

The Consequences of Watershed Boundaries of the ACT

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ABSTRACT

About a hundred years ago, it was decided to establish Canberra as the capital of Australia. The boundaries generally followed watersheds ignoring existing cadastral boundaries. The Federal Government purchased properties affected by the boundaries and a consequence of the boundaries not following cadastral boundaries was the creation of numerous residue parcels within New South Wales (NSW) adjacent to the Australian Capital Territory (ACT) boundaries. Many of these residue parcels still exist in the ownership of the Commonwealth, and Landdata Surveys was contracted to undertake surveys of the parcels and to prepare a report identifying issues associated with boundaries, improvement, access and easements. This paper describes the survey as well as issues associated with differing coordinate and land administration systems on either side of boundaries, and access in mountainous terrain and through sensitive government controlled land. The use of the original boundary survey and its amazing accuracy and detail in determining property boundaries is outlined. The various methods used in our survey are described, highlighting difficulties and accuracies achieved. The scope also included investigating zoning and land use, legal access and how to achieve it in the current cadastre, and suggesting recommendations regarding the disposal and future use of the sites. A contour survey of sites was required and the heighting and contour determination is described. The scope included two interesting non-border property sites. The Tidbinbilla Space Centre is a significant site in rural ACT. It is partly managed by NASA and comprises a main site with three satellite sites. The Commonwealth acquired a strip of land on which Two Sticks Road is constructed. The road runs through steep parts of ACT and NSW. Management of the road is thus split amongst a variety of jurisdictions. The report concludes by highlighting problems associated with ignoring existing property boundaries in the determination of ACT's boundaries.

KEYWORDS: *Cadastre, access, administration, improvements, contours.*

1 INTRODUCTION – “CAPITAL ALMOST GOT SOLD DOWN THE RIVER”

A year ago, a newspaper article in the Canberra Times described the water issues associated with the selection of Canberra as the nation's capital (Warden, 2012): “*Canberra has been green and lush for months and now we've just had these deluges of flooding, refreshing, cabbage-swelling rains. And so it's amusing to recall that during the “Battle of the sites” (1899-1908) opponents of Canberra as the federal capital used to call it a shrivelled wilderness. No city was possible here they warned. A lack of water would make it unsanitary and paradise for typhoid. Farms and gardens would be impossible. In the unlikely event of anyone here ever managing to grow a single stunted cabbage, it would be front page news. ‘What crime have we committed that we should be exiled to the unknown regions of Yass-Canberra?’ the pro-Dalgety Senator James Stewart whinged to the upper house in 1908. He said he'd heard it was ‘an arid desert bleached with the bones of animals that have died of*

thirst’.”

In 1900, the Commonwealth of Australia Constitution Act 1900 was enacted. This provided for the site for a capital city within New South Wales (NSW), but at least 100 miles from Sydney. Charles Scrivener was tasked with investigating options and recommending a site. Water was a critical issue in the site selection and when Canberra was eventually chosen, boundaries between NSW and the Australian Capital Territory (ACT) were defined by watersheds of nearby rivers. The reader is referred to the wording of the Seat of Government Surrender Act 1909 (Commonwealth of Australia, 1909) in the Annexure.

In 1910, Percy Sheaffe commenced the survey of the borders, which included defining the relevant watersheds without regard for the existing cadastral boundaries. The Commonwealth acquired all of the land within the borders and also the residue land within NSW of the portions divided by the watershed boundaries. As a consequence, the Commonwealth took ownership of a number of small residue parcels within NSW. In 2010, Landdata Surveys were contracted to undertake surveys of the various sites and prepare reports on a range of issues associated with the sites.

2 SCOPE

The scope was wide, including features generally beyond the expertise of a surveying company or department. However, the primary component involved surveying work. The Department of Finance contracted a large multi-disciplinary company, ironically without local surveying expertise, to undertake the project.

Landdata Surveys was thus employed as a subcontractor to undertake the surveying and planning aspects of the scope, which included:

- Undertaking “ID” surveys of 33 sites. This was interpreted as being an Identification Survey where improvements, burdens and encroachments on the site are identified and where possible surveyed, and an associated report provided.
- Identifying services on the site. This entailed surveying any services found on the site, undertaking a Dial Before You Dig search of the land, and mapping and reporting on such services and the implications thereof.
- Identifying access to the sites. This involved determining and mapping how to access the site, and to report on legal access to the site.
- Providing contours for the site.
- Identifying zoning and town planning issues associated with the site, and compliance therewith.
- Identifying any heritage issues found on or associated with the site.
- Providing a “GIS” of the site. This was interpreted as providing a digital Computer-Aided Design (CAD) file of the survey.
- Providing recommendations regarding the resolution of issues associated with the site and opportunities for the disposal thereof.
- In addition to the border properties, two interesting non-border properties were included in the brief. The Tidbinbilla Space Centre houses satellites used in NASA’s space program, and the main site, together with associated satellite sites, was included. The Commonwealth had acquired a road reserve for a road known as Two Sticks Road, spanning the NSW-ACT border. The road extended well beyond the acquired reserve and the status of the road needed resolution.

3 ACT-NSW BORDER SURVEY 1910-1915

The ACT-NSW border was surveyed between 1910 and 1915. The surveys were drawn on a series of maps FC1-18 (Figure 1), which are now heritage listed (ACT Heritage Council, 1995).

