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RCP2 Project Overview Document

Project:	**Haywards Local Service Third Incomer**
Expenditure Class:	**Base Capex**
Expenditure Category:	**Grid – Enhancement & Development**
As at date:	**June 2014**

Expenditure Forecast *Real 2012/13 NZ$ (m)*	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	**Total**
CAPEX	0.6					**0.6**

Need Identification

Describe the reason for proposing a project (i.e. **need or trigger**)	The project will increase the N-1 security during maintenance outages of the 11 kV local service supply to the Haywards synchronous condensers, bringing it into line with existing security levels for the HVDC converter stations. This is to be achieved by installing an additional in-feed to the Haywards 11 kV AC station local service system, via a new cable. Currently, during planned maintenance of one incomer, the loss of the second incomer can cause an HVDC run- back, leading to a major under-frequency incident and operation of automatic under-frequency load shedding (AUFLS). The risk can be managed operationally by applying constraints on HVDC transfer during local service outages but the cost of applying constraints is around $0.9m (NPV). <u>Background</u> Haywards has two 11 kV local service supply systems: • one supplies the HVDC Pole 2 and Pole 3 converter stations, and was upgraded as part of the Pole 2 project in 1991. This local service supply has three sources. Thus during maintenance outages of any one branch of this local service system, the HVDC converter station auxiliaries still have N-1 security; and • the other local service system supplies the condensers (and other AC station load). This local service system has two sources, one from the single 110/11 kV supply transformer (T11), and the other from the single 110/33 kV supply transformer (T12) and a 33/11 kV local service transformer (T16). Thus, during maintenance outages of either branch of this system, the power supply to the condensers has N security. All Haywards condensers are exposed to a single contingent event during such outages. If, during a maintenance outage, the local service at Haywards tripped, all condensers would lose their 400V power supply. The cooling pumps are run off the local service supply. The loss of local service would result in an Emergency Trip order for the water cooled condensers after 60s to

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	prevent damage from loss of cooling. This will cause the HVDC controls to instantaneously reduce HVDC transfer at high levels of transfer to a predetermined level where operation without the support of the condensers is stable. A large sudden drop (or runback) in HVDC transfer will cause an under-frequency excursion in the 'receiving' island and might trigger the operation of AUFLS if the HVDC transfer was high enough prior to the event.
What is the **timing** of the need and the **confidence level** that issue(s) will eventuate	The need date of this project is 2016. We have a moderate level of confidence that this project will proceed. We have yet to confirm that the project is economic, although we have indicative costs and benefits which suggest it will be. We will not have an accurate estimate of the capital costs of a third incomer until the investigation has been carried out. If the project is not economic then it will not proceed.
Generic assumptions underpinning the need – including any modelling used	

Long list of options and high level assessment

Option Type	Option	Fit	Feasible	Practical	GEIP	Security	Cost	Short list
Transmission options	a) Third incomer to Haywards local service supplying the condensers	✓	✓	✓	✓	✓	✓	✓
	b) System Operator intervention/operational measures	✓	✓	✓	✓	✓	✓	✓

- Fit for purpose – will meet the transmission need.
- Technical feasibility – complexity of solution; reliability, availability and maintainability of the solution; future flexibility – Grid Development Strategy.
- Practicality of implementation – Solution implementable by required date (probability of proceeding); property and environmental risks; implementation risks.
- Good electricity industry practice (GEIP) – consistent with good international practice; ensure safety and environmental protection; accounts for relative size, duty, age and technological status.
- System security (additional benefit resulting from an economic investment) – improved system security; system operator benefits (controllability); Dynamic benefits (modulation features and improved system stability).
- Indicative cost – whether an option will clearly be more expensive than another option with similar or greater benefits.

Short list of options

Option 1 – third incomer cable	This option involves installing an 11 kV cable between the switchboards supplying the condensers and HVDC local service transformers.

P50 option costs

Brief description of the approach used to estimate capex, and, if	A desk-top assessment of a high level scope and 'building block' cost is used to estimate the cost for each option and determine the preferred option. The cost of the preferred option has been substituted with a detailed site specific estimate. The approach and key assumptions used to

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applicable, opex	compile the preferred option estimate are: • the project scope and likely location of the new assets have been determined from a desktop review of aerial photographs, site layout drawings, underground services drawings, and available cable ducts; • the scope assessments have been used to estimate materials and work quantities; • the component costs for material and work quantities have been taken from TEES (US Costs); • material and plant costs have been determined with reference to period supply contracts currently in place and historic installation costs respectively; • civil and earthworks costs have been extrapolated from historic costs; and • installation costs are informed by similar historic projects and or current quotes from service providers and applied based on the requirements of the site. The total project cost is consistent with historic costs for similar types of projects completed in the past.
Option 1 – third incomer cable supplying local service	$0.6m.[1]

