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MEMORANDUM CIRCULAR NO. 2010 - 13


SUBJECT : ADOPTION OF THE MANUAL ON LAND SURVEY PROCEDURES

Pursuant to Executive Order No. 192 dated June 10, 1987, and DENR Administrative Order No. 2007-29 dated July 31, 2007, otherwise known as the Revised Regulations on Land Surveys, the attached Manual on Land Survey Procedures is hereby adopted.

The Manual on Land Survey Procedures is a useful reference for Geodetic Engineers/Contractors, Land Management Bureau (LMB), Land Management Services (LMS) in the different DENR Regional Offices, the Local Government Units (LGUs) and other stakeholders as it embodies the updated guidelines on the execution of all types of land surveys taking into consideration the technological advances in recent times.

All other memoranda, memorandum circulars and other issuances which are inconsistent with the provisions of this Manual are hereby amended accordingly.

This Memorandum Circular shall take effect immediately.


HORACIO C. RAMOS
Acting Secretary



Republic of the Philippines
DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES



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Manual on Land Survey Procedures



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MANUAL ON LAND SURVEY PROCEDURES

Pursuant to DENR Administrative Order No. 2007-29 dated July 31, 2007, otherwise known as the Revised Regulations on Land Surveys, the following procedures are hereby issued for the guidance and compliance of all concerned.

Part 1. Pre-Survey Activities and Field Operation

Chapter I - Control Surveys

Section 1. Control Surveys shall be fixed in a position on the surface of the earth by monuments of permanent nature. As per Sections 4 and 28, DAO No. 2007-29, the control surveys are defined and classified into geodetic and project control surveys. The manner of conducting survey for the aforementioned types of survey is described below.

Article 1 - Geodetic Control Surveys

Section 2. All Geodetic Control Surveys shall be conducted in the Philippine Reference System of 1992 (PRS 92) using survey grade GNSS receivers. The calibration/testing and registration of the instrument prior to their use shall be in accordance with Section 22, DAO No. 2007-29.

Section 3. The conduct of Geodetic Control Survey shall be in accordance with the following conditions:

- a. The project area selected shall be based on the recommendation of the Regional Executive Director (RED) concerned.
- b. The person to be authorized to conduct the survey shall be a qualified professional pursuant to RA 8560, otherwise known as the Philippine Geodetic Engineering Act of 1998, as amended. Moreover, Sections 9 and 13, Article 3, DAO No. 2007-29 shall be applied in the process.
- c. Survey Order as defined in Section 15 of DAO No. 2007-29 shall be issued by the NAMRIA Administrator.
- d. A copy of the Contract with the Notice to Proceed shall be transmitted to the contractor and shall signal the start of survey activities. The date when the contractor received the said documents shall serve as the official date of commencement of the project.

Section 4. Organization of the Geodetic Control Survey Party – The survey party and its component shall be as determined by the Project Contractor or the Chief of Party. However, the Geodetic Control Survey Party to be established shall have the following three (3) basic components:

- a. **Project Main Office** – for general supervision, coordination activities, administrative and other related matters. The Chief of Party shall be a

licensed Geodetic Engineer and his/her qualifications should conform to the requirements under Article 3, DAO No. 2007-29 and RA 8560, as amended.

- b. **Office Operations** – for data research, computations, cartographic, and other related activities. Manpower shall include computer literate personnel with knowledge on GNSS processing software.
- c. **Field Operations** – for reconnaissance, monument setting, observations, and other related activities.
 - 1) Survey Control Team
 - 2) Reconnaissance and Monument Recovery Team
 - 3) Monument Setting Team

All personnel in the three components mentioned above shall be listed in the proposed Geodetic Control Work Plan. The Geodetic Control Survey Project shall be composed of licensed geodetic engineers which include the Chief of Party, Assistant Chief of Party and instrument observer, in consonance with the provisions of RA 8560, as amended.

Section 5. Geodetic Control Work Plan – The Work Plan shall be composed of Project Management and Technical Plans. The Work Plan with the aforementioned documents together with the sketch plan of the project site shall be forwarded to the NAMRIA for approval before the commencement of the project. The approved Work Plan shall form part of the Survey Returns and shall include the following:

a. **Project Management Plan:**

- 1) Geodetic Control Survey Party : It shall enumerate the manpower compliments as mentioned in **Section 4** of this Manual;
- 2) Financial Plan: It shall include activity costing and the bill of materials, both for the office and field operations. The estimated miscellaneous expenses such as photocopying of documents, blue printing of maps, certification fees, etc. shall also be included;
- 3) Equipment complement for the project and their corresponding allocation in the different phases of work, both in the office and in the field. The surveying instruments to be indicated in the plan should be registered in accordance with Section 22 of DAO No. 2007-29; and
- 4) The estimated duration of the project expressed in number of days as per component project activities shall be presented in an Activity Graph, Time and Motion Diagram, PERT-CPM, etc. In the determination of project duration, the nature of the terrain and other physiographic features as shown in the Topographic map should be considered.

b. **Technical Plan:**

- 1) Using available NAMRIA Topographic Map of the area, the estimated boundary sketch of the project site shall be plotted on appropriate scale. This shall be used as the base map for the Geodetic Network Design.
- 2) The estimated number of control points to be established and their proposed locations shall be shown on the project site map; and
- 3) The proposed leveling measurement activities shall be included if NAMRIA has no available data for the area.

Section 6. Data Research and Old Monuments Inventory – The individual status of reference points of previously established Geodetic Control and Project Control Network adjacent to or within the project area shall be researched, evaluated and verified on the ground. Their corresponding Geographic Position and Plane Coordinates (GPPC), both in the Local and in the Philippine Plane Coordinate System (PPCS), shall be determined. Only stable or undisturbed control or reference points shall be considered in the design of Control Network. Moreover, the established PRS92 control points in the area which were validated and approved by NAMRIA shall also be included in the project design. The monument recovery report shall be accomplished using the prescribed form as illustrated in **Annex XIX** of this Manual.

Section 7. Notification of Survey - The following shall be notified in writing before the conduct of the survey, if applicable:

- a. The Provincial Governor's Office thru the Provincial Engineer's Office
- b. The Provincial Environment and Natural Resources Office (PENRO) concerned
- c. The DPWH District Engineer's Office
- d. The Community Environment and Natural Resources Office (CENRO) concerned
- e. The City or Municipal Mayor thru the City or Municipal Engineer's Office
- f. The Head of the Field Office of an agency which has jurisdiction over a land wherein at least one survey station or control point/reference monument will be established
- g. The Barangay Chairman
- h. Lot owner/claimant affected by the survey

Section 8. Geodetic Network Design - The network of controls covering the project site shall be plotted on the map as mentioned in Section 5.b of this Manual. The network design shall be composed of recovered/new control points and shall serve as guide in the conduct of actual ground survey.

Section 9. Baseline Length – the conduct of survey shall start from an established PRS 92 control point and shall end at another PRS 92 control point (check base) for checking purposes. In order to ensure their correctness, the following shall be taken into consideration:

- a. The baseline length for the Primary Geodetic Network (First and Second Order) shall be in accordance with the nominal space as provided for Section 28, DA0 2007-29.
 - 1) 1st Order - 50 kilometers
 - 2) 2nd Order - 25 kilometers
- b. In addition, for the Secondary Geodetic Network (3rd and 4th Order), the following shall apply:
 - 1) 3rd Order - 5 kilometers
 - 2) 4th Order - variable (each Barangay shall have at least a pair of Control Points not more than 2 kilometers apart)

Section 10. Designing Network of Controls – The inter-visibility of stations are not necessary in order to have a good Network Geometry in the GNSS observations. However, in the preparation of the Network Design, it is necessary that the points selected can be occupied, located in a stable ground and shall not be affected by any construction activities in the near future. Swampy or loose soil areas should be avoided.

Section 11. In the Network Design, the following shall be considered:

- a. The terrain and the physiographic features of the project area
- b. The availability of old Geodetic Controls
- c. Number of GNSS Receivers. More than Three (3) Receivers are sufficient for the purpose.
- d. Appropriate number and length of observations. These are dependent on the type of receivers (single or dual) to be used and the purpose of the survey.
- e. See **section 25** for other details.

Section 12. The following shall apply in the preparation of the map of the project site:

- a. The available NAMRIA Topographic Map on the area shall be used as base map;
- b. All the fixed controls (Old Control Points) based on the available records shall be plotted;
- c. The Points to be established shall be approximately plotted on the selected locations;
- d. Caution shall be taken in order to scale the map correctly. The distance between points is an important factor;
- e. Each station shall be numbered in accordance with **Section 16** of this Manual; and
- f. The Network Design's final map may be modified upon the conduct of Field Reconnaissance.

Section 13. Using the project site map mentioned in **Sections 5.b, 8 and 12** of this Manual as reference, it shall be ascertained that the Network Design shall be made to conform to the following conditions:

- a. The lines connecting the control points within the network should create closed polygons with the minimum number of sides, such as triangles that will create a rigid network.
- b. The Network shall be designed so that all stations or points included therein have at least three (3) known PRS 92 control points.
- c. The designed Network should have an adequate amount of Redundancy, or additional measurement over and beyond the absolute minimum required considering that the main objective is to have a required precision of the control point's final coordinates. As such, an optimal number of known points should be included, with as many cross-ties and repeated measurements as possible.

- d. Schedules for the field observation shall also be included in the plan. The field observations shall be timed when the Position Dilution of Precision (PDOP) is low. A low PDOP value indicates a higher probability of accuracy.

Section 14. Reconnaissance of the area shall be conducted to determine if there are control points that need to be transferred from their proposed sites to strengthen weak geometric figures. The result of the Reconnaissance shall finalize the preliminary Network Design. During the reconnaissance, the following shall be determined:

- a. Accessibility of the proposed locations of the control points. They should not be within an on-going or a proposed construction road or structures;
- b. Ground stability of the proposed location. It should support the permanency of the monuments. They should be far from the areas prone to flooding, land slides, peoples activity route, and others which will cause the probable disturbance of the monuments;
- c. The best route to reach each survey station (in any type of weather and at any time of the day or night). The route map shall be drawn and the directions are written so that the survey team shall easily find the site;
- d. Proximity of radio station towers that may possibly disrupt transmission of data and presence of any obstructions above 15° of the horizon;
- e. Estimated travel time between stations. The travel time from the field office to the project site shall also be determined. This shall serve as input in the finalization of the Work Plan of the project;
- f. Actual number of the old control points to be recovered by the survey team and their corresponding status on the ground; and
- g. The private property owners from whom to obtain the permission to enter the premises where the survey stations are proposed to be established, or if the owners are already known, secure the said permission.

Section 15. Geodetic Control Monuments - The position of reference points shall be defined and marked on the ground by monuments of permanent nature in the form of a square base frustum illustrated in **Annex III.A.1** of this Manual and in accordance with the following standards:

- a. Dimension of Survey Control Monuments:

Order of Accuracy	Top Cross-Section	Bottom Cross-section	Length	Above Ground	Below Ground
First	30 x 30 cm	40 x 40 cm	120 cm	20 cm	100 cm
Second	30 x30 cm	40 x 40cm	120 cm	20 cm	100 cm
Third	25 x 25 cm	35 x 35 cm	120 cm	20 cm	100 cm
Fourth	20 x 20 cm	35 x 35 cm	100 cm	20 cm	80 cm

- b. Concrete monuments shall be fabricated with reinforced steel bar (10 mm in diameter for vertical bars and 8 mm in diameter for ties) and satisfying the requirements of class A concrete specifications in the ratio of 1:2:4 or translated into a concrete mixture such as 1 cubic meter of cement, 2 cubic

meters of sand, and 4 cubic meters of gravel or 2 bags of cement, 4 bags of sand and 8 bags of gravel. Sand and gravel must be clean, free from dust or mud or other organic matter.

- c. The concrete monuments shall be cast in place where they will be established.

Section 16. Markings of Reference Monuments - They shall be marked on top with engraved letters and shall consist of five (5) parts namely, Provincial Code, Control Point Number, Year Established, Order of Accuracy and the office or entity that established the Reference Monument. Illustration is found in **Annex III.A.1** of this Manual. In addition, the following shall be taken into consideration:

- a. The List of Provinces and their corresponding Code is found in **Annex IV** of this Manual. The NAMRIA shall be consulted for assignment of Code to the newly created provinces.
- b. The numbering of control points shall be from 1 to 3000 for those established by NAMRIA and 3001 and so forth for those established by LMB/LMS and other entities.
- c. The name of the office or entity that established the control point shall be inscribed using only one word which could either be an acronym, company name or surname of a person.
- d. To avoid duplication of numbers, the establishing entity shall coordinate with NAMRIA for the First and Second Order control points and with the concerned LMS Regional Office for the Third and Fourth Order control points. The LMS shall furnish the data to LMB on the established control points for the updating of the Reference Points National Database.
- e. All the letters and numbers shall be in "**Arial Bold**" Font Type, all capital and shall be 2.5 cm in height, 2 cm in width and 0.4 cm in thickness with margins not less than 2 cm. along the edge of the monument to give allowance for chipping.
- f. It should bear the mark "GOV PROP" which stands for government property.

Section 17. Selection of Location for Establishing Reference Monuments – The monuments shall be established as close as possible to the position as stated in the Network Design taking into consideration the objective of preventing its destruction and loss. The following shall be considered in selecting location for establishing the monuments:

- a. The spot shall be readily identifiable and easy to find.
- b. It shall provide the most stable ground and has considerable distance from shorelines, river banks, ravines, ditches, etc. to prevent its displacement in case of landslide, erosion or rising of water level.
- c. The monuments shall be located in an area with a safe distance from the road, a right of way or from the proposed expansion or road widening where it is likely to be subjected to damage, disturbance or obliteration in the future.
- d. The nature of soil shall be observed so that the required depth below the ground and the length exposed above the ground can be determined.
- e. The priority area shall be a government owned land wherein the accessibility and the security of the monument can be assured.

Section 18 . The control point shall be identified by its complete geographic position which shall be expressed in latitude, longitude and elevation. In order to easily locate the site, the following data shall be recorded for every established monument:

- a. General location with respect to Island and province, distances and directions from the larger towns or other well-known and easily found features;
- b. Location with respect to local features, namely settlements, poblacion, highways, topographic features such as bodies of water and prominent ground forms, etc.;
- c. Land ownership, whether consent of the owner has been obtained to establish the station through a special agreement. The Reconnaissance Team should obtain permission to enter upon private property, if there is a necessity to establish a station therein. The notification letter and the corresponding written permission/special agreement signed by the owner or his duly appointed representative, should be furnished to the Observing Team;
- d. Direction for reaching the station starting from sizeable towns, adequately describing roads and junctions, stating mileages, and including descriptions of alternate routes, if advisable;
- e. Detailed location with respect to roads, fence lines, buildings, etc. including directions and paced or measured distances, notes of special markings;
- f. Include vicinity and detailed sketch of the monuments;
- g. Description of the monument including dimensions and inscription.

Section 19. The establishment of geodetic control covering the First and Second Order Accuracy shall be done only using a GNSS Receiver. There shall be at least three (3) receiver units per survey team. The employment of more than four (4) Receivers is preferable.

Section 20. The GNSS receivers to be used in the conduct of ground survey shall undergo calibration/testing and registration pursuant to Section 22 of DAO No. 2007-29.

- a. Minimum specifications - The minimum specifications shall be in accordance with **Section 202.g** of this Manual.
- b. The types of receivers to be used shall depend on the following:

Receiver	Baseline Length	Mode of Positioning
Single Frequency	Up to 10 km	Limited to Static
Dual Frequency	No Limitation	Static, Rapid Static, Kinematic, Real-Time Kinematic (RTK)

Section 21. Instrument Preparation Prior to Fieldwork – Before going out in the field, the following should be checked/done:

- a. There shall be no mixing of different receiver types or even model.
- b. Fully charge the battery to ensure maximum power supply. At no stage during the field observation should the Receiver be powered down, not even for a few seconds. There should always be spare batteries. Changing of

batteries shall not be done during the observation as it will cause the Receiver to lose lock on satellites, which in turn will cause a major cycle slip.

- c. Ensure that the memory device of the receiver has an ample storage capacity left for storing the estimated observations as per Network Design. Field notes shall still be used for purposes of counter-checking and cross-referencing during the data processing; and
- d. Ensure that the receiver settings such as elevation mask, synchronous rates, observation types, etc., are the same for all types of receivers.

Section 22. Before the start of operation, the following procedural conditions shall be observed:

- a. Control points that are to be observed at the same time shall form a Session and shall be linked together through pivot sites. Pivot sites shall be the stations that are common to two or more sessions.
- b. All receivers shall be set at the same logging interval (default is 15 seconds.)
- c. All receivers shall have the same elevation mask (default is 13°)
- d. All receivers shall be set at the same coordinate system (UTM, Zone 51 North, WGS84)
- e. The Maximum PDOP shall be 7 and shall preferably less than 5 particularly for shorter observation such as Rapid Static.
- f. The survey mode shall be the same (if one is in the Static Mode others should also be in the Static Mode; if one is in Real-Time Kinematic others should also be in Real Time Kinematic, and so on).
- g. The equipment frequency shall be the same in all the observation points (if dual frequency is being used by one station, the other stations should be also using dual frequency)

Section 23 . The following shall be the prescribed activities in the conduct of GNSS field observations:

- a. The GNSS receiver unit shall be set up on the survey mark/monument with the receiver's center exactly over the center of mark/monument which is usually a brass or steel bar.
- b. The observer shall follow the amount of warm-up time as per manufacturers' specification considering that it is instrument dependent.
- c. The receiver shall be properly connected to the power source (battery packs). A second of glitch in the power source will affect the entire observations.
- d. The antenna height shall be measured to the nearest millimeter. One of the major blunders that resulted to ultimate GNSS observation mistake is to misread the antenna height. At least two (2) members of the team shall be assigned to measure the antenna height separately.
 - 1) The antenna shall be centered to the station to the nearest millimeter. Antenna shall be oriented to the North. All antennae shall be oriented in the same direction, as this helps eliminate any systematic errors in antenna center location. Antenna are usually marked with an arrow on the ground plane to aid orientation;

- 2) The observer shall indicate where the antenna height's measurements were taken. (Bottom of notch, Hook using tape, etc.)
 - 3) The antenna heights measurement shall be taken before and after observations. Measured data shall be written on field sheets.
 - 4) Precautions shall be taken to make sure that the instrument height measurements are recorded correctly in the field sheets, as well as the station name, unit serial number, and the time. Mistakes in height measurements are the most common source of error in GNSS surveying. Effort shall be made in order to reduce the possibility of blunders caused by incorrect measurement such as considering using Fixed-height tripods.
- e. The height, station name, serial number, antenna model, and start and stop time shall be properly recorded in the field sheets. All information in the field sheet found in the **Annex XX** of this Manual shall be completely and properly filled-up.
 - f. The observation shall begin after verifying if the instrument is logging data when the unit is turned ON.
 - g. The guide to baseline length based on the Network Design and the observation time shall be followed by the observer. Some of the baselines shall be observed more than once to increase the level of redundancy.

Section 24. A minimum of four (4) satellites shall be observed with the following duration:

- a. The following shall be the observation time and number of session for Static Mode:

Types of Receivers	Baseline Length (kms)	Minimum Observation Time	Session	Interval Between Session
Single Frequency	0-5	1 hr	2	At least 30 mins
	5-10	2 hrs		
Dual Frequency	10-20	1.5 hrs	2	At least 30 mins.
	20-30	2 hrs		
	30-50	3 hrs		
	50-150	4 hrs		

- b. The following shall be the minimum session length for the Rapid/Fast Static Mode:

No. of Satellites	Up to 5 kms	5-10 kms.
4	20 min	35 min
5	15 min	25 min
6 or more	10 min	20 min

- c. The minimum session lengths stated above shall be the minimum period of unbroken data. In case of doubt, more data shall be recorded in order to ensure redundancy.
- d. If observations are being conducted in a remote area where the baselines cannot be processed and validated before the survey team leave the area, longer observation periods shall be considered.

Section 25. Connection to existing controls - Connection shall be made to control of the same or higher Order of Accuracy with the following number of observations:

To Achieve	Minimum Observations	Recommended Observations
1 st Order	3	4 or more
2 nd Order	2	3 or more
3 rd Order	2	2

Section 26. In conducting independent observations, the following shall be noted:

- a. Each point shall have a minimum of two independent observations to ensure true redundancy.
- b. Each independent observation shall be of different antenna height.
- c. To ensure different satellite geometry while conducting independent observations on the same day, the time difference between succeeding observations shall be at least one (1) hour. The full specified minimum observation period shall be observed with each occupation.

Section 27. The following shall be observed during and after the GNSS session in order to prevent loss of data, low data quality, and other blunders which will necessitate field re-observations:

- a. During the recording session, the observer shall take note of the Geometric Dilution of Precision (GDOP) which indicates the geometrical strength of a four or more satellite constellation as it applies to instantaneous point position fixing. The lower the number of the GDOP, the better the geometry for achieving an accurate point position.
- b. The data stored inside the receiver shall be downloaded as soon as possible and determine if there is a need to delete previous observed data to avoid overload on the receiver's memory which could prevent recording of the next session.
- c. While collecting data, the use of electronic device such as radio, cellphone, laptop, etc. within 10 meters from the GPS Receiver should be avoided.

Section 28. Status of the Old Geodetic Control Points – The Old Geodetic Control Points shall be included in the Geodetic Network Design pursuant to **Sections 6, 11 and 12** of this Manual and shall be observed together with the new control points. Each of the recovered control points shall have both the old PTM (PPCS) and PRS92 coordinates due to the possibility that a number of titled properties are tied to the said monuments. This procedure shall remain until a legislative act is promulgated to address the matter.

Article 2 - Project Control Surveys

Section 29. Project Control Surveys shall be conducted in order to establish set of reference points for a Cadastral Survey, Public Land Subdivision Survey, Townsite Reservation, and other similar survey projects which cover a whole or a portion of municipality or city, with accuracies belonging to Primary Control or Third Order Geodetic Survey, Secondary Control or Fourth Order Geodetic Survey and Tertiary Control. The kinds of reference monuments are listed in Section 34, DAO No. 2007-29. The survey instruments to be used are the following:

- a. Electronic Total Station (ETS), GNSS Receivers, or combined GNSS/ETS.
- b. If ETS surveying instruments are to be used, the control survey shall be conducted either by traverse, triangulation or any combination thereof, referred from an established PRS 92 reference monument.

Section 30. The Survey Order of the survey projects mentioned in **Section 29** of this Manual shall cover this activity, it being a portion of the said survey projects. However, if the Project Control is an independent project, provisions of **Section 3** of this Manual shall apply subject to the following conditions:

- a. The corresponding Survey Order shall be issued by the RED concerned; and
- b. The project area shall be based on the recommendation of the RTD for Lands.

Section 31. Organization of the Survey Party – The survey party shall be the Survey Control Team of the survey projects mentioned in **Section 29** of this Manual. However, if the Project Control is an independent project, the survey party shall be established with at least three (3) major components as listed in **Section 4** of this Manual. The conduct of project control independent from a cadastral survey shall be the function of the LMS Survey Team. If the said group is unavailable, the project may be done through a Contract with a qualified Private Geodetic Engineer/Contractor pursuant to RA 9184.

Section 32. Project Control Work Plan – The work plan for the conduct of Project Control is included in the work plan of the survey project where it is a component, e.g. Cadastral Survey Management Plan (CSMP) of the Cadastral Survey Project where the the establishment of Main and Subsidiary Controls, are incorporated. However, if the Project Control is an independent project, the provisions of **Section 5** of this Manual shall apply. Once the Project Control Work Plan is approved, there shall be no changes to be made therein without prior approval of the RTD for Lands concerned.

Section 33. Data Research and Old Monuments Inventory –The provisions of **Section 6** of this Manual shall apply. In addition, the following shall also be collated to be used as reference data:

- a. The Projection Maps (PM) for the entire area of the project showing all previous surveys;
- b. Copy of plans and computations of all previous surveys within the project;
- c. Last Progress Map of each adjoining cadastral project in progress or completed;
- d. Approved horizontal angle, distances and other data on the primary traverse stations of adjoining projects; and
- e. Approved data on municipal boundaries and lot corners equivalent to that of the municipal boundaries of adjoining projects.

Section 34. If the Survey Control is an independent project, the survey team shall establish and maintain a survey office properly identified with a signboard 60 x 120 centimeters in dimension, in the poblacion of the municipality/city to be surveyed. The office shall be maintained until the final inspection of field operations by the Chief, Regional Surveys Division, and shall be closed only upon the written permission of the RTD for Lands concerned.

Section 35. Notification of Survey – the provisions of **Section 7** of this Manual shall apply.

Section 36. Network Design or Scheme – A map of the project site, which shall form part of the Work Plan as mentioned in **Section 32** of this Manual, shall be prepared and the network of controls shall be plotted therein following the provisions stated in **Sections 5, 8 to 14** of this Manual. It shall also contain a location plan drawn in appropriate scale with the indicated approximate distance of the project from the poblacion of the municipality or center of the city and show the nearest place of point accessible to transportation. This shall serve as guide in the conduct of actual ground survey. The order of accuracy to be used shall be governed by the area of the project as provided for in Section 28.b of DAO No. 2007-29.

- a. Reference Control – The conduct of survey shall take-off from an established PRS 92 control point and shall end at another PRS 92 control point (check base) for checking purposes. The Network Design shall be used as a guide of the survey team to locate the selected control points. In the case of conventional surveying methods, control points should be inter-visible.
 - 1) **Section 9.b** of this Manual shall be followed in the establishment of baselines for the 3rd Order (Primary Control) and 4th Order (Secondary Control) when using GNSS receivers. The length of baseline for the lower order of controls shall follow the requirement as prescribed for 4th Order Accuracy.
 - 2) The Project Control to be established using ETS shall be in accordance with Section 28.b, DAO No. 2007-29.
- b. Designing Network of Controls – **Sections 10 and 11** of this Manual shall be considered in designing Network of Controls when the instruments to be used are GNSS Receivers. In a Network Design for field survey using terrestrial (conventional) instruments and techniques, the following shall be considered:
 - 1) The terrain and the physiographic features of the project area. Control points should be established on solid ground. Those prone to floods, swampy or loose soil areas should be avoided.
 - 2) The inter-visibility of stations shall be the primary concern. The lines connecting the control points within the Network should create closed polygons with the minimum number of sides, such as triangles for strength of figure. The inter-visibility of stations should remain as such in the future. In that case, care should be taken to ascertain whether a potential obstruction may possibly occur in the future.
 - 3) A minimum of two reference points (three is preferred) should be visible from each control point. Lines occupied at only one end should be avoided.
 - 4) The Network triangles should preferably be equilateral.
 - 5) The availability of data on old Geodetic and Project Controls based on records. Also the leveling data from NAMRIA, if available.

- 6) The maximum range of the instrument to be used.

Section 37. The provisions on **Sections 12 and 13** of this Manual shall be followed in Network Design of Project Controls using GNSS instruments. In the design of the Network Controls and the preparation of preliminary project control sketch map for conventional methods of surveying, the following shall apply:

- a. The available NAMRIA Topographic Map on the area shall be used as the base map;
- b. The map shall show all the proposed control points numbered consecutively starting from number one (1). Each station shall be given a unique identification code number;
- c. Caution shall be taken in order to scale the map correctly. The distance between points is an important factor in estimating accurately the distance on the ground;
- d. All the main control points in a proposed Cadastral Project, Public Land Subdivision Projects, Townsite Reservation Subdivision, and other similar large survey projects shall be conducted with a Primary (3rd Order) Accuracy and shall be designated as Bureau of Lands Location Monuments (BLLMs). The first primary control point known as P1 of the main control shall be designated as BLLM No. 1 of the project, the second primary control point(P2) or the last main control station shall be designated as the BLLM No. 2 of the project.
- e. The main control shall start from PRS 92 Primary Control Point and closes to another PRS 92 Control Point of the project and their proposed location shall be plotted as accurately as possible on the Network Scheme considering that they shall control all subsidiary reference points within the project;
- f. When no location monuments have been previously established, a pair of Bureau of Lands Location Monuments (BLLMs), to be numbered 1 and 2 shall be approximately plotted on the map at the most suitable location and as near as possible to the center of the municipality or the project.
- g. The points to be established shall be approximately plotted on the map. The approximate line routes or the connection lines from one control point to another shall be shown on the map;
- h. All the fixed controls (old Control Points) based on the available records shall be accurately plotted. At least three (3) Second Order or Third Order Geodetic Control stations shall be included in the Network;
- i. Whenever the main control includes established geodetic control stations, the main control shall be designed such that it can be divided into loops wherein each loops shall start from one geodetic control station and shall close to another geodetic control station;
- j. The main controls to be established, as much as possible, shall follow the project boundary. If the place is rugged as shown in the topographic map, the controls shall be placed near the boundary where it is fairly level, although they are a little beyond the administrative jurisdiction of the concerned LGU;
- k. In case mountain peaks or hills define the boundary of municipality or project, the primary controls shall be located at the base of the mountains or hills. If the terrain is rugged, it may be plotted along the existing road lines located as near as possible to the boundary;

- i. Additional pairs of location monuments shall be established along the main control of the project at an interval of around 5 kilometers or at least a pair for every Barangay, whichever provides the shorter distance, and shall be designated and numbered as BLLM No. 3 and BLLM No. 4; BLLM No. 5 and BLLM No. 6; etc.. Pursuant to Section 28, DAO No. 2007-29, consideration should be taken by the Geodetic Engineer to ensure that no lots shall have a distance of more than one (1) kilometer from the nearest reference point, whenever possible, based on the project control network design.

Section 38. The reconnaissance of the area shall be conducted to determine if there is a need to amend the proposed locations of the control points plotted in the Network Design to achieve rigid geometric figure. Provisions of **Section 14** of this Manual shall apply in addition to the following conditions:

- a. That there are no vertical structures in the area that will affect the inter-visibility between pairs of stations as reflected in the Network Design;
- b. That the line of sight is not in any way obstructed by transportation vehicles in a busy street which will negatively affect the transmission of signal from the instrument to the prism and vice-versa; and
- c. That the general condition of the atmosphere of the area such as vapor, refraction, temperature, pressure humidity, and others, should not affect the electronic measuring capability of the ETS.

Section 39. Project Control Monuments - The position of reference points shall be defined and marked on the ground by monuments of permanent nature in accordance with the standards set forth in **Section 15** of this Manual for the 3rd Order Accuracy.

Section 40. Markings of Reference Monuments - Reference monuments shall be marked on top with engraved letters and shall consist of five (5) parts namely, Municipality, BLLM Number, Project Number, the Office or entity that funded the project, and the Year Established. Illustration is found in **Annex III.A.2** of this Manual. In connection therewith, the following conditions should be taken into consideration:

- a. The numbering of control point shall be coordinated with the LMS Regional Office concerned. The LMS shall furnish the data to LMB on the established control points for the updating of the Reference Points National Database.
- b. To avoid duplication of cadastral project numbers, the establishing entity through the concerned LMS Office, shall coordinate with LMB for the numbering thereof. The LMS shall furnish the data to LMB on the approved Cadastral Projects for updating the National Database. The LMS shall issue survey project number for other large survey projects such as Pls, Sgs, Ts, etc.
- c. The name of the office or entity which funded the project shall be inscribed in the monument pursuant to **Section 16.c** of this Manual. The style and sizes of letters and numbers shall be in accordance with **Section 16.e** of this Manual.

Section 41. Selection of Location for Establishing Project Control Reference Monuments – The provisions of **Section 17** of this Manual shall be observed in the selection of location where the monuments are to be established.

Section 42. The data to be gathered and recorded for every established monument shall be in accordance with **Section 18** of this Manual.

Section 43. The GNSS Receiver and ETS to be used in the conduct of project control survey shall undergo calibration/testing and registration pursuant to Section 22 of DAO

No. 2007-29. The specifications and types of GNSS instruments to be used shall be in accordance with **Section 20** of this Manual. For the ETS, **Section 202.f** of this Manual shall apply.

Section 44. Instrument Preparation Prior to Fieldwork – The condition of the GNSS receivers should be checked pursuant to **Section 21** of this Manual. For ETS equipment, the following shall apply:

- a. The instrument's battery should be fully charged in order to ensure maximum power supply. There should always be spare batteries. Cautions should be taken when resorting to cars and motorcycle batteries as improvised external batteries as these may cause problems in the internal circuitry of the instruments.
- b. Memory device of the field data recorder shall be checked if there is an ample capacity left for storing the estimated observations scheduled for the day. Previous projects data should be downloaded to the computer immediately and clear the memory device to be ready for the present project. Field notes shall still be used for purposes of counter-checking and cross-referencing during the data processing.
- c. The equipment shall be checked for prism off-center constant which is either zero or +/- 30 millimeters. The use of prism belonging to other brand may result to erroneous appreciation of distance due to the prism constant. The prism of some brand that has a 30 millimeter prism constant are either to be manually inputted or are automatically compensated by the instrument in the computation of horizontal distance.
- d. For purposes of establishing controls, the prism shall have a separate tripod wherein it can be mounted over the station at the end of the line being measured.
- e. A partial testing/calibration over one of the established calibration base should be carried out before its use in any project, if the instrument has not been used for around six (6) months. Small check base should be established in the project area by the project chief. Two stations, approximately 300 meters apart, should be located and pegged with an intervening station at a commonly measured distance. A test of the instrument over this check base prior to the start of work may suffice to ascertain whether the same is fit for standard measurements or not. The field notes of this test shall form part of the survey returns.
- f. If any discrepancy is noted as larger than the prescribed allowable linear error for 3rd Order under Section 28, DAO No. 2007-29, then a full testing/calibration may be necessary over the established baseline of the LMB.

Section 45. Conduct of Project Control Surveys – Ground survey for the establishment of Project Control using GNSS instrument shall be conducted following the provisions of **Sections 23-27** of this Manual. For the ETS, the procedure as stated in **Annex XVII.A.1** of this Manual shall be followed. In addition, the following shall be taken into consideration:

- a. For ETS with electronic data recorder, a printed and a digital file of raw data shall be included in the survey returns in an acceptable format.
- b. For those without electronic data recorder, all field observations shall be recorded by the Geodetic Engineer in the field notes and the following shall apply:

1. In case of surveys executed by geodetic engineers in private practice, field notes and field notes cover on authorized LMB forms shall be properly filled-out and sworn to before a notary public. In case of geodetic engineers employed in the government, the said documents should be sworn to before an official authorized to subscribe oath.
2. All survey data should be legibly written in the field notes by the geodetic engineer or his authorized assistant performing as instrument man under his direct supervision during the conduct of the survey.
3. Field notes shall be bound in hard book cover made on prescribed cardboard materials for record preservation and shelf filing. The number and name of the field book shall be indicated on the cover. The pages of each book shall be numbered consecutively from one to not more than 150 pages which shall be written on the upper right hand corner of the right face of the field notes.

Section 46. Distances of primary control lines that cannot be directly measured shall be indirectly determined by triangulation with the following requirements:

- a. The position of triangulation stations shall be selected so that no angle may be less than thirty (30) degrees and each angle of the triangle shall be measured using the repetition method or the direction method as in the case of the measurements of the horizontal angle of primary controls.
- b. Whenever possible, a scheme of quadrilateral shall be established and the angles between the diagonals and sides of the quadrilaterals shall be measured.
- c. At least two base lines shall be measured, one situated at the beginning and the other at the end of the triangulation scheme and the triangulation control shall be adjusted between these base lines. The length of the base line shall be measured with the same degrees of accuracy as that of the primary control lines.

Section 47. When the instrument to be used in the establishment of Project Control is a combination of GNSS and Total Station, provisions from **Section 29 to 45** of this Manual shall be followed. The geodetic engineers shall have the options to switch either to the GNSS mode or to the ETS mode of the instrument to make use of the advantages of both system (i.e. GNSS- line of sight not required between measured points but requires long period of observations; ETS- not requiring horizon clearance but requires inter-visibility of stations). However, the following shall be observed when using the said instrument:

- a. The Network Design shall reflect the instrument's mode in every control station. This shall be strictly followed except when conditions on the ground do not warrant the use of such mode at the time of observation. The matter shall be noted on the field notes/survey returns.
- b. Field data shall be properly labeled in the survey returns (which data are from GNSS Observation and which are from ETS). The corresponding corrections/adjustments shall be applied and these must be clearly indicated therein.
- c. The strength of figure shall be the primary consideration. There shall be no mixing of instrument in a polygon, except to determine the coordinate of the starting point (i.e. the loop started using the ETS shall be finished using the ETS). Interconnection between loops maybe made with either GNSS or ETS. This shall be noted on the field notes/survey returns.

Section 48. The geographic position of BLLM No. 1 of the survey project shall be derived from the 2nd and 3rd Order geodetic control stations as identified in **Section 37.h** of this Manual. In the absence of 2nd and 3rd Order geodetic control stations within the distance of ten (10) kilometers from the project boundary, connection of primary precision shall be made to any other point of reference certified by LMB. All the control points wherein the connections are to be made shall be in PRS92 or if not, shall be first transformed into the PRS92 . The central meridian of the zone which shall be determined in the PRS92 , shall be the base meridian to which all azimuths of lines of the project shall be referred.

Section 49. Grid Azimuth - The grid azimuth to be used in the Cadastral Project shall be derived from the PRS92 grid coordinates. The following provisions shall apply in connection with the PRS92-based determination of grid azimuth:

- a. When the grid azimuth for the cadastral project cannot be obtained by direct connection to established PRS92 geodetic control lines, a GNSS observations on BLLM Numbers 1-2 of the project shall be conducted independent of any previous determination. GNSS observation shall be made on other pairs of main control location monuments of the cadastral project to check on the carried grid azimuth of the line;
- b. GNSS observations to determine the azimuth of other lines of the main control such as BLLM Nos. 1-2, 3-4, 9-10, etc. shall be used only as a check on the carried grid azimuth of the lines;
- c. Check on azimuth shall be from azimuth line to another azimuth line. The azimuth line is computed from the PRS92 position of two selected points reduced to grid. The angular error in azimuth if within the specifications as provided for in Section 28.b of DAO No. 2007-29 shall be distributed among the angles between the azimuth lines;
- d. The linear error of closure is determined and if within the allowable limit as provided for in Section 28.b of DAO No. 2007-29, the latitude and departure shall be distributed accordingly; and
- e. When the main primary control is divided into traverse loops, GNSS observations shall be made at the main station common to the loops.

Section 50. Connection with Adjoining Projects – The Main Control of the project shall be connected to the adjoining cadastral projects for conformity. However, the following shall govern this process:

- a. The adjoining project/s must be in the PRS92 and was duly approved by the DENR-LMS Office concerned.
- b. GNSS observations shall be conducted on the two extreme stations common to the two projects to determine the azimuth and distance of the line connecting the said points.
- c. If there is a discrepancy between the adjoining projects and the on-going project as provided for in Section 28, DAO No. 2007-29, a report shall be made and shall be forwarded to the LMS, which in turn shall form a Technical Committee to investigate the matter and submit a corresponding recommendation to the RED.
- d. If the adjoining project is in the PPCS/PTM, the main control of the projects shall be transformed into PRS92 and perform operation as in above (a) to (c) of this Section. The same shall also be done to those adjoining projects in the Local Plane Coordinate System (LPCS).

