LandTasmania

GDA2020 Implementation Policy

June 2020

Department of
Primary Industries, Parks, Water and Environment

Tasmanian Government

Document Development History

Version	Date	Author	Build and amendment summary	Sections	Issued to
1.0	24/02/2020	Land Tasmania	Various amendments	All	Public
2.0	12/06/2020	Land Tasmania	General update to accommodate COVID-19 impacts and WGS84 Web Mercator advice including revision of policy statements and reference to DPIPWE Datum Modernisation website content	All	Public

Contents

1. Policy Context

1.1. Introduction

The purpose of the Land Tasmania GDA2020 Implementation Policy (the Policy) is to describe how Land Tasmania will address the management of GDA94, GDA2020 and WGS84 as it implements the first stage of Australia's datum modernisation program. The objective is to facilitate the adoption of GDA2020 (static) by current and future Tasmanian geospatial consumers, by ensuring that timelines for introduction and support of the above datums, by Land Tasmania, are clear to all users. This Policy will then provide a framework for a technical implementation of GDA2020 by Land Tasmania.

1.2. Scope

This Policy applies to the management and provision of all Land Tasmania datasets and services to clients. Other Department of Primary Industries and Water Divisions, external agencies, such as other Tasmanian Government Departments and Private Stakeholders, are encouraged to adopt a policy for GDA2020 implementation which is informed by this policy.

This policy does not apply to the implementation of the new time dependent Australian Terrestrial Reference Frame (ATRF) or the Australian Vertical Working Surface (AVWS).

It is recognised that ICSM will continue to expand the definition and capabilities of the Australian Geospatial Reference System (AGRS) (e.g. https://www.icsm.gov.au/upgrades-australian-geospatial-reference-system). The new time-dependent ATRF and the AVWS were available for use from 1 January 2020. In the short to medium term, Land Tasmania will not be able to offer wide-spread support for these capabilities, nor expect most other spatial professionals to adopt ATRF or AWVS.

2. Background

2.1. Datum Modernisation Initiative

GDA2020 was gazetted as Australia's new National Datum in October 2017. This modernised datum provides the framework for coordinating all spatial information to a greater and more consistent accuracy. GDA2020 defines coordinates which are approximately 1.5 metres to the north east of GDA94 in Tasmania, a distance which represents the tectonic motion of the Australian plate since GDA94 was defined in 1994.

ANZLIC nominated the GDA2020 adoption date for all jurisdictions as 30 June 2020. By this date *"all member agencies in Australian states and territories will be ready to deliver and receive foundation spatial data on the GDA2020 datum"*[1].

Due to COVID-19, several jurisdictions, including Tasmania have experienced interruptions and delays to GDA2020 preparatory work. Whilst the national GDA2020 Implementation Working Group has decided not to recommend changing the 30 June 2020 date, Tasmania will not be able to meet that timetable for its GDA2020 readiness.

Tasmania expects to be able to catchup with preparatory work such that it will be able to deliver and receive foundation spatial data on GDA2020 by 30 September 2020. Land Tasmania does not expect that this delay will significantly inconvenience users.

2.2. Benefits to Modernisation

Adoption of GDA2020 is required to support the increased accuracy requirements and capabilities of modern positioning applications.

GDA2020 is of a higher accuracy than GDA94 due to the number and quality of GNSS stations used to define the reference frame. Coordinates derived in GDA2020 can be expressed with a higher-accuracy (lower-uncertainty) than in GDA94. GDA2020 also removes the known distortions inherent in GDA94. These distortions were created when GDA94 was defined due to the limitation of the technology at the time.

GDA2020 is more closely aligned with the reference frameworks used by modern devices including smart phones, remotely piloted aircraft, autonomous vehicles, etc. This will bring Australia's national coordinate system in line with global positioning systems, enabling positioning technologies to accurately locate features marked on maps.

GDA2020 aligns more closely with modern GPS and GNSS positioning. GPS provides coordinates to users in the current epoch (i.e. where the user is located at that moment). In contrast, GDA94 represents where Australia was positioned, in a global sense, at epoch 1994.0 (that is, 1st January 1994). The Australian tectonic plate moves at ~7cm per year and as a result GDA94 data is ~1.5 to 1.8 metres south west of current GPS positioning. GDA2020 expresses spatial data in epoch 2020.0 (01 Jan 2020)

[1] https://www.anzlic.gov.au/news/anzlic-announcement-gda2020-adoption-date

and is therefore already in alignment with modern data from GPS. In future, users will determine, based on the accuracy and intended use of their data, if the 7cm per year tectonic movement will require the use of the Australian plate motion model of ATRF to bring data back to epoch 2020.0.

A new time dependent reference frame called Australian Terrestrial Reference Framework (ATRF) has been available from 1 January 2020 for specialist use cases. This dynamic reference frame will provide for coordinate information that reflects the tectonic plate motion of the Australian continent. The implementation of this frame is outside the scope of this Policy.

More information on GDA2020, and the benefits of the Australian Geospatial Reference System, can be found at https://www.icsm.gov.au/gda2020 and https://www.icsm.gov.au/australian-terrestrial-reference-frame.

