embankment (up to 12m) and deep cutting (10m) have poor landform fit A904 link road and embankment cutting across farmland to roundabout results in visual severance and land take Impact upon Dundas Estate Designed Landscape New junction lighting in relatively dark area of the landscape Significant impacts for Dundas Designed Wooded Local Landscape Character Area 	Amber (High)	<p><u>Positive features:</u></p> <ul style="list-style-type: none"> While the junction is elevated above the main carriageway it is located within a dip with views backed by rising landform and woodland in Dundas Estate Mitigation planting would be in character with Dundas Estate shelterbelts/Echline Strip <p><u>Negative features:</u></p> <ul style="list-style-type: none"> Higher embankment (up to 14m) at edge of Dundas Estate has poorer landform fit than Option 1. Deep cutting (10m) has poor landform fit A904 link road and embankment cutting across farmland to roundabout results in visual severance and land take Impact upon Dundas Estate Designed Landscape New junction lighting in relatively dark area of the landscape Significant impacts for Dundas Designed Wooded Local Landscape Character Area 	Amber (High)
	Visual:	<ul style="list-style-type: none"> Significant impacts for Dundas Home Farm and southern edge of South Queensferry. Elevated mainline-gantries likely to be prominent. Higher visual impact at southern edge of South Queensferry but reduced impact in west areas of South Queensferry. 	Amber (High)	<ul style="list-style-type: none"> Significant impacts for Dundas Home Farm and southern edge of South Queensferry. Lowered mainline - gantries likely to be less prominent than Option 1, but elevated gyratory more visible than Option 1. Higher visual impact at southern edge of South Queensferry but reduced impact in west areas of South Queensferry. 	Amber (High)
	Air Quality:	<ul style="list-style-type: none"> Both stretches of the A904 (i.e. east and west of the Queensferry junction) would be adversely affected. West of Queensferry Junction 349 properties are likely to experience deterioration due to increased traffic and east of Queensferry Junction approximately 243 properties could be affected due to increased public transport. No sensitive receptors in the vicinity of the gyratory so underbridge does not cause an air quality issue. 	Amber (High)	<ul style="list-style-type: none"> Both stretches of the A904 (i.e. east and west of the Queensferry Junction) would be adversely affected. West of Queensferry Junction 349 properties are likely to experience deterioration due to increased traffic and east of Queensferry Junction approximately 243 properties could be affected due to increased HDV's (public transport). No sensitive receptors in the vicinity of the gyratory so overbridge does not cause an air quality issue. 	Amber (High)
	Traffic Noise & vibration	<ul style="list-style-type: none"> FRC – Mainline 120kph with resulting high traffic noise Public Transport – No flow data has been analysed for this assessment, however it is unlikely to be a significant impact compared to overall traffic flow. Gyratory underbridge is a negative factor as it pushes mainline higher. 	Amber (High)	<ul style="list-style-type: none"> FRC – Mainline 120kph with resulting high traffic noise Public Transport – No flow data has been analysed for this assessment, however unlikely to be a significant impact compared to overall traffic flow. Gyratory overbridge preferred as some shielding of mainline. 	Amber (High)
	Cultural heritage:	<ul style="list-style-type: none"> The road is in cutting close to the Category B Listed Building at Echline Farm and the Category C (S) Echline cottages. As a result, there is very little intervisibility between the road and the Listed Buildings. Countering this slightly is the elevated nature of the Queensferry Junction interchange that will impact upon the setting of Dundas Home Farm Category B Listed Building. The views in this area have already been compromised by the existing approach to the Echline Junction. All options impact directly upon the Dundas Castle Inventory Designed Landscape although the impacts are mitigated by the presence of the Echline strip and further woodland between the proposals and the Castle itself. 	Amber (Low)	<ul style="list-style-type: none"> The road is in cutting close to the Category B Listed Building at Echline Farm and the Category C (S) Echline cottages. As a result, there is very little intervisibility between the road and the Listed Buildings. Countering this slightly is the elevated nature of the Queensferry Junction interchange on the eastern and western sides. This has the potential to impact upon the setting of Dundas Home Farm Category B Listed Building and the Listed Buildings at Echline. At this location, views have already been compromised by the existing approach to the A90 Echline Junction. All options impact directly upon the Dundas Castle Inventory Designed Landscape although the impacts are mitigated by the presence of the Echline strip and further woodland between the proposals and the Castle itself. 	Amber (Low)
	Peds, cyclists and equestrians	<ul style="list-style-type: none"> NMUs not affected by gyratory underbridge. Impacts on path journey length at Echline – sections of informal local paths lost to scheme. Alternative route via A904 overbridge – as per IDR2 design, footpaths should be maintained along northern side of A904 and on A904 overbridge. New path link to be created west of mainline to continue access to western recreational area. Negligible impact on segregated cycleway along A8000 - should be maintained along realigned A8000. 	Amber (Medium)	<ul style="list-style-type: none"> NMUs not affected by gyratory overbridge. Impacts on path journey length at Echline – sections of informal local paths lost to scheme. Alternative route via A904 overbridge – as per IDR2 design, footpaths should be maintained along northern side of A904 and on A904 overbridge. New path link to be created west of mainline to continue access to western recreational area. Negligible impact on segregated cycleway along A8000 - should be maintained along realigned A8000. 	Amber (Medium)
	Vehicle Travellers	<ul style="list-style-type: none"> Increased opportunity for views from mainline elevated above gyratory 	Green (Medium Positive)	<ul style="list-style-type: none"> Reduced opportunity for views from mainline below gyratory 	Red (Low negative)
	Disruption due to construction	<ul style="list-style-type: none"> Temporary impacts expected to be similar to permanent impacts considered e.g. footpath diversions, landscape/visual, heritage, noise, etc. issues would all occur during construction. 	Amber (Medium)	<ul style="list-style-type: none"> No information on phasing/earth works/land take available therefore assumes impacts are the same as for Option 1. 	Amber (Medium)

		Option 1 without PT (As per *Figure 1)		Option 2 without PT (As per *Figure 2)	
Criteria	Issue	Comment	Score	Comment	Score
		<ul style="list-style-type: none"> Need to ensure temporary access to Dundas Home Farm is considered. 			
	Polices and Plans	<ul style="list-style-type: none"> Impact on Green Belt south of South Queensferry, then Countryside to the south west crossing an area allocated for Environmental Improvements (ENV 6) and Housing (HSG 2 Springfield and HSG 7 Society Road). The maintenance road could provide access to the site (HSG 2/ENV6) for future development. 	Amber (Medium)	<ul style="list-style-type: none"> Impact on Green Belt south of South Queensferry, then Countryside to the south west crossing an area allocated for Environmental Improvements (ENV 6) and Housing (HSG 2 and HSG 7). The maintenance road could provide access to the site (HSG 2/ENV6) for future development. 	Amber (Medium)
	Sustainability	<ul style="list-style-type: none"> The key impacts for sustainability relate primarily to the provision of integrated public transport and the effect that this has on social, economic and environmental factors. In general, the effects of this option would help to promote cross-Forth movement by public modes of transport which will help to improve access to economic opportunities, reduce the use of private transport and its effect on the environment, and promote social inclusion. Cut / Fill Balance = 345k / 590k m³ so only 245k will need to be imported. Other aspects of the sustainability appraisal framework (e.g. nature conservation, water resources, landscape issues) are reported in previous sections of this schedule. 	Amber (Medium – High positive)	<ul style="list-style-type: none"> The key impacts for sustainability relate primarily to the provision of integrated public transport and the effect that this has on social, economic and environmental factors. In general, the effects of this option would help to promote cross-forth movement by public modes of transport which will help to improve access to economic opportunities, reduce the use of private transport and its effect on the environment, and promote social inclusion. Cut / Fill Balance = 200k / 645k m³ so 445k will need to be imported, more than for Option 1. Other aspects of the sustainability appraisal framework sustainability (e.g. nature conservation, water resources, landscape issues) are reported in previous sections to this schedule. 	Amber (Medium – High positive)
Cost	Cost	In comparison with IDR2, the cost has decreased by, approximately £4.5m (23%). This is based on the earthworks.	Green	In comparison with IDR2, the cost has decreased by, approximately £1.7m (9%). This is based on the earthworks.	Red

*Figures are contained in Appendix A.

The following table shows the findings from Phase 2 of the assessment.

