

NATIONAL LAND AUDIT • ZAMBIA

NLA–ZNSDI Geospatial Standards Manual

*Standards for producing, validating, documenting and publishing
National Land Audit geospatial data*

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How to use this manual “Must” is an NLA requirement; “should” is recommended practice; “may” is optional. Where a custodian’s legal rule is stricter, the stricter rule applies.

1. Purpose, authority and scope

This manual defines the practical geospatial standards to be applied to National Land Audit datasets intended for internal use, institutional exchange or publication through the Zambia National Spatial Data Infrastructure (ZNSDI). It converts the ISO 19100 and OGC standards framework into implementable NLA rules.

1.1 Objectives

1. Ensure that datasets from different producers can be combined and interpreted consistently.
2. Make every published product discoverable, assessable, accessible and reusable through ZNSDI.
3. Separate source precision, pixel size, mapping scale and measured accuracy so users are not misled.
4. Preserve provenance from source acquisition through processing, quality control and publication.
5. Provide one acceptance basis for producers, custodians and ZNSDI reviewers.

1.2 In scope

Included	Examples
Vector products	Land use, state land, customary land, administrative boundaries, cadastral/surveyed data, reserves, protected areas, hydrography, transport and utility buffers.
Raster products	Land-cover classifications, image-derived products, masks and analytical grids.
Supporting artefacts	Feature catalogues, code lists, styles, validation reports, metadata and service links.
Lifecycle stages	Specification, production, QA, delivery, ZNSDI entry, review, publication and revision.

1.3 Fitness-for-use limitation

Important NLA thematic products are not cadastral title evidence and must not be used to determine legal parcel ownership or boundaries unless the responsible cadastral authority explicitly certifies the relevant source data.

2. Standards framework and conformity

Interoperability is a chain. A dataset may be technically readable but still fail if feature meanings, CRS, quality, metadata or access methods are inconsistent.

Standard / specification	Role in this manual	NLA implementation
ISO 19101-1	Reference model	Common conceptual framework for geographic information.
ISO 19103	Conceptual schema language	Consistent types, names and UML-style schemas.
ISO 19107	Spatial schema	Geometry and topology rules.
ISO 19110:2016	Feature cataloguing	Feature types, attributes, domains and definitions.
ISO 19111	Referencing by coordinates	Complete CRS identification.
ISO 19131:2022	Data product specifications	Product requirements and acceptance contract.
ISO 19115-1:2014 + amendments	Metadata fundamentals	Identification, extent, quality, lineage, distribution and responsibility.
ISO 19115-2:2019	Acquisition and processing metadata	Additional raster/imagery provenance.
ISO 19115-3:2023	XML implementation	Modern XML schema implementation; portal configuration may retain ISO 19139-era exchange.
ISO 19157-1:2023	Data quality	Quality elements, measures, evaluation and reporting.
OGC GeoPackage	Vector exchange	Preferred master vector exchange container.
GeoTIFF / COG	Raster exchange	Lossless georeferenced raster delivery; use COG label only after validation.
OGC WMS / WMTS	Map viewing	Rendered portrayal.
OGC WFS / OGC API – Features	Vector access	Feature-level query and download.
OGC WCS / OGC API – Coverages	Coverage access	Raster/coverage access where implemented.

2.1 Conformance classes

Class	Meaning
NLA production conformant	Meets applicable vector/raster, schema, CRS, QA, lineage and packaging rules.
ZNSDI metadata conformant	Passes mandatory field, controlled-value and logical-content validation.
Publication conformant	Metadata is approved and every advertised download/service endpoint works.
Non-conformant	One or more mandatory requirements fail; dataset remains draft or is returned for correction.

3. Governance, roles and lifecycle

Role	Minimum responsibility
Data custodian	Own the authoritative product; approve definitions, access rules, quality claims and revisions.
NLA producer	Follow the product specification; keep processing records; perform first-line QA.
NLA QA reviewer	Independently test the delivered product and record pass/fail evidence.
Organisation metadata editor	Create and maintain the ZNSDI record; resolve validation issues.
ZNSDI reviewer / administrator	Check profile compliance, institutional authority, discoverability and access before publication.
Service administrator	Publish stable services/downloads and monitor availability.

3.1 Controlled lifecycle

6. Define or approve a Data Product Specification (DPS), feature catalogue, legend and quality requirements.
7. Acquire source data with identifiers, custodians, dates, versions, licences and resolution/scale recorded.
8. Produce the dataset using reproducible processing steps and controlled software settings.
9. Run producer QA; correct errors; freeze a candidate release.
10. Run independent acceptance checks against this manual and the DPS.
11. Create or update the ZNSDI metadata record; validate and submit for review.
12. Publish approved files and services; test every link.
13. Maintain change logs; assign a new version when content or schema changes.

