Foundation Spatial Data Framework – Data Manager's Baseline 2014

Survey Outcomes

Intergovernmental Committee on Surveying & Mapping (ICSM)
Spatial Information Delivery & Access (SIDA) Working Group
December 2014

Acknowledgement

The survey has been developed by the Spatial Information Delivery and Access (SIDA) working group, Intergovernmental Committee for Survey and Mapping (ICSM) in conjunction with ANZLIC.

The role of SIDA is to understand and provide support for better delivery and access of spatial information nationally.

This report would not have been possible without the support of survey respondents who contributed their time to answer the many questions relating to the accessibility of their geographic data sets.

SIDA working group extends its sincere thanks to the people whose expert knowledge has contributed to this baseline survey. It will enable ANZLIC and ICSM to understand the current and desired future state for each national Foundation Spatial Data Framework Data Theme and allow the working groups to define measurable targets throughout the program.

This survey sets a benchmark for current capabilities and provides a tool for assessing where future enhancements are required to best support national needs.

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The survey and this report were produced by Geospatial Frameworks Pty Ltd, Darlington, Western Australia
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Note to Readers

The inferences made in this report are drawn from survey responses recorded in December 2014. They reflect a general situation and trends in data management, access and delivery across Australian State/Territory and Commonwealth jurisdictions, and New Zealand. The targeted respondents to this survey were the data managers of data sets that make up the data themes under the FSDF program. This aligns to understanding the capability and readiness of jurisdictions to deliver on the aspirational goals of the FSDF.

These learnings provide a focus for discussion and in many cases pose more questions than answers. Further investigation is proposed to enable informed decision making and direction setting.

The Elevation and Depth FSDF Data Theme has been separated in this survey for logistical purposes as the organisational groups (survey populations) are discrete.

Business investment information, relating to production systems and future data quality improvements, has been collected for this survey and will be used at a later date for financial analysis.

Contents

Executive Summary

The Intergovernmental Committee on Surveying Mapping (ICSM), Spatial Information Delivery and Access (SIDA) Working Group in conjunction with ANZLIC has conducted a survey to understand the jurisdictional readiness for access to data sets required. These data sets are identified as components of the Foundation Spatial Data Framework (FSDF) Data Themes.

The FSDF recognises ten (10) national data themes that will provide a common reference for the assembly and maintenance of Australian and New Zealand foundation level spatial data. The themes are:

1. Geocoded Addressing
2. Administrative Boundaries
3. Positioning
4. Place Names
5. Land Parcel and Property
6. Imagery
7. Transport
8. Water
9. Elevation and Depth
10. Land Cover

The intention of the survey is to establish a benchmark from which progress towards FSDF aspirational goals can be measured. Data Managers of datasets that make up the data themes under the FSDF within each jurisdiction were identified as the respondents to this survey. This survey has not focused on the end users of the data sets within the themes.

This report provides a high-level analysis of results and is intended as a starting point for further discussion. It is accompanied by a Survey Matrix which provides a summary of results for easy reference (Appendix D).

The report has outlined findings in the current capabilities within jurisdictions and points to general trends in the application of spatial technology, standards, models, processes and delivery modes.

The report also proposes actions for consideration when developing the FSDF Data Theme Road Maps. These propositions are based on the survey data collected which provide a jurisdiction perspective on current capabilities (as at December 2014). The results have then been interpreted in the context of being able to supply and readily compile national data sets.

Importantly, a more detailed analysis of survey results is warranted as some theme-specific trends are lost in this high-level design of this survey and report. Raw survey data is available for this purpose.

The following provide general observations interpreted from the survey data.

Custodianship

The survey highlights that data custodianship is a complex matter. The authoritative source of information is not clear for some date sets within the themes. Geocoded Addressing, Land Parcel and Property data have a strong sense of custodianship and are well mandated through policy and/or legislation. Other data themes and their corresponding data sets are characterised by duplication. This suggests information silos still exist within jurisdictions and potentially between commonwealth and state/territory government agencies. This may make it difficult for end-users to determine which data sets are the most ‘fit for purpose’ data source.

Accessibility

In the main, spatial data sets are publicly accessible and data delivery is predominantly via online services. The exception is bathymetry data which is generally accessible to government only and is primarily delivered via email.

The majority of jurisdictions collects descriptive metadata in some form or other and has adopted the ISO 19139:2007 – Metadata XML Schema Implementation Standard. This metadata, combined with a high level of online accessibility, signifies that search and query capabilities are highly likely to be technically supported at a national data set level. However, there is limited metadata in machine-actionable form meaning that national catalogues will have to be developed manually in many cases.

There is a high degree of commonality in spatial data formats and with the software systems used to collect and manage data. Therefore, interoperability between jurisdiction systems is likely. Data is also available in an extensive range of formats which suggests that end-users have considerable choice

Business Model

There is no common business model across jurisdictions. Each jurisdiction has its own intellectual property management model and licensing arrangements (terms and conditions).

Financial (revenue and funding) models also vary and fall into three categories – (a) free, (b) cost recovery/subsidised and (c) full-commercial. However, responses indicate a general shift toward universal free access for some themes over the shorter term. Imagery and land parcel and property data are likely to remain commercial.

The FSDF Data Themes, whether free or commercial, will require a financial model that accommodates jurisdictional differences and is sustainable in the longer term.

Data Standards and Metadata

This report has found that there are relatively low levels of compliance with data standards across many of the data sets within the themes. This is a concern as compliance is one mechanism by which jurisdiction data sets can be aggregated to create a nationwide data view.

An alternative to standards compliance, is to federate 'non-standard' data sets on-the-fly. Research by CRC-SI is investigating solutions. However, the survey data indicates limited compliance with OGC web services implementation specifications. This means the investment required to integrate multiple jurisdiction data sets on-the-fly (or otherwise) in a single viewing system is likely to be higher than if standards are adopted.

Data Quality

The survey revealed that nationwide data will be inconsistent in terms of positional accuracy and completeness, and data edge matching along state and territory borders will require rectification. A work plan is required to collectively focus on agreed nationwide data improvement priorities. It is proposed this work plan be in line with market needs and aimed at supporting advanced evidenced-based decision making by governments.

The most significant areas of data improvement indicated by the survey are:

- Back-capture of gated community addresses and the geocoding of buildings where multiple buildings occur in one property
- Spatial upgrading of administrative boundaries
- General maintenance issues associated with place names
- Historical imagery in analogue format
- Spatial upgrading of land parcel boundaries
- Vertical integration of land parcel boundaries with rights, restriction and responsibilities
- Edge matching of land cover, water and transport data along state/territory boundaries
- Complete gaps in land cover, elevation and bathymetry coverage nationwide

Data currency for the datasets making up each of these varies between jurisdictions, and timeliness is likely to be driven by end-user requirements specific to each jurisdiction. From a national perspective it is important to understand what the market requires of a national data set. The FSDF Data Themes, at best, will only be as current and as accurate as jurisdiction data sets. Future FSDF road maps will need to factor in what the national data set end-users require of data currency as well as other 'value' criteria.

Usability

The survey revealed that the majority of data sets reflect the intended purpose of the FSDF Data Themes[1]. However, the survey only illustrates the view point of data managers and not that of the intended end-user. More investigation is required to understand the value proposition afforded to consumers through access to FSDF data themes and whether they are fit for the purpose they are intended. This proposition for action is supported by the fact that many respondents were understandably unsure if their end-customers have to manipulate data sets before they can be used.

Results indicate that the government and utilities sector are the main users of spatial information across all themes. Administrative boundaries, land parcel and property, imagery and transport data have the highest level of cross sector penetration. However, it is not clear which industry groups are under-represented. More investigation and analysis is required. In many cases respondents had no visibility of some industry sectors.

Aspirational Goals

FSDF aspirational goals are considered in this survey against jurisdiction current capabilities. At this point in time, future FSDF requirements for data delivery under each theme are not able to be delivered.

Current jurisdiction capabilities are extremely diverse. The following trends are observed:

- Real-time delivery of data updates is envisaged as a short to long term goal for most themes.
- The provision of data CC-BY at zero cost is unlikely for positioning, land parcel and property, imagery, transport, elevation and bathymetry data.
- A two-way feedback mechanism is unlikely to be achieved for administrative boundaries, land parcel and property, imagery and depth.
- In the main, future positional accuracy requirements of FSDF themes have moderate achievability. However, respondents for administrative boundaries, water, elevation, depth and land cover suggests FSDF accuracy requirements are unachievable.

[1] Intended purpose is derived from the FSDF Data Theme profiles available at http://www.anzlic.gov.au/foundation_spatial_data_framework

1. Introduction

1.1 Foundation Spatial Data Framework Data Themes

The Spatial Information Delivery and Access (SIDA) Survey is designed to assist in the documentation of the current state of each Foundation Spatial Data Framework (FSDF) Data Theme from a jurisdiction perspective.

The Foundation Spatial Data Framework recognises ten (10) date themes that will provide a common reference for the assembly and maintenance of Australian and New Zealand foundation level spatial data. The themes are:

1. Geocoded Addressing
2. Administrative Boundaries
3. Positioning
4. Place Names
5. Land Parcel and Property
6. Imagery
7. Transport
8. Water
9. Elevation and Depth
10. Land Cover

The aim is to deliver authoritative nationwide foundation spatial data, sourced from the best and most current information available. This will require on-going collaborative partnerships between jurisdictions to achieve a sustainable, uniform and quality controlled spatial information infrastructure that can be leveraged by government, industry, academia and the broader community.

To achieve this aim the FSDF will describe the national data product as per an agreed specification and deliver a statement of work for its production and on-going management.

1.2 Survey Purpose

This survey sets a benchmark from which progress towards FSDF aspirational goals can be measured.

It also provides a tool for assessing where future enhancements are required to best support national needs. This includes:

- Data access issues that may be barriers to integration
- Where institutional mandates need to be strengthened
- Interoperability issues between jurisdiction datasets that needs to be addressed
- Search and query capabilities that can be achieved at the national level through understanding available metadata
- Future data enhancements required to advance evidenced-based decision making capabilities and the funding necessary for essential data quality improvement
- Industry groups that are underrepresented as spatial data users
- Potential research projects to ensure the on-going sustainability of the FSDF including its preparedness for future technologies

1.3 Survey Population

The SIDA survey population includes experts on the data sets to be incorporated into the foundation spatial data themes and a list of organisation's participating in the survey is available through the SIDA Working group.

1.4 Survey Results

This report presents a high level overview of SIDA survey results. The intention is to establish a starting point for further discussion.

The report indicates a general trend in the application of spatial technology, standards, models, processes and delivery modes.

It also highlights findings in capability and action propositions for consideration in future FSDF Data Theme Road Maps. However, a more detailed analysis of survey results is warranted. Raw survey data is available for this purpose. This includes financial data that is not included in this report.

The propositions made in this report are on the basis of survey results and at a particular point in time.

It is important to note that survey questions are necessarily broad and in some cases respondents were unable to provide answers at the time of the survey. All 'Don't Know' responses are not included in the determination of general trends, unless otherwise stated.

The survey topics are listed below and commentary on results provided in the following sections:

- Governance
- Accessibility
- Data standards and metadata
- Data quality
- Usage
- FSDF aspiration goals

2. Governance

2.1 Custodianship

Currently there are multiple avenues by which users obtain information. Understanding which organisation is the recognised authority and whether or not data is duplicated is important to understanding where authoritative data should be sourced for national data themes.

Custodianship is supported through the existence of policy and legislation, which provides organisations with the mandate to collect and administer spatial data.

In contrast, a high level of duplication across the sector suggests that an organisation's custodianship is not recognised externally. For example, all respondents of the Transport Theme (road, rail and aviation) indicate that other data sets exist in their jurisdiction.

Similarly, where more than one respondent from a jurisdiction indicates custodianship of the same data type there is a suggestion that custodianship is not clearly defined. For example, five (5) respondents indicate custodianship of Federal Electoral Boundary data sets. The question then arises, which data set is the authoritative source and which one should be included as a national data set?

