

# *100 years of National Topographic Mapping*

## **Topographic Mapping in Australia 1910-1945**

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### **Abstract**

Series topographic mapping in Australia had its beginnings in 1910 when the Australian Army commenced a program of one inch to one mile mapping in Victoria and New South Wales. With very limited resources in the 1920s and 1930s the Army continued mapping some priority areas in the south-east and south-west of the Country. The Commonwealth's civilian activities over this period were limited to the production of nine sheets of the Australian sector of the International Map of the World, and strip maps for aircraft navigation along the principal air routes. State Government mapping activities were, until then, focused on the production of cadastral maps and plans for land administration purposes.

When Australia declared war on Germany in 1939, and then Japan in 1941, the military was confronted with the serious problem of a lack of maps to plan and execute the defence of the Country. As a result, an Emergency Mapping Program was instigated to meet the urgent requirement for strategic and tactical maps. The State Governments were called in to assist the Army Survey Corps until additional personnel could be recruited and trained in topographic mapping.

By the end of the war, 80% of the Country had been provisionally mapped under the Strategic Mapping Program at scales of four miles to the inch around most of the coast and hinterland, and eight miles to the inch over more remote areas. Areas around the principal cities, ports, strategic towns and military establishments were mapped in more detail at one mile to the inch under the Survey Mapping Program.

## **Introduction**

Series topographic mapping in Australia was, by default, the exclusive domain of the Army until the Second World War. The civilian Commonwealth and State Government agencies were not seriously involved until the National Mapping Council was formed in 1945 largely as a consequence of the war. Until then, the mapping activities within the Commonwealth Government Departments were limited to small scale mapping for aeronautical and general reference purposes whilst the States focused on the production of cadastral maps for land administration. So the history of series topographic mapping in Australia in the first half of the 20<sup>th</sup> Century is largely the history of the mapping activities of the Australian Army.

## **Origins of Topographic Mapping in Australia**

Series topographic mapping in Australia began in 1910 when four topographers were seconded from the British Army to establish a survey unit within the Royal Australian Engineers. Their task was to produce maps over training areas and other areas of military importance under the direction of the Intelligence Corps. A program of one inch to one mile topographic mapping (1:63,360) was commenced over priority areas starting with the ports of Geelong and Western Port in Victoria and Newcastle in NSW.

The map sheets were compiled in the field by plane table methods with control largely derived from existing parish cadastral plans. A Cartographic Section was established in Melbourne to fair draw the plane table compilations on the polyconic projection and prepare the reprographics for printing by the Government Printer. A triangulation section was added in 1914 to provide better geodetic control for the plane table surveys.

In 1915 the survey section of the Royal Australian Engineers formed the nucleus of a new Australian Survey Corps. The one mile series mapping continued during the early years of the First World War but came to a halt in 1917 as most of the 20 personnel then attached to the Survey Corps had transferred to the Australian Imperial Force and were serving on the Western Front or in the Middle East.

Many millions of people were killed or died as a result of the First World War. The war was aptly described as the war to end all wars because it was then said that such a cataclysm must never occur again. At the Paris Peace Treaty in 1919 nations agreed to disarm and the League of Nations was established to promote international cooperation and to achieve global peace and security. Australia joined the League and accordingly set about reducing the size of its military forces.

So throughout the 1920s and early 1930s expenditure on defence, including topographic mapping, was low on the political agenda. In 1919 the strength of the Australian Survey Corps stood at 22 but three years later was reduced to a mere 14 and remained at that level until 1935.

Within these constraints a limited amount of one inch to one mile mapping was carried out in pockets of south-eastern and south-western Australia. Technical innovation in cartography was

not neglected. Aerial photography for map compilation flown by the RAAF was trialed in the 1920s and was successfully used on the Albury Sheet in 1931. The British Modified Grid was adopted in 1932 to provide a rectangular grid based on the Transverse Mercator projection to replace the previous graticule of the polyconic projection. Photogrammetric techniques using the British developed *Arundel* method of graphical triangulation and radial line plotting superseded plane table methods for map compilation in the early 1930s. The 1936 Sale Sheet was the first to be completely compiled from aerial photography.

