



The London Resort Development Consent Order

BC080001

Utilities Statement

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Revision: 00

December 2020

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009
Regulation 5(2)(q)

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Revisions

Revision	Description	Issued by	Date	Approved by
00	Issue for DCO Submission	LC	24/12/20	BUR/LRCH

Buro Happold Ltd

Camden Mill

230 Lower Bristol Road

Bath

BA2 3DQ

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Executive Summary

Baseline utilities information

This document forms part of the DCO application for London Resort (henceforth referred to as the 'Proposed Development'). The Proposed Development is envisioned to be an entertainment resort consisting of a theme park with a variety of rides, attractions as well as hotels, shopping malls and event areas.

A review of the existing utilities infrastructure located within the DCO Order Limits has been undertaken using the following information sources:

- Ground-wise desk-top surveys;
- Information from existing utility suppliers.

The information has been compiled into a single database to understand key design constraints and provide the basis for further ground truthing surveys to support the detailed design moving forwards.

The existing utility connections will be fully investigated as part of the Detailed Design stage to develop a schedule of utility diversions and disconnections required to enable construction of the Project Site with minimal disruption to adjacent businesses and residents. All works will be undertaken in accordance with the relevant regulations and guidelines and will be subject to approval by the owners of the existing utility assets.

Energy Strategy

For a detailed description of the proposed energy strategy, please refer to the Energy Statement (document reference 6.2.20.3). The Energy Statement focusses on the off-site grid connections for both power and gas required to support the energy strategy.

It is intended that power to the Kent Project Site will be provided via the Ebbsfleet 132kV/33kV sub-station. It is proposed to supply power to the Essex Project Site via a new 11kV sub-station that will be constructed within the DCO Order Limits within the vicinity of Fort Road. LRCH will continue to work with UKPN to determine the most appropriate method of procuring and installing these connections.

A gas connection will be provided to the Kent Project Site for top-up heat generation within the centralised plant. No gas connection is proposed to service the Essex Project Site. Electricity will be used for cooking.

Water strategy

The water strategy for LRCH will comprise a blend of demand mitigation measures to reduce the baseline demands augmented by greywater and on-site black-water recycling where appropriate.

Potable water demands for the Kent Project Site exceed capacity within the existing network. LRCH has been working with Thames Water and will continue to do so to refine water demands as the design develops, however it is currently anticipated that Thames Water will need to source additional supplies of water and reinforce local water treatment and supply networks to cater for the demands of the site. LRCH is working with Thames Water to develop a solution that is mutually beneficial to both parties and will continue to do so post DCO submission. Essex and Suffolk Water have confirmed the Essex Project Site can be simply connected into an existing water main on an adjacent road based on estimated demands at this site.

Wastewater strategy

Southern Water have confirmed that their planned infrastructure upgrades will not provide sufficient treatment capacity until 2030 for the Kent Project Site. As a result, LRCH is proposing to construct an on-site waste-water treatment plant, similar to that done for the nearby Castle Hill Development, a residential development in Kent at Ebbsfleet Valley. The intention is to recycle as much of the treated waste-water as possible for non-potable uses (including irrigation), the balance will require discharge into the Thames subject to regulatory approvals (Environment Agency/MMO). It is intended these approvals will be managed separately via the environmental permitting process. There are no capacity constraints for the Essex Project Site based on estimated demands at this site.

Digital Infrastructure strategy

The digital infrastructure strategy will develop fixed fibre, cellular and Wi-Fi networks to support the Proposed Development throughout its life-time.

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Glossary

Term	Definition
4G	4th generation
5G	5th generation
ANPR	Automatic Number Plate Recognition
BAU	Business as usual
BREEAM	Building Research Establishment Environmental Assessment Method
BSIRIA	Building Services Research and Information Association
CIRIA	Construction Industry Research and Information Association
DBC	Dartford Borough Council
DMR	Digital Mobile Radio
DNO	Distribution Networks Operator
EDC	Ebbsfleet Development Corporation
EMF	Electromagnetic Field
GBC	Gravesham Borough Council
HV	High Voltage
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ICP	Independent Connections Provider
IDNO	Distribution Networks Operator
IoT	Internet of Things
KCC	Kent County Council
LDP	Leisure Development Partners
LP	Low Pressure
LV	Low Voltage
MAN	Metropolitan Area Network
MNO	Mobile Network Operator
PoP	Point Of Presence
RF	Radio Frequency
SGN	Scotia Gas Networks
TC	Thurrock Council
TETRA	Terrestrial Trunked Radio
UKPN	United Kingdom Power Networks
WWTW	Waste-water Treatment Works

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Chapter One ◆ Existing Utilities

Information sources

- 1.1 Existing utility information has been provided from the following Sources:
- Kent Project Site - Groundwise Report 2663DM – September 2020
 - Essex Project Site - Groundwise Report 2662JS – September 2020
 - Groundwise Report 2662JS – September 2020
- 1.2 These sources have been supplemented/verified by information received from key utility providers consulted as part of the design development of the London Resort. Note that none of these sources are exhaustive and further surveys and on-site verification/validation of survey results are likely to be required during the detailed design stage of the Project.

Existing utility asset owners

- 1.3 Current existing utility asset owners within the Project Site are as follows:

Kent Project Site

- UKPN Power
- National Grid Power (Transmission)
- SGN Gas
- Southern Water Potable Water and Wastewater
- Thames Water Potable Water
- Virgin Media Telecommunications
- Openreach Telecommunications
- Vodafone Telecommunications

Essex Project Site

- UKPN Power
- Cadent Gas

THE LONDON RESORT ♦ UTILITIES STATEMENT

- Anglian Water Wastewater
- Essex & Suffolk Water Potable Water
- Virgin Media Telecommunications
- Openreach Telecommunications
- Vodafone Telecommunications

Existing Utility Infrastructure

Power

- 1.4 Existing overhead transmission lines owned by National Grid are conveyed through the eastern part of the Kent Project Site. The proposed works will not affect the existing network.
- 1.5 Drawing LR-DG-BUR-DCP-160.0 shows the existing UKPN HV and LV cables that serve existing areas within the Kent Project Site. Where areas are to be demolished and removed from the Proposed Development, disconnections will be required from the development boundaries. Any existing assets within third party land that is served by UKPN within the development area will be diverted or undergrounded as required whilst keeping supply to third party land. A schedule of disconnections and diversions will be produced as part of the next stage of the design.
- 1.6 The Essex Project Site no existing electricity infrastructure is affected by the Proposed Development.

Gas

- 1.7 For existing gas SGN have provided existing utility plans of their apparatus and there will be a need to have various disconnections points within the Kent Project Site at the boundary of the proposed development area on the Lower Road, through to Northfleet Industrial Estate. The affected pipes will be as follows:
- 1.8 Existing 90mm MP main served from Lower Road and is conveyed above the HS1 tunnel into the existing industrial complex to the west of the HS1 tunnel and south of Galley Hill Road; and
- 1.9 5" cast iron LP main within the Northfleet Industrial Estate.
- 1.10 Other gas providers supply gas to the western edge of the proposed Kent Project Site but are not affected by the proposed works.
- 1.11 Cadent are the gas supplier for the Essex Project Site and their apparatus are not affected by the proposed works.
- 1.12 Refer to drawing LR-DG-BUR-DCP-150.0 for details of the existing gas infrastructure.

Water

- 1.13 The Essex Project Site is within the Essex and Suffolk Water potable water service area. The site is serviced by:
- Trunk mains – 355mm main on Ferry Road
 - Distribution mains – 180mm mains off the trunk main
- 1.14 Reference is made to drawing LR-DG-BUR-DCP-130.0 Existing Water Infrastructure - Essex Site for details, provided as an appendix to this chapter.
- 1.15 The Kent Project Site is within the Thames Water potable water service area. The site is serviced by:
- Trunk mains – 500mm Ductile Iron (DI) main on London Road and 600mm main on Manor Way, which terminates at the HS1 box
 - Distribution mains – 200mm and 150mm distribution mains off London Road and Manor Way
- 1.16 Reference is made to drawing LR-DG-BUR-DCP-130.1 Existing Water Infrastructure - Kent Site for details, provided as an appendix to this chapter.

Wastewater

- 1.17 The Essex Project Site is within the Anglian Water wastewater (foul) service area. The nearest treatment facility is the Tilbury Water Recycling Centre, to the east of the site. Several existing 225mm collection mains run through the site, however full extents of the network are not available at this point. Anglian Water has advised possible connection points at manholes in the vicinity of the site.
- 1.18 Reference is made to drawing LR-DG-BUR-DCP-131.0 Existing Wastewater Infrastructure - Essex Site for details, provided as an appendix to this chapter.
- 1.19 The Kent Project Site is within the Southern Water wastewater service area. The nearest treatment facility is the Northfleet wastewater treatment works (WWTW), to the south-east of the site. Within the development area exists:
- Swanscombe WWTW - decommissioned
 - Influent and effluent lines to the Swanscombe WWTW – decommissioned
 - 600mm PP gravity trunk main, pump station and 400mm PE rising main, which runs west to east along Manor Way and discharging at the south-east corner of the site

- 1.20 Reference is made to drawing LR-DG-BUR-DCP-131.1 Existing Wastewater Infrastructure - Kent Site for details, provided as an appendix to this chapter.