Net benefits and outputs	
Reference case – Operational Measures	The risk of the loss of local service and a bipole runback during planned maintenance of the Haywards 11 kV local service can be managed operationally by applying constraints to HVDC transfer. Constraints on HVDC transfer will increase the cost of generation in the 'receiving' island: the cost of constraints is estimated at up to $64k for a single eight hour maintenance outage each year. This has a NPV cost of $0.9m[2].
Option 1 – third incomer cable supplying local service	This is a long term solution to maintaining N-1 security during maintenance outages of the local service supply for the condensers, minimising the risks of interruption to HVDC transfers during local service maintenance. The key benefits are: • reduced system risk – avoid a widespread loss of supply from AUFLS in the North Island due to an HVDC runback caused by loss of local service supply; and • enable extended outages for pro-active maintenance work on local service system assets. Any such work will be more efficient as it will not need to be scheduled around outage availability within the current constraints.

[1] We have reassessed the costs since the December 2013 submission. Given the low cost further detailed examination is not warranted.
[2] This calculation assumes that 200 MW of low fuel cost South Island hydro is replaced by North Island thermal generation with a fuel cost of $40 per MWh for eight hours. The NPV uses a discount rate of 7 % over a period of 40 years.

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Option risk assessment	
Reference case – Operational Measures	The Operational Measures option carries the risk of higher markets costs if generation costs increase over time.
Option 1 – third incomer cable transformer supplying local service	There is potential for significant cost variation from the estimated P50 cost of $0.6m. Cost estimates will be refined in the next stage of investigation.

Preferred option(s)	
What is the currently preferred option / sequence of options / or short-listed options?	Provided the project is found to be economic, the preferred approach is Option 1 – install an 11 kV cable between the switchboards supplying the condensers and HVDC local service transformers.
Set out the reasons for choosing the preferred option(s).	This option minimises risk of loss of local service supply to the Haywards condensers, and thereby minimises potential interruption to HVDC transfers and consequential operation of AUFLS, without requiring constraints on HVDC transmission during planned or unplanned outages of local service system assets. The estimated cost of the constraints is $0.9m NPV.
List key **assumptions** used in determining the preferred option(s).	The assumptions used in determining the preferred option, to date, are set out above.
List any **interdependencies** which the preferred option is reliant upon for a successful outcome.	The ability to obtain sufficient outages for work, both in number and duration, will be important to project delivery.

Steps to completion	
What are the next step(s) in choosing the solution	The next step will be BC2 investigation of the preferred solution. In accordance with our business case process (as described in section 3.6.1 of AM03 - Planning Lifecycle Strategy) the next steps will be to: • carry out a detailed investigation (BC2) to determine the preferred option; and • obtain internal approval to proceed with the project (BC3).

When did / will the steps in the internal approval process occur / take place and where were / will they be documented and described	The anticipated timeline is: • conduct BC2 investigation to confirm the preferred option Q3 2014; • complete consultation with affected stakeholders Q4 2014; • submit the preferred solution for Board approval Q2 2015; • complete the BC3 for project execution Q4 2015; and • expected commissioning date – 2016.
Identify the key services and assets that will need to be procured to complete the preferred option	Depending on the preferred solution identified in the detailed assessment (BC2) phase, key assets to be installed will be 11 kV cables between the switchboards supplying the condensers and HVDC local service transformers. We expect to outsource the detailed design of the preferred solution. In accordance with our Procurement Policy, we will ensure that a robust and auditable purchase decision-making process is followed. We will complete a Procurement Plan to document the procurement process and for audit purposes. The plan helps us plan for the external procurement of goods and services in a way that ensures we are making the most appropriate purchasing decision for our stakeholders and ourselves.
Identify the key delivery risks	• Projects not properly scoped can lead to cost overruns and not meeting deadlines. During the planning process, we will ensure project scope is adequately defined and it can be implemented within the required timeframe and cost. • We will ensure the project is designed to its specification, the appropriate design reviews are completed and, where appropriate, detailed factory inspections are carried out to manage risks. • In the process of procurement, it is essential that we select a supplier that is able to consistently meet quality requirements. Quality must not be compromised in favour of other factors because of the critical influence of quality on risk to safety and the network. • If applicable, we will standardise specifications and procurement of primary equipment to limit diversity and increase inter-changeability. This also allows procurement efficiencies to be attained. • Safety is paramount, the design of all equipment installed must be safe to operate and maintain without compromising performance. Vendors are selected with great care to ensure safe installation and commissioning work and full compliance with all our safety requirements and expectations. • All works required on site will be carried out in full compliance with all of our safety requirements and expectations.

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Supporting Documents and Models	
List of all relevant documents (including relevant policies and consultant reports) taken into account in estimating project costs and describing anticipated deliverability.	AM03 - Planning Lifecycle Strategy
Provide a schedule of any models used (including descriptions of model operation and scope).	