Section 51. Status of the Old Project Control Points – The Old Project Control Points which shall be evaluated pursuant to relevant provisions of **Sections 143 to 155** of this Manual shall be included in the Geodetic Network Design pursuant to **Sections 11 and 12** of this Manual and shall be observed together with the new control points. Each of the recovered control points shall have both the old PTM (PPCS) and PRS92 coordinates due to the possibility that a number of titled properties are tied to the said monuments. This procedure shall remain until a legislative act is promulgated to address the matter.

Section 52. The RED and/or the RTD for Lands and/or their duly authorized representative/s upon coordination with the CENRO concerned shall have the full and unrestricted rights to inspect and supervise the operations of the survey team and to issue instructions from time to time, as they may deem necessary for the proper execution of the project. They shall have free access to the records such as progress maps, sketches, and other data in connection with the project, in order to check and verify the accuracy and completeness thereof.

Chapter II - Cadastral Surveys

Article 3 - Numerical Cadastre

Section 53. Cadastral Survey as defined in Section 5, DAO No. 2007-29 has the following stages of activities:

- a. Project Control Survey – refers to the establishment of main and subsidiary controls over the entire area subject of the cadastral project.
- b. Political Boundary Survey – refers to the establishment of political boundary monuments defining the boundary lines of the entire city/municipality and their component barangays.
- c. Lot Surveys - refers to the determination of individual lot boundaries and their corresponding area primarily for the purpose of acquiring title thereto. Other lands which cannot be subjected to private ownership shall also be included in the lot survey and shall be issued a Cadastral Lot Number. However, in the cadastral maps and in the List of Claimants, they are identified as Reservations, Forestland/Timberland, Protected Areas/Sanctuaries, Government Centers, etc.

The survey of cadastral project shall be considered as in progress from the issuance of Survey Order/Survey Contract by the Regional Executive Director until the final approval of the survey returns by the Regional Technical Director for Lands.

Section 54. All Cadastral Survey Projects shall be conducted in PRS92 with accuracies required under Section 29, DAO No. 2007-29 in relation to Section 28 of the same DAO.

Section 55 . The provisions of DAO 2008-14 dated August 05, 2008, otherwise known as the Guidelines on the Conduct of Bidding and Awarding of Cadastral Survey Projects Contracts Pursuant to RA 9184, and **Section 3** of this Manual shall apply in awarding of survey project except that the Survey Order shall be issued by the RED who has jurisdiction over the area, upon recommendation of the Regional Bids and Award Committee (RBAC) headed by the Regional Technical Director (RTD) for Lands.

Section 56. Cadastral survey project numbers shall be issued by LMB. This shall prevent the duplication of number considering that a particular cadastral number shall pertain to a particular municipality/city in the country.

Section 57. The Survey instruments to be used in the different phases of the project shall be the following:

- a. Survey instruments to be used shall be in accordance with Section 21, DAO No. 2007-29 for Project Control and Municipal Boundary Survey.
- b. In the conduct of Barangay Boundary Survey and Lot Surveys, the use of ETS is sufficient. However, the Geodetic Engineer may also use GNSS in the Barangay Boundary Survey and ETS for Lot Surveys.

If ETS instruments are to be used, the control survey shall be conducted in accordance with the provisions of **Sections 45** of this Manual, and Lot Survey with that of **Section 90-92** of this Manual. In any case, all instruments shall be calibrated/tested and registered first before their use in any survey in accordance with Section 22, DAO 2007-29.

Section 58. Organization of the Survey Party – The survey party shall be established with at least three (3) major components as listed in **Section 4** of this Manual. However, under the Cadastral Survey, as the project progresses, the following changes may occur:

- a. After the conclusion of the Survey Control Activities and the corresponding approval thereof, the Survey Control Team may later serve as the Lot Survey Team.
- b. The Reconnaissance and Monument Recovery Team upon approval of the Project Control may later serve as the Political Boundary Survey Team.
- c. The Monument Setting Team upon completion of the setting of control monuments, may be grouped into two. One group may conduct setting of monument of political boundary monuments and the other may accompany the Lot Sketching Party which will set monuments on the lot corners once an agreement is reached during the BAP.

Section 59. Data Research and Old Monuments Inventory –The provisions of **Section 33** of this Manual shall apply. Moreover, the list of approved surveys, surveys filed for registration and the corresponding status thereof such as decreed, pending, dismissed, etc. shall also be collated to be used as reference data.

Section 60. Status of On-going Isolated Surveys within the Cadastral Project – For all on-going isolated surveys within the Cadastral Project, the following shall apply:

- a. Within sixty (60) days from the date of such order, geodetic engineers shall submit to the cadastral survey project chief a list of his surveys in progress within the project.
- b. The field notes, computations and sketches or plans of isolated surveys within a cadastral project shall be submitted to the concerned LMS for verification through the chief of the cadastral project within four (4) months from the date of inauguration of the project.
- c. Surveys submitted after the lapse of four months shall be accompanied with a satisfactory explanation to the RTD for Lands who may accept or reject the survey for verification and approval.
- d. Upon approval of the contract or issuance of the survey order for the conduct of Cadastral Survey, the CENRO concerned shall no longer issue any survey authority over parcels of land within the same project. In this regard, the RTD for Lands should furnish copy of the contract/survey order to the CENRO concerned for his/her information and reference.

Section 61. Cadastral Survey Management Plan (CSMP) – The CSMP shall include the Project Management Plan and Technical Plan and shall be prepared in accordance with **Section 5** of this Manual. However, the Technical Plan does not include the activity on gravity measurements and shall only cover the three (3) activities as mentioned in **Section 53** of this Manual. Under this plan, the base map shall contain the plotting of Project Control Network Design instead of Geodetic Network Design.

Using the data mentioned in **Section 59** of this Manual, the Technical Plan as stated in **Section 5.b** of this Manual shall also include the following:

- a. Estimated area of the whole municipality/city covered by the project and each of the component barangay; and
- b. Estimated number of lots;

Section 62. The following shall be the basic scheme of work for a cadastral survey project:

- a. Preliminary Activities
 1. Organization of Cadastral Survey Party, preparation and submission of Cadastral Survey Management Plan;
 2. Posting and distribution of general public notice of the survey project in English and Filipino languages and in the local dialect. The form to be used is illustrated in **Annex X** of this Manual;
 3. Inauguration of Cadastral Survey Project;
 4. Data research and information drive;
- b. Manufacture of standard concrete reference and corner monuments;
- c. Reconnaissance and location of the main and subsidiary control lines;
- d. Monument setting of project control stations and running the preliminary survey:
 1. The estimated position of the stations shall be determined using single measurement from the ETS;
 2. Reference points of the monuments shall be located during the preliminary survey;
- e. Preparation of the Progress and the Project Control Maps from the preliminary survey and sketching thereon the boundary of the project;
- f. GNSS observation to establish base meridian. Conduct project control surveys;
- g. Preparation and submission of the Project Control Survey returns for verification and approval;
- h. Setting of Monuments of Political Boundary (barangay and city/municipality);
- i. Distribution of individual notice to the lot claimants/owners for the conduct of BAP informing them to appear on the ground on the scheduled date of monument setting and sketching of their lots to present their documents, both legal and technical, in support of their claims. The claimants/owners shall confirm their respective boundaries and shall be marked on the ground using

standard monuments by the team. The form to be used is illustrated in **Annex XI** of this Manual;

- j. Reconstruction and projection of old surveys;
- k. Preparation of the sketch map and plotting thereon the previous surveys;
- l. Conduct of BAP, sketching, monument setting of lots and signing of PIS by all concerned parties;
- m. Upon approval of project control survey returns, the conduct of Political Boundary Survey will follow;
- n. Plotting and locating in the project control and progress map the areas in dispute between barangays, municipalities, provinces, etc., if any;
- o. Issuance of the “30-days notice“, to give chance for those claimants who failed to appear on the day of sketching and monument setting of lots and/or did not participate in the BAP. The 30-day notification form shall be as illustrated in **Annex XXI** of this Manual;
- p. Preparation and submission of political boundary survey returns for verification and approval;
- q. Upon expiration of the “30-day notice“, lot survey shall commence. Other details and data such as those needed for Land Use Inventory, physiographic features for those lots with natural boundaries, man-made features for road network, etc. shall be determined during this phase of work;
- r. Plotting on the Cadastral Map the corners as located from control station, connecting the corners in accordance with the sketch of the survey. Transformation of the previously approved survey to PPCS/Grid-PRS 92 system. Adjustment of old surveys after the verification and approval of Lot Survey documents;
- s. Numbering of the lot corners in the Cadastral Maps according to the field notes. The Lot Data Computations shall be prepared ;
- t. Tracing and validating of the cadastral map in the field;
- u. Posting of the preliminary cadastral maps with the corrections and the list of claimants with the indicated lot numbers in the Barangay Hall. This shall enable the claimants to comment on the result of survey in their respective lot;
- v. Final checking shall be done to verify discrepancies. The work shall be scheduled in such a way that the field work in localities of difficult access will be performed during favorable weather;
- w. Completion and inking of the Progress Map and the Cadastral Maps;
- x. Preparation of the Barangay/Case Boundary of Index Maps;
- y. Preparation of the Municipal/Project Boundary and Index Map;
- z. Completion of the survey returns of the project and submission for verification and approval.

Some activities are pre-requisite of other activities; however, there are activities which may be done simultaneously. A flowchart for the conduct of cadastral survey operation is illustrated in **Annex IX** of this Manual.

Section 63. Survey Notification– the provisions of **Section 35** of this Manual shall apply. In addition, lot claimants, being the project’s most affected groups in the

community, shall be properly notified. The notice is of two kinds. The first is the general notice and the second is the lot claimant's notice which shall be in the following forms:

- a. General Public Notice - Copies of the general notice of the survey in Filipino, English and local dialect, showing general information on the project, shall be distributed and posted in conspicuous place in the barangay being surveyed and in the municipal building of the municipality in which the lands or any portion thereof are located. Copies of the notice shall also be sent to the barangay, municipal and provincial authorities. A general notice of survey is shown in **Annex X.A** of this Manual.

The Geodetic Engineer/Contractor shall attach a certification of posting as shown in **Annex X.B** of this Manual. This signed certificate with one copy of the notice in each language mentioned hereof and local dialect shall be countersigned by the Municipal/City Mayor and the Barangay Chairman concerned upon completion of the posting and shall be returned promptly to the RBAC concerned. A received copy thereof shall be included by the geodetic engineer/contractor in the submission of the survey returns.

- b. Notification to Lot Claimants – A Survey Notification Letter shall be prepared in the local dialect, for posting and general distribution, by the Monument Setting and Sketching Party for every barangay, at least two weeks before the start of defining and sketching of lot boundaries and the setting of monuments therein. A notice to lot claimant and the adjoining claimants is shown in **Annex XI.A** of this Manual.

The Geodetic Engineer/Contractor shall attach a certification of posting as shown in **Annex XI.B** of this Manual. Copies of this notice shall be posted in prominent and public places and each claimant shall be furnished with a copy of the notice in the local dialect. A copy thereof with translation in Filipino and English shall also be posted in the main municipal and barangay halls at the time that the general delivery and posting is made in each barangay. One copy in local dialect, Filipino and English shall be transmitted to the Land Management Services with the corresponding certificate attached thereto.

Cadastral Project Control Survey

Section 64. In the conduct of Project Control Survey for the purpose of the establishment of the Main and Subsidiary Controls, the provisions of **Sections 29 to 52** of this Manual shall govern.

Political Boundary Survey

Section 65. The Political Boundary of the municipality or city covered by a Cadastral Project shall be located, marked with concrete monuments and surveyed based primarily on the Laws or Executive Orders creating the same, if any. This survey is done primarily in order to:

- a. Determine the extent of coverage of the project which shall be within the territorial jurisdiction of a municipality/city; and
- b. Determine the exact location of the lots which data are necessary in the accurate derivation of the corresponding technical description;

Section 66. The Survey Order issued over a Cadastral Survey Project shall cover this activity, if executed as part of the said project. However, if the Political Boundary Survey is an independent project, the geodetic engineer who is hired by the LGU concerned to conduct the survey shall be required to submit a Resolution of the Local Council thereof. The conduct of the said survey shall be subject to the issuance of the

corresponding Survey Authority by the RTD for Lands concerned upon submission of the other documentary requirements pursuant to DAO No. 2007-29.

Section 67. The Political Boundary Survey shall be conducted with the required accuracy as provided in **Section 54** of this Manual. As much as possible, the Political Boundary corners of the municipality/city shall be identified and marked with monuments on their exact location. However, if this is not possible, the monuments to be established shall be as near as possible to the true location of the said corners. These shall serve as reference in defining some of the boundary lines of the city/municipality and their political subdivisions such as barangays and districts. **Section 29.a and b** of this Manual shall apply for the types of instruments to be used.

Section 68. Organization of the Survey Party – The survey party shall be the Political Boundary Control Survey Team of the Cadastral Survey projects. However, if the Political Boundary Survey is an independent project, the survey party shall be established with at least three (3) major components as listed in **Section 4** of this Manual except that the survey team shall be called Political Boundary Survey Team, not Survey Control Team .

Section 69. Political Boundary Survey Work Plan – The work plan for the conduct of Political Boundary shall be included in the work plan of the Cadastral Survey project where it is a component, i.e. the Cadastral Survey Management Plan (CSMP). The Political Boundary Survey being conducted and funded by the LGU shall not require the submission of the Project Work Plan. However, other documents such as survey authority, LGU Council Resolution, availability of funds and other requirements pursuant to applicable DENR issuances that need to be included in the survey returns shall be required.

Section 70. Data Research - The hierarchy of preliminary data to be used as reference in the conduct of Political Boundary Survey shall be as follows:

- a. The Laws or Executive Orders creating the municipality/city. The technical description stated therein, if any there be, shall be accurately plotted in the NAMRIA Map. If however, there is no technical description on the said legal document, the natural and man-made features stated therein as the limit of the territorial jurisdiction shall be identified and plotted in the Projection Map in the DENR-LMS Regional Office or in the NAMRIA Topo Map;
- b. The Torrens Titles issued in the municipality/city particularly those covering large tracks of lands;
- c. Approved surveys in the municipality/city especially those covering large tracks of lands such as Public Subdivision Surveys (PIs), Group Settlement Surveys (Gss), Municipal Reservations (Mr), etc.;
- d. Approved Comprehensive Land Use Plan (CLUP) of the municipality/city;
- e. Existing Municipal/City Tax Map;
- f. NAMRIA Topographic Map;
- g. Land Classification (LC) Map from NAMRIA or the then Bureau of Forestry;
- h. Data and maps from other government agencies pertaining to locations, landmarks, monuments and historical sites;
- i. NAMRIA Administrative Maps; and
- j. Basemaps produced by other organizations, the work of which is of acknowledged standard.

Section 71. Pre-survey Conference - All concerned Local Chief Executives of the LGU covered by the project, including those of the adjacent cities/municipalities, shall be informed of the survey. A pre-survey conference headed by the RED and assisted by the RTD for Lands shall be attended by the aforementioned Local Officials to discuss the purpose and mechanics of the survey. The conference shall be held at least one (1) month before the start of the survey. Reference materials gathered as mentioned in **Section 70** of this Manual shall be discussed. Other documents that may be used as additional reference materials shall be deliberated upon as to their acceptability.

Section 72. Political Boundary Monuments - The position of the Political Boundary Monuments shall be defined and marked on the ground by monuments of permanent nature in the form of a square base frustum and in accordance with the specifications on the 3rd and 4th Order Accuracy found in **Section 15** of this Manual, for the Municipal and Barangay boundaries, respectively, except that the projection below the ground is 70 centimeters as illustrated in **Annex III.B.1 and 2** of this Manual.

Section 73. Markings of Political Boundary Monuments – They shall be marked in the following manner:

- a. The city, municipal, and barangay boundary monuments shall be designated as City Boundary Monuments (CBM), Municipal Boundary Monuments (MBM) and Barangay Boundary Monuments (BBM), respectively.
- b. The CBM, MBM, and BBM shall be numbered consecutively from one (1) for each municipality and city. The said numbers (e.g. CBM No. 1, MBM No.5, BBM No. 3, etc.) shall be inscribed or chiseled under the name of their respective municipality and city. If the Political Boundary is being conducted as a part of the Cadastral Project, the Cadastral Project Number shall also be indicated.
- c. Inscribed or chiseled also in each BBM and under the monument number, is the name of the province where the city or municipality belongs. The same shall be done to each MBM and CBM; the name of the province where the municipality or city belongs shall also be inscribed or chiseled. The requirement on name of province shall not be applicable to the CBM of a chartered city.
- d. In case a BBM is common to two or more barangays, the monument number for each barangay and the corresponding name shall be chiseled or inscribed on the faces of the monument in such a way that a person reading the marker is also facing towards the direction of the barangay. The same shall be done to the MBM and CBM in the same situation.
- e. The corner of the city and municipal boundary already defined by a provincial or adjoining municipal or city boundary monument shall be given its equivalent municipal boundary monument number without altering the old inscription on the monument. The matter shall be indicated in the sketches, filed notes, maps and other documents of survey returns. The same shall be done to the corner of the barangay boundary already defined by the municipal, city or provincial boundary monuments.
- f. All the letters and numbers shall be in “**Arial Bold**” Font Type, all capital and embossed by 0.25 cm, with height of 5 cm., width of 2.5 cm, thickness of 0.5 cm in thickness and with a margin of not less than 2 cm. along the edge of the monument to give allowance for chipping as illustrated in **Annex III.B.1 and 2** of this Manual.

Section 74. The following shall govern the conduct of the Political boundary survey in addition to the pertinent provisions of **Sections 45 to 51** of this Manual:

- a. Political Boundary monuments shall be established at the prominent turns or angles of the boundaries and where they cross roads or large streams;
- b. Where the said boundary lines follow roads, stream or other natural features, a monument shall be placed near their junction points;
- c. Intermediate points along said road or natural boundary need not be marked with monuments but shall be marked with at least two (2) witness monuments located as near as possible to the true corner (e.g. along both sides of the road, along the river banks, etc.);
- d. Municipal and Barangay boundary monuments shall be established along straight Municipal and Barangay boundaries at an interval of not more than one kilometer except when boundary passes through forest lands, in which case, the monument shall be at an interval of more or less five (5) kilometers. However, should the barangay boundary passes through surveyed parcels of land, it should follow the established/approved lot/property lines;
- e. The boundaries as defined by law or executive order creating the LGU concerned, as much as possible, shall be located on the ground. Also, the points which the LGUs are claiming to be the location of the their boundary corner, shall also be observed and recorded;
- f. All corners accepted as common by the concerned LGUs shall be defined by monuments specified in **Sections 72 and 73** of this Manual;
- g. The boundary survey shall follow the limit as defined in the existing law or the executive order creating the local government unit. No attempt shall be made to settle the political boundary conflict between the concerned municipalities or among the component barangays of a municipality during the conduct of survey. However, the concerned LGUs shall be given opportunity to resolve amicably their dispute in accordance with RA 7160, otherwise known as the Local Government Code of 1991. **Section 75** of this Manual shall be followed in the treatment of the said case.

Section 75. In case of boundary dispute, the following shall be observed:

- a. The corners shall be temporarily defined by hard wood post or monuments, with a diameter of at least 10 cm. and a length of 2 meters. The said post shall be established on the disputed spot with 50 cm below the ground.
- b. The dispute area shall be drawn on the sketch sheet and report shall be forwarded to the RTD for Lands, copy furnished the LMB and the LGUs concerned. The report shall include a tracing of the disputed area as indicated on the sketch and shall show the general claims of each LGUs. The municipalities in which each of the affected lots being declared in their real estate tax, shall be indicated on the sketch sheets by their initial letters. Contested areas declared in two or more municipalities shall be determined and indicated on the sketch sheet accordingly.
- c. The claims of one LGU shall be indicated by heavy dotted lines and of the other LGUs by heavy dash lines. A heavy full line shall mark the division between the LGUs as indicated by tax declarations. Lot lines shall be indicated by ordinary full line. All topographical information such as rivers, mountains, etc. that will assist the authorities in their decision shall be shown.
- d. The local authorities shall be given opportunities to arrive at an agreement in accordance with RA 7160, otherwise known as the Local Government Code

of 1991, before report on the dispute is forwarded to the concerned RTD for Lands, copy furnished the Director of LMB.

Section 76. In case the boundary dispute is not settled before the completion of the field work of the cadastral project, the disputed area with all the lots contained therein shall be surveyed and treated as separate cadastral case. However, the land area involved in the dispute when it comes to LMB land area statistics shall continue to be credited to the LGU which is physically occupying the said area or presently acknowledged by several government official records, until the dispute is settled amicably or resolved in the court of law with finality. The concerned LGU shall be properly informed on the matter.

Cadastral Lot Sketching, Monument Setting and Survey

Section 77. Lot Surveys as part of a large Survey Project such as Cadastral and Pls shall be conducted using Tertiary Precision as stated in **Section 54** of this Manual and shall constitute major activities such as Sketching, Monument Setting and Lot Survey. However, these activities can be further subdivided into the following activities:

- a. Data Research and Survey Notification
 1. Data for Planning Purposes
 2. Research of Old Survey Data (Technical Description from the certificates of title and approved plans)
 3. Preparation of Sketch Base Map
 4. Preparation of Survey Notification Letter and Issuance to the claimants and the adjoining claimants
 5. Databasing of Preliminary List of Claimants (Alphabetical and Numerical)
- b. Lot Sketching Activities
 1. Meeting with Barangay Officials for proper coordination
 2. Boundary Agreement Process (BAP) with the individual lot claimant and the adjoining claimants. Filling out of Parcel Information Sheet (PIS).
 3. Actual sketching of Lots based on agreement as per Pls
- c. Manufacture/Setting of Corner Monuments
 1. Manufacture of Lot's Corner Monuments
 2. Hauling of Monuments
 3. Setting of Monuments
- d. Lot Surveys Activities
 1. Securing the Approval of the Main and Subsidiary Control Survey
 2. Securing the Approval of Political Boundary Surveys (not needed for PLS)
 3. Lining of Traverse Stations

4. Lot Survey
 5. Posting of 30-day Notice
 6. Determination of Final List of Claimants
 7. Final Determination of Lot Lines Connection
 8. Correction Work
- e. Preparation of Final Lot Data Computation and other Lot Survey Returns

Some of the activities stated above may be done simultaneously. Other activities are pre-requisite of another activities, e.g. boundary agreement process shall be conducted prior to lot sketching, lot sketching before monument setting, monument setting before lot survey, etc. However, if the lot survey is a component of a survey project such as Cadastral Survey, some activities may be started at the early stage of the project, e.g. data gathering and research of old survey, manufacture of monuments, posting of public notice, etc. as illustrated by the Flowchart found in **Annex IX** of this Manual.

Section 78. Organization of the Survey Party – The survey party shall be the Lot Survey Team of the Cadastral Survey Project. The said team may be divided into sub-groups which shall handle activities such as sketching (with BAP and PIS activities), manufacturing and setting of monuments, and lot survey. Due to the adjudication component of BAP/PIS activities, there shall be a Land Management Officer (LMO) in the Lot Survey Team. If the Lot Survey is an independent project, the survey party shall be established with manpower compliment as stated in **Section 4** of this Manual. The LMO of the survey team who shall handle BAP/PIS shall be from the CENRO concerned.

Section 79. All cadastral lot surveys shall be conducted in PRS92 with accuracies belonging to Tertiary Control as stated in **Section 54** of this Manual. The instruments to be used in the conduct of lot survey shall be those stated in **Section 57.b** of this Manual and shall follow the procedure as stated in **Section 91** of this Manual.

Section 80. After thirty (30) days from the date of issuance of Survey Order or signing of Survey Contract of the cadastral project, as the case may be, no geodetic engineers other than those executing the cadastral survey shall be allowed to conduct survey except when the said surveys began prior to the date of the issuance of Survey Order/Survey Contract. Relative thereto, all requests for Survey Authority within the cadastral project area shall be rejected.

Lot Sketching and Monument Setting

Section 81. Sketching and Monument Setting – These activities may be done independently or simultaneously. If done separately, the monument setting must follow immediately the sketching activity, otherwise, the temporary corner markings made by sketching party may be removed or uprooted. Generally, the following procedures apply to the herein activities, to wit;

- a. Lot Sketching - This activity shall be done to gather information in the field, prepare preliminary maps, determine the estimated number of lots, etc. which shall serve as a guide to the Lot Survey Team. This activity may also include courtesy call to the barangay officials concerned, information dissemination, issuance of notification letters, and other pre-survey activities. The following shall be observed in the conduct of this activity:
 1. Sketches shall be made using compass and steel tape, preferably 100 meters in length. The base map to be used shall be prepared on any mapping paper in the same standard size as cadastral maps in the

scale of 1:4000. However, sketch sheets on a scale larger than 1:4000 may be prepared for the sectioning thereof in cases where the lots are too small to be shown in the standard scale.

2. Each sketch sheet shall be given the corresponding cadastral map number or sectional cadastral map number. All previously approved surveys shall be drawn in pencil and all new monuments and control stations shall be inked on the sketch sheets.
3. Where competent sketch men are available, sketches may be made by the free hand method. All data secured shall be indicated by using the conventional cartographic symbol and sign as prescribed for cadastral maps.
4. All lots whether unsurveyed or with previously approved survey, judicially titled, patented, leased, decreed and untitled shall be reflected on the sketch sheets. All corner markers shall be located and definitely identified as original monuments.
5. All lots titled or not, shall be subjected to Boundary Agreement Process (BAP) wherein all concerned parties, both the claimant and the adjoining claimants, shall amicably agree on the lot's boundary and affix their respective signature on the Parcel Information Sheet (PIS) as a sign of conformity to the placement of the said boundary. BAP process is discussed in **Section 86** of this Manual while the PIS Form is shown in **Annex XII** of this Manual.
6. The corners sketched shall be marked temporarily by stakes in the presence of claimants whose names shall be written on the sketch map. In case lots or portion of lots are claimed by two or more persons, the areas in dispute shall be sketched as separate lot and the names of all claimants shall be noted therein. The said corners shall only be marked with monuments upon verification and approval of the survey.
7. Lot corners, marks and boundaries such as stone walls, trees, stakes or monuments shall be indicated on the sketch. Trees shall be marked on the side opposite the lot in which they are claimed,
8. Roads, rivers, streams, lakes, ponds, pools, irrigation canals or ditches, political boundaries, railroads, etc., shall be plotted on the sketch sheets and their local name indicated.
9. The name of the municipality, cadastral survey number, scale and sketch sheets number shall be shown in ink on the lower right hand border. The sketches shall be dated and signed by the sketch men.
10. The corners of each tract shall be numbered consecutively from one in a clockwise direction.
11. No single lot or tract shall be in more than one city or municipality or barangay.
12. As soon as sketching is finished and before final Lot Numbers are assigned to each lot, the entire Cadastral Project shall be divided into Cadastral Cases which shall be co-extensive with the Barangay. The rule on "One Barangay, One Case" shall strictly be observed. Lots shall be numbered consecutively in each cadastral case/barangay.

13. The extent of public land within the cadastral project shall be determined. Consequently, information relative to illegal or unauthorized occupation or claim on public land shall be gathered.
 14. In case private claims extend beyond the limit of cultivation and occupation, investigation shall be made to determine the nature of the claims.
 15. Claimants/occupants of lands of the public domain classified as alienable and disposable shall be advised to file the appropriate public land applications. In any case, the land shall be sketched, marked with monuments and surveyed.
- b. Monument Setting – This activity may include the manufacturing, hauling, and the actual setting of the monument in the ground. **Sections 85 to 87** of this Manual shall be followed in constructing standard monuments taking into consideration other acceptable lot corner markers.
1. All corners identified during the sketching shall be marked with monument whenever possible.
 2. All corners which are not possible to be marked with concrete monument shall be marked in accordance with **Sections 87 (b) and 88** of this Manual.
 3. In case the conditions stated in Paragraph b (1) and (2) of this Section are still unavailable, there shall be at least two (2) witness monuments located as near as possible to the true corner; e.g. along both sides of the road, along the river banks, etc.
 4. Public land claims from which final inspection has been made and approved shall be marked with monument.

Sketching and Monument Setting of Titled or Previously Surveyed Properties

Section 82. All properties covered by approved survey whether titled or not, shall be properly reflected on the sketch map. Efforts should be made to have a complete inventory thereof and plot them in the sketch map. The following shall govern the said activity:

- a. The sketch men shall compare the plan of the approved survey with the actual boundaries of the land as found on the ground. Diligent search shall be made for old monuments and their existence and the corresponding status thereof shall be noted on the sketch map.
- b. In case of minor difference between the plan and the previous survey and the actual boundaries thereof, the latter may be accepted provided the adjoining owners agree and the adjoining lots are not yet decreed or titled. The lot as per approved plan shall be reflected on the sketch plan which shall be later on adjusted accordingly in the cadastral survey.
- c. In case it is evident that areas claimed are clearly outside the boundaries as registered and not the result of errors of measurement in the original survey, such area shall be sketched, surveyed and numbered as separate lots.
- d. Claims inside an approved survey which has not yet been titled shall be sketched as separate lots. Claims inside titled lots shall be disregarded unless supported by an order from the court of law concerned and those

inside leased properties shall be supported by written authority from the RTD for Lands, for each claim.

- e. In case of leased untitled properties, the adverse claim must be supported by the following documents before it shall be considered:
 - 1. Written authority from the RTD for Lands upon endorsement by the CENR Officer concerned.
 - 2. If the claim is already subjected to a land case, an order from the Regional Trial Court (RTC) for each specific claim.
- f. In case the corners of the approved survey were not marked with monuments or in case the monuments were not found during the conduct of survey, the same shall be relocated and correspondingly marked.
- g. Portions of previously surveyed lots which form part of river, estero, arroyo, creek and the mandatory stream bank protection as stated in **Section 84.b** of this Manual shall be sketched, and later surveyed, as separate lots and indicated as such in the cadastral maps.

Sketching and Monument Setting along Public Works

Section 83. Special care shall be taken when sketching lot claims along the existing or proposed roads, railways, man-made canals, etc. As much as possible, claims traversing these features shall not be allowed. The Sketching Team shall make it a point to reflect the road network, right-of-way, facilities, and other improvements in the Sketch Map. The following shall serve as guide in the said activity:

- a. Portions of lots which fall within the right-of-way of roads as determined by the District, City or Municipal Engineer shall be sketched and numbered as separate lots when claimed as private property. Such claims, however, should be discouraged.
- b. The owners or claimants of land adjoining public highways or street shall be advised of the minimum right-of-way measured from lot line to lot line for that particular streets, highways or railways as per information provided by the above officials. Legitimate effort shall be exerted to inform survey applicants of the importance of accepting the right-of-way lines as the boundary of their properties. In view thereof, the following shall be consulted/informed on the width and center line of the road, railway and right-of-way:
 - 1. District Engineer of the Department Public Works and Highways (DPWH) on the existing public highways or road or those to be constructed;
 - 2. The *Sangguniang Bayan* and *Sangguniang Barangay* on the municipal and barangay roads.
 - 3. The Local Government Planning and Development Officer on the roadways within residential subdivision.
 - 4. The railway company shall be consulted on the railroad right-of-way.
- c. Right-of-way of highway or railways shall be marked with monument as follows:
 - 1. The point of curvature (P.C) and points of tangency (P.T) shall be marked with monuments or acceptable markers as provided for in **Section 87** of this Manual.

2. The points along the curve need not be marked with monument unless expressly desired by the owners or claimants. The position of points along the curve shall be determined by computation using the standard metric curve of twenty meter chord.

Curves of right-of-way of railways and highway shall be laid out and marked with monument as required above. For other curves of short radii such as those of streets, circular plazas, etc., the laying out and monument setting shall depend upon plans of layout, if any, of the local authorities.

- d. As the sketching progresses, the municipal engineer shall be requested to indicate the center line and widths of all streets and roads within their jurisdiction. The corner at the points of intersection of the road and lot boundary lines shall be marked with monument.
- e. The District Engineer shall be notified before sketching and monument setting in the areas along provincial roads. The railroad company shall also be informed when the said activities shall be conducted along the railways. Plans of railroads right-of-way or data on the width thereof may be secured from the said company.
- f. The railroad company shall be notified before conducting survey of a property adjoining a railroad right-of-way and shall be requested to show the extent of the right-of-way in the ground. Monuments shall be established at the points of intersection between the right-of-way lines and the boundaries of the property and along the tangent of curve of the right-of-way, as provided in item (c) of this Section.
- g. When a claimant insists upon his/her right to a portion of the proposed right-of-way, the area claimed by him/her shall be surveyed and indicated as a separate parcel, but monuments shall be set only upon the right-of-way line. If the public highways is unimproved and the District Engineer authorized agent fails to establish the center line of the right-of-way, the geodetic engineer shall locate the boundary of the land as pointed out by the survey applicant, stating the fact in the field notes and Geodetic Engineers Certificate.
- h. When the boundary adjoins the private roads, the owners of such road shall be notified of the survey. Monuments shall be set along the common boundary of the property undergoing survey and the private road. The width of the road and the name of the owner shall be indicated in the field notes, plans and certificate of survey.

Sketching and Monuments Setting of Lot that Includes or Adjacent to Natural Features

Section 84. The sketching and setting of monuments of lots that include or adjoin bodies of water shall take into consideration the provisions of RA 1273, PD 705 and DAO 13, series of 1992. The sketching along the said bodies of water shall strictly be followed during the conduct of actual survey:

- a. The following shall be considered in the sketching and monument setting of lot that includes or adjoins natural features:
 1. In cases of doubt during the classification of stream as arroyos, esteros, creek or rivers due to the difficulty as in the case of such streams gradually merging into one or the other, the local designation or name of the stream shall determine its classification and shall be clearly indicated in the sketch plan, field notes and on the plan of the survey.

2. If the adjoining arroyo, estero, river, or any stream five (5) meters or less in width, or an irrigation ditch, the claimant or claimants of the land on the opposite bank of said arroyo, estero, river, stream or irrigation ditch shall be indicated in the sketch plan and in the survey plan.
 3. However, if the arroyo, estero, river, or any stream even five (5) meters or less in width is navigable and it is supposed to be of public ownership, the names of the owners or claimants on the opposite bank of the said arroyo, estero, river or stream shall also be indicated on the plans.
 4. The sketch plan, field notes and the survey plans of the tract of land which adjoins or includes irrigation ditches, creeks, arroyos, esteros, rivers, etc., shall indicate the following:
 - a) The width of the body of water.
 - b) Whether it is navigable or not.
 - c) Whether the lot is located at the right or left bank, with the observer facing downstream.
 - d) The direction of flow of water by an arrow.
 - e) The distance in meters from the bank of the river or creek to the lot line.
 5. Along the shore of lakes, the water of which advance or recede as the season changes, all private claims approximate boundary line shall be sketched up to the high water mark at the time of greatest depth of water. The high water mark at the lake's greatest water depth and the position of shore line at the time of survey shall be plotted on the plan. In the case of Laguna de Bay, a consultation on this matter should be done with the Laguna Lake Development Authority (LLDA).
 6. The municipal authorities shall be informed of the indication of the shore line of adjoining shallow lakes and marshes used mainly as municipal fishponds. This shall be properly indicated in the sketch plan.
 7. Both government facilities and private claims, with permanent structures or other artificial works which will interfere with the legal easement shall be approximately indicated in the sketch plans. The accurate location of the said structures shall be done during the conduct of survey.
- b. The sketch plan shall show and indicate properly the following:
1. Stream five (5) meters or more in width;
 2. Stream less than five (5) meters in width through which water flows continuously. The direction of flow of the water shall be indicated by an arrow;
 3. Irrigation ditches or canals;
 4. A strip of forty (40) meters wide starting from the bank on each side of any rivers or stream shall be demarcated pursuant to RA 1273, amending Section 90 of Act 141, as amended.

5. The following strip of lands along the edge of bodies of water shall be reserved as easement of public use pursuant to Section 54, DAO No. 2007-29 and these shall be indicated in the sketch plan with the following information:
 - a) Urban areas: three (3) meters
 - b) Agricultural areas: twenty (20) meters
 - c) Forested areas: forty (40) meters

6. For the lands bordering the sea or its arm:

- a) **Foreshore lands** shall be sketched as a separate cadastral lot and clearly indicated on the sketches, field notes and survey plans as foreshore lands. The corners that fall into the sea shall not be marked with monument but a witness monument shall be established along the shoreline at the low tide level and shall be indicated on the sketches by appropriate survey symbols. Concrete monuments, galvanized iron spike, fixed rocks, boulders or wooden post shall be set to define the corner of the claim along the shoreline at the low tide level.

The boundary line of lands bordering the sea or its arms shall be the shoreline which is the line reached by the highest equinoctial tide. When the tide line is not distinguishable, the boundary line shall extend to the limit reached by the sea water during ordinary tempest or storms.

- b) As per Section 55, DAO No. 2007-29, lands bordering the seas, gulfs, bays, or ports shall be subjected to easements of Salvage Zone of twenty (20) meters measured land ward from the interior limit of the shore line. This need not be reflected in the sketch plan if the area is within the forty (40) meter bank protection of a forestland.
- c) Likewise, the easement of Coast Police which is the obligation to leave a right of way six (6) meters wide within the Salvage Zone in accordance with Section 55, DAO No. 2007-29 and as illustrated in **Annex XVI.A** of this Manual, may not need to be indicated in the sketch plan if within the forty (40) meter bank protection of the forestland.

7. Buffer zone between the lot and the natural boundaries that were included in the area declared as sanctuary, protected or ecologically critical, shall be sketched and established on the ground in the following manner:

- a) A twenty (20)-meter strip of land along the edge of normal high waterline on rivers and streams with channels of at least five (5) meters wide shall be reflected on the sketch map. The same shall also be done with the lot bordering natural features if the water is continuously flowing even the width is less than five (5) meters;
- b) A strip of land at least fifty (50) meters in width fronting the sea, ocean or other bodies of water that has a considerable mangrove trees and was declared as mangrove forest , shall be reflected on the sketch map. Likewise, a strip of twenty (20) meters on both sides of rivers channels/banks that has existing mangrove

plantation that need to be maintained and developed, shall be indicated in the sketch maps;

- c) In storm-prone areas, mangrove forest strip 100 meters wide inward along shoreline fronting the seas, oceans and other bodies of water and 50-meters strip river bank protection;
- d) Twenty-meter strips of land outside the boundaries and immediately adjacent to designated protected areas;
- e) Twenty-meter strip of forest land adjoining Community-Based Forest Management Projects;
- f) Twenty-meter strips of land along the boundaries of reforestation projects adjacent to private/alienable or disposable lands; and
- g) A buffer zone about 100 meters of residual forest shall be established immediately surrounding the old growth forest stands. However, when the old growth forest stands is adjacent to natural ground features such as waterways (rivers, streams, creeks), gullies, or ridges tops, these shall be used as boundaries pursuant to DAO 13, series of 1992.