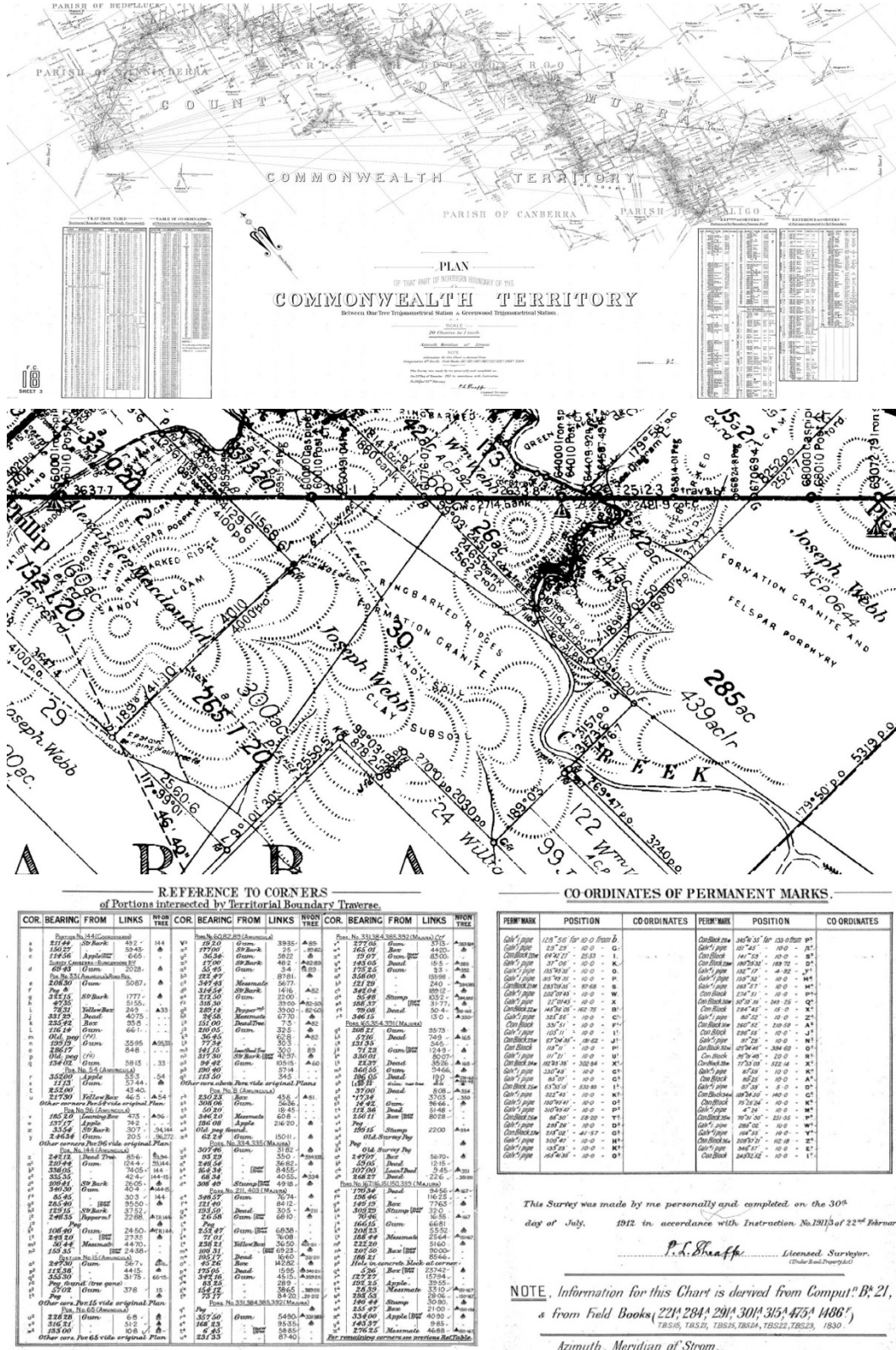


Figure 1: Plan of ACT-NSW border survey.

The survey was very accurate considering the instruments in use at the time, and the boundaries were very well monumented with very large wooden pegs and reference marks consisting of iron pipes and concrete blocks (Figures 2-4). Many of these marks still exist, and consequently the determination of the site boundaries common to the border was relatively easy. Landdata surveyors were amazed at the excellent agreement found between the new surveys (Figure 5) and that of 1911.

Furthermore, in determining the border, the terminals of boundaries cut by the border were generally also located and surveyed. Thus, whilst many of these terminals no longer exist, by locating border marks and determining the border location it was generally possible to confidently determine the boundaries of the relevant border properties. As well as being dimensioned, corners and references were coordinated relative to still existing trigonometric stations.



Figure 2: Rock spit marking bend in border (Evans, 2012).

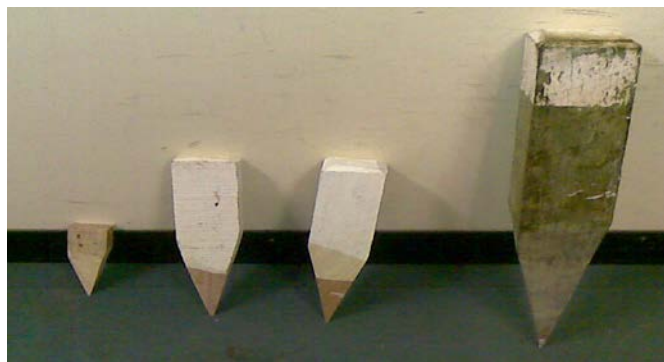


Figure 3: Border boundary peg (right) compared to modern pegs.



Figure 4: Oak Trig Station – adopted as corner mark.

