Sunday – 0600-0900 4 trams per hour
0900-1800 4 trams per hour
1800-0000 4 trams per hour

Thus, in the peak daytime hours there will be one tram pass-by just under every four minutes, and in the off peak there will be a vehicle pass-by every seven and a half minutes.

Vibration Prediction Methodology

Estimates of levels of ground vibration have been made based on levels measured adjacent to comparable systems, including a detailed investigation into vibration levels from Phase 1 of the Manchester Metro in 1996 (5). The Manchester Metro study involved 150 train pass-by vibration measurements, at four locations involving street running operation and three locations involving ballasted track running. The trackform of street running sections comprised welded rail mounted in an Edilon lined resilient trench. The results are summarised in Table B.4.

Table B.4 Measured Vibration Levels from the Manchester Metrolink – Street Running Sections at Full Speed

Distance to nearest rail (m)	Peak particle velocity (mm/s)	Weighted acceleration (m/s^2)	Estimated VDV_{day} ($m/s^{1.75}$)(1)
1 to 3	1.5 to < 2.0	0.06 to < 0.1	0.5 to < 1.0
3 to 5	1.0 to 1.2	0.03 to 0.06	0.2 to 0.5
5 to 10	0.6 to 1.0	0.01 to 0.03	0.08 to 0.2
10 to 15	0.3 to 0.6	0.005 to 0.01	0.03 to 0.08
15 to 20	0.15 to 0.3	0.003 to 0.005	0.015 to 0.03

(1) Vibration Dose Value

It is anticipated that the scheme will incorporate some form of resilient track mounting system for the street running sections, as incorporated into the Manchester Metrolink system. The levels tabulated above are considered to provide a reasonable estimate of the ground vibration levels that can be expected without additional mitigation.

Strategic Transport Appraisal Methodology

The strategic appraisal has focussed on the impact on noise of changes in road traffic flows caused by the scheme. Although light rail traffic forms a part of the overall study, noise from the tram scheme is appraised separately using the more detailed and localised assessment methodology described previously.

The noise appraisal has followed the Guidance on the Methodology for Multi-modal Studies (GOMMMS) strategy level approach as referred to in the STAG guidance, and is based on outputs from traffic modelling (namely link-based traffic flow, speed and heavy vehicle composition data). The key performance measure used in the appraisal is the change in estimated population annoyed by noise.

The estimated population annoyed by noise has been determined for each of five cases (Base 2001, Do Minimum 2011 and 2026, With Scheme 2011 and 2026) by undertaking the following steps:

- Indicative traffic noise levels (the Basic Noise Level from the Calculation of Road Traffic Noise) have been calculated for each link in each test case.

(5) Presentation of Vibration Data Measures on Phase 1 of the Manchester Metrolink, ERM, Halcrow Fox and CES, February 1996

- The population exposed to traffic noise has then been estimated. This population is taken to be that which lies within a standard 50m wide swathe (the assumed zone of noise influence) around each link. The population figure for each link has been determined by taking the population density of each census Enumeration District through which the link passes and multiplying it by the area of the 50m swathe formed by that part of the link. Population data is drawn from household data at Enumeration District level, and is the permanent residential population.

- Where the 50m buffer around road links overlap, the population is counted twice or more, once for each link. This double counting has been addressed by introducing a correction factor based on the actual population in the study area.

- The GOMMMS noise/annoyance response relationship has then been applied to the calculated noise levels and populations to give the estimated population annoyed for each link. These are then summed across all links to give the total estimated population annoyed for the whole study area, thus allowing the overall population annoyed to be established for each scenario under consideration.

The noise level calculations are necessarily broad brush. For example, effects of road gradient and topographic screening are not considered, and a nominal road to receptor separation distance is assumed. However, these approximations do not affect the *change* in noise that may be produced from the change in traffic flow, speed and composition produced by the strategy under test. Problems with noise calculation at slow speed (less than 10 kph) using the Calculation of Road Traffic Noise method are not significant in this study as less than about 1% of road links have speeds below 10 kph. In these cases a minimum speed of 10 kph has been assumed. The main study routes where noise changes are likely are expected to have speeds higher than 10 kph .

While this overall approach to the traffic noise appraisal is an indicative one, it allows the overall noise effect of approximately 1300 road links in the study area to be assessed, and it is considered adequate to yield comparative results between the situation with and without the scheme in terms of change in population annoyed at the required strategic level.

Construction Noise Mitigation Measures

Best practicable means [6] will be used during the construction of the scheme in order to reduce noise levels as far as possible.

All contractors will be expected to comply with requirements regarding methods of construction, choice of plant and equipment and hours of work during construction. Mitigation measures to reduce severe, substantial and moderate impacts will include the following where required comply with CEC requirements:

- low noise construction plant will be used wherever suitable and necessary;

- all vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good and efficient working order;

- all compressors, generators and pumps will be silenced models fitted with properly lined and sealed acoustic covers or enclosures, which will be kept closed whenever the machines are in use;

(6) Defined in section 79 (9) of the Environmental Protection Act 1990

- all pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufactures;
- all machines in intermittent use will be shut down in the intervening periods between work, or throttled down to a minimum, and noise emitting equipment which is required to run continuously should be housed in a suitable acoustic enclosure;
- all items of plant will be maintained in good working condition to minimise extraneous noises arising from mechanical vibration;
- as far as practicable, demolition works will be carried out using equipment which breaks concrete by bending, in preference to percussive methods;
- where practicable, rotary drills and bursters actuated by hydraulic or electrical power will be used for excavating hard materials;
- noisy plant and equipment will be sited as far away as possible from noise sensitive receptors, and the use of barriers (eg site huts, acoustic sheds or partitions) to reduce the level of construction noise at the receptor will be employed wherever possible;
- care will be taken when loading or unloading vehicles, dismantling scaffolding or moving materials etc to reduce noise emissions; and
- access to work compounds will be situated such that disturbance arising from site personnel and vehicles entering or leaving the site is kept to a minimum.

A further means of reducing construction noise will be the use of acoustic enclosures and fixed or mobile noise barriers (typically to a height of approximately 2.4 m). These will be used, as necessary, directly adjacent to areas of noisy ground level construction activity to minimise noise impacts at adjacent receptors. Barriers, if located sufficiently close to construction plant activity, can reduce noise levels by 5 to 10 dB (7).

Acoustic enclosures are another effective way of reducing noise levels, particularly where multi-storey receptors overlook the construction works. Enclosures will be used where appropriate and to the specifications outlined in BS5228.

Operational Noise Mitigation Measures

Noise impacts have been assessed against the noise impact criteria outlined above. Where impacts above the slight category are predicted, mitigation measures will be considered for affected properties.

Noise control will form an important requirement of the design of the tram and track systems, and will be tested though the development and implementation of the scheme. It will be particularly important to ensure a high standard of maintenance during the operating life of the system to avoid noise levels increasing unnecessarily due to ware and tear of the wheel and rail surfaces.

Noise barriers will be the most effective means of reducing remaining noise . However, barriers are not feasible on street running sections, due to conflicts with other road users.

(7) A reduction in noise levels of 3 dB will give rise to a noticeable reduction in noise levels. A reduction of 10 dB equates approximately to a halving of the loudness of the noise.

In addition, there may be a need for careful design of the stops and their audible announcement systems. The use of screens at the rear of platforms in addition to directional speakers and signal limiting devices will help to minimise noise impacts from audible announcements. Output sound levels will also be lowered within applicable guidance limits, in sensitive locations.

Vibration

Ground vibration is expected to be perceptible at some receptors but not at levels that are likely to give rise to structural damage. Adverse comments are not expected from building occupiers, provided a high quality resilient track-mounting system is adopted in the design.

B.2 Air Quality

This Appendix sets out the following information:

- air quality objectives;
- background air quality for the City of Edinburgh;
- local air quality management;
- a detailed methodology of the assessment; and
- detailed results of the assessment.

B.2.1 Air Quality Objectives

Until recently, the only air quality standards that had legal status in the UK were Directives set by the European Commission (EC) adopted into UK law via the *Air Quality Standards Regulations 1989*. These have been complemented and updated in the *Air Quality (Scotland) Regulations 2000* and the *Air Quality (Scotland) Amendment Regulations 2002*.

These are incorporated within the Government's strategy for improving air quality as set out in the *Air Quality Strategy (AQS)* published by the Department for Environment, Food and Rural Affairs (DEFRA). The *AQS* published in January 2000, set objectives for eight pollutants and these have been revised in a consultation draft published in September 2001. The revised objectives have been adopted in Scotland in the *Air Quality (Scotland) Amendment Regulations 2002*.

Local Air Quality

The relevant objectives for nitrogen dioxide and particulate matter are set out in Table B.7 below.