Digital Infrastructure

Existing Fibre Infrastructure

- 1.21 To support the digital infrastructure at the Project Site external fibre optic connections would be sourced from a company such as Openreach or Virgin Media.
- 1.22 The Project Site is situated just outside the M25 and although it is in an urban area there is limited access to fixed fibre services at the current site location. This reflects the current land use of the site.
- 1.23 The buildings on Swanscombe Peninsula are mainly warehousing or heavy industries, which traditionally do not have a requirement for high bandwidth connectivity. There are two BT exchanges close to the Kent Project Site. The closest is located in Greenhithe to the west of site and the other is located in Gravesend. On the northern side of the River Thames the Essex Project Site has an exchange located just to the north. Given its proximity it is assumed that there is existing connectivity at the Essex Project Site.
- 1.24 Reference is made to drawing LR-DG-BUR-DCP-140.0 Existing Digital Infrastructure, provided as an appendix to this chapter.
- 1.25 All exchanges near to the site are classified as Market B exchanges. A Market B telephone exchange is an exchange where there are three or more operators present or forecast to be present.

Existing Mobile Infrastructure

- 1.26 Mobile Network Operators (MNOs) do not offer significant coverage at the Kent Project Site beyond covering the existing businesses within the DCO Order Limits. The Essex Project Site has better existing coverage due to the presence of the existing port area.
- 1.27 o2 Has indicated that their existing infrastructure does not cover the Kent Project Site. It advises also that all existing towers are running close to full capacity and that all of the current planned improvements are to service new residential developments in Ebbsfleet Garden City. All of o2's current planned expansion is aimed at providing capacity for the new and proposed housing.
- 1.28 Vodafone has also confirmed that its existing infrastructure will not be able to support the envisaged future demand that will be generated by the London Resort.
- 1.29 EE has a number of masts in the area with coverage provided over the Swanscombe Peninsula. However these are deployed are arranged in a way to serve the current demand from existing users. Therefore, the current infrastructure will not be suitable to provide the required coverage and capacity that London Resort will need.

- 1.30 Reference is made to drawing LR-DG-BUR-DCP-140.0 Existing Digital Infrastructure, provided as an appendix to this chapter.

Existing utility infrastructure capacities

Power

- 1.31 At present there is insufficient capacity within the UKPN network to serve the demands of the Kent Project Site. Discussions are ongoing and a strategy has been agreed with UKPN on how to provide the required capacity through a connection to the new Ebbsfleet 132/33kV substation currently under construction. LRCH are considering how to procure the contestable element of the proposed works to identify a solution that is most cost and time efficient. Contestable works are elements of the connection works which can be undertaken by and Independent Connections Provider (ICP) or Independent Distribution Networks Operator (IDNO) rather than UKPN. Further information on the proposed strategy is presented in Section 3 of this document.
- 1.32 The Essex project Site is also served by UKPN and an enquiry has been opened on the proposed point of connection and required power demand for the proposed development to support preliminary discussions with UKPN. A new 11kV sub-station is required to serve the proposed development. For reference to the proposed strategy please refer to Chapter Two of this document.

Water

- 1.33 Thames Water has advised that the existing network does not have capacity to service the Proposed Development at the Kent Project Site and strategic supply sourcing and network upgrades are required.
- 1.34 Essex and Suffolk Water has advised there is currently capacity to service the Essex Project Site, with 7l/s flow rate. This is based on Essex and Suffolk Water proposed connection point into the existing 355mm main on Ferry Road, with a supply pressure between 17-20m. The reference number the enquiry is NS/FERR/270667675082 where this information was confirmed. Reference is made to drawing LR-DG-BUR-DCP-130.0 Existing Water Infrastructure - Essex Site for details, provided as an appendix to this chapter.

Wastewater

- 1.35 Southern Water has advised that the Northfleet wastewater treatment works is currently oversubscribed and does not have immediate capacity available to service the site.

- 1.36 Anglian Water has advised there is currently capacity in the existing networks (used water networks) and at the Tilbury Water Recycling Centre to service the development. A number of connection options were advised by Anglian Water into manhole 8900, manhole 3501 or to the existing onsite private sewer (subject to permission from the Port of Tilbury). The pre-planning enquiry reference number is PPE-0097995. Refer to drawing. Reference is made to drawing LR-DG-BUR-DCP-131.0 Existing Wastewater Infrastructure - Essex Site for details, provided as an appendix to this chapter.

Digital Infrastructure

Kent Project Site

- 1.37 At present there is no capacity to support the digital infrastructure that would be required at the Kent Project Site. New site-specific links from local exchanges will be required to connect into Points of Presence (PoPs). These Points of Presence will act as consolidation points where service providers can route their connections within the Kent Project Site. This is required due to the specific requirements that the site will have. Openreach and Virgin have a presence in the local area and would be potential providers of these connections.
- 1.38 Discussions with EE, o2 and Vodafone have made it clear that there is no capacity within their current cellular networks to host the envisaged future capacity that will be required to host their services at the Kent Project Site. New cellular masts would be required to ensure that the London Resort is adequately covered. Further detail is provided in Section 2 of this document.

Essex Project Site

- 1.39 The Essex Project Site has far more existing digital infrastructure including existing connections to Openreach networks. Any extra demand from Resort visitors can be met.
- 1.40 Given the Essex Project Site's proximity to a residential area to the north and relative minimal change to population number in the proposed site area, the area is covered by the existing mobile cellular presence. However, at present there is no 5G coverage in the area and the current infrastructure will need to be upgraded to meet operators 5G coverage requirements.

Existing utility relocation

Power

- 1.41 Refer to the Power section.

Water

- 1.42 Reference is made to the Water Strategy section for description and plans of existing infrastructure within the Proposed Development areas.

Essex Project Site

- 1.43 Existing water distribution mains are located within the Essex Project Site. At this stage, there are no proposed works to divert or relocate these existing mains. If these mains will be impacted by the works, Essex and Suffolk Water will be consulted to agree a design and sequencing of works, to mitigate any impacts to existing users.
- 1.44 A short section of abandoned asbestos distribution pipe at the intersection of Ferry Road and Fort Road has been identified on the Essex and Suffolk Water plans, within the DCO Order Limits. This is noted in drawing LR-DG-BUR-DCP-130.0 Existing Water Infrastructure - Essex Site, provided as an appendix to this chapter. Where construction works will result in disturbance of this asbestos pipe, a licensed asbestos contractor will be procured in addition to following relevant health and safety, asbestos and CDM regulations.

Kent Project Site

- 1.45 Existing water distribution mains and a 600mm trunk main, are located within the Kent Project Site. Distribution mains within the development area that service plots, which are being resumed as part of the Proposed Development, will be removed in agreement with Thames Water.
- 1.46 Diversion of the 600mm trunk main on Manor Way is proposed, which currently supplies the HS1 tunnel. Supply along the trunk main will need to be maintained.
- 1.47 Further discussions with Thames Water are required at future design stages, to develop designs for diversion of the existing mains within the Kent Project Site. It is envisaged that these designs will be developed in conjunction with the wider reinforcement works required (see section 0 below). Design and construction of the diversion works will be under a Section 185 Agreement under the Water Industry Act 1991, with Thames Water.
- 1.48 Reference is made to drawing LR-DG-BUR-DCP-130.4 Proposed Water Strategy – Existing Asset Diversions - Kent Site for further details of the above discussed existing asset diversions.

Wastewater

- 1.49 Reference is made to the Wastewater Strategy section for description and plans of existing infrastructure within the Proposed Development areas.

Essex Project Site

- 1.50 Existing wastewater mains and infrastructure are located within the Essex Project Site. At this stage, there are no proposed works to divert or relocate these existing mains. If these mains will be impacted by the works, Anglian Water will be consulted to agree a design and sequencing of works, to mitigate any impacts to existing users. This will be completed under the S185 process for agreement.

Kent Project Site

- 1.51 Existing wastewater mains and infrastructure are located within the Kent Project Site.
- 1.52 Southern Water own the decommissioned Swanscombe WWTW, which is located in the centre of the Kent Project Site. It is proposed that this plant, including the influent and effluent lines, will be demolished and removed as part of the Proposed Development.
- 1.53 In addition, Southern Water own and operate a sewage pump station on Manor Way, within the Kent Project Site, and rising main that discharges to the Northfleet WWTW. It is understood that this services a catchment area to the west of the site and is currently operational. It is proposed to relocate the pump station to the west of Manor Way and re-align the rising main within the extents of the Kent Project Site.
- 1.54 The proposal has been provided to Southern Water for comment and all works on existing assets will go through the S185 Developer Diversion of Sewer process for approval.
- 1.55 Reference is made to drawing LR-DG-BUR-DCP-131.4 Proposed Wastewater Strategy – Existing Asset Diversions–Kent Site for details.

Gas

- 1.56 SGN have existing LP gas mains that serve existing areas within the Kent Project Site. Where these areas are to be demolished and removed from the development area then disconnections will be required from the development boundaries. Any third party land that is served by SGN within the development area will be diverted as required whilst keeping supply to third party land.
- 1.57 For the Essex Project Site no existing gas infrastructure is affected by the proposed development.

Digital Infrastructure

- 1.58 Openreach is the only operator with significant infrastructure within the Kent and Essex development areas. Virgin Media and Vodafone have a presence but their infrastructure is limited to the wider residential areas and the highways respectively.
- 1.59 Diversions will have to be made to Openreach that will be maintained beyond the redevelopment of the site. While all other connections will need to be disconnected.