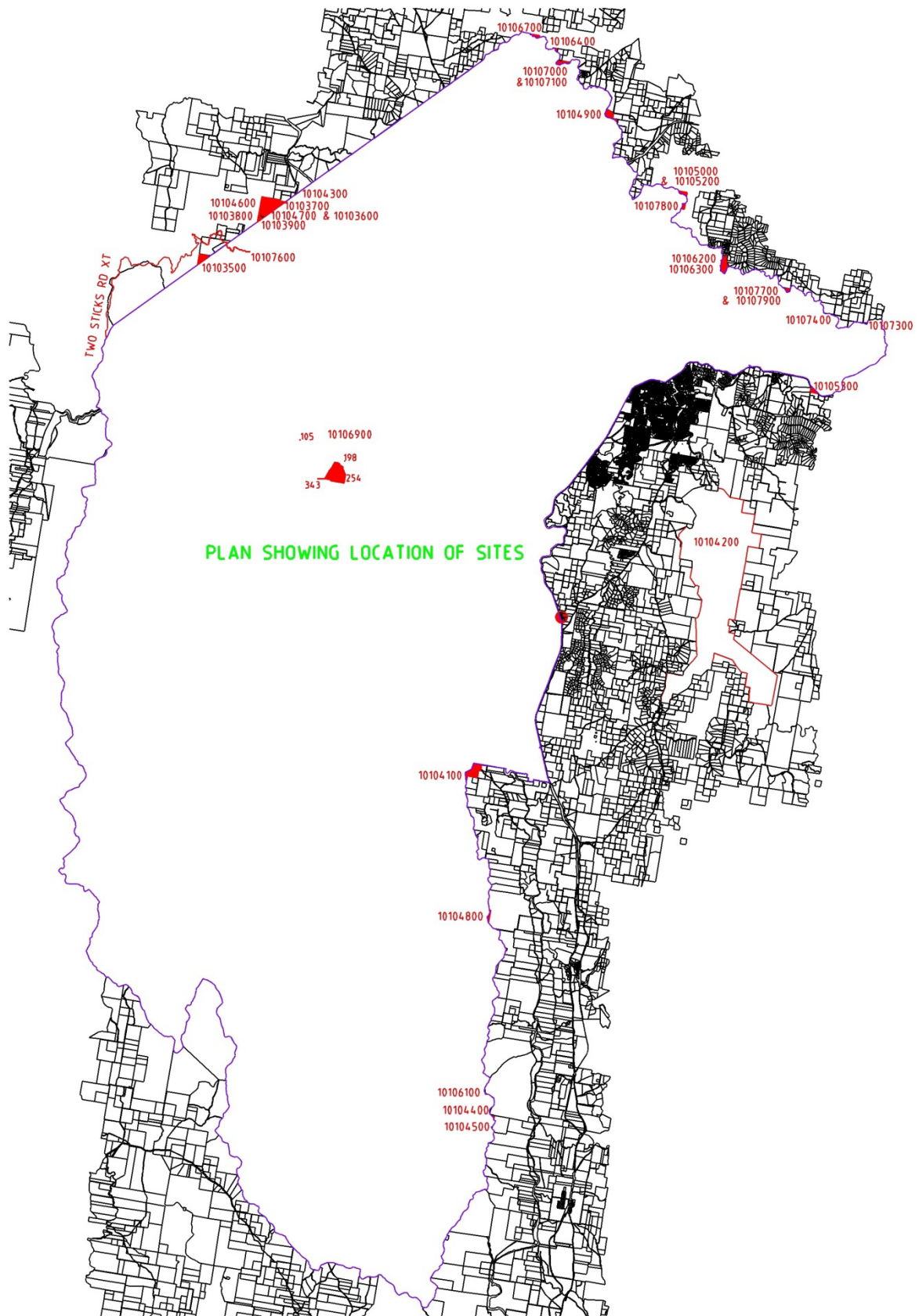


Figure 5: Location of the sites to be surveyed on the ACT border.

4 ACCESS

The access requirements of the project were two-fold:

- Determine how best to get to the site, i.e. practical access.
- Establish whether the site had legal access.

4.1 Practical Access

This involved in the first instance the examination of available aerial imagery, which was readily available thanks to the NSW and ACT databases as well as private providers such as Google and Nearmap. This enabled Landdata to identify roads, tracks and feasible routes to reach the site. Relevant owners were then approached for permission to access the sites via the chosen route.

This sometimes was quite challenging due to the physical nature of the access, requiring very careful 4-wheel driving. Challenges also presented themselves in dealing with government authorities who managed many of the sites through which access was sought. Examples included:

- Obtaining access through a Defence Force firing range. Staff were required to be 'chaperoned' while passing through this property.
- Due to the extreme nature of the terrain, the ACT government department responsible for the management of reserves would only allow Landdata access if a satellite phone was carried and staff had formal 4WD and chainsaw training. As the available course timetables in Canberra did not meet the required survey schedule, it was chosen to obtain access via the more difficult access routes through NSW.

4.2 Legal Access

Prior to the establishment of the ACT, most of the sites had legal access via Crown or public roads. When the ACT was created, many of these roads were severed, leaving remnant road pieces and effectively removing legal access to the parcels (Figure 6). It was thus necessary to identify where legal access was lacking and make recommendations regarding how it could be obtained.