Table B.5 Assessment Criteria for NO_2 and PM_{10} in Scotland

Pollutant	Objective	Date for Compliance
Nitrogen Dioxide (NO_2)	Annual Mean : 40µg m^{-3}	31st December 2005
	99.8th %ile of Hourly Means: 200µg m^{-3}	31st December 2005
Particulate Matter (PM_{10})	Annual Mean : 40µg m^{-3}	31st December 2004
	90.4th %ile of Daily Means: 50µg m^{-3}	31st December 2004
	Annual Mean : 18µg m^{-3}	31st December 2010
	98.1%ile of Daily Means : 50µg m^{-3}	31st December 2010

B.2.2 Baseline Air Quality

Data for ambient concentrations of air pollutants are taken from the UK Air Quality Data and Statistics Database (8). The database contains tables of analysed data and statistics from monitoring networks operated on behalf of the DEFRA and the devolved administrations.

There are over 1,500 sites across the UK that monitor air quality. There are two major types - automatic and non-automatic networks. Automatic Networks produce hourly pollutant concentrations, with data being collected from individual sites by modem. Non-automatic networks have longer sampling periods - either daily, weekly or monthly - and samples are collected by physical means (such as diffusion tube or filter).

Background maps of air quality are available for nitrogen dioxide and particulate matter for the year 2001 and projections for 2010. These maps are produced through a complex interpolation exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites.

Nitrogen Dioxide (NO_2)

Information on the ambient concentrations of NO_2 in the study area is taken from data acquired through the automated network, non-automated network and background air quality maps.

NO_2 concentrations from an Automatic Urban and Rural Network (AURN) site in Edinburgh are presented in Table B.6 below.

Table B.6 Comparisons of Monitored Dioxide Data with Objectives (µg m^{-3}) Source: NAQIA

Monitoring Site	Year	Annual Mean	99.8th % of Hourly Means
Edinburgh City Centre	2003 (a) (b)	25	109
	2002	42	115
	2001	43	156
	2000	45	124
	1999	42	112
	1998	47	124
Air Quality Objective	2005	40	200

(a) Less than 75% data capture
(b) Provisional data

The annual mean has exceeded the *AQS* objective concentration value for the past four years. The 1-hour mean objective value has not been exceeded.

Additional data on NO_2 from diffusion tube sites are also available from NAQIA . Table B.7 summaries these results for 1996 to 2001.

(8) NAQIA database is available at www.airquality.co.uk. It is run by NETCEN part of AEA Technology on behalf of Defra.

Table B.7 National NO_2 Survey Annual Average Results for 1996-2001 (µg m^{-3}) Source: NAQIA

Monitoring Site	Representative of:	Year	Annual Average Concentration (µg m^{-3})
EDINBURGH 3N	City of Edinburgh	2001	20
		2000	23
		1999	21
		1998	21
		1997	-
		1996	25
EDINBURGH 4N	City of Edinburgh	2001	19
		2000	19
		1999	19
		1998	19
		1997	-
		1996	17
EDINBURGH 5N	City of Edinburgh	2001	51
		2000	51
		1999	49
		1998	41
		1997	-
		1996	-
EDINBURGH 6N	City of Edinburgh	2001	-
		2000	41
		1999	35
		1998	37
		1997	-
		1996	-
AQS Objective		2005	40

With the exception of Edinburgh 5N and Edinburgh 6N, none of these areas exceeded the criterion for nitrogen dioxide annual mean concentrations.

Further data are available from the City of Edinburgh Council[9] . These are presented in Tables B.8 and B.9.

(9) City of Edinburgh (May 2002) Stage 4 Review and Assessment of Air Quality. http://www.edinburgh.gov.uk/airquality

Table B.8 Summary of Nitrogen Dioxide Passive Diffusion Tube Data for 1999-2002

Location	Annual Average Concentration			
	1999	2000	2001	2002
St John's Road	-	48	51	48
St John's Road		-	48	47
St John's Road		-	41	33
Glasgow Rd A8, (Eastbound no 9)		Site started 2002		39
Glasgow Rd A8,(Westbound no 68)		Site started 2002		39
Deanhaugh St	-	34	40	39
Queensferry Rd, Craigleith		Site started end 2001/2002		39
Morningside Rd	-	36	41	38
Morningside Rd		-	39	36
Hope Park Terrace	-	38	45	38
Grassmarket	-	35	40	35
Grassmarket		-		34
Portobello High Street	-	34	Site discontinued end 2000	
Trinity Crescent, Newhaven)		Site started 2002		37
Dundas Street	-	31	36	32
Home StTollcross	-	35	37	34
Pier Place, Newhaven		Site started 2002		31
Commercial St, No 11 Leith		Site started 2002		31
Commercial St, No 78 Leith		Site started 2002		41
Calder Rd	-	34	28	29
Inverleith Row	-	33	Site discontinued end 2000	
Slateford Rd	-	30	Site discontinued end 2000	
Dean PathQueensferry Rd	-	34	Site discontinued end 2000	
India Street	-	23	26	23
Melville Drive	-	23	29	24
Melville Drive	-	26	28	24
Melville Drive	-	23	27	24
Hillview Terrace		-	19	21
Midmar Drive		-	18	15
West Maitland St, Palmerston Pl	61	67	72	60
West Maitland St	Site started mid 2000		59	57
Roseburn Terr/St	62	60	57	55
Roseburn Terr	Site started mid 2000		43	43
Princes St	48	51	53	69
North Bridge 1*	57	55	55	58
North Bridge 2*	-	49*	57	60
Gorgie Road/Ardmillan	44	42	58	55
Ardmillan Terrace	Site started mid 2000		40	35
Leith Walk, McDonald Rd	46	42	43	43
Leith Walk/Brunswick Rd	Site started mid 2000		36	40
Leith Walk/Gayfield Pl	-	39	Site discontinued end 2000	
Leith Walk	-	42	Site discontinued end 2000	
Queen St/Frederick St	50	45	43	51
Queen St/Frederick St		Site started 2002		49
Queen St/York Pl	38	36	38	44

* North Bridge has had scaffolding erected at the building façade for 18 months, this may have had an effect on the flow of air, leading to poor dispersion

Table B.9 Real time (Chemiluminesence analyser) Nitrogen Dioxide Data within AQMA

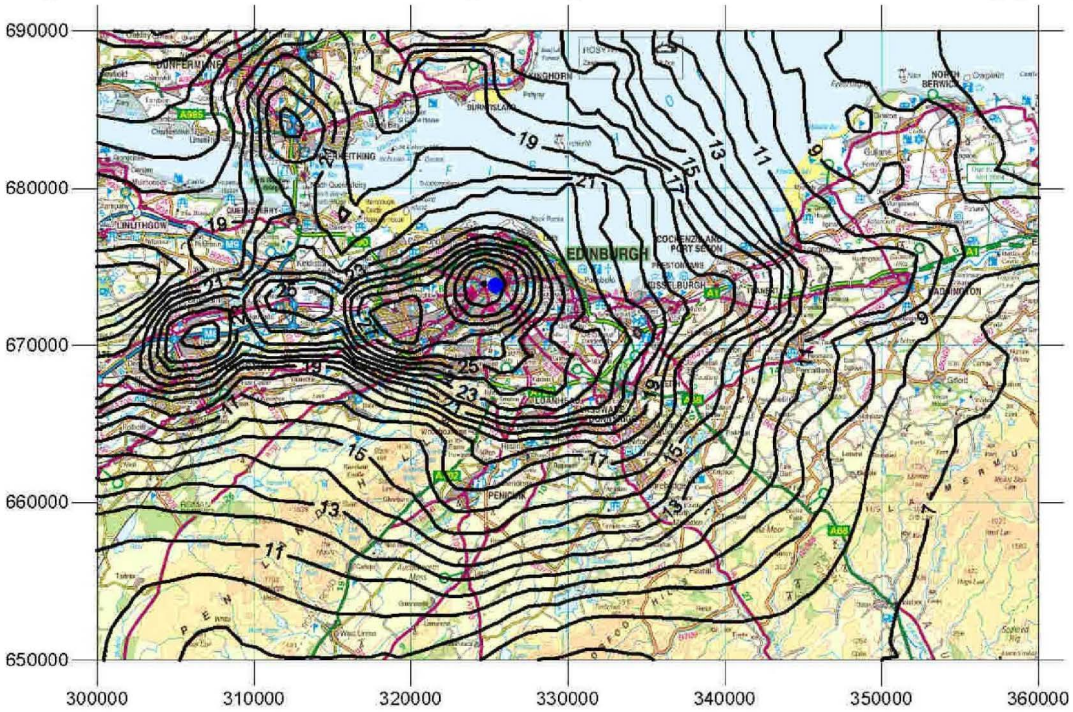
Location	Site Description	Annual Mean				No of hourly exceedences of 200 µg m^{-3}			
		1999	2000	2001	2002	1999	2000	2001	2002
Princes St Gdns National Network	Urban Centre	42	45	43	48	0	1	8	0
Haymarket Terr	Roadside	38	37	42	42	0	0	10	0
Queen St/North Castle St	Roadside	42	38	39	44	0	0	6	0
Gorgie Rd	Roadside	42	38	40	38	0	0	**	0
Leith Walk (Shrubhill)	Roadside	-	-	37	-	-	-	11	-
Cowgate *		31	-	-	-	0	-	-	-

* Site not within AQMA
** Analyser fault during December

The monitoring locations outside the AQMA are estimated to meet with the annual average air quality objectives for nitrogen dioxide apart from one site (the canyon/junction site at St Johns Road). Monitoring sites within the AQMA exceed the annual average air quality objectives except for Leith Walk.