Chapter Two ◆ Power and Gas strategy

Introduction

- 2.1 A separate energy strategy document has been provided as part of the DCO application documentation. This document contains a full policy review and provides additional explanation of how the energy strategy for the Proposed Development has been developed.
- 2.2 Consequently this section has been limited to avoid undue replication and focuses on the off-site infrastructure required to ensure both power and gas connections can be made to supply the Project Site with the energy it requires.

Aim and objectives

- 2.3 The aim of the off-site power and gas connection strategy is to ensure connections can be provided in a timely manner to enable power and gas supplies to be provided in accordance with the demand assessment.
- 2.4 Key objectives include:
- Ensuring the connections are provided as cost effectively as possible;
 - Connections are provided by the most practical means possible
 - Connections are provided in accordance with the programme requirements for the project.
- 2.5 As both power and gas grid connections will be provided by the statutory undertakers (UK Power Networks and Scotia Gas respectively), Buro Happold have been in regular dialogue with both organisations on behalf of LRCH to determine the connection options available given the likely demands requested.

Demand assessment

Power

- 2.6 The electricity demand for the Project Site has been estimated for the two different phases of the Project and is provided in the Tables below. A summary of demands which excludes power for heating, cooling and EV charging is presented in Table 2-1 to identify demands which are largely interdependent of the heating and cooling strategy. Table 2-2 presents total power demands, taking into account the chosen heating, cooling and EV (electric vehicle) charging strategy.

Table 2-1 Power breakdown by area (excluding heat, cooling and EV charging)

-	MW	GWh/a
Kent Project Site Gate One – Associated Development	29.3	148
Kent Project Site Gate Two	11.4	58.7
Essex Project Site	0.3	1.3
TOTAL	41.0	208.0

Table 2-2 – Power breakdown by usage

	Peak Power Demand (MW)	Annual Power Consumption in 2038¹ (GWh/yr)
Principal Development	41.5	208
Diversified EV charging	6.2	17.4
Power for cooling	7.5 (summer peak load)	7.1
Power for heating	1.3 (corresponding summer load)	17.8
Power for development catering	10	17.3
TOTAL undiversified	66.5	267.6
TOTAL diversified (90%)	59.9	

Please note the demands presented in

-	MW	GWh/a
Kent Project Site Gate One – Associated Development	29.3	148
Kent Project Site Gate Two	11.4	58.7
Essex Project Site	0.3	1.3
TOTAL	41.0	208.0

Table 2-2 are provided for preliminary guidance purpose and subject to detailed design.

¹ Year of maturity

2.7 For a full break-down of the power demands, please refer to the Energy Statement (document reference 6.2.20.3).

Gas

2.8 The London Resort energy strategy will use natural gas only as a means of providing back-up and top-up / peaking heat demands during periods of high heat demands. Although gas capacity will be sized to meet the peak winter heat demands, only 8% of annual heat requirements will be met by natural gas. The gas demand for the Project site has been estimated for the different phases of the Project and are provided in the Table below.

Table 2-3

Peak Gas Demand (2038)	30 MW
Annual Gas Demand from 2024	3466 MWth/yr
Annual Gas Demand from 2029	4067 MWth/yr
Gas standard volumetric flow requirement	3264 Sm ³ /h

Please note the demands presented in Table 2-3 are provided for preliminary guidance purpose and subject to detailed design.

- 2.9 For a full break-down of the power demands, please refer to the Energy Statement (document reference 6.2.20.3).

Grid Connection - Power

Kent Project Site

- 2.10 Through discussions with UKPN and the investigation of a series of different options, UKPN has proposed that the best point of connection for the Kent Project Site will be the Ebbsfleet Grid 132/33kV substation. The sub-station is still under construction but due to be completed by Q1 2021 and will be operational in time for the connection to the London Resort to be made. The location of the Ebbsfleet Grid substation relative to the site boundary and the proposed route for the interconnecting cabling is shown in drawing LR-DG-BUR-DCP-160.0 Power Infrastructure.

Essex Project Site

- 2.11 UKPN have advised LRCH that a new 11kV sub-station will need to be installed for the Essex Project Site Boundary within the vicinity of Fort Road. The final location of the substation will be confirmed at the time of requesting a formal quote. It is shown indicatively on drawing LR-DG-BUR-DCP-160.0 Power Infrastructure.
- 2.12 All works would be undertaken in accordance with the relevant regulatory requirements and those of the Statutory provider.

Grid Connection - Gas

Kent Project Site

- 2.13 A range of supply options have been considered in dialogue with SGN. SGN propose that a new medium pressure supply is installed, with a new connection at London Road. The available gas capacity in the area is likely to have reduced since previous investigations were carried out with SGN (in 2017) and as such further reinforcement of the local network would be required. An indicative location for proposed connection point is shown on drawing LR-DG-BUR-DCP-150.0 Gas Infrastructure.

Chapter Three ◆ Water strategy

Policy review

Kent County Council (KCC)

3.1 Kent County Council Drainage and Planning Policy (Dec 2019), section states:

- *'Surface water run-off from roofs and uncontaminated paved surfaces, can be captured and stored for use'; and*
- *'Rainwater harvesting systems can be designed to deliver surface water management benefits in addition to water supply'.*

Gravesham Borough Council (GBC)

3.2 The Gravesham Local Plan Core Strategy (Sep 2014), Policy CS18 Climate Change, Water Demand Management states:

- *'All new homes to be built to at least Code Level 3/4 (105 litres per person per day consumption)',*
- *'A small percentage of new homes, e.g. 5%, should be built to level 5/6 of the Code for Sustainable Homes in terms of water use, possibly as exemplars (80 litres per person per day consumption)', and*
- *'New non-household developments should meet the Building Research Establishment Environmental Assessment Method (BREEAM)" excellent" rating for water efficiency, and the collection of rainwater should be implemented'.*

Dartford Borough Council (DBC)

3.3 The DBC Core Strategy (Sep 2011) Policy CS25 Water Management, states:

- *New homes: Reach 'level 4 of the Code for Sustainable Homes (105 litres per person per day)'; and*
- *'Sites of 500 units or more will be expected to act as exemplars' (rain and grey water recycling, reduction of water hungry activity, potential for retrofitting to highest level of Code for Sustainable Homes water use).*
- *'Require all non-residential developments of 1,000 sqm and above to meet the BREEAM 'excellent' standards of water efficiency'.*

Ebbsfleet Development Corporation (EDC)

- 3.4 EDC prepared the Ebbsfleet Garden City Implementation Framework (2017). The EDC functions as a master-planning role for the area but does not prepare statutory development plan documents, deferring to the development plan context formed by DBC, GBC and KCC to determine planning applications submitted to it.

Thurrock Council (TC)

- 3.5 Core Strategy and Policies for Management of Development (Jan 2015), PMD2 Design and Layout states:
- Energy and Resource use – *‘Development should be designed to minimise energy and resource use. This includes integrating sustainable construction techniques, siting and orientation of buildings to maximise energy and water efficiency’.*

Aim and objectives

- A key aim of the water supply strategy is to provide a sustainable and reliable servicing to the development that will meet variations in demands, while reducing the impact on external networks.
- The objectives can be summarised as:
 - Reducing potable water demands as far as reasonably practical;
 - Maximise opportunities for use of recycled and other non-potable water sources;
 - Provide a reliable supply to site throughout all stages of the development; and
 - Placement and design of water infrastructure to minimise any impact on the user experience (visual, odour etc).

Demand assessment

- Project planning is in the preliminary stages of design and demand estimation has been made to provide an indication of site requirements, potential impacts and mitigations.
- An assessment of typical 'business as usual' (BAU) demands has been undertaken using available industry benchmarks. The BAU estimate assumes typical demands, before the introduction of any water savings initiatives.
- Incorporation of water demand management practices are proposed at the London Resort development and should be applied to all water use activities. A minimum target reduction of 25% from BAU will be targeted as required by local planning policy described above. Reference is also made to the separate Outline Sustainability Strategy (document reference 7.7) for details of sustainability aspirations for the project. Future buildings and asset developers will be required to design water fittings and features in alignment with this requirement.
- Demands are provided separately for buildings and landscape irrigation as the former will be supplied by the potable water network, whilst the latter will be supplied by a separate, dedicated irrigation water network.
- The estimation of demands is presented in the following components:
 - Leisure Core (Gates 1 and 2) and Water Park
 - Associated Development
 - Landscape irrigation
 - Contingency and allowances
- Demands are estimated for two scenarios:
 - Average day demands – the average daily demand across the year
 - Peak day demands – a high occupancy scenario such as during summer, assumed to be 2x average day (based on prior experience in tourism areas)

Leisure Core and Water Park Demand Estimation

- The Leisure Core covers approximately more than 50% of the Kent Project Site and will support the Entertainment Resort feature attractions and theme parks, identified as Gates 1 and 2. In addition a Water Park is proposed, external to the Gates. Detailed planning for Gates 1 and 2 and the water park is not developed at this stage. All estimates made for these areas require further assessment and revision at future design stages.

Previous 2014 Assessment

- In 2014 an estimate of theme park demands was completed based on a detailed area schedule and a summary of which is provided below. This estimate has been included here and modified to match the proposed theme park area, as area schedules within the theme parks have not been established at this stage, and therefore a detailed estimate on the current proposal cannot be undertaken. All demand estimates will be revised as designs progress.
- This was based on a 48 hectares of development area within the Gates. The estimate has been uplifted to the Proposed Development Leisure Core area of 81 hectares. The Water Park is external to the Gates, as a separate area, and therefore has not been uplifted.