The Boundary Agreement Process (BAP) and the Parcel Information Sheet (PIS)

Section 85. The Boundary Agreement Process (BAP) is a formal process which aims to obtain a graphical representation of the parcel to be surveyed and document the agreement of parcel boundaries by adjoining landowners in all the original, cadastral and other large survey projects (public land subdivision, group settlement survey and townsite subdivision).

The BAP shall be a part of the systematic adjudication activities wherein the land claimant/s, adjoining claimants/owners, barangay representative, survey team and DENR representatives (land inspector/land management officer from the CENRO and survey verifier from the LMS) participate in the boundary agreement process which shall result to the accomplishment of the Parcel Information Sheet (PIS). The PIS is a document to be prepared during lot sketching and prior to a land survey, recording the boundary delineation agreement by all concerned, adjacent and participating land claimants or owners to a public land parcel, indicating and describing on it the boundaries of a land parcel, its improvements and any natural features, marks and occupations that are on or near the boundary.

The PIS Form which sample copy is shown in **Annex XII** of this Manual shall replace the Sketch and Survey Record Card. The same shall be accomplished based on the following:

- a. General Instructions
 - 1. The Parcel Information Sheet (PIS) shall be accomplished in legal size, good quality paper (preferably, 80 gsm, substance 20);
 - 2. All entries shall be neat and legible in permanent black ink;
 - 3. All spaces must be filled with the relevant information;
 - 4. Names and lot numbers of adjoining claimants shall be indicated;
 - 5. The names of signatories should be printed; and

6. A representative shall have a written authority and shall likewise sign the form.

b. Sketching Instructions

1. Show boundary lengths inside and along the boundary line in bolder numbers in a clockwise direction;
2. All directions should be oriented along the North-South line using a magnetic compass;
3. All easements must be shown, including dimensions;
4. All waterways must be shown, indicating their width and the direction of flow;
5. Political boundary lines are to be shown, the name of the adjoining municipality or barangay is indicated;
6. Information common to two lots shall be shown in their respective PIS form;
7. Indicate title number under lot number, if any;
8. All physical and natural features must be indicated;
9. Roads must be indicated with their width;
10. Indicate lot number of lot subject of PIS on sketch;
11. Indicate adjacent lot number or claimant's name instead when there is no lot number;
12. Use offsets and chainages to fix positions of reference marks on sketch in relation to corners. The chainage distance should always be measured clockwise and indicated inside and along the boundary line, while offset distance should be indicated perpendicular from boundary line to reference mark;
13. Reference marks may be nearby building corners, posts, marked tree trunks, etc., of permanent nature;
14. Accessible corners may be provided with witness corners for purposes of the PIS sketching; and
15. Indicate specific land use classification, whether residential, commercial industrial, institutional, agricultural, reservation, forestland, etc., and its cultivation/improvements, such as crops planted and structures constructed.

c. Procedures

1. When a corner position is agreed upon by all participating claimants, one of them will place the marker, witnessed by the others;
2. Measure distances of boundary lines;
3. Measure offsets and chainages for reference marks;
4. Complete sketch of land parcel, indicating all needed features;

5. Assignment of lot numbers shall be made by the geodetic engineer;
6. Complete all entries on the PIS form;
7. Solicit signatures on Survey Information Sheet of all participating claimants, including those of the geodetic engineer, barangay official, and sketchperson; and
8. Inform all claimants that upon completion of Sketching Activities, they have still a 30-day period to present their evidence that will support their claim in contradiction to the agreement as per PIS.

Section 86. Precautions in the sketching Activities – The following shall serve as important reminders to the Sketching Party in order that their output shall not confuse the Lot Survey Team and shall serve to facilitate the survey activity:

- a. Sketches must be prepared with care especially with regard to lots and spelling of all proper names. Lots occupied by government agencies, shall be properly identified, as much as possible, in their full name and not acronym. The same shall be done to lots owned by private companies.
- b. The lots shall be formed such that no single lot shall fall in more than one barangay.
- c. The boundaries along borders of the adjoining sheets shall be carefully compared and checked in order to avoid omitting or duplicating side shots during the lot survey.
- d. Claims inside patented or decreed properties shall be disregarded unless supported by an order from the Regional Trial Court for each specific claim.
- e. In case of disputed ownership, the sketching party shall not intervene by siding with one of the party nor providing data that will support one of the parties. However, efforts should be made to bring the claimants to an agreement in the field in order to reduce the number of such conflicting claims.
- f. Mandatory areas for exclusion from the lots adjoining public works and bodies of water pursuant to **Sections 83 and 84** of this Manual shall be properly plotted on the sketch map.
- g. Roads, ponds, streams, etc. included within previously approved surveys shall be located as such. These shall be assigned separate cadastral lot numbers, however, their identification as road, ponds, stream, etc. shall be clearly indicated on the map.

Standard Monuments and Other Acceptable Lot Corner Markers

Section 87. The Nature of Lot Monuments – After the lot was subjected to BAP and sketching, the position of corners of boundary lines shall be defined and marked on the ground by monuments of permanent nature, except when such corners situated near physiographic or natural features. Whenever possible, all the lot corners which were identified in the Sketch Map and in the PIS shall be marked with standard concrete monuments. The first and last corner situated near natural boundaries shall be marked with monument. The following objects shall be considered as monuments of permanent nature to be used in defining and marking corners of lot, titled or to be subjected to administrative or judicial titling;

- a. Standard monument – It shall be concrete and cylindrical in forms, at least fifteen (15) centimeters in diameter by fifty (50) centimeters in length, set fifteen (15) centimeters above the ground and thirty five (35) centimeters below the ground.
- b. In the event that the exact location of the lot corner can not be established with the standard concrete monument due to the presence of concrete building, concrete wall, full grown tree, etc. wherein digging activities may weaken the supporting post of the structure, result to accident, cause the uprooting of a valuable tree, etc., the following shall be considered as acceptable corner mark in lieu of the said standard monument, to wit:
 1. Concrete posts which are part of the fence when not less than ten centimeters in diameters, or metal pipes not less than two centimeters in outside diameters.
 2. Living edible fruit trees not less than fifteen centimeters in diameters or trees belonging to the first group (as per Forestry Classification) with diameter not less than fifteen (15) centimeters.
 3. Points of masonry or concrete walls.
 4. Immovable or fixed hard rock or boulders with exposed surfaced of more than one meter in diameter.
 5. Peg, being of a composition that will resist destruction by fire, natural corrosion, or decay with nominal dimension of 50 millimeters square in cross-section for at least 100 millimeters from the top and not less than 400 millimeters in length.

Section 88. Conditions in accepting corner markers other than the standard concrete monuments and those stated in the immediately preceding section – the following shall be done to enable the substitute markers to be acceptable corner of lots:

- a. Acceptable living trees when used to define corners shall be blazed at about twenty (20) centimeters above the ground and when possible, by cutting the bark on the side where the boundary line passes.

The blaze shall at least be ten centimeters. A cross shall be chiseled upon the blaze and at the point of intersection of the cross, a galvanized iron spike be driven to indicate the corner to which measurement shall be made.
- b. Wooden post of narra, ipil, molave, yacal, or any other durable hardwood of not less than fifteen (15) centimeters in diameter forming part of a house, a fence or other permanent structures may be used as corner marker when such posts are situated at the corner of a tract to be surveyed. This corner shall be defined by a galvanized iron spike set at the center of a cross to be marked thereon.
- c. When concrete posts, masonry, concrete walls, immovable rock, or boulders are used, the corner shall be defined by a galvanized iron spike driven into the structure to which measurements shall be made. If for any reason it is not feasible to drive a galvanized iron spike into a structure, the corner shall be defined by a cross (x) mark chiseled upon such structure.
- d. When metal pipes having an outside diameter greater than two (2) centimeters are used, such pipes shall be filled with concrete in the corner and shall be defined either by a galvanized iron spike or by a conical hole not exceeding two (2) centimeters in diameter and not less than one centimeter in depth, or by a cross (x) mark chiseled on the concrete top.

- e. When a cross (x) is used to define a corner, such mark shall be chiseled to a depth of at least five (5) millimeters. Each arm of the cross shall be, whenever possible, not less than five (5) centimeters in length in the point of intersection of the arms and shall define the corner to which measurement shall be made.

Section 89. Construction of Lot Corner Monuments – The following shall be followed in the construction of lot corner monuments:

- a. Concrete monuments shall be fabricated following the requirements of Class A concrete specifications in the ratio of 1:2:4 or translated into a concrete mixture such as 1 cubic meter of cement, 2 cubic meters of sand, and 4 cubic meters of gravel or 2 bags of cement, 4 bags of sand and 8 bags of gravel. Sand and gravel must be clean, free from dust or mud or other organic matter. The dimension as stated in **Section 87** of this Manual shall be followed.

The top shall be centered by galvanized iron spike or by a conical hole not exceeding two (2) centimeters in diameter and not less than one (1) centimeter in depth to define the corner to which measurements shall be made. It shall be marked as “CAD”.

- b. The galvanized iron spike used to indicate center of other acceptable corner markers shall preferably be at least one centimeter in diameter and eight (8) centimeters in length driven flush or level to the surface of the objects used.

Individual Lot Survey

Section 90. The individual lot survey shall only be conducted after the 30-day posting of the PIS. The PIS shall be posted in Barangay Halls/Centers for cadastral projects for 30 days, and such posting shall be certified by the Barangay Chairman concerned.

Section 91. Upon approval of the main and subsidiary controls and termination of 30-day period for the concerned claimant to protest with the result of PIS, the survey of the individual lots therein shall be surveyed as per **Section 57.b** of this Manual and of at least tertiary precision as per **Section 54** of this Manual.

- a. The traverse that shall be used to locate lot corners and shall be run in the same manner as in **Section 45** of this Manual but shall start from a Primary (3rd Order) or Secondary (4th Order) Control Stations and shall close to another Primary or Secondary Control Stations.
- b. The Chief of Party, upon conformity of the project contractor, may create additional sub-teams each headed by a geodetic engineer with the approval of the RTD for Lands in writing.
- c. Tertiary stations for each cadastral project shall be numbered consecutively from one. The numbers 1-1000 may be assigned to one geodetic engineer for his use; the numbers 1001 to 2000, to a second; the numbers 2001 to 3000, to a third and so forth. The unused numbers need not be accounted for.
- d. The sketches shall be used in the field by the survey party for the purpose of identifying lots and lot corners. A careful check of all information thereon must be made.
- e. Lot corners shall be located by side shots from the nearest traverse station occupied by the survey team. The corner 1 of any lot shall not be more than

one kilometer from its reference point, whenever necessary. The reference point shall be any of those mentioned in Section 34, DAO No. 2007-29.

- f. The adjoining sketches shall be compared before the survey is made and duplicate corners should be excluded. Corners outside the margin of both sketches shall be included in only one sketch, by a semi circle in ink, to avoid missing corners and duplication of work. Lot surveys shall be confined to the interior limits of each sketch which shall be absolutely complete.
- g. The marking of the corners on the ground, i.e., by monuments (old and new), trees, stakes, etc. which was previously identified in sketching must be carefully verified and entered in the field book.

Section 92. The survey shall cover as much as possible all the lots which were included in the sketch map and the PIS.

Isolated Survey within the Cadastral Project

Section 93. Approved Surveys – The following shall be observed in the conduct of survey covering lots with approved survey:

- a. In case that upon the conduct of actual survey, the lot with approved survey/titled and sketched lot differ substantially and the owner is actually claiming additional land, the additional area shall be made as a separate cadastral lot in accordance with **Section 82.c** of this Manual.
- b. In case the land surveyed has not been titled and the claimant wants to combine the surveyed area and the additional unsurveyed area in one cadastral lot, he/she shall be required to surrender the approved tracing cloth/sepia plan of the survey together with certification from the Register of Deeds (that the land is not covered by any title), RTC or MTC sitting as Cadastral Court (that it is not a subject of any land registration proceedings) and an affidavit requesting the RTD for Lands for the cancellation of the subject plan.
- c. If the claimant voluntarily excludes portion or portions of the surveyed and untitled lot, the excluded area shall be numbered as a separate cadastral lot. In the case of titled properties, the land owner shall be made to execute an affidavit stating therein his/her voluntary decision to exclude the area.
- d. The following shall be surveyed:
 - 1. Titled/Untitled properties without lot descriptions;
 - 2. Titled/Untitled with erroneous or missing lot description; and
 - 3. Titled/Untitled with technical descriptions from magnetic surveys.

The survey shall include the relocation of the corners and boundaries of the same property when they were originally surveyed on the basis of the existing data and the best evidence available.

- e. In case it has been established that there is a definite overlapping between previously approved surveys, the following procedure shall be followed:
 - 1. When overlap is between surveys not yet titled and leased properties, the area in conflict shall be made as separate cadastral lot;
 - 2. When the overlap is between titled and leased properties, the area in conflict shall also be made as a separate cadastral lot; and

3. When the overlap is between titled or leased property and the property not yet leased or titled, the latter shall be amended to exclude therefrom the portion in conflict, except when there is a court order or an order from the Regional Executive Director in case of the leased property, directing the showing/treatment of the area as a separate cadastral lot.
- f. In case the claimant of untitled property covered by an approved survey within a cadastral project desires subdivision, he shall secure the authority from the Regional Technical Director for Lands for each change. The provisions stated above in Paragraph b. of this Section on the turn over of copy of the approved plan shall be followed.
 - g. Approved surveys shall be adopted, whenever necessary, into the cadastral system and upon performing the following procedures:
 1. The tie line of the approved survey shall be converted to the cadastral/grid system and plotted on the cadastral map. However, this tie line need not fix the location of corner one of the survey unless it cannot be otherwise identified.
 2. Common point with previously patented, leased or decreed survey situated within cadastral project shall be located.
 3. The area given in the lease, patent or title shall be accepted as final.
 4. The bearing should be reduced to the cadastral bearings either from actual shots on the ground or by applying correction for convergence.
 5. Three or more corners of the previously approved survey shall be located for used in comparing and reducing the system of coordinates of old survey to the cadastral survey.
 6. An old survey shall be considered adjusted in the cadastral survey if its corner and boundaries are located in the cadastral system at the same places where they were originally surveyed.
 7. Existing monuments, marked occupation or agreement of the owner and adjoining claimant shall be given preference in determining the location of the common point or other points of the boundary.

Section 94. All lands of the Public domain shall be surveyed as one lot with the authority of the RED. Private claim inside unclassified areas shall not be surveyed.

Section 95. Geodetic engineers may undertake surveys within decreed or titled parcels inside cadastral projects free from the limitations of **Sections 80 and 82** of this Manual. A copy of the approved survey plan shall, however, be furnished to the cadastral project chief.

Section 96. All government lands mentioned in Section 6.e of DAO 2007-29 which are located within a cadastral project shall be sketched, marked with monuments, surveyed and assigned cadastral lot numbers..

Section 97. All patented mineral lands within a cadastral project shall be surveyed as regular lots of the project in accordance with the plan of each survey as approved. All other mineral land surveys shall be projected by their tie lines or by coordinates and shall be indicated on the cadastral maps by dotted line. The Geodetic Engineer concerned shall research the documents needed with the regional office of the Mines and Geosciences Bureau (MGB).

Section 98. Public Land Subdivision (Pls) and Group Settlement Surveys (Gss) within the Cadastral Project – In case of existence of approved Pls and Gss inside the Cadastral Project, the following shall apply:

- a. The main control of the cadastral project shall traverse Pls or Gss within the cadastral project. Recovered BLLMs, boundary monuments (MBMs and BBMs) shall be made part of the cadastral main control.
- b. When there are no recovered BLLMs or boundary monuments in the Pls or Gss, main control points shall be established in these areas and BLLMs are established in accordance with **Sections 29 to 51** of this Manual.
- c. The BAP and the PIS shall not be applicable inside the area covered by the Pls and Gss.
- d. The Pls or Gss shall be plotted on the cadastral map as one big lot. However, the individual lot in the Pls or Gss shall be indicated in the cadastral map by dotted red line.
- e. For purposes of plotting, the Pls or Gss boundary data shall be transformed into the system of the cadastre.

Advance Survey

Section 99. Advance Survey (**As**) of a lot pertains to the survey and preparation of the survey returns of cadastral lots and the verification thereof ahead of the other lots. The said survey shall be made after the primary and secondary controls of the project have been completed, verified and approved, and before submission of lot survey returns to the LMS concerned for verification and approval. However, the request for advance survey of parcels located within the project shall not be allowed except on the following conditions:

- a. There is a court order for the immediate conduct of survey in connection with the resolution of a land case; or
- b. There is a written authority from the RED upon recommendation of the RTD for Lands due to the urgency for such survey and the applicant is willing to bear the expenses.

Section 100. If the project was abandoned, cancel immediately the contract and assign to the DENR Survey Team to conduct necessary correction and validation leading to the approval thereof.

Section 101. Once an authority to conduct **As** is granted the following conditions shall be observed:

- a. Each contested area shall be made a separate lot.
- b. After the conduct of survey, the survey returns shall be submitted to the DENR Regional Office concerned for verification and approval. The project chief shall indicate the class and survey numbers assigned to the advance survey on the cadastral maps, lot data computation sheets, and the **PIS**.
- c. Once approved, said properties and all its adjoining properties shall be plotted on the cadastral maps which shall be included in the survey returns of the project. The cadastral lot number shall be indicated next to the designated survey symbol **As** and the corresponding numbers.

- d. The administrative cost of the **As** which shall be computed based on the cost per lot of the Cadastral Project , shall be paid to the DENR Regional Office concerned, plus appropriate fees and other expenses .

Article 4 - Graphical Cadastre

Section 102. When a massive conversion and subdivision into numerical cadastre of previously approved graphical cadastre is conducted it shall be in accordance with the provisions of **Sections 53 to 101** of this Manual and the following shall be considered:

- a. The control monuments in both the Project and the Political Boundary established in the Graphical Cadastre shall be adopted as the control monuments of the numerical cadastre but shall be transformed into the PRS92. The recovered monuments shall be included in the Network Design;
- b. All graphical cadastral lots previously converted into numerical cadastral lots and were approved, whether titled or not, shall be reflected in the Cadastral Maps. However, the provisions on the BAP and PIS shall not be applied;
- c. The lot numbers in the Graphical Cadastre shall be adopted in the Numerical Cadastre as far as possible.
- d. If the graphical lot is subdivided into two or more lots, one lot will retain the original lot number and the other lot will be assigned the highest lot number indicating below the original graphical lot number as a portion of the original lot. The said subdivision is only allowed upon presentation of proof of conveyances by the concerned parties.

Article 5 - Public Land Subdivision Project

Section 103. Pls Surveys Projects as defined in Section 5.c, DAO 2007-29 shall compose the following activities:

- a. Project Control Survey – shall be conducted in accordance with the accuracy requirement stated in Section 28.b.1, DAO No. 2007-29.
- b. Lot Surveys - shall be conducted in order to determine individual lot boundaries and their corresponding area primarily for the purpose of acquiring title thereto.

Section 104. Public Land Subdivision (Pls) project which shall cover only A&D lands shall not be required to conduct Political Boundary Survey. However, established Political Boundary Monuments within the coverage of the project shall be observed, verified and plotted in the Pls Maps. Pertinent provisions of **Section 98** of this Manual shall be applied in the determination of reference or control monuments for inclusion in the project network of controls.

Section 105. The provisions of **Section 3** of this Manual shall apply in awarding of survey project except that the Survey Order shall be issued by the concerned RTD for Lands pursuant to Section 16, DAO No. 2007-29, and upon recommendation of the Regional Bids and Awards Committee – Technical Working Group (RBAC-TWG).

Section 106. Pls survey project numbers shall be issued by the DENR LMS concerned. To prevent the duplication of number, the Regional Code shall be indicated in the Pls number. The LMB shall periodically be provided listing of Pls survey projects approved by the LMS, indicating therein the location (barangay, municipality, and province), total area and the number of lots. Also, the established location monuments, with the PTM and PRS92 coordinates, shall be furnished to the LMB for the updating of the national database on reference points.

Section 107. The Survey instruments to be used in the different phases of the project shall be the following:

- a. Survey instruments to be used are either of conventional type, GNSS Receivers, as described in Section 21, DAO No. 2007-29 for Project Control.
- b. Lot survey may be conducted using ETS or GNSS, as may be applicable.

If ETS instruments are to be used, the control survey and lot survey shall be conducted in accordance with the provisions of **Sections 47 and Section 90** of this Manual, respectively. In any case, all survey instruments shall be tested/calibrated and registered first before their use in any survey in accordance with Section 22, DAO No. 2007-29.

Section 108. Organization of the Survey Party – The survey party shall be established with at least three (3) major components as listed in **Section 4.c** of this Manual. However, under the Pls Survey, as the project progresses, the following changes may occur:

- a. After the conclusion of the Survey Control Activities and the corresponding approval thereof, the Survey Control Team may be utilized as the Lot Survey Team.
- b. The Reconnaissance and Monument Recovery Team upon approval of the Project Controls may be designated as the Monument Setting Team.
- c. The Monument Setting Team, upon completion of the setting of control monuments, may assist/accompany the Lot Sketching Party to set monuments on the lot corners once an agreement is reached during the BAP.

Section 109. Data Research and Old Monuments Inventory – The provisions of **Section 33** of this Manual shall apply. Moreover, the list of approved surveys and all surveys filed for registration together with the corresponding status thereof whether decreed, pending, dismissed, etc. shall also be collated to be used as reference data. Efforts shall be exerted to identify and collate the data of all the isolated surveys in progress within the project area. Relative thereto, all requests for Survey Authority therein shall not be allowed unless the survey is to be conducted by the Pls Survey Project Chief. In addition, survey returns of lots subject of verification in the LMS concerned shall be forwarded to the Pls Survey Project Chief for inclusion in the project.

Section 110. Pls Project Management Plan (PPMP) – The PPMP shall be composed of the Project Management Plan and Technical Plan. It shall be prepared following the process stated under **Section 5** of this Manual. However, the Technical Plan excluded the activity on gravity measurements but shall include the two (2) activities as mentioned in **Section 105** of this Manual. Moreover, the base map to be secured will be used for the plotting of Project Control Network Design instead of Geodetic Network Design. Based on the data gathered in accordance with **Section 109** of this Manual, the technical plan shall be prepared following the applicable provisions of **Section 61** of this Manual.

Section 111. The basic scheme of work on a Pls survey project shall follow the activities on the conduct of Cadastral survey project as enumerated in **Section 62** of this Manual except the activities on the Political Boundary Survey.

Section 112. Notification of Survey – The provisions of **Section 64** of this Manual shall apply in the notification of survey, both for the general public and the individual lot claimant.

Section 113. In the conduct of Control Survey for Pls, applicable provisions of **Sections 29 to 52** of this Manual shall be followed.

Section 114. In the conduct of lot sketching, setting of monuments and survey, applicable provisions of **Sections 77 to 98** of this Manual shall apply.

Chapter III - Isolated Surveys

Article 6. Public Land Subdivision.

Section 115. Pls considered as isolated survey under Section 5.c, DAO No. 2007-29 where the area involved is 1,500 hectares and below shall be governed by the same procedure **Article 5** of this Manual.

Article 7 - Group Settlement Survey (Gss) /Townsite Subdivision Survey (Ts)

Section 116. Gss and Ts Surveys Projects as defined in Section 6(a), DAO No. 2007-29, shall be conducted in the PRS92 system and shall follow the accuracy requirement stated in Section 28 (b), DAO No. 2007-29. The conduct of GSS and TS survey shall be governed by the following:

- a. Determination of position of the lot's boundary from an established reference point shall be conducted using:
 1. GNSS Observations, if the area is at least 1,500 hectares
 2. ETS Observation for Traverse, Triangulation, or trilateration from established PRS92, if the area is below 1,500 hectares. However, the Geodetic Engineer concerned shall have the option to use GNSS receivers.
- b. Lot Corners shall be determined by side shot using conventional instruments with the minimum specification as follows:
 1. If area is at least 1,500 hectares: ETS
 2. If area is 500 to 1,500 hectares: One-second (1") optical or electronic (digital) theodolite with EDM for distance determination
 3. If area is 10 to 500 hectares: Six-second (6") optical or electronic (digital) theodolite with EDM for distance determination
 4. If area is 5 to 10 hectares: Twenty-second (20") engineer's transit with 100-meter steel tape for measuring distance.
 5. If area is less than 5 hectares: Thirty-second (30°) engineer's transit with 50-meter steel tape for measuring distance.

Instruments of higher precision and longer length or range than the one specified above for corresponding area of lots may be used in the conduct of survey (e.g. for 5 to 10 hectares, a 6" optical or digital theodolite and EDM may be used). In all cases, all survey instruments should have undergone the testing/calibration and registration prior to their use as required under Section 22, DAO No. 2007-29.

Section 117. Pursuant to Section 15, DAO No. 2007-29, Geodetic Engineers shall undertake Gss or Ts survey only upon receipt of authority issued by the concerned DENR Officials stated in the Section 16, DAO 2007-29. The conditions as mentioned in Section 19, DAO No. 2007-29 shall be imposed in the granting of survey authority.

However, if the land is within the jurisdiction of a certain government agency by virtue of an existing law, Section 17, DAO No. 2007-29 shall apply.

Section 118. Data Research of Adjoining Claims – The Geodetic Engineer shall conduct research on the lot and the adjoining lots if they are covered by approved survey, surveys filed for registration and their corresponding status whether decreed, pending, dismissed, etc.

Data of reference points of established Geodetic Control and Project Control Network adjacent to or within the vicinity area preferably one kilometer or less in consonance with **Section 91.e** of this Manual, shall be researched, collated and evaluated. Thereafter, verify their individual status on the ground to ascertain whether the monuments set on the ground are intact/undisturbed. Their corresponding Geographic Position and Plane Coordinates (GPPC), both in the Local and in the Philippine Plane Coordinate System (PPCS), shall also be determined. Only stable or undisturbed control or reference points shall be considered in the establishment of control around the lot to be surveyed. Moreover, PRS92-control points established in the area as validated and approved by NAMRIA shall also be determined and shall be included in the list of reference points to be considered. Based on the researched data, a preliminary sketch of the lot shall be made and the names of the adjoining owners shall be indicated therein.

Section 119. Before the conduct of survey, a reconnaissance and validation of sketch of the tract of land to be surveyed shall be made. The names and addresses of all persons claiming ownership of a part of the entire tract to be surveyed and of adjoining lands shall be indicated therein.

Section 120. Notification for this survey shall follow those stated in **Section 7** of this Manual.

Section 121. Organization of the Survey Party – The composition of the survey party and its manpower complement shall be as determined by the Chief of Party provided that they are qualified to serve as such under this Manual.

The Lot Survey Team may be divided into sub-group which shall handle major activities such as sketching (with BAP and PIS activities), manufacturing and setting of monuments, control establishment and lot survey. For a small area and non-project survey, the conduct of control and lot survey may be done by a single team.

Section 122. Isolated Survey Accuracy – The conduct of isolated survey shall be done in accordance with the accuracy requirement for Tertiary Control as stated in Section 28.b.1, DAO No. 2007-29. Provided that, the length of side shots from the traverse station to the lot corners shall not exceed 500 meters when using ETS or EDM and 100 meters when using steel tapes.

Section 123. Boundary Agreement Process (BAP) and Parcel Information Sheet (PIS) – The conduct of BAP and formalizing the agreement through the PIS pursuant to **Section 85** of this Manual shall be done before the monument setting of lot corners. The adjudicator shall be an LMO assigned by the DENR, who shall, together with the Chief of Party and the Barangay representative, stand as witness to the agreement. They shall affix their signatures on the PIS.

The sketching of the lot, adjoining properties, public works and the natural features shall follow the pertinent provisions of **Sections 81 to 85** of this Manual.

Section 124. Lot Corners Monument Setting – The corners of the lot shall be marked with monuments based on the result of BAP as sketched and agreed upon in the PIS of all concerned parties pursuant to **Sections 87 to 89** of this Manual.

Section 125. Conduct of Lot Survey – The survey for the determination of point of reference and the lot corners shall be in accordance with the accuracy requirements stated in Section 28.b.1, DAO 2007-29.

Setting the Permanent Position of Lot Corners

Section 126. Tie Lines – A tie line shall be a straight line with known bearing and distance expressed in degrees, minutes and seconds computed based on the position of corner 1 of the lot from an established reference monument. The following shall be the procedures and conditions in the establishment of tie lines:

- a. Tracts to be surveyed shall be tied by a closed traverse to the nearest points of reference as provided for in Section 34, DAO 2007-29.
- b. However, corner-markers of an approved survey, may be used as reference, provided that a common point pursuant to **Section 128** of this Manual can be established from at least three (3) available corner-markers which could be relied upon as to their permanency and stability.
- c. In case no corner markers of an approved/decreed/patented survey can be found on the ground, at least three (3) corner-markers of nearby approved/decreed/patented survey may be used as reference provided a common point can be established pursuant to **Section 128** of this Manual.

Section 127. Connection of Surveys - All surveys shall be adequately connected to existing surveys, or the position of the survey shall be determined by a method that will enable the survey to be shown in relation to existing surveys taking into consideration the accuracy appropriate to the circumstances. The survey shall be adequately connected to permanent reference points existing in close proximity to the survey.

Section 128. Common Point - When a previous survey and the survey in progress overlap or adjoin each other, a common point shall be selected from among the corners which have been located.

- a. The selection of the corner to be adopted as a common point shall depend on the following:
 1. The permanency of the corner monument of an approved survey as verified on the ground.
 2. The degree of precision between the computed positions of the corner monuments as found in place on the ground determined from the data of the approved surveys and of the survey in progress.
 3. In general, a living tree, a boulder or any other object of permanent nature used as corner in the approved survey, which is identified beyond doubt in the course of the survey in progress and which is not likely to have been removed from its original place, shall be selected as a common point in preference to concrete stone or other monuments which may, with comparative ease, be removed from their original location and be placed elsewhere.
- b. When monuments of approved surveys appear to have been moved, such observation shall be recorded in the field notes and the subject monuments shall be reinstated/re-established. Should the monuments have been determined to be fixed/undisturbed as to their location on the ground, they may be used as witness monuments to the true corners.
- c. When the position of a corner of an approved survey and its position as determined in a latter survey is within the allowable position of error as

provided for in Section 30.b, DAO No. 2007-29, the position as determined in the earlier survey shall be accepted and adopted as the position of such corner in the latter survey.

- d. When the discrepancy in position exceeds the limits set forth in the preceding section, the geodetic engineer shall make such verification as may be necessary to check the data of the survey in question. A complete report on the discrepancies and the results of verification shall be made and submitted to the concerned Regional Technical Director for Lands, through the Regional Chief of Surveys Division for decision.
- e. If the recovered corner of the previous survey is not identical to its description in the plan, investigation shall be conducted by the geodetic engineer to ascertain the cause thereof and the result of the investigation shall be reported in writing to the concerned Regional Technical Director for Lands.

Article 8 – Survey of Public Lands

Section 129. Original survey of land and the setting of monument for the purpose of public land application for **Homestead, Free Patent, Sales**, and other modes of disposition under CA 141, as amended, otherwise known as the Public Land Act, shall be conducted following pertinent provisions of **Sections 115 to 128** of this Manual. Restrictions regarding the adjoining natural features shall be observed. Moreover, limitations pertaining to land areas based on existing laws shall be applied.

Section 130. The survey of public land shall be conducted upon issuance of survey authority or survey order from the concerned DENR official as mentioned in Section 16, DAO No. 2007-29. Likewise, Section 17, DAO No. 2007-29 shall be followed for survey of lands under the jurisdiction of other government agencies.

Section 131. The following shall be applied in the conduct of survey of reclaimed lands:

- a. No survey on proposed or existing reclaimed lands survey shall be conducted without prior issuance of survey order or authority required under Section 16, DAO 2007-20.
- b. The boundary survey of reclaimed lands shall be conducted following the applicable provisions of **Sections 115 to 128** of this Manual.
- c. No submerged portion of the project shall be included in the determination of the land area of the lot nor shall the lot corner be established within the submerged portions of the reclamation.
- d. The boundary survey of the reclaimed land shall be first submitted for verification and approval before its subdivision into smaller lots. Buffer zone of at least twenty (20) meters shall be maintained along the edge of the reclaimed land between the waterline and the sub-lots.

Section 132. Foreshore lands shall be surveyed upon determination of the average highest and lowest level of the sea water in the area based on the published tide table from NAMRIA. If the adjoining lot is an approved cadastral lot, the landward boundary line of the foreshore land shall conform to the cadastral boundary. **Sections 115 to 128** of this Manual shall be followed in the conduct of survey of foreshore land, while applicable provisions of **Section 84** of this Manual shall be followed in the setting of monuments and sketching of foreshore land. The Geodetic Engineer should make proper coordination with the RTD for Lands and other concerned agencies as to the establishment of access roads pursuant to existing laws and policies.

Section 133. No survey shall be allowed within mangrove, marshy, swamp lands and other similar wet lands except for the purpose of determination of the area to be covered by a proposed wildlife reservation, protected area, marine sanctuary and other similar purposes.

Article 9 - Amendment Surveys

Section 134. *Amendment Survey* of approved surveys (Psu, F, H, and the like) shall be conducted only upon submission of the following requirements:

- a. Sepia copy of the approved survey plan including the narrative technical description issued to the owner;
- b. Certification from the concerned LRA/RTC/CENRO that the same has not been registered or subject of a land registration proceeding;
- c. Written explanation of the claimant for the reason to request for amendment survey; and
- d. If the person requesting the amendment is not the owner or claimant of the land, he shall be required to submit a written authorization duly notarized or a special power of attorney from the owner authorizing him/her to cause the amendment survey.

Section 135. The survey number shall be retained but with suffix Amd.,Amd-2, Amd-3.....etc. Pertinent provisions of **Sections 115 to 128** of this Manual shall be followed in the conduct of amendment survey.

Article 10 – Private Land Surveys

Section 136. Private land surveys shall either be a simple or complex subdivision survey which shall be conducted in consonance with the provisions of Section 18 of DAO No. 2007-29. Verification survey conducted over private lands shall be in accordance with Sections **146 to 155** of this Manual while amendment survey shall be conducted pursuant to **Sections 136 to 137** of this Manual.

- a. Applicable provisions of **Sections 115 to 128** of this Manual shall be adopted in the conduct of complex subdivision survey of a private land in addition to the following:
 1. A complex subdivision is define for the purpose of this Manual as a subdivision of a *registered land* pursuant to BP-220 and PD-957, as amended.
 2. The approved subdivision scheme shall be strictly followed in the actual setting of lot parcels on the ground. Moreover, the said document shall be included in the survey returns to be submitted to the DENR-LMS concerned for verification and approval.
 3. The block boundary corners shall be marked with permanent concrete monuments in accordance with **Sections 87 to 89** of this Manual.
 4. The block and individual lot corners may be temporarily marked with stakes or iron rods to be replaced with permanent concrete monuments upon completion of the land filling or grading on the project site.
 5. Subsequent subdivision/ consolidation survey on the lot covered by a previously approved housing subdivision project shall require an approved alteration permit and scheme of the local government unit concerned.

6. In cases where titled property was already transferred to the buyer, alteration permit is not a requirement.
- b. A plan describing the boundaries of land may be made particularly in the case of simple subdivision of a lot wherein two old corners were connected by straight line, provided that the old corners are intact on the ground; the boundaries of the land are defined conspicuously by walls, shrubs and other markers; and the information to be shown on the plan are sufficient to satisfy the requirements in this Manual. The survey plan bearing the conformity of land owner may be submitted for verification and approval with the notarized field notes cover without the field notes.
 - c. In case of subdivision survey of ten (10) or more resultant lots and the last subdivision was approved within the last six (6) months, the following shall be required as part of the survey returns.
 1. Affidavit of Landowner that the subdivision is not intended for housing subdivision projects;
 2. Certification of Community Mortgage Program, if applicable;
 3. Land Use Certification from the LGU concerned; and
 4. Investigation report and comments from LGU/HLURB.

In cases of subdivision among co-owners, the foregoing shall not apply in areas with densified PRS 92 monuments. However, in cases of areas where there are no PRS 92 reference point within a radius of 1 km, connection survey shall not be required.

Article 11 – Government Land Surveys

Friar Land Surveys

Section 137. Surveys affecting the Friar Land Estates, the list of which shall be found in **Annex XVIII** of this Manual, shall be conducted in the PRS92 system tracing the original position of lot corners and following the applicable provisions of **Sections 115 to 128** of this Manual.

Section 138. Geodetic Engineers shall undertake friar land survey only upon receipt of authority issued by the concerned DENR Official stated in the Section 16, DAO No. 2007-29. The conditions as mentioned in Section 19, DAO No. 2007-29 shall be imposed in the granting of survey authority.

Section 139. Data Research and Investigation of Adjoining Claims – The Geodetic Engineer shall conduct research on the status and the technical description of the lot. Only friar lands not covered by conveyance shall be issued Survey Authority (SA). The adjoining lots shall also be researched for the status and technical description. Determine also if the previously surveyed adjoining lots were already transformed into PRS92. As much as possible, locate the old reference point and determine the status thereof to ascertain whether it can be used as reference point of the lot subject of the survey, otherwise, new established reference point within the vicinity shall be used.

In case where no data is available in LMB and LMS concerned, a resurvey may be conducted following the applicable provisions of **Section 115 to 128** of this Manual.

National Government Land Surveys

Section 140. Survey of National Government lands shall be conducted in consonance with the provisions of Section 16 or 17 of DAO No. 2007-29 and shall be treated as an isolated survey.

- a. The following are also considered as National Government land
 1. Land forfeited for non-payment of taxes.
 2. Land adjudicated to the government through foreclosure proceeding.
 3. Lands acquired by the national government through forfeiture of bonds in criminal cases or as a result of execution of judgment in civil action.
 4. Lands acquired through expropriation proceeding, donations, purchase or exchange when no longer devoted to public uses.
 5. Lands where old structures formerly used as fortifications and known as “cotas”, “baluartes”, etc. are built or situated.
 6. All other private properties of the national government acquired or held in whatever form when not needed for public purposes.
- b. Applicable provisions of **Sections 115 to 128** of this Manual shall be adopted in addition to the following:
 1. A narrative report stating the land use and general condition of improvement, if any, shall be included in the survey return. The existing improvements shall be plotted in dotted lines in the survey plan.
 2. The survey of private lands to be purchased, expropriated or acquired in any other manner by the national government shall be made in accordance with the requirements of **Section 136** of this Manual.

