- Youth Club.

5.274 There are currently no specific provisions for cyclists along the existing carriageway of the Shore Road or within Greenisland. The nearest cycle routes within the local area are shown in Figure SAR2/5.8.

5.275 There are no specific provisions for equestrians in the area.

5.276 The population of the Greenisland Ward (covering the area along the Shore Road from the University to Castlerocklands) is approximately 2,500, while the Gortalee Ward (which covers most of the Greenisland housing estate) is 1,500 (ref: Northern Ireland Statistics and Research Agency).

Effects of S5 Options – New Road Inland Corridor

5.277 Options S5-1 and S5-2 would cause substantial severance in the university campus and in Greenisland by introducing a division in those areas. There would be significant severance to the University of Ulster campus, with some of the student accommodation and the Harry Ferguson Research facilities becoming separated from the main campus.

5.278 They would have the potential for moderate severance effects on pedestrians and cyclists in the Greenisland community as the estate would effectively be divided in half. The new road could increase journey times to community facilities by between 250 to 500m, so would have a moderate impact as defined in Volume 11, Section 3 of the DMRB. Examples of this could include, residents in the north of Greenisland travelling to the doctors surgery or primary school, or residents in the south of the estate travelling to the shopping facilities at Glassillan Court.

5.279 Option S5-2-V3 would also separate some student accommodation from the main campus but as a large part of the Harry Ferguson Research facilities would be demolished, they could be rebuilt within the campus. It would cause a division in the Belfast High School separating the school from playing fields. It would cause a division between Greenisland and parts of Station Road and Shore Road but as it would not be central in Greenisland, there would not be the same impact upon journey times to community facilities as in Options S5-1 and S5-2.

5.280 Option S5-2-V4 would cause no severance to the university but it would cause Belfast High School campus to be separated from Shore Road. The effect along the edge of Greenisland would be as for Option S5-2-V4.

5.281 All S5 options should improve the conditions on Shore Road for cyclists and pedestrians, as the majority of through traffic would be on the new carriageway alignment. However, the reverse is that all the options would introduce at some point a new road into established educational and residential areas. There would be major doubts from the local community that a new road could be introduced into the area safely.

Mitigation for S5 Options – New Road Inland Corridor

5.282 Where the S5 options run through the university, it is anticipated that footbridges or underpasses (footbridges are usually preferred) would be provided as there would be significant demand by pedestrians. As the High School would be wholly to one side of the new road in Option S5-2-V4, a footbridge may not be warranted but a controlled pedestrian crossing facility would be warranted

for access to bus stops regardless of whether buses used the new road or continued to use Shore Road. All such facilities, footbridges or crossings, would be provided for shared use of cyclists.

5.283 Within Greenisland, Option S5-1 would have a local road crossing at existing ground level and that would reduce severance to some extent. Station Road would also cross the new road at-grade. Option S5-2 would have a footbridge or underpass at a suitable point and there would be pedestrian crossing facilities at the Station Road junction. All bridges and controlled crossings would provide facilities for both pedestrians and cyclists.

5.284 At the edge of Greenisland, with Options S5-2-V3 and S5-2-V4, pedestrian and cycle facilities at the new road would be provided via controlled crossings at the junctions and any other location that proves to be warranted. On all of the inland options, consideration would have to be given to physical barriers to prevent pedestrian access to the new road except at controlled crossings.

Effects of S7 Options – Existing Road Corridor Improvements

5.285 Pedestrian access to community facilities along the Shore Road is currently difficult if it is necessary to cross the road, as there are only formal crossing points at Station Road and Jordanstown junctions. For example, school children using bus stops, or residents on the lough side wishing to access the High School or the small shopping precinct, or residents on the landward side wishing to gain access to the Loughshore Park or care homes, would have to cross the A2 carriageway largely without assistance.

5.286 With the Online S7 Options, the introduction of a wider single carriageway would obviously increase the distance that pedestrians would need to cross, but this would be less than 25m and would be classed as a slight adverse impact, in accordance with Volume 11, Section 3 of the DMRB. If a dual carriageway were created rather than a wide carriageway, pedestrians would be able to cross each direction of traffic separately and as conditions would be less congested there could be more breaks in the traffic flow and more safe opportunities for pedestrians to cross the road than there is at present. Hence in that situation, it could be considered to be beneficial.

5.287 All of the S7 options would have the beneficial effect of introducing a continuous footway on both sides of the A2. The provision of a high quality footway on both sides of the Shore Road would be a slight benefit, as pedestrians will no longer have to cross as frequently, unlike the present conditions where the footway is discontinuous.

5.288 The lough side footway would actually be a shared cycleway/footway. It is considered that this shared arrangement would be a safer proposal than cyclists using the carriageway, as that would remove them from immediate conflict with vehicles. This could be used by people travelling to and from the University, and between Belfast and Carrickfergus and could extend the National Cycle Network along Shore Road, improving access from Belfast and up to the Antrim coast.

5.289 The nature of the A2, both in its existing state and after any widening work, makes it inappropriate for any equestrian access.

Mitigation for S7 Options – Existing Road Corridor Improvements

5.290 The provision of a continuous footpath on both sides of the A2 Shore Road in slight beneficial, but the increased distance to cross would result in a slight adverse impact. This could be mitigated by the provision of a greater number of assisted crossing points. The junctions at Shore Avenue

(University), Shorelands and Station Road would all have controlled pedestrian crossing facilities. Other crossing facilities could be provided where this is warranted, for example at the High School.

5.291 The provision of a dual carriageway would assist the provision of formal assisted crossings, but would also provide safer crossing points than a wide single carriageway.

5.292 On the lough side only, there would also be the opportunity to introduce a cycle lane next to the footpath, with pedestrians and cyclists having right of way over cars emerging from the various accesses. This could provide the opportunity to extend the National Cycle Network to Carrickfergus and beyond to the Antrim Coast, which is something that Sustrans supports.

Effects of S5S7 Options – Combined Partial Bypass

5.293 Over the length from Jordanstown Road to Station Road, the Combined S5S7 Options the effects would be as for the S7 options. Shore Road north of Station Road would be unchanged and in that respect the S5S7 options should improve the conditions on that part of Shore Road for cyclists and pedestrians, as the majority of through traffic would be on the new carriageway alignment.

5.294 North of Station Road where it would move inland, it would introduce new severance to the agricultural land over which it crosses and to Whinfield Lane. The actual extent of severance to farming activities has not been determined at present. There would be less than 5 dwellings separated from the rest of Whinfield Lane and Shore Road.

Mitigation for S5S7 Combined Options

5.295 Mitigation for S5S7 options would be similar as for S7 options, as far as Station Road. In addition, alternative access provisions would be made for Whinfield Lane. This could be an accommodation bridge over the new road or connecting the severed part of Whinfield Lane to say the Seapark junction or to Station Road via Longfield Gardens. If it is connected to the new road it would be limited to a left-in / left-out arrangement.

5.296 The various solutions for Whinfield Lane would incur different degrees of detour. The most likely solution has not been determined at this stage.

Comparison of Options

5.297 The Inland S5-1 and S5-2 Options could be considered to have the greatest adverse effect on non-motorised road users and the community at large. They would introduce a new heavily trafficked road into areas that are relatively traffic free, in particular the university and Greenisland housing area. On the beneficial side, they would leave the greatest length of Shore Road as a relatively low traffic road.

5.298 Option S5-2-V3 has less impact but the same benefits and S5-2-V4 would have least impact of the S5 options and the least benefit.

5.299 All of the Online S7 Options would have similar impact except that the impacts would be least with a dual carriageway rather than a wider single carriageway. They would have less impact than the inland options in that there is no new severance. They would all have benefits in that there would be more assisted crossing points and a wholesale improvement of pedestrian and cycling facilities along Shore Road.

5.300 The Combined S5S7 Options are considered to have the least impact of all options in that they would affect only part of Shore Road and the section of new road would have only a severance effect limited to farming activities and a small number of dwellings. The benefits of the combined options are a wholesale improvement of pedestrian facilities along part of Shore Road and the remainder of Shore Road becoming a low traffic road.

Driver Stress

Baseline Conditions

5.301 The DMRB defines driver stress as the adverse mental and physiological effects experienced by the driver traversing a road network. The A2 Shore Road currently experiences a daily two-way traffic flow of 30,000 vehicles, which can give rise to significant periods of congestion at peak times and can lead to cars diverting to other roads such as the B90. This congestion can lead to significant driver stress caused by the frustration of long queues. There are also a large number of private drives and public accesses emerging onto the existing A2 Shore Road.

5.302 The views from the road were assessed in the Landscape and Visual Section.

Effects of S5, S7 and S5S7 Options

5.303 The effects are broadly the same for all options in that upon completion of the scheme there would be less driver stress for motorists using both the new and existing roads. There would not be the same levels of congestion, and associated delays or extensions to travelling time, therefore the existing frustrations should be reduced. There would be more assisted junctions therefore leaving and joining the main A2 road would be easier than at present.

5.304 Where there is a new road within the options, that would be expected to have a low accident rate as it would be designed to current standards and would have positive separation of, or positive assistance for, vehicle and pedestrian activity. There would nevertheless be a perceived road safety problem of the introduction of a new road into an established residential area. The online widening options would be to a design to best fit the circumstances and would have a mix of vehicle and pedestrian activity but would nevertheless be a significant improvement on present conditions.

5.305 The type of accident currently experienced on Shore Road caused by slow moving traffic would be expected to be significantly reduced. The inland options would remove large volumes of traffic from Shore Road and would also make it easier for travellers to turn onto this road from minor accesses and residential properties. The online widening options would be expected to have possibly greater difficulties than at present for access to minor accesses and properties with a wider single carriageway and more free flowing traffic along the road. For that reason, a dual carriageway would be preferred, which would limit access to left-in / left-out manoeuvres and prevent the inherently more hazardous movements involving turning right across traffic flows.

Mitigation for S5, S7, S5S7 Options

5.306 Upon completion of the scheme, there would be less driver stress for motorists using the roads and in that sense no further mitigation would be necessary. Nevertheless, it should be noted that where options involve new roads, maximum benefit would be achieved by minimising conflicting vehicle and pedestrian activities and reducing the number of junctions.

5.307 Where options involve the widening of Shore Road, maximum benefit would be achieved by providing assisted crossings for pedestrians and preventing right turning vehicle movements except at formal controlled junctions.

Comparison of Options

5.308 All the Options would lead to an overall reduction in driver stress. Option S5-1 would be most beneficial due to having the least number of junctions. The other Inland S5 Options would be less so but nevertheless highly beneficial.

5.309 The Online S7 Options would be least beneficial as they would still have close vehicle and pedestrian activity and minor accesses and driveways with direct access to the improved road. The Combined S5S7 Options would be more favourable than the online options in that part of the route would be a new road off-line.

