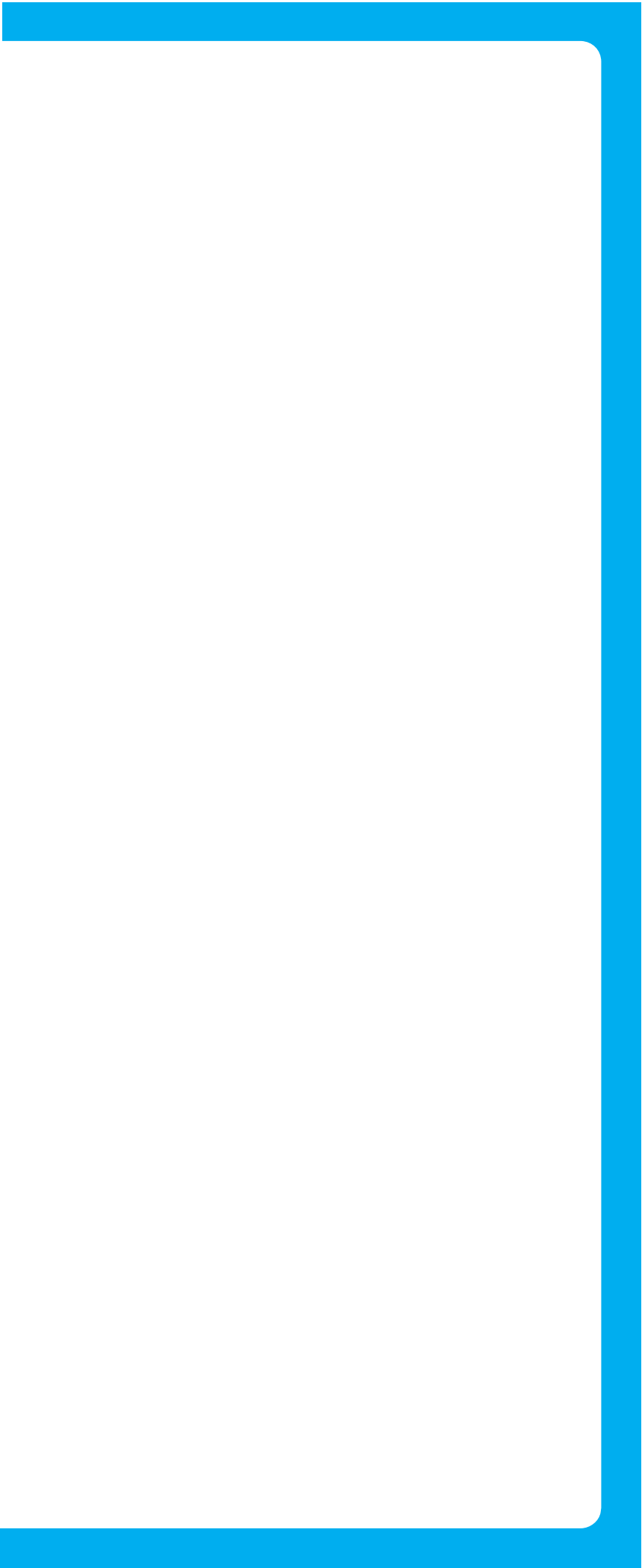


Mervyn Davies' Enquiry: Power and Water's First Progress Report

June 2009



Executive summary

Power and Water delivers electricity in one of the toughest natural environments in the world. This environment accelerates the ageing and deterioration of electricity generation and network assets. In September and October 2008, approximately 15,000 customers were affected by separate power outages as a result of equipment faults in and around the Casuarina 66/11kV Zone Substation. The equipment faults involved an 11kV circuit breaker, two 11kV cable boxes and three 11kV cables.

Inevitably, there was widespread community disruption and, understandably, concern.

As a consequence, the Northern Territory Government commissioned an Enquiry, led by Mervyn Davies, to investigate these faults and Power and Water's substation maintenance practices.

The Enquiry provided its Final Report in February 2009, in summary recommending that:

- There be a move to a more 'condition based' approach to substation maintenance management.
- A significant Human Resources Development program will be required.
- A condition assessment and remedial program for all zone and distribution substation equipment should be carried out.
- Casuarina Zone Substation 11kV switchboard should be replaced.

Power and Water immediately committed to implementing the Enquiry's Recommendations as soon as possible. Its workforce was already working hard to improve reliability.

This document is Power and Water's first report on progress and plans, detailing 37 major milestones to give effect to the Davies' Recommendations. This document is intended to provide a transparent report to stakeholders, including the Government, the Utilities Commission and the wider community. The next report will be published in three months.

Power and Water expects that it will take until December 2010 to complete every milestone and Recommendation. That said, there has already been good progress in the months since the events and the Enquiry Report, with each Recommendation on track or largely on track:

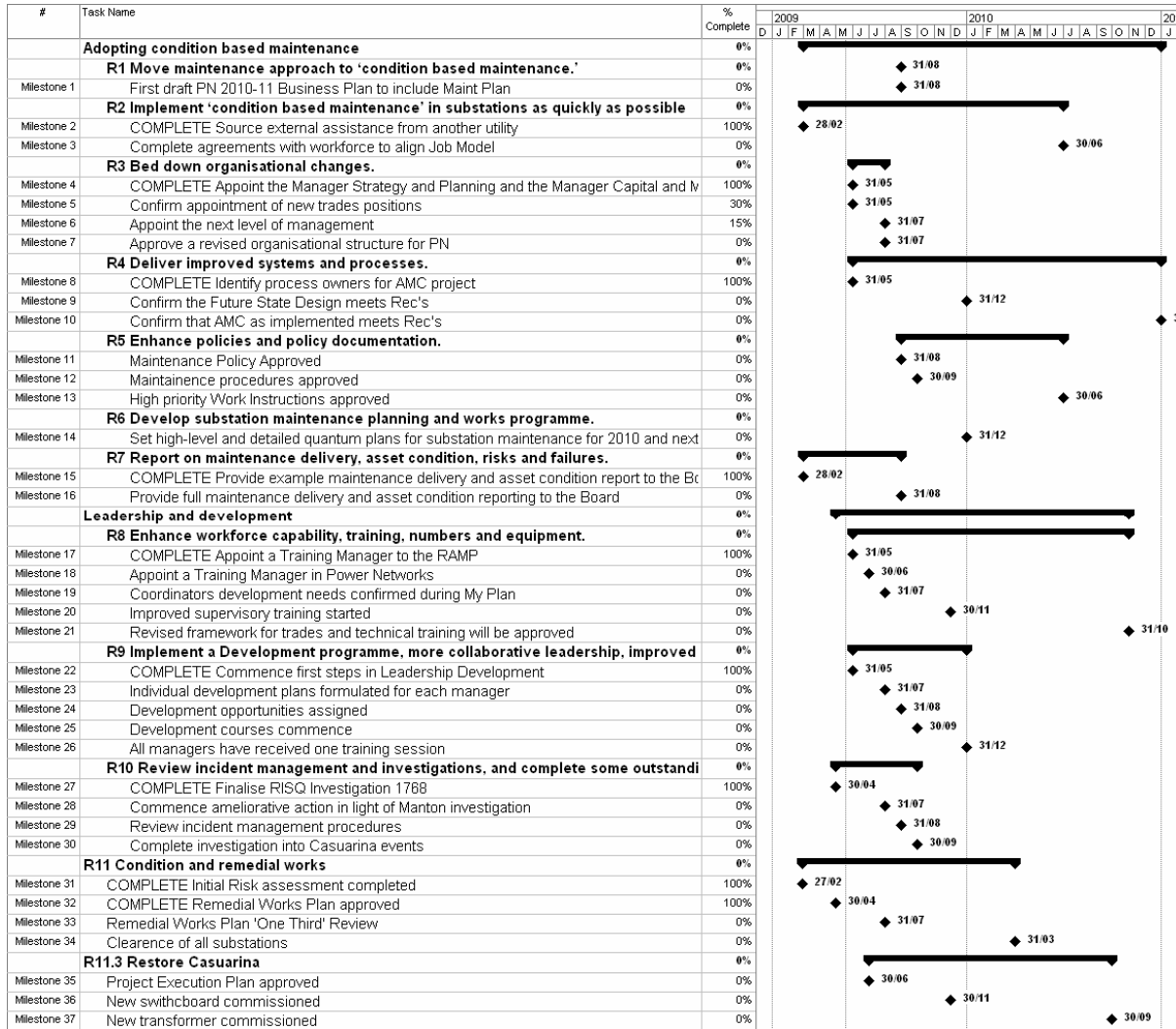
- Condition-based maintenance has commenced on a number of assets, with training already underway on test gear and new, technically expert training managers being appointed.
- A wide-ranging restructure of the Power Networks' business has continued, and recruitment action taken to fill key roles.
- A Leadership Programme has just commenced in the Power Networks' business intended, among other things, to improve collaboration with the workforce.
- Staff communication has improved, with a number of communication forums to air longstanding concerns.
- A condition assessment and remedial program has commenced, with crews, on many occasions, working through the night to access equipment safely and with minimum disruption to customers.
- A temporary switchboard has been installed at Casuarina to restore the substation to its original capacity, and plans for its permanent replacement are well advanced.

