



Title: Redbridge – Brimsdown (Buckhurst Hill)

LPN Regional Development Plan

Version: 2.2

Date: March 2014

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Document History

Version	Date	Revision Class	Originator	Section Update	Details
1.0/1/2	01-03/2013		Chris Winch		Initial drafts for review
1.3/4/5/6	06/06/13		Chris Winch		Final with 7 th May NAMP, LI and HI profiles
1.7	25/06/13		Sophie Motte		Amendment following document review
1.8	25/06/13		Sophie Motte		P2/6 table included – Initial submission
2.0	21/02/2014	Minor	Panagiotis Xenos	Contents	Updated table of contents
2.0	21/02/2014	Minor	Panagiotis Xenos	1 Executive Summary	Revised and edited the text/content/wording
2.0	21/02/2014	Major	Panagiotis Xenos	1 Executive Summary	Updated NAMP costs summary table
2.0	21/02/2014	Major	Panagiotis Xenos	1 Executive Summary	Updated LI figure
2.0	21/02/2014	Major	Panagiotis Xenos	1 Executive Summary	Updated HI figures
2.0	21/02/2014	Minor	Panagiotis Xenos	2 Network Configuration	Revised and edited the text/content/wording
2.0	21/02/2014	Major	Panagiotis Xenos	2.3 Projects in Progress	Updated NAMP costs summary table
2.0	23/02/2014	Minor	Panagiotis Xenos	3 Network Development Considerations	Revised and edited the text/content/wording
2.0	23/02/2014	Major	Panagiotis Xenos	3.2 Asset Health	Updated HI tables pre-intervention, added HI table for FFC's (Table 9)
2.0	23/02/2014	Minor	Panagiotis Xenos	4 Recommended Strategy	Revised and edited the text/content/wording
2.0	23/02/2014	Major	Panagiotis Xenos	4.3 Proposed Interventions	Updated proposed interventions table
2.0	23/02/2014	Major	Panagiotis Xenos	4.4 Costs and Phasing	Updated NAMP costs summary table
2.0	23/02/2014	Major	Panagiotis Xenos	4.5 HI / LI Improvement	Updated HI tables post-intervention, added HI table for FFC's (Table 18)
2.0	23/02/2014	Minor	Panagiotis Xenos	6 References	Updated references table
2.1	21/03/2014	Major	Panagiotis Xenos	3.6 Network Constraints	Removed section and transferred content to 3.4
2.1	21/03/2014	Minor	Panagiotis Xenos	Contents	Updated table of contents
2.2	27/03/2014	Minor	Regulation	All	Final publication

LPN Regional Development Plan



Redbridge –Brimsdown

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Redbridge -Brimsdown

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1 Executive Summary

This Development Plan reviews the LPN EHV network supplied from Redbridge 275/33kV and Brimsdown (Buckhurst Hill) 275/132kV Grid Supply Points (GSP's) which have an aggregated peak group demand of circa 267MVA (Winter) and 172MVA (Summer) across 6 LPN 11kV substations.

The network is composed entirely of underground cables installed between 1950 and early 1960's with 4 transformer primary substations providing a high level of resilience to this predominantly residential urban area.

No significant developments are predicted for the plan period as the existing supply capacity is well matched to demand.

Targeted asset replacement is proposed to maintain the reliability of switchgear, gas pressure and fluid filled cables.

Proposed Projects >£1M

- Buckhurst Hill – Fairlop Road: FFC cable replacement £1.1M
- Perth Road – Fairlop Road: 33kV gas cable replacement £1.4M

Cost Profiles

Table 1. **Costs Summary (2013-2023), NAMP 19th February 2014**

Cat.	Description	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
A & H	Total Asset Replacement	0	0	0	163,485	681,497	1,505,890	690,125	309,447	739,965	299,660
R	Total Reinforcement	0	0	0	0	0	0	0	0	0	0
	Grand Total	0	0	0	163,485	681,497	1,505,890	690,125	309,447	739,965	299,660

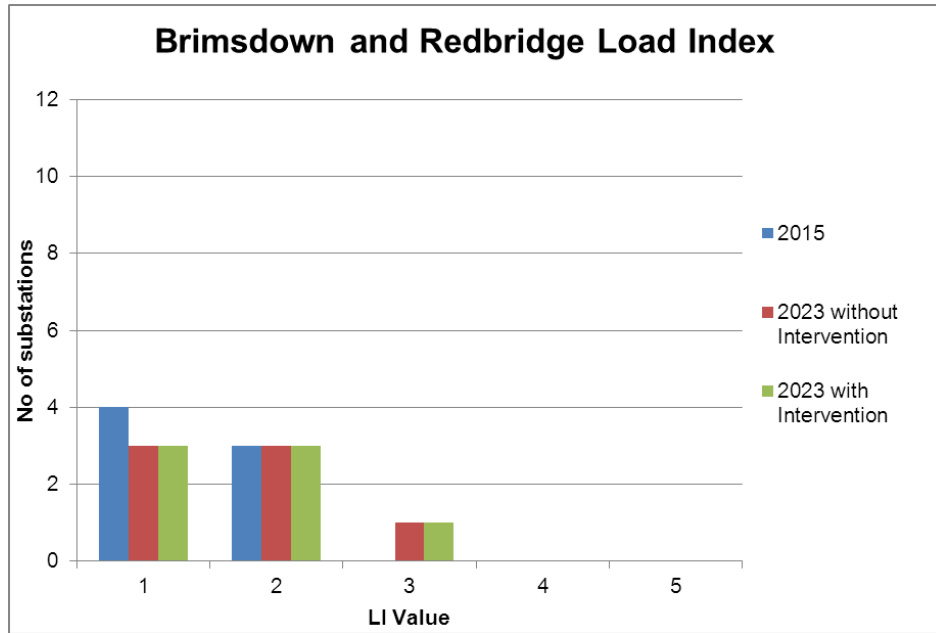
Table 1 above provides the forecast aggregate NAMP cost for network expenditure under this RDP during the last two years of DPCR5 and the ED1 period subject to project feasibility studies and final approval. These costs do not include work in progress, listed in paragraph 2.3.

