

Master Specification

Part PC-SI4

GIS & Aerial and Remote Data Capture Standard

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Department for Infrastructure
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PC-SI4 GIS & Aerial and Remote Data Capture Standard

1 Part A - Geographic information systems (GIS) standard

1.1 General

- a) This section 1 sets out the requirements for geographical information services (GIS) and geospatial deliverables, including:
 - i) the requirements for coordinate systems, projections and datums, as set out in section 1.2;
 - ii) the data accuracy requirements, as set out in section 1.3;
 - iii) the deliverables requirements, as set out in section 1.4;
 - iv) the metadata standards, as set out in section 1.5; and
 - v) the Hold Point requirements, as set out in section 1.6.
- b) This section 1 in relation to GIS includes:
 - i) map production;
 - ii) digital mapping;
 - iii) spatial analysis and modelling in 2D and 3D;
 - iv) spatial dataset manipulation;
 - v) time series spatial data; and
 - vi) web based GIS services.
- c) GIS must comply with the Reference Documents, including:
 - i) Department Geospatial Services Project Report Template (available from: https://dit.sa.gov.au/standards/standards_and_guidelines); and
 - ii) GIS Metadata Template (available from: https://dit.sa.gov.au/standards/standards_and_guidelines).

1.2 Coordinate systems, projections and datums

1.2.1 Horizontal datum

- a) Unless specified otherwise in the Contract Documents, the horizontal datum and projection must be:
 - i) GDA 2020 / SA Lambert (EPSG: 8059); or
 - ii) GDA 2020 / MGA zone 'XX' where 'XX' is the zone appropriate to the site location (for example: GDA 2020 / MGA zone 54 (EPSG:7854)).
- b) All geospatial data files must have a referenced coordinate system.

1.2.2 Vertical datum

Unless specified otherwise in the Contract Documents, datasets containing height values must adopt the Australian Height Datum (AHD) as the vertical datum.

1.3 Data accuracy

- a) All data deliverables must be accompanied by a statement of data accuracy and intended use. Accuracies must be defined in metres and satisfy a 95% confidence level (e.g. +/-5 m at 95% confidence level).

- b) Accuracy statements must be documented in the appropriate GIS Metadata Template for each dataset, and the project transmittal report / Geospatial Services Project Report.

1.4 Deliverables

1.4.1 Digital file formats

- a) Unless specified otherwise in the Contract Documents, all data must be provided as a package in ESRI compatible formats, which includes the relevant intact dataset links.
- b) Accepted formats for the GIS services work include:
 - i) ESRI file geodatabase (*.gdb) feature dataset and feature class types, version 10.0+;
 - ii) ESRI ArcGIS Pro Package (.ppkx or .mpkx), version 3.0+; and
 - iii) GeoPackage - open source (Open Geospatial Consortium (OGC)) (refer to: <https://www.geopackage.org/>).
- c) Where specified in the Contract Documents, feature classes in section 1.4.1a) must be accompanied with their relevant symbology layer (*.lyr or *.lyrx) files.
- d) The minimum file naming convention for geospatial data is described below and includes:
 - i) Project Site or unique contract ID;
 - ii) discipline;
 - iii) work task / description; and
 - iv) revision,with each element separated with an underscore between each element (i.e. <PROJECT SITE/UNIQUE ID>_<DISCIPLINE>_<WORK TASK/DESCRIPTION>_<REVISION>).

1.4.2 Map production

- a) Unless specified otherwise in the Contract Documents, map source documents must be supplied as:
 - i) ESRI ArcGIS Pro project (.aprx); or
 - ii) ESRI ArcMap document (.mxd).
- b) All maps must contain the following information as a minimum;
 - i) title;
 - ii) scale bar and numeric scale;
 - iii) coordinate system details;
 - iv) north arrow;
 - v) legend;
 - vi) ArcGIS Pro project and or map ID as dynamic text;
 - vii) source acknowledgement of all datasets included in the map;
 - viii) applicable organisation logos;
 - ix) publication date; and
 - x) all applicable disclaimers, intellectual property statements, warnings, and limitations (if applicable).
- c) Unless specified otherwise in the Contract Documents, standalone digital map outputs must be supplied in Adobe pdf format.