Key Issues

5.310 The main beneficial impact of the proposal would be on vehicle travellers who would experience a significant reduction in driver stress. The levels of congestion at peak times will be significantly reduced and there would be positive road safety measures whatever option is chosen. However, this improvement can only be achieved by significant adverse impacts on established areas.

5.311 The main environmental issue for the Inland S5 Options is that of severance for Greenisland, the University of Ulster and Belfast High School and all of the attendant issues of noise, air quality and access to community facilities that do not prevail at present. Regardless of design provisions, the local population would have major doubts that a new road could be introduced into those areas safely. There would also be the significant issue of the loss of a number of educational and other community buildings as well as residential property at various points along the alignment of the road.

5.312 The Online S7 Options would also cause property loss, mainly to residents along the existing Shore Road but also to the Belfast High School and a grocery store. There would also be impacts to the visual character of the area because of the land take from gardens and the loss of mature trees, which would have an adverse impact on the Shore Road Area of Townscape Character. The optimum choice of an online option would be that which minimises loss of property and better manages the construction of the works.

5.313 The Combined S5S7 Options would also cause property loss along the existing Shore Road, but on a lesser scale. There would also be impacts to the visual character of the area because of the land take from gardens and this would again have an adverse impact on the Shore Road Area of Townscape Character, but again on a lesser scale. These impacts would be much reduced from the S7 options, as a significant part of Shore Road would be bypassed. The section of new bypass road would encroach into a Draft Belfast Metropolitan Area Plan designated green wedge between communities.

Environmental Impact Tables

5.314 The main environmental issues have been summarised in the Environmental Impacts Table in Table 5.23. In order to keep the tables to manageable extent, the comments have been given for each of the groups of options as in the text above.

Table 5.23 Environmental Impacts Table

APPRAISAL GROUP 1 LOCAL RESIDENTS AND THE COMMUNITY

			Option Group			COMMENTS
Community Effects	Community severance	-	Major Adverse	Neutral	Neutral	Option S5 would cause substantial severance in Greenisland by introducing a division in the middle of the residential area. Also significant severance to the University of Ulster campus. Variation S5-2-V3 would cause severance to the Belfast High School campus.
	Demolition of Property	No of properties	<35	<30	<30	
Landscape	Impact upon Areas of Townscape Character	-	Minor Adverse	Moderate Adverse	Minor Adverse	Option S5: Key features of the Greenisland ATC are the terraced and detached houses, view of Knockagh and War Memorial, narrow roads and mature trees and leafy embankments on Station Road. Option S7: Key features of the Shore Road ATC are the mature trees, gardens and houses.
	Loss of property, gardens, mature trees	-	Moderate Adverse	Moderate Adverse	Moderate Adverse	Option S5 - substantial adverse effects - fragmenting the Greenisland residential area and University of Ulster Campus. Option S7 – substantial loss of mature vegetation, garden landscapes and demolition of several buildings along Shore Road. Option S5S7 – as S7 but half the length of Shore Road affected.
	Fragmentation of RLW and Green Belt	-	Minor Adverse	Neutral	Minor Adverse	
	Impacts to the settings of Castle Lug and Listed Buildings	-	Negligible	Moderate	Moderate	Options S5 and S5S7 would require land take from the frontage of Castle Lug and may impact on the setting
Air Quality		Number of properties within 200m of options	650	400	300	Greater number of properties affected for Option S5

			Option Group			COMMENTS
Disruption Due to Construction		Number of properties within 100m of existing route	350	300	200	Greater number of properties affected for Option S5
Land Use	Land take from agricultural land	m^2	48,000	140	40,000	The agricultural land is not classified as being of the Best and Most Versatile Land.
	Loss of public amenity land	m^2	9,300	-	-	Option S5: Requires land take from Areas of Open Space
Traffic Noise	Noise Effects	No of properties within 300m of the options	1,000	500	400	Greater number of properties affected by Option S5.
Journey Time/Access	Journey length, local travel patterns	-	Minor	Minor	Minor	

APPRAISAL GROUP 2: VEHICLE TRAVELLERS

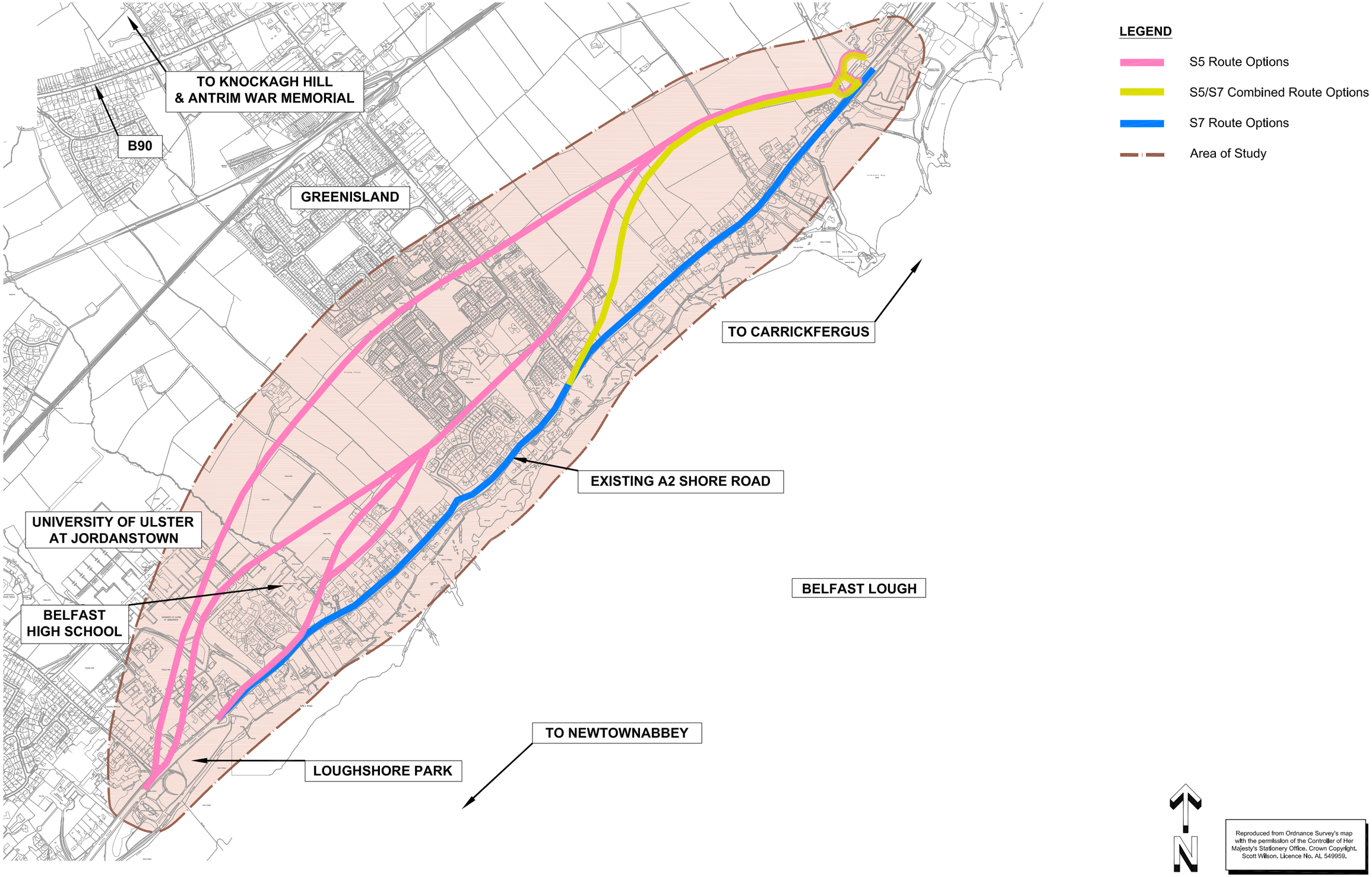
			Option Group			COMMENTS
A2 Shore Road Traffic	Disruption due to construction	-	Moderate adverse	Moderate adverse	Minor adverse	Vehicle travellers likely to be subject to delays during construction.
	Driver Stress	-	Moderate beneficial	Moderate beneficial	Moderate beneficial	Beneficial effect on through travellers stress due to improved traffic flows.
	Bus Journey Times	-	Moderate beneficial	Moderate beneficial	Moderate beneficial	Beneficial effect due to improved traffic flows.
Cyclists and Pedestrians	Disruption due to construction	-	Minor adverse	Minor adverse	Minor adverse	
	Change in Amenity	-	Minor adverse	Moderate beneficial	Moderate beneficial	Option S5: Substantial severance in Greenisland by introducing a division in the middle of a residential area. Option S7 & S5S7: The route could introduce a new continuous footpath on both sides of the road a cycleway along the landward side of the current alignment of the existing Shore Road.
Equestrians	Change in amenity	-	No provisions current or proposed	No provisions current or proposed	No provisions current or proposed	

APPRAISAL GROUP 3: CULTURAL HERITAGE AND NATURAL HERITAGE

			Option Group			COMMENTS
Cultural Heritage	**Castle Lug** Impact on setting	-	-	Minor Adverse	Minor Adverse	
	Land take	m		11	11	Land required from the frontage of Castle Lug
	Listed Buildings Demolition	No of properties	1	0	0	684 Shore Road demolition required for Variation S5-2-V3
	Impact on Setting	-	-	Minor adverse	Minor Adverse	
Belfast Lough SPA, Ramsar and ASSI	Disruption due to Construction	-	Neutral	Neutral	Neutral	Appropriate Assessment not required
Protected Species	Otters	-	Neutral	Neutral	Neutral	Appropriate mitigation required in the form of suitable culverts
	Bats	-	Unknown	Unknown	Unknown	Further surveys to be carried out
Loss of Habitat	Trees Hedgerows	-	Minor Adverse	Moderate Adverse	Minor Adverse	Tree survey to be carried out. There are no trees with a Tree Preservation Order on them. Further surveys to be carried out