The plans described here are realistic but there is still a lot to do. There may be some delays. The Power and Water team is determined to complete these Recommendations safely and with minimum disruption to customers. On completion, Power and Water will offer a more reliable service, with a well-funded, well-trained and well-led workforce to keep it that way.

This will ultimately benefit all Power and Water's customers.

Major milestones

The following GANTT chart illustrates the major milestones for each of Mervyn Davies' Recommendations, grouped under the headings used in his summary.



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Glossary

AMC	Asset Management Capability
CAIDI	Customer Average Interruption Duration Index (a measure of reliability)
CB	Circuit breaker
CT	Current transformer
DAR	Defective Apparatus Record
EMC	Executive Management Committee
FIS	Facilities Information System
HV	High voltage
LTAP	Long Term Action Plan
MMS	Maintenance Management System
OCB	Oil circuit breaker
PEP	Project Execution Plan
RAMP	Remedial Asset Management Program
RISQ	Risk, Investigation, Safety and Quality – Power and Water’s hazard investigation database, among other things
RWP	the Remedial Works Plan
SAIDI	System Average Interruption Duration Index (a measure of reliability)
SAIFI	Customer Average Interruption Frequency Index (a measure of reliability)
SCADA	System Control and Data Acquisition
VT	Voltage transformer
WIMS	Works Implementation Management System

1 Introduction

This is the Power and Water Corporation's (Power and Water's) first Progress Report on the Northern Territory Government's independent Enquiry into electrical equipment failures at Casuarina Zone Substation and general asset maintenance practices.¹

This Report summarises Power and Water's actions to:

- ensure that the condition of Power and Water's electrical equipment meets established industry standards;
- improve maintenance practice and performance; and so
- fulfil all the Enquiry's recommendations.

Power and Water welcomed Mervyn Davies' Preliminary and Final Reports on publication and remains committed to carrying out their recommendations. Power and Water has been working on the Enquiry's Recommendations since the Preliminary Report. This document provides the first public progress report to stakeholders (including the Board, Utilities Commission, NT Government and the wider community).

The overarching objective is to provide a secure and reliable electricity supply to customers. We must ensure that all Power and Water's electrical assets meet established industry standards and to ensure their continued operation at those standards. This will require changes to maintenance practices, training, leadership and culture.

1.1 Background

In September and October 2008, a number of electrical equipment failures resulted in widespread disruption to Darwin's Northern Suburbs. Consequently, the Northern Territory Government established an independent Enquiry headed by Mervyn Davies, into these events, Power and Water's operational response and electrical substation maintenance practices in Darwin.

During the course of the investigation, Mervyn Davies and his team were provided with complete cooperation and unrestricted access to Power and Water's records and staff.

A Preliminary Report was published in November 2008 and the Final Report was published in February 2009. The Enquiry's principal Recommendations were that Power and Water should:

- 1 Move its maintenance approach to 'condition based maintenance.'
- 2 Implement 'condition based maintenance' in substations as quickly as possible by acquiring information, support and clarifying accountabilities.
- 3 Bed down organisational changes.
- 4 Deliver improved systems and processes.

¹ Independent Enquiry into Casuarina Zone Substation Events and Substation Maintenance Across Darwin, Final Report. Chairman: Mervyn Davies. 26 January 2009.

- 5 Enhance policies and policy documentation.
- 6 Develop substations maintenance planning and works programme.
- 7 Report on maintenance delivery, asset condition, risks and failures.
- 8 Enhance workforce capability, training, numbers and equipment.
- 9 Implement a Development programme, with the objective of a more collaborative leadership style, improved communication and individual accountability.
- 10 Review incident management and investigations, and complete some outstanding investigations.
- 11 Undertake an overall remedial program.
 - 11.3 Take immediate action to replace the Casuarina Zone Substation 11kV switchboard.

The full Davies' recommendations are provided in [Appendix A](#) for convenience.

1.2 Report structure

Power and Water's progress and plans in meeting the recommendations arising from the Mervyn Davies' Enquiry are addressed as follows:

- A summary of progress on remedial works and the reform of substation maintenance operations, in [Section 2](#).
- Power and Water's immediate and short term response to the Casuarina Zone Substation equipment failures and an extensive program of equipment condition in [Section 3](#).
- Longer term measures to bring the standard of substation maintenance to established industry practice in its circumstances, described more fully in [Section 4](#).
- The effect on customers of these activities, both in the short and longer term in [Section 5](#).

Detail on each of the principal Recommendations and associated timelines is presented in [Appendix B](#).

1.3 Future reports

This format will form the basis for further quarterly reports to stakeholders (including the Board, Utilities Commission, NT Government and the wider community).

Feedback would be welcomed.

Future versions will be subject to an independent audit, an example scope of which is provided in [Appendix C](#).

2 Progress

This section summarises progress made on the Inquiry's Recommendations so far. As can be seen from the table, some of this work began before the Casuarina incident and some began immediately after, where it was urgent or obviously had merit.

Ref	Recommendation summary	Start Date	Target Completion	On track
1	Move maintenance approach to 'condition based maintenance.'	2/09	8/09	Yes
2	Implement 'condition based maintenance' in substations as quickly as possible by acquiring information, support and clarifying accountabilities.	11/08	6/10	Yes
3	Bed down organisational changes.	2/09	7/09	Largely
4	Deliver improved systems and processes.	2/08	12/10	Yes
5	Enhance policies and policy documentation.	11/08	6/10	Yes
6	Develop substation maintenance planning and works programme.	2/09	12/9	Largely
7	Report on maintenance delivery, asset condition, risks and failures.	11/08	8/09	Yes
8	Enhance workforce capability, training, numbers and equipment.	12/08	2/10	Largely
9	Implement a Development programme, with the objective of a more collaborative leadership style, improved communication and individual accountability.	2/09	2/10	Yes
10	Review incident management and investigations, and complete some outstanding investigations.	2/09	8/09	Largely
11	Undertake Remedial Programs	11/08	3/10	Yes
11.3	Take immediate action to replace the Casuarina Zone Substation 11kV switchboard.	10/08	11/09	Yes

The remainder of this section highlights the most significant areas where progress has been made. It is not intended to cover every Recommendation in detail.

2.1 Apply 'objective need' to maintenance

In the detail of Recommendation 1, Mervyn Davies recommended that Power and Water should:

"Accelerate the implementation of its documented planning intention of adopting a 'framework of objective need' as the basis for maintenance, progressively implement systemic and rigorous condition monitoring, and adopt asset condition as the prime basis for determining 'objective need'."

Power and Water has made major improvements to its business planning process over the past three years. Five year Business Plans were first established in each of the business units in 2007, with an update each year. This change in approach to planning was fundamental to the preparation of the Corporation's 2007/08, 2008/09 and 2009/10 Statements of Corporate Intent (in effect, its Business Plans and Budgets).

The Corporation adopted the '**objective need, capacity to deliver**' approach for each business unit, compared to the previous 'constrained' approach. The change in approach resulted from an internal review of capital expenditure and maintenance practices, having regard for the Blanch Report². It was recognised continuing to constrain expenditure would not be sufficient to ensure sustainable power supply and reliability going forward.

The impact was both immediate and dramatic. Actual capital expenditure in 2007/08 for Power Networks of \$58 million was around 50% higher than 2006/07, with further significant increases proposed over the next three years.

The latest Business Plans cover the period 2008/2009 to 2012/2013 and see a projected capital spend of \$319.1 million over this period. These plans include detailed actions and deliverables for the first year, with strategic actions for subsequent years. The outcome of this planning work has been a significant increase in the Power and Water's infrastructure investment program.

In parallel, the Power Networks business has been revising its Network Planning Criteria. These revisions, commenced in early 2008, are intended to provide a clear basis for investment in the distribution network. The revisions have drawn on practice across Australia and would help ensure that the power network in the Northern Territory would be designed to similar standards as the rest of Australia. Power and Water will consult on these revisions shortly and then submit the resulting criteria to the Utilities Commission for approval.

