



INTERGOVERNMENTAL COMMITTEE ON
SURVEYING & MAPPING

Fundamentals of Land Ownership, Land Boundaries, and Surveying

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About the Paper

This paper has been prepared as an introductory paper to provide a general overview of key matters related to the ownership of land, and the boundaries which define the limitations of that ownership. The role of surveyors in the determination of land boundaries is also reviewed.

It has been commissioned by the Intergovernmental Committee on Surveying and Mapping (ICSM) to provide a guide for students and members of the general public who have an interest in the subject.

It is not a source of legal advice, nor is it intended as a complete and/or absolute treatise of the subject.

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1.0 Introduction

1.1 Historical Perspective

The fundamentals of land ownership and land boundaries date back to the very roots of civilisation and matters relating to possession and control (“ownership”) of land are well documented in historical records. Indeed, the territorial control of land has been a fundamental issue in the rise and fall of empires throughout history (eg the Roman Empire), and has been the cause of a great number of the world’s wars since civilisation began.

In the centuries BC, the importance of land ownership was focussed on arable lands used for productive agriculture, and even in those times there were issues associated with occupation and boundaries – “in 173 BC Lucius Postumius Albinus, a statesman of the Roman Republic, was sent to Campania (a region in Southern Italy) to separate the land of the state from that of private persons, because private land owners had slowly expanded their boundaries into public lands” (*Lucius Postumius Albinus (Consul 173 BC) wiki* 2011).

Biblical references to the Land of Israel, and its boundaries, can be found in Genesis 15; Exodus 23; Numbers 34; and Ezekiel 47 (*Land of Israel wiki* 2012) and, in fact, the boundaries of the Middle Eastern States have changed regularly throughout history.

In more modern times we continue to witness wars arising, in part, over control of territorial boundaries – for example the Six Day War in the Middle East in 1967 between Israel and Jordan, Egypt and Syria; and the Bosnian War that took place between April 1992 and December 1995 as a result of the breakup of Yugoslavia.

1.2 The Relevance and Importance of Land Ownership Systems in a Modern Society

In recent times, the importance of control of land (and a nation’s offshore and seabed maritime boundaries) is more likely to be centred on rights of economic development, and control of important resources such as oil and fishing rights.

In particular, our land tenure (a manner of possession) system is fundamental to, and provides investor and community confidence in:

Development planning, and economic growth and sustainability
Social stability through housing and employment

Financial security in economic development and property markets,
and
Natural resource and environmental management and sustainability

Land Ownership systems also underpin:

Much of government policy making and program delivery
Functions such as taxation, land administration, and electoral
administrative boundaries, and
Land use management and regulation

2.0 Concepts of Land and Land Ownership

The concept of land ownership as Australia and New Zealand understand and practice it is not universal and there are many other forms of “ownership” existing in different cultures throughout the world. Many are quite informal in the way they operate – in fact, our system is very formal and highly structured by comparison with developing countries.

The system in use in Australia and New Zealand is a comparatively recent development in world history and is based on “common law” (that part of law developed over a long period of time by decisions of courts). Other countries which use common law include Canada, Ireland, United Kingdom and the United States of America. Common law principles can, however, be overruled by “Statute Law” which is established by legislative enactments such as Acts or Regulations.

Land under common law is said to be held in “fee simple”, which describes a form of ownership that can be held by owners and their heirs indefinitely.

2.1 The Meaning of “Land”

Land is often referred to as “real property” which, in very basic terms, means property which is fixed and immovable – as distinct from personal property which, again in basic terms, means property (as in goods and chattels) which is not fixed and can be moved.

The general principles of ownership at common law have long been established in the courts of equity although the concept of extent of ownership has changed significantly in interpretation from the nineteenth to the twenty first century. In addition, statutory law continues to place increasing restrictions on the rights and benefits which would otherwise accrue with land ownership (Donnelly 1985).

“At common law, the term “land” when used in relation to a particular parcel meant the surface of the Earth, the soil beneath the surface to the centre of the Earth and the column of air above the surface. It included all things growing on or affixed to the soil, such as trees, crops and buildings. It also included all the minerals in the soil excepting gold and silver, which at law belonged to the Crown as royal metals” (Hallmann 1994, 9.1).

This concept in the twenty first century is, however, subject to limitation by statutory law and comes increasingly under challenge at common law.

As examples, ownership of the air space above the land surface is qualified by Air Navigation Acts, and unregistered wayleaves and easements under Electricity Easements Acts. Apart from these, and other similar statutory exceptions, the surface owner does own the airspace above their land in the sense that, subject to building regulations, they are fully entitled to extend their occupation of the air, by building hi-rise developments for example. However, judgements in recent cases are interpreted to mean that an owner's rights extend only so far as is necessary for the ordinary use and enjoyment of their land.

It should also be noted that “in all States (of Australia) there are statutory definitions of “land” which lay down the meaning to be ascribed to the term where it occurs in Acts of Parliament. These definitions do not materially interfere with the common law meaning except with regard to its use in Acts dealing with specific subjects. For example, an Act which regulates mining would naturally introduce substantial qualifications on the rights of an owner of land to take minerals from it” (Baalman 1979, p. 95).