APPRAISAL GROUP 4: IMPACT OF ROAD SCHEMES ON POLICIES AND PLANS

			Option Group			COMMENTS
Transport	Policy TRAN1		Neutral	Beneficial	Beneficial	Public transport/cycling.
	Policy TRAN2		Adverse	Beneficial	Beneficial	Widening of Shore Road
	Proposal MNY23		Adverse	Beneficial	Beneficial	Widening of Shore Road
	Proposal GD06		Adverse	Beneficial	Beneficial	Widening of Shore Road
Urban Environment	COU1		Adverse	-	Adverse	BMA Green Belt
	COU2		Adverse	-	Adverse	Rural Landscape Wedge
	MNY54		Adverse	-	-	University of Ulster LLPA
	PPS6		Neutral	Adverse	Adverse	Area of Townscape Character
	UE8		Adverse	-	-	Greenisland AQMA
Natural Environment	ENV2		Adverse	Adverse	Adverse	Jointure Bay SLNCI
	ENV3		Adverse	-	-	Protection of LLPA
Countryside and Coast	COU1		Adverse	-	-	BMA Green Belt
	COU2		Adverse	-	Adverse	Rural Landscape Wedge
	COU3		Neutral	Neutral	Neutral	Coastal Area
	COU4		Neutral	Neutral	Neutral	Coastal Area
	COU6		Neutral	Neutral	Neutral	Area of High Scenic Value
	GD 07		Adverse	-	-	Area of Townscape Character Greenisland
	GD 08		-	Adverse	Adverse	Area of Townscape Character Shore Road
	GD 11		Neutral	Neutral	Neutral	LLPA – Seapark
Open Space and Recreation	OS1		Adverse	-	-	Areas of Open Space
Education, Health and Community	CF1		Adverse	-	-	Protection of land for Education, Health, Community Facilities
	MCS02		Adverse	-	-	Employment/Industry Land



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A2 SHORE ROAD GREENISLAND

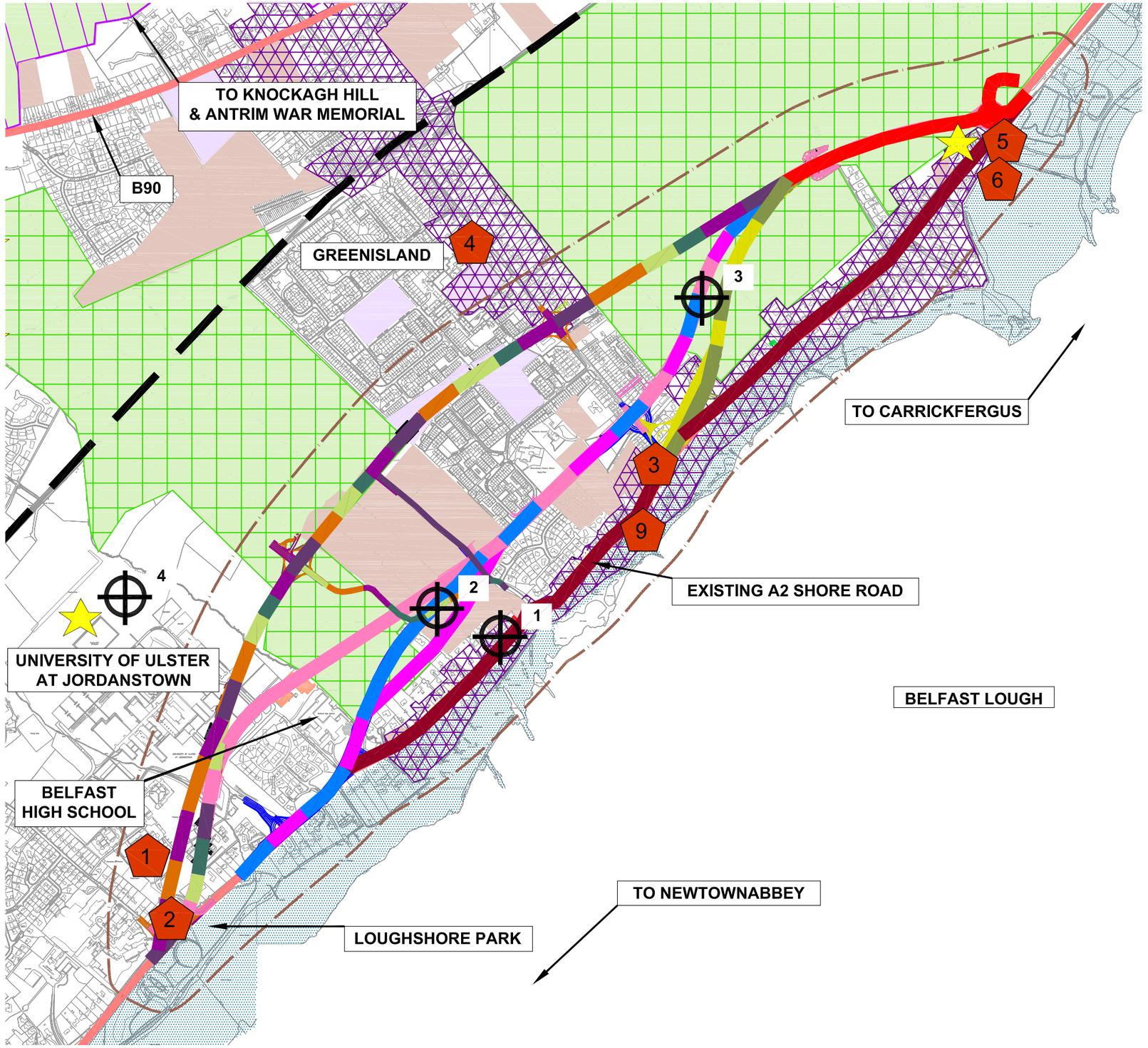
STAGE 2 SCHEME ASSESSMENT

Figure Title

AREA OF STUDY

FIGURE SAR2/5.1

Scale at A3 : **NTS**



LEGEND

Area of Study

Route Options

- S5-1
- S5-1-V1
- S5-2
- S5-2-V1
- S5-2-V2
- S5-2-V3
- S5-2-V4
- S5-Gyratory
- S5S7-1
- S5S7-2
- S7-2-a
- All S5 routes

BMAP Policies

- Rural Landscape Wedge (Policy COU2)
- Belfast Metroplitan Area (BMA) Coastal Area (Policy COU4)
- Local Landscape Policy Area (Policy ENV3)
- **P**rotected Route (Policy Tran2)
- Railway (Belfast - Larne)
- Green Belt (Policy COU1)
- BMAP Area of Open Space
- Area of Townscape Character (Policy UE3)
- BMAP Land Zoned for Housing

Designations

Archaeological Site Monument

1. Castle Lug
2. Soutterain
3. Rath
4. Local Landscape Policy Area Archaeology

Listed Buildings

1. Dalriada,
2. 684 Shore Rd
3. Ballynascreen House, 39 Shore Rd
4. Church of The Holy Name
5. Seapark House
6. The Lodge, Seapark House

N

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A2 SHORE ROAD GREENISLAND

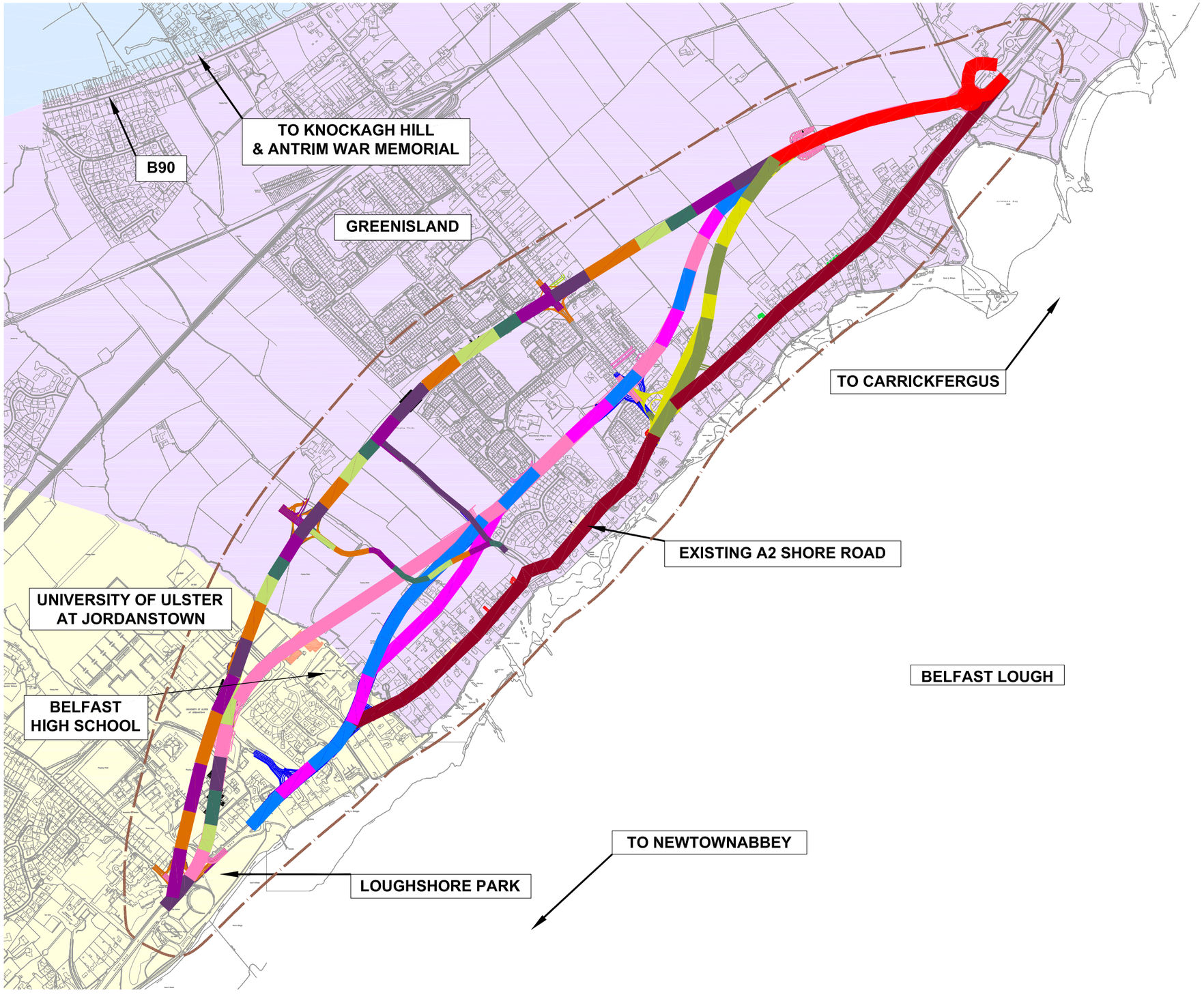
STAGE 2 SCHEME ASSESSMENT

Figure Title

ROUTE OPTIONS/
BMAP POLICIES
& DESIGNATIONS

FIGURE SAR2/5.2

Scale at A3 : **NTS**



LEGEND

Landscape Character Areas

- Carrickfergus Shoreline
- Carrickfergus Farmed Escarpment
- Three and Six Mile Water Valleys
- Area of Study

