



# SURVEYOR-GENERAL OF THE AUSTRALIAN CAPITAL TERRITORY

GUIDELINE No. 8 (08/11/2010)

## PRESERVATION OF SURVEY INFRASTRUCTURE

### 1.0 INTRODUCTION

Survey control marks are a fundamental component of spatial infrastructure. This infrastructure includes geographic information systems and databases that are the management tools for Government records. It is inevitable that some survey control marks will be destroyed from time to time by various types of developments and construction works. The loss of these marks can significantly impact on infrastructure projects and on the planning and management of resources that have a spatial component such as land titling, town planning, mapping and environmental management.

Furthermore, survey control marks are fundamental to the definition of the cadastre in the ACT. The loss of these marks can degrade the integrity and accuracy of the cadastre and significantly add to the cost and integrity of subsequent boundary redefinition surveys.

Section 53 of the *Surveyors Act 2007* states that a person must not interfere with, change or remove any survey mark unless authorised to do so by the Surveyor-General. Therefore, permission from the ACT Surveyor-General is required before knowingly destroying a survey mark. This permission can be sought via the [Survey Control Mark Status Report form](#), available on the ACTPLA website. Early advice provides an opportunity for a surveyor to recover the mark prior to its destruction.

Like any other piece of existing infrastructure, such as electricity lines and stormwater pipes, it is the responsibility of the developer or authority undertaking the work to pay for the cost of preserving or recovering survey control infrastructure. In this Guideline, “recover” means installing a new survey mark in a safe nearby position, and establishing horizontal and vertical coordinates for the new mark. In order to obtain authority from the Surveyor-General to remove a survey control mark, the procedures within this guideline should be followed.

This guideline should be read in conjunction with the current version of the *Surveyors Practice Directions* (SPDs), the *Standards and Specifications for Deposited Plans* and other Surveyor-General Guidelines. Where survey control marks are affected by road construction works, these guidelines shall be read in conjunction with *ICSM QA Specification G71: Road Construction Surveys* (ICSM, 2009a) and *ICSM Guide NG71: Guide to ICSM QA Specification G71* (ICSM, 2009b)<sup>1</sup>.

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<sup>1</sup> In the event of an inconsistency between the ICSM G71 and these guidelines on road surveys the former takes precedence.

## **2.0 AUTHORITY TO UNDERTAKE WORK**

Any survey necessary to recover the position of survey marks likely to be destroyed may only be undertaken by a suitably qualified surveyor. If the survey control marks proposed to be destroyed are also cadastral reference marks (see Sections 3.2 and 4.0 below) then the survey work may only be undertaken by a surveyor registered under the *Surveyors Act 2007* or made under the supervision of a registered surveyor.

## **3.0 METHODOLOGY**

The following procedures detail the method of survey to be adopted to preserve the survey control infrastructure when the destruction of survey control marks is proposed. ACT Planning and Land Authority (ACTPLA) survey staff have the authority to modify these procedures to cover specific cases.

### **3.1 Survey Control Procedures**

The aim of the survey is to replace survey control marks proposed to be destroyed and to provide sufficient survey measurements to be able to co-ordinate the replacement mark to a similar standard of accuracy. Survey control marks that will survive but may have been disturbed due to their proximity to the construction work must also be re-surveyed in order to verify their co-ordinates (E, N, RL).

### **3.2 Search**

Ascertain from a search of plans on public record whether the survey control mark to be replaced has also been used as a cadastral reference mark. For a survey control mark to qualify as a reference mark it must be within 30 metres of the corner and be shown on a Deposited Plan. If the survey control mark is also a reference mark as defined by the SPDs then the procedure for recovering cadastral reference marks (see Section 4.0 below) must also be followed.

In addition to the plan search, obtain an up to date Survey Control Mark Search from ACTMAPi.

### **3.3 Identify Marks**

Identify the existing survey marks that are likely to be destroyed or disturbed during the project, including survey marks with cover boxes that may need to be raised or lowered. Survey marks near the construction work that are likely to survive should be protected by temporarily fencing off with para-webbing, or by other means.