In 1925, the Commonwealth, after some deliberation, made on start on the production of 1:1,000,000 sheets of the International Map of the World (IMW) Series - a project first proposed at an International Geographical Conference held in London back 1895. A small team was established within the Property and Survey Branch of the Commonwealth Department of Works to undertake production of the Australian sector. The Sydney Sheet was the first to be published in 1927 and by the time the project was suspended in 1940 due to wartime priorities a total of nine sheets had been completed. These covered all of NSW and Victoria with some overlap into South Australia and Queensland - about fifth of the Australian land mass. These maps were office compilations based on cadastral maps, census reports and data supplied by state and local governments.

However the resources allocated to national mapping were pitifully small given the magnitude of the task. Sixty maps at one inch to one mile had been published by 1931 but the area mapped covered only about 1% of the Australian land mass.

The poor state of national mapping was of concern to many. Several committees comprising representatives from governments, the military, the scientific community and professional associations were convened through the 1920s and 30s to lobby the Commonwealth on the need for a national geodetic and topographic survey. But this was to no avail as mapping was not regarded as a priority when competing with other more visible areas for the allocation of resources.

However there was support from some politicians. For example in a speech delivered in the House of Representatives in 1938 the Member for the Northern Territory the Honorable A.M. Blain stated the following...

*I refer to the need for the complete triangulation and mapping of Australia for defence and other purposes. I deplore, as does everyone in the surveying and engineering world, Australia's lack of progress in the work of coordinating the surveys of the various States. Australia is far behind the civilized counties of the world in the mapping of the country's physical features and contours. I have in mind particularly the great ordnance surveys of India and the British Isles. I instance also the surveys by the little principalities of the Malay Peninsula, Siam, Burma and the Straits Settlements. They made a major triangulation, so that they know the whole surround of the country first, and then fill in the detail with small surveys afterwards. We in Australia did not follow that course and so we have chaos.*

However the government's interest in mapping was soon to change.

## **Outbreak of World War Two**

Following Hitler's breach of the Munich agreement in 1939 over German occupation of Czechoslovakia, it appeared that war was imminent. Resources allocated to defence were increased substantially, the Survey Corps was expanded to 50 and a long range one inch to mile mapping program adopted.

But it was awfully late in coming.

When Prime Minister Menzies announced in September 1939 that Australia was at war with Germany the military had a serious problem as there was no complete map coverage over the country suitable for defence purposes. The successful waging of war requires access to topographic maps showing the lay of the land. Strategic maps at small scales are required by the military high command to plan and implement campaigns. Troops in the field need tactical maps at larger scales to find and fight the enemy.

On the eve of war the topographic map coverage of Australia suitable for tactical operations stood at 80 one inch to one mile sheets - 73 in the south east and 7 in the south west of the country covering about 1.3% of the Australian land mass. The coverage suitable for broad strategic planning stood at nine 1:1,000,000 IMW sheets also limited to the south east corner. There was no strategic or tactical map coverage over northern Australia where enemy activity was most likely to occur in the first instance.

The government's response to its defence mapping predicament was to approve a further expansion to the Survey Corps and initiate an Emergency Mapping Program. However as time was needed to recruit and train army personnel the State Governments were called in to assist.

The RAAF's aerial photography capability was increased in 1939 with the formation of a dedicated Survey Flight. Three Tugan Gannet and two Avro Anson aircraft equipped with Williamson Eagle IV cameras were initially assigned to the Flight. The cameras were subsequently replaced with Fairchild K17 cameras and the Gannets with Lockheed Hudsons. Additional photography for mapping was also flown by the civilian contractor Adastra Airways who at the time was the only firm in Australia with vertical aerial photography capability.

