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'WATER VIEWS' FROM CYBERSPACE: BUILDING RESILIENT COMMUNITIES BY IDENTIFYING WATER RISKS

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ABSTRACT

The perceived desirability of water views continues to lead to increasing numbers relocating to coastal regions. Proximity to coastal water brings with it unique risks from rising sea levels; however, water can present a risk in any area, whether or not you have water views. Recent Australian and international disasters show that even inland populations not located in traditional flood areas are not immune from water risks. The author examines the nature of these risks and shows how the internet can be used as a tool in identifying risk areas. The author also highlights the need to ensure accuracy of the data for valuation and planning purposes and identifies flaws in the current data provision.

Keywords: broadband, access, flood, storm surge, sea level rises, property development

INTRODUCTION

Flooding, and associated water issues, is becoming more prevalent worldwide, particularly for coastal areas (Bonyhady, 2010). As local and international news stories reflect, however, water can adversely impact inland communities as well; even those not located near a watercourse (for example see - Agence France-Presse, 2010). Water issues, as a 'natural hazard', are an increasing problem for communities globally, with deaths and property damage the primary adverse impacts (Small, Newby & Clarkson, 2013, p.2).

It is suggested that water issues have, and will increasingly have, significant impacts for the valuation profession. This is because all relevant circumstances, both negative and positive, must be taken into account in the valuation process (*Spencer v Commonwealth*, 1907, p.441). All circumstances would include the propensity for land to be adversely affected by water risks, however defined and from whatever source. The issue is how to identify 'at risk' property when recent disasters show that available data, although previously accurate (Eves, 2002), is no longer so.

The paper overviews the impact of water risks for land use and users before providing an explanation of the various types of risk. These are grouped according to the water source – *sea*, *river*, *sky* and *flood*. The paper then provides guidance as to how the susceptibility of a property to water risk may be more easily identified through use of easily accessible internet resources. The need for caution in relying on available data is highlighted by means of a discussion of issues of accuracy and currency of available data. The paper concludes with considerations for future processes.

In order to provide context for the discussion of examples the paper draws specifically from the Australian, and in particular, Queensland experiences. However, the growing demand for water-side developments internationally, particularly in Asia (Yassin, Bond & McDonagh, 2011), means that the matters discussed are relevant for any jurisdiction and for the valuation profession internationally.

IMPACT

More people, whether by choice or circumstance, are moving to, or are living in, areas that are at risk from rising water levels or other water risks. This is evidenced, for those with choice, by the ever-increasing number of residential developments being built in coastal areas (Robson, 2007) or in land reclaimed from the sea, river or other watercourse (Yassin, Bond & McDonagh, 2011). The fact of increasing values in these areas may explain the ongoing development despite the known risks (Sheehan, 2012). However, it is not only those that choose to live in these clear 'at risk areas' that are at risk. For those living inland, as seen in the 2011 Queensland floods, large volumes of water from the sky are equally a concern for those living on hillsides, in valleys and on plains even where there is no local river. The adverse consequences of living in 'at risk' areas is most recently evidenced internationally by regular news stories of buildings slipping down hill-sides, being swept away by storms or flooded rivers or falling into the sea.

The adverse impacts from water risks can be felt widely in the community (Scott, Simpson & Sim, 2012). For the homeowner, they will lose their residence, and even with insurance it may be many months before it is rebuilt if it can in fact be rebuilt in its previous location. For businesses they risk losing their premises, stock and fixtures and fittings, which, even with insurance will take time to replace. From a longer-term perspective, businesses will suffer ongoing economic constraints depending on the time it takes to re-establish their local communities and clients. The longer it takes to re-establish communities the greater the adverse economic and social impacts generally. This is perhaps most clearly illustrated in the aftermath of Hurricane Sandy, which battered a number of countries in October 2012. In New York for example, while the storm lasted only a few days, some residents and businesses took months to recover while others still have not recovered (Shephard, 2013).

