Milehouse BSP and Associated 33kV Network

Network Development Report – South West

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Electricity Distribution

nationalgrid

Contents

Milehouse BSP and Associated 33kV Network

1. Network Overview

Milehouse Bulk Supply Point (BSP) supplies an urban 33 kV network, within the City of Plymouth. It is supplied from two 132/33 kV GTs, which feed approximately 32,900 customers.

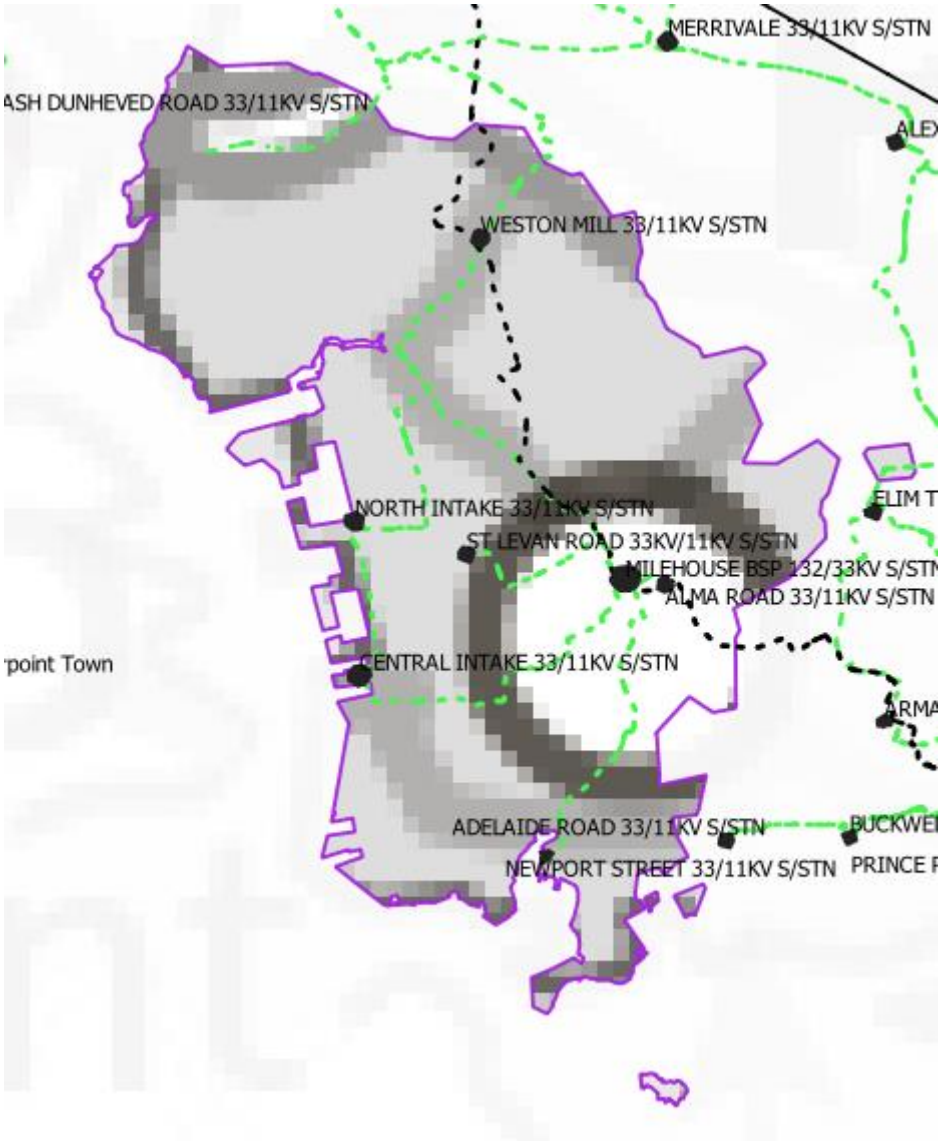

Figure 1.1 Milehouse BSP geographic network coverage

This report discusses all existing and future network constraints over a 0-10 year horizon associated with the 33/11 kV transformers, 33 kV circuits and 132/33 kV transformers which supply Milehouse BSP. This uses the methodology outlined in the Network Development Plan Methodology Report with Network Operability Modelling applied as outlined below.

For the purposes of this analysis the NGED Best View Distribution Future Energy Scenario (DFES) has been used to study the years 2022 (baseline), 2028 and 2034, with consideration given to how proposals could change under the other scenarios. Five representative days have been studied across the four seasons: Winter Peak Demand, Intermediate Warm Peak Demand, Intermediate Cool Peak Demand, Summer Peak Demand and Summer Peak Generation.