The Royal Australian Air Force was also in urgent need of aeronautical charts over the country. The rapid growth in civil aviation in the 1930s had led to the production of a series of strip maps covering the air routes between principal aerodromes. By 1939 about 54 such strip maps had been produced for supply in roll form for attaching to rollers mounted on a board in the cockpit of the aeroplane. These maps were produced by the Property and Survey Branch of the Department of Works who supplied the base topographic data, and the Civil Aviation Branch of the Department of Defence added the aeronautical information.

The rolled strip maps were of limited use for air defence purposes so as a matter of urgency work commenced on a new Australian Aeronautical Series at a scale of 1:1,000,000 drawn on the standard Mercator projection. Production was a joint venture between the RAAF, the

Department of Civil Aviation and the Department of the Interior who had now taken over the Commonwealth's property and survey function from the Department of Works. By August 1942 the first aeronautical map coverage had been completed and work commenced on a cycle of revision.

It soon became obvious that it would not be possible to produce one inch to one inch mile map coverage of strategic areas within the time frame required by the military planners who were now faced with the looming threat of Japan. So in early 1940 a Strategic Mapping Scheme was adopted to supplement the one inch to one mile mapping with one inch to four mile (1:253,440) mapping. As one 4 mile sheet (format 1.5deg x 1.0deg) covered 12 one mile sheets (format 0.5deg x 0.25deg) it meant that some provisional cover, albeit less detailed, could be obtained in a short time frame. In the remoter parts of the country it was decided to map at one inch to 8 miles (1:506,880) due to the scant information available and the low level of development.

The State Surveyors-General provided staff to compile the strategic map sheets from whatever material was available – cadastral plans, aeronautical maps, road maps, information from municipal authorities, farmers and pastoralists. Cartographic standards for the first edition were relaxed for expediency but subsequent editions were improved as better information became available.

After France fell in June 1940 and German eyes turned towards Britain, the Australian War Cabinet approved a further major expansion of the Survey Corps. The 2/1 Corps Field Survey Company, a unit comprising survey, drafting and mobile map reproduction elements was raised for service in the Middle East to support the Australian and allied operations in that theatre.

The Cartographic Section in Melbourne was expanded into a Cartographic Company and equipped with photo lithographic equipment and printing presses for map reproduction. The unit soon outgrew its Melbourne city premises so was relocated to Bendigo, Victoria, where it occupied the historic mansion known as *Fortuna*. This was the start of a 54 year association that the Survey Corps at *Fortuna* was to have with the City of Bendigo until the Corps disbanded in 1996.

A Field Survey Company of around 240 personnel comprising survey, drafting and transport sections was raised in each of the four military commands – Northern Command covering Queensland (No.5 Field Survey Company); Eastern Command covering NSW (No.2 Field Survey Company); Western Command covering WA (No.4 Field Survey Company); and Southern Command covering Victoria, South Australia and Tasmania (No.3 Field Survey Company). The 7<sup>th</sup> Field Survey Section was raised out of volunteers from Nos. 2 and 3 Companies and deployed to the Northern Territory in mid-1941. These units continued with one inch to one mile mapping of priority areas now referred to as the “survey mapping program” as distinct from the one inch to four mile and one inch to eight mile “strategic mapping program” being undertaken largely by the States.

## War with Japan

On 7<sup>th</sup> December 1941 Japanese carrier based aircraft attacked Pearl Harbour in the US state of Hawaii. The USA declared war on Japan and Australia followed suit. American troops were deployed to Australia where the US military planners found, to their concern, that there was no suitable complete map coverage of Australia to plan defences and mount operations. So the US Army Map Service was called upon to remedy the situation by completing the 1:1,000,000 series that then stood at nine IMW sheets in the south-east. Thirty two sheets were published by the Army Map Service during 1942 and 1943. Production was undertaken in Washington using compilation material obtained from a multitude of existing sources.