Worse still, communities can disappear forever leaving no trace of either buildings or the people that built them. This most extreme water impact is seen in the damage suffered by towns, such as those in Peru, that are buried by mudslides (Agence France-Presse, 2010). Equally disastrous will be the affect to the small Pacific Islands. These, if not actually washed away or submerged by the sea (Stone, 2012, p.38) will be unlikely to be able to feed their populations in the future (Nunn, 2013). There also will be an appreciable adverse impact for heritage sites (Bickler, Cough & Macready, 2013). In addition to the risk to communities and property from climate change, changes in the urban landscape will alter the risk to property from water damage (Diaz-Nieto *et al*, 2012). This may explain, in part, why the 2011 and 2013 floods affected areas of Queensland that had not flooded in previous record floods. In order for valuers, planners and developers to be in a position to fully appreciate water risks, the impacts they cause, and their affect on property and its potential uses; these risks must first be identified.

RISK TYPES

While the following risks are overviewed separately, they are to a large degree interrelated. For example – rising sea levels are a specific concern by themselves. In combination with storms surges, however, they are likely to cause more areas to flood, and more severe floods (Strauss, Tebaldi & Ziemlinksi, 2012). Equally, flood can be caused by rising river levels as well as rising sea levels.

Sea - rising levels and erosion

This risk is most relevant for coastal properties and the buildings built on them (Mason, 2011). Due to a wealth of literature regarding the impacts of climate change on sea levels, of which recent articles are merely an indication of the ongoing discussion (for example see – Cradduck & Teale, 2014; Hu *et al*, 2013; Scott, Simpson & Sim, 2012; and Sheenan, 2012), and the impacts of Super Storm Sandy and Hurricane Katrina, this risk is perhaps most commonly known. Simply, this is the risk of property becoming submerged as the level of the neighbouring sea rises.

However, rising sea levels are more than just a concern for coastal properties. Increased sea levels will result in more widespread flooding. This in turn will adversely impact other areas, including essential farming land (Strauss, Tebaldi & Ziemlinksi, 2012). In the shorter term, however, it is likely that extreme rises, caused by a variety of other, more immediate and isolated factors, will be more challenging to address than that of the general sea level rises, which tend to occur more progressively (Cooper & Lemckert, 2012). This will include the impact from matters such as erosion and flooding from tidal inundation (Zeppel, 2012).

River – rising levels and debris

Most graphically depicted in recent footage from Canada, (Austen, 2013) and Nepal (Thagunna, 2013) rising river levels can appear more devastating than rising sea levels and are equally a concern internationally (Wilby & Keenan, 2012). Due to a build up of water up stream, river levels can rise exponentially within a very limited time period. Buildings and people can be swept away with little warning or time to prepare. As a recent Nepalese disaster shows, (Thagunna, 2013) this can occur in areas not previously affected and with thus with limited, if any, planning in place.

Even with warning, there may be limited action that can be taken to protect property. In 2010 the town of St George, located on the Balonne River, was subjected to severe flooding although it had no rainfall itself. Upstream, however, other parts of Queensland were in a monsoonal trough (Walker & Elks, 2010). Although with several days notice, and sandbagging and other preparations, that the extensive damage was not worse was only due to the fact the river rose 13.28m not the predicted 14m (Campbell, 2010). A further risk comes in the form of the debris brought down stream, such as houses, logs or other matter hidden under the water. This means that rising river levels can cause more than just water damage as buildings and pipelines, also, can be damaged with flow on dangerous effects (Austin, 2013).

Sky - storms and storm surges

A storm surge has been defined as *"the difference between the observed water level and that which would have been expected at the same place in the absence of the storm"* (Harris, 1963, p.2). The elements that influence the creation of a storm surge have been identified as being - *the pressure effect, the direct wind effect, the effect of the earth's rotation, the effect of waves,* and *the rainfall effect* (Harris, 1963, p.4). Due to ongoing climatic issues, storm surges are likely to become more prevalent (Shepard *et al.*, 2012).