“Ownership also involves a significant element of possession (refer **Possessory Title**), and.....it can be stated that ownership of the land surface extends just so far in each direction upwards or downwards vertically as the owner is able to bring and retain under their effective control” (Donnelly 1985).

2.2 “The Cadastre”

The concept of “the cadastre” is either unknown or not understood by the population at large – it is, however, a vital tool used by professionals involved in land and land related dealings.

In plain English, a cadastre is an official register showing details of ownership, boundaries, and value of real property in a district, made for taxation purposes (Collins English Dictionary 1979).

A cadastral map displays how boundaries subdivide land into units of ownership.

The cadastre is used as the foundation for dealings in:

- Land valuation and taxation
- Land registration and land transfers
- Land use planning
- Sustainable development and environmental protection
- Mapping
- Management of leases and licences
- Electoral boundary determinations, and
- Other land based administrative purposes

Digital Cadastral DataBases (DCDB's) are the modern versions of "the cadastre" and provide spatial views of land parcels. Although they are based on original paper plans, records and maps the database information has been digitised by computer to deliver maps showing digital coordinates of land parcels, as well as a great deal of supplementary information related to the land.

2.3 Systems of Ownership and Registration

Over history, many forms of land ownership (ie ways of owning land) have been established.

Land tenure can be defined as the mode of holding or occupying land (Burke 1976, p.323).

Land tenure systems dealing with ownership of land in Australia and New Zealand include:

- General Law (or "Old System") Title
- Torrens (or "Real Property") Title
- Strata Title
- Native and/or Maori Title, and
- Possessory Title

In Australia and New Zealand, land is predominantly held under the Torrens Title system, although remnants of Old System Title (Deeds of Conveyance) still remain. All land in the Australian Capital Territory is leasehold (effectively Torrens freehold) and much of the Northern Territory is held under Crown lease. Native/Aboriginal Title and Maori Title are recognised as separate forms of ownership by both Acts of Parliament and the Courts of the land. Crown Land is "remaining" land which has not been allocated and is still held by the Crown.

2.4 General Law Title

Land originally granted by the Crown was subsequently held and dealt with under the English general law system of tenure through the issue of a deed of conveyance. All subsequent dealings with the land required verification of the validity of the deed under transfer by searching (at each and every transaction) the previous chain of history of the deed for a period of up to 30 years preceding the transfer to ensure there was proof of a good root of title and that there were no legal impediments to the effectiveness of the deed transfer.

Whilst this system operated well enough in the early days of settlement when transactions were simple and few in number, it was soon realised that there was no guarantee that all the interests in the land had been uncovered through recordings and/or searching, and that previous defects and deficiencies could easily pass to a new owner.

Soon after, Registries of Deeds were established under Acts of Parliaments to protect purchasers and mortgagees through registration of all conveyancing transactions at a single State controlled repository, and thus simplifying searching of land records for further dealings with land parcels.

However, it was quickly realised that, in a quickly expanding country, there was a need for still greater surety and protection of the parties involved in land dealings, and that further simplification of the land tenure system was required.

This led to the development of the Torrens system of title which is still in place today.

2.5 Torrens Title

The Torrens system of land title was devised by Sir Robert Torrens in South Australia in 1858, and was actually based on the shipping register of Lloyd's of London.

Its key feature is that it captures all interests in a property, including transfers, mortgages, leases, easements, covenants, resumptions and other rights in a single Certificate of Title which, once registered with the State by a Registrar General or Recorder of Titles, is guaranteed correct by the State.

In other words, the register is conclusive evidence of ownership. This is known as the principle of "Indefeasibility of Title". Thus, there is no need

to search behind or beyond the Certificate of Title to ensure proven ownership of the land.

It should be noted however, that the State guarantee of ownership does NOT extend to the boundaries of the land shown in a title being correct.

2.6 Strata Title

“Strata Title is a form of ownership devised for multi-level apartment blocks and horizontal subdivisions with shared areas. The ‘strata’ part of the term refers to apartments being on different levels, or “strata”. ...Strata Title Schemes are composed of individual lots and common property. Lots are either apartments, garages or storerooms and each is shown on the title as being owned by a Lot Owner. Common Property is defined as everything else on the parcel of land that is not comprised in a Lot, such as common stairwells, driveways, roofs, gardens and so on” (*Strata Title wiki* 2012).

2.7 Native and Maori Title

In Australia, native title is a common law concept that recognises “Aboriginal people have property rights and interests in land arising from traditional law and custom. The traditional relationship to land is dual in character, having spiritual and material dimensions” (Rigsby 1999).

Prior to this recognition, it was generally recognised that, at the time of British settlement, the doctrine of *terra nullius* prevailed - that is, Australia was a “land belonging to no one”. This was rejected by the High Court in 1992 where it was held that Australia recognises a form of native title, to be determined in accordance with Indigenous law and custom (*Mabo v Queensland No. 2*).

