The Surveyor's Roles in Developing a Sustainable Society

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Key words: Surveyor's role, sustainable development, urban development, design objectives and guidelines, subdivision design.

SUMMARY

The sustainability of the human race and 'life as we know it' is likely to be the most pressing issue that this generation faces. There are a number of different key issues that are facing Australia in the immediate future including;

- Global warming
- Urban sprawl
- Housing affordability

> "*The biggest threat to sustainability is low-density suburban growth, because it is very clear that low-density housing is high intensity in terms of energy consumption*." (Penalosa 2008, cited in Brown 2008).

Low density suburban housing is where the majority of Australians live. The majority of all new residential developments are low density Greenfield sites with very limited or no access to suitable public transport or social services.

The Surveyors of today (and tomorrow) are in a unique position to influence the societies of the future and they need to establish their role as the lead professionals in the area of sustainable land development. It appears that the profession in general is finally starting to realise that 'business as usual' is just no longer acceptable and something needs to be done to ensure that the developments we create now and in the future do not have a detrimental effect on the surrounding environment.

Through research this paper investigates a variety of aspects of sustainable development and the role that surveyors should play to help develop a more sustainable society. The lessons and knowledge gained have been used to develop a set of objectives and guidelines for surveyors to implement when designing developments. These have then been applied to a real world situation, the proposed development of Vault Hill, Picton.

Is real sustainable development actually achievable or is it all just a 'buzz' word and clever marketing to encourage people to buy in a particular subdivision to make them feel better about the consumptive way we live?

The Surveyor's Roles in Developing a Sustainable Society

Narelle UNDERWOOD, Australia

1. INTRODUCTION TO SUSTAINABILITY

1.1 Sustainability and Ecologically Sustainable Development

Contrary to popular belief the issue of sustainability is not a new concern. The industrialised western world first became interested in the concept during the 1960's. Author Rachael Carson is often credited as the catalyst for international acknowledgement of environmental issues following the publishing of her book *The Silent Spring* (1962). During the next decade a number of publications such as *Population Bomb* (Elrich 1968) and *Limits to Growth* (Meadows et al. 1972) highlighted the issues of population growth and global development issues.

The United Nations (UN) hosted a number of international forums during this period, including the *UN Conference on the Human Environment* in 1972 and *Habitat* in 1976. These forums culminated in the World Commission on Environment and Development releasing their report entitled *Our Common Future*, which has become more commonly known as the Brundtland Report. In this report 'sustainable development' was defined as:

> "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (Brundtland 1987).

The concept of Ecologically Sustainable Development (ESD) originates from the UN workshops on a global action plan for sustainable development during the early 1980's. ESD was formally adopted in June 1992 at the UN Conference on Environment and Development (UNCED) held in Rio de Janeiro which has become more commonly known as *Earth Summit*.

Australia's National Strategy for *Ecologically Sustainable Development 1992* (NSESD) defines ESD as:

> "*using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased*" (Commonwealth Government 1992)

According to the Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008) there are three fundamental principles underlying ESD:

1. *Intergenerational equity*
2. *The precautionary approach*
3. *Biodiversity Conservation*

Appropriate use and implementation of these principles aims to prevent and reverse the impacts that economic and social development have had on the environment/ecosystem that we live in, while still allowing the continued "sustainable, equitable development of societies" (DEWHA 2008)

1.2 What is a Sustainable Society

There are thousands of definitions, ideas, concepts and models that define what a sustainable society is. Put simply, a sustainable society is one that "persists and thrives" (Skinnarland 2008) throughout time or "one that can progress without catastrophic setbacks in the foreseeable future" (Chen 2007).

For billions of years the Earth has been a sustainable system with the laws of nature ensuring a stable balance and population of all species of flora and fauna. If a species grew too quickly or became too dominant in its ecosystem then nature had its way of suppressing it through starvation and disease. That was until the human race discovered other ways to utilise the reserve of natural resources that the Earth had accumulated in the past (Chen, 2007).

Humans have developed technologies to overcome sickness and disease, and use natural resources at an exponential rate to accommodate our 'comfortable' lifestyles. These natural resources are not an infinite supply, but a finite amount that has taken millions of years to create. The modern human society relies solely on these reserves to operate and in just a few generations has managed to deplete these reserves to an almost critical level. To compound matters, our expansive development is diminishing the Earth's capability to ever generate new resources, meaning that our current society is not sustainable. In the words of Mahatma Gandhi "Earth provides enough to satisfy every man's need, but not every man's greed".

The unsustainable society that we are faced with today has not risen solely from ignorance, greed or a lack of planning but as a:

> "*collective consequence of rational, well-intended decisions made by people caught up in social, political and economic systems that make it difficult or impossible to act in ways that are fully responsible to all those affected in the present and in the future*" (Skinnarland 2008).