		Option 1 without PT (as per *Figure 1)		Option 1 with PT (as per *Figure 4)		Option 3 with PT (as per *Figure 3)	
Criteria	Issue	Comment	Score	Comment	Score	Comment	Score
Design	Embankment Height and Earthworks Balance	<ul style="list-style-type: none"> Maximum embankment height = 12.3m Level AOD at maximum height = 63.9 Approximate Mainline Chainage = 2615 Cut / Fill Balance = 345k / 590k m³ 	Amber	<ul style="list-style-type: none"> Maximum embankment height = 12.3m Level AOD at maximum height = 63.9 Approximate Mainline Chainage = 2615 Cut / Fill Balance = 350k / 645k m³ 	Amber	<ul style="list-style-type: none"> Maximum embankment height = 6.3m Level AOD at maximum height = 59.308 Approximate Mainline Chainage = 2750 Cut / Fill Balance = 345k / 290k m³ 	Green
	Alignment	<p>The mainline connects the Forth Replacement Crossing to the existing A90 just south of Echline Junction as an extension of the existing A90. The alignment continues westward on embankment, crossing over the strategic pipeline in two locations and Queensferry Junction, before dropping into cutting, to pass under the A904, sweeping through 90 degrees with a 720m radius curve northwards, passing west of South Queensferry and connecting into the approach viaducts.</p> <p>The proposed grade-separated junction (Queensferry Junction) is located under the mainline to the south of South Queensferry, between the two strategic pipeline crossings. The level of this junction is dictated by the clearance required above the strategic pipeline and drainage requirements, which in turn controls the height of the mainline embankment over the junction.</p>	Amber	<p>The mainline connects the Forth Replacement Crossing to the existing A90 just south of Echline Junction as an extension of the existing A90. The alignment continues westward on embankment, crossing over the strategic pipeline in two locations and Queensferry Junction, before dropping into cutting, to pass under the A904, sweeping through 90 degrees with a 720m radius curve northwards, passing west of South Queensferry and connecting into the approach viaducts.</p> <p>The proposed grade-separated junction (Queensferry Junction) is located under the mainline to the south of South Queensferry, between the two strategic pipeline crossings. The level of this junction is dictated by the clearance required above the strategic pipeline and drainage requirements, which in turn controls the height of the mainline embankment over the junction.</p> <p>Bus priority links are provided from Echline Interchange to the A90 southbound and northbound from the A90 via the A8000 to Echline.</p>	Amber	<p>The mainline connects the Forth Replacement Crossing to the existing A90 just south of Echline Junction as an extension of the existing A90. The alignment continues westward on embankment, crossing over the strategic pipeline in two locations, before dropping into cutting, to pass under the new Queensferry Junction, sweeping through 90 degrees with a 720m radius curve northwards, passing west of South Queensferry and connecting into the approach viaducts.</p> <p>A new grade-separated junction (Queensferry Junction) is located over the mainline at the existing A904, to the west of South Queensferry.</p> <p>Bus priority links are provided from Echline Interchange to the A90 southbound and northbound from the A90 via the A8000 to Echline.</p>	Green
	Drainage	<p>Low point is at the junction gyratory. Deep carrier pipes are used to drain from this point back to Dolphington Burn. The A904 link road will drain into the A904 existing drainage system. The dualled section of the A904 between Echline and the A904 will drain into the A904 existing drainage. The realigned Builyeon and B924 roads will tie into existing or the mainline drainage. The mainline to the west of the junction drains to a basin near Linn Mill on the west side of the mainline.</p> <p>Issues:</p> <ul style="list-style-type: none"> Deep carrier pipe back to Dolphington Burn Difficulty with draining dualled A904 and link road as they cannot drain to Dolphington and have to tie into the existing A904 drainage. Issues with draining pre-earthworks on south of mainline however the intention is to drain to Ferry Burn. <p>Pros:</p> <ul style="list-style-type: none"> Smaller basin required at Linn Mill than Option 3 	Amber	<p>Low point is at the junction gyratory. Deep carrier pipes are used to drain from this point back to Dolphington Burn. The A904 link road will drain into the A904 existing drainage system. The dualled section of the A904 between Echline and the A904 will drain into the A904 existing drainage. The realigned Builyeon and B924 roads will tie into existing or the mainline drainage. The mainline to the west of the junction drains to a basin near Linn Mill on the west side of the mainline.</p> <p>Issues:</p> <ul style="list-style-type: none"> Deep carrier pipe back to Dolphington Burn Difficulty with draining dualled A904 and link road as they cannot drain to Dolphington and have to tie into the existing A904 drainage. Issues with draining pre-earthworks on south of mainline however the intention is to drain to Ferry Burn. <p>Pros:</p> <ul style="list-style-type: none"> Smaller basin required at Linn Mill than Option 3. 	Amber	<p>Low point is at, approx., Ch2350. Deep carrier pipes are used to drain from this point back to Dolphington Burn. The mainline to the west of this point and the junction drain to a basin at Linn Mill.</p> <p>Issues:</p> <ul style="list-style-type: none"> Larger basin required at Linn Mill than Option 1. Deep carrier pipe back to Dolphington Burn although shorter in length than Option 1. Issues with draining pre-earthworks on south of mainline however the intention is to drain to Ferry Burn. <p>Pros:</p> <ul style="list-style-type: none"> Smaller basin at Dolphington Burn than Option 1. Less roadworks proposed on the A904 therefore simpler drainage design. As low point of mainline is closer to the A8000 the deep carrier pipes are shorter and the outfall to Dolphington Burn is higher. 	Amber
	Standards	<p>There are nine Departures from Standard associated with the mainline and junction geometry and fourteen associated with the various side road realignments.</p> <p>The Departures required for all options are broadly similar in extent and severity with the exception of the weaving lengths, which are significantly improved with Option 3</p> <p>Departures and Relaxations are listed below. Departures are in bold. All chainages are approximate.</p> <p>Mainline:</p>	Amber	<p>There are nine Departures from Standard associated with the mainline and junction geometry, fourteen associated with the various side road realignments and three with the bus links.</p> <p>The Departures required for all options are broadly similar in extent and severity with the exception of the weaving lengths, which are significantly improved with Option 3</p> <p>Departures and Relaxations are listed below. Departures are in bold. All chainages are approximate.</p> <p>Mainline:</p>	Amber	<p>There are seven Departures from Standard associated with the mainline and junction geometry, seventeen associated with the various side road realignments and three with the bus links.</p> <p>The Departures required for all options are broadly similar in extent and severity with the exception of the weaving lengths, which are significantly improved with Option 3</p> <p>Departures and Relaxations are listed below. Departures are in bold. All chainages are approximate</p> <p>Mainline: Weaving Length</p>	Green

		Option 1 without PT (as per *Figure 1)		Option 1 with PT (as per *Figure 4)		Option 3 with PT (as per *Figure 3)	
Criteria	Issue	Comment	Score	Comment	Score	Comment	Score
		<p><u>Weaving Length</u> Mainline northbound – Ch 1460 – 2130m L_{act} = 670m (2000m required)</p> <p>Mainline southbound – Ch 2250m - 1130m L_{act} = 1120m (2000m required)</p> <p><u>Horizontal Alignment</u> Ch 1490m - 1565.215m, Radius = 965.5m, Desirable Minimum = 1020m Ch 2721.998m - 3995.847m, Radius = 720m, Desirable Minimum = 1020m</p> <p><u>Vertical Alignment</u> None</p> <p><u>Stopping Sight Distance</u> Desirable Minimum = 295m</p> <p>Northbound Ch 2540 to 2660, SSD = 240m Ch 2665 to 3400, SSD = 240m – within the immediate approach to junction. Ch 3405 to 3525, SSD = 240m</p> <p>Southbound Ch 3830 to 3795, SSD = 292m – within the immediate approach to junction. Ch 3315 to 3225, SSD = 230m – within the immediate approach to junction. Ch 3220 to 3180, SSD = 215m. Ch 3180 to 2940, SSD = 214m. Ch 2935 to 2850, SSD = 215m. Ch 2845 to 2615, SSD = 237m – within the immediate approach to junction. Ch 1980 to 1845, SSD = 242m</p> <p><u>Merge / Diverge Layouts</u> A904 to FRC NB Merge Layout Type A Taper Merge Provided Type F Lane Gain at Ghost Island Required</p> <p>FRC SB to A904 Diverge Layout Type A Taper Diverge Provided Type C Ghost Island Required</p> <p>A8000 Ch 118 to 150, K crest is 17, desirable minimum 100 Ch 24 to 85, K sag is 13, absolute minimum 26 Ch 0 to 150, SSD of 84m, desirable minimum 215 Ch 91, junction visibility of 120m n/b, desirable minimum of 215m Ch 50, junction visibility of 160m n/b, desirable minimum of 215m Ch 0 to 150m, cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges Ch 54 to 127, horizontal curve with no elimination of adverse camber or transition, required 3.5% superelevation and transitions. Ch 425, no transition provided where required. Ch 90 and 390, maximum gradient of 8.8%, desirable maximum gradient of 8.0%</p> <p>A904 Cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges Ch 13, no transition provided where required. Ch 535, junction visibility of 90m e/b, desirable minimum of 160m</p> <p>Builyeon Rd</p>		<p><u>Weaving Length</u> Mainline northbound – Ch 1460 – 2130m L_{act} = 670m (2000m required)</p> <p>Mainline southbound – Ch 2250m - 1130m L_{act} = 1120m (2000m required)</p> <p><u>Horizontal Alignment</u> Ch 1490m - 1565.215m, Radius = 965.5m, Desirable Minimum = 1020m Ch 2721.998m - 3995.847m, Radius = 720m, Desirable Minimum = 1020m</p> <p><u>Vertical Alignment</u> None</p> <p><u>Stopping Sight Distance</u> Desirable Minimum = 295m</p> <p>Northbound Ch 2540 to 2660, SSD = 240m Ch 2665 to 3400, SSD = 240m – within the immediate approach to junction. Ch 3405 to 3525, SSD = 240m</p> <p>Southbound Ch 3830 to 3795, SSD = 292m – within the immediate approach to junction. Ch 3315 to 3225, SSD = 230m – within the immediate approach to junction. Ch 3220 to 3180, SSD = 215m. Ch 3180 to 2940, SSD = 214m. Ch 2935 to 2850, SSD = 215m. Ch 2845 to 2615, SSD = 237m – within the immediate approach to junction. Ch 1980 to 1845, SSD = 242m</p> <p><u>Merge / Diverge Layouts</u> A904 to FRC NB Merge Layout Type A Taper Merge Provided Type F Lane Gain at Ghost Island Required</p> <p>FRC SB to A904 Diverge Layout Type A Taper Diverge Provided Type C Ghost Island Required</p> <p>A8000 Ch 118 to 150, K crest is 17, desirable minimum 100 Ch 24 to 85, K sag is 13, absolute minimum 26 Ch 0 to 150, SSD of 84m, desirable minimum 215 Ch 91, junction visibility of 120m n/b, desirable minimum of 215m Ch 50, junction visibility of 160m n/b, desirable minimum of 215m Ch 0 to 150m, cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges Ch 54 to 127, horizontal curve with no elimination of adverse camber or transition, required 3.5% superelevation and transitions. Ch 425, no transition provided where required. Ch 90 and 390, maximum gradient of 8.8%, desirable maximum gradient of 8.0%</p> <p>A904 Cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges Ch 13, no transition provided where required. Ch 535, junction visibility of 90m e/b, desirable minimum of 160m</p> <p>Builyeon Rd</p>		<p><u>Mainline northbound – Ch 1450m - 3065m</u> L_{act} = 1615m (2000m required)</p> <p><u>Mainline southbound – Ch 3100m - 1150m</u> L_{act} = 1950m (2000m required)</p> <p><u>Horizontal Alignment</u> Ch 1490m - 1565.215m, Radius = 965.5m, Desirable Minimum = 1020m Ch 2721.998m - 3995.847m, Radius = 720m, Desirable Minimum = 1020m</p> <p><u>Vertical Alignment</u> None</p> <p><u>Stopping Sight Distance</u> Desirable Minimum = 295m</p> <p>Southbound Ch 3205m, SSD at back of nose = 214.5m Ch 3100m - 2810m, SSD = 244.4m Ch 1985m - 1845m, SSD = 241.0m</p> <p>Northbound Ch 2540m - 2887.5m, SSD = 240.4m Ch 2887.5m - 3330m, SSD = 240.4m - within the immediate approach to junction Ch 3330m - 3557.5m, SSD = 240.1 Ch 3557.5m - 3685m, SSD = 240.1m - within the immediate approach to junction</p> <p><u>Merge / Diverge Layouts</u> A904 to FRC NB Merge Layout Type A Taper Merge Provided Type F Lane Gain at Ghost Island Required</p> <p>FRC SB to A904 Diverge Layout Type A Taper Diverge Provided Type C Ghost Island Required</p> <p>A8000 Ch 118 to 150, K crest is 17, desirable minimum 100 Ch 24 to 85, K sag is 13, absolute minimum 26 Ch 0 to 150, SSD of 84m, desirable minimum 215 Ch 91, junction visibility of 120m n/b, desirable minimum of 215m Ch 50, junction visibility of 160m n/b, desirable minimum of 215m Ch 0 to 150m, cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges Ch 54 to 127, horizontal curve with no elimination of adverse camber or transition, required 3.5% superelevation and transitions. Ch 425, no transition provided where required. Ch 90 and 390, maximum gradient of 8.8%, desirable maximum gradient of 8.0%</p> <p>A904 Ch24 to 62, crest K is 10, desirable minimum 55 Ch62 to 126, sag K is 9, absolute minimum 26 Ch126 to 167, Crest K is 17, desirable minimum 55 SSD of 140m, absolute minimum 160 (on approach to a junction) SSD of 154m, absolute minimum 160 (on approach to a junction)</p> <p>B924 SSD of 74m, absolute minimum 90 (on approach to a junction) Junction visibility is 125m</p>	