Local Government Land Surveys

Section 141. Survey of local government lands shall be conducted in consonance with the provisions of Section 17 of DAO No. 2007-29 and shall be treated as an isolated survey. The Provincial Board Resolution, in case of province or the Municipal/City Board Resolution shall be secured prior to the conduct of survey. Applicable provisions of **Sections 140.b** of this Manual shall be followed in the conduct of local government land survey.

Article 12 – Conversion Surveys

Section 142. Survey for the purpose of transforming/converting individual lots covered by approved graphical cadastral survey, cadastral mapping (Cadm), and photocadastral mapping (PCadm) shall be conducted in consonance with the applicable provisions of **Sections 115 to 128** of this Manual. The survey work undertaken for the purpose shall be subjected to verification and approval by the concerned LMS offices.

Article 13 – Other Land Surveys

Provincial Boundary Surveys

Section 143. The boundaries of provinces and sub-provinces shall be surveyed in accordance with the applicable provisions of **Sections 65 to 76** of this Manual. In the conduct of survey, the existing legal boundaries of its component cities and municipalities shall be considered.

Municipal/City Boundary Surveys

Section 144. The boundaries of municipality or city shall be surveyed in accordance with the applicable provisions of **Sections 65 to 76** of this Manual. In the conduct of survey, the boundaries of the municipality or city based on the technical description

appearing on the law creating the same shall be considered, unless the definition of the legal boundaries cannot be determined on the ground due to the ambiguities contained in the said law.

Barangay Boundary Surveys

Section 145. The boundaries of the barangays shall be surveyed in accordance with the applicable provisions of **Sections 65 to 76** of this Manual. In the conduct of survey, the boundaries of the barangays based on the technical description appearing on the law creating the same shall be considered, unless the definition of the legal boundaries cannot be determined on the ground due to the ambiguities contained in the said law.

Verification Surveys

Section 146. The Regional Technical Director for Lands may issue order to conduct a verification survey whenever any approved survey is reported to be erroneous, or when titled lands are reported to overlap or where occupancy is reported to encroach another property. In the conduct of verification survey, the Geodetic Engineer shall, among others:

- a. Ascertain the position and descriptions of the existing survey monument or marker, buildings, fences, walls, and other permanent improvements, which are used to provide evidence of original boundaries;
- b. Give primary consideration to original survey marks, except where other evidence, including original measurements, position of improvements, or statements by occupants, suggest that the original markers were incorrectly placed or have been disturbed;
- c. Ascertain the position of buildings, fences, walls or other permanent improvements adversely affected by the determination of the boundaries;
- d. Inform the parties concerned of the effect of the determination of the boundaries and secure a statement from the parties that they have been informed of these findings; and
- e. Include the submission of a narrative report under oath.

The conduct of verification survey on the basis of a court order directing the Geodetic Engineer of the LMS office concerned shall be made with the authority issued by the RTD for Lands specifying therein the name/s of the designated LMS officials/employees.

Section 147. When gross errors or discrepancies in adjoining surveys are discovered, an explicit statement of the line found to be erroneous and other discrepancies shall be recorded in the field notes. It shall be the responsibility of the geodetic engineer to disclose any doubt or discrepancy associated with the survey.

Section 148. The geodetic engineer whose survey is reported to be erroneous shall be required to make a thorough evaluation of the area and the survey conducted and to report his/her findings under oath. In case he/she finds discrepancy in his/her survey, he shall report the technical differences between the new survey and the previous survey and submit an explanation as to the cause thereof. If on the contrary, he finds his survey correct, he/she shall report this to the RTD for Lands who may order a joint survey of the two geodetic engineers involved and the DENR-LMS geodetic engineer in order to settle the difference in findings.

Section 149. All survey work undertaken for verification purposes shall be subject of verification and approval in the DENR-LMS Regional Office concerned and shall be designated as Verification Surveys (**Vs**). However, the original survey symbol and

number of the lot shall be stated immediately above the Vs survey symbol and number. This shall apply to verification surveys of isolated surveys and cadastral lots.

Section 150. Astronomical Observation - In order to determine the original position of corner 1 and other selected corners of an old survey not approved in the system of PRS92, an astronomical observation shall be conducted.

- a. Specifically, astronomical observations shall be conducted to determine the following:
 1. The latitude and longitude of points of reference which have not been connected to other points of known geographic coordinates.
 2. The azimuths of lines of survey.
 3. To check the geographic position of lot corners.
- b. Astronomical observation shall also be conducted to determine the time for the following purposes:
 1. The error in the time shown by watches or chronometers.
 2. To determine the time of astronomical observations previously conducted over the old point. This verification with the aid of Almanac, shall also determine what celestial bodies were observed during the astronomical observation.
- c. The following provisions shall serve as general guide in the astronomical observations, to wit:
 1. Astronomical observation shall be made on either the sun (solar observation) or the star (stellar observation), as the geodetic engineer may prefer, using the procedures as prescribed in this Manual. However, old azimuth between BLLM Nos. 1 to 2 shall be checked through stellar observation.
 2. All observed altitude of the sun shall be corrected for index error, refraction and parallax in the order given. Only correction for index error and refraction shall be applied to observed altitude of the star.
 3. The altitude of the sun's center shall be determined by observing its lower or upper limb and correcting the vertical angle observed. The correction shall be done in the following manner:
 - a) Add its angular semi-diameter when observing lower limb or subtract its angular semi-diameter when observing upper limb;
 - b) Or center the sun's disc in the solar circle or square which shall be taken first with the telescope direct, then twice with the telescope reversed and finally with the telescope direct.
 4. In the solar observations and computation of declination of the sun, the standard time (120° EMT) shall be determined by:
 - a) Observing for local apparent time, converting it into mean time and finally reducing to standard time.
 - b) Comparing watch time with the official standard time signals.

5. The index correction for vertical angles in a solar observation shall be as follows:
 - a) The index error of the vertical circle shall be determined by direct and reversed sighting at a fixed point.
 - b) The average of at least ten direct and ten reversed readings on as many points of different elevations shall be used for determining the index error.
 - c) The observed vertical angles shall be corrected by the amount of the index error.
 - d) The value of the index correction shall be entered with the data for each solar observation.
 - e) Observation shall be taken when the altitude is not less than twenty degrees.
6. If the direct and reversed readings of the vertical angles to a point after correcting for index error, differ by more than thirty seconds of arc, the instrument shall be tested and adjusted accordingly.

Section 151. Time - For the purpose of determining the hour angle of the sun's center or the hour angle of the vernal equinox at any instant, observations for time shall be made to find the error of a timepiece. Watch error shall be used to correct the timepiece which is necessary in the azimuth derivation. The following provisions shall serve as guide in the time determination:

- a. Observations on celestial bodies shall be made when the observed body is on the prime vertical. If this is not possible, observations can be made along the meridian but this should not be done over BLLM Nos. 1 and 2.
- b. Any of the following methods for determining the time shall be followed.
 1. Time by transit of the sun
 2. Time by transit of a star
 3. Time by an altitude of the sun at any hour angle
 4. Time by an altitude of a star at any hour angle
 5. Time by equal altitudes of a star
- c. The official or standard time to be used in astronomical observation shall be the mean time corresponding to the one hundred twentieth degree (120°) meridian east of Greenwich.
- d. Geodetic engineers shall use accurate watches or chronometers for astronomical observations. The accuracy of the times kept by a watch or chronometer shall be verified by comparison with standard chronometers or by observations for local mean time. This is to determine the correction to be applied to the time indicated by the watch or chronometer.
- e. Local mean time shall be determined by altitude observation on the sun or stars at the moment of meridian passage or at any hour angle. When local mean time is determined by altitude of the sun before or after the meridian passage, the procedure outlined in **Annex XVII B.3** of this Manual for determining azimuth shall be followed.

- f. Any formula for determining the hour angle may be used, but the formula found in **Annex XVII B.1** of this Manual shall be adopted in the altitude observation for time. Separate computations shall be made for each set of observations with the telescope in the direct and the reversed position as provided in **Section 155.b and c** of this Manual.
- g. The time obtained by observations on the sun is local apparent time which shall be transformed into local mean time. Equation of time is equal to apparent time minus local mean time. On the other hand, the time obtained by observation on the star is local sidereal time which shall be transformed into local mean time.
- h. At least two complete sets of observations shall be made. The average shall be transformed into local mean time. The data obtained for determining time may be used also for determining the azimuth of line.

Section 152. Latitude – Observation for latitude shall be made whenever the latitude of the station occupied is not known from previous observations or from connection to a station or point of reference of known latitude. The following provisions shall serve as guide in the latitude determination:

- a. Of the various methods for determining latitude, the following may be used with the transit or theodolite:
 - 1. By a circumpolar star at culmination
 - 2. By a meridian altitude of a southern star
 - 3. By circum-meridian altitudes
 - 4. By altitude of Polaris at any hour angle
 - 5. By altitude of sun at noon
- b. The highest recorded altitude of sun when corrected for refraction, index error, semi-diameter and parallax may be accepted and used for determining the latitude.
- c. Observations on the sun shall consist of a series of not less than eight (8) altitude observations alternately with the transit or theodolite in the direct and the reversed positions. Half of the series shall be made before the time of the meridian passage and the other half after the time of meridian passage.
- d. When more accurate result is desired, the latitude shall be determined by observation of Polaris at culmination. The averages of the reduced altitudes shall be accepted and used for determining latitude.
- e. When latitude is determined by Polaris or any circumpolar star at any hour angle, this procedure shall be followed:
 - 1. Set and level the instrument over the point.
 - 2. By means of the upper motion, take several altitude observations on Polaris in the direct and reversed position.
 - 3. Take note of the time at each pointing of the star.

4. Apply index correction to the observed altitude when necessary and then take the mean of the altitude and the mean of the times and treat the result as a single observation.
 5. Compute the hour angle of the star.
 6. Compute the latitude using the formula found in **Annex XVII B.2.a** of this Manual.
- f. In all lands surveys, the latitude shall be determined by a control connection with points of reference of known geographic positions.
 - g. Latitude determination by observation on the star or the sun at meridian passage shall be made using the formula found in **Annex XVII B.2.b** of this Manual.
 - h. The latitude used in the computations for azimuth shall be derived from the latitude as determined by the position computation.
 - i. If the above method is not feasible, the latitude shall be determined by astronomical observations.

Section 153. Longitude – The Longitude shall be determined by means of closed circuit or loop traverse starting from reference points of known geographic positions. Other method for determining longitude shall be as follows:

- a. By transportation of a time piece
- b. By transit of sun at noon
- c. By the time signals
- d. By Laplace observation method

Section 154. Elevation – The Elevation may be determined by lines of levels starting from bench marks of known elevation, by trigonometric leveling, spirit leveling or by means of barometer/altimeter.

Section 155. Azimuth - The azimuths of all lines of survey lines shall be reckoned from the south as zero direction following clock wise of the quadrants. This shall be carried from the astronomical azimuth of one or more lines of the survey. The following provisions shall serve as guide in the azimuth determination:

- a. The astronomical azimuth of a line shall be determined by observations on the sun or stars. It shall consist of at least one to eight series of observations as required using an instrument tested before hand.
- b. Each series shall consist of two sets of observations. One set shall consist of the mean of observed readings with the telescope in the direct and reversed position.
- c. In solar observation for azimuth using the vertical and horizontal cross wires, the cross wire shall be made tangent to the left and lower, right and upper, right and lower, or left and upper limbs of the sun, as the case may be. The procedures in **Annex XVII B.3** of this Manual shall be followed.
- d. In case of stellar observations, the star shall be centered as closely as possible at the intersection of the crosswire. The accuracy of the observations shall be tested by comparing the rate of motion of the stars in the horizontal and vertical angles.

- e. For observations on circumpolar star for azimuth at elongation, the formulas found in **Annex XVII B.4** of this Manual for determining the hour angle and azimuth of a star shall be used. The procedure found in **Annex XVII B.5** of this Manual for observing stars for azimuth at elongation shall be followed.
- f. In all azimuth observations, points occupied and observed shall always be stations of the surveys controls.
- g. The following formula found in **Annex XVII B.6** shall be used for determining azimuth of a line by observations on the sun or stars at any hour angle.

Segregation Survey

Section 156. Segregation survey (Sgs) are surveys for the purpose of segregating twenty (20) percent or less of the area of previously surveyed large tract of public land. In addition to the applicable provisions of **Sections 115 to 128** of this Manual, the following shall serve as guide in the conduct of segregation survey:

- a. As much as possible, the original reference point of the mother lot shall be used as the reference point of the lot to be segregated.
- b. The portion of the mother lot which can be shown on the isolated survey plan shall be plotted in dash lines and adjoining claimants shall be indicated in the plan while the LMS concerned shall indicate the remaining area in the footnote, if possible.
- c. The geodetic engineer shall submit the lot data computation of the mother lot and/or adjoining lots.

Segregated lot shall be assigned the highest cadastral lot number while the remaining portion thereof shall retain the original cadastral lot number. The subdivision of the former, if still untitled, shall follow the subdivision of the cadastral lot (Csd) and indicate in the footnote the Sgs survey number.

Relocation Survey

Section 157. The relocation of corners or re-setting of boundary lines of approved surveys shall be made using the bearings, distances, and the area stated in the approved survey or written in the lease contract, if any, or Torrens Title. In addition to the applicable provisions on the conduct of Verification Survey as stated in **Section 146 to 155** of this Manual, the following shall apply in the conduct of re-setting survey:

- a. When it is positively established that a boundary survey mark has not been set as originally intended, re-set the mark after having recorded the position of the mark that is to be re-set.
- b. Record any encroachment caused by the differences between the positions of boundaries as determined in reinstatement/relocation survey and the original or earlier survey. This shall be stated in the narrative report which shall be included in the survey returns.
- c. The relocation of corners, re-establishment of boundary lines, etc, of magnetic surveys, upon which valid land titles have been based, shall be relocated following the metes and bounds as stated in the certificate of title, taking into consideration the adjoining natural and man-made features and as many as old corners as possible.

- d. The survey returns of the relocation/reinstatement survey shall be forwarded to the DENR-LMS Regional Office concerned for verification and approval. The survey symbol of **Rel** and the corresponding number shall designate this survey with the original survey symbol and number shall be indicated immediately next to it.

Notwithstanding the foregoing, the verification and approval of survey returns of a relocation survey is optional.

Re-survey

Section 158. A resurvey (**Rs**) shall be a survey made on approved survey under the following circumstances:

- a. This survey shall be made on a lot under the following conditions:
 1. For purposes of inscribing the technical description on the title of a tract of land and whose technical description is no longer available in the Lands Management Bureau/Land Management Services or the Land Registration Authority.
 2. For purposes of transforming the previously titled lot covered by magnetic survey into numerical survey.
 3. For purposes of establishing the technical description of approved survey which is missing as certified by LMB and LMS office concerned.
- b. The corners as indicated/agreed upon by the landowner and the adjoining lot owners/claimants shall be surveyed. The survey shall conform to the boundaries of adjoining decreed/undecreed or titled/untitled properties which title or approved survey plans contain complete technical description.
- c. The lots covered by magnetic surveys, upon which valid land titles have been based, shall be resurveyed following the metes and bounds as stated on the title, with consideration on the adjoining natural and man-made features and as many as old corners as possible.

The new survey returns which shall be accompanied by a detailed explanation why the resurvey was necessary, shall be forwarded to the DENR-LMS Regional Office concerned, for verification and approval.

Patented and Decreed Land Survey

Section 159. The following provisions shall apply to the survey of patented or decreed land:

- a. The survey of patented or decreed properties which shall be conducted in accordance with the applicable provisions on the private land surveys as stated in **Section 136** of this Manual, shall be made using the bearings, distances and areas in the original approved survey or in the antecedent subdivision survey or that appearing in the title.
- b. Patented land shall not be subdivided within the period of restriction as provided for under CA 141, as amended, from the date of the issuance of patent thereon, except when there is a final and executory court order expressly stating otherwise.
- c. The retracing of the boundary lines of the aforementioned lots shall be in accordance with the pertinent provisions of **Sections 146 to 155** of this Manual.

- d. In case of discrepancy, the data in the approved survey shall prevail. The discrepancy shall be reported for reference in administrative or judicial correction of the title.
- e. All improvements, especially those described in the title or patent, shall be plotted on the plan on each lot. In the absence of such improvements, the words "No Improvement" shall be noted correspondingly on the plan.

Topographic Survey

Section 160. The topographic survey in addition to a special instructions contained in a cadastral project, irrigation projects, estates, mineral claims, etc. shall be made in accordance with the following provisions:

- a. The primary and secondary control stations and political boundary monuments shall be used to control the topographic survey of cadastral projects.
- b. The elevations of the BLLM No. 1 of the municipality or cadastral project shall be determined using the existing data of NAMRIA or the actual conduct of leveling from an established bench mark..
- c. Topographic survey of an isolated land survey shall be done approximately using altimeter or interpolation from an existing topographic map or aerial photograph, in case the elevation cannot be obtained by more accurate methods.
- d. The elevation of all primary and secondary control station and of the political boundary monuments shall be determined by leveling starting from and closing at the BLLM No. 1 of the municipality or project.
- e. The conduct of topographic survey in a survey project shall be done using either the transit and stadia, leveling, GPS or plane table methods.
- f. Topographic survey shall be made in accordance with the procedures described in standard surveying textbooks and the specifications for the survey.

Special Surveys

Section 161. Surveys for geographic and scientific investigations, experiments and all other surveys not otherwise mentioned in this Manual shall be made in accordance with special instructions which may be issued for the purpose following the tertiary accuracy of an isolated survey. This shall be designated as "Special Work Order" (**SwO**) which cannot be a subject of titling and must be clearly stated on the plan.

Article 14 – Mineral Land Surveys

Section 162. The conduct of mineral land survey shall be in accordance with the procedures and standards set by the Mines and Geosciences Bureau (MGB) under DAO No. 96-40 pursuant to the pertinent provisions of RA No. 7942, otherwise known as the Philippine Mining Act of 1995.

Article 15 - Forestlands and National Parks/Protected Areas Delimitation Survey

Section 163. The conduct of the survey shall only proceed after the enactment of the corresponding law by Congress adopting the final report of the Regional Assessment

and Delineation Team (RADT) as a result of their assessment/delineation of forestland boundary pursuant to DAO No. 2008-24.

Section 164. The Survey Party tasked to conduct the survey shall be composed of Geodetic Engineers of the Field Network Survey Party (LMS), at least two (2) members of the RADT (FMS) and a representative of NAMRIA.

Section 165. Delimitation of Forest Boundary Line – The following shall apply in the conduct of forest boundary line:

- a. The Survey Order shall be issued in accordance with Section 16 of DAO No. 2007-29. The issuance thereof shall be supported by the law passed by Congress for the purpose and the corresponding Forestland, National Parks, Agricultural Land Boundary Map (FNPABM).
- b. Delimitation survey shall be conducted with prior written notice to all the claimants thereof, provincial, municipal and barangay officials, cultural/tribal communities, appropriate government and private entities, and other parties concerned. The said survey shall commence not earlier than five (5) days upon receipt of such notice. If there are nearby or adjacent on-going survey projects, the Head of the Team/Party executing said survey shall be informed in writing for purposes of work coordination.
- c. Delimitation survey shall be undertaken in the same manner as an isolated survey pursuant to applicable provisions of **Sections 115 to 128** of this Manual
- d. The FNPABM shall serve as a reference to the Survey Party in the conduct of delimitation survey of Forest Boundary lines. The survey shall be at least in the 4th Order Accuracy. The existing corner points of titled/decreed properties and those areas covered by previously approved surveys within and along the perimeter should be observed for connection and checking purposes.

Part 2. Survey Returns

Chapter IV- Control Survey Returns

Article 16 – Geodetic Control Survey Returns

Section 166. The following shall form part of the survey returns of the Geodetic Control Survey:

- a. Copy of the Required Certifications and other Legal Documents shall include the following:
 1. Transmittal Letter, enumerating therein the documents being submitted as part of the survey returns, signed and sealed by the Chief of Survey Party;
 2. Project Contract as per **Section 3.d** of this Manual;
 3. Survey Order as per **Section 3.c** of this Manual;
 4. Approved Geodetic Control Work Plan consisting of Project Management Plan and the Technical Plan;
 5. Certificate of GPS Testing from NAMRIA and Registration from the LMB. The brand, model, serial number of GPS receiver and antennae used should be indicated;

6. Notification Letter pursuant to **Section 7** of this Manual;
 7. Field Inspection Report;
 8. Geodetic Engineer's Certificate signed by the Chief of Survey Party, marked with dry seal and duly notarized; and
 9. Certificate of Instrument Registration.
- b. References and other Technical Documents:
1. Certification of Geographic Position of reference points used in the project which are not available in the LMS.
 2. Monument Recovery Report. The physical status of the old control monuments shall be described. A photograph of the monument (top and perspective views) shall be attached. The sample form to be used for the purpose is illustrated in **Annex XIX** of this Manual.
- c. GPS/ETS observation
- c.1 GPS Observation
- a. Raw Observed GPS data in NAMRIA prescribed format in digital files. If the instruments used are non-Trimble receivers (Ashtech, Sokkia, Leica, etc.) convert the GPS raw data to RINEX digital format.
 - b. Processed GPS Data using an appropriate software (i.e. transformed observed WGS84 coordinates into PRS92 coordinates, adjusted coordinates, printed copies using NAMRIA-prescribed form and stored in digital files).
 - c. Fully accomplished GPS Field Sheet using the form as illustrated in **Annex XX** of this Manual.
 - d. Description of all PRS92 controls used.
 - e. Photograph of the established monuments (top and perspective views). The location (sitio, barangay, municipality, and province) sketch, accessibility, and other relevant information.
- c.2 ETS Observation
- a. If the instrument used is an ETS, in addition to the applicable provisions stated in **Section 166.d** of this Manual, the following shall also be prepared:
 1. The following shall have each field notes as stated in **Section 47** of this Manual:
 - a) Primary Traverses as per procedure enumerated in **Annex XVII.A.1** of this Manual;
 - b) Secondary Traverses; and
 - c) Astronomical observations

The traverse and astronomical observations shall follow the procedure as enumerated in **Annexes XVII.A.1 and XVII.B**, respectively of this Manual

2. The Original Computations of;
 - a) Survey Control Traverses;
 - b) Astronomical Observations;
 - c) Elevation and Sea Level Reductions;
 - d) Scale Factor and Grid Distance and other miscellaneous computation;
 - e) Azimuth Derivations;
3. Test Traverse field notes and computations;
4. The Project Control Map shall be prepared in lieu of Geodetic Control Map in accordance with the applicable provisions of **Section 166.d.3** of this Manual.

d. Established Controls Points

1. Computer-print out of position derivation of PRS92 control points and other computations in the prescribed forms;
2. Monument Description Book in prescribed LMB Forms which includes the following:
 - a) The geographic and grid coordinates of BLLM No. 1;
 - b) There should be at least three (3) references for each station. Each reference points should be described with corresponding distance and bearings from station and BLLMs;
 - c) Each station and BLLM should be sketched in its location.
3. PRS92 Geodetic Network Control Map prepared in 54 x 54 cm drafting film with marginal lines of 50 x 50 cms in prescribed LMB forms duly signed by the Chief of Party and shall contain the following:
 - a) The boundary of the project;
 - b) The adjoining municipalities with their corresponding cadastral survey number, and survey projects undertaken within the area being surveyed, if any;
 - c) The existing provincial and national roads, rivers, creeks, timber or forest lands (shaded), unclassified areas, and other natural features within the project;
 - d) The First and Second Order control stations established shall be plotted in appropriate scale;
 - e) Existing triangulation stations and location monuments (old and those belonging to approved project within the boundary);

- f) The following details shall also be indicated:
 - 1) locality of the project (municipality, province, and island);
 - 2) PPCS Zone No.;
 - 3) Bar scale;
 - 4) Approximate area;
 - 5) Project No.;
 - 6) Date submitted; and
 - 7) Date surveyed.
- g) The Conventional symbols shall be used in the preparation of Geodetic Control Maps.

Section 167. In lieu of duplicate hard copies of the aforementioned documents, the same shall be submitted in digital forms, i.e. scanned image for certifications, excel files for computations and data, and auto-cad drawing files. Additional technical document that the NAMRIA may deemed necessary may be required from the geodetic engineer/contractor, and shall be stated in the project contract.

Article 17 – Project Control Survey Returns

Section 168. The following, unless otherwise stated, shall be accomplished using the LMB prescribed forms and shall be included in the submission of survey returns for Project Control Survey:

- a. Copy of the Required Certifications and other Legal Documents – In addition to the relevant provision as mentioned in **Section 166.a** of this Manual, the following shall also be included in the survey returns:
 - 1. Approved Project Control Work Plan consisting of Project Management Plan and the Technical Plan.
 - 2. If the instrument used is ETS, an instrument certification before and after use from the LMB shall be presented.
 - 3. The Certificate of Acceptability and Endorsement Letter from the LMS GE Project Inspector addressed to the RTD for Lands.
- b. Copy of References and other Technical Documents as stated in **Section 166.b** of this Manual.
- c. **Section 166.c** of this Manual shall apply when the instrument used is a GPS. If the instrument used is an ETS, in addition to the applicable provisions stated in **Section 166.d** of this Manual, the following shall also be prepared:
 - 1. The following shall have each field notes as stated in **Section 47** of this Manual:
 - a) Primary Traverses as per procedure enumerated in **Annex XVII.A.1** of this Manual;
 - b) Secondary Traverses; and
 - c) Astronomical observations.

The traverse and astronomical observations should be executed in accordance with the procedure as enumerated in **Annexes XVII.A.1 and XVII.B**, respectively of this Manual

2. The Original Computations of;
 - a) Survey Control Traverses;
 - b) Astronomical Observations;
 - c) Elevation and Sea Level Reductions;
 - d) Scale Factor and Grid Distance and other miscellaneous computation;
 - e) Azimuth Derivations;
 3. Test Traverse field notes and computations;
 4. The Project Control Map shall be prepared in lieu of Geodetic Control Map pursuant to the provisions of **Section 166.d.3** of this Manual.
- d. Established Controls Points – The survey returns shall be prepared In accordance with provisions of **Section 166.d** of this Manual, except that the control points are in the 3rd and 4th Orders and plotted on the Project Control Map.

Section 169. In case of Triangulation Method using ETS, the following shall be submitted:

- a. Method of directions in four (4) positions (List of Direction);
- b. Reduction to center;
- c. Strength of Figures;
- d. Inverse position computation;
- e. Preliminary triangle computation;
- f. Spherical excess computation;
- g. Least squares adjustment by Doolittle Method;
 1. Condition equation;
 - a) Angle equation;
 - b) Side equation;
 2. Table of correlates;
 3. Normal equations;
 4. Forward solutions;
 5. Backward solutions;
 6. Final residuals;

- 7. Adjustment of angles;
- h. Final triangle computations;
- i. Forward position computations;
- j. Geographic to grid conversions; and
- k. Summary of positions, astronomical observations and control connections.

Section 170. When using ETS, the field notes shall be prepared as follows:

- a. Field notes cover shall be properly filled out, signed and sealed by the Chief of Party;
- b. Geodetic Engineer's Certificate shall be properly filled out, signed and sealed by the Chief of Party, and duly notarized;
- c. Field notes shall be in the LMB prescribed forms and properly filled out:
 - 1. With page number;
 - 2. All pages signed by field inspector;
 - 3. Blank pages shall be crossed-out;
 - 4. Equivalent of stations shall be declared;
 - 5. Stations shall be properly described;
 - 6. ETS or EDM distance (10 repetitions for primary and at least 5 repetitions for secondary);
 - 7. All data necessary for sea level reduction such as HI, HP and vertical angles shall be indicated;
 - 8. Measurement of horizontal angles shall be done by method of direction for two positions; and
 - 9. The name of observer, date of survey and serial number of instrument used shall also be indicated.

Section 171. In addition to the provisions on Section 168.d, the following provisions shall apply in the preparation of Project Control Maps (PCM):

- a. The PCM shall be divided into one minute by one minute quadrant in latitude and longitude and must have at least one control station in each quadrant; and
- b. The Map shall show the main and subsidiary control stations and the BLLMs of the project established. Other features mentioned in Section 173.c.3.(a) of this Manual shall also be shown.

Section 172. For duplicate copies of the documents included in the survey returns, the provisions of Section 167 of this Manual shall apply. GPS observed data shall be stored in digital files in accordance with Section 166.c of this Manual.

Chapter V - Cadastral Survey Returns

Article 18 – Numerical Cadastral Survey Returns

Section 173. The following shall form part of the survey returns for Cadastral Survey:

- a. Copy of the Required Certifications and other Legal Documents – In addition to the relevant provision as mentioned in **Section 168.a** of this Manual, the following shall also be included in the survey returns:

1. The Final Report of the Project

A final report shall be prepared in the form of a technical report after the completion of each cadastral project. The final report shall be prepared on standard size bond paper (double spaced) in three hardbound copies. Two copies shall be for the LMB and the third copy for the LMS. A fourth copy in digital file shall also be submitted.

- a) First Part: The Project Profile - The profile shall contain the following information:

- 1) Geographical location – Name of locality, important natural features such as rivers, lakes, mountain, etc. with their local names;
- 2) Demography – Approximate number of inhabitants, statistics on birth and deaths, natives and foreigners, local dialect, religions, schools, etc;
- 3) Local history – Important historical events, places, monuments, etc;
- 4) Government – Organization of local government, names of local officials; and
- 5) Commerce and industry – Industrial and commercial enterprises.

- b) Second Part: The Inauguration of Survey - Authority and order of survey, dialogues with local and other national officials, establishment of field office, general mobilization of personnel, equipment and other resources, posting of notices, formal inauguration ceremonies showing the attendance and participation of local officials and the public.

- c) Third Part: The Survey –

- 1) The local condition, difficulties, etc., encountered in establishing base meridian, primary and secondary controls and sketching, monument setting and lot surveys, etc.
- 2) The method of work which had been devised to meet local conditions.
- 3) Analyzed result of the work and conditions which may have influenced final results in surveying operations, etc.
- 4) General matters regarding political boundary questions, conflicts, etc.

- d) Fourth Part: Land Questions
 - 1) The conditions of land ownership, tenurial structure, impact of land reform.
 - 2) The situation with regard to public, government and mineral lands, general or special problems or questions affecting administration or the land resources.
- e) Fifth Part: Party Administration
 - 1) Organization/staffing.
 - 2) List of all officials and employees engaged in the work including tape man, sketch men and survey men.
 - 3) Method of work, field and office.
 - 4) Equipment, supplies and appropriations.
 - 5) Summary of the statistic of the survey such as:
 - i. Number of barangays;
 - ii. Total number of lots;
 - iii. Aggregate area;
 - iv. Number of lots in the A and D Area;
 - v. Number of lots in the forest lands; and
 - vi. Area of each case/barangay.
 - 6) Project cost data.
 - 7) Project management plan and other matters which may be deemed worthy to mention such as dates of survey and personnel turnover.
2. Cadastral Survey Management Plan (CSMP) as described in **Section 62** of this Manual;
3. Certification of public notice as per form shown in **Annex X.A and B** of this Manual.
4. Certification of notice to the individual lot claimants as per form shown in **Annex XI.A and B** of this Manual.
5. Copies of “30-day” notice as shown in **Annex XXI** of this Manual.
6. Report on all public, government and mineral land applications and corresponding cadastral lot numbers
7. Copy of Law creating the Municipality and the component barangays, if any.
8. Geodetic Engineer’s Certificate – shall be prepared on LMB prescribed form for each case/barangay, each bearing the original signature of the

Chief of Party, dry sealed, duly notarized and submitted as part of the survey returns. The certificate shall contain the names of claimants of adjoining parcels listed in numerical order of said adjoining parcels. The manner and date of notification relative to contested lots shall be noted in the certificate.

9. Certificate of Acceptability issued by the CENRO.
- b. In addition to the provision in **Section 168.b** of this Manual on References and other Technical Documents, the following shall also be included in the survey returns:
1. Report on all previous surveys. Their corresponding technical description, status (accepted, amended or rejected) and the assigned equivalent cadastral lot number, if any, shall be included;
 2. List of unclaimed lots within the project and doubtful claims to be opposed by the National Government during registration. Their corresponding technical description, status (accepted, amended or rejected) and the assigned equivalent cadastral lot number, if any, shall be included;
 3. List of all public, government and mineral land claims within the project. Their corresponding technical description, status (accepted, amended or rejected) and the assigned equivalent cadastral lot number, if any, shall be included;
 4. List of foreshore lands. The corresponding technical description of previously approved surveys in these areas, if any, shall be included;
- c. The documents as stated in **Section 168.c** of this Manual shall be prepared in addition to the following:
1. Field notes:
 - a) Reference book for primary stations, location monument and political boundary monuments.
 - b) Lot survey book/s.
 2. Computations:
 - a) The Survey Control which shall be composed of Main and Subsidiary Control computations, shall include :
 - 1) Primary controls
 - 2) Secondary controls
 - 3) Location monuments
 - b) Political boundary controls
 - c) Tertiary control computation books
 - d) Intersection and other reference computations books
 - e) Lot data computation books
 - f) Old survey computation book

- g) Other pertinent information
3. All maps shall be prepared on reproducible material of stable base such as drafting film approved for use by the LMB. The mapping conventional symbols as listed in **Annex II** of this Manual shall be used:
- a) Project Control Maps – The Project Control Maps shall be prepared in accordance with **Section 171** of this Manual
 - b) Progress Map – The updated copy of the Progress Map in a white print paper shall be submitted once every three (3) months to the LMS thru the Chief, Regional Surveys Division together with the periodic report of information on the progress of the survey.
 - 1) The progress map for the cadastral survey of a portion of the municipality shall have a location plan drawn to an appropriate scale. It shall indicate the approximate distance of the project from the poblacion of the municipality or center of the city and shall show the nearest place of point accessible to transportation.
 - 2) The progress map shall be prepared at a scale that will permit the plotting of the entire municipality of project on 104 x 104 centimeters, with the marginal lines of 100 x 100 centimeters and shall show the following in addition to those stated in Paragraph c.3.(a) of this Section:
 - i. Forest land and marshy lands.
 - ii. Large tract of land as haciendas, parks and protected areas and other reservations.
 - 3) The progress map shall contain a table showing the total for each class of work accomplished for each month.
 - 4) The monthly progress of sketching, monument setting and lot survey shall be shown separately on the progress map by miniature sketches.
 - c) Cadastral Maps (CM) – The cadastral lots and other details of the cadastral survey shall be plotted on the cadastral map on 54 x 54 centimeters with marginal lines 50 x 50 centimeters and shall show the following:
 - 1) The names of claimants, the numbers of the concrete monuments and the description of lot corner shall be indicated on the cadastral map except when space limitation does not permit it. The respective lot numbers shall, in every case, be indicated thereon as nearly as possible in consecutive and regular order.
 - 2) Cadastral map shall show the name of all claimants adjoining the project boundaries as well as the lines between the adjoining claims which shall be drawn in dash line. Adjoining unsurveyed parcels shall be assigned consecutive numbers beginning from 1 in a clockwise direction. These number shall be preceded by the letter “A”, as A-1, A-2, etc. Adjoining approved survey shall be indicated by the lot and corresponding survey number and name of claimant.

- 3) When a cadastral lot covers an area previously patented, leased or surveyed, the relationship of the lot to the previous survey shall be indicated on the cadastral map as follows:
 - i. When the cadastral lot is equivalent to a previously approved survey, both the cadastral number and the number of the previously approved survey shall be shown.
 - ii. If the previous survey has been subdivided, the plat of the corresponding subdivision lot shall bear the cadastral number and words "Portion of Lot _____ Survey No. _____ L.R.C. Case No. _____."
 - iii. When the accepted boundaries of the cadastral lot cause rejection of the former survey of untitled property, the cadastral plat of such lot bear the notation.

"Resurveyed, Lot _____ Survey No. _____"
 - iv. The Land Registration Case (L.R.C.) number shall be noted on the plat for all lots previously registered or for which application for registration has been made when the numbers of this case can be positively determined.
- 4) The local names of natural features such as mountains and all bodies of water, rivers, lakes, esteros, arroyos, shall be ascertained, the spelling verified and their names indicated.
- 5) The names of Barangay shall be indicated with their respective boundaries.
- 6) Control station shall be plotted by coordinates and the side shots taken from the same control station.
- 7) When two adjoining cadastral project are in progress at the same time, the cadastral map showing their common boundaries shall be plotted first. Each survey party shall trace the data plotted on the cadastral map of the other survey party. These tracing shall be submitted together with the survey return of the cadastral projects.
- 8) The following provisions shall apply in the preparation of CM:
 - i. The cadastral maps shall comprise an area within the spheroidal quadrangle of one minute of arc in latitude and one minute of arc in longitude and shall be drawn in the PPCS/PTM-PRS 92 to the standard scale of 1:4000 on a stable base drafting materials of uniform size of approximately 54 x 54 centimeters.
 - ii. Sectional cadastral maps shall be drawn on larger scales on the same materials and of the same size as the standard cadastral maps to show tracts of lands which otherwise will appear too small on the standard scale of 1:4000.

The sectional cadastral maps shall be in the scale of 1:2,000, 1:1,000, 1:500, 1:250 and shall comprise areas within spheroidal quadrangles of thirty seconds (30"),

fifteen seconds (15"), seven and one half seconds (7.5") or three and three-fourths seconds (3.75") of arc, respectively.