By early 1942 the military situation was grim.

Rabaul, in the Australian mandated Territory of New Guinea fell to the Japanese invaders on 23<sup>rd</sup> January. Ambon in the Netherlands East Indies fell on 30<sup>th</sup> January, and Singapore fell on 15<sup>th</sup> February. The 20,000 Australian troops mostly from the ill fated 8<sup>th</sup> Division AIF who had been defending those places had been either killed in action, executed or were taken as prisoners. Other parts of the Netherlands East Indies had been occupied or were being invaded. The Japanese carrier fleet that had attacked Pearl Harbour and then Rabaul, moved in to the Timor Sea and launched a devastating attack on Darwin on the 19<sup>th</sup> February 1942.

Following the bombing of Darwin a massive defence build up got underway in Queensland and the Northern Territory. Apart from the units operating in Western Australia and the Northern Territory all other field survey units, including the unit back from the Middle East, were relocated to Queensland to continue with the survey mapping program along the coast. Mobile map reproduction equipment was set up at *Gabbinbar*, an historic homestead near Toowoomba, Queensland, to supplement the cartographic and printing capability of *Fortuna*.

Following the Battle of the Coral Sea in May 1942 when a Japanese invasion fleet bound for the Australian Territory of Papua was repelled by US and Australian forces, the Japanese landed troops on the north and east coasts of Papua with the objective of taking Port Moresby overland from 2 fronts – one from the north along the Kokoda Trail and the other from the east through Milne Bay. Papua and New Guinea now became the priority so several Survey Corps units were deployed there to undertake mapping in that theatre. However work on the survey mapping program was able to continue in northern Australia by units not operating in Papua and New Guinea.

The threat of invasion or raids along the north coast prompted the military high command in June 1942 to request one inch to four mile strategic mapping of the coast and hinterland from Exmouth Gulf in Western Australia to Cape York in Queensland. This massive task required a new approach to expedite the process. The area was photographed by the US Army Air Corps with a trimetrogon aerial camera rather than the conventional vertical aerial camera. Trimetrogon photography had been earlier adopted for medium to small scale mapping in remote northern Canada and Alaska.

The trimetrogon camera comprises an assembly of 3 cameras that simultaneously take photos – one vertical and high obliques on either side to cover a swath of ground from horizon to horizon. This enables the distance between runs to be increased and fewer photos and ground control points are required to cover an area. Ground control over this vast remote region of northern Australia was obtained by position line astro-fixes rather than the conventional survey methods of triangulation and traversing. Although not as accurate as the more rigorous conventional methods the astro-fixes gave expeditious results adequate for provisional four miles to the inch scale mapping.

By 1944 the tide of the war was beginning to turn for the better. The last Japanese air raid on Australia occurred on the 12<sup>th</sup> November 1943 when nine enemy bombers attacked targets in Darwin and nearby bases.

By the end of 1944 most survey corps units then in Australia were being assembled in north Queensland for deployment overseas to support the final campaigns of the war. Field survey activity in Australia ground to a halt but the Cartographic Company in Bendigo continued at maximum capacity to compile and print maps for both Australian and US Forces operating in the South West Pacific Area until the end of the war.

## **Mapping Achievements 1910-1945**

Map indexes 1 to 4 on pages 8 to 11 depict the state of series topographic mapping in Australia in 1945 and show the number of sheets produced up to the beginning of the war and the number at the end of the war. Some of these sheets were revised over this period and new editions printed.