Route Options

- S5-1
- S5-1-V1
- S5-2
- S5-2-V1
- S5-2-V2
- S5-2-V3
- S5-2-V4
- S5-Gyratory
- S5S7-1
- S5S7-2
- S7
- All S5 routes

N

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A2 SHORE ROAD GREENISLAND

STAGE 2 SCHEME ASSESSMENT

Figure Title

ROUTE OPTIONS/
LANDSCAPE CHARACTER
ASSESSMENT AREAS

FIGURE SAR2/5.3

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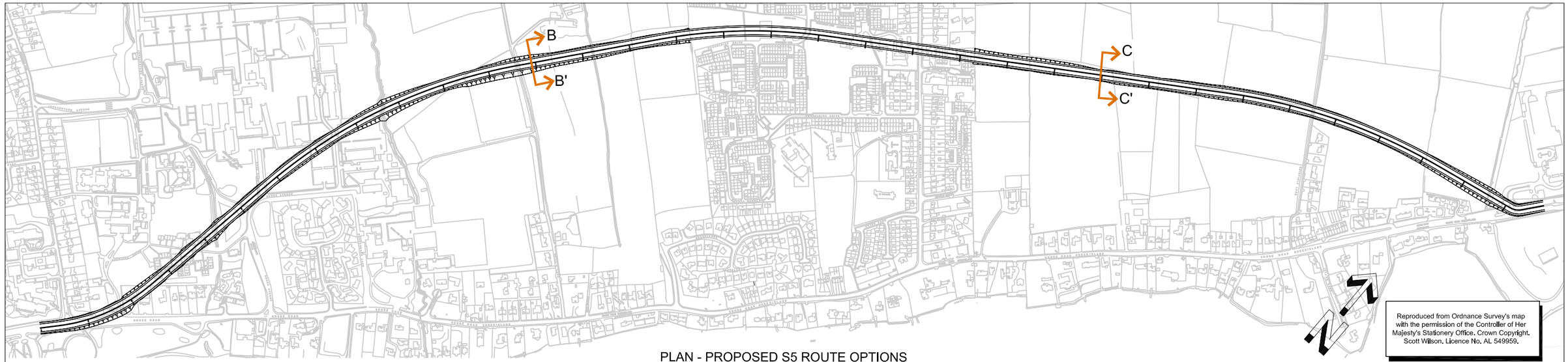
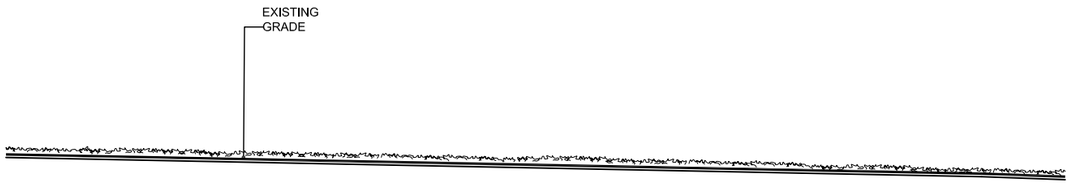
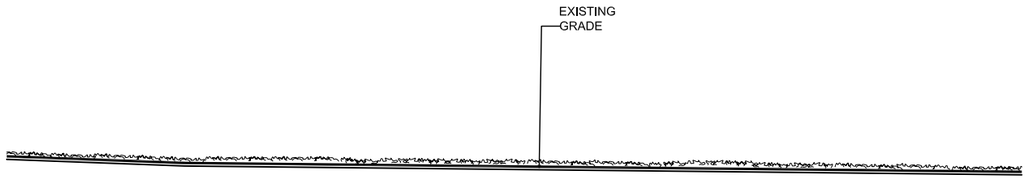


PLAN - PROPOSED S5 ROUTE OPTIONS



EXISTING SECTION ELEVATION B-B'



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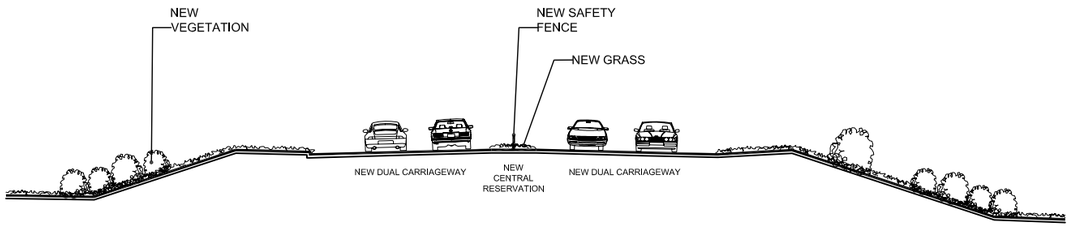
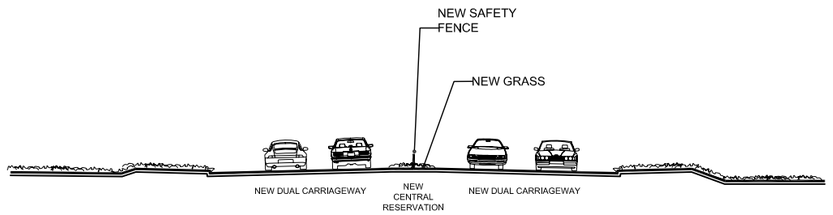


PROPOSED SECTION ELEVATION B-B'
LOOKING EAST THROUGH
NEW **S5** ROUTE OPTION



PROPOSED SECTION ELEVATION C-C'
LOOKING EAST THROUGH
NEW **S5** ROUTE OPTION

A2 SHORE ROAD GREENISLAND

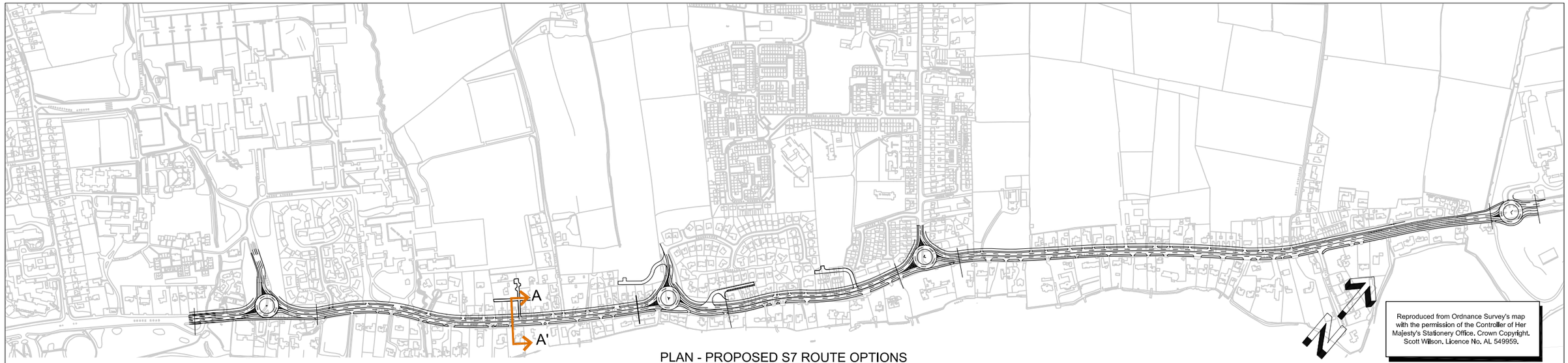
STAGE 2 SCHEME ASSESSMENT

Figure Title

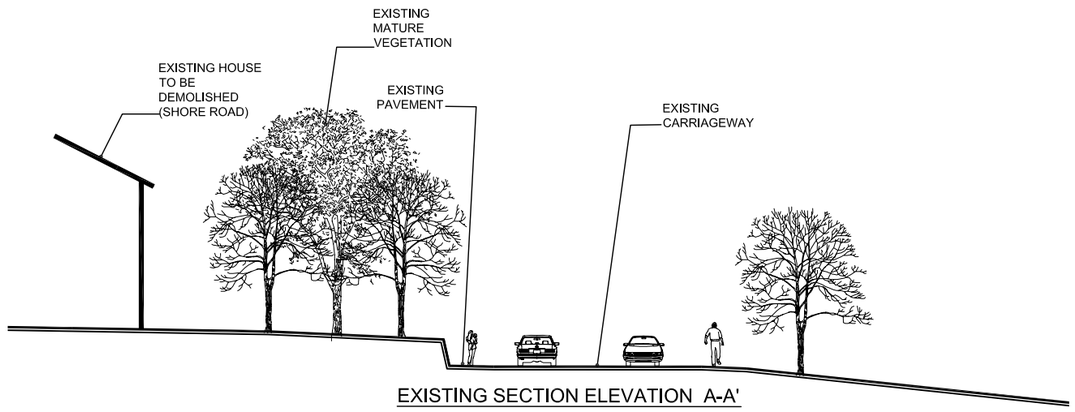
TYPICAL CROSS SECTIONS
SHOWING LANDSCAPE MITIGATION
S5 ROUTE OPTIONS

FIGURE SAR2/5.4

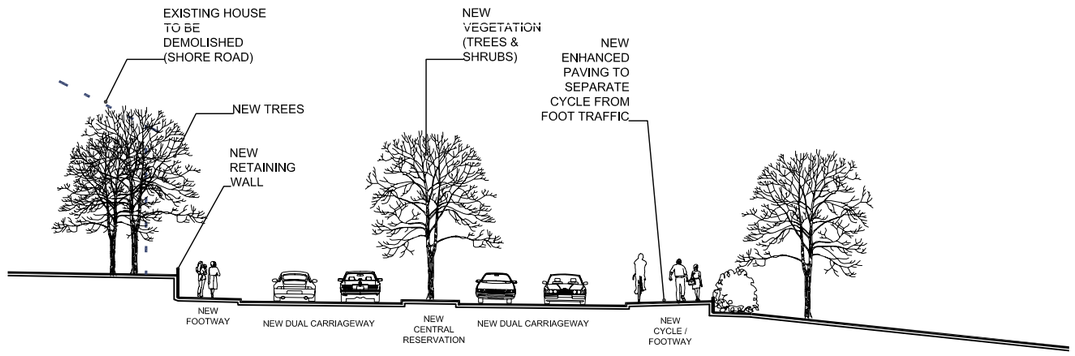
Scale at A3 : NTS



PLAN - PROPOSED S7 ROUTE OPTIONS



EXISTING SECTION ELEVATION A-A'