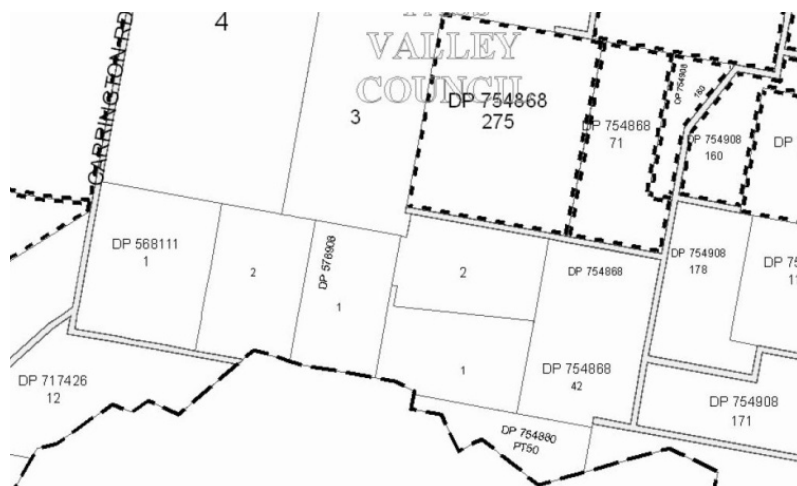


Figure 6: Legal access removed.

5 CONTOURS

The scope of work required the provision of contours in digital form. To undertake a full new contour survey of each site would have made achieving the required timeframes and budgets impossible. Some of the sites were heavily wooded and very steep. Consequently, the method used generally involved the heighting of our own survey control either from existing nearby control or a Global Navigation Satellite System (GNSS) Continuously Operating Reference Station (CORS). Additional heighting was done on features surveyed for other purposes such as boundary determination, fences and services. The heights of surveyed points were then used to confirm existing contour sources such as existing maps (Figure 7). It was fortunate that the ACT has been comprehensively contoured and the contours often extend into the neighbouring parts of NSW on which the sites are located.

Contours, where not readily available digitally, were digitised from existing paper copies of plans to provide the required digital version. An appropriate disclaimer was obviously inserted. It is believed that the required heighting met the need of the client who did not object to the adopted methodology.

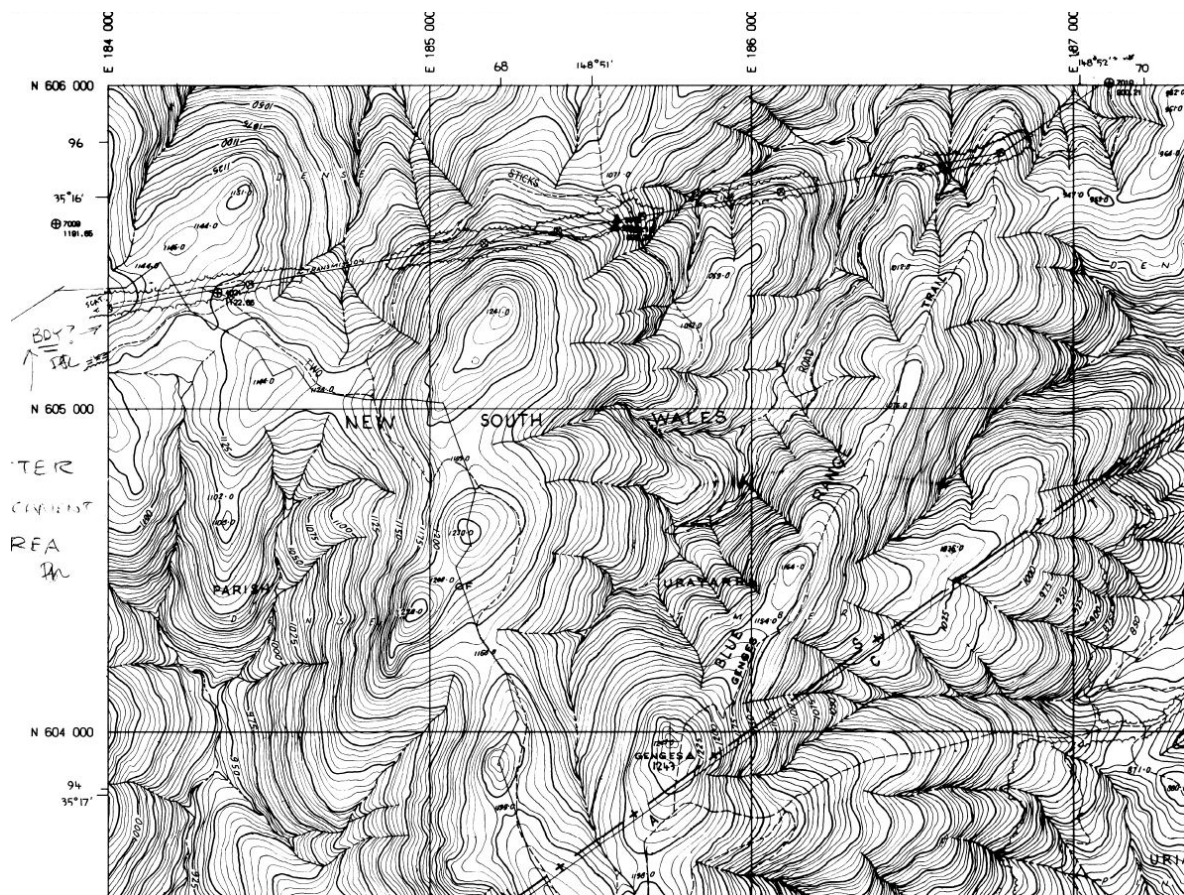


Figure 7: Example of an ACT topographical map.

