Climate Change and the Cadastral Surveyor

Mike STAPLETON, Australia

Key words: Climate Change impacts, cadastral surveyor, boundaries, property encumbrances, titles, drought, sea change, sustainability, rights trading.

SUMMARY

Climate changes pose many challenges to the people of the world. Changes in climate are said to contribute to natural disasters such as flash floods, tsunamis and drought.

Cadastral surveyors are largely involved in determining the locations, and measuring the extents of rights associated with land and property. Natural disasters can impact on the locations of property rights and boundaries. How we plan to combat the impacts of climate change can influence rights imposed on properties and the locations thereof.

In this paper I investigate current land boundary definitions, land tenure and easement options. I consider whether changes may be required with respect to legal definitions and policies related to boundary definition. I identify roles in which surveyors are already involved in sustainability issues associated with climate change, and suggest roles which may expand, as well as potential new opportunities, as a consequence of climate change.

RESUMEN

Los cambios climáticos plantean muchos desafíos para los pueblos del mundo. Los cambios en el clima se dice que contribuyen a los desastres naturales como inundaciones, tsunamis y sequías.

Los agrimensores están involucradas en la determinación de las localizaciones, y la medición de las extensiones de los derechos vinculados a la tierra y la propiedad. Los desastres naturales pueden tener un impacto sobre la ubicación de los derechos de propiedad y límites. Cómo plan para combatir los impactos del cambio climático puede influir en los derechos de impuesto propiedades y la ubicación de la misma.

En este trabajo de investigar las definiciones actuales límites de la tierra, tenencia de la tierra y las opciones de servidumbre. Considero que si los cambios pueden ser exigidos con respecto a las definiciones legales y políticas relacionadas con la definición de límites. Identifico funciones en las que los inspectores ya están involucrados en temas de sostenibilidad relacionados con el clima el cambio, y sugieren que pueden ampliar las funciones, así como el potencial de nuevas oportunidades, como consecuencia del cambio climático.

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Climate Change, impacts and consequences

Global warming is a consequence of climate change which is said to have numerous impacts on the environment, including rising sea levels and the increase in frequency of extreme weather events. These events can impact on property boundaries and rights, and can result in governments amending property legislation to manage the anticipated consequences. Cadastral surveyors whose work is primarily involved with boundaries and property rights will increasingly be involved in projects associated with boundary change.

As property is considered to be a cornerstone of many economies the surveyor in the role of defining the extent of properties and associated rights, has a critical role in the future prosperities of most if not all countries in the world.

In including climate change aspects affecting surveyors in this paper, I have concluded that projects instigated for "sustainability", "energy efficiency" or "global warming" purposes fall under the "climate change" umbrella.

Surveyors and climate change consequences.

Surveying is largely about location and measurement. Cadastral surveying relates to the location and measurement to property boundaries and rights.

The cadastral surveyor is increasingly being involved in measurement and location determination as a result of consequences of climate change such as rising sea-levels, drought and floods.

Owners are being encouraged by government incentives and their desire to be more sustainable, to make their properties more energy efficient. Energy efficiency changes to buildings can be expensive and owners therefore are keen to protect their investment, by maintaining the energy benefits and protecting them from influences from other properties. As sustainability gains value with respect to property it may become increasingly important to measure, locate and document such features.

Climate change has focused attention on "new" rights, associated with climate, mainly due to the shortage thereof creating value. These rights such as carbon and water rights may not be easily identified, located and measured. Well defined property may be the basis on which other less definable rights are attached.

1. Drought

Parts of Australia have been gripped in severe drought for many years and El Nino climate patterns associated with climate change are said to be the cause. It is anticipated that droughts are likely to continue and become more common. An obvious result of drought is the reduction in the flow of rivers. Rivers form the boundary between properties and consequently the definition of what constitutes a river boundary is critical to determining the extent of the properties bordering on the river.

Long lasting droughts causing extensive water shortages can impact on the cadastral surveyor in a variety of ways such as decreasing river beds, infrastructure provision in the form of dams and associated water pipes requiring easements, and an emphasis on community title developments with water assets being the required common property.