The rights to native title have also been enshrined in Acts of Parliaments, both Federal and State.

For native title to exist in a particular area today, a number of conditions have to be satisfied (van Hattem 1997).

“When the Crown acquired sovereignty over the claimed area, which happened at different times in different parts of Australia, there had to be an identifiable group of Aboriginal people inhabiting the claimed area, with traditional laws and customs giving rise to native title rights at that time

There must be an unbroken chain of inheritance or succession, in accordance with traditional Aboriginal laws and customs, from the original native titleholders to the present day claimants

The Aboriginal laws and customs giving rise to the native title rights must have been observed and recognised continuously during that period, and

There must not have been an event that had the effect of extinguishing the native title rights, such as a valid freehold grant, or valid extinguishing legislation”

In New Zealand, a totally different scenario unfolded following British settlement, in that the British Crown decided to treat with the Maori people to obtain sovereignty of the country and in February 1840 signed the Treaty of Waitangi which (LINZ undated):

“Ceded to the Crown of England all the powers of sovereignty exercised by the chiefs of the tribes of New Zealand

Guaranteed to the Chiefs and tribes of New Zealand, and to the respective families and individuals thereof, the full exclusive and undisturbed possession of their lands and estates, forests, fisheries and other properties which they may collectively or individually possess, so long as it is their wish and desire to retain the same in their possession, and

Gave the Maori people all the rights and privileges of British subjects

With the signing of the Treaty, two systems of land law confronted each other – the English system and the indigenous Maori system. This created difficulties in land dealings and the transfer of land, particularly as European settlement increased and settlers demanding land sought to buy it from Maori owners. This led to a series of disputes in the 1850’s, and the establishment of the Maori Land Court in 1865 to deal with disposal and transfer of traditional Maori lands. Today, the English land law system prevails but not exclusively – the indigenous Maori system has not disappeared entirely”.

2.8 Possessory Title (Adverse Possession)

“Possession is prima facie evidence of ownership. “Possession is nine-tenths of the law” means that possession is good against all the world except the true owner” (Burke 1976, p. 257).

At common law, ownership may be claimed by an adverse occupier against the true owner of the land (limited to the land actually possessed and not a greater area held under the same title). The true owner is said to have been dispossessed and their rights of ownership are extinguished.

For any claim to be successful there are a number of basic requirements. There must be clear and irrefutable evidence that:

“The possession was open, not secret; peaceful, not by force; and adverse, not by the consent of the true owner” (Hallmann 1994, 9.51)
Actual possession of the property occurred for the required statutory period governed by the relevant statute of limitations (varies but generally accepted as 12 years), and was exclusive and uninterrupted

The occupant exercised all the rights of a true owner, for example through the payment of due rates and taxes, and by making improvements to the land or by cultivation or construction of enclosures, and so on.

Claims for adverse possession against the Crown are more limited and complex, and run over much longer periods of time (30 – 60 years, depending on the circumstances of the possession). In some cases there can be no adverse possession against the Crown, for example in the case of crown reserves or reserved roads.

2.9 Freehold vs Leasehold Ownership

Although the vast majority of land in Australia and New Zealand is held under freehold tenure, leasehold tenures does exist, that is “ownership” is held as a lease over a number of years.

The best example is in the Australian Capital Territory where all land is held under leasehold title (generally as a 99 year lease) but is effectively a Torrens freehold title.

In other States, particularly the Northern Territory, pastoral leases and other forms of Crown leases form part of our land tenure system and are quite common.

2.10 Co- ownership of Property

“Where two or more persons own the same property at the same time they are said to be co- owners.....the different forms of ownership are said to be joint tenancy and tenancy in common” (Baalman 1979, p. 133).

A joint tenancy is where land is held by more than one owner and there is a right of survivorship, ie if one owner dies that owner’s interest in the land passes to the survivor(s) as a right in law – the deceased owner’s interest in the property evaporates and cannot be inherited by their heirs.

This is the most common form of co-ownership between husband and wife, or parent and child, where parties want ownership to pass immediately and automatically to the survivor. Sale of property held under joint tenancy requires the joint consent of all parties.

Tenancy in common is where ownership of a property is held by owners who each have separate and distinct shares of the same property (generally in equal shares), but there is no right of survivorship, and an individual owner's interest is capable of passing by inheritance to their heirs. Tenants may, subject to the agreement under which the property is held, sell or otherwise deal their particular share without the consent of the other tenants. This form of ownership is most common where the co-owners are not married or have contributed different amounts to the purchase of the property. The assets of a joint commercial partnership might be held as a tenancy in common.

2.11 Ownership Rights and Obligations

“Ownership implies the right to exclusive enjoyment of a thing, and can be either “absolute” (the right of free and exclusive enjoyment, including the right using, altering, disposing of or destroying the thing owned) or “restricted” (ownership limited to some extent, - which is the situation with land since it cannot be destroyed).

Ownership is always subject to the rule that a person must use their property as not to injure their neighbour” (Burke 1976, p. 243).