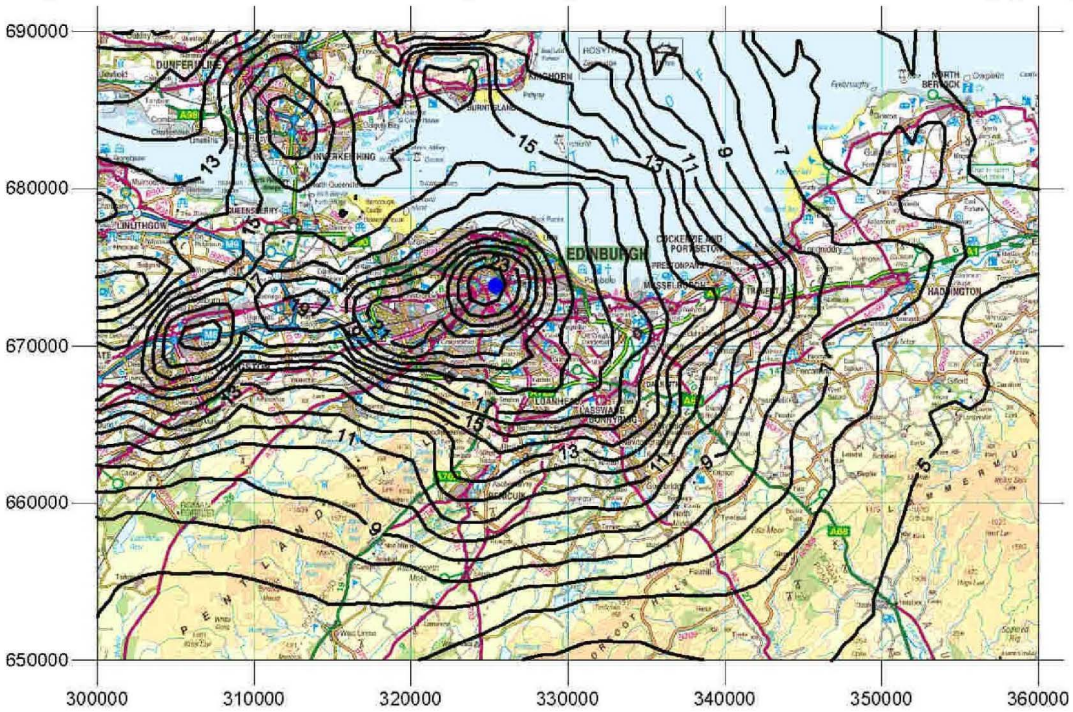
Maps of current and projected background concentrations of NO_2 in the study area for 2001 and 2010 are shown in Figures B.1 to B.4.The projections for 2010 take into account the predicted success of emissions reductions strategies, including the introduction of cleaner vehicles into the UK vehicle fleet, the use of cleaner fuels, and the reduction in emissions from industrial sources.

Figure B.1: Estimated Annual Average Background NO_2 Concentrations 2001 (µg m^{-3})



Source: NAQIA. Edinburgh AURN marked as blue dot.

Figure B.2: Predicted Annual Average Background NO_2 Concentrations 2010 (µg m^{-3})



Source: NAQIA. Edinburgh AURN marked as blue dot.

Estimated background NO_2 concentrations in 2001 and predicted concentrations for 2010 are within the annual mean objective for NO_2 of 40 µg m^{-3}.

Particulate Matter (PM_{10})

Information on the ambient concentrations of PM_{10} in the study area is taken from data measured through the automated network and the background maps.

Particulate matter concentrations from the Automatic Urban and Rural Network (AURN) site in Edinburgh are presented in Table B.10 below.

Table B.10 Comparison of PM_{10} Data with Objectives Source: NAQIA

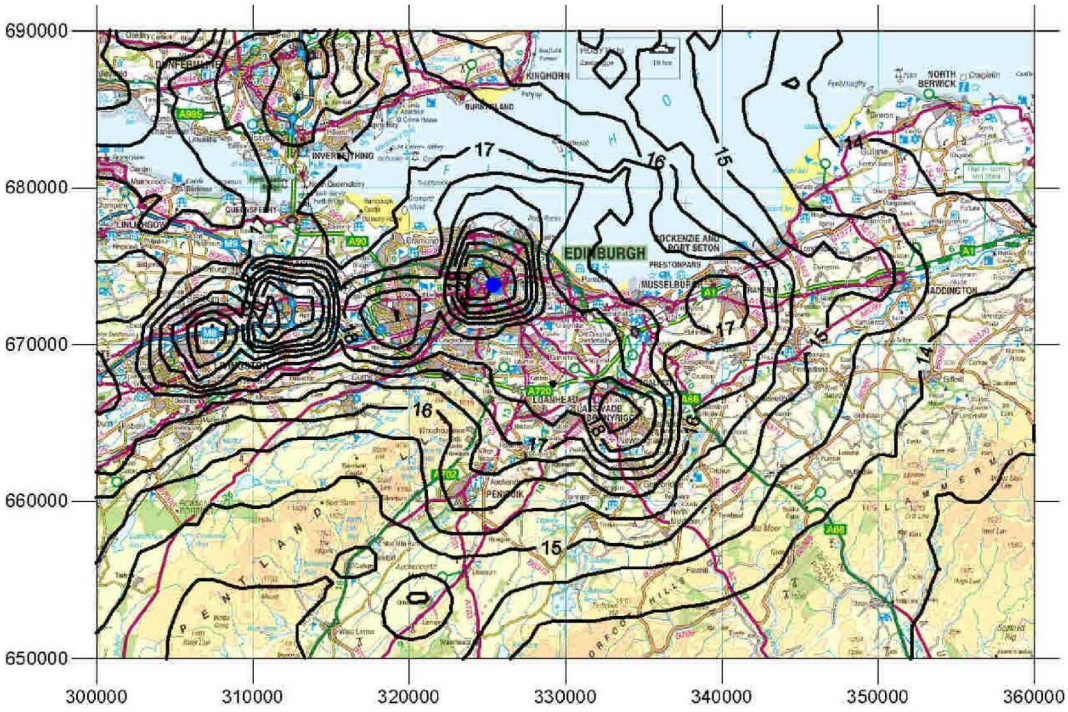
Monitoring Site	Year	Annual Mean[(a)]	90.41st Percentile[(a)]
Edinburgh City Centre	1997	24	32
	1998	20	26
	1999	19	25
	2000	23	31
	2001	25	35
	2002	22	44
	2003[(b) (c)]	13	38
AQS Objective	2004	40	50
	2010	18 [(d)]	

(a) These results are gravimetric units. The published data have been multiplied by a factor of 1.3 to convert from TEOM units to gravimetric units in accordance with Guidance note LAQM.TG4(00). This factor accounts for the under-reading of TEOM instruments.
(b) Data capture rate was less than 75%
(c) Provisional Data
(d) The objective of 18 µg m^{-3} for Scotland came into force 12/06/2002

The PM_{10} concentrations recorded for the area meet the annual mean objective for 2004 but the majority do not meet the 2010 objective.

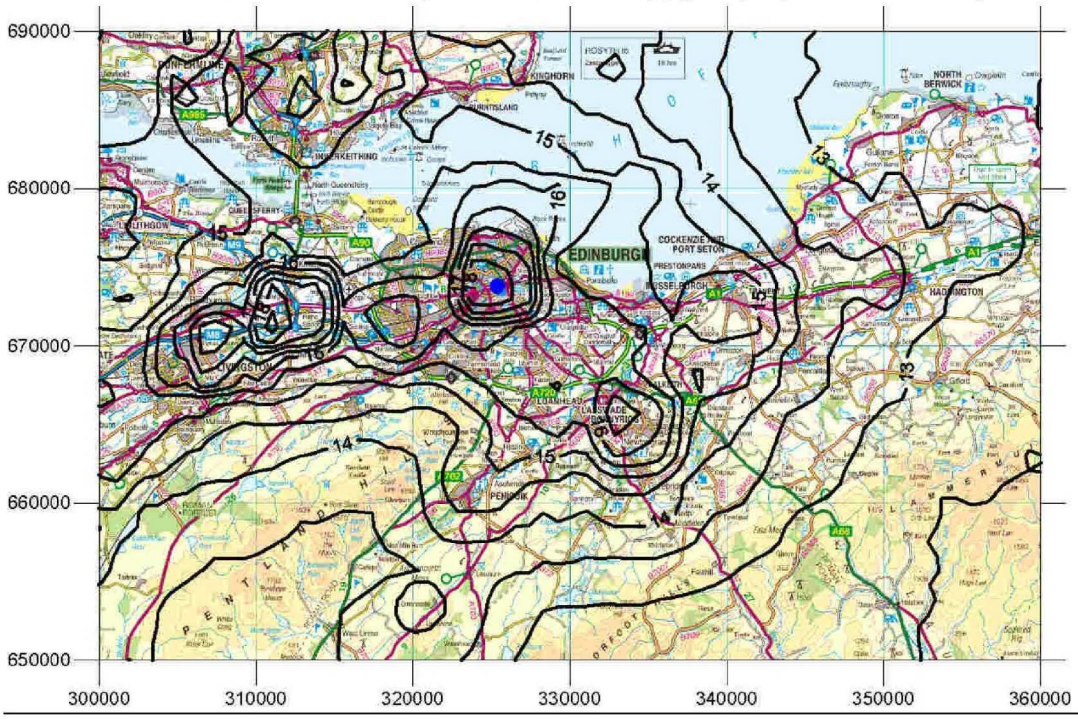
Maps of current and projected PM_{10} concentrations presented in Figures B.3 and B.4.