1.1 River boundaries

River boundaries are common in rural areas, with the property boundary generally extending to the river bank or the middle of the river, defined as midway between the banks. The bank is defined in New South Wales as the limit of the "bed" which is in turn defined as "the whole of the soil of any lake or river, … which is adequate to contain the lake or river at its **average or mean** stage…"

So what is its "average or mean stage"? Over what period of time does one consider the bed for the purpose of determining the bank position? Previously river boundaries were considered to be ambulatory as a result of erosion and accretion. Can the boundaries also mow move as a consequence of prolonged drought and possibly a "permanent" reduction in its bed (as defined) as a result?

Hallman refers to a case, The State of Alabama v The State of Georgia in which a river bed is definition is referred to *its average and mean stage during the entire year*
Willis referred to a case, Kingdom v. The Hutt River Board (1905) 25 N.Z.L.R 145, in which reference is made to extreme events *happening once in every two or three years*.

To take the illustration to the extreme, consider the Castlereagh River in western NSW where recent flooding took place. The State Emergency Services website describes the river bed as "Normally the river here has a dry, sandy bed" (www.ses.nsw.gov.au). Does normally suggest "*average or mean stage"*? If so, does the river bed legally exist?

As a result of drought the banks containing the water in a stream could be significantly reduced for long periods. Surveyors are likely to have to grapple with this issue more frequently as they are required to define the extents of properties with river frontage. With the need to optimize the use of land, it is becoming important to be able to make better use of land previously falling within a river bed.

Boundaries of properties abutting the Murrumbidgee River near Bredbo, NSW

1.2 Water infrastructure

With the prolonged drought causing serious water shortages, governments are urgently pursuing projects to ensure the water supply to their regions. As a consequence routes are sought for the location of pipelines from dams to their destination. Surveyors with their spatial knowledge and understanding of title aspects to easements are well positioned to contribute to these projects. New and enlarged dams may also have compulsory acquisition requirements and new boundaries will be required to be surveyed.

In addition major infrastructure projects will often generate the need for a densified survey control network.

1.3 Community Title

In non-urban areas not served by a town water supply, innovative methods are being increasingly used to ensure the supply of water to rural residential estates. These include the provision of community dams, bore or reservoir sites. Title to the land can be in the form of community title with the water facility site being the common property, or alternatively Torrens title, with jointly owned water facility sites providing the necessary water by management statements registered on the respective titles.

The surveyor may need to resolve complex easement, covenant and restriction issues to ensure that the right to water of the prospective residents is ensured. Furthermore the surveyor with a knowledge of title and administration aspects of community title, will be well positioned to advise on and recommend innovative schemes which could enhance the energy efficiency of properties in developments. Often these ideas are initiated by engineers or architects who may not have the understanding of the associated title issues. Alternatively the developer may be frightened off by a new concept which may not sell and it could be up to the surveyor to provide encouragement and reassurance to proceed along a course which will benefit not only the development, but also the wider community.

The "Transition Towns" concept has begun in Australia with groups forming to attempt to turn their suburbs or towns into low-carbon areas (Marriner). This often involves community areas used for a specific purpose. If groups wish to have the areas measured, defined or protected by formalizing it in title, surveyors will have a role.

1.4 Fire

An indirect consequence of prolonged drought is the drying out of the land making it far more vulnerable to fires especially in the summer. The cadastral surveyor may be impacted in two ways as a result of fire or fire threat.

As the threat of bush fires increases, governments may increasingly impose fire protection restrictions on proposed developments such as fuel free zones around the proposed buildings. Defining and mapping these restrictions will be the responsibility of the cadastral surveyor.

Fire has caused immense destruction to Australian communities. Included in the destruction has been the destruction of monuments defining the local cadastre. Both the recent Victorian fires and the Canberra fire of 2005 resulted in many survey marks being destroyed, and a need after the event to quickly re-establish boundaries. Authorities may need to include the consequences of these natural disasters in formulating cadastral policies and legislation.

After a major fire, it is necessary to quickly clear the debris to enable reconstruction to commence. Whilst the fire itself may not have destroyed the cadastral monuments, the essential clearing may well do. It may be appropriate for emergency services support teams and policies to include surveying components, to enable the location and preservation of strategic control marks and cadastral monuments prior to clearing. This could facilitate both the re-establishment of cadastral boundaries and redevelopment of the land.

Surveying after the Victorian Bushfires 2008 (Victoria)

2. Sea Change

2.1 Sea levels

Rising sea levels will have impacts on boundaries defined by the Mean High Water Mark with properties gradually decreasing in size. High water mark surveys, as with river bed surveys, can be subjective as to interpretation and hence there is the potential for disputes between surveyors to exist.