- iii. System of Numbering Cadastral Maps – The extreme west and east meridians and the stream south and north parallels of cadastral maps in scale of 1:4000 shall be full minute's meridians and parallels, respectively. The latitude and longitude of the point of intersection of the extreme west meridian and extreme south parallel of each spheroidal quadrangle shall be used to designate the corresponding map number of the quadrangle. The procedure as stated in **Annex XXIII** of this Manual shall be followed in numbering and identifying CMs.
 - iv. Contiguous cadastral maps (CCM), consisting of four or sixteen sheets, shall be drawn on a single sheet of the same material and size as the standard cadastral map in the scale of 1:8,000 or 1:16,000, respectively, to show parcels which would be too big on the standard scale of 1:4,000. The cadastral map number of the extreme southwestern cadastral map shall be used to designate the contiguous cadastral map number. If the extreme southwestern cadastral map number is CM 14° 24' N-120° 36' E, the contiguous cadastral map number is CCM14° 24' N- 120° 36' E, scale 1:8,000 or CCM14° 24' N - 120° 36' E scale 1:16,000.
 - v. The map number of adjacent cadastral maps, whether standard, sectional or contiguous, shall be indicated on the left side of the quadrangle below the lower marginal line of each cadastral map.
- d) Political Boundary Maps (PBM) - The political boundary map of the cadastral project shall be prepared in accordance with procedure as stated in **Annex XXII** of this Manual on cadastral map size drafting film, 54 x 54 centimeters with marginal lines 50 x 50 centimeters. Moreover, the map shall shown/contain the following information in addition to those mentioned in Paragraph c.3(a) of this Section:
- 1) Political subdivisions (barangay) of the project.
 - 2) Bounded project area and aggregate areas of numbered cadastral lots.
- e) Case/Barangay Boundary and Index Maps (BBIM) – This shall be drawn in a manner as stated in **Annex XXII** of this Manual on a cadastral map size drafting film, 54 x 54 centimeters with marginal lines of 50 x 50 centimeters.
- 1) This shall show the following in addition to those mentioned in Paragraph c.3(b)(2) of this Section:
 - i. LMB survey number
 - ii. Cadastral case number
 - iii. Location of the Land

- iv. Aggregate area and the number of parcels in the alienable and disposable and the forest land of the case; case boundary area
 - v. Scale (numerical and graphical)
 - vi. Date of Survey
 - vii. Legal authority (Survey Order No., issuing Official, and Date)
 - viii. Name and signature of Project Chief; Professional GE License No.
 - ix. Date of approval
 - x. Name and signature of the recommending and the approving DENR-LMS Officials
 - xi. PPCS-PTM/PRS 92 zone number and point of origin
 - xii. Tie point and tie line
 - xiii. Bearing and distance of boundary lines except when too numerous to be tabulated on the map
 - xiv. Description of each corner as marked on the ground
 - xv. Adjoining properties, survey and names of claimant or owners of adjoining properties
 - xvi. Cadastral map sheet number. Sectional and contiguous cadastral map number
 - xvii. Political boundaries and monuments
 - xviii. Residential sites and settlements
- 2) The bearing and distance of the tie line of corner 1 of the case/barangay boundary shall originate from BLLM No. 1 of the project.
 - 3) The corners of the case/Barangay boundary shall be indicated by circle (1) millimeter in diameter except corners defined by the political boundary monuments. Appropriate conventional symbol as listed in **Annex II** of this Manual shall be used.
 - 4) The technical description of the case of Barangay boundary shall be prepared and submitted after the approval by the RTD for Lands of the cadastral maps and the case of Barangay boundary and index map.
- f) Project/Municipal Boundary and Index Map (MBIM) - After the completion of all the case boundaries and index maps of the project, a project or municipal boundary and index map shall be prepared. This shall be based on the data of the regular progress map, the case/boundary and index map, the project or municipal boundary computation, and shall be plotted in a manner as stated in **Annex XXII** of this Manual on the same size as cadastral map of 54 x 54 centimeters with marginal lines of 50 x 50 centimeters.

- 1) The project MBIM shall serve as an index of case/Barangay boundary index maps. It shall define the boundary of the project/municipality and shall show the following in addition to those listed in Paragraph c.3.(e)(1) of this Section:
 - i. The whole boundary of the municipality (project)
 - ii. All the component barangays of the municipality
- 2) In addition to the provision of Paragraph c.3.(e)(2) of this Section, the boundary lines of the project/municipality shall be included in the lot description of the last case/barangay if the same cannot be tabulated on the map.
- 3) The corners of the project/municipal boundary shall be indicated by circle (1) millimeter in diameter except corners defined by the political boundary monuments. Appropriate conventional symbol as listed in **Annex II** of this Manual shall be used.
- 4) The correct numbers of all points of reference shall be properly indicated.
 - g) Set of prints of cadastral maps posted in the barangay hall wherein the lot owner indicated their conformity or their protest in the result of lot survey.
 - h) Tracing or prints of previously approved surveys in the area
4. List of Claimants and PIS
 - a) Numerical and alphabetical List of Claimants
 - b) Numerical and alphabetical set of PIS as per form shown in **Annex XII** of this Manual.
 - c) One set of index cards for adjoining lots not covered by the cadastral project.

Section 174. In case of Triangulation Method using ETS, the technical documents as stated in **Section 169** of this Manual shall be prepared.

Section 175. For duplicate copies of the documents included in the survey returns, the provisions of **Section 167** of this Manual shall apply. GPS observed data shall be stored in digital files following instructions as stated in **Section 166.c** of this Manual.

Article 19 – Survey Returns of a Survey Covering Previously Approved Graphical Cadastre

Section 176. Cadastral sketching and graphical cadastral project may be converted into, or completed as, numerical cadastral project by performing the remaining phases of each cadastral operation. The survey returns to be submitted shall be in accordance with the pertinent provisions of **Section 173 to 175** of this Manual with the following considerations:

- a. The recovered controls established in the Graphical Cadastral Survey as stated in **Section 102.a** of this Manual and found to be undisturbed and within the required accuracy for project control shall be used in the computation and preparation of survey returns for numerical cadastre.

- b. The original cadastral survey numbered assigned to the cadastral sketching or graphical cadastre shall be retained minus the letter “P”, “M” or “S”, as the case may be.
- c. The lot numbers assigned previously during the Graphical Survey shall be retained as provided for in **Section 102.c** of this Manual, except when there is a subdivision survey duly approved covering a lot, in which case the highest lot number assigned by the DENR-LMS shall be adopted.
- d. The inspection and verification thereof shall be in accordance with **Section 194** of this Manual.

Article 20 – Survey Returns of Public Land Subdivision Survey

Section 177. The survey returns to be submitted shall be in accordance with the pertinent provisions of **Section 173** of this Manual with the following considerations:

- a. The documents such as field notes, computations and maps on the Political Boundary Survey shall not be included in the survey returns of Pls. The provisions of **Section 104** of this Manual shall govern in the consideration for reflecting the Political Boundary on the Pls Map.
- b. The forest land, protected areas and other reservations that cannot be subjected to land disposition shall not be included in the survey; however, the Pls maps shall indicate only the said land as adjoining lots.

Chapter VI - Isolated Survey Returns

Article 21 – Survey Returns Common to All Kinds of Isolated Land Surveys

Section 178. The following, unless otherwise stated, shall be accomplished in the LMB prescribed forms and shall be included in the submission of basic survey returns for Isolated Survey:

- a. Letter of transmittal, enumerating therein the documents being submitted as part of the survey returns, signed and sealed by the Geodetic Engineer.
- b. Original drafting film plan, complete in details indicated by appropriate conventional symbols as listed in **Annex II** of this Manual, signed and sealed by the Geodetic Engineer.
- c. Parcel Information Sheet (PIS). PIS is required in the survey of Alienable and Disposable lands of the public domain such Cadastral survey, Pls, Gss, Tss. It does not apply to Ap and titled properties.
- d. The original field notes and field notes cover duly notarized.. For Ap, only the field notes cover is required.
- e. Survey notification letter. All are required except Ap.
- f. Lot data computation. Traverse computation. All are required except Ap. When a traverse has been executed, submit a traverse computation.
- g. Astronomical Observation Computation. All are required except As, Ap, and Cvn. The requirement is optional to Psd, Pcs, Csd, and Ccs.
- h. GE Certificate duly notarized for original surveys .

- i. Certificate of Instrument Registration pursuant to Section 22, DAO 2007-29. All are required except Ap.

Section 179. Other requirements for inclusion in the survey returns for specific type of isolated survey are listed in **Annex XIV** of this Manual. In all cases, duplicates shall always be stored and submitted in digital form. GPS observed data shall be stored in digital files in accordance with **Section 166.c** of this Manual.

Section 180. All plans of isolated surveys which shall be used for administrative or judicial registration purposes shall be drawn on the LMB prescribed format. If, however, the plans were prepared using a computerized method, the Geodetic Engineer shall also secure authority from the LMB. Sample print-out of the survey form shall be submitted to the LMB for evaluation before their regular use in the preparation of survey returns.

a. Preparation of Isolated Survey Plans:

1. Details to be shown on plans of isolated land survey - The details on the plans shall be clearly and neatly drawn in ink in the following manner:
 - a) The boundaries of the property in full black ink line heavier than those of adjoining properties. Permanent walls along boundaries shall be drawn by conventional symbols.
 - b) The line from the lot corner to the control stations, from which side shots were taken, by dotted red ink lines.
 - c) The relative position of adjoining survey properties, indicating by dotted lines the boundaries between them and the names of all adjoining owners and all important improvements, roads, and streams, etc., including the width, in black ink.
 - d) The corners indicated by small circles two millimeters in diameter drawn in black ink and their respective descriptions noted.
 - e) The boundary lines with corresponding bearings and distance in black ink.
 - f) Tie line of corner 1 from reference control point in thin black line with bearing and distance.
 - g) Horizontal (latitude) and vertical (longitude) lines passing through corner 1 in thin black line and geographic and Cartesian (grid) coordinates in PPCS-TM/PRS 92 indicated in black ink.
2. Coordinates Lines – The Vertical and Horizontal center lines of plane coordinates divisible by five shall be accurately drawn on the original plan and inked in red. The latitude and longitude lines of corner 1 of a lot or any corner 1 of a group of adjoining on the original survey plan in shall be reflected in the following manner:
 - a) The latitude line shall be drawn horizontally from left to the right marginal lines through corner one. The corresponding northing based on BLLM No. 1 shall be written above along the latitude line from the left hand border line of the plan towards the right while the geographic latitude shall be indicated below the northing.
 - b) The longitude shall be drawn vertically from the top to the bottom marginal lines through corner 1. The easting based on BLLM No. 1

shall be written on the left side of and along the longitude line from the bottom border line towards the top while the geographic longitude shall be indicated opposite the easting on the other side of longitude line.

3. Scale for isolated survey – The scale to be used in plotting survey shall depend on the difference in the northing of the extreme north and south corner or in the easting of the extreme east and west of the lots, whichever is bigger. **Annex XXIV** of this Manual provides the table on scale that shall be used in plotting isolated plan.
 4. Plotting and centering of lot in an isolated survey plan:
 - a) The lot shall be centered and plotted on the plan so that its extreme corners shall not be less than four centimeters from each marginal line when using any of the scale provided above.
 - b) When the maximum coordinate difference exceeds three thousand meters, the plan shall be drawn on scales which are exact multiples of 1:4,000, such as 1:12,000, 1:16,000, etc. If any of these scales would make the length of the property lines generally less than one half centimeter, the survey shall be plotted on more than one sheet using an appropriate scale.
 - c) In plotting one whole big parcel on more than one sheet, the parcel shall be divided into convenient portions, each to be centered and plotted on the sheet in accordance with **Annex XXIV** of this Manual.
 - d) When a parcel is divided into many small lots, which, if plotted using any one of the one of the largest possible scales mentioned in **Annex XXIV** of this Manual would result in diminutive geometrical figures, the subdivisions plans shall be prepared on two or more sheets on a uniform scale with each of its portions centered on the sheet in accordance with Paragraph a.4.(b) of this Section. The numbers of the sheets on which the other portion of the subdivisions are plotted, shall be properly indicated on the plan.
 - e) Long narrow tract such as highways, canals, etc. may be plotted by dividing the tract into sections and plotting the section on two or more plans.
 5. One plan of each parcel, tract or lot in isolated land survey shall be prepared to a scale in accordance with **Annex XXIV** of this Manual.
 6. Bearings and distances of the survey shall be tabulated on the plan when these are too numerous to be drawn or shown clearly along or near the boundary lines. When there are more than fifty lots on the plans, lot descriptions thereof shall be prepared on LMB authorized forms.
 7. In the case of subdivisions or consolidation subdivision surveys, the boundary data of the lot being subdivided or of the lots being consolidated- subdivided shall be tabulated in black ink in a boxed portion at the upper- left corner.
- b. Only information that cannot be inscribed on the plan shall be indicated on the space provided for “Notes” at the bottom left corner. For uniformity in the preparation of isolated survey plan, the illustrations found in **Annex XXV** of this Manual shall serve as guide on what to include in the “Notes”.

- c. Plans of isolated land survey shall be prepared as shown in **Annex XXVI** of this Manual. The lettering to be used in all plans shall be simple, uniform, mechanical and not ornamental lettering.
- d. Description of vegetation and terrain:
 - 1. For lots with areas of one hectare or more, the approximate boundary of the area under cultivation and the nature of its vegetation such as rice, pastures, woods, etc. with a brief description of the topographic features such as plain, rolling, hilly or mountainous shall be indicated in light black dotted lines.
 - 2. For lots less than one hectare in area, a general classification, such as, “residential lot”, “home lot”, “rice land”, “sugar cane land”, “commercial lot”, shall be indicated on said plans. For a group of lots shown on one plan in diminutive geometrical figures, a notation on the plan regarding the topographic features and/or general classification for each lot is sufficient in both cases.
 - 3. Regardless of the area, permanent structures such as buildings with concrete foundation, stone wall, etc., shall be indicated by dotted black lines on the plans and maps.

Article 22- Political Boundary Survey Returns

Section 181. The following, unless otherwise stated, shall be done in the LMB prescribed forms and shall form part of the survey returns for Political Boundary Survey:

- a. Copy of the Required Certifications and other Legal Documents – In addition to the applicable provision as mentioned in **Section 168.a** of this Manual, the following shall also be included in the survey returns:
 - 1. Project Contract shall not be required if the project is funded by the LGU concerned. However, a *Sangguniang Bayan* Resolution shall be attached.
 - 2. Certification of the Barangay Chairmen and the Municipal Mayor as per boundary agreement and the conformity of the adjoining municipalities.
 - 3. Copy of Law creating the Municipality and the component barangays, if any.
- b. Copy of References and Technical Documents as stated in applicable provisions of **Section 168.b** of this Manual.
- c. Field notes and computations as stated in the applicable provisions of **Sections 168.c , 169 and 170** of this Manual.
- d. Political Boundary Maps as stated **Section 173.c.3.d** of this Manual.

Section 182. For duplicate copies of the documents included in the survey returns, the provisions of **Section 167** of this Manual shall apply. GPS observed data shall be stored in digital files in accordance with **Section 166.c** of this Manual.

Article 23 - Mineral Land Survey Returns

Section 183. The survey returns shall be in accordance with the requirements of MGB pursuant to DAO No. 96-40.

Article 24 - Forestlands and National Parks/Protected Areas Delimitation Survey Returns

Section 184. The following, unless otherwise stated, shall be done in the LMB prescribed forms and shall be included in the submission of survey returns for Project Control Survey:

- a. Copy of the Required Certifications and other Legal Documents – In addition to the relevant provision as mentioned in **Section 178** of this Manual, the following shall also be included in the survey returns:
 1. Survey Order
 2. Field Completion Report with inspection and photo documentation from CENRO
 3. Certificate of Acceptability issued by the PENRO
 4. Joint Endorsement from the RTDs for Forestry, Lands and PAWCZMS
 5. Other legal documents as may be prescribed
- b. References and other Technical Documents:
 1. GPS Field Sheets (duly notarized)
 2. Geographic Position of Reference Points (Approved)
 3. Final List of Position
 4. Grid Distance Computation
 5. Monument Description Sheet(s)
 6. Location Monument Recovery Report
 7. Old LC Maps covering the area
 8. Copies of technical description of previously approved surveys based on:
 - a) Land Titles
 - b) Approved Survey Plans
 - c) Legal documents containing technical descriptions of lots, reservations, protected areas, law creating concern municipalities, etc. based on the Republic Acts, Executive Orders, Presidential Decrees, and Proclamations.
- c. Maps
 1. Preliminary LC Line Maps
 2. Indicative Maps
 3. Progress Maps

4. Forestland and Protected Area Boundary Map (FPABM) duly signed by the Chief of RCST

Section 185. For duplicate copies of the documents included in the survey returns, the provisions of **Section 167** of this Manual shall apply. GPS observed data shall be stored in digital files following instructions as stated in **Section 166.c** of this Manual.

Part III. Inspection, Verification and Approval of Survey Returns

Chapter VII – Survey Controls

Article 25 – Geodetic Controls

Section 186. The NAMRIA shall verify the correctness and technical accuracy of the survey returns of the First and Second Order Geodetic Control Surveys. The following basic procedure shall apply in addition to the requirements that shall be issued on the matter by the NAMRIA:

- a. **Preliminary Evaluation** or initial examination shall be conducted to determine if the survey returns are complete as per List of Transmittal:
 1. Certifications, Reports, endorsement letters, etc. as enumerated in **Section 166.a** of this Manual.
 2. References and Technical Documents as stated in **Section 166.b** of this Manual.
 3. GPS Observation raw data on digital form and RINEX files (if non-Trimble receiver was used).
 4. GPS Field Sheet properly accomplished.
 5. Processed GNSS data in hard copies and in digital files.
 6. Position derivation and the computations.
 7. Geodetic Network Control Maps with all the control points plotted and complete in details, both the natural and man-made features.
 8. Monument Description Book and the Photograph of all established monuments.
 9. Other technical documents and data gathered in the field.
- b. **Technical Evaluation** shall be conducted in order to determine accuracy, analyze error in observation, and detect mistakes.
 1. Office Processing of GNSS raw data shall be conducted using computer with any of the GNSS data analysis software (TGO, GNSS QC, GrafNav, etc.).
 - a) Logged RINEX data shall be checked for compliance to the RINEX standard.
 - b) The following data analysis shall be performed:
 - i. Data gaps
 - ii. Cycle slips

- iii. Multipath
 - iv. Signal to noise ratio (SNR)
- c) Baseline processing shall be conducted to distribute the random error using Least Squares method, check the Network Reference Factor (NRF), and launch the Chi Square Test. After data processing, the following statistics shall deem that the adjustment is successful:
- i. NRF = 1.00
 - ii. Chi Square Test = Pass
 - iii. Redundancy Number = maximum
 - iv. Scalar = less than 20
 - v. PPM = 1 ppm to 0.1 ppm
2. Field checking shall be conducted to cross check the survey work using independent measurements in the following manner:
- a) There shall be two (2) old established GPS stations within the area to be selected as the starting point for survey evaluation work. The observer shall see to it that there are no new structures built near the old GPS station that shall obstruct the satellite signals during observations. Otherwise, different established GPS station shall need to be occupied for the purpose.
 - b) Likewise, there shall be one or two (2) stations to be selected among the set of newly observed GPS stations subject of validation. The horizon adequate clearance shall also be the major consideration in the selection of points to be occupied and be included in the validation process.
 - c) The old and the new GPS stations shall be connected, making a triangular or rectangular closed polygon.
 - d) The GPS observation shall be conducted in accordance with **Section 25** of this Manual with minimum two (2) sessions per station.
 - e) The GPS Field Sheet as shown in **Annex XX** of this Manual shall be used in every session and the GPS observation shall follows the procedures as stated in **Section 23** of this Manual.
 - f) The GPS data shall be downloaded to a computer for processing following the provisions as stated in b.1. of this Section.
3. From the adjusted coordinates, determine the strength of figure of the polygon and compute the accuracy. The relative error of closure shall be in accordance with Section 28 of DAO 2007-29. The plotting of the acceptable points in the Geodetic Network Control Map shall be check for accuracy.

Section 187. The completeness of the documents included in the survey returns initially inspected in **Section 186.a** of this Manual shall be checked. The details of the following shall be evaluated:

1. Accuracy of plotting the control points on the Geodetic Network Control Map;
2. Printout of list of control points; and
3. The forms if properly accomplished, etc.

Section 188. Pursuant to Section 67 of DAO No. 2007-29, copies in digital form of the approved Geodetic Control Points shall be furnished by NAMRIA to LMB/LMS.

Article 26 – Project Controls

Section 189. The LMS shall verify the correctness and technical accuracy of the survey returns of the Project Control Surveys. The following shall serve as guide in the inspection, verification and approval of Project Controls:

- a. **Preliminary Evaluation** or initial examination shall be conducted to determine if the survey returns are complete as per List of Transmittal:
 1. Certifications, Reports, endorsement letters, etc. as enumerated in **Section 168.a** of this Manual. Replacement of key personnel and equipment shall be with prior authority from the RED upon endorsement of the RTD for Lands.
 2. References and Technical Documents as stated in **Section 166.b** of this Manual.
 3. If the ETS is used, it shall be calibrated/field tested by the LMB/LMS before and after its use in the project. If the instruments used are GPS Receivers, the requirement as listed in **Section 166.c** and d of this Manual shall be submitted.
 4. Field notes and computations as listed in **Section 168.c** of this Manual. Field notes, Geodetic Engineer's Certificates, and computation sheets shall be properly filled-out, signed and sealed by the Chief of Survey Party. Other details as stated in **Section 170** of this Manual shall be examined if properly accomplished.
 5. If the method of Triangulation was used in some part of the project, the field notes and computations as listed in **Section 169** of this Manual shall be submitted.
- b. **Technical Requirement Evaluation** shall be conducted in order to determine accuracy, analyze error in observation, detect mistake and determine the acceptability of the field observations and the map preparation.
 1. GPS observations shall be evaluated following procedures as stated in **Section 186.b** of this Manual. However, if the instrument used is ETS, Paragraph b.4 of this Section shall be followed.
 2. Ascertain if the Project Control Map (PCM) is of standard size (54 x 54 cm. with 4 cm. borderlines), signed by the Chief of Party, prepared in a convenient scale and contain complete information/features as stated in **166.d.3 and Section 171** of this Manual.
 - a) The PCM should be divided into one minute by one minute quadrant in latitude and longitude and should have at least one control station in each quadrant;
 - b) All observed stations should be properly plotted;

- c) Other stations that need to be shown such as 2nd and 3rd Order Geodetic Controls should be plotted within or near the boundary of the project in the project control sketch map;
 - d) Astronomical Observations should be indicated; and
 - e) The PCM shall show the main and subsidiary control stations and BLLMs established.
3. For controls established by Triangulation method, verify the completeness of the documents submitted pursuant to **Section 169** of this Manual. The technical verification shall be conducted as follows:
- a) Check the prepared abstracts of direction from the field notes.
 - b) Check the prepared list of directions from the abstract of directions.
 - c) Examine the computed observed angles from the lists of direction and the entries on the triangle computation form. Verify the plane angles used in the computation of the sides of the triangles.
 - d) Check the adjustment on the triangle closure error. The adjustment was made either by the method of simple triangle adjustment or quadrilateral adjustment as required.
 - e) Check the derivation of the grid or true azimuth as the case may be, for all the lines of the triangulation control. Then check the transferred data of triangle sides and azimuths derived on the control/traverse computation sheets.
 - f) Check the computed, adjusted and listed coordinates of the triangulations control.
4. Verify if the horizontal angles were done by method of direction for two positions. The sum of the angles should not differ from 360° by 10" and the mean of the two positions should not differ from any of the readings by 5". In a control consisting of traverse and triangulations, verify if the triangulation control is adjusted independently of the traverse.
5. The computation for geodetic positions, least square adjustment of triangulation control and all other similar computation shall be carefully verified. In the form for intersections computation, the formula (either the sine or tangent formula) shall be also be evaluated.
6. Astronomical Observation Requirements :
- a) Check that for every series, there are eight (8) and four (4) series of observations for solar and stellar respectively, consisting of 2 sets each (with telescope position for set I – D & R, set II – R & D);
 - b) Check that there are eight (8) and four (4) series of observations for primary and secondary lines respectively;
 - c) For solar observations, check that there are four (4) morning and four (4) afternoon series of observations for primary lines and two (2) morning and two (2) afternoon series of observations for secondary lines. Check that two consecutive sightings within a set of observations did not exceed two (2) minutes of time;

- d) For stellar observation, check that there are four (4) west star and four (4) east star series of observations for primary lines and four (4) west or four (4) east star series of observations for secondary lines;
 - e) Check that the astronomical observations were taken at the following stations :
 - 1) At the station where position was taken (only stellar observation should be observed);
 - 2) At every BLLMs pair. However, for BLLM Nos. 1 and 2, only stellar observation should be conducted;
 - 3) At the junctions of subsidiary loops;
 - 4) At the junctions of test traverse;
 - 5) Along the primary traverse at every 20-25 stations;
 - 6) Along the secondary traverse at every 25-35 stations.
7. Control connection requirements – Check the connection made at the following:
- a) Stations of previously approved adjoining projects;
 - b) Triangulation stations within the boundary of the projects.
8. Monument Description Book Requirements :
- a) Check that the geographic and grid coordinates of BLLM No. 1 are indicated;
 - b) Check that there are at least three (3) references for each station. Each reference points should be described with corresponding distance and bearings from station and BLLMs;
 - c) Check that each station and BLLM is sketched in its location.
9. The Technical Verification Procedures shall be as follows:
- a) Examine the Field Notes Book :
 - 1) Angle Book - check the mean interior and exterior angles;
 - 2) Distance Book – check the mean horizontal distance;
 - 3) Astronomic Book – check the input in astronomic computation.
 - b) In verifying Astronomical Observation Computation :
 - 1) Check the data entry in the computation sheet against the data recorded in the field notes;
 - 2) Check the mean and variation of horizontal angle, time, and altitude;
 - 3) Check the corrected value of altitude and North Polar Distance;

- 4) Check the Geographic Coordinates (Latitude and Longitude) of station occupied;
 - 5) Check the azimuth of the sun and mark;
 - 6) Check the mean azimuth of mark and the probable error if within allowable limit of ± 5 mins.;
 - 7) Check the watch error if within allowable limit of ± 5 mins;
 - 8) Check the probable error of all series of line if within allowable limit of ± 5 mins. and $10''$ for primary and secondary respectively. If not, the astronomical azimuth having residuals greater than (3) three times the probable error shall be rejected;
 - 9) Check the convergence correction;
 - 10) Check the grid azimuth of line and compare it with carried azimuth, the discrepancy should not exceed $20''$ and $30''$ for primary and secondary respectively;
 - 11) Check the astronomical observations summary.
- c) In verifying Azimuth Derivation :
- 1) Check the initial azimuth which is computed azimuth from stellar observation of eight (8) series, 4 series each for west and east star;
 - 2) Check the exterior or interior horizontal angle from the Angle Field notes. Either of the (2) two can be used for azimuth derivation;
 - 3) Check the carried azimuth of each line;
 - 4) The angular error of closure should not exceed the following allowable limit:
 - i. Primary = $2.5'' \sqrt{P}$
 - ii. Secondary = $10'' \sqrt{S}$
 - iii. Tertiary = $30'' \sqrt{T}$

Where P, S, and T are the numbers of Primary, Secondary, and Tertiary Stations, respectively.
 - 5) Check the application of corrections and the final carried grid azimuth.
- d) In verifying Grid Distance Computation:
- 1) Check the slope or horizontal distance , vertical or zenithal angle, height of instrument (HI), and height of prism (HP) from the field notes;
 - 2) Check the initial elevation from topographic maps and initial coordinates;
 - 3) Check the grid azimuths;

- 4) Check the elevation, sea level correction, sea level distance, scale factor, and finally the grid distance of each line.
- e) In verifying the Traverse Computation :
- 1) Check the initial and final coordinates;
 - 2) Check the grid azimuth and distance of each line;
 - 3) Adjust the traverse by transit rule;
 - 4) Check the relative precision if within allowable :
 - i. Primary = 1:20,000
 - ii. Secondary = 1:10,000
 - iii. Tertiary = 1:5,000
- f) In verifying the Secondary Control Connection Looping:
- 1) Check the field notes;
 - 2) Check the azimuth error of closure of the secondary control connection loop if within the amount as determined by:

$$A_s = 10'' \sqrt{S}$$

Where A_s is the maximum allowable azimuth error of closure of the secondary control stations and S is the number of secondary stations.
 - 3) Check if relative precision is within allowable limit of 1:5,000.
- g) In verifying connections on Previously Approved Adjoining Projects:
- 1) Connection should be circuit traverse and not an open traverse;
 - 2) Connection traverse should be within the precision as stated in paragraph b.9.(e)(4) of this Section.
 - 3) Check connections on previously established location monuments and control stations (BLLMs, PBMs, MBMs, BBMs, Primary and Secondary) of adjoining approved projects along their common boundaries.
 - 4) Check the written reports on those not recovered and non-existing monuments. For those that were recovered, the written report should have an attached Monument Recover Report Form as required in **Section 166.b.2** of this Manual;
 - 5) Check the summary of connections on adjoining approved projects.
- h) In verifying Monument Description Book (MDB) :
- 1) Check the geographic and grid coordinates of BLLM No. 1 on all sheets as computed;
 - 2) Check the grid coordinates of all BLLMs and primary stations;

- 3) Check the grid azimuths and distances of primary lines and pairs of BLLMs;
- 4) Check references, there should be at least three references for each primary control station and BLLM. Each reference should be described and have distance and bearing from station and BLLM;
- 5) Check if the location of stations and BLLMs were sketched.

Section 190. Field Monitoring, Evaluation/Inspection and Supervision of the Project

- a. The LMS Geodetic Engineer designated by the RTD for Lands concerned upon recommendation of the Chief, Regional Surveys Division to administer, monitor and inspect a particular survey project, shall:
 1. Monitor the progress of the project and inform the contractor for any deficiency noted in the conduct of survey;
 2. Assist the project implementation by serving as consultant to the contractor and provide any assistance relevant to the said project;
 3. Personally supervise the following:
 - a) Execution of test traverse/triangulation to the said project;
 - b) Conduct of astronomical observations for azimuth taken at the start and closing lines;
 - c) Computation of the result of test traverse/triangulation and the astronomical observation.
- b. The returns of the test traverse/triangulation shall be included in the inspection report, together with the following:
 1. Brief description of the project;
 2. Project execution:
 - a) Procedure of field observation and computation method of:
 - 1) Position of Survey
 - 2) Grid azimuth
 - 3) Connection to adjoining project
 - b) The execution of survey and the placing of the control points on the ground are either strictly in accordance with or with deviation from the submitted Project Control Work Plan particularly the Network Design.
 3. Findings and observations confirming the following:
 - a) That the key personnel employed and the major instruments/equipment used are authorized as per approved Project Control Work Plan and the Survey Project Contract;

- b) That the primary and secondary stations and the location monuments of the project controls as inspected conform to specifications;
 - c) All stations are marked with monuments in accordance with the prescribed regulations;
 - d) All observations are actually performed by persons appearing and signing the field notes;
 - e) The deficiencies discovered and remedial instructions given to contractor shall be made annexes to the report;
 - f) Primary control stations, political boundaries and locations monuments in the adjoining projects near their common boundaries are either recovered or could not be found on the ground. A certification on the matter should be attached pursuant to **Section 189.b.9** of this Manual.
 - g) The test traverse/triangulation controls were run under the supervision of the LMS GE and the result should be stated in detail. The test traverse/triangulation survey returns shall be submitted as annex to the report.
 - h) Other pertinent remarks considered relevant for the survey returns verification and project management purposes.
- c. The LMS GE assigned to the project shall check the completeness of the project control survey returns listed in the letter of transmittal as provided for in **Sections 168 to 172** of this Manual. If found in order, he shall issue Certificate of Acceptability and Endorsement Letter addressed to the RTD for Lands concerned.

Section 191. The Verifiers shall stamp or write their name and affix signature on all pages of the field notes, computation sheets, and monument description book, etc. during the process of verification. If defective, prepare Pending Letter to the contractor informing him/her of the defects, to be signed by the RTD for Lands concerned. If found in order, the Chief of Regional Surveys Division shall sign the Project Control Map and other necessary documents and prepare endorsement letter to the concerned RTD for Lands for approval in accordance with Section 62, DAO 2007-29.

Section 192. Pursuant to Section 67 of DAO 2007-29, copies in digital form of the approved Geodetic Control Points shall be furnished by the LMS concerned to the LMB and NAMRIA for updating of the GNIS.

Chapter VIII – Cadastral Survey

Article 27 – Numerical Cadastre

Section 193. The LMS shall verify the correctness and technical accuracy of the survey returns of the Numerical Cadastre. The following shall serve as guide in the inspection, verification and approval of a project covered by a numerical cadastral survey:

- a. The Project Control shall be verified following in accordance with **Sections 189 to 191** of this Manual. The approval of the Main Project Control and Subsidiary Control is a prerequisite in the conduct of Political Boundary and Lot Survey, respectively.

- b. The Political Boundary Survey shall be verified as follows:
1. The survey returns submitted shall be checked against the list in the transmittal letter as provided for in **Section 181** of this Manual;
 2. The technical verification of Political Boundary Controls shall be conducted in accordance with **Sections 189 to 191** of this Manual, with the accuracy of Primary Control (3rd Order) for the Municipal/City Boundary Survey and Secondary Control (4th Order) for the Barangay Boundary Survey.
 3. The Political Boundary Maps shall be evaluated if prepared in accordance with **Section 173.c.3.(d)** of this Manual.
 4. Monument Description Book for Political Boundary should be prepared in accordance with **Section 166.d.2** of this Manual.
- c. The Lot Survey shall be verified as follows:
1. The survey returns submitted shall be checked against the list in the transmittal letter as per relevant provisions in **Sections 173 to 174** of this Manual.
 2. Verify if all the Lots have corresponding PIS. Examine if the figure of the Lots plotted in the CM conform to that of the PIS.
 3. Check completeness of the field notes and field notes cover. Verify if the reference point stated therein are found in the PCM and with the corresponding coordinates. Field notes cover should be properly filled-out;
 4. Check the completeness of the computation sheets (area sheet and traverse). Check Lot Description against Lot Data Computation Sheet. Verify if all the lots are included in the Lot Description Book;
 5. Verify if the following are within the standard accuracy of Tertiary Survey as provided for in Section 30, DAO 2007-29:
 - a) Solar/stellar computation
 - b) Traverse computation
 - c) Lot data computation
 8. Check the reference monument used and the tie line of the lots.
 9. Determine the lots with the old approved surveys and check if they conform. If not, find out the justification and the corresponding technical documents to support the same.
 10. CM evaluation :
 - a) Check the completeness of the CM. Examine if prepared in accordance with **Section 173.c.3.(c)** of this Manual. All the cadastral lots and other details should be plotted;
 - b) Compare the field notes, computation sheets, and CM. All lots and corners observed in the field notes and computed in the area sheets should correspond to the lots reflected in the CM;

- d. The Verifiers shall stamp or write their names and affix signature on all pages of the field notes, computation sheets, and monument description book, etc. during the process of verification. If defective, prepare Pending Letter to the contractor informing him/her of the defects, to be signed by the RTD for Lands concerned. If found in order, the Chief of Regional Surveys Division shall sign the Project Control, Political Boundary, and Cadastral (MBIM, BBIM, and CM) Maps and other necessary documents and prepare endorsement letter to the RTD for Lands for approval in accordance with Section 63, DAO 2007-29.

Article 28 – Graphical Cadastre and Public Land Subdivision Survey

Section 194. Previously Approved Graphical Cadastre - The LMS shall verify the correctness and technical accuracy of the survey returns of the survey covering the whole or a large part of the previously approved graphical cadastre. The following shall serve as guide in the inspection, verification and approval thereof:

- a. Check the submitted documents against the Transmittal which should be in accordance with the requirements stated in **Section 176** of this Manual.
- b. Check if the provisions of **Section 102** of this Manual were complied with.
- c. The relative position of the lots should be determined by closed circuit traverse connecting at least three (3) well-defined and undisturbed corners of the previously approved survey in numerical system.
- d. Upon verification-computation, the survey should have a tertiary precision in accordance with Section 29, DAO 2007-29.
- e. Compare the coordinates of the corners of the lot in graphical system with their corresponding coordinates in the converted numerical system. A list of the lots affected by deviation in coordinates should be prepared and an investigation on the documents and on the ground shall be conducted.
- f. The Cadastral Survey and number of the graphical cadastre shall be retained minus the letter m, e.g. Cadm-472 will become Cad-472, PCadm-534 will become Cad-534, etc.
- g. The Verifiers shall stamp or write their names and affix their signatures on all pages of the field notes, computation sheets, and monument description book, etc. during the process of verification. If defective, prepare Pending Letter to the contractor informing him/her of the defects, to be signed by the RTD for Lands. If found in order, the Chief of Regional Surveys Division shall sign the Project Control, Political Boundary, and Cadastral (MBIM, BBIM, and CM) Maps and other necessary documents and prepare endorsement letter to the RTD for Lands for approval in accordance with Section 63, DAO 2007-29.

Section 195. Public Land Subdivision Survey - The LMS shall verify the correctness and technical accuracy of the survey returns of the survey covering a Public land Subdivision Survey. The following shall serve as guide in the inspection, verification and approval thereof:

- a. Check the submitted documents against the Transmittal which should be in accordance with requirements stated in **Section 177** of this Manual.
- b. Check if the provisions of **Sections 103 to 114** of this Manual were complied with.

- c. Upon verification-computation, the survey should have a primary and secondary precision for survey controls while the lot survey should have a tertiary precision in accordance with Section 29, DAO 2007-29.
- d. The Verifiers shall stamp or write their names and affix their signatures on all pages of the field notes, computation sheets, and monument description book, etc. during the process of verification. If defective, prepare Pending Letter to the contractor informing him/her of the defects, to be signed by the RTD for Lands. If found in order, the Chief of Regional Surveys Division shall sign the Project Control and Pls Maps and other necessary documents and prepare endorsement letter to the RTD for Lands for approval in accordance with Section 63, DAO 2007-29.

Chapter IX - Isolated Land Survey

Article 29 – Verification Common to all Kinds of Isolated Land Survey

Section 196. The LMS shall verify the correctness and technical accuracy of the survey returns of the survey covering Isolated Lots. The following shall serve as guide in the inspection, verification and approval thereof:

- a. Check the submitted documents against the Transmittal which should be in accordance with requirements stated in **Sections 178 to 180** of this Manual.
- b. Check if the provisions of **Sections 115 to 128** of this Manual were complied.
- c. Upon verification-computation, the lot survey should have a tertiary precision in accordance with Section 30, DAO 2007-29.
- d. The Verifiers shall stamp or write their names and affix signature on all pages of the field notes, computation sheets, lot descriptions, etc. during the process of verification. If defective, prepare Pending Letter to the geodetic engineer informing him/her of the defects, to be signed by the RTD for Lands. If found in order, the Chief of Regional Surveys Division shall sign the survey plan and other necessary documents and prepare endorsement letter to the RTD for Lands for approval in accordance with Section 64, DAO 2007-29.

Article 30 – Political Boundary Survey

Section 197. The LMS shall verify the correctness and technical accuracy of the survey returns of the survey covering a Political Boundary Survey. The following shall serve as guide in the inspection, verification and approval thereof:

- a. Check the submitted documents against the Transmittal which should be in accordance with requirements stated in **Sections 181 to 182** of this Manual.
- b. Check if the applicable provisions of **Sections 143 to 145** of this Manual were complied with.
- c. Upon verification-computation, the survey for the municipal boundary and the barangay boundary should have a primary and secondary precision, respectively, in accordance with Section 29, DAO 2007-29.
- d. The Verifiers shall stamp or write their name and affix their signatures on all pages of the field notes, computation sheets, lot descriptions, etc. during the process of verification. If defective, prepare Pending Letter to the geodetic engineer informing him/her of the defects, to be signed by the RTD for

Lands. If found in order, the Chief of Regional Surveys Division shall sign the survey plan and other necessary documents and prepare endorsement letter to the RTD for Lands for approval in accordance with Section 64, DAO 2007-29.

Article 31 - Mineral Land Survey

Section 198. The concerned Regional Office of MGB shall verify the correctness and technical accuracy of the survey returns of the survey pursuant to the provision of DAO No. 96-40.