Output Measures Load Index

The forecast load indices for 2023, with and without intervention, are detailed below.

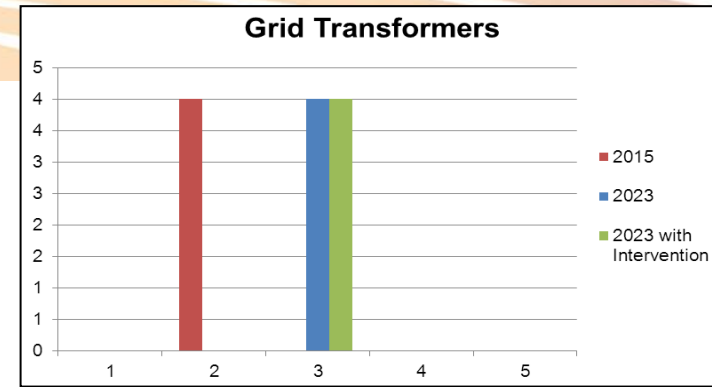
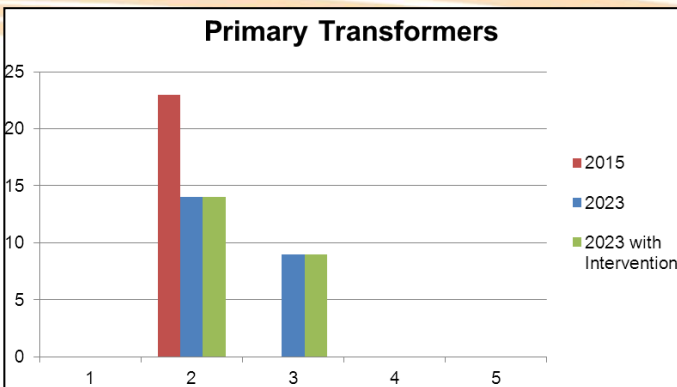
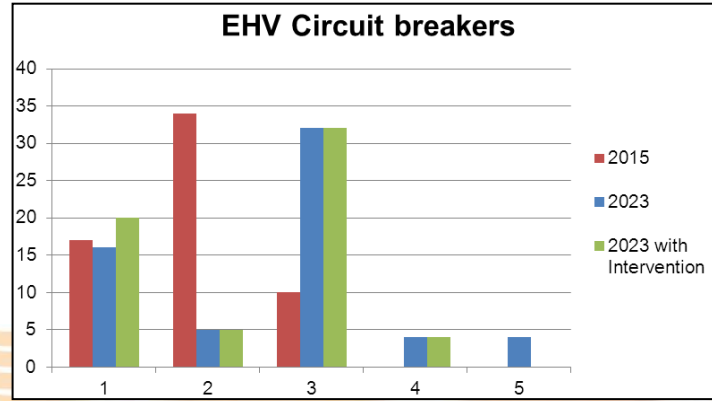
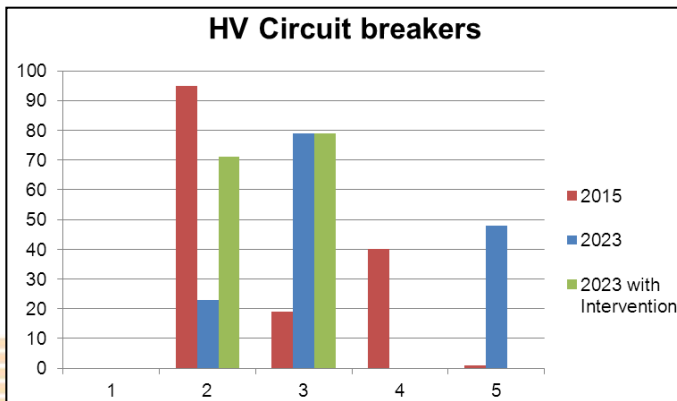
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Output Measures Health Index

The forecast health indices for 2015 and 2023, with and without intervention, for each plant category are detailed below:



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Principal Risks and Dependencies

High levels of street service congestion may introduce delivery risks, both cost and programme, to open-cut cable installations.

The schemes covered in this RDP have been planned based on the planning load estimates dated 27/02/2013 taking into account the 2011/12 maximum demand figures. The load forecasts are based on the Element Energy model. If the economic situation improves there is a risk that there will be shortfall of reinforcement schemes in the plan.

The load forecasts also include an assumed level of embedded generation being connected to the network. Should this generation not materialise, then a larger than forecast load growth could be realised.

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2 Network Configuration

2.1 Existing Network

This Development Plan reviews the LPN EHV network supplied from Redbridge 275/33kV and Brimsdown 275/132kV Grid Supply Points (GSP's). Geographical and network diagrams are included in Appendices A to C.

Redbridge 33kV Substation

Redbridge operational site is shared with National Grid comprising 2x 100MVA and 1x 120MVA SGT's connected to a double busbar, 2 section indoor switchboard. The site is designed to accept a future 4th super grid transformer.