6 ZONING AND OTHER TOWN PLANNING ISSUES

The brief required the identification of the zoning of the sites as well as any other planning issues that affect the site. The existing land use was required to be identified to check conformance with the zoning.

The ACT is surrounded by four shires, i.e. Yass, Palerang, Queanbeyan and Cooma-Monaro. Satisfying this requirement involved the following steps:

- Identify the shire in which the site is located.
- Research the relevant Shire Local Environmental Plan (LEP), usually found on the Shire webpage.
- Locate the site on the LEP maps and hence determine the relevant zone.
- From the site visit, determine the existing use and also that of surrounding properties.
- Identify any other issues that may affect the site.

The process was complicated a little by a recent change of shire boundaries. This resulted in LEPs from adjacent or former shires applying to the site (e.g. Yarrowlumla Shire Council, 2002). Figure 8 illustrates an example of the former Yarrowlumla Shire Council LEP 2002. Furthermore, the shires were in the process of preparing new LEPs. Consequently, one needed to investigate the current zoning but also determine whether any changes were envisaged in the new LEP.

Whilst most of the sites were themselves zoned rural, adjacent uses in the ACT included a military zone and nearby gun club, forestry uses, national park and expanding residential areas in the north. Other issues that affected the site included the aforementioned adjacent uses and their associated impact on access and future use, and the flight path of Canberra International Airport that impacted on many of the sites along the eastern border of the ACT (Figure 9).

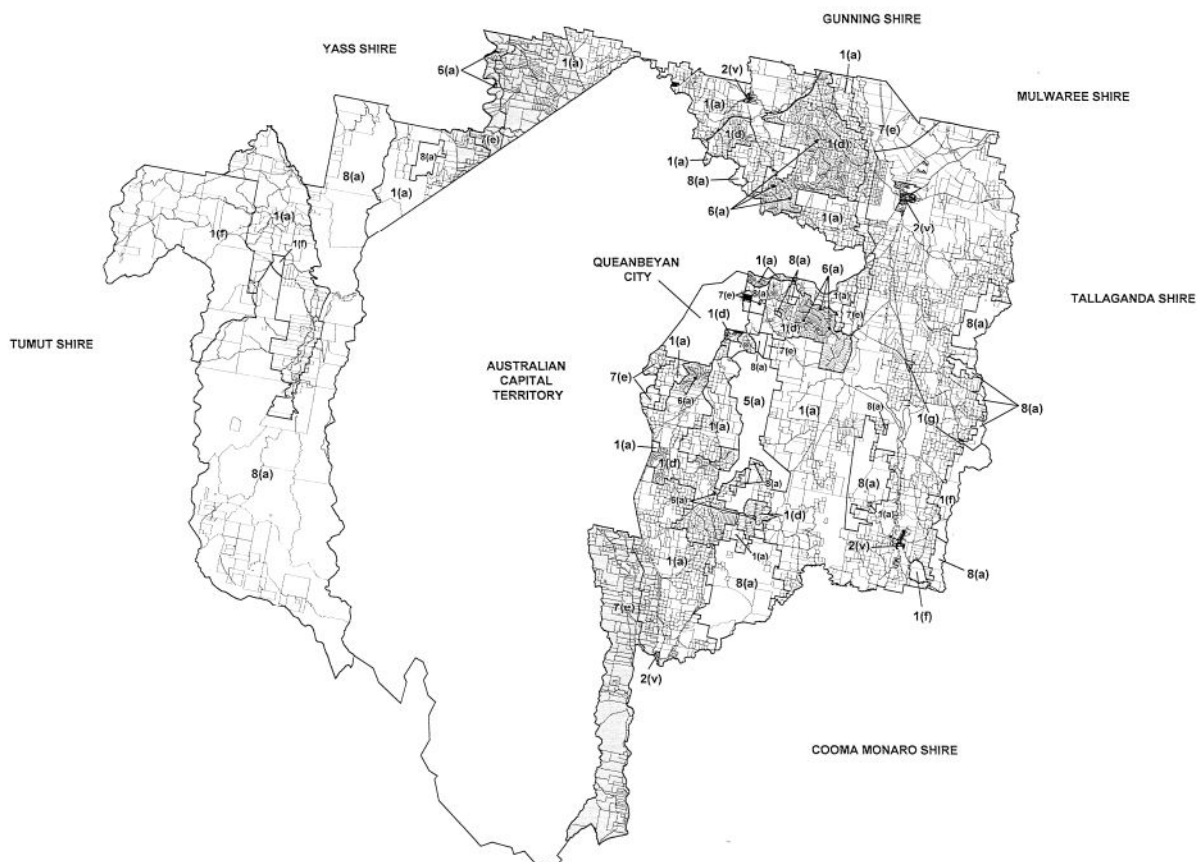


Figure 8: Former Yarrowlumla Shire Council LEP 2002 (NSW Government, 2002).

