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MANUAL OF PROCEDURES ON THE TRANSFORMATION AND INTEGRATION OF CADASTRAL DATA INTO THE PHILIPPINE REFERENCE SYSTEM OF 1992 (PRS92)

Pursuant to Section 22 of the Department of Environment and Natural Resources (DENR) Administrative Order No. 2005-13 entitled "Revised Guidelines for the Implementation of the Philippine Reference System of 1992", this Manual is hereby issued for the guidance and compliance of all concerned.

SECTION 1. Objectives – This Manual is issued (a) to provide standards in converting and transforming cadastral data, surveys, and maps into PRS92, (b) to ensure spatial consistency in integrating these datasets to PRS92, preparation of Control/ Land Information Maps (projection maps), and utilization of these data by other users; and (c) to adopt basic database management practices to ensure quality, integrity and accessibility of datasets.

SECTION 2. Scope – This Manual shall cover the transformation and integration of all cadastral data to PRS92, and provide database management mechanisms covering the transformed datasets.

SECTION 3. Definition of Terms – The following terms used in this Manual shall be defined as follows:

a. Adjusted Coordinates – the resulting PRS92 coordinates after the application of the transformation parameters.

b. Analog data – traditional cadastral paper maps and records.

c. Cadastral data – records of cadastral and isolated surveys.

d. Cadastral database – a collection of logically related geo-referenced seamless digital vector data and raster data organized to facilitate data retrieval, exchange and integration, and a data model designed for all legal land objects managed by Land Management Bureau (LMB)/ Land Management Services (LMS) based on a survey of their boundaries. Such legal land objects are systematically identified by means of some separate designation and are defined by existing laws.

e. Cadastral map – a map made as a result of a Cadastral Survey, drawn to appropriate scale and showing all land parcels and important natural and man-made features within a municipality/project, for purposes of describing and recording ownership.

f. Cadastral survey projects – projects covering surveys of extensive areas covering an entire municipality or city consisting of several or many parcels of land undertaken for the purpose of title clearance and land registration.

g. Check points – control points used in assessing the accuracy of the transformation parameters derived.

h. Control Points – points whose coordinates are known, marked by a monument, and used as references for land surveys.

i. Conversion – the process of producing a digital version of an analog data.

j. Coordinate system – a fixed system of lines used to define the position of a point, line or plane.

k. Digital data – analog data recorded electronically that such storage and other operations can be made using computers.

I. Global Navigation Satellite System – a standard generic term for satellite navigation systems that provide autonomous geospatial positioning with global coverage.

m. Graphical Cadastre – a cadastral survey wherein the bearings and distances of the individual lots are determined using transit and stadia, scaling from photo maps, and other graphical methods.

n. Integration – the process of transforming and consolidating data, surveys and maps into PRS92.

o. Local transformation parameters – numerical constants used in the transformation of local or area-based coordinates into PRS92.

p. Metadata – a structured data which describes the characteristics of a feature.

q. Numerical Cadastre – a cadastral survey wherein the bearings and distances of the individual lots are determined from the computations based on the actual ground survey.

r. Philippine Reference System of 1992 (PRS92) – the national common coordinate reference system for all surveys and maps pursuant to EO 45, series of 1993, as amended by EO 321 and EO 280, series of 2000 and 2004, respectively.

s. Residual – the difference between the observed and the computed coordinates based on the transformation parameters derived.

t. Source Map – the map outputs of a cadastral survey used in the conversion of existing cadastral data such as cadastral maps, and boundary index maps.

u. Transformation – the process of converting spatial datasets from one coordinate system to another.

v. WGS84 – an earth-centered, earth-fixed global reference frame for the Earth, currently the reference frame being used by the Satellite-based Positioning System (SPS), for use in geodesy and navigation.

SECTION 4. Cadastral Data Conversion – The transformation and integration of approved cadastral data shall follow the process flow shown in Annex A^* . It shall start with the conversion of lot corners, survey project controls and other reference points. The data conversion of coordinates and maps is an initial step in the creation of the digital cadastral database.

The sources of data to be used in the conversion are as follows:

- a. lot data computation sheets
- b. lot description sheets
- c. field notes

- d. monument description books
- e. monument recovery reports
- f. municipal or boundary index maps
- g. project control maps
- h. traverse computation sheets
- i. political boundary computation sheets
- j. other relevant records

The conversion process shall be governed by the following order: (a) lot data computation sheets shall be the primary source of information for the cadastral lot data conversion, (b) in the absence of these, lot description sheets shall be used, (c) in the absence of the above, reconstruct the lot data computation and lot description sheets using the original field notes on file. (d) in case all of the above-mentioned sources of data are unavailable and after exerting all efforts thereon to retrieve from other sources, individual lots/parcels shall be resurveyed under the new reference system in accordance with the existing regulations thereof.

4.1 Inventory of Records – A comprehensive physical inventory of cadastral records shall first be conducted by the regional land sector offices in order to assess the completeness and quality of the records and facilitate the integration of these datasets into PRS92. The results of the inventory shall be reported following the format shown in Annex $B.1^*$ to $B.3^*$

4.2 Conversion of Coordinates – The coordinates to be used in the transformation shall be in Philippine Plane Coordinate System – Transverse Mercator / Luzon 1911 (PPCS- TM/ Luzon 1911) coordinates. Coordinates based on the Local Plane Coordinate System (LPCS) shall be converted to PPCS-TM/Luzon 1911 using the procedures prescribed by the Land Management Bureau (LMB) for conversion between the two coordinate systems.