An owner in fee simple is entitled to use it in any manner they please, subject only to (Baalman 1979, p. 98):

- (i) their obligations towards neighbours and the public;
- (ii) any condition which may have been imposed in the Crown grant;
- (iii) obligations entered into by express agreement with others; and
- (iv) restrictions and qualifications imposed by legislation

2.12 Relevance of Property Boundaries to Ownership

Marked boundaries are prima facie evidence of the legal extent of ownership of property and may be marked by natural boundaries, survey pegs, or enclosed occupation such as fences, hedges or walls.

However, occupation, and described measurements of the ownership, can often be misleading, what is really required is to determine the true nature of the boundary – “what the boundary is, and where it is located” – and for this, the services of a Registered Surveyor is required.

Determination of property boundaries is ultimately a matter for judgement by the Courts – the surveyor’s role is that of an expert witness capable of discovering all evidence relating to the location of the boundary.

Property boundaries are dealt with more fully in the following section.

3.0 Land Boundaries

3.1 Kinds of Boundaries

Boundaries can be classified at many levels – they may be international (as between countries); national (as between states of a country); regional (as between regions of a state); local (as between localities of a region or local government) or, as in the context of this paper, individual boundaries separating the land parcels of subdivided land.

Boundaries between countries and states are more commonly referred to as borders, and may be either natural (eg seas, rivers or lakes) or artificial (eg defined by geographic lines of latitude and longitude). Borders serve political, legal and economic purposes in the separation of the jurisdictions of the abutting countries.

Other kinds of boundaries include maritime boundaries which define the exclusive rights of a country or state over the resources of oceans adjoining the land of the country – “in Australia a 3 nautical mile limit of coastal waters; a 12 nautical mile limit of the territorial sea, 24 nautical mile Contiguous Zone; and a 200 nautical mile limit of the Australian *Exclusive Economic Zone*” (Geoscience Australia, 2011). Maritime boundaries may also exist for specific purposes such as marine parks and fishing zones, and

“administrative boundaries” which are based on cadastral maps and used for political and governmental administrative purposes – for example electoral boundary divisions, or for censuses taken periodically for planning and future development of a country at a national or regional level.

3.2 Definition of Boundaries of Land Parcels

Boundary lines (also commonly called property lines) define the extent of the legal limits of ownership of any parcel of land.

At common law, the rule of “marks (monuments) before measurements” prevail in the definition of a boundary.

There is also a presumption at common law that where land is described as being bounded by a road, ownership extends to the middle of the road (the *ad medium filum viae* rule), unless there is a clearly defined intent to the contrary.

If the description of a boundary is ambiguous or otherwise uncertain or is in conflict with the occupations, courts may settle the position of the disputed boundary.

Courts have established precedents granting priorities of weight where any two or more of the following boundary features present conflicting evidence in the determination of a true boundary position.

These are in order of priority (Hallmann 1994, 13.13):

- “Natural boundaries (eg rivers, cliffs)
- Monumented lines (boundaries marked by survey or other defining marks, natural or artificial)
- Old occupations, long undisputed
- Abuttals (a described “bound” of the property eg a natural or artificial feature such as a street or road)
- Statements of length, bearing or direction (“metes” or measurements in a described direction)

This ranking order is not rigidly adhered to; special circumstances may lead a court at times to give greater weight than normal to a feature of lower rank”.

Subject to any evidence to the contrary, courts have consistently ruled in favour of long, acquiescent and undisturbed occupation dating to the time of survey as the most convincing evidence of a boundary between properties.

Further, it is a fact of law that where a property is described by “metes and bounds” ie both measurements and a feature which describes the extent of ownership, the described bounds (abuttals) take priority over the stated measurements.

Strata title boundaries are specifically defined by the strata title plan and, commonly, are the centre of the walls, floor and ceilings enclosing a lot.

The actual location of any boundary is subject to the evidence of an on-ground assessment of the facts pertaining to the matter, and is best undertaken by a Registered (or Licenced) Surveyor. (refer also **Boundary Disputes and Judicial Determination**)

3.3 The Nature of Boundaries

Generally, boundaries of land are fixed and do not move, although the interpretation of the location of the boundary can be difficult and professional judgements may vary in the interpretation of the evidence of the location.

The situation with regard to “natural” boundaries formed by seas, lakes, rivers etc is more complex in that such boundaries are said to be ambulatory. Ambulatory boundaries cannot be marked on the ground and are not fixed in one place but can change position over time through slow and imperceptible accretion or erosion of the described feature.

Different rules of interpretation of the definition of natural boundaries apply, depending upon:

- whether the boundary adjoins tidal or non-tidal waters
- the existence or otherwise of Crown reserves
- the determination of high or low water mark, or the water’s edge
- the definition of a river bank and, perhaps more importantly
- whether or not changes in the situation were slow and imperceptible over time, or sudden as in the change of course of a river caused by flooding or deviation.

In future years, there will no doubt be great interest in the impact of climate change on sea level, and the subsequent effect on boundaries bordering those waters.

It should also be noted that there is a presumption at common law that where land is described as being bounded by a non-tidal river or stream, ownership extends to the middle line of the water (the *ad medium filum aquae* rule), unless there is a clearly defined intent to the contrary.