Table 3-1 Demand Estimate - Uplifted 2014 Theme Park Estimate

Area	Area (m2)	Population	No.	Demand Benchmark	Units	Demand (m3/day)	Uplifted Demand (m3/day)
Food and Beverage		2,723		230	l/employee/day	625	1,054
Retail	13,594			2	l/m2/day	29	49
Attraction / shows		13,867		10	l/person/day	132	222
Rides			31	540	l/ride/day	17	28
Rides req. extra water		1,400		98	l/person/day	137	230
Operations		587		16	l/person/day	9	16
Separate Toilets			12	44,800	l/unit/day	538	906

Water Park		2800		98	l/person/day	273	273
Total Average Day						1,487	2,779
Total Peak Day							5,557
Total Peak Day – Target 25% Reduction							4,168

- As the plans for within the current Leisure Core area are not yet defined, no detailed investigation of these numbers is proposed at this time.

Comparison with other Parks

- A separate exercise was completed for comparison, with freely available information. The research identified a range of demands for different theme parks, however detailed information on the breakdown of water uses within the developments is not available. It is noted that the reference article found is from 1990, and it is expected that technology for theme park construction used today will provide significant reductions in water use. This should include, for example, SMART metering within the development, recycling of water within rides and use of efficient water fixings as well as generic water efficiency within buildings. Additional variances apply in location of each park, such as between the United Kingdom and some areas of America with higher temperatures and evaporation rates expected in the latter.

Table 3-2 Theme Park Water Use Comparison (Source: <https://www.latimes.com/archives/la-xpm-1990-05-05-ca-340-story.html>)

Location	Annual Visitors	Annual Water Use (m3)	Land Take (m2)	Open Days / Year	Water Use (m3/day)	Water Use (l/m2/day)	Water Use (l/visitor)	Comment
Knott's (California)	5,000,000	757,082	141,640	360	2,104	14.9	152	50% of demands landscaping
Universal Studios	5,100,000	98,420	1,699,681	360	274	0.2	20	
Oasis Water Park	250,000	41,640	48,562	360	116	2.4	167	high water loss to evaporation
Raging Waters	525,000	5,300	178,061	360	15	0.1	11	very little use in

								landscaping
Wild Rivers	400,000	3,785	80,937	360	11	0.2	10	
Monsoon Lagoon	100,000	1,515	12,140	100	16	1.3	16	

- High variability in demands is shown in the table above. The top two users, Knott’s and Oasis Water Park, were noted to also have a high percentage of use attributed to landscaping and evaporation respectively. A 50% reduction in demands at Knott’s theme park can be applied here, as landscape irrigation is assessed separately. The percentage lost to evaporation at Oasis Water Park cannot be quantified.
- Assessment of the figures is below, with a 50% reduction applied to the Knott’s theme park to remove irrigation demands.

Table 3-3 Assessment of Theme Park Demand Benchmarks

Assessment	Water Use (L/year)	Water Use (m3/day)	Water Use (l/m2/day)	Water Use (l/visitor)
Minimum	1,514,164	11	0.10	10
25% Quartile	4,163,951	15	0.20	12
Median	23,469,542	66	0.75	18
75% Quartile	84,225,373	235	2.13	62
Maximum	378,541,000	1,052	7.50	167
Mean	88,200,053	247	1.95	50

- Leisure Development Partners LLP (LDP) completed an assessment of visitors to the London Resort Development. A peak day visitor count of 89,369 people was estimated for full build-out in year 2038.
- Using the mean of 50 l/visitor and peak day visitor count of 89,369 people, the peak day demand estimate is 4,468 m³/day, prior to the application of any demand management measures. This figure is comparable to the uplifted 2014 estimate.
- The uplifted 2014 assessment was adopted for this budget estimate, as it was calculated for a previous iteration of the Proposed Development site.

Associated Development

- An area schedule has been provided by Apt for the Associated Development including hotel accommodation, back of house areas, people mover and transport interchange, resort access road, local transport links, river transport infrastructure, service infrastructure, flood defence works, habitat enhancement and public access, security and safety provisions, related housing.
- Benchmark unit demands were adopted as per the table below. Various industry standards were referenced in the development of benchmarks including Building Services Research and Information Association (BSRIA) and Construction Industry Research and Information Association (CIRIA).

Table 3-4 BAU Demand Benchmarks

Item	BAU Benchmark	Target 25% Reduction Benchmark	Units
F&B	10.5	7.9	L/cover/day
Fire Station	5	3.8	L/m ² /day
Hotel	430	322.5	L/guest night
Medical	3.9	2.9	L/m ² /day
Office	2.4	1.8	L/m ² /day
Passenger Interchange	0.24	0.2	L/m ² /day
Residential	150	112.5	L/resident/day
Retail	2.4	1.8	L/m ² /day
Theatre	4.5	3.4	L/person/day
Warehouse	2.6	2.0	L/m ² /day

- In the hotel demand estimation, an average of 1.5 persons per key has been assumed and 82% occupancy rate, which is the London average.
- Reference is made to the appendix for full details of the demand estimate.

Table 3-5 Summary of Associated Development Demand Estimate

Item	No.	Demand (m3/day)
Related Housing	2,500 residents	394
Hotels	3,550 keys	1,971
Other (Commercial, Office etc.)		615
Average Day Total		2,992
Peak Day Total		5,984
Peak Day Total – Target 25% Reduction		4,488

Landscape Irrigation

- Landscape irrigation demands were provided by EDP. These irrigation demands include water demand efficiency measures including drip fed irrigation and therefore no further reduction has been applied.
- Landscape irrigation in the first three years is the ‘establishment period’ where plants require higher water volumes. The reduction in water demands is shown below.
- A summary is provided in the table below.

Table 3-6 Landscape Irrigation Demands

Area	Years 1-3 Demand (m3/day)	Years 3 Onwards Demand (m3/day)
Gate 1	900	600
Gate 2	390	260
Associated Development Area	689	218
Average Day Total	1,979	1,078
Peak Day Total	3,957	2,155

- Year 3 onwards demands have been adopted for long-term planning.

Contingency and Allowances

- To account for the budgetary nature of the demand estimate at this level of planning, a contingency of 20% has been applied to the gross water demand estimate.
- Additionally, 5% non-revenue water to account for network losses has been applied to the average day demands. Peak factors were not applied to non-revenue water allowance.

Summary of Demand Estimate

- The following provides a summary of the long-term demand estimate, including the target 25% reduction from BAU.

Essex Project Site

Table 3-7 Essex Project Site Water Demand Estimate

Development Area	Demand	Demand (m3/day)
Essex Project Site	Potable water	9
Contingency 20%		2
Average Day Total		10
Average Day Total + Non-Revenue Water		11
Peak Day Total		21

Kent Project Site

Table 3-8 Kent Project Site Water Demand Estimate

Development Area	Demand	Demand (m3/day)
Gate Areas	Potable water	2,084
	Irrigation water	860
Balance of Site (hotels, staff housing, other)	Potable water	2,236
	Irrigation water	218
Contingency 20%		1,079
Average Day Total		6,477
Average Day Total + Non-Revenue Water		6,801

Peak Day Total	13,278
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Liaison with Thames Water

- Water demand estimation for the Kent Project Site at this stage is based on the assumptions described above and will require further development and revision in future design stages. The assumptions and build-up of the water demand estimate was reviewed and discussed with Thames Water representatives. Discussions with Thames Water are ongoing and will continue throughout the development of project into future design stages. The above demand figure for the Kent Project Site of 13.278 m³/day has been agreed with Thames Water for assessment of strategic supply as the current estimate of demands, until further information becomes available.
- It has been agreed with Thames Water that options to reduce potable water demands are to be further pursued after the submission of to DCO application. Opportunities for using non-potable water sources are to be incorporated where possible, as discussed in the following sections. As a minimum, it is expected that in the long-term supply strategy, irrigation water will be supplied by a combination of either greywater, treated sewage effluent (recycled water) or rainwater harvesting.

Options appraisal

- The following options were assessed in developing the water supply strategy:
 - Direct supply from Thames Water or Essex and Suffolk water networks, with service pressure provided by the networks.
 - Supply from Thames Water or Essex and Suffolk water networks with on-site storage to buffer peak demands.
 - Alternative supply from groundwater abstraction, privately managed through a New Appointments and Variations (NAV). A NAV is limited company which provides a water and/or sewerage service to customers in an area which was previously provided by the incumbent monopoly provider.
 - Greywater recycling on-site for toilet flushing and irrigation.
 - Treated sewage effluent (recycled water) used for irrigation.
 - Rainwater harvesting for irrigation and other non-potable uses.

- At the Essex Project Site, Essex and Suffolk water confirmed that direct supply is available, and therefore no further options for this site have been assessed as this option presents a low impact and timely water supply.
- The Proposed Development at the Kent Project Site will require high volumes of water, with spikes in peak demands likely to occur throughout the day. These spikes in demands are likely to result in increased impacts to the external water networks. To mitigate this, it is proposed that on-site storage is provided, as described in option 2 above and located within the Order Limits. Peaks in demands throughout the day will therefore be met by the storage tanks (where possible), and external networks demands limited to filling of the tanks.
- Additional water supply to the Kent Project Site will be required regardless of whether it is through Thames Water or private supply. Any additional abstraction would still therefore require coordination with Thames Water, as it is within their service area. It is not proposed to utilise a NAV for private supply to the Kent Project Site.
- It is proposed that greywater recycling systems be installed within hotels, offices and residential apartment blocks, to reduce potable water demands and reuse water for toilet flushing. The potential for utilising excess greywater for irrigation will be assessed further in future design stages. Water recycling at all theme park rides and the Water Park will further reduce demands and will be explored as the level of design information matures.
- An on-site wastewater treatment plant is likely to be required at the Kent Project Site, at the north-east and within the Order Limits (see the following Wastewater Strategy section), which will produce treated sewage effluent. This will provide a locally generated source of non-potable water that may be reused for irrigation, to reduce potable water demands. This option will be considered further in future design stages for use in irrigation to reduce the potable water demands.
- The site covers a large area, with buildings and impermeable surfaces proposed that provide a means for capture of rainwater. Rainwater can be filtered and reused for irrigation or other non-potable uses within the Kent Project Site. This option will be considered further in future design stages to reduce the potable water demands.