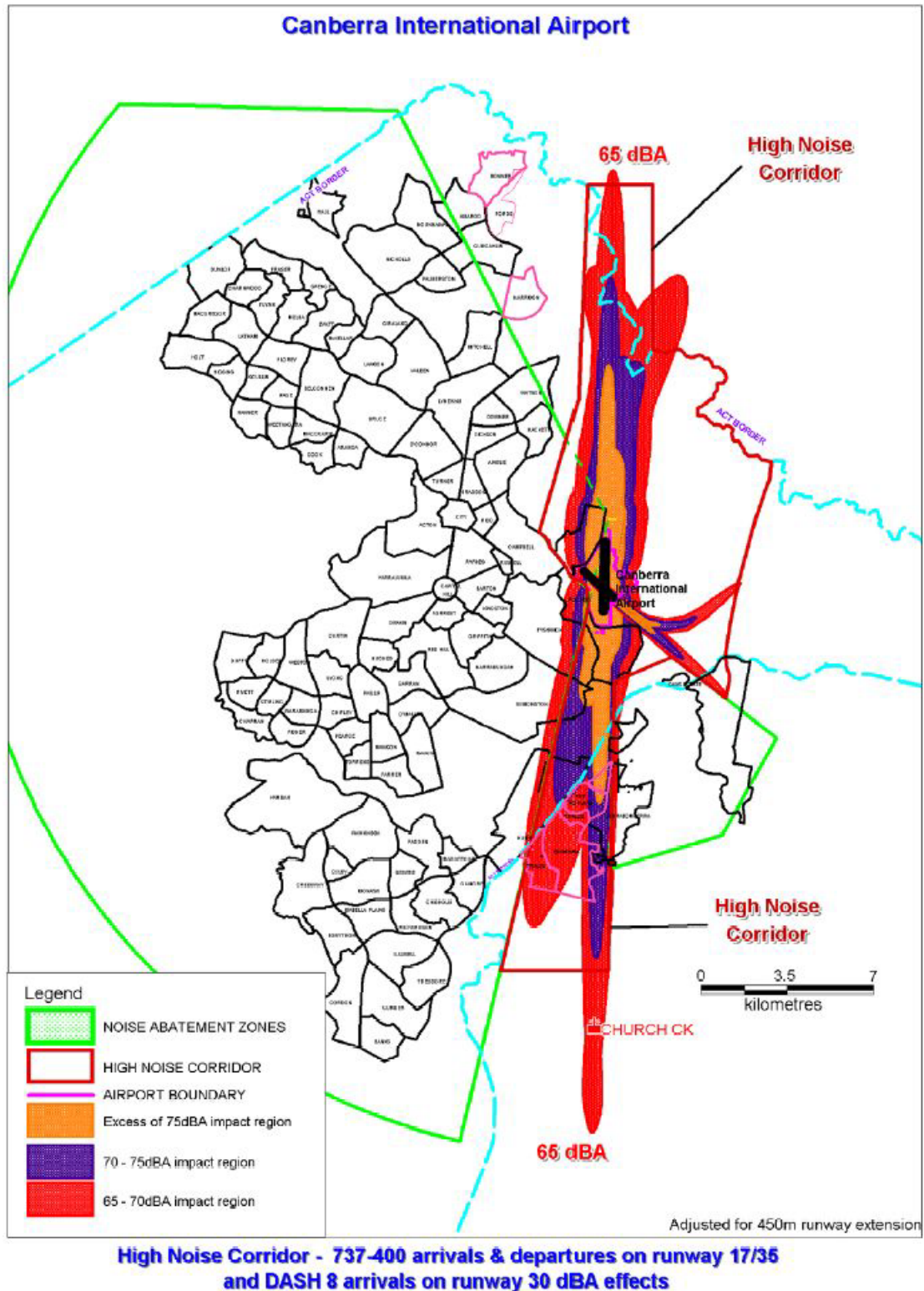


Figure 9: Noise map used to determine noise impacts on sites (Canberra International Airport, 2012).

7 HERITAGE ISSUES

Some of the ACT-NSW border survey marks have been heritage listed. It is unclear to the author why not all of the remaining marks were listed. The site on the National Trust register of significant places is “a strip of land twenty metres in width, centred on the ACT-NSW

border and following the border for approximately 97 kilometres between Mt Coree and the Boboyan Road/Shannons Flat Road. The place comprises a total of 272 sites, being:

1. *Original border markers.*
2. *Original reference trees.*
3. *Original mile markers.*
4. *Original mile reference trees.”*

The crossings of Two Sticks Road with the border are included within this ‘place’. The sites generally fell in areas where the marks were not listed and themselves did not contain heritage sites. It was, however, necessary to check whether nearby heritage items could affect access to and future uses of the border sites. Thus, investigations of the heritage documentation of the relevant jurisdictions needed to be made.

8 RECOMMENDATIONS

Recommendations were generally fairly common-sense suggestions involving investigating options for sale and consolidation with adjacent owners or extension of existing national park boundaries. It was also necessary to suggest ways of resolving site legal access issues. In making the recommendations, it was necessary to justify such suggestions based on adjacent land uses, zoning and heritage issues described above.

9 ADMINISTRATION

The border sites were situated in areas governed by a number of authorities or government departments. As described earlier, sites were located within three local government authorities, i.e. Yass Valley, Palerang and Cooma-Monaro. Other government departments that influenced issues associated with the sites included:

ACT

- ACT Planning and Land Authority (with respect to land use in ACT).
- Territory and Municipal Services (with respect to the management of ACT roads, forestry, national parks and reserves).

NSW

- Forestry NSW.
- Land and Property Information (LPI) – Crown Lands.
- NSW Office of Environment and Heritage.
- NSW National Parks and Wildlife Service.

Federal

- Defence.
- National Capital Authority.
- Finance and Deregulation (client).
- Department of Sustainability, Environment, Water, Population and Communities.

10 THE LANDDATA SURVEY

Generally, control was established on sites using GNSS and nearby CORS belonging to LPI's CORSnet-NSW network (Janssen et al., 2011) as it existed at the time (i.e. Dickson, Stromlo and Tidbinbilla).

