VISUAL WATER – AN INNOVATIVE PLATFORM FOR VISUALISING THE URBAN WATER CYCLE

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ABSTRACT

If seeing is believing, then it logically follows that to gain a greater understanding of the urban water cycle we need to be able to visualise what is happening both above and below the ground. The ability to visualise water and sewer networks, pumps, valves, pressure and other aspects in real-time, combined with the power of seeing things such as rock and tree roots in three dimensions, would provide water utilities with much improved planning capability to deliver more effective and efficient outcomes for the end customer and community.

'us' – Utility Services understands the potential for this next generation technology to deliver value through visualisation of under and above ground assets. We have partnered with technology provider Nextspace (NZ) to build a platform to support our capital works program with 3D visualisation.

Visual Water, whilst still in pilot stages, has already provided significant planning improvements and efficiencies. As a 3D visualisation platform, Visual Water enables extraction of geospatial data, 3D transformation through evidence-based processing and the deployment of data for 3D visualisation in workflow applications, the web and also smart devices (eg iPad). This is transforming the way 'us' – Utility Services plans and undertakes capital works, manages assets, deploys training and engages stakeholders.

KEY WORDS

3D Visualisation, Water Cycle, Planning, Below Ground Assets, Customer Engagement, Smart Applications, Save time and money, More thorough understanding.

1.0   INTRODUCTION

South East Water Limited provides water and sewerage services to more than 600,000 residential, industrial and commercial properties in an area covering 3,640 square kilometres in the eastern part of Melbourne, Australia. South East Water manages infrastructure and assets with a net book value in excess of $1.3 billion and is responsible for 8336KM of water mains, 7724KM of sewer pipes, 78 water pump stations, 237 sewer pump stations and 9 sewer treatment plants that serve 1.3M people.

One of three key Melbourne water retailers, South East Water Limited has maintained and updated its Geographic Information System (GIS) system over many years. The GIS system is fundamental to the company's day to day operations, supporting asset management and customer service activities across the business. South East Water's system is ranked highly for its quality and integrity, traditionally providing information in 2 dimensions via a suite of applications, tools, products and customised developments, designed to meet the company's growing needs. In recent times, South East Water has been exploring opportunities to represent key infrastructure and asset management information in 3D, leading to the establishment of an association with Nextspace (Nextspace was established as a partnership between Right Hemisphere and the New Zealand Government providing 3D visualisation solutions for businesses).

In mid to late 2009, South East Water started to explore the potential for 3D visualisation and modelling and its application across the Water Industry. A key objective for Nextspace is to develop a three dimensional 'visual city' that would allow numerous businesses, government organisations, councils and utilities to draw on data from a centralised source, using it to generate 3D visualisations. Between South East Water and Nextspace an opportunity was identified to 'pilot' 3D visualisation technology in support of communication and vital decision making processes as part of the Belgrave Heights Pressure Sewer Project.

2.0   DISCUSSION

Case Study: *Belgrave Heights Pressure Sewer System (PSS), South East Water Ltd*

Construction Benefits

In cooperation with the Capital Delivery team for *'us'* – Utility Services (South East Water's Operations, Maintenance and Capital Delivery Program Alliance), the Belgrave Heights PSS project was selected for the pilot program. This particular project provided the potential to explore the potential cost and communication benefits for 'construction' as well as 'engagement' with South East Water's end user customers.

During the planning stages, models were built and 3D visualisation technology was then used to identify the location of critical rock formations in Belgrave Heights. Drawing in geological survey data from a number of sources, the system was able to show the project team underground land form that has previously not been available in a visual format. Teams planning for pipeline alignments and the position of infrastructure, including grinder tanks for individual properties, were able to draw on this additional information. Rock formations in the local area were of particular concern and the added capacity to visualise their location assisted with design – finding alternative and more cost-effective pipeline alignments.

During the pilot, 3D visualisation supported the South East Water project team to make decisions and minimise risks, modelling potential cost savings and demonstrating the potential for future construction program value.

Customer Engagement Benefits

Throughout the construction phase of the Belgrave Heights PSS project, South East Water has worked to reduce its impact on the local community and the environment. The successful delivery of any PSS project is reliant on maximising the number of end user customers who connect to the system. By integrating 3D visualisation technology into South East Water's customer and community engagement program, value at the residential property level can be demonstrated. The customer connection process includes consultations, site audits, surveys, construction and commissioning elements that each take time to implement for each residential property.

The development and use of visualisation technology means timeframes at each step of the connection process are reduced, resulting in increased efficiencies and lower costs. Each process improvement, supported by system developments, can potentially have a positive impact on customer satisfaction. 3D visualisation means consultations could take place off-site (for example, at the client's work place).

Residents and project team members will be able to take a tour of properties and construction zones in 3D, adding details to the system and locations for a variety of assets.

Interfacing applications will allow for diagrams and plans to be viewed and edited in the field, improving the accuracy and availability of South East Water's information. Reduced administration and certification times with third party auditors, surveyors and South East Water having access to shared property information, synchronised in 'real time'.