In order to become sustainable we as individuals, communities, regions, states and nations need to change the way we live in order to level out the delicate balance between the current and future needs of the population of Earth. A sustainable society will provide a fair and equitable (as opposed to equal) quality of life for all inhabitants while not depleting the productivity of the natural systems and resources that life depends upon.

2. THE SURVEYOR'S ROLE

Further development is a required part of our economic society, land is a commodity that can be bought, sold and traded in an open market economy. In order for land to have an economic value, you must be able to use/develop the land. The challenge for the surveyor is to find the harmony between development and the surrounding environment in order to provide the community with ESD.

FIG President, University Professor Dr.-Ing. Holger Magel in his keynote address at the Opening Ceremony of the 8th SEASC 2005 said:

"Surveyors should play a visible role in society, and then should try to become actively and additionally involved in fields of spatial planning, urban and rural development, valuation, real estate management and decision making! In fields which are traditionally not regarded as surveyors' domains! ...
It is perhaps still my personal vision that we should share and reach to become;

- *enablers for local people, CBO's and NGO's*
- *mediators between citizens and authorities*
- *Advisors to politicians and state institutions."*

During the 9th SEASC in 2007 entitled *Developing Sustainable Societies* the convenor, Simon Ironside identified that the idea of sustainable development is currently a "haphazard legislative and strategic environment" and he also felt that: "Sustainability is a multi-disciplinary approach that cannot be owned by one particular professional body". During the final session of the conference a statement was issued and agreed to by the more than 400 delegates.

"Surveyors, as members of a profession that has a leading influence on the land and built environments of today's and tomorrow's communities, commit themselves to:

a) Developing and implementing strategies to deliver environmentally sustainable outcomes
b) Embracing best practice to achieve sustainability
c) Supporting and promoting education for best practice in sustainable development
d) Facilitating and promoting collaboration between clients, councils, consultants and communities so as to achieve mutually beneficial outcomes
e) Supporting the collection and responsible use of scientific and technical information that will lead to informed decision making"

In my opinion, there are four key areas in which surveyors play a critical role in sustainable development;

1. Development Design
2. Project Management
3. Land Administration
4. Monitoring

Development Design - As previously discussed, a surveyor may be the first contact that a developer has with relation to any proposed development. During the course of their education, surveyors receive generalist training in a variety of disciplines. Other than the traditional areas of surveying and land use they also have a basic knowledge of water drainage and design, geotechnical aspects including soil and pavement design, hazard identification and site analysis, town planning and planning policies, sustainability and law. This places them in a unique position which allows them to identify the best use and development of a site and places them in the best position to act as the leaders of any form of development.

The ideas behind sustainability and ESD severely challenge the traditional ideas behind land developments. Surveyors are typically resistant to change and for a very long time the main forces driving the development industry have been population and economic growth. For

many people the ideas behind ESD threaten to stifle that growth and thus our profession. The key to moving forward into a new, more environmentally aware society is to embrace the concepts and exert ourselves as the industry leader.

Project Management - Surveyors need to take a more senior and integrated approach to land development and management. By this I mean that surveyors need to become project managers from the onset of a development as part of the initial planning and design team. Aspects such as road and lot orientation, as well as size, landscaping, house design and water and energy consumption all need to be considered.

Government policies in NSW & Australia such as; the *Environmental Protection and Biodiversity Conservation Act 1999* (EP&BC Act), the *Environmental Planning and Assessment Act 1979* (EP&A Act), and *State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004* as well as concepts such as Water Sensitive Urban Design (WSUD) all adopt and encourage the principles of ESD and provide the framework for surveyors to convince their clients to create better, more sustainable developments. These need to be used as tools, along with community consultation to ensure that the developments we create now and in the future are meeting the wants and needs of those who are going to reside in them.

Land Administration – Surveyors are the creators and keepers of the cadastre and the land administration systems of the future will need to be able to handle an increasingly complex combination of rights, restrictions and responsibilities over land due to environmental, social and economic issues. The UN-FIG Declaration on Land Administration for Sustainable Development, known as the Bathurst Declaration, confirmed that appropriate land administration systems are an integral part to the achievement of the sustainable development objectives as outlined in Agenda 21 (Ting & Williamson 2000). Figure 1 illustrates an example of a land administration system capable of supporting sustainable development.