- d) Subject to section 1.4.2e), file naming of maps must include the following, as a minimum:
 - i) title;
 - ii) publish date; and
 - iii) revision.
- e) Where a series of maps are provided as a deliverable package, a unique map ID and associated map register containing the elements in sections 1.4.2d)i), 1.4.2d)ii), and 1.4.2d)iii) (as a minimum) must be provided.
- f) If requested by the Principal, project documents (*.aprx or *.mxd) must have relative pathing enabled.

1.4.3 Web based services

If specified in the Contract Documents, the Contractor may be required to supply the following:

- a) authorised access to a web browser portal site; and
- b) URL address to access the project approved web services, including:
 - i) ESRI format web services; and
 - ii) OGC standard web services.

1.4.4 Items to be supplied by the Contractor

- a) The Contractor must supply the following items:
 - i) digital data in ESRI based file formats or web based services; and
 - ii) a Geospatial Services Project Report using the Department Geospatial Services Project Report Template.
- b) The Contractor must submit the GIS deliverables referred to in this section 1.4, which constitutes a **Hold Point**.

1.5 Metadata standards

1.5.1 GIS metadata standard

- a) This section 1.5 forms the minimum metadata accompaniment for each GIS dataset supplied by the Contractor. The minimum metadata standard must utilise the ESRI electronic metadata sheet.
- b) The metadata standard for each spatial dataset is outlined in Table PC-SI4 1-1.

Table PC-SI4 1-1 Metadata standard for each spatial dataset

Element	Description
Project	
Dataset title	Name of the dataset record.
Custodian	Details of the dataset provider (e.g. name, organisation, email and contact phone no).
Project number	Assigned project number if applicable.
Description	
Description	Describes the content of the dataset, its spatial type, textual properties, geographic extent, attribute information, classification themes and associated information.
Dataset use	Describes the usage of the dataset for a non- expert user, in plain language.
Projection / coordinate system	Identifies the projection in which the dataset is referenced and stored.
Data quality	
Data origin	Describes the source and ownership of the dataset, including method of capture and editing.
Completeness	Percentage of dataset completeness for the spatial geometry, thematic classes and attribute information, and compliance to standards.
Positional accuracy	Assessment of the dataset's closeness in relation to their true position on the Earth. Accuracy defined in metres which must satisfy a 95% confidence level.
Capture scale	Describes the scale range used to create or edit the dataset. a) Digitalising 1:1000 b) Data entry 1:1000 c) Survey data 1:500
Data status	
Last updated	Date when the dataset was last updated.
Revision	As required for each new dataset updated.

1.6 Hold Points

Table PC-SI4 1-2 details the review period or notification period, and type (documentation or construction quality) for each Hold Point referred to in this section 1.

Table PC-SI4 1-2 Hold Points

Section reference	Hold Point	Documentation or construction quality	Review period or notification period
1.4.4b)	GIS deliverables	Documentation	10 Business Days review