Figure B.3: Map of Estimated Annual Average Background Particulate Matter Concentrations for 2001 (Gravimetric Units, µg m^{-3}). (Source: NAQIA).



Edinburgh AURN marked as blue dot.

Figure B.4: Map of Predicted Annual Average Background Particulate Matter Concentrations for 2010 (Gravimetric Units, µg m^{-3}). (Source: NAQIA).



Estimated background concentrations of PM_{10} in 2001 are within the 2004 objective of 40 μg m^{-3}, but concentrations in 2010 will not be compliant with the 2010 objective for Scotland of 18 μg m^{-3} in some areas.

B.2.3 Local Air Quality Management Areas

As a requirement of Part IV of the Environment Act 1995 local authorities have been required to complete a review and assessment of air quality to determine whether the air quality objectives are likely to be met, and where necessary designate Air Quality Management Areas (AQMAs)

The review and assessment of air quality report (10) for Edinburgh recommended that a single AQMA be declared in order that an integrated action plan can be prepared. This was based on the fact that the NO_2 annual mean objective was not likely to be met at the following locations:

- George Street;
- Leith Walk/McDonald Road;
- Princes Street;
- Roseburn Terrace;
- Gorgie Road/Ardmillan;
- North Bridge;
- Queen Street; and
- West Maitland Street.

Edinburgh City Centre has been declared an Air Quality Management Area on the basis that the nitrogen dioxide objectives for the annual and hourly mean are not likely to be met in 2005.

The measures included in the proposed Edinburgh City Council Action Plan for the AQMA are:

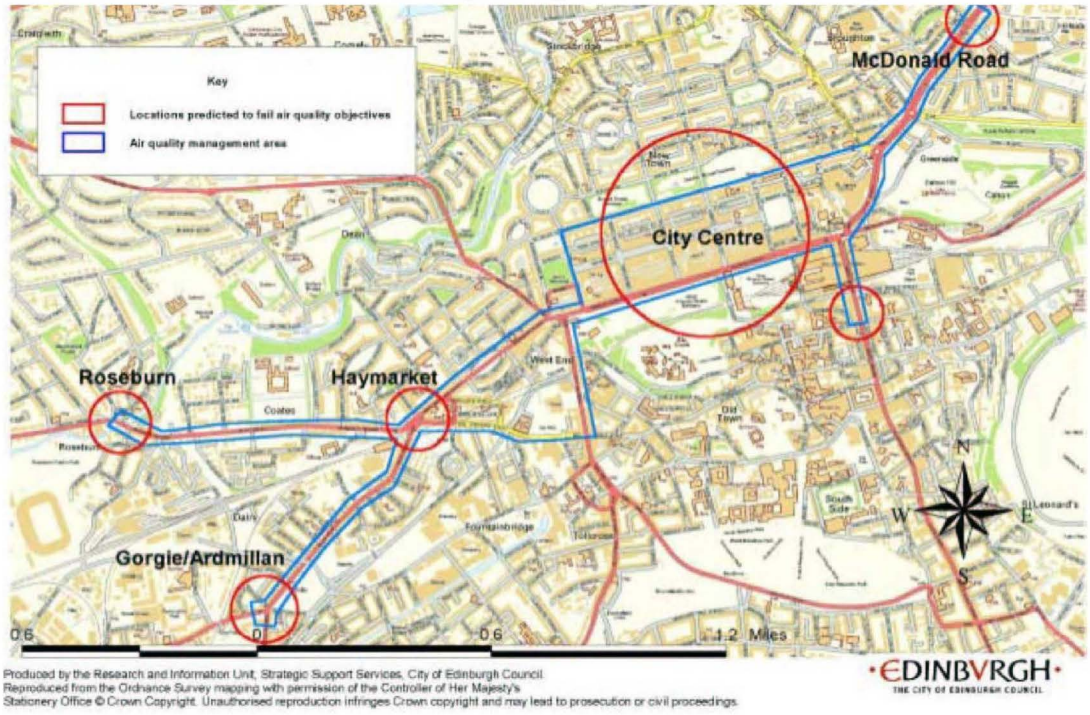
- reducing the amount of traffic; and
- easing traffic congestion.

Studies in Edinburgh have shown that 88 percent of nitrogen oxides come from road transport with the remaining 12 percent coming from domestic heating and Edinburgh International Airport (11).

Figure B.5 below shows the demarcation (in red) of the AQMA for NO_2 designated in Edinburgh (12).

(10) City of Edinburgh (2001) Stage 3 Review and Assessment of Air Quality. http://www.edinburgh.gov.uk/airquality
(11) Summary Air Quality Action Plan from the Edinburgh City Council Website. http://www.edinburgh.gov.uk/airquality
(12) Summary Air Quality Action Plan from the Edinburgh City Council Website. http://www.edinburgh.gov.uk/airquality

Figure B.5: Air Quality Management Areas in Edinburgh



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There are plans to extend the AQMA to the West of the City of Edinburgh [13].

B.2.4 Methodology

Air Quality Assessment

A spreadsheet model has been used for this assessment to assess the impact on air quality of changes in road traffic resulting from the scheme. This is based on the STAG approach to multi modal studies and the graphical screening method set out in DMRB. At present it is not possible to apply the latest DMRB spreadsheet (version 1.01 February 2003) to the STAG methodology due to the Visual Basic programming embedded in the spreadsheet. Instead the previous version of DMRB has been used. The approach quantifies the relative potential for exposure of the population to pollutants generated by road traffic and has been used to assess the Base year 2000, Do Minimum years 2011 and 2026 (without the tram) and the Do Something years 2011 and 2026 (with the tram) [14] . The study area is illustrated in Figure 7.2 (Main Volume).

The main steps in the assessment are as follows:

- Roadside [15] concentrations of NO_2 and PM_{10} are predicted using the methodology set out in DMRB on a link by link basis.
- The number of road links with a predicted improvement in air quality and the number of road links with a predicted degradation in air quality are reported.

(13) Personal communication with Janet Brown of CEC Environmental Services (24/07/03 and 06/10/03)

(14) The year 2025 has been used instead of 2025 as the DMRB does not accept years later than 2025.

(15) A distance of 10 m from the centre of the road to the roadside has been assumed.

- The number of households within 50 m, 100 m, 150 m and 200 m on either side of each road link is determined from postcode-based household counts (16) using a geographical information system (GIS).

- The households within 200 m on either side of the road link are weighted according to their distance to the roadside using weighting factors from DMRB. This accounts for the fact that traffic-related pollution decays rapidly with distance from the road .

- The number of weighted households near roads with an increase or decrease in roadside air quality is calculated.

- The change in air quality and the number of weighted households are factored together for each road link and aggregated to give an air quality index for each scenario.

This assessment does not quantify the cumulative impact of several roads at individual houses, or at a specific location, but instead aggregates the populations affected by each individual road link. The counting of households within 200m of each road link leads to multiple counting in areas where there is more than one road link within 200 m of the same properties. To address this a correction factor has been applied to reduce the effect of the multiple counting. It is estimated that each household is counted approximately 4 times and a correction factor of 0.25 has therefore been applied .

The number of households exceeding the relevant air quality objectives in each scenario is also estimated taking into account background NO_2 and PM_{10} concentrations from the maps in *Figures B.1* to *B.4*. These background concentrations are assigned on a link by link basis.

As a result, the number of households that are predicted to comply with and exceed the *AQS`* objectives under the various scenarios is calculated and the net change in households predicted to be non-compliant with the air quality objectives for NO_2 and PM_{10} as a result of Edinburgh Tram Line One is reported.

Greenhouse Gas Assessment

Carbon dioxide is the most significant transport induced greenhouse gas and has a direct effect on climate change (17). In STAG assessments CO_2 is taken as a proxy for global impacts from emissions to atmosphere.

CO_2 emissions from each scenario are estimated using DMRB, Version 1.02 (c), November 2003. The assessment uses the total number of vehicle kilometres travelled over the entire transport model (not just within the A720), the HGV composition and the average speed for each scenario.