Rule The metadata record is part of the product. A dataset is not complete if the metadata or advertised access link is missing, inaccurate or obsolete.

4. Common spatial reference and extent rules

4.1 CRS declaration

Every dataset must carry a machine-readable CRS and the metadata must repeat its full name and EPSG identifier. “UTM” or “WGS 84” alone is insufficient.

Use	Required CRS statement
NLA production and area calculations	WGS 84 / UTM zone 35S — EPSG:32735, unless the approved DPS specifies otherwise.
Catalogue geographic bounding box	WGS 84 geographic longitude/latitude — EPSG:4326.
National web publication	Native CRS plus service-supported CRS; EPSG:4326 and web-map CRS may be offered as service representations without altering the master data.

4.2 Coordinate handling

14. Do not assign a CRS to unknown coordinates merely to make a layer display. Determine the source CRS first.
15. Use an explicit transformation when datum conversion is required; record the operation and software.
16. Calculate area in an appropriate projected CRS. Do not calculate hectares or square kilometres from geographic degrees.
17. For national products in EPSG:32735, record that Zambia extends beyond one UTM zone and describe any implications for accuracy at the edges.
18. Derive the bounding box from the final delivery, not from an earlier source or a copied example.

4.3 Extent checks

19. Features or cells must lie within the approved national/administrative scope, except for documented cross-boundary context.
20. No null, NaN or infinite coordinates are permitted.
21. Coordinate magnitudes must be plausible for the declared CRS.
22. Raster bounds, transform, rows, columns and pixel dimensions must be mutually consistent.

5. Vector data standard

5.1 Mandatory practical minimum

Data element	What the producer must deliver
Geometry	Valid point, line, polygon or multipolygon geometry appropriate to the feature definition.
CRS	Embedded machine-readable CRS and full metadata statement with EPSG code.
Feature identifier	Stable unique identifier; not dependent only on an editable row number or FID.
Feature class	Approved NLA code and name from the controlled legend/catalogue.
Source	Source dataset/custodian code traceable to a lineage source entry.
Reference date	Date or period to which the feature information applies.
Administrative attribution	District and province where required; values must use approved spellings/codes.
Area / length	Derived units clearly named; e.g., area_ha and area_sqkm; recalculated after final geometry changes.
Null handling	Null and unknown values follow defined rules; empty strings are not used as an undocumented substitute.
Metadata and QA	Dataset metadata, feature catalogue/data dictionary and completed validation report.

5.2 Geometry and topology

Check	Acceptance rule
Validity	No self-intersections, ring errors, duplicate vertices causing invalidity or corrupt geometries.
Empty geometry	Not permitted unless the feature catalogue explicitly allows a non-spatial record.
Geometry type	Matches declared layer type; geometry collections require explicit approval.
Duplicates	No unexplained duplicate geometries with identical business keys.
Overlaps	Apply class-specific rules. Overlap is not automatically an error; it must be prohibited, allowed or priority-resolved by the DPS.
Gaps	For wall-to-wall polygon coverage, no unintended gaps; permitted exclusions must be coded.
Multipart	Use only when one logical feature legitimately contains multiple parts.
Slivers	Evaluate against tolerance and MMU; do not delete legitimate narrow features merely because they are small.

Check	Acceptance rule
Z/M dimensions	Retain only when required and documented; otherwise deliver consistent 2D geometry.

5.3 Schema and attributes

23. Field names must be stable, unique, documented and portable. Prefer lowercase snake_case for new NLA schemas.
24. Each coded field must reference a controlled value list; free-text variants of the same class are not acceptable.
25. Use ISO 8601 dates (YYYY-MM-DD) and four-digit years.
26. Numeric fields must declare units and precision. Do not store numeric measurements as formatted text.
27. Keep current code and legacy code in separate fields where needed.
28. Source fields must identify provenance, not the local filename alone.
29. The published schema must not expose temporary processing fields, personal information or internal paths.

5.4 Recommended NLA land-use core fields

Field	Type	Obligation	Definition
feature_id	text	Mandatory	Persistent unique feature identifier.
code	text/integer	Mandatory	Current approved NLA class code.
type	text	Mandatory	Approved class label.
name	text	Conditional	Official or commonly used feature name.
oldcode	text	Conditional	Legacy/source code retained for crosswalk.
district	text	Recommended	Approved district name/code.
province	text	Recommended	Approved province name/code.
source_id	text	Mandatory	Identifier linking to lineage source register.
ref_date	date	Mandatory	Feature reference date or best available source date.
area_ha	decimal	Polygon	Calculated area in hectares.
area_sqkm	decimal	Polygon	Calculated area in square kilometres.
qa_status	coded text	Recommended	draft / checked / accepted / exception.