2 Part B - Aerial and remote data capture standard

2.1 General

- a) This section 2 sets out the requirements for aerial and remote data capture, including:
 - i) the requirements for coordinate systems, projections and datums, as set out in section 2.2;
 - ii) the data accuracy requirements, as set out in section 2.3;
 - iii) the deliverables requirements, as set out in section 2.4;
 - iv) the data production methodology requirements, as set out in section 2.5; and
 - v) the Hold Point requirements, as set out in section 2.6.
- b) This section 2 in relation to aerial and remote data capture includes:
 - i) aerial imagery;
 - ii) terrestrial, mobile or airborne laser scanning;
 - iii) LIDAR; and
 - iv) stereo imagery or 3D DSM.
- c) Aerial and remote data capture must comply with the Reference Documents and all applicable Laws, including:
 - i) Department Survey String Identifiers (available from: https://dit.sa.gov.au/standards/standards_and_guidelines);
 - ii) Department Geospatial Services Project Report Template (available from: https://dit.sa.gov.au/standards/standards_and_guidelines);
 - iii) GIS Metadata Template (available from: https://dit.sa.gov.au/standards/standards_and_guidelines);
 - iv) the Civil Aviation Safety Regulations (CASR);
 - v) the Civil Aviation Regulations (CAR);
 - vi) the Civil Aviation Orders (CAO); and
 - vii) Manuals of Standards (MoS) (available from: <https://www.casa.gov.au/rules>).

2.2 Coordinate systems, projections and datums

2.2.1 Horizontal datum

- a) Unless specified otherwise in the Contract Documents, the horizontal datum and projection must be:
 - i) GDA 2020 / SA Lambert (EPSG: 8059); or
 - ii) GDA 2020 / MGA zone 'XX' where 'XX' is the zone appropriate to the site location (for example: GDA 2020 / MGA zone 54 (EPSG:7854)).
- b) All data files must have a referenced coordinate system.

2.2.2 Vertical datum

Unless specified otherwise in the Contract Documents, datasets containing height values must adopt the Australian Height Datum (AHD) as the vertical datum.

2.3 Data accuracy

- a) All data deliverables must be accompanied by a statement of data accuracy and intended use. Accuracies must be defined in metres and satisfy a 95% confidence level.
- b) Accuracy statements must be documented in the appropriate GIS Metadata Template and Geospatial Services Project Report.
- c) Accuracy claims must be supported with evidence appropriate to the method of capture which must include separate checks on the model surface covering both horizontal and vertical positioning residuals.

2.4 Deliverables

2.4.1 Aerial imagery

- a) Unless specified otherwise in the Contract Documents, the Contractor must comply with the requirements in this section 2.4.1.
- b) The Contractor is responsible for all flight planning, manifests, and approvals.
- c) The Contractor must comply with all relevant Civil Aviation Safety Authority (CASA) requirements and must be appropriately licensed to carry out such work including for drone operation.
- d) Regarding digital file formats, aerial imagery must be supplied in ECW format with void pixels removed or set in the alpha channel, and include all associated mosaic tiles in native format (i.e. individual geotiff mosaic tiles). If specified in the Contract Documents, .jpg2000 or geoTiff may also be accepted.
- e) File naming of data for aerial imagery/LIDAR must include the following, as a minimum:
 - i) Project title;
 - ii) originator code;
 - iii) EPSG code; and
 - iv) date,with each element separated with an underscore between each element (i.e. <PROJECT TITLE>_<ORIGINATOR CODE>_<EPSG CODE>_<DATE>).
- f) Regarding spectral resolution, a photogrammetric digital camera providing 3 colour bands - red, green, blue and opacity null channelling band to mask background void pixel cells must be used.
- g) Regarding spatial resolution, digital imagery resolution will be defined as a ground sampling distance (GSD) in the Contract Documents.
- h) The radiometric resolution must be 8 bit.
- i) Regarding ortho-rectification, aerial imagery must be rectified and calibrated to the specified datum. Aspect of all structures obscuring adjacent ground level features must be minimised. There must be no cloud, cloud shadow or smoke haze obscuring the image.
- j) Regarding image compression, imagery compression must not exceed 10 times and must minimise image quality loss.
- k) Regarding intellectual property agreement, all data supplied by the Contractor must become the property of the Principal and must not be copied or reproduced by the Contractor without prior written approval from the Principal.

2.4.2 Laser scanned and remote data capture

- a) Unless specified otherwise in the Contract Documents, the Contractor must comply requirements in this section 2.4.2.

