

TRANSPORT FOR LONDON

SAFETY, HEALTH AND ENVIRONMENT ASSURANCE COMMITTEE

**SUBJECT: MANAGING THE ENVIRONMENTAL IMPACTS OF
CONSTRUCTION IN TFL**

DATE: 17 NOVEMBER 2009

1 PURPOSE AND DECISION REQUIRED

1.1 To provide the Committee with a report on how the environmental impacts of construction are managed in TfL, as requested by the Committee at its meeting in September 2009.

1.2 The Committee is asked to note the Report.

2 BACKGROUND

2.1 TfL commissions a wide range of construction works associated with 'new build' and maintenance activities. Examples of major construction activities include the London Underground station and line upgrades, building the East London Line and Crossrail, and maintenance of roads, bridges and tunnels.

2.2 The main environmental issues associated with TfL's construction activities are management of waste and resources, including minimising waste sent to landfill; managing noise, vibration, air emissions and dust; reducing pollution to water; improving biodiversity as well as reduction of energy use and carbon emissions.

2.3 The TfL Group Health Safety and Environment Management System (HSEMS) requires each of the modes to have an HSEMS and sets requirements for them, within an aligned framework for identifying and controlling health, safety and environmental impacts across TfL. This framework covers a range of environmental management processes appropriate to the different stages of construction projects. The modes have all implemented an HSEMS and require their key contractors to have an environmental management system that is certified to an international standard, ISO 14001.

2.4 Each mode has within their HSEMS documented processes that address specific environment related construction management elements, such as the initial appraisal of project impacts, obtaining consents and setting key performance indicators for contractors. Details of environmental management processes and examples of how these address specific environmental impacts for each mode are presented in Appendix 1.

2.5 These management processes have developed considerably over recent years and have been demonstrated to be effective. The processes include elements that ensure compliance with Codes of Construction Practice and legal requirements such as the need for Environmental Impact Assessment for certain larger scale construction projects and Site Waste Management Plans for projects with budgets

over £300,000.

2.6 Specific management processes are in place to address the different stages of construction projects:

- (a) **General frameworks** – Health Safety and Environment Management Systems, London Underground Project Management Framework and Crossrail Environmental Management Requirements.
- (b) **Prior to the project** - environmental impact assessment or project evaluation, obtaining the necessary consents.
- (c) **Planning the project** – procurement (contract specification and terms and conditions), environmental management plans and site waste management plans, developing key performance indicators and reporting requirements.
- (d) **Managing contractors on the project** – stakeholder consultation, monitoring and reporting on key performance indicators, training.

2.7 In addition, TfL has implemented the Mayor’s Responsible Procurement Policy that requires that a range of social and environmental elements are addressed in relevant contracts. The Policy has the following strategic aims:

- Encouraging a diverse range of suppliers
- Promoting fair employment practices
- Promoting workforce welfare
- Meeting strategic labour needs and enabling training opportunities
- Promoting community benefits
- Encouraging ethical sourcing practices
- Promoting greater environmental sustainability

2.8 Where any breaches of environmental legislation are identified they are reported through the General Counsel Legal Compliance Report to the Audit Committee and the Safety, Health and Environment Assurance Committee.

2.9 Taken together, this hierarchy of environmental management controls enables TfL to manage the environmental impacts of construction and maintenance activities in an effective manner.

3 RECOMMENDATION

3.1 The Committee is asked to NOTE the Report.

4 CONTACT

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MANAGING THE ENVIRONMENTAL IMPACTS OF CONSTRUCTION IN TFL

1 INTRODUCTION

The TfL Group Health Safety and Environment Management System (HSEMS) requires each of the modes to have an HSEMS and sets requirements for them, hence providing an aligned framework for identifying and controlling health, safety and environmental impacts across TfL. This framework covers a range of environmental management processes appropriate to the different stages of construction projects. The modes have all implemented an HSEMS and require their key contractors to have an environmental management system that is certified to an international standard, ISO 14001.

Each mode has within their HSEMS documented processes that address specific environment related construction management elements, such as the initial appraisal of project impacts, obtaining consents and setting key performance indicators for contractors. Details of environmental management processes and examples of how these address specific environmental impacts for each mode are presented below.

Procurement policy and processes also require that environment is appropriately addressed.

2 LONDON UNDERGROUND

2.1 Scope of Construction Activities

London Underground (LU) is delivering a number of major projects as part of the TfL Investment Programme. The PPP contract with Tube Lines is delivering improvements to train depots, service control buildings, stations and lines. Major projects outside the PPP contract include Congestion Relief projects (eg King's Cross / St Pancras re-development project, Tottenham Court Road upgrade and Victoria Station Upgrade), Step Free Access projects (eg Green Park and Southfields), Cooling the Tube projects and the Operational Accommodation Improvement Programme

2.2 Environmental Management in Construction

The environmental impacts of the construction elements of LU's projects are managed through the following:

(a) Environmental Management System

LU has an integrated Health Safety and Environmental Management System (HSEMS). This sets the framework for managing the environmental impacts and risks from activities, with broad requirements for managing environmental impacts

and requirements for reporting on environmental performance. Requirements in the HSEMS apply to our contractors and suppliers, as well as to LU itself.

