Title: Beddington

SPN Regional Development Plan

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Version	Date	Revision Class	Originator	Section Update	Details
1.2	22/02/2014	Minor	Itayi Utah	Cover page	Version and date update
1.2	22/02/2014	Minor	Itayi Utah	Contents	Update
1.2	22/02/2014	Major	Itayi Utah	1.1 Executive Summary	Wording
1.2	22/02/2014	Major	Itayi Utah	1.2 Proposed Projects (>£1M)	Update of Costs and removal of unwanted projects
1.2	22/02/2014	Major	Itayi Utah	1.3 Costs Profile	Costs update
1.2	22/02/2014	Major	Itayi Utah	1.4 Output Measures	LI's update
1.2	22/02/2014	Major	Itayi Utah	2.2 Embedded Generation (G59/2)	Embedded generation update
1.2	22/02/2014	Major	Itayi Utah	2.3 Projects in Progress	NAMP table and wording update
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1.2	22/02/2014	Major	Itayi Utah	4.2 Reinforcement	Remove unwanted projects, correct dates
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1.3	26/03/2014	Major	Sharon Green	Whole document	Formatting of all headings and text. Spelling and grammar corrections.
1.3	26/03/2014	Minor	Sharon Green	Contents	Update
1.3	26/03/2014	Minor	Sharon Green	1.2 Proposed Projects (>£1M)	Formatting and removal of unnecessary text
1.3	26/03/2014	Minor	Sharon Green	1.3 Costs Profile	Added reference to 19th Feb NAMP
1.3	26/03/2014	Minor	Sharon Green	2.3 Projects in Progress	Added reference to 19th Feb NAMP

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1.3	26/03/2014	Minor	Sharon Green	2.3 Projects in Progress	Project text modified
1.3	26/03/2014	Major	Sharon Green	3.4 Operational and technical constraints	Table 13 removed. New text added.
1.3	26/03/2014	Minor	Sharon Green	4.3 Costs and phasing	Added reference to 19th Feb NAMP
1.3	26/03/2014	Major	Sharon Green	4.4 HI/LI Improvement	Tables 19, 20 and associated text removed.
1.3	26/03/2014	Major	Sharon Green	6 References	NAMP and PLE reference updated
2.0	27/03/2014	Minor	Regulation	All	Final publication

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Contents

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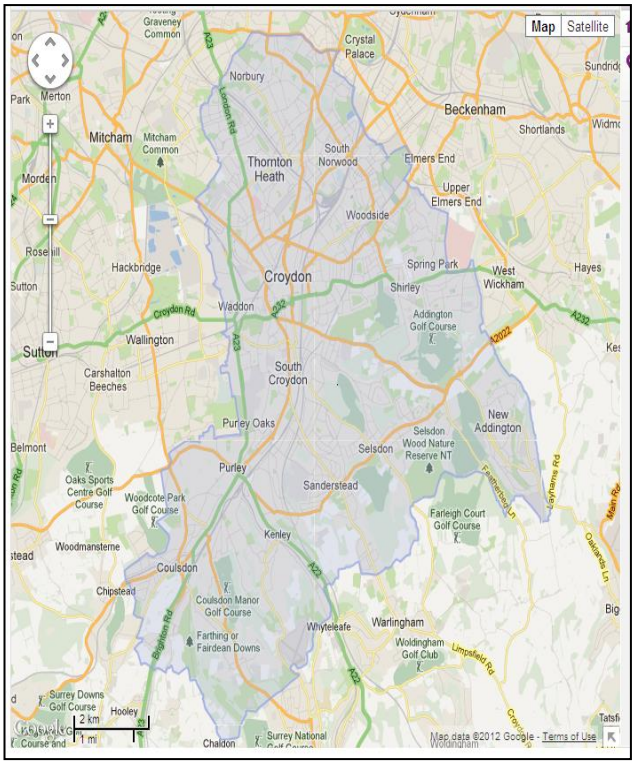
1 Introduction

1.1 Executive Summary

This Regional Development Plan (RDP) reviews UK Power Networks (UKPN)'s SPN EHV network supplied from Beddington 400/132kV Grid Supply Point (GSP) with an aggregate total demand of 521MW (Winter-W) and 339MW (Summer-S) across 8 SPN 132kV grid substations and 26 SPN 33kV primary substations. The firm capacity for Beddington GSP is 829.4MW (W) and 732.7MW (S) with forecast demand by 2023 of 565MW (W) and 384.6MW (S). Geographically the network footprint covers London Borough of Croydon and its surrounding local areas as illustrated in figures 1 an 2 below. Croydon Borough has the largest population of any London borough with a total population of circa 339,000 people and 150,000 homes.

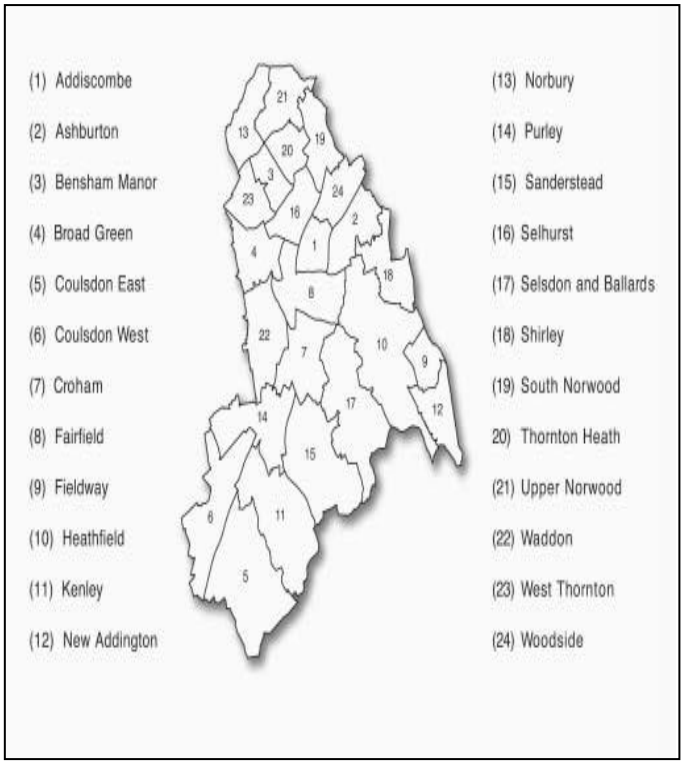
London Borough of Croydon's Local Development Framework (LDF) and Core Strategy (CS) includes the Croydon Metropolitan Centre (CMC) regeneration, which is expected to result in 22MW of new demand that can be supported from Croydon Central 33/11kV primary substation, which has a firm capacity of 39.6 MW (W) and 29.7MW (S) and current maximum demand (MD) of 5.1MW (W) and 5.9MW (S). The new load will result in a combined forecast total load demand of 27.1MW (W) and 27.9MW (S) if the proposed CMC regeneration goes ahead. It is proposed to work proactively with the local planning authority and all principal land developers to develop a resilient and reliable network to accommodate 21,510 new houses earmarked for development up to 2031. However the proposed London Borough of Croydon's development strategy is outside the control of UK Power Networks and the programme is expected to be volatile.

Figure 1 Croydon Borough Map



(Source - www.croydon.gov.uk)

Figure 2 Croydon Borough Ward Map



(Source - www.croydon.gov.uk)

Reinforcement of five primary substations and transfer of load from highly loaded sites to sites with more capacity headroom is part of the recommended strategy under this RDP. Selective and targeted asset replacement schemes are proposed to maintain the reliability of switchgear, transformers and cables.

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DPCR5 major works currently under construction or approved and scheduled to start soon include Croydon B Grid GT2 and 33kV switchboard decommissioning, Norbury Primary load transfer and Beddington-Purley 132kV GPC replacement. Replacement of Purley Local T1 and T2 was completed recently. Recovery of the poor asset health GT2 and the L120T 33kV switchgear at Croydon B has been suspended pending completion of the Croydon Grid –Croydon B 33kV interconnector.

1.2 Proposed projects (>£1M)

The projects listed below are identified in this RDP and 19th February 2014 NAMP for implementation during the current DPCR5 and ED1 periods.

- Beddington/Purley - Gas Pressure Cable Replacement – **£ 1,976k**
- Beddington Local 33kV-Sutton Grid 33kV - 33kV FFC replacement – **£ 1,725k**
- East Croydon 33/6.6kV - Replace Primary Transformer (T1, T2) – **£ 1,104k**
- Norbury Primary - Transfer Load to Croydon B - **£ 1,848k**
- Addington Local - Replace Primary Transformers (T1, T2) **£ 1,081k**
- Addington Local. Replace 11kV switchgear **- £ 2,153k**
- West Wickham 33/11kV - Replace Primary Transformer (T1, T2) – **£ 1,010k**
- St Helier 33kV/11kV – ITC – **£ 3,348k**
- Beddington-Addington Grid - 132kV Fluid filled cable replacement – **£ 11,099k**
- Purley Grid: 33kV Interconnection to Addington – **£4,154k**
- Sutton B 33/11kV Reinforcement – **£1,177k**

1.3 Costs profile

Table 1 - NAMP Costs Summary (2014-2023) – Table J Less Indirects 19th February 2014

SR _ Table J - S&R - Baseline_Final_RIIO_ED1 Re-Submission_19th Feb_2014 _15:15 (£)													
Description		2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	DPCR5 Total	Total ED1
A &H	Total Asset Replacement	816,519	1,514,409	3,327,485	5,715,618	4,666,735	1,479,068	3,135,713	293,267	1,601,260	686,366	2,330,928	**20,905,511**
Q & R	Total Reinforcement	3,059,848	4,247,940	1,059,102	1,059,102	1,588,848	115,172	345,517	22,923	198,811	519,902	7,307,789	**4,909,378**
	GRAND TOTAL	**3,876,368**	**5,762,349**	**4,386,587**	**6,774,720**	**6,255,583**	**1,594,240**	**3,481,229**	**316,190**	**1,800,071**	**1,206,268**	**9,638,717**	**25,814,889**

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.

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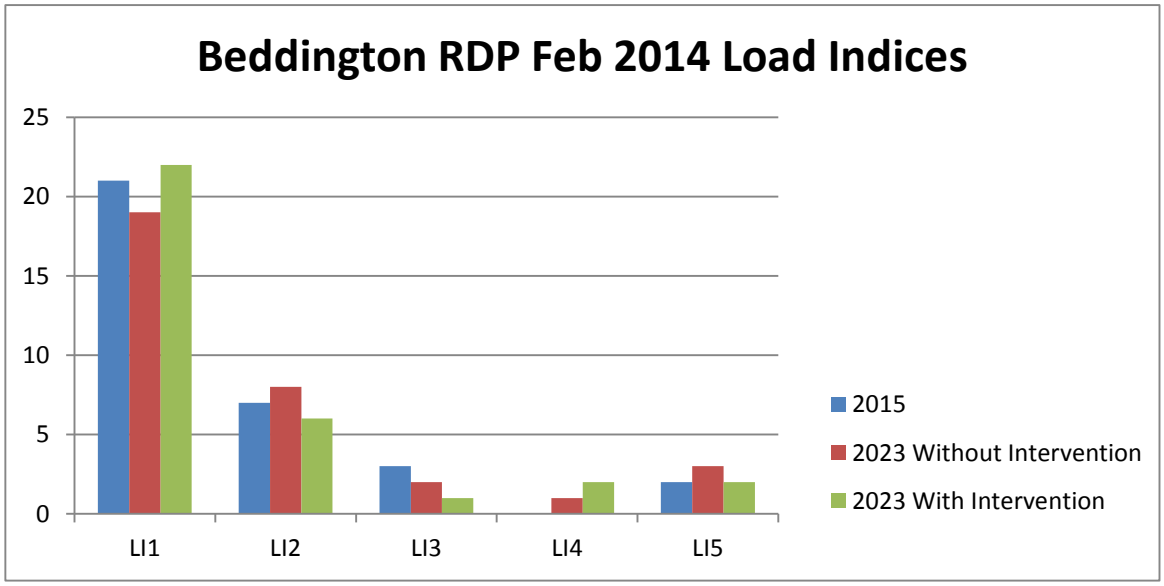
1.4 Output Measures

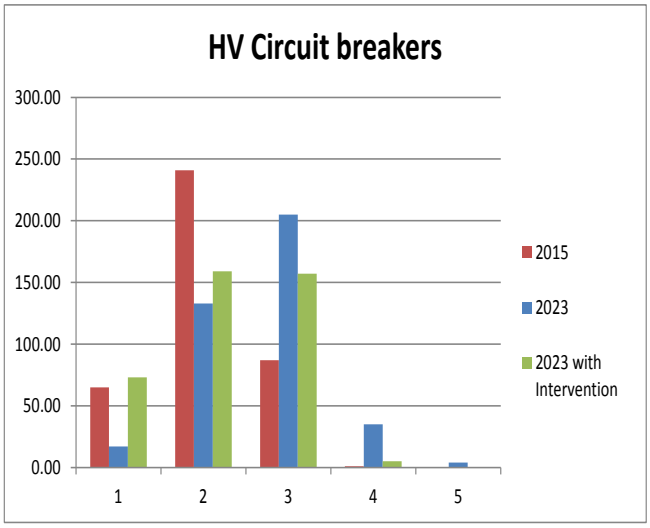
The forecast load indices for 2023, with and without intervention, are detailed below:

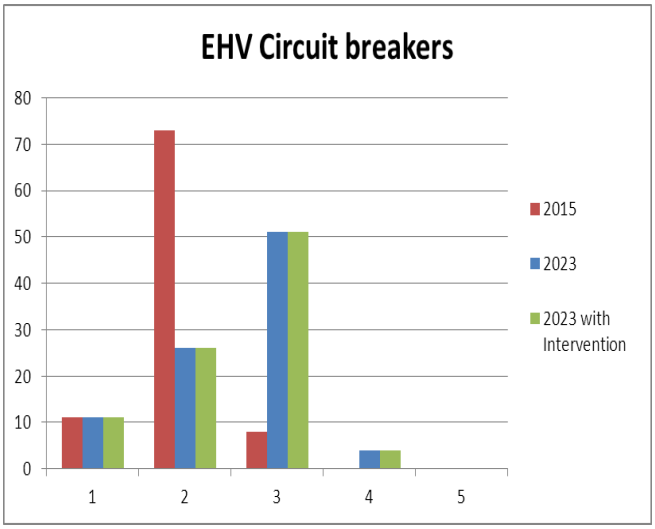


The above chart provides an illustration of load indices before and after proposed investment and intervention strategies for all substations covered in this RDP. The substations projected to be LI 4/5 at the end of ED1 include Sutton B, Caterham, Croydon Central and Croydon B.