Demonstrated Value from Visualisation To try and put a value on the potential for reducing construction costs, South East Water estimates that the difference between installing PSS 'grinder units' in rock when compared with softer ground. By utilising visualisation technology to find alternative locations for each high risk unit, project teams estimate significant savings in both construction time and cost of materials and resources. These planning calculations highlight the potential for visualisation technology to provide the project with more of the information needed to make the most informed, cost-effective planning decision possible.

South East Water expects to demonstrate construction cost value in terms of planning and infrastructure placement. It has also been able to recognise the potential for further system developments that will provide customers with more detailed and powerful information, using state-of-the-art communication tools.

System mobility is a key success factor and with the relatively recent release of the Apple iPad (and similar devices) in Australia, this device enables a portable and interactive tool for customer interface applications. Each of these platforms will dramatically improve our mobile communication systems to support the base visualisation technology.

There are potential benefits for end user customers throughout the process with reduced times for 'sign-off' at each stage and reduced construction costs for customers and South East Water. For every potential improvement in time and cost, there is a direct impact on customer satisfaction which ultimately influences the number of customers connecting to the system.
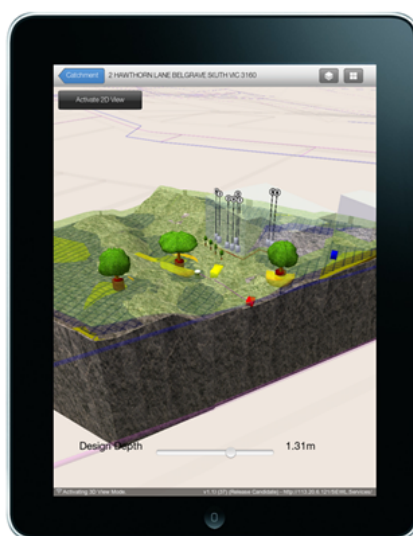

Figure 1: *Apple iPad 3D Visual Water Application*
Make-up of the Current System and Future Developments

At the systems core is the Visual City platform which gathers and amalgamates information from a variety of sources. The forms of data available for integration include:

- Asset Information – water and sewer network assets
- LIDAR (Light Detection and Ranging) Surface Data
- Property Information – property polygons and addresses
- High Resolution Aerial Photos – accurate to 10cm
- Sub-surface Terrain Data – sourced from geological surveys
- Geomorphology Studies – based on local erosion, terrain and aspect information
- Proposed Pipeline Design – proposed alignment of assets with respect to sub-surface terrain
- Feature Survey Information - location of above ground features and obstacles
- Other Utility Assets – above and below ground

In further development is a variety of interfacing tools that can effectively integrate and display desired information and produce a better understanding of:

- Sub surface construction zone – from surface to a depth of 2.0 metres
- Areas where the top soil is deep – low risk of obstruction
- Areas with high likelihood of large boulders below the surface and within the construction zone – medium risk of obstruction
- Areas with high likelihood of solid rock at the surface – high risk of obstruction
- Trees and other above ground immovable obstacles
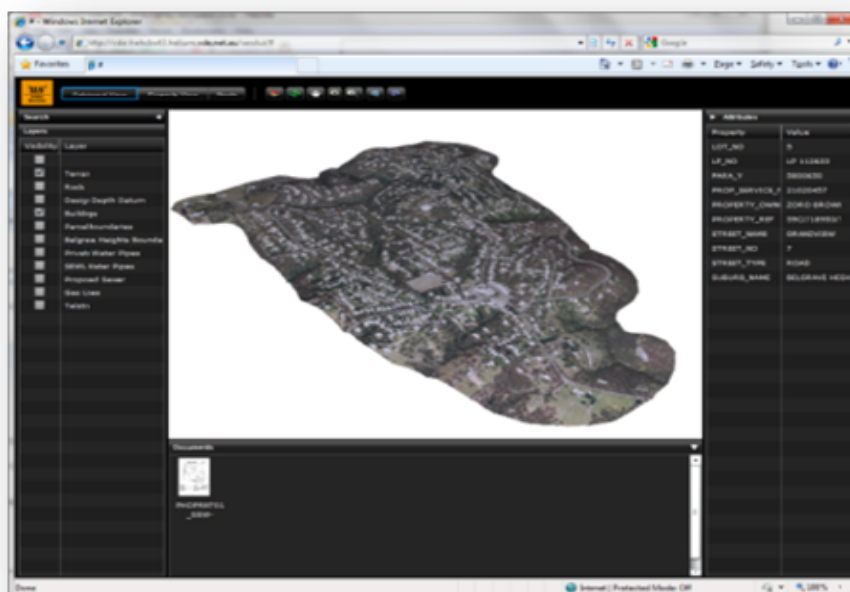- Property Aesthetics – how the low pressure sewer system work will look in its landscape

