



CLIENT: LONDON UNDERGROUND LIMITED

CONTRACT REF: TLL 7917

NORTHERN LINE EXTENSION

MAIN WORKS CONTRACT

WATER MANAGEMENT PLAN



Issue and Revision Control

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1.0 Introduction

This Water Management Plan applies the commitments within the Northern Line Extension (NLE) Code of Construction Practice Part A and associated contractual environmental requirements regarding the conservation of water and water efficiency measures on the NLE worksites. To ensure that this document remains relevant, adequate and effective as the works progress the Water Management Plan will be reviewed and updated as necessary:

- following any change that has a significant impact on water usage;
- as instructed by the London Underground (LU) Project Manager; and
- at least every 6 months.

2.0 Scope of NLE works

The NLE will create a new underground line as an extension to the existing Charing Cross branch of the Northern line between Kennington and a terminus station to the south of Battersea Power Station. The extension will consist of new twin bore running tunnels of 5.2m internal diameter and covering a distance of approximately 3.3km with new stations at Battersea and Nine Elms.

The surface worksites associated with the construction of the NLE are located at Battersea, Nine Elms, Kennington Park, and Kennington Green, as described below:

Battersea Station worksite is located within the south western section of Battersea Power Station (BPS) development, within London Borough of Wandsworth. Where the worksite abuts Battersea Park Road, Battersea Park Road is at a higher level than the site. The site is bounded to the west by Network Rail, to the north by Battersea Power Station and to the east by the Battersea Power Station Development Company;

Nine Elms Station worksite including part of the Covent Garden Market Authority (CGMA), is located on the land to the west of A3036 Wandsworth Road and north of its junction with Pascal Street, within London Borough of Lambeth. The worksite includes the north footway of Pascal Street. The worksite is bounded to the north by a Sainsbury's worksite and to the west by land owned by Covent Garden Market within London Borough of Wandsworth. The demolition of the Banham building on the west end of the worksite, the CGMA office, boiler house, including the chimney and underground fuel tanks and the relocation of two substations are necessary to release the full area of the worksite.

Kennington Green worksite is located at Kennington Green within the London Borough of Lambeth. The triangular site is bounded on all three sides by Kennington Road, the eastern boundary being the main route of the road. The worksite includes footways and parking bays. It is necessary to carry out some demolition to release the full worksite. There is a local satellite worksite (hereafter referred to as Montford Place) to the west of Kennington Green adjacent to the Beefeater Gin Distillery and this is accessed via a narrow road to the west of Kennington Green. The area, although not containing any permanent works for the NLE, is very close to the Kennington Green shaft. FLO has taken early occupation of the area and developed it for 'satellite' temporary offices and storage.

Kennington Park worksite is located in the north east corner of Kennington Park, south of Kennington Park Place and west of its junction with St Agnes Place, within the London Borough of Lambeth. It is necessary to demolish Kennington Park Lodge to release the full worksite.

Two shafts of approx. 25m deep will be sunk at Kennington Green and Kennington Park respectively. These shafts will be used to remove the Tunnel Boring Machine's (TBM), service the Sprayed Concrete Lining (SCL) running tunnels up to the step plate junction, build the step plate junction and build the four cross passages at Kennington Station. The current proposal to build the step plate junction includes two SCL gallery tunnels but this method is currently being reviewed.

3.0 Objectives and targets

The objective of this plan is to implement the water hierarchy approach to the management of water on site as set in order of preference; the highest options will be adopted where reasonably practicable, but usually a combination of options will be appropriate.

- a) **Eliminate** - eliminate water use by identifying if the water-using process or activity is really necessary and/or if there is a cost effective alternative to using water.
- b) **Substitute** – identify and use alternative ‘non-potable’ sources and eliminate inappropriate use of drinking (potable) water. Assess whether rainwater or grey water can be used for the activity/process.
- c) **Reduce** - explore options that improves efficiency, e.g. by regular maintenance of water using equipment (to ensure they are working to maximum efficiency), metering and monitoring supplies, updating fittings and/or processes.
- d) **Reuse** – identify whether water (including grey water) can be treated/filtered for reuse in a process or activity, e.g. wheel washing.
- e) **Recycle** – identify if and where water can be recycled for use offsite
- f) **Disposal** - dispose of excess water legally and responsibly to ensure there is no flooding, pollution or inconvenience to stakeholders.