1.1 Network Topology

The Milehouse BSP network is arranged as follows:

- Alma Road Primary substation is supplied by two 33 kV circuits as ‘transformer feeders’.
- Newport Street Primary substation is supplied by two 33 kV circuits as ‘transformer feeders’.
- St Leven Road Primary substation is supplied by two 33 kV circuits as ‘transformer feeders’.
- Weston Mill Primary substation is supplied by two 33 kV circuits with two interconnecting circuits to Ernesettle BSP, with the normal open point on circuit breakers 4L5 & 21L5 at Ernesettle BSP.
- There are two 33kV feeders to Central Intake.

1.2 Network Operability Modelling

The following network automation and manual switching schemes have been modelled in the analysis of this area, aligning to how the network is currently operated, as well as proposed actions, to manage some constraints identified operationally.

- For an outage on a Milehouse BSP to Central Intake feeder the normal open points at North intake are closed with the remaining Milehouse to Central Intake feeder being run open.

2. Network Constraints and Solution Options

2.1 Summary of Network Constraints

The following constraints were identified for the Best View Scenario, for which mitigation options will be discussed:

- Milehouse BSP 132/33 kV Grid Transformer overloads
- Alma Road 33/11 kV T1 & T2 overloads
- St Levan Road 33/11 kV T1 & T2 overloads
- Milehouse BSP 7L5 to St Leven Road 33kV circuit overload

3. Network Constraint Details and Solution Options

3.1 Milehouse BSP 132/33 kV GT Overloads

Generation | Demand

Constraint Overview

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at intermediate cool peak demand.

Table 3.1.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First studied year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Milehouse GT1 overload	Milehouse GT2 or 33kV busbar outage	None		2034		
Milehouse GT2 overload	Milehouse GT1 or 33kV busbar outage	None		2034		

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.1.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	**Discounted**
Reinforcement					
1	Application of an increased rating following checks on ancillaries	✓	×	✓	**Viable**
Operational Mitigation					
-	*None Identified*	-	-	-	-
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
2	Procure flexibility under Milehouse BSP at 33kV or below	✓	×	✓	**Viable**

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full cost benefit analysis (CBA). This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the Distribution Network Options Assessment (DNOA) process.

Option 1 – Application of an increased rating following checks on ancillaries

Capacity released for constraint(s) considered: TBC

Viable

Detailed description: Uprate the existing GTs at Milehouse via use of cyclic ratings in accordance with British Standard 171/IEC60076 and NGED Standard Technique SD8C. This requires a capability assessment of all ancillaries, such as busbars, isolators, CTs, cables (including cabling within the substation), switchgear, tap changer, transformer bushings, conservator and earthing transformer. In addition, an assessment of the cyclic profile of the load is required to determine if transformer temperature and ageing is within acceptable limits.

New limiting factor for constraint(s) considered: TBC following assessment

Option 2 – Procure flexibility under Milehouse BSP at 33kV or below

Flexibility service type: Generation turn up/demand turn down

Detailed description: Flexibility services could be procured to alleviate projected seen on the Grid Transformers at Milehouse BSP. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to undertake an assessment using NGED Standard Technique SD8C to achieve the full rating of both Grid Transformers (Option 1).

3.2 Alma Road T1 & T2 Overloads

Generation | Demand

Constraint Overview

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads initially seen at intermediate cool peak demand.

Table 3.2.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Alma Road T1 overload	Alma Road T2 or circuit outage	None		2034		
Alma Road T2 overload	Alma Road T1 circuit outage	None		2034		

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.2.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Review transformer ratings	✓	×	✓	Viable
2	Replace transformers with larger units	✓	×	×	Viable
Operational Mitigation					
-	*None Identified*	-	-	-	-
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
3	Procure flexibility under Alma Road at 11kV or below	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full cost benefit analysis (CBA). This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the Distribution Network Options Assessment (DNOA) process.

Option 1 – Review transformer ratings

Capacity released for constraint(s) considered: Subject to review

Viable

Detailed description: Overloads are only seen in 2034 for intermediate cool. It is therefore possible that this constraint could be delayed slightly by reviewing NGED's internal policy regarding transformer ratings, which does not currently distinguish between summer and intermediate cool ratings (which may be overly pessimistic). This solution is dependent on an internal review and would not be a long term solution.

New limiting factor for constraint(s) considered: Subject to review

Option 2 – Replace transformers with larger units

Capacity released for constraint(s) considered: TBC

Viable

Detailed description: Replace the transformers with larger units (20/40MVA).