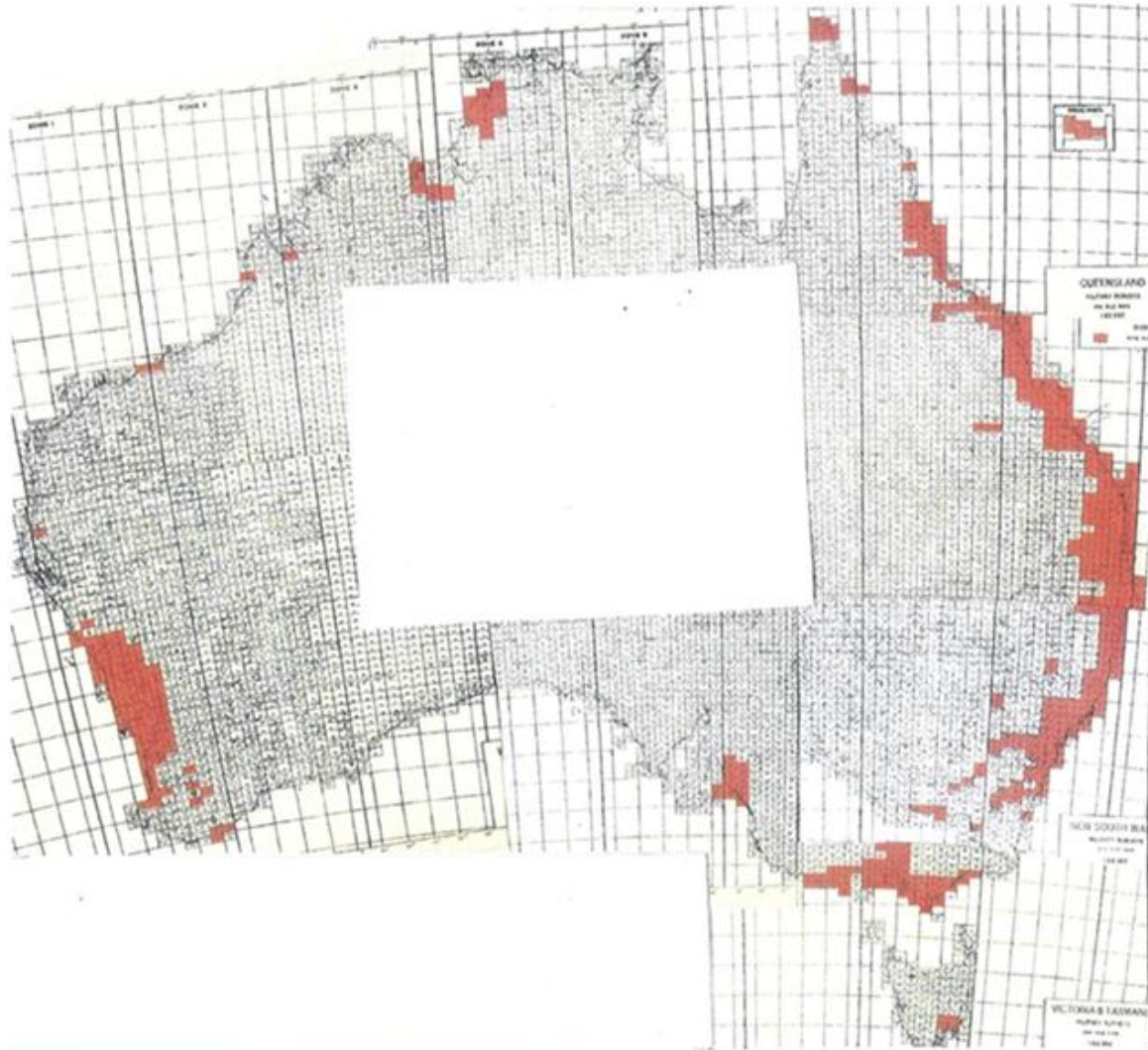
## **Post War Mapping Policies**

After the experience of 1942 with an enemy on the doorstep and a lack of maps to plan and mount defences, the politicians had been convinced of the need for topographic maps.

Many of the map sheets produced during the war, particularly the strategic map series, were emergency editions in which cartographic accuracy was justifiably compromised for expediency. Post war reconstruction and national development were high on the political agenda and these initiatives added support for funding quality topographic map coverage of the country.