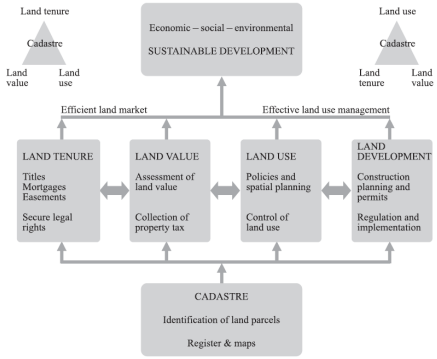

Figure 1: A global land administration perspective in support of sustainable development (Enmark 2001, p.369)

In order to make good planning decisions for sustainable development the authorities need access to accurate and relevant information. Geographic Information Systems (GIS) may be the tool for ensuring that the impacts of development do not have detrimental effects on the environment. There are large amounts of data available but access to them is often hampered

due to a lack of standardisation and metadata. Surveyors, with the support of other professions, can solve these issues and accurately map and identify both the natural and man-made environment and place the information into GIS to allow the relevant authorities to make well informed decisions.

Monitoring – in project management it has been said that the last day of your project becomes Day 1 for the occupants. As the implementation of sustainable development in housing estates is only a relatively new concept it is essential to ensure that our current understandings, designs and the devices we install are working to reduce our eco-footprint and creating happy inhabitants. Therefore it essential for the surveyor as a project manager to have post-occupancy surveys carried out in the short, medium and long term to not only identify what is and is not working but to also gain recommendations for future projects. Monitoring/audit programs should also be established with utility and service providers so we can better understand how much water/energy we are saving.

I feel that it is evident from all the facts and opinions previously discussed that Surveyors play an important part in the development process. They are privileged with a unique set of tools and knowledge which gives them a professional responsibility to not only their clients and the community, but to the environment as well. In order to achieve ecologically sustainable development a surveyor needs an in-depth understanding of all of the environmental, social and economic impacts of a proposed development. They need to adopt attitudes which embrace and promote the concepts of sustainable development and to find a way to successfully integrate development with the surrounding environment.

3. SUBDIVISION DESIGN – AN INTEGRATED APPROACH

3.1 Building Sustainability Index – BASIX

The Building Sustainability Index (BASIX) is a State Environmental Planning Policy (SEPP) that has been phased in by the NSW Government since July 2004. The aim of the legislation is to ensure that new homes are built to be both more energy and water efficient, thus providing owners with higher quality housing that are more suited to the natural environment and thus are less expensive to run.

The BASIX tool is divided into three compliance sections;

1. Water – currently in NSW the average person uses 90,340 litres of potable water each year (Department of Planning, 2006). The current BASIX water targets are set based on the location of the house or unit complex and range between reductions of 0% to 40% of potable water usage.
2. Thermal Comfort - is either a pass or fail benchmark, which evaluates how efficiently a proposed home will stay warm in winter and cool in summer. Based on the previous Nationwide House Energy Rating Scheme (NatHERS) rating scheme there are two ways to complete this section; a do-it-yourself option or a simulation method that requires an accredited assessor.

3. Energy – reduction targets vary from 5% to 40% depending on the type of building and its location. The targets are based on a reduction of the average greenhouse gas emissions which currently equal 3,292kg of CO_2 per person per year (Department of Planning, 2006).

3.2 Waters Sensitive Urban Design – WSUD

Over the past decade there has been a push for new urban developments to be more sympathetic to the natural water cycle. The fact is that 50% of the world's population currently lives in urban areas and this coupled with the large increase in use of impervious surfaces has led to greater run-off volumes and flow velocities in urban waterways. Conventional water management practices are being increasingly linked to a variety of adverse impacts on the urban water cycle including; poor water quality, increased localised flooding, reduced base flows and a degradation of aquatic and riparian ecosystems (CSIRO 2008; WSUD in the Sydney Region Project 2003).

Water Sensitive Urban Design (WSUD) offers an alternative to standard stormwater management systems by trying to imitate the natural water cycle. The principle behind it is to minimise the amount of impervious surfaces and mitigate changes to the natural water cycle by incorporating on-site detention and re-use of stormwater.

An integrated approach is the key to WSUD. This means using stormwater as a resource as opposed to a burden and considering all aspects of a development including environmental, social and cultural issues (CSIRO 1999 p.47). Some design elements commonly used in WSUD include detention and retention basins, grassed and vegetated swales, and water features such as wetlands.

3.3 Lot Orientation and Solar Access

In the past, lot orientation and solar access were given little thought in subdivision design. Traditionally single dwellings will generally 'face the road' and be parallel to side boundaries, regardless of lot orientation. In addition to this, the majority of windows will also 'face the road' and standard boundary setbacks in NSW do not recognise the solar access needs of neighbouring properties. So why is this an issue?

In Australia we have a significantly variable climate and we use a large amount of energy to cool our houses in summer and warm them in winter. The design and orientation of a building on a parcel of land can be used to admit or exclude the suns heat/energy, thus land characteristics such as orientation, slope, size, shape and width are important considerations.

The following guidelines are based on the Sydney climatic region which is located at a latitude of 30°50'S. Estate design for other climatic regions will have a different set of parameters.