### **3.4 Surveyor-General to be notified**

Notify ACTPLA survey staff of the proposed mark replacement. They will be able to provide advice if required.

### **3.5 Recovery Marks**

In consultation with the ACTPLA survey staff, replace all survey control marks proposed to be destroyed with new survey control marks located in safe, stable positions that will not be affected by the proposed works. While selecting the location of a new survey control mark, consideration should be given to minimising the OH&S risks, and minimising obstructions to the sky for possible GNSS applications.

The type of new marks placed shall be the same as the mark to be destroyed. Where this is impractical, ACTPLA survey staff may authorise the use of another type of mark.

Approved mark types include:

- A RM Control Mark as detailed in plan MISC824;
- A brass plaque (CRM) placed in kerb, or placed in the top of a concrete block cast in situ as shown in plan MISC825;
- Drill Hole and Wings cut into concrete as shown in plan MISC826; or
- A deep driven steel rod with cast iron cover box (SR) as shown in plan MISC339.

### **3.6 Accuracy of Horizontal Control**

If the existing survey control marks have a horizontal Class/Order of C/3 or better, then the horizontal co-ordination of new and surviving survey control marks must, as a minimum, meet SP1 (ICSM, 2007) C/3 standards of accuracy.

If the existing survey control marks have a horizontal Class/Order of less than C/3, then the horizontal co-ordination of new and surviving survey control marks must, as a minimum, achieve a standard of accuracy commensurate with the existing mark accuracies.

If the existing survey control marks have more than one set of coordinates with different horizontal datums (ie: SGC, AGC, PGC, MGA94, etc), the surveyor shall seek advice from ACTPLA survey staff regarding the requirements for recovery of those coordinate values.

### **3.7 Accuracy of Vertical Control**

If the existing survey control marks have a vertical Class/Order of LC/L3 or B/2 standard or better, the vertical co-ordination of new and surviving survey control marks must, as a minimum, meet SP1 (ICSM, 2007) LC/L3 or B/2 standards of accuracy.

If the existing survey control marks have a vertical Class/Order of less than LC/L3 or B/2, then the vertical co-ordination of new and surviving survey control marks must, as a minimum, achieve a standard of accuracy commensurate with the existing mark accuracies.

### **3.8 Observation Requirements**

Observations to new and surviving control marks, along with sufficient redundancies, are to be made to co-ordinate survey control marks. Additional observations between the control marks and to distant trigonometrical stations, over and above the traditional closed traverse, are strongly recommended. The observations must then be adjusted using a least squares computation program.

It is recommended that connections between new control marks and marks proposed to be destroyed are made prior to the commencement of works. The remainder of the survey shall occur after the completion of the works.

The field practices as described in ACT Surveyor-General *Guideline No.2: Cadastral Control Surveys* are recommended.

### **3.9 Network Connections**

All control marks are to be included in a closed survey network. No mark is to be left “hanging” at the end of a radiation. A connection to the cadastre shall not be used to close a survey network.

New survey control should be enclosed on all sides by a network of existing control marks. The more existing control marks that are included in the network, the better the adjustment can be fitted into the existing control.

All new and existing survey control marks are to be occupied, and have observations made from them, to adjacent control. No mark, with the exception of distant trigonometrical stations, shall only have observations to it (i.e. radiated from one or more marks).

### **3.10 EDM Calibration**

Pursuant to SPD 17(2), Electronic Distance Measuring equipment used in the establishment of horizontal control marks must have been calibrated on a certified baseline within the 12 months preceding the survey. The Surveyor-General maintains the Watson EDM baseline as a Reference Standard for length. Surveyors wishing to use the EDM base should contact ACTPLA survey staff (ph: 6207-1639).

The instrument’s additive constant, scale error and cyclic error, as determined by the EDM calibration, shall be applied to the observed distances prior to the network adjustment.

### **3.11 GNSS Equipment Verification**

Pursuant to SPD 17(3), GNSS equipment used in the establishment of horizontal control marks must have been verified on a GNSS base or on an approved geodetic network within the 12 months preceding the survey. The Surveyor-General maintains a GNSS base that incorporates the Watson EDM baseline. Surveyors wishing to use the GNSS base should contact ACTPLA survey staff (ph: 6207-1639).