2.2 Bed down organisational changes

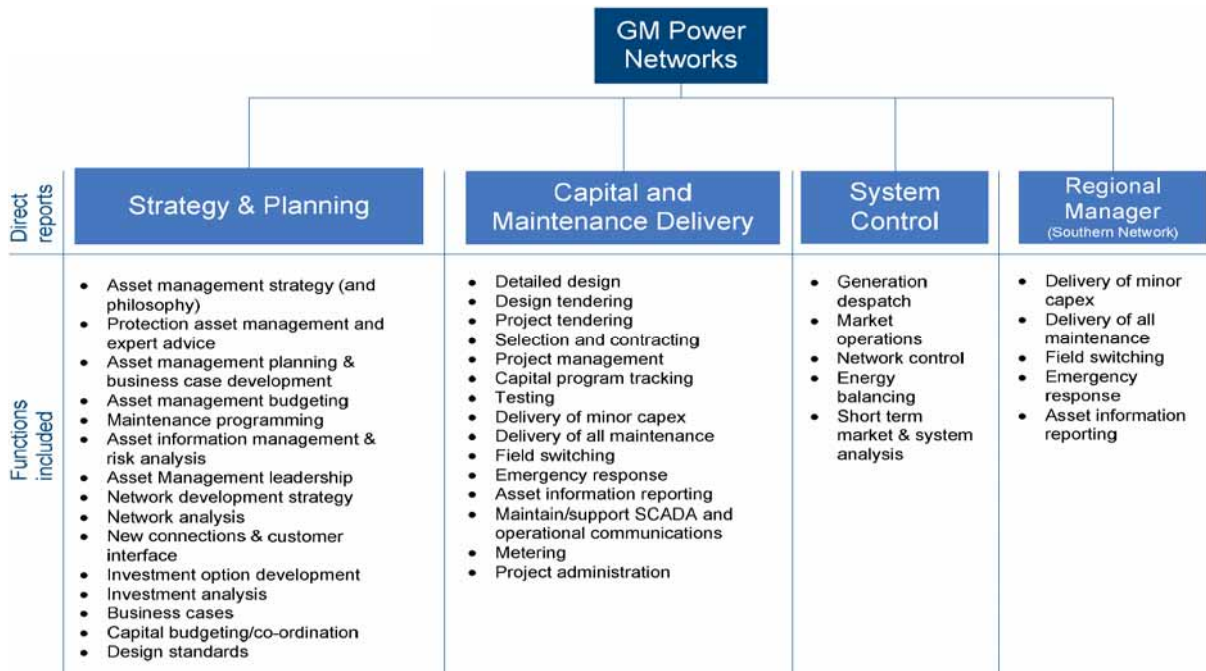
The Managing Director approved the Power Networks business unit restructure in March 2008. The objective was to progressively provide new roles, responsibilities, skills and processes into each business unit to refresh and modernise knowledge and practices.

The restructure was put on hold as the Mervyn Davies' Enquiry's Report was awaited. The Enquiry's Report in large measure endorsed the restructure and provided some additional guidance on desirable maintenance outcomes.

The restructure is now proceeding at a good pace. The Power Networks business unit is in the process of appointing suitably experienced managers to fill key but vacant positions. In addition, 37 front line staff are being recruited (2.4)

² The Blanch review is a report of the findings of a joint Union and PAWC investigation into various aspects of PAWC's operations 2006

The revised organisational structure is shown below:



Power Networks revised organisational structure

The main feature of the restructure was to separate accountability for the performance of maintenance into a 'planning' team and a 'delivery' team. This revised structure is aimed at better supporting the workforce with planning advice, technical knowledge, and documentation (in the form of Policies, Procedures, Work Instructions and technical specifications).

2.3 Deliver improved systems and processes

In early 2008, Power and Water's Board approved a strategy to reform the Corporation's asset management practice. The resulting Asset Management Capability project (AMC) will upgrade asset related systems, policies, procedures and culture and ultimately drive better plant and network reliability and more efficient maintenance.

In the detail of Recommendation 4, Mervyn Davies recommended that Power and Water should:

"Ensure that the systems and processes delivered by the AMC, do as they are expected to do and, provide capabilities for substation maintenance management and asset condition management, that support the recommendations of this report."

In February 2009, a detailed four year \$29M program was approved by the Board. Tenders are currently under consideration for the IT system and a detailed design being completed.

Roll-out to the Generation business unit is scheduled for the start of 2010, and progressive rollouts to all other business units scheduled each quarter thereafter. A successful AMC project will go a long way to support the wider intent of the Davies' Enquiry.

2.4 Enhance workforce training, numbers and equipment

Mervyn Davies identified a number of areas where specific training should be improved, workforce numbers increased and equipment upgraded.

Power and Water will invest just under \$1M on training in Power Networks in the 2008/09 financial year. This training activity will encompass the Mervyn Davies' Enquiry recommendations for a greater level of craft based training.

Power and Water has revitalised its training program by:

- Establishing an in-house training team to determine training needs and coordinate training to meet operational requirements.
- Establishing direct contractual arrangements with a wide variety of service providers.
- Appointing an expert technical training manager to oversee the improvement of Power and Water's network training facilities and courses
- Appointing an expert training manager to the RAMP program, described in Section 3, to ensure that as the assets are remediated, all training opportunities are taken.

These steps will ensure that Power and Water's workforce receives training that is exactly tailored to its needs and Power and Water's equipment. In parallel, Power and Water are recruiting 37 additional staff in Power Networks as follows:

- Six additional EFM's as a result of the Mervyn Davies Report
- Six additional people to the RAMP team
- Five apprentice EFMs for the 2009 intake, up from 3 in 2008
- Five Adult Trades Assistants/Adult Apprentices
- Nine additional professionals as part of the overall Power Networks Restructure
- Six additional people identified in a review of System Control operations

The Mervyn Davies' Enquiry identified a need to upgrade and modernise some items of test equipment to allow the more effective monitoring of asset condition. Since the Enquiry report, significant condition monitoring units and workshop tools have been purchased.

Power and Water has made a simple commitment to its workforce: if equipment is needed to work safely and effectively, then it will be provided.

Equally, a number of necessary spare parts have been identified and ordered, with delivery expected in the immediate future.

2.5 Remedial works

Immediate Priorities after Casuarina

Thermal scanning

Once the failure mechanism from the Casuarina Zone Substation incident was clear, it was possible to carry out thermal scanning of indoor switchboards to see if any others were overheating. Additional thermal scanning of 22kV and 11kV indoor switchboards and other outdoor equipment (not previously included in the routine program) at 27 of 32 zone substations and switching stations were carried out between mid October 2008 and mid December 2008.³

The results showed no instances of abnormal temperatures.

The usefulness of thermal scan testing has resulted in these tests being incorporated into normal maintenance practice. Additional thermal scan units have been purchased to enable this work to be carried out.

Sites critical to system security

Following the Casuarina incidents, it was necessary to restrict access to it and other zone substations with similar equipment to maintain staff safety. While absolutely justified, this clearly restricts the Corporation's ability to carry out maintenance and respond to faults.

Power and Water identified priority sites to be condition assessed as soon as possible, based on their contribution to system security, including works at:

- McMinns 66/2kV Zone Substation
- Berrimah 66/11kV Zone Substation
- Katherine Power Station 22kV assets
- City Zone Substation
- Snell Street Zone Substation

These works took longer than expected but were all completed by the middle of April 2009. They have enabled a number of critical assets to be returned to service.

Remedial Works Plan

Recommendation 11 of the Davies's Enquiry included a rigorous condition assessment of all zone substation equipment, undertaking a high level risk analysis to determine programme priorities and set a timetable.

A detailed Remedial Works Plan has been approved by the Managing Director, and is well underway. The Plan schedules condition testing at 20 zone substations and switching stations for OCBs, CTs and VTs operating at 66kV, 22kV and 11kV. Equipment with a higher risk rating is to be inspected and restored to acceptable condition before equipment in lower risk ratings. Timing is based on a preliminary risk assessment as recommended by Davies.

³ Power Networks has an established program of routine thermal scanning of outdoor equipment in substations and field locations. Over the last four years, the majority of outdoor equipment at every zone substation and switching station has been scanned once each year. All field locations have been scanned every two years.

These risk ratings are summarised below:

← Highest Risk 5	4	3	Lowest Risk 2 →
<ul style="list-style-type: none"> ■ Oil Circuit Breakers, OCB (66, 22 and 11kV) ■ Oil insulated VTs and CTs (132, 66, 22 and 11kV) ■ Feeder cable terminations (22 and 11kV) ■ Equipment earths 	<ul style="list-style-type: none"> ■ Indoor enclosed switchboards (22 and 11kV) ■ Power transformers (132/66kV; 132/22kV; 66/22kV; 66/11kV) ■ Protection (Sensitive earth fault, busbar) ■ Distribution transformers (22kV/415 V; 11kV/415V) and associated switchgear 	<ul style="list-style-type: none"> ■ Brown Boveri switchgear operating at 11kV ■ Oil ring main units in field locations (22 and 11kV) ■ Air break switches in field locations (22 and 11kV) 	<ul style="list-style-type: none"> ■ Non-oil circuit breakers operating at 132, 66, 22 and 11kV

The risk rating methodology is based on standard industry risk management practices and provides a means of assessing the characteristics of the equipment in a consistent manner when little or unreliable information is available. The ratings are used for prioritising the order of the condition testing work. These ratings will be superseded once equipment condition is established through testing.