Perhaps less easily identified is land with a predisposition to slide after heavy rains or land based storms. While whether a property is likely to be subject ongoing constant torrential rain may be more easily identifiable, for example, in tropical areas or those areas subject to a designated 'wet' or cyclone season; identifying properties at risk in other areas is not as easy. As the previously mentioned example from Peru shows, (Agence France-Presse, 2010) it can be that as a consequence of just a 'little' more rain than usual on already water logged ground, the ground will slip and cover entire whole villages.

Flood – water anywhere, any time

What is or is not a 'flood' can be confusing, particularly when terms such as flash flood or flash flooding are interchangeably used (Cradduck & Teale, 2014). A definition recently adopted by Australian insurance law, is that flood is *"the covering of normally dry land by water that has escaped or been released from the normal confines of …"* lakes, rivers, creeks, dams, reservoirs, canals or other natural watercourses (ICA Section 37B(2)(a) and ICA Regs Reg. 29D). As can be seen this definition also encompasses rising river levels, and also flooding on tidal plains. It does not, however, address waters 'gathering' as a consequences of storms, as was seen in Queensland.

Water damage from flooding also can occur when everything on the surface appears in order. Using another example of just a 'little' more rain than usual, many residents in the 2007 UK floods (Karouski, 2009) were caught out not by water from rivers, or the sea but by rising water table levels that the already waterlogged ground could not carry away (Wilby & Keenan, 2012). In one instance, of which the author has personal knowledge, a recently renovated basement flat in Cheltenham filled in a matter of minutes when water came gushing out of the walls that had, supposedly, been sealed.

In many countries work has been undertaken to erect flood barriers or levees in an attempt to halt the water (Pasterick, 1998). However, as seen for example in the case of Hurricane Katrina, a breach in but one part of the levee leads to the whole of the otherwise unprepared area being flooded. Arguably these measures simply exacerbate the problem, as people do not appreciate the true risk (Kunreuther, 1984). As a consequence of the existence of levees developers build where they would not, and should not, otherwise build and people buy to live there.

HOW TO IDENTIFY POTENTIAL PROBLEM AREAS

Research shows that most people ordinarily do not fully appreciate risk and in particular tend to underestimate the risks associated with water events (Browne & Hoyt, 2000). This is particularly so where such events do not occur frequently (Small, Newby & Clarkson, 2013). In the recent 2013 Queensland floods, it is noted that many water-affected areas had not previously flooded, or had not flooded for several decades. Many residents, although desiring to be prepared, were caught unawares and with little capacity to resist the water. A similar situation arose in the US where some of the affected areas had a measure of flood mitigation in place that, despite the low lying areas, had prevented previous inundations. This time however, those mitigation measures failed. It is important therefore, for industry and consumers, to be able to easily and quickly identify at-risk properties for valuation, and planning and development purposes.

The internet has had an appreciable impact upon both property use (Cradduck, 2012) and how the valuation profession operates (Cradduck, 2013). Most significant is the ease by which land data may now be accessed (Parker, Lockwood & Marano, 2012). The information that can be accessed to determine whether a property may be 'at risk' from water includes that available by undertaking a governmental search (free and for fee); and/or by means to using other on-line search engines and packages. The available services include tools that can integrate with both online and user data, which can be used to analyse available information and/or produce related reports.

Internationally, Nyarko and Lemmen (2008) observed the effectiveness of geo-information technology, such as state developed integrated geographic information systems ('GIS'), in streamlining service delivery and ensuring accuracy of data. Use of GIS generally has become more common. No longer are they systems only for the specialist. As part of the push for open government the data provided by governments is more accessible to all by means of on-line tools (Salkin, 2010). GIS can be used to identify coastal areas at risk from cyclones (Poompavai & Ramalingam, 2012). In integration with satellite images GIS also is a means to be used in the process of identifying mitigation works that may be undertaken to reduce the impact of flooding (Patel & Srivastava, 2013). Torabi and Kahourizadeh (2013), albeit it in the context of geotechnical engineering, noted that the benefits of using a GIS were – *"*[c]*ost savings and increased efficiency*, [b]*etter decision making*, [i]*mproved communication*, [b]*etter record keeping, and* [m]*anaging geographically*" (p.1). It is suggested the benefits of a GIS for the valuation profession would be similar, once the necessary skills are acquired to enable its use.