2.3. GDA94 – GDA2020 transformation methods

There are several different methods for transforming data between GDA94 and GDA2020. These methods include:

- **7-parameter similarity transformation**: A mathematical process that relates two datums by three origin translations, a rotation about each axis, and a scale. This is a ***conformal*** translation which preserves the shape of spatial data.
- **Conformal only NTv2 Transformation Grid:** This method uses a grid of latitude and longitude shift vectors to transform coordinates. The results of this transformation method are equivalent to the 7-parameter similarity transformation with the grid format being provided to support the requirements of some users.
- **Conformal and distortion NTv2 Transformation Grid:** This method also applies a grid of latitude and longitude shift vectors which incorporates the conformal transformation in conjunction with a grid of vectors that model the distortion in GDA94 coordinates present in the survey control network.

Since the third transformation method may produce different results to the first two it is essential that the transformation method is stored as metadata with any transformed dataset.

Whether a Conformal or Conformal and distortion transformation method is the most appropriate method to apply to a coordinated dataset depends upon several factors, including the origin of the data coordinates and the intended use of the data.

Within Tasmania, the known distortion in GDA94 coordinates across the survey control network modelled in the **Conformal and distortion NTv2 Transformation Grid** is generally less than 0.05 metres. The small magnitude of the distortion in conjunction with the fact virtually all spatial software and tools will default to a conformal transformation unless the **Conformal and distortion NTv2 Transformation Grid** is specifically chosen otherwise by the user, has led to Land Tasmania adopting the **7-parameter similarity transformation** as the default transformation method.

Further information can be found on the DPIPWE website:

https://dpipwe.tas.gov.au/land-tasmania/datum-modernisation/choosing-a-gda94-gda2020-transformation

2.4. Web Mapping and WGS84 / Web Mercator

For several years Australian jurisdictions have been aware of challenges with mixing GDA94 and GDA2020 data through the web mapping medium. This is due to historical reasons, where in the early days of web mapping, WGS84 was adopted globally as the default or hub datum for web mapping. In 1994, GDA94 and WGS84 could be considered equivalent, so null transformation parameters between GDA94 and WGS84 were introduced as EPSG codes, since for lower accuracy applications (regarded as one meter or greater in 1994) no processes were compromised. When GDA2020 was created, a similar argument was employed to create another null transformation between GDA2020 and WGS84, since in 2020 GDA2020 is equivalent to WGS84 with the consequence that GDA94 ≈ WGS84 ≈ GDA2020 for low accuracy applications. **This equivalence doesn't hold for higher accuracy applications.**

Further information about this issue is available on the DPIPWE website :

https://dpipwe.tas.gov.au/land-tasmania/datum-modernisation/web-mapping-and-wgs84-web-mercator

3. Policy Statements

3.1. Land Tasmania will continue to provide Positioning (survey control mark) data in both GDA94 and GDA2020 for the foreseeable future.

3.2. There are no CORS services in Tasmania provided by DPIPWE. However, all CORS service providers operating within Tasmania comply with the national policy concerning the provision of GDA94 and GDA2020 coordination products.

3.3. Land Tasmania will continue to hold and maintain Foundation Spatial data and maintenance environments in GDA94, except for Positioning data which is maintained in GDA2020.

3.4. From 30th September 2020, Land Tasmania Foundation Spatial Data will be available for delivery in GDA2020 upon request. This includes all vector and raster datasets but **does not** include web-services.

3.5. From 30th September 2020, Land Tasmania will be able to receive stakeholder data in both GDA94 and GDA2020.

3.6. Where transformation of Tasmanian spatial data is required between GDA94 and GDA2020, the 7-parameter transformation method will be the default transformation method used by Land Tasmania. The Conformal and Distortion NTv2 grid transformation method will only be applied if a specific assessment concludes this is appropriate. In all cases, the transformation method will be included in the metadata record for the transformed dataset.

3.7. Any spatial dataset provided to Land Tasmania must have an associated Metadata Statement detailing what projection, datum, epoch (where appropriate) and transformation (where appropriate) has been used.

3.8. All LIST web services (services.thelist.tas.gov.au) and all web mapping applications (LISTmap, COP, LISTdata) will remain publishing data on WGS84. See the DPIPWE Datum Modernisation website section for up to date information on this topic.

3.9. All new TASMAP hardcopy and digital products will include a change to the Horizontal Datum field, changing from '**Geocentric Datum of Australia 1994**' to '**Geocentric Datum of Australia 2020**'. This change was applied from 1 March 2020.

3.10. Survey Directions, Tasmania: All surveys of land for a statutory purpose in Tasmania that are commenced after 30th September 2020 will need to be coordinated on GDA2020, or otherwise at a date specified by the Surveyor-General.

3.11. From 30th September 2020, all administrative plans lodged in the Central Plan Register dated post 30th September 2020 shall be based on the GDA2020 datum, except where use of another datum is prescribed by legal instrument.