These factors have influenced the rating for custodianship in this survey (see Survey Matrix). General observations include:

- Data indicating a strong sense of custodianship are the geocoded addressing, administrative boundaries, positioning (geodetic network only), land parcel and property, imagery (aerial photography only), and elevation. Respondents indicate that their organisation is the recognised custodian of the data in their jurisdiction.
- Respondents for the place names data sets indicate that they are the custodian for the collection and management of geographic feature and locality names in their jurisdiction. This function is consistently mandated through policy and/or legislation across all jurisdictions. However, place names associated with government, commercial and defence infrastructures are not mandated. Data duplication is noted as being high for all place names, suggesting custodianship is not recognised externally.
- Themes that demonstrate a weaker sense of custodianship are imagery (satellite only), transport, depth and land cover (land use (vector)). These data sets are not formally mandated and are also characterised by a known high level of data duplication across the sector (see Section 1.3).
- Water data sets are mandated through policy and/or legislation in each jurisdiction, however a significant level of duplication across the sector is also noted.

Finding 1.1	Custodianship is not fully understood or recognised.
Proposition 1.1	Produce a register of recognised data custodians for data sets in each FSDF Data Theme.

2.2 Policy and Legislation

The mandate for the collection of spatial information varies across the themes. Those themes with a mandate through policy/legislation include geocoded addressing, administrative boundaries, and place names, land parcel and property, positioning (geodetic network only) and water. General observations from a jurisdiction perspective are:

- Respondents for geocoded addressing (50%) indicated that this function is mandated through a Local Government Act (or equivalent), but not always enforceable.
- Place names are the only data set to have a specific legislative Act for data collection and this applies to all jurisdictions. However, the Act generally covers geographic feature naming only.
- Administrative boundaries, such as localities, are not consistently mandated. However, statistical boundaries are formally mandated through the Census and Statistics Act 1905, Electoral boundaries under Commonwealth and State Electoral Acts, and Maritime boundaries under Seas and Submerged Act 1973. Respondents indicate that policy and legislation related to local government areas, suburbs and postal boundaries exist, but they are not named.
- Geodetic network and land parcel data sets are a requirement under survey and land title Acts (or equivalent) in each jurisdiction, neither are a commonwealth mandated function.

The collection of imagery, transport, elevation, depth and land cover data are not specifically mandated through policy or legislation. This correlates to a low level of recognised custodianship in each jurisdiction (see Section 1.1) and a higher than average amount of data duplication (see Section 1.3).

Finding 1.2	The collection and management of data sets is not a formally mandated function under some of the data themes
Proposition 1.2	Consider formalising mandates for data collection and management where none exist
Finding 1.3	Policy and legislation is not consistently administered across jurisdictions
Proposition 1.3	Seek alignment of policy/legislation across all jurisdictions focusing on consistent application and outputs as a priority. *Note: This action is both time consuming and resource intensive and therefore may be a barrier to realising consistency across national data sets.*

2.3 Duplication

Respondents were asked to indicate if there are similar data sets collected and maintained by other government agencies in their jurisdiction. Where data duplication is low this indicates that the authoritative source is well known and that the supply chain is robust. Where duplication is prevalent there is potential for process and productivity improvement through interagency collaboration or automation of processes.

More particularly, where duplication occurs, more investigation is required to determine which data set collected under what purpose best contributes to the national data set.

Duplication occurs for a variety of reasons. Respondents identified with the following issues and provided supporting commentary:

- Not suited to their customers business needs.
- Lack of awareness that their data sets exist.
- Unclear governance arrangements surrounding the authoritative source.
- Entrenched 'historical' business processes.
- A client base with specific needs that cannot be otherwise met by the agency.
- Technical barriers relating to interagency collaboration.
- Difficulties in determining which of the duplicated data sets is the most 'fit for purpose' source.

The following general observations are made with respect to data duplication across and within jurisdictions:

- In comparison to other data sets, the geocoded addressing supply chain stands out as having the least level of duplication from a data aggregation perspective. However, address data is typically collected by thousands of organisation's in the course of their daily business. A lack of awareness of the authoritative source and entrenched historical business processes may have fostered this situation. This suggests there is a significant opportunity for data aggregators to provide address verification services to businesses to improve productivity.
- The Land and Property Theme is well managed with duplication occurring in only two (2) jurisdictions. This is mostly across the utilities and local government sectors where data are not suitable for their needs or where entrenched historical business processes continue to obstruct more collaborative methods.
- Noticeably, the Place Names Theme had the highest level of duplication with the majority of respondent's indicating that duplication occurs within their jurisdiction. Two (2) jurisdictions noted more than 20 additional data sets are likely to exist. Unclear governance arrangements and entrenched historical business processes are the likely contributing factors to duplication.

- Imagery also rated high with duplicated services noted in five (5) jurisdictions, and in two (2) jurisdictions there are 3-10 organisations believed to be collecting remote sensing imagery[2]. Aerial photography rated lower; however duplication is still noticeably high within jurisdictions and between state/territory commonwealth agencies. The most recognised reason is that other organisations have a client base with specific needs.
- Duplication is prevalent across the Transport Theme (road, rail and aviation) with 3-10 organisations within a jurisdiction collecting transport data in addition to the respondent's organisation. Duplication also occurs between jurisdiction and commonwealth data sets. Entrenched historical processes are seen as the most likely factor contributing to duplication.
- Lack of collaborative arrangements is noted as an issue for Water and Land Cover Themes with all jurisdictions indicating duplication occurs.
- Respondents for the elevation (70%) indicated that duplication is unlikely.
- Bathymetry data is duplicated. However, half of the respondents indicate they do not know if duplication occurs or not, and that there is a lack of awareness of bathymetry data in general.

In terms of duplication between state/territory and commonwealth data sets, indications are that duplication exists for imagery (satellite and aerial), water (natural and manmade features), transport (road, rails and aviation features), administrative boundaries (Federal Electoral), and land cover.

PSMA respondents note that there is no duplicated collection/maintenance of jurisdiction data sets, as they provide data aggregation services only.

Finding 1.4	The supply chains for many data sets are characterised by data duplication
Proposition 1.4	Research is required to model the web of multiple networks and relationships that exist in current spatial data supply chains with a view to addressing the gaps in capability[3]

2.4 Intellectual Property

Intellectual Property Rights Management (IPRM) and licensing arrangements (see Section 2.3) are intrinsically linked to custodianship. The custodian of spatial data generally holds the intellectual property (IP) rights over the information gathered. However, third party suppliers may own intellectual property. For example, third party data is a characteristic of the Imagery and Land Parcel and Property Themes and will require further consideration in terms of national data coverage and use.

The survey indicates that the custodian is generally responsible for maintaining copyright provisions and ensuring that use of information does not infringe on IP ownership, privacy and confidentiality. Some jurisdictions are encouraged to commercialise IP, meaning protections are an essential part of their business.

The range of survey responses indicates that an understanding of jurisdiction data release policies is required to adequately evaluate and treat any intellectual property disclosure risks that may be associated with a future national dataset.

The survey also indicates that there is a heightened awareness of government owned intellectual property rights and recognition of IP associated with third-party supplied data. Most jurisdictions, across all data within a theme, indicate that intellectual property ownership applies to their data and some note that third party data is acquired and used transparently.

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[2] It is not clear if data resolution and satellite services are duplicated and this requires clarification.

[3] CRCSI Program is currently undertaking research in Spatial Data Supply Chains

For place names, administrative boundaries, water and positioning data sets, the Creative Commons BY standard is the default license in the majority of cases. Contracts and other agreements are used to safeguard and manage intellectual property rights across all other themes.

PSMA recognise the intellectual property of jurisdiction data for all nationally aggregated data sets, and claim a level of IP for national products.

Finding 1.5	There is no Intellectual Property Rights Management model for national datasets
Proposition 1.5	Investigate an agreed policy for intellectual property management, open/exclusive innovation rights and/or instruments to manage shared intellectual property.

2.5 Privacy

For data sets within the themes there is little or no private information collected, and therefore public concern is unlikely. However, in the process of managing and maintaining place names and land parcel and property data, private information is collected. In each case, respondents indicate that reasonable steps are taken to protect personal information and individuals are informed about the collection of their information and its purpose. These privacy provisions need to be considered in the management of trans-border data flows.

2.6 Sensitive Data

Respondents indicate that sensitive data is contained in land parcel and property, land cover, imagery and transport data sets. In each case decisions on restricting access to these data sets are based on privacy, commercial sensitivity, national security, environmental sensitivity and/or legislation.

In general, respondents noted that open access to spatial data takes precedence over restricted access unless there are specific, compelling reasons to restrict access.

3. Accessibility

3.1 Access Levels

The majority of responses suggest that data sets are publicly accessible. The following exceptions are noted:

- Only one respondent indicates bathymetry data is available to the public.
- In some jurisdictions satellite imagery, elevation, bathymetry and land cover (vector only) data sets are for 'government use only'

3.2 Access Methods

The most common form of access in each jurisdiction is via online services. This indicates 24/7 availability to a wide-ranging audience. It also suggests data can be searched and queried to a high degree.

Email, FTP sites, post and over the counter sales are still a regularly used alternative for geocoded addressing, administrative boundaries, transport, elevation, aerial photography, transport, land and property boundaries, land cover and water. Depth data is an exception, as email is the predominant delivery method.

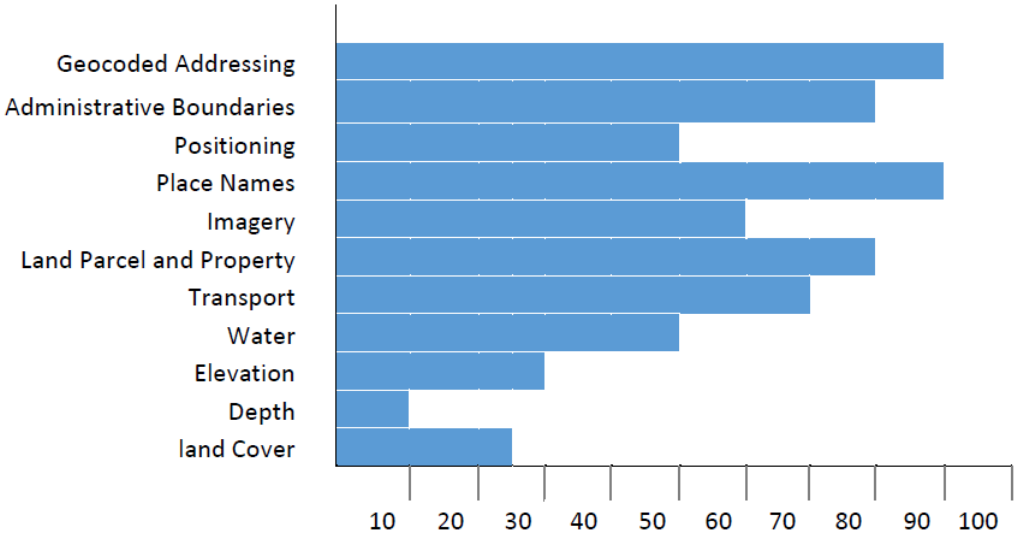

Figure 1: Access trends illustrated by average percentage of online services by theme

Value added resellers (VARS) are also acknowledged as being a mechanism by which consumers can access jurisdiction data. However, the survey did not differentiate between national VARS, such as PSMA and jurisdiction-specific VARS and this warrants further investigation.

A typical spread of survey results for access methods is shown in Figure 2 for geocoded addressing.