3.4 Home Boundaries

The extent of the boundaries of home ownership are subject to the same rules described in the **Definition of Boundaries of Land Parcels**.

Where a new subdivision is under development, the primary indicators of land boundaries will be the survey marks placed by a Registered Surveyor for that purpose.

In a developed subdivision the primary indicator of boundaries will most likely be fences, however caution should be taken to confirm that they are truly located and are not subject to encroachment by the owners of adjoining lands.

Caution is also advised when checking measurements of land on the ground, as distances shown on survey plans and land titles are always stated as horizontal distances which are always subject to adjustment for any slope of the land itself.

It is not safe to rely on results from hand-held Global Positioning System (GPS) devices as these do not necessarily give the same coordinates as a local system, and vary in accuracy and repeatability of measurements, nor should digitised coordinates derived from Digital Cadastral DataBases be relied upon as the “best evidence” of the location of boundaries.

The only sure way of knowing where true boundaries lie is to engage the services of a Registered Surveyor and, given the investment any owner makes in home purchase or building, it makes great sense to do this.

3.5 Boundary Disputes and Judicial Determination

Boundary disputes can occur at many different levels – they may be international border disputes (often leading to wars between nations); national border determinations between states; regional boundaries between the localities of a region; or, as in the context of this paper, a dispute between the owners of adjoining lands.

Boundary disputes generally arise because of one landowner’s lack of consideration for the owners of neighbouring land. Disputes between residential neighbours are more likely to be about access issues, or the location and/or type of boundary separating the land parcels and, although not common, still provide much angst between the aggrieved parties (and great expense!).

As previously indicated, where a dispute exists, a Surveyor is not the final arbiter of boundaries which are under dispute between owners. This role falls to the courts of the land.

The Surveyor's role in these matters is one of fact-finder and expert witness, providing the evidence of what has gone on before, upon which the courts will make their judgements.

3.6 Some Interesting Cases

Land law is recognised as one of the more "static" branches of law, and consequently there are relatively few recorded disputes over the boundaries of land in Australia. Much of the law related to the subject has been determined from decisions in other countries with a similar legal history and system to ours, including New Zealand, England, Canada and the United States of America.

Nevertheless, history has provided some interesting cases worthy of record here, particularly in relation to state borders (Geoscience Australia 2010; New South Wales – Victoria Border Guidelines 1993):

The definition of where state and territory boundaries lie has been constantly reviewed, sometimes causing great contention. Although most Australian borders were defined in letters of patent in meridians, determining the physical ground position that corresponds with those meridians has never been easy...surveyors had a difficult job to do...Given the possibility of discrepancies, border disputes have occurred between several states. Generally speaking, rulings have upheld the position of borders with established physical references or property lines. This is despite the advent of technologies which allow modern surveyors to accurately plot their location as originally described in the letters of patent for the formation of specific states. As a result, few state borders are actually where they were originally intended, or as simple as a straight line marked by a meridian of longitude – as an example, the Western Australia–South Australia–Northern Territory border (Surveyor General's Corner) is marked by two monuments (in 1968) approximately 127 metres apart at the junction of the boundaries.

Probably the most famous case is the determination of the state boundary between South Australia and Victoria. The border was established in 1836 by imperial letters patent as the 141st degree meridian of longitude, but due to human error by numerous explorers and surveyors was marked on the ground in a position 4.03 kilometres west of the specified geographic location. After a protracted legal dispute lasting more than 75 years it was finally

ruled by the Privy Council that the line erroneously marked was such to have established that line as the legal boundary between the two States *South Australia v. Victoria* (1914).

The Murray River also provides a backdrop to a number of cases arising from the nature of the border description between Victoria and New South Wales, and also between Victoria and South Australia.

Since 1851, the border between Victoria and New South Wales has officially been the top of the bank of the southern side (ie none of the river is actually in Victoria). However, this boundary definition is as muddy as the waters of the great river itself, due to river course changes and modification of some of the river banks, and has been the cause of many arguments and debates between those states.

As an example, in 1859 NSW claimed the pastoral leases of Pental Island near Swan Hill on the grounds that the island lay to the north of the watercourse of the River Murray. In 1872 the case was decided in Victoria's favour when the Privy Council maintained that the main watercourse, being the channel of greatest discharge of the Murray, was to the north of the island.

The confusion over determination of the boundary between NSW and Vic. has been such that "Guidelines for the Determination of the State Border Between New South Wales and Victoria Along the Murray River" were issued jointly by the Surveyor-Generals of both states in 1991, "to assist surveyors to determine land boundaries which form part of the State Border along the Murray River".

In another rather unusual case dealing with boundaries and jurisdiction between states *Ward v the Queen* (1980) 142 CLR 308, the High Court considered if a murder on the Murray occurred in Victoria or New South Wales. The shot was fired from Victoria (from the top of the riverbank); the victim was at the water's edge on the Victorian side of the river.