In 1945 the Commonwealth joined with the six States to establish the National Mapping Council with the goal of achieving complete topographic map coverage of Australia in 3 dimensions. In 1947 a national mapping office was established within the Commonwealth Department of the Interior, later to become the Division of National Mapping, as the lead government agency for national mapping.

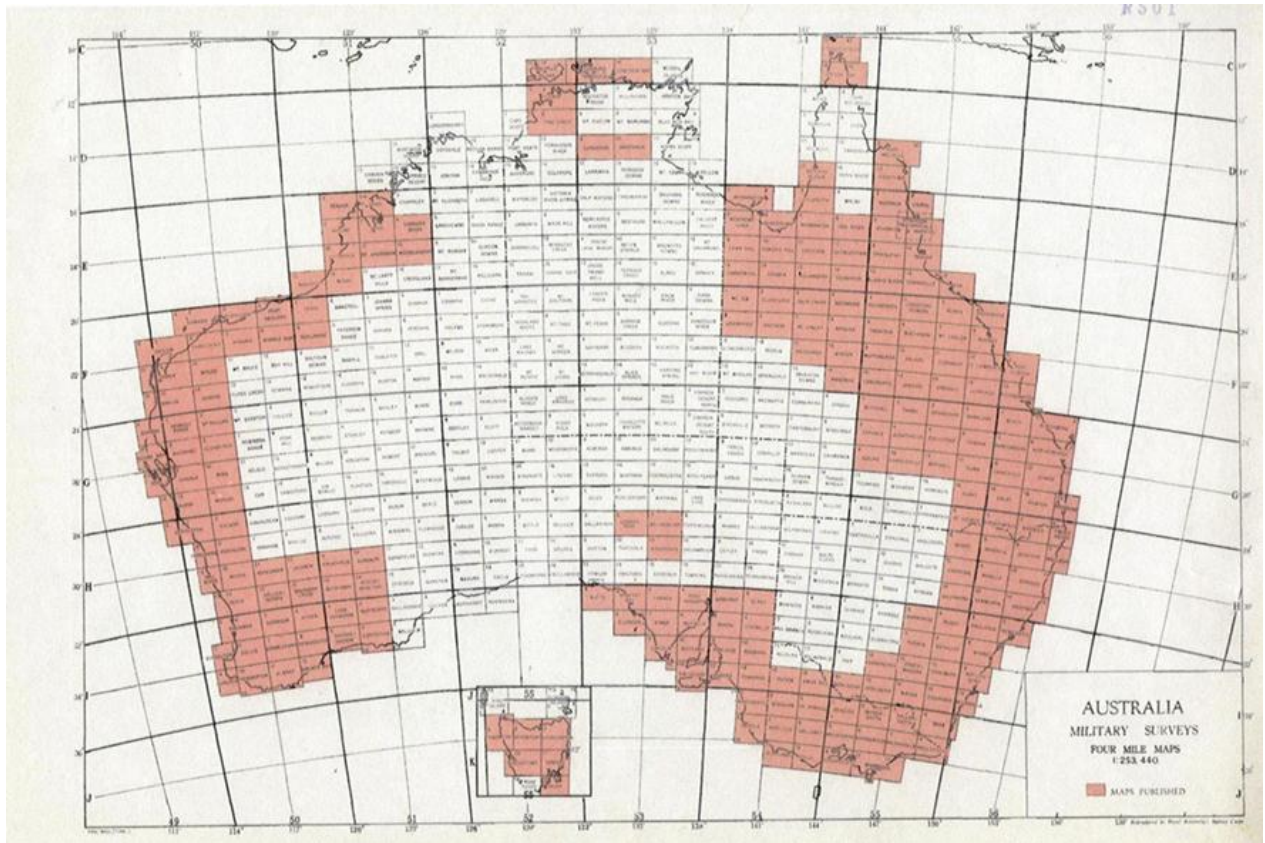
The extensive activities and achievements of the National Mapping Council and its member organisations are covered in the conference papers that follow.