		Option 1 without PT (as per *Figure 1)		Option 1 with PT (as per *Figure 4)		Option 3 with PT (as per *Figure 3)	
Criteria	Issue	Comment	Score	Comment	Score	Comment	Score
		<p>Cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges</p> <p>B924 Ch 38 & 92, no transitions provided where required.</p>		<p>Builyeon Rd Cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges</p> <p>B924 Ch 38 & 92, no transitions provided where required.</p> <p><u>Southbound Bus Link</u></p> <p>Merge Taper: substandard taper on lane gain provided to allow smoother alignment for buses.</p> <p>Visibility: SSD drops to 140m on approach to nose to the 1.05m target height, full visibility achieved to the 0.26m target height. Caused by substandard vertical curvature of existing road which is mirrored by bus lane.</p> <p>Visibility: SSD drops below desirable minimum on approach to the nose. This is caused by substandard vertical alignment, see above</p>		<p>Builyeon Rd Cross-section with no hardstrips and 2.0m verges provided, required 1.0m hardstrips and 2.5m verges</p> <p><u>Southbound Bus Link</u></p> <p>Merge Taper: substandard taper on lane gain provided to allow smoother alignment for buses.</p> <p>Visibility: SSD drops to 140m on approach to nose to the 1.05m target height, full visibility achieved to the 0.26m target height. Caused by substandard vertical curvature of existing road which is mirrored by bus lane.</p> <p>Visibility: SSD drops below desirable minimum on approach to the nose. This is caused by substandard vertical alignment, see above</p>	
	Local network connection	<p>Connects to the A904 via a dualled section of carriageway from Queensferry Junction to a new roundabout on the A904. The A904 will be dualled between the new roundabout and Echline junction to enable resilience if the FRC is closed.</p> <p>Builyeon Road will be realigned to the west of the mainline alignment.</p> <p>A8000 will be realigned to the east of its current location to enable offline construction of the new overbridge.</p>	Green	<p>Connects to the A904 via a dualled section of carriageway from Queensferry Junction to a new roundabout on the A904. The A904 will be dualled between the new roundabout and Echline junction to enable resilience if the FRC is closed.</p> <p>Builyeon Road will be realigned to the west of the mainline alignment.</p> <p>A8000 will be realigned to the east of its current location to enable offline construction of the new overbridge.</p>	Green	<p>Builyeon Road will be realigned to the west of the mainline alignment.</p> <p>A8000 will be realigned to the east of its current location to enable offline construction of the new overbridge.</p> <p>The A904 is realigned to connect to the Queensferry junction gyratory and the B924 is realigned to tie-in with realigned A904.</p>	Amber
	Utilities	<p>There are 3 required crossings of the strategic pipeline (2 mainline and 1 side road), which requires to be protected and would also require a false cutting / high containment barrier on the mainline as it runs parallel to the alignment closer than 50m.</p>	Amber	<p>There are 4 required crossings of the strategic pipeline (2 mainline, 1 side road and 1 bus link), which requires to be protected and would also require a false cutting / high containment barrier on the mainline as it runs parallel to the alignment closer than 50m.</p>	Amber	<p>There are 3 required crossings of the strategic pipeline (2 mainline and 1 bus link), which requires to be protected but it is likely that a false cutting / high containment barrier will not be required on the mainline as it runs parallel to the alignment.</p>	Green
Traffic	Junction operation - Paramics						
	- Overall network speed	<p>No issue.</p>	Amber	<p>No issue.</p>	Amber	<p>A reduction in distance travelled, reduced number of junctions, and therefore points of conflict, results in an overall slight increase in average vehicle speed.</p> <p>There is expected to be an improvement in the operation of the weaving section between Queensferry Interchange and the M9 Spur.</p>	Green
	- Junction Operation	<p>Under TEMPRO growth levels there are no significant queuing issues. Under higher growth conditions, congestion on the gyratory due to high volumes turning right to the North can affect other movements at the junction. Within Paramics under a higher growth scenario, traffic queuing on the gyratory can impact the northbound diverge, which could lead to issues regarding blocking back towards the mainline.</p> <p>Transyt results indicate that the junction operates within the recommended Degree of Saturation (DoS) (90%) during both AM and PM peaks. During the PM peak the circulating section between the south facing slips has a queue length of approximately 100m. This may result on queues impacting on the operation of the junction if this blocks the access to the A90 Southbound on-slip. The maximum queue length occurs at the A90 Southbound off-slip during the PM peak, with a DoS of 86% and queue length of 156m. The link road from the Gyratory to the A904 junction is approaching 90% DoS and has a queue length of approximately 90m. Although this is not excessive, this could become critical</p>	Amber	<p>Under TEMPRO levels there are no significant queuing issues. Under higher growth conditions, congestion on the gyratory due to high volumes turning right to the North can affect other movements at the junction. Within Paramics under a higher growth scenario, traffic queuing on the gyratory can impact the northbound diverge, which could lead to issues regarding blocking back towards the mainline.</p> <p>Transyt results indicate that the junction operates within the recommended Degree of Saturation (DoS) (90%) during both AM and PM peaks. During the PM peak the circulating section between the south facing slips has a queue length of approximately 100m. This may result on queues impacting on the operation of the junction if this blocks the access to the A90 Southbound on-slip. The maximum queue length occurs at the A90 Southbound off-slip during the PM peak, with a DoS of 86% and queue length of 156m. The link road from the Gyratory to the A904 junction is</p>	Amber	<p>Under TEMPRO levels there are no significant queuing issues. Under higher TMfS demand levels, queuing can be better managed and any significant queuing is likely to be limited to the A904.</p> <p>Transyt results indicate that the junction operates within the recommended Degree of Saturation (90%) during both peaks. The maximum queue length occurs on the A90 Southbound off-slip, with an 85% DoS and a queue length of approximately 90m. No excessive queuing occurs on any of the links; however the SB off-slip could become critical during particularly busy traffic periods.</p> <p>Paramics tests indicate that the re-location of the interchange to the A904 would result in a saving in journey time for the majority of trips through the junction. Based on savings within the AM and PM peak in year 2017 the potential overall annual reduction in travel time amounts to approximately 32,500 – 41,750 hours at the interchange. This range is likely to increase under a greater demand scenario.</p>	Green

		Option 1 without PT (as per *Figure 1)		Option 1 with PT (as per *Figure 4)		Option 3 with PT (as per *Figure 3)	
Criteria	Issue	Comment	Score	Comment	Score	Comment	Score
		during particularly busy traffic periods.		approaching 90% DoS and has a queue length of approximately 90m. Although this is not excessive, this could become critical during particularly busy traffic periods.			
	- Impact on specific movements (4 movements and mainline)	Traffic demand between South Queensferry and the south experiences a benefit in terms of shorter distance travelled from a junction located further east on the A904. Journeys between all other movements through the interchange travel an additional distance and experience greater junction delay under this layout. It is expected that under a TMfS based growth scenario that additional junction delay would be experienced under this option.	Amber	Traffic demand between South Queensferry and the south experiences a benefit in terms of shorter distance travelled from a junction located further east on the A904. Journeys between all other movements through the interchange travel an additional distance and experience greater junction delay under this layout. It is expected that under a TMfS based growth scenario that additional junction delay would be experienced under this option.	Amber	Traffic demand between South Queensferry and the south experiences a disbenefit in terms of journey distance, from a junction located further west on the A904, however the journey is expected to experience less junction delay during the trip. All other movements through the interchange travel a reduced distance and experience less junction delay under this layout.	Green
	- Overall Performance	Overall the junction will operate under TEMPRO growth to year 2017. No significant queuing under a TEMPRO growth scenario but under higher growth it would be more difficult to manage demand, with potential queuing issues for circulating traffic between the south facing slip roads and the link road connecting to the A904. There is a greater potential for queuing on the northbound diverge to lead to a possible safety risk if it extends far enough to block back towards the A90 mainline. Management of traffic demand within the interchange could mitigate this issue. Majority of trips at junction experience additional travel distance when compared to Option 3 although the distance between South Queensferry and the south is shorter.	Amber	Overall the junction will operate under TEMPRO growth to year 2017. No significant queuing under a TEMPRO growth scenario but under higher growth it would be more difficult to manage demand, with potential queuing issues for circulating traffic between the south facing slip roads and the link road connecting to the A904. There is a greater potential for queuing on the northbound diverge to lead to a possible safety risk if it extends far enough to block back towards the A90 mainline. Management of traffic demand within the interchange could mitigate this issue. Majority of trips at junction experience additional travel distance when compared to Option 3 although the distance between South Queensferry and the south is shorter.	Amber	Overall the junction will operate under TEMPRO growth to year 2017. No significant queuing under a TEMPRO growth scenario but under higher growth it would be more difficult to manage demand. However, it is expected that the queuing can be better managed under this option. Majority of trips at junction would experience reduced travel distance when compared to Options 1 and 2, with the exception of trips between South Queensferry and the south. Under TEMPRO growth levels at year 2017 Paramics tests indicate that this equates to approximately 32,500 – 41,750 hours saved per year at the interchange. The savings are expected to be greater under higher traffic growth.	Green
	Traffic Demand						
	- Robustness of Data	Junction turning count data and Automatic Traffic Count data is available at key locations and is consistent. Single count data at Echline compared against average annual data recorded at the ATC sites, therefore indicating a good correlation. A further count was undertaken, which indicated similar movements to the initial count in 2008. This provides a degree of confidence on the existing movements.	Green	Junction turning count data and Automatic Traffic Count data is available at key locations and is consistent. Single count data at Echline compared against average annual data recorded at the ATC sites, therefore indicating a good correlation. A further count was undertaken, which indicated similar movements to the initial count in 2008. This provides a degree of confidence on the existing movements.	Green	Junction turning count data and Automatic Traffic Count data is available at key locations and is consistent. Single count data at Echline compared against average annual data recorded at the ATC sites, therefore indicating a good correlation. This provides a degree of confidence on the existing movements. A further count was undertaken, which indicated similar movements to the initial count in 2008. This provides a degree of confidence on the existing movements.	Green
	- Demand Constraints	There is unconstrained demand on the model, with existing constraints at Newbridge, Barnton, etc. removed for mini Paramics models to obtain a worst-case demand into the area. Local trips are not robust with TMfS, and therefore observed data has been used as the basis of the assessment. The counts have been factored using standard TEMPRO based approach to obtain local growth projections.	Green	There is unconstrained demand on the model, with existing constraints at Newbridge, Barnton, etc. removed for mini Paramics models to obtain a worst-case demand into the area. Local trips are not robust with TMfS, and therefore observed data has been used as the basis of the assessment. The counts have been factored using standard TEMPRO based approach to obtain local growth projections.	Green	There is unconstrained demand on the model, with existing constraints at Newbridge, Barnton, etc. removed for mini Paramics models to obtain a worst-case demand into the area. Local trips are not robust with TMfS, and therefore observed data has been used as the basis of the assessment. The counts have been factored using standard TEMPRO based approach to obtain local growth projections.	Green
	- Re-routing	Promotes use of the trunk-road network via Junction 1a and the M9 Spur, due to travel time and distance for journeys between the A904 and the north. Re-assignment combined with growth on the A904 (based on TMfS), increases traffic demand west of the gyratory by approximately 13% (15,500 increasing in the Do-Minimum compared with 17,500 vehicles in year 2017).	Amber	Promotes use of the trunk-road network via Junction 1a and the M9 Spur, due to travel time and distance for journeys between the A904 and the north. Re-assignment combined with growth on the A904 (based on TMfS), increases traffic demand west of the gyratory by approximately 13% (15,500 increasing to 17,500 vehicles).	Amber	Promotes use of the A904 as an alternative route to the gyratory rather than via Junction 1a and the M9 Spur. Re-assignment on the A904 (based on TMfS), will further increase traffic on the A904 by an additional 5% west of the gyratory (the 17,500 vehicles in Layout 1 increases to 18,500 vehicles). However traffic demand within South Queensferry to the east of the gyratory on the A904 is expected to decrease by approximately 71% when compared with Layout 1, (18,800 decreasing to 5,500 vehicles). In terms of a comparison against the traffic demand within the Do-Minimum, traffic demand west of the gyratory on the A904 is expected to increase by approximately 20% (from 15,500 to 18,500 in year 2017). However east of the re-located interchange, within South Queensferry traffic levels are expected	Green