Brimsdown (Buckhurst Hill) 132kV Substation

Brimsdown GSP is located within EPN licence area providing an infeed to the LPN network via 2x 132kV cable circuits with double banked 132/33kV transformers at Buckhurst Hill.

Network Configuration, Grid and Primary Substations

Buckhurst Hill (Brimsdown) - Redbridge interconnected 33kV network is composed entirely of underground cables with the majority of circuits installed in the 1950's and early 1960's.

The network is operated in a ring configuration with an 'open point' at Redbridge to ensure fault levels do not exceed equipment ratings. At Grove Lodge, inline 33kV circuit breakers provide an alternative location for the 'open point'.

Perth Road, Buckhurst Hill and Redbridge are 33kV switching stations with no local demand.

The substation hierarchy and embedded generation totalling 1.97MVA are listed in Tables 2 & 3 below.

Table 2. **Redbridge Group: Grid and Primary Substations**

Redbridge -Brimsdown

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Substation	Voltage kV	Transformers	
		No	Rating MVA
Redbridge	275/33	3	120 / 100
Ley Street	33/11	4	15
Woodgrange Park	33/11	3	15
Perth Road	33	n/a	n/a
Clarks Road	33/11	4	15
Buckhurst Hill	132/33	4	60
Epping New Road	33/11	4	15
Fairlop Road	33/11	4	15
Grove Lodge	33/11	4	15

2.2 Embedded Generation

Table 3. Generation

Generation Plants	Type	Substation	DNC (MVA)	F (%)	pf	DG Output = F*DNC		
						MVA	MW	MVA _r
Bank of England, Printing Works Langston Road	11kV Diesel	Epping New Road	0.315	0	0	0	0	0

Bank of England, Langston Road	11kV Diesel	Epping New Road	1.654	0	0	0	0	0
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2.3 Projects in Progress

As shown in Table 4, the only on-going project in the area is the refurbishment of the Ley Street 11kV circuit breakers, which is programmed to commence in 2014.

Table 4. Ongoing Projects (NAMP 19th February 2014)

Cat.	Reference	Description	2013/14	2014/15	2015/16	2016/17
A	1.50.01.7792	Ley St B - Retrofit 11kV Switchgear	0	130,825	242,639	0

Redbridge -Brimsdown

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On-going works:

7792: Let Street B – Retrofit 11kV switchgear

The condition assessment of the 1962-64 AEI QF Oil Switchgear installed at Ley Street B has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep this asset in use without compromising operational requirements; therefore this project recommends its refurbishment. Completion of the project will see 24 circuit breakers retrofitted.

3 Network Development Considerations

3.1 Development Areas

The network predominantly serves the London Borough of Redbridge (Appendix D - Boundary map refers).

The Local Development Framework (LDF) is currently at a post-consultation stage and the Core Strategy Review document is being shaped. During the period between the 2001 and 2011 censuses the area population increased by 15% resulting in pressure on housing stock and a key element of the plan is to construct 11,400 new homes over 15 years equating to an average of 760 per annum representing a reduction on the current annual target of 905 homes due to a limited number of suitable sites and the Councils determination to protect open spaces and natural areas.

The council also forecast the need for an additional 22 primary school and 44 secondary school forms.

The Borough has 2 Business Improvement Districts (BID) at Ilford and Hainault Business Park with expected infrastructure investments of £1.5m and £0.5M respectively over the next 5 years.

No significant developments have been identified in the adjacent Epping District.

3.2 Asset Health

The forecast health indices (without intervention) for switchgear, transformers and gas pressure and fluid filled cables are tabulated below:

Table 5. HV Circuit Breakers (11kV)

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
CLARKS RD B		28	5				1	27		
EPPING NEW RD		21	3					24		
FAIRLOP RD			1	22	1					24
GROVE LODGE		20	4					24		
LEY ST B			6	18						24

Redbridge -Brimsdown

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WOODGRANGE PARK	26	22	4
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Table 6. EHV Circuit Breakers (33kV)

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BUCKHURST HILL 33KV	1	14	6				1	16	4	
GROVE LODGE 33KV			4							4
PERTH RD B 33KV	16					16				
REDBRIDGE SUPERGRID 33KV		20					4	16		

Table 7. Primary Transformers

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
CLARKS RD B		4					4			
EPPING NEW RD		4					1	3		
FAIRLOP RD		4					2	2		
GROVE LODGE		4						4		
LEY ST B		4					4			
WOODGRANGE PARK		3					3			

Table 8. Grid Transformers (132/33kV)

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BUCKHURST HILL 33KV		4						4		

Redbridge -Brimsdown

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Table 9. Gas Pressure and Fluid Filled Cables (33kV)