As a result of these considerations the optimal orientation of roads for NSW is an east-west direction so the houses can be orientated with a north-south axis. Figure 2 shows that by designing lots with this orientation good solar access is available to lots on both sides of the road, and the east-west overshadowing caused by this layout will help to limit the summer sun. Ideally, the home should be designed so that the living areas and majority of windows are facing the north.

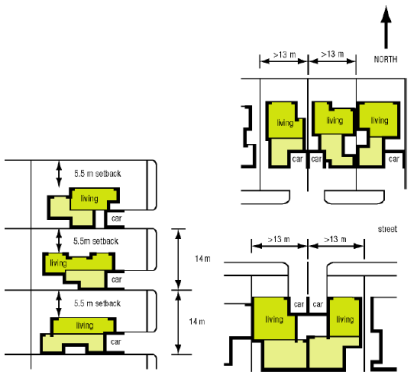

Figure 2: Solar access design (Sustainable Energy Authority Victoria n.d.)

Figure 2 also shows how houses on east-west orientated blocks (on north-south roads) can be designed to optimise good solar access. Although the ideal subdivision design in terms of solar access is based on roads which run along the cardinal directions, this is not always feasible due to other site constraints. For this reason, a range of preferred orientation angles has been established as is illustrated by Figure 3.

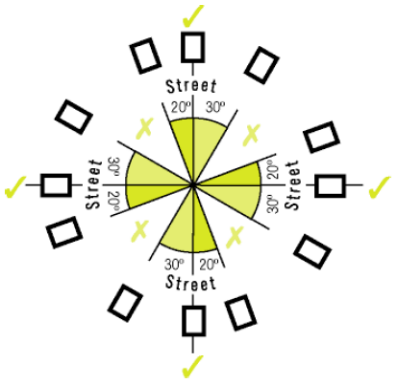

Figure 3: Solar access preferred angles (Sustainable Energy Authority Victoria n.d.)

While this figure shows the preferred angles of orientation they cannot be considered in isolation and like all aspects of sustainable development the overall site constraints must be considered. As previously noted characteristics such as slope and aspect will also have major impacts on shadowing and solar access.

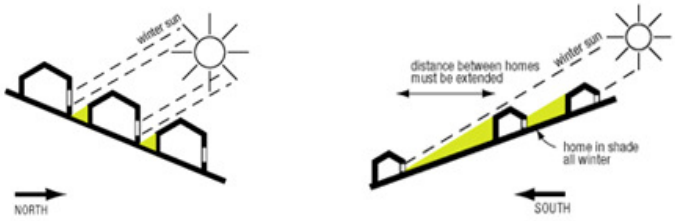

Figure 4: The impact of slope and aspect on shadows (Sustainable Energy Authority Victoria n.d.)

Figure 4 shows the impact of north and south facing slopes on shadows and solar access. A north facing slope will provide the best opportunity for solar access while south facing slopes will impose severe restrictions. As a result it is recommended that small lots are best located on north facing slopes with gradients less than 15% and south facing slopes should be limited to lower densities and larger lots (Ambrose 2008).

Therefore, if we can recognise the traditional values and environmental constraints that each site presents and then design developments accordingly we can achieve lower overall energy requirements.

4. AFFORDABILITY, SUSTAINABILITY AND CONSUMER SENTIMENT

Housing affordability in Australia has been on a steady decline for the past 10 years. The combination of shortage in housing stock, high interest rates and development costs has lead the HIA-Commonwealth Bank Housing Affordability Index to fall to record lows. Although housing prices in NSW have stalled/slumped in recent times due to the unsustainable growth in the past, this has provided little relief for home owners, investors or renters. But how does housing affordability impact on sustainability? And how does sustainability impact on housing affordability?

In the winter edition of its New Update (2006) The Insulation Council of Australia and New Zealand (ICANZ) reported that several studies (Money Magazine, Synovate, and Victorian Government) have shown that "consumers support energy efficient sustainable homes". Money Magazine found that in Brisbane, home buyers were prepared to pay up to 8% more when purchasing a home to have greater comfort levels and reduced water and energy costs. The Victorian Government found that 90% of occupants who lived in a 5 star home for 12 months or more would recommend a 5 star rating home to others, while the ACT's Home Energy Advice Team reported that the energy costs for a zero star home were around $2000, compared to $400 for a 6 star home. Synovate's survey for the Western Australian Government found that 93% of first home buyers and 73% of homeowners supported the introduction of mandatory sustainable housing standards (ICANZ 2006).

The results of these surveys show that even though housing affordability in Australia is at an all time low, the community in general understands the long term environmental and economical gains achieved by installing energy and water saving devices in their homes. The short term expenses are not only returned via lower utility bills, but can also be seen as a long

term investment that will make a property more valuable when it is placed on the market. So while the recent government initiatives are directed towards the improvement of new houses, the current and future housing markets could see a new industry quickly develop in the retro-fitting of such devices into existing homes.