1.5 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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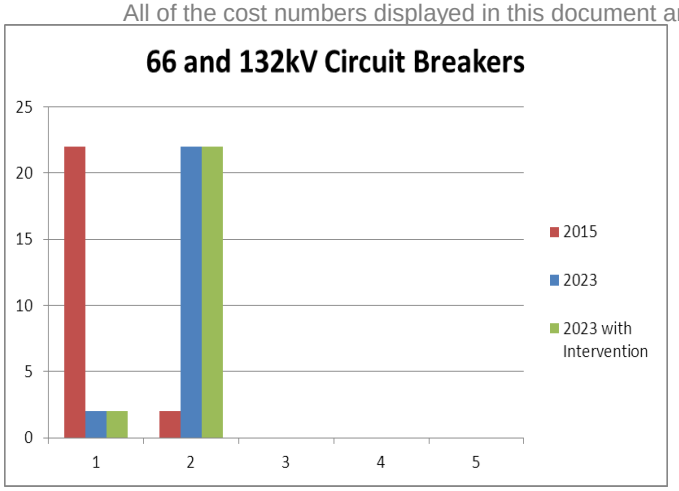

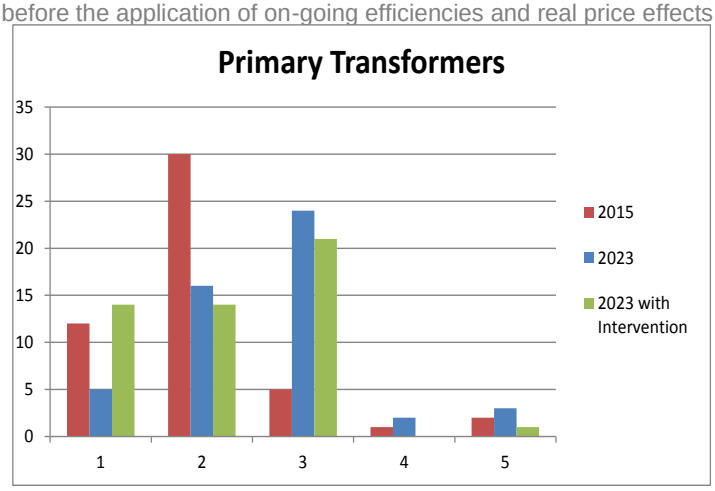

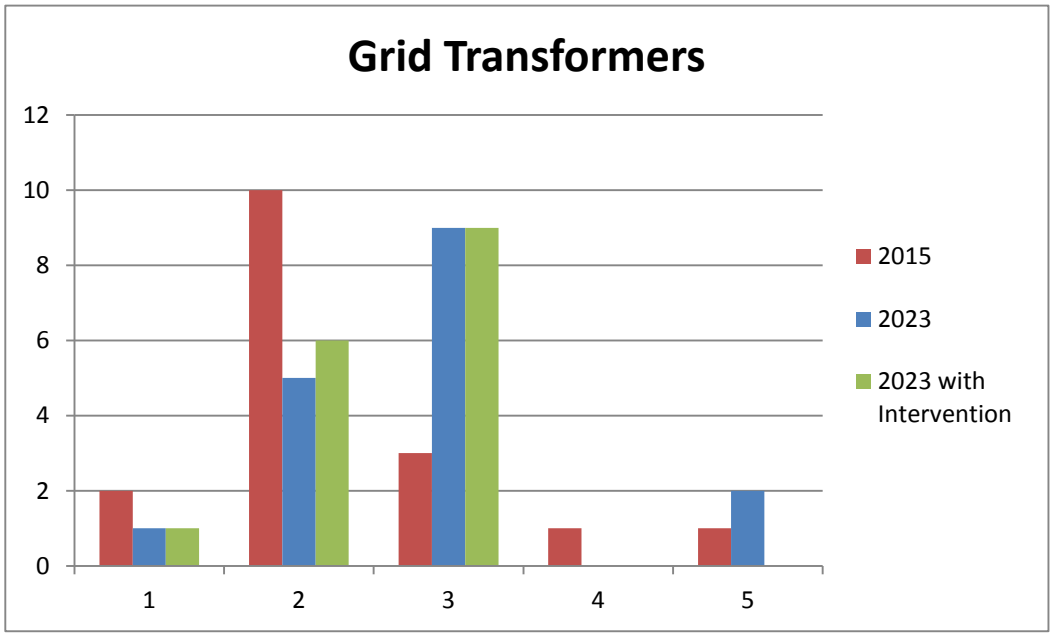

The charts above provide projected health indices for network assets considered under this RDP during the ED1 period with and without investment.

1.6 Principle Risks and Dependencies

The schemes covered in this RDP have been planned based on the planning load estimates 2013. The load forecasts have assumed a poor economic and low growth future. If the economic situation should improve beyond current expectations there is a risk that there will be shortfall of reinforcement schemes planned.

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

Where Demand Site Response has been included at a substation, this is based on an assumption that customers will be willing to accept the scheme. In most cases these customers have not as yet been identified.

The decommissioning of Croydon B GT2 and 33kV L120 switchgear is dependent on the completion of the new Croydon Grid-Croydon B 33kV interconnector.

The replacement of Beddington-Purley 132kV gas pressurised cable circuits is dependent on the provision of 33kV contingency to support for Purley Grid load to cover N-3 conditions.

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2 Network configuration

2.1 Existing Network

This Regional Development Plan reviews the SPN EHV network supplied from Beddington 400/132kV Grid Supply Point (GSP).

Beddington GSP

Beddington GSP is located within a National Grid site comprising 400/275/132/33kV assets supplying LPN and SPN networks. The site is located in a busy combined housing, industrial and commercial area of London Borough of. Wayleave easements and consents for cable routes in and out of the site are difficulty to acquire if not almost impossible because the road leading into the site is privately owned.

Figure 3: Beddington GSP Site Map

The 132kV double busbar GIS at Beddington GSP is fed via 4x240MVA 400/132kV super grid transformers (SGT's) and has 18x132kV outgoing circuits, which include the following 132kV feeders: -

Addington Grid 2x60MVA, 1x30MVA 132/33kV – Connection is via 2x132kV composite circuits comprising 6.5km 132kV oil filled cables and 2.46km OHL each. The oil filled cables are rated 87MVA (W) and 78 (S) while the OHL conductors are rated 130MVA (W) and 105MVA (S). The site is located in a residential area. Primary substations fed from Addington Grid include Addington Grid 33/11kV, Addington Local, Biggin Hill, Selsdon and West Wickham

Ashburton Grid 2x90MVA 132/33kV – Connection is via 2x5.7km 132kV oil filled cables rated 97MVA (W) and 81MVA (S). The site is located in a residential area and located in a land depression, which highly prone to flooding. Primary substations fed from Ashburton Grid include Selhurst, Shirley, Suffolk Road and Network Rail.

Beddington Grid 2x60MVA 132/33kV – This site is located within the GSP substation perimeter fence and connected via 2x0.9km 132kV cables rated 205MVA (W) and 185MVA (S). The 60MVA transformers are being installed currently owing to poor asset health of the previously installed 30MVA transformers. However the transformer tails, which run over a distance of 200m to the 33kV switchboard are limited to 38MVA (W) and 32MVA (S), which is way below the rating of the newly installed 60MVA transformers hence need replacement

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in the near future in order to benefit from the extra capacity provided by the new transformers. Currently Beddington Grid only supplies East Croydon primary but can also supply West Croydon and St Helier directly.

Beddington Local/Bridges Lane Grid 2x30/30MVA double wound secondary 132/11kV transformers – This site is located close to the GSP substation and connected via 2x0.9km 132kV cables rated 205MVA (W) and 185MVA (S). The 60MVA transformers are secondary dual wound transformers each split between Beddington Local and Bridges Lane 11kV switchboards. The Beddington Local 11kV switchboard is directly interconnected with Prologis 11kV switchboard, which is a high demand customer data centre.

Croydon Grid 2x90MVA 132/333kV – Connection is via 2x132kV composite circuits comprising 0.9km 132kV cables and 1.4km OHL each. The oil filled cables are rated 205MVA (W) and 185MVA (S) while the OHL conductors are rated 158MVA (W) and 139MVA (S). Primary substations fed from Croydon Grid include Croydon Grid 33/11kV, Croydon Central, Croydon A, Norbury and Spurgeons Bridge

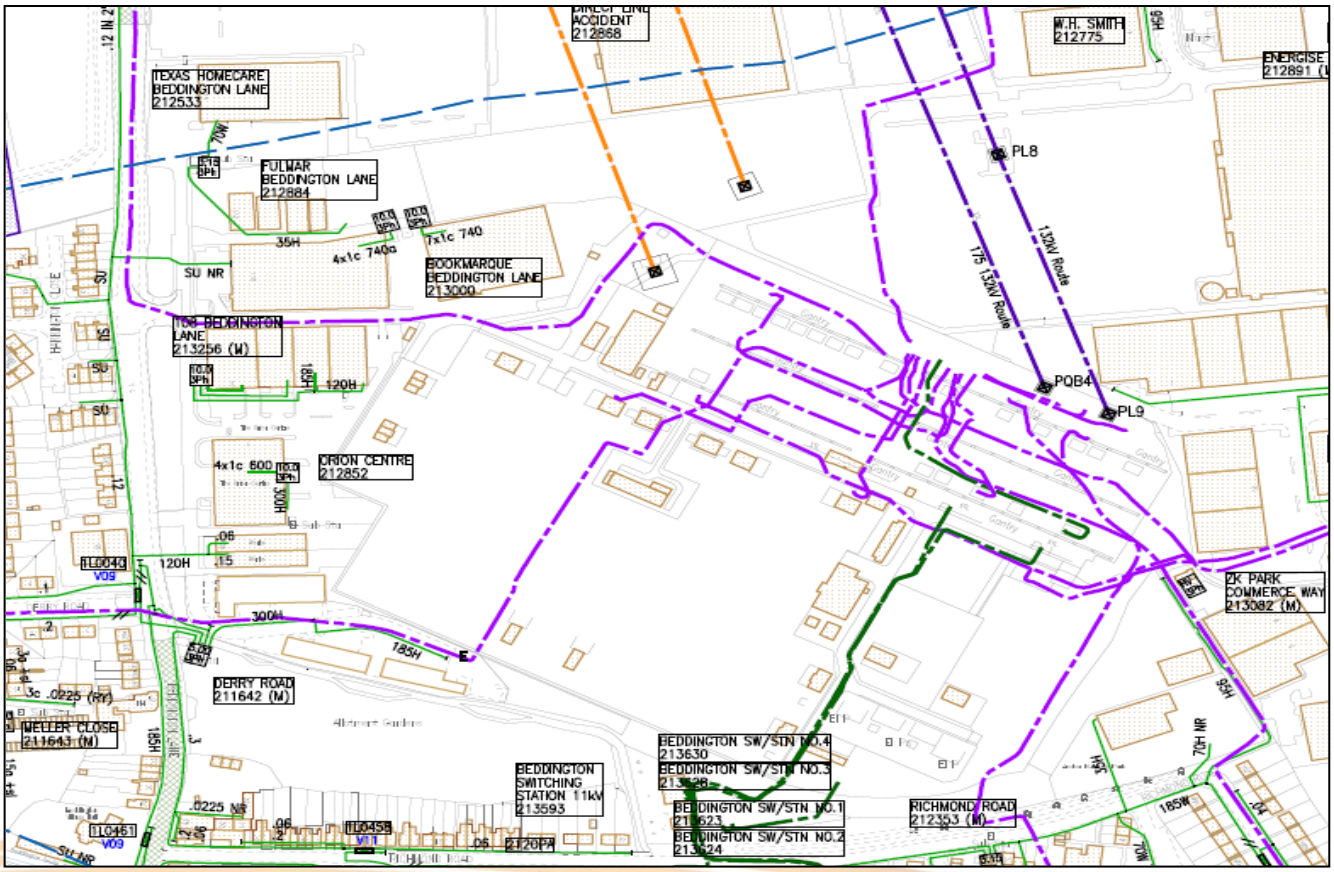
Croydon B 1x60/90MVA, 1x45MVA 132/33kV – Connection is via 2x132kV composite circuits comprising 0.9km 132kV cables and 0.7km OHL each. The cables are rated 205MVA (W) and 185MVA (S) while the OHL conductors are rated 130MVA (W) and 105 (S). The 45MVA transformer and L120 33kV switchgear are earmarked for decommissioning owing to poor asset health. The site will eventually run in parallel with Croydon Grid when the proposed new 33kV interconnector is commissioned. Currently Croydon B Grid only supplies Bensham Grove primary and Network Rail but can also supply Suffolk Road and Selhurst.

Prologis Grid 2x30MVA 132/11kV – Connection is via 2x1.7km 132kV cables rated 92MVA (W) and 85MVA (S). This is a dedicated customer substation.