PROPOSED SECTION ELEVATION A-A'
LOOKING EAST THROUGH
NEW **S7** ROUTE OPTION

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A2 SHORE ROAD GREENISLAND

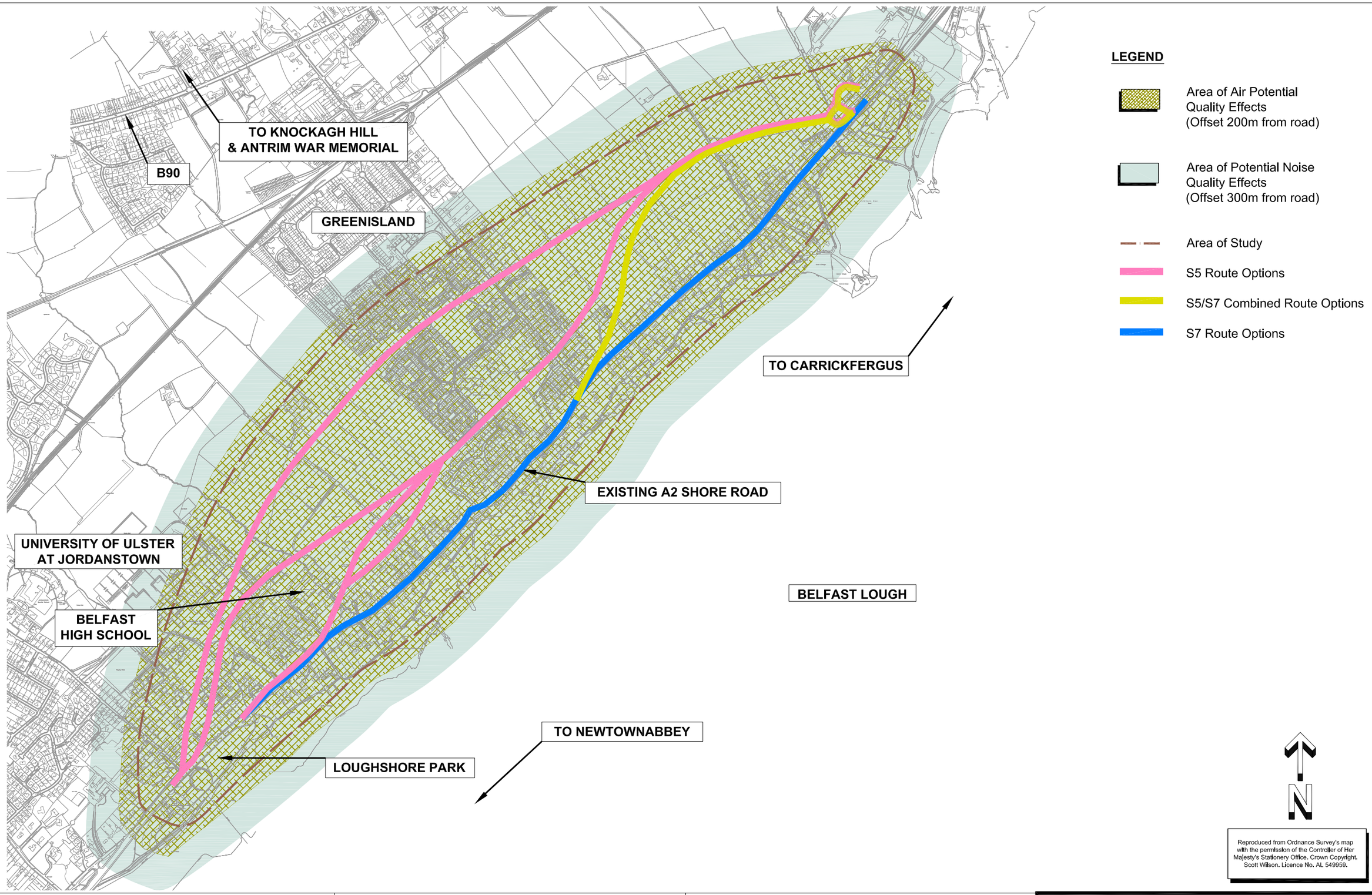
STAGE 2 SCHEME ASSESSMENT

Figure Title

TYPICAL CROSS SECTIONS SHOWING LANDSCAPE MITIGATION S7 ROUTE OPTIONS

FIGURE SAR2/5.5

Scale at A3 : NTS



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A2 SHORE ROAD GREENISLAND

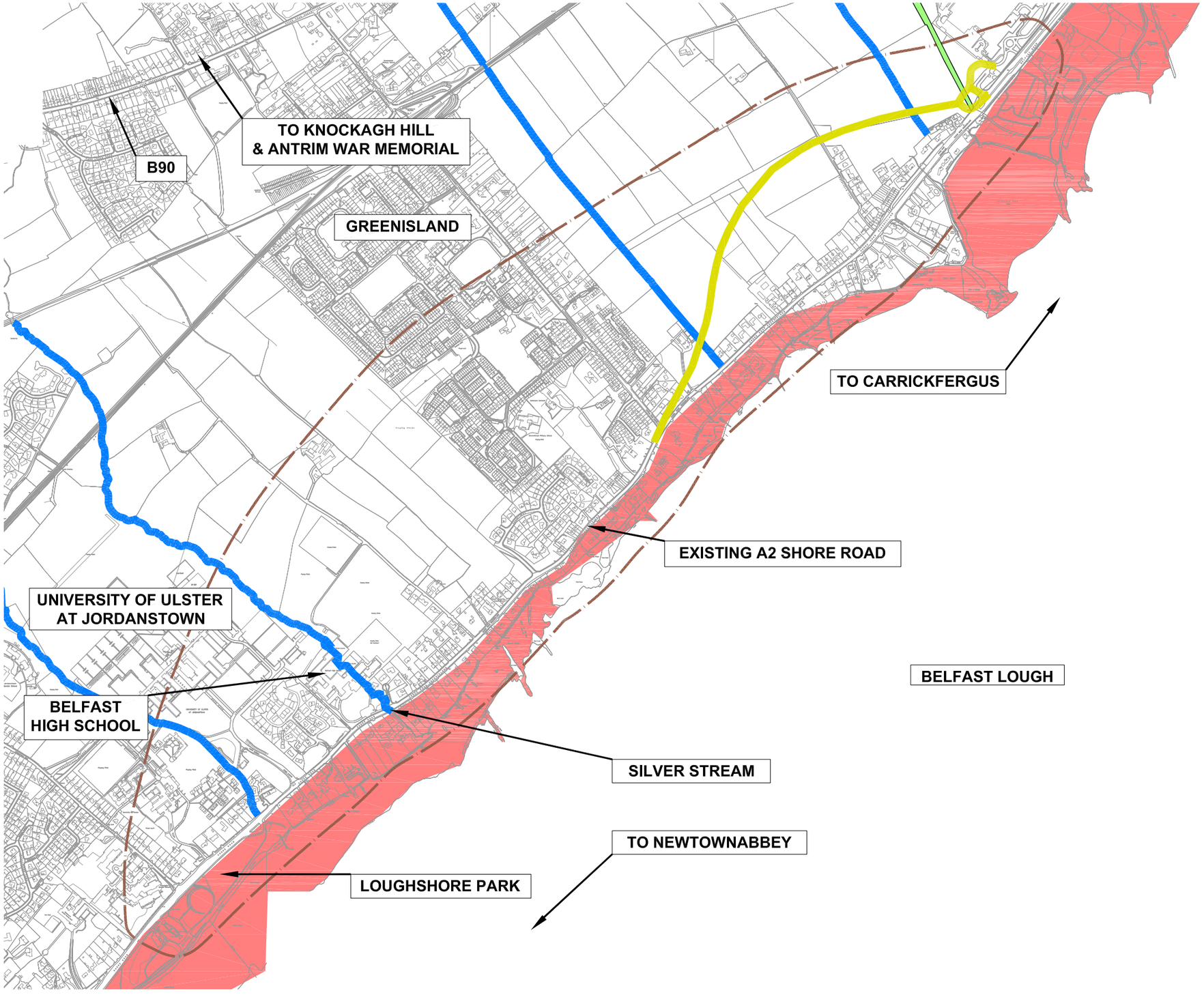
STAGE 2 SCHEME ASSESSMENT

Figure Title

ENVIRONMENTAL CONSTRAINTS
AIR QUALITY
AND NOISE RECEPTORS

FIGURE SAR2/5.6

Scale at A3 : **NTS**



LEGEND

- Jointure Bay Stream Site of Local Nature Conservation Importance
- Belfast Lough Special Protection Area (SPA) Ramsar Site, Area of Special Scientific Interest (ASSI)
- Watercourses
- Area of Study