Properties with straight line boundaries may find their sea side boundary becoming increasingly closer to the beach and sea, and may even become inundated. Before such a scenario eventuates legislation will need to be put in place to resolve the associated boundary issues. The sea bed is generally considered to be Crown land. Legislation has also been called for to enable acquisition of property when boundaries "encroach" on the beach, thus limiting access to the public.

2.2 Coastal Protection

Authorities have brought in new legislation to protect coastal areas and maintain public access to sea areas. Areas along and near the coast have been classified as being within the zone which has additional constraints to those of non coastal areas.

In due diligence surveys or "idents", should surveyors be declaring whether land is located within the coastal protection zone? The encumbrances on properties imposed by various acts could exceed those listed on title documents.

Changes in boundaries as a result of erosion and accretion are limited by coastal protection legislation. Some local government authorities, like Byron Council in NSW, are considering radical acquisition policies to deal with properties significantly impacted by erosion. (Byron Shire Council)

Erosion at Old Bar (New South Wales)

Local Councils are not happy with a NSW government decision to allow owners of coastal properties to build structures to protect against erosion. Owners would evidently have to pay for both the structures and any impacts on other residents. Clearly this appears to be an area for potential litigation and surveyors could become involved in measuring the situation at the time of litigation as well as researching the probable situation at the time of the construction of the protecting structure.

An innovative development type has recently been lodged near Taree in New South Wales in which application has been made for a "removable housing estate". Councils may impose locational conditions on such developments, requiring active involvement from surveyors. (Moore and National Sea Change Task Force)

Old Bar (Moore)

2.3 Building levels

With the increased awareness of the anticipated consequences of rising sea levels, floor level information both on buildings been built, and also in due diligence investigations of properties put on sale. Councils responsible for approving building plans are likely to be more diligent in enforcing minimum floor levels, and this may mean that they will require the confirmation from a registered surveyor. Due diligence studies may well soon require floor levels and building heights to be included if they influence value as a result of associated rights or restrictions.

2.4 Property boundaries

Laws defining the littoral boundaries of land have, it is suggested by Flushman and Frank, been *adopted based on long experience with physical regimes that were stable over the long term and tended toward an equilibrium; what was gained over time could also be lost over time.* They suggest further that *climate change challenges the basic assumption on which our traditional boundary rules have been based.*

Land administrators will need to consider the consequences of potential sudden loss of land or change of boundary position as a result of tsunami or similar events.

3. Sustainability

3.1 Easements and/or restrictions

With the increasing awareness of global warming, local governments are increasingly imposing design and siting conditions on the development of land. Boundary setbacks, height restriction and shade provision are common in local government building and land development codes. I suggest that they are receiving far greater emphasis than they did in the past. Energy rating of new buildings is now required, and the achievement of a high rating is valuable in the case of the sale of older buildings.

As the maintenance of these energy efficiency features increases, authorities and developers may use the registration of easements or restrictions as a way of protecting parcels of land against the reduction of the affects of the features by development on neighbouring properties. These easements may not be easy to describe or define on the ground and could pose challenges to surveyors. Easements are already being used in some states in the United States of America (Lathrop)

Alternatively property owner rights may be protected or limited by legislation which may not be noted on title documents. Examples of these are legislation providing tree protection or utility provider access, or more stringent building codes.

Carbon Trading may result in the creation of "Conservation Easements" which may require measurement and definition by a cadastral surveyor (Aaronson and Manuel).

At Old Bar, a coastal town near Taree in New South Wales, a recent development application was lodged for a "Removable Housing Estate". In the application it is specified that an encumbrance will be provided on the title "that would require the dismantling of residences and their removal … in circumstances where the coastal recession [erosion] comes to within 50 metres." Such encumbrances could become common on developments in areas prone to inundation. In the USA the use of "rolling easements" has been considered. They appear to be a restriction on the title which allows

development close to the shore, but recognizes that the property might eventually "return to nature (Titus)

3.2 Due diligence

Due to the increasing emphasis on sustainability features for properties and the associated value thereof, it is likely to become important for these features to be included in due diligence investigations. Surveyors are well placed to provide these services by mapping and describing the features in reports. The "drive-by" identification survey may well be a thing of the past.