Purley Grid 2x90MVA 132/33kV – Connection is via 2x4.9km 132kV gas compressed cables rated 99MVA (W) and 87MVA (S). The site is located in a residential area. Primary substations fed from Purley Grid include Purley Local, Caterham, Coulsdon and West Croydon.

Sutton Grid 2x90MVA 132/33kV – Connection is via 2x6.1km 132kV cables rated 112MVA (W) and 90 (S). The site is located in a residential area. Primary substations fed from Sutton Grid include Sutton A, Sutton B, Nork, North Cheam and St Helier.

Figure 4: Beddington GSP Netmap Diagram



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(source: SPN Netmap)

2.2 Embedded Generation (G59/2)

Table 2. List of G59/2 Embedded Generators Connected to the Network covered by this RDP

Customer Name (MAVIS)	Site Name	Type	Installed DG (MW)	Operating Voltage (kV)
CROYDON ENERGY LTD	ROLLS ROYCE POWER DEVELOPMENT LTD	Gas	55.500	132.000
DIRECT LINE INSURANCE		Diesel	0.440	6.600
VIRIDOR WASTE MANAGEMENT LTD	LANDFILL SITE	Landfill gas	7.000	11.000
LASER ENERGY BUYING GROUP	BALAAM HOUSE	CHP	0.052	0.400
MR S GERRISH	TOP FLOOR	PV	0.001	0.230
MISS SMITH		PV	0.001	0.230
MISS I BELL	TOP FLOOR	PV	0.001	0.230
MR W S PTAK		PV	0.001	0.230
MAYDAY HEALTHCARE NHS TRUST	ENERGY CENTRE	CHP	0.900	6.600
GENERAL HEALTHCARE GROUP LIMITED	SHIRLEY OAKS HOSPITAL	CHP	0.110	0.400
SUTTON & EAST SURREY WATER PLC (NON POSTAL)	CHEAM PUMPING STATION	Diesel	3.500	11.000
SUTTON & EAST SURREY WATER PLC (NON POSTAL)	THE OAKS PUMPING STATION	Diesel	1.800	0.400
	LEISURE CENTRE	CHP	0.012	0.400
THAMES WATER UTILITIES LTD (IMPORT) (NON POSTAL)	PUMPING STATION	Diesel	0.800	11.000
TESCO STORES LTD	TESCO STORE	CHP	0.060	11.000
RIALTO HOMES LTD	CITY HOUSE	Wind	0.048	6.600
RIALTO HOMES LTD	CITY HOUSE	CHP	0.070	6.600
ROYAL MARSDEN HOSPITAL	ROYAL MARSDEN HOSPITAL	PV	0.046	0.400
KENT COUNTY COUNCIL (LASER)	VICTOR SEYMOUR INFANT SCHOOL	PV	0.041	0.400
Joju Ltd	Beacon School	PV	0.043	0.400
ROYAL ALFRED SEAFARERS SOCIETY	BELVEDERE HOUSE	PV	0.170	0.400
SUTTON GRAMMAR SCHOOL FOR BOYS	SUTTON GRAMMAR SCHOOL FOR BOYS	PV	0.004	0.230
WTG Commercial	Highview Primary School	PV	0.019	0.400
SAINSBURY'S SUPERMARKETS LTD	SAINSBURY'S SUPERSTORE	PV	0.125	0.400
Solar Above	82	PV	0.005	0.230
KENT COUNTY COUNCIL (LASER)	Sunnydown School	PV	0.010	0.400
MS T GELDARD	1	PV	0.000	0.230
J B RENEWABLES LTD	Manor Park School	PV	0.050	0.400
WTG Commercial	Thomas Wall Nursery	PV	0.025	0.400
KENT COUNTY COUNCIL (LASER)	Greenshaw School	PV	0.043	0.400
Cofely Project Services	YMCA	PV	0.017	0.400
Cofely Project Services	YMCA	CHP	0.015	0.400
ECOLUTION	Acorn House	PV	0.012	0.400
SOUTH LONDON YMCA	SOUTH LONDON YMCA	PV	0.020	0.400

The total installed capacity of G59/2 embedded generation under this RDP is 71MW with Croydon Energy generation contributing 55MW from its gas turbine. Croydon Energy is a STOR generator directly connected on the 132kV network at Croydon grid substation and contracted by NG to provide short term system support during times of high load demand or poor frequency levels.

2.3 Projects in progress

DPCR5 NAMP projects approved to date are listed in table 5 below.

Table 3. NAMP Table J Less Indirect 19th February 2014

Project ID	Description	2013/2014	2014/2015	2015/2016
3138	Beddington/Purley - Gas Pressure Cable Replacement	508,169	1,468,132	0
5829	North Cheam Primary Substation - Retrofit 11kV Switchgear	222,163	0	0
8434	Sutton Grid 132kV - Refurbish Grid Transformer (GT2)	86,187	0	0
3236	Norbury Primary - Transfer Load to Croydon B	1,293,958	554,553	0
8059	St Helier 33kV/11kV Reinforcement - Replace T1/T2 with 20/40 MVA, Install 3rd 3 km UGC Circuit & Replace 11 Panel SWB	47,462	351,624	836,948
8339	Sutton A 33/11kV Reinforcement: Replacement of 11kV Switchboard Due to Fault Level	18,683	111,587	222,154
8517	Purley Grid: 33kV Interconnection to Addington	924,000	3,230,176	0

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Approved Works:

3236: Norbury primary load transfer includes the introduction of a new 33kV interconnector between Croydon Grid and Croydon B, which will facilitate parallel running arrangement of the two grid sites. Feasibility studies and cable route trial holes have been initiated. This project is scheduled for completion by 2014. Croydon Grid and Croydon B will be operated in parallel once the Croydon Grid/Croydon B 33kV interconnector is completed. Norbury primary load will be transferred from Croydon Grid to Croydon B as the new normal running arrangement.

3138: Beddington/Purley - Gas Pressure Cable Replacement

The existing 132kV circuits between Beddington GSP and Purley Grid are in poor condition and pose environmental risks due to gas leaks. The cables will be replaced with XLPE cables to improve health indices and achieve an environmentally friendly operating status.

8059: St Helier 33kV/11kV Reinforcement - Replace T1/T2 with 20/40 MVA, Install 3rd 3 km UGC Circuit & Replace 11 panel Switchboard

St Helier primary is projected to be out firm by 2017 and this project will provide the necessary reinforcement to meet future demand and maintain P2/6 compliance.

8339: Sutton A 33/11kV Reinforcement: Replacement of 11kV Switchboard due to Fault Level

The existing 11kV switchboard is rated 12.5kA and poses health and safety risks to personnel and plant during abnormal running arrangements when paralleled with Sutton B due to anticipated higher fault levels.

8517: Purley Grid: 33kV Interconnection to Addington

The proposed 33kV interconnector will provide contingency support for Purley Grid during replacement of the existing 132kV GC circuits between Beddington GSP and Purley Grid.

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3 Network Development Considerations

3.1 Development areas

Croydon Metropolitan Centre

Five master plans to develop and improve the Croydon Metropolitan Centre (CMC) have been produced taking advantage of the newly introduced London East overland train network linking Croydon to London Underground network for the first time in 2010. The five master plans include East Croydon Master Plan, Fair Field Master Plan, Mid-Croydon Master Plan, Old Town Master Plan and West Croydon Master Plan as illustrated in appendix D. The master plans propose introduction of distinctive shopping malls, hotels, new restaurants, new offices, new homes, entertainment space and multi-functional buildings including the revamping of existing buildings around West Croydon train station, Derby road, Station road, London road buildings, Whitgift Link, North End, Wandle Park and All Angels church compound among other initiatives. Currently four UKPN primary substations feed into the CMC zone. Primary substations in the proximity include Croydon Grid 33/11kV, Croydon A 33/6.6kV, Croydon Central 33/11kV and East Croydon 33/11kV. Croydon Central primary substation is expected to accommodate most of the load arising from these new developments. An enquiry for 20MVA load for Ruskin Square was processed recently on behalf of Major Connections with proposals to introduce a new primary substation (Croydon North) fed form Ashburton Grid. Several enquiries for new connections within the CMC zone have been processed by Distribution Planning and these have been accommodated or assigned connections from the existing network.

Figure 5 – West Croydon Master Plan

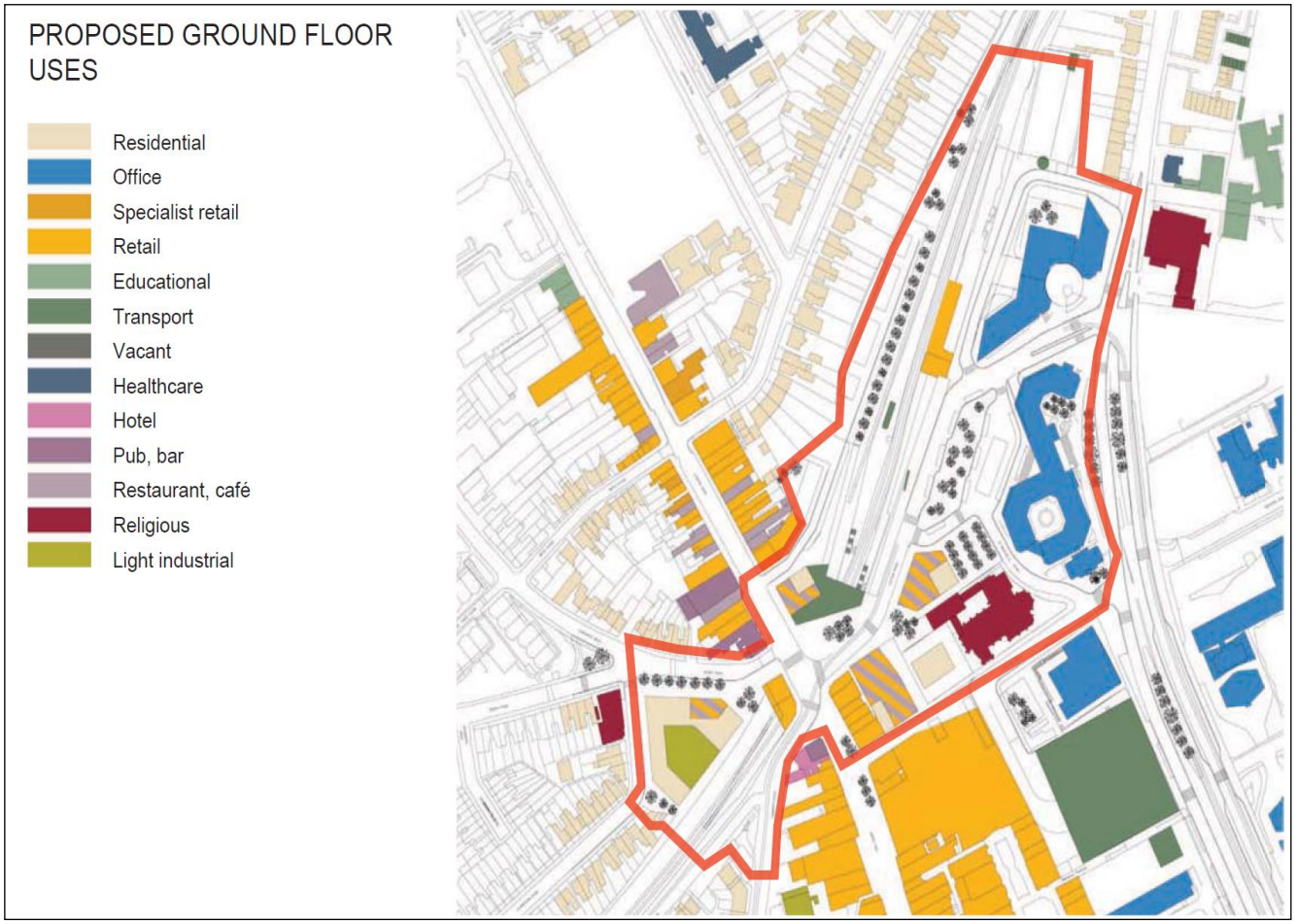

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Figure 6 – Arial View of West Croydon Master Plan

Housing

Addington – Land in this location is physically constrained by the National Green Belt embargo and most developments will be based on targeted infilling of existing housing sites, which will not cause any major changes to the existing electricity supply network.

Addiscombe – Moderate residential growth is expected, which not affect the existing electricity network to a great extent.

Broad Green and Selhurst – Moderate residential growth is expected, which will not affect the existing electricity network to a great extent.

Cousldon – Major residential growth will be delivered through the Coulsdon Master Plan, which includes Cane Hill. Coulsdon 33/11kV primary substation is currently out of firm and undergoing increase in firm capacity by

the addition of 20/40MVA in place of the existing 16/20MVA transformers, which will significantly improve electricity supply availability in the area and equally accommodate the proposed new housing development.

Croydon Opportunity Area – Nearly 7,300 new homes are proposed in this location, which is a third of all the new homes proposed in Croydon Borough. The proposed new homes have a potential for 14MVA new power demand in the area currently supplied by East Croydon and Croydon Central primary substations. Both sites have combined firm capacity headroom of 40MVA during winter and 27MVA during summer, hence adequate to meet significant load from new connections.

Crystal Palace and Upper Norwood - Moderate residential growth is expected, which will not affect the existing electricity network to a large extend.

Kenley and Old Coulsdon – Low potential for new residential growth is forecasted in this area, hence very little impact on the existing electricity supply network is expected.

Norbury - Low potential for new residential growth is forecasted in this area, hence very little impact on the existing electricity supply network is expected.

Purley - Moderate residential growth is expected, which will not affect the existing electricity network to a large extent.