The border of NSW was the River Murray (its south side) – the High Court held that it ended at the top of the river bank, which meant that Ward's victim died in NSW. The High Court considered that the terminatory theory of crime determined jurisdiction, and that meant Ward's murder conviction in the Victorian Supreme Court was set aside!

Photos by the author of the NSW/VIC Boundary at Echuca Wharf



4.0 Surveyors and Surveying

4.1 What Surveyors do

Surveying is the science of the accurate determination of the relative positions of points above, on, or below the earth's surface for the planning and efficient administration of the land, the sea and any structures thereon.

There are a number of different branches of surveying, all of them to do with measurement of the earth's surface in one form or another:

Land (or cadastral) surveying, which deals with the determination of land boundaries for legal purposes and land ownership

Geodetic surveying, which is concerned with very high precision measurement of the earth's surface for the determination of geographic meridians of latitude and longitude

Topographic surveying, which refers to the mapping of the earth's surface by aerial, photogrammetric or ground surveys, or a combination of these methods

Engineering surveying, which means the location, design and construction of engineering works and installations

Hydrographic surveying, which consists of the preparation of nautical charts and maps of the marine environment and seabed, and

Mining surveying, which pertains to above-ground open cut mines, and below-ground mines and tunnels

For the purposes of this paper, the primary focus is on land surveying.

4.2 Evolution of Surveying and Surveying Technology

The history of surveying dates back to ancient times, with a recorded land register in Egypt in 3000BC and re-establishment of farm boundaries following floods of the Nile River and construction of the Great Pyramid of Giza all recorded about the same era.

Under the Romans, land surveyors were established as a profession and they established the basic measurements under which the Roman Empire was divided, such as a tax register of conquered lands (300AD).

Biblical references to land boundaries and landmarks can be found in Deuteronomy 19.14 and 27.17; Proverbs 22.28 and 23.10; and Job 24.2

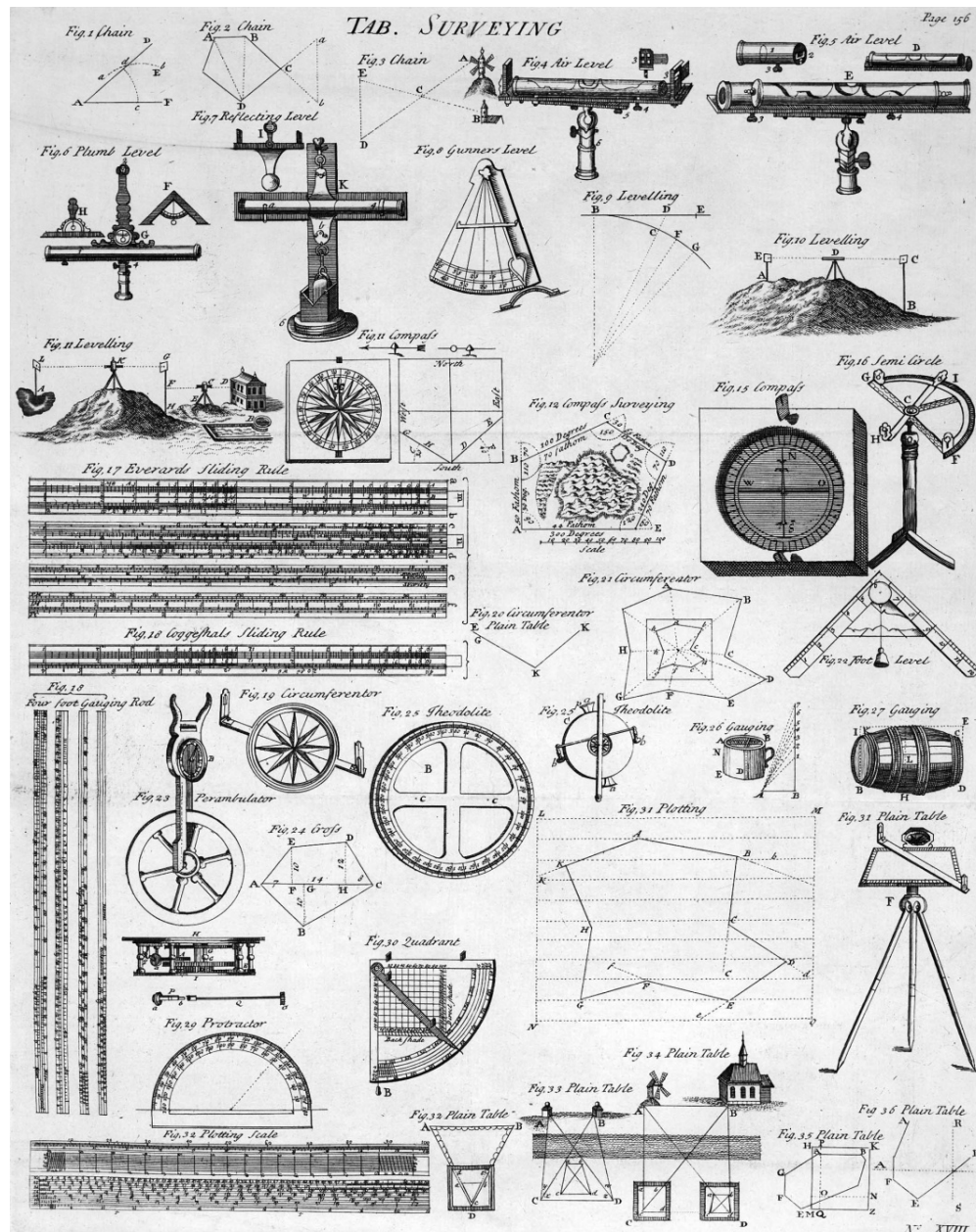
In the 18th century in Europe, a method of surveying known as triangulation, which relied on the measurement of angles, was used to build a hierarchy of networks to allow point positioning within a country.