(b) Project Management Framework

LU recently developed a Project Management Framework (PMF) to improve project management in LU. This tool identifies how projects should be delivered and assists the project manager and sponsors ensure that environmental and other LU requirements are appropriately implemented. Key elements of the PMF include processes such as the Environmental Hazard and Permit Identifier, Design Risk Register and Management Plan and Construction Phase Plan.

(c) Contract Management

The majority of LU's major suppliers have been procured via our PPP and PFI arrangements, and as such, have been subject to thorough evaluation process in terms of overall capability, including environmental aspects. These are supported by robust contractual provisions relating to environmental management, e.g. requirements for the contractor to gain and maintain accreditation to international standards for environmental management systems such as ISO14001.

These systems are designed to ensure that environmental impacts are considered at the earliest stage of a project and that appropriate controls are put in place at each stage of the project.

Specific environmental criteria or outcomes are included in contracts for other projects where this is appropriate. This allows LU to ensure that issues can be addressed on a project/ programme specific basis.

LU ensures that the environmental impacts of construction and maintenance projects are managed effectively using a risk based approach. Verification Activity Plans (VAPs) identify the risk-based assurance evidence and the corresponding level of surveillance activity required for the project and details the activities LU will undertake to verify assurances given by suppliers undertaking the project. Waste management and noise management are two of the high risk activities often identified in the VAP process for construction activities. LU also carries out audits of certain suppliers (pre- and post-contract) in line with our risk-based audit programme.

LU monitors a number of environmental Key Performance Indicators (KPIs) to monitor ongoing project and corporate performance as well as to share good practice with other projects where appropriate. The environmental KPI set for construction projects include:

- Construction & Demolition waste and waste recycled or reused;
- Hazardous Construction & Demolition waste and waste recycled;
- Major environmental incidents; and
- Enforcement action/regulatory notices.

2.3 Managing Specific Environmental Impacts

LU has published a five year Environmental Strategy (2008-2013) which identifies six priority areas for environmental management:

- Improving resource use and waste management;
- Managing carbon and energy use;
- Conserving wildlife and habitats;
- Managing noise;
- Managing potential pollution; and
- Improving air quality.

The Environmental Improvement Plan includes work further to enhance environmental provisions within contracts to require sustainable resource use, diversion of waste from landfill and sustainable distribution and freight.

(a) Improving Resource Use and Waste Management

Significant quantities of waste are generated as part of LU's construction and maintenance activities. The quantities of waste each year vary depending on planned project activities, e.g. the track ballast renewal programme. In 2008/09, over 118,000 tonnes of construction and demolition waste was generated by LU projects. Of this, 72 per cent was recycled. During 2009/10 Quarters 1 and 2, LU's activities have generated 73,500 tonnes of construction and demolition material; of this, 74 per cent has been recycled.

The legally required Site Waste Management Plans (SWMP) are the main process for recording and implementing waste minimisation and good material management during a construction project. LU has developed a SWMP template which sets out how designers should record decisions which affect waste and how Principal Contractors should forecast, minimise and analyse waste (based on cost reduction as a driver). LU has been working with the Government Agency - the Waste and Resource Action Programme (WRAP) to improve the quality of LU's SWMP template and the associated procurement process. An improved template will be rolled out across LU in November 2009.

As part of the Tottenham Court Road Station Upgrade project, the designer was required to identify how waste could be minimised. A reduction in the tunnel profiles of the proposed Northern Line tunnels resulted in a considerable reduction in construction material as well as waste (an estimated reduction in excavated material of over 2,000 tonnes). In Quarter 2 of 2009/10, over 80 per cent of demolition material from the Tottenham Court Road Station Upgrade was recycled. The WRAP Waste Recovery Index for demolition sets 50 per cent as baseline performance and 80-90 per cent as good performance.

As part of the LU track upgrade programme, used ballast is often removed and replaced. LU has improved the process for managing used ballast to ensure that almost all of the ballast, including contaminated material, can be reused as secondary aggregate or as engineering material. In 2008/09, this resulted in over 97 per cent of ballast being re-used or recycled.

(b) Managing Carbon Emissions and Energy Use

LU is the single largest user of electricity in London. The majority of this energy (approx 90 per cent) is used to operate the train service but there are opportunities to deliver reduced carbon emissions through the construction and maintenance programmes.

London Underground recently produced a bespoke “Carbon Valuation Tool” with assistance from the Carbon Trust. This tool will be used in business case development to make the case for higher investment in low carbon technologies that would lead to operational cost savings.