An obvious implication for surveyors would be determining the extent of their instructions and clear disclosure of the sources researched or excluded. For example, to what extent are neighbouring properties investigated to determine the impact on the subject land. Aspects on neighbouring land can impact on the sustainability and development potential of the subject land. Large trees, for example, located on neighbouring land can influence the shade or sunlight provided, whilst its drip line extending into the subject property, may restrict potential development thereof.

Historically our "ident" surveys have been required by amongst others finance providers for a purchase or development. As energy efficiency or sustainability features are increasingly perceived as adding value to a property, so too will the need to report on their presence, their compliance with planning rules and threats to their effectiveness.

3.3 Floor Areas

Floor area surveys are common for surveyors for leasing and planning purposes, including determining nett lettable areas (Property Council surveys), or gross floor areas for planning purposes. A newer purpose for determining floor areas is for energy efficiency rating of building. Rating systems such as Green Star, ABGR and Nabers include aspects based on the floor area of the building.

The determination of floor area may vary, depending on the purpose of the survey. Inclusions and exclusions may determine whether a building meets its objectives from an energy efficiency or minimum lease area perspective. This may necessitate the itemizing of "grey" areas (areas whose inclusion or exclusion is dependent on the purpose). Definitions of floor areas may also vary from jurisdiction to jurisdiction as well as from purpose to purpose. Surveyors need therefore to be very clear as to their instruction and the relevant definition.

<u>Due to the value and costs associated with the floor area determination authorities should be encouraged to provide more clarity and uniformity in both definitions and the way in which they are interpreted and applied.</u>

3.4 Medium Density Green Field Estates

Recently in Canberra there has been a trend to provide "affordable" and energy efficient homes on new green field estates. This has resulted in the approval of terrace type housing with party walls on very small land parcels. The Australian Capital Territory land administration system does not allow for variation from the approved boundaries and requires the registration of the survey plan prior to building. This creates difficulties for developers and cadastral surveyors as developers need to "sell" properties "off the plan" prior to registration or construction. The construction of buildings, being less precise than surveying, may result in the construction of walls inconsistent with the boundaries, with resultant encroachments over boundaries.

To accommodate the need to provide this type of housing, land administration policies and procedures may need to be adapted.

3.5 Higher Densities

A likely impact to the wider community of the need for sustainability in our cities is a densification of our cities. Planning authorities are likely to encourage denser redevelopment, especially close to commercial zones and transport nodes. Consolidation and resubdivision will obviously involve the cadastral surveyor. These new developments will also have energy efficiency conditions attached which may also have easement implications for surveyors.

3.6 Other sustainability measurements

In order to determine sustainability or energy efficiency ratings surveyors may be required to measure a variety of features on existing buildings such as the grade of a roof and the size of shade structures and water storage features, as well as other features on the land associated with the building such as the size of trees and its canopy. In areas where extreme temperatures are prevalent in summer and winter, and water shortages severely limit the ability to have gardens, features enhancing the ability to keep a building warm or cool, and to irrigate a garden are becoming increasingly relevant and valuable.

4. Rights trading

As rights associated with property become more valuable the need and/or desire to be able to trade those right will increase. The surveyor's ability to define and map those rights makes them well placed to be a leading professional in these transactions. It may however require traditional surveying companies to diversify and bring in innovative methodologies. A common method of creating rights over property in New South Wales is often done via an instrument involving both the surveyor preparing the deposited plan and legal representatives.

4.1 Carbon Trading

When I think of Carbon trading I, as a layperson, generally associate it with treed areas being utilized as carbon sinks. The carbon credit would then be associated with the treed area. In many cases determining these areas may simply be a computer exercise using a rectified aerial photo image. However if these rights are to be registered and the rights are interwoven with other property rights, there may be a need for more precise survey and area definition.

In Victoria the Forestry Rights Act enables the ownership of trees to be separated from the ownership of land. A Forest Property Agreement can be registered on the title to the land (Victoria).

There may also be cases where a closer identification of aspects of imagery and traditional cadastral practice may diversify to include remote sensing in their services offered. Furthermore if registered surveyors are to be the professional responsible for authenticating measurement, size and location for title purposes, survey regulations may need to be adapted to accommodate the alternative forms of measurement.