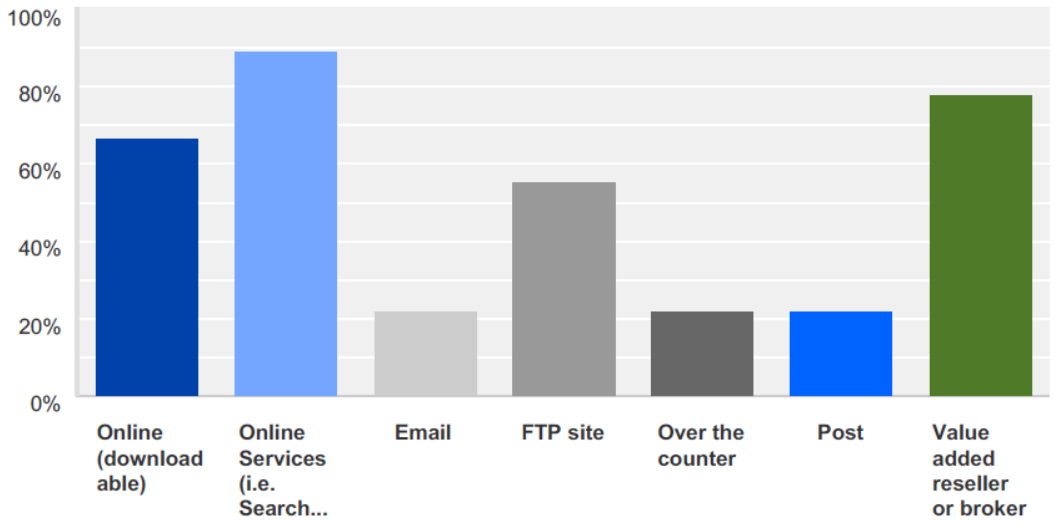

Figure 2: Methods for accessing geocoded address data

Finding 2.1	Bathymetry data is not readily accessible to the public
Proposition 2.1	Investigate if there is a consumer need for the inclusion of nationwide bathymetry data in an online environment

3.3 Data Format

There is a high degree of commonality in available data formats and services across all data. This indicates a significant level of system interoperability exists between jurisdiction data sets. General observations include:

- GIS databases and web services are the most commonly used formats for geocoded addressing, administration boundaries, place names, land parcel and property, imagery, transport, water, elevation and land cover data. Figure 3 illustrates data formats under the transport data theme.
- Positioning (geodetic network only) data is available as CSV (Comma Separated Value) and Adobe PDF in most jurisdictions.
- Imagery is generally stored as GeoTIFF, JPEG 2000, ECW and Web Map Tile Services.

Most respondents noted that data which is available in a range of formats shows that consumers have considerable choice (Figure 3). Understanding the value of this choice remains unmeasured.

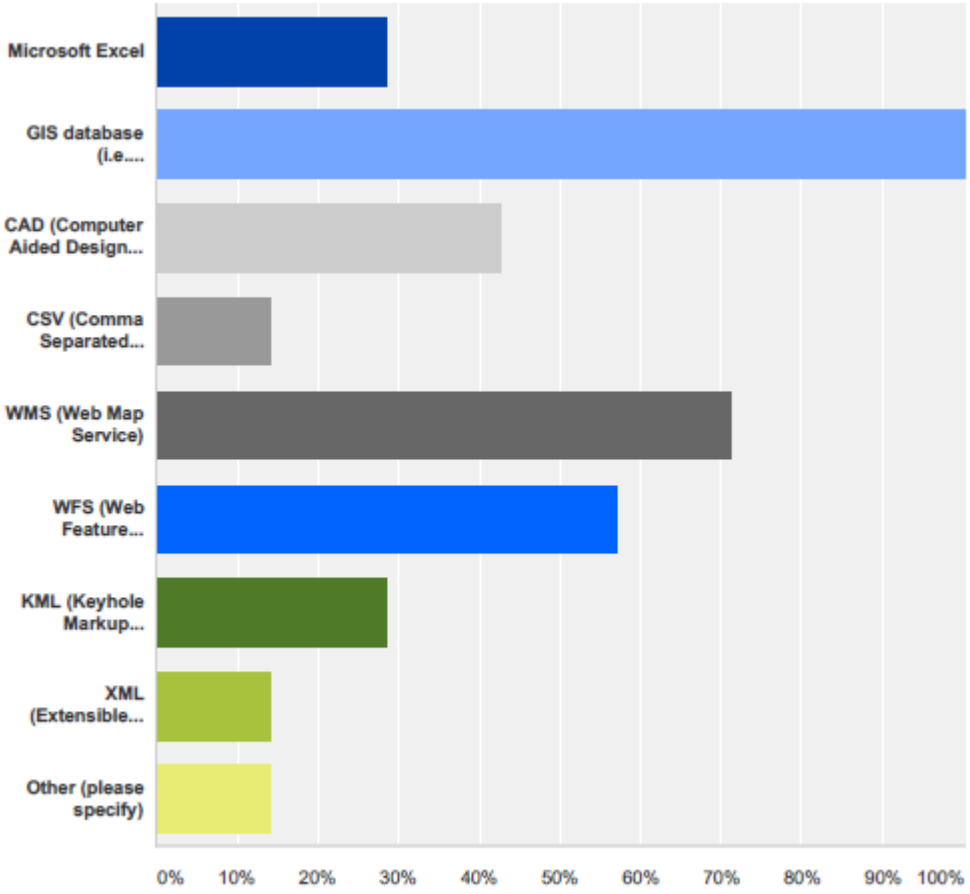

Figure 3: Data formats/services available for transport data sets

3.4 Financial Model

Each jurisdiction (state/territories and commonwealth) finances their own spatial data infrastructure, and collaborate nationally - predominately though in-kind contributions with Geoscience Australia or contractual arrangements with PSMA. The approach is data dependent.

Financial (revenue and funding) models vary across jurisdictions and fall into three categories – (a) free, (b) cost recovery/subsidised and (c) full-commercial. Table 1 highlights the predominant financial model for each data theme.

The FSDF Data Themes, whether free or commercial, will require a financial model.

The financial models adopted by jurisdictions vary considerably, and therefore a future national product model will need to:

a. accommodate individual jurisdictional differences or

b. require jurisdictions to agree on product and pricing models for foundation data and value-added products.

The choice of financial model is not an easy task. Whilst the case for implementing an open (universally free) data environment across government is expected to provide significant economic, social and environmental benefits arising for both the public sector and society; it is recognised that at an agency level there are costs in providing high quality fit for purpose data and potentially revenue losses associated with opening up content.

With the current government funding environment characterised by budget cutbacks and efficiency measures, it is reasonable for agencies to ensure that the financial model is sustainable.

Data Theme	Financial Model	Data Theme	Financial Model
Geocoded Addressing	30% Open Access (universal free access) Note: 30% did not know.	Land Parcel and Property	40% Open Access (universal free access) 40% Commercial 20% Subsidised or Cost
Administrative Boundaries	80% Open Access (universal free access)	Transport	Mainly Open Access or Subsidised
Positioning	62% Open Access 25% Subsidised	Water	90% Open Access
Place Names	80% Open Access (universal free access)	Elevation	Full range but majority identified Cost Recovery and Subsidised models
Imagery - Satellite	Full range but majority identified Cost Recovery and Subsidised models	Depth	30% Open Access (universal free access) Note: 30% did not know.
Imagery - Aerial	70% Commercial	Land Cover	60% Open access 25% Subsidised.

Table 1. Predominant Financial Model by Data Theme

Importantly, there are many circumstances where the respondent simply did not know what financial model is in place in their jurisdiction. This may be a consequence of the survey population, which mainly includes data manages and not business managers (Figure 4).

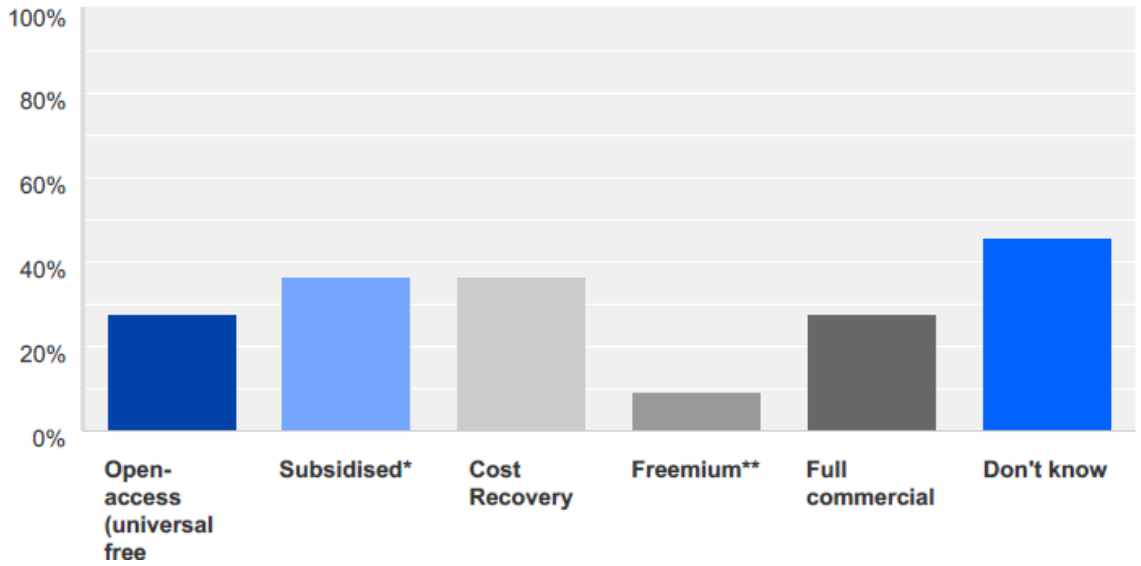

Figure 4: Financial Models for Satellite Imagery

Finding 2.2 There is no common financial model for data sets across jurisdictions making it difficult to collaborate on equal terms within a theme

Proposition 2.2 Investigate and develop a financial model for FSDF Data Themes, one that is sustainable over the longer term

3.5 Licensing

Importantly, the licensing models used in all jurisdictions do not inhibit access to spatial data sets. However, they do define how data can be used, by whom and for what purpose, and license stipulations are different across jurisdictions.

Currently, there is no common approach to data licensing across data sets within the themes.

Within each data set, jurisdictions indicate they use a variety of mechanisms when releasing/provisioning data. Methods include public domain (not copyrighted, CCBY), non-commercial (copyrighted) and commercial licenses.

The land parcel and property data sets indicate the highest level of commercial licensing (Figure 5).

Indications from the survey suggest that terms and conditions are likely to be specific to each jurisdiction and have unique provisions for copyright and intellectual property. These stipulations are often embedded within state/territory/commonwealth laws and/or subject to policy constraints.

A National License Framework for FSDF Data Themes will need to consider jurisdiction and agency- specific individual differences and endeavour to find common ground for a future NSDF License Framework.

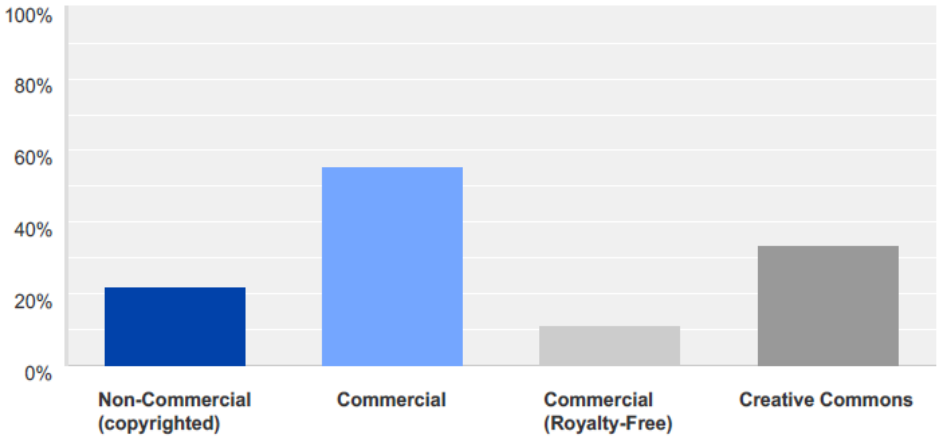

Figure 5: Licensing for Land Parcel and Property Theme

Finding 2.3	There is currently no common licensing model for data sets across jurisdictions.
Proposition 2.3	Investigate and develop a License Framework for FSDF Data Themes, one that supports collaboration over the longer term on each data set.