- b) Regarding digital file format:
 - i) string based data must comply with the coding requirements in accordance with PC-SI5 “Engineering Survey”; and
 - ii) point cloud data must be provided in a .las, .laz or .fbx file format or as specified in the Contract Documents.
- c) File naming of data for aerial imagery/LIDAR must include the following, as a minimum:
 - i) Project title;
 - ii) originator code;
 - iii) EPSG code; and
 - iv) date,with each element separated with an underscore between each element (i.e. <PROJECT TITLE>_<ORIGINATOR CODE>_<EPSG CODE>_<DATE>).
- d) Regarding file size and cloud viewing, determinations must be made on an appropriate file size ensuring suitable usability and rendering performance in the intended application.
- e) Regarding shadowing or low-resolution areas, efforts must be made to minimise the effect of shadowing and subsequent accuracy loss. Low accuracy areas and shadowing must be detailed in the Geospatial Services Project Report. Areas may be requested to be depicted in the model by a closed loop string.

2.4.3 Items to be supplied by the Contractor

- a) The Contractor must supply the following items:
 - i) digital data as specified in this section 2 unless detailed otherwise in the Contract Documents; and
 - ii) a Geospatial Services Project Report using the Department Geospatial Services Project Report Template.
- b) The Contractor must submit the aerial and remote data capture deliverables referred to in this section 2.4, which constitutes a **Hold Point**.

2.5 Data production methodology

2.5.1 General

In order to achieve the required standards, the methodology used must be documented to support accuracy statements and provide context for the use / application of the data. Details of this must be included as a brief summary as per the requirements of the Geospatial Services Project Report.

2.5.2 Data origin

Methodology statements must include the origin of datasets. The Contractor must nominate whether information has been captured via GPS, digitised / drafted or via automated feature extraction techniques etc. Details must be noted as per the Geospatial Services Project Report.

2.5.3 Capture scale

Methodology statements must include the captured scale range of datasets for data quality. Details must be noted as per the Geospatial Services Project Report.

2.6 Hold Points

Table PC-SI4 2-1 details the review period or notification period, and type (documentation or construction quality) for each Hold Point referred to in this section 2.

Table PC-SI4 2-1 Hold Points

Section reference	Hold Point	Documentation or construction quality	Review period or notification period
2.4.3b)	Aerial and remote data capture deliverables	Documentation	10 Business Days review

3 Part C - Other requirements

3.1 General

This section 3, sets out other requirements in relation to GIS and aerial remote data capture standards, including:

- a) the data requirements, as set out in section 3.2; and
- b) the handover process, as set out in section 3.3.

3.2 Data requirements

3.2.1 Digital engineering

Where the requirement to utilise digital engineering is specified in the Contract Documents, data requirements must also comply with PC-EDM5 "Digital Engineering".

3.2.2 Legacy data

Data provided in legacy data formats (such as those generated by Third Parties or Subcontractors, the use of personal geodatabases being updated to file or enterprise geodatabase formats, and obsolete project files (i.e. ArcGIS *.mxd version 9.3)) must be updated to meet the requirements of this Master Specification Part.

3.2.3 Digital engineering

Use of a web based or enterprise GIS systems must take into consideration the use of "extract, transform, load" (ETL) processes associated with conversion between multiple authoritative GIS and BIM formats including cross compatibility with IFC2x3 and IFC4 (BIM) and ArcGIS Pro 3.0+ and ArcGIS Enterprise (Portal) 10.9.x+.

3.3 Handover process

- a) On completion of the Project and as a condition precedent to Completion, GIS and aerial and remote captured data must be provided electronically in the agreed formats described in this Master Specification Part.
 - b) Where the requirement to utilise digital engineering is specified in the Contract Documents, the handover of electronic deliverables must comply with PC-EDM5 "Digital Engineering".
 - c) The handover of deliverables must comply with PC-CN2 "Asset Handover".
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