5.5 Formats

Preferred master format OGC GeoPackage (.gpkg), one logical feature table per product layer, with spatial index where appropriate. ESRI Shapefile may be supplied only as a secondary compatibility format because of field-name, type, encoding and size limitations.

6. Raster data standard

6.1 Mandatory practical minimum

Raster element	What the producer must enter or deliver
Product type	Categorical, continuous, mask, image or analytical coverage.
Format	GeoTIFF; Cloud Optimized GeoTIFF only when formally validated as COG.
CRS	Embedded CRS plus full name and EPSG identifier in metadata.
Grid geometry	Rows, columns, pixel size, origin, extent and affine transform.
Band definition	Band count, name, units, data type and interpretation.
NoData	Explicit value distinct from valid codes; document any mask/alpha band.
Class domain	For categorical data, integer code table with label, definition and colour.
Compression	Lossless LZW, DEFLATE or another approved lossless method for categorical products.
Resolution	Pixel dimensions and source resolution; do not equate pixel size with positional accuracy.
Lineage and QA	Exact sources, acquisition period, processing, resampling, validation design and results.

6.2 Categorical raster rules

30. Use integer class codes. Every valid non-NoData value must occur once in the approved class catalogue.
31. Never use bilinear or cubic resampling for categorical classes; use nearest neighbour.
32. Maintain a single approved grid alignment for tiles and revisions when comparison through time is intended.
33. Pyramids/overviews must preserve categorical interpretation; nearest-neighbour overview generation is required.
34. Do not apply lossy JPEG compression to thematic class values.
35. Attach or link a machine-readable class catalogue; a rendered legend image alone is insufficient.

6.3 Land-cover 10 m profile

Property	NLA rule / example
Cell size	10 m × 10 m for the 2026 land-cover product — CONFIRM from final raster.
Effective resolution	Describe source imagery and processing. State explicitly that 10 m cell size is not a 10 m accuracy claim.
Band	Single categorical band unless the DPS approves confidence/provenance bands.
Data type	Unsigned 8-bit or 16-bit integer — CONFIRM from final raster and class count.
NoData	0 or approved alternative — CONFIRM; must not conflict with a valid class.
National grid	Origin, extent, dimensions and alignment — CONFIRM from final file.
Validation	Independent sample design, confusion matrix, overall accuracy, user’s and producer’s accuracy by class; publish only measured results.
MMU	CONFIRM NLA land-cover MMU and treatment of narrow features.

6.4 Raster validation commands and evidence

The producer must preserve a machine-readable inspection report from GDAL/QGIS or equivalent showing driver, CRS, geotransform, size, band types, NoData, statistics/value range and compression. The QA reviewer must compare these values with the metadata and DPS.

7. Feature catalogues and data dictionaries

The feature catalogue defines what the data means; metadata describes the dataset as a resource. Both are required for a reusable NLA product.

Catalogue component	Required content
Feature type	Unique code, preferred name, definition and aliases.
Inclusion criteria	Observable or legal conditions for inclusion.
Exclusion criteria	Cases that appear similar but must not be included.
Geometry	Permitted spatial representation and multipart rule.
Attributes	Name, definition, type, length/precision, units, obligation and null rule.
Value domain	Permitted codes/values and definitions; source vocabulary where applicable.

Catalogue component	Required content
Relationships	Parent/child, adjacency, containment or source relationships where maintained.
Portrayal reference	Stable style/legend identifier; portrayal does not replace semantic definition.
Lifecycle	Version, custodian, approval date and change history.

7.1 Definition quality test

36. Can two trained producers classify the same object consistently from the definition?
37. Does the definition state both inclusion and exclusion conditions?
38. Is the class distinguishable from every sibling class?
39. Is legal status separated from observed land cover where both are relevant?
40. Does the class specify the reference date and evidence source?

NLA modelling rule Keep land cover (observable physical cover), land use (human purpose/activity), tenure/administrative status and legal designation as distinct concepts or fields. Do not collapse them into one ambiguous class without an approved crosswalk.

8. Data quality and acceptance

8.1 ISO 19157 quality elements

Quality element	NLA questions	Typical evidence
Completeness – omission	Are expected features/classes missing?	Coverage comparison, source register, omission sample.
Completeness – commission	Are unexpected or duplicate features present?	Duplicate/overlap analysis, commission sample.
Logical consistency	Are schema, domains, geometry and topology valid?	Automated validation log.
Positional accuracy	How close are locations to appropriate reference data?	Checkpoint/sample method and statistic.
Thematic accuracy	Are class labels correct?	Confusion matrix, user's/producer's accuracy.
Temporal quality	Are dates and time validity correct/current?	Date checks and revision comparison.
Usability	Is the product fit for its stated NLA use?	DPS-based review and limitations statement.