Sanderstead - Low potential for new residential growth is forecasted in this area, hence very little impact on the existing electricity supply network is expected.

Selsdon - Most of the new residential developments will be based on targeted infilling of existing housing sites and wind fall sites, which will not cause any major changes to the existing electricity supply network.

Shirley – This is an area of low residential growth, hence very little impact on the existing electricity supply network is expected.

South Croydon – Moderate residential growth is expected with a mixture of developments, which will have little impact on the existing electricity network.

South Norwood and Woodside - Moderate residential growth is expected, which will not affect the existing electricity network to a large extent.

Thorton Heath - Moderate residential growth is expected, which will not affect the existing electricity network to a large extent.

Waddon – This is an area of major new residential growth along Purley Way. This area is close to three primary substations (Purley Local, West Croydon and Beddington Local) with substantial firm capacity headroom between them to accommodate any new load demand from the proposed new homes.

3.2 Asset Health

Health indices for all network equipment covered in this RDP are listed in tables 4 to 10 below. The equipment groups covered include HV circuit breakers (6.6kV and 11kV), EHV circuit breakers (33kV), 66kV&132kV circuit breakers, primary transformers (33/11/6.6kV), grid transformers (132/33/11kV), overhead lines (132kV) and underground cables (33kV and 132kV)

It should be noted that HIs presented in the RDP will not align with the RIGS. The HI's presented in the RDP are the outcome of our ARP models on an asset by asset basis. Different rules are applied for RIGs reporting, as agreed with Ofgem, where assets may be grouped and all assets in the group take the same HI.

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

Table 4. HV Circuit breakers (Without Intervention)

Substation	2015 No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	2023 No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ADDINGTON GRID 11KV		9	1					10		
ADDINGTON LOCAL		4	12	1				7	9	1
BEDDINGTON 132/11KV	17						17			
BENSHAM GROVE 6.6KV		15					15			
BIGGIN HILL 33KV		5	5					7	3	
BRIDGES LANE 11KV	2	11				2	11			
CATERHAM 33/11KV			12					6	5	1
COULSDON 33/11KV		12	3					15		
CROYDON A 6.6KV		36						36		
CROYDON CENTRAL 33/11KV	13						13			
CROYDON GRID 33/11KV		12	3				2	12	1	
EAST CROYDON 33/6.6 KV	18						18			
NORBURY 33/6.6KV		16	2					18		
NORK 33/11KV		12					12			
NORTH CHEAM 33/11KV			13					3	8	2
PROLOGIS 132/11KV	10					10				
PROLOGIS 132KV	2					2				
PURLEY 11KV		20						20		
SELHURST 33/6.6 KV		10					5	5		
SELSDON 33/11 KV		6	4				1	9		
SHIRLEY 33/11kV	1	9	2			1	11			
SPURGEONS BRIDGE		6	12					18		
ST HELIER 33/11KV			11					6	5	
SUFFOLK ROAD 6.6KV	2	14				2	14			
SUTTON A 33/11KV		14					13	1		
SUTTON B 33/11KV		12					12			
WEST CROYDON 33/11KV		14						14		
WEST WICKHAM 33/11KV		4	7					7	4	

Table 5. EHV circuits breakers

Substation	2015 No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	2023 No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ADDINGTON GRID 132 KV		3						3		
ADDINGTON GRID 33 KV		12						13		
ASHBURTON GRID 132 KV		2					2			
ASHBURTON GRID 33 KV		11					5	6		
BEDDINGTON 132/33KV		9					9			
CROYDON B 132 KV	2		2			2			2	
CROYDON B 33KV	9		1			9			1	
CROYDON GRID 132 KV		2					2			
CROYDON GRID 33KV		13					4	9		
PURLEY GRID		6	5				2	8	1	
PURLEY GRID 132 KV		2						2		
SUTTON GRID 132 KV		2					2			
SUTTON GRID 33KV		11						11		

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

Table 6. 66 and 132kV circuit breakers

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BEDDINGTON	22					2	20			
CROYDON ENERGY 132KV SWITCHING STATION		1					1			
CROYDON GRID 132 KV		1					1			

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
ADDINGTON GRID 11KV		2						2		
ADDINGTON LOCAL			1	1					1	1
BENSHAM GROVE 6.6KV	2					2				
BIGGIN HILL 33KV		2						2		
CATERHAM 33/11KV		2						2		
COULSDON 33/11KV	1	1					1	1		
CROYDON A 6.6KV		2					1	1		
CROYDON B 132 KV	1					1				
CROYDON CENTRAL 33/11KV	2						2			
CROYDON GRID 33/11KV		2						2		
EAST CROYDON 33/6.6 KV			2					1	1	
NORBURY 33/6.6KV		2					2			
NORK 33/11KV		2					1	1		
NORTH CHEAM 33/11KV		2					2			
PURLEY 11KV	2	1					3			
SELHURST 33/6.6 KV		2					1	1		
SELSDON 33/11 KV		2						2		
SHIRLEY 33/11kV		1			1	1				1
SPURGEONS BRIDGE		2						2		
ST HELIER 33/11KV		2						2		
SUFFOLK ROAD 6.6KV	2					2				
SUTTON A 33/11KV	2						2			
SUTTON B 33/11KV		2						2		
WEST CROYDON 33/11KV			2					2		
WEST WICKHAM 33/11KV		1			1			1		1

Table 8. Grid transformers

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ADDINGTON GRID 132 KV		3						3		
ASHBURTON GRID 132 KV		2					2			
BEDDINGTON		2						2		
BEDDINGTON 132KV										
CROYDON B 132 KV				1						1
CROYDON GRID 132 KV		2					1	1		
PROLOGIS 132KV	1	1				1	1			
PURLEY GRID 132 KV			2					2		
SUTTON GRID 132 KV			1		1			1		1

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

Table 9. Over Head Lines

Corporate Asset ID	Equipment Group ID	Section (Route)	Equipment Type	Left Circuit Operational Voltage	Right Circuit Operational Voltage	(LC) OFGEM HI 2015	(LF) OFGEM HI 2015	(RC) OFGEM HI 2015	(RF) OFGEM HI 2015	(EC) OFGEM HI 2015	(EF) OFGEM HI 2015	(TSW) OFGEM HI 2015	(F) OFGEM HI 2015
000000304603	132TOWER	PL	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	2
000000304604	132TOWER	PL	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	2
000000304605	132TOWER	PL	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	3
000000304606	132TOWER	PL	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	3
000000304607	132TOWER	PL	Tower with 2 circuits	132	132	2	2	2	2	2	2	3	NO RESUL
000000304608	132TOWER	PL	Tower with 2 circuits	132	132	2	5	2	2	2	2	3	NO RESUL
000000304609	132TOWER	PL	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	2
000000304610	132TOWER	PL	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	2
000000304611	132TOWER	PL	Tower with 2 circuits	132	132	2	2	2	2	2	2	3	NO RESUL
000000305262	132TOWER	PQ	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	3
000000305264	132TOWER	PQ	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	3
000000305265	132TOWER	PQ	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	3
000000305266	132TOWER	PQ	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	3
000000305267	132TOWER	PQ	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	3
000000305269	132TOWER	PQ	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	3
000000305271	132TOWER	PQ	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	3
000000305273	132TOWER	PQ	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	3
000000305275	132TOWER	PQ	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	3
000000305277	132TOWER	PQ	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	2
000000305289	132TOWER	PQB	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	2
000000305290	132TOWER	PQB	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	2
000000305291	132TOWER	PQB	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	2
000000305292	132TOWER	PQB	Tower with 2 circuits	132	132	2	2	2	2	2	2	4	2

Table 9 above illustrates that most of the overhead lines covered in this RDP have good asset heath condition except for left side fittings on one of the PL route towers and tower structure painting requirements, which is HI4.

Table 10 below provides health indices for cable circuits covered under this RDP. Three cable circuits are identified to be in HI4/5 during DPCR5 and ED1 periods. Replacement of these circuits is included in the current NAMP.

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

Table 10. Underground Cables

Corporate Asset ID	Section (Route)	Cable Section	Voltage	OFGEM HI in 2015	OFGEM HI in 2024
000002064610	BEDDINGTON LOCAL 33-SUTTON GRID 33	CABLE SECTION: 91039147-1-E-J	33	4	5
000002064612	BEDDINGTON LOCAL 33-SUTTON GRID 33	CABLE SECTION: 91039147-2-E-J	33	3	4
000002064576	BEDDINGTON MAIN-ADDINGTON GRID 132	CABLE SECTION: 90AA9901-2-1B	132	5	5
000002065058	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-A-B-P3	132	5	5
000002065072	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-D-E-P2	132	5	5
000002065067	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-E-F-P1	132	4	5
000002065078	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-DE1-P3	132	4	5
000002065071	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-B-D-P2	132	4	5
000002065059	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-B-D-P3	132	4	5
000002065109	BEDDINGTON-ASHBURTON GRID 132	CABLE SECTION: 99039979-2-A-B	132	3	4
000002064850	PURLEY GRID-WEST CROYDON 33/11	CABLE SECTION: 91418509-2-A-C	33	4	5
000002064851	PURLEY GRID-WEST CROYDON 33/11	CABLE SECTION: 91418509-2-C-F	33	4	5
000002064599	ADDINGTON GRID 33-WEST WICKHAM 33/11	CABLE SECTION: 91018513-1-A-B	33	3	3
000002064604	BEDDINGTON LOCAL 33-EAST CROYDON 33/6.6	CABLE SECTION: 91038395-1-3	33	3	3
000002064606	BEDDINGTON LOCAL 33-EAST CROYDON 33/6.6	CABLE SECTION: 91038395-2-2	33	3	3
000002064577	BEDDINGTON MAIN-ADDINGTON GRID 132	CABLE SECTION: 90AA9901-2-1R	132	3	3
000002065063	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-A1A-P1	132	3	3
000002065069	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-A1A-P2	132	3	3
000002065057	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-A1A-P3	132	3	3
000002065064	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-A-B-P1	132	3	3
000002065070	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-A-B-P2	132	3	3
000002065065	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-B-D-P1	132	3	3
000002065066	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-D-E-P1	132	3	3
000002065060	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-D-E-P3	132	3	3
000002065073	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-E-F-P2	132	3	3
000002065061	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-E-F-P3	132	3	3
000002065068	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-F-G-P1	132	3	3
000002065074	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-F-G-P2	132	3	3
000002065062	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-1-F-G-P3	132	3	3
000002065082	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-A1A-P1	132	3	3
000002065089	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-A1A-P2	132	3	3
000002065075	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-A1A-P3	132	3	3
000002065083	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-A-B-P1	132	3	3
000002065090	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-A-B-P2	132	3	3
000002065076	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-A-B-P3	132	3	3
000002065084	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-B-D-P1	132	3	3
000002065077	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-B-D-P3	132	3	3
000002065085	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-DE1-P1	132	3	3
000002065092	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-DE1-P2	132	3	3
000002065079	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-E1E-P3	132	3	3
000002065087	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-E-F-P1	132	3	3
000002065080	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-E-F-P3	132	3	3
000002065088	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-F-G-P1	132	3	3
000002065081	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-F-G-P3	132	3	3
000002065107	BEDDINGTON-ASHBURTON GRID 132	CABLE SECTION: 99039979-1-A-B	132	3	3
000002065103	BEDDINGTON-SUTTON GRID 132	CABLE SECTION: 99039947-1-A-B	132	3	3
000002064848	PURLEY GRID-WEST CROYDON 33/11	CABLE SECTION: 91418509-1-A-C	33	3	3
000002064849	PURLEY GRID-WEST CROYDON 33/11	CABLE SECTION: 91418509-1-C-F	33	3	3
000002064867	SUTTON GRID 33-ST HELIER 33/11	CABLE SECTION: 91478477-2-2	33	3	3
000002064601	ADDINGTON GRID 33-WEST WICKHAM 33/11	CABLE SECTION: 91018513-2-A-B	33	3	3
000002064603	BEDDINGTON LOCAL 33-EAST CROYDON 33/6.6	CABLE SECTION: 91038395-1-2	33	2	3
000002064607	BEDDINGTON LOCAL 33-EAST CROYDON 33/6.6	CABLE SECTION: 91038395-2-3	33	2	3
000002064578	BEDDINGTON MAIN-ADDINGTON GRID 132	CABLE SECTION: 90AA9901-2-1Y	132	2	3
000002065097	BEDDINGTON-ADDINGTON GRID 132	CABLE SECTION: 99039901-1-1-P1	132	2	3
000002065098	BEDDINGTON-ADDINGTON GRID 132	CABLE SECTION: 99039901-1-1-P2	132	2	3
000002065096	BEDDINGTON-ADDINGTON GRID 132	CABLE SECTION: 99039901-1-1-P3	132	3	3
000002065091	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-B-D-P2	132	2	3
000002065086	BEDDINGTON-ADDINGTON GRID PQ1	CABLE SECTION: 990390AB-2-E1E-P1	132	2	3