5. SURVEYORS' DESIGN OBJECTIVES AND GUIDELINES TO DEVELOPING A SUSTAINABLE SOCIETY

In order to create a sustainable society we need to develop more sustainable communities. The key to creating a sustainable community is the establishment of well defined design objectives and guidelines to ensure that the members of the multi-disciplinary design team (including surveyors) are aware of the expected outcomes. One method to help identify the relevant objectives and guidelines for each development is outlined in *Design Charrettes for Sustainable Communities* (Condon 2008): "a design charrette is a time-limited, multiparty design event organised to generate a collaboratively produced plan for a sustainable community" (p.1). The idea is to organise a one or two day event where all relevant stakeholders are invited to discuss the desired objectives, guidelines and outcomes of a possible development. The process will allow developers to become aware of all the areas of concern from a variety of stakeholders including members of the public, planners, engineers, surveyors and environmentalists, before the development design has even begun, allowing for the greatest flexibility in design and desired outcomes.

It is suggested that the following be used as the basis for any proposed sustainable community development:

Objectives:

1. Reduce car dependence (transport)
2. Environmental protection
3. Reduce energy consumption (energy efficiency)
4. Reduce potable water usage (water efficiency)
5. Create communities with identity and character that integrate into the existing urban environment
6. Promote walking, cycling and the use of public transport

Guidelines:

1. Identify sites that are currently under or un-developed that are within close proximity to existing public transport services. It is generally much less expensive to upgrade existing services than to construct new ones especially with rail transport. For this reason all new urban developments should be located along the existing or planned rail infrastructure.
2. Areas of environmental significance (including natural bushland) need to be identified and assessed. The resulting subdivision should be designed to retain areas of significant vegetation and rehabilitate areas as necessary. If used to create public open spaces these areas can become a considerable asset to the community.

3. Energy consumption within a community can be significantly reduced by considering solar access at the subdivision stage. In order to reduce the demand on electricity generated by fossil fuels it is imperative to design a subdivision to allow the maximum use of solar energy for not only heating and cooling purposes but to also increase the potential of electrical generation via grid connected solar. For this reason east-west and north-south road and lot orientation should be preferred and consideration given to increasing the energy reduction targets required by BASIX. Post occupation energy audits and resident education on ways to reduce energy consumption should be considered essential elements of any community.
4. The reduction of potable water usage can be achieved by a number of means. Resident education will help stop water wastage and where possible grey water reuse systems should be designed to be installed in new estates to reduce the demand on our limited potable water supplies.
5. The success of any new development will require it to be unique in character and identity while also integrating into the existing surrounding urban environment. Any proposed developments should link with existing surrounding development via both road and pedestrian access while housing design guidelines and restrictions will ensure that all new dwellings meet the prescribed character requirements.
6. A reduced dependence on private car transport will need to be supported by access to walking and cycle pathways and adequate public transport. Well designed subdivisions will provide adequate access to all of these facilities and can become a valuable marketing aspect in these times of heightened environmental concern and rising petrol prices.

6. APPLICATION – VAULT HILL, PICTON, NSW, AUSTRALIA

Picton is a small town located in the Wollondilly Shire approximately 90km south-west of Sydney. Wollondilly's proximity to the freeway and existing rail infrastructure make it the ideal logical expansion of Sydney's urban boundary. Picton is the main town and administrative centre of the shire and as such there are extensive existing social and public infrastructure, services and facilities available within the town. The development and growth of Picton has been limited to the topography of the surrounding area as the town is surrounded by steep hills, with the most prominent being known locally as Vault Hill, so named as it is the final resting place of Major Henry Colden Anthill and his family, who were the founders of the private township of Picton.

The aim of the investigation was to analyse approximately 225ha of rural agricultural land on the north eastern side of Picton (as highlighted in red on the aerial photograph shown as Figure 5) and determine what areas are suitable for urban development. The resulting concept plan is a real world application of the knowledge gained and lessons learnt during the course of this research and it embodies the design objectives and guidelines previously discussed.

Figure 5: Aerial photograph highlighting the location of the proposed development (Department of Lands 2008, edited by Underwood)

6.1 Site Analysis

In order to be able to identify the areas of the subject land which are suitable for urban development it is necessary to identify and analyse the physical site constraints. Following an evaluation of the results of the site analysis it will be possible to prepare a development concept plan which incorporates the principles of ESD.

The major physical site constraints were identified as; slope, soil, agricultural land capability, bushfire hazard risk, flooding and heritage. Each of these issues were located, mapped and analysed to prepare a site constraints analysis plan (shown in Figure 6) which identified which areas were most suitable (green), moderately suitable (yellow) and not suitable (red) for urban development.