Equipment rated as risk level 5, 4 or 3 is being condition tested as part of the Remedial Works Plan. The equipment rated as 'risk level 2' will be condition tested as part of the routine maintenance program under the control of the GM/Power Networks.

An indication of the scale of work (the total number of zone substation plant items affected) is provided below:

Item	Number
Zone substations and switching stations	23*
<i>132 and 66kV</i>	
Oil CBs	65
Power transformers	39
Voltage transformers	168
Current transformers	198
<i>11 or 22kV</i>	
Oil CBs	74
Voltage transformers	37

* 23 of 25 Power and Water substations: 21 on the Darwin to Katherine interconnected network, 2 in Alice Springs

Experience so far indicates that roughly half the assets tested will require at least some maintenance before they are returned to service. Some required substantial refurbishment. Based on some simplified analysis, it is possible to complete all condition testing and remedial maintenance work on the higher risk equipment by the end of the first quarter 2010, with two work teams deployed.

Aside from the priority sites described above, Power and Water has also completed works at:

- West Bennett 11kV Switching Station
- Humpty Doo 66/22kV Zone Substation
- Tindal 22/11kV Zone Substation
- Tennant Creek 22kV Zone Substation

2.6 Casuarina 11kV switchboard

Zone substations are designed to maintain customer supplies following a single 'event'. In practical terms, even with a transformer out of service, there is no interruption to customer supply. In engineering terms, the substation provides a 'firm' supply.

After the first fault occurred at Casuarina on 19 September 2008, the damage sustained to the No.1 11kV switchboard limited the zone substation to 2/3rds of its normal capacity. This meant that further faults would cause customer outages and exacerbated the impact of the further faults in early October. In engineering terms, the substation was 'non-firm.'

As the substation was considered vulnerable to a further significant event, 32MVA of generators were located throughout the Northern Suburbs network to provide 'firm' supplies if the entire substation was lost for an extended period.

In parallel, the planning and purchase of a temporary 11kV switchboard started. This switchboard was energised on 22 January and four feeders progressively placed on load on 24 and 25 January 2009. The temporary switchboard restored the zone substation to a firm supply. The generators were stood down shortly afterwards.

Mervyn Davies' Preliminary Report recommended that the entire 11kV switchboard be replaced. The existing equipment is oil-insulated, giving rise to the risk of widespread damage following a significant fault. More modern equipment uses vacuum technology which, among other things, limits the extent of any damage even if the circuit breaker fails in service.

The permanent replacement is well under way. New switchgear has been purchased from AREVA in Brisbane and is having protection equipment installed in Darwin. The installation plan is designed to minimise the risk of customer outages and to ensure staff safety. A further mobile substation will be installed at Casuarina, while the old board is removed safely and the new permanent switchboard installed.

A number of other remedial works have been carried out since early October 2008, including thermal scanning and refurbishment of some equipment.

The remaining 66kV OCBs, CTs and VTs will be scheduled for condition testing in accordance with the priorities established in the Remedial Works Program. The 66kV equipment will be tested during the dry season, currently scheduled for the end of June 2009.

3 Remedial asset management program

Summary of Mervyn Davies Recommendations

A condition assessment and remedial program for all zone and distribution substation equipment should be carried out.

Casuarina Zone Substation 11kV switchboard should be replaced.

Almost immediately after the events at Casuarina, Power and Water established a Remedial Asset Management Program (RAMP) to ensure safe access to substations, carry out remedial works and replace the Casuarina Zone Substation 11kV switchboard. This is a major undertaking.

Dr Keith Beven is the General Manager RAMP, reporting directly to the Managing Director. Dr Beven has extensive leadership experience in electricity distribution operations and maintenance in Australia and New Zealand.

The RAMP team has been charged with identifying the state of Power Network's electricity related assets and undertaking immediate remediation of any equipment that does not meet established standards. Its overarching objective is to restore the confidence of staff, consumers and the wider community in the NT power network.

RAMP works are scheduled for each location based on rigorous risk assessment, as described in Section 2.

3.1 Condition assessment and remedial works

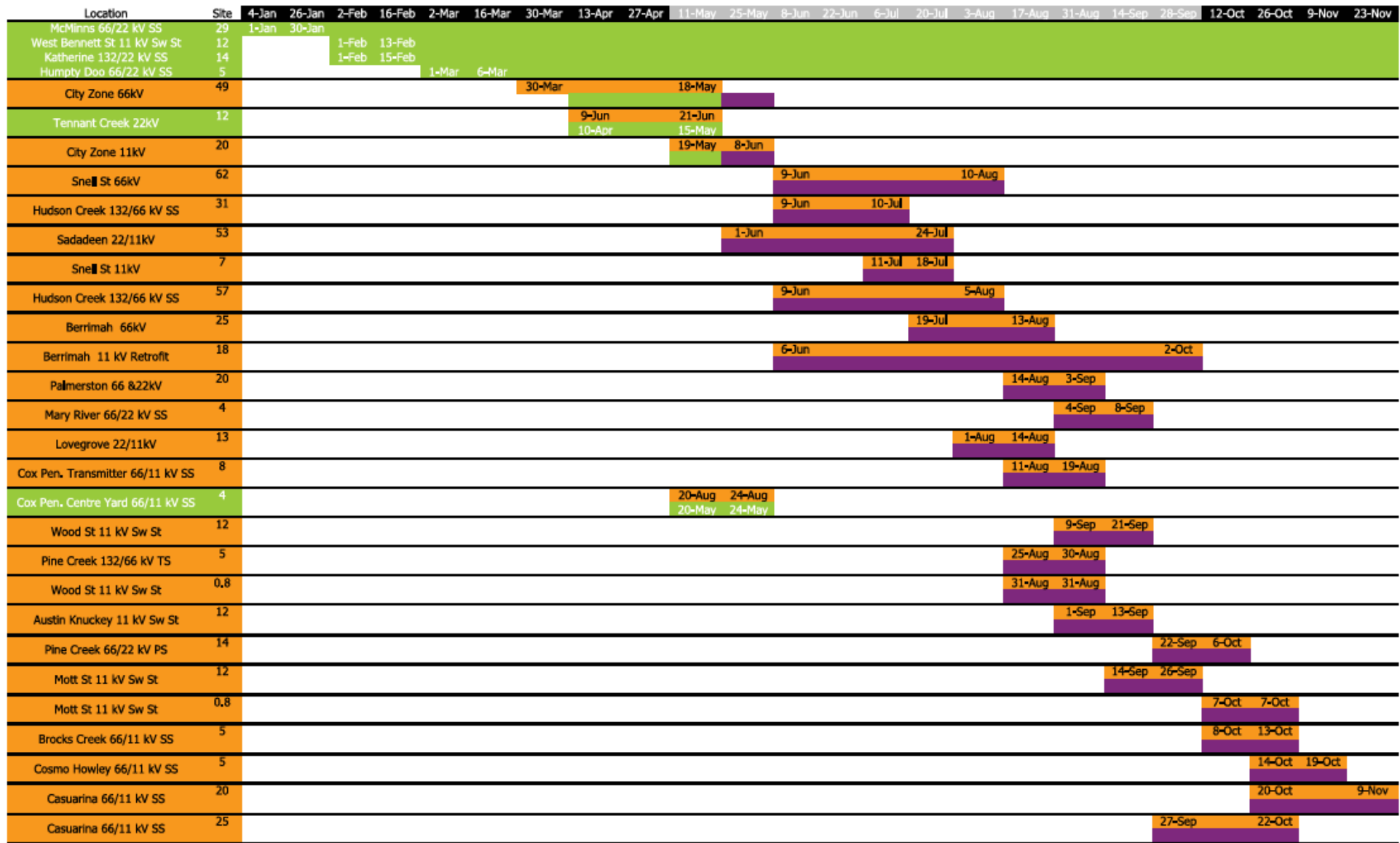
The Remedial Works Plan (RWP) is intended to address Recommendations 11.1, 11.2 and 11.4 from the Davies Enquiry, the need for urgent action in zone and distribution substations, and on busbar protection. It is based on the following principles:

- A safe working environment must be maintained when carrying out remedial works.
- Customer outages are to be avoided wherever possible. Week night and weekend work will continue to be used to reduce the need for planned outages to customers during weekdays. If customer outages are unavoidable and can be planned, advance notice to customers must be given using letterbox leaflets, newspaper or radio advertising, in accordance with the Customer Charter.
- All necessary technical training will be provided to the work teams.
- The results of equipment condition checks must be recorded in a central location and used as the basis from which to determine further maintenance actions.
- All employees within Power Networks have been consulted on the RWP for their awareness, constructive comment, and assistance with its implementation. This will continue.