4. Data Standards and Metadata

4.1 Data Standards

There is relatively low compliance with data standards across many of the FSDF Data Themes. This is a concern as compliance with data standards is one mechanism by which jurisdiction data sets can be aggregated to create a nationwide data view. This is because they establish a common reference that enables interoperability between different kinds of spatial systems.

The geocoded addressing and positioning (geodetic network) are the only themes that display a high level of compliance with FSDF nominated data standards. Geocoded addressing in all jurisdictions is compliant with the address assignment standard, data schema standard, and data exchange standard. The majority are also compliant with the National Address Management Framework (NAMF). Similarly, the geodetic network in each jurisdiction is compliant with National Measurement Act 1960, Standard for the Australian Survey Control Network Special Publication 1 (SP1) version 2, and GDA Technical Manual. The New Zealand geodetic network has its own standard.

Administrative boundaries, land parcel and property, imagery, elevation, depth and land cover have relatively low levels of 'database schema' compliance with ISO and Australian and New Zealand Standards. In many cases respondents are unsure if their data is compliant or not.

In the majority of cases, place names are assigned according to a guideline. However, these guidelines are jurisdiction specific and not consistent nationally. The place names data schema is not standardised.

Responses indicate that water data sets are moderately compliant, with 40% indicating that they have adopted the ISO/TS 19131:2008 Geographic Information – Data Product Specifications.

Transport (roads only) data are moderately compliant with ICSM standards, with approximately half of the jurisdictions indicating that they have adopted the ICSM Roads Data Model and Data Dictionary. Fewer jurisdictions have adopted the ISO/TS 19131:2008 Geographic Information – Data Product Specifications, and no jurisdiction uses the ISO 14825:2011 Intelligent Transport Systems -- Geographic Data Files (GDF) -- GDF5.0 (Figure 6).

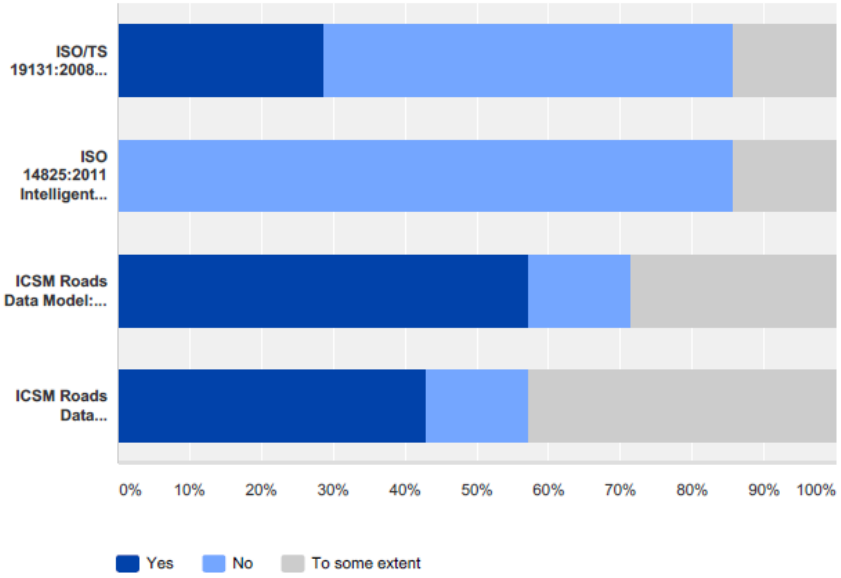

Figure 6: Indication of compliance with roads data standards

Finding 3.1	There is limited adoption of data standards across FSDF Data Themes
Proposition 3.1a	Jurisdictions to progressively comply with FSDF nominated standards OR
Proposition 3.1b	Research and develop methods to aggregate data sets that have different data schemas.

4.2 Spatial Data Services

Web Feature Service (WFS), Web Map Services (WMS) and Web Map Tile Service (WMTS) enable the data to be easily consumed by software systems and presented to users as a map view. Web services are simplest and most versatile tool for serving georeferenced map images and map features over the Internet

The survey revealed limited compliance with OGC Web Services implementation specifications. This is a concern because non-standard web services lack interoperable machine-to-machine interaction over a network. This generally means that more investment is required to integrate multiple jurisdiction data sets in a single viewing system, such as the National Map Portal. It also means that system maintenance costs will be higher as web services are likely to be tightly coupled with jurisdiction systems and linkages lost as systems are updated/evolve.

Those themes that rate low for OGC web service compliance are positioning (geodetic network), place names, land parcel and property, aerial photography, elevation, depth and land cover. However, it is important to note that many respondents do not know whether their data is compliant or not and therefore compliance levels may be higher. Further investigation is required.

Respondents for administrative boundaries and water data sets indicate 70% or higher compliance rates for Web Feature Services and 75% or higher compliance for Web Map Services. Geocoding addressing rated moderately compliant with 40% of respondents indicating compliance with OGC Web Map Services, and similar results were recorded for satellite and transport data (Figure 7).

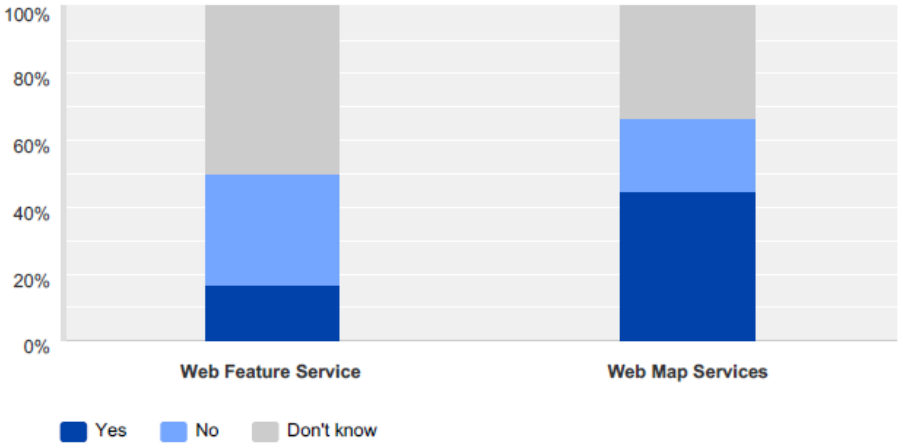

Figure 7: Compliance with OGC Web Services for Geocoded Addressing

Finding 3.2	Limited compliance with OGC Web Services
Proposition 3.2	Investigate and encourage compliance with minimum standards required for online access to ensure interoperability between the various software solutions

4.3 Metadata Format and Standards

The majority of jurisdictions collect descriptive metadata (data about data) in some form or other. This is a positive finding. Metadata helps search engines find and catalogue data, as well as enabling users to perform detailed searches and understand the context of data collections.

Ideally, metadata in standard machine-actionable form and is a far more robust solution for accessing data in repositories when compared with analogue methods.

Metadata is recorded in digital form for geocoded addressing, administrative boundaries, positioning, place names, land parcel and property, transport, and land cover. However, machine-readable metadata is limited. Nonetheless, metadata for these themes is generally compliant with the ISO standard.

Those data sets that exhibit a high level of machine-readable metadata are imagery, water and elevation. These themes also displayed a high level of compliance with the ISO 19139:2007 – Metadata XML Schema Implementation Standard. The Water Data Theme is depicted in Figure 8.

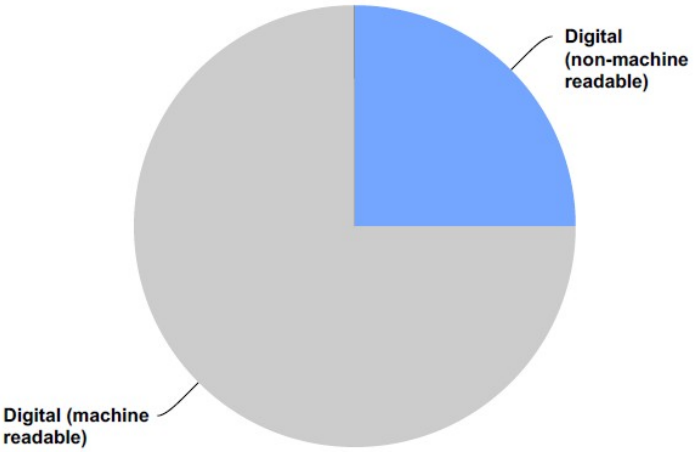

Figure 8: Compliance with OGC Web Services for the Water Data Theme

4.4 Unique Identifiers

For data to be readily aggregated into a seamless national product and support update propagation, a persistent global unique identifier (ID) is required for individual geographic features.

While all data sets for each data theme record a unique 'system' identifier, this is not appropriate for an aggregated national data set. There is a risk that data integrated from more than one provider may have the same unique 'system' feature ID. While IDs can be reassigned on import, the ability to automate updates and manage data lineage is significantly reduced and rework may be necessary to integrate updates.

On-the-fly federated data sets do not require global unique identifiers. A system unique identifier (ID) combined with Unique Resource Identifier (URI) will provide adequate differentiation[4].

Finding 3.2	Real-time updating of nationwide data sets is currently not possible
Proposition 3.2	Adopt Global Unique Identifiers to enable update propagation in a federated environment OR develop methods to federate data on-the-fly.

4.5 Data Storage and Archiving

The survey sought to understand how data is preserved across jurisdictions.

The land parcel and property data sets indicate the highest compliance with an information technology standard or government record keeping Act. In many cases respondents do not know whether their data storage and archival procedures complied with an Act and are unaware of agency guidelines for disposal.

Nonetheless, respondents do indicate that (a) data is maintained in a secure environment and transmitted through secure methods, and (b) data is held with adequate provision for long-term care including disaster recovery and backup procedures.

4.6 Software

There is a high level of commonality of software solutions across all jurisdictions with the majority using off-the-shelf GIS systems for their collection and maintenance. As an example, Figure 9 depicts the software used for imagery data. Place names and bathymetry are the only themes where in-house developed systems exist.

[4] CRCSI Program 3 is investigating on-the-fly federated data sets.

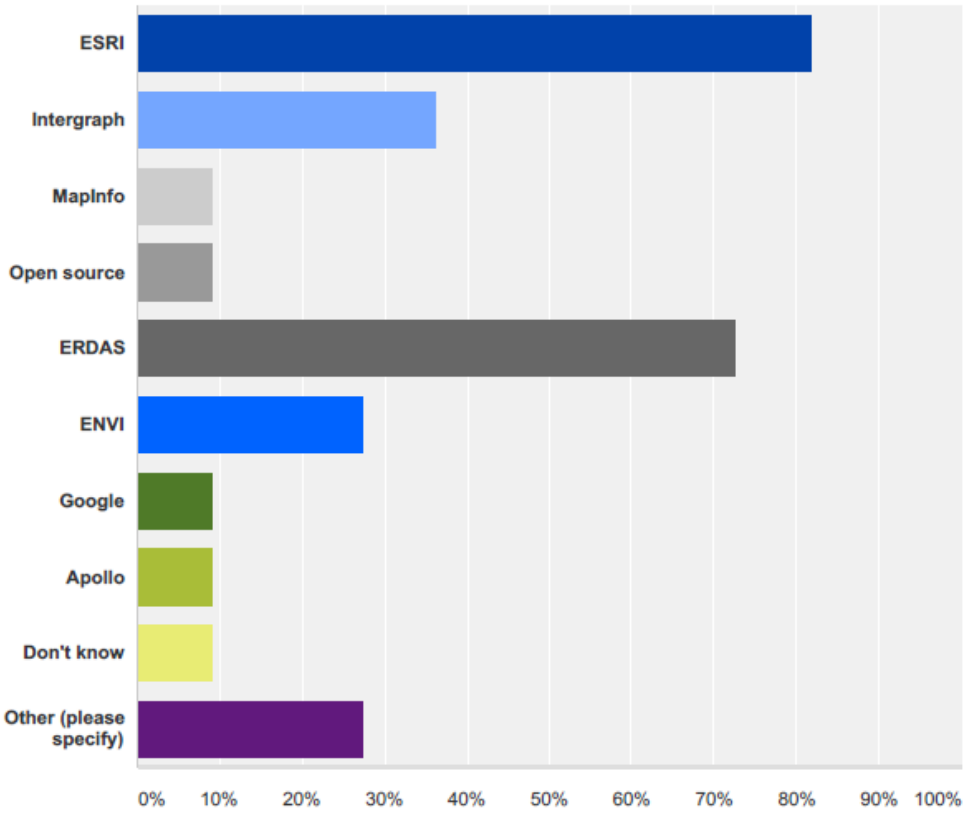

Figure 9: Software used for image data collection, manipulation and maintenance.