Section (Route)	Cable Section	Voltage	2015 HI	2023 HI
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-3-C-F	33	5	5
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-4-A-C	33	3	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-1-A-C	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-1-C-F	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-1-F-I	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-1-I-J	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-2-A-C	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-2-C-F	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-2-F-I	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-2-I-J	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-3-A-C	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-3-F-I	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-3-I-J	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-4-C-F	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-4-F-I	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-4-I-J	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-B-A-C	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-B-C-F	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-B-F-I	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-B-I-J	33	2	2
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-1-A	33	3	3
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-1-B	33	2	3
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-2-A	33	2	3
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-2-B	33	2	3
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-3-A	33	2	2
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-3-B	33	2	3
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-4-A	33	3	3
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-4-B	33	2	2
PERTH ROAD 33KV-CLARKS RD B	CABLE SECTION: 35650514-1-A	33	2	3
PERTH ROAD 33KV-CLARKS RD B	CABLE SECTION: 35650514-2-A	33	2	3
PERTH ROAD 33KV-CLARKS RD B	CABLE SECTION: 35650514-3-A	33	2	2
PERTH ROAD 33KV-CLARKS RD B	CABLE SECTION: 35650514-4-A	33	2	2
PERTH ROAD 33KV-FAIRLOP RD (GAS)		33	4	5
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-2-B	33	4	5
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-1-A	33	2	3
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-1-B	33	2	3
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-2-A	33	2	3
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-3-A	33	2	2
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-3-B	33	2	3
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-4-A	33	2	3
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-4-B	33	2	3
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-3-B	33	4	5
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-1-A	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-1-B	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-1-C	33	2	3
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-2-A	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-2-B	33	2	3
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-2-C	33	2	3
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-3-A	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-3-C	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-4-A	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-4-B	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-4-C	33	2	3
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-2-B	33	3	3
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-1-A	33	2	2
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-1-B	33	2	3
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-2-A	33	2	3
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-3-A	33	2	2
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-3-B	33	2	2
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-4-A	33	2	3
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-4-B	33	2	3

Redbridge -Brimsdown

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3.3 Security of Supply and Load Index Analysis

The forecast demands referenced against the site firm capacity are detailed in Table 10 below (February 2013 PLE). Highlighted in orange are any loads that exceed the substation firm capacity plus any post fault transfer capability.

Table 10. P2/6 Assessment Table

Sub-station	Secondary Voltage	Firm Capacity (MW)	Transfer (MW)	Winter 12/13 Summer 2012 (M W)	Winter 13/14 Summer 2013 (M W)	Winter 14/15 Summer 2014 (M W)	Winter 15/16 Summer 2015 (M W)	Winter 16/17 Summer 2016 (M W)	Winter 17/18 Summer 2017 (M W)	Winter 18/19 Summer 2018 (M W)	Winter 19/20 Summer 2019 (M W)	Winter 20/21 Summer 2020 (M W)	Winter 21/22 Summer 2021 (M W)	Winter 22/23 Summer 2022 (M W)
Brimsdown n	132kV	741.00		120.74	121.28	122.30	123.46	124.46	125.59	126.75	127.96	129.20	130.95	132.76
Brimsdown n	132kV	654.20		76.34	76.68	77.32	78.04	78.68	79.38	80.11	80.87	81.65	82.75	83.88
Buckhurst Hill 33kV via Brimsdown n	33kV	147.70		117.32	117.87	118.88	120.04	121.05	122.17	123.34	124.54	125.79	127.54	129.34
Buckhurst Hill 33kV via Brimsdown n	33kV	115.80		76.34	76.68	77.32	78.04	78.68	79.38	80.11	80.87	81.65	82.75	83.88
Epping New Road	11kV	57.92		50.56	50.81	51.26	51.75	52.18	52.65	53.15	53.65	54.18	54.90	55.63
Epping New Road	11kV	42.75		33.34	33.49	33.78	34.09	34.37	34.67	34.98	35.31	35.64	36.10	36.57
Fairlop	11kV	56.75		37.20	37.33	37.58	37.88	38.15	38.45	38.75	39.07	39.39	39.88	40.39
Fairlop	11kV	42.75		24.40	24.48	24.64	24.83	25.00	25.19	25.38	25.58	25.79	26.10	26.42
Grove Lodge	11kV	56.75		30.28	30.47	30.79	31.15	31.47	31.83	32.21	32.59	33.00	33.55	34.12
Grove Lodge	11kV	42.75		18.64	18.74	18.94	19.15	19.34	19.56	19.78	20.01	20.25	20.58	20.92
Clarks Road	11kV	56.75		44.02	44.37	44.96	45.58	46.09	46.68	47.28	47.89	48.51	49.32	50.15
Clarks Road	11kV	42.75		28.88	29.10	29.48	29.87	30.20	30.57	30.95	31.34	31.74	32.25	32.78
Ley Street	11kV	57.92		39.06	39.26	39.63	40.04	40.39	40.79	41.19	41.61	42.03	42.63	43.25
Ley Street	11kV	44.55		25.02	25.14	25.37	25.62	25.83	26.07	26.32	26.58	26.83	27.20	27.58
Redbridge Supergrid 33kV	33kV	215.60		133.89	134.85	136.47	138.21	139.67	141.30	142.98	144.70	146.46	148.76	151.11
Redbridge Supergrid 33kV	33kV	207.80		86.49	87.11	88.16	89.29	90.22	91.28	92.37	93.48	94.61	96.10	97.61
Woodgrange Park	11kV	56.70	13.05	46.53	46.95	47.61	48.32	48.91	49.57	50.25	50.95	51.65	52.55	53.46
Woodgrange Park	11kV	41.85	13.75	30.84	31.11	31.54	31.99	32.37	32.80	33.23	33.68	34.13	34.71	35.29

Table 11. LI Table Without Intervention

Substation	Voltage kV	Load Index	
		2015	2023
Epping New Road	33/11	2.00	3.00
Fairlop	33/11	1.00	1.00
Grove Lodge	33/11	1.00	1.00
Buckhurst Hill 33kV via Brimsdown	132/33	2.00	2.00
Clarks Road	33/11	1.00	2.00
Ley Street	33/11	1.00	1.00
Woodgrange Park	33/11	2.00	2.00

Redbridge -Brimsdown

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3.4 Operational and Technical Network Constraints

Locations where an incident can cause complete or partial loss of a substation (such as cable bridges, cable tunnels or railway crossings) have been looked at. No such location has been identified in the Redbridge – Brimsdown area.