8.2 Quality result requirements

41. Name the measure, scope, evaluation method, sample/population, reference data, date, result, unit and pass threshold.
42. Report “not evaluated” when no valid evaluation exists; do not substitute vague claims such as “high accuracy”.
43. Separate pixel size, source scale, mapping scale, MMU and measured accuracy.
44. Record exceptions with feature IDs or spatial locations and decide whether they block release.
45. Quality claims in metadata must match the signed QA report.

8.3 Minimum automated checks

Dataset	Required checks
All	Readable; non-corrupt; CRS present; extent plausible; identifiers unique; schema matches dictionary; no undocumented nulls.
Vector	Geometry validity; empty geometry; type consistency; duplicates; domain values; topology rules; area/length recalculation.
Categorical raster	CRS/grid; NoData; allowed codes; undefined cells; compression; alignment; overview method; statistics.
Metadata	Mandatory fields; controlled values; extent/CRS/date agreement; valid contacts; working URLs; no local file paths.

8.4 Release decision

Status	Rule
PASS	All mandatory requirements meet their thresholds; no blocking exception.
PASS WITH DOCUMENTED LIMITATION	A formally approved non-blocking limitation is described in the QA report and metadata.
FAIL	Any mandatory requirement fails, evidence is missing, or a material claim cannot be verified.

9. Lineage and provenance

Lineage must allow a competent reviewer to understand what sources were used, what was done, by whom/which software, when, and with what quality controls. A statement such as “derived from GIS data” is insufficient.

9.1 Required lineage structure

46. Resource-level lineage statement: concise end-to-end production narrative.
47. Source register: exact title, custodian, identifier/version, date, scale/resolution, licence and role of each source.
48. Process steps: chronological operations, parameters, software/version, date and responsible organisation.
49. Quality controls: validation methods, reference sources, corrections and unresolved limitations.
50. Output statement: final schema, CRS, resolution/MMU, edition and release decision.

9.2 Example – land-use vector

Text for ZNSDI / GeoNetwork The national NLA land-use vector dataset was compiled from available authoritative cadastral, administrative, forest, protected-area, hydrographic, infrastructure, mining and settlement datasets, supplemented by project digitising of agricultural and other land-use features from recent satellite/Google Earth imagery. Sources were inventoried, inspected, reprojected to WGS 84 / UTM zone 35S (EPSG:32735), geometry-repaired and harmonised to the approved NLA feature and attribute schema. Layers were clipped or merged as required; class codes were cross-walked; areas were recalculated; and duplicate, overlap, gap, geometry and attribute-domain checks were performed. The final national layer was reviewed visually and subjected to NLA QA. Exact source titles, dates, versions, processing software, MMU and measured accuracy: CONFIRM before publication.

9.3 Example – land-cover raster

Text for ZNSDI / GeoNetwork The 2026 Zambia NLA land-cover raster was produced from cloud-screened Sentinel-2 Level-2A imagery and approved ancillary reference layers. Imagery acquisition dates, compositing window, bands, cloud-screening method and ancillary sources are recorded in the source register. The product was classified to the approved NLA land-cover legend, post-processed to remove unsupported artefacts and align the national grid, and exported as a single-band categorical GeoTIFF at 10 m cell size. Categorical resampling used nearest neighbour and all valid class values were checked against the legend. Independent validation used a documented reference-sample design and confusion matrix. Exact imagery dates, algorithms, software, MMU, NoData, grid dimensions and accuracy statistics: CONFIRM before publication.

9.4 Source-resolution statement for multi-source land use

Source group	How to state resolution / scale
Sentinel-2 / comparable imagery	State sensor, product level, pixel size, acquisition period and effective interpretation scale.
Google Earth / Esri imagery	State imagery platform, visible acquisition dates where available, digitising scale/range and access date; do not imply a uniform ground resolution.
Cadastral/survey data	State authoritative source, survey/cadastral basis and known scale/positional specification.
Forest/protected/legal boundaries	State gazette/legal source and map/database scale or accuracy where documented.
Global thematic products	State exact product, version, nominal resolution and how it was used.
Derived buffers	State source line/polygon, buffer distance, side/end-cap rules and CRS used for measurement.

