

## Cadastre NSW: A Single Land Cadastre

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## ABSTRACT

*The NSW cadastre does not belong to any one agency or organisation. While Land and Property Information (LPI) is its custodian in NSW, the cadastre transcends organisations and industry groups as the link between all interests, restrictions and affectations of land. It is a fundamental building block that enhances the State's location intelligence and supports the NSW share of the \$5.4 trillion of real property held across Australia. NSW, however, does not have a 'single' digital representation of the cadastre used ubiquitously across government and industry. Instead, many organisations maintain separate cadastral datasets, which represent the same core information but vary in their spatial positioning, attribution and the type of features displayed. Consequently, NSW is hindered through duplication of effort and misalignment when spatial information from multiple sources is combined. The Cadastre NSW Working Group has been formed to identify and address issues related to the creation of a single land cadastre for NSW. The group is planning a digital transformation to improve the way that cadastral information is sourced, managed and delivered to implement their vision for a next-generation cadastre for NSW. This paper discusses the actions taken to date to prepare for the development of a collaborative business case for Cadastre NSW. It also discusses the policy and social drivers for change such as the NSW Government's digital transformation agenda and public expectation for access to information instantly, anywhere and on any device. To initiate the development of Cadastre NSW, LPI has commenced work on a number of projects including stakeholder needs analysis and engagement, and implementation of ePlan and LandXML processes to enable electronic submission and management of survey plans.*

**KEYWORDS:** *Cadastre, digital transformation, location intelligence.*

## 1 INTRODUCTION

Cadastral information is used across government and industry to manage land, plan and assess development, build and manage infrastructure, protect the environment and deliver vital services. It underpins the NSW share of \$5.4 trillion of real property held across Australia and is a core component of many systems and processes that drive our economy. However, due to duplication of effort and lack of coordination, the cadastre is still not being used to its full potential.

This paper discusses the actions taken to date to prepare for the development of a collaborative business case for Cadastre NSW. It also discusses the policy and social drivers for change such as the NSW Government's digital transformation agenda and public expectation for access to information instantly, anywhere and on any device. To initiate the development of Cadastre NSW, LPI has commenced work on a number of projects including stakeholder needs analysis and engagement, and implementation of ePlan and LandXML processes to enable electronic submission and management of survey plans.

## **2 BACKGROUND**

Since the 1980s, LPI has maintained a Digital Cadastral Database (DCDB) to provide a spatial representation of land parcels current within its titles register. The DCDB is consumed by individuals and organisations across government and industry for a vast array of purposes including planning and development of Local Environment Plans (LEP), disaster management, evaluation of Development Applications (DA), asset design, surveying and customer management and billing.

While LPI is the custodian of NSW's state-wide DCDB, many local councils and utilities also maintain digital cadastral datasets to meet their organisational needs. These needs often relate to ensuring early or proposed information is captured during the development process. The current time lag for information reaching LPI is problematic as plan lodgement and registration occurs right at the end of the development process. The accuracy or type of features included in LPI's cadastre may also not be sufficient for an organisation's business needs.

It is estimated that there are around 140 cadastral datasets being maintained on a day-to-day basis across NSW. Some organisations have developed their own DCDB from scratch, while others have adopted LPI's DCDB at a point in time but updated it independently since. While all stakeholders recognise the benefits of greater coordination, there is significant complexity and risk in adjusting existing business processes to an externally managed dataset.

Many organisations who maintain a DCDB regularly update their dataset to make it more spatially accurate. However, changes to the position of features in the DCDB cause a ripple effect for the hundreds, if not thousands, of layers that need to be aligned to it. This can either be a coincident alignment (common for planning layers) or relative relationship (common for asset information). While it was accepted that upgrades need to happen from time to time, most of the organisations needed to be in control of when changes to the DCDB occur to ensure they have the resources and time available to update all the other related datasets.

The fact that various versions of the DCDB exist also means that combining DCDBs or any related dataset from different sources will result in misalignments. This problem has increased complexity for the Department of Planning and Environment's new ePlanning viewer, which brings together planning layers produced by councils across NSW and overlays them with LPI's DCDB. For NSW the implications include significant duplication of effort, a higher regulatory burden on industry, poor decision making and unnecessary barriers to digital government services.

To address these issues, a single land cadastre workshop was held on 1 July 2015 with the aim of agreeing on an approach to the design, development and implementation of a single land

cadastre for NSW. The workshop consisted of 35 representatives from across industry and government and achieved a broad consensus in rebranding the single land cadastre initiative as ‘Cadastre NSW’ and producing a vision and strategic roadmap to achieve that vision.