### **3.12 Plan of Survey**

At the completion of the fieldwork the surveyor shall prepare a Plan of Control Recovery Survey, an example of which is shown at Appendix A. Connections between the new control marks, along with connections to existing control marks are to be shown, including all adjusted directions, distances, height differences, coordinate values used to constrain the survey, and derived co-ordinates (E, N, RL). All bearings shall be shown to the nearest second of arc, and all distances, height differences and coordinates shall be shown to the nearest millimetre.

### 3.13 Report and Lodgement

Prepare a report detailing the method of survey with proof that the accuracy standards have been met, detailing:

- The background and purpose of the survey;
- Equipment and observation techniques;
- Network geometry and redundancies;
- Adjustment software, options, analysis and results; and
- Recommendations for Class and Order.

The Plan of Control Recovery Survey, report and full adjustment report shall be lodged with the Surveyor-General. Lodgement of a comprehensive plan and report will generally make it unnecessary for the Surveyor-General to require the surveyor to submit field notes. Following approval of the survey results, ACTPLA survey staff will make the appropriate updates to the survey control database which can be viewed via ACTMAPi.

## 4.0 CADASTRAL REFERENCE MARKS

Any survey necessary to recover the position of survey control marks proposed to be destroyed that are also cadastral reference marks (see Section 3.2 above) may only be undertaken by a surveyor registered under the *Surveyors Act 2007* or made under the supervision of a registered surveyor.

The aim of the recovery survey is to provide sufficient measurements to be able to re-establish the position of the cadastral infrastructure, including reference marks, within the accuracies specified in the Directions after the original marks have been destroyed by the proposed works.

For these recovery surveys the following procedure should be implemented:

- 4.1 Conduct a thorough search of Survey Control Marks on ACTMAPi and all relevant plans on public record;
- 4.2 Ascertain the survey marks (including survey control, cadastral reference marks and cadastral corner marks) and monuments affected by the proposed works;
- 4.3 Conduct a thorough visual inspection of the site to locate any additional survey marks affected by the proposed works e.g. private survey marks, new marks (unregistered plans);
- 4.4 Carry out the required fieldwork to connect all survey marks that are proposed to be destroyed or disturbed to survey control marks (or reference marks if survey control marks are not available in the vicinity) that will not be affected by the proposed works;
- 4.5 Ensure all survey marks are surveyed by closed traverses. The field practices as described in ACT Surveyor-General *Guideline No.2: Cadastral Control Surveys* are recommended.

- 4.6 The survey must connect to at least 3 established survey control marks that will not be affected by the proposed works. If there is a scarcity of established survey control marks in the vicinity then stable reference marks may be substituted;
- 4.7 At the completion of the fieldwork the surveyor shall prepare a Plan of Survey Information (in accordance with the *Standards and Specifications for Deposited Plans*) detailing the actual reduced field measurements, an example of which is shown at Appendix B. It is not intended that the plan re-defines or coordinates cadastral boundaries unless requested by the client. The following information must be shown on the plan:
- Road names;
  - Division/District;
  - Cadastral linework and adjoining information (block, section and DP numbers);
  - Closed connections (as observed) by bearings and horizontal ground distances to all marks found or placed;
  - Details of the type and origin of all survey marks located; and
  - If survey control marks are available, include a table of all survey control marks connected, specifying the coordinates (E, N and RL if applicable), class, order and date of ACTMAPi search.
- 4.8 Prepare a report detailing the method of survey with proof that the accuracy standards have been met, as described in Section 3.13 above;
- 4.9 Lodge the Plan of Survey Information and the report for examination by ACTPLA. Upon completion of the plan examination process, the plan will be placed on the public record as a Miscellaneous Survey (MS) Plan.

## **5.0 ADVICE ON THE PRESERVATION OF SURVEY INFRASTRUCTURE**

Questions relating to the preservation of survey marks can be directed to the Surveyor-General (ph: 6207-1639).

Numbered CRM plaques can be purchased from the ACTPLA Plan Room, Ground Floor South, Dame Pattie Menzies House, 16 Challis Street, Dickson.