There is a wealth of information easily accessible through the internet that may be used to identify potential water risks for any property. Interactive maps are available through the Queensland Reconstruction Authority website. These maps provided access to a range of data including *"flood mapping, flood studies, floodlines and imagery from historic events and data linked from Queensland Government Information Services".* As well, most Local Government Authorities ('LGAs') now have flood maps readily available on their websites. The information available can include details of river heights, recent flood activity and the likelihood of properties being impacted by flood. Moreton Bay Regional Council in Queensland, for example, provides suburban maps for *river and creek flood mapping* and *storm tide flood*

mapping for suburbs in their LGA area (Moreton Bay, 2013). This information is freely, and immediately, available to anyone with access to the internet. Not all relevant information, however, is free.

In Bundaberg, for example, similarly to other LGAs, formal and property-specific information can be obtained from the Bundaberg Regional Council on lodgement of a search request and payment of a fee. Unlike the online data, however, the formal LGA search information can take anywhere between 5-10 days to be received. The information provided by the Bundaberg Regional Council includes details of the 2013 *Flood and Floor Levels*, as well as details of the *Natural Ground Level* of the property described in the search. Theses levels are stated to be *"based upon the January 2013 Burnett River Flood Event of a peak flood height at the Bundaberg gauge"* (Bundaberg Council, 2013). Additionally, in many Australian States and/or Territories there is a requirement for the seller to provide flood data as part of the information given to prospective buyers. (Eves, 2002)

At a federal level, a variety of information is available through the Australian Government websites. The *Bureau of Meteorology* website provides information on a State-by-State and national basis. This includes historical, recent and predictive data encompassing – rainfall and flood data, river heights, rainfall and seasonal streamflow forecasts, and information on tropical cyclones and, climate variability and change. Through the *National Flood Risk Information Project* information is available on flood studies and other research by Geoscience Australia.

Finally, there are also a number other services providers, such as *Google Maps*™ and *OzCoasts*, which provide online information. *OzCoasts* provides information regarding Australia's coasts including access to information on habitat mapping, landform and stability maps, and tropical rivers. Sea level rise maps are provided for various coastal areas of Australia, which are designed to *"illustrate the potential impacts of climate change for key urban areas."* This would provide at least an indication of which coastal areas, particularly the lower lying areas, would be more likely to be at risk from the related effects of sea level rises as discussed above.

The maps available through use of *Google Maps*™ provide a bird's eye view of suburbs and streets, and individual street level images of specific properties. As Kershaw and Rossini (2008) discuss, *Google Maps*™ can be utilised with other web service data, and other applications and users' own data, in the provision of valuation reports. As a preliminary to undertaking a physical inspection of the property, it would show whether a property is near a watercourse but not its height above that watercourse.

ISSUES

Requiring provision of water risk data during the conveyancing process would enable purchasers and valuers to be proactively informed of relevant risks. Unlike New South Wales (Eves, 2002) and other Australian States/Territories, there is no requirement in Queensland for flood search data to be provided to prospective purchasers. Professional experience shows that, unless required to undertake searches (usually at their financier's insistence), most Queensland purchasers will only undertaken the bare minimum of searches needed to effect the purchase.