5. Data Quality

5.1 Positional Accuracy

Positional accuracy of data sets across all themes requires detailed comparative analysis to understand the similarities and differences between jurisdiction data sets.

Positional accuracy varies across jurisdictions and therefore, it is important that jurisdiction metadata captures the nature of positional accuracy in a uniform way so that accuracy statements can be developed for national data sets.

The following high level trends are observed from the survey results:

- The majority of respondents indicate that address geocodes are automatically calculated as a centroid of a cadastral parcel or placed within an address site boundary
- There is no clear accuracy statement for administrative boundaries; however a marginally higher number of respondents indicate boundaries are accurate to the digital representation of the natural feature to which they are aligned or are a digital representation based on survey accurate cadastral coordinates.
- Respondents indicate place names are mainly interpreted from hardcopy maps or imagery. However, a broad range of methods are used and therefore accuracy statements vary.
- The majority of aerial photography in urban regions is ±0.1m and rural regions is ±0.2m. There is little commonality for positional accuracy for remote regions.

- Respondents estimated the positional accuracy across their whole land parcel and property boundary data sets. When aggregated the nationwide accuracy statement is in the order of[5]:
  - Survey accurate coordinates (25%)
  - Transformed from survey accurate position (24%)
  - Digitised map representation (19%)
  - Other (22%)
- There are no significant positional accuracy trends for transport, water, elevation, depth and land cover.

Finding 4.1	Positional accuracy varies across jurisdiction data sets
Proposition 4.1	Develop a uniform approach and minimum level of metadata to enable positional accuracy statements for national data sets.

5.2 Completeness

Prior to making data accessible it is important to understand if there are any issues associated with incomplete data sets that may impact end-users. Some respondents indicate that back capture, process improvement and the collection of new data is required to complete data sets.

Issues for data sets are listed below along with the number of jurisdictions that identified with the problem. The number and complex nature of these issues suggest that an incremental program of work is required to tackle data improvement priorities.

- Geocoded Addressing
  - Back-capture of gated community (complex) addresses (6)
  - Capture indigenous community addresses (4)
  - Complete remote and rural addressing (4)
  - Addresses that are missing because they are unknown (8)
  - Multiple buildings within a property are not represented in their physical location (8)
  - Some addresses are not compliant with the AS/NZS 4819-2011 (4)
- Administrative boundaries
  - There are incorrect administrative boundaries as we are not notified about changes (3)
  - Administrative boundaries require spatially upgrading (5)
  - Contains historical boundaries that do not comply with policies and guidelines (4)

Positioning

  - There are edge matching issues at jurisdictional boundaries (1)
  - Private industry have survey marks that we do not know about (1)
  - Survey marks are recorded in the database but may no longer exist on the ground (7)
  - Some data is in analogue format (5)
  - Conversion to the new datum 2015 (4)
  - New CORS sites are yet to be established (5)

[5]Note: This is not an indication of positional accuracy for individual jurisdictions as some jurisdictions have completed spatial upgrades and indicate close to 100% survey accurate land parcel digital representations.

- Place Names
  - There are places that exist but are not named due to resourcing/process issues (9)
  - Incorrect Spelling (6)
  - The 'origin' of a name is not routinely collected (5)
  - Place names exist but the features are no longer in existence (8)
  - The spatial positioning and thus representation of features is not the same at state/territory borders i.e. mountain range, desert, water body (1)
  - Contains names that do not comply with current policies and guidelines (5)
  - Place names are not linked to a spatial representation – point, line polygon (1)
  - Dual naming not supported (1)
- Imagery
  - Some aerial photography in analogue format (7)
  - Gaps in coverage across the jurisdiction (4)
  - Edge matching issues at jurisdictional boundaries (3)
- Land Parcel and Property
  - Spatial upgrade is incomplete resulting in varying degrees of positional accuracy (8)
  - Not all land parcels have a geocoded addresses (5)
  - Planned parcels are not included in the land parcel property data set (4)
  - Limited vertical integration with rights, restriction and responsibilities (7)
- Transport
  - There are edge matching issues at jurisdictional boundaries (4)
  - Proposed road and rail networks are not part of the transport database (2)
  - Road, rail and aviation names are inconsistent with the authoritative place names (1)
  - Road and rail data is not a network 'topological' model (1)
- Water
  - Data captured under the National Topographic Information Coordination Initiative (NTICI) is not completely integrated with jurisdiction data (3)
  - Data is not consistent with the GEODATA Topo-250K series produced by Geoscience Australia and the Geofabric dataset by produced by BOM (1)
  - Edge matching issues along jurisdictional boundaries (3)
  - Water feature names not consistent with the authoritative place names database (1)
  - Water network is not a 'topological' model (3)
- Elevation
  - Gaps in coverage across the jurisdiction (8)
  - Edge matching issues at jurisdictional boundaries (4)
  - Existence of vertical error associated with collection processes (4)
  - Systematic errors due to current procedures (1)
  - Random errors beyond our control (3)

- Depth
  - There are gaps in coverage across jurisdiction waters (2)
  - There are edge matching issues at jurisdictional boundaries (1)
- Land Cover
  - Buildings captured under the National Topographic Information Coordination Initiative (NTICI) are not completely integrated with jurisdiction data (2)
  - There are edge matching issues at jurisdictional boundaries (5)
  - There are gaps in coverage across the jurisdiction (5)

Finding 4.2	Data themes are not complete and data improvement is required.
Proposition 4.2a	Market research is required to better understand what improvement actions will add the most value for consumers.
Proposition 4.2b	Develop a work plan for data improvement priorities
Proposition 4.2c	Investigate the funding necessary to achieve data improvements and develop strategies to mitigate risks, such as technical barriers and lack of skilled resources.

5.3 Currency

Timeliness is one of the key market differentiators for consumers and spatial data products are no different. The following information indicates the predominant maintenance cycles for data under each theme.

- Geocoded addresses are updated daily (45%) or weekly (55%)
- Administrative Boundaries are updated daily (7%); weekly (23 %); and monthly or more (45%)
- Geodetic Network is updated weekly (100%). However there is a lag between lodgement and database updating that can be as long as 1 year in 2 jurisdictions.
- Place names are updated daily (22%); weekly (44%) and monthly (11%)
- Imagery is generally updated in metropolitan regions every 1-2 years; 5 years in rural regions and 10 years or more in remote areas.
- Land parcel boundaries are updated daily (11%); within a week (45%); and monthly or more (33%).
- Roads are updated daily (43%) and two jurisdictions have a 5 day turnaround. Other jurisdictions indicate 3 month cycles. There a no formal update cycles for rail and aviation.
- Water features often have update cycles of more than 2 years (50%) in urban, rural and remote locations.
- Elevation (DEM) data is updated every 1-2 years in some jurisdictions (40%) and more than 2 years in others (40%).
- The update cycle for near shore bathymetry is one year (1 jurisdiction) and 3 years in other Australian waters (1 jurisdiction). All other respondents do not know.
- Land cover is updated annually in metropolitan regions (50%); 3-5 years or more in rural areas (50%), and 5-10 years or more in remote areas (50%)

It is important to note that data within some themes, such as elevation and water, will not change as often as others and therefore update cycles are normally over longer periods.

The FSDF Data Themes, at best, will only be as current as the jurisdiction data sets, and this is assuming real-time updating is implemented. What is important, is to understand what the consumer requires of data currency.

Finding 4.3	Little is known about how often data should be updated to meet the needs of end users.
Proposition 4.3	Market research is required to better understand the value proposition afforded to consumers from having access to real-time updated data sets

5.4 Consistency

The question relating to consistency endeavoured to understand if there are discrepancies between similar data sets, as this may impact on users and can have negative consequences for emergency service response, service delivery and personal navigation. Validation is often used to manage potential inconsistencies. The survey revealed the following:

- Regular validation occurs for geocoded address data sets, usually against local government rates notices.
- Administration boundaries are not regularly validated against other data sets as jurisdiction data is recognised as the authoritative source. However, 23% indicate that validation occurs along state/territory borders.
- Place names are generally not validated, although topographic databases, other state/territory place names data sets and admiralty charts were noted as data validation sources (<20%).
- Land parcel and property is regularly audited against other data and adjusted to fit accurate controls where necessary i.e. least squares adjustment (67%).
- Roads data is validated against a jurisdiction transport authority dataset (57%) but only 30% indicate validation occurs along jurisdiction borders.
- Water data is validated against the jurisdiction water authority dataset (50%) and GEODATA Topo-250k data (50%). Only 38% indicate validation occurs along borders.
- Elevation is generally not integrated or consistent with topographic data themes (streams, lakes, hills etc.) (>30%) although one respondent indicated it depends on the data source.
- Bathymetry data is seamlessly integrated with coastal elevation models according to 40% of respondents.
- Land cover data are not regularly validated.

Given the high level of duplication in some data themes, it is plausible that data validation is warranted. This is supported by the fact that many themes are inconsistent across borders. Further investigation is required to understand the value of data validation.

Finding 4.4	Data validation is not adopted widely
Proposition 4.4	Investigate the value of automated data validation methods, particularly for trans-border data management in spatial supply chains

5.5 Feedback

Feedback mechanisms help to improve the integrity of data and the understanding of customer needs. Methods of feedback range from online services (one or two-way), to more traditional email/phone/fax methods. The majority of respondents noted that there is a mechanism in place for the community to notify custodians of new or modified features. However, the majority predominantly use traditional methods with the exception of the following:

- Place names use online (one way) methods (60%) and land cover data (70%) (Figure 10).
- The land parcel boundaries seldom have mechanisms, however where systems are in place they are generally online (30%).
- Transport, water, and elevation rarely have a feedback mechanism and bathymetry not at all.

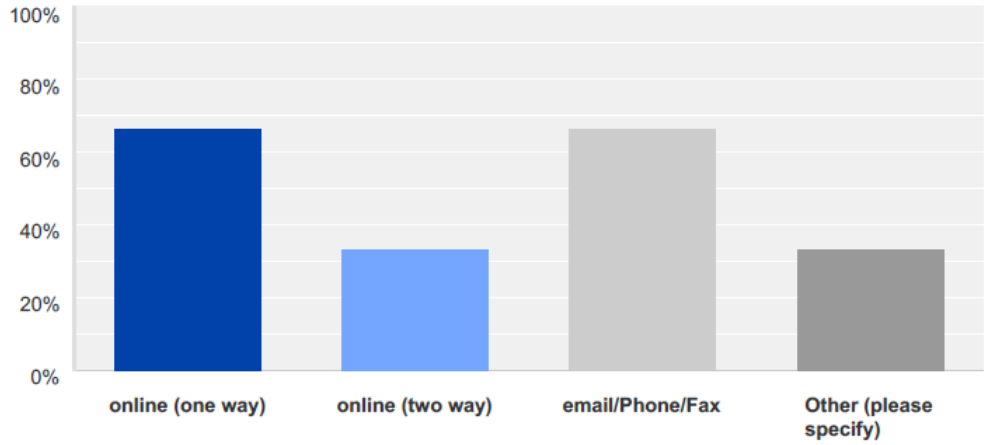

Figure 9: Land cover feedback mechanisms (respondents could choose more than one option).

Finding 4.5	Limited online mechanisms to receive feedback from the community.
Proposition 4.5a	Research and development directed towards systems that enable community or trusted partner engagement to assist in the maintenance of data sets.
Proposition 4.5b	Solutions that support the automatic integration of volunteered data with authoritative sources.

