



MEMORANDUM CIRCULAR NO. 109
Series of 2025

TO : THE SENIOR DEPUTY ADMINISTRATOR, DEPUTY ADMINISTRATORS, REGIONAL/ DEPARTMENT/ OPERATIONS/ PROJECT/ DIVISION MANAGERS, AND ALL OTHER CONCERNED

SUBJECT : NIA GUIDELINES IN THE CONDUCT OF THE SURVEYING AND MAPPING ACTIVITIES FOR IRRIGATION DEVELOPMENT

In aid with the streamlining of the project preparation stage for irrigation development as enshrined in Memorandum Circular No. 137 series of 2023 or the “*NIA Guidelines in Project Preparation for Irrigation Development*”, the NIA Guidelines for the Conduct of Surveying and Mapping Activities for Irrigation Development is hereby promulgated.

The attached guidelines set the comprehensive surveying and mapping activities to be conducted during the project preparation stages i.e., Preliminary Feasibility Study (Pre-FS), Feasibility Study (FS), Detailed Engineering Study (DES), and Detailed Engineering Design (DED).

This memorandum shall take effect immediately after publication, and shall hereby repealed all existing memoranda inconsistent with these guidelines.

For strict compliance.

ENGR. EDUARDO *EJG* G. GUILLEN
Administrator

Date: 28 NOV 2025



NIA GUIDELINES ON THE CONDUCT OF SURVEYING AND MAPPING FOR THE PROJECT PREPARATION STAGE OF IRRIGATION DEVELOPMENT

SECTION 1. INTRODUCTION

1.1 RATIONALE

The conduct of Surveying and Mapping plays a vital role in providing accurate and reliable data necessary to ensure that projects are completed on time and within the budget. Formulating guidelines to standardize the practice, output, variation methods, and formats of data builds uniformity in project design, feasibility assessment, and cost estimations. As a result, delays, technical errors in planning and design, increased costs, and redundant efforts will be prevented.

In view of the foregoing, this guideline is presented to systematize the surveying and mapping activities and to establish concise information in the conduct, review, and approval of surveying and mapping activities for irrigation development.

1.2 OBJECTIVES

1.2.1 GENERAL

- To establish uniformity in the conduct of surveying and mapping activities;
- To generate accurate and reliable data that is essential in the project preparation stage, up to project implementation; and
- To support existing NIA guidelines and aid in the streamlining of the project preparation stage of irrigation development.

1.2.2 SPECIFIC (for Outsourced Contracts)

A. FEASIBILITY STUDY

To conduct surveying and mapping activities on the proposed Project and to produce a complete, realistic, and acceptable Surveying and Mapping Report and Maps necessary in the preparation of the feasibility study level engineering design and analysis.

B. DETAILED ENGINEERING DESIGN/STUDY

- The engineering survey works aim to validate and verify the accuracy and usefulness of the available topographic map using the survey data from the previously approved Pre-Feasibility Study or Feasibility Study.
- The detailed scope of work in this undertaking is outlined in Memorandum Circular No. ____ series of 2025 or the "*Terms of Reference for the Survey and Mapping Activities*".

1.3 SCOPE

These Guidelines shall apply to the proposed irrigation projects under the project preparation stage, whether conducted by the Administration or outsourced to consultancy services.

SECTION 2. DEFINITION OF TERMS, ACRONYMS AND ABBREVIATIONS

2.1 Definition of Terms

Alignment – refers to the path of a linear feature defined by a straight section, curved section, or a combination of both. It represents the view of a path in the horizontal plane (Horizontal), or the profile of the path showing its slope and steepness (Vertical).

Automatic Level - refers to a precision optical surveying instrument that establishes and verifies points on the same horizontal plane using an internal compensator mechanism, which automatically corrects for slight tilting of the instrument.

Azimuth – The horizontal direction reckoned clockwise from the meridian plane.

Benchmark - shall refer to a permanent or fixed physical marker for a known elevation that can serve as a reference point or a vertical datum from which the elevations of other topographical points or surfaces are measured and controlled for accuracy in leveling.

Boundary Monument – A material object placed on or near a boundary line to preserve and identify the location of the boundary line on the ground.

Centerline – The line connecting opposite corresponding quarter corners or opposite subdivision-of-section corners or their theoretical positions.

Conduit – is an enclosed channel used to convey flows through or under a dam.

COGO Points - shall refer to the points often found in software like AutoCAD Civil 3D, defined by their coordinates in a plane, and also include additional properties such as unique ID, name, and descriptions.

Cross section – a vertical slice or profile of the ground surface, taken perpendicular to a survey line (like a road or river centerline). It essentially shows the elevation changes across a specific location, perpendicular to a chosen alignment.

Dam – is a structure or any artificial barrier and its appurtenances constructed for the purpose of diverting or holding water, other fluids, sediments, including debris for any or whatever purpose.