N

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A2 SHORE ROAD GREENISLAND

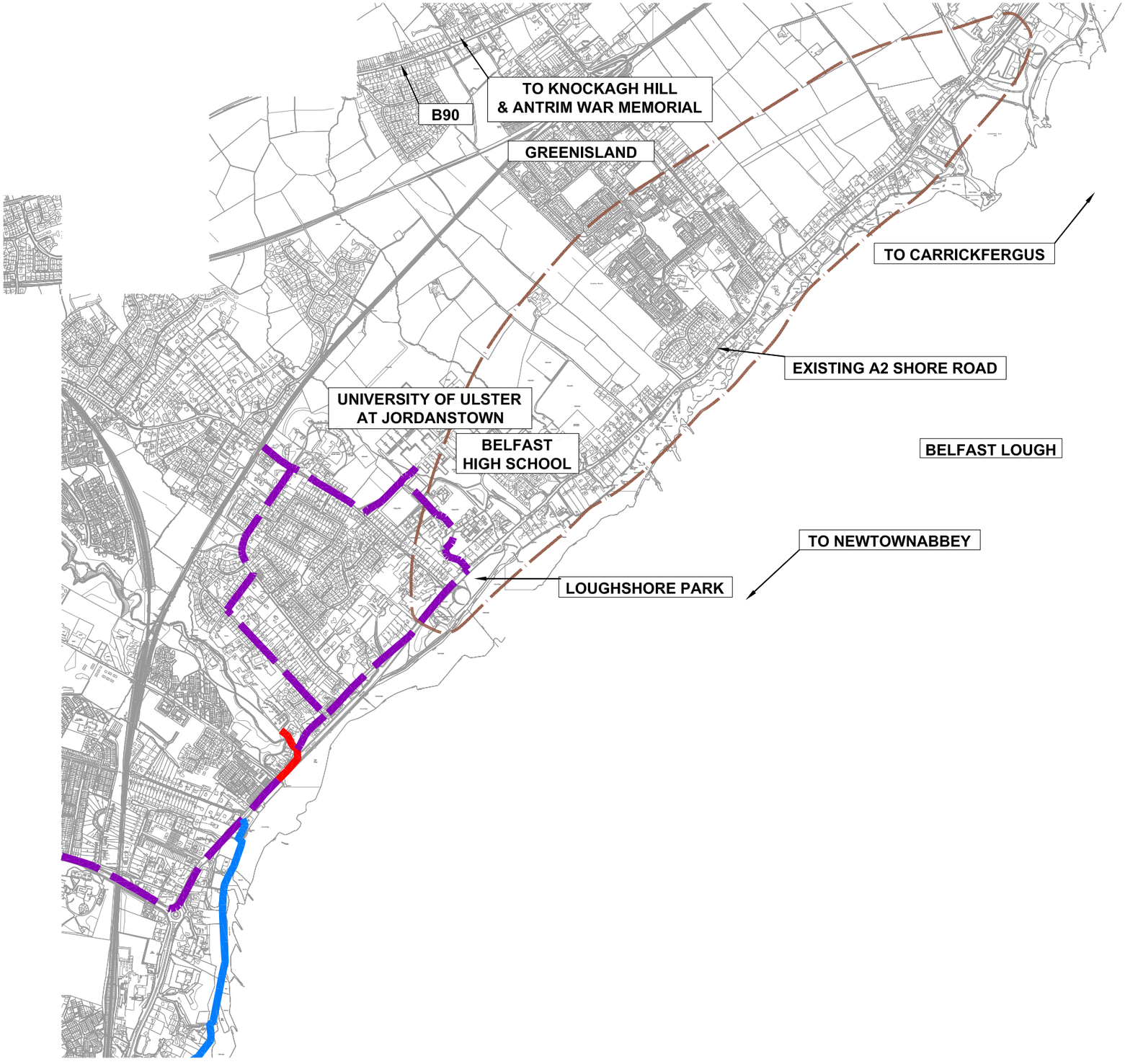
STAGE 2 SCHEME ASSESSMENT

Figure Title

ENVIRONMENTAL CONSTRAINTS – ECOLOGY & NATURE CONSERVATION, STATUTORY & NON-STATUTORY DESIGNATED SITES AND WATERCOURSES

FIGURE SAR2/5.7

Scale at A3 : **NTS**



LEGEND

- National Cycle Network On-Road Route
- Other Signed On-Road Cycle Route
- National Cycle Network Traffic-Free Route
- Area of Environmental Study

N

ROADS Service | FERGUSON McILVEEN | Scott Wilson

A2 SHORE ROAD GREENISLAND

STAGE 2 SCHEME ASSESSMENT

Figure Title

CYCLE ROUTES

FIGURE SAR2/5.8

Scale at A3 : **NTS**

6.0 TRAFFIC AND ECONOMIC ASSESSMENT

Introduction

6.1 A wide range of options has been described, representing two strategies and also a combination of the two strategies. Ignoring some variations of the options, there are four inland options, four on-line, two combined and a gyratory. Several of the options were developed during the course of the Stage 2 assessment process, as constraints and opportunities emerged. It would have been a large task to model each and every one and therefore it was determined that six options would be modelled that would give sufficient information to enable an informed view to be taken of relative traffic effects and economic value of the options.

6.2 This chapter sets out why the six options tested were chosen, explains how the modelling and economic testing was carried out, describes the predicted effects of the tested scheme options and summarises their predicted economic performance.

Selection of Options to be Tested

6.3 The options that were chosen for testing were as follows:

- TEST 1 Option S5-2 – New Road Inland Corridor - Greenisland At-grade
- TEST 2 Option S5-1 – New Road Inland Corridor - Greenisland Cutting
- TEST 3 Variation S5-2-V4 – New Road Inland Corridor - Parallel to Shore Road at School
- TEST 4 Option S7-3 – Existing Road Corridor Improvements - 5 Lanes Widened Both Sides (representing 5-Lane Single Carriageway)
- TEST 5 Option S7-1 – Existing Road Corridor Improvements - 4 Lanes Widened Both Sides (representing Dual 2-Lane Carriageway)
- TEST 6 Option S5S7-1 – Combined Partial Bypass – Widened to 4 Lanes With Roundabouts

6.4 The choice was helped in that some decisions were taken in regard to the suitability of options relatively early in the assessment process. For example, the Gyratory Option G1 was not considered to be an appropriate solution and the Inland Option S5-2-V3 was considered too costly and too damaging to various established areas at Greenisland.

6.5 However, other decisions were made where assessments were continuing in parallel with the development of the options. For two of the options, the actual tests were altered in respect of the type of carriageway. These were for tests 5 and 6 as described below.

6.6 The purpose of test 5 with a 4-lane dual carriageway and roundabouts was to determine whether there was a difference of benefit from test 4, which is a 5 lane single carriageway with traffic signal junctions. It had been determined that a 4-lane road with unrestrained turning movements would not be proposed for safety reasons. In effect it would have to act as a dual carriageway and it was further considered that such a dual carriageway should have a material central reserve. This would give a physical separation of traffic flows as opposed to double white lines, and provide safe crossing points for pedestrians and cyclists.

6.7 Thus test 5 was run as if for all practical purposes it was a dual 2-lane carriageway. Similarly, in test 6, that part of Shore Road northwards to Station Road was also treated as a dual 2-lane carriageway, within the combined option.

6.8 The existing road network diagram, the reference case, is shown in Figure SAR2/6.1. The corresponding diagrams for the tests 1 to 6 are shown in Figures SAR2/6.2 – 6.7 respectively.

6.9 The purpose of tests 1 and 2 was to determine whether the higher cost options for the new inland road would have a positive benefit and if so which would have the greater benefits. Test 1 would have a lower cost and local traffic would enter the network earlier as there would be a junction at Station Road, but that would introduce another delay point for through traffic. Test 2 would be a higher cost option but there would be one less junction and a higher speed limit. These two tests would have an additional travel of some 200m over the equivalent base network distance of 3055m, a 6.5% increase.

6.10 Test 3 is the third and final testing of an inland option and a variation of test 1 but because it is in a different location it has a much lower cost than tests 1 and 2 and is only 165m over the base distance, a 4.4% increase. It was considered that these factors might result in a higher benefit or at least a higher cost/benefit ratio, but there would be one more junction than in test 1 and that could have a potential delay factor, reducing the benefits.

6.11 Test 4 is the highest cost option of the 4 online widening options and it was tested to illustrate whether the wide single carriageway with unrestrained turning movements would have a positive value.

6.12 Test 5 has been run as a dual carriageway and will determine whether there is a significant difference in the value from test 4.

6.13 Test 6 is similar to test 5 but it includes a partial bypass to the north of Station Road and is a lower cost than test 5. Although it has been described as a 40mph urban dual carriageway bypass, the final design speed of the bypass section has not been determined and it has therefore been tested at 50mph to see what its full benefit might be. The additional cost would be fairly nominal.

6.14 Tests 4, 5 and 6 also have one more junction than test 1.

Modelling

6.15 The traffic modelling for the Stage 2 Scheme Assessment was carried out using CUBE Voyager computer software. The work carried out using the Belfast Transportation Model during the Stage 1 Scheme Assessment work indicated that there would be no transfer of traffic between this and other areas. Therefore the area modelled was limited to the immediate area of the various scheme options.

6.16 The area modelled was divided into 17 zones. The zones were decided upon by simply dividing up sections of housing and other trip generators such as the High School, the University and development sites, into logical areas which shared a common access point or area of access onto the road network to be modelled. The 17 zones are shown in Figure SAR2/6.8. Zones 1, 2 and 3 cover the most northern, southern and western respectively of the areas shown and everything beyond the limits of the drawing to the north, south and west respectively.

Base Model

6.17 The base model, which is essentially a representation of the existing conditions of the A2 Shore Road and other major roads within the study area, was defined by a series of links and nodes as shown in Figure SAR2/6.1. Each of the 17 zones feeds into the network at one of the nodes. Many of the nodes represent a single junction, however some are a simplified representation of more than one minor junction and/or private access or accesses. All the major junctions within the modelled area are represented by one of the nodes. The links between nodes 100 and 250 represent the A2 Shore Road. The links between nodes 190 and 220 represent Station Road.

6.18 The road categories used in the model are based on those given in the COBA Manual in DMRB Volume 13, Section 1, Part 5, Table 1/1. The link lengths and number of lanes are based on the existing physical conditions and the link capacities are based on DMRB Volume 5, Section 1, Part 3, TA 79/99, Traffic Capacity of Urban Roads. Every link was modelled in two directions. Speed limits are based on the actual speed limits on the existing roads, i.e. 40mph on A2 Shore Road and 30mph on Jordanstown Road, Shore Avenue, Langley Hall, Shorelands and Station Road.

6.19 A2 Shore Road and Station Road were modelled as suburban single carriageway. The junctions of A2/Jordanstown Road, A2/Station Road and A2/Seapark, nodes 100, 190 and 250 respectively, were modelled as signalised junctions. The junctions of A2/University Shore Avenue, A2/Langley Hall, A2/High School and A2 Shorelands, nodes 120, 130, 140 and 170 respectively were modelled as priority junctions. Geometric parameters were entered for these junctions to allow modelling of queues and delays to traffic caused by the junctions

6.20 Table A6.1.1 in Appendix 6.1 contains a complete list of road categories, link types, link lengths, numbers of lanes, link capacities and speed limits for each link in the base model.

Models for Tests

6.21 The models used for the six tests were basically versions of the base model modified to represent the proposed improvements of each of the six options to be tested. Schematic representations of these models are shown in Figures SAR2/6.2-6.7. The various parameters used for each link, in each of the six models are shown in Tables A6.1.2 to A6.1.7 in Appendix 6.1.

6.22 The main features and changes from the base model, for the six test models are detailed below.

Test 1: Option S5-2 New Road Inland Corridor - Greenisland At-grade

- Inland route modelled as Suburban Dual Carriageway with 40mph speed limit;
- Junctions of existing A2/Jordanstown Road, existing A2/Station Road, Inland Route/University Access and Inland Route/Station Road, nodes 100, 190, 330 and 340 respectively, modelled as signalised junctions;
- Junction of Inland Route/existing A2/Seapark, node 250, modelled as roundabout with 60m ICD;
- Movements between nodes 100 and 110 banned;
- University access moved to node 330.

Test 2 Option S5-1 New Road Inland Corridor - Greenisland Cutting

- Inland route modelled as Suburban Dual Carriageway with 50mph speed limit;
- Junctions of existing A2/Jordanstown Road, node 100, modelled as signalised junction;
- Junctions of Inland Route/Existing A2/Seapark and Inland Route/University Access, nodes 250 and 330 respectively, modelled as roundabouts with 60m ICD's;
- Movements between nodes 100 and 110 banned;
- University access moved to node 330.