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

3.3 Security of supply and load index analysis

Table 11. P2/6 Assessment table

DPCR5 Intervention					RIIO-ED1 without intervention				RIIO-ED1 with Intervention		P2/6 at End of ED1
Substation	Season	First Limitation	FC NOW (MVA)	FC ED1 Start (MVA)	2014 (S) 14/15 (w)	2022 (S) 22/23 (W)	2014 (S) 14/15 (w)	2022 (S) 22/23 (W)	FC ED1 end (MVA)	2022 (S) 22/23 (W)	P2/6 Class
Addington Grid	W	Circuit(s)	86.9	86.9	77.2	81.1	LI2	LI2	86.9	LI1	D
Addington Grid 33/11	W	Transformer	23.0	23.0	8.0	8.5	LI1	LI1	23.0	LI1	B
Addington Local	W	Switchgear	23.0	23.0	18.8	19.7	LI2	LI2	24.0	LI2	C
Ashburton Grid	W	Transformer	117.0	117.0	55.6	58.6	LI1	LI1	117.0	LI1	C
Beddington 132/33	S	Transformer	30.0	30.0	15.4	16.7	LI1	LI1	60.0	LI1	C
Beddington Local	S	Transformer	30.0	30.0	18.5	19.2	LI1	LI1	30.0	LI1	C
Bensham Grove	W	Switchgear	22.9	22.9	10.8	11.4	LI1	LI1	22.9	LI1	B
Biggin Hill	W	Circuit(s)	22.3	22.3	13.0	13.7	LI1	LI1	22.3	LI1	C
Bridges Lane	W	Circuit(s)	33.8	33.8	23.1	24.1	LI1	LI1	33.8	LI1	C
Caterham	W	Switchgear	23.0	23.0	22.1	23.0	LI3	LI3	24.0	LI4	C
Coulsdon	W	Switchgear	23.0	38.1	29.8	30.7	LI1	LI2	38.1	LI2	C
Croydon A 6.6kV	S	Transformer	30.0	30.0	24.6	25.1	LI2	LI2	30.0	LI2	C
Croydon B	W	Transformer	58.5	58.5	61.6	62.8	LI5	LI5	58.5	LI5	D
Croydon Central	S	Transformer	30.0	30.0	29.9	30.3	LI3	LI4	30.0	LI4	C
Croydon Grid	S	Transformer	90.0	90.0	63.1	65.4	LI1	LI1	90.0	LI1	D
Croydon Grid 11kV	S	Transformer	28.5	28.5	20.0	21.0	LI1	LI1	28.5	LI1	C
East Croydon	S	Aux Equipment	20.0	20.0	15.2	15.5	LI1	LI1	20.0	LI1	C
Norbury 441	W	Aux Equipment	24.0	24.0	19.2	19.8	LI1	LI2	24.0	LI2	C
Nork	W	Aux Equipment	22.9	22.9	13.5	14.0	LI1	LI1	22.9	LI1	C
North Cheam	W	Aux Equipment	21.7	21.7	18.0	19.2	LI2	LI2	21.7	LI2	C
Purley Grid	W	Aux Equipment	99.5	99.5	91.4	94.9	LI2	LI3	99.5	LI3	D
Purley Local	W	Aux Equipment	47.7	47.7	28.5	29.9	LI1	LI1	47.7	LI1	C
Selhurst	W	Aux Equipment	22.9	22.9	15.3	15.6	LI1	LI1	22.9	LI1	C
Selsdon	W	Aux Equipment	23.0	23.0	16.6	17.6	LI1	LI1	23.0	LI1	C
Shirley	W	Aux Equipment	23.0	23.0	17.3	18.3	LI1	LI1	23.0	LI1	C
Spurgeons Bridge	W	Switchgear	23.0	23.0	17.1	17.7	LI1	LI1	23.0	LI1	C
St Helier	W	Switchgear	23.0	23.0	22.7	24.1	LI3	LI5	38.1	LI1	C
Suffolk Road 973	W	Switchgear	22.9	22.9	12.4	13.4	LI1	LI1	22.9	LI1	C
Sutton A	S	Transformer	18.0	18.0	12.4	13.4	LI1	LI1	18.0	LI1	C
Sutton B	W	Switchgear	32.2	32.2	32.6	33.8	LI5	LI5	32.2	LI5	C
Sutton Grid	W	Circuit(s)	112.0	112.0	99.2	104.5	LI2	LI2	112.0	LI1	D
West Croydon	W	Switchgear	23.0	23.0	14.5	15.0	LI1	LI1	23.0	LI1	C
West Wickham	W	Switchgear	23.0	23.0	20.5	21.4	LI2	LI2	23.0	LI2	C

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

Table 11 above illustrates the firm capacity figures and projected load growth for all substations covered in this RDP. Figures highlighted in brown and red (LI4 and LI5 respectively) depict sites where firm capacity is exceeded and five substations have their firm capacity exceeded. Beddington GSP is a class E site in terms of P2/6 compliance. The site is P2/6 compliant for both N-1 conditions and N-2 conditions as required. Work is already in progress to address the firm capacity violation at Coulsdon primary and Croydon B grid while Sutton B primary relies on an auto switching scheme to Sutton A for firm capacity compliance.

The firm capacity for Croydon B will be addressed once the new 33kV interconnector between Croydon Grid and Croydon B is completed, which will facilitate the parallel running arrangement for the two sites.

Table 12. LI Profile (Without Investment)

Substation	Voltage (kV)	Load Index	
		2015	2023
Beddington SGT	400/132	LI1	LI1
Prologis 132/11	132/11	LI1	LI1
Beddington Local	132/11	LI1	LI1
Bridges Lane	132/11	LI1	LI1
Beddington 132/33	132/33	LI1	LI1
East Croydon	33/6.6	LI1	LI1
Addington Grid	132/33	LI2	LI2
Addington Grid 33/11	33/11	LI1	LI1
Addington Local	33/11	LI2	LI2
Biggin Hill	33/11	LI1	LI1
Selsdon	33/11	LI1	LI1
West Wickham	33/11	LI2	LI2
Ashburton Grid	132/33	LI1	LI1
Selhurst	33/6.6	LI1	LI1
Suffolk Road 973	33/6.6	LI1	LI1
Shirley	33/11	LI1	LI1
Croydon B	132/33	LI5	LI5
Bensham Grove	33/6.6	LI1	LI1
Croydon Grid	132/33	LI1	LI1
Croydon Central	33/11	LI3	LI4
Croydon A 6.6kV	33/6.6	LI2	LI2
Croydon Grid 11kV	33/11	LI1	LI1
Norbury	33/6.6	LI1	LI2
Spurgeons Bridge	33/16.6	LI1	LI1
Purley Grid	132/33	LI2	LI3
Caterham	33/11	LI3	LI3
Coulsdon	33/11	LI1	LI2
Purley Local	33/11	LI1	LI1
West Croydon	33/11	LI1	LI1
Sutton Grid	132/33	LI2	LI2
Nork	33/11	LI1	LI1
North Cheam	33/11	LI2	LI2
St Helier	33/11	LI3	LI5
Sutton A	33/11	LI1	LI1
Sutton B	33/11	LI5	LI5

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

3.4 Operational and technical restrictions

The existing 132kV auto close scheme was installed as part of a switchgear change project but it was only designed to operate with the bus section circuit breakers running open. With Beddington 132kV running with a vertical split (bus sections open) the fault level at some Grid sites would operate near their maximum rating. Therefore, the site is run with a horizontal split (bus couplers open) to reduce the fault levels.

3.5 National Grid

National Grid's (NG) supply for Beddington Grid is secure until at least 2020 based on extrapolated load growth data by NG. SPN owns the 132kV busbars, bus-sections, bus-couplers and operates the site. The GIS substation has 40kA rated switchgear, albeit derated to 31.5kA due to a 120ms DC Time Constant. The SPN demand is supplied by 4 SGTs coupled onto a 132kV bus coupler split busbar with an auto-close facility which runs the site solid following single SGT outage. The combined demand of the site is >300MW (CAT E) where (FCO = 1x240; SCO = 2x240) for P2/6 compliance.

The Modification Notice issued by National Grid for the asset replacement of SGT3B was been accepted by UKPN and development works are underway to support the asset replacement completion date of October 2013 by NG.

National grid has indicated that asset replacement of SGT1B would take place in 2016. NG's proposed location for SGT1B would prevent the extension of the new 132kV substation in future. UKPN's IDP Co-ordinator will raise this issue with NG in writing in due course. During the last JTMP meeting NG advised SPN that they are reviewing their future strategy for the Beddington site. It considers the asset replacement of the 275/132kV SGTs with 400/132kV SGTs with the potential development of a new 400kV GIS substation on land released following the 132kV AIS replacement with the GIS in around 2019. This development will impact the existing land lease arrangement with NG.

3.6 Network Constraints

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Table 13. - Cable Constraints

Asset Name	New Site Number	Site Name	Parish	Gis Ref	CB No	Post Code	Voltage	Assessed	Recommended Mitigations	Mitigation Completed (Yes/No)
1102	**1102BR**	BETWEEN RAILWAY LINES LANGLEY PK RD SUTTON	Sutton	TQ2632963948	CB021	SM1 4TE	132	Yes	The access needs to be made to the brige so a proper inspection can be carried out, the vegitation needs clearing and the property label updating.	No

3.7 Smart Solutions

Studies are still in progress to determine the level of investment and benefits that can be derived from various smart solutions initiatives.

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.

The Croydon Metropolitan Centre regeneration offers both challenges and opportunities for network development. The forecast maximum demand of circa 22MW can be supplied from the adjacent Croydon Central 33/11kV primary substation. However any demand beyond the existing firm capacities of Croydon Grid 33/11kV, Croydon A 33/6.6KV, Croydon Central 33/11kV and East Croydon 33/11kV will require the establishment of a new primary substation in the Croydon north area to be named Croydon North 33/11kV substation. Initial feasibility studies carried out suggest that the new primary substation can be supplied form Ashburton Grid, which has a firm capacity of 112.3MW (W) and 86.4MW (S) and projected load demand of 85.7MW (W) by 2023.

The 132kV gas compression cables from Beddington GSP to Purley Grid are HI5 and due for replacement during the DPCR5 period. The cables will be replaced with higher rating XLPE city cables using the existing gas cable pipes, which is expected to increase firm capacity at Purley Grid to the full potential of the grid transformers and 33kV circuit breakers (114MVA-W and 90MVA -S).

Beddington 132/33kV transformers have been replaced with higher rated 60MVA transformers. However the 200m 33kV tails form the grid transformers to the 33kV switchboard will limit the site firm capacity to 32.8MW (W) and 27.3MW (S). Uprating the transformer tails will significantly boost the firm capacity to the full potential of the new transformers and existing 33kV CB's rating (71MW – W and 55MW – S). Once the firm capacity at Beddington 132/33kV is increased, St Helier primary may be transferred from Sutton Grid to Beddington 132/33kV to increase the firm capacity headroom for Sutton Grid.

4.1 Asset Replacement

The following projects are identified in this RDP as interventions to address assets with poor health indices: -

3138 - Beddington/Purley - Gas Pressure Cable Replacement (2014 - 2015)

The condition assessment of the Beddington / Purley Gas Pressure Cables has shown that the probability of failure due to degradation of this asset and associated risks to the network are unacceptable. It is not possible to keep this asset in use without compromising operational requirements, therefore this project recommends overlaying these circuits. The project has already passed Gate B and awaiting Gate C development including contigency support for the 33kV network in the event of N-2 conditions.

3256 - Addington Local - Replace 11kV switchgear. (2019-2020)

The 11kV switchboard has been condition assessed and classified as condition HI3/4/5 during ED1. Therefore this project recommends the replacement of the existing 11kV switchboard with 2000A 20kA switchboard to match the proposed substation ITC under project number 7873.

3742 – West Wickham – Replace 11kV Switchboard/ITC (2017-2019)

The condition assessment of the 1959 - 64 Reyrolle C gear Oil Switchgear installed at West Wickham 33/11kV has shown that the probability of failure due to degradation will become unacceptable and HI3/4 during ED1 period. It is not possible to keep these assets in use without compromising operational requirements; therefore this project recommends its replacement in order to match the proposed ITC of the site under project 7915 for

transformer replacement due to poor asset health. Completion of the project will see 11 circuit breakers replaced with 11 new circuit breakers.

5829 - North Cheam 33/11kV - Retrofit 11kV Switchgear (2013-2014)

The condition assessment of the 1963 South Wales Switchgear C4X Oil Switchgear installed at North Cheam 33/11kV has shown that the probability of failure due to degradation will become unacceptable and projected to be in HI4/5 during ED1 period. It is not possible to keep these assets in use without compromising operational requirements, therefore this project recommends its refurbishment. Completion of the project will see 13 circuit breakers refurbished.

7822 - Biggin Hill 33kV - Retrofit 11kV Switchgear (2020-2021)

The condition assessment of the 1964 Reyrolle C gear Oil Switchgear installed at Biggin Hill 33kV has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising operational requirements, therefore this project recommends its Refurbishment. Completion of the project will see 6 circuit breakers refurbished.

7823 - Caterham 33/11kV - Replace 11kV Switchgear (2019-2020)

The condition assessment of the 1960 - 62 Reyrolle C gear Oil Switchgear installed at Caterham 33/11kV has shown that the probability of failure due to degradation will become unacceptable and will be HI 3/4/5 during ED1 period. It is not possible to keep these assets in use without compromising operational requirements, therefore this project recommends its replacement. Completion of the project will see 12 circuit breakers replaced with 12 new circuit breakers. This project will be optimised with project 8053 for ITC.

7846 - Spurgeons Bridge - Retrofit 11kV Switchgear (2021-2022)

The condition assessment of the 1966 Reyrolle LMT Oil Switchgear installed at Spurgeons Bridge has shown that the probability of failure due to degradation will become unacceptable and will be HI3/4 during ED1 period. It is not possible to keep these assets in use without compromising operational requirements, therefore this project recommends its Refurbishment. Completion of the project will see 18 circuit breakers refurbished.

7873 - Addington Local - Replace Primary Transformers (T1, T2) (2019-2020)

The condition assessment of the 1956 Fuller Electric Primary Transformers with Fuller HS tap changers installed at Addington Local has shown that the probability of failure due to degradation will become unacceptable with HI5 rating. It is not possible to keep these assets in use without compromising operational requirements. Therefore this project recommends the replacement of T1 and T2. As the predicted load at Addington Local will exceed the existing firm capacity, the two 16/20 MVA units will be replaced with larger 20/40 MVA transformers to cater for increased load. Completion of the project will see 2 x 16 MVA primary transformers replaced with 2 x 20/40MVA transformers. This project is linked 3256 to replace the existing 11kV switchboard owing to poor asset health.