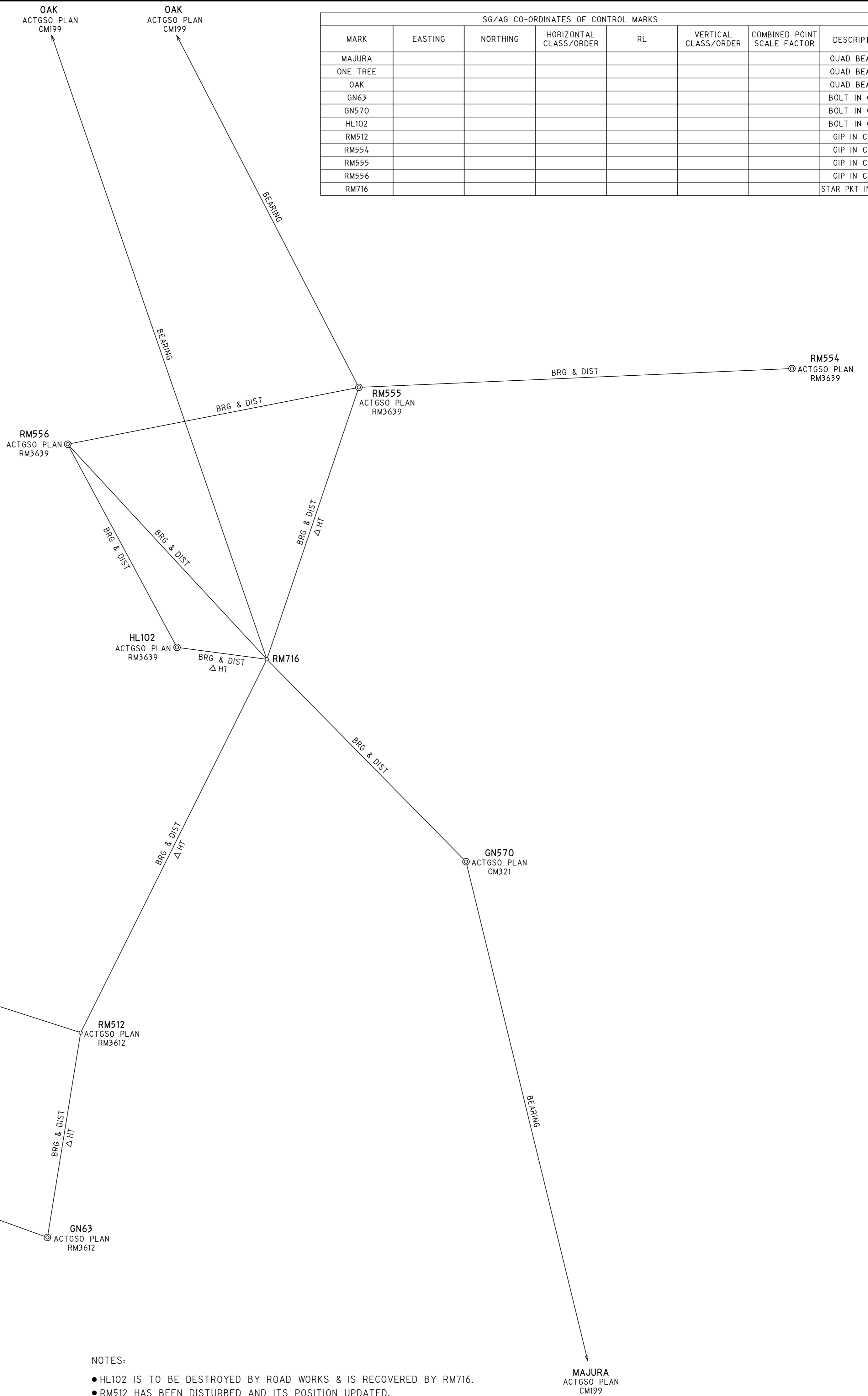
Bill Hirst  
Surveyor-General of the ACT  
8 November 2010