10. ZNSDI metadata profile

10.1 Mandatory practical minimum

Metadata element	What the producer must enter
Title	Unique, human-readable dataset or service title.
Abstract	What the data contains, geographic coverage, reference period, main source and intended use.
Purpose	Why the dataset was created and the decisions or activities it supports.
Topic/category and keywords	Select the appropriate category; include theme, place and project keywords using ZNSDI vocabularies where available.
Responsible party	Custodian organisation, role, email and other required contact details.
Dates	Creation/publication/revision date as applicable, with date type clearly identified.
Geographic extent	Correct bounding box and named administrative/geographic coverage.
Temporal extent	Time period represented by the content, distinct from publication date.
CRS	Full CRS name and EPSG identifier.
Spatial representation	Vector, grid/coverage, tin or other applicable type.
Spatial resolution	Raster pixel size; vector equivalent scale/MMU/source resolution as applicable.
Lineage	Sources, processing, QA, output and limitations.
Quality	Measured results or an honest not-evaluated statement with planned/actual method.

Metadata element	What the producer must enter
Constraints and licence	Access classification, use limitations, licence and attribution.
Distribution	Format/version, file/service URL and distributor.
Metadata administration	Metadata identifier, language, scope, date, standard/profile and metadata contact.

10.2 Content rules

51. Use a persistent dataset identifier, not a temporary path or QGIS layer name.
52. Title and abstract must distinguish vector from raster and include reference year/version where relevant.
53. The abstract must answer what, where, when, resolution/scale, main source and intended use.
54. Dates must identify date type: creation, publication or revision.
55. Use institutional role mailboxes where possible.
56. State limitations plainly, including that NLA thematic data are not cadastral title evidence.
57. Every service record must link to the related dataset record; every dataset record should link to its services.

10.3 ISO mapping summary

Profile content	ISO 19139-era location / ISO concept
Metadata identifier	gmd:fileIdentifier / metadata identifier
Title and dates	gmd:identificationInfo ... gmd:citation
Abstract and purpose	gmd:abstract / gmd:purpose
Responsible party	gmd:pointOfContact and citation responsible party
Extent	EX_Extent / geographic and temporal extent
CRS	gmd:referenceSystemInfo
Resolution	MD_Resolution or grid representation
Lineage	DQ_DataQuality ... LI_Lineage
Quality result	DQ_DataQuality evaluation/result
Constraints	MD_LegalConstraints / MD_SecurityConstraints
Distribution	MD_Distribution / online resource
Metadata contact/date	gmd:contact / gmd:dateStamp

Encoding note ZNSDI is the authoritative entry interface. Portal exports may use an ISO 19139-era profile while ISO 19115-3:2023 is the current XML schema implementation standard. The portal administrator must document the supported schema/profile and validation rules; producers should not hand-edit XML unless trained and authorised.

11. ZNSDI / GeoNetwork submission workflow

11.1 Recommended provider route

58. Sign in with the editor account assigned to the responsible organisation.
59. Create a record from the approved ZNSDI Dataset or Service template.
60. Enter the mandatory and relevant recommended fields using this manual.
61. Draw or calculate the extent from the final delivery and verify it visually.
62. Link the download and/or service endpoints; remove temporary local paths.
63. Run portal validation and correct both schema errors and content inconsistencies.
64. Save as Draft and submit for institutional/ZNSDI review.
65. Reviewer checks authority, clarity, lineage, quality, constraints and working access.
66. Publish only after acceptance; record the publication date and edition.
67. Update metadata whenever the dataset, service, access rule, link or responsible contact changes.

11.2 Alternative routes

Provider capability	Route	Control
Most agencies	Direct ZNSDI / GeoNetwork form	Recommended default; national template enforces required fields.
Existing ISO metadata	Import supported ISO XML	Validate against the ZNSDI profile; repair missing resolution/lineage/constraints.
Mature institutional SDI	Approved harvesting/API/CSW route	Custodian remains responsible for source metadata and synchronisation.

11.3 Reviewer rejection triggers

68. Missing custodian or non-institutional contact.
69. Copied national extent that does not match the file.
70. “10 m accuracy” claimed only because the raster cell is 10 m.
71. Vague lineage without named sources or processing.
72. “High quality” without measure, method or result.
73. Undefined access status or licence.
74. Broken, private, expiring or local download link.
75. Dataset title, dates, CRS, version or schema inconsistent with the delivery.

12. Distribution formats and web services

Need	Preferred publication	Notes
Vector master exchange	GeoPackage	Include feature table, CRS, UTF-8 text, stable schema and spatial index where useful.
Raster master exchange	GeoTIFF / validated COG	Lossless categorical values; internal tiling/overviews for large products.
Map visualisation	WMS or WMTS	Rendered image; not a substitute for data download.
Vector query/access	WFS and/or OGC API – Features	Apply access controls and limits appropriate to dataset size/sensitivity.
Raster/coverage access	WCS and/or supported OGC API	Use where server capability and user need justify it.
Bulk download	Stable HTTPS landing page or file endpoint	Publish checksum, size, format and version.
Style	QGIS QML and/or SLD as applicable	Style must reference the approved legend; style does not replace class definitions.