		Option 1 without PT (as per *Figure 1)		Option 1 with PT (as per *Figure 4)		Option 3 with PT (as per *Figure 3)	
Criteria	Issue	Comment	Score	Comment	Score	Comment	Score
						to decrease by approximately 65% against the projected Do-Minimum level (15,500 reducing to 5,500 vehicles in year 2017). Potential re-assignment of local traffic to the B924. It is anticipated that approximately 350 vehicles per day would re-route from Kirkliston Road to Bo'ness Road, resulting in a daily flow of Bo'ness Road of 5,250 vehicles. This equates to an increase of 7% when compared to the do-minimum. In addition, although there is an increase in journey distance for movements between South Queensferry and the south, the majority of trips will experience a reduction in journey distance. Based on existing traffic flow movements this equates to a vehicle kilometre saving of 650,000 annually in the AM Peak period and a vehicle kilometre saving of 950,000 annually in the PM Peak period. This equates to a total peak period saving of approximately 1.6m vehicle kilometres. Under TEMPRO levels at year 2017, Paramics modelling indicates total peak period savings of approximately 2.1million vehicle kilometres per year.	
Public Transport	Operational benefits	Buses using the existing bridge would be required to travel via the gyratory, thereby increasing journey distance and time. This would result in the existing bridge being a less attractive route for buses and therefore limit the benefit of a dedicated public transport corridor.	Amber	East facing connections between the existing bridge and the A90 (Edinburgh) would provide enhanced connectivity. This would encourage the use of the existing bridge as a public transport corridor, and the potential success of a Park and Ride adjacent to Echline Interchange. Services to and from the south via the M9 spur would use the new bridge.	Green	East facing connections between the existing bridge and the A90 (Edinburgh) would provide enhanced connectivity. This would encourage the use of the existing bridge as a public transport corridor, and the potential success of a Park and Ride adjacent to Echline Interchange. Services to and from the south via the M9 spur would use the new bridge.	Green
	Travel Time						
	Travel Distance	N/B 2780m S/B 3255m	Amber	N/B 1820 S/B 2020 For M9 Spur buses unless they use A8000 N/B 2780m S/B 3255m	Green	N/B 1820 S/B 2020 For M9 Spur buses unless they use A8000 N/B 2780m S/B 3255m	Green
	Impact on P&R options	No direct impact, however the number of services passing the potential Park and Ride site at South Queensferry would be limited without the inclusion of direct connections for PT.	Amber	No direct impact, however the inclusion of direct PT links between the existing bridge and the A90, is expected to contribute to the success of a Park and Ride site at South Queensferry.	Green	No direct impact, however the inclusion of direct PT links between the existing bridge and the A90, is expected to contribute to the success of a Park and Ride site at South Queensferry.	Green
Environmental	Land Use:	<ul style="list-style-type: none"> Primarily impacting upon Green Belt. Goes through Echline strip, and extending into Countryside (maintenance access to the west of Queensferry). Maintenance access would impact on development land for Open Space and Housing (Springfield Housing and Environmental Improvements) No additional landtake or access impacts to local businesses/residential uses that those assessed for IDR2. Agricultural impact expected as fields would be bisected by A904 Roundabout Link and Builyeon Road Re-alignment. Note: Businesses located along A904 (BP, Premier Inn and McDonalds), also Scotstoun House near A8000 – potential minor land take impacts although no land take info available. 	Amber	<ul style="list-style-type: none"> In addition: Northbound segregated bus lane would impact upon Green Belt. South bound dedicated bus lane would impact on Green Belt south of Scotstoun. Potential to straddle economic development site at Ferrymuir. No expected landtake or access impacts to local businesses. No residential properties demolished. Minor Agricultural landtake by Northbound Segregated Bus Lane, likely to have negligible/minor impact (possible new landowners would need to be interviewed as Dalmeny Estate may be affected). Positive impact for wider commuter community with inclusion of designated bus land. 	Amber	<ul style="list-style-type: none"> Primarily impacting upon Green Belt although the impact at Dundas is slightly reduced. Cuts the eastern edge of the Echline strip. Some impact on Countryside to the west of South Queensferry. Impact on development land designated for Environmental Improvements and Housing development at Echline Fields (Springfield) and a housing development allocated at Society Road (HSG7). Northbound segregated bus lane would impact upon Green Belt. Southbound dedicated bus lane would impact on Green Belt south of Scotstoun. Potential to straddle economic development site at Ferrymuir. Preferred impact for agricultural impact as fields would only be bisected by Builyeon Road Re-alignment/some severance to west of A904 overbridge. No severance issues associated with A904 roundabout as per other options. No expected landtake or access impacts to local businesses. No residential properties demolished. 	Amber
	Geology, contaminated land and ground water.	Contaminated land: <ul style="list-style-type: none"> No major contamination issues-mainly routed through Greenfield sites. Low flow elevated methane identified approx. 200m from route. 	Green	Contaminated land: <ul style="list-style-type: none"> No major contamination issues with Option 1 alignment-mainly routed through Greenfield sites. Low flow elevated methane identified approx. 200m from route. Public transport corridor passes through a former oil shale mining area. Significantly elevated carbon monoxide concentrations recorded in the area. 	Amber	Contaminated land: <ul style="list-style-type: none"> No major contamination issues-mainly routed through Greenfield sites. Low flow elevated methane and carbon dioxide identified adjacent to route. Public transport corridor passes through a former oil shale mining area. Significantly elevated carbon monoxide concentrations recorded in the area. Elevated groundwater contaminants also identified in this 	Amber

		Option 1 without PT (as per *Figure 1)		Option 1 with PT (as per *Figure 4)		Option 3 with PT (as per *Figure 3)	
Criteria	Issue	Comment	Score	Comment	Score	Comment	Score
				<ul style="list-style-type: none"> Elevated groundwater contaminants also identified in this area. Road construction in this area may pose a risk to human health and the Water Environment (dependant on final construction design). 		<ul style="list-style-type: none"> area. Road construction in this area may pose a risk to human health and the Water Environment (dependant on final construction design). 	
	Water environment:	<ul style="list-style-type: none"> No watercourses crossed. 	Amber	<ul style="list-style-type: none"> Small watercourse crossed by northbound bus lane. 	Amber	<ul style="list-style-type: none"> Small watercourse crossed by northbound bus lane. 	Amber
	Ecology and nature conservation:	<p>Designated sites</p> <ul style="list-style-type: none"> Will impact upon northern edge of Dundas Estate Listed Wildlife Site (LWS) as well as Dundas Hill/Barren Craig Wood SINC. <p>Habitats</p> <ul style="list-style-type: none"> Primary impact will be on amenity grassland and poor semi-improved grassland, but will also impact on mixed plantation woodland of Echline Strip. Minor impact on species poor hedges and dry-stone walls. Small area of amenity grassland to be lost to west of South Queensferry for maintenance road. <p>Protected Species:</p> <ul style="list-style-type: none"> Potential impact on 4 unconfirmed bat tree roosts. Potential impact on 1 main badger sett and 2 outlier setts. 	Amber	<p>Designated sites:</p> <ul style="list-style-type: none"> Will impact upon northern edge of Dundas Estate Listed Wildlife Site (LWS) as well as Dundas Hill/Barren Craig Wood SINC. Potential slight impact on eastern edge of Dundas Estate LWS and Dundas Hill/Barren Craig Wood SINC. <p>Habitats:</p> <ul style="list-style-type: none"> Primary impact will be on amenity grassland and poor semi-improved grassland, but will also impact on mixed plantation woodland of Echline Strip. Minor impact on species poor hedges and dry-stone walls. Small area of amenity grassland to be lost to west of South Queensferry for maintenance road. Northbound segregated bus lane will impact on dense scrub and tall ruderal herb habitat as well as broad-leaved semi-natural woodland. <p>Protected Species:</p> <ul style="list-style-type: none"> Potential impact on 4 unconfirmed bat tree roosts. Potential impact on 1 main badger sett and 2 outlier setts. 	Amber	<p>Designated sites:</p> <ul style="list-style-type: none"> Will impact upon northern edge of Dundas Estate LWS as well as Dundas Hill/Barren Craig Wood SINC. Potential slight impact on eastern edge of Dundas Estate LWS and Dundas Hill/Barren Craig Wood SINC. <p>Habitats:</p> <ul style="list-style-type: none"> Primary impact will be on amenity grassland and poor semi-improved grassland, but will also impact on mixed plantation woodland of Echline Strip. Minor impact on species poor hedges and dry-stone walls. Northbound segregated bus lane will impact on dense scrub and tall ruderal herb habitat as well as broad-leaved semi-natural woodland. <p>Protected Species:</p> <ul style="list-style-type: none"> Potential impact on 4 unconfirmed bat tree roosts. Potential impact on 1 main badger sett and 2 outlier setts. 	Amber
	Landscape:	<p><u>Positive features:</u></p> <ul style="list-style-type: none"> Junction located within a dip with views backed by rising landform and woodland in Dundas Estate Mitigation planting would be in character with Dundas Estate shelterbelts/Echline Strip Slightly lower visual impact than Option 3 despite embankment (increased impact at southern edge of South Queensferry but reduced impact in west areas of South Queensferry) Slightly less impact on Duddingston Hill and Valley Farmland Local Landscape Character Area than Option 3 due to less visible position of junction. <p><u>Negative features:</u></p> <ul style="list-style-type: none"> Higher embankment at edge of Dundas Estate (up to 12m) has poorer landform fit than Option 3. Deeper cutting through A904 (10m) has poorer landform fit than Option 3. A904 link road and embankment cutting across farmland to roundabout results in greater visual severance and land take than required for Option 3. Slightly greater impact upon Dundas Estate Designed Landscape and Designed Wooded Local Landscape Character Area than Option 3. New junction lighting in relatively dark area of the landscape 	Amber	<p>As for Option 1 without public transport corridor, but:</p> <ul style="list-style-type: none"> Marginally increased significant impacts for Dundas Designed Wooded Local Landscape Character Area. 	Amber	<p><u>Positive features:</u></p> <ul style="list-style-type: none"> Less visual severance and land take than Option 1. Lower embankment at edge of Dundas Estate (6m) has better landform fit than Option 1. Shallower cutting through A904 (8m) has better landform fit than Option 1. Slightly less impact on Dundas Estate Designed Landscape and Designed Wooded Local Landscape Character Area than Option 1. Junction lighting would be close to existing street lighting on A904 and local roads. <p><u>Negative features:</u></p> <ul style="list-style-type: none"> Slightly greater visual impact than Option 1 (increased impact at west end of South Queensferry, but reduced impact in southern areas of South Queensferry). Junction in visually prominent location on higher open ground (low rise in landform). Mitigation of visual impacts harder than for Option 1, as closer to visual receptors and mass screen planting is not in character with open farmland. Slightly greater impact on Duddingston Hill and Valley Farmland Local Landscape Character Area than Option 1 due to position of junction on brow of a hill. Minor visual impact on housing at the edge of Scotstoun area due to bus land. 	Green
	Visual:	<ul style="list-style-type: none"> Significant impacts for Dundas Home Farm and southern edge of South Queensferry. Elevated mainline - gantries likely to be prominent. Increased visual impact at southern edge of South 	Amber	<ul style="list-style-type: none"> Marginally increased significant impacts for Dundas Home Farm and southern edge of South Queensferry. Elevated mainline - gantries likely to be prominent 	Amber	<ul style="list-style-type: none"> Significant impacts at south west corner of South Queensferry and single property at White Lodge. Significant impacts for Dundas Home Farm and southern edge of South Queensferry. Reduced impacts for Dundas estate. 	Green