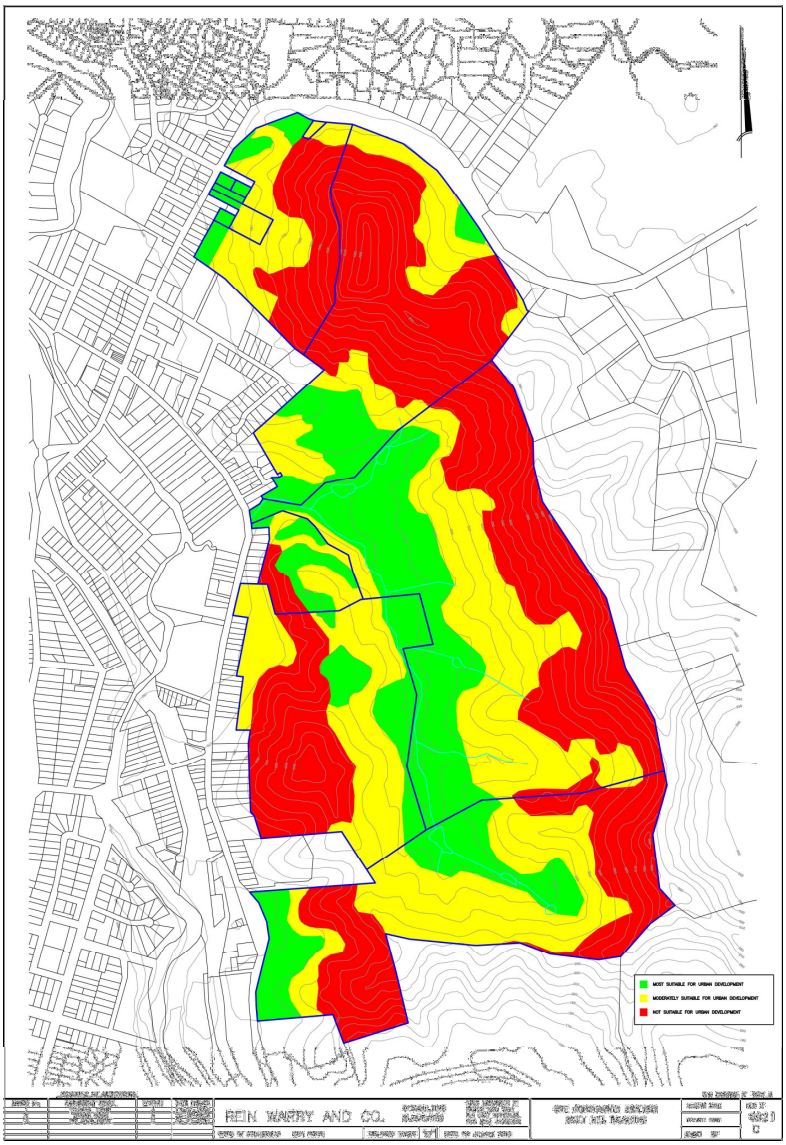

Figure 6: Site Constraints Analysis Plan

6.2 Proposed Development

The subject proposal seeks to have the subject land rezoned from Rural 1(a3) to Residential 2(a) to allow a residential Community Title development. To support such an application a draft concept master plan has been prepared and is shown in Figure 7. Through the rezoning process the proposed development will be subject to community consultation and input to ensure that the final design is the most appropriate use of the land environmentally, socially and economically.