The vision comprises ‘a cadastre as a service’, a single source of truth that is underpinned by agreed management rules and governance, is technology agnostic and of known currency, accuracy and completeness to support the legality of location-based decisions. The roadmap endorsed communication of the benefits to stakeholders, formal analysis of the current state, establishing pilots and business models, and ultimately development of a business case for the initiative.

### **3 CADASTRE NSW**

Around the world, government providers are trying to keep pace with technological change and community demand for accessible, accurate and temporal information. The Cadastre NSW vision is to utilise technology to enable users to access what they need, at any time, on any device. As such the initiative also supports a number of the strategic goals and state priorities of the NSW Government such as digital government (NSW Office of Finance and Services, 2014), faster housing approvals, improving government services and increasing digital transactions to 70% by 2019 (NSW Government, 2016).

#### **3.1 Cadastre NSW Working Group**

Following the workshop on 1 July 2015, the Cadastre NSW Working Group (CNWG) was formed to provide leadership and strategic direction of the Cadastre NSW initiative. The working group is a mix of industry and government representatives, which reflects the broad scope of business and government stakeholders whose core business transactions rely on cadastral information. Membership of the CNWG includes:

- Surveyor General of NSW.
- Land and Property Information (LPI).
- Local Government professionals.
- Department of Planning & Environment.
- Urban Development Institute of Australia (UDIA).
- Australian Property Institute (API-NSW).
- Australian Consulting Surveyors (ACS) / Country Surveyors NSW.
- Institute of Surveyors (IS) NSW.
- Sydney Water.
- Hunter Water.
- Water Directorate.
- Energy Networks Association (ENA).
- Department of Industry.

#### **3.2 Stakeholder Review: Problems, Opportunities and Benefits**

In December 2015, the CNWG supervised the production of a stakeholder review with the aim of gathering information to inform the development of a business case for Cadastre NSW. The stakeholder review included a total of four stakeholder workshops, which identified three common priorities or problem and opportunity areas within current cadastral management arrangements.

The problems and opportunities chosen by stakeholders represent the areas within cadastral management that have maximum potential for reform or where reform will create maximum impact. The three problems and opportunities identified are (Figure 1):

- *Proposed plan data is not consistently distributed* – The lack of a coordinated dissemination of proposed plan data has led to delays in connecting new homes to utilities, higher cost regulatory processes for housing development and reduced planning capacity for utilities. The review found that the opportunity to address this problem is high in the short term (~2 years) as changes in processes and existing systems will remediate problems in this area.
- *Users are uncertain about the cadastre's accuracy* – The absence of definitive information on the accuracy of cadastral data means that there is uncertainty around the location of underground assets, reduced ability of authorities to enforce regulation for the benefit of the public and adds to the cost of infrastructure and property development. Given the greater complexity of this problem, the review found that it would take around 3 to 5 years to address this problem.
- *Lack of a coordinated minimum NSW cadastre* – The lack of a coordinated minimum cadastre means that there are a number of hindrances for NSW. These include the issue of unnecessary duplication of effort across government and industry, barriers to open data and digital government services, reduced accuracy of land valuations and delays in processing the sale of Crown land. Implementation of a minimum cadastre will require targeted and progressive change in existing systems and processes projected to be achievable in around 5 years.

The five broad benefits to NSW that can be realised from addressing the problems identified are:

- Improving the efficiency of local council operations.
- Improving the efficiency, reliability and safety of building infrastructure.
- Reducing land and property development costs.
- Accelerating online government service delivery and private sector opportunities.
- Strengthening strategic planning, decision making, compliance, enforcement and prosecution.