LU is working with Tube Lines, to assess low carbon technologies that could be introduced to LU stations. As well as delivering carbon savings, these technologies would deliver whole life operational cost savings for LU. A feasibility study has shown that operational cost savings of £70,000 per station and reductions in station carbon footprints of 72 per cent could be achieved. The project is funded from TfL’s Climate Change Fund and will see technologies such as efficient lighting and heating control systems delivered at a number of stations over 2009 and 2010. A similar project is also being carried out as part of the upgrade of Neasden depot, LU’s largest train depot. Low carbon/energy opportunities are being built into the final designs to deliver a high level BREEAM (Building Research Establishment Environmental Assessment Method) rating with the intention to roll these out to future depot upgrades.

A number of new Signal Equipment Rooms (SER) will be delivered under the Sub Surface Line (SSL) upgrade. LU is assessing the opportunities to deliver low carbon solutions as part of the construction as well as ‘future proofing’ them against future climate change. LU will also assess the standards to which new operational accommodation is constructed to determine whether it delivers sufficiently high levels of whole life resource efficiency.

(c) Conserving Wildlife and Habitats

LU is one of the biggest landowners in London and to ensure that this resource is managed effectively LU produced a Biodiversity Action Plan in 2007. This plan sets out actions for conserving, and where possible improving, the biodiversity value of LU’s property. LU also works with its contractors to ensure that their activities consider and improve the biodiversity value of LU’s land.

A number of green roofs have been installed on LU property including the new Northern line control centre, Stratford Train Crew Accommodation building and Brixton Train Crew Accommodation building. Work is underway to install a living roof with integrated electricity-generating solar panels at 55 Broadway. As well as providing a habitat for local wildlife, these roofs can help improve thermal comfort and energy performance and are excellent for adapting to climate change as they soak up rainwater and reduce the risk of flooding.

Embankment stabilisation projects provide the opportunity to deliver simple but effective biodiversity enhancement measures. During stabilisation of embankments and cutting slopes on the section of track between Hillingdon and Uxbridge stations, stag beetle ‘loggeries’ and great crested newt ‘hibernacula’ were created in an adjacent grassland meadow. A continuous line of mature trees was maintained

throughout the works at the base of embankment slopes and a disused badger sett was identified, monitored and maintained. Once the stabilisation works was complete, the vegetation was re-established using a native wildflower seed mix and native shrubs to create a woodland edge type effect, which should provide excellent habitat for invertebrates.

During an embankment stabilisation project between Wembley Park and Kingsbury, Tube Lines developed the site as an area where wildlife would be able to flourish. Woodpecker boxes, barn owl boxes, field mouse and dormouse habitats, solitary bee boxes and hedgehog habitats were installed. The site was seeded with a variety of native wildflower seeds and replanted with shrubs and trees, selected to maximise their wildlife potential.

(d) Managing Noise and Vibration

The LU network extends across London and into neighbouring counties, sometimes close to peoples' homes, hospitals and other sensitive areas. LU works to ensure that noise and vibration from our activities is minimised. However, LU understands that activities can result in nuisance locally. LU identified this as a key priority within its Environment Strategy and is committed to minimising noise and vibration nuisance associated with the railway.

LU has a well established process for identifying the noise management requirements for its projects. Noise controls are identified in the Construction Phase Plan and Method Statements. Where appropriate, LU (or its contractors) works with the local council to identify the best practical means to manage noise during works. Where complaints are received, these complaints are investigated to ensure the works are compliant with the Construction Phase Plan. LU works with the local residents to identify the relevant issues, including taking noise measurements at the site and close to the complainant's residence. LU monitors noise complaints and is working towards an annual corporate target of 1.25 complaints per 100,000 hours worked.

Managing noise was identified as a key issue for the Tottenham Court Road Station Upgrade due to the location and the nature of the works, which includes extensive demolition and construction lasting for a number of years. Consequently, a large number of specific controls have been implemented.

(e) Managing Potential Water Pollution

Potential risks to water resources are identified as early as the feasibility stage of projects. LU's Environmental Hazard and Permit Identifier is used to identify potential permit requirements (such as discharge and abstraction permits) and groundwater protection zones for each project. This allows the designers an opportunity to design out risk where possible. Where this is not possible, risk is either mitigated through complying with the restrictions of required permits or best practice on site construction practices. Site works are inspected regularly to ensure that controls detailed in the Construction Phase plan are implemented.

(f) Improving Air Quality

Construction projects have the potential to impact on air quality through dust generated during demolition and construction. LU works to identify projects which

have the potential to produce dust at an early stage of the project (using the Environmental Hazard and Permit Identifier) and requirements to control dust are detailed in the Pre-Construction Information Pack and Construction Phase Plan.

3 LONDON RAIL

3.1 Scope of Construction Activities

London Rail is currently undertaking a series of major construction projects. In particular, London Rail is converting the East London Line (ELL) from London Underground to National Rail operation and extending it to Highbury & Islington in the north and Crystal Palace/West Croydon in the south at a cost of approximately £1bn. Major projects are also underway on the DLR, including an extension of the network to Stratford International station and upgrading the network to accommodate longer (3-car) trains.