CO_2 emissions from to the power used to run the tram are calculated from its predicted annual power consumption using published emission factors for the National Grid.

B.2.5 Results

An estimate of the number of weighted households experiencing an improvement or worsening in air quality is presented in Table 7.9 (see main volume). The number of households that are predicted to experience no change in air quality is also presented.

(16) 2001 Household counts, Scottish Executive Geographic Information Service.
(17) Scottish Transport Appraisal Guidance (STAG), V1.0 September 2003.

The Air Quality Index then provides an indication of the relative magnitude of the exposure to pollutant emissions. A negative value implies an improvement in air quality and a positive value a deterioration in air quality. The larger the value, the more significant the impact. The air quality indices for the proposed scheme are presented in Table 7.10 (see main volume).

Further analysis of the results has been carried out to provide a sense of the magnitude of the changes in air quality as a consequence of the tram. The results are illustrated in Figures B.6 to B.9. These bar charts show the number of road links predicted to experience changes in roadside air quality of different magnitudes. These changes are also plotted on an individual road by road basis in Figure 7.3 (see Main Volume).

The large peaks indicate the significant number of road links with very small changes in air quality (changes smaller than 1 µg m^{-3}) showing that the majority of roads (and therefore households) are predicted to experience a neutral impact on air quality as a result of the tram. This is true for both pollutants and both of the years assessed. In 2011 there is a larger number of road links experiencing improvements in NO_2 and PM_{10} concentrations than a worsening. By 2026 there are slightly more experiencing a worsening in pollutant concentrations than an improvement.

Figure B.6: Bar Chart of Roadside Changes in NO_2 Concentrations (µg m^{-3}) in 2011 as a Consequence of Line 1

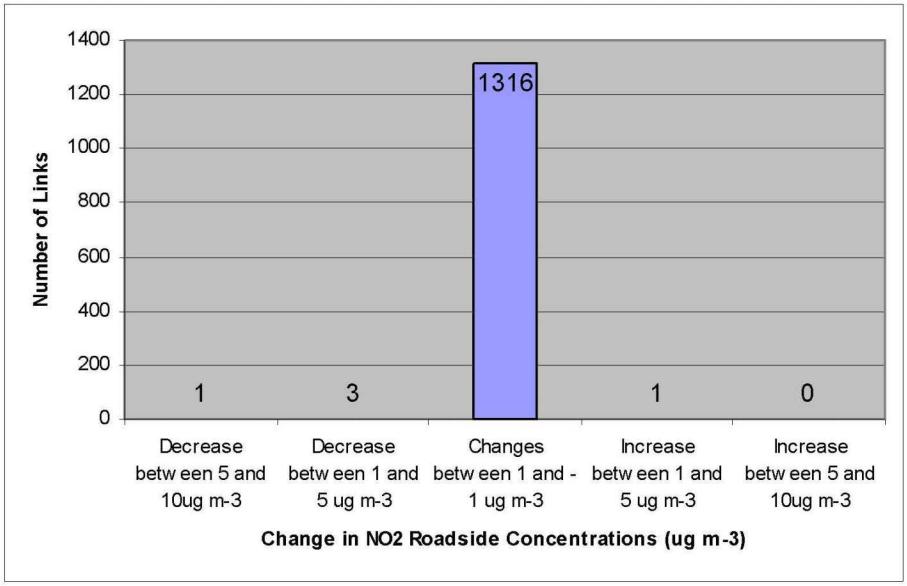

Figure B.7: Bar Chart of Roadside Changes in PM_{10} Concentrations (µg m^{-3}) in 2011 as a Consequence of Line 1

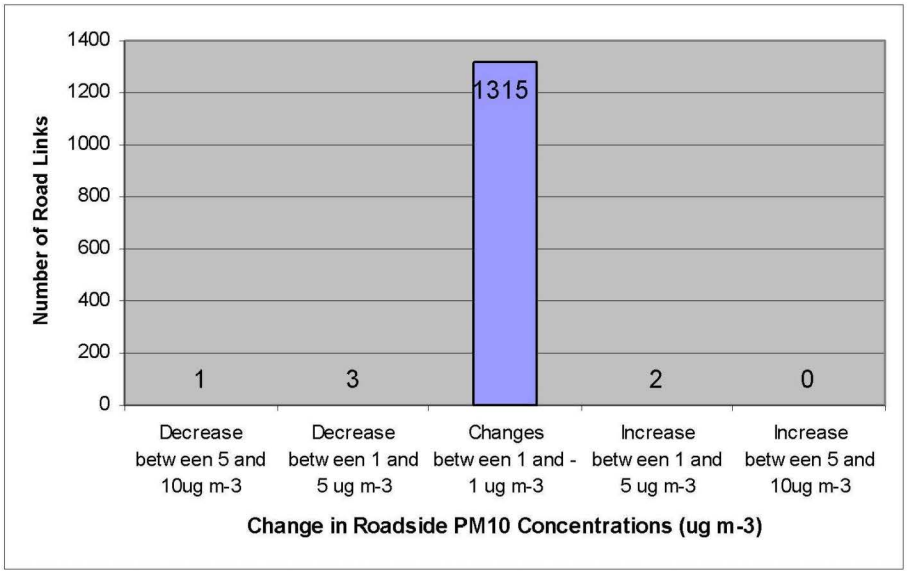

Figure B.8: Bar Chart of Roadside Changes in NO_2 Concentrations (µg m^{-3}) in 2026 as a Consequence of Line 1

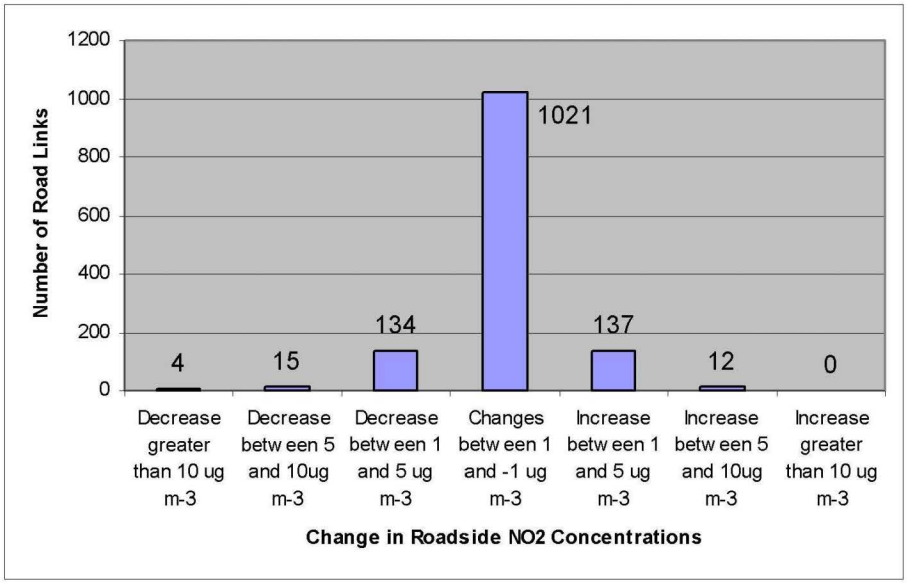

Figure B.9: Bar Chart of Roadside Changes in PM_{10} Concentrations (µg m^{-3}) in 2026 as a Consequence of Line 1

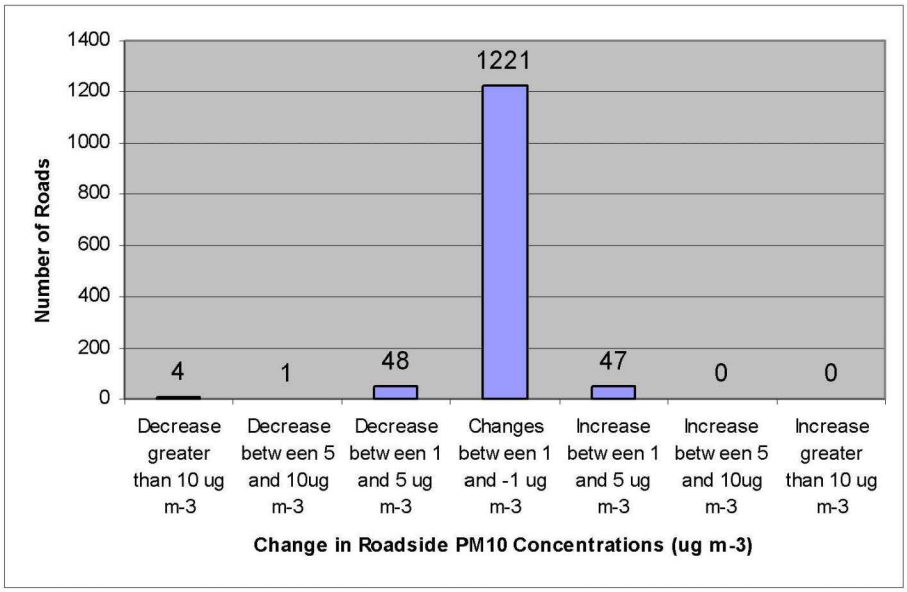

Table B.11 below details the number of road links predicted to exceed the relevant objectives at the roadside in each of the scenarios.