3.5 National Grid

No National Grid works are programmed in the area for this period.

3.6 Smart Demand Response

No sites have been identified as suitable for implementation of Demand Side Response (DSR) in ED1.

4 Recommended strategy

The network strategy for this area is designed to ensure:

- Continued adherence to the security of supply criteria defined in Engineering Recommendation P2/6
- Maintaining reliable network operation by asset replacement, or refurbishment, of poorly performing equipment identified through asset condition monitoring (HI) techniques

Whenever possible the asset replacement and reinforcement works are to be co-ordinated to achieve an efficient economic solution.

4.1 Asset Replacement

4.1.1 Switchgear

The health index (HI) analysis predicts that two sites, Fairlop Road and Grove Lodge, require intervention due to deteriorating condition. The 33kV switchgear at Grove Lodge will be replaced however the scope of works at Fairlop Road involves retrofit of the interrupter mechanisms rather than complete switchboard replacement. Ley Street 11kV switchgear is currently being retrofitted and will be re-commissioned in 2015.

4.1.2 Cables

One gas pressure (Perth Road to Fairlop Road) and three fluid filled 33kV cable circuits (Buckhurst Hill to Fairlop Road, Redbridge Supergrid to Grove Lodge and Redbridge Supergrid to Perth Road) have been identified as requiring intervention due to deteriorating condition.

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4.2 Reinforcement

The Borough Council's Local Development Frame Work, although still at the consultation phase, does not identify any significant infrastructure or regeneration projects. Forecast residential development is below the current annual target and is therefore not expected to impact upon the demand growth trend.

4.3 Proposed Interventions

Table 12. Proposed Interventions at Substations

Substation	Driver	Commissioning Year	Scope of works	Existing Firm capacity	New Firm capacity
Grove Lodge	Asset Health	2017	Replace 33kV switchgear	58.5MVA	No change
Fairlop Road	Asset Health	2022	Retrofit 11kV switchgear	58.5MVA	No change

Switchgear: The interventions will be replacement or refurbishment basis as appropriate to the type of switchgear.

Reinforcement: No schemes are proposed.

4.4 Costs and Phasing

Table 13. Proposed Projects – NAMP 19th February 2014

Cat.	Reference	Description	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
A	1.07.90.8305	Perth Rd-Fairlop 33kV Gas Cable Replacement	0	0	0	0	0	690,125	690,125	0	0	0
A	1.48.02.7781	Buckhurst Hill 33kV - Refurb 33kV Switchgear	0	0	0	0	0	0	0	0	0	99,489
A	1.48.02.7785	Grove Lodge 33kV - Replace 33kV Switchgear	0	0	0	163,485	358,556	0	0	0	0	0
A	1.50.01.7791	Fairlop Rd - Retrofit 11kV Switchgear	0	0	0	0	0	0	0	0	117,744	200,171
H	1.29.01.7942	Redbridge Supergrid 33kV-Perth Road 33kV (Circuit 3-B)- 33kV FFC	0	0	0	0	0	0	0	141,784	272,291	0
H	1.29.01.7943	Redbridge Supergrid 33kV-Grove Lodge (Circuit 2-B) - 33kV FFC	0	0	0	0	0	0	0	167,663	349,930	0
H	1.29.01.7945	Buckhurst Hill to Fairlop Rd (Circuit 3-C-F) - 33kV FFC Replacement	0	0	0	0	322,942	815,765	0	0	0	0

4.5 HI / LI Improvement

Projected Asset Health Indices (With Investment)

Health indices for all network equipment covered in this RDP with investments are listed in red font in Tables 14 to 18 below. The equipment groups covered include HV circuit breakers (11kV), EHV circuit breakers (33kV), primary transformers (33/11kV), grid transformers (132/33kV) and gas pressure and fluid filled cables (33kV).

Red numbers indicate changes due to ED1 projects. Note: There are no HI's for solid cables replacing existing fluid filled or gas pressure cables.

Table 14. HV Circuit Breakers (11kV)

Redbridge -Brimsdown

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Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
CLARKS RD B		28	5				1	27		
EPPING NEW RD		21	3					24		
FAIRLOP RD			1	22	1		24			
GROVE LODGE		20	4					24		
LEY ST B			6	18			24			
WOODGRANGE PARK		26					22	4		

Table 15. EHV Circuit Breakers (33kV)

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BUCKHURST HILL 33KV	1	14	6				1	16	4	
GROVE LODGE 33KV			4			4				
PERTH RD B 33KV	16					16				
REDBRIDGE SUPERGRID 33KV		20					4	16		

Table 16. Primary Transformers

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
CLARKS RD B		4					4			
EPPING NEW RD		4					1	3		

FAIRLOP RD		4					2	2		
GROVE LODGE		4						4		
LEY ST B		4					4			
WOODGRANGE PARK		3					3			

Table 17. Grid Transformers (132/33kV)

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BUCKHURST HILL 33KV		4						4		

Delivery of the proposed plan will ensure that all equipment will be HI4 or lower by the end of ED1.