6. Usage

6.1 Intended Purpose

This survey question looks at the intended purpose of data from a producer's perspective and asked respondents to rate its fitness for purpose.

The categories identified reflect those specified as the purpose[6] for each FSDF Data Theme as well as other purposes included for completeness and comparison.

With the exception of the Depth Data Theme, respondents indicate that data is either well suited or good enough for the majority of purposes listed. The following strengths and weaknesses provide an insight into the main purpose of each theme.

- **Geocoded addressing** is well suited to communication, address validation, service delivery, emergency response, voter registration and land administration; and good enough for demographic analysis and socio-economic analysis. However, 50% were unsure if address data is suited to fraud prevention.
- **Administrative boundary** data is well suited to a broad range of purposes (Figure 2).
- **Positioning** data is well suited to most purposes including mapping, land administration, asset management infrastructure development, personal navigation, precision agriculture and meteorology.
- **Place names data** is well suited to mapping and emergency services, and good enough for personal navigation, land administration, and cultural identity and heritage. The majority of respondents are unsure whether place names are suited to indexing functions and spatial accounting.
- **Imagery** is well suited to mapping, disaster management, land usage and urban planning; and good enough for climate change, hazards risk management, tourism, natural resource management, and defence and national security. In the main, imagery is regarded as not suited to geological science.
- **Land parcel and property** is most suited to mapping, land administration, land valuation, service delivery, emergency response and heritage protection. However, respondents are unsure of its suitability to water and carbon accounting.
- **Transport** data is well suited to emergency response, mapping, disaster management, and recreation and tourism; but not suited to intelligent transport systems.
- **Water** data is suitable for mapping and good enough for emergency response, disaster management, recreation and tourism, mining, environmental monitoring and natural resource management.
- **Elevation** data is good enough for land usage, mapping, social economic analysis, and recreation and tourism; but it is unclear whether it is fit for the purpose of climate change applications, hazard risk assessment, engineering and mining. Some responses suggest elevation data is not suited to climate science, and engineering and mining projects.
- **Depth** data sets do not rate highly as being well suited or good enough across a range of purposes. The majority of respondents are unsure of the 'fit for purpose' nature of this data set; and 40% of respondents felt that their bathymetry data is not suited to navigation purposes.
- **Land Cover** is mostly suited to natural resource management, and good enough for mapping, water management, salinity mapping, hazard risk assessment, socio-economic analysis, land usage, disaster management and emergency response; but not suited to geological science.

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[6] FSDF Data Theme purpose is drawn from the ANZ Foundation Data Framework narratives, available at http://www.anzlic.gov.au/foundation_spatial_data_framework

Further investigation is required to understand why some data sets are not suited for a particular purpose as it is not clear if a lack of suitability is related to data schemas, accessibility, formats, completeness or technical issues.

In addition, there is a need to understand 'fit for purpose' from a user's perspective. This means understanding what the value of each spatial data set is to the consumer, and being able to communicate this value in an easily understood way.

Finding 5.1	Some data sets are not suited to FSDF intended purposes.
Proposition 5.1	Compare and contrast the suitability of each data set against the intended FSDF purpose and investigate reasons where there is significant divergence.
Finding 5.2	The value of the FSDF Themes to the consumer cannot be determined from this survey population.
Proposition 5.2	Investigate the value proposition of FSDF themes to consumers to understand whether they are fit for purpose in the user context.

6.2 Usability

The survey sought to understand if customers had to convert or manipulate spatial data before it could be used. Many of the respondents for geocoded addressing, positioning, and transport indicated that this is the case (Table 2). However, the reasons are not clear and could include inflexible data schemas, system incompatibility issues and end-user value enhancements. More investigation is required.

In addition, many respondents indicated that they simply 'do not know' if their customers have to manipulate data or not[7]. This indicates that in some jurisdictions there is a disconnect between data producers and users, potentially due to organisational structures that lack strong customer interfaces between these groups. A lack of customer knowledge is a characteristic of place names, land parcel and property, depth and land cover data, which recorded over 50% 'don't know' responses.

Data Theme	Yes (%)	No (%)	Don't Know (%)	Data Theme	Yes (%)	No (%)	Don't Know (%)
Geocoded Addressing	44	12	44	Land Parcel and Property	0	44	56
Administrative Boundaries	15	46	39	Transport	43	14	43
Positioning	50	25	25	W	12	38	50
Place Names	0	22	78	Elevation	0	50	50
Imagery	11	56	33	Depth	20	20	60
Land Cover	25	12	63				

[7] This question only asked if data had to be manipulated before use and did not ask about the extent of likely value-adding.

Finding 5.3	Data is not necessarily suited to multiple business/user needs.
Proposition 5.3	Investigate reasons why data is not suited to multiple uses including data schemas, accessibility, formats, completeness or technical issues.
Finding 5.4	There is a lack of awareness of how data is used by customers.
Proposition 5.4	Develop use cases for data manipulation processes applied by customers to better understand their needs.

6.3 Industry Sectors

The survey sought information on the level of cross-sector usage of spatial datasets to understand market penetration trends. However, the survey does not provide an insight into what customers want and this aspect warrants consideration in the future.

The survey revealed that land parcel and property, imagery and transport data sets have the highest level of cross sector penetration. Geocoded addressing, imagery and water have a moderate to high level of dispersion, while positioning, place names, elevation, depth and land cover are predominately used by the government sector only. Examples are provided below.

- **Geocoded addressing** is predominantly entrenched in the utilities (electricity, gas and water), government departments, local government, real estate and property, insurance, telecommunications, administrative support, health care, and social assistance sectors. Respondents have limited visibility across the agriculture, forestry, conservation, aquiculture and fishing, mining, manufacturing, information media, scientific and technical services, and recreation services. Approximately 30% of respondents had no visibility of data usage at all.
- **Administrative boundary** data is mostly used by government departments. However, results suggest a low to medium level of use across other industry sectors.
- **Positioning** data is mainly used by government departments, local government, utilities, construction, and mining; and is used moderately by the agriculture, forestry, and conservation sectors.
- **Place names** are mainly used in government departments and local government.
- Imagery use is significant across all sectors except financial, administrative, retail and telecommunications functions.
- **Land parcel and property** data are well embedded in the government, telecommunication, utility, and real estate sectors but have moderate penetration in other sectors. The majority of respondents have visibility of usage across all sectors.
- **Transport** data is mostly used in the government and utilities sectors with moderate adoption in the agriculture, tourism and forestry sectors.
- **Water** data has limited cross sector usage. Government, conservation and utility sectors are the predominant users. However, there is low to moderate usage across the insurance, scientific, agriculture, forestry and aquiculture sectors.
- **Elevation** data has a high level of use in the government sector. Other industries display a moderate level of usage including agriculture, forestry, conservation, utilities, insurance and scientific sectors. Approximately 50% of respondents have no visibility of usage at all.
- **Depth** data indicates a low level of usage across all sectors. However, approximately 40% of respondents indicated that they had no visibility of industry sector uses.
- **Land Cover** is mostly used in professional and scientific fields. Responses also indicate government, conservation, forestry and agriculture usage is high.

Finding 5.5	The level of usage by industry sector is unclear from this survey, which only signifies industry sector trends
Proposition 5.5	Market research is required to better understand what level of functionality, completeness and currency consumers want from the FSDF Data Themes

7. Alignment with FSDF Future Needs

The survey sought to understand the gaps between what jurisdictions are currently able to provide and the functionality envisaged for the future FSDF.

At this point in time, there are no jurisdictions that are able to deliver on all future FSDF requirements. Responses indicate that current capabilities are extremely diverse. For example, while some jurisdictions able to deliver on aspirational goals now; for others the same functionality is seen as an unlikely or long term deliverable.

The following provide a general overview and predominant trends for the current state of jurisdiction data with respect to FSDF requirements:

- There is only one (1) criterion where all jurisdictions indicate that an FSDF future requirement is already achieved. This is the ability to distinguish official place names from unofficial place names.
- **Real-time** delivery of data updates is envisaged as a short to long term goal for most themes, with the exception of water, depth and land cover where this is not an FSDF requirement.
- **CC-BY at zero cost** is unlikely for positioning, land parcel and property, imagery, transport, elevation and depth.
- In the main, **positional accuracy** requirements of FSDF themes have moderate achievability with administrative boundaries, water, elevation, depth and land cover having a high number of respondents suggesting accuracy requirements are unachievable.
- The preservation of **historical** data is not a requirement for all FSDF Data Themes. Respondents for geocoded addressing indicate historical data is unlikely to be preserved; whereas administrative boundaries and land cover respondents mainly indicate short to long term achievability for keeping data record histories. The majority of place names' data sets already collect historical content.
- The FSDF Themes require **enhanced dataset content** and specifications are unique to each theme. The majority of themes display short to long term achievability. However, the enhancements required for geocoded addressing, water, depth and land cover themes are felt to be unachievable by many respondents.
- The **two-way feedback** mechanism is unlikely to be achieved for administrative boundaries, land parcel and property, imagery and depth.

The perceived barriers include limited funding, lack of skilled resources, technical limitations and that activities are not recognised as either a business priority or policy.

Financial and strategic focus are the most often cited barriers to achieving aspirational goals. This is likely because the respondents are drawn from a population of data managers who may have less opportunity to influence funding and business direction and, as a consequence, these barriers manifest as insurmountable obstacles.

At a strategic level, decision makers have the opportunity to assuage these barriers through firm direction setting and a multi-faceted strategy that considers sustainable business models at a jurisdiction and national level.

Interestingly, technical limitations is the least perceived barrier, suggesting data managers have the 'knowhow' to deliver enhanced content, real time delivery and improved positional accuracy.

Where technical limitations are sighted, these are usually accompanied by a perceived lack of skilled resources or where automated methods are not available.

Technical limitations are noted in relation to:

- 3-dimensional data modelling (geocoded addressing and land parcel and property themes)
- Enhanced classification systems to achieve commonality across jurisdiction models
- Development of complex relationships between date elements within a data schema
- Establishment of relationships across data sets including vertical integration
- Data correspondence across state/territory borders
- Two-way mechanism for user notifications and feedback

Finding 6.1	Limited funding and lack of business priority is likely to impact on the delivery of FSDF aspirational goals.
Proposition 6.1	Provide clear strategic direction and road map for each data set within a data theme and consider funding requirements for new initiatives.
Finding 6.2	Technical solutions do not exist for suitable 3D models and enhanced semantic classification schemas.
Proposition 6.2	Research and development required into 3D solutions and enhanced data models[8]

[8] University of Melbourne and CRCSI Program 3 Research respectively.