7881 - Croydon B 132kV - Remove Grid Transformer (GT2) (2015-2016)

The condition assessment of the 1948 C.A. Parsons Grid Transformer with Fuller H tap changer installed has shown that the probability of failure due to degradation will become unacceptable with HI5. It is not possible to keep this asset in use without compromising operational requirements, therefore this project recommends its removal following LRE circuit transfers to the new 33kV switchboard. Completion of the project will see 1 Grid Transformer removed from service.

7884 - East Croydon 33/6.6kV - Replace Primary Transformer (T1, T2) (2021-2022)

The condition assessment of the 1962 Hackbridge Hewitt Primary Transformers with Fuller HS tap changers installed has shown that the probability of failure due to degradation will become unacceptable with HI4/5 during ED1 period. It is not possible to keep these assets in use without compromising operational requirements, therefore this project recommends its replacement. Completion of the project will see 2 Primary Transformers replaced with 2 new Primary Transformers.

7905 - Shirley 33/11kV - Refurbish Primary Transformer (T1) (2016-2017)

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

The condition assessment of the 1967 AEI Primary Transformer with Fuller HS tap changer installed at has shown that the probability of failure due to degradation will become unacceptablewith HI5. 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 1 Transformer refurbished.

7915 - West Wickham 33/11kV - Replace Primary Transformer (T1, T2) (2017-2019)

The condition assessment of the T2 1966/67 English Electric Primary Transformers with Fuller HS tap changers installed at has shown that the probability of failure due to degradation will become unacceptable with HI3/5 during ED1 period. It is not possible to keep these assets in use without compromising operational requirements, therefore this project recommends replacement and increased rating. T1 will be replaced for load reinforcement. Completion of the project will see 2 primary transformers replaced with 2 new 20/40MVA primary transformers. This project is linked to project number 3742 for 11kV switchgear replacement on poor asset health.

7929 - St Helier 33/11kV - Retrofit 11kV Switchgear (2021-2022)

The condition assessment of the 1965 Reyrolle LMT oil switchgear installed at ST HELIER 33/11kV has shown that the probability of failure due to degradation will become unacceptable with HI3/8 during ED1 period. It is not possible to keep these assets in use without compromising operational requirements, therefore this project recommends its refurbishment. Completion of the project will see 11 circuit breakers refurbished. This project is linked to project number 8059 for ITC.

7965 - Purley Grid-West Croydon 33/11 (Circuit 2-A-C & 2-C-F) - 33kV FFC replacement (2022-2023)

The condition assessment of the Purley Grid-West Croydon 33/11 33kV fluid filled cable has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising CI and CML performance, therefore this project recommends replacement. Completion of the project will see 2.763 km of 33kV fluid filled cable replaced.

7970 - Beddington Local 33kV-Sutton Grid 33kV (Circuit 1-E-J & Circuit 2-E-J) - 33kV FFC replacement (2016)

The condition assessment of the Beddington Local 33kV-Sutton Grid 33kV 33kV fluid filled cable has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising CI and CML performance, therefore this project recommends replacement. Completion of the project will see 5 km of 33kV fluid filled cable replaced.

7973 - Beddington-Addington Grid (Circuit 1-A-B-P3,Circuit 1-D-E-P2,Circuit 1-E-F-P1, Circuit 2-DE1-P3,Circuit 1-B-D-P3,Circuit 1-B-D-P2) - 132kV Fluid filled cable replacement (2016-2018)

The condition assessment of the Beddington-Addington Grid 132kV fluid filled cable has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising CI and CML performance, therefore this project recommends replacement. Completion of the project will see 8 km of 132kV fluid filled cable replaced.

8434 - Sutton Grid 132kV - Refurbish Grid Transformer (GT2) (2014)

GT2 at Sutton Grid 132kV has severe oil leaks requiring urgent action. It is proposed to refurbish this Grid Transformer including regasketing and repair of a broken bushing.

4.2 Reinforcement

The following projects are identified in this RDP as reinforcement projects to improve network reliability and resilience: -

3190 - Coulsdon 33/11kV Primary - Reinforcement (2009 - 2014)

The predicted load at Coulsdon Primary will exceed the existing firm capacity, including the transfer capacity to Purley Local. Currently there are two transformers T1 16/20MVA and T2 20/40MVA. It is proposed to replace T1 with a larger unit. The existing 33kV circuits supplying the transformers are currently rated for the smaller unit T1. It is therefore proposed to replace one of these circuits and double up the existing circuits. The existing 11kV switchgear is not fully rated for this increased load. It is therefore proposed to replace this switchgear. This project interacts with project 3691 to reinforce the adjacent Banstead Primary. Once Coulsdon is reinforced, enhanced 11 kV interconnection with Banstead might defer the need for EHV reinforcement at Banstead. Reinforcement work at Coulsdon primary is almost complete.

3236 - Norbury Primary - Transfer Load to Croydon B (2014 - 2015)

This project proposes the transfer of Norbury 33/6.6kV primary substation from Croydon Grid to Croydon B 33kV. This will reduce the demand at Croydon Grid which would otherwise exceed its firm capacity. The Norbury 33 kV circuits pass close to Croydon B and this option is more cost effective than reinforcing Croydon Grid. Work to transfer Norbury primary from Croydon Grid to Croydon B and introduce a new 33kV interconnector between the two sites is scheduled to start during 2014 for completion by 2015.

3351 - Sutton B 33/11kV Reinforcement-ITC (2021-2024)

The predicted load at Sutton B 33kV/11kV will exceed the existing rating of the associated transformer circuits. It is not possible to lower the load without compromising operational and planning requirements. It is therefore proposed to increase transformer circuit capacity by replacing 2 x 16/20 MVA transformers with 2 x 40 MVA transformer/s, replacing 0.6 km of 33kV underground cable from Sutton Grid. Completion of this project will see the tranformer feeder circuit uprated by addition of 2 x 33kV/11kV transformer/s and replacement of 0.6 km of 33kV underground cable.

8057 - Norbury 33kV/6.6kV – ITC (2023-2024)

The predicted load at Norbury 33kV/6.6kV will exceed the existing rating of the associated transformer circuits by 2023. It is not possible to lower the load without compromising operational and planning requirements. It is therefore proposed to increase transformer circuit capacity by replacing 16/20 MVA transformers with 20/40 MVA transformer/s, installing a 3rd 33kV x 5 km underground cable circuit from Croydon Grid and replacement of the 17 panel 6.6kV switchboard. Completion of this project will see the transformer feeder circuit uprated by addition of 2 x 40 MV A transformer/s installation of a 3rd 40 MVA 33kV cable circuit and banking of the existing circuits on one new transformer.

8059 - ITC St Helier 33/11kV primary from 2x16/20MVA to 2x20/40MVA (2014-2018)

The predicted load at St Helier Primary will exceed the existing firm capacity, including the available transfer capacity by 2023. Currently there are 2x16/20MVA transformers installed. It is proposed to replace existing transformers 20/40MVA units and uprate existing and 33kV circuits from 23MVA to 40MVA.

8339 - Sutton A 33/11kV Reinforcement: Replacement of 11kV switchboard due to fault level (2014-2018)

The predicted fault level at Sutton A 33/11kV will exceed the existing rating of the associated 11kV switchboard and bus bars. It is not possible to lower the fault level without compromising operational and planning requirements. It is therefore proposed to replace the 12.5kA 14 panel switchboard with a new switchboard. Completion of this project will see 14 panels of 11kV switchboard replaced.

8445 - Beddington 132/33kV transformer tails reinforcement – 0.3km (2019-2020)

The existing 30MVA transformers at Beddington 132/33kV are being replaced with new 60MVA transformer due to poor asset health. Despite the increase in transformer capacity, this will not be exploited since the existing 33kV transformer tails will limit the site firm capacity to 32.4MW (Winter) and 27.3MW (Summer). It is proposed

to reinforce the existing 33kV tails to match the full potential of the newly installed transformers and increase firm capacity to 71MW (Winter) and 55MW (Summer).

Table 14. – Summary of Proposed Interventions

Substation	Driver	Commissioning Year	Scope of works	Existing Firm Capacity	New Firm capacity
West Croydon	Asset replacement	2023	Replace 2.8km 33kV FFC from Purley Grid to West Croydon (Circuit 2-A-C & 2-C-F)	22.3MW	22.3MW
St Helier	Asset retrofit	2022	Replace 5km 33kV FFC from Beddington Local 33kV to Sutton Grid 33kV (Circuit 1-E-J & Circuit 2-E-J)	22.3MW	22.3MW
North Cheam	Asset retrofit	2014	Retrofit existing 11kV SWS C4X switchboard	21.5MW	21.5MW
Addington Local	Asset replacement	2020	Replace existing 11kV Reyrolle C5 switchgear	22.5MW	22.5MW
Beddington Main-Addington Grid	Asset replacement	2018	Replace 0.1km 132kV (Circuit 2) 132kV FFC	83.4MW	83.4MW
Biggin Hill	Asset retrofit	2021	Retrofit 11kV switchgear	21.2MW	21.2MW
Caterham	Asset replacement	2020	Replace 11kV switcgear	22.77MW	22.77MW
Spurgeons Bridge	Asset retrofit	2022	Retrofit 11kV switchgear	22.3MW	22.4MW
Croydon B	Asset replacement	2016	Decommission GT2	56.2MW	117MW
Sutton Grid	Asset refurbishment	2014	Refurbish GT2	108.4MW	108.4MW
Addington Local -	Asset replacement & ITC	2020	Replace T1 & T2 with bigger units	22.5MW	40MW (Winter) 30MW (Summer)
Shirley	Asset refurbishment	2017	Refurbish T1	22MW	22MW
West Wickham	Asset replacement and ITC	2017	Replace T1 & T2 with bigger units	22.77MW	40MW (Winter) 30MW (Summer)
East Croydon	Asset replacement	2022	Replace T1 & T2	22.04MW	40MW (Winter) 30MW (Summer)

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

Substation	Driver	Commissioning Year	Scope of works	Existing Firm Capacity	New Firm capacity
Beddington 132/33kV	Reinforcement	2020	transformer tails reinforcement – 0.3km	32.8MW	71MW (Winter) 55MW (Summer)
St Helier	Reinforcement	2018	ITC from 2x16/20MVA to 2x20/40MVA and uprate existing 33kV circuits and 11kV switchboard	22.3MW	40MW (Winter) 30MW (Summer)

Table 14 above provides a list of all projects identified for implementation during ED1 period. Projects highlighted in same colour indicate opportunities for combining asset replacement and reinforcement triggered projects in order to minimise costs and maximise benefits.

4.3 Costs and phasing

Table 15. NAMP Table J Less Indirects 19th February 2014

Table 15 above illustrates the full list of Beddington RDP projects identified in the current NAMP for implementation during DPCR5 and ED1 periods. The total budget cost for these projects amounts to **£35,969k.**

SR_ Table J - S&R - Baseline_Final_RIIO_ED1 Re-Submission_19th Feb_2014 _15:15 (£)													
Cat	Namp Line	Project ID	Description	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023
A	1.50.01	3256	Addington Local - Replace 11kV Switchgear	0	0	0	0	0	589,599	1,615,736	0	0	0
A	1.50.01	5829	North Cheam Primary Substation - Retrofit 11kV Switchgear	222,163	0	0	0	0	0	0	0	0	0
A	1.50.01	7822	Biggin Hill 33kV - Retrofit 11kV Switchgear	0	0	0	0	0	0	23,844	71,531	0	0
A	1.50.01	7823	Caterham 33/11kV - Replace 11kV Switchgear	0	0	0	0	0	311,897	782,632	0	0	0
A	1.50.01	7845	Southwick 33kV - Replace 11kV Switchgear	0	0	0	299,725	746,115	0	0	0	0	0
A	1.50.01	7846	Spurgeons Bridge - Retrofit 11kV Switchgear	0	0	0	0	0	0	0	109,796	176,328	0
A	1.51.01	3306	Beddington 132/33kV - Replace GT3 and GT4	0	0	0	0	0	0	0	0	0	0
A	1.51.01	7881	Croydon B 132kV - Remove Grid Transformer (GT2)	0	55,715	167,145	0	0	0	0	0	0	0
A	1.51.03	3188	Ashington Primary - Replace T1/T2 with 12/24MVA Txs	110,000	1,143,000	0	0	0	0	0	0	0	0
A	1.51.03	7873	Addington Local - Replace Primary Transformers (T1, T2)	0	0	0	0	0	174,739	1,041,265	0	0	0
A	1.51.03	7884	East Croydon 33/6.6kV - Replace Primary Transformer (T1, T2)	0	0	0	0	0	0	0	102,040	1,318,149	0
A	1.51.11	7874	Banstead 33/11kV - Refurbish Primary Transformer (T2)	0	0	0	100,917	49,898	0	0	0	0	0
A	1.51.11	7905	Shirley 33/11kV - Refurbish Primary Transformer (T1)	0	0	75,969	74,846	0	0	0	0	0	0
A	1.51.11	8434	Sutton Grid 132kV - Refurbish Grid Transformer (GT2)	86,187	0	0	0	0	0	0	0	0	0
H	1.29.01	7965	Purley Grid-West Croydon 33/11 (Circuit 2-A-C & 2-C-F) - 33kV FFC Replacement	0	0	0	0	0	0	0	0	279,809	686,366
H	1.29.01	7970	Beddington Local 33kV-Sutton Grid 33kV (Circuit 1-E-J & Circuit 2-E-J) - 33kV FFC Replacement	0	0	1,725,312	0	0	0	0	0	0	0
H	1.29.02	7972	Beddington-Addington Grid (Circuit 1-A-B-P3,Circuit 1-D-E-P2,Circuit 1-E-F-P1, Circuit 2-DE1-P3,Circuit 1-B-D-P3,Circuit 1-B-D-P2) - 132kV Fluid Filled Cable Replacement	0	0	1,387,374	5,549,494	4,162,121	0	0	0	0	0
R	1.33.01	3190	Coulsdon 33/11kV Primary - Reinforcement	834,401	0	0	0	0	0	0	0	0	0
R	1.33.01	3351	Sutton B 33/11kV Reinforcement - Replace T3/T4 with 20/40 MVA Units & Add 0.3 km of UGC Circuit from Sutton Grid	0	0	0	0	0	0	0	25,000	216,821	567,000
R	1.33.01	8057	Norbury 33kV/6.6kV Reinforcement - Replace T1/T2 with 20/40 MVA Units, Install 5 km of UGC Circuit & Replace 17 Pane SWB	0	0	0	0	0	0	0	0	0	0
R	1.33.01	8059	St Helier 33kV/11kV Reinforcement - Replace T1/T2 with 20/40 MVA, Install 3rd 3 km UGC Circuit & Replace 11 Panel SWB	51,020	377,981	899,683	899,683	1,370,366	0	0	0	0	0
R	1.33.03	8339	Sutton A 33/11kV Reinforcement: Replacement of 11kV Switchboard Due to Fault Level	21,150	126,321	251,487	251,487	355,503	0	0	0	0	0
R	1.37.07	3236	Norbury Primary - Transfer Load to Croydon B	1,400,000	600,000	0	0	0	0	0	0	0	0
R	1.37.07	8445	Beddington 132/33kV Transformer Tails Reinforcement	0	0	0	0	0	121,723	365,169	0	0	0
R	1.37.07	8517	Purley Grid: 33kV Interconnection to Addington	924,000	3,230,176	0	0	0	0	0	0	0	0