Test 3 Variation S5-2-V4 New Road Inland Corridor - Parallel to Shore Road at School

- Inland route modelled as Suburban Dual Carriageway with 40mph speed limit and existing road between nodes 110 to 130 upgraded to Suburban Dual Carriageway with 40mph Speed limit;
- Junctions of existing A2/Jordanstown Road, widened A2/University Shore Avenue, A2/Station Road, Inland Route/New Development Area Access and Inland Route/Station Road, nodes 100, 120, 190, 350 and 360 respectively, modelled as signalised junctions;
- Junction of Inland Route/existing A2/Seapark, node 250, modelled as roundabout with 60m ICD;
- Movements between nodes 130 and 140 banned.

Test 4 Option S7-3 Existing Road Corridor Improvement - 5 Lanes Widen Both Sides

- Widened A2 Shore Road modelled as Suburban Single Carriageway with 40mph speed limit;
- Junctions of existing A2/Jordanstown Road, widened A2/University Shore Avenue, widened A2/Shorelands, widened A2/Station Road, and widened A2/Seapark, nodes 100, 120, 170, 190, and 250 respectively, modelled as signalised junctions.

Test 5 Option S7-1 Existing Road Corridor Improvements - 4 Lanes Widen Both Sides

- Widened A2 Shore Road modelled as Suburban Dual Carriageway with 40mph speed limit and right turn movements banned;
- Junction of existing A2/Jordanstown Road, node 100, modelled as signalised junction;
- Junctions of widened A2/University Shore Road, widened A2/Shorelands, widened A2/Station Road, and widened A2/Seapark, nodes 120, 170, 190, and 250 respectively, modelled as roundabouts with 50m ICD.

Test 6 Option S5S7-1 Combined Partial Bypass - Widen 4 Lanes with Roundabouts.

- Widened A2 Shore Road between nodes 100 and 190 modelled as Suburban Dual Carriageway with 40mph speed limit and bypass between nodes 190 and 250 modelled as Suburban Dual Carriageway with 50mph speed limit;
- Junction of existing A2/Jordanstown Road, node 100, modelled as signalised junction;

- Junctions of widened A2/University Shore Road, widened A2/Shorelands and widened A2/Station Road, nodes 120, 170, and 190 respectively, modelled as roundabouts with 50m ICD. Junction at Inland Section/existing A2/Seapark, node 250, modelled as roundabout with 60m ICD;
- Movements between nodes 190 and 230 banned;
- Speed limit reduced to 30mph on A2 Shore Road between nodes 230 and 250.

6.23 A summary of the main model inputs for each of the six tests is given in Table 6.1 below.

Table 6.1 Summary of Model Input

TEST	Option to be tested	Option actually tested
Test 1 : S5-2 New Road Inland Corridor - Greenisland At-grade	Urban Dual 2x7.3m + 1.8m c/r (22.4m)	Urban Dual 2x7.3m 200m over base 3055m (6.5%)
	2xTS + 1xRbt	**2xTS + 1xRbt**
	40mph	**40mph**
Test 2 S5-1 New Road Inland Corridor - Greenisland Cutting	Rural Dual 2x9.3 +2.5m c/r (27.1m)	Urban Dual 2x7.3m 200m over base 3055m (6.5%)
	2xRbt	**2xRbt**
	50mph	**50mph**
Test 3 S5-2-V4 New Road Inland Corridor - Parallel to Shore Rd At School	Urban Dual 2x7.3m (22.4m)	Urban Dual 2x7.3m 135m over base 3055m (4.4%)
	3xTS + 1xRbt	**3xTS + 1xRbt**
	40mph	**40mph**
Test 4 S7-3 Existing Road Corridor Improvemts - 5 Lanes Widened Both Sides	Urban Single 4x3.5m + 1x3.0m (23.0m)	Urban Single 17.0m Length same as base
	4xTS	
	40mph	**40mph**
Test 5 S7-1 Existing Road Corridor Improvemts - 4 Lanes Widened Both Sides	Urban Single 4x3.5m (20.0m)	Urban Dual 2x6.75m Length same as base
	4xRbt	**4xRbt**
	40mph	**40mph**
Test 6 S5S7-1 Combined Partial By-pass – Widened to 4 Lanes with Roundabouts	Urban Single 4x3.5m (20.0m) Urban Dual 2x7.3m (22.4m)}	Urban Dual 2x6.75m} Urban Dual 2x6.75m} 150m over base 3055m (4.9%)
	4xRbt	**4xRbt**
	40mph 50mph	*40mph 50mph*

Base Trip Matrix

6.24 To enable a base trip matrix to be prepared, manual turning counts were carried out on 26th May 2005 at the following key junctions within the area to be modelled. The counts covered the periods 0730 to 0930 and 1530 to 1830 to ensure that the peak hour periods were covered.

- A2/Jordanstown Road;
- A2/University Shore Avenue;
- A2/Langley Hall;
- A2/High School;
- A2/Shorelands;
- A2/Station Road.

6.25 The traffic counts showed that the peak hour occurred at different junctions at different times and that at most junctions the peak period extended over more than 1 hour and nearer 2 hours. For these reasons the base trip matrices were initially calculated for 2-hour am and pm peaks, then factored down to represent a peak hour. The peak periods are 0700 to 0900 (am peak) and 1600 to 1800 (pm peak).

6.26 Using the traffic counts in conjunction with typical trip generation rates for the trip generators within each of the 17 zones, and using a common sense approach, the base traffic was distributed to give 17 by 17, origin/destination, base trip matrices for the 2005 am and pm peak periods. These matrices are shown in Tables A6.1.8 and A6.1.9 in Appendix 6.1. The 17 zones are as shown in Figure SAR/6.8.

6.27 An allowance was made for the effects of congestion at present by increasing through trips, i.e. trips from and to zones 1 and 2, by the average number of vehicles queuing at the ends of the scheme at peak times.

6.28 Data from automatic traffic counters stationed on A2 Shore Road near Carrickfergus and Jordanstown Road were used to obtain factors to convert the 2-hour peak trip matrices to typical 'between peaks' and typical 'overnight' hours. 'Between peaks' is defined as 0700 to 1600 and 1800 to 1900 (the period between 0700 and 1900 excluding the peak periods). 'Overnight' is defined as between 1900 and 0700. The am and pm peak period matrices were added to negate the effects of tidal flow in the morning and evening peak periods. The resulting 4-hour matrix was then factored down to represent a typical 'between peaks' or 'overnight' hour. The resulting matrices are shown in Tables A6.1.10 and A6.1.11 in Appendix 6.1.

6.29 Am and pm peak hour base trip matrices were calculated by factoring down the 2-hour peak flows. The factor was obtained by summing the peak hour flows entering the network and dividing that by the sum of corresponding 2-hour flows into the network. The resulting am and pm peak hour matrices are shown in Tables A6.1.12 and A6.1.13 of Appendix 6.1. Figure SAR2/6.9 shows a desire line diagram of the main movements in the 2005 peak hour matrices and the 2005 peak hour flows at selected points on the network are shown in Figure SAR2/6.10.

6.30 Factors to calculate peak hour, interpeak and overnight matrices are as follows:

Table 6.2 Factors to peak, inter-peak and overnight hours

From	To	Factor
2 hr am peak period	am peak hour	0.56
2 hr pm peak period	pm peak hour	0.56
$\frac{\text{(am peak hour + pm peak hour)}}{2}$	average interpeak hourly flow	0.80
$\frac{\text{(am peak hour + pm peak hour)}}{2}$	average overnight hourly flow	0.27

Calibration of the Base Model

6.31 A Base Year Model to May 2005 flows was developed, with different assignment procedures for AM, Inter-Peak and PM Periods. Having developed and implemented the different parts of the Base Year Model system, they were integrated into a single framework and the relationships within and between the components calibrated.

6.32 A series of range and logic checks were carried out, so that records with incomplete, missing or dubious data could be removed from the data set. The range of checks included:

- movement logic checks;
- directions of trip flows;
- travel times, distances and costs; and
- network connectivity.

6.33 In accordance with standard modelling practices and Government advice, a series of statistical goodness-of-fit tests were carried out comparing predicted against observed flows. Any discrepancies were investigated and remedial measures carried out.

6.34 As recommended in Government Guidance, the GEH statistic was used:

$$GEH = \sqrt{\frac{(V_2 - V_1)^2}{(V_1 + V_2)/2}}$$

where V1 is the observed value and V2 is the modelled value.

6.35 This statistical goodness-of-fit test was carried out to various sites in the model area, which capture observed movements in May 2005. Various iterations were carried out, which involved carrying out statistical tests and making improvements to the highway assignment model, until a suitable level of fit was achieved. The observed counts have been measured against the estimates from the

Base Year Model, with a standard GEH statistical criterion of 5.0 as the measure of goodness-of-fit.

6.36 Table 6.3 shows the results of the tests for the AM and PM peak hours, to help gauge the level of calibration. As can be seen all tests in each time period (AM and PM) meet the GEH criteria.

Table 6.3 Base Year Model Calibration Results

Ref	Location	A-Node	B-Node		Flow (pcu)		Obs - Mod	Percent	GEH Stat.	Criteria Tests	
					Observed	Modelled		Diff.		GEH	Flow
Calibration Links - AM Peak Hour											
1		130	120	130120	1,611	1,655	44	2.73	1.1	✓	✓
2		120	110	120110	1,562	1,589	27	1.73	0.7	✓	✓
3		110	100	110100	1,554	1,587	33	2.12	0.8	✓	✓
4		170	160	170160	1,551	1,584	33	2.13	0.8	✓	✓
5		190	180	190180	1,527	1,543	16	1.05	0.4	✓	✓
6		180	170	180170	1,525	1,559	34	2.23	0.9	✓	✓
7		230	190	230190	1,153	1,164	11	0.95	0.3	✓	✓
8		100	110	100110	936	885	-51	-5.45	1.7	✓	✓
9		110	120	110120	932	886	-46	-4.94	1.5	✓	✓
10		120	130	120130	837	898	61	7.29	2.1	✓	✓
11		190	230	190230	826	844	18	2.18	0.6	✓	✓
12		180	190	180190	795	811	16	2.01	0.6	✓	✓
13		170	180	170180	791	814	23	2.91	0.8	✓	✓
14		160	170	160170	790	817	27	3.42	1.0	✓	✓
			Totals		**16,390**	**16,636**	**246.00**	**1.50**	**1.9**	**100%**	**100%**
Calibration Links -PM Peak Hour											
1		130	120	130120	995	953	-42	-4.22	1.3	✓	✓
2		120	110	120110	1,025	932	-93	-9.07	3.0	✓	✓
3		110	100	110100	1,039	926	-113	-10.88	3.6	✓	✓
4		170	160	170160	967	959	-8	-0.83	0.3	✓	✓
5		190	180	190180	976	968	-8	-0.82	0.3	✓	✓
6		180	170	180170	968	960	-8	-0.83	0.3	✓	✓
7		230	190	230190	962	938	-24	-2.49	0.8	✓	✓
8		100	110	100110	1,390	1,367	-23	-1.65	0.6	✓	✓
9		110	120	110120	1,374	1,375	1	0.07	0.0	✓	✓
10		120	130	120130	1,411	1,441	30	2.13	0.8	✓	✓
11		190	230	190230	1,318	1,388	70	5.31	1.9	✓	✓
12		180	190	180190	1,392	1,462	70	5.03	1.9	✓	✓
13		170	180	170180	1,397	1,457	60	4.29	1.6	✓	✓
14		160	170	160170	1,413	1,463	50	3.54	1.3	✓	✓
			Totals		**16,627**	**16,589**	**-38.00**	**-0.23**	**0.3**	**100%**	**100%**

Forecasting

6.37 Future traffic flows for the base network were estimated for 2010 and 2025 i.e. the expected opening year for the scheme and 15 years after the expected opening year. The estimated future flows were calculated using National Road Traffic Forecast (NRTF) growth factors. The 2005 traffic flows were split into cars, LGV's, Rigid HGV's, Artic HGV's and PSV's and the appropriate growth factors applied to each vehicle category. It was considered that 60% of the low growth factor and 40% of the high growth factor would be appropriate for each of the vehicle categories.