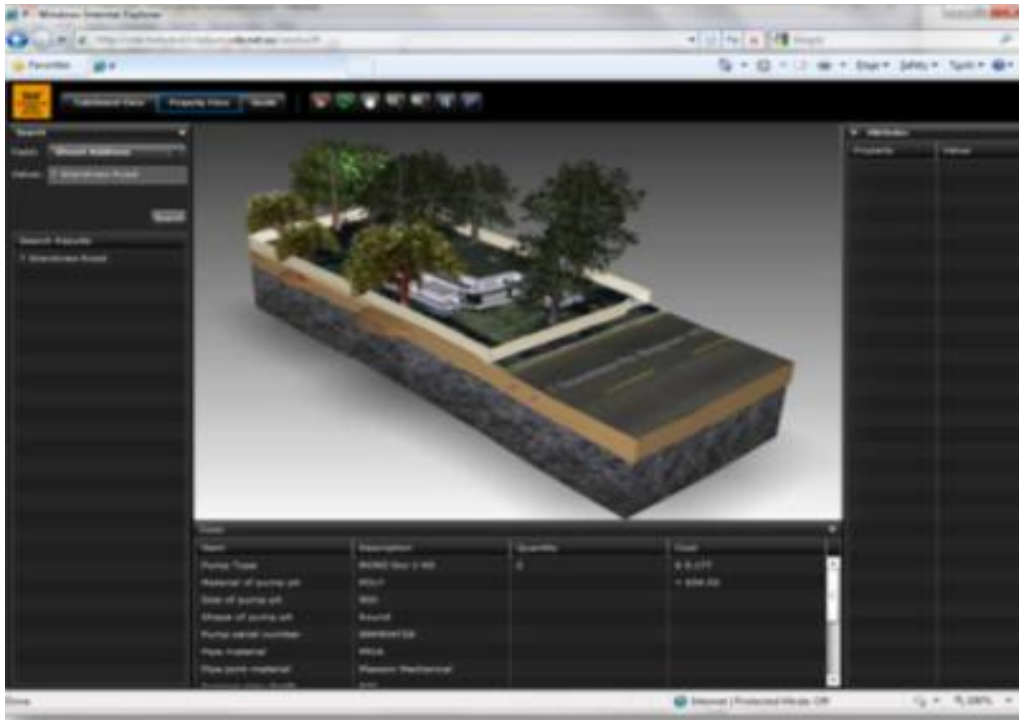**Figure 2:**   *3D catchment View*

Figure 3: *3D Property View*

South East Water will be able, in Belgrave Heights, to adjust pipeline alignments and the proposed location of infrastructure to accommodate the local, natural environment. Once pipeline alignments within the construction zones have been identified, a series of final tests in high risk areas will be undertaken to confirm the planning data and terrain conditions prior to work commencing. This confirmation data feeds back into the system and enhance accuracy in specific areas over time and is available for future projects. The range of confirmation surveys and tests include:

- Geotechnical surveys – soil samples to determine depth and density of rock
- Ground penetrating radar – to identify depth of solid rock or possible sub surface boulders
- Vegetation – to avoid damage to root systems
- Areas of cultural significance – possible location of archaeological sites
- Location of contaminated ground – retired land fill sites pose a high risk for OH&S

Combining this additional information using one system that is then capable of producing 3D visualisations for a variety of purposes, will reduce construction costs, improve OH&S, better protect the environment and reduce the use of loud construction equipment – all of which has a positive impact on the community and environment.

Using 'real' property examples, South East Water is now able to finalise development and field test applications using mobile devices such as the Apple iPad. South East Water staff and its independent audit contractors will be able use mobile and 3D applications for the following activities:

- Plumbing compliance checks for each property
- Electrical checks and testing for each property
- Generate design drawings
- Customer consent and connection agreements
- Track installation progress.

By enabling its staff and contractors to access and update information at each property

(approximately 800 in Belgrave Heights) South East Water will be able to reduce timeframes for each network connection.

3.0 CONCLUSION

Together, we are seeing the development of a technology approach that will take us forward and solve business problems in an innovative and visual way, not previously explored within the Water Industry. In doing so, we hope to enhance understanding and therefore clarity between all parties, decreasing the gap between what parties 'know'. We hope to develop a flexible and scalable technology platform that will meet the demands and challenges we will face over the next 20 years, with the application of powerful 3D information and visualisation.

The case study in Belgrave Heights demonstrates the power of the Visual City platform in integrating multiple data sources and known solutions to inform an entire service or system, community and stakeholders using visualisation. Visualisation is driving innovation, enabling collaboration and curation - letting us see things and relationships we can't actually see.

"There are clear benefits in being able to communicate visually with our customers and our operators, we see that at Belgrave, and we will get continued benefit from the customer design tools."
Rohan Ogier, TOC Development Manager, *'us'* – Utility Services

4.0 ACKNOWLEDGEMENTS & REFERENCES

This paper resulted from discussions with a number of people involved across SE Water, *'us'* – Utility Services and Nextspace. Thanks to all those involved.