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

4.4 HI / LI Improvement

Table 16. – LI Table (With Investment)

Substation	Voltage kV	2023 Load Index	
		Without Investment	With Investment
Beddington			
Addington Grid	132/11	2.00	1.00
Addington Grid 33/11	33/11	1.00	1.00
Addington Local	33/11	2.00	2.00
Ashburton Grid	132/33	1.00	1.00
Beddington 132/33	132/33	1.00	1.00
Beddington Local	132/11	1.00	1.00
Bensham Grove	33/6.6	1.00	1.00
Biggin Hill	33/11	1.00	1.00
Bridges Lane	33/11	1.00	1.00
Caterham	33/11	3.00	4.00
Coulsdon	33/11	2.00	2.00
Croydon A 6.6kV	33/6.6	2.00	2.00
Croydon B	132/33	5.00	5.00
Croydon Central	33/11	4.00	4.00
Croydon Grid	132/33	1.00	1.00
Croydon Grid 11kV	33/11	1.00	1.00
East Croydon	33/6.6	1.00	1.00
Norbury 441	33/6.6	2.00	2.00
Nork	33/11	1.00	1.00
North Cheam	33/11	2.00	2.00
Purley Grid	132/33	3.00	3.00
Purley Local	33/11	1.00	1.00
Selhurst	33/6.6	1.00	1.00
Selsdon	33/11	1.00	1.00
Shirley	33/11	1.00	1.00
Spurgeons Bridge	33/6.6	1.00	1.00
St Helier	33/11	5.00	1.00
Suffolk Road 973	33/6.6	1.00	1.00
Sutton A	33/11	1.00	1.00
Sutton B	33/11	5.00	5.00
Sutton Grid	132/33	2.00	1.00
West Croydon	33/11	1.00	1.00
West Wickham	33/11	2.00	2.00

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

Table 16 above provides load indices for each substation covered in this RDP. Sutton B and Croydon B are the only sites to remain on LI5 after investment in ED1 and expected to change to LI1 after project completion during ED2. The Load index for St Helier is expected to improve from LI5 to LI1 once the works proposed in this RDP are implemented.

Table 17. ED1 Health Indices (Circuit Breakers)

Substation	2015					2023 with Intervention				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ADDINGTON GRID 11KV		9	1					10		
ADDINGTON LOCAL		4	12	1		17				
BEDDINGTON 132/11KV	17						17			
BENSHAM GROVE 6.6KV		15					15			
BIGGIN HILL 33KV		5	5				10			
BRIDGES LANE 11KV	2	11				2	11			
CATERHAM 33/11KV			12			12				
COULSDON 33/11KV		12	3					15		
CROYDON A 6.6KV		36						36		
CROYDON CENTRAL 33/11KV	13						13			
CROYDON GRID 33/11KV		12	3				2	12	1	
EAST CROYDON 33/6.6 KV	18						18			
NORBURY 33/6.6KV		16	2					18		
NORK 33/11KV		12					12			
NORTH CHEAM 33/11KV			13			13				
PROLOGIS 132/11KV	10					10				
PROLOGIS 132KV	2					2				
PURLEY 11KV		20						20		
SELHURST 33/6.6 KV		10					5	5		
SELSDON 33/11 KV		6	4				1	9		
SHIRLEY 33/11kV	1	9	2			1		11		
SPURGEONS BRIDGE		6	12				18			
ST HELIER 33/11KV			11				11			
SUFFOLK ROAD 6.6KV	2	14				2	14			
SUTTON A 33/11KV		14				14				
SUTTON B 33/11KV		12					12			
WEST CROYDON 33/11KV		14						14		
WEST WICKHAM 33/11KV		4	7					7	4	

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

Substation	2015					2023 with Intervention				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ADDINGTON GRID 132 KV		3.00						3.00		
ADDINGTON GRID 33 KV		12.00						12.00		
ASHBURTON GRID 132 KV		2.00					2.00			
ASHBURTON GRID 33 KV		11.00					5.00	6.00		
BEDDINGTON 132/33KV		9.00					9.00			
CROYDON B 132 KV	2.00		2.00			2.00			2.00	
CROYDON B 33KV	9.00		1.00			9.00			1.00	
CROYDON GRID 132 KV		2.00					2.00			
CROYDON GRID 33KV		13.00					4.00	9.00		
PURLEY GRID		6.00	5.00				2.00	8.00	1.00	
PURLEY GRID 132 KV		2.00						2.00		
SUTTON GRID 132 KV		2.00					2.00			
SUTTON GRID 33KV		11.00						11.00		

Substation	2015					2023 with Intervention				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BEDDINGTON	22					2	20			
CROYDON ENERGY 132KV SWITCHING STATION		1					1			
CROYDON GRID 132 KV		1					1			

Table 17 above illustrates NLRE projects identified in the current NAMP and their respective equipment health indices after intervention. Several sites have more than one NAMP number associated with them, which provides an opportunity for collaboration and optimisation to manage costs.

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

Table 18. – ED1 Health Indices (Transformers)

Substation	2015					2023 with Intervention				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ADDINGTON GRID 11KV		2						2		
ADDINGTON LOCAL			1	1		2				
BENSHAM GROVE 6.6KV	2					2				
BIGGIN HILL 33KV		2						2		
CATERHAM 33/11KV		2						2		
COULSDON 33/11KV	1	1					1	1		
CROYDON A 6.6KV		2					1	1		
CROYDON B 132 KV	1					1				
CROYDON CENTRAL 33/11KV	2						2			
CROYDON GRID 33/11KV		2						2		
EAST CROYDON 33/6.6 KV			2			2				
NORBURY 33/6.6KV		2				2				
NORK 33/11KV		2					1	1		
NORTH CHEAM 33/11KV		2					2			
PURLEY 11KV	2	1					3			
SELHURST 33/6.6 KV		2					1	1		
SELSDON 33/11 kV		2						2		
SHIRLEY 33/11KV		1			1	1	1			
SPURGEONS BRIDGE		2						2		
ST HELIER 33/11KV		2				2				
SUFFOLK ROAD 6.6KV	2					2				
SUTTON A 33/11KV	2						2			
SUTTON B 33/11KV		2				2				
WEST CROYDON 33/11KV			2					2		
WEST WICKHAM 33/11KV		1			1	2				
Substation	**2015**					**2023 with Intervention**				
	No. HI1	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
ADDINGTON GRID 132 KV		3						3		
ASHBURTON GRID 132 KV		2					2			
BEDDINGTON		2						2		
BEDDINGTON 132KV										
CROYDON B 132 KV	1			1			1			
CROYDON GRID 132 KV		2					1	1		
PROLOGIS 132KV	1	1				1	1			
PURLEY GRID 132 KV			2					2		
SUTTON GRID 132 KV			1		1		1	1		

Table 18 above illustrates that transformers at Addington Local will be replaced to become HI1 during ED1 period. However the switchgear at the same site is also earmarked for replacement due to poor asset health condition under project 3256, which provides an opportunity for project optimisation as the site is also due for an ITC due to firm capacity violation under project 7873.

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

5 Alternatives Considered

The following projects are identified in the current NAMP but have been rejected in this RDP for reasons stated below.

5.1 Alternative Strategy 1

7929 - St Helier 33/11kV - Retrofit 11kV Switchgear - £175k (2021-2022)

The condition assessment of the 1965 Reyrolle LMT oil switchgear installed at ST HELIER 33/11kV has shown that the probability of failure due to degradation will become unacceptable with HI3/8 during ED1 period. It is not possible to keep these assets in use without compromising operational requirements; therefore this project recommends its refurbishment. Completion of the project will see 11 circuit breakers refurbished.

The option to refurbish the 11kV switchgear is rejected because the site is also due for an ITC from 2x16/20MVA to 2x20/40MVA, which requires switchgear uprating to match the new transformer ratings.

5.2 Alternative Strategy 2

8062 - Sutton Grid 33kV Reinforcement - £6,892 (2017-2020)

The predicted load at Sutton Grid 33kV will exceed the existing rating of the associated transformer circuits. It is not possible to lower the load without compromising operational and planning requirements. It is therefore proposed to increase transformer circuit capacity by replacing the 15 panel 33kV switchboard and replacing 7 km of 132kV underground cable from Beddington. Completion of this project will see the transformer feeder circuit uprated by replacement of 15 panels of 33kV switchboard and addition of a new Beddington-Sutton Grid 132kV cable circuits while the existing 132kV FFC are to be banked on T2.

This strategy is rejected because of the extra capacity created by the ITC at Beddington 132/33kV and possibility of transferring St Helier primary load from Sutton Grid to Beddington Grid in order to improve firm capacity at Sutton Grid.

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

6 References

References	Description
Reference 1	SPN Planning Load 2011 – 2023 (27th February 2013)
Reference 2	SPN 132kV System Diagram East
Reference 3	SPN 132kV System Diagram West
Reference 4	SPN LTDS Network Schematics
Reference 5	DPCR5 19th February 2014
Reference 6	ED1 NAMP 19th February 2014

6.1 Appendices

Appendix	Description
Appendix A	Geographical diagram
Appendix B	Single Line Diagram – Existing Network
Appendix C	Single Line Diagram – Recommended Strategy
Appendix D	Croydon Borough of London's Five Master Plans

6.2 Document History

Version	Date of Issue	Author	Details
1	06/10/2012	Itayi Utah	Draft for approval
1.2	23/02/2014	Itayi Utah	ED1 Resubmission draft
1.3	26/03/2014	Sharon Green	ED1 Resubmission
2.0	28/03/2014	Regulation	Final for publication

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

7 Document Sign Off

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.

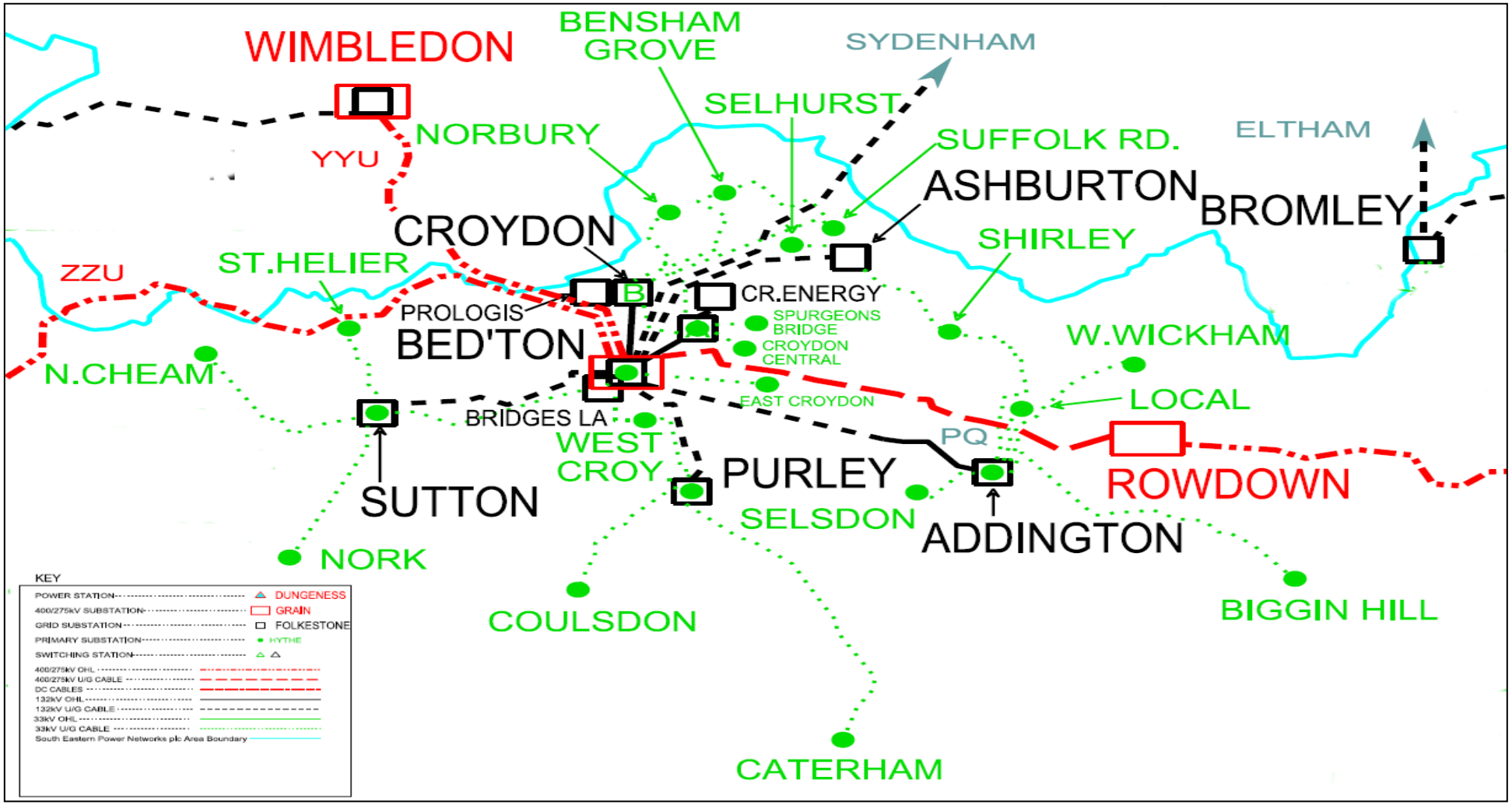
Recommended by:

Name	Role	Signature	Date
Itayi Utah	Infrastructure Planning Engineer		
Tendai Matiringe	IDP Coordinator (SPN)		
Chris Winch	Planning Manager (South)		

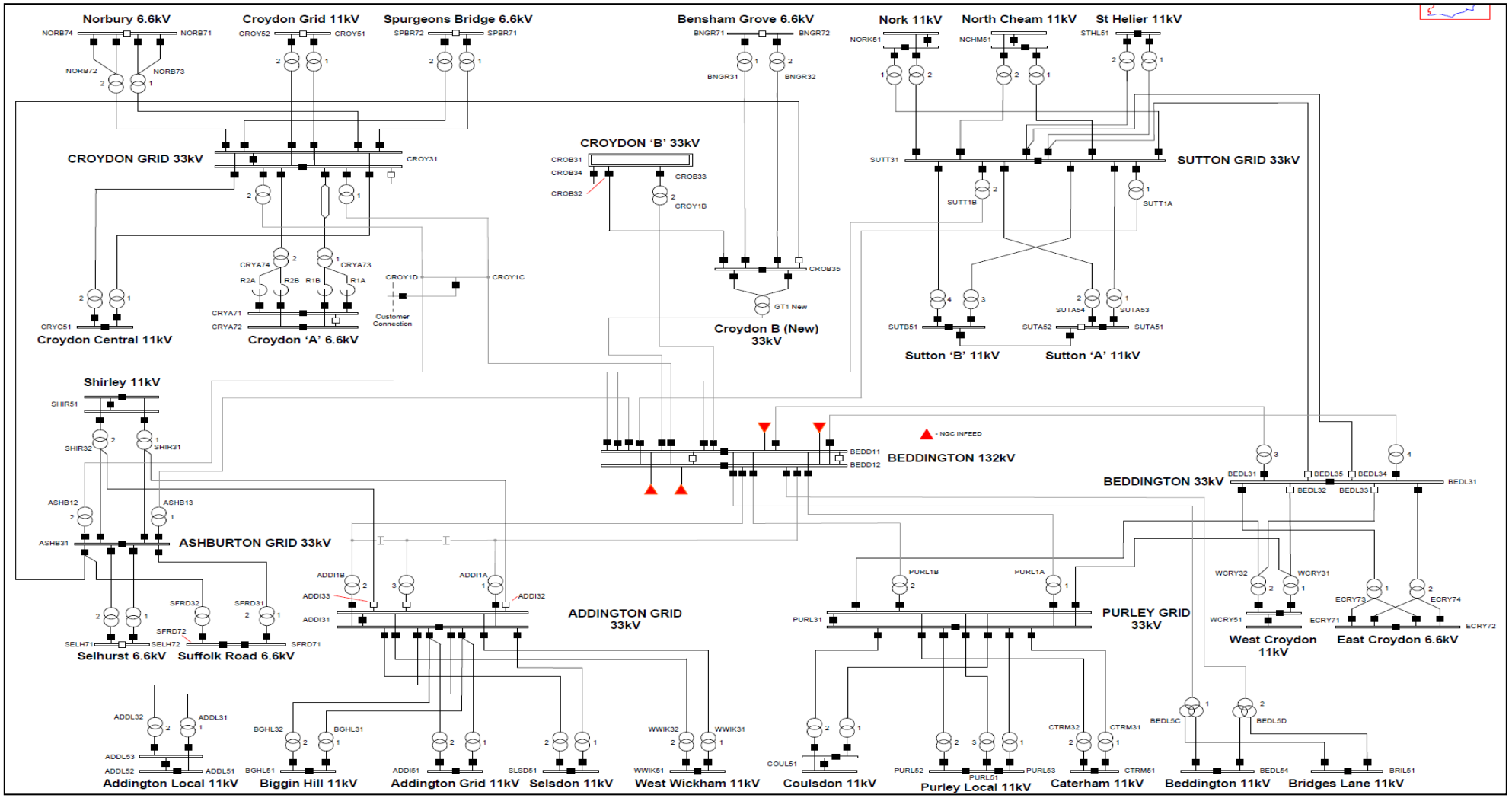
Approval by:

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

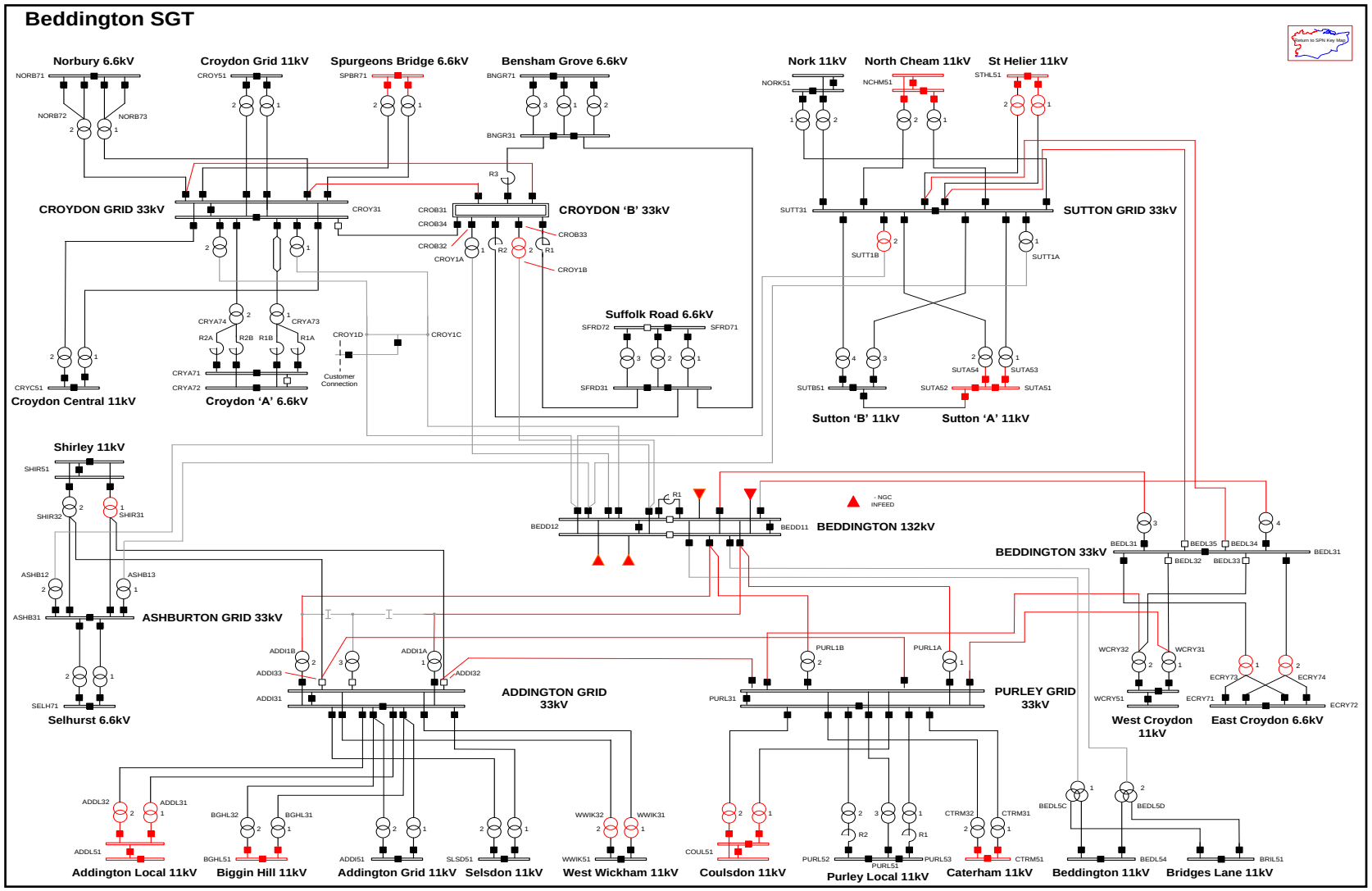
APPENDIX A: GEO-PHYSICAL NETWORK DIAGRAM



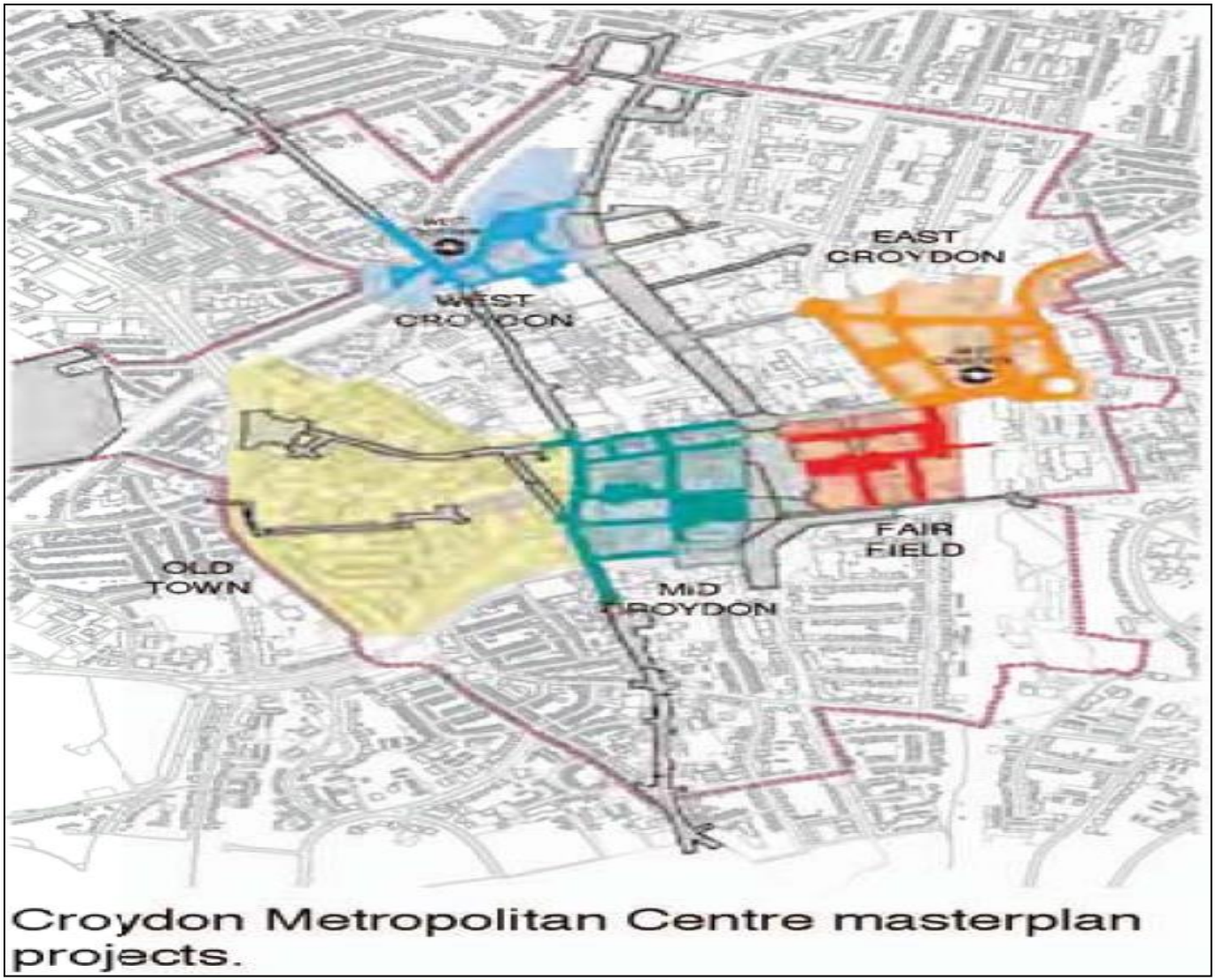
APPENDIX B: SINGLE LINE DIAGRAM – EXISTING NETWORK



APPENDIX C: SINGLE LINE DIAGRAM – RECOMMENDED STRATEGY



APPENDIX D: CROYDON BOROUGH OF LONDON'S FIVE MASTER PLANS



Croydon Metropolitan Centre masterplan projects.