Table B.11 Number of Road Links Exceeding Relevant Objectives

	Base 2001	Do Minimum 2011	Do Something 2011	Do Minimum 2026	Do Something 2026
Number of road links not meeting NO_2 objective at the roadside	865	468	442	385	375
Number of road links not meeting PM_{10} objective at the roadside	0	487	481	453	453

In 2011 the number of road links that are non-compliant with objectives will decrease as a result of the tram. In 2026, the number of roads where the NO_2 concentrations are non-compliant with objectives will decrease with the tram but there will be no change for PM_{10} . There are no road links in the Base 2001 scenario with roadside concentrations that are predicted to be non-compliant with the PM_{10} objective of 40µg m^{-3} but the objective tightened in 2010 to a concentration of 18 µg m^{-3}, and as a result there is an increase in non-compliance in both the Do Minimum and With Scheme scenarios.

This can also be illustrated in terms of the number of households near roads which are brought into compliance with the objectives as a result of the scheme, and the number of those caused to exceed as a result of the scheme.

Table B.12 Change in Number of Weighted Households Exceeding Air Quality Objectives as a Result of the Proposed Scheme

	NO_2 2011	PM_{10} 2011	NO_2 2026	PM_{10} 2026
Number of weighted properties near roads not meeting objective as a result of the scheme	1,300	0	2,500	5,750
Number of weighted properties near roads meeting objective as a result of the scheme	5,950	1,600	5,000	10,200

Approximately twice as many households are near roads predicted to meet the PM_{10} and NO_2 objectives as are near roads failing the objectives as a result of the tram. The introduction of the tram therefore causes a net improvement in compliance with the objectives.

B.2.6 Results of Greenhouse Gas Assessment

The results of the carbon dioxide calculations are presented in Table B.13.

Table B.13 Carbon Dioxide Emissions from the Modelled Road Transport Network

	Base 2001	Do Minimum 2011	Do Something 2011	Do Minimum 2026	Do Something 2026
Annual Carbon Dioxide Emissions (Kilotonnes)	1,219	1,252	1,251	1,451	1,440

There is a decrease in CO_2 emissions across the road transport network as a result of the proposed tram due to a decrease in vehicle kilometres travelled. The decrease in CO_2 emissions in 2011 is predicted to be 1,000 tonnes, and in 2026, 11,000 tonnes. These figures can be compared with the total emissions from the Scottish transport sector in 2000 of 7.3 million tonnes.

The tram is predicted to have an annual power consumption of 14,355 MWh. Assuming that this power comes from the National Grid, using an emission factor of 0.43kg of CO_2 per kWh of electricity generated, it is predicted that the tram will result in an annual emission of 626 tonnes of CO_2.

The net CO_2 emissions in each scenario is presented in Table B.14.

Table B.14 Net Carbon Dioxide Emissions

Scenario	Carbon Dioxide Emissions (Kilotonnes/annum)
Base	1,219
Do Minimum 2011	1,252
Do Something 2011	1,252
Do Minimum 2026	1,451
Do Something 2026	1,441

CO_2 emissions resulting from the power consumption by the tram will offset the decrease in road traffic transport CO_2 emissions in 2011 but lead to a small net reduction in emissions of 10,000 tonnes by 2026.

B.3 Water Quality, Drainage and Flood Defence

B.3.1 Introduction

This chapter describes the effects of the proposed Edinburgh Tram Line One on water resources along the route including:

- Aquatic features along the scheme;
- Surface water quality and sensitivity;
- Hydrogeology and groundwater resources; and
- Drainage and flooding.

B.3.2 Approach to the Assessment

General Approach

The approach to assessment of impacts on water resources has been based on a desktop study. Surface watercourses crossed by, and in the vicinity of, the proposed alignment are identified and described in terms of their baseline characteristics. Potential impacts and mitigation have been identified through:

- Consultation with the Scottish Environment Protection Agency (SEPA), City of Edinburgh Council (CEC) and other statutory and non-statutory consultees;
- A desk based review of baseline water quality data, existing drainage and flooding patterns;
- A review of proposed construction methodology with respect to the use of water during construction and drainage patterns at proposed construction sites;
- Assessment of potential effects on water quality with respect to drainage and run-off implications on the Water of Leith and Firth of Forth; and
- Assessment of the effect of any increased risk to flooding for the surrounding area as a result of the project.

In carrying out the assessment, the following have been taken into account:

- National policy in respect of surface and groundwater standards and objectives;
- Relevant Local Plan objectives relating to water resources in the area; and
- SEPA's guidelines on pollution prevention during construction.

Assessment Criteria

Policy Relating to Surface and Groundwater Use

National Planning Policy Guidelines (NPPGs), currently being replaced by Scottish Planning Policy (SPP), provide guidance for developers. NPPG 7 Planning and Flooding (soon to be amended by SPP 7) sets out guidance for development within areas of flood risk. The guidance sets out the responsibilities of planning authorities in regulating and controlling development in areas of flood risk,

in order to prevent increased risk of flooding in the future. The note emphasises the need to apply sustainability principles to the prevention of flooding and the control of future development. If a development is located within a floodplain, a flood risk assessment may be required. Developers should consult with the Local Authority and SEPA at the earliest opportunity.

NPPG 13 Coastal Planning is also relevant to the proposed scheme and sets out how planning can contribute to sustainable development and biodiversity along Scotland's coasts. The guidance states that development plan policies must distinguish between policies for developed, undeveloped and remote coastline and how the planning system should respond to the risk of flooding and coastal erosion.

Planning Advice Note (PAN) 61 promotes the use of Sustainable Urban Drainage Systems (SUDS). SUDS provide more natural approaches to runoff management and, when incorporated into developments, helps to prevent increases in flood or water pollution risk downstream of the development. SUDS will be incorporated into the scheme where practical and appropriate.

SEPA is responsible for the protection of water resources within Scotland under the *Environment Act 1995* (18). It is an offence to cause pollution of controlled water, either deliberately or accidentally. In addition, SEPA must grant consent for any discharges to controlled waters. SEPA also have responsibility for the flood defence and maintenance issues for all 'main rivers' under the *Environment Act 1995*.

The following SEPA policies on water resources have been taken into account within this assessment:

- SEPA Policy No.15 – Regulation of Urban Drainage;
- SEPA Policy No.19 – Groundwater Protection for Scotland; and
- SEPA Policy No. 26 – Policy on the Culverting of Watercourses.

Pollution Prevention Guidelines (PPGs) prepared by SEPA set out good construction practice and indicative mitigation measures to minimise potential impacts of works. The following PPGs from SEPA have been used within this assessment:

- Pollution Prevention Guidelines No.5: *Works in, Near or Liable to affect Watercourses*; and
- Pollution Prevention Guidelines No.6: *Working at Construction and Demolition Sites*.

The City of Edinburgh Council (CEC) is responsible for flooding issues within Edinburgh. As a result of flooding in late 2000, CEC commissioned a Flood Assessment Report (19) in late 2001 to assess potential flood risks within Edinburgh. The report identified flood prevention measures to be implemented within the city, which include construction of floodwalls, pump stations and floodgates. This assessment has taken these proposed measures into account considering potential impacts.

Statutory Water Quality Standards

The water quality of Scotland's rivers is classified by SEPA. Each river is assessed and given a grade as Excellent, Good, Fair, Poor or Seriously Polluted (classes A1, A2, B, C and D respectively). The classification scheme uses water chemistry, biology, aesthetic and toxicity assessments to determine the classification of water quality.

The vulnerability of groundwater to pollution is dependent on the presence and nature of the overlying soils and drift deposits, the geology and the depth to the water table. This will determine the rate at

(18) Controlled waters include all watercourses and water contained in underground strata (or groundwater)
(19) City of Edinburgh Council (2001) Flood Assessment Report.

which a contaminant can migrate into the water. Consequently, groundwater abstractions in the UK have designated inner and outer protection zones, defined according to the above criteria. SEPA's approach to controlling and preventing the pollution of groundwater is set out in its Groundwater Protection Policy for Scotland (SEPA Policy No.19).

B.3.3 Baseline

Aquatic Features

The primary watercourses in the corridor of the tram route, as shown in *Figure 7.1*, are:

- The Water of Leith; and
- The Firth of Forth.

The Water of Leith is the main watercourse within the City of Edinburgh and flows in a general northeast direction through Edinburgh. The Water of Leith flows from the Pentland Hills through Balerno and a number of Edinburgh suburbs, including Colinton, Longstone, Murrayfield, Roseburn, Dean Village, Stockbridge, Warriston and Bonnington before entering the Firth of Forth at Leith Port.