However, even when LGA data is accessed, there is no guarantee that the information is accurate. The availability and consistency of data varies from one local government authority area to another (Small, Newby & Clarkson, 2013). Also, most LGAs are likely to seek to disclaim all responsibility for accuracy of the information provided. Similarly to other LGAs, the disclaimer on the Moreton Bay Regional Council website states:

> *… Council, makes no representation and gives no warranty about the accuracy, reliability, completeness or suitability for any purpose of the information. To the full extent that it is able to do so in law, the Council disclaims all liability … for losses and damages, … caused by or arising from anyone using or relying on the information for any purpose whatsoever…*

Even the information obtained through undertaking a formal flood search, which attracts a fee, are not guaranteed by the LGA. The formal certificate, for example, from the Bundaberg Council, which currently costs $50, provides:

> *Council makes no warranty or representation regarding the accuracy or completeness of this flood enquiry. Council disclaims any responsibility or liability in relation to the use or reliance by any person on the information contained in this flood enquiry.*

International research points to clear inadequacies in some LGA search data. In some areas, due to the existence of a flood levee and the location of the property behind the levee, governmental searches fail to indicate that a property is in fact located in a flood plain. This contributes to the impossibility of identifying all water risks (Ludy & Kondolf, 2011).

The use and effectiveness of GIS by the valuation profession is the subject ongoing research and commentary. In response to the complexities of these systems, Kershaw and Rossini (2008) proposed a simplified GIS model that could be utilised without the need for high-level user training and therefore at a reduced cost. Parker, Lockwood and Marano (2011) reviewed the use of GIS for mass appraisals, noting that its use can assist in ensuring a robust and transparent process. Nevertheless, discussion to date on the use by the valuation profession of internet services generally as tool for

identification of water risk areas is limited. Why is not certain but perceived ease of use (or lack thereof) may be relevant. Of more concern is that generally, it appears that it is not safe practice to assume that any of the data that can be accessed, whether by free of paid service, is in fact current and reliable.

Currency, and accuracy, of data available through use of online services must be addressed. As the author discovered when researching this paper, the street view of the author's property available on *Google Maps*™ is several years out of date as the available view includes long removed trees *and* fails to reflect the significant weeding and work on garden beds undertaken in the last six months! However, as the Terms of Service provide:

> *(a) GOOGLE AND ITS LICENSORS (INCLUDING BUT NOT LIMITED TO TOMTOM AND ITS SUPPLIERS) MAKE NO REPRESENTATIONS OR WARRANTIES REGARDING THE ACCURACY OR COMPLETENESS OF ANY CONTENT OR THE PRODUCTS. (b) SUBJECT TO THE "OUR WARRANTIES AND DISCLAIMERS" SECTION OF THE GOOGLE UNIVERSAL TERMS, GOOGLE AND ITS LICENSORS (INCLUDING BUT NOT LIMITED TO TOMTOM AND ITS SUPPLIERS) DISCLAIM ALL WARRANTIES IN CONNECTION WITH THE CONTENT AND THE PRODUCTS, AND WILL NOT BE LIABLE FOR ANY DAMAGE OR LOSS RESULTING FROM YOUR USE OF THE CONTENT OR THE PRODUCTS.* (Capitals used in the online version – assumedly for emphasis)

Finally, the data that is provided by the *Queensland Reconstruction Authority*, which was established after the 2010-2011 Queensland floods, and promotes its mission as being *"to reconnect, rebuild and improve Queensland communities and its economy"* may be of limited use. In order to access a map the user is required to agree to the 'terms and conditions of use'. In part this provides:

> *The Forecasts reflect various assumptions concerning anticipated results and are subject to uncertainties and contingencies outside our control. Actual future results may vary from the anticipated results or assumptions relied on and such variations, and their impacts on the locations subject to flooding, may be material. No representations, warranties or guarantees are made as to whether any Forecasts will be achieved, the accuracy or reasonableness of the Forecasts or the assumptions on which they are based.*

Putting the issues of the impact of the disclaimers to one side, the websites themselves are not necessarily intuitive and it can take some time to navigate to find the information needed, if at all. Despite 'playing' with the *OzCoasts*' maps for quite a while the author, although liking to consider themself to be 'tech-savvy', had difficulty in connecting with any meaningful data. It would appear therefore that there is an ongoing need for access to a system/information that is easy to use; cost effective; and, most importantly of all, accurate!