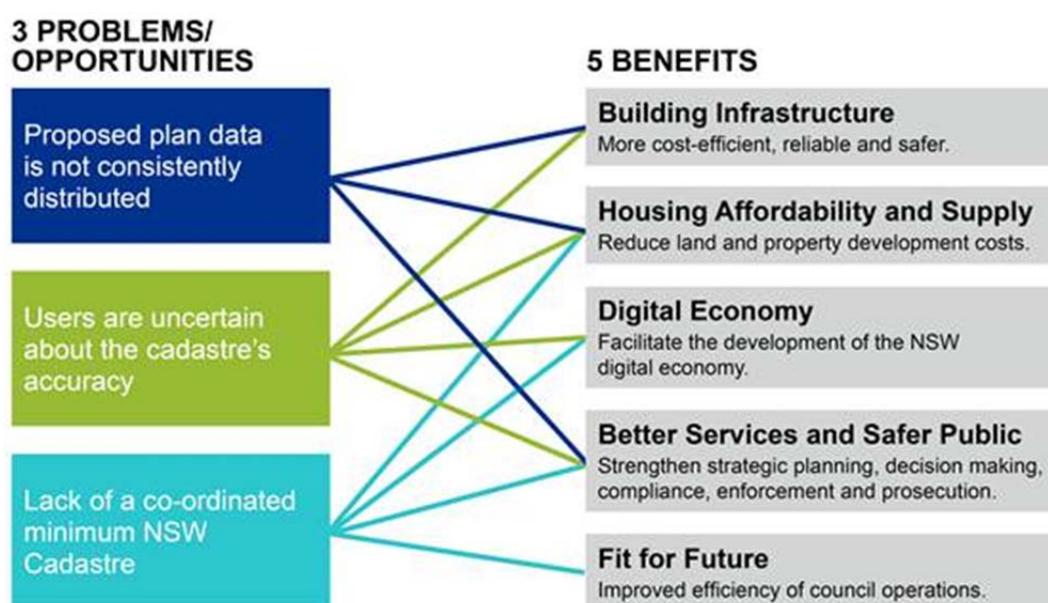


Figure 1: Problem/opportunities and the benefits for NSW in addressing the issues.

Many of the benefits are also complimentary to larger reform initiatives such as improving Australia's digital economy through digital transformation and the NSW Government's 'Fit for the Future' Local Government reforms in addition to other NSW strategic goals, as illustrated in Figure 1.

### **3.3 Next Step: Business Case**

The next step is to develop a business case to seek capital funding from NSW Treasury for the project. The business case will set out costs, benefits, document the need for the service, analyse the risks and demonstrate the lead agencies' capability to implement the project.

## **4 IMPLEMENTATION: DPXML**

The foundation for any cadastre in NSW is the catalogue of registered survey plans held by LPI. New plans being registered are able to be submitted (lodged), or captured post-lodgement, in the digital LandXML format. This allows for examination, registration, storage and use of plan data in a seamless ePlan environment and avoids many of the shortcomings of a manual plan registration system.

Pre-existing survey plans are currently stored as digital TIFF images that were captured from hardcopy originals or from microfilm copies. These plan image files are easily accessible but are essentially a 'dumb' image, requiring interpretation and data entry for any digital spatial environment or system of cadastral data management.

ePlan and LandXML provide a standardised format for generating, lodging, storing and accessing survey data for individual plans. LPI is undertaking a project to capture existing Deposited Plans (DPs) into LandXML for use by Cadastre NSW stakeholders and to help develop the single land cadastre. The project will run for approximately 4 years and capture some 800,000 DPs.

### **4.1 Guideline Development: New Format / Old Plans**

The international schema for LandXML has been ratified by the Intergovernmental Committee on Surveying and Mapping (ICSM) for use in representing surveying information in Australia (see <https://icsm.govspace.gov.au/files/2012/11/LandXML-1.2.xsd> for an example). The LandXML schema forms part of the ICSM ePlan protocol, which has been implemented by LPI as the NSW LandXML recipe (LPI, 2016).

The Deposited Plan LandXML (DPXML) project is now underway to capture existing, previously registered DPs into the LandXML format based on the NSW recipe. Converting the old plans into a new digital format presents a significant challenge. LandXML is designed to facilitate the interoperability of data, based on standardisation of information in an XML format, while the plans themselves represent an evolution of survey information and regulatory requirements that have continually changed during more than 100 years of practice.

The NSW recipe has been developed for new plans which conform to current Acts and Regulations. Any DPs more than about 25 years old tend to be quite variable in their content and format. Changes in standards over time as well as individual surveyor's drafting methods result in older plans being more difficult to interpret and convert to LandXML.

Some common issues that arise in capturing older plans include:

- Plans with missing or inaccurate SCIMS reference table (including pre-SCIMS and MM plans).
- Plans without (or with limited) connection to Permanent Marks.
- Missing or inaccurate observations.
- Inadequate irregular boundary definition.
- Missing or inaccurate administrative information.
- Misclose and other errors that have not been corrected during lodgement and examination.

In order to ensure consistency of data across all plans being captured during the DPXML project, a register of unique plan issues has been established. This records non-standard scenarios that occur in the wide variety of plans and may be a result of original field observations, plan drafting or limitations in data capture.

## **4.2 Quality Assurance**

The unique nature of each survey project and subsequent plan, as well as the many complexities contained in compiled plans, highlight the importance of good quality controls during the plan capture process. Data capture of plans is being outsourced and the quality control processes during capture are managed by the service provider, with final quality assurance undertaken by LPI. It is important to note that while all efforts are made to ensure that the LandXML file is an accurate representation of the original plan, it is the plan TIFF image which remains the legal point of truth for each registered DP.

Quality control during data capture includes check observations, validation of all marks and connections, validation of area and misclose, double data entry of tables and administrative information, visual checks of the geo-referenced TIFF plan, automated mathematical and logical checks, the LPI ePlan validation service report, and LPI python scripts.