12.1 Service metadata

76. Service title, abstract and keywords identify the underlying NLA product.
77. Record service type/version, endpoint, operations, geographic extent, constraints and responsible party.
78. WMS layer names and WFS/API collection identifiers must be stable and documented.
79. Advertised formats and CRS options must be tested.
80. Services should expose a link back to the authoritative ZNSDI dataset metadata record.

13. Access, licensing and sensitive information

Open publication is the default only where authorised. Custodians must classify the resource and confirm that source licences allow redistribution and derivative publication.

Field	Required decision
Access constraints	Open / restricted / confidential or approved national category — CONFIRM.
Use constraints	Named licence or approved terms; do not enter only “copyright”.
Attribution	Exact organisation/product wording required when reused.
Security	Sensitivity classification, reason and handling instruction where applicable.
Personal information	Exclude or aggregate unless lawful, necessary and approved.
Source restrictions	Record third-party limitations and whether derived data may be distributed.
Disclaimer	Fitness-for-use and liability wording approved by custodian/legal authority.

Required limitation For NLA land-use and land-cover products: appropriate for national, provincial and regional assessment. Not suitable for determining legal cadastral boundaries, ownership, title or site-specific engineering decisions.

14. File naming, packaging and versioning

14.1 Naming pattern

Pattern NLA_<theme>_<representation>_<geography>_<reference-year>_v<major.minor>.<extension>

Example: NLA_LandUse_Vector_Zambia_2026_v1.0.gpkg. Use ASCII filenames, underscores, no trailing spaces and no ambiguous terms such as “final_final”.

14.2 Version rules

Change	Version action
Metadata spelling or link correction only	Metadata revision; dataset version may remain unchanged.
Non-semantic packaging/style correction	Increment patch/minor version according to custodian policy.
Feature additions/deletions, geometry/class changes, raster reclassification	Increment dataset version and revision date; update QA and metadata.
Schema, legend or methodology change affecting interpretation	New major version; publish migration/crosswalk note.
New reference year / edition	New product edition and persistent identifier relationship to previous edition.

14.3 Delivery package

81. Primary dataset file(s).
82. README with title, identifier, version, CRS, file inventory and contact.
83. Metadata export where available, plus the authoritative ZNSDI record identifier/URL after publication.
84. Feature catalogue/data dictionary and code lists.
85. Approved legend and style files.
86. Lineage source register and processing summary.
87. QA report, exception log and release approval.
88. Checksums and file sizes for transferred release files.

15. NLA delivery and publication checklist

Control	Acceptance criterion
Product specification	Approved scope, purpose, representation, CRS, schema, quality thresholds and distribution identified.
Identity	Persistent identifier, title, reference year, edition and filenames agree.
CRS and extent	Embedded CRS and EPSG are correct; extent is calculated from final files.
Vector geometry	Validity, geometry type, duplicates, gaps/overlaps and multipart rules checked.

Control	Acceptance criterion
Raster structure	Grid, pixel size, dimensions, NoData, band type, class values, compression and overviews checked.
Attributes/classes	Schema matches dictionary; identifiers unique; values and nulls obey domains.
Resolution and MMU	Source resolution/scale, product pixel size/equivalent scale and MMU stated separately.
Lineage	Exact sources and process steps are recorded; generic placeholders removed.
Quality	Evaluation evidence and statistics match the released product; limitations stated.
Constraints	Access, licence, attribution, security and fitness-for-use approved.
Distribution	GeoPackage/GeoTIFF and services open successfully; URLs stable and tested.
Metadata	All mandatory ZNSDI elements complete; validation passes.
Governance	Custodian, QA reviewer and publication authority approved the release.
Archive	Release files, checksums, QA, metadata and change log preserved.

Annex A. Fully populated vector metadata example

Example status Values marked CONFIRM remain operational placeholders and must be verified from the final 2026 NLA release.