To manage the environmental impacts London Rail develops a Code of Construction Practice (CoCP) for use on its projects. These are developed in consultation with key stakeholders such as Local Authority Environmental Health Officers (EHOs) and other statutory bodies. The CoCP defines minimum standards of construction practice acceptable to London Rail. Contractors are also required to prepare an Environmental Management Plan to demonstrate how the requirements of the CoCP will be met.

3.2 Environmental Management in Construction

In any railway construction project in an urban area, close environmental management of the project is required because of the various sensitive receptors adjacent to the railway. Contractor environmental performance is managed closely by London Rail. For example, on the ELL Project, the main works contractor is required to undertake regular environmental inspections and surveillances, and to report on environmental performance every period, providing a summary of any incidents and performance against a series of environmental parameters.

External communication and consultation is also of key importance to ensure stakeholders are satisfied that the environmental impact of construction is being minimised. On the ELL Project, regular flyers and newsletters were issued to local residents and businesses to advise them of forthcoming works and, in particular, out of hours works that had the potential to give rise to disturbance. Internal targets were also set for responding to complaints with goals of responding to 75 per cent of external complaints within one working day and 100 per cent of complaints within five days.

A particular concern of many of the neighbours of the ELL has been construction noise impacts. To address this, noise monitoring data has been made available to interested parties via a website set up by the main works contractor.

A project of the scale of the ELL has many stakeholders, both statutory consultees and non-statutory interested parties. To ensure the views of all stakeholders were considered, both an Environmental Forum and an Ecology Forum were run during the project. These have ensured that stakeholders have been kept informed of developments and have had an opportunity to raise any issues they had. This process has been useful in helping retain the support of key influencers and with

various environmental agencies such as Natural England and the Environment Agency.

3.3 Managing Specific Environmental Impacts

(a) Improving Resource Use and Waste Management

A number of opportunities to reduce significantly the volume of waste sent to landfill have been adopted on the ELL Project including:

- Reuse of approximately 37,000 tonnes of waste from the demolition of Bishopsgate Goods Yard to fill a railway cutting and create a bridge embankment;
- Reuse of approximately 20,000 tonnes of spoil and fill materials across the project. This has been implemented through the development of an internal tracking system to manage and document material transfers on the project;
- Excavated materials that could not be incorporated directly into the works have been exported to a soil washing plant for processing prior to reuse either on the project or on other sites; and
- At New Cross Gate and Silwood, Japanese Knotweed has been buried within specifically engineered cells in order to avoid transportation and disposal of vegetation and infested spoil to a licensed landfill site.

The Delta Junction flyunder works on the DLR are another excellent example of minimising waste on London Rail projects. Here, temporary supports for the existing viaduct were created by inserting shipping containers under the viaduct with hydraulic jacks on top of the containers, avoiding the use of materials in constructing temporary supports. The project also reused sections of existing viaduct that were no longer required to minimise the creation of waste.

(b) Managing Carbon and Energy Use

A significant amount of CO₂ has been saved in the construction of the ELL Project as a result of using Pulverised Fuel Ash (PFA) in concrete mixes wherever possible, thus avoiding the need to quarry, transport and process primary aggregates. A total of 5,000 tonnes of CO₂ was saved to September 2008 through the use of this recycled material. In addition, the PFA used does not need to be disposed to landfill.

(c) Conserving Wildlife and Habitats

During the early stages of the ELL Project, a project wide Ecology Strategy was developed in consultation with key stakeholders. This has provided a framework for the mitigation and enhancements implemented during the design and construction of the railway.

The ELL Project identified a number of species protected under the provisions of the Wildlife and Countryside Act 1981 on or in close proximity to the construction

site. The measures have helped to protect a range of mammals, invertebrates and birds including great crested newts, black redstarts, kestrels and woodpeckers.

On the DLR, there are specific requirements to protect habitats adjacent to the railway, including a focus on the impacts of dust, air and water pollution. There are also requirements for Contractors not to disturb breeding birds and prevent the loss of mature trees wherever possible. Any tree that is damaged or cut down without approval or dies as a consequence of the construction has to be treated or replaced by a suitably sized transplant from elsewhere.

(d) Managing Noise and Vibration

Constructing a new railway through a densely populated urban area has the potential to give rise to a number of environmental impacts. In particular, given the close proximity of residents to much of the ELL alignment, noise and vibration has been a key concern to residents and Environmental Health Officers during the construction phase.

The CoCP for the ELL details the procedures that the contractor is required to go through and the requirements to apply for and obtain Section 61 Noise and Vibration consents from the Local Authority. It also details the overarching measures that should be implemented to ensure the use of best practicable means to reduce noise and vibration impacts and the monitoring requirements that ensure the contractor is measuring and reporting noise and vibration levels during construction. There is close tracking of performance against levels predicted in the Section 61 consent and against trigger levels for provision of noise insulation or temporary re-housing defined in the CoCP.

Likewise there are similar requirements in the CoCP for DLR construction projects. Limits on hours of working are specified to reduce the impact on local residents and businesses. Contractors are also required to use the 'best practicable means' to minimise nuisance from noise. There are also specific requirements on construction vehicles and machinery and on piling works.