- Condition reporting and progress reporting for the duration of the remedial works program must be to each Executive Management Committee meeting and each Board meeting.
- A major Review when the RWP is roughly a third complete, to ensure that lessons are learnt and planning assumptions reviewed.

Major Milestones

- Milestone 1:** The completion of the initial risk assessment recommended by the Davies' Enquiry Preliminary Report to be noted by the Board by February 2009. **COMPLETE**
- Milestone 2:** The approval of the RWP by the Managing Director by April 2009. **COMPLETE**
- Milestone 3:** The completion of roughly a third of the RWP and the consequent formal Review of progress and lessons learnt, by July 2009.
- Milestone 4:** The clearance of each substation in line with the schedule overleaf, following testing and remediation as required, with all substations cleared by March 2010.



Completed Planned Outstanding

3.2 Restoring Casuarina Zone Substation

Section 2 described the works that have already been carried out at Casuarina. The following actions remain:

- construct a 2nd temporary switchboard adjacent to the substation building;
- install new circuit breaker equipment in the 2nd temporary switchboard;
- decommission the existing switchboard;
- build a new switchboard on the site of the demolished switchboard;
- install vacuum circuit breakers in the new switchboard;
- commission the new switchboard;
- decommission temporary switchboards; and
- restore substation to normal operation.

It is then intended to replace and refurbish 66kV/11KV Transformer 1 at Casuarina.

Major Milestones

- Milestone 5:** The GM-RAMP to approve a final Project Execution Plan and detailed installation plan by the end of June 2009.
- Milestone 6:** The GM-PN to accept the new switchboard for service during the fourth quarter of 2009.
- Milestone 7:** The GM-PN to accept the new transformer for service during the third quarter of 2010.

4 Long term action plan

Summary of Mervyn Davies Recommendations

There should be a transition to a more 'condition based' approach to substation maintenance management.

A significant Human Resources Development program will be required.

Most of the Mervyn Davies Recommendations relate to improving Power and Water's maintenance operations into the longer term. Power and Water has prepared a Long Term Action Plan to ensure that these Recommendations are diligently implemented and to provide clear direction for its leaders and workforce.

The Long Term Action Plan covers the following matters:

- The maintenance cycle and move towards condition based maintenance.
- Accountability and organisational structural changes.
- Documentation of policy, procedures, work instructions.
- Reporting of maintenance activity and asset condition.
- Training and development of Power Networks staff.
- Incorporating improvements into the Power Networks Business Plan.

4.1 Adopting condition-based maintenance

Recommendation 1 - Move to 'condition-based maintenance'

'Condition based maintenance' refers to the practice of only carrying out intrusive maintenance on switchgear when testing indicates that it is clearly required. The triggers for intrusive maintenance are test results that indicate a previously identified failure mode has started to develop. An analogy is modern diagnostic testing for cars, where the car mechanic only works on the engine when the computer indicates it is necessary.

The Mervyn Davies Enquiry endorsed Power and Water's investment policy of '**objective need, capacity to deliver.**' This finding requires that the basis for maintenance planning be 'condition based' – that is that the plans are based mostly on condition testing and intrusive maintenance action only when required.

Power Networks will incorporate this approach in their business plan developed during the 2010-11 Statement of Corporate Intent process. It will be informed by the findings from the RAMP testing and remediation programme.

Major Milestones

Milestone 8: The first draft Power Networks 2010-11 Five Year Business Plan and 20 Year Outlook maintenance forecasts to include a summary of planned maintenance as well as costs, based on a 'condition based maintenance' approach by August 2009.

Recommendation 2 - Implement condition-based maintenance in substations as quickly as possible

With switchgear, testing includes:

- Thermal cameras – that provide a crude indication of where overheating is occurring. This is a useful test as it must be carried out with the equipment in service, carrying load current and with no disruption to customers. If overheating is found, the equipment must be maintained to remove the root cause.
- Insulation resistance – that provides an indication of the quality of the equipment's insulation to earth. If insulation resistance is relatively low, it indicates that there is a higher probability of insulation breakdown and subsequent failure. Insulation resistance tests must be carried out with the equipment out of service.
- Contact resistance – that provides an indication of the quality of the equipment's current path. If contact resistance is relatively high, it causes overheating in the equipment. Contact resistance tests must be carried out with the equipment out of service.

Since Casuarina, Power and Water has acquired more modern test equipment and provided training to its workforce on its use. It is basing its day-to-day maintenance on test results and as such, has already commenced 'condition based maintenance' in substations.

Power and Water has also engaged heavily with the Industry Working Group on switchgear and transformers, hosting its latest meeting in Darwin. This group includes Australia's leading switchgear experts and cooperates on understanding common failure modes for different switchgear designs. This Group has already contributed significantly to Power and Water's knowledge about its assets, by learning from other utilities many times its size.

Major Milestones

Milestone 9: Source external assistance from another utility to aid with maintenance training and support by February 2009. **COMPLETE**

Milestone 10: Complete agreements with workforce to ensure that Job Model and Remuneration arrangements support 'condition based maintenance' by June 2010.

Recommendation 3 - Bed down organisational changes

Power Networks is in the process of appointing to key positions, positions that have either been vacant or been held on an acting basis. This will facilitate the implementation of other Davies' recommendations throughout the business.

In light of the Davies' Recommendation 3.2, it will be necessary to consider some aspects of the organisational design as the Power Networks' restructure is carried out. With Mr Davies appointment to the Board, the Managing Director will discuss these matters with him.

Major Milestones

- Milestone 11:** Appoint the Manager Strategy and Planning and the Manager Capital and Maintenance Delivery by May 2009. **COMPLETE**
- Milestone 12:** Confirm appointment of new trades positions by May 2009.
- Milestone 13:** Appoint the next level of management by July 2009 (noting that this level of management would be unaffected by Recommendation 3.2).
- Milestone 14:** The Managing Director to approve a revised organisational structure for Power Networks (following discussion with Mervyn Davies on Recommendation 3.2) by July 2009.

Recommendation 4 - Deliver improved systems and processes

As acknowledged in the Davies' Report, the intended approach to the AMC project will support the wider changes required in the business. It is absolutely critical that Power Networks mobilises to engage with this 'whole of Corporation' project.

Major Milestones

- Milestone 15:** Identify process owners and ensure they have sufficient time to contribute to the AMC project by May 2009. **COMPLETE**
- Milestone 16:** Confirm that the Future State Design⁴ does, in fact, address the requirements of Recommendation 4.2 by December 2009.
- Milestone 17:** Confirm that the AMC as implemented does, in fact, address the requirements of Recommendation 4.2 by December 2010 and take remedial action if not.

Recommendation 5 - Enhance policies and policy documentation

There is still a lot of work to do to ensure that substation maintenance policies are revised to reflect the new practices, checked by our workforce, embedded in training programmes and reported upon. The necessary people to carry out this work have been identified and will commence in June 2009.

Major Milestones

- Milestone 18:** A revised Maintenance Policy based on 'condition based maintenance' will be approved by the GM-PN by August 2009.
- Milestone 19:** A Review of high priority Maintenance Procedures, including detailed consultation with the workforce, resulting in a revised set by September 2009.
- Milestone 20:** A Review of high priority Work Instructions, including detailed consultation with the workforce, resulting in a revised set by June 2010.

⁴ Detailed design for the AMC Project

Recommendation 6 - Develop substations maintenance planning and works programme

As recommended by Davies, the new structure separates decisions on “how much maintenance” from scheduling decisions. This distinction is reflected in Position Descriptions.

This will be reflected in maintenance plans and schedules, once the Maintenance Policy and Procedure work described above are completed.

Major Milestones

Milestone 21: Set high-level and detailed quantum plans for substation maintenance for 2010 and the following five years by December 2009. A spend of \$113.2 million during the period 2008/09 – 2012/13.

Recommendation 7 - Report on maintenance delivery, asset condition, risks and failures

The Board reporting of maintenance delivery and asset condition will provide necessary oversight that Power and Water is in good operational and asset health. If a backlog of maintenance is obviously developing, the Board can intervene to ensure that adequate resources and leadership are deployed.

This gap was recognised by Power and Water as it developed the AMC project. The events at Casuarina increased its urgency. As such, and as it turned out in line with Mr Davies’ Recommendation 7, in November 2008 Power and Water commenced work to institute a maintenance delivery and condition reporting framework. An example report was received by the Board in February 2009, which reported on five priority asset classes. This reporting will be extended to all asset classes by August 2009.

Major Milestones

Milestone 22: Provide example maintenance delivery and asset condition report to the Board for five asset classes by February. **COMPLETE**

Milestone 23: Provide full maintenance delivery and asset condition reporting to the Board by August 2009.