Article 32 - Forestlands and National Parks/Protected Areas Delimitation Survey

Section 199. The LMS shall verify the correctness and technical accuracy of the survey returns of the survey covering a forestland and national parks/protected areas boundary. The following shall serve as guide in the inspection, verification and approval thereof:

- a. Check the submitted documents against the Transmittal which should be in accordance with requirements stated in **Sections 184 to 185** of this Manual.
- b. Check if the applicable provisions of **Sections 163 to 165** of this Manual were complied with.
- c. Upon verification-computation, the survey should have a precision in accordance with Section 28.b.(1), DAO 2007-29.
- d. The Verifiers shall stamp or write their names and affix their signatures on all pages of the field notes, computation sheets, lot descriptions, etc. during the process of verification. If defective, prepare Pending Letter to the geodetic engineer informing him/her of the defects, to be signed by the RTD for Lands. If found in order, the Chief of Regional Surveys Division shall sign the survey plan and other necessary documents and prepare endorsement letter to the RTD for Lands for approval in accordance with Section 66, DAO 2007-29.

Part 4. Miscellaneous

Chapter X - Surveying Instruments

Article 33 – Instrument Registration and Calibration

Section 200. The appropriate instrument shall be used in performing a survey. Such equipment must be capable of achieving the standards of accuracy prescribed for each kind of survey as stated in Sections 28, DAO 2007-29. As such, surveying instruments are subject to the following conditions:

- a. To ensure accuracy of angular and linear measurements, surveying instruments used in the survey of lands especially surveys for registration purposes shall be examined, tested/calibrated, standardized and approved by the Lands Management Bureau. Renewal of the registration or calibration of instruments may be done in the LMS except for the GPS and ETS/EDM;
- b. The instruments should be presented to the LMB/LMS for a full testing/calibration or check and registration, in any of the following situation:

1. Upon receipt of new instrument.
2. After any repair which affects the component such as the light source, internal centering and/or alignment, replacement of parts, etc.;
3. When malfunction is suspected or when the linear error as a result of partial test over the check base established in the project was found to be beyond the allowable as prescribed in Section 28, DAO 2007-29;
4. When the instrument was used in the conduct of survey and the survey returns were submitted for verification and approval as required in Section 22, DAO 2007-29;
5. The testing/calibration is required in the registration of the instruments subject of change of ownership;
6. When the distances measured may be or are to be challenged in a Court of Law.

Section 201. Required Documents for Registration of Surveying Instrument – The following shall be presented when registering surveying instruments (common to all kinds of surveying instruments):

- a. Written request for registration, renewal or change of ownership and mentioning therein the kind of instrument, the brand, model and serial number;
- b. The instrument being registered and the necessary accessories such as tripod, range pole, prism, extra battery, etc.;
- c. Technical Brochure of the instrument. Brochure of the same kind and brand but different model shall not be accepted.
- d. Invoice Receipt from the vendor. In the absence thereof, an affidavit mentioning the name and address of the entity or person who sold the instrument and explaining thereon the reason for the absence of receipt or deed of sale on the matter. The vendor shall affix his/her signature on the affidavit as a proof of conformity. If this is not possible, mention in the affidavit the valid reason. The affidavit shall be under oath.
- e. Registration Fee which amount shall be based on the applicable DENR issuances.

Section 202. Required Standards for Issuance of Certification of Instrument Registration

- a. Steel Tapes:
 1. Only Steel Tapes (graduated in metric system) which are at standard length at temperatures between twenty-seven (27) degrees Celsius and thirty-seven (37) degrees Celsius shall be used in the conduct of land surveys. The temperature of thirty-two (32) degrees Celsius shall be adopted as the standard temperature at which each tape shall be at standard length with a tension of ten (10) kilograms when supported horizontally throughout its entire length;
 2. Steel Tapes with a width of more than 5 mm. shall not be accepted for registration, considering that the wider the tape, the greater the effect of sag due to the weight.

3. Only Steel Tapes which are 100 meters in length shall be certified as fit for land survey of secondary precision (1:10,000).
 4. Fifty-meter (50) tape with no break shall be allowed only in lot survey of Tertiary Precision (1:5,000).
 5. Other tapes such as Fiberglass, Phosphor Bronze or Nylon-Coated Steel Tapes shall be used only in locating details in topographic surveys, road surveys, etc. which are not subjected to verification and approval for land registration purposes. These shall not be registered with LMB;
 6. One Hundred (100) meters Steel Tapes which have at least one (1) break may be used only in lot survey of Tertiary Precision (1:5,000). A 50-meter tape with one (1) or more breaks, shall not be accepted for renewal of registration.
- b. Engineer's Transit:
1. Telescope with Center Cross Wires preferably with Solar Squares and a Magnification of not less than Twenty Diameters (20X);
 2. Stadia Constant preferably 100. Stadia Constant shall be indicated in the field notes;
 3. The Horizontal and Vertical Circles shall be full circles with Angular Units in Sexagesimal. If the inside diameter of the Horizontal Circle is less than One Hundred Twenty millimeters (120 mm), the Least Reading of the Vernier shall be Thirty Seconds of Arc (30") or more;
 4. Magnetic Compass shall be full circle and with a Least Reading of One Degree of arc (1°) or less;
 5. Two (2) Plate Levels shall have a Sensitivity of Seventy-Five Seconds of Arc (75") or less per 2 mm. graduation.
- c. Optical Theodolites:
1. Telescope with Center Cross Wires preferably with Solar Squares and a Magnification of not less than 30X;
 2. Stadia Constant preferably 100. Stadia Constant must be indicated in the field notes;
 3. Horizontal and Vertical Circle readings either in Sexagesimal or Centesimal must be at most Twenty Second of arc (20") or equivalent, through Optical Micrometer;
 4. With Optical Plummet and Sighting Collimator;
 5. With one (1) Plate and one (1) Circular Levels.
- d. Electronic Theodolites:
1. Telescope with Center Cross Wires preferably with Solar Squares and a Magnification of not less than 30X;
 2. Stadia Constant preferably 100. Stadia Constant must be indicated in the field notes;

3. Horizontal and Vertical Angle readings either in Sexagesimal or Centesimal must be at most Twenty Second of arc (20") or equivalent, through Digital display either in LCD or LED;
 4. With Optical Plummet and Sighting Collimator;
 5. With one (1) Plate and one (1) Circular Levels.
- e. Electronic Distance Meters (EDM):
1. A measuring range of at least 1000 meters when using one (1) prism;
 2. It should operate with an accuracy of +/- (5mm+5ppm) in a temperature range of -15 to + 40°C;
 3. Digital display of measured distance either in LCD or LED up to the nearest millimeter;
 4. Can be mounted either on the Theodolite or Transit (with adaptor) or direct on the tribrach;
- f. Electronic Total Stations (ETS):
1. The telescope shall have an erect image and a magnifying power of not less than 30 diameters. The minimum focus distance shall be at least 1.3 meters.
 2. The horizontal and vertical circles shall have a least reading of one second of arc on the centesimal units displayed on Liquid Crystal Displays (LCD) or Light Emitting Diodes (LED). Angular units may be in the sexagesimal or centesimal system.
 3. The measuring range of at least 1,000 meters when using one prism. For purposes of establishing controls, the maximum range shall be at least 5,000 meters when using three (3) prisms.
 4. It should operate with an accuracy of at least +/- (5 mm + 5 ppm) probable error and within temperature range of -15°C to +40°C.
 5. It should have a measuring range read-out up to one millimeter on Fine Measurement Mode and up to ten millimeter on Coarse or Tracking Measurement Mode, displayed on LCD or LED.
 6. It should be provided with automatic or manually inputted correction for meteorological or atmospheric conditions, earth curvature, refraction, and reflector constant including cyclic errors.
 7. With a circular bubble (sensitivity of 10' per 2mm) and a plate bubble (sensitivity of 30" per 2 mm). Provided with automatic compensator for tilt correction;
 8. With Optical Plummet and Point Guide or Optical Sighting Device.
- g. Global Positioning System (GPS) Receiver
1. Field test for Survey Accuracy for the issuance of Certification shall be done only upon presentation of at least a pair (two units) of GPS Receivers: one (1) as Base Receiver and the other (1) as Rover, for differential (simultaneous) observations.

2. The Receivers, either of single frequency (L1 C/A Code) or dual frequency (L1/L2 P-code) shall have the following minimum accuracy:
 - a) At Static Survey:
 - Horizontal: 5 mm+1 ppm, multiply by baseline length
 - Vertical: 10 mm+ 1 ppm, multiply by baseline length
 - b) At Kinematic Survey:
 - Horizontal: 20 mm+1 ppm, multiply by baseline length
 - Vertical: 20 mm+ 1 ppm, multiply by baseline length
3. Must be a survey grade receiver and a dual frequency (L1/L2) for the establishment of First and Second Order Accuracies and single frequency for the lower accuracies;
4. Preferably capable of receiving signals from several satellite systems (GPS, GLONASS, Galileo, etc.);
5. Capable of tracking at least four (4) common satellites with good geometry;
6. Capable of obtaining carrier phase observable (not just C/A code);
7. Position is expressed in Longitude, Latitude and Altitude;
8. Capable of observing and logging at common times;
9. Capable of achieving precision of 1 part per million (ppm) to 0.1 ppm.

Chapter XI – The Survey Forms and Symbols

Article 34 – Survey Form for Registration and other Purposes

Section 203. All plans of land surveys which shall be used for administrative or judicial registration purposes as required to be prepared pursuant to **Sections 166 to 185** of this Manual shall be drawn on LMB prescribed format. The corresponding field notes, field notes cover, area computation sheets, and other forms for inclusion in the survey returns shall also be written on authorized LMB forms. If, however, the plans and forms were prepared using a computerized method, the Geodetic Engineer must secure authority from LMB.

- a. Required Documents for Issuance of Authorization to Print:
 1. Written request mentioning the form/s to be secured authorization;
 2. Sample Print Out of the Survey Forms and Plans, at least five (5) copies;
 3. Authorization Fees;
 4. If private practicing geodetic engineer:
 - a) Copy of PRC ID;
 - b) Copy of PTR;

- c) If registered as surveying company submit copy of DTI or SEC Registration;
5. If commercial printer:
- a) DTI or SEC Registration;
 - b) Mayor's Permit as an establishment.
- b. Forms Evaluation:
- 1) Commercial Print Out
 - a) Field Notes, Computation Sheets, Lot Description – shall be evaluated based on prescribed thickness of paper used for durability purposes. The print out linear column and rows, the font, and over all pattern shall also be in accordance with the prescribed forms of the LMB.
 - b) Survey Plans – the drafting film to be used shall be of matt type, 0.03mm thickness and shall be tested as against the effect of drawing ink on the surface and the thickness of the medium which is usually a drafting film. The print out linear column and rows, the font, and over all pattern shall also be in accordance with the prescribed forms of the LMB.
 - 2) Computerized Print Out
 - a) Field Notes Field Notes, Computation Sheets, Lot Description – shall be evaluated in the same manner as in Paragraph b.(1).(a) of this Section. If the pattern and fonts of the form submitted by the requesting geodetic engineer does not conform with the LMB design, the LMB shall furnished the form in digital file to the said geodetic engineer at cost.
 - b) Survey Plans - shall be evaluated in the same manner as in Paragraph b.(1).(b) of this Section. If the pattern and fonts of the form submitted by the requesting geodetic engineer does not conform with the LMB design, the LMB shall furnished the form in digital file to the said geodetic engineer at cost.

Article 35 – Land Information Map (LIM)

Section 204. LIM Form Specifications – As a standard spatial index map pursuant to Section 52, DAO 2007-29, the LIM shall be prepared with the specific format dimension and labeling, and shall be produced using drafting film and printing ink materials of acceptable standards specifications. The drafting film shall be of the single matt type, with a thickness of 0.03 mm, while a printing ink hall is a waterproof with permanent adhesiveness compatible with a drafting film surface.

- a. **Labeling Specifications** – The LMB shall design an exact physical model of a LIM, complete with labeling, following a standard lay-out spacing and line thickness, to serve as example for dissemination and reference.
- b. **Scales and Grid intervals** – Scale to be used shall be exclusively set within 1:4000 as the smallest scale, followed by sectional LIMs of scales of 1:2000, 1:1000 and 1:500, corresponding to grid quadrangle dimensions of 1 minute of arc, 30 seconds of arc, 15 seconds of arc and 7.5 seconds of arc, respectively, indicated at map scale.

- c. **Numbering** – The LIM number is derived from the geographical coordinates corresponding to its extreme west meridian and extreme south parallel at the 1:4000 scale. Thus, a 1:4000 CIM corresponding to 14°49' N, 120°54' E acquires the LIM number 14492054000, which is exclusive to it. Sectional LIMs of greater scale values follow a system of sequential and clockwise quadrant numbering different from the Cadastral numbering system as stated in **Annex XXIII** of this manual with the NW quadrant as 1, NE quadrant as 2, SW quadrant as 3 and SE quadrant as 4. These numbers are then appended in sequence to the 1:4000 LIM number. If the 1:2000 LIM is the NW quadrant of the 1:4000 LIM, its LIM number is 14492054100; if the 1:1000 LIM is the SW quadrant of LIM 14492054100 then its LIM number is 1449254130; and if the 1:500 LIM is the SE quadrant of LIM 1449205130, then its LIM number is 14492054134.
- d. **Populating the LIM** – After the LIM is prepared, it is populated manually or digitally by projecting survey plans from different sources, whether those emanate from isolated surveys, cadastral projects, forest land delineation surveys, or civil/military, mineral and environmental reservations. Projection shall be done exclusively under the PRS-92 system of coordinates and with the following instructions:
- 1) Since the LIMs are prepared under the PTM/PRS-92 coordinate and projection system, all surveys for projection not in the PRS-92 coordinate system shall first be transformed.
 - 2) Population of the LIM shall be done by overlays on existing projection maps, including those of the LRA's municipal index maps, and cadastral maps, followed by isolated survey plans.
 - 3) Lot in each LIM is numbered consecutively from its top left to the right and then in the reverse direction, following a "z" pattern and even if crossing or traversing political boundary lines. Such a lot number shall be the lot's **Unique Parcel Identifier (UPI)**.
 - 4) If a lot falls across the edge to an adjoining LIM, the UPI is placed on the CIM containing a larger portion of the lot without any number on the other.
 - 5) All barangay, municipal and provincial political boundaries are indicated in their appropriate line-identity designations, while mineral, forest and reservation boundaries are similarly projected if these are covered by approved surveys or with technical descriptions in their reservation proclamation and given UPIs without retiring the other UPIs they overlap with, otherwise, if source graphically from a map without a technical description, shall be tentatively indicated in pencil but without a UPI.
 - 6) During LIM updating, any lot that is altered by either subdivision or consolidation which have the originally assigned UPI superseded but not deleted nor re-used, a new UPI is assigned following the last UPI assigned on that LIM.
 - 7) A survey plan, whether titled or not, is first tentatively projected in pencil to verify its relationships with other lots that may be already on the LIM and then finally projected in ink when it conforms with a mother UPI it is superseding and where there is no overlap with a different UPI.
 - 8) Details indicated in a LIM derived from a survey plan of any kind shall be those similarly indicated in the projection map, such as physical and natural features and public easements, but not to include specific man-

made improvements and vegetation features, nor corner descriptions and numbers.

- 9) Care should be exercised such that edge matching with the adjacent map is properly done by any practical technique available to render the parcels in their true configuration.
- e. **LIM Cross indexing** – For the purpose of screening out double survey, claim or titling, and as a means of extending the utility of the graphical information in the LIM to form a wider database a corresponding cross index shall be prepared for each LIM with a design to suit a particular purpose of the DENR, the cross index database shall constitute the following: UPI number, SPI number, name of Claimant, Area , Title number, barangay Location, Land Use Classification and Remarks

Article 36 - Standard Survey Signs and Symbols

Section 205. Survey Symbols and Numbers for Plans - Survey symbols and numbers shall be used in order to classify and identify all kinds of surveys which facilitate the recording, filing and record keeping of survey plans and maps and their corresponding survey returns. This system of identifying lots shall be called Standard Parcel Identifier (SPI) and shall be done as follows:

- a. The system of classifying and identifying surveys shall consist of four (4) parts, as follows:
 - 1) The first part shall be the Survey Symbol consisting of up to four (4) characters such as H, Psu, Cadm, etc. which shall be in accordance with the Survey Symbols in **Appendix A** of this Regulation;
 - 2) The second part shall consist of two (2) to four (4) characters which indicates the Region where the lot is located such as 05 (Region 5), CAR (Cordillera Administrative Region), etc. and shall be in accordance with the NEDA Regional Code;
 - 3) The third part is the serial number (control number) of survey based on their entry with the Survey Registry Book;
 - 4) The fourth part of the numbering system shall be applied only if applicable, and these are the following letters to be put after the serial number and to be enclosed by open and close parenthesis:
 - a) Amd - Approved Survey Plans which were not subjected to Registration and have to be amended as per request of the claimant/owner for the purpose of changing the boundary lines by increasing or reducing the number of corners without including any new area, shall adopt the old survey symbol and number but add the word "Amended" or "Amd". A clearance from the Register of Deeds certifying that no title was issued and from the CENRO that no patent was issued covering the old survey plan must be submitted by the requesting party. The certified sepia copy or the old approved survey plan must be surrendered by the claimant/owner to the LMS, together with the Survey Returns of the new subdivision plan
 - b) Arf – for a subdivision survey of a track of land under the coverage of Comprehensive Agrarian Reform Program (CARP), which will be issued Certificate of Land Ownership Allocation (CLOA)

Illustration:

Psd-03-000141(Amd)

where:

Psd	- survey symbol
03	- regional code
000141	- serial or control number of survey based on Registry Book
Amd	- subdivision survey was amended

- 5) The assignment of a one-letter suffix letter “D”, shall be confined to the Cadastral Survey, which indicates that the survey was conducted by a Geodetic Engineer in private practice. The absence of this suffix “D” means that the survey was undertaken by the government. The LMB shall be consulted by the LMS in the assignment of Cadastral Survey number to avoid duplication of cadastral number.
 - 6) Untitled Lots to be subdivided but still covered by original survey (Psu), shall still retain the old survey symbol (Psu) and number but with added comment at the end as “Amd”.
- b. The survey symbols to be used in the different types of land surveys shall be as listed in **Annex I** of this Manual.

Section 206. System of Numbering - Survey Symbols, Regional Codes and the Control Numbers shall only be affixed to the Survey Plan upon its approval. The Receiving Log Book Entry Number shall be annotated on the lower right portion of the Survey Plan and shall be used in tracking the whereabouts of still unapproved survey plans. The use of public land application number in lieu of serial, entry or control number in the survey number of public land survey shall be discontinued.

Section 207. The Conventional Cartographic Symbols as shown in **Annex II** of this Manual shall be used in all type of maps and plans.

Chapter XII - Management of Survey Records and Information

Article 37 – Evaluation/Validation of Survey Records

Section 208. In support to the land sector’s projects of national importance such as the completion of Cadastral Survey, Land Disposition under CARPer and *Handog Titulo* Program of the government, implementation of the PRS92 project and LAMP2 technology roll-out, the LMB and DENR-LMS Regional Offices shall conduct physical inventory and evaluation/validation of cadastral maps, survey plans, technical description and other survey records. All cleansed survey records shall be transformed into PRS92 system and shall be converted into digital files. The said offices shall likewise review the status of all cadastral survey projects within their area of jurisdiction and recommend appropriate actions as well as policy considerations to the DENR through the LMB.

Section 209. To expedite the process of activities required in the above section, the LMB shall cause the immediate turn-over of all remaining land survey records, both maps/plans and technical descriptions, of the Bureau of Lands-approved Cadastral (CAD), public land subdivision (PLS), group settlement (GSS), townsites (TS), friar lands (FLS), isolated and other survey projects to the DENR LMS Regional Offices concerned. The said decentralization of survey records shall also be done with the Primary (Third Order), Secondary (Fourth Order), and Tertiary Control Points. The LMB shall submit monthly progress report to the DENR Secretary and shall include the same in their Monthly and Annual Accomplishment Report.

Article 38 – National Land Survey Records Management

Section 210. Survey Records in the National Level – Upon evaluation, transformation and conversion of the aforementioned survey records into digital files, the DENR-LMS Regional Offices shall furnish the same to the LMB for integration of land survey records nationwide in consonance with Sections 68 and 69, DAO 2007-29.

The digital files of reference points (3rd and 4th Order) shall likewise be shared with NAMRIA for the completion of the National Geodetic Network Information System (GNIS) pursuant to Section 67, DAO 2007-29.

Article 39 - Cancellation of Survey Plan

Section 211. The following procedure shall apply in the cancellation of approved survey plan:

1. There should be a request for the cancellation of the approved survey from the private party/government agency affected expressly stating therein the reason for cancellation.
2. The request should be under oath.
3. On the basis of such request, the RTD for Lands concerned shall issue an Order of Investigation to the FNSP or a separate survey party created for the purpose.
4. An investigation/ground verification shall be conducted by the FNSP or Survey Party to ascertain whether there is a valid ground to cancel the previously approved survey.
5. After completion of the investigation/ground verification, the team shall immediately submit their findings and recommendations;
6. An Order shall be issued by the RTD for Lands concerned indicating therein whether the subject plan is cancelled or not, among other information. Any approved survey plan, including its lot data computations, etc., cancelled by virtue of such Order shall be marked on its face with the words “Cancelled by virtue of Order dated _____”;
7. Those isolated plans (original survey, subdivision, consolidation-subdivision) which are superseded by subsequent subdivision, consolidation or consolidation-subdivision, as the case may be, should only be indicated on the plan in the space provided for additional information after date of approval as “This survey amends/supersedes _____”.
8. Notice to parties shall be served with a copy of the Order as finally approved by the RTD for Lands concerned.
9. In cases where the DENR initiates the cancellation of fake and illegal titles in accordance with Memorandum Circular No. 2000-06, otherwise known as the Guidelines in the Disposition of Cases Involving Fake and Illegally Issued Title, the resolution of the case which provides for the cancellation of the title will serve as a reference for LMS to determine if the supposed approved survey covered thereof can likewise be subjected to cancellation or not.

Article 40 – Projection Maps

Section 212. The following shall serve as a guide in the use of projection maps:

1. Inventory the available maps such as Cad, Pls, Gss, Ts covering the entire region. Index all available maps and reflect in a regional base map. In the absence of these maps, construct provisional projection map with their corresponding index number and reflect the same on the map. Index number shall start from number one (1) from the top left of the base map going to the right for every line thereof.
2. Use blueprints of previously approved cadastral survey, public land subdivision, Gss, townsite subdivision survey for projection.
3. If no Cad, Pls, Gss, Ts maps are available, construct a provisional projection map but should only be used after reflecting all the previously approved isolated surveys using the available lot data computations.
4. Use pencil when projecting submitted surveys for approval and use permanent ink after the approval thereof by the RTD for Lands concerned. If found to overlap other previously approved surveys, immediately return the survey documents to the GE concerned emphasizing the reasons of the rejection thereof and advise him to make the necessary correction/adjustment.
5. The Head, Projection Unit, Section Chief concerned and the Chief, Regional Surveys Division should strictly monitor the use of projection map. They shall be held responsible for any loss, tampering and inability to implement these provisions without justifiable reason.
6. LMS officials/employees found violating these provisions shall be charged administratively subject to due process of law.
7. The grounds for cancellation shall be as those provided in Section 50, DAO No. 2007-29.

Chapter XIII – Supplementary and Mandatory Provisions

Section 213. Supplementary Regulations - Whenever additional or supplementary regulations to this Manual is necessary, the same shall be issued by the LMB Director in the form of LMB Memorandum Circular.

Section 214. Annexes - All the Annexes herewith, both technical forms and detailed field and office procedures, shall form part of this Manual. The said annexes shall be updated through the issuance of Memorandum Circular by the LMB Director.

Section 215. Penalty and Sanctions - Violation of any provision of this Manual shall be dealt with accordingly pursuant to Section 73 to 80, DAO No. 2007-29.

Section 216. Effectivity – This Manual shall take effect immediately.

Approved:

ATTY. ALLAN V. BARCENA
OIC-Director
Land Management Bureau

ANNEXES

I. Survey Symbols

Symbols		Description
New	Old	

A. Public Land Surveys (ORIGINAL)

—	Rlla	—	Reclaimed Land Lease Application
—	Tsa	—	Townsite Sales Application
Ac	Ac	—	Agricultural Colony
Ap	—	—	Advance Plan approved project
As	—	—	Advance Survey within project in progress
F	Fp	—	Free Patent Application
Flc	Fl, Sh	—	Foreshore Lease Application: Corporation
Fld	—	—	Foreshore Land Delimitation
Fli	Fl, Sh	—	Foreshore Lease Application: Individual
Gss	—	—	Group Settlement Surveys
H	G	—	Homestead Application
Lc	La, L, E	—	Lease Application, Corporation
Li	La, L, E	—	Lease Application (Agricultural): Individual
Mla	—	—	Miscellaneous Lease Application: Corporation
Mli	Mla	—	Miscellaneous Lease Application: Individual
Mr	Mn	—	Municipal Reservations
Msc	Msc	—	Miscellaneous Sales Application by Charitable Institution and Corporation
Msi	Msa	—	Miscellaneous Sales Application: Individual
Ng	Ig, Ff	—	Insular Government Land or Private Land to be acquired by the (Insular) National Government
Nr	Ir, In	—	National (or Insular) Reservations
Pld	—	—	Public Land Delimitation
Pls	—	—	Public Land Subdivision
Plsm	—	—	Public Land Subdivision Mapping
PPIs	—	—	Photo Public Land Subdivision
PPIsm	—	—	Photo Public Land Subdivision Mapping
Pr	Pn	—	Provincial Reservations
RI	Rec	—	Reclaimed Land
Rs	Rs	—	Resurvey
Sc	Ps	—	Sales Application: Corporation
Si	Pi	—	Sales Application: Individual
Tb	Kb	—	Townsite Reservation Boundary
Ts	Ksd	—	Townsite Reservation Subdivision
Tsc	—	—	Townsite Reservation Subdivision: Corporation
Tsi	—	—	Townsite Reservation Subdivision: Individual

B. Private Land Surveys (ORIGINAL)

—	Psi	—	Private Surveys, Insular <i>Barangay</i>
Ps	Psp	—	Private Surveys, <i>owned/claimed by</i> Provincial
Ps	—	—	Private surveys, <i>owned/claimed by</i>
Ps	Psm	—	Private Surveys, <i>owned/claimed by</i> Municipal
Ps	Psn	—	Private Surveys, <i>owned/claimed by</i> National
Psu	Psu	—	Land Surveys by Private Geodetic Engr.
Psu-G	Psu-B	—	Private Surveys by Government GE
	Ps, II		
Upl	—	—	Untitled Private Agricultural Lands

C. Subdivision, Consolidation and/or Consolidation-Subdivision of:

1) Untitled Property

Ccn	Ccn	___	Consolidation
Ccs	Ccs	___	Consolidation & Subdivision
Csd	Csd	___	Subdivision

2) Titled Property

Gcn	Bcn	___	Consolidation by Government GE
Gcs	Bcs	___	Consolidation and Subdivision by Government GE
Gsd	Bsd	___	Subdivision by Government GE
Pcn	___	___	Consolidation by Private GE
Pcs	___	___	Consolidation and Subdivision by Private GE
Psd	Psc	___	Subdivision by Private GE

D. Cadastral Land Surveys

Cad	Cad	___	Cadastral Surveys by Government GE
Cad-D	Psc	___	Cadastral Survey by Private GE
Cadm	Cadm,	___	Cadastral Mapping(x)
Cadm	CadS	-----	Cadastral Sketching
Ipb	Ipb	___	Irrigation Project Boundary
Ips	Ips	___	Irrigation Projects Subdivision not funded by DENR/LMB
Pcad	Pcad	___	Photo Cadastral Survey
Pcad-D	PPsc	___	Photo Cadastral Survey by Private Enterprise
Pcadm	Pcadm	___	Photo Cadastral Mapping(x)
Pcadm-D	PPScm	___	Photo Cad Mapping by Private Enterprise(x)
Psc	___	___	Cadastral Survey by Private GE

E. Mineral Land Surveys(for further study)

Cl	___	___	Coal Lease Surveys
Cp	___	___	Coal Patent Surveys
Crp	___	___	Coal Revocable Permit Surveys
Li	___	___	Lode Location Surveys
Lp	___	___	Lode Patent Surveys
Mi	___	___	Mineral Investigation Surveys
Pdl	___	___	Petroleum Drilling Lease Surveys
Pel	___	___	Petroleum Exploration Lease Surveys
Pl	___	___	Placer Location Surveys
Pp	___	___	Placer Land Surveys

F. Government Land Surveys

Flb	Ab	___	Friar Land Boundary
Flr	Flr	___	Friar Lands Relocation
Fls	Fls	___	Friar Land Subdivision
Frs	___	___	Friar Lands Resurvey
NgI	Igl, Ige	___	(Insular) National Government Property Lease
NgS	Igs	___	(Insular) National Government Property Sale

G. General Land Surveys

Cvn	—	—	Conversion Survey (from Graphical to Regular Cadastral Lot)
Fis	—	—	Fishpond Application Surveys
Pb	Bvs	—	Political Boundary Verification Survey
Pb	Cb	—	Political Boundary- City
Pb	Mb	—	Political Boundary-Municipal
Pb	Pb	—	Political Boundary-Provincial
	Ppb	—	Political Boundary Portion Establishment Survey
Rel	—	—	Relocation Surveys
	Sp	—	Special Plans
Swo	Swo	—	Special Work Orders
Vs	—	—	Verification Surveys
Fbs	—	—	Forest Boundary Surveys
Fld	—	—	Foreshoreland Delimitation
Lc	—	—	Land Classification
Ml	Mp	—	Monument Location Surveys
Ms	Mp	—	Municipal Street Surveys
Prs	Prd	—	Provincial Road Surveys
Sgs	—	—	Segregation Surveys
Sk	—	—	Sketch Plan/Special Plan (Not subject for Registration approved by the Regional Technical Director).
Tri	—	—	Triangulation Surveys

Note: All surveys executed under Agrarian Reform shall have a suffix (AR)

II. Conventional Map Symbols

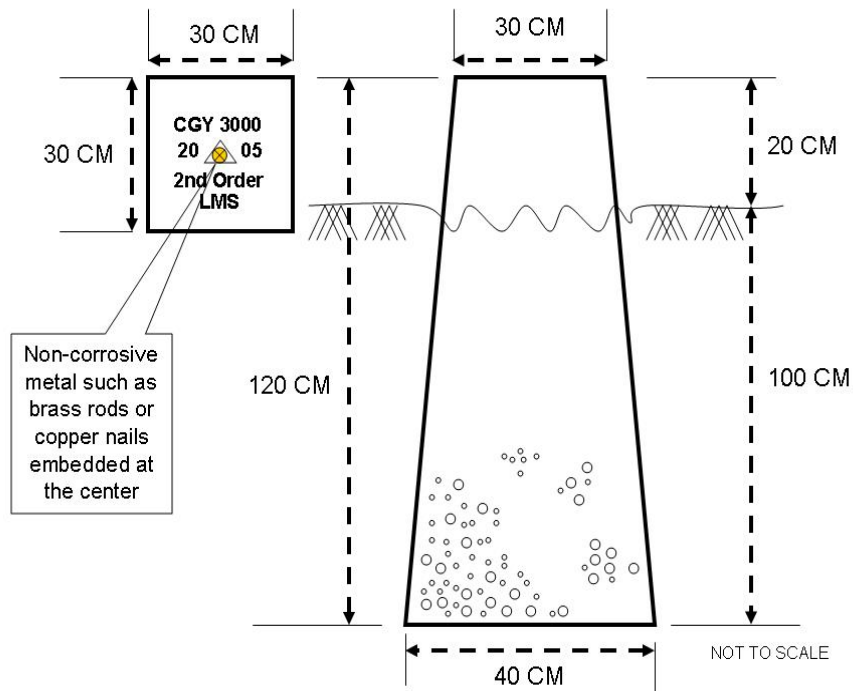
NO	FEATURES	SYMBOLS	DIMENSION	COLOR
1	LOT CORNER MONUMENT AND LINE		1 mm DIAMETER CIRCLE	ALL BLACK
2	LOT CORNER MARKED BY STAKES			BLACK
3	GIS ON "X" MARKED ON TREE		3 mm X 3 mm clover leaf	ALL BLACK
4	GIS ON/OR "X" MARKED ON POST		2 mm Diameter circle	ALL BLACK
5	GIS ON "X" MARKED ON WALL		2 mm Diameter circle bars 1/2 mm thick 2 mm long	ALL BLACK
6	"X" MARKED ON ROCK OR BULDER		Ellipse Major axis 3 mm minor axis 2 mm minor axis	ALL BLACK
7	CORNER OF OLD SURVEY		3 mm Diameter outer circle 1.5 mm diameter inner circle	ALL BLACK
8	BARRIO BOUNDARY MONUMENT AND LINE		3 mm square, thicks at 1 mm interval	ALL BLACK
9	MUNICIPAL BOUNDARY MONUMENT AND LINE		3 mm filled square, long thick 10 mm, short thick 2 mm interval 1mm	ALL BLACK
10	CITY BOUNDARY MONUMENTS AND LINE		4 mm outer square, 2 mm filled inner square 3 mm short thick, 10 mm long thick 1 mm interval	ALL BLACK
11	PROVINCIAL BOUNDARY MONUMENT AND LINE		Same as CBM but heavier line	
12	LOCATION MONUMENT		5 mm Diameter circle with square inscribed	BLACK
13	TRIANGULATION STATION		Black equilateral triangle 4 mm to a side	
14	CONSERVATION POINT		Black square 3 mm to a side	
15	BENCH MARK		2 mm Black lines	
16	PRIMARY TRAVERSE STATION AND LINE		Outer circle, 3 mm diameter, inner filled circle 1.5 mm diameter, long thick 6 mm short thick, 6 mm short thick, 2 mm interval 1 mm	ALL RED
17	SECONDARY TRAVERSE STATION AND LINE		2 mm diameter filled circle, thick same as primary line	ALL RED
18	TERTIARY TRAVERSE STATION AND LINE		2 mm diameter circle, 2 mm thick at 1 mm interval	ALL RED
19	RAIL ROAD SINGLE TRACK		2 mm thick at 5 mm interval	BLACK
20	RAIL ROAD DOUBLE TRACK		1 mm thick at 3 mm thick at 5 mm interval	BLACK
21	BRIDGE		To scale	ALL BLACK
22	IRRIGATION DITCH AND CANAL		To scale	ALL BLACK
23	DAM		To scale	ALL BLACK
24	RIVER		To scale	ALL BLACK
25	SHORELINE			ALL BLACK

III. Monument Dimensions and Markings Illustration

A. Control Monuments:

1. Geodetic Control Monuments:

Illustration:



Where:

CGY - is the Provincial Code (Cagayan)

3000 - is the Control Point Number

2005 - is the year when the monument established

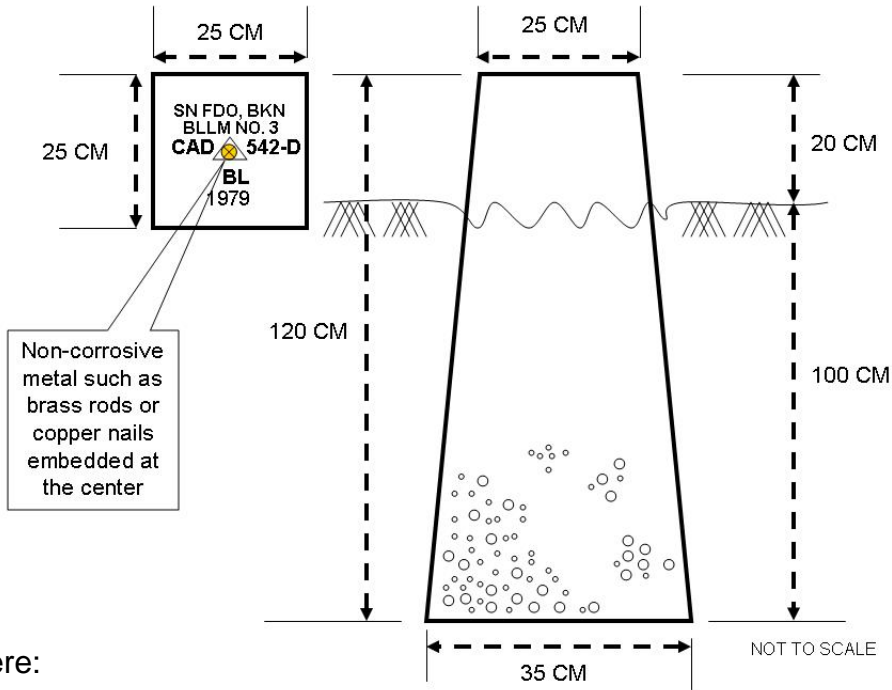
Δ - is the Control Point mark, with any non-corrosive metal such as brass rods or copper nails embedded at the center of the triangle

2nd Order – is the order of accuracy of the monument

LMS2 - is the office or entity that established the Reference Point

2. Project Control Monuments:

Illustration:



Where:

SN FDO, BKN - is the name of the Municipality and the Province (Municipality of San Fernando)

BLLM No. 3 - Bureau of Lands Location Monument Number

CAD 542-D - is the Cadastral Project Number

Δ - is the Control Point mark, with any non-corrosive metal such as brass rods or copper nails embedded at the center of the triangle

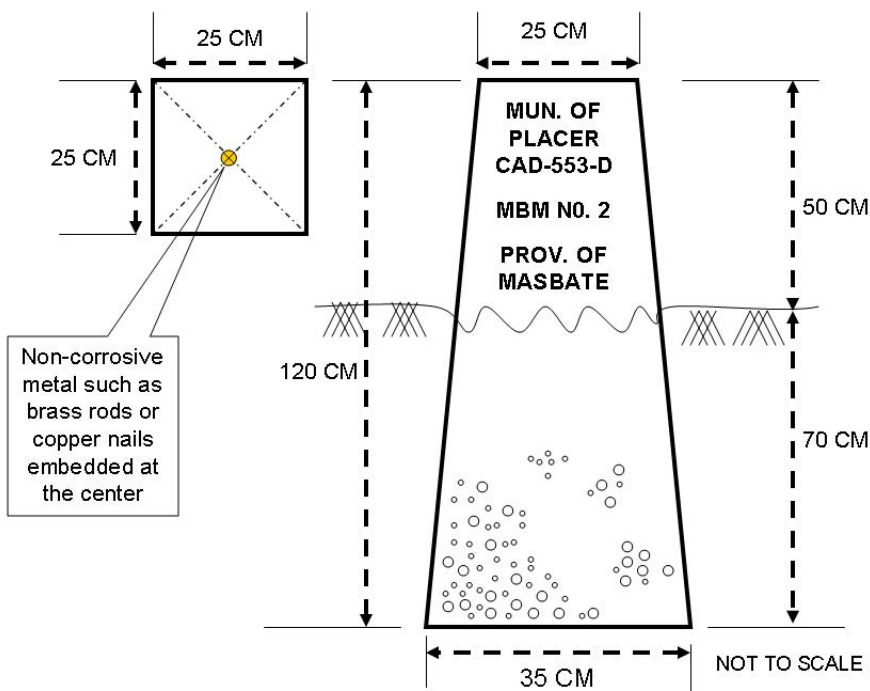
BL - is the office or entity that funded the project