Digital Level - an electronic surveying instrument that features a digital display showing real-time readings. It uses electronic sensors and image processing to accurately measure height differences, slopes, and angles with a bar-coded staff.

Digital Orthophoto - refers to a corrected digital image acquired from an aerial or satellite imagery, wherein distortions caused by camera perspective and terrain elevation have been removed.

Drainage Area – is the area which drains naturally to a particular point on a river.

Elevation - is referring to the vertical distance of a point above or below a reference point, often mean sea level (MSL).

Geodetic Engineer – shall refer to a natural person with professional expertise in the field of surveying and the corresponding survey data presentation in the form of maps,

plans, geo-spatial digital maps, etc.; either in the government service or in the private practice, and who has been issued a Certificate of Registration and Identification Card by the Professional Regulation Commission (PRC) – Board of Geodetic Engineering pursuant to Republic Act 8560, the Geodetic Engineering Act, as amended.

Geographic Coordinates - refers to a three-dimensional system for specifying locations on Earth using latitude, longitude, and elevation.

GNSS RTK - is referring to a surveying technique that uses a base station and a rover unit providing real-time corrections to address errors in satellite signals to achieve a highly accurate positioning.

Grid Coordinates - is a system used to precisely locate points on a map or grid using a pair of numbers. It is also used to represent positions on a map projection rather than directly on the Earth's curved surface.

GSD Resolution - shall refer to the size of a single pixel on the ground which represents the smallest noticeable ground element in an image in remote sensing and photogrammetry.

Major Contour - refers to the bolder, thicker lines on a topographic map that are labeled with their elevation value.

Mean Sea Level - shall refer to the average height of the sea's surface which serves as a reference point for measuring elevation and depth.

Minor Contour - shall refer to the intermediate elevations between the labeled major contours in a topographic map.

Monument – shall refer to any concrete object that is set permanently in the ground to mark the position of a point or a boundary corner.

Network Adjustment Report - is a report in surveying which summarizes the results of processing survey measurements to determine the most probable coordinates of points within a network.

LAS Format- refers to a vector format for storing LiDAR data as 3D point clouds.

Parallax - shall refer to the object's change in the apparent position with respect to the reference marks of an instrument due to its imperfect adjustment, or to a change in the position of the observer.

Periodic Peg-Test - shall refer to a method used to check the accuracy of a leveling instrument by detecting and correcting an error wherein the line of sight of the level is not perfectly parallel to the bubble tube's horizontal axis.

Planimetric Feature - shall refer to the features that are independent of elevation. (e.g., roads, buildings, rivers, lakes, vegetation)

PRS92 – shall refer to the Philippine Reference System of 1992, a national common coordinate reference system for all surveys and maps pursuant to Executive Order No. 45 dated January 5, 1993, as amended.

Raw Data - shall refer to the unprocessed, original data from a GNSS receiver.

Refraction - refers to the bending of light rays as they pass through the Earth's atmosphere caused by variations in the air's density which changes the speed of light, affecting the accuracy of measurements.

Reservoir – is an artificial body of water or lake formed due to the development of obstruction on a natural waterway or the construction of a barrier or dam on a river channel.

Rinex Data - is a standardized format for storing and exchanging raw data to make it compatible with various software and processing tools.

Side shots – refers to a measurement taken from a survey station to locate a point that is not intended to be used as a base for extending the survey or for further calculations.

Spillway – is a hydraulic structure or an appurtenant structure of a storage dam which discharges flow or functions as an outflow/outlet structure.

Total Station - shall refer to a surveying instrument that combines an electronic theodolite and an electronic distance meter (EDM) that is used to measure horizontal and vertical angles, as well as distances.

TIFF - is referring to a raster image format known for its high quality and flexibility used for storing images, particularly aerial and satellite imagery.

Watershed – is the boundary between the catchment areas or drainage areas.

2.2 Acronyms

AEC	Angular Error of Closure
BBM	Barangay Boundary Monuments
BLLM	Bureau of Lands Location Monuments
BM	Bench Marks
COGO	Coordinate Geometry
CSV	Comma-Separated Values
DAO	DENR Administrative Order
DEM	Digital Elevation Model
DENR	Department of Environment and Natural Resources
DTM	Digital Terrain Model
EO	Executive Order
GCP	Geodetic Control Points
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GSD	Ground Sampling Distance
LAS	LiDAR Aerial Survey
LIDAR	Light Detection and Ranging
MBM	Municipal Boundary Monuments
MC	Memorandum Circular
MOA	Memorandum of Agreement

MOU	Memorandum of Understanding
MSL	Mean Sea Level
NAMRIA	National Mapping and Resource Information Authority
NIA	National Irrigation Administration
NWL	Normal Water Level
OWL	Ordinary Water Level
PPM	Parts per Million
PRS	Philippine Reference System
RA	Republic Act
RTK	Real-Time Kinematic
TIFF	Tagged Image File Format
TOR	Terms of Reference

2.3 Abbreviations

cm.	centimeters
has.	hectares
km.	kilometers
mm.	millimeters

SECTION 3. SCOPE OF WORKS

A. PRELIMINARY FEASIBILITY STUDY

1. Establish Ground Control Points
2. Undertake Topographic Surveying and Mapping for Dam 500 meters Upstream and 500 meters Downstream
3. Undertake Strip Topographic Survey for Main Canal Alignment
4. Undertake a profile and cross-section on 1km upstream and 1km downstream of the river.