Proposed strategy

- Water demand management with the following minimum requirements are proposed across the development:
 - All buildings to be installed with efficient water fittings and fixtures;
 - Greywater systems installed in hotels, offices and residential apartment blocks for re-use in toilet flushing;

- Capture, treatment and re-use of water supplied and used for all water rides and other rides in the theme park;
- Low maintenance planting for landscaped areas to minimise water demands post-establishment;
- Manage stress on external networks (where required) through on-site storage.

- A minimum reduction of 25% from baseline, BAU water demands is proposed where appropriate.
- Supply for construction works is not quantified at this stage of design. Temporary supply through Thames Water at the Kent Project Site and through Essex and Suffolk Water at the Essex Project Site will need to be acquired. This will be undertaken as part of the detailed design stage.

Essex Project Site

- Essex Project Site in its current state is developed and new demands as a result of the London Resort project are not anticipated to cause a significant increase to servicing requirements.
- As agreed with Essex and Suffolk Water, it is proposed to connect in to the existing 355mm main on Ferry Road, with supply pressure between 17-20m head. Water will be supplied directly from the network to each point of use within the Essex Project Site, with no additional storage proposed to be provided on site. The potable water network will supply for buildings and firefighting use. Detailed network assessment in future design stages will determine if localised pressure boosting is required within the site.
- Reference is made to drawing LR-DG-BUR-DCP-130.2 Proposed Water Strategy - Development Servicing - Essex Site for details of proposed servicing at the Essex Project Site.

Kent Project Site

- Kent is in a water stressed area, with London Resort being located at the downstream end of the Thames Water supply area. A water-stressed area occurs when the demand for water exceeds the available supply amount. Thames Water have identified that network upgrades and additional supply will be required to provide supply to the development. Therefore, the water supply strategy has been developed to allow greatest flexibility in operations within the site while also mitigating impact to the external networks, thereby reducing extent of external network upgrades and impact on the wider community.
- The following provides a summary of the proposed water supply strategy at the Kent Project Site, in addition to the water demand management measures described above:
 - Peak hourly / instantaneous demands from hotel and commercial areas (including the Gates) to be managed through on-site storage;
 - On-site potable water storage to provide potable demands plus emergency firefighting reserve;
 - Irrigation storage and pump station to be provided separately to potable water;

- Manage times for filling of storage tanks to mitigate amplified impacts on the Thames Water networks, to be agreed with Thames Water;
 - Firefighting systems supplied by the internal potable water networks, with hydrants provided along access roads as required.
- Storage is proposed within the site, to manage peak instantaneous demands on the Thames Water networks. Allocation for a central water storage space and a pump station has been made in the site planning, at the Bamber Pit utility compound, to the south of the development. Any constraints on the time period or filling rate for the storage tanks will be agreed with Thames Water to alleviate pressures on external networks. A direct drinking water supply will be provided to residential areas.
 - An internal potable water network will be constructed through the site from the storage and pump station compound. The network will be looped, with dead end mains avoided wherever possible, to improve internal resilience and maintain pressure. Pressure boosting will be provided within the site as required. Fire hydrants will be located at intervals along access roads, serviced by the potable water network. Spacing of the fire hydrants will be confirmed in future design stages.
 - Land allocation for a separate irrigation water storage and pump station is provided at the south utility compound (the 'sports ground'). Water supply discussions with Thames Water, considered the worst-case scenario, with all irrigation water supplied by the potable network. However, options for alternative long-term supply from the following sources will be considered at future design stages, pending availability:
 - Rainwater harvesting on-site through integration with the surface water drainage strategy (see Surface Water Drainage Strategy report) or at building-level tanks to collect roof water; and
 - Greywater recycling on-site (excess from toilet flushing).
 - Treated sewage effluent from the on-site wastewater treatment works (WWTW);

- Further assessment in detail design stages will provide more detail on available volumes of irrigation water supply from each of the above alternative water sources.
- Temporary supply for landscape irrigation establishment period, is proposed to be provided from the potable water network, where there is spare capacity, or from a tanked water supply.
- Reference is made to drawing LR-DG-BUR-DCP-130.3 Proposed Water Strategy - Development Servicing - Kent Site for details

Off-site infrastructure strategy

Essex Project Site

- No off-site infrastructure works are anticipated for water supply at the Essex Project Site.

Kent Project Site

- Thames Water have identified that water treatment and supply network upgrades, as well as sourcing of additional supply will be required to provide service the Proposed Development. This will require reinforcement works external to the Project Site and potentially external to the DCO Order Limits. As confirmed in Thames Water's statutory consultation response, the development design team is in contact with Thames Water to agree a water strategy, which is in the early stages. In accordance with the Thames Water response, the development shall not be occupied until either an infrastructure phasing plan, or all external network upgrades are confirmed and constructed. It is anticipated that some, or all, of the following may be required:
 - Additional supply, such as via groundwater bore abstraction;
 - Network reinforcement (upgrades);
 - Additional water treatment capacity; and
 - Additional strategic storage capacity in Thames Water network.

Chapter Four ◆ Wastewater strategy

Policy review

Kent County Council (KCC)

- Kent County Council Drainage and Planning Policy (Dec 2019) was reviewed for references to wastewater and no specific references were identified. Separate wastewater (foul) and surface water drainage systems are therefore assumed.

Gravesham Borough Council (GBC)

- The Gravesham Local Plan Core Strategy (Sep 2014), Policy CS18 Climate Change, Water Demand Management is discussed in the Gravesham Borough Council (GBC) section of Chapter Three. The water efficiency requirements described have a direct impact on reducing the volumes of wastewater generated at the site.

Dartford Borough Council (DBC)

- The DBC Core Strategy (Sep 2011) Policy CS25 Water Management, states the following with reference to greywater, which is a stream of wastewater:
 - *'Sites of 500 units or more will be expected to act as exemplars'* (rain and grey water recycling, reduction of water hungry activity, potential for retrofitting to highest level of Code for Sustainable Homes water use).

Ebbsfleet Development Corporation (EDC)

- EDC prepared the Ebbsfleet Garden City Implementation Framework (2017). The EDC functions as a master-planning role for the area but does not prepare statutory development plan documents, deferring to the development plan context formed by DBC, GBC and KCC to determine planning applications submitted to it.

Thurrock Council (TC)

- Core Strategy and Policies for Management of Development (Jan 2015), PMD2 Design and Layout is discussed in Thurrock Council (TC) section of Chapter Three. The water efficiency requirements have a direct impact on reducing the volumes of wastewater generated at the site.

Aim and objectives

- A key aim of the wastewater strategy is to provide a reliable servicing to the development that will meet variations in wastewater flows through each phase of the development, while mitigating any nuisance impact on surrounding developments as far as reasonably practical.
- The objectives can be summarised as:
 - Separate wastewater and surface water drainage networks;
 - Collect and treat all wastewater from the development;
 - Maintain existing wastewater servicing for surrounding development; and
 - Provide opportunity for the recycling and reuse of wastewater, if feasible.

Demand assessment

- Wastewater demands have been estimated using a 90% return rate from potable water demands, to account for water losses such as cleaning, consumption etc. Reference is made to the Water Strategy section for details of the water demand estimate.
- A summary of the estimated wastewater demands is provided in the table below. The estimate incorporates the 25% demand reduction target. The peak demand cases of 1.4, 2.0 and 2.5 x dry weather flow are as per Southern Water demand scenarios.
- The wastewater demands have been assessed assuming separate foul and surface water networks.
- A 10% infiltration allowance have been assumed.

Essex Project Site Demands

Table 0-1 Essex Project Site Wastewater Demand Estimate

Area	Demand (m ³ /day)
Essex Project Site	7
Contingency	1
Total Dry Weather Flow (DWF)	8
Total 2.5 DWF + Infiltration	21
Total 2.0 DWF + Infiltration	17
Total 1.4 DWF + Infiltration	12

Kent Project Site Demands

Table 0-2: Kent Project Site Wastewater Demand Estimate

Area	Demand (m ³ /day)
Gate Areas	1,876
Balance of Site (hotels, staff, other)	2,012
Contingency	778
Total Dry Weather Flow (DWF)	4,666
Total 2.5 DWF + Infiltration	12,130
Total 2.0 DWF + Infiltration	9,798
Total 1.4 DWF + Infiltration	6,998

Options appraisal

- The following options were assessed in developing the wastewater supply strategy:
 - Direct connection to existing sewer networks
 - New wastewater main to existing wastewater treatment works (WWTW)
 - On-site wastewater treatment
- It is proposed that if existing networks have sufficient capacity, a direct connection is made for wastewater servicing. This option provides the lowest impact wastewater service, both to external areas and utilities existing infrastructure. This option is available at the Essex Project Site.
- The nearest WWTW to the Kent Project Site is the Northfleet WWTW to the south-east of the site and is operated by SW. The option to provide a new connection into the Northfleet WWTW was discussed with SW. However, it was confirmed there is currently no spare capacity within the catchment. SW also noted that the Proposed Development is not within their 2020-2025 Business Plan, which addresses agreed infrastructure improvements across the service area.
- The Project Development team will continue to liaise with SW as the Project progresses through future design stages and to pursue future options to service the site or under the next 2025-2030 Business Plan. SW advised that the earliest an upgrade could be delivered is March 2030.
- An on-site WWTW has been constructed as part of the adjacent Castle Hill development in Ebbsfleet. Again, this was confirmed to not have capacity for the Proposed Development.