These requirements have been put to good practice on the recently completed construction of a new flyunder at Delta Junction near Canary Wharf where hydro-demolition technology (high pressure water jetted at the concrete) was used instead of jackhammers in the modification of the supporting columns for the flyunder. This dramatically reduces the noise and vibration impact of demolition and allows the rest of the column structure to be retained undamaged by the process.

In some cases, London Rail has gone beyond the requirements set out by Local Authorities. An example of this is at the New Cross Gate depot, where a large volume of excess spoil has been reused successfully in the construction of a bund that provided both visual and noise attenuation to local residents from the impacts associated with the operation of the depot. The bund was beyond the planning requirements stipulated by the London Borough of Lewisham and achieved both waste reduction and reduced lorry movements in addition to visual and noise attenuation.

(e) Managing Water Pollution

DLR's contractors on construction projects are required to develop and implement a site drainage plan which includes measures to ensure that surface water runoff is contained and managed appropriately. Any effluent must be monitored to ensure it can be released into watercourses and must pass through treatment facilities such as sediment traps and/or settlement lagoons. There are also requirements on the treatment of contaminated land and mitigation required to ensure the contaminants do not enter the wider environment. Good working practices are also used regarding the control of oil drums or containers of other potential contaminants.

(f) Improving Air Quality

Good working practices are employed on London Rail projects to minimise the production of dust, which is the primary pollutant affecting air quality from the construction projects. For example, dusty materials have to be sprayed with water during dry weather, cutting or grinding of materials on site is controlled and the loads of any vehicles carrying potentially dusty materials have to be covered during transportation.

There are also requirements as set out in the DLR CoCP on other air pollutants such as the banning of burning of materials on site and processes that generate hazardous fumes and/or dust. Instructions are also given for vehicles being used on site, e.g. switching off engines when stationary to reduce exhaust emissions (and noise).

4 CROSSRAIL

4.1 Scope of Construction Activities

Crossrail will provide a railway system from Maidenhead and Heathrow in the west through central London to Shenfield and Abbey Wood in the east. The project consists of new tunnels and stations on an east-west alignment under central London and the modification of existing National Rail infrastructure to the east and west of central London.

Currently, (as at October 2009), with the exception of Canary Wharf station, there are only limited on-site construction works taking place, these principally being geotechnical activities, utilities trial trenches and the establishment of site facilities at a few locations. In the coming months, Crossrail will be commencing key enabling works (such as utility diversions and demolitions), with the main construction works due to commence in 2010. One of the key activities of the project at the moment is to establish appropriate contract requirements to, amongst other things, ensure that the environmental impacts of construction works are managed in accordance with all Crossrail's requirements.

4.2 Environmental Management in Construction

A Hybrid Bill was submitted to Parliament to obtain appropriate powers for the construction of Crossrail. As part of this process, an Environmental Impact Assessment (EIA) was undertaken and an Environmental Statement (ES) was produced. The ES describes the findings of the assessment of the likely significant

environmental effects (both negative and positive) for both construction and operation and establishes the environmental baseline for the project.

Generally, there are three distinct components that taken together effectively control the environmental impacts of the construction and operation of Crossrail, they are:

- Arrangements within the Crossrail Act 2008;
- Policies and commitments entered into outside of the Act; and
- Existing legislation, unless expressly or impliedly disapplied or modified by the Crossrail Act.

In relation to the second bullet, there are a variety of control mechanisms and mitigation strategies which fall outside of the Crossrail Act. The overall framework is set out in what are known as the Crossrail Environmental Minimum Requirements (EMR). The EMR is a suite of documents that has been developed in consultation with local authorities, statutory agencies and other relevant stakeholders. Any nominated undertaker is contractually bound to comply with the controls set out in the EMR. The EMR comprise the undertakings and assurances given to Parliament and petitioners by the Secretary of State during the passage of the Crossrail Bill and has four elements, namely the *General Principles*, the *Planning and Heritage Memorandum*, the *Construction Code* and the *Environmental Memorandum*.

It is a requirement that the nominated undertaker will adhere to the arrangements provided for in the EMR in designing and constructing the Crossrail Works. The principal document which sets out the requirements for managing the environmental impacts of construction is the Crossrail Construction Code (the Code). This document provides best practice guidance which must be complied with, for the following topic areas:

- Public access and highways;
- Noise and vibration;
- Air quality;
- Water resources;
- Contaminated land;
- Excavated material, waste management and recycling;
- Ecology and nature conservation;
- Archaeology & heritage; and
- Settlement.

(a) Environmental Minimum Requirements – General Principles

It is the intention to carry out the project so that its impact is as assessed in the ES. The controls contained in the EMR along with powers contained in the Act and the undertakings given by the Secretary of State will ensure that impacts which have been assessed in the ES will not be exceeded (subject to certain caveats such as the impact results in a change of circumstances not considered likely at the time of the preparation of the ES). In addition, any nominated undertaker is required to use reasonable endeavours to adopt mitigation measures that will further reduce any adverse environmental impacts caused by Crossrail, insofar as these mitigation measures do not add unreasonable costs to the project or unreasonable delays to the construction programme.