CONSIDERATIONS FOR THE FUTURE

The need to identify easily 'at-risk' properties will increase, as there is no 'quick fix' or simple solution to the risks posed by water. Rising sea levels are perhaps the more recognisable risk for coastal areas but more severe weather is predicted generally (Wilby & Keenan, 2012; Strauss, Tebaldi & Ziemlinski, 2012). Seeking to reduce pollution may help (Hu *et al.*, 2013) but may not address the climatic disparities seen in the increased frequency of storms and the other unusual weather patterns experienced globally. Long-term solutions also may include the gradual relocation of communities to land located above the risk area (Niven & Bardsley, 2013) and appropriate development policy and law (Zeppel, 2012). As Jha, Miner and Stanton-Geddes (2013) identify:

> *"Resilience goes beyond risk migration; it increases preparedness and the capacity to respond swiftly to a disaster and recover from it faster. It has to be part of everyday urban development, medium- and long-term investment and planning, urban governance, and hazard management."* (p.39)

As town planning and planners become more aware of the issues arising as a consequence of climate change (Leitch, Harman & Lane, 2010) greater consideration is being given how related laws regarding planning processes may be applied to reduce the impacts of adverse water events (Bonyhady, 2010). Development applications pre-dating current flood and/or events, even for land not directly affected, are not immune from this consideration. The Queensland Planning & Environment Court recently refused to grant preliminary approval for a development plan as it was submitted before relevant risk data was available and therefore did not consider the data, this was despite the fact the application was made before the report existed (*Rainbow Shores,* 2013 [360]). Addressing potential water risks must clearly now be factored into planning applications for at least coastal properties. This, however, does not address the current and ongoing issue of the need for easy access to accurate and current information.

Finally, particularly in the context of a conference held in New Zealand, it must be acknowledged that water damage also can be caused and/or exacerbated by the after effects of earthquakes. That is damage can be caused by water escaping from earthquake damaged pipes, storage and/or aqueducts (Jha, Miner & Stanton-Geddes, 2013, p.148). However, identifying, addressing and factoring such specific issues into valuation methodologies are not just an issue for New Zealand. As recent events show, these matters are required to be addressed for the valuation professions in a number of countries.

CONCLUSION

While appropriate planning laws may be a useful tool in order to address the water issues arising as a consequence of climate change, and also serve as a warning of 'at-risk' properties, these take time to be adopted and implemented. (Bonyhady, 2010) Working to build communities in areas less likely to be susceptible to water events, while continuing to work towards appropriate laws and policies, is a necessary requirement in the short to medium term. As more and more of the world's population live in cities (Stone, 2012) which, still, have a tendency to be built in coastal areas, properly identifying 'at risk' properties becomes more crucial.

As Wyatt (1996) previously noted, the benefits that ease of access to complete and current information brings and the change it causes to valuation reporting is that it facilitates a desire for more in-depth analysis as well as enabling report provision in a more timely (and cost effective) manner. Online searching, in combination with the use of GIS and global positioning system ('GPS') data, enable a complete picture of the land, and its comparators, to be formed much more quickly and accurately than previously possible. Ease of access to more current and accurate data in turn has increased the daily output of the valuer, in some cases doubling it. (Kummerow & Chan Lun, 2005) However, there remains a need to ensure that what information is provided is in fact both accurate *and* easy to access and use.

The paper overviewed the most common types of water risk and provided examples of the means by which related data may be sourced online. However, in order to make use of the variety of online resources requires the need for the user to have a working knowledge of the various systems as well as a working knowledge of the relevant region. The paper warns against blind reliance on data in view of the discussed issues of accuracy and currency, and the variety of disclaimers attached. The use of online resources (except perhaps for mass appraisals for rating purposes) is not a substitute for *walking the land*.

For planners, developers and valuers the common issue of identifying and addressing water-risk is one of access to accurate and current information. This is required in order for valuers to provide accurate reports and planners and developers to understand the land's potential. This demands that all risks must be identified and accounted for and requires appropriate access to timely and up-to-date information. Until accurate information is easily and readily available, and until all available services are easy to use, the view from cyberspace is clouded.

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