3.12. Australian Height Datum (Tasmania)- (AHD83) - will continue as the legislated height datum for mainland Tasmania except where an alternate height datum is required, for example when undertaking hydrographic surveys or special projects.

3.13. Land Tasmania will not be able to formally accept ATRF data but will nominate at a future date when it will be able to accept this information.

4. Further Information

For questions and further information please contact:

LIST Help Desk
Phone: (03) 6165 4444
Email: listhelp@dpipwe.tas.gov.au

5. Glossary of Terms

Term	Acronym	Definition
Australian Height Datum (Tasmania)	AHD83	Australian Height Datum (Tasmania) establishes the height reference system in Tasmania and passes through mean sea level at Hobart and Burnie as determined by tide gauge measurements in 1972.
The Australia and New Zealand Spatial Information Council	ANZLIC	The Spatial Information Council (ANZLIC) is a joint initiative of the Australian and New Zealand Governments, and the State and Territory Governments of Australia. ANZLIC is the peak Government body in Australia and New Zealand with the core responsibility for the stewardship of spatial information.
Australian Plate Motion Model	APMM	A 2-dimensional model which can be used to propagate GDA2020 coordinates through time in accordance with the movement of the Australian tectonic plate, to ATRF.
Australian Terrestrial Reference Frame	ATRF	A regional densification of the International Terrestrial Reference Frame. ATRF is a time-dependent reference frame, defined from a large number of permanent CORS on the Australian mainland and external territories. ATRF is equivalent to GDA2020 at 01/01/2020 and changes over time according to the Australian Plate Motion Model. The extent of ATRF is the same as GDA2020.
Coordinate Reference System	CRS	A coordinate reference system that is related to an object or objects by a datum. A CRS is typically referenced in Web Service calls by an EPSG code.
Datum	-	Datum (more recently called a Reference Frame) is a mathematical model of the earth that defines the origin, scale and orientation of a coordinate system against which features can be represented as coordinates.

Term	Acronym	Definition
Dynamic Datum or more appropriately: "Time-dependent Datum"	-	A reference frame in which the defining parameters include time evolution. With a dynamic datum, the reference frame is fixed to the earth as a whole. As the earth's tectonic plates move (by a few centimetres a year), a feature's coordinates also change to reflect that movement. Examples include the WGS84 datum used by Global Positioning Systems (GPS), and the International Terrestrial Reference Frame (ITRF).
Datum Ensemble	-	A group of multiple realizations of the same terrestrial or vertical reference system that, for approximate spatial referencing purposes, are not significantly different.
Epoch		A point in time, as applied to time dependent datums, expressed in decimal years. Example 2017-03-25 in the Gregorian calendar is epoch 2017.23.
European Petroleum Survey Group Code	EPSG Code	Online database that contains definitions of numerous datums and map projections, along with formulas to translate between them. Each is uniquely identified via an EPSG code. See https://www.epsg-registry.org/ Note that ISO 19127:2019 has been developed to further standardise this information and will in future replace the EPSG defacto standard.
Global Positioning System / Global Navigation Satellite Systems	GPS / GNSS	Satellite delivered navigation systems which provide geo-spatial positioning with global coverage, allowing small autonomous receivers to determine position, altitude and time.
Geocentric Datum of Australia 1994	GDA94	The national Australian mapping datum in force from 1994 to 2017, superseded by GDA2020.
Geocentric Datum of Australia 2020	GDA2020	The current Australian mapping datum, first gazetted by the Commonwealth in 2017.
ICSM	ICSM	Intergovernmental Committee on Surveying and Mapping
Map projection		Coordinate conversion from the earth's ellipsoidal coordinate system to a plane.

Term	Acronym	Definition
Open Geospatial Consortium	OGC	The Open Geospatial Consortium is an international not for profit consortium of over 535 companies, government agencies and universities participating in a consensus process to develop open, publicly available interface standards.
Reference Frame		See – Datum
Spatial data		Data that identifies a geographic location, usually stored as coordinates and can be mapped.
Static Datum		A reference frame in which the defining parameters exclude time evolution. With a static datum, the reference frame is locked to the regional tectonic plate; features on a static datum have coordinates which remain the same over time. For example, both GDA94 and GDA2020 are static datums for Australia.
Web Mercator		WGS84 Web Mercator (EPSG::3857) is the defacto standard projection used in web-mapping. (Its official name is "WGS84 Pseudo Mercator"). WGS84 Web Mercator is projected from the WG84 datum ensemble (EPSG::6326).
World Geodetic System	WGS84	WGS is a geocentric mapping datum first developed by the United States Department of Defense in 1960 (as WGS60). WGS has since evolved with continued improvements to the measurement and modelling of the global system and is currently referred to as WGS84. The 'WGS84 datum' is not a single unique reference frame; it has been updated six times to date, with significant changes (up to 0.7m) especially between older realisations. WGS84 is also time-dependent, changing coordinates in Australia at 7 cm per year. Together, these realisations form a datum ensemble, which should be taken to have an accuracy of several metres, and to be appropriate for approximate spatial referencing purposes only.