(b) Environmental Management System

It is a requirement of the Environmental Memorandum that the nominated undertaker will develop and implement an environmental policy and an Environmental Management System (EMS) for the project, which is consistent with the principles of ISO 14001. In accordance with this requirement Crossrail has developed and implemented an EMS consistent with the principles of ISO14001, but has elected to go one step further and set itself the target of achieving a fully accredited EMS by March 2010.

The EMS provides the overall framework within which the environmental impacts of construction are managed. It is also a Crossrail contract requirement that all main construction contractors must have a fully accredited EMS, and this requirement is implemented from the pre-qualification stage of procurement.

All main contractors are required to produce and have accepted an Environmental Plan prior to commencement of all their works. The Environmental Plan states how the environmental impacts of their construction activities will be managed and a draft plan is required as part of the tender evaluation process. In addition, full details of proposed on-site environmental personnel are required and must be accepted by Crossrail or its agents. This allows Crossrail to ensure that contractors are competent to manage environmental issues.

(c) Implementation/Enforcement of Environmental Minimum Requirements

The EMR have been reviewed and incorporated within the relevant construction contracts and thus made contractually binding. The majority of Code requirements have been included within one generic document and site-specific requirements are included on a work package basis.

4.4 Managing Specific Environmental Impacts

(a) Improving Resource Use and Waste Management

Crossrail is committed to the sustainable management of surplus materials that will arise from the construction of Crossrail. Surplus materials are categorised as excavated materials and demolition and construction waste. The majority of the surplus material will be clean material excavated from the tunnel sections of the Crossrail route, the remainder being mainly construction and demolition waste.

The underlying approach to managing waste is to follow the national hierarchy for sustainable waste management for surplus materials management. In order of preference, the following approach is adopted:

- Minimise (generation of material).
- Reuse and/or Recycle (materials within the Crossrail Project).
- Reuse and/or Recycle (materials for beneficial use on other projects).
- Dispose (of material at licensed sites).

All main contractors are required to produce Site Waste Management Plans (SWMPs) in accordance with the Site Waste Management Plans – Guidance for Construction Contractors and Clients – Voluntary Code of Practice.

SWMPs include detailed procedures for compliance with the requirements for waste transfer notes in accordance with the Environmental Protection (Duty of Care) Regulations 1991 and arrangements for auditing the actions of other parties in the waste handling chain.

Through the design process, the project has sought to reduce the amount of excavated material and waste that will be produced, within the constraints of the project specification. This has been achieved primarily by keeping to a minimum the size of tunnels, shafts and stations, and building demolition.

It is a requirement to minimise waste from construction activities as far as reasonably practicable. The successful application of waste minimisation techniques and on-site segregation of surplus materials and packaging for recycling should reduce the residual waste from construction to a level that will be comfortably absorbed into the existing materials and recovering and transfer infrastructure in London without a major impact on the waste management strategy.

The main re-use of excavated clean material will be to create a new wildlife reserve at Wallasea Island in Essex. At least two-thirds of all Crossrail excavated material, or 4 million m³, will be used to do this. Clay, chalk, sand and gravel taken from the construction of Crossrail will be transferred by ship to Wallasea Island, eight miles north of Southend-on-Sea, which the Royal Society for the Protection of Birds (RSPB) will transform into 1,500 acres - nearly 2.5 square miles - of tidal wildlife habitat.

Last year the RSPB submitted a planning application to Essex County Council and consent was issued on 9 July. Development of Wallasea Island is expected to start in 2010.

(b) Managing Carbon and Energy Use

Crossrail issued a Carbon Footprint Policy Statement in 2007 and in November 2008 the objective of reducing Crossrail's carbon footprint through the design, construction and operation of the railway was adopted. Specifically in relation to construction, the focus is on the management of logistics to limit road traffic and reduction of energy usage by contractors.

The movement of materials to construction sites and excavated material and waste from construction sites is critical to the successful delivery of the project. Therefore, the planning and implementation of these activities is important in ensuring sustainable construction. Crossrail is considering the following to increase the sustainability of the project's construction:

- Reduction in road transport by using rail and water transport where practicable.
- Consolidation centres to reduce the number of vehicle movements.
- Reducing the impact of road transport by specifying the use of sustainable vehicles.
- Using excavated material for beneficial reuse.
- Controlling logistics activities so that efficiencies are realised.

To date, Crossrail has signed a Memorandum of Understanding with the Port of London Authority to confirm the project's commitment to move excavated material by barge. Approximately five million tonnes of material will be transported in this way, saving up to half a million lorry journeys.

To encourage sustainability in its suppliers, Crossrail has integrated carbon saving requirements into works contracts. Contractors are required to:

- Develop and implement energy management plans for their activities.
- Investigate options for procuring energy from renewable sources.
- Purchase energy efficient equipment (using commercial road vehicles that meet Euro 3 standards).
- Install electricity metering.