4.2.1 Project Controls and Reference Points – Using the keyboard, encode the PPCS-TM/Luzon 1911 or LPCS coordinates (Northings and Eastings) of project controls or reference points using the customized Geodetic Network Information System (GNIS) or other spreadsheet or database templates developed for the purpose (see Annex C^{*} for the sample database template)

4.2.2 Individual Lots/Parcels – The Northings and Eastings coordinates in PPCS-TM/Luzon 1911 of lot corners including the corresponding tie point shall be encoded through keyboard entry using the customized Land Survey Data Management System (LSDMS) or other spreadsheet or database templates developed for the purpose (see Annexes D^{*} and E^{*} for the sample templates, respectively). The bearings and distances as computed from the encoded lot corner coordinates shall be checked with the technical descriptions indicated in the lot data computation sheets (LMB Form No. GSD-B-9A)

4.3 Conversion of Bearings and Distances – In the absence of lot data computation sheets, lot description sheets containing the bearings and distances of all lines of boundary surveys and individual parcels shall be used as reference for the data conversion.

4.3.1 Project Controls and Reference Points – Encode the bearings and distances of the project controls or reference points using the customized GNIS or other spreadsheet or database templates developed for the purpose.

4.3.2 Individual Lots/Parcels – The bearings and distances of all lines in the lot, including the corresponding tie line, shall be encoded through keyboard entry using the customized LSDMS or other spreadsheet or database templates developed for the purpose. The coordinates of the individual lot corners shall be computed based on the technical descriptions of the lot (see Annex F^* for the sample spreadsheet template.)

4.4 Reconstruction of Lot Data Computation and Lot Description Sheets Using Original Field Notes On File - In the absence of lot data computation and lot description sheets, and in case the original field notes of the cadastral survey is still available on file, lot data computation and lot description sheets shall be reconstructed using the prescribed procedures and computations.

4.5 Resurvey – A resurvey shall be conducted for lots with unavailable or missing records. The resurvey shall only be conducted after all efforts in researching data from other sources such as the Register of Deeds/Land Registration Authority (LRA), local government units (LGUs)/Assessor's Office, Court and other agencies or individuals, have been exerted and the affected lot is not titled/decreed. The new survey shall already be PRS92-compliant and shall no longer be transformed using the local transformation parameters.

4.6 Conversion of Graphical Cadastres (Cadastral Mapping) – Lot data computation for cadastral survey projects under the graphical cadastre system shall be generated after a resurvey of the affected lots have been conducted. The new survey shall already be PRS92-compliant and referenced to existing PRS92 control points. The lot data computation shall be converted for incorporation into the digital cadastral database.

4.7 Standardization of Data Conversion – To ensure uniformity and compatibility of converted data using different templates, the conversion shall follow the basic conventions set in Annex G^* for the encoding of cadastral records.

4.8 Quality Control for Data Conversion – Quality control measures shall be implemented by the regional offices to ensure the integrity of the cadastral data to be converted.

Errors observed in any of the data or records mentioned in Section 4, Paragraph 2 shall be properly noted for future technical/legal remedy.

In case of discrepancies in untitled/undecreed parcels /lots, correction shall be made by the Lands Management Services of the regional office concerned.

In case the discrepancy involves titled/decreed parcels/lots, corrections shall be made through court proceedings in accordance with the existing guidelines and procedures by the Lands Management Bureau. **4.9 Adoption and Approval of Coordinates from Converted Cadastral Data** – The coordinates of individual parcels derived from the converted cadastral data, shall be adopted as official lot data computation and shall be incorporated into the cadastral database.

Any discrepancy observed between the original and the converted cadastral data shall be noted for future technical/legal remedy.

4.10 Plotting and Projection – Using the encoded or computed coordinates, project controls and reference points, as well as individual lot parcels per cadastral case of the city or municipality shall be plotted and projected using appropriate Computer-Aided Design (CAD) or Geographic Information System (GIS) software. The resulting digital graphics shall be consolidated to form digital cadastral and index maps.

4.11 Setting up of the Digital Cadastral Database – A digital cadastral database containing the converted coordinates, bearings and distances shall be set up and maintained for easy access and retrieval. The database shall also include any available descriptions, sketches, and remarks pertaining to the boundary monuments and parcels of lots.

Cadastral, boundary index and other maps on record shall also be converted and incorporated into the database for reference purposes. The conversion of maps shall follow the prescribed guidelines and procedures.

SECTION 5. Recovery and Observation of Existing Control Points - Records mentioned in Section 4 Paragraph 2 shall be used as reference in the recovery and observation process.

5.1 Recovery of Existing Project Control and Reference Points – The Composite Survey Teams (CSTs) shall undertake the reconnaissance and recovery of all existing control and reference points. An additional six (6) points per adjoining municipality/ cadastral survey project shall be recovered in order to tie the local transformation parameters to its adjoining areas. The six points shall be located near the common boundary of the adjoining municipalities/cadastral survey projects.

Recovered points shall be preserved and maintained for use in subsequent surveys and in the process of transforming other environment and natural resources (ENR) datasets to PRS92.

A monument recovery report with the corresponding monument recovery sheets of all the reference monuments and the project control scheme shall be submitted by the CSTs to the Chief of the Regional Surveys Division for evaluation and reference purposes. The monument recovery sheet and project control scheme to be attached in the report shall follow the templates shown in Annex H^* and I^* , respectively.

5.2 Selection of Recovered Points for GPS Observation – Using the monument recovery report and project control scheme as reference, the CST shall select a sufficient number of recovered points for GPS observation. The selection of points shall comply with the following criteria set for the determination of transformation