Criteria	Issue	Option 1 without PT (as per *Figure 1)		Option 1 with PT (as per *Figure 4)		Option 3 with PT (as per *Figure 3)	
		Comment	Score	Comment	Score	Comment	Score
		Queensferry but reduced impact in west areas of South Queensferry.				<ul style="list-style-type: none"> May potentially require additional gantries where mainline is at grade, south of A904 junction - likely to be prominent. Will cut through the brow of the hill and would be widely visible in a relatively open area Mitigation of visual impacts would be more difficult in this location Increased visual impact at west end of South Queensferry, but reduced impact in southern areas of South Queensferry 	
	Air Quality:	<ul style="list-style-type: none"> Increased exposure along Builyeon Road (A904) between Echline junction and new carriageway as higher traffic flows (compared with Option 3) will result in higher air pollution concentrations. Both stretches of the A904 (i.e. east and west of the Queensferry junction) would be adversely affected. West of Queensferry Junction 349 properties are likely to experience deterioration due to increased traffic and east of Queensferry Junction approximately 243 properties could be affected due to increased public transport. More vehicle km travelled compared to Option 3 (access to new and old bridge longer) No sensitive receptors in the vicinity of the gyratory so underbridge does not cause an air quality issue. 	Amber	<ul style="list-style-type: none"> Potentially higher exposure at North Lodge, Newbigging Lodge, Ashley Cottage and other residential properties along the A8000 up to Echline Junction (compared to no public transport option) due to increased HDV emissions as route is used by northbound buses. 245 properties fall within 200m of this route. Little impact from southbound segregated bus lane. Only 54 properties within 200m of this stretch and in any case flows/emissions would be substantially lower compared to current situation due existing carriageway being made redundant (to majority of traffic). Benefits along Builyeon Road (A904) east of Echline Junction (between Echline Junction and Queensferry Junction) compared with no public transport option, as number of buses using this route is reduced. 349 properties fall within 200m of this road stretch. 	Amber	<ul style="list-style-type: none"> Reduced exposure at properties along Builyeon Road (A904) east of Echline junction compared with Options 1 as traffic would not use this road as a main access route. 446 properties fall within 200m of this road. Higher AADT flows on A904 west of new Queensferry junction (A904 towards Newton) compared with Options 1 could result in slightly higher pollutant concentrations along this road. 93 properties fall within 200m of this road. Public transport – as per Option 1. 	Green
	Traffic Noise & vibration	<ul style="list-style-type: none"> FRC – Mainline 120kph, with resulting high traffic noise. Public Transport – No flow data has been analysed for this assessment, however it is unlikely to be a significant impact compared to overall traffic flow. Gyratory underbridge is a negative factor as it pushes the mainline higher. 	Amber	<ul style="list-style-type: none"> FRC – Mainline 120kph with resulting high traffic noise. Public Transport – No flow data has been analysed for this assessment, however unlikely to be a significant impact overall apart from local negative impacts at Newbigging/ Dundas Home Farm (link 17245-1810) and along link 2062-17635. 	Amber	<ul style="list-style-type: none"> FRC – Mainline 120kph with resulting high traffic noise. Public Transport – No flow data has been analysed for this assessment; however it is unlikely to have a significant impact apart from local negative impacts at Newbigging/Dundas Home Farm (17245-1810) and link 2062-17635. Benefit to large number of noise sensitive receptors north of A904 in Queensferry. Negative impact on smaller number of noise sensitive receptors along the A904 west of Queensferry. 	Green
	Cultural heritage:	<ul style="list-style-type: none"> The road is in cutting close to the Category B Listed Building at Echline Farm and the Category C (S) Echline cottages. As a result, there is very little intervisibility between the road and the Listed Buildings. Countering this slightly is the elevated nature of the Queensferry Junction interchange that will impact upon the setting of Dundas Home farm Category B Listed Building. The views in this area have already been compromised by the existing approach to the Echline Junction. All options impact directly upon the Dundas Castle Inventory Designed Landscape although the impacts are mitigated by the presence of the Echline strip and further woodland between the proposals and the Castle itself. 	Green	<ul style="list-style-type: none"> With the addition of the public transport corridor there are additional impacts upon the Category B Listed Dundas Gatelodge and Category C Newbigging Gatelodge where the B8000 has been elevated and extended across the A90. 	Amber	<ul style="list-style-type: none"> Least preferred option, particularly as a result of the impact on the setting of the Category B Listed Echline Farmhouse and the Category C Listed Echline Cottages. This is due to the elevated nature of the interchange on the A904 and the on-ramp to same from the eastern side of the A904. This junction would also be more prominent in views from the observation platform at the top of Dundas Castle keep. However, this is mitigated slightly by the less elevated section between the A904 junction and the A90 Echline section. Impacts remain on the setting of Dundas Home Farm Category B Listed Buildings. However, these are again reduced slightly due to the less elevated nature of this section. All options impact directly upon the Dundas Castle Inventory Designed Landscape although the impacts are mitigated by the presence of the Echline strip and further woodland between the proposals and the Castle itself. With the addition of the public transport corridor there are additional impacts upon the Category B Listed Dundas Gatelodge and Category C Newbigging Gatelodge where the B8000 has been elevated and extended across the A90. 	Amber
	Peds, cyclists and equestrians	<ul style="list-style-type: none"> NMUs not affected by Queensferry Junction overbridge. Impacts on path journey length at Echline – sections of informal local paths lost to scheme. Alternative route via A904 overbridge - as per IDR2 design, footpaths should be maintained along northern side of A904 and on A904 overbridge. New path link to be created west of mainline to continue access to western recreational area. Negligible impact on segregated cycleway along A8000 - 	Amber	<ul style="list-style-type: none"> NMUs not affected by Queensferry Junction overbridge. No impact on NMUs from segregated bus lanes. Impacts on path journey length at Echline – sections of informal local paths lost to scheme. Alternative route via A904 overbridge - as per IDR2 design, footpaths should be maintained along northern side of A904 and on A904 overbridge. 	Amber	<ul style="list-style-type: none"> Impacts on path journey length at Echline – sections of informal local paths lost to scheme. Alternative route proposed via Queensferry overbridge roundabout - it is assumed that footpaths will be maintained from east to west on the realigned A904 and roundabout overbridge. New link footpath to be provided to the west of the mainline would be a slightly longer route. Impacts on amenity value of the local paths and alternative 	Amber