Currently, Crossrail is considering the establishment of energy targets for contractors.

(c) Conserving Wildlife and Habitats

It is a requirement of the Code that the nominated undertaker ensures that procedures are implemented to control and limit disturbance to areas of nature conservation interest and protected species in accordance with relevant legislative requirements and accepted industry practice.

As required by the Code, a General Ecological Management Plan has been produced, which sets out a programme for relevant surveys, methods for watching briefs, measures to be adopted in the event of the discovery of protected species and measures for the relocation of certain species. In addition, the Environmental Memorandum requires the production of site specific environmental management plans for environmentally sensitive sites identified in the EMR, focusing on ecological issues.

(d) Managing Noise and Vibration

The Code requires the nominated undertaker, as far as reasonably practicable, to seek to control and limit noise and vibration levels so that affected properties and other sensitive receptors are protected from excessive noise and vibration levels associated with construction activities. Crossrail is implementing this commitment through requiring all construction contractors to apply Best Practicable Means (BPM), as defined under the Control of Pollution Act (CoPA) 1974, to all activities, and for enabling and main works contractors to apply for Noise and Vibration consents.

In addition, Crossrail has implemented a Noise Insulation and Temporary Re-housing policy, which will provide further mitigation (noise insulation and/or temporary re-housing) for residential properties that experience noise levels above the levels/durations stated in the policy.

(e) Managing Water Pollution

The overall Code requirement is to undertake works and implement working methods to protect surface and groundwater from pollution and other adverse impacts, including change to flow volume, water levels and quality. The Crossrail Act sets out protective provisions for the Environment Agency, British Waterways, and the Port of London Authority, under which the nominated undertaker will be required to obtain Agency approval for works, which would be likely to affect any surface or groundwater resource.

(f) Improving Air Quality

The Code requires the nominated undertaker, as far as reasonably practicable, to control and limit emissions to the atmosphere in terms of gaseous and particulate pollutants from vehicles and plant used on the site and dust from construction activities. The Code specifies a suite of measures which can potentially be employed at all Crossrail construction sites. Three levels of control for dust impacts are planned, with the standard level, Tier 1, as the minimum that will be implemented on any site. A risk-based approach is used to identify construction sites with potential to generate significant quantities of dust near sensitive receptors and which require additional levels of control, Tier 2 and Tier 3.

The techniques identified are in line with the Greater London Authority and London Councils - *The Control of Dust and Emissions from Construction and Demolition Best Practice Guidance (2006)* and the Building Research Establishments publication 'Controlling particles, vapour and noise pollution from construction sites (2003)' which are used as references for dust control on site.

5 SURFACE TRANSPORT

5.1 Scope of Construction Activities

The majority of Surface Transport's (ST) construction activities are improvement projects and maintenance schemes, although there is some building such as the new West Ham Bus Garage.

5.2 Managing Environmental Impacts of Construction

ST has put in place a number of environmental assurance tools which aim to manage the environmental impacts throughout the lifecycle of the project or maintenance scheme, including impacts of construction activities. The Health Safety and Environment Management System includes a number of procedures relating to construction activities as outlined below.

(a) Project Environmental Evaluation

The Project Environmental Evaluation procedure defines the appropriate level of environmental evaluation required for a project. The purpose of the evaluation is to identify and manage the potential environmental impacts, both adverse and beneficial. Since its introduction in Streets and Traffic and ST Strategy early 2007/08, 154 projects have been evaluated including Cycle Highways, Cycle Hire Scheme, East London Transit (ELTB1b) and Henley's Corner.

(b) Environmental Management Plans (EMPs)

The Environmental Evaluation procedure identifies the need for EMPs to translate recommended environmental mitigations for projects into specific actions to be carried out by the contractor and forms the basis for environmental impact management during construction and operation. Projects such as the Cycle Hire Scheme, Henley's Corner and ELT1b will have an EMP in place before construction begins.

(c) Environmental Checklist for Maintenance Activities

This checklist was developed for capital renewal and maintenance activities to ensure a similar level of environmental input as projects. The checklist is completed by the TLRN Highway Maintenance and Works Contractors (HMWCs) before any maintenance activities start. The checklist ensures that environmental impacts, including those of construction, are identified and managed.

(d) Site Waste Management Plans (SWMPs)

The SWMP is initiated by the relevant TfL Project Manager and a template is completed by the contractor. The ELT1b project will have a SWMP in place before construction begins.

(e) Environmental Consents

Certain projects or maintenance schemes require third party consent before construction can begin. Conditions for consent usually require that appropriate measures to manage environmental impacts are adopted during construction. ST identifies the need for consent(s) and a consents procedure is in place. For example, Flood Defence Consent from the Environment Agency has been granted for Cycle Hire Stations located close to the River Thames. Conditions for consent include the production of an EMP.

(f) Removal of Street Trees or Group of Plants from the TLRN

There is a procedure to ensure that a robust methodology for determining the removal of trees or removal of groups of plants from the TLRN is applied, whether for safety reasons or to facilitate a project or third party development. The procedure requires an arboriculture report.