Quality assurance of LandXML data supplied to LPI is undertaken by a project team of six staff who run a series of automated and manual checks against the plan files. This includes logical, accuracy and attribute checks for coordinates, marks, reduced observations and parcels. The LandXML is also rendered into a shapefile for scrutinising coordinate, geometry and connection information. DPXML plans which fail quality assurance are returned to the service provider for correction.

Despite all efforts being made during the data capture and quality assurance steps, there is going to be a significant number of errors and anomalies in this data. Many of these will be minor and have little impact of the fit-for-purpose quality of the LandXML representation of the original plan. However, an essential requirement for release of LandXML for broader use is the communication of quality information, which highlights the limitations, possible errors and quality checks that have been undertaken for each plan.

## **4.3 Applications**

### **4.3.1 Pilot(s)**

In 2015, a pilot project was undertaken to test the proposed capture methodology for DPXML. The first trial area was completed using approximately 1,500 DPs from The Hills Local Government Area (LGA). The initial pilot results were very encouraging. During the

first part of the pilot activity, many areas for improving capture processes were identified and subsequently incorporated into the workflows. With pilot work proving very successful, a decision was made to extend the trial area with some supplementary and more complex plan scenarios and fully test the end-to-end capture process, also over The Hills.

A final pilot stage will comprise a 3-part limited production run, through to the end of June 2016. The intention of this stage is to increase throughputs and stress test all production processes, as well as identify areas for ongoing quality improvements. The plans for this stage were sourced from the southwest and northwest Sydney growth areas, as well as Gosford LGA. The limited production stage 1 pilot has been a success, confirming requirements for moving ahead with stages 2 and 3. Full project production should start in July 2016 and will continue to ramp up through the calendar year, reaching peak throughputs in December 2016.

#### **4.3.2 Plan Test**

One of the benefits of DPXML is the time that will be saved during the electronic plan lodgement (ePlan) and examination process (plan test). During plan examination for newly lodged plans, a thorough analysis of existing survey information is undertaken for the subject plan and adjoining reference plans. Where existing plans are available in LandXML, as a result of DPXML capture, it will mean that plan data will not need to be manually entered, a significant resource saving for LPI and time saving for lodging parties. The plan test process can proceed much more efficiently for newly lodged plans.

#### **4.3.3 DCDB, Valnet, SCIMS and Addressing**

There are several other important areas of LPI activity which will benefit from the availability of LandXML data. The DCDB is updated using new survey plans and also upgraded (improvements in spatial accuracy) from existing plan data and other source information. DCDB maintenance will benefit greatly from ready-to-use plan data. Valnet will be able to use area information derived from LandXML file data to verify property details, and LPI's addressing database will access standard and complex address details. These changes represent a significant improvement to workflows and reduction in manual data entry for LPI.

#### **4.3.4 RMS Cadastral Models**

Roads and Maritime Services (RMS) have a very significant Forward Work Program 2020, which encompasses major projects for the next 4 years. RMS has indicated that any assistance from LPI in enabling the use of LandXML in cadastral models for its surveying and construction activities would be helpful. Given the scale and importance of these infrastructure projects, LPI will be collaborating with RMS on some test areas and, if possible, schedule DPXML capture on a priority basis.

#### **4.3.5 Survey Industry**

The availability of DPs in LandXML means that surveyors will have access to ready-to-use data from already registered plans in the area of interest at the start of each survey job. Observations, marks, coordinates, connections, parcels, roads, areas, arcs, administrative information and all other plan data can be used without the overhead of data entry. Planning and preparation for cadastral survey work should become more streamlined and plan preparation and drafting can become more efficient with survey project software and drafting packages ingesting the LandXML data as well as outputting LandXML for lodgement.

#### **4.3.6 Other Applications**

Inefficient access to data and long lead-in times for planning and development approvals are a significant overhead for urban planning, design and development feasibility analysis. While hard to measure, the time savings and data improvements made possible through readily available digital plan data will be significant.

### **5 CONCLUDING REMARKS**

The NSW DCDB is a key information asset for NSW which supports the delivery of new homes, infrastructure and government services. The current level of duplication and lack of coordination for managing cadastral and associated information is a barrier to the NSW Government achieving its strategic outcomes, such as improving housing affordability and providing online digital services.

Through LPI's current data capture agenda, as well as a whole of government approach through the Cadastre NSW Working Group, the time is right to reform the way cadastral information is sourced, managed and delivered in NSW. The next major step will be the development of a business case for Cadastre NSW to secure the funding and resources necessary to achieve a single land cadastre for NSW. It should be noted that the information given in this paper is correct at the time of writing and may be subject to change.

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