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All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Table 18. Gas Pressure and Fluid Filled Cables (33kV)

Section (Route)	Cable Section	Voltage	2015 HI	2023 HI
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-3-C-F	33	5	N/A
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-4-A-C	33	3	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-1-A-C	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-1-C-F	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-1-F-I	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-1-I-J	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-2-A-C	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-2-C-F	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-2-F-I	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-2-I-J	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-3-A-C	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-3-F-I	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-3-I-J	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-4-C-F	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-4-F-I	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-4-I-J	33	2	3
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-B-A-C	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-B-C-F	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-B-F-I	33	2	2
BUCKHURST HILL 33KV-FAIRLOP RD	CABLE SECTION: 35070526-B-I-J	33	2	2
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-1-A	33	3	3
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-1-B	33	2	3
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-2-A	33	2	3
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-2-B	33	2	3
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-3-A	33	2	2
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-3-B	33	2	3
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-4-A	33	3	3
BUCKHURST HILL 33KV-GROVE LODGE	CABLE SECTION: 35070534-4-B	33	2	2
PERTH ROAD 33KV-CLARKS RD B	CABLE SECTION: 35650514-1-A	33	2	3
PERTH ROAD 33KV-CLARKS RD B	CABLE SECTION: 35650514-2-A	33	2	3
PERTH ROAD 33KV-CLARKS RD B	CABLE SECTION: 35650514-3-A	33	2	2
PERTH ROAD 33KV-CLARKS RD B	CABLE SECTION: 35650514-4-A	33	2	2
PERTH ROAD 33KV-FAIRLOP RD (GAS)		33	4	N/A
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-2-B	33	4	N/A
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-1-A	33	2	3
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-1-B	33	2	3
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-2-A	33	2	3
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-3-A	33	2	2
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-3-B	33	2	3
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-4-A	33	2	3
REDBRIDGE SUPERGRID 33KV-GROVE LODGE	CABLE SECTION: 35770534-4-B	33	2	3
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-3-B	33	4	N/A
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-1-A	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-1-B	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-1-C	33	2	3
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-2-A	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-2-B	33	2	3
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-2-C	33	2	3
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-3-A	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-3-C	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-4-A	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-4-B	33	2	2
REDBRIDGE SUPERGRID 33KV-PERTH ROAD 33KV	CABLE SECTION: 35773565-4-C	33	2	3
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-2-B	33	3	3
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-1-A	33	2	2
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-1-B	33	2	3
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-2-A	33	2	3
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-3-A	33	2	2
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-3-B	33	2	2
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-4-A	33	2	3
REDBRIDGE SUPERGRID 33KV-WOODGRANGE PARK	CABLE SECTION: 35770697-4-B	33	2	3

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Projected Load Indices (With Investment)

Substation	Voltage kV	2023 Load Index	
		Without Investment	With Investment
Epping New Road	33/11	3.00	3.00
Fairlop	33/11	1.00	1.00
Grove Lodge	33/11	1.00	1.00
Buckhurst Hill 33kV via Brimsdown	132/33	2.00	2.00
Clarks Road	33/11	2.00	2.00
Ley Street	33/11	1.00	1.00
Woodgrange Park	33/11	2.00	2.00

5 Alternative Strategies

No material changes to the network are proposed during ED1 with the recommended strategy formulated to maintain the operational integrity of the existing assets.

6 References

References	Description
Reference 1	Planning Load Estimates February 2013 (Element Energy)
Reference 2	LPN Standard Running Arrangements (SRA's) March 2012
Reference 3	Asset Condition Reports June 2013
Reference 4	London Borough of Redbridge Local Development Framework
Reference 5	NAMP LPN Table J Less Ind. 19 th February 2014

6.1 Appendices

Redbridge -Brimsdown

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Appendix	Description
Appendix A	Geographical Diagram
Appendix B	Single Line Diagram – Buckhurst Hill Existing Network
Appendix C	Single Line Diagram – Redbridge Network
Appendix D	London Borough Boundary Schematic

6.2 Document History

Version	Date of Issue	Author	Details
1.0/1/2	Jan-March 2013	Chris Winch	Initial drafts for review
1.3/4/5/6	06/06/13	Chris Winch	Final with 7 th May NAMP, LI and HI profiles
1.7	25/06/13	Sophie Motte	Amendment following document review
1.8	25/06/13	Sophie Motte	P2/6 table included
2.0	28/02/14	Panagiotis Xenos	Amended for ED1 Plan Resubmission
2.1	21/03/14	Panagiotis Xenos	Final amendments for ED1 Plan Resubmission

7 Document Approval

Sign-off of this Mandate certifies that the Sponsor has ratified the above and approval is sought to proceed to the development of the necessary PG&C Gate B documentation.

Recommended by:

Name	Role	Signature	Date
Panagiotis Xenos	Infrastructure Planner		
Sophie Motte	IDP Coordinator LPN		
Chris Winch	Infrastructure Planning Manager (South)		

Approval by:

Redbridge -Brimsdown

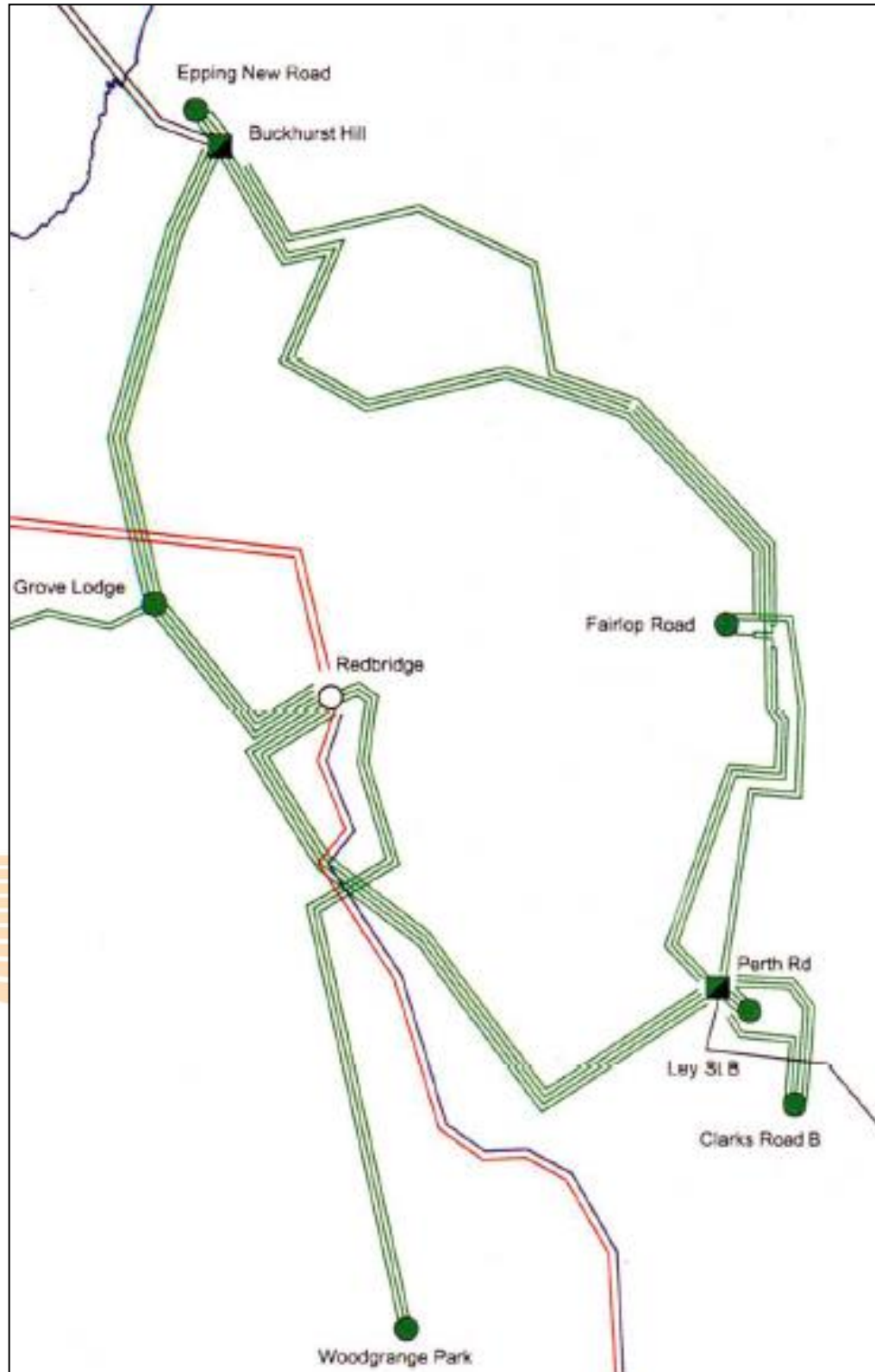
All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Name	Role	Signature	Date
Robert Kemp	Head of System Development		
Barry Hatton	Director of Asset Management		

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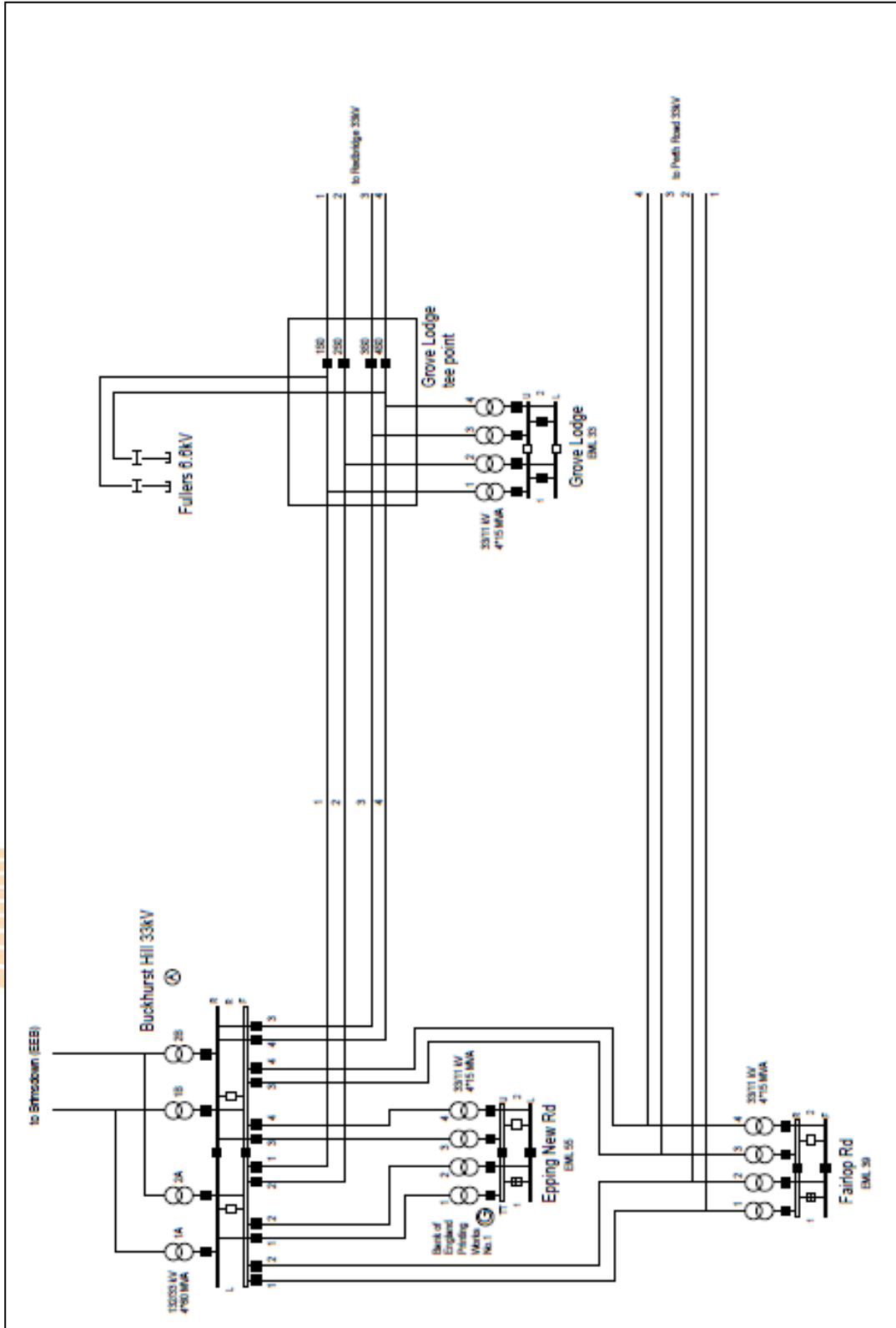
Appendix A: Geographical Diagram