1979 - is the year when the monument was established

B. Political Boundary Monument:

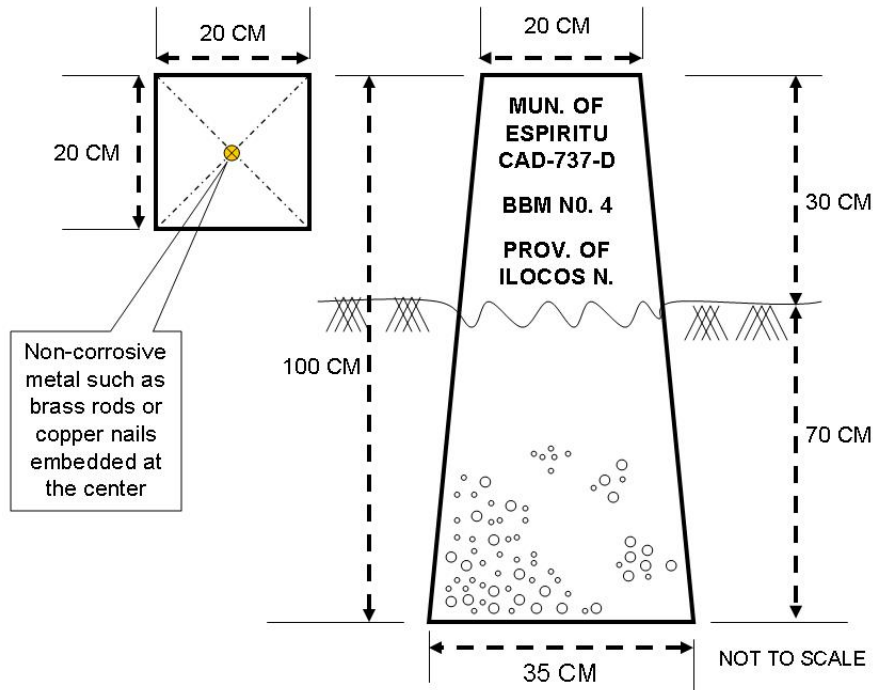
1. Municipal Boundary Monuments:

Illustration:

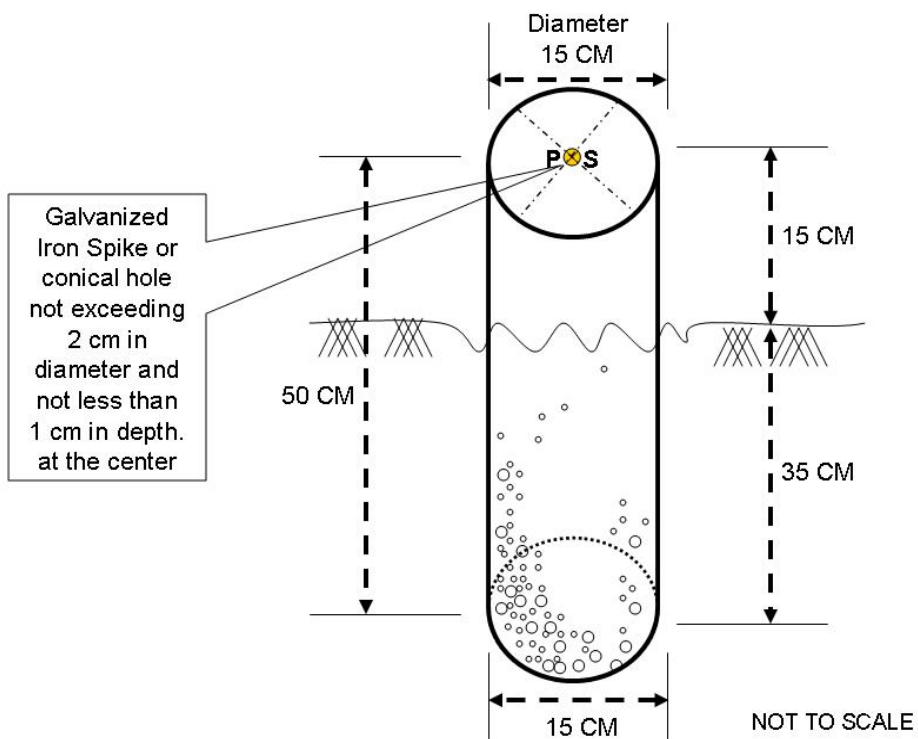


2. Barangay Boundary Monument:

Illustration:

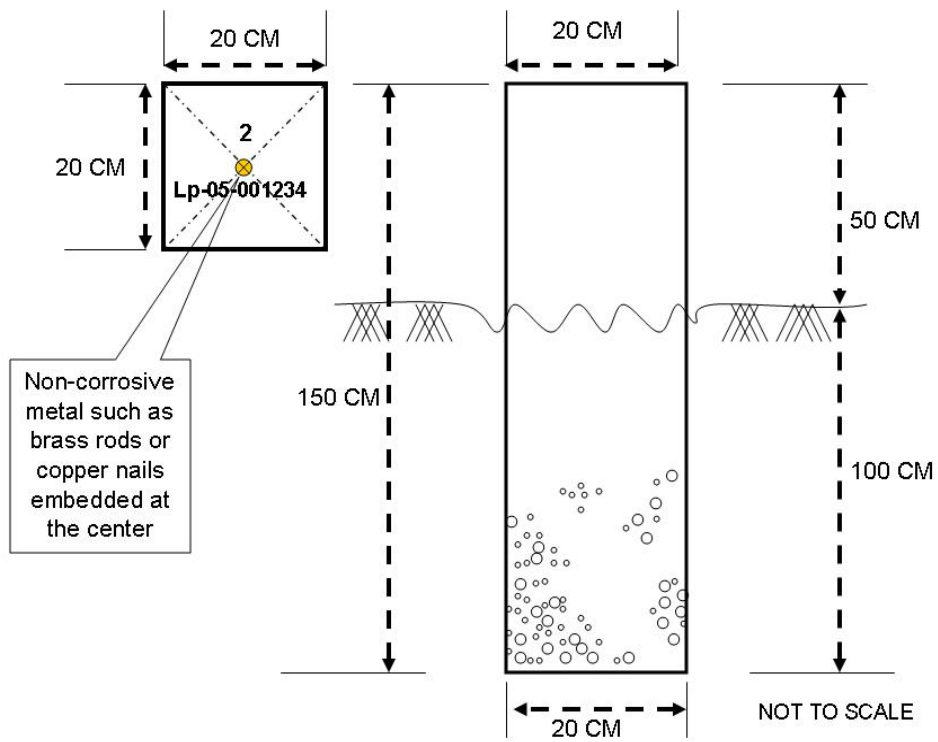


C. Standard Lot Corner Monument:

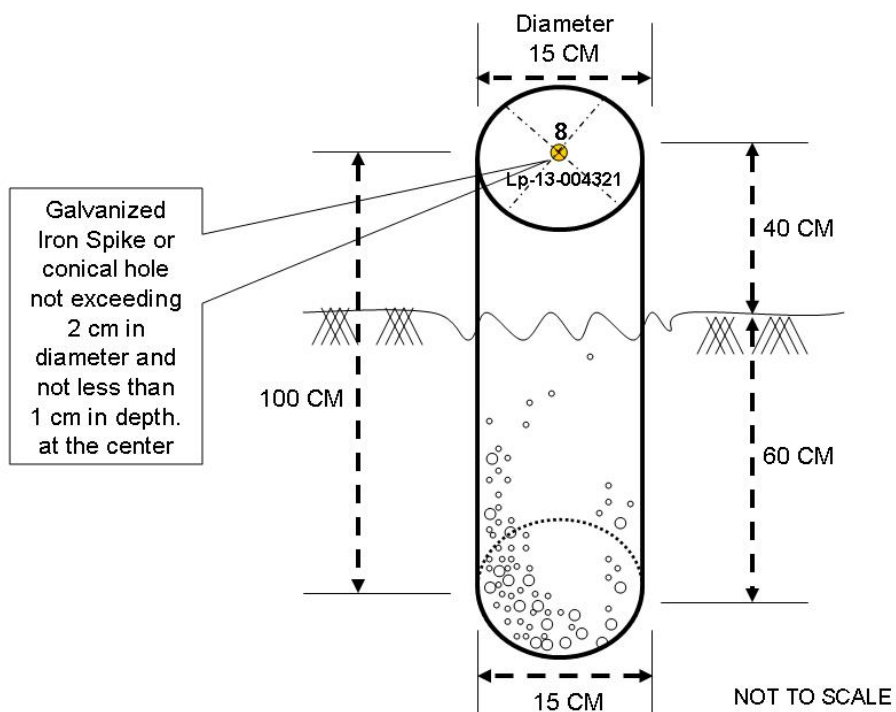


D. Mineral Land Survey Monuments:

1. Principal Mineral Land Corners:

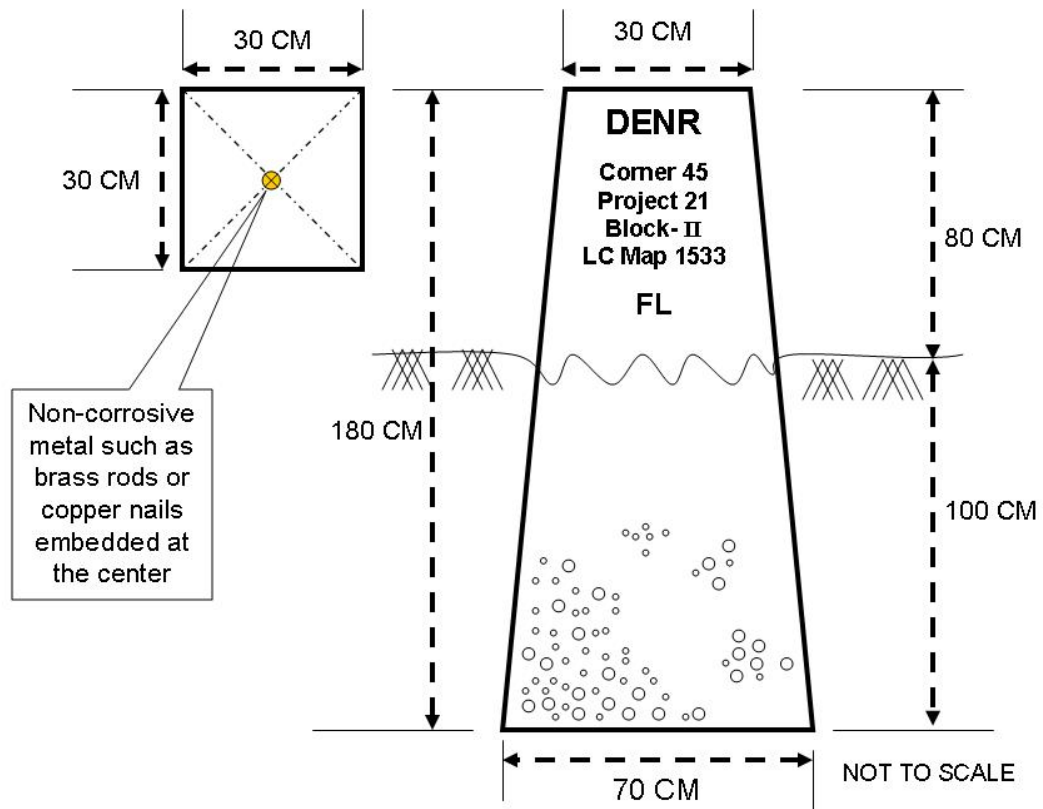


2. Other Corners of Mineral Land

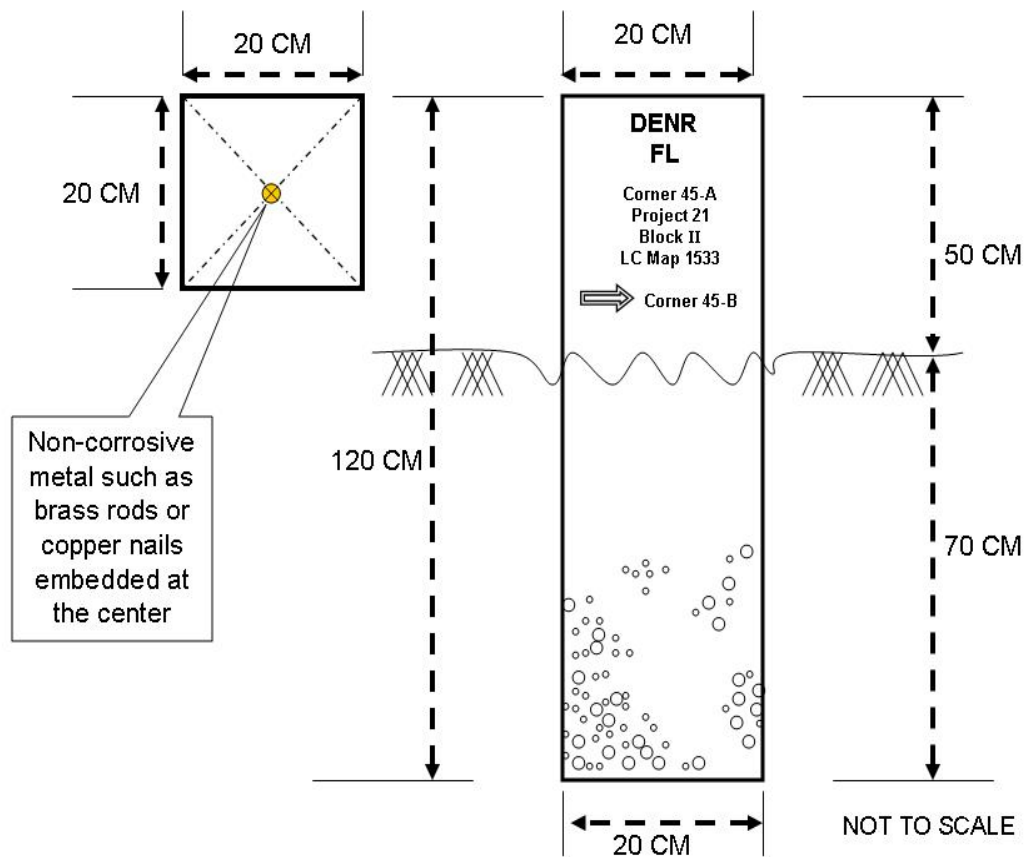


E. Forest Boundary Monuments

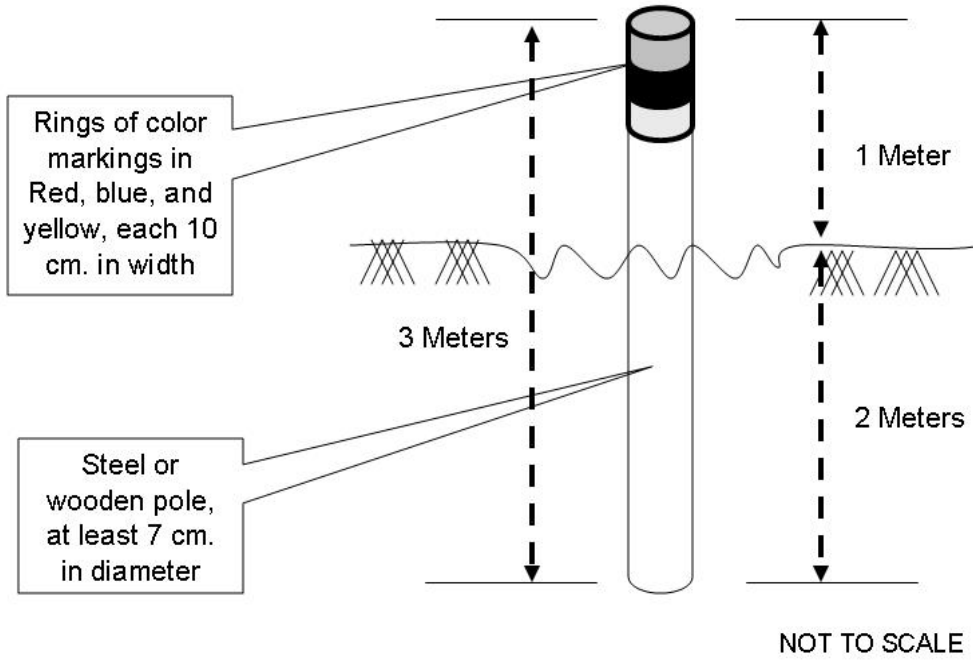
1. Permanent Major Boundary Monument



2. Permanent Intermediate Boundary Monument



3. Preliminary Forest Boundary Marking



IV. PRS92 Provinces Codes

(Based on the Provincial Code provided by NAMRIA)

Province	Code
a. Cordillera Administrative Region	
1) Abra	ABR
2) Benguet	BGT
3) Ifugao	IFG
4) Mountain Province (Bontoc)	MPV
5) Kalinga	KAL
6) Apayao	APA
b. National Capital Region	
1) Metro Manila	MMA
c. Region No. I	
1) Ilocos Norte	ILN
2) Ilocos Sur	ILS
3) la Union	LUN
4) Pangasinan	PNG
d. Region No. II	
1) Batanes	BTS
2) Cagayan	CGY
3) Isabela	ISB
4) Nueva Vizcaya	NVY
5) Quirino	QRN
e. Region No. III	
1) Bataan	BTN
2) Bulacan	BLN
3) Nueva Ecija	NVY
4) Pampanga	PMG
5) Tarlac	TRC
6) Zambales	ZBS
f. Region No. IV	
1). Aurora	ARA
2.) Batangas	BTG
3) Cavite	CVT
4) Laguna	LAG
5) Marinduque	MRQ
6) Occidental Mindoro	MRW
7) Oriental Mindoro	MRE
8) Palawan	PLW
9) Quezon Province	QZN
10) Rizal	RZL
11) Romblon	RML
g. Region No. V	
1) Albay	ABY
2) Camarines Norte	CMN
3) Camarines Sur	CMS
4) Catanduanes	CNS
5) Masbate	MST
6) Sorsogon	SRG
h. Region No. VI	
1) Aklan	AKN
2) Antique	ATQ
3) Capiz	CPZ
4) Ilo-Ilo	ILO
5) Negros Occidental	NGW
6) Guimaras	GMS

i. Region No. VII	
1) Bohol	BHL
2) Cebu	CBU
3) Negros Oriental	NGE
4) Siquijor	SQJ
j. Region No. VIII	
1) Eastern Samar	SME
2) Leyte	LYT
3) Northern Samar	SMN
4) Samar (Western Samar)	SMR
5) Southern Leyte	LYS
6) Biliran	BLR
k. Region No. IX	
1) Zamboanga Del Norte	ZGN
2) Zamboanga Del Sur	ZGS
3) Zamboanga Sibugay	ZSI
l. Region No. X	
1) Bukidnon	BKN
2) Camiguin	CGN
3) Lanao Del Norte	LAN
4) Misamis Occidental	MSW
5) Misamis Oriental	MSE
m. Region No. XI	
1) Compostela Valley	COV
2) Davao Del Norte	DVA
3) Davao Del Sur	DVS
4) Davao Oriental	DVE
n. Region XII	
2) North Cotabato	CTN
3) Sarangani	SNI
3) South Cotabato	CTS
4) Sultan Kudarat	SKT
o. Region No. XIII	
1) Agusan Del Norte	AGN
2) Agusan Del Sur	AGS
3) Dinagat Islands	
4) Surigao Del Norte	SRN
5) Surigao Del Sur	SRS
p. Autonomous Region of Muslim Mindanao	
1) Basilan	BSL
2) Lanao Del Sur	LAS
3) Maguindanao	MGD
4) Shariff Kabunsuan	
5) Tawi-tawi	TTW
6) Sulu	SUL

V. Transformation Formula from WGS84 to PRS92 Datum

The transformation parameters shall be:

Translation : $\Delta X = 127.62195$ meters
 $\Delta Y = 67.24478$ meters
 $\Delta Z = 47.04305$ meters

Rotation : Rot X = -3.06762 seconds
 Rot Y = +4.90291 seconds
 Rot Z = +1.57790 seconds

Scale Parameter = 1.06002

The **signs shall be reversed** when transforming from Luzon Datum to World Geodetic System 1984 (WGS 84). Transformation formula from WGS84 to PRS92 and vice-versa shall be as follows:

$$\begin{pmatrix} X_2 \\ Y_2 \\ Z_2 \end{pmatrix} = \begin{pmatrix} \Delta X \\ \Delta Y \\ \Delta Z \end{pmatrix} + (1+S_c \cdot 10^{-6}) \begin{pmatrix} 1 & R_z \\ -R_z & 1 \\ R_y & -R_x \end{pmatrix} \begin{pmatrix} R_y \\ R_x \\ 1 \end{pmatrix} \begin{pmatrix} X_1 \\ Y_1 \\ Z_1 \end{pmatrix}$$

Where: X_2, Y_2, Z_2 are the transformed Cartesian coordinates

$\Delta X, \Delta Y, \Delta Z$ are the shifts for the change in origin

R_x, R_y, R_z are the rotations of each axis

S_c is the scale change in part per million

X_1, Y_1, Z_1 are the coordinates to be transformed.

VI. Philippine Plane Coordinate System (PPCS)

A. Philippine Plane Coordinate System (PPCS), also known as the Philippine Transverse Mercator (PTM) Grid, are transformed from geographic coordinates to Cartesian coordinates on the Luzon 1911 Datum, determined through astronomical observations. PPCS-PTM was adopted as the reference system in the Philippines pursuant to Lands Circular No. 64, dated June 30, 1965 with the following characteristics:

Spheroid : Clarke 1866

Projection: Transverse Mercator, in Zones of two degrees net width

Point of Origin : Intersection of the Equator and the Central Meridian of each zone, with Northing of 0 meter and an Easting of 500,000 meters

Scale factor at the Central Meridian: 0.99995

Zonification:

Zone No.	Central Meridian	Extent of Zone
I	117°	116° 00' to 118° 30'
II	119°	117° 30' to 120° 30'
III	121°	119° 30' to 122° 30'
IV	123°	121° 30' to 124° 30'
V	125°	123° 30' to 127° 00'

B. The Formula for the conversion from Geographic Coordinate and vice-versa shall be as follows:

a) From Geographic to Grid Coordinates:

$$N = (I) + (II)P^2 + (III)P^4 \quad \text{(Northing in meters)}$$

$$E = (IV)P + (V)P^3 + (VI)P^5 + 500,000 \quad \text{(Easting in meters)}$$

$$P = .0001 (\Delta\lambda'') \quad \text{(difference in Longitude)}$$

b) From Grid to Geographic Position:

$$\Phi = \Phi' - (VII) q^2 + (VIII) q^4 \quad \text{(Latitude)}$$

$$\lambda = (IX)q - (X)q^3 + \lambda_{CM} \quad \text{(Longitude)}$$

$$q = 0.000001(E-500,000) \quad \text{(difference in Easting)}$$

VII. PPCS-PTM Zone Assignment of Provinces

The assignment of provinces into the map projection zones of the PPCS-TM shall be as follows:

a. Cordillera Administrative Region	CAR
1) Abra	Zone No. III
2) Benguet	-do-
3) Ifugao	-do-
4) Mountain Province (Bontoc)	-do-
5) Kalinga	-do-
6) Apayao	-do-
b. National Capital Region	NCR
1) Metro Manila	Zone No. III
c. Region No. I	Northwestern Luzon
1) Ilocos Norte	Zone No. III
2) Ilocos Sur	-do-
3) Ia Union	-do-
4) Pangasinan	-do-
d. Region No. II	Northeastern Luzon
1) Batanes	Zone No. III
2) Cagayan	-do-
3) Isabela	-do-
a. Mun. West of 122° E Longitude	Zone III
b. Mun. East of 122° E Longitude	Zone IV
4) Nueva Vizcaya	Zone No. III
5) Quirino	-do-
e. Region No. III	Central Luzon
1) Bataan	Zone No. III
2) Bulacan	-do-
3) Nueva Ecija	-do-
4) Pampanga	-do-
5) Tarlac	-do-
6) Zambales	-do-
f. Region No. IV	Southern Tagalog
1). Aurora	Zone No. III
2.) Batangas	-do-
3) Cavite	-do-
4) Laguna	-do-
5) Marinduque	-do-
6) Occidental Mindoro	-do-
7) Oriental Mindoro	-do-
8) Palawan	Zone 1
Central Meridian	118° 30' E
9) Quezon Province	
a. Mun. East of 122 E. Longitude	Zone No. IV
b. Mun. West of 122° E. Longitude	Zone No. III
c. Polillo Islands	-do-
10) Rizal	Zone No. III
11) Romblon	Zone No. IV
g. Region No. V	Bicol
1) Albay	Zone No. IV
2) Camarines Norte	-do-
3) Camarines Sur	-do-
4) Catanduanes	-do-
5) Masbate	-do-
6) Sorsogon	-do-
h. Region No. VI	Western Visayas

1) Aklan	Zone No. IV
2) Antique	-do-
3) Capiz	-do-
4) Ilo-Ilo	-do-
5) Negros Occidental	-do-
6) Guimaras	-do
i. Region No. VII	Central Visayas
1) Bohol	Zone No. V
2) Cebu	Zone No. IV
a. Camotes Islands	Zone No. V
3) Negros Oriental	Zone No. IV
4) Siquijor	-do-
j. Region No. VIII	Eastern Visayas
1) Eastern Samar	Zone No. V
2) Leyte	-do-
3) Northern Samar	-do-
4) Samar (Western Samar)	-do-
5) Southern Leyte	-do-
6) Biliran	-do-
k. Region No. IX	Western Mindanao
1) Zamboanga Del Norte	Zone No. IV
2) Zamboanga Del Sur	-do-
3) Zamboanga Sibugay	-do-
l. Region No. X	Northern Mindanao
1) Bukidnon	Zone No.V
2) Camiguin	-do-
3) Lanao Del Norte	-do-
4) Misamis Occidental	Zone No. IV
5) Misamis Oriental	Zone No. V
m. Region No.XI	Southern Mindanao
1) Compostela Valley	Zone No. V
2) Davao Del Norte	-do-
3) Davao Del Sur	-do-
4) Davao Oriental	-do-
n. Region XII	Central Mindanao
2) North Cotabato	-do-
3) Sarangani	-do-
3) South Cotabato	-do-
4) Sultan Kudarat	-do-
o. Region No. XIII	CARAGA
1) Agusan Del Norte	Zone No. V
2) Agusan Del Sur	-do-
3) Dinagat Islands	- do -
4) Surigao Del Norte	-do-
5) Surigao Del Sur	-do-
p. Autonomous Region of Muslim Mindanao	ARMM
1) Basilan	Zone No. IV
2) Lanao Del Sur	Zone No. V
3) Maguindanao	-do-
5) Tawi-tawi	Zone No. III
6) Sulu	-do-

VIII. The description of Triangulation Station Balanacan (PPCS-PTM/PRS92) shall be as follows:

Spheroid = Clarke 1866

Latitude = N 13° 33' 41.000"

Longitude = E 121° 52' 03.000"

Geoid-Spheroid separation = 0.34 meters

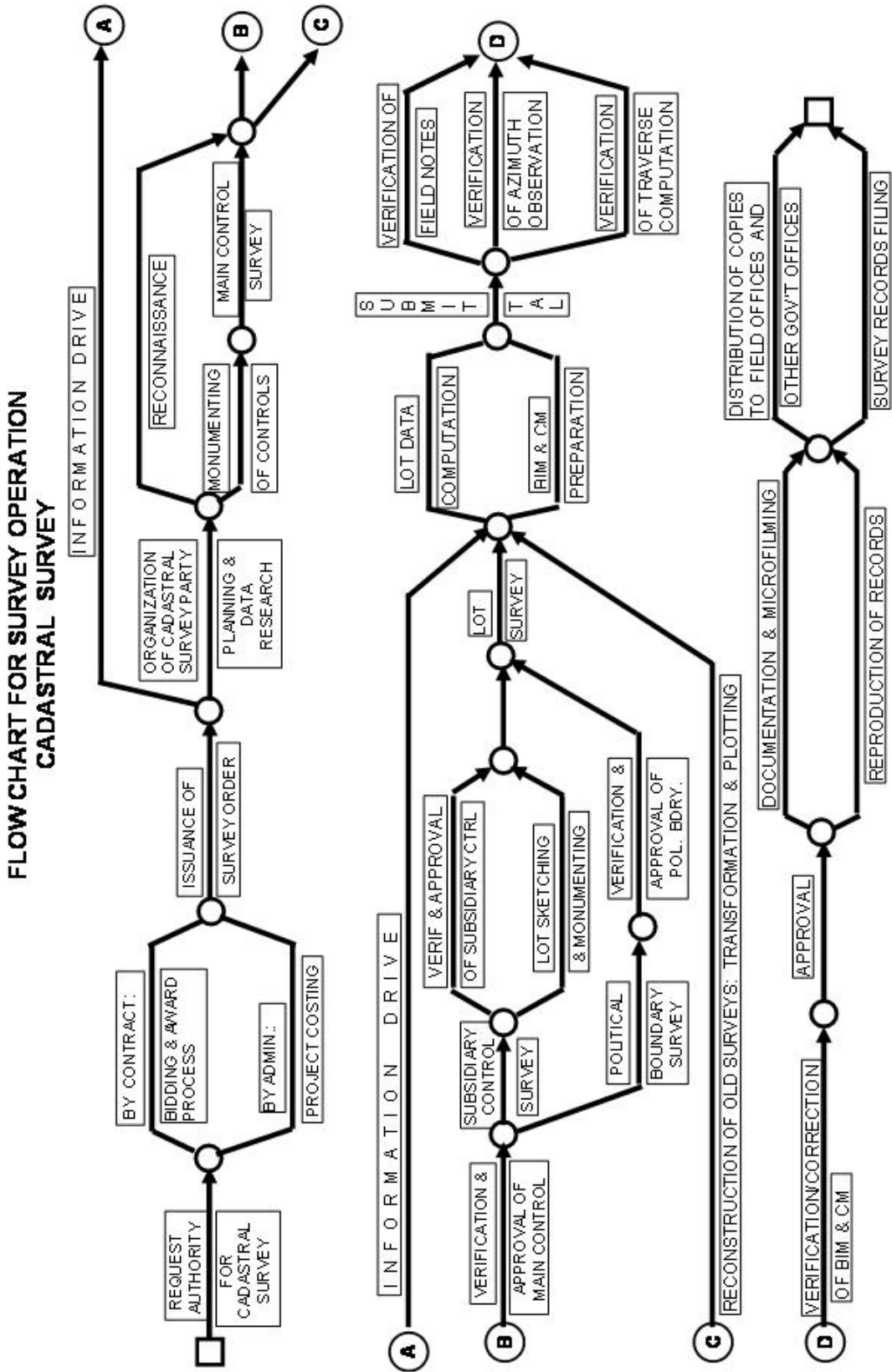
The azimuth from triangulation station "Balanacan" to triangulation station "Baltazar" is 9° 12' 37.000" and the distance is 37,680.90 meters. The back azimuth is 189° 11' 50.60".

The description of the triangulation station, Balanacan, is as follows:

Balanacan (Marinduque Province, O.W. Ferguson, 1906, 1907). On the highest hill at the northwest point of Marinduque Island. Salvaria Island in the entrance of Looc Bay bears N. 9° E., distance 3 kilometers, and the highest point to the western one of the two San Andres Islands bears S. 80° E., distance 3 kilometers. It is on the northwest end of the hill, 10 meters northwest of the highest point, and is in a commanding situation, seeing a hundred miles of the south coast of Luzon, much of the north and west coasts of Marinduque, the coast of Mindoro and other islands. Station mark is the center of a hole 1.5 centimeters in diameters and 6 centimeters deep, drilled at the center of a triangle 16 centimeters on a side, cut in a hard rock. Reference mark is on a hard, white boulder of about one cubic meter in volume, standing 80 centimeters above the ground and 90 centimeters higher than the station. The mark is a hole 1.5 centimeters in diameter and 8 centimeters deep, at the center of a cross cut on top of this stone. From the station, the reference mark is in azimuth 326°34' and is distant 18.85 meters.

IX. Flowchart of Cadastral Survey

Note: Review Std symbols for flowcharting



X. Notification of Cadastral Survey to Public:

A. The General Public Notice in English is as follows:

Republic of the Philippines
Department of Environment and Natural Resources
Land Management Services, Region _____

CADASTRAL SURVEY PROJECT)
:
_____)

SUBJECT: Cadastral Project No. _____
Cadastral Survey of the
Municipality of _____,
Province of _____

- 1) Pursuant to the provisions of Section 1851 of the Administrative Code (Act No. 2711 as amended), notice is hereby given to all persons claiming interest therein and to the general public that on the _____, 20__ in the municipality of _____, province of _____ a cadastral survey of all lands situated within the boundaries of the said municipality will be commenced by the _____ .
- 2) In accordance with Section 1853 of the said Code, the geodetic engineers and other employees of the _____ shall have the full authority of law to enter upon the above mentioned lands for the purpose of making the survey and placing monument thereon; it is the duty of all persons claiming said lands or interest therein to fully inform the said geodetic engineer and other employees concerning the boundaries of their respective land claims.
- 3) Any person who shall willfully refuse to give such information or shall in any manner interfere with the survey and placing of the monuments, or shall after the location of the same, or shall deface, destroy or remove the said monuments, or remove notice of survey posted upon the land shall be liable to prosecution under the provision of Section 2753 of the Administration Code, as amended by Act No. 3077.
- 4) Practicing geodetic engineers are hereby requested to submit to the Land Management Services, within sixty (60) days from _____ 20____, a list of the isolated surveys being made within the aforementioned cadastral project and another list of contracts for isolated survey entered into a good faith by them prior to _____ . Isolated surveys not listed as herein required will not be accepted for verification and approval.
- 5) Upon the completion of this cadastral survey, a process of adjudication of a titles to the land included in the said survey in favor of all persons entitled thereto under the law will be conducted in the DENR Regional Office No. _____ in _____ through the Lands Management Services (LMS).
- 6) The full cooperation of all land owners and other members of the community is being requested to be extended to the geodetic engineer engaged in the project. This cooperation may be expressed in the form of furnishing all desired information concerning property boundaries, refraining from disturbing the planted monuments, allowing the access of the survey team in their respective properties, and other means as may be found appropriate and feasible in each case.

Regional Executive Director

- B. The following certificate shall be attached to one copy of the notice in each language and local dialect:

“ I hereby certify that on this date, _____, 20 ____, in accordance with provisions of Section 1, Act 2259, as amended, I posted a copy of the attached notice of survey at the following described points: _____ and on the principal building in the Barangay of _____, Municipality of _____, Province of _____.”

Geodetic Engineer
Chief of Party, _____ Cadastre
Cad- _____

XI. Notification to Lot Claimants in a Cadastral Survey:

A. The Survey Notification Letter in English is shown as follows:

Survey Notification Letter
 Cadastral Survey No. _____
 Municipality of _____
 Province of _____

TO:

Name of Claimant/ Adjoining Claimants or Authorized Representatives	Address	Reg. Number or Signature (If representative, write the name of claimant being represented)

You are hereby notified that the property, situated in the Sitio of _____, Barangay of _____, Municipality of _____, Province of _____ initially designated as Lot No. _____ and being claimed by _____, will be subjected to a boundary delimitation agreement process, preparatory to its survey, by and among the concerned land claimants and to be presided by the undersigned on _____, starting at _____(AM/PM). A lot sketching activity shall be conducted on the same day to reflect on sketch plan the agreement of both parties. The Regional Executive Director has given due notice to the general public on the conduct of the Cadastral Survey in the municipality in accordance with the provision of Section 1 of Act No. 2259, entitled "The Cadastral Act" as amended by Section 1850 of the Revised Administrative Code, Act 2711.

As the adjoining owner, you are requested to appear either personally or through your representative or agent and be on the premises at the above-stated time and date to exhibit and/or furnish all pertinent information in your possession to the undersign or the duly representative of the survey party concerning the boundary lines of said property, participate in their location or establishment and sketching and signify your conformity or disagreement therewith, all in accordance with Sections 2 and 4 of said Act as amended by Sections 1852 and 1854, respectively, of the Revised Administrative Code, Act 2711.

You or your representative's failure to appear shall be initially treated as a default on your part, and within 30 days following the boundary agreement date, during which you may examine the result of the boundary establishment, if no disagreement or protest by letter is received from you by the undersigned, it shall be deemed that you agree to its result and your non-appearance shall be considered a waiver to participate

 Geodetic Engineer/Chief of Party

Office Address _____

Copy for:

NOTE: If a copy of this notice was served personally, the signature of the person notified should be secured. If he refuses to sign, this fact should be stated and shall be attested to by the Chairman of Barangay. If the notice was sent by registered mail, the registry number should be stated in the last columns. All notices should be received with at least 15 days lead time before date of the boundary agreement process.

- B. The following certificate shall be attached to one copy of the notice in each language and local dialect:

I certify that on this date _____, 19 ____ in accordance with the provisions of Section 2 of Act 2259, as amended, I have caused copies of the foregoing notice in the local dialect to be distributed to the local claimants of land located in the Barangay of _____, Municipality of _____, Province of _____ and have caused copies of said notice to be posted in prominent and public places in the district and copies of said notice to be posted in prominent and public places in the district and copies of said notice in the English, Spanish, and Filipino languages and the local dialect were also posted in the municipal and the Barangay buildings of said municipality.

Geodetic Engineer
Chief of Party, _____ Cadastre
Cad- _____

XII. Parcel Information Sheet Form

PARCEL INFORMATION SHEET

Cadastral Survey No. _____

Lot No. _____

Date: _____ Time: _____ Brgy.: _____ Mun.: _____

Name of Owner/s : _____ Signature : _____

Name of Claimants/Occupants of adjoining lots :	Lot No.	Signature to signify conformity:
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

SKETCH OF THE LOT

SPECIFIC LAND USE _____	CULTIVATION/IMPROVEMENTS	
(residential,	commercial,	industrial,
agricultural,	institutional,	reserve.)

We hereby certify that the information contained herein are true and correct to the best of our knowledge and belief, except the indicated distances, which may be approximate.