B. FEASIBILITY STUDY

1. Establish Ground Control points. *(Specify no. of monuments to be established)*
2. Undertake a strip topographic survey for the main canal, access road, and any other alignment. *(Specify the Length of the strip topo to be conducted)*
3. Undertake topographic surveying and mapping for the dam, reservoir, and service *(specify each area)*
4. Undertake a profile and cross-section survey on 1km upstream and 1km downstream of the river from the Dam Axis, Conduit Alignment, and Spillway Alignment. *(Specify the length to be profiled and cross-section swath width)*

C. DETAILED ENGINEERING DESIGN/STUDY*

1. Undertake validation on the existing established controls.
2. Undertake a map test on the available topographic map from the survey data of previously conducted Pre-Feasibility or Feasibility Study.
3. Update topographic surveying and mapping

***Note:**

If the result of the map test failed, the consultant (if the study is outsourced to a consultancy service) or the implementing office (if the study is conducted inhouse) shall conduct sections III.A.2 to III.A.4 of this section. However, the authorization and

instruction of the procuring entity are required; otherwise, the consultant/implementing office shall not proceed with these survey works.

If the result of the map test is successful, the consultant/implementing office shall conduct section III.B.3 of this TOR. However, the authorization and instruction of the client/procuring entity are required; otherwise, the consultant/implementing office shall not proceed with these survey works.

SECTION 4. SURVEYING AND MAPPING ACTIVITIES

In order to meet the objective of streamlining the project preparation stages set by Memorandum Circular No. 137 series of 2023, the following table indicates the specific activities that should be observed.

Table 1 Survey and Mapping Activities for Preliminary Feasibility Study and Detailed Engineering Study

<15 meters				
INHOUSE				
	Item of Work	Project ID	Pre-FS	DES
1	Establishment of Control Points	a. Data Gathering b. Preparation of Location Map	- Horizontal (Static Observation) - Vertical - Leveling	
	Impounding Dam <15m, Intake, Pump, Diversion Dam Area	c. Fieldwork Validation - Site Condition	4 Primary Controls	
	Reservoir	- Existence of NAMRIA Reference Control Stations (Horizontal and Vertical) - Assessment of the capability of the implementing office to conduct surveying and mapping activities for the next phase of the study.	Primary Control Points -Minimum of 12 control points	
	Main Canal Alignment		Primary Controls - Established at the beginning and at the end of the canal alignment and distributed every 500m interval	
	Service Area	d. Collection of Final Scheme Components e. Preparation of Final Base Map	Less than 100 hectares, a minimum of 6 primary controls. For 101-500 hectares, 8 control points For 501-1,000 hectares, 10 control points. An additional pair of primary control points/stations shall be established for every 1,000 hectares.	
2	Topographic Survey			

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of Surveying and Mapping Activities**

	Impounding Dam <15m, Intake, Pump, Diversion Dam Area		Ground Conventional Survey Method - 500 meters U/S & D/S - 3m to 5m side shot intervals - Highest to lowest peak of Left and Right abutment.	Confirmatory Survey If the Map Test failed: - 500 meters U/S & D/S -3m to 5m side shot interval
	Reservoir		IFSAR	Required: a. Ground Conventional Survey Method - 10m to 20m side shot interval b. LIDAR* - extracted points 3m to 5m meters interval
	Service Area		IFSAR	Required: a. Ground Conventional Survey Method - 10m to 20m side shot interval b. LIDAR - extracted points 3m to 5m meters interval
3	Profile Survey			
	Impounding Dam <15m, Intake, Pump, Diversion Dam Area		Ground Conventional Survey Method - every 10m interval along the center line of the alignment.	

	River		<p>Ground Conventional Survey Method</p> <ul style="list-style-type: none"> - 1km U/S & D/S - every 20m interval along the center line of the river. 	
	Main Canal Alignment		<p>a. Ground Conventional Survey Method</p> <ul style="list-style-type: none"> - every 20m interval along the center line from the proposed head gate to the end check of the proposed main canal and tunnel/link canal. 	
4	Cross-Section Survey			
	Impounding Dam <15m, Intake, Pump, Diversion Dam Area		<p>Ground Conventional Survey Method</p> <ul style="list-style-type