6.38 There are currently no known committed developments or land use changes likely to have a significant effect on traffic flows within the study area therefore only flows from the NRTF growth factors were added to the 2005 flows to obtain predicted flows for 2010 and 2025. The predicted future peak hour flows are shown in Figure SAR2/6.10 for key points on the network.

6.39 It should be noted that the predicted future flows, especially those for 2025, are in reality unlikely to occur on the existing road network as in many locations they are above the capacity of the existing roads. However as the CUBE software uses demand modelling the predicted future flows must be based on unrestrained growth.

Effects of Scheme Options

6.40 The CUBE modelling was used to obtain the predicted future flows for 2010 and 2025 on each link for each of the six options tested. The predicted flows are shown at a selection of points on the road network for each of the six options on Figures/SAR2/6.11 to 6.16. As discussed earlier CUBE software uses demand modelling and therefore the flows given are based on unrestrained growth and may for some links exceed the capacity of the road.

6.41 Following the modelling of the six tests, the likely effects of the six corresponding scheme options were considered, based on both the modelling results and on common sense. It is considered that the main effects of each option would be as detailed below.

Test 1 S5-2 New Road Inland Corridor - Greenisland At-grade

- Should attract through traffic from bypassed section of A2 Shore Road, although junctions, changes in direction and additional length will reduce the attractiveness of the bypass route for through traffic;
- Traffic calming or priority measures may be necessary to discourage traffic, particularly northbound traffic, from using existing road;
- New dual carriageway to current standards should be safer than existing road and reduced flow on Shore Road should also improve safety on that road;
- Significant journey time savings at peak times and improved reliability;
- Significant increase in total distance travelled;
- Geometric delays for all traffic if roundabouts used and potential capacity related delays;
- Significant time and reliability improvements for local bus services using the quieter Shore Road.

Test 2 Option S5-1 New Road Inland Corridor - Greenisland Cutting

- Should attract through traffic from bypassed section of A2 Shore Road. Although junctions, changes in direction and additional length will reduce the attractiveness of the bypass route, this has the least number of junctions for through traffic. Local journeys to the A2 may be longer;
- Traffic calming or priority measures may be necessary to discourage traffic, particularly northbound traffic, from using existing road though less so than in test 1;
- New dual carriageway to current standards should be safer than existing road and reduced flow on Shore Road should also improve safety on that road;
- Significant journey time savings at peak times and improved reliability;
- Significant increase in total distance travelled;
- Geometric delays for all traffic if roundabouts used and potential capacity related delays;

- Significant time and reliability improvements for local bus services using the quieter Shore Road.

Test 3 Variation S5-2-V4 New Road Inland Corridor - Parallel to Shore Road at School.

- Should attract through traffic from bypassed section of A2 Shore Road, although junctions and additional length will reduce the attractiveness of the bypass route for through traffic;
- Traffic calming or priority measures may be necessary to discourage traffic, particularly northbound traffic, from using existing road;
- New dual carriageway to current standards should be safer than existing road and reduced flow on Shore Road should also improve safety on that road;
- Significant journey time savings at peak times and improved reliability;
- Some increase in total distance travelled but less so than tests 1 and 2;
- Geometric delays for all traffic if roundabouts used and potential capacity related delays;
- Significant time and reliability improvements for local bus services using the quieter part of Shore Road.

Test 4 Option S7-3 Existing Road Corridor Improvements - 5 Lanes Widened Both Sides

- All traffic continues to use A2 Shore Road, junctions will reduce the attractiveness of the route for through traffic;
- The single 5-lane carriageway will permit right turns across through traffic to and from driveways and minor junctions therefore less safety offered;
- Improved reliability as proposed 5-lane carriageway will provide more consistent and reduced journey times.
- Significant journey time savings at peak times and improved reliability;
- No increase in journey lengths;
- Geometric delays for all traffic if roundabouts used and potential capacity related delays;
- Local bus services will continue to use Shore Road but should have more reliable timetable with reduced congestion.

Test 5 Option S7-1 Existing Road Corridor Improvements - 4 Lanes Widened Both Sides

- All traffic continues to use A2 Shore Road, junctions will reduce the attractiveness of the route for through traffic;
- Widened to dual carriageway to an evolved standard, but should be safer than existing road;
- Improved reliability as proposed dual carriageway will provide more consistent and reduced journey times.
- No increase in journey lengths;
- Geometric delays for all traffic if roundabouts used and potential capacity related delays;

- Local bus services will continue to use Shore Road but should have more reliable timetable with reduced congestion.

Test 6 Option S5S7 Combined Partial Bypass – Widened to 4 Lanes with Roundabouts

- All traffic continues to use A2 Shore Road as far as Station Road but north of that will be new road; junctions will reduce the attractiveness of the route for through traffic;
- Partly widened to dual carriageway to an evolved standard, but should be safer than existing road; northern section designed to current standard and should be safer;
- Improved reliability as proposed dual carriageway will provide more consistent and reduced journey times.
- Small increase in journey lengths;
- Geometric delays for all traffic if roundabouts used and potential capacity related delays;
- Local bus services will continue to use Shore Road but should have more reliable timetable with reduced congestion.
- Traffic calming or priority measures may be necessary to discourage traffic, particularly north bound traffic from using the bypassed section of Shore Road.

Economic Performance of Options

6.42 Before the effects of the various tested options are considered and compared against the base case it should be noted that the base case is not a Do-Minimum option, as is usual, but a Do-Nothing Option. Initially it had been considered that the construction of the existing carriageway on A2 Shore Road, which is in a poor condition, would form the Do-Minimum option; however as this is not a committed work programme scheme it has not been taken into account.

6.43 It is evident from the condition surveys discussed in the Stage 1 Scheme Assessment Report that major renewal of the existing carriageway will be required in the near future. However the cost of this work has not been discounted from the costs of the options, the economic assessment therefore errs on the side of caution.

6.44 The economic analysis of the six options was carried out using the methods in the DfT's Transport Appraisal Guidance (www.WebTAG.org.uk). The resulting Transport Economic Efficiency (TEE) Tables are included in Appendix 6.2 with the main findings summarised in Table 6.4 below.

Table 6.4 Traffic Economic Efficiency Summary

Test Evaluated	Option Cost (current)	NPV over 60 Years (discounted)	Benefit / Cost Ratio
Test 1 Inland bypass at-grade	£62.9m	-£33.92	0.31
Test 2 Inland bypass grade-sep	£68.9m	-£0.25	1.00
Test 3 Inland bypass at school	£41.2m	-£5.69	0.87
Test 4 Online widening 5 lanes	£49.2m	£9.33	1.14
Test 5 Online widening d c/way	£44.6m	£23.14	1.31
Test 6 Online widening + bypass	£41.1m	£22.64	1.34

6.45 Based on the figures in Table 6.4 the combined partial bypass option has marginally the best benefit to cost ratio. This arises because it has only slightly less than the best net present value but

is the lowest cost option. In practice, the actual figures would be subject to more accurate design and costing, not least in the most appropriate form and design of junctions.

6.46 It is perhaps a reasonable argument that there is no value for money to be gained from a more costly and extensive solution. The most appropriate solution would appear to be based on an online widening scheme, probably with a section of offline bypass.

6.47 The breakdown of the elements in the TEE Tables is given below. It can be seen from TEE tables and the summary table below that the accident savings are greatest for Test 1, closely followed by Test 2, with Tests 3 and 6 having approximately half the saving and Tests 4 and 5 having no saving. It appears that the accident savings for the 6 tests are roughly in proportion to the length of the bypass provided by that option.

Table 6.5 Accident Savings Summary

Test Evaluated	Accident Savings Over 60 Years (discounted)
Test 1 Inland bypass at-grade	£1.50 million
Test 2 Inland bypass grade-sep	£1.37 million
Test 3 Inland bypass at school	£0.57 million
Test 4 Online widening 5 lanes	£0
Test 5 Online widening d c/way	£0
Test 6 Online widening + bypass	£0.68 million

6.48 It should be noted that in the absence of more detailed information, default accident rates have been used. There is no distinction in the default accident rates between 2-lane, 4-lane or 5-lane single carriageway or between dual carriageway with frequent or infrequent at grade access. In view of this the common sense statements regarding accidents made in the 'Effects Of Scheme Options' section are not necessarily reflected in the accident savings values predicted in the TEE tables.

6.49 In terms of highway time savings, Tests 2, 5 and 6 offer the greatest savings with Test 4 slightly behind and Tests 1 and 3 offering approximately half the savings. The results seem to indicate that in terms of highway time savings:

- Some of the benefits of the bypass options are offset by the longer distance that must be travelled and by the fact that the 'internal junctions' are 4-arm as opposed to 3-arm on the online and combined options;
- Of the longer bypasses only Test 2 with its higher speed bypass and grade separated junction offers the same benefit as improving the existing A2 Shore Road;
- Roundabouts seem to offer greater highway time savings than signalised junctions. This is particularly highlighted by Tests 4 and 5, where the 5 lanes and signalised junctions of Test 4 offer less savings than the 4 lanes and roundabouts of Test 5. The reason is likely to be that the modelled roundabouts cause less delay to the major straight ahead flows, than to the smaller traffic flows turning onto the major route, which must wait for a break in the major flows. The modelled signal controlled junctions will not only have periods of 'lost time' between green periods on different approaches but may also adopt more balanced priorities for major and minor arms, at the expense of increased delay overall to the major flows. Detailed design of the junctions is required to confirm the most appropriate option.