Provisional coordinates of the ACT border component of the sites were taken from the ACT cadastral database. For the remaining boundaries, provisional coordinates were determined, where possible, using the border survey maps. This was possible due to the extent of the border survey, which generally included the surveying of the terminals of boundaries crossed by the border. Preliminary coordinates were thus determined for the required reference marks to enable the staking out of their positions and the locating thereof. Generally, marks were found very close to their calculated positions, testifying to the high accuracy of the border survey.

Where existing survey control marks were in the proximity of the site, they were connected to provide local heights to be used in the contour check. If no such marks were available, the height obtained from GNSS observations in conjunction with AUSGeoid09 (Brown et al., 2011) was used. A survey was then undertaken of critical features, locating fences, and improvements and services if present.

The field trips also included annotating maps to illustrate the access used, where this was not clear from aerial photography. The existence of locked gates and any issues associated with access were recorded. Notes were also taken describing land use of the site and adjacent land. Surveying on the border has additional challenges in dealing with coordinate systems and plans from different jurisdictions.

11 RESEARCH SOURCES

In undertaking this project, besides researching the obvious sources such as the local government authority or relevant government department websites, the relevant site was 'googled' to see whether there were any extraordinary aspects recorded relating to the site. In doing this, a very useful and interesting website was discovered. A local bushwalker has developed a fascination for discovering the ACT border survey marks and created a blog on which he posts his experiences in walking the border as well as numerous photographs (Evans, 2013). His interest was such that he obtained the corner coordinates from the ACT survey office and then with his handheld GPS located such marks and photographed many. This source proved to be valuable and some of his photographs are used in this paper.

Other sources included the border survey sheets, portion plans and parish maps, topographical maps, local government and departmental documents and information obtained using the Google search engine.

12 NON-BORDER PROPERTIES

Two sites were included in the brief that were not considered as border properties, and Landdata was asked to separate the report on these sites from the border properties report. The sites in question were the Tidbinbilla Tracking Station (together with its satellite sites) and

Two Sticks Road.

12.1 Tidbinbilla Tracking Station

The Tidbinbilla Space Centre, now known as the Canberra Deep Space Communication Complex (CDSCC), is operated and maintained on behalf of NASA by the CSIRO (NASA, 2013). The land used by the tracking station consists of a large primary site and three secondary sites being two remote sites for communication purposes and a thin passage site containing water pipes from a nearby river to the primary site (Figure 10). The sites for the tracking station were removed from the existing rural lease at the time.



Figure 10: The Tidbinbilla Space Centre with two close satellite stations in blue (ACT Government, 2012).

The site now contains extensive improvements of very high value and a significant network of services. For the purpose of the project, neither was required to be fully surveyed. Instead, use was made of supplied plans, previous work done on the site and digital imagery. The perimeter of the main site was surveyed to determine any encroachments or near encroachments.

Whilst the main site was very large and thus took time to survey, the small remote sites provided more challenges. The boundaries of one of the sites within ACT land had not been defined by survey, and, whilst it was shown on the ACT cadastral database, finding documentation to confirm its location was difficult. The situation was exacerbated by the Landdata survey, which indicated that the existing structures on the site did not fall within the boundaries as defined by the ACT database. The recommendation in this instance was to have the site surveyed and a formal survey plan lodged with the ACT survey office. There were further encroachments associated with a second site. ACT control marks were located within it. The boundaries of the third site created to contain water service infrastructure to the main site were vague and appeared to terminate short of the river from which water was being pumped. Water service infrastructure was found apparently outside of the site boundaries.

12.2 Two Sticks Road

The Two Sticks Road site involved the survey of a road that runs in both the ACT and NSW, crossing the ACT western border twice. The site requiring survey was uncertain, as the

Commonwealth did not appear certain of their extent of ownership. Consequently, the survey and site report covered the full extent of the road from its intersection with Mountain Creek Road.

Two Sticks Road is well summarised on the Bonzle website (<http://maps.bonzle.com>): *“The Two Sticks Road is an unsealed road in New South Wales and the Australian Capital Territory. ... The Two Sticks Road’s highest elevation along its length is 1320 m and the lowest point is at 588 m. ... Two Sticks Road is mountainous along its 25.6 km length, with about 7.9 km that is steeper in incline/grade than 5% (2.5 km is steeper in incline/grade than 10% and 1.2 km of that has an incline/grade more than 15%!). The total ascent / descent along the length of the Two Sticks Road is 956 m / 541 m.”*

The road in the ACT is in two parts. The northern part is defined by a road reserve that is illustrated in plans DP435676, DP109594 and RP1009. It is now a gazetted road. The reserve forms part of the land acquired by the Commonwealth in 1943. The area within the ACT is 4.79 ha. The western section, which starts at a location known as Piccadilly Circus at its intersection with Brindabella Road (Figure 11), runs in a northerly direction through the Namadgi National Park until it crosses the ACT-NSW border. The southern section does not have formalised road reserve boundaries and is not a gazetted road.



Figure 11: Heritage border mark at the Piccadilly Circus end of Two Sticks Road (Evans, 2013).

In NSW, the northern section lies within road reserve boundaries. The road reserve is illustrated in DP109594 and DP1032871. The road reserve extends to the western boundary of Lot 1 DP1032871. This forms part of the land acquired in 1943 and has an area of 7.57 ha. West of Lot 1, the road passes through the Brindabella State Conservation Area and Brindabella National Park, but no road boundaries are defined. The road is not a public road under the Roads Act. The road is managed by the National Parks and Wildlife Service of the NSW Office of Environment and Heritage. It is listed by Yass Valley Council as a “rural unsealed road of hierarchy category 5”. This provides one maintenance grade every two years. Further south, the road again crosses into the Namadgi National Park in the ACT, but is not located within a road reserve.