(g) Managing Contractors

This procedure establishes the environmental arrangements for the management of contractors, consultants and suppliers undertaking work on behalf of, or providing a service to, ST. In the selection of an appropriate provider, account is taken of any specialist environmental skills or operational requirement needed.

TfL has been developing "standard" environmental clauses that can be used in contracts. The contracts include the requirement to report against environmental Service Performance Indicators, based on TfL's environmental KPIs, which aim to reduce emissions to air (i.e. PM10 and NOx), reduce CO₂ emissions, reduce the amount of waste generated and promote the purchase of "green" products.

A number of environmental requirements have been included in the contracts for the Cycle Hire Scheme, including the requirement to have an ISO:14001 accredited Environmental Management System, Waste and Environmental Management Plans, to follow guidance issued by the National Joint Utilities Group when installing Cycle Hire Stations near trees and to use lower carbon vehicles.

(h) Freight Construction Logistics Plan

TfL's London Freight Plan identifies ways of delivering freight in London more sustainably. The Construction Logistics Plan (CLP) project is focused on changing the behaviour of the construction industry and the awareness of boroughs in construction-related freight activity. By managing deliveries to construction sites more effectively, and reducing the number of journeys required, the Plan aims to improve the efficiency of freight in the Capital and help cut costs for both freight operators and their clients.

The CLP aims to provide a framework to manage better all types of freight vehicle movement to and from construction sites. Benefits of using the CLP and freight initiatives include reduced CO2 emissions, increased efficiency, sourcing more local materials and those with recycled content.

The TfL Freight Unit encourages Land Use Planning to take into consideration the freight elements of construction (both short-term and longer term phases) of all proposed developments before permission is granted and the Unit comments and advises on both referred planning applications and submitted CLPs. The production of a CLP allows developers to evaluate proposed plans and investigate opportunities to mitigate the wider environmental impacts of the build at the design and procurement stage.

A basic CLP guidance brochure and the results of the London Construction Consolidation Centre study have been published and a CLP Advisory Board, including key industry members, has been created.

Work underway includes the further development of CLPs with the Waste and Resources Action Plan (WRAP) and the Building Research Establishment, and data collection and research studies of construction traffic impacts.

5.3 Managing Specific Environmental Impacts

(a) Improving Resource Use and Waste Management

Contractors are required to develop site waste management plans (where required), ensure that appropriate on-site waste storage is in place and minimise waste sent to landfill. For example, Service Performance Indicators and targets encourage the HMWCs to minimise waste. The current recycling rates achieved by the HMWCs are considered to meet industry best practice by WRAP.

Contractors are required to purchase "green" products where possible. For example, Service Performance Indicators (SPIs) and targets encourage the HMWCs to do so. Whilst the targets set in the HMW contract for these SPIs are not currently being achieved, the current HMWCs' performance is considered to meet

industry good practice by WRAP and the targets have been reviewed on WRAP's recommendation.

(b) Reducing Energy Use and Associated CO2 Emissions

Contractors are required to deploy lower carbon vehicles through SPIs and targets. The HMWCs use electric and hybrid vehicles.

(c) Managing Wildlife and Habitats

Contractors are also required to put in place their own safeguards and, if these fail to work, steps are taken to prevent re-occurrence.

As part of the A40 Bridges improvement project, a number of measures were introduced to protect species and habitats and the project has won a number of awards in recognition of its achievements as a considerate constructor. For example, trees were enclosed to protect them from accidental damage, bird nesting boxes were erected and a reptile barrier was installed at the site boundary which prevented slow worms from entering the site where they could have been in danger.

(d) Managing Noise and Vibration

ST requires contractors to use the correct plant and machinery for the works, with noise suppressing systems if appropriate. As part of ST's aim to be a good neighbour, Project Managers inform the Local Environmental Health Officers in advance of construction works and contractors are required to work within the limits set by the relevant Local Authority. These include hours of working, turning off engines when vehicles and plant are not in use and ensuring that that appropriate equipment is always used.

(e) Minimising Water Pollution

Relevant contractors are required to have robust environment procedures in place, usually achieved via an implemented EMS. The HMWCs have ISO:14001 accredited environmental management systems and perform on-site inspections and audits. Specific measures include the use of sand bags and spill kits to avoid spillage and subsequent water and soil contamination.

(f) Reducing Air Pollutants and Dust

Contractors are required to follow the Greater London Authority and London Councils - *The Control of Dust and Emissions from Construction and Demolition Best Practice Guidance (2006)* and to deploy vehicles with lower PM10 and NOx emissions. For example, SPIs and targets encourage the HMWCs to use current Euro standard vehicles in their fleets.

(g) Protecting and Enhancing the Built Environment

ST also works to protect and enhance the built environment. The procedures described above include identification of impacts and the need for consents, including those associated with heritage designations. Opportunities for streetscape improvement, such as removing street clutter, are identified as part of improvement and maintenance schemes.