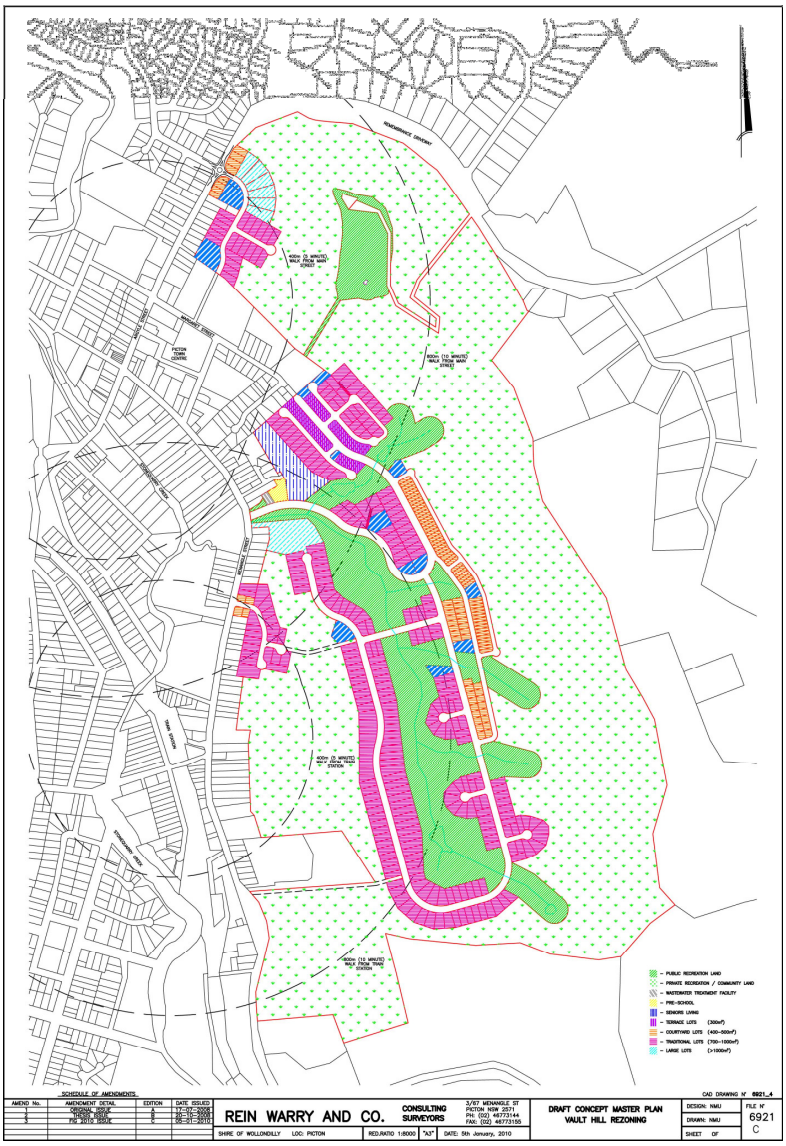

Figure 7: Draft Concept Master Plan

6.3 Sustainability Assessment of Vault Hill

6.3.1 Transport

The majority of Picton residents currently travel outside of the local area for employment and this trend is not expected to change for the residents of Vault Hill and therefore transport will be a major environmental consideration.

Travel via public transport will be encouraged in the development as a considerable proportion of the proposed lots are within a 10 minute walk to the train station. To supplement this, the existing bus route runs along the Menangle Street and Remembrance Driveway frontages. Negotiation will be carried out with the local bus company Picton Buslines to include the proposed link from Remembrance Driveway to Margaret Street on the bus route.

It is hoped that the proximity and ease of access to public transport will encourage residents to utilise these services and the increased patronage will cause the state government to improve the quality and provision of the existing train services.

As well as encouraging residents to use public transport it is believed that the inclusion of substantial pathway networks throughout the development linking the site with the existing commercial centre in Picton will see more people walking or cycling to the shops.

6.3.2 Environmental Protection

The subject site is mostly devoid of native vegetation except for the areas surrounding the creek and a number of scattered stands of trees along the ridge-tops. The proposed development seeks to create a large amount of public reserve (over 15ha) along the riparian area of the creek. This would create a corridor for protection and regeneration of native flora and fauna.

The creek that runs along the subject site leads into Stonequarry Creek. Currently it is in poor condition with cattle running along its banks causing continual erosion and degradation to the creek and its banks. The proposed development of the site seeks to rehabilitate the creek and the surrounding riparian corridor. Potable water use will be reduced by the development via the collection and use of rainwater by the new residential houses. Innovative water sensitive urban design principles such as grey water re-use, black water irrigation and integrated stormwater management systems will be implemented on the site meaning that the water quality entering the creeks can be greatly improved.

6.3.3 Energy Efficiency

The topography of the site limits the ability of the roads to be orientated on the east west axis, but the north-south roads provide sufficient solar access and protection to allow the use of passive solar design. Extensive street planting will be included in the development with deciduous trees along north-south roads to provide light and heat into houses during winter and local endemic species on the east-west roads to provide shade during the warmer seasons.

Restrictions can be placed on lots to require them to have houses built to a higher standard than that required by Council or the State Government. As such a minimum 5 star NatHERS rating should be required as well as an increase in the standard energy reduction targets as set out in BASIX with an emphasis on building materials and permanent solutions as opposed to lighting schemes. Solar hot water systems should be compulsory and mains/grid connected solar panels should be encouraged to reduce the demand for power on the existing electrical infrastructure.

In conjunction with these individual energy efficient and saving principles there are also a number of community wide schemes that could also be implemented to reduce the communities impact. Solar powered street and park lighting could be easy installed in the new streets. Another, more controversial approach from a local government perspective would be

the creation of a wind farm along the ridge line that runs through the development site. It is the personal opinion of the author the site would be ideal for such a project and provide not only a valuable environmentally friendly source of electricity but could also become a tourism generating development. It is understood that any proposal for a wind farm is likely to be met with strong public opposition and would need to be further investigated to ensure that the site is environmentally and economically suitable.