**Map Index 1**  
**One Inch to One Mile (1:63,360) Series**

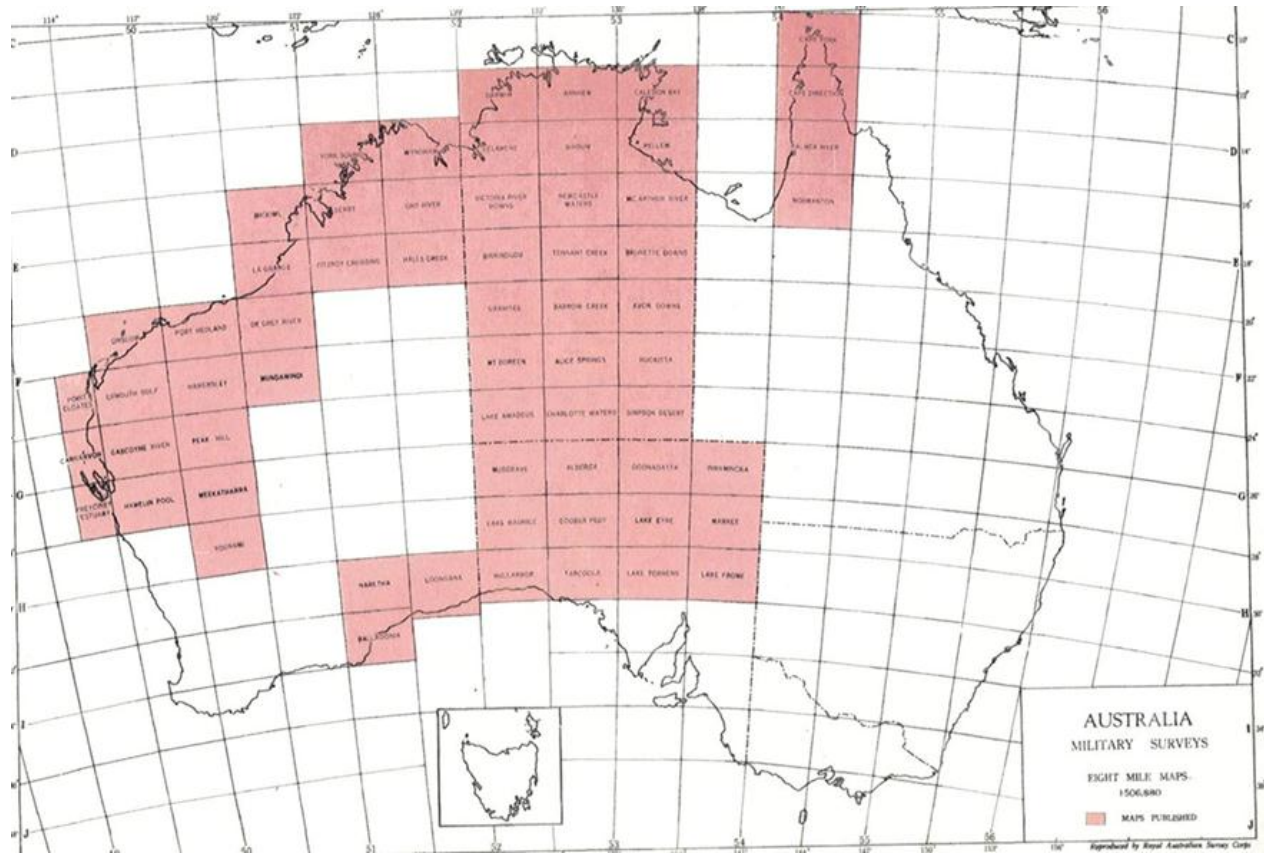
Number of sheets produced to 1939 – 80  
Number of sheets produced to 1945 – 342