In the early days of British settlement in Australia and New Zealand “much of the survey work undertaken to open up the country and provide land holdings to settlers was carried out using Gunter’s chains, measuring wheels, circumferenter, Kater’s compass and even pacing where approximation sufficed. ... so long as the corners of the land were clearly staked and marked by the surveyor, the accuracies of measurement and direction were left to chance” (Hallmann 1994, 2.3)

Over time, the Gunter’s chain was replaced by steel bands and invar tapes, and later by Electronic Distance Measurement (EDM) equipment, and subsequently Global Positioning System (GPS) devices, each in turn being capable of improved efficiency and greater accuracies of measurement than preceding forms. Likewise, compasses were replaced by transits, later theodolites and then Total Stations which combined angular and distance measurement in a single survey instrument.

In all of these situations, the status of measurements of preceding times were undermined by alternative forms of evidence of “what the land boundary was intended to be, and where it was intended to be located” – measurements and mathematics do not provide the correct answers!

The following picture shows some of the historic surveying instruments from times long past:



(Tableis of Surveying, 1728 Cyclopaedia)

4.3 Control of Surveying Standards and Survey Quality

The practice of land surveying is governed in both Australia and New Zealand by legislation, regulations and by-laws which control not only the activities associated with land surveying (including standards and accuracy of surveys), but also the qualifications and professional experience necessary to become a Registered Surveyor. Without this registration, a person is not entitled to hold themselves out to be authorised to undertake surveys for dealings in land boundary matters.

When a Registered (or Licenced) Surveyor determines the location of a boundary for their client they are also effectively determining the boundary of the neighbouring land. For this reason such Surveyors are said to be 'agents of the Crown' and have dual obligations both to their client and to the integrity of the cadastre. The system of registration (or licensing) of Surveyors ensures they meet these obligations.

The administration of the Acts and Regulations is a joint function of state and territory Surveyors-General (or their named equivalents) who act in the interests of the Crown (maintenance of the register of surveyors, investigation of survey errors and their correction, and monitoring of surveyors' work performance through periodic audit), and Surveyors Boards who are elected for the certification of qualifications of surveyors to become registered, and the professional conduct of surveyors in the undertaking of surveys and their ethical dealings with clients. This includes hearing of complaints against surveyors and dealing with charges where warranted.

4.4 Using a Registered or Licensed Surveyor

There are many reasons to call on the services of a Registered Surveyor or survey firm, for instance:

- Advice on all matters related to land, land rights and land dealings
- Identification of boundaries when purchasing property
- Location of boundaries required for any other purpose
- Advice on the processes of land development and land administration
- Preparation of subdivision proposals
- Pegging out of the lots of a subdivision, and the supervision of subdivision works and services
- Dealing with planning approval appeals, and
- Dealings with strata ownership and boundaries

4.5 Finding a Registered Surveyor

Initially, the local Yellow Pages of the phone directory makes a good starting point to find surveyors or, alternatively, a web search of the Internet will turn up details of surveyors in the local area, together with a description of the services they provide.

Word-of-mouth experiences of people who use, or have used, surveyors may also be useful in selecting a surveyor in a local area.

4.6 Becoming a Registered Surveyor

Becoming a Registered Surveyor initially requires an undergraduate university degree primarily related to surveying (these days may be called surveying; spatial science; geomatics; or something similar).

This is followed by prescribed training and work experience under the supervision of a Registered Surveyor and in accordance with a Surveyors Board Professional Training Agreement, and the undertaking of prescribed examinations conducted by the Boards in each state or territory.

On successful completion of the examinations, a candidate is then accredited by the Surveyors Board as being proficient in the practice of land surveying, and is entitled to become registered (or licenced) to act as a land surveyor, under the register held by the Surveyor-General in each state or territory.

4.7 Professional Surveying Bodies

The peak governmental body which looks after national interests in surveying and mapping is the Intergovernmental Committee on Surveying and Mapping (ICSM), with representatives from the Australian Government (Geoscience Australia); the States and Territories of Australia, New Zealand, and Australian Defence.

The Surveying & Spatial Sciences Institute (SSSI) is Australia's peak body representing the interests of surveying and spatial science professionals, combining the disciplines of land surveying, engineering & mining surveying, cartography, hydrography, remote sensing and spatial information science. It was incorporated in 2003 after a merger with the Institution of Surveyors Australia (ISA). SSSI has Divisions in each state and territory.