## REFERENCES

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<http://www.linz.govt.nz/docs/surveysystem/geodetic/specification-reinstating-replacing-marks-v2-2.pdf>
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[http://www.fig.net/pub/fig2010/papers/ts06d/ts06d\\_ollis\\_4001.pdf](http://www.fig.net/pub/fig2010/papers/ts06d/ts06d_ollis_4001.pdf)

APPENDIX A

SG/AG CO-ORDINATES OF CONTROL MARKS							
MARK	EASTING	NORTHING	HORIZONTAL CLASS/ORDER	RL	VERTICAL CLASS/ORDER	COMBINED POINT SCALE FACTOR	DESCRIPTION
MAJURA							QUAD BEACON
ONE TREE							QUAD BEACON
OAK							QUAD BEACON
GN63							BOLT IN CONC
GN570							BOLT IN CONC
HL102							BOLT IN CONC
RM512							GIP IN CONC
RM554							GIP IN CONC
RM555							GIP IN CONC
RM556							GIP IN CONC
RM716							STAR PKT IN CONC



NOTES:

- HL102 IS TO BE DESTROYED BY ROAD WORKS & IS RECOVERED BY RM716.
- RM512 HAS BEEN DISTURBED AND ITS POSITION UPDATED.
- ADJUSTED BEARINGS & DISTANCES ARE GRID, BASED ON THE ACT STANDARD GRID AT THE 610m SURFACE.

REFERENCE MARKS

- Denotes Trigonometrical Station
- GIP in road 1.83 radially from TP
- CB " " 1.83 " " TP
- PLAQUE IN KERB
- DEEP DRIVEN ROD
- DH&W IN KERB
- (Except as otherwise shown)

Field Books:

I, \_\_\_\_\_ of CANBERRA  
 a surveyor registered under the Surveyors Act 2007 hereby certify  
 that the survey represented on this plan is accurate and has been  
 made in accordance with Surveyors (Surveyor-General) Practice  
 Directions 2010 (No.1) and Guideline No.8 and was completed on