4.0 Water Conservation Measures

Water minimisation is considered during the planning stages for each stage of works, and is incorporated into the method statements. Steps to eliminate or minimise water usage is utilised where possible. Where possible, water is treated and reused on site. All connections to the mains water supply will be fitted with a meter, so that monitoring of water consumption on each site can occur. Certain activities on the project have been identified as having potentially high water use, opportunities to reduce water use using the water hierarchy have been proposed below.

4.1 Tunnelling Activities

A significant amount of water will be used to lubricate the cutting head of the TBM. However this is carefully controlled and monitored to optimise the efficiency of this operation. Steps to eliminate or minimise water usage are utilised where possible i.e. the cooling system for the

Tunnel Boring Machine (TBM) is closed circuit. All water will travel through a cooling tower on site which will then be pumped back to the TBM, making the process more water efficient.

4.2 Bentonite for Piling Works

Bentonite is required for the piling works at Battersea and Nine Elms. This mud slurry uses a significant amount of water. Opportunities to use non potable water and recycling water from waste bentonite is being investigated and implemented where practicable. This may include a use of a de-silter /de-sander for onsite treatment of waste water from this process.

4.3 Dust Suppression

Dust suppression during demolition and on the site roads regularly uses large volumes of water. To minimise the quantities used, hard-standing areas are regularly cleaned, and equipment are fitted with dust bags and vacuums to capture dust at source. Mist sprays will also be used to minimise water usage while maximising the capture of dust. Equipment is fitted with the ability to switch water off at point of use, such as trigger guns on hoses and consideration will be given to chemical treatments (such as Dust Buster).to compliment dust suppression using water.

4.4 Site Accommodation

The following water saving measures or similar will be implemented within the site accommodation:

- dual flush toilets;
- push or spray taps to all cold-water supplies
- passive infrared (PIR) sensors for urinals

Other water efficient washroom products are also fitted where possible, such as low-flow taps and waterless urinals.

It is not anticipated that rain water harvested from the worksites will be used in site accommodation due to the additional sanitary requirements needed during its storage e.g. dosing with chlorine.

4.5 Dewatering Activities

It is understood that currently there is limited requirements for dewatering across the scheme however FLO will consider using this water for dust suppression where practicable.

4.6 Road Cleaning and Vehicle/wheel Wash

Where possible the requirements for road cleaning and vehicle wheel washing will be avoided, however where it is needed, consideration will be given to using non-potable water and utilising water-efficient equipment.

5.0 Pollution prevention

In addition to the water saving measures implemented during construction activities, preventative measures are also used to avoid uncontrolled events adversely impacting on water resources.

All fuels and chemicals used on site are carefully managed to minimise the risk of spills. Such spills could potentially enter site surface water drainage and adversely impact on local streams and rivers. The management of these products includes:

- secure storage;
- use of secondary containment e.g. double bunded containers and plant nappies;
- accountability by site storemen and supervisors for these products.

There is likely to be a need to dispose of surplus water on site e.g. from construction activities. This disposal is done in a controlled way with the appropriate consent or permit from regulatory bodies (normally Thames Water or the Environment Agency). Consideration will be given to reusing clean surplus waste water for onsite construction activities such as dust suppression and wheel washing.

Any water discharged will be of sufficient quality to meet the consent or permit requirements. For example FLO will be installing a waste water treatment plant for the surplus water from the tunnel grout washing, which will be treated to remove solids and correct the pH before discharge. The quality of water discharged is routinely monitored to ensure compliance with the conditions of the permit. Access is given to the relevant regulatory body to obtain water samples and determine flow as required. Settlement tanks, separators and water treatment facilities are utilised where necessary.

Please refer to the NLE Environmental Incident and Non-Conformity Plan for the steps to take in the event of an Environmental Incident.

6.0 Management of flood water

During extreme weather events there may be a risk of storm and rainwaters causing surface water flooding on the NLE construction worksites. FLO will undertake proactive and reactive measures to mitigate this risk, including:

Proactive measures:

- Regular maintenance of site drainage including any interceptors;
- Temporary site drainage to be installed as appropriate;
- Local water courses and surface water connections identified on the site plans;
- Ensure flows are free to effectively drain an area;
- Areas of potential erosion and sediment transport identified.