ZNSDI field	Value to enter	Obligation
Metadata identifier	znsdi:nla:landuse:vector:2026:v1 — CONFIRM final namespace	Mandatory
Resource title	National Land Audit — National Land Use Vector Dataset, Zambia, 2026	Mandatory
Alternate title	NLA National Land Use Polygons 2026	Recommended
Resource type / scope	dataset	Mandatory
Language / character set	English (eng) / UTF-8	Mandatory
Abstract	National polygon dataset representing major land-use categories across Zambia for the 2026 National Land Audit. It integrates authoritative and project source layers, including cadastral/surveyed data, administrative and legal designations, forest and protected areas, hydrography, infrastructure, mining, settlement and agriculture interpreted from imagery. Intended for national and subnational audit, planning, reporting and ZNSDI sharing; not cadastral title evidence.	Mandatory
Purpose	Provide a consistent national land-use baseline for the NLA and support cross-government planning, monitoring and data discovery.	Mandatory
Status	completed — CONFIRM	Mandatory
Topic category	planningCadastre and environment; select portal-controlled value(s)	Mandatory
Keywords	National Land Audit; NLA; land use; state land; customary land; agriculture; forest reserve; protected area; Zambia	Mandatory
Geographic coverage	Republic of Zambia; bounding box calculated from final file	Mandatory
Temporal extent	Source-dependent, latest available through 2026 — replace with exact range	Mandatory
Reference date	2026; publication/revision date CONFIRM	Mandatory
CRS	WGS 84 / UTM zone 35S — EPSG:32735	Mandatory
Spatial representation	vector; surface / multipolygon	Mandatory
Spatial resolution	Multi-source. Record each source scale/resolution; final MMU CONFIRM. Not a single uniform positional accuracy.	Mandatory
Core attributes	feature_id; code; type; name; oldcode; district; province; source_id; ref_date; area_ha; area_sqkm	Mandatory
Lineage	Use the complete vector statement in section 9.2 plus exact source and process entries.	Mandatory
Completeness	Not yet quantified nationally; record tested omission/commission results — CONFIRM.	Mandatory

ZNSDI field	Value to enter	Obligation
Logical consistency	Geometry, schema, domain, duplicate and applicable topology tests completed; attach QA results — CONFIRM.	Mandatory
Positional accuracy	Varies by source. Report source specifications and any independent sample result; do not infer from EPSG or digitising display scale.	Mandatory
Thematic accuracy	CONFIRM measured class validation results or state not evaluated.	Mandatory
Use limitation	National/provincial/regional assessment; not legal cadastral or site engineering use.	Mandatory
Access / licence	CONFIRM approved classification, licence and attribution.	Mandatory
Format	OGC GeoPackage; version generated by final software — CONFIRM	Mandatory
View/access	ZNSDI landing page; WMS; WFS/OGC API – Features and/or bulk download — URLs CONFIRM	Mandatory
Owner/custodian	Government of the Republic of Zambia; responsible ministry/unit — CONFIRM official name	Mandatory
Metadata contact/date	Institutional role, email, phone/address and metadata revision date — CONFIRM	Mandatory

Annex B. Fully populated land-cover raster metadata example

ZNSDI field	Value to enter	Obligation
Metadata identifier	znsdi:nla:landcover:2026:10m:raster — CONFIRM final namespace	Mandatory
Resource title	Zambia National Land Cover 2026 — 10 m Raster	Mandatory
Alternate title	NLA Land Cover Raster 2026	Recommended
Resource type / scope	dataset / coverage	Mandatory
Language / character set	English (eng) / UTF-8	Mandatory
Abstract	National wall-to-wall categorical raster of dominant land-cover classes for Zambia for the 2026 NLA reference period. Produced primarily from cloud-screened Sentinel-2 imagery and approved ancillary data, classified to the NLA land-cover legend at 10 m cell spacing. Intended for national and subnational assessment, statistics and change analysis subject to the stated MMU and accuracy.	Mandatory
Purpose	Provide a consistent national land-cover baseline supporting the NLA, planning, environmental assessment, monitoring and ZNSDI dissemination.	Mandatory
Topic category	imageryBaseMapsEarthCover	Mandatory
Keywords	land cover; earth cover; raster; Sentinel-2; remote sensing; National Land Audit; NLA; Zambia	Mandatory
Geographic coverage	Republic of Zambia; exact bounding box from final raster — CONFIRM	Mandatory
Temporal extent	Exact imagery acquisition/composite period — CONFIRM	Mandatory
CRS	WGS 84 / UTM zone 35S — EPSG:32735 — CONFIRM final delivery CRS	Mandatory
Spatial representation	grid; georectified; two dimensions	Mandatory
Cell size	10 m × 10 m; distinguish from accuracy	Mandatory
Grid	Origin, rows, columns, extent and alignment — CONFIRM from final GeoTIFF	Mandatory
Bands	1 categorical class-code band — CONFIRM	Mandatory
Pixel type	Unsigned 8-bit or 16-bit integer — CONFIRM	Mandatory
NoData	0 or approved alternative — CONFIRM	Mandatory
Class catalogue	Machine-readable NLA class code, name, definition, colour and version table attached/linked	Mandatory
Lineage	Use the complete raster statement in section 9.3 plus exact sources/process steps.	Mandatory
Positional accuracy	Cell spacing is 10 m; effective positional accuracy depends on imagery geolocation, interpretation and processing. Report measured result if available.	Mandatory
Thematic accuracy	Independent validation: overall, user's and producer's accuracy and confusion matrix — CONFIRM values/report.	Mandatory