(Signature) \_\_\_\_\_  
 Surveyor registered under the Surveyors Act 2007

EXAMINED BY

\_\_\_\_\_

PLAN OF

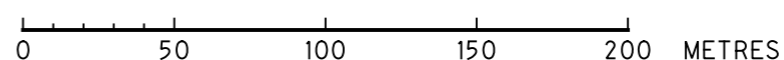
CONTROL RECOVERY SURVEY

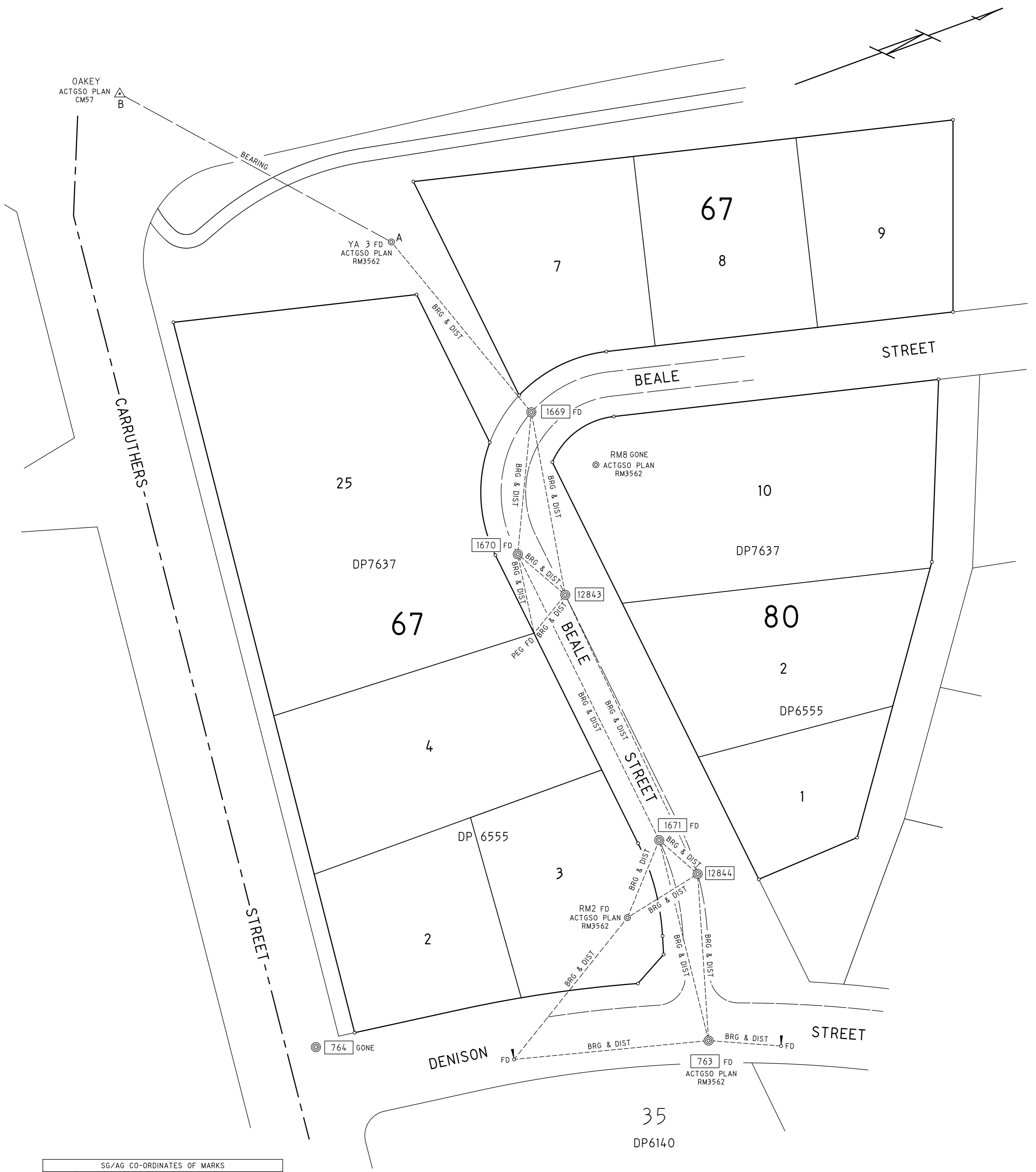
DIVISION: BONNER & FORDE

DISTRICT: GUNGAHLIN

AUSTRALIAN CAPITAL TERRITORY

SCALE 1 : 2500





SG/AG CO-ORDINATES OF MARKS				
No.	EASTING	NORTHING	RL	DESCRIPTION
763				PLAQUE IN KERB
1669				PLAQUE IN KERB
1670				PLAQUE IN KERB
1671				PLAQUE IN KERB
12843				PLAQUE IN KERB
12844				PLAQUE IN KERB
YA3				BOLT IN CONC
OAKEY				QUAD BEACON

NOTE: RM2, CRM1670 & CRM1671 ARE PROPOSED TO BE DESTROYED BY CONSTRUCTION WORKS.

REFERENCE MARKS

- ⊙ Denotes GIP in road 1.83 radially from TP
- ⊙ CB " " 1.83 " " TP
- ⊙ PLAQUE IN KERB
- ⊕ DEEP DRIVEN ROD
- ⊙ DH&W IN KERB
- (Except as otherwise shown)

Azimuth: A-B (Strom)

Field Books:

All Easements are 2.5 metres wide  
(Except as otherwise shown)

I, \_\_\_\_\_ of CANBERRA  
a surveyor registered under the Surveyors Act 2007 hereby certify  
that the survey represented on this plan is accurate and has been  
made in accordance with Surveyors (Surveyor-General) Practice  
Directions 2010 (No.1) and Guideline No.8 and was completed on

(Signature) \_\_\_\_\_  
Surveyor registered under the Surveyors Act 2007

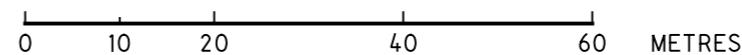
EXAMINED BY

\_\_\_\_\_

PLAN OF  
SURVEY INFORMATION  
SECTIONS 67 & 80

DIVISION: DEAKIN  
DISTRICT: CANBERRA CENTRAL  
AUSTRALIAN CAPITAL TERRITORY

SCALE 1 : 800



MISCELLANEOUS  
SURVEY PLAN