In their Policy Paper, the Australian Property Institute stated:

> *Land surveys will be critical to this* (carbon sequestration) *validation process as the subsequent valuation of carbon property rights will only be successfully undertaken if the definition of property rights is settled prior…The carbon property right will need to be defined in terms of not only of its location on the cadastre, but also fix the quantity of carbon and sequestration for the life of the property.*

Governments may wish to capitalize on their land resources by using parts of their land for carbon sequestration. Surveyors would then be required to both determine the boundaries of the land to be utilized for sequestration purposes, and possibly also the extent of treed areas.

Canberra Arboretum (Gardening Australia)

4.2 Water rights

As water, due to its shortage, becomes a more valuable commodity, so too do the rights and legislation associated with water usage. Surveyors in rural areas are already involved with water rights in determining volumes of farm dams to ensure compliance with legislation and to assist in determining whether land has potential for further development or whether additional dams can be constructed.

Where water rights need to be accurately located or measured, it is likely that surveyors will become increasingly involved. Where the rights are associated with property rights, it is important that the cadastral surveyor is involved in management decision making relating to the water rights to ensure that measurement and title issues receive adequate consideration.

5. Advocacy

Whilst the world's close interest in climate change has been around for some time now, many consequences to every day life are only now being felt. It will be the surveyors' responsibility to be active in the policy formulation of spatial aspects of measures put in place to combat climate change. Surveyor organisations should now seek opportunities to be involved in discussions, studies and consultations relating to climate change.

Legislation or policy prepared without surveyor involvement can lead to vague terms being included, unnecessary administration being involved, and rights or restrictions infiltrating into the public arena without the community being adequately made aware of their consequences.

To take on these leadership roles surveyors will need to widen their repertoire of knowledge to include skills such as public speaking, negotiation, conflict resolution and consultation.

Surveyors and climate change consequences.

I have identified a number of areas in which the cadastral surveyor is already involved as a consequence of climate change, and some which I anticipate could become more prevalent in the near future. Surveyors may not have identified them as being a consequence of climate change. There will surely be some others which I have not considered. Some of the roles identified should clearly become areas of further research.

The challenge to the cadastral surveyor is to meet the needs of the community for expert advice regarding measurement and location with respect to their rights. This may involve increasing skills in unfamiliar areas of surveying or business, and may require diversification into other areas of survey and measurement to provide the most cost effective means of providing the required service.

To continue to successfully adapt to climate variability and climate change, the community will need to increase its 'climate literacy' so that political, social, economic and environmental decisions are better informed. (McKeon)

It is clearly apparent from recent international events that climate change is one of the most critical issues facing us now and in the future. Opportunities will present themselves for surveyors to play their part in addressing consequences of climate change, to grow their businesses and to play leadership roles in policy formation. If surveyors fail to meet the community need their influence in the community will decline further and we will become even more insignificant.

Grab the opportunities and meet the challenge!

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BIOGRAPHICAL NOTES

I was born in Zimbabwe in 1956 and raised as son of a Land Surveyor mainly in King William's Town in South Africa.

I graduated with a Bachelor of Science (Surveying) from the University of Cape Town in 1978 and worked for ten years for Escom, the organisation responsible for electricity supply in South Africa, being stationed firstly in Johannesburg and then East London. I registered as a Land Surveyor in 1980.

In 1988 I migrated to Australia and registered as a surveyor in New South Wales in 1990. I have been employed in local government with Baulkham Hills Shire Council, and surveying consultancies, Donavon Consultants, W.L. Backhouse Pty Ltd in Sydney, Lean Lackenby and Hayward in Bowral NSW, and Fisher Stewart and Earth Tech in Canberra. I am currently a partner with Landdata Surveys, a surveying and land development consultancy in Canberra.

In 1986 I completed a management development program at the University of South Africa, and in 1994 I completed a Master of planning at the University of Technology, Sydney. I have completed the requirements for recognition as a Certified Practicing Plannner in Australia.

I am a member of the Planning Institute of Australia (PIA) and Surveying and Spacial Sciences Institute (SSSI). I have served on committees of the Institution of Surveyors (Eastern Cape), Institute of Surveyors (Canberra Division) and Spacial Sciences Institute (ACT).

I am married to Luanne and have three children, Amy, Sarah and Craig.

CONTACTS

Mr Michael Stapleton
Landdata Surveys Pty Ltd
PO Box 363
Fyshwick 2609
AUSTRALIA
Tel. +61 2 62393088
Mob. +61 427393088
Fax +61 2 62393089
Email:mike.stapleton@landdata.com.au
Web site: www.landdata.com.au