4.2 Leadership and development

Recommendation 8 - Enhance workforce training, numbers and equipment

Davies recommended that Power and Water improve its training in a number of areas, recruit more staff and obtain better equipment for its workforce. As discussed in Section 2, there has been good progress already. However, management will formalise these approaches to ensure they are embedded in the organisation.

Major Milestones

- Milestone 24:** Appoint a Training Manager to the RAMP programme with strong technical knowledge by May 2009. **COMPLETE.**
- Milestone 25:** Appoint a Training Manager in Power Networks with strong technical knowledge by June 2009.
- Milestone 26:** Coordinators development needs will be confirmed during Power and Water's annual performance appraisal process by July 2009.
- Milestone 27:** Improved supervisory training will be provided to all coordinators from November 2009.
- Milestone 28:** A revised framework for trades and technical training will be approved by October 2010.

Recommendation 9 - Improved leadership and communication

The Enquiry recommended that Power Networks improve its leadership style in general, and specifically:

- Improve communication and interpersonal skills for all personnel (structured to their role).
- Provide specific leadership, mentoring programs and personal development for those in 'people management' roles.
- Clarify role and job requirements.

As described in Section 2, this work is underway. Power Networks has started Leadership Communication forums that bring together the wider leadership team once every two months. It has also recently commenced a Leadership Development Program that will provide targeted training and development to improve the skills of its leaders.

Major Milestones

- Milestone 29:** Commence first steps in Leadership Development by May 2009. **COMPLETE**
- Milestone 30:** Individual development plans will be formulated for each manager, which align with and contribute to their current performance development plans by July 2009.
- Milestone 31:** Suitable external leadership development opportunities will be assigned to each person by August 2009.
- Milestone 32:** Development courses will commence by September 2009.
- Milestone 33:** All relevant managers receiving at least one session of development by December 2009.

Recommendation 10 - Review incident management and outstanding investigations

Davies recommended that Power and Water review its incident management procedure and complete a number of its outstanding investigations.

The review of incident management procedures has been included in the Long Term Action Plan. Clear accountabilities for incident investigation have been identified. These individuals will provide a focus for keeping our investigation skills up to date.

Two of the three outstanding investigations have been progressed. As recognised by Davies, the completion of the investigation into the Casuarina events will only be possible once the remaining Casuarina switchboard has been decommissioned. At that time, aside from removing the equipment, it will be necessary to carry out a full forensic examination of the protection and earthing systems.

Major Milestones

- Milestone 34:** Complete Risk, Insurance, Safety & Quality (RISQ) Investigation 1768⁵ - by April 2009. COMPLETE
- Milestone 35:** Commence ameliorative action in light of Manton investigation⁶, and further information on Yorkshire switchboards by July 2009.
- Milestone 36:** Review incident management procedures and approve resulting Work Instruction by August 2009.
- Milestone 37:** Complete investigation into Casuarina events on access to the old switchboard by September 2009.

⁵ Investigation 1768 refers to the events of Casuarina Zone Substation Incident in 2008.

⁶ The Manton Investigation was an internal PAWC investigation into the bus bar failure on the YSF6 22kV switchboard at Manton Zone Substation on the 21st March 2008

5 What it means for customers

Power and Water will be taking more equipment out of service than normal as it fixes up the network. This increases the risk of customer outages.

In the longer term, customers will benefit from a more reliable electricity supply. With reliable switchgear, customer outages are less likely and, when they occur, to affect fewer customers for a shorter time.

5.1 In the short-term, reliability will continue to be a challenge

RAMP will drive significant maintenance activity. Careful planning will, to some extent, minimise the impact on customers:

- Customer outages will be avoided wherever possible.
- Where a planned customer outage is unavoidable, advance notice to affected customers will be given using letterbox leaflets, newspaper or radio advertising. Those customers will be given at least 7 days advanced notice of any planned interruptions.
- Where maintenance action gives rise to the risk that an item of equipment cannot be returned to service within a reasonable period, arrangements will be developed prior to the outage to limit the impact on customers. Week night and weekend work will be utilised to reduce the need for planned outages during weekdays.

At this stage in the remedial maintenance planning process, there are no anticipated interruptions for maintenance work scheduled over the period to the end of March 2010. This outcome is primarily due to the design of the network, which at most levels can withstand the loss of one piece of equipment without causing interruptions to any customers.

At a later stage, it may become necessary to plan interruptions to maintain items of equipment which are dedicated to servicing individual customers or small groups of customers. Any planned interruptions that become necessary to carry out the remedial maintenance work will be at least conducted in accordance with the above principles.

However, until the program is completed, Power and Water is at risk of further equipment failures and these may cause some customer disruption. The Corporation is doing all it can to put in place adequate contingency plans to minimise the impact on customers.

5.2 In the long-term, reliability will improve

In the longer term, an increased emphasis on maintenance will provide customers with a substantial improvement through the reliable operation of power network equipment.

Specifically, the increased emphasis on:

- education for trades people, technicians, supervisors and the management team;
- a streamlined maintenance cycle;
- increased accountability of maintenance activities;
- improvements in maintenance documentation;
- increased resources to perform the work; and
- specific requirements for reporting maintenance performance to the Board and executive management,

will ensure that maintenance practices, in line with established industry asset management practices, are kept up to date and plant failures minimised. This will be supported by a strategic spares holding and contingency plans will also be implemented.

The costs of these improvements will be far outweighed by the community benefits of a more secure and reliable electricity supply.

Appendix A: Davies' recommendations in full

1 Substation Maintenance Approach

- 1.1 Accelerate the implementation of its documented planning intention of adopting a "framework of objective need" as the basis for maintenance, progressively implement systemic and rigorous condition monitoring, and adopt asset condition as the prime basis for determining "objective need".
- 1.2 Take into account the circumstances of size, remoteness, climate and the lasting effects of past legacies when implementing this, its new condition based approach, and not attempt to emulate too closely the maintenance arrangements implemented in the much larger distribution businesses elsewhere in Australia.

2 Strategy for Implementing Condition Based Maintenance - in the PAWC Substations Context

- 2.1 Negotiate and implement arrangements with one or more of the larger distribution businesses in Australia to be supplied with access to "failure mode" data, inspection and test regimes, conditional failure criteria, and requirements for corrective action. In selecting a partner choose a distributor who is well advanced in the implementation of condition based maintenance, and has the best matched asset set.
- 2.2 Develop the "in house" maintenance policy resource to be a pragmatic adopter of what other distributors are doing. Adapt what other distributors are doing, to the specific environmental conditions and asset set of PAWC, with the minimum sufficient resort to analysis.
- 2.3 Specialise in monitoring and diagnostics. Develop the "in house" maintenance delivery resource to be a specialist in monitoring, testing and diagnostics.
- 2.4 Utilise the "in house" maintenance delivery resource for most routine preventative tasks and common corrective tasks, but engage outside resources for specialist and uncommonly needed skills, (as is currently done for tap changer maintenance). Negotiate and implement arrangements with external providers to undertake the highly specialised tasks, within appropriate time frames. Either as "fly in fly out" contractors or by shipping to other parts of Australia.
- 2.5 Foster a culture of local ownership by:
 - Providing an appropriate level of autonomy and status to the Maintenance Supervisor.
 - Providing adequate resourcing, and placing the responsibility and accountability for: the delivery of the substation maintenance works programme and; for maintenance task outcomes, with the Maintenance Delivery section.
 - Enforcing accountability through measurement and reporting.

- Routinely involving the delivery team in the maintenance policy decision process. (By systemically seeking feedback regarding failure modes and the effectiveness of corrective actions.)
 - Placing responsibility and accountability for asset condition and performance with the Asset Management section.
 - Enforcing accountability through measurement and reporting.
- 2.6 Implement its new condition based approach at the maximum possible pace, consistent with circumstances, and prioritise implementation to address areas of greatest benefit first.

3 Organisation

- 3.1 In implementing the organisational changes, currently underway, ensure the following outcomes, or alternatively make changes which do:
- Work priorities are managed so as to ensure continuity of an adequate resource allocation to routine substation maintenance.
 - The Maintenance Delivery group, are empowered by providing them with a sense of control and an environment which ensures a sense of ownership, pride in the assets and their performance.
 - The Asset Management group, are able to focus on asset management, without becoming embroiled in works and resource management issues. Ensure that this group can focus on integrating policies for the “what” of maintenance with replacement/refurbishment and whole of life cycle cost optimisation.
 - Works management and scheduling are kept simple.
 - Seamless integration of the routine condition based substation maintenance activity with the test activity is achieved.
 - System access for routine maintenance and protection testing is optimally coordinated.
- 3.2 Consider making the following changes to the organisational arrangements, currently in the course of implementation:
- Establish “Substation Maintenance, Protection and Test” as a separate dedicated resource with direct reporting responsibility to the General Manager Power Networks.
 - Operate “Substation Maintenance” and “Protection and Test” as two separate sections, within that accountability.
 - Place responsibility for routine testing with the Substation Maintenance Section and upskill the workers in the Section. Advanced diagnostic testing (partial discharge, dielectric dissipation factor and high voltage withstand) should remain with the Protection and Test Section.
 - Place the responsibility for works planning as well as scheduling with the Substation Maintenance, Protection and Test Section.