Appendix A: Survey Population

Theme	Number of Respondents	Jurisdiction
Geocoded Addressing	9	ACT, VIC, QLD, SA, NT, NSW, WA, TAS, New Zealand
Administrative Boundaries	13	ACT, VIC, QLD, SA, NT, NSW, WA, TAS, New Zealand Australian Electoral Commission Australian Bureau of Statistics Geoscience Australia PSMA
Positioning	8	ACT, QLD, SA, NT, NSW, WA, TAS Geoscience Australia
Place Names	9	ACT, VIC, QLD, SA, NT, WA, TAS, New Zealand Geoscience Australia
Imagery	9	ACT, QLD, SA, NT, NSW, WA (x2 Satellite and Aerial), TAS Geoscience Australia
Land Parcel and Property	8	ACT, VIC, QLD, SA, NT, NSW, WA, TAS
Transport	7	ACT, VIC, SA, NT, NSW, WA, TAS
Water	8	VIC, SA, NT, NSW, TAS, New Zealand Bureau of Meteorology Geoscience Australia
Elevation	10	ACT, VIC, QLD, SA, NT, NSW, WA, TAS, New Zealand Defence
Depth	5	VIC, SA, NT, TAS, New Zealand
Land Cover	8	ACT, VIC, SA, NT, WA, TAS, New Zealand Geoscience Australia

Appendix B: Findings

1. Governance	
Finding 1.1 Custodianship is not fully understood or recognised	**Proposition 1.1** Produce a register of recognised data custodians for data sets in each FSDF Data Theme
Finding 1.2 The collection and management of data sets is not a formally mandated function under some of the data themes	**Proposition 1.2** Consider formalising mandates for data collection and management where none exist
Finding 1.3 Policy and legislation is not consistently administered across jurisdictions	**Proposition 1.3** Seek alignment of policy/legislation across all jurisdictions focussing on consistent application and outputs as a priority
Finding 1.4 The supply chains for many data sets are characterised by data duplication	**Proposition 1.4** Research is required to model the web of multiple networks and relationships that exist in current spatial data supply chains with a view to addressing the gaps in capability
Finding 1.5 There is no Intellectual Property Rights Management (IPRM) model for national datasets	**Proposition 1.5** Investigate an agreed policy for intellectual property management, open/exclusive innovation rights and/or instruments to manage shared intellectual property
2. Accessibility	
Finding 2.1 Bathymetry data is not readily accessible to the public	**Proposition 2.1** Investigate if there is a consumer need for the inclusion of nationwide bathymetry data in an online environment
Finding 2.2 There is no common financial model for data sets across jurisdictions making it difficult to collaborate on equal terms	**Proposition 2.2** Investigate and develop a financial model for FSDF Data Themes, one that is sustainable over the longer term
Finding 2.3 There is no common Licensing Framework for data sets across jurisdictions	**Proposition 2.3** Investigate and develop a License Framework for FSDF Data Themes, one that supports collaboration over the longer term on each data set
3. Data Standards and Metadata	
Finding 3.1 There is limited adoption of data standards across FSDF Data Themes	**Proposition 3.1a** Jurisdictions to progressively comply with FSDF nominated standards OR **Proposition 3.1b** Research and develop methods to aggregate data sets that have different data schemas

Finding 3.2 Limited compliance with OGC Web Services	**Proposition 3.2** Investigate and encourage compliance with minimum standards required for online access to ensure interoperability between the various software solutions
Finding 3.3 Real-time updating of nationwide data sets is currently not possible	**Proposition 3.3** Adopt Global Unique Identifiers to enable update propagation in a federated environment OR develop methods to federate data on-the-fly
4. Data Quality	
Finding 4.1 Positional accuracy varies across jurisdiction data sets	**Proposition 4.1** Develop a uniform approach and minimum level of metadata to enable positional accuracy statements for national data sets
Finding 4.2 Data themes are not complete and data improvement is required	**Proposition 4.2a** Market research is required to better understand what improvement proposals will add the most value for consumers **Proposition 4.2b** Develop a work plan for data improvement priorities **Proposition 4.2c** Investigate the funding necessary to achieve data improvements and develop strategies to mitigate risks such as technical barriers and lack of skilled resources
Finding 4.3 Little is known about how often data should be updated to meet the needs of end users	**Proposition 4.3** Market research is required to better understand the value proposition afforded to consumers from having access to real-time updated data sets
Finding 4.4 Data validation is not adopted widely	**Proposition 4.4** Investigate the value of automated data validation methods particularly for trans-border data management in spatial data supply chains
Finding 4.5 Limited online mechanism to receive feedback from the community	**Proposition 4.5a** Research and development directed towards systems that enable community or trusted partner engagement to assist in the maintenance of data sets **Proposition 4.5b** Solutions that support the automatic integration of volunteered data with authoritative sources

5. Usability	
Finding 5.1 Some data sets are not suited to FSDF intended purposes	**Proposition 5.1** Compare and contrast the suitability of each data set against the intended FSDF purpose and investigate reasons where there is significant divergence.
Finding 5.2 The value of the FSDF Themes to the consumer cannot be determined from this survey population	**Proposition 5.2** Investigate the value proposition of FSDF themes to consumers to understand whether they are fit for purpose in the user context
Finding 5.3 Data is not necessarily suited to multiple business/user needs	**Proposition 5.3** Investigate reasons why data is not suited to multiple uses including data schemas, accessibility, formats, completeness or technical issues.
Finding 5.4 There is a lack of awareness of how data is used by customers	**Proposition 5.4** Develop use cases for data manipulation processes applied by customers to better understand their needs.
Finding 5.5 The level of usage by industry sector is unclear from this survey, which only signifies industry sector trends.	**Proposition 5.5** Market research is required to better understand what level of functionality, completeness and currency consumers want from the FSDF Data Themes
6. Alignment with FSDF Aspirational Goals	
Finding 6.1 Limited funding and lack of business focus is likely to impact on the delivery of FSDF aspirational goals	**Proposition 6.1** Provide clear strategic direction and road map for each data set within a data theme and consider funding required for new initiatives
Finding 6.2 Technical solutions do not exist for suitable 3D models and enhanced semantic classification schemas	**Proposition 6.2** Research and Development required into 3D (vector) modelling and semantic ontologies

Appendix C: Aspirational Goals

Geocoded Addressing

FSDF Requirement	Achievability (in the main)	Barrier
Geocoded Address data delivered nationally in real-time	Short-Long Term	Funding
For each property there is an officially assigned address	Mostly Achieved or Long Term	Business Policy
Addresses are recorded in your address database within 2 days of assignment by the local authority etc	Short-Long Term	Funding, lack of skilled resources
The address database is updated daily	Mostly Achieved	Funding
Each address will include a number on the road	Mostly Achieved or Long Term	Funding
Each address will include at least one geocode	Mostly Achieved	Funding
Each address will include a persistent identifier	Mostly Achieved	Funding
The dataset will include a relationship to historical addresses	Unlikely	Not a business priority or policy
The dataset will include the currency of the address information	Mostly Achieved	Funding
The dataset will include the relationships between sub-addresses and primary addresses	Mostly Achieved or Long Term	Lack of skilled resources, technical limitations and not a business priority
The dataset will include physical Addresses in multi storey buildings defined in 3D	Unlikely	Funding, technical limitations
The dataset will include complete and current indigenous communities	Long Term	Funding, Technical limitations
The dataset will include complex addresses within facilities that have private road addresses	Unlikely	Lack of skilled resources, technical limitations and not a business priority
The dataset will include multiple buildings within a property	Unlikely	Funding
The supply chain will include a two-way mechanism for user notifications/feedback (additions and changes)	Mostly Achieved or Long Term	Funding, technical limitations, not a business priority
Be available nationally under CC-BY at zero cost	Mostly Achieved or Long Term	Not a business policy

Blue = High Achievability; Green = Moderate Achievability; Orange = Low Achievability or Unlikely

Administrative Boundaries

FSDF Requirement	Achievability(in the main)	Barrier
Be delivered nationally and in real-time	Short Term	Other
Have an official name for each Administrative Boundary	Mostly Achieved	NA
Record boundary changes within 2 days of approval	Unlikely	Not a business priority
Have a data schema that can be extended to include other categories of administration boundary information	Mostly Achieved or Long Term	NA
Link boundaries to feature representations, such as cadastral boundaries and natural landmarks, to which they are legally described	Mostly Achieved or Long Term	Other
Maintain historical boundaries for comparative analysis	Mostly Achieved or Long Term	Not a business priority
Ensure the Jurisdiction administrative boundary data aligns with ABS Statistical Geographic Boundaries	Unlikely	Other
Ensure the Jurisdiction administrative boundary data aligns with Australian Electoral boundaries	Unlikely	Not a business priority or policy
Ensure the Jurisdiction administrative boundary data aligns with adjacent State/Territory Borders	Short Term	Funding, Not a business priority, other
Be available nationally under CC-BY at zero cost	Mostly Achieved or short Term	Other
Provide a two-way mechanism for user notifications/feedback	Unlikely	Funding, Not a business priority, other

Blue = High Achievability; Green = Moderate Achievability; Orange = Low Achievability or Unlikely

Positioning

FSDF Requirement	Achievability (in the main)	Barrier
Contribute to a nationwide positioning system in real-time	Mostly Achieved or Long Term	Funding, Not a business priority, other
Deliver coordinated, centimetre accuracy real time positioning services	Mostly Achieved or Long Term	Funding, Not a business priority
Be augmented with fully multi-GNSS capable, high integrity, trusted CORS network with a 200 km inter-station spacing	Mostly Achieved or Long Term	Funding, Not a business policy
Have consistent edge matching across state and territory borders	Short Term	Funding
Be consistent and complete in the classification, status and delineation of Positioning data, nationally	Long Term	Lack of skilled resources
Be compliant with GeodesyML data transfer standard	Short-Long Term	Funding, Lack of skilled resources
Be available nationally under CC-BY at zero cost	Unlikely	Not a business priority or policy
Provide a two-way mechanism for user notifications/feedback	Long Term	Funding

Blue = High Achievability; Green = Moderate Achievability; Orange = Low Achievability or Unlikely

Place Names

FSDF Requirement	Achievability (in the main)	Barrier
Be delivered to national aggregator in real-time	Long Term - Unlikely	Funding
Include the physical extent of a place (feature)	Long Term	Funding, not a business priority
Have a spatial accuracy of ±10m	Long Term	Funding, not a business priority
Include alias and historical place names	Mostly Achieved	NA
Distinguish official from unofficial names	Achieved	NA
Include government buildings and service delivery points	Long Term	Funding, not a business priority
Have place names that correspond across state and territory borders (toponomy and geometry-wise)	Long Term	Funding, technical limitations, not a business priority
Name all indigenous locations	Long Term	Funding, not a business priority
Include Road Names	Mostly Achieved or Short Term	NA, technical limitations, not a business priority or policy
Provide all Place names including Road Names and Features of Interest as CC BY at zero cost	Mostly Achieved or unlikely	NA, Not a business Policy
Provide a two-way mechanism for user notifications/feedback (additions and changes)	Mostly Achieved or Long Term	Not a business priority

Blue = High Achievability; Green = Moderate Achievability; Orange = Low Achievability or Unlikely

Land Parcel and Property

FSDF Requirement	Achievability (in the main)	Barrier
Be updated daily	Long Term	Technical limitations
Be a nationwide dataset delivered in real-time	Long Term	Funding, technical limitations, not a business priority
Be associated with a Primary and or Secondary Addresses	Long Term	Technical limitations
Have ±1m accuracy in urban regions	Long Term	Funding
Have a spatial accuracy of ±10m rural regions	Long Term	Funding, lack of skilled resources, technical limitations
Have lot on deposited plan/diagram	Mostly Achieved	NA
Include public rights (i.e. access)	Mostly Achieved or Long Term	NA
Include secondary rights (i.e. easements/covenants)	Unlikely	Technical limitations, not a business priority or policy
Consistent edge matching across state and territory	Short Term	Funding, not a business priority
Include proposed subdivisions (pre-calculations)	Long Term	Technical limitations
Allow for integration with other datasets to depict rights restrictions and responsibilities	Long Term	Funding, lack of skilled resources, not a business priority
Visualise property data in 3D	Long Term	Funding, technical limitations
Be available nationally under CC-BY at zero cost	Unlikely	Not a business policy
Provide a two-way mechanism for user notifications/feedback (additions and changes)	Short-Long Term	Technical limitations

Blue = High Achievability; Green = Moderate Achievability; Orange = Low Achievability or Unlikely

Imagery

FSDF Requirement	Achievability (in the main)	Barrier
Contribute to nationwide imagery products	Mostly Achieved or Long Term	Funding, not a business priority
Have seamless coverage of imagery across the jurisdiction	Mostly Achieved or Long Term	Funding
Have very high to high resolution in urban areas annually	Mostly Achieved	Funding
Have medium resolution in regional areas annually	Mostly Achieved or Unlikely	Funding
Generally be of low resolution and high frequency in remote areas	Mostly Achieved or Unlikely	Funding
Be available nationally under CC-BY at zero cost	Unlikely	Not a business policy
Provide a two-way mechanism for user notifications/feedback (additions and changes)	Mostly Achieved or Unlikely	Funding, technical limitations, not a business priority

Blue = High Achievability; Green = Moderate Achievability; Orange = Low Achievability or Unlikely