The scheme crosses the Water of Leith at two locations. Within the Roseburn former railway corridor, the scheme crosses at the Coltbridge Viaduct and the scheme also crosses along Ocean Drive near Leith Port. At each of these crossings, the scheme will use the existing bridge structures to cross the Water of Leith. Minor alterations and improvements to accommodate the tram will be completed prior to implementation of the scheme.

Although the scheme does not cross the Firth of Forth, construction works will be located within the tidal area of the Forth, designated as a Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI). The activities involve the erection of a wooden footway with concrete footings outwith the existing road along Starbank Road. The predicted impacts on natural heritage are discussed in detail in the appropriate section below.

Surface Water Quality and Sensitivity

SEPA recently undertook a water quality assessment of the Water of Leith. The classification for relevant sections of the Water of Leith in 2002 is shown below in Table B.15:

Table B.15 Water of Leith Water Quality Classification

Location	Classification	Description Of Water Crossing	Nearest Scheme Crossing
Murrayfield	C	Poor	Coltbridge Viaduct
Anderson Place	A2	Good	Ocean Drive

As shown above, the water quality of the Water of Leith varies between the two crossing points. Overall, SEPA has classified the Water of Leith as salmonid waters of high amenity [20].

A status report on the geology/hydrogeology features along the proposed route of the scheme was undertaken by Envirocheck [21] in 2002. The report listed known discharge consents, integrated

(20) Capable of sustaining a salmonid fish population. The ecosystem may have been previously modified by human activity.
(21) Envirocheck Report for Mott MacDonald, August 2002

pollution controls, integrated pollution prevention and control measures and groundwater vulnerability. A summary of the surface water issues is summarised in Table B.16.

Table B.16 Summary of Envirocheck Report

Item	Presence On Site	Presence within 250m
Discharge Consents	None	7
Integrated Pollution Prevention and Control	None	None
Pollution Incidents to Controlled Waters	None	None
Water Abstractions	None	None

Hydrogeology and Groundwater Resources

The scheme is within an area of a minor aquifer, which contains fractured or potentially fractured rocks that do not have a high primary permeability or other variations of varying permeability. However, short sections of the scheme within the city centre are within the areas of non-aquifer. These areas have formations of rock with negligible permeability that are generally regarded as containing insignificant quantities of groundwater.

Drift deposits were also identified from source information. However, these were low permeability drift deposits which included till, peat, lacustrine deposits, clay-with-flints and brick earths.

In consultation with SEPA it was confirmed that there are no source protection zones designated along the tram alignment. The area in general, is underlain by strata of the Calciferous Sandstone Measures, which are classified as moderately permeable on the Groundwater Vulnerability Map of Scotland. There are also small areas underlain by igneous rocks (such as Arthur's Seat), which are classified as weakly permeable. Areas in the vicinity of the Water of Leith are associated with Alluvium.

Drainage and Flooding

Drainage

Much of the area along the route is developed and is hard surfaced with drainage. The majority of the route runs along existing roads and surface run-off is drained via a series of underground sewers and storm drains.

The Roseburn Railway Corridor is an area along the scheme alignment where the gradient of the alignment varies within the limits of deviation of the scheme. The existing drainage regime of the corridor consists of stormwater drains installed for the railway.

Flooding

CEC commissioned a report [22] in 2001 to review the existing flood prevention arrangements for the Water of Leith. The report recommended a series of works to be associated with a Flood Prevention Order to be approved by the Scottish Executive. Within this proposal, flood alleviation works will be constructed within flood risk areas identified along the Water of Leith.

Major improvements are planned to prevent flooding from extreme flows in the Water of Leith. The replacement of existing arbitrary flood defences such as boundary walls, most of which were never designed as such, is therefore a significant part of the work required. However, the locations of the flood prevention measures are largely in areas not located near the scheme. Minor CEC construction works are envisaged for the watercourse banks to the south of the Coltbridge Viaduct.

(22) City of Edinburgh Council (2001), Water of Leith Flood Study.

It is presently uncertain when the Flood Prevention works will commence. However, it is possible that construction of flood defence works could coincide with construction of the tram, which is programmed for 2007.

B.3.4 Potential Impacts

Construction or Temporary Impacts

Construction activities, such as foundation work and road resurfacing, may require the use of water on site. Possible site run-off and discharges may impact on the water quality of the Water of Leith and the Forth during the construction phase of the project. As such, mitigation measures will be identified and incorporated into the construction activities and the detailed design of the proposed tram system.

Potential impacts that may arise during the construction of the scheme are as follows:

- Direct discharges to ground and surface water from run-off during the construction phase, possibly containing increased loads of suspended solids and/or contaminants;
- Accidental spillage or leakage resulting from storage of potentially polluting substances during construction, affecting groundwater and surface waters;
- Disposal of drainage and effluent from construction sites, and from any concrete batching plant used at construction compounds;
- Possible localised increased flooding from increased siltation in surface watercourses as a result of construction site run-off;
- Possible localised increases in flooding as a result of any construction activities affecting the land drainage;
- The effect of direct loss, disturbance or other effects on aquatic habitats;
- Potential for pollution of the Water of Leith and Firth of Forth during works associated with construction in close proximity to these areas; and
- Surface water hydrology may be affected during construction by compaction of soils and increase in impermeable surfaces, such as within the Roseburn Railway Corridor and between Craigleith and Ferry Road.

Permanent Landtake Impacts

The potential permanent landtake impacts of the scheme are as follows:

- Introduction of new hardstanding areas (for example within the Roseburn Railway Corridor and north of Ferry Road) may locally increase the runoff coefficient and reduce infiltration, ultimately affecting groundwater recharge. It is envisaged that the overall extent of new hardstanding areas will be minimal, due to the majority of the scheme alignment being along existing roadway; and
- Permanent alteration to the drainage system along the Roseburn Railway Corridor by excavation and earthworks to widen the corridor for the construction of the scheme may impact upon future drainage patterns within this area.

Operational Impacts

The potential operational impacts of the scheme include the following:

- A vehicle washing facility will operate within the depot site. The operation of the facility will use water and result in discharge that is potentially contaminated with washing detergents and dirt/oil from the tram vehicles; and
- Other potential operation impacts may include direct discharges to ground and surface water from runoff during operation and possible accidental spillages of contaminants during operation from trams or maintenance activities.

B.3.5 Mitigation

Mitigation for the scheme to minimise predicted impacts during construction and operation are likely to include the following measures:

- All surface water discharges during construction will pass through sediment traps (such as settlement lagoons or tanks) in order to reduce suspended solids prior to discharge. Similarly decontaminating filters and oil separators will be incorporated into the site drainage systems in order to minimise the risk of contamination to surface waters (SEPA PPG No.5 [23]);
- The contractor will implement the requirements stated in PPG6. The guidance states that it is essential that particular care with all works involving concrete and cement especially if working near a river, stream or surface water drain is undertaken. Suitable provision will be made for the washing out of concrete mixing plant, and such washings will not be allowed to flow into any drain or watercourse;
- All construction works will be undertaken in accordance with SEPA's Pollution Prevention Guidelines and in particular PPG6 [24]. Construction vehicles will be maintained to reduce the risk of hydrocarbon contamination and will only be active when required. Other construction materials will be managed in such a way as to effectively minimise the risk posed to the aquatic environment, particularly for construction along Starbank Road;
- All drainage measures will be discussed and approved by SEPA;
- Adoption of Good Construction Practice and appropriate SEPA Pollution Prevention Guidelines will ensure that the risk of pollution during construction is minimised and that surface runoff during construction does not impact upon the local watercourses and existing urban drainage;
- Disturbance to areas close to watercourses will be reduced to the minimum necessary for the work. Exposed soil areas, such as within the Roseburn Railway Corridor, will be minimised in order to reduce the potential for increased siltation and contaminated runoff. Where it is necessary to introduce new areas of hardstanding surfaces, requirements from SEPA on Sustainable Urban Drainage System (SUDS) will be implemented during the detailed design stage;
- A flood risk assessment will be undertaken for the detailed design to ensure local flooding risks are not increased. The flood risk assessment will be submitted to SEPA and CEC to ensure that planned flood prevention measures have been considered during detailed design;

(23) Scottish Environmental Protection Agency, Pollution Prevention Guidelines No.5 - Works in, Near or Liable to Affect Watercourses.
(24) Scottish Environmental Protection Agency, Pollution Prevention Guidelines No.6 - Working at Construction and Demolition Sites.

- A construction method statement will be submitted for approval by the relevant statutory authorities prior to commencement of construction. The method statement will outline mitigation measures designed to minimise potential impacts upon the water quality of the Firth of Forth, including temporary coffer dams to surround the works;
- Bins will be provided on site for collection of construction waste; and
- Dust suppression techniques will be applied to all soil stockpiles.

B.3.6 Impact Assessment

This section assesses the impacts to water resources that may occur as a result of permanent landtake, construction and operation of the scheme.