In New Zealand the peak body representing surveyors is the New Zealand Institute of Surveyors (NZIS).

4.8 Dealing with Complaints and Disputes

In New South Wales, Queensland, Tasmania and Victoria, the Surveyor-General (or an equivalent statutory officer) has the power to consider appeals to resolve disputed or conflicting surveys. In all other states and New Zealand, these matters need to be resolved by either an Administrative Appeals Tribunal or a court of law.

If agreement between the parties to any boundary dispute cannot be reached, then any of the parties have a common law right to take the matters before a court for resolution of the issue.

Complaints against surveyors can be referred to a Surveyors Board and, where proven, can result in disciplinary action against the surveyor as determined by the Board.

A surveyor's client also has protection through consumer protection legislation (national and state) with regard to misleading or deceptive conduct, negligence, and warranties for services (including professional advice).

5.0 References and Websites

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5.2 Useful Websites

The following websites are either useful for further information, or at least interesting for other reasons:

Intergovernmental Committee on Surveying and Mapping (ICSM):

www.icsm.gov.au

(provides links to State and Territory, and New Zealand land and surveying authorities)

Surveying and Spatial Sciences Institute (SSSI): www.sssi.org.au

Institute of Surveyors New Zealand (ISNZ): www.surveyors.org.nz

International Federation of Surveyors (FIG): www.fig.net

Geoscience Australia: www.ga.gov.au

Australia's state and territory borders:

www.heritageaustralia.com.au/magazine.php?article=393

Indigenous land rights and native title:

www.dfat.gov.au/facts/indigenous_land_rights.html

Adverse Possession (wiki): http://en.wikipedia.org/Adverse_possession

Surveying Career Information:

www.smicnsw.org.au

www.alifewithoutlimits.com.au

Surveying Education (Guide for School Leavers):

www.gooduniguide.com.au/School-Leavers/Fields-of-Study/Surveying

Australian and New Zealand Universities offering degree courses in Surveying that are accredited by Boards of Surveyors with responsibility for training and accreditation in Land Surveying:

University of Newcastle
<http://www.newcastle.edu.au/>

University of New South Wales
<http://www.unsw.edu.au/>

University of Melbourne
<http://www.unimelb.edu.au/>

RMIT University
<http://www.rmit.edu.au/>

University of Tasmania
<http://www.utas.edu.au/>

University of South Australia
<http://www.unisa.edu.au/>

Curtin University
<http://www.curtin.edu.au/>

Queensland University of Technology
<http://www.qut.edu.au/>

University of Southern Queensland
<http://www.usq.edu.au/>

University of Otago, New Zealand
<http://www.otago.ac.nz/>

6.0 Acknowledgements

The author wishes to thank the following for their assistance in the development of this project, and contributions to the preparation of the paper:

Dr Jon Osborn, School of Geography and Environmental Studies, University of Tasmania for his encouragement and support, and guidance and review in the development of the project and preparation of the paper

Bill Hirst, Surveyor-General, ACT Planning & Land Authority for review and suggestions for improvement of the paper

Don Grant, Surveyor General, Land Information New Zealand for information and data related to New Zealand, and

Peter Murphy, Surveyor-General, and John VanderNiet, Program Manager Cadastral Standards, Department of Primary Industries, Parks, Water & Environment Tasmania for information, records and other data relative to the preparation of the paper

7.0 About the Author

Gus Donnelly qualified as a Registered Surveyor in 1966 and in the subsequent years to 1990 gained a wide range of professional experience in State Government, Federal Government and the private sector.

He completed a Graduate Diploma in Professional Management (Tas. State Institute of Technology, now UTas) in 1985.

He was appointed as Chief Surveyor, Department of Main Roads (more lately Department of Infrastructure, Energy & Resources) in May 1986, and then Manager Survey and Property in the then Dept. of Transport & Works (DIER) in May 1991.

From September 1993, his career switched to management roles in Quality and Continuous Improvement, Road Maintenance and then Project Management.

He retired from full-time Government employment in December 2000 and set up a consultancy in Facilitation and Project Management.

Gus has played a major professional role in surveying over a number of years including:

- President of the Tasmanian Division of the Institution of Surveyors Australia in 1987-88
- Member of the Land Surveyors Board 1983-1991
- Member of the Board of Studies, and the Survey Industry Consultative Committee at the University of Tasmania 1985-1991.
- Federal Councillor of the Institution of Surveyors, 1991-1994.

He was elected as a Fellow of the Institution of Surveyors in 1989.

Other roles include:

- Facilitation and reporting the transfer of the Surveyors Board from Government to ISA in Tasmania in 2004, and
- Facilitation and reporting of an ICSM Cadastral Reform Workshop in April 2008

Publications include:

"Highways in Tasmania", a paper dealing with legal aspects of the creation and ownership of highways in Tasmania, the rights and restrictions of land ownership and specific applications to highways and adjoining lands published in the ***"The Australian Surveyor"*** - December, 1986 (vol. 33 No. 4).