Transport

FSDF Requirement	Achievability (in the main)	Barrier
Contribute to the nationwide dataset in real-time	Short-Long Term	Funding
Include new roads within 2 weeks of gazettal	Mostly Achieved	Lack of skilled resources
Have ±1m accuracy in urban regions	Long Term	Funding
Have a spatial accuracy of ±10m rural regions	Mostly Achieved or Short Term	Funding
Have consistent edge matching across state and territory borders	Mostly Achieved or Long Term	Not a business priority
Be consistent and complete in the classification, status and delineation of transport features, nationally	Mostly Achieved or Long Term	Funding, not a business priority
Include all public transport networks	Achieved or Long Term	Funding, not business policy
Be linked/networked to other transport themes	Long Term	Funding, not a business priority
Be available nationally under CC-BY at zero cost	Unlikely	Not business policy
Provide a two-way mechanism for user notifications/feedback (additions and changes)	Short Term	Funding, technical limitations

Blue = High Achievability; Green = Moderate Achievability; Orange = Low Achievability or Unlikely

Water

FSDF Requirement	Achievability (in the main)	Barrier
Include new water features within 2 weeks of notification	Long Term or Unlikely	Funding, lack of skilled resources
Contribute to the nationwide dataset in real-time	Long Term or Unlikely	Funding, not a business priority
Contribute water data nationally as per the Water Regulations 2008	Long Term or Unlikely	Funding, not a business policy
Have ±1m accuracy in urban regions	Long Term or Unlikely	Funding, not a business priority
Have a spatial accuracy of ±10m rural regions	Long Term or Unlikely	Funding
Contain a high precision stream hierarchy	Short to Long Term or Unlikely	Funding
Have consistent edge matching across state and territory borders	Short Term	Lack of skilled resources
Be consistent and complete in the classification, status and delineation of Water features, nationally	Long Term	Funding, not a business priority
Be integrated with Land Parcel and Property and Administrative Boundary Data Themes	Long Term	Funding, not a business priority
Be compatible with elevation datasets	Short-Long Term	Funding
Be compliant with emerging Water Data Transfer Format	Short Term	Lack of skilled resources, not a business priority
Support modelling of water flows in 3D	Mostly Achieved or Unlikely	Lack of skilled resources, not a business priority
Be available nationally under CC-BY at zero cost	Mostly Achieved or Short Term	Not business policy
Provide a two-way mechanism for user notifications/feedback (additions and changes)	Short Term	Funding, lack of skilled resources

Blue = High Achievability; Green = Moderate Achievability; Orange = Low Achievability or Unlikely

Elevation

FSDF Requirement	Achievability (in the main)	Barrier
Contribute to nationwide elevation products	Mostly Achieved or Long Term	Funding, technical limitations
Have seamless integration of elevation coverage across the jurisdiction	Mostly Achieved or Long Term	Funding, technical limitations, not a business priority
Have ±1m contours/spot height accuracy in urban regions	Mostly Achieved or Long Term	Funding, lack of skilled resources
Have a contours/spot height accuracy of ±10m rural areas	Mostly Achieved or Long Term	Funding,
Have ‹5m cell sizing or urban , coastal, environmental and high risk regions	Mostly Achieved or Long Term	Funding, lack of skilled resources
Have 10m cell sizing for rural regions	Mostly Achieved or Long Term	Funding, lack of skilled resources
Have 30m cell sizing for remote regions	Mostly Achieved or Long Term	Funding, lack of skilled resources
Have consistent edge matching across state and territory borders	Long Term or Unlikely	Not a business priority
Be consistent and complete in the classification, status and delineation of Elevation features, nationally	Mostly Achieved or Short Term	Technical limitations
Provide open access to multi-scale digital elevation models under CC-BY licensing at no cost	Long Term or Unlikely	Not a business policy
Provide a two-way mechanism for user notifications/feedback (additions and changes)	Mostly Achieved or Unlikely	Not a business priority

Blue = High Achievability; Green = Moderate Achievability; Orange = Low Achievability or Unlikely

Depth

FSDF Requirement	Achievability (in the main)	Barrier
Contribute to nationwide Bathymetry products	Long Term or Unlikely	Funding, not business policy
Have seamless integration of Bathymetry coverage across Jurisdiction waters	Long Term or Unlikely	Funding, not business policy
Have consistent edge matching across state and territory borders	Long Term or Unlikely	Funding, not business policy
Be consistent and complete in the classification, status and delineation of Bathymetry features, nationally	Long Term or Unlikely	Funding, not business policy
Provide open access to multi-scale digital bathymetry models under CC-BY licensing at no cost	Long Term or Unlikely	Funding, not a business priority or policy
Provide a two-way mechanism for user notifications/feedback (additions and changes)	Long Term or Unlikely	Not a business policy

Blue = High Achievability; Green = Moderate Achievability; Orange = Low Achievability or Unlikely

Land Cover

FSDF Requirement	Achievability(in the main)	Barrier
Contribute to the nationwide dataset in real-time	Unlikely	Funding, technical limitations, not a business priority
Have ±1m accuracy in urban regions for built environment	Long Term or Unlikely	Funding, lack of skilled resources, technical limitations, not a business priority
Have a spatial accuracy of ±10m in rural regions for built environment	Long Term	Funding
Have 3D visualisations of building footprints	Unlikely	Funding, not a business priority
Include construction materials used for all Buildings	Unlikely	Funding, lack of skilled resources, not a business priority
Have consistent edge matching across state and territory borders	Short-Long Term	Funding, not a business priority
Be consistent and complete in the classification, status and delineation of Land Cover features,	Short-Long Term	Funding, not a business priority
Record historical data views for time-series analysis	Short Term or Unlikely	Funding
Be available nationally under CC-BY at zero cost	Mostly Achieved or Short Term	Not a business priority
Provide a two-way mechanism for user notifications/feedback (additions and changes)	Achieved or Long Term	Funding, not a business priority

Blue = High Achievability; Green = Moderate Achievability; Orange = Low Achievability or Unlikely

Appendix D:Survey Matrix

Questions		Geocoded Addressing	Administrative Boundaries	Positioning		Place Names	Land Parcel and Property	Imagery		Transport	Water	Elevation	Depth	Land Cover Ratser	Vector
				Geodetic	CORS			Aerial	Satellite	Road				Land Cover	Land Use
Governance															
Custodianship	Sense of Custodianship: Strong, Moderate, Weak	Strong	Strong	Strong	Moderate	Moderate	Strong	Strong	Weak	Weak	Weak	Strong	Weak	Mod	Weak
Policy and legislation	Mandate: Strong, Moderate, Weak	Strong	Strong	Strong	Weak	Strong	Strong	Weak	Weak	Weak	Strong	Weak	Weak	Mod	Weak
Duplication	Level of Duplication: High, Moderate, Low	Low	Low	Low	Don't Know	High	Moderate	Mod	High	High	High	Low	High	Mod	High
Intellectual Property	IP applies to: Most, Some, None	Most	Most	Most		Most	Most	Most		Most	Most	Some	Some	Most	
Privacy	Level of public concern: High, Moderate, Unlikely	Unlikely	Unlikely	Unlikely		Moderate	Moderate	Unlikely		Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	
Sensitive Data	Level of public concern: High, Moderate, Unlikely	Unlikely	Unlikely	Unlikely		Unlikely	Moderate	Moderate		Moderate	Unlikely	Unlikely	Unlikely	Unlikely	
Accesibility															
Access Levels	Publicly accessible: High, Moderate, Low	High	High	High	High	High	High	High	Mod	High	High	Moderate	Low	High	Mod
Access Methods	Online Methods: High, Moderate, Low	High	High	High	Moderate	High	High	Moderate		High	High	Moderate	Low	High	Mod
Data Format	Commonality: High, Moderate, Low	Low	High	Moderate	High	Moderate	High	High		High	High	High	Moderate	High	Mod
Financial Model	Commonality: High, Moderate, Low	Moderate	High	Moderate	High	High	Low	Low		High	High	Low	Low	High	High
Licensing	Commonlaity: High, Moderate, Low	Moderate	Moderate	Moderate	Low	High	Low	Low	Mod	Moderate	High	High	Low	High	High
Data Standards and Metadata															
Standards	Compliance: High, Moderate, Low	High	Low	High	*na*	Moderate	Low	Low	Low	Moderate	Moderate	Low	Low	Low	
Spatial Data Services (OGC)	Compliance: High, Moderate, Low	Moderate	High	Low	NA	Low	Low	Low	Mod	Moderate	High	Low	Low	Low	
Metadata Format	Digital (Machine readable): High, Moderate, Low	Moderate	Moderate	Moderate		Moderate	Moderate	High		Moderate	High	High	Low	Mod	
Metadata Standard	Compliance: High, Moderate, Low	Moderate	High	Low		Moderate	High	High		High	High	High	Low	Mod	
Unique Identifiers	Global ID in use: High, Moderate, Low	Low	Low	Low		Low	Low	*na*		Low	Low	Low	Low	Low	
Data Storage and Archiving	Compliance: High, Moderate, Low	Moderate	Moderate	Low		Low	High	Moderate		Moderate	Moderate	Moderate	Low	Low	
Software	Level of commonality: High, Moderate, Low	High	High	Moderate		Low	High	High		High	High	High	Low	High	
Data Quality															
Positional Accuracy of jurisdiction data	Variability across the dataset: High, Moderate, Low	Moderate	Low	Low	Mod	Moderate	Low	Moderate		Low	Low	Low	Low	Low	
Completeness of jurisdiction data	Completeness: High, Moderate, Low	Moderate	Moderate	Mod	NA	Moderate	High	Moderate		High	High	Moderate	Moderate	Moderate	
Currency of jurisdiction data	Regularly Updated: High, Moderate, Low	High	Moderate	Mod	NA	Moderate	High	Moderate		High	Moderate	Moderate	Moderate	Moderate	

Consistency of jurisdiction data	Validation: High, Moderate, Low	Moderate	Moderate	NA	NA	NA	High	NA	Moderate	Moderate	Low	Moderate	Low
Feedback	Online Methods: High, Moderate, Low	Moderate	Low	Low	NA	Moderate	Low	Low	Low	Low	Low	Low	High
Usability													
Intended Purpose	Suitability: Well Suited, Good Enough, Not suited	Well Suited	Well Suited	Well Suited	Good Enough	Well Suited	Well Suited	Well Suited Not its	Good Enough	Good Enough (hard to call)	Good Enough	Good Enough
Usability	Fit for Purpose: High, Moderate, Low	Moderate	Moderate	Low	Don't Know	High	High	Moderate	Moderate	Moderate	Low	Low
Industry Sectors	Level of cross sector usage: High, Moderate, Low	Moderate	High	Moderate (gov. only)	Low (Gov. only)	High	High	High	Moderate	Low (Gov. only)	Rare	Low (gov. only)
Aspirational Goals													
Real-time	Achievability: High, Moderate, Unlikely	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	NA	NA	NA
Availability (CC-BY at Zero Cost)	Achievability: High, Moderate, Unlikely	Moderate	Moderate	Moderate	Moderate	Unlikely	Unlikely	Unlikely	Moderate	Unlikely	Unlikely	Moderate
Completeness	Achievability: High, Moderate, Unlikely	Unlikely		Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Unlikely	Unlikely	Moderate
Positional Accuracy	Achievability: High, Moderate, Unlikely	Moderate	Unlikely	Moderate	Moderate	Moderate	Moderate	Moderate	Unlikely	Unlikely	Unlikely	Unlikely
Historical Data Preserved	Achievability: High, Moderate, Unlikely	Unlikely	Moderate	NA	High	NA	NA	NA	NA	NA	NA	Moderate
Enhanced Content	Achievability: High, Moderate, Unlikely	Unlikely	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Unlikely	Moderate	Unlikely	Unlikely
Two-way Feedback	Achievability: High, Moderate, Unlikely	Moderate	Unlikely	Moderate	Moderate	Unlikely	Unlikely	Moderate	Moderate	Moderate	Unlikely	Moderate

KEY

Percentage of Respondents

Greater than 65%
40% to 65%
Less than 40%