Land Management Officer/Adjudicator

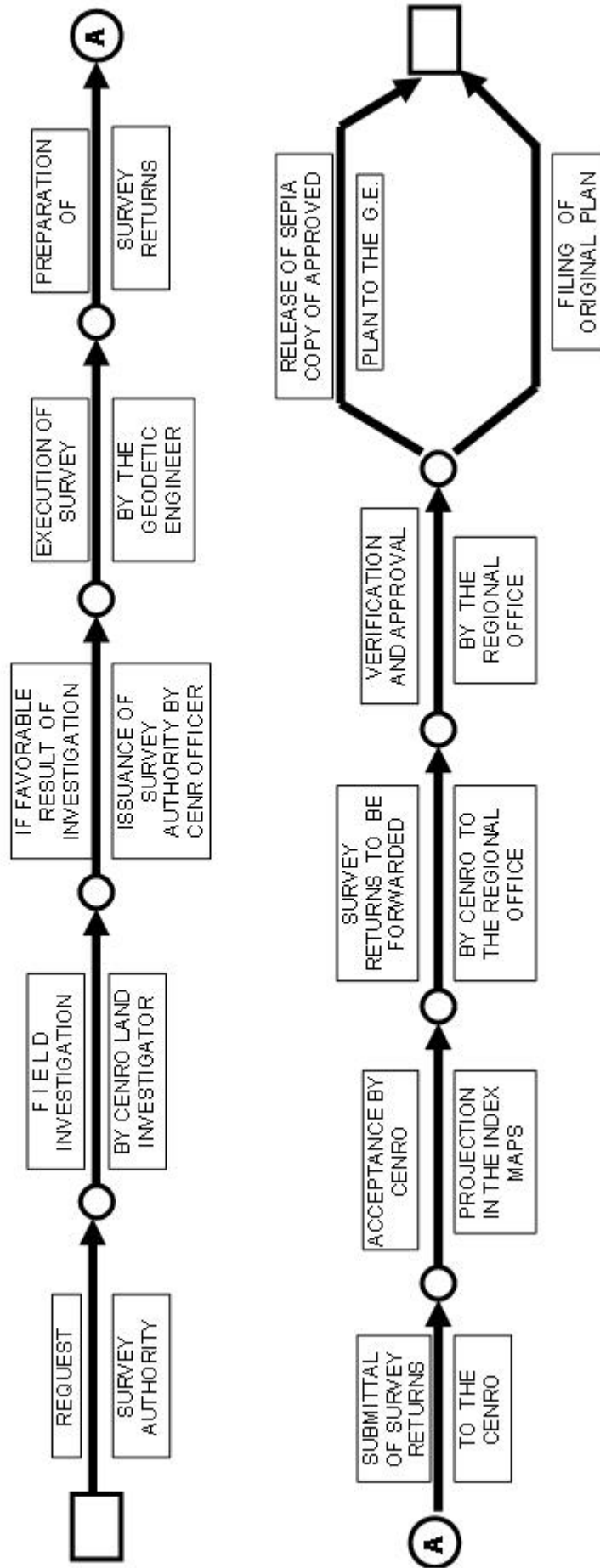
Barangay Representative

Geodetic Engineer/Chief of Party

Note: All distances are approximate and are subject to final survey. As per agreement of both parties, the lot corners whenever feasible will be marked with concrete monuments.

XIII. Flowchart for Isolated Survey

**FLOW CHART FOR SURVEY OPERATION
ORIGINAL AND OTHER SURVEY**



XV. Classification and Standard of Accuracy (As per Section 28, DAO 2007-29)

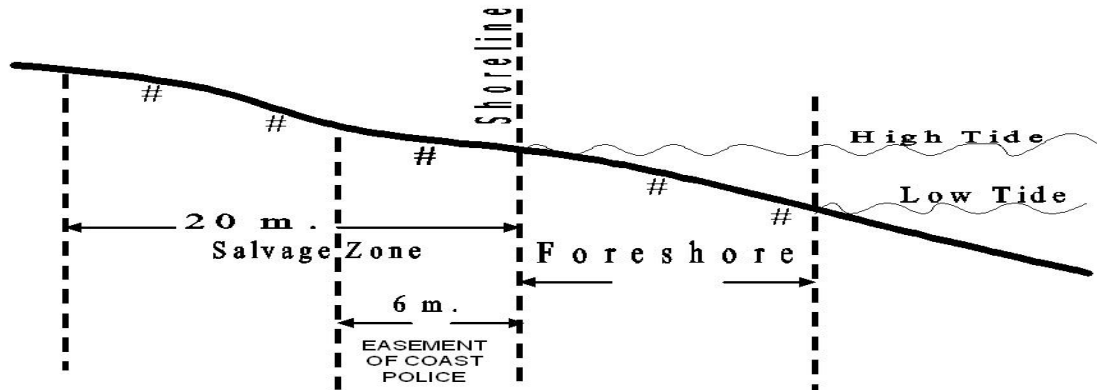
SPECIFICATION	T R A V E R S E		
	Primary	Secondary	Tertiary
Spacing of stations	Between 100 m. to 1,000 m	100 m. to 500 m.	As required
Area to be controlled (hectares)	Over 15,000	1,500 to 15,000	Less than 1,500
* Angular error of closure not to exceed	$2''.5 \sqrt{P}$	$10''.0 \sqrt{S}$	$30''.\sqrt{T}$
No. of observations: Positions with 1" Theo.	2	1	as required
Sets with 20" or 30" transit	6 D/R for interior and exterior angles	4 D/R for interior angle for circuit and loop traverse clamped	clamped plate
** Linear error of closure not to exceed	0.0001 Pp (5cm per km)	0.0002 Ps (10cm per km)	0.05 t (20cm per km)
Azimuth reading	1"	10" to 15 "	30" to 1 minute
Instrument least reading	1" Theo 20" to 30" transit	1" Theo or 20" to 30" transit	1 minute transit
Astronomic obsn: No. of series night or day	8 or 4, am and 4,pm	4 or 2,am and 2,pm	
Probable error of astro. obsn not to exceed	5"	10"	15"
Azimuth checks not to exceed	20"	30"	as required
No. of stations between azimuth checks not to exceed	25	35	50
*** Distance Measurement	Nearest mm. with Cs, C t, Cp Cg and Csl measured twice	Nearest mm. with Cs, Ct, Cp Cg and Csl measured twice	Nearest cm. measured once
Probable error or distance measurement not to exceed	1:40,000	As required	As required

Vertical accuracy	12.0 mm. multiplied by the square roots of the Distance		
Relative error after azimuth adjustment	1:20,000	1:10,000	1:5,000
<p>* P, S, T is the no. of stations ** P p, P p, P t is the perimeter of the control *** Cs, Ct, Cp, Cg, & Csl is correction due to sag, temperature, pull, grade & sea level</p>			

SPECIFICATION	TRIANGULATION		
	1-3 Km	1 Km	Consistent with good sighting
Spacing of stations not to exceed	1-3 Km	1 Km	Consistent with good sighting
Angular observations Position with 1" theodolite	2	2	as required
Set with 20-30" transit	6 D/R for interior and exterior angle	4 D/R for interior and exterior angle	2 D/R
Triangle closure not to exceed Base Measurement:	5"	10"	30"
Probable error not to exceed	1:40,000	as required	as required
Check on based not to exceed	1:20,000	1:10,000	1:5,000

XVI. Physiographic Features

A. Foreshore Land



Foreshoreland – refers to that part of the shore which is alternately covered and uncovered by the ebb and flow of the (equinoctial) tide.

Shoreline – is the line along the sea coast reached by the highest Equinoctial Tide.

Salvage Zone – is an easement of lands bordering the seas, gulfs, bays, or ports measured landward from the interior limit of the shoreline.

Easement of Coast Police- is the obligation to leave a Right-of-Way Six (6) meters wide within the Salvage Zone.

Buffer Zone- refers to a strip of land with natural or established vegetation which provides an added layer of protection to the natural forest including mangrove forests. This is usually between 50 to 100 meters measured from the shoreline and towards inland and includes the salvage zone

B. Bodies of Water Bordering Lots (Article 11, DAO 2007-29)

For the purposed of the manual, the following are defined:

1. **Arroyo** - shall be a narrow natural bed or channel through which the water flows continuously or intermittently throughout the year.
2. **Estero** - shall be any bed or channel trough which stagnant, dirty or salt water flows under the influence of the tides.
3. **Creek** - is stream of water longer than a brook that empties into the rivers.
4. **River** - shall be any wide natural bed or channel through w/c water flows continuously or intermittently throughout the year.
5. **Lake** - shall be considerable inland body of standing water, also an expanded part of a river.

6. **Pond** - is a body of water naturally or artificially confined and usually smaller than a lake.
7. **Pool** - is a small body of standing stagnant water.
8. **Seacoast** - is a shore or border of the land adjacent to the sea or ocean.
9. **Natural bed or channel of arroyos, esteros, creek or rivers** - shall be the ground within the banks covered by water during the highest floods which does not cause inundation.
10. **Navigable esteros or rivers** - shall be those which contain sufficient water to allow rafts, boat, cascos, etc., to float thereon and engage in transportation or other activities.
11. **Buffer zone** – shall refer to a strip of land with natural or established vegetation which provides an added layer of protection to the natural forest including mangrove forest. (Section 57, DAO 2007-29)

XVII. Procedures and Formulas

A. Survey Instrument Operations:

1. Electronic Total station Operation:

- a. Based on the Network Design, determine the route to be followed. The observer should properly note down the designation of the monuments set on the ground.
- b. Occupy the first monument with the tripod's center approximately above the center mark of the said monument. The tripod screw must be tightened to secure its legs.
- c. The ETS must be placed at the tripod head and securely mounted on it using the threaded centering screw. However, the screw is loosened slightly to enable the instrument to be shifted laterally on the tripod head for precise positioning over the monument center point.
- d. Initially level the instrument over the mark by centering the circular bubble by adjusting the tripod legs. Tighten screws on the tripod legs. Be sure also that the tribrach is securely fastened.
- e. To accurately level the instrument, use the leveling screw and simultaneously check its position using the optical plummet as against the center marking of the monument. When exactly over the center of monument mark, tighten the tripod centering screw to securely fasten the instrument on the tripod.
- f. Check if the circular bubble is in the center of the circular bull's eye spirit vial. If off-centered, it means that the instrument is not in the level position. It may be centered by adjusting the tripod legs. Check also that the cross hair of the optical plummet is centered on the station mark.
- g. If the circular vial bubble is still off-centered, level the instrument using the tubular plate level vial by rotating the instruments alidade so that the tubular spirit vial on the top plate is parallel to an imaginary line running through the centers of any pair of leveling screws. The bubble in the tube is centered by rotating those two screws simultaneously in a direction either towards each other or away from each other.
- h. Next, the instrument is rotated 90° , and the bubble is centered in the tube with the one screw that was not used before. This process with the plate level vial is repeated for additional 90° revolutions of the instrument until the bubble remains centered in all positions.
- i. Simultaneous with the setting up and leveling of the ETS on one station, the prism at the same time, is being set up on the tripod over the other point.
- j. The ETS is turned on. Observe the instrument's warm up and battery check. Atmospheric correction factor, prism constant, etc. may be entered into the instrument, if needed, at the end of battery check.
- k. The operating mode shall be set with a switch on Fine Measuring Mode. Other data such as height of instrument, elevation of the ground, coordinates of the point, etc. may be entered into the instrument;

- l. The telescope is aimed at the backsight station and the upper-and lower-motion clamps are tightened.
- m. The ETS is then approximately aimed at the prism(s) using the attached sighting device and accurately centering the line of sight using the theodolite telescope. If the other end of the line is too far for visual confirmation, the proper alignment with the prism(s) can be determined upon hearing an audible tone.
- n. The measurement shall only be started upon making sure that the signal between the ETS and the prism is stable. The proper alignment and the absence of obstructions are indicated by optimized return signal level which shall be displayed by the instrument.
- o. The instrument shall be switched to horizontal angle mode and set to zero (the value $h = 00.00.00$ is displayed on the LCD or LED). The vertical angle mode shall also be switch and set to zero (the value $v = 00.00.00$ is displayed).
- p. Measurement of both the angles (horizontal and vertical) and distances shall be made by pressing appropriate switch or button; on some instruments, measurement is made automatically when the return signal is optimized. Both the horizontal and slope distances shall be recorded. Each primary line shall be measured ten (10) times and must have a rejection limit of not greater than 0.005 meter from the mean.
- q. Transfer the instrument to the next station as per Network Design, upon acquisition of sufficient number of observations. Cautions should be taken when transferring from one station to another due to the sensitivity of the electronic component of the instrument.

2. Engineer's Transit

- a. Based on the sketch of the lot and with consideration on the situation of adjoining lots, extent of man-made structures and presence of natural features, determine the route to be followed. The observer should properly note down the designation of the corner monuments planted on the ground.
- b. Orient the instrument at the first monument (presently occupied) with the magnetic meridian.
- c. Loosen the upper motion and rotate the instrument about its vertical axis and sight on the monument at the backsight (the monument preceding monument presently occupied). Tighten upper motion and bisect the backsight monument at its center rod with the upper tangent screw.
- d. Read the inner circle at vernier A of the engineers transit. Record this as the azimuth of the first monument.
- e. Read the compass box. Record the reading pointed by the N-end of the compass needle as the magnetic bearing of the line from the first monument to the backsight monument.
- f. Loosen upper motion and sight on the foresight monument (the monument next to the monument presently occupied). Tighten upper motion and bisect the foresight monument at its center rod with the upper tangent screw.
- g. As in steps (d) to (e), read and record the azimuth and magnetic bearing.

- h. Read and record the stadia distance and difference in elevation from the monument occupied (first monument) to the foresight monument (second monument).
- i. Measure by tape and record the distance from first to second monument.
- j. Observe the following before transferring instrument to the 2nd monument:
 - 1) Clamp telescope in a vertical position.
 - 2) Tighten needle lifter of the compass.
 - 3) Loosen lower motion and leave upper motion clamped.
 - 4) Bring leveling screws to the same height and center instrument on the foot plate.
 - 5) Loosen all screws of the tripod legs.
 - 6) Hold the plumb bob or detach it from the tripod and keep it in the instrument box.
 - 7) Bring the legs of tripod together and carry the instrument under the arm or on the shoulder.
- k. Set up the transit over the 2nd monument.
- l. Check the recorded azimuth of 1st to 2nd monuments (the azimuth at the 1st occupied monument when the 2nd monument was sighted) from vernier A inner circle. Note down under remarks if vernier A inner circle reading varies from recorded reading.
- m. Backsight at the 1st occupied monument with inverted position of the telescope tightening lower motion and bisecting it at its center rod with the lower tangent screw.
- n. Loosen upper motion and foresight on the 3rd monument with telescope inverted. Tighten upper motion and bisect the 3rd monument at its center rod with the upper tangent screw.
- o. Read inner circle reading at vernier B. Record this as the azimuth of the 2nd monument to 3rd monument.
- p. Record the reading pointed by the S-end of the needle of the compass box.
- q. Read and record the stadia distance and difference in elevation from the monument occupied (2nd monument) to the foresight monument (3rd monument)
- r. Measure with tape and record the distance from 2nd to 3rd monument.
- s. Follow step (j) and transfer instrument to 3rd monument.
- t. Set up the instrument over 3rd monument.
- u. Check the recorded azimuth of the 2nd to 3rd monument from vernier B inner circle reading. Note down the actual reading as in step (l).
- v. Backsight at 2nd monument with direct position of the telescope.
- w. Loosen upper motion and foresight on the 4th monument with direct position of the telescope. Tighten upper motion and bisect 4th monument at its center rod with the upper tangent screw.

- x. Record inner circle reading at vernier A. Record this as the azimuth of the 3rd monument to 4th monument.
- y. Read the compass box. Record the reading pointed by the N-end of the compass needle as the magnetic bearing of the line from the 3rd monument to 4th monument.
- z. Read and record the stadia distance and difference in elevation from the monument occupied (3rd monument) to the foresight monument (4th monument).
- aa. Measure by tape and record the distance from 3rd to 4th monument.
- bb. Transfer the instrument to the 4th monument. Follow steps (l) and (m) this time backsighting at the 3rd monument and foresighting at the next monument until the observation returns to the point of origin (1st monument). Record the usual observations stated in step (o) to (r).

B. Astronomical Observations

1. Time Determination

$$\text{Tangent } \frac{1}{2}T = \sqrt{\cos S \sec (S-P) \sin (S-H) \csc(S-L)}$$

Where:

T = Hour angle of the observed celestial body

$$S = \frac{1}{2} (P+H+L)$$

H = Observed altitude of the celestial body, corrected for refraction in case of stars and parallax and refraction in the case of the sun.

L = Latitude of the place of the observation.

P = North polar distance of the celestial body

2. Latitude Determination

- a. By Polaris or Circumpolar star:

$$\text{Lat} = h - p \cos t + \frac{1}{2} p^2 \sin^2 t \tan h \sin 1''$$

Where:

h = corrected mean observed altitude

t = hour angle of Polaris or any circumpolar star (difference between sidereal time and the star's right ascension)

p = polar distance in second of Polaris or any circumpolar star.

- b. By Sun or star at meridian passage:

For the star's and the sun's center south of the zenith but north of the equator:

$$L = Z + D$$

For those south's of the zenith but north of the equator:

$$L = Z - D$$

For those north of zenith and north of the equator:

$$L = D - Z$$

Where :









L = Latitude of observer

Z = Zenith distance of celestial body

D = Declination

3. Procedure for Solar Observation for azimuth determination:

- a. Set up the instrument over the station and level the instrument.
- b. Set the vernier plate or micrometer reading to 00°00' 00' and sight the rearward station, the azimuth of which is to be determined using the lower motion and lower tangent screw.
- c. Screw the colored prismatic glass to the eyepiece and using the upper motion and upper tangent screw turn the telescope toward the sun.
- d. Observe the sun in accordance with the following tangent positions and record the time, vertical angle or zenith distance and horizontal angle for each sighting as shown by the following example:

Set	Telescope Position	Time	Horizontal Circle Reading	Zenith Angle
I	(1) 	8:34:10	69-56-03	50-58-39
	(2) 	8:34:39	70-41-18	50-20-20
	(3) 	8:35:36	250-47-55	309-22-44
	(4) 	8:36:19	250-11-41	310-04-00
II	(5) 	8:36:48	250-15-26	309-38-47
	(6) 	8:37:18	251-01-00	310-17-35
	(7) 	8:38:25	71-10-11	50-00-35
	(8) 	8:38:57	70-32-26	49-20-43

- | | |
|-----------------------|-----------------------|
| (1) Telescope direct | (5) Telescope reverse |
| (2) Telescope direct | (6) Telescope reverse |
| (3) Telescope reverse | (7) Telescope direct |
| (4) Telescope reverse | (8) Telescope direct |

- e. After the eight sightings, turn the telescope to the rearward station using the upper motion then read and record the horizontal angle. The time interval between successive sightings shall in no case exceed two minutes. The eight sightings constitute one series of observation and shall be completed within twenty minutes otherwise the results shall be voided and another series shall be made.
- f. The allowable horizontal a closure shall be within +/- 30 seconds of arc and must be distributed equally among the horizontal angle readings.

- g. After the observations have completed, test the accuracy of observations by determining the rate of motion of the sun. This is to detect any mistake in the observations and to be able to make additional series as required.

The test for solar variation shall be made by horizontal and vertical variation methods as follows:

- 1) To find the variation in horizontal angle divide the difference in horizontal angle readings by the corresponding difference in time. Combinations are from any two horizontals readings from the left-side of the telescope vertical cross-hairs or any two readings from the right-side of the vertical cross-hairs.

$$HVar = \frac{(H_n - H_m)}{(T_n - T_m)}$$

(1) (4-1) (5) (8-4) (9) (7-2)

(2) (5-1) (6) (8-5) (10) (6-3)

(3) (8-1) (7) (3-2) (11) (7-3)

(4) (5-4) (8) (6-2) (12) (7-6)

- 2) To find the variation of vertical angle divide the difference in vertical angle readings by the corresponding difference in time. Combinations are from any two vertical readings from the upper-side of the telescope horizontal cross-hair or any two readings from the lower-side of the horizontal cross-hair.

$$Vvar = \frac{(V_n - V_m)}{(T_n - T_m)}$$

(1) (3-1) (5) (7-3) (9) (8-2)

(2) (5-1) (6) (7-5) (10) (6-4)

(3) (7-1) (7) (4-2) (11) (8-4)

(4) (5-3) (8) (6-2) (12) (8-6)

In both cases, the results should not differ from the mean variation by more than two seconds of arc per second of time. Other combinations using the mean of a direct and reverse positions shall be used to determine the variation.

Additional safeguard against mistake in observations shall be determined by noting that the average apparent angular diameter of the suns is about thirty-two minutes of arc divided by secant of altitude in horizontal.

4. Observations on circumpolar star for azimuth at elongation:

$$\cos t = \tan L \cot D$$

$$\sin Z = \sin P \sec L$$

Where:

t = hour angle of the star at western elongation, and

$t = 24 - t$ at eastern elongation

L = latitude of place

D = declination of star

P = north polar distance of star

The time shall be determined from the following formulas:

$$S = \alpha_{\text{star}} + t_{\text{star}}$$

$$S = (\alpha_{\text{sun}} + 12\text{h}) + T$$

Where:

S = side real time

α_{star} = right ascension of star

T = local civil time

T_{star} = hour angle of star

α_{sun} = right ascension of sun

5. The procedure for observing stars for azimuth at elongation shall be as follows:

a. Find sidereal time of elongation:

1) Compute the hour angle (t) of the star of elongation

$$\cos t = \tan L \cot D$$

2) Add the hour angle for western or eastern elongation to the right ascension of the star to get sidereal time.

b. Find the local civil time at the same instant.

a) Determine the $(\alpha_{\text{sun}} + 12\text{h})$ corrected for longitude.

b) Subtract the result of (a) for the sidereal time determine in step (1). The result is sidereal interval which shall be converted to local civil time by the application of correction from sidereal into mean solar time.

c) The result shall be corrected for longitude difference to reduce to 120° E time.

- c. Set the instrument over the station in position at least thirty minutes before the time of elongation.
 - d. Set the micrometer (vernier) reading to approximately 00°00 '00" and sight the azimuth mark.
 - e. About five minutes before elongation bisect the star with the cross wires and follow it as it moves toward elongation using the tangent screw.
 - f. At elongation, read and record the horizontal angle and time.
 - g. Reverse the telescope, bisect the star again and read and record the horizontal angle and time.
 - h. Return the telescope to the azimuth mark and check the closing reading.
6. Formula for determining azimuth of a line by observations on the sun or stars at any hour angle:

$$\text{Cot } \frac{1}{2} A = \frac{\sec S \sec (S-P) \sin (S-H) \sin (S-L)}{\dots}$$

The result shall be checked using the formula:

$$\text{Cos } A = \tan H \tan L - \cos P \sec H \sec L$$

In both formulas:

A = angle between the celestial body and the south

H = observed altitude of the celestial body corrected for refraction in case of stars and for parallax and refraction in the case of the sun.

L = Latitude of the place of observation

P = north polar distance of the observed celestial body

$$S = \frac{1}{2} (P + H + L)$$

P = 90 - D when the declination is north, and

P = 90 + D when the declination is south.

D = apparent declination of the observed celestial body. The signs of D should be reversed for south declinations.

In the morning the azimuth of sun is 360° - A and in the afternoon, the azimuth of sun is equal to A. If the station mark is left of the sun, the horizontal angle is to be subtracted from the azimuth of the observed celestial body; if to the right it is to be added.

C. Projection System Transformation

1. Philippine Plane Coordinate System
 - a. Transformation: Local Coordinate to Grid
 - b. Transformation: Grid to Geographic
 - c. Transformation: Geographic to Grid
2. Philippine Reference System of 1992 (PRS92)
 - a. Transformation: WGS84 to PRS92 and vice-versa
 - b. Transformation: PRS92 to PPCS and vice-versa

XVIII. List of Friar Lands

Name of Estates and Provinces	Location	Area in Hectares
Bataan 1. Orion	Orion, Bataan	935.4741
Bulacan 1. Binagbag 2. Dampol 3. Guiguinto 4. Lolomboy 5. Malinta 6. Matamo 7. San Marcos 8. Sta. Maria de Pandi	Angat, Bulacan Plaridel, Bulacan Guiguinto, Bulacan Bocae, Marilao, San Jose del Monte & Sta. Maria, Bulacan Polo, Bulacan Malolos, Bulacan Calumpit, Bulacan Angat, Bigaa, Bucaue, Bustos, Sta. Maria & Pandi, Bulacan	281.8099 926.4915 929.9936 5,207.8943 3,514.8021 11.7290 87.3289 10,1 53.4477
Cavite 1. Imus 2. Naic 3. Sta. Cruz de Malabon 4. San Francisco de Malabon	Imus, Bacoor, Kawit, & Dasmaringas, Cavite Naic & Indang, Cavite Tanza, Cavite General Trias & Rosario, Cavite	17,166.3660 7,270. 5635 9,558.6963 11,128.4573
Cebu 1. Banilad 2. Talisay - Minglanilla	Cebu City Talisay & Minglanilla, Cebu	1,873.8061 8,154.9058
Isabela 1. Isabela	Aurora, Antatet, San Mateo, Cabatuan, Isabela	19,506.9267
Laguna 1. Binan 2. Calamba 3. Sta. Rosa	Binan, Laguna Calamba, Laguna Sta. Rosa, Laguna	3,563.7399 13,364.9758 5,413.3436
Occidental Mindoro 1. San Jose	Sa Jose, Occ. Mindoro	22,484.8150
Rizal 1. Muntinglupa 2. Piedad 3. Tala	Muntinglupa Caloocan City Caloocan City	2,816.9507 3,812.5498 6,991.4314
TOTAL	23 Estates	154,976. 4930

XIX. Monument Recovery Sheet

PR382 FORM No. _____

MONUMENT RECOVERY SHEET

LAND MANAGEMENT SERVICE DENR REGIONAL OFFICE No. _____	MONUMENT TYPE BLLM No. 1		
SURVEY No. _____ GEODETIC ENGINEER: _____ DATE of SURVEY: _____ DATE ESTABLISHED: _____	GEOGRAPHIC COORDINATES		
	OLD		
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">LATITUDE</td> <td style="width: 50%; text-align: center;">LONGITUDE</td> </tr> </table>	LATITUDE	LONGITUDE
	LATITUDE	LONGITUDE	
PR382			
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">LATITUDE</td> <td style="width: 50%; text-align: center;">LONGITUDE</td> </tr> </table>	LATITUDE	LONGITUDE
	LATITUDE	LONGITUDE	
GRID COORDINATES			
ISLAND: _____ REGION: _____ PROVINCE: _____ CITY/MUNICIPALITY: _____ BARANGAY: _____ SITE DESCRIPTION: _____	UPCS		
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">NORTHING</td> <td style="width: 50%; text-align: center;">EASTING</td> </tr> </table>	NORTHING	EASTING
NORTHING	EASTING		
	PPCS/ TSI LUDON 1911		
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">NORTHING</td> <td style="width: 50%; text-align: center;">EASTING</td> </tr> </table>	NORTHING	EASTING
NORTHING	EASTING		
ACCESS: _____ _____ _____ REMARKS: _____ _____ _____	PPCS/ TSI PR382		
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">NORTHING</td> <td style="width: 50%; text-align: center;">EASTING</td> </tr> </table>	NORTHING	EASTING
NORTHING	EASTING		
SKETCH	PHOTO (TOP VIEW)		
	PANORAMIC PERSPECTIVE VIEW		

GPS STATION FIELD SHEET

Page No. ____

ANTENNA SETUP: Tripod / Plumbing Pole Ground Plane / NO Ground Plane

DATE		STATION	
Province		8 Character I.D.	
City / Mun.		Day Number	
Barangay		Session Number	
Sitio		Receiver Type	
Observers		Receiver S/N	
Survey Type		Antenna Type	
Frequency		Antenna S/N	

Antenna Height	Slope 1	T. V. 1
	Slope 2	T. V. 2
	Slope 3	T. V. 3
	MEAN	MEAN True Vertical
Measured to:		

Local Time

Scheduled Start Time		Actual Start Time	
Scheduled Stop Time		Actual Stop Time	
Available Memory	Start:	Stop:	

Position

C/A Latitude	C/A Longitude	C/A Height	PDOP

Station Monument

Size	Length:	Width:	Height:
Type of Mark			
Inscription			

Comments:

XXI. Final Notification to the Lot Claimants covered by On-going Cadastral Survey Project

- A. The Final Notification Letter in English which also known as “30-day notice” is shown as follows:

PUBLIC NOTICE

All persons claiming land within the Barangay of _____ municipality of _____, who have lot filed claim to such parcels of lands in connection with the cadastral survey, are hereby notified to do so at the office of the cadastral survey party within 30 days from the date hereof to given notice or enter such protest as the case may require to protect their rights as claimants, or to protest against any action of the geodetic engineer or survey made by him, in default wherefore it shall be understood that there are no further claims or pending protests.

Chief of party _____ Cadastre
Cad - _____

- i. The following certificate shall be attached to one copy of the notice in each language and local dialect:

“I hereby certify that copies if the attached notices were posted in conspicuous places in the Barangay of _____ on _____ 20 ____ and on the municipal building of _____.

Chief of party _____ Cadastre
Cad - _____

XXII. Plotting of BBIM and MBIM

Barangay Boundary and Index Maps (BBIM) and Municipal Boundary and Index Maps (MBIM) shall be prepared and drawn in the grid system on drafting material of stable base and of uniform size of 54 x 54 centimeters, using a scale based on the maximum differences in northings or easting, whichever is bigger, tabulated as follows:

Maximum difference in coordinates	Scale to be used
0 to 2400	1 : 8000
2400 to 3600	1 : 12000
3600 to 4800	1 : 16000
4800 to 6000	1 : 20000
6000 to 9000	1 : 30000
9000 to 12000	1 : 40000
12000 to 18000	1 : 60000
18000 to 24000	1 : 80000
24000 to 30000	1 : 100000
30000 to 36000	1 : 120000
36000 to 45000	1 : 150000
45000 to 60000	1 : 200000
60000 to 75000	1 : 250000
75000 to 90000	1 : 300000

XXIII. System of Numbering Cadastral Maps

A. The extreme west and east meridians and the stream south and north parallels of cadastral maps in scale of 1:4000 shall be full minute's meridians and parallels, respectively.

1. The latitude and longitude of the point of intersection of the extreme west meridian and extreme south parallel of each spheroidal quadrangle shall be used to designate the corresponding map number of the quadrangle. If the latitude and longitude of the point of intersection of the extreme west meridian and extreme south parallel of the maps are 14° 49' N and 120° 54' E, respectively, the map shall be numbered as follows:

CM14° 49' N - 120° 54' E.

2. Sectional cadastral maps in the scales of 1:2000 may be prepared to indicate the NW, NE, SE, and SW section of the standard cadastral maps and shall be numbered, respectively as follows:

NW Quadrant CM 14°49'N - 120°54'E sec.1
NE Quadrant CM 14°49'N - 120°54'E sec.2
SE Quadrant CM 14°49'N - 120°54'E sec.3
SW Quadrant CM 14°49'N - 120°54'E sec.4

3. Sectional cadastral maps in the scale 1:1000 may be prepared to indicate NW, NE, SE and SW quadrant sections of the sectional cadastral maps scale 1:2000 and shall be numbered, respectively as follows:

NW Quadrant CM 14°49'N - 120°54'E sec.1-A
NE Quadrant CM 14°49'N - 120°54'E sec.2-B
SE Quadrant CM 14°49'N - 120°54'E sec.3-C
SW Quadrant CM 14°49'N - 120°54'E sec.4-D

4. Sectional cadastral maps in the scale 1:500 may be prepared to indicate NW, NE, SE, and SW quadrant sections of the sectional cadastral maps of scale 1:1000 and shall be numbered, respectively as follows:

NW Quadrant CM 14°49'N - 120°54'E sec.1-A-NW
NE Quadrant CM 14°49'N - 120°54'E sec.2-A-NE
SE Quadrant CM 14°49'N - 120°54'E sec.3-A-SE
SW Quadrant CM 14°49'N - 120°54'E sec.4-A-SW

5. Sectional cadastral maps in the scale 1:250 may be prepared to indicate NW, NE, SE and SW quadrant sections of the sectional cadastral map scale 1:500 and shall be numbered, respectively as follows:

NW Quadrant CM 14°49'N - 120°54'E sec.1-A-NW-1
NE Quadrant CM 14°49'N - 120°54'E sec.2-A-NE-2
SE Quadrant CM 14°49'N - 120°54'E sec.3-A-SE-3
SW Quadrant CM 14°49'N - 120°54'E sec.4-A-SW-4

B. Other sectional cadastral maps on larger scale may be likewise prepared. The general rule in numbering sectional cadastral map is as follows:

The first sectional cadastral map number shall be assigned to the top left (NW) quadrant; the second, to the top right (NE) quadrant; the third, to the bottom right (SE) quadrant and at last, to the bottom left (SW) quadrant.

XXIV. Scales to be used in Plotting Isolated Survey Plans

Scale to be used	Maximum Difference in Coordinates
1 : 100	0 to 30 meters
1 : 200	30 to 60 meters
1 : 300	60 to 90 meters
1 : 400	90 to 120 meters
1 : 500	120 to 150 meters
1 : 600	150 to 180 meters
1 : 800	180 to 240 meters
1 : 1000	240 to 300 meters
1 : 2000	300 to 600 meters
1 : 3000	600 to 900 meters
1 : 4000	900 to 1200 meters
1 : 5000	1200 to 1500 meters
1 : 6000	1500 to 1800 meters
1 : 8000	1800 to 2400 meters
1 : 10000	2400 to 3000 meters

XXV. Illustrations for Uniform inscriptions on the "Notes" of the Isolated Survey Plans:

1. Description of corners as:
 - a) All corners marked "P.S." are cylindrical concrete monuments 15 x 50 centimeters.
 - b) All corners not otherwise described are stakes (or pegs, or "x" on boulders or concrete nail on wall or tree).
2. Adverse claims as:
 - a) Lot 2 is claimed by Juan de la Cruz
 - b) Lot 3 is a portion of Psu-610427 as surveyed for Bien Cruz.
3. Relation with any cadastral or public land subdivision survey project or reservation (if survey is near a known reservation), as:
 - a) This survey is outside Cad 69, Pagsanjan Cadastre.
 - b) This is outside Ancestral Domain/Lands
 - c) This is outside Fort Bonifacio reservation
4. If lot is a portion of undecreed cadastral lot, the cadastral lot number pertaining to said portion, as:

Lot 7 = Lot 2010, Cad-666, Famy Cadastre
5. Classification of lot, as:
 - a) For survey inside classified/unclassified forest:

This survey is within classified/unclassified forest and therefore shall not be the basis for registration or titling purposes.
 - b) For original survey:

This survey is inside the alienable and disposable area, Block B, Project No. 4-A, Land Classification Map No. 2423 for the Province of Surigao

The survey was approved based on the investigation report submitted by Deputy Public Land Investigator Jack Ibagbaga dated April 27, 1961.
 - c) For complex subdivisions

This subdivision survey is in conformity with the approved subdivision scheme.

XXVI. Title of an Isolated Survey Plans:

ORIGINAL SURVEY _____ Surveyed: _____ Approved: _____
Card/Pis/Gss _____
Lot No. _____ Patent No. _____ Date _____
Decree No. _____ Date _____ LRC Rec. No. _____
OTC No. _____ Dated _____ Issued to _____
TCT No. _____ Dated _____ Issued to _____

PLAN OF LAND

AS SURVEYED FOR

(Name of Claimant)

SITUATED IN THE

URBAN CODE _____
BARANGAY OF _____
MUN/ CITY OF _____
PROVINCE OF _____
ISLAND OF _____
Containing an area of _____ Sq. M.

PPCS-TM/PRS-92 ZONE NO. :
BEARINGS :
SCALE :
(GRAPHICAL SCALE) :

I hereby certify that this is a correct plan of the survey made by me personally or under my direct supervision in conformity with the provision of RA 8560, as amended, otherwise known as "The Geodetic Engineering Act of 1998" and the rules and regulations of the Department of Environment and Natural Resources.

I further certify that this plan accurately indicates the boundaries of the property as pointed to me on the ground by the survey claimant or his authorized representative and/or based on the available legal and/or official technical documents and that I assume full responsibility for the technical correctness of the survey and accuracy of the monument setting.

Date of Survey:

Geodetic Engineer
PRC ID No. _____ Date _____
PTR No. _____ Date _____
TIN No. _____

Republic of the Philippines
 Department of Environment and Natural Resources
 Land Management Services
 Regional office _____

 (Location of Office)

The survey plotted herein is found to be in order as per submitted survey returns of the Geodetic Engineer and therefore recommended for approval.

Chief, Regional Surveys Division

Date Approved: _____

(This approved plan, however, shall not be construed as title to the land)

Regional Technical Director for Lands

Date Submitted / Re-submitted	Date Returned	Remarks	Documents Received by:

Printed Name & Signature

Date

Position verified by: _____
 Projected on PM _____ N _____ E by _____
 Field notes checked by: _____
 Traverse Computation checked by: _____
 Astronomical Computation checked by: _____
 Lot Data Computation checked by: _____
 Plotted/Inked by: _____
 Traced by: _____
 Checked and verified by: _____

ADDITIONAL INFORMATION AFTER DATE OF APPROVAL

XIV- ISOLATED SURVEY RETURN CHECKLIST REQUIREMENTS TABULATED

1. Survey envelope with plastic cover	
2. Survey verification fee payment	26. payment of cadastral survey cost if cad lot and proportional survey cost for PLS if needed
3. Transmittal letter of survey return	27. BF AR survey authority
4. Original drafting film plan/indicate easements, improvements(lat/long) etc.	28. BFAR endorsement letter
5. Copy of latest tax declaration	29. Request for advance survey
6. Lot data computation	30. DENR survey authority for advance and verification survey
7. Traverse computation	31. certified extracts of computations
8. Reference computation(certified)	32. certified extracts of field notes cover
9. Boundary computation (certified if untitled)	33. payment fee for advance survey
10. Astronomical computation	34. surrender of tracing plan or polyester plan copy
11. Field notes with cover duly notarized	35. certified Xerox copy of title by ROD (within 3 months from submission)
12. Survey Notification Letter	36. HLURB/LGU approval of subdivision plan scheme
13. Documentary stamp on field notes	37. Affidavit of loss of plan for failure to surrender same
14. GE certificate duly notarized	38. Request for authority by the PEA
15. Affidavit of private ownership	39. Print copy of previous approved plan
16. Affidavit of Joint registration (if more than 1 lot)	40. PPA clearance certification when area surveyed is adjacent to sea/ocean (includes all original surveys adjacent to sea/ocean)
17. Certification fee	41. DENR turnover of jurisdiction to DAR if lot surveyed per DAR/DENR M.C. 14, if not inside DAR resettlement area
18. CENRO certification on LC status	42. GE narrative report duly notarized
19. CENRO survey authority with copy of inspection report	43. Supporting documents (deed of sale, agreement, etc.
20. CENRO endorsement	44. approved scheme of subdivision by LGU/HLURB
21. DAR survey authority (or contract)	45. Resolution from SB
22. MARO/PARO endorsement	46. Development permit
23. CENRO certification on lot disposition status	47. DAR clearance/PALC
24. LRA certification that the lot is not or has not been subject of a land registration case	
25. Request for issuance of advance plan stating purpose	