		Option 1 without PT (as per *Figure 1)		Option 1 with PT (as per *Figure 4)		Option 3 with PT (as per *Figure 3)	
Criteria	Issue	Comment	Score	Comment	Score	Comment	Score
		should be maintained along realigned A8000.		New path link to be created west of mainline to continue access to western recreational area. <ul style="list-style-type: none"> Negligible impact on segregated cycleway along A8000 - should be maintained along realigned A8000. 		route - pedestrians would have to negotiate a busier route using the roundabout. If signalised controlled crossing points were installed this would reduce the impact. <ul style="list-style-type: none"> Negligible impact on segregated cycleway along A8000 - should be maintained along realigned A8000. No impact on NMUs from segregated bus lanes. Mitigation may be slightly more difficult than for Option 1, but not significantly so. 	
	Vehicle Travellers	<ul style="list-style-type: none"> Increased opportunity for views from mainline elevated above gyratory 	Green	<ul style="list-style-type: none"> Increased opportunity for views from mainline elevated above gyratory 	Green	<ul style="list-style-type: none"> Reduced opportunity for views from mainline on reduced embankment at Dundas and below A904 gyratory. 	Amber
	Disruption due to construction	<ul style="list-style-type: none"> Temporary impacts expected to be similar to permanent impacts considered e.g. footpath diversions, landscape/visual, heritage, noise etc issues would all occur during construction. Need to ensure temporary access to Dundas Home Farm is considered. 	Amber	<ul style="list-style-type: none"> Additional disruption due to construction of public transport corridor particularly for Dundas Home Farm. 	Amber	<ul style="list-style-type: none"> No information on phasing/earth works/land take available therefore assumes impacts are the same as for Option 1. Additional disruption due to construction of public transport corridor particularly for Dundas Home Farm. 	Amber
	Polices and Plans	<ul style="list-style-type: none"> Impact on Green Belt south of South Queensferry, then countryside to the south west crossing an area allocated for Environmental Improvements (ENV 6) and Housing (HSG 2 Springfield and HSG 7 Society Road). The maintenance road could provide access to the site (HSG 2/ENV6) for future development. 	Amber	<ul style="list-style-type: none"> As per option without the PT corridor with some additional minor impact of the Green Belt for both northbound and southbound segregated bus lanes. 	Amber	<ul style="list-style-type: none"> Impact on Green Belt south of South Queensferry however slightly reduced when compared to Option 1 with the most significant impact at the gyratory (just situated within the Green Belt). Impact to countryside to the south west and west of South Queensferry before crossing an area allocated for Environmental Improvements (ENV 6) and Housing (HSG 2 and HSG 7). It's not clear if the maintenance road could be utilised to access the site (HSG 2/ENV6) for future development. Some additional minor impact of the Green Belt for both northbound and southbound segregated bus lanes. 	Amber
	Sustainability	<ul style="list-style-type: none"> The key impacts for sustainability relate primarily to the provision of integrated public transport and the effect that this has on social, economic and environmental factors. In general, the effects of this option would help to promote cross-Forth movement by public modes of transport which will help to improve access to economic opportunities, reduce the use of private transport and its effect on the environment, and promote social inclusion. Cut / Fill Balance = 345k / 590k m³ so 245k would need to be imported. Other aspects of the sustainability appraisal framework (e.g. nature conservation, water resources, landscape issues) are reported in previous sections of this schedule. 	Amber	<ul style="list-style-type: none"> The key impacts for sustainability relate primarily to the provision of integrated public transport and the effect that this has on social, economic and environmental factors. In general, the effects of this option would help to promote cross-Forth movement by public modes of transport which will help to improve access to economic opportunities, reduce the use of private transport and its effect on the environment, and promote social inclusion. This would be more so with the public transport corridor, as public transport would be allocated a more direct link between the A90 and Forth Road Bridge, which would result in either shorter journey times between specified points, or a greater distance of travel being available to commuters. Cut / Fill Balance = 350k / 645k m³ so 295k would need to be imported. Other aspects of the sustainability appraisal framework (e.g. nature conservation, water resources, landscape issues) are reported in previous sections of this schedule. 	Amber	<ul style="list-style-type: none"> The key impacts for sustainability relate primarily to the provision of integrated public transport and the effect that this has on social, economic and environmental factors. In general, the effects of this option would help to promote cross-Forth movement by public modes of transport which will help to improve access to economic opportunities, reduce the use of private transport and its effect on the environment, and promote social inclusion. This would be more so than with the public transport corridor, as public transport would be allocated a more direct link between the A90 and Forth Road Bridge, which would result in either shorter journey times between specified points, or a greater distance of travel being available to commuters. Cut / Fill Balance = 345k / 290k m³ so this option would generate some 55k of material which could be used as fill material elsewhere on the scheme. Other aspects of the sustainability appraisal framework (e.g. nature conservation, water resources, landscape issues) are reported in previous sections of this schedule. 	Green
Cost	Mainline Cost	In comparison with IDR2, the cost has decreased by, approximately £4.5m (23%). This is based on the earthworks.	Amber	In comparison with IDR2, the cost has decreased by, approximately £4.5m (23%). This is based on the earthworks.	Amber	In comparison with IDR2, the cost has decreased by, approximately £15m. This is based on the earthworks quantities and the removal of the A904 overbridge and BP protection structures.	Green
	Public Transport	N/A		The bus priority links are estimated to be approximately £2.2m based on the earthworks and pavement quantities and the requirement for a protective structure at the pipeline crossing. The costs exclude any requirements to amend the Dalmeny Railway Overbridge and works to mineworkings.	Amber	The bus priority links are estimated to be approximately £2.2m based on the earthworks and pavement quantities and the requirement for a protective structure at the pipeline crossing. The costs exclude any requirements to amend the Dalmeny Railway Overbridge and works to mineworkings.	Amber
	- Traffic economics	Junction would not significantly reduce journey times, due to distance travelled or increased speeds for the main traffic movements in the area, therefore journey time savings are considered to be neutral.	Amber	Junction would not significantly reduce journey times, due to distance travelled or increased speeds for the main traffic movements in the area, therefore journey time savings are considered to be neutral.	Amber	Junction would reduce travel time and costs for the majority of traffic movements in the area and would therefore be expected to provide economic benefits. The increased distance between interchanges is expected to reduce the potential for congestion	Green

		Option 1 without PT (as per *Figure 1)		Option 1 with PT (as per *Figure 4)		Option 3 with PT (as per *Figure 3)	
Criteria	Issue	Comment	Score	Comment	Score	Comment	Score
						due to weaving traffic. Overall the operation improvements, coupled with the reduced cost would contribute to an improved economic performance.	

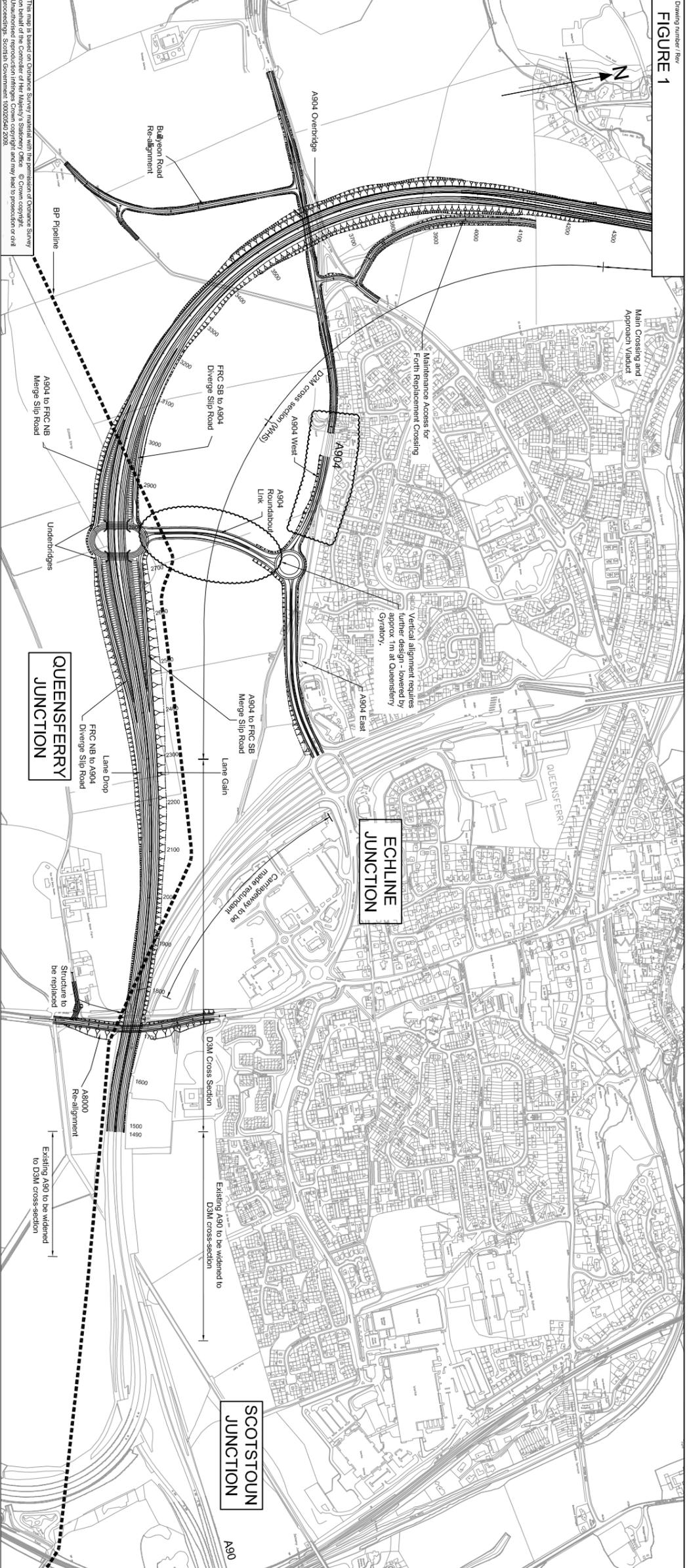
*Figures are contained in Appendix A.

Option 3 was considered the optimum solution as it scored higher overall in Design, Traffic Performance including Public Transport and Cost. In the case of the Environmental assessment, Option 3 scored slightly higher in the areas of landscape, visual impact, noise, air quality and sustainability.

In light of the findings of the assessment, Option 3 was subsequently taken forward as the preferred junction layout.

Appendix A Figures

Drawing number / Rev
FIGURE 1



Level Datum = 4,000

CHAINAGE	VERTICAL	HORIZONTAL	GRADIENT	PROPOSED
4300.000	34.513	0.890	40.142	39.697
4250.000	39.143	0.578	39.408	39.408
4200.000	40.839	0.266	39.275	39.275
4150.000	41.312	0.047	39.299	39.299
4100.000	43.302	0.359	39.478	39.478
4050.000	45.354	0.672	39.614	39.614
4000.000	45.993	0.984	40.306	40.306
3950.000	48.462	1.297	40.955	40.955
3900.000	49.662	1.609	41.759	41.759
3850.000	49.069	1.922	42.720	42.720
3800.000	51.598	2.234	43.837	43.837
3750.000	53.939	2.547	45.111	45.111
3700.000	54.204	2.736	46.479	46.479
3650.000	55.402	2.738	47.848	47.848
3600.000	57.042	2.738	49.217	49.217
3550.000	56.843	2.738	50.586	50.586
3500.000	57.872	2.738	51.955	51.955
3450.000	57.585	2.738	53.324	53.324
3400.000	56.480	2.738	54.693	54.693
3350.000	57.888	2.738	56.062	56.062
3300.000	58.887	2.738	57.431	57.431
3250.000	58.694	2.628	58.745	58.745
3200.000	59.096	2.355	59.923	59.923
3150.000	60.113	2.081	60.963	60.963
3100.000	61.116	1.806	61.866	61.866
3050.000	60.816	1.531	62.631	62.631
3000.000	59.634	1.256	63.260	63.260
2950.000	58.204	0.982	63.750	63.750
2900.000	56.680	0.707	64.104	64.104
2850.000	55.540	0.432	64.320	64.320
2800.000	54.065	0.158	64.399	64.399
2750.000	53.011	0.117	64.340	64.340
2700.000	52.574	0.392	64.144	64.144
2650.000	52.144	0.667	63.811	63.811
2600.000	51.623	0.941	63.340	63.340
2550.000	51.844	1.216	62.732	62.732
2500.000	51.999	1.491	61.987	61.987
2450.000	51.861	1.766	61.104	61.104
2400.000	51.983	2.040	60.084	60.084
2350.000	52.233	2.306	58.931	58.931
2300.000	52.223	1.606	58.127	58.127
2250.000	51.800	0.255	58.000	58.000
2200.000	51.218	0.979	58.489	58.489
2150.000	53.074	1.016	58.997	58.997
2100.000	54.762	0.741	59.368	59.368
2050.000	56.642	0.466	59.601	59.601
2000.000	57.161	0.192	59.696	59.696
1950.000	56.317	0.083	59.655	59.655
1900.000	55.492	0.358	59.476	59.476
1850.000	56.045	0.633	59.160	59.160
1800.000	56.448	0.907	58.706	58.706
1750.000	55.768	1.182	58.115	58.115
1700.000	55.744	1.457	57.387	57.387
1650.000	56.066	1.580	56.597	56.597
1600.000	56.226	1.135	56.029	56.029
1550.000	55.995	0.750	55.258	55.258
1500.000	55.725	0.365	54.407	54.407

South Mainline - Design Speed 120kph
Scale 1:5,000 Horizontal, 1:1,000 Vertical

Notes
1. Structure locations and levels are indicative only.