6.3.4 Water Efficiency

It is intended that a complete water cycle management strategy will be created and implemented within the proposed development. The most important aspect of water within the development is the quality of the water going into the creek that traverses the site. A rehabilitation program will be implemented and the use of fertilisers restricted to ensure the health and quality of the creek which is a tributary of Stonequarry Creek that forms part of the upper Nepean River catchment.

WSUD principles will be incorporated into the design of the proposed development with the main street road reserve being 23m wide with a central vegetated strip to decrease the impervious areas within the development and to improve the quality of the water flowing off the roads.

It is the intention of the development to collect the waste and storm water from the resulting dwellings and treat it to a suitable standard. The recycled water will then be supplied back to the dwellings to be used for non-drinking purposes and used for irrigation purposes on the surrounding open spaces, thus reducing the demand of the development on the potable water supply.

6.3.5 Integration into Existing Urban Environment

The proposed development is well designed to link with the existing town structure and infrastructure of Picton. The proposed main street of the development will bypass the congested intersection of Argyle and Menangle streets, therefore not increasing traffic through the main street. Smaller access roads also create edge streets to define the new edge of town, and create a buffer to minimise the bushfire risk.

A considerable amount of the site is within 800m (10 minute) walk to either the town centre and/or the train station. An extensive network or footpath and cycleways are proposed both within the road reserve and through the public reserves which surround the development. The inclusion of these facilities will encourage residents to walk and/or cycle throughout the development and existing town instead of using their cars.

7. CONCLUSIONS

In conclusion, the research shows that we as a society are faced with an uncertain future unless we change the way that we interact with our surrounding environment. It is clear that the surveyor's role in developing a sustainable society is through the promotion and identification of sustainable land uses.

There is no definitive answer or process on how we become a sustainable society:

> *"A transition to sustainability is a no less important chapter in human history than the agricultural and industrial transitions, whose excesses have contributed to the environmental crisis which we now confront"* (Goldie et. al. 2005 p.vii).

The past twenty years has seen a greater public awareness of the environment and our impact upon it, but it has also been an era which has seen a dramatic decline in environmental sustainability. The term 'sustainability' has been used so extensively over this period that it is in danger of becoming meaningless.

Rapid population growth in our city centres and urban sprawl in Australia has stretched the boundaries of our cities to unsustainable limits. Coupled with our growing dependence on cars and lack of public transport infrastructure/use indicates both social and political problems. Sustainability is therefore an issue that needs to be addressed at many levels and a significant paradigm shift is required if our society is to become sustainable. Political and social standards need to be revised nationally and internationally as well as at state, regional and local levels.

The current political stance is to promote sustainability and environmental awareness but not at the risk of economic losses. Population growth is encouraged and rewarded through significant tax and family benefits and significant changes within parliament will need to occur to support sustainable development and technologies with both legislation and funding.

The initiatives previously discussed (BASIX, WSUD, and solar access) are encouraging and facilitating those who want to reduce their ecological footprint and thus their impact on the Earth. These technologies though are limited in their effectiveness by the residents. It is now considerably easy to design a house and a community that is energy and water efficient but it relies on the occupants using these technologies wisely as it is still possible for their lifestyle habits to cause excessive energy and water consumption. People need educational assistance to help them take full advantage of the technology and adjust to a more conservative lifestyle.

The current largest limiting factor for sustainable development appears to be economics. Development is primarily controlled by profit margins and developers need to believe that they can achieve a substantial profit. A developer is only involved for a short period of time when compared to the lifetime of a development and therefore cannot reap any benefits from the long term environmental benefits. In recent times there has been a consumer driven shift in the market and there have been a number of attempts to create sustainable communities which appear to be considerably successful and have the potential to make a substantial difference to the society in which we live.

Further research is required to monitor new and existing developments so that we can further understand the impacts on the environment in the short, medium and long term. Are the current initiatives making a difference and are the occupants experiencing any of the perceived benefits?

All of us play many roles in our society both personally and professionally. Our commitment to developing a sustainable society needs to be reflected in all aspects of these roles. Our personal roles as an individual/parent/child/sibling/friend is to make well informed decisions in our everyday life to consciously reduce our own impact on the earth. While our role as a professional surveyor is to work with other professionals to protect the welfare and rights of the community by promoting the principles of ESD. We should also be involved in the education of our clients and the general public not only about the services we can provide but also about the benefits of environmentally, socially and economically sustainable development.

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BIOGRAPHICAL NOTES

Narelle Underwood completed her Bachelor of Engineering in Surveying and Spatial Information Systems at the University of NSW, graduating in 2009 with Honours Class 1 and the University Medal. This paper is a revision of her thesis (supervised by Michael Green, UNSW and Darryl Warry, Rein Warry & Co) which was awarded the University Student Project of the Year at the NSW Awards for Excellence in Surveying and Spatial Information 2009.

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