- Unless SW is able to advance their infrastructure improvements, an on-site wastewater treatment is proposed for the Kent Project Site in lieu of alternate options to connect into existing infrastructure, within a reasonable timescale. Local treatment of wastewater allows the wastewater systems to be contained within the Kent Project Site and for the Project to deal with its own waste.
- Further details on the proposed strategy for an on-site WWTW is described in the following section.

Proposed strategy

- Separate wastewater and surface water drainage systems will be provided at the Project Site. Reference is made to the Surface Water Drainage Strategy report for details of the drainage systems.
- Wherever possible, wastewater will be collected with gravity systems within the Project Site. Lifting stations or pumping stations with rising mains will be provided if required, to overcome elevations in topography.

Essex Project Site

- Essex Project Site is developed and new demands as a result of the London Resort project are not anticipated to cause a significant increase to servicing requirements.
- As agreed with Anglian Water, a direct connection into the existing wastewater networks is proposed and treatment provided Tilbury Water Recycling Centre. Three options for connection points were provided by Anglian Water. It is proposed to connect into the existing network at manhole no. 3501, to the west of the Essex Project Site. The location of which is shown in the drawing described below.
- Reference is made to drawing LR-DG-BUR-DCP-131.2 Proposed Wastewater Strategy - Development Servicing – Essex Site for details.

Kent Project Site

- As described previously, on-site wastewater treatment will be required at the Kent Project Site. LRCH are currently investigating the most appropriate method to procure and operate the WWTW. A site for the WWTW has been proposed at the north-east of the Project Site, adjacent the existing leachate treatment plant. This location is situated at distance away from the London Resort and from existing development, reducing potential impacts from odour. The site elevation is approximately 7m AOD.
- Sludge produced as a by-product at the WWTW will require transport as solid waste off site for specialist treatment. Reference is made to ES Chapter 9 Land Transport for details on overall transportation strategy at the Project Site, which will include trucks for transporting sludge.
- Further details on the on-site WWTW is provided in the following section.
- Lifting stations will be required to transfer wastewater from within the Kent Project Site to the on-site WWTW. It is proposed to drain wastewater via gravity within the development area and lifting stations incorporated to overcome higher elevations.
- Reference is made to drawing LR-DG-BUR-DCP-131.2 Proposed Wastewater Strategy - Development Servicing – Kent Site for details.

Kent Project Site – On-Site WWTW

- Unless SW is able to advance their infrastructure improvements, an on-site wastewater treatment is proposed for the Kent Project Site in lieu of alternate options to connect into existing infrastructure, within a reasonable timescale. Local treatment of wastewater allows the wastewater systems to be contained within the Kent Project Site and for the Project to deal with its own waste. A by-product of the treatment process is treated effluent, which, if treated to the appropriate quality, may also be re-used for non-potable use, including irrigation. The potential for treating the effluent to a standard suitable for reuse will be further investigated as the detailed design stages progress. Where effluent is not reused, an outfall into the River Thames will be required and it will be treated to an appropriate standard for this situation.

- A site for the WWTW has been promoted at the north-east of the Kent Project Site, adjacent the existing leachate treatment plant. This location is situated at a distance away from the habitable areas of the Proposed Development and from existing development, and the prevailing wind direction will beneficially reduce odour. Modern WWTW are designed to mitigate odour issues, however locating the WWTW in this location will further reduce any potential risk.

- The treated effluent outfall pipe is proposed to be direct from the WWTW, east towards the tidal River Thames. PLA charts of the River Thames adjacent the WWTW site indicates that the riverbed level drops sufficiently such that a submerged outfall pipe can be designed, if this is required by the EA. Appropriate scour protection will be incorporated into the design of the outfall.

- Design parameters and constraints for the on-site WWTW and discharge of treated effluent into the River Thames or for reuse, require co-ordination and agreement with the EA and PLA, among other stakeholders. It is anticipated this will be progressed via the Environmental Permitting process. The EA regulate WWTW by assessing the quality of the wastewater they discharge against set compliance limits. The level of treatment and monitoring that's required is based on the population the WWTW serves and where the sewage is discharged, among other influencing parameters.

- The design for the on-site WWTW is likely to include the following elements:
 - Storage tanks
 - Screening and disposal
 - Primary settlement
 - Secondary treatment
 - Tertiary treatment

- Disinfection
 - Tertiary treatment will reduce ammonia and nitrates. Sludge is likely to require removal offsite for treatment at a regional sludge centre, this will be removed via a tanker approximately fortnightly. The WWTP will therefore include some form of dewatering in order to avoid transporting excessive volumes of water.
 - An EA discharge permit will set the required maximum peak and daily concentrations in the flow from the works. This will be for a range of parameters as determined by the EA and NE. The permit may also limit the volume of flow that can be discharged in any 24-hour period. Schedule 3 of the EA discharge permit will set out the emission limits and monitoring requirements. An indicative permit will be applied for which will set the appropriate discharge limits for the WWTP; detailed design of the WWTP will be undertaken to enable these criteria to be met.

Off-site infrastructure strategy

Essex Project Site

- No off-site infrastructure works are anticipated for wastewater at the Essex Project Site.

Kent Project Site

- No off-site infrastructure works are anticipated for wastewater at the Kent Project Site. The proposed on-site WWTP is located within current definition of the DCO Order Limits.

Chapter Five ◆ Digital Infrastructure strategy

Policy review

- Chapter 8: Human Health production of the Environmental Statement (6.1.8) considers the impact of exposure to electromagnetic field (EMF) sources and potential ill effects caused by exposure from Radio Frequency (RF) sources. The conclusion of this review is that RF exposure that is within the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines will not cause any adverse health conditions. All stakeholders that install such sources of RF equipment are required to comply with these guidelines.

Aim and objectives

- The aim of the digital infrastructure strategy for London Resort is to provide connectivity to visitors and workers of the development via a suite of new and existing networks and components thereof.
- The primary design philosophy of the digital infrastructure is to minimise duplication wherever practically possible to minimise capital and operational expenditure whilst meeting operational requirements of the development.
- As the development design progresses, the operators will be key stakeholders to engage to ensure full connectivity is provided across the Resort and that high priority areas are identified to ensure appropriate capacity is provided. End-point digital infrastructure will be coordinated with the operators to minimise visible components and coordinate with building facades or lighting columns.
- Proposed digital infrastructure comprises:
 - Fixed fibre networks and associated duct pathway systems for to provide internet connectivity to plots and backhaul connectivity for development systems and services;
 - Cellular networks for mobile communications;
 - Site wide developer owned Metropolitan Area Network (MAN) to connect development specific systems such as CCTV, Wi-Fi, digital signage and security access systems;
 - Public realm Wi-Fi networks targeted to key areas within the development;
 - Internet of Things (IoT) networks to facilitate the monitoring of physical systems throughout the development;

- Equipment spaces (including but not limited to Points of Presence (PoPs), data centres and micro data centres) for hosting active network equipment and servers, and consolidating the distribution of fixed networks into and through the development; and
- Control Rooms from which digital services can be administered and the development’s infrastructure, digital or otherwise, can be monitored and operated.

Demand assessment

- Fixed fibre bandwidth demands shown below have been calculated through a top-down approach by applying connection bandwidth, contention ratio and expected occupancy to the number of potential connections per net floor areas.

Table 0-1 Site Wide Demands

Total Gbps		
BAU	Stretch	Pioneering
125.25	431.11	1123.11

- The benchmarks used to derive the totals via calculations are shown in Table 0-2

Area	Connection Bandwidth			Contention Ratio			Occupancy	GFA Per Connection
	Mbps			1:X			%	m2
	BAU	Stretch	Pioneering	BAU	Stretch	Pioneering	ALL	ALL
Staff	100	100	1000	20	20	15	90	9.3
Plaza	100	100	100	20	20	15	5	200
Arena	100	1000	2000	20	20	15	90	200
eSports	1000	1500	2000	20	20	15	90	9.3
Arena	100	100	1000	20	20	15	90	200
Terminal s	100	100	1000	20	20	15	50	200
Car Park	10	100	100	20	20	15	5	200
Hotel	100	1000	2000	20	20	15	65	23

Area	Connection Bandwidth			Contention Ratio			Occupancy	GFA Per Connection
	Mbps			1:X			%	m2
	BAU	Stretch	Pioneering	BAU	Stretch	Pioneering	ALL	ALL
Offices	100	100	1000	20	20	15	90	9.3
Gate	100	100	100	20	20	15	90	9.3
Staff	100	100	1000	20	20	15	5	200
Medical	100	1000	1000	20	20	15	65	64
Security/ Safety	1000	1000	1000	20	20	15	50	64
Storage	10	100	100	20	20	15	50	200
Utilities	100	100	1000	20	20	15	50	200

- . These benchmarks are applied to the differing land uses within London Resort to derive the site wide demand. The Connection Bandwidth is the given bandwidth for an individual connection. The amount of connections is estimated via the average connection per square meter, GFA Per Connection. This forms the baseline demand. The Contention Ratio, how many users are using accessing a line and Occupancy rate a just the demand for the likely real world demand.