4 Systems and Processes

- 4.1 4.1. Ensure that the next phase of the AMC project, does as it is expected to do, and:
- Deliver outcomes that are in keeping with PAWC's size, and so far as possible, avoids complexity.
 - Embrace the possibility of a continuing role for suitably controlled local PC systems and avoids the pedantic pursuit of a single enterprise system.
 - Address the disempowering aspects of the current WIMS system.
- 4.2 Ensure that the systems and processes delivered by the AMC, do as they are expected to do and, provide capabilities for substation maintenance management and asset condition management, that support the recommendations of this report regarding:
- Substation Asset condition recording.
 - Substation maintenance planning and programme works development.
 - Substation maintenance works programme reporting.
 - Substation Asset condition reporting.

And incorporate:

- Condition as well as time based triggers.
- Enforcement of condition reporting and other job closure procedures.

5 Policies and Policy Documentation

- 5.1 Adopt a three tier approach to substation maintenance policy documentation, as described in Technical Appendix T2.2 Evaluation of Policies.
- 5.2 Either renegotiate the arrangements with ETSA, for the acquisition of a set of documentation that is more suitable to PAWCs requirements, or negotiate to acquire a set from another Australian distributor. Such negotiations should make provision for the routine updating of the documentation.
- 5.3 Adapt the acquired documentation to the PAWC environment and asset set.

6 Substations Maintenance Planning and Works Programme Development

- 6.1 Ensure that quantum planning is separate from delivery planning.
- 6.2 Set quantum plans for substation maintenance on a one and five year basis and resource to deliver:
- Ensure that firm preventative maintenance and condition monitoring programmes are set annually.

- Ensure that the plan makes adequate provision for corrective tasks, based on expected conditional failure rates.
- Ensure that the plan makes adequate provision for “breakdown maintenance” tasks, based on historical breakdown rates and trends.
- Ensure that the planning process makes adequate provision for resourcing and that the assessment of resource requirements is informed by industry benchmarks and past reporting of task times.
- Five year plans should be set on an indicative basis, suitable for use in forecasting and workforce planning.
- In the longer term (five to ten years) introduce 15 year planning as well.

7 Reporting Systems

7.1 Substations Maintenance Works Programme Reporting

Develop simple multi level reporting of work delivery targets and delivery progress against targets. (Three levels of reporting are suggested – supervisor/coordinator; Management and; Board)

Report quantum (as well as dollars) progressively aggregated over tasks for the higher level upstream reporting.

Report risk consequences of backlogs, monthly.

7.2 Substations Asset Condition Reporting

Systematize condition data recording:

- Maintain condition data records at the individual asset level.
- Analyse and summarise the data by asset class.
- Develop simple multi level reporting of asset class condition, structured by asset class and reporting level (Three levels of reporting are suggested – asset planners; Management and; Board.)
- Make reports available to the Maintenance Delivery. Section, as well as the Asset Management Section.
- Report key condition measures and risks, suitably aggregated or truncated for different reporting levels. For the higher level reports, highlight trends and forecast the outcomes of remediation programmes.
- Incorporate asset failure reporting, at all reporting levels. Board level reporting of all failures involving risk to personnel and public safety is suggested.

7.3 Reporting Medium

Implement ad hoc paper/PC based reporting systems, in the interim, before new AMC systems and reporting capability is developed.

8 Resources

8.1 Workforce Capabilities - Training and Development

Provide training to refresh the craft skills of the current substation maintenance personnel. Engage an industry training provider to undertake a training needs analysis and provide tailored training.

Provide training to refresh the testing skills of the current Protection and Test personnel. Provide specific training in the operation of all new test equipment and in the interpretation of results. Negotiate with other Australian distributors and test equipment suppliers, for assistance with the provision of such training.

Provide specific condition monitoring training. Negotiate with other Australian distributors for assistance with the provision of such training.

Provide generic Supervision training to supervisors (Coordinators).

Negotiate opportunities for employee exchanges or secondments with the other Australian distributors, for trades worker, apprentices and engineering staff.

Provide opportunities for ongoing participation by engineering staff, in relevant industry forums.

8.2 Workforce Levels

Initially recruit an additional 6 electrically trades qualified personnel. (Ideally such additional recruits would be experienced in condition monitoring techniques.)

Annually review the five year forecast of substation maintenance requirements and reassess the manning level required to deliver the programme. Implement appropriate manpower planning (a mix of recruitment and apprentice intake) to ensure the sustained level of manning required to match the forecast works programme.

8.3 Equipment

Upgrade and progressively acquire additional new condition monitoring equipment, as required to keep pace with the progress in implementing condition monitoring techniques and matched to the particular techniques adopted. Make a thorough review, of the equipment available and of the equipment in use in other distribution business around Australia. Undertake the review with the involvement of personnel who are to use the equipment, after they have received the specific training in condition monitoring techniques recommended in 8.1.

9 Human Resources Development

Devise and implement a Human Resources Development programme, incorporating the following key elements:

- Communication and Interpersonal skills development training, for all personnel, (structured to their role).
- Specific Leadership and/or mentoring programmes for those in "people management" roles.

- Personal development opportunities for those in key roles.
- Role and job requirements clarification.

And having the objective of delivering the following outcomes:

- A more inclusive and collaborative supervision and leadership style.
- Improved communication and collaboration between functional areas, and up and down the responsibility hierarchy.
- Strong personal ownership of roles and PAWC initiatives.
- All personnel are confident in their role and in their personal authority within the role.
- Acceptance of individual accountability.
- Improved performance measurement and recognition.
- All personnel are all in jobs which match their individual skills sets and personal relationship styles.

10 Miscellaneous

10.1 Incident Management System and Accountabilities.

Review the current incident management arrangements to ensure that the system of incident management provides for:

- Incident organisational and accountability structures.
- Intelligence gathering, consolidation and reporting arrangements.
- Escalation procedures.
- Resourcing flexibility.
- Stakeholder communication procedures.
- Procedures for coordinating with the Territory's other Emergency Management Agencies.
- Formal documentation.
- That will provide PAWC with the credibility to manage its own system incidents.

10.2 Asset Failure Investigation Accountabilities

Assign responsibility for investigating asset failure incidents as follows:

- Asset Management be assigned accountability for deciding what incidents to investigate, for coordinating the investigation, and for "close out" and reporting. (Oversight by the "Power Technical Committee" would also be appropriate.)

- Assessment and diagnoses of the incident be assigned to the testing accountability of the Protection and Test Section.
- Assessment of OH&S issues be assigned to Employee and Organisation Services.

10.3 The Manton Investigation

Pursue further the Manton Investigation, and undertake investigation work in an attempt to establish the root cause of the failure and to assess whether better environmental controls would help to mitigate the risk of further failures.

10.4 Residual Casuarina Incidents Investigation

As soon as access conditions at Casuarina permit, perform the access dependent residual outstanding investigation work and attempt to resolve the outstanding aspects of the failure investigations.

10.5 RISQ Hazard/Incident Report System

Complete the investigation of Hazard/Incident No 1768, without further delay. Implement a system of routine monthly reporting of the number of incidents logged and resolved and of backlogs of outstanding Hazard/Incidents.

11 Remedial Programmes

- 11.1 Initiate a programme of rigorous condition assessment of all Zone Substation equipment immediately. Undertake a high level risk analysis to determine programme priorities and set a timetable.
- 11.2 Implement a programme to verify the efficacy of all frame leakage protection systems (or other high speed busbar protection systems) and remediate, if necessary. Also review the associated earthing system designs, to verify their adequacy under all feasible fault conditions.
- 11.3 Take immediate action to replace the Casuarina Zone Substation 11kV switchboard.
- 11.4 Undertake a rigorous condition assessment of all Distribution Substation Equipment.