That part of the road acquired by the Commonwealth was acquired as a “road” and not as a freehold (NSW) or leasehold (ACT) parcel. It has been treated as a road for public access. In the ACT it is designated a “road”, while in NSW it is treated as a “reserved road”.

As can see from the aforementioned description, one of the main challenges was accessing the site, due to its steepness (Figure 12). In winter, the access was exacerbated by frost making the icy road very slippery and dangerous, and tree falls across the road were common. The density of tree cover also limited the use of GNSS survey techniques. Thus, long traverses were surveyed closing between spaced control marks where sufficient GNSS signal reception was possible. Fortunately, it was possible to make use of contours from existing topographic maps.

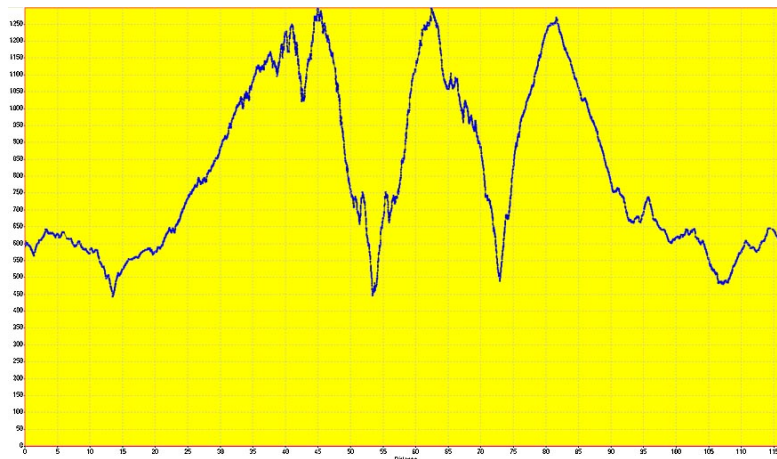


Figure 12: Graph illustrating the vertical profile of Two Sticks Road (Vernon, 2012).

Whilst from the cadastral map of the Two Sticks Road acquisition site it was possible to determine the extent of that part of the road, it was less easy to determine the authority responsible for the road in NSW. Parts had been dedicated as public road and thus fell under the jurisdiction of Yass Valley Shire Council, and those parts within road reserves in the ACT were under the control of ACT roads. However, those parts of the road in the Brindabella National Park and Brindabella Reserve were not within road reserves and thus did not have road status. They were generally managed by the NSW National Parks and Wildlife Service and the ACT Parks Conservation and Lands.

13 CONCLUDING REMARKS

One wonders whether using watersheds for the definition of the ACT-NSW border was the most appropriate policy. It may have been more appropriate to follow the existing cadastre beyond the watershed. This would have avoided the consequences of severing existing properties to create the border.

The Seat of Government Surrender Act 1909 (Commonwealth of Australia, 1909 – see Annexure) describes many of the boundaries on the ACT-NSW border as watersheds. Could such watersheds be considered somewhat ambulatory or a “natural boundary”? One wonders how the border surveyors determined the locations of the watershed.

The NSW Registrar General’s Directions define a natural boundary as follows (NSW Government, 2013): “A *boundary that is formed by a natural feature (bank of stream, mean high water mark, edge of cliff etc.) must be surveyed so that each change of course or direction is determined to the appropriate accuracy. This may be achieved by the surveyor adopting a series of bearings and distances that approximates the boundary. These bearings*

and distances are derived from the end points of a series of radiations taken from one or more field stations to each change in direction of the bank of the stream etc. In order to ensure the plan of survey remains clear and legible it is common practice to list each bearing and distance in a table of short lines. The actual bank etc. is delineated on the plan as an irregular line.” Could the definition in the survey plans of the border be challenged on the basis that the watershed was not adequately defined?

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ANNEXURE: SEAT OF GOVERNMENT SURRENDER ACT 1909

The State shall surrender to the Commonwealth, and the Commonwealth shall accept, for the purposes of the Seat of Government, the territory (hereinafter called the Territory), now being part of the State, described hereunder, namely—

Counties of Murray and Cowley, area about 900 square miles: Commencing on the Goulburn-Cooma Railway at its intersection with the Queanbeyan River at Queanbeyan, and bounded thence by that railway generally southerly to the south-eastern corner of portion 177, Parish of Keewong, County of Murray, by the southern boundaries of that portion and portions 218, 211, 36, and 38 generally westerly to the Murrumbidgee River, by that river downwards to a point east of the south-east corner of portion 68, Parish of Cuppacumbalong, County of Cowley, by a line partly forming the southern boundary of that portion west to the eastern **watershed** of *Gudgenby River*; by that **watershed** and the eastern and southern **watersheds** of *Nass Creek* by part of the western **watershed** of *Gudgenby River*, generally southerly, westerly, and northerly to the southern **watershed** of *Cotter River*, by that **watershed** and the western **watershed** of that river, passing through Mount Murray and through Bimberi Trigonometrical Station, generally northerly to Coree Trigonometrical Station; thence by a line bearing north-easterly to One-Tree Trigonometrical Station; thence by the **watershed** of *Molonglo River* north-easterly and generally south-easterly to the Goulburn-Cooma Railway aforesaid, and thence by that railway generally south-westerly to the point of commencement.