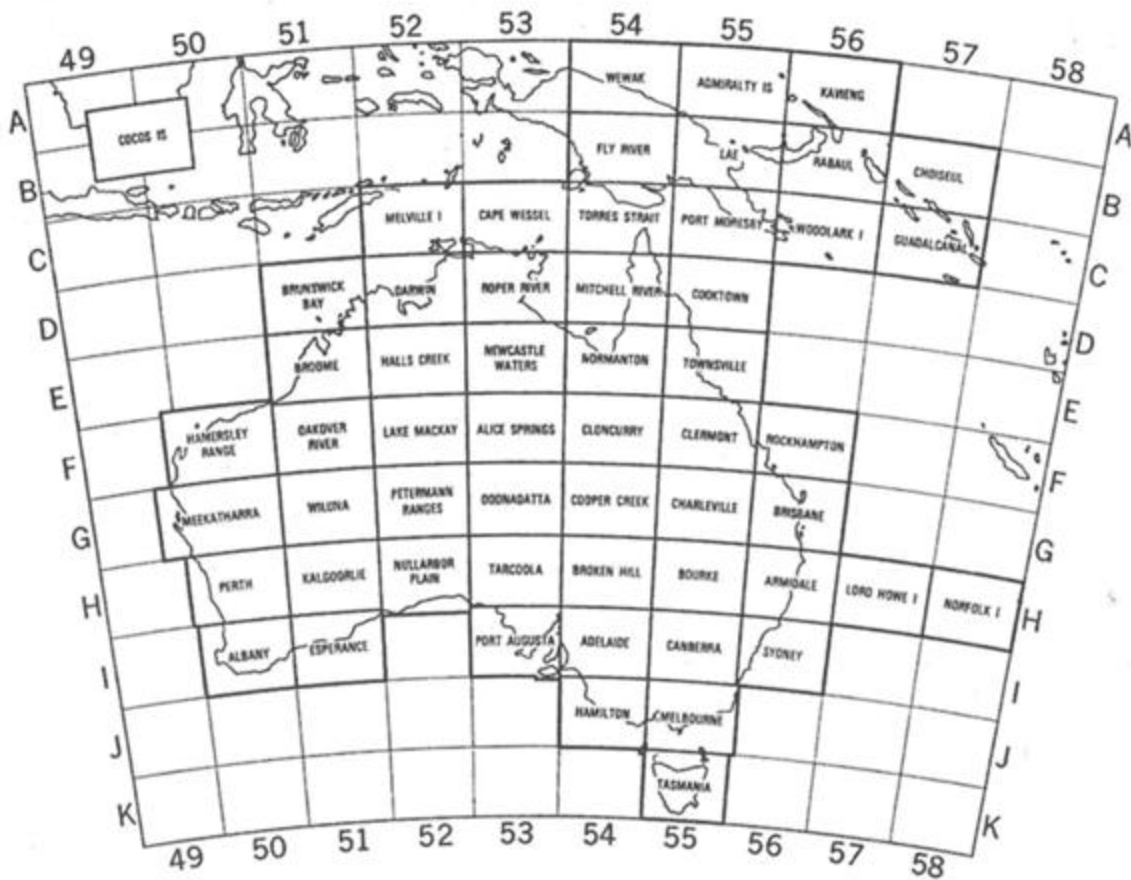
**Map Index 2**  
**One Inch to Four Miles (1:253,440) Series**

Number of sheets produced to 1939 – 0  
 Number of sheets produced to 1945 – 230



### Map Index 3 One Inch to Eight Miles (1:506,880) Series

Number of sheets produced to 1939 – 0  
 Number of sheets produced to 1945 – 62



**Map Index 4**  
**Australian Aeronautical Series (1:1,000,000)**

Number of sheets produced to 1939 – 0  
 Number of sheets produced to 1945 – 45

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