Appendix B: Recommendations, timelines and progress

Ref	Recommendation	Plan Ref	Owner	Target Date	Progress
1	Move maintenance approach to 'condition based maintenance.'	LTAP	GM-PN	08/09	Condition based maintenance commenced, Maintenance Policy document to reflect new maintenance regime
2	Implement 'condition based maintenance' in substations as quickly as possible by acquiring information, support and clarifying accountabilities.	LTAP	GM-PN	06/10	Substation CB maintenance implemented.
2.1	Negotiate and implement arrangements to access data.	LTAP	M-AM		Obtained ETSA & EA Maintenance instructions that were developed using failure mode analysis
2.2	Be a pragmatic adopter of what other distributors are doing on maintenance.	LTAP	M-AM		Resource identified to develop PWC maintenance instructions
2.3	Develop 'in house' maintenance delivery team to be specialist in monitoring, testing and diagnostics.	LTAP	M-C&MD		Training resources identified, substation maintenance resource on deck.
2.4	Use 'in house' maintenance delivery team for routine preventative tasks and common corrective tasks/Use outside resources for specialist and uncommonly needed skills.	LTAP	M-C&MD		Current practice, have let specialist service contracts
2.5	Foster a culture of local ownership.	LTAP	M-C&MD		Maintenance instructions to be developed with trades staff
2.6	Implement its new condition based approach at the maximum possible pace, consistent with circumstances, and prioritise implementation to address areas of greatest benefit first.	LTAP	GM-PN		Remedial Asset Management Program Documented in accordance with this.

Ref	Recommendation	Plan Ref	Owner	Target Date	Progress
3	Bed down organisational changes.	LTAP	GM-PN	07/09	Service Agreement between Strategy & Planning and Capital & Maintenance Delivery completes this.
3.1	In implementing organisational changes, ensure good maintenance outcomes.	LTAP	GM-PN		Maintenance Cycle process flow completed with responsibilities agreed
3.2	Consider making the changes to the organisational arrangements.	LTAP	MD		Still being considered
4	Deliver improved systems and processes.	AMC	PD-AMC	12/10	Implementation of AMC will complete this Recommendation
4.1	Ensure the next phase of the AMC project, does as expected, and addresses disempowering aspects of the WIMS system.	AMC	PD-AMC		Key personnel including process owners identified and allocated to AMC project development and implementation
4.2	Ensure that the systems and processes delivered by the AMC, do as expected and support the Davies' recommendations.	AMC	PD-AMC		Long Term Action Plan addresses all recommendations
5	Enhance policies and policy documentation.	LTAP	GM-PN	06/10	Production of maintenance procedures and implementation of staff training program will continue till target date.
5.1	Adopt a three tier approach to substation maintenance policy documentation.	LTAP	M-AM		Adopted
5.2	Acquire a set of maintenance documentation from another Australian distributor.	LTAP	M-AM		Obtained ETSA & EA Maintenance instructions that were developed using failure mode analysis
5.3	Adapt the acquired documentation to the PAWC environment and asset set.	LTAP	M-AM		Resource identified to develop PWC maintenance instructions
6	Develop substations maintenance planning and works programme.	LTAP	GM-PN	12/09	Maintenance Policy will drive one & 5 year programs
6.1	Ensure that quantum planning is separate from delivery planning.	LTAP	M-S&P		Strategic planners identified in AM and JD's reflect role as opposed to works planners

Ref	Recommendation	Plan Ref	Owner	Target Date	Progress
6.2	Set quantum plans for substation maintenance on a one and five year basis and resource to deliver.	LTAP	M-S&P		Maintenance Policy first, manual programming next then eventually AMC solution
7	Report on maintenance delivery, asset condition, risks and failures.	LTAP	GM-PN	08/09	Progressively implemented through to August
7.1	Develop simple multi level reporting of work delivery targets, delivery progress and risks against targets.	LTAP	M-AM		Reporting framework complete
7.2	Develop simple multi level reporting of asset class condition, risks, and asset failure reporting.	LTAP	M-AM		Condition based index reporting complete, risk based started.
7.3	Implement ad hoc paper/PC based reporting systems, in the interim, before new AMC systems and reporting capability is developed.	LTAP	M-AM		Consultants engaged to develop.
8	Enhance workforce capability, training, numbers and equipment.	LTAP	GM-PN	02/10	Effective development and implementation of Workforce Training and development program
8.1	Provide workforce and supervisor training and development.	LTAP	M-TPN		2 Power Network based training managers identified, first one commenced within RAMP team.
8.2	Recruit an additional 6 electrically trades qualified personnel experienced in condition monitoring techniques.) and annually review need.	LTAP	M-C&MD		Commenced.
8.3	Upgrade and progressively acquire additional new condition monitoring equipment.	LTAP	GM-RAMP		All equipment either arrived or on order.
9	Implement a Development programme, with the objective of a more collaborative leadership style, improved communication and individual accountability.	LTAP	GM-PN	02/10	Leadership Program initiated. PN has also commenced regular leadership forums
10	Review incident management and investigations, and complete some outstanding investigations.	LTAP	GM-PN	08/09	
10.1	Review the current incident management arrangements, including escalation procedures.	LTAP	M-SC		Not commenced yet but identified separately in LTAP

Ref	Recommendation	Plan Ref	Owner	Target Date	Progress
10.2	Assign clear asset failure investigation accountabilities.	LTAP	GM-PN		Not commenced yet but identified separately in LTAP
10.3	Pursue further the Manton Investigation, and undertake investigation work in an attempt to establish the root cause of the failure	LTAP	C-PTC		Identified design issue with YSF6 gear and need to replace all three examples.
10.4	Complete the residual Casuarina incidents' investigation.	LTAP	GM-RAMP		Will be completed as the existing switchboard is decommissioned.
10.5	Complete the investigation of Hazard/Incident No 1768, without further delay.	LTAP	GM-RAMP		Completed.
11	Undertake Remedial Programmes	RAMP	GM-RAMP	09/10	Completion of RAMP Program
11.1	Initiate a programme of rigorous condition assessment of all Zone Substation equipment.	RWP	M-RWP		Commenced, includes immediate remediation of assets in unsatisfactory condition
11.2	Implement a programme to verify the efficacy of all frame leakage protection systems.	RAMP	M-RWP		Commenced, Included in RAMP
11.4	Undertake a rigorous condition assessment of all Distribution Substation Equipment.	RAMP	M-RWP		Commenced, RAMP managing
11.3	Take immediate action to replace the Casuarina Zone Substation 11kV switchboard.	PEP	PM-C		Switchboard ordered, completion expected Nov 2009.

Key to People

C-PTC	Chairman – Power Technical Committee	M-RWP	Manager Remedial Works Plan
GM-PN	General Manager Power Networks	M-S&P	Manager Strategy & Planning
GM-RAMP	General Manager RAMP	M-SC	Manager System Control
M-AM	Manager – Asset Management	M-TPN	Manager Training, Power Networks
M-C&MD	Manager Capital & Maintenance Delivery	PD-AMC	Project Director AMC
MD	Managing Director	PM-C	Project Manager Casuarina

Appendix C: Scope of audit

The following indicative scope of work is for the procurement of an independent auditor to enable the Power and Water Board to enforce compliance with the controls it has established in response to the recommendations of the Mervyn Davies' Enquiry for the short term and long term improvement in network maintenance activities:

B.1 Introduction

The Power and Water Corporation (Power and Water) is an entity owned by the Northern Territory Government. Power and Water operates four business units, being Generation (of electricity), Power Networks, Retail (of electricity), Water Services (including sewage services) and Remote Operations.

In the Power Networks business unit, asset management covers construction activities, response to emergency events, and network maintenance activities. The need for improvements in the undertaking of network maintenance has been a focus of the business unit for several years, including actions to review all processes in an Asset Management Capability project that commenced in late 2006 and will be progressively implemented across the organisation in 2010 and 2011. In 2008 a restructure of the Power Networks business unit was undertaken to improve the focus on network maintenance delivery. Also in 2008, and due to an interruption at a substation in the suburbs of Darwin, the reform of maintenance activities has accelerated through recommendations arising from the Mervyn Davies' Enquiry, which was handed down in January 2009.

To understand the extent of compliance of the network maintenance activity with corporate controls, the Board of Power and Water require an independent auditor to undertake an audit of the maintenance activities of the Power Networks business unit.

B.2 Audit objective

The objective of the Power Networks maintenance audit is to provide an opinion on the extent of compliance of the maintenance activity against the:

- Major Milestones specified in the Power and Water's First Progress Report on the Mervyn Davies' Enquiry; and
- Maintenance Policy, Maintenance Procedures and Maintenance Work Instructions that have been established and revised to control the maintenance activity.

B.3 Audit frequency and duration

The audit is to be conducted on an annual basis, and are to be based on a sample of activities that represent high or medium risk to the organisation. Twenty days of audit work are to be allocated to this task annually.

B.4 Audit report

The auditor is required to provide a report to the Audit and Risk Sub-committee in accordance with an agreed work plan which will be confirmed at the commencement of the audit. The structure of the audit report is to be agreed at the commencement of the audit, and would be expected to provide an opportunity for management to respond to any audit findings.

The auditor is to provide in the report a review opinion on compliance with the nominated controls (including specified Major Milestones) established by the Board.