0	23/03/08	For Information	MAL	KO	RAI	JRC
Rev	Rev. Date	Purpose of revision	Drawn	Checked	Reviewed	Approved

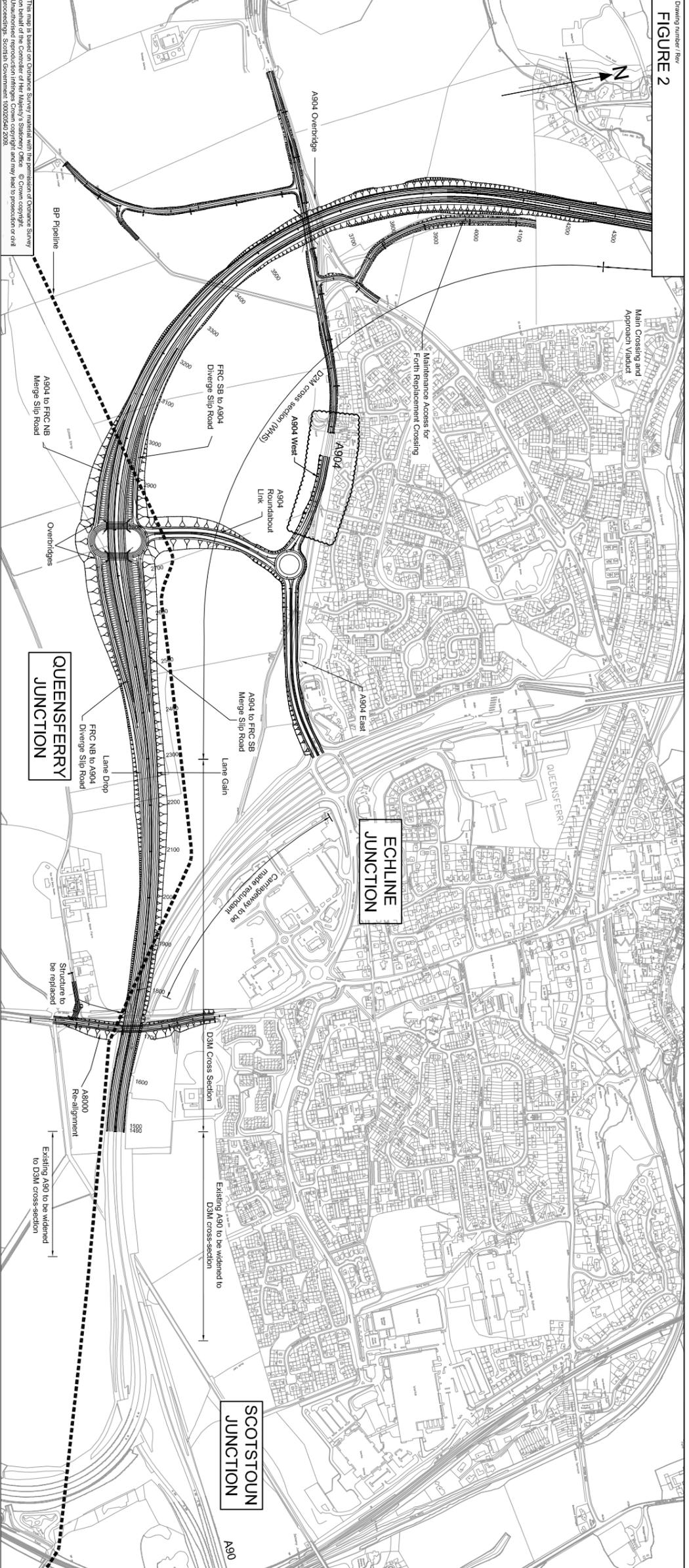
Client: **TRANSPO** **SCOTLAND**
 A member of **The Scottish Government**
JACOBS **ARUP**

Project: **FORTH REPLACEMENT CROSSING**
QUEENSFERRY JUNCTION ASSESSMENT OPTION 1

FOR INFORMATION
 Scale: 1:5000 @ A1
 Client no: RD 001675
 Drawing number: **FIGURE 1**
 Rev: 0

This drawing is not to be used in whole or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

FIGURE 2



Level Datum $\pm 4,000$

CHAINAGE	VERTICAL	HORIZONTAL	GROUND LEVELS	GRADIENT	PROPOSED LEVELS
4300.000			34.513	0.890	40.142
4250.000			39.143	0.578	39.697
4200.000			40.830	0.266	39.408
4150.000			41.312	0.047	39.275
4100.000			43.302	0.359	39.299
4050.000			45.354	0.672	39.478
4000.000			45.993	1.079	39.814
3950.000			48.462	2.259	40.354
3900.000			49.662	3.580	41.483
3850.000			49.069	4.000	43.273
3800.000			51.598	3.639	45.273
3750.000			53.939	3.680	47.243
3700.000			54.204	3.405	49.083
3650.000			55.402	3.130	50.785
3600.000			57.042	2.856	52.351
3550.000			56.843	2.581	53.779
3500.000			57.872	2.306	55.069
3450.000			57.585	2.032	56.222
3400.000			56.480	1.757	57.238
3350.000			57.888	1.482	58.116
3300.000			58.887	1.207	58.858
3250.000			58.694	0.933	59.461
3200.000			59.096	0.658	59.928
3150.000			60.113	0.383	60.257
3100.000			61.116	0.108	60.448
3050.000			60.816	0.166	60.502
3000.000			59.834	0.441	60.419
2950.000			58.204	0.716	60.199
2900.000			56.680	0.990	59.841
2850.000			55.540	1.265	59.346
2800.000			54.065	1.540	58.713
2750.000			53.011	1.815	57.943
2700.000			52.574	2.019	57.036
2650.000			52.144	1.074	56.026
2600.000			51.623	0.277	55.489
2550.000			51.844	0.916	55.628
2500.000			51.999	0.916	56.085
2450.000			51.861	0.916	56.543
2400.000			51.983	0.916	57.001
2350.000			52.233	0.916	57.459
2300.000			52.223	0.916	57.917
2250.000			51.800	0.916	58.374
2200.000			51.218	0.916	58.832
2150.000			53.074	0.849	59.290
2100.000			54.762	0.586	59.714
2050.000			56.642	0.312	60.007
2000.000			57.161	0.037	60.163
1950.000			56.317	0.238	60.182
1900.000			55.492	0.513	60.063
1850.000			56.045	0.787	59.807
1800.000			56.448	1.062	59.413
1750.000			55.768	1.337	58.882
1700.000			55.744	1.611	58.214
1650.000			56.066	1.623	57.408
1600.000			56.226	1.135	56.597
1550.000			55.995	0.750	56.029
1500.000			55.758	0.815	55.558

South Mainline - Design Speed 120kph
Scale 1:5,000 Horizontal, 1:1,000 Vertical

Notes
1. Structure locations and levels are indicative only.

0	23/03/09	For Information	RT	KO	RA	JK
Rev	Rev. Date	Purpose of revision	Drawn	Checked	Reviewed	Approved



JACOBS ARUP

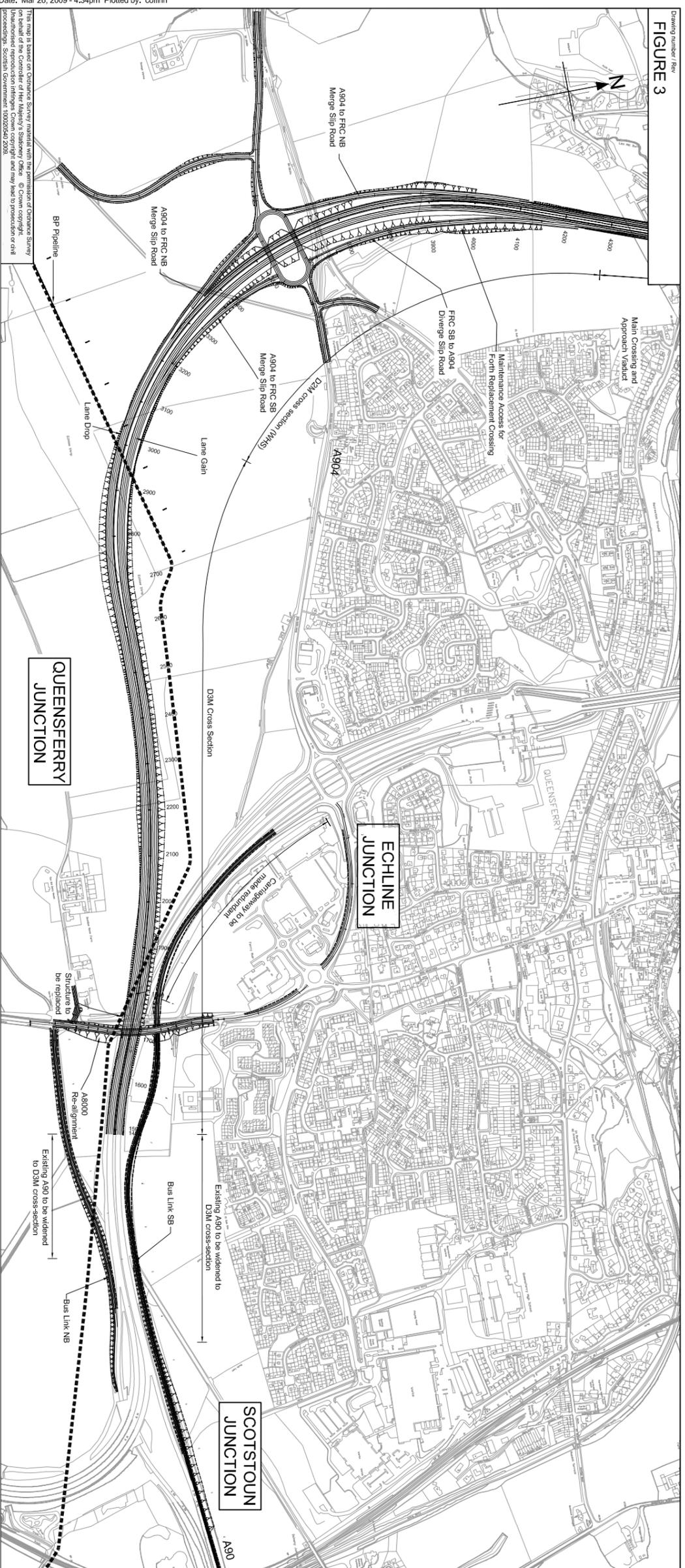
FORTH REPLACEMENT CROSSING

QUEENSFERRY JUNCTION ASSESSMENT OPTION 2

FOR INFORMATION

Scale 1:5000 @ A1
Client no. RD 001675
Drawing number **FIGURE 2**
Rev 0

This drawing is not to be used in whole or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.