Table 0-2 Digital Infrastructure Benchmarks

Area	Connection Bandwidth			Contention Ratio			Occupancy	GFA Per Connection
	Mbps			1:X			%	m2
	BAU	Stretch	Pioneering	BAU	Stretch	Pioneering	ALL	ALL
Staff	100	100	1000	20	20	15	90	9.3
Plaza	100	100	100	20	20	15	5	200
Arena	100	1000	2000	20	20	15	90	200
eSports	1000	1500	2000	20	20	15	90	9.3
Arena	100	100	1000	20	20	15	90	200

Area	Connection Bandwidth			Contention Ratio			Occupancy	GFA Per Connection
	Mbps			1:X			%	m2
	BAU	Stretch	Pioneering	BAU	Stretch	Pioneering	ALL	ALL
Terminal s	100	100	1000	20	20	15	50	200
Car Park	10	100	100	20	20	15	5	200
Hotel	100	1000	2000	20	20	15	65	23
Offices	100	100	1000	20	20	15	90	9.3
Gate	100	100	100	20	20	15	90	9.3
Staff	100	100	1000	20	20	15	5	200
Medical	100	1000	1000	20	20	15	65	64
Security/ Safety	1000	1000	1000	20	20	15	50	64
Storage	10	100	100	20	20	15	50	200
Utilities	100	100	1000	20	20	15	50	200

Proposed strategy

- The proposed digital infrastructure site strategy will include the following measures:
 - Recommendations for metropolitan scale fixed optical fibre network deployment to enable fixed high bandwidth connectivity to all buildings, residences, critical infrastructure and digital infrastructure;
 - Recommendations for cellular network deployment to ensure ubiquitous network coverage;
 - Recommendations for the deployment of a development public realm Wi-Fi network;
 - Recommendations of deployment of IoT networks within the development;
 - Recommendations for deployment suitable digital infrastructure to enable connectivity through multiple service providers providing a competitive

telecommunications market; and

- Recommendations for deployment of digital infrastructure to enable the deployment of bespoke digital systems and services throughout the development.

PoPs and Site-Wide Connectivity

- PoPs would provide centralised points from which fixed fibre networks will be distributed throughout the Project Site. As such, the PoP locations provide ideal sites to collocate primary micro data centres that contain equipment to host any digital services required for the development. Having these key functions placed closer to the systems using them can ensure those systems are resilient and responsive. Additionally, because this data traffic remains relatively local it allows the wider network to be utilised by other processes on the network.
- A site-wide fixed fibre network and duct pathway system will be required to allow the developer's MAN to connect the development systems and services back to the primary micro data centres. These networks will need to be owned and operated by the developer or their agent. The provision of these networks provides an opportunity for the developer to minimise the total network footprint within the development by consolidating that network with those required to deliver service provider networks to plots through the provision of a single neutral host network deployment model.
- Several options exist for how this model could be implemented and will depend on the developer's decision on how to operate the digital infrastructure and agreement from the service providers. The neutral host network could be limited to a single duct pathway system through which both the developer and service providers can extend their fixed fibre networks from the PoPs. Conversely, in addition to deploying their own MAN for development systems and services, the developer could deploy fixed fibre networks connecting plots to PoPs where these networks would interface with service provider networks. This would enable the developer to ensure a consistent network quality is provided across the development and will enable the ability to access a unique revenue stream by leasing the last mile of connectivity to service providers. The developer would however be required to meet service availability requirements set out by service providers. Whichever model is selected the fibre optic connectivity for the site would be routed through the site internally via a site wide duct network supported from the PoPs.
- This strategy can be extended to provision of shared cellular sites with shared antenna systems and space provided for individual MNO's. Connectivity to site external networks would then be provided via the Proposed Developments' site-wide fixed fibre networks and duct pathway systems and not the MNO's own private network. This allows for a minimisation of the amount of cellular infrastructure such as equipment spaces, cellular towers and antennas deployed into the public realm which will help to lower the spatial and visual impact of these networks. This would be done in coordination with the MNO's. Vodafone and o2 have stated that they are open to such an arrangement.
- Reference is made to drawing LR-DG-BUR-DCP-140.1 Proposed Digital Infrastructure.

- Regardless of the level of consolidation applied to the development's fixed fibre networks, a site wide duct pathway system must be extended to all buildings in The London Resort. This pathway system should be sized for the full development requirements with additional capacity provided to accommodate future needs. The pathway system should be deployed to enable diverse cable routing. Should service providers refuse to share infrastructure then the developer may need to provide individual duct banks along a common utility corridor for their own MAN which would increase costs and the network footprint. Service providers would then adopt their individual banks and then operate and maintain those banks along with their wider networks. The full extent of a neutral host network model deployed at the Proposed Development should be developed further in coordination with the developer team and service providers as part of the next stage of design.

Mobile Cellular

- Full cellular coverage is required throughout the Project Site. Plans for the deployment of cellular infrastructure must be progressed in line with the design of the Project.
- Mobile network operators are starting to deploy 5th generation (5G) cellular networks. Mobile network operators started deployment of these 5G networks in 2019. The geospatial impact of deploying 5G networks will be that a high density of antennas will need to be deployed across the site with individual cells covering a circular area with diameter of between 50m and 500m depending on the expected device density within those cells.
- Through these discussions with Mobile Network Operators (MNOs) the preferred location for new mobile cellular infrastructure at the London Resort site would be on top of any of the planned buildings. When placed at these high vantage points a larger area of coverage is possible and the height is not provided by a purpose-built mast. By deploying cellular infrastructure in this method, it is possible that less equipment will be required to cover the outdoor environment and it is less visually impactful to the aesthetic of the site when compared with deploying masts at ground level. O2 and Vodafone have both stated that they are willing to share space within the London Resort site.
- In summary the following information would be used to confirm the most appropriate locations for future cellular sites:
 - population projections
 - building typology or building use
 - building locations
 - building dimensions including height

- proposed building material
- radio frequency surveys of the region surrounding London Resort
- The following points would be taken into consideration when planning the implementation of plant to support cellular mobile infrastructure for London Resort:
 - Cellular base stations would need to be interconnected to the fixed telecommunication network in order to backhaul radio traffic onto national service provider voice and data networks;
 - Where base stations and antenna are deployed as macrocells in dedicated compounds this interconnection will be enabled via underground containment;
 - Cellular compounds would also require the provision of suitably specified electrical power, appropriate access, security etc.
 - Where appropriate, space within buildings (especially multi floored, multi tenanted buildings) would be allocated to accommodate equipment & cable terminations for in-building cellular systems;
 - Mobile network operator equipment would be deployed safely in line with ICNIRP guidelines and the Mobile Operators Code of Best Practice; and
 - Further engagement with local mobile network operators should be a priority in order to confirm their technical requirements for cellular sites.

Wireless Connectivity

- By providing public realm Wi-Fi networks the development can open several options for providing unique services and revenue streams. While these networks would allow residents and visitors access to the Internet, public realm Wi-Fi can also provide the opportunity to provide tailored digital services. Data acquired from public realm Wi-Fi networks can allow the developments operators a unique insight into the how the visitors are using the development which can help to inform future planning decisions.
- The public realm Wi-Fi zoning strategy will be developed in close coordination with the developer to ensure the network can be aligned to their development goals.



IoT Connectivity

- Physical devices such as sensors and actuators and potentially including vehicles, appliances and many other devices form part of the Internet of Things. These devices will be integral to the delivery of many of the digital services deployed into London Resort's public realm.
- The primary method for connecting many of these devices involves the use of low power wide area wireless networks. An analysis of the connected devices required by London Resort would be completed to inform development of a wireless IoT zoning strategy to ensure networks are deployed to meet those requirements.

Security and Operational Networks

- The London Resort site will have a number of discrete security systems that will require connectivity to the digital infrastructure. Including Automatic Number Plate Recognition (ANPR) cameras, CCTV, Digital Signage, access control and on-site radio communications. These systems can make use of the site wide duct pathway system and unless precluded by any security requirements, a neutral host network.
- Particular consideration must be taken for any on site radio communications as delivering this as a service will require specialised radio equipment. Traditionally Terrestrial Trunked Radio (TETRA) and Digital Mobile Radio (DMR) systems, such as those used by the UK's emergency services have been employed on sites to provide voice communications for staff. Although this technology is robust and well tested it has limited bandwidth compared to more modern technologies such as 4G and 5G. Alternatively it may be more appropriate for the London Resort to operate one of these systems if users are required to be able to send live images or videos back to security and operations centres. This requirement would be defined by security and operational strategies. Regardless of which technology is taken forward both will require base station equipment that must be connected to the site wide MAN to allow communications with security and operational centres.

Off-site infrastructure strategy

- As a minimum, two distinct core routes into the Kent Project Site from external service provider networks should be provided to ensure resilience of services deployed within the development. Given the location of the Greenhithe and Gravesend exchanges it is recommended that a connection from each of these is procured to provide access to external services. The Essex Project Site already has existing infrastructure and it is assumed that no further connections will be required.