ZNSDI field	Value to enter	Obligation
Completeness/consistency	National valid-code, NoData, gap, undefined class, grid and file-integrity tests — CONFIRM results.	Mandatory
MMU	CONFIRM approved minimum mapping unit and narrow-feature treatment.	Mandatory
Use limitation	National/provincial/regional assessment; not cadastral, ownership or site-engineering use.	Mandatory
Access / licence	CONFIRM approved classification, licence and attribution.	Mandatory
Format	GeoTIFF; COG only if validated; lossless compression — CONFIRM details	Mandatory
View/access	ZNSDI landing page; WMS/WMTS; download/WCS/API endpoint — URLs CONFIRM	Mandatory
Owner/custodian	Government of the Republic of Zambia; responsible ministry/unit — CONFIRM official name	Mandatory
Metadata contact/date	Institutional role and current contact; metadata revision date — CONFIRM	Mandatory

Annex C. Templates and checklists

C.1 Mini Data Product Specification template

Section	Required content
Identification	Product title, identifier, owner, version and approval.
Scope and purpose	Intended decisions, geography, reference period and exclusions.
Content	Feature/raster classes, schema, legend and relationships.
Spatial representation	Geometry/grid, topology, CRS, extent and resolution/MMU.
Data capture/production	Sources, methods, parameters and update process.
Quality requirements	Elements, measures, thresholds and evaluation methods.
Portrayal	Approved style/legend and scale ranges where applicable.
Delivery	Formats, packaging, metadata, services and licence.
Maintenance	Revision frequency, triggers, responsibilities and archive.

C.2 Source register template

source_id	Exact title / custodian	Version / date	Scale / resolution	Licence / access	Role in product
SRC-001					
SRC-002					
SRC-003					

C.3 Process-step template

Step	Date	Organisation / software	Input	Operation and parameters	Output / QA evidence
01					
02					

Step	Date	Organisation / software	Input	Operation and parameters	Output / QA evidence
03					

C.4 Raster class catalogue minimum fields

Field	Definition
class_code	Unique integer stored in the raster.
class_name	Approved short label.
class_definition	Observable inclusion and exclusion criteria.
parent_code	Optional hierarchy parent.
colour_hex	Approved six-digit RGB portrayal colour.
priority	Overlap/generalisation priority where applicable.
source/evidence	Expected interpretation evidence.
valid_from / valid_to	Catalogue lifecycle dates.
catalogue_version	Approved legend version.

C.5 Exception log template

ID	Requirement	Location / feature	Finding	Risk	Decision / owner	Status
EX-001						
EX-002						

Annex D. Standards and implementation references

Reference	Purpose
ISO 19101-1	Geographic information — Reference model — Part 1: Fundamentals.
ISO 19107	Geographic information — Spatial schema.
ISO 19110:2016	Geographic information — Methodology for feature cataloguing.
ISO 19111	Geographic information — Referencing by coordinates.
ISO 19115-1:2014, Amd 1:2018, Amd 2:2020	Geographic information — Metadata — Part 1: Fundamentals.
ISO 19115-2:2019	Metadata extensions for acquisition and processing.
ISO 19115-3:2023	XML schema implementation for fundamental metadata concepts.
ISO 19131:2022	Geographic information — Data product specifications.
ISO 19157-1:2023	Geographic information — Data quality — Part 1: General requirements.
OGC GeoPackage	Open, standards-based SQLite container for portable geospatial information.
OGC WMS	Map-image viewing interface.
OGC WFS	Feature query/exchange interface.
OGC API – Features	Resource-oriented web access to feature data.
GeoNetwork documentation	Portal template, validation, workflow and metadata-management implementation reference.

Official online references (checked September 2026):

89. <https://www.iso.org/standard/53798.html>
90. <https://www.iso.org/standard/78900.html>
91. <https://www.iso.org/standard/80874.html>
92. <https://www.ogc.org/standards/geopackage/>
93. <https://www.ogc.org/standards/wms/>
94. <https://www.ogc.org/standards/wfs/>
95. <https://ogcapi.ogc.org/features/>

D.1 Interpretation and maintenance

Interpretation note This manual is an NLA application guideline. It does not reproduce proprietary ISO text. Where a conformity dispute arises, consult the cited official standard, the approved NLA DPS and the documented ZNSDI application profile.

Review this manual whenever the ZNSDI metadata application profile, NLA product specifications, approved legend, publishing platform or cited standards change. Record each approved amendment in the document-control register before issuing a replacement edition.