Level Datum =34,000

CHAINAGE	VERTICAL	HORIZONTAL	GROUND LEVELS	GRADIENT	PROPOSED LEVELS
4300.000			34.513	1.020	40.141
4250.000			39.143	0.854	39.631
4200.000			40.639	0.355	39.204
4150.000			41.312	0.154	39.027
4100.000			43.302	0.663	39.104
4050.000			45.354	1.172	39.436
4000.000			45.993	1.682	40.022
3950.000			48.462	2.191	40.863
3900.000			49.662	2.503	41.958
3850.000			49.069	2.506	43.209
3800.000			51.598	2.506	44.462
3750.000			53.939	2.506	45.715
3700.000			54.204	2.506	46.969
3650.000			55.402	2.506	48.222
3600.000			57.042	2.506	49.475
3550.000			56.843	2.506	50.728
3500.000			57.872	2.506	51.981
3450.000			57.585	2.506	53.234
3400.000			56.480	2.389	54.487
3350.000			57.888	2.115	55.882
3300.000			58.887	1.841	56.740
3250.000			58.694	1.566	57.660
3200.000			59.096	1.291	58.443
3150.000			60.113	1.016	59.088
3100.000			61.116	0.742	59.597
3050.000			60.816	0.467	59.968
3000.000			59.634	0.192	60.201
2950.000			58.204	0.082	60.297
2900.000			56.680	0.357	60.256
2850.000			55.540	0.632	60.077
2800.000			54.065	0.907	59.762
2750.000			53.011	1.181	59.308
2700.000			52.574	1.456	58.718
2650.000			52.144	1.731	57.990
2600.000			51.623	1.668	57.124
2550.000			51.844	0.631	56.290
2500.000			51.999	0.500	55.974
2450.000			51.861	0.500	55.724
2400.000			51.983	0.362	55.474
2350.000			52.233	0.787	55.204
2300.000			52.223	1.828	55.687
2250.000			51.800	1.673	56.602
2200.000			51.218	1.398	57.438
2150.000			53.074	1.123	58.137
2100.000			54.762	0.848	58.698
2050.000			56.642	0.574	59.122
2000.000			57.161	0.299	59.409
1950.000			56.317	0.024	59.559
1900.000			55.492	0.251	59.571
1850.000			56.045	0.525	59.445
1800.000			56.448	0.800	59.183
1750.000			55.768	1.075	58.783
1700.000			55.744	1.349	58.245
1650.000			56.066	1.624	57.571
1600.000			56.226	1.495	56.759
1550.000			55.995	0.715	56.011
1500.000			55.619		55.252
1450.000			55.102		54.483

South Mainline - Design Speed 120kph
Scale 1:5,000 Horizontal, 1:1,000 Vertical

Notes
1. Structure locations and levels are indicative only.

0	23/03/09	For Information	RT	KO	RA	JXC
Rev	Rev. Date	Purpose of revision	Drawn	Checked	Reviewed	Approved

Client: **TRANSPO**
SCOTLAND

As part of **The Scottish Government**

JACOBS ARUP

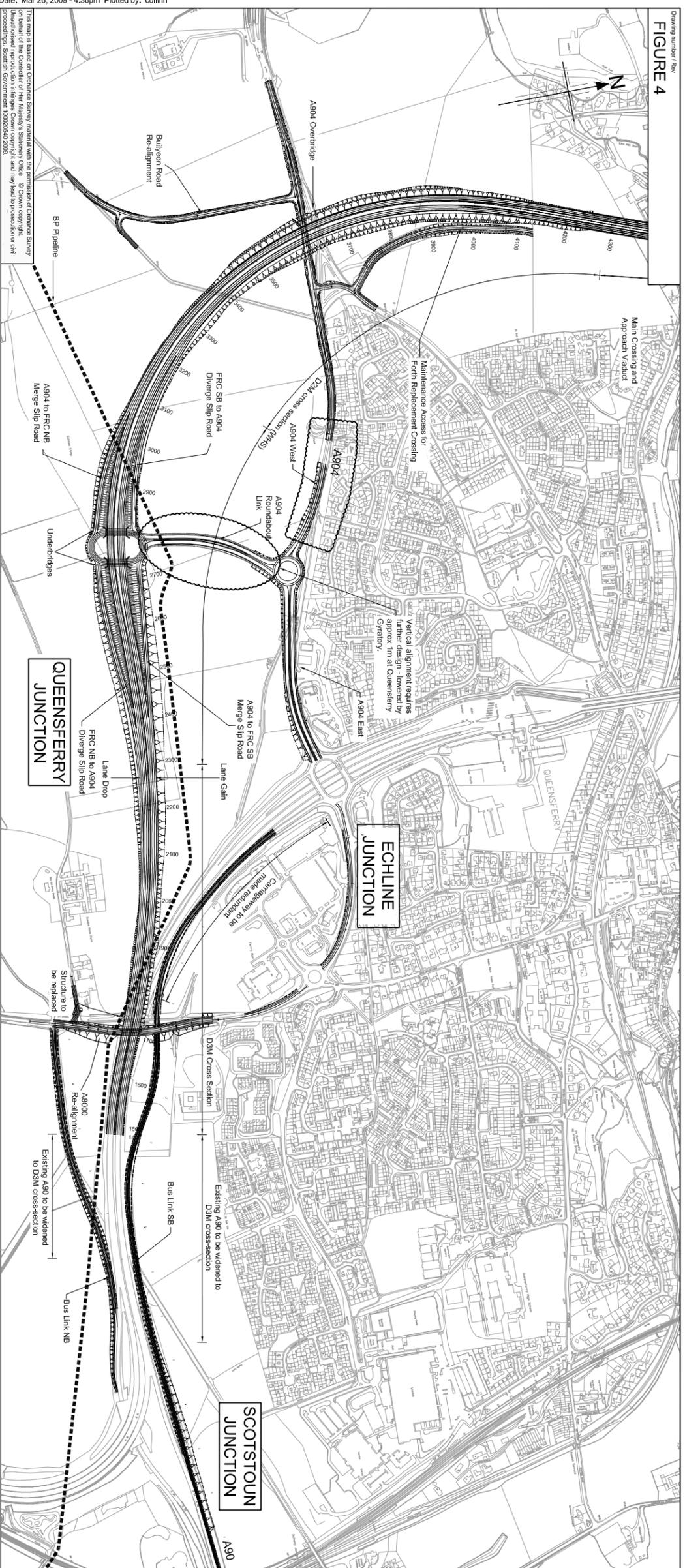
Project: **FORTH REPLACEMENT CROSSING**

Drawing title: **QUEENSFERRY JUNCTION ASSESSMENT OPTION 3**

FOR INFORMATION

Scale: 1:5000 @ A1
Client no: RD 001675
Drawing number: **FIGURE 3**
Rev: 0

This drawing is not to be used in whole or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.



Level Datum \approx 4,000

CHAINAGE	VERTICAL	HORIZONTAL	GROUND LEVELS	GRADIENT	PROPOSED
4300.000			34.513	0.890	40.142
4250.000			39.143	0.578	39.697
4200.000			40.839	0.266	39.408
4150.000			41.312	0.047	39.275
4100.000			43.302	0.359	39.299
4050.000			45.354	0.672	39.478
4000.000			45.993	0.964	39.614
3950.000			48.462	1.297	40.306
3900.000			49.662	1.609	40.955
3850.000			49.069	1.922	41.759
3800.000			51.598	2.234	42.720
3750.000			53.939	2.547	43.637
3700.000			54.204	2.736	45.111
3650.000			55.402	2.738	46.479
3600.000			57.042	2.738	47.848
3550.000			56.843	2.738	49.217
3500.000			57.872	2.738	50.586
3450.000			57.585	2.738	51.955
3400.000			56.480	2.738	53.324
3350.000			57.888	2.738	54.693
3300.000			58.887	2.738	56.062
3250.000			58.694	2.628	57.431
3200.000			59.096	2.355	58.745
3150.000			60.113	2.081	59.923
3100.000			61.116	1.806	60.963
3050.000			60.816	1.531	61.866
3000.000			59.634	1.256	62.631
2950.000			58.204	0.982	63.260
2900.000			56.690	0.707	63.750
2850.000			55.540	0.432	64.104
2800.000			54.065	0.158	64.320
2750.000			53.011	0.117	64.399
2700.000			52.574	0.392	64.340
2650.000			52.144	0.667	64.144
2600.000			51.623	0.941	63.611
2550.000			51.844	1.216	63.340
2500.000			51.999	1.491	62.732
2450.000			51.861	1.766	61.987
2400.000			51.983	2.040	61.104
2350.000			52.233	2.306	60.084
2300.000			52.223	1.606	58.931
2250.000			51.800	0.255	58.127
2200.000			51.218	0.979	58.000
2150.000			53.074	1.016	58.489
2100.000			54.762	0.741	58.997
2050.000			56.642	0.466	59.368
2000.000			57.161	0.192	59.601
1950.000			56.317	0.083	59.696
1900.000			55.492	0.358	59.655
1850.000			56.045	0.633	59.476
1800.000			56.448	0.907	59.160
1750.000			55.768	1.182	58.706
1700.000			55.744	1.457	58.115
1650.000			56.066	1.580	57.387
1600.000			56.226	1.135	56.597
1550.000			55.995	0.750	56.029
1500.000			55.725	0.815	55.528

South Mainline - Design Speed 120kph
Scale 1:5,000 Horizontal, 1:1,000 Vertical

Notes
1. Structure locations and levels are indicative only.

0	23/03/08	For Information	MJM	KO	RAI	JK
Rev	Rev. Date	Purpose of revision	Drawn	Checked	Reviewed	Approved



Project
FORTH REPLACEMENT CROSSING

Drawing title
QUEENSFERRY JUNCTION 1 ASSESSMENT OPTION 1 WITH BUS LINKS

FOR INFORMATION

Scale
1:5000 @ A1
RD 001675

Client no.
RD 001675

Drawing number
FIGURE 4

This drawing is not to be used in whole or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.