Reactive measures:

- In the event of flooding, consideration will be given to temporary flood water retention areas to allow the local surface water drainage system to recover;
- Discharge and dewatering activity may be halted where there is no risk to health and safety and engineering requirements.

7.0 Inspection

Regular site inspections are carried out which include checks on water conservation measures. In addition, the Environment Manager undertakes specific environmental inspections to ensure overall compliance and to address any key issues. These inspections include:

- checks for water leaks;
- checks on plant to ensure that they are in good condition in order to minimise leaks;
- checks to ensure that the best practicable means of pollution prevention are utilised on site.

8.0 Monitoring and Reporting

Water consumption data will be collected from each worksite and monitored on a monthly basis. This data will be assessed against a water forecast for the project. The water forecast will be based on data from a similar project and normalised against project spend. A 10% reduction target over the duration of the contract will be incorporated into the forecast and actual water usage performance is plotted against this water reduction forecast on a monthly basis. In the event of the water reduction target not being achieved, a water action plan will be developed and implemented.

8.1 Water Environmental Incident

The following situations are examples of a water related Environmental Incident and as such will be subject to the relevant controls and procedures set out within the incident plan:

- A complaint received from a member of the public or the Local Authority;
- An incident or activity which results in a breach of discharge consent conditions e.g. non-compliance with the consented water quality;
- A pollutant gaining access to a drainage system, surface water and/or groundwater.

9.0 Review

An annual review of the effectiveness of this water management plan and the associated water saving measures is undertaken, which includes:

- Water audits to identify all water-using processes, activities and equipment on site (aligned with significant changes in site activities through the project life cycle);
- Implementation of an action plan, including staff engagement and training to reduce the consumption of all water using processes, activities and equipment on site;
- Reporting of water usage to determine the effectiveness of site water conservation measures.

This review will be communicated to the project management and LU, so that appropriate corrective actions and initiatives can be implemented in a timely manner.

9.1 Water Audits

FLO will undertake a programme of water audits to identify all water using activities and equipment on site. The audits to be undertaken every 6 months will include a review of the

measurement and recording of water usage on site and any water conservation measures that are implemented.

9.2 Action Plans

Following a water audit site specific action plans are developed to implement water conservation initiatives. The action plan include:

- Staff engagement and training;
- Water saving opportunities for the activities that have the highest water consumption;
- The monitoring regime to assess the effectiveness of water conservation measure.

The action plan uses the water hierarchy to target water conservation opportunities, examples of which are presented in the table below:

	Options	Water Conservation Opportunities
a.	Eliminate	Avoid wetting down by having sealed site roads, and keeping muck away wagons in 'clean' loading bays. Waterless urinals in site accommodation
b.	Substitute	Rainwater harvesting on site accommodation to provide non-potable water for dust suppression Compressed air for boot washing facilities
c.	Reduce	Low flush toilets in site accommodation Low flow taps on hand basins in site accommodation Regular monitoring on site water supplies, boot washes, hoses to minimise water lost through leakage Low flow jet wash units for washing piling equipment Fine mist spays fitted to demolition plant to provide effective dust suppression
d.	Re-use	Re-use of bentonite water using an onsite de-silter / de-sander Re-use of Tunnel Boring Machine cooling water by having an closed system with on line treatment
e.	Recycle	Rainwater harvesting to use water for onsite dust suppression
f.	Disposal	On site discharge to foul sewer in compliance with a Thames Water effluent discharge permit Offsite disposal of waste water at the licence treatment facility Discharge to a surface water in compliance with a discharge permit agreed with the Environment Agency

The action plan includes a level of cost benefit analysis in the assessment of the value of implementing water conservation initiatives. It also includes timescales for implementation and named individuals responsible for completing any actions. The effectiveness of the plan is reported to LU annually.

10.0 Training

Toolbox talks are given to all personnel during site induction, detailing site-specific details and to highlight the need for water conservation. Site personnel are also trained in pollution incident mitigation and clean-up, including the correct use of spill kits.

Method statements and risk assessments are written and briefed to all site personnel before any works are carried out on site. Integrated into these documents are specific control and risk mitigation methods relating to the water conservation and water pollution issues as detailed in this document.