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Appendix B: Single Line Diagram (Part 1) Buckhurst Hill



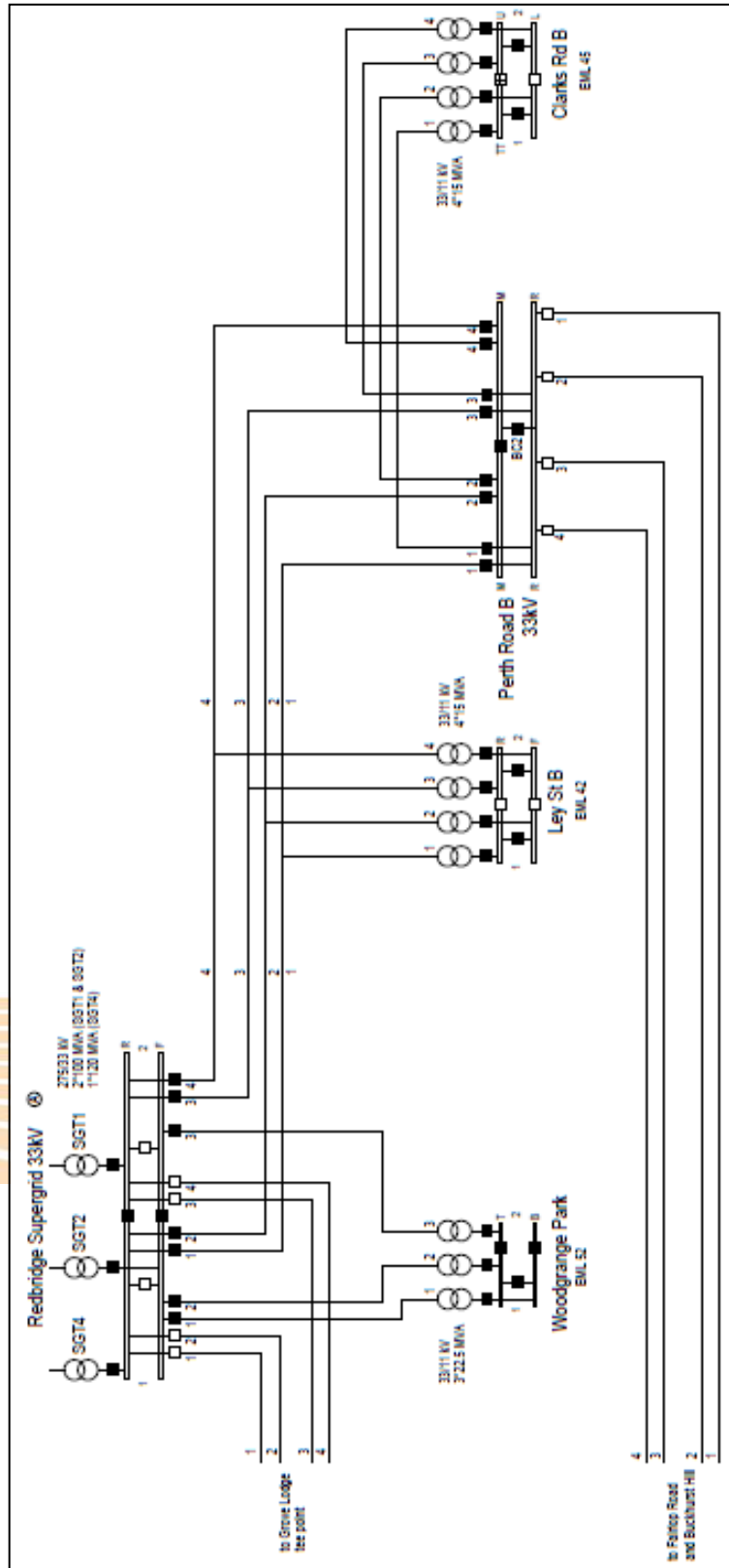
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Appendix C: Single Line Diagram (Part 2) Redbridge



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Appendix D: London Borough Boundaries