New limiting factor for constraint(s) considered: TBC

Option 3 – Procure flexibility under Alma Road at 11kV or below

Flexibility service type: Demand turn down **or** Generation turn up

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads seen on the transformers at Alma Road. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended that a review of transformer ratings is undertaken since the overload is small and does not occur until 2034 (Option 1).

3.3 St Levan Road T1 & T2 overloads

Generation | Demand

Constraint Overview

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at intermediate cool/warm peak demand.

Table 3.3.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
St Levan Road T1 overload	St Levan Road T2 outage	None		2034	2034	
St Levan Road T2 overload	St Levan Road T1 outage	None		2034	2034	

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.3.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	**Discounted**
Reinforcement					
1	Review transformer ratings	✓	×	×	**Viable**
2	Replace transformers with larger units	✓	×	×	**Viable**
Operational Mitigation					
-	*None Identified*	✓	✓	✓	**Viable**
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
3	Procure flexibility under St Levan Road at 11kV or below	✓	✓	✓	**Viable**

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full cost benefit analysis (CBA). This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the Distribution Network Options Assessment (DNOA) process.

Option 1 – Review transformer ratings

Capacity released for constraint(s) considered: TBC

Viable

Detailed description: Overloads are only seen in 2034 for intermediate cool. It is therefore possible that this constraint could be delayed slightly by reviewing NGED's internal policy regarding transformer ratings, which does not currently distinguish between summer and intermediate cool ratings (which may be overly pessimistic). This solution is dependent on an internal review and would not be a long term solution.

New limiting factor for constraint(s) considered: TBC

Option 2 – Replace transformers with larger units

Capacity released for constraint(s) considered: TBC

Viable

Detailed description: Replace the transformers with larger units (20/40MVA).

New limiting factor for constraint(s) considered: TBC

Option 3 – Procure flexibility under St Levan Road at 11kV or below

Flexibility service type: Generation turn up/demand turn down

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads seen on the transformers at St Levan Road. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended that a review of transformer ratings is undertaken since the overload is small and does not occur until 2034 (Option 1).

3.4 Milehouse BSP 7L5 to St Levan Road 33kV circuit Overload

Constraint Overview

Generation Demand

The table below outlines the nature of the network constraints identified in the network analysis, with the worst overloads seen at intermediate cool peak demand.

Table 3.4.1 constraint(s) and condition under which constraint occurs

Constraint	N-1 Condition	Subsequent N-2 Condition	First year constraint is observed in each season under Best View			
			Winter	Int Cool	Int Warm	Summer
Milehouse BSP 7L5 to St Levan Road 33kV circuit overload	Milehouse 33kV Main 2 busbar or T2 circuit outage	None		2034		

Uncertainty under other Distribution Future Energy Scenarios: Constraints may be triggered earlier for higher growth scenarios

Solution Options

A list of each of the options considered for this constraint is given in the table below.

Table 3.4.2 solution options to solve constraint(s)

Solution Options	Description	Solves Constraint	Wider Area Benefit	Potential to be cost effective	Viable or Discounted
0	No Intervention	×	×	×	Discounted
Reinforcement					
1	Review protection settings to increase circuit rating	✓	×	✓	Viable
Operational Mitigation					
-	*None Identified*	-	-	-	-
Load Management Schemes					
-	*None Identified*	-	-	-	-
Flexibility services					
2	Procure flexibility under at St Levan Road at 11kV or below	✓	✓	✓	Viable

Solution Development

These options have been assessed on their technical viability and their likely cost-effectiveness pending a full cost benefit analysis (CBA). This CBA will be subsequently carried out by the DNO to determine the optimal reinforcement solution, which will then be tested against market provided flexibility by the DSO as part of the Distribution Network Options Assessment (DNOA) process.

Option 1 – Review protection settings to increase circuit rating

Capacity released for constraint(s) considered: TBC

Viable

Detailed description: Review protection settings on Milehouse BSP 7L5 to St Levan Road to determine if the circuit rating may be increased.

New limiting factor for constraint(s) considered: TBC

Option 2 – Procure flexibility under St Levan Road at 11kV or below

Flexibility service type: Generation turn up/demand turn down

Viable

Detailed description: Flexibility services could be procured to alleviate projected overloads seen on the Milehouse BSP 7L5 to St Levan Road 33kV circuit. The viability of utilising flexibility will be further investigated as part of the DNOA process.

Solution Recommendation

It is recommended to review the protection settings to remove the current rating restriction to enable the full cable rating to be utilised (Option 1).

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