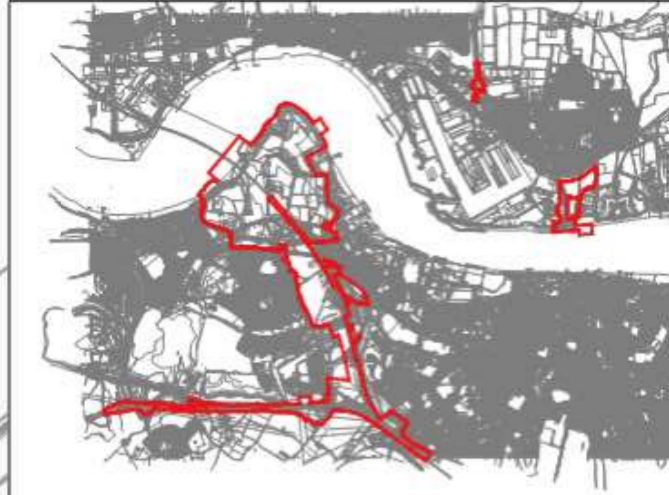
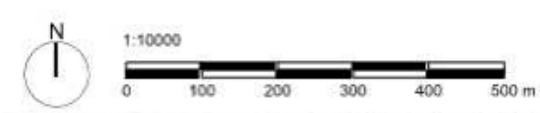
- These external services from ISPs, deployed with optical fibre cabling, will provide the site with high bandwidth connectivity to plots and support the development's digital systems and services. Additional physically diverse site entry points can be provided should the development require further resiliency or bespoke services on site. It is recommended that two physically diverse PoPs are provided within the development to centralize and consolidate the distribution of fixed fibre networks, facilitating efficient routing of cabling and increasing the resiliency of services deployed throughout the development.
- Reference is made to drawing LR-DG-BUR-DCP-140.1 Proposed Digital Infrastructure for details proposed works.
- The utility area on the south side of the London Road and the Security Control and Crisis Management Centre would make for good locations given their proximity to the site boundary and security coordination respectively.

Appendices

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Appendix 1.0 Dry Utilities Plan

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Legend:

- Existing o2 Mast
- Existing EE Mast
- Existing Tilbury Exchange
- Existing Greenhithe Exchange
- Existing Gravesend Exchange

- Notes:
1. The Essex Project Site is covered by existing mobile cellular presence, however there is no 5G coverage.
 2. Existing dry utilities at Essex Project Site to be mapped at next stage.
 3. Reference is made to the Utilities Statement (7.6) for details of the digital infrastructure strategy.
 4. All mapped utilities to be confirmed with detailed survey data at next stage.

BURO HAPPOLD

Project: The London Resort Project No: 0042936

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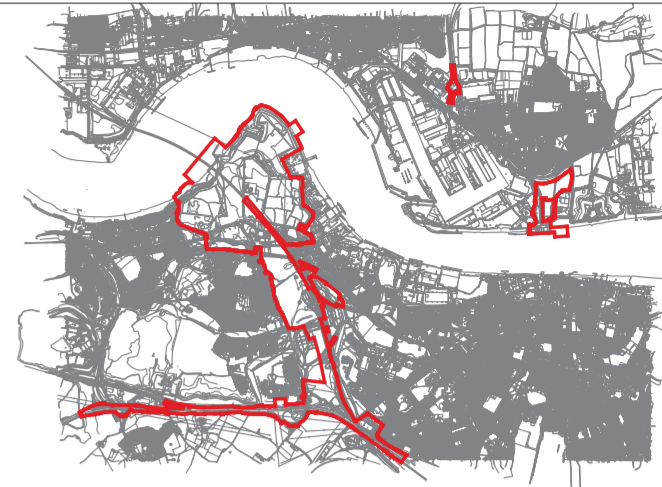
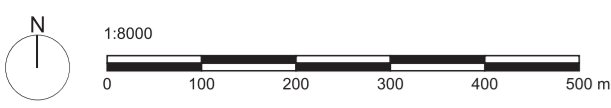
THE LONDON RESORT DEVELOPMENT CONSENT ORDER
EXISTING DIGITAL INFRASTRUCTURE

Sheet 1 of 1

Application Number: **BC080001**
Drawing Reference: **LR-DG-BUR-DCP-140.0**

Scale: **1:10000 @ A1** Sheet: **1 of 1** Revision: **0**





Legend:

- Digital Infrastructure Entry Point
- Digital Infrastructure PoP

- Notes:**
1. The Essex Project Site is covered by existing mobile cellular presence, however there is no 5G coverage.
 2. Existing dry utilities at Essex Project Site to be mapped at next stage.
 3. Reference is made to the Utilities Statement (7.6) for details of the digital infrastructure strategy.
 4. All mapped utilities to be confirmed with detailed survey data at next stage.



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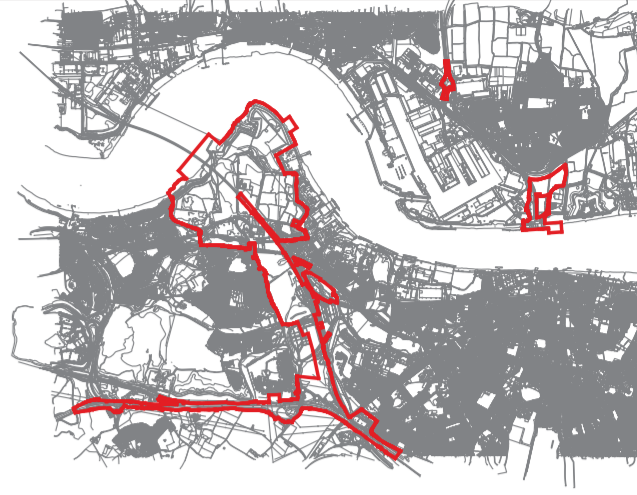
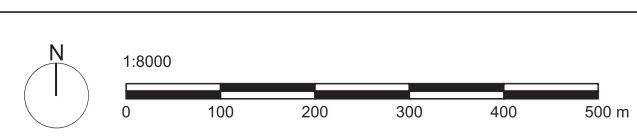
THE LONDON RESORT DEVELOPMENT CONSENT ORDER
PROPOSED DIGITAL INFRASTRUCTURE

Sheet 1 of 1

Application Number
BC080001

Drawing Reference
LR-DG-BUR-DCP-140.1

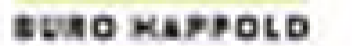
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Legend:

- DCO Order Limits
- Existing Low Pressure Gas
- Existing Medium Pressure Gas
- Proposed Medium Pressure Gas Connection (SGN)
- Proposed Energy Centre
- Proposed Gas Main

- Notes:
1. Existing utilities at Essex Project Site to be mapped at next stage.
 2. No gas connection proposed at the Essex Project Site.
 3. Reference is made to the Utilities Statement (7.6) for details of the gas supply strategy.
 4. All mapped utilities to be confirmed with detailed survey data at next stage.



Project The London Resort	Project No. 0042936
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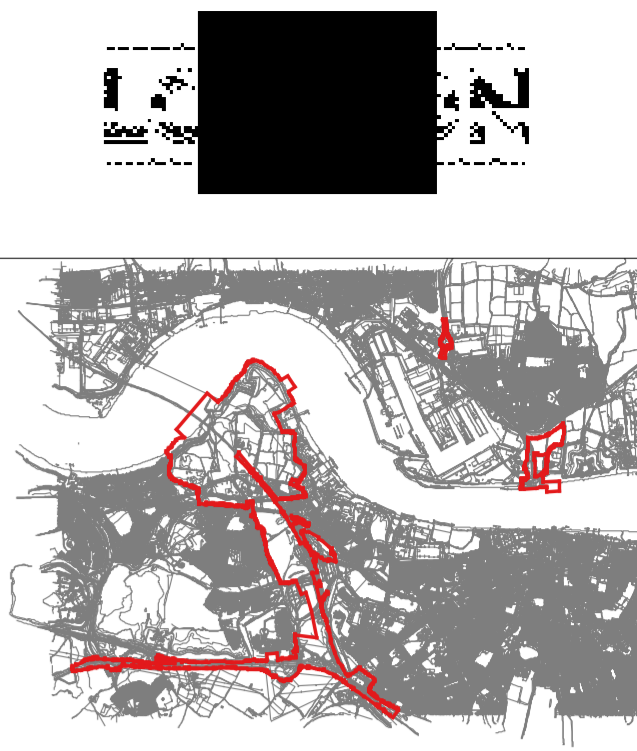
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THE LONDON RESORT DEVELOPMENT CONSENT ORDER
Gas Infrastructure
Sheet 1 of 1

Application Number BC080001		
Drawing Reference LR-DG-BUR-DCP-150.0		
Scale 1:8000 @ A1	Sheet: 1 of 1	Revision 0



- Legend:**
- DCO Order Limits
 - - - Proposed 3 x 33kV circuit
 - Proposed London Resort Substation
 - Ebbsfleet Grid
 - Existing HV
 - Lighthouse power cable
 - Power Cables
 - Pylon power cable
 - Radar power cable

- Notes:**
1. Major power infrastructure shown only.
 2. Existing dry utilities at Essex Project Site to be mapped at next stage.
 3. Location of the proposed sub-station is indicative only and is to be confirmed at next stages of design.
 4. Reference is made to the Utilities Statement (7.6) for details of the power supply strategy.
 5. All mapped utilities to be confirmed with detailed survey data at next stage.



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THE LONDON RESORT DEVELOPMENT CONSENT ORDER
Power Infrastructure
Sheet 1 of 1

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