Construction or Temporary Impacts

The scheme crosses the Water of Leith at two points along the alignment at Coltbridge Viaduct and on Ocean Drive. Whilst the scheme will use existing structures to cross the Water of Leith at these points, construction of the scheme is predicted to increase sedimentation near the two watercourse crossings during the short term when activities are directly overhead or close to river banks.

It is expected that the implementation of mitigation measures outlined above will ensure that the water quality of the Water of Leith will not be adversely affected during the construction of the scheme. Additional requirements from SEPA regarding pollution prevention measures will be implemented during construction.

Construction works along Starbank Road extend beyond the existing seawall. These works are required due to available space constraints for the accommodation of a tramway and a footway in addition to existing parking bays and roadway. Construction activities will involve the erection of concrete buttresses along the foreshore. These buttresses will be used as foundations for a footway, which will be placed on the buttresses.

Construction plant will be located within the tidal area of the Firth of Forth for construction of the buttresses, which may impact upon the water quality through accidental fuel spillage and sediment disturbance. A construction method statement will be prepared by the contractor detailing mitigation measures to minimise the risk of accidental spillages and sediment disturbances. The method statement will be submitted for approval by the relevant statutory authorities prior to commencement of construction.

Construction of the scheme will involve trench excavation for the laying of the tram tracks. . The length and width of each trench will be determined by each section of the scheme alignment. Whilst the sensitivity of groundwater to contamination arising from construction works is considered to be low, mitigation measures will be implemented during construction to ensure that groundwater resources in the vicinity of the scheme are not adversely affected.

Permanent Landtake Impacts

The tram tracks incorporate extensive ducting beneath the base slab and this will be laid concurrently with the drainage. Connecting ducts/pipes across the tram tracks above the base slab will normally follow laying of the rails. Along the on-street sections of the scheme, these ducts/pipes will be connected to the existing urban drainage system and reduce the potential for alterations to the existing drainage regime.

Existing drainage will be utilised where the scheme is on-street running and in off-street sections such as the Roseburn Railway Corridor and between Craigleith and Ferry Road, new drainage systems will be installed where existing drainage systems are inadequate. The contractor will identify opportunities along the scheme alignment for the implementation of SUDS in accordance with SEPA requirements and guidelines. The contractor will ensure that the detailed drainage design will create no significant impacts on downstream flooding as a result of runoff discharges. All detailed mitigation measures will be approved with SEPA prior to construction.

Operational Impacts

Discharges from the vehicle washing facility at the depot site may be contaminated with washing detergents and dirt/oil from the tram vehicles. The contractor will use biodegradable products during vehicle washing. Excess water from the depot will be treated via an oil/grit interceptor prior to approval of a discharge consent from Scottish Water or SEPA for discharge of effluent to the public sewer or to a watercourse.

Runoff from the tramway during operation (as a result of rainfall) may become contaminated with oils from tram vehicles and tramway maintenance activities. Drainage systems will be required to incorporate suitable oil and sediment traps to prevent discharge of potentially polluting run-off to urban drainage systems or watercourses.

The contractor will ensure that all SEPA requirements and guidance are implemented for operation of the tram to minimise the risk of accidental spillages of contaminants and resulting discharges into controlled waters.

B.3.7 Summary

The scheme will utilise existing bridges to cross the Water of Leith at two points along the alignment, at Coltbridge Viaduct and on Ocean Drive. Construction activities are located within the tidal area of the Firth of Forth along Starbank Road. A construction method statement will be submitted for approval by the relevant statutory authorities prior to commencement of construction. The method statement will include mitigation measures designed to minimise potential impacts upon the water quality of the Firth of Forth. These mitigation measures will include ensure no polluted materials enter the Firth of Forth.

Existing urban drainage will be utilised where the scheme is street running minimising potential impacts to drainage and flooding. The development of the scheme is not expected to create adverse impacts to water resources. However, the scheme may improve the existing drainage regime in areas where the principles of sustainable urban drainage (SUDS) are applied.

The contractor will ensure that all SEPA requirements and guidelines on waste disposal and discharge will be adopted during the operational life of the scheme to minimise potential impacts such as accidental fuel spillage and obtain appropriate consents for waste disposal and waste discharge. The operation of the scheme will result in minimal impacts to water resources.

Adoption of mitigation measures such as SEPA Pollution Prevention Control Guidelines and Good Construction Practice will ensure minimisation of potential construction impacts.

B.3.8 References

City of Edinburgh Council (CEC), Water of Leith Flood Study November 2001.

Landmark (2002), Envirocheck Report on North Edinburgh Rapid Transit Scheme. Prepared for Mott MacDonald.

Scottish Environment Protection Agency (SEPA) – Pollution Prevention Guideline PPG5 – Works in, Near or Liable to Affect Watercourses.

Scottish Environment Protection Agency (SEPA) – Pollution Prevention Guideline PPG6 – Working at Construction and Demolition Sites.

Scottish Environment Protection Agency (SEPA) 1997 – Groundwater Policy for Scotland, Policy No.19.

Scottish Executive – *National Planning Policy Guideline 7 "Planning and Flooding"*

Scottish Executive – *National Planning Policy Guideline 13 "Coastal Planning".*

Scottish Executive – *Scottish planning Policy (SPP) 7 - Planning and Flooding (Consultation Draft)* (March 2003).

B.4 Geology, Soils and Contaminated Land

Table B.17 Geology, Soils and Contaminated Land Worksheet

Proposal Name:		Edinburgh Tram – Northern Loop Line One		**Worksheet: Geological Features - Strategy & Project Level**					
Existing & Future Issues:		No significant issues to record.					Assessment Date:		October 2003
Scale it Matters[1]	Attribute / Feature / Designation	Location / Status[2]	Relevant Objectives[3]	Potential Impact	Ease of Substitution	Timescale: When / Duration	Uncertainty	Mitigation	Impact Significance Assessment[4]
Geological Sites									
National	Firth of Forth Geological Site of Special Scientific Interest (SSSI)	Immediately north of the alignment along the shore of the Firth of Forth	Ensure access by construction traffic does not impinge on geological interest	No significant impact assuming preferred option for route design is implemented	N.A.	N.A.	N.A.	Columns placed on existing concrete apron or through shingle at the top of the beach	No significant impact
Regional	Craigleith Regionally Important Geological Site (RIGS)	Approximately 30 metres east of the alignment at the Roseburn former railway corridor	N.A.	None	N.A.	N.A.	N.A.	N.A.	No significant impact
Mineral Reserves									
None identified									
Key Assumptions:		Preferred option for Starbank Road at Wardie Shore is implemented							
Key Data Sources:		Firth of Forth SSSI Citation – Scottish Natural Heritage, 15th August 2000 Lothian & Borders RIGS Group Proposal Form for Craigleith, 21st July 1999 Exploring Craigleith Quarry, Lothian & Borders RIGS Group information brochure, Sarah Arkley and Ewan Hislop, 16th July 2003							

B.5 Biodiversity

B.5.1 Introduction

This section assesses the ecological impacts that may result from the proposals. The baseline nature conservation interests of the site are described, mitigation measures listed and the permanent residual impacts, taking these measures into account, reported. Impacts relating to the construction and operation of the scheme are also reported.

B.5.2 Sources of Information

The following sources of information have been used for the assessment:

- Consultation with statutory and non-statutory bodies to identify sites of nature conservation interest in proximity to the proposals and any other known habitats or species of note including:
  - City of Edinburgh Council (CEC) Biodiversity Officer;
  - Edinburgh and Lothians Badger Group;
  - Friends of the Earth Scotland;
  - Lothian Wildlife Information Centre;
  - Lothians Bat Group;
  - Royal Society for the Protection of Birds (RSPB);
  - Scottish Environment Protection Agency (SEPA);
  - Scottish Executive Countryside and Natural Heritage Unit (CANHU);
  - Scottish Natural Heritage (SNH); and
  - Scottish Wildlife Trust (SWT).
- A Phase I Habitat Survey [25] undertaken by the City of Edinburgh Council in 2001 [26];
- Site visits in 2003 to update the previous Phase 1 work and to assess the potential impacts of the proposals on the nature conservation interests in proximity to the proposals;
- A bat survey undertaken by Nocturne Environmental Surveyors in September 2003 [27];
- Relevant national and local planning policies, including *NPPG14: Natural Heritage (2002)* and *PAN 60*, *Lothian Structure Plan 1994 (approved 1997)*, *Edinburgh and the Lothians Structure Plan 2015 (Finalised Draft 2003)*, the relevant Edinburgh Local Plans and the *City of Edinburgh Local Biodiversity Action Plan LBAP* [28].

(25) A standardised system developed by the former Nature Conservancy Council to allow identification of areas of habitat of nature conservation interest relatively rapidly over a wide area.
(26) Phase 1 Habitat maps and Target Notes from this survey were provided by the Lothian Wildlife Information Centre.
(27) Nocturne Environmental Surveyors (September 2003) *Edinburgh Tram Line One Roseburn Corridor Bat Survey.*
(28) *The Edinburgh Biodiversity Action Plan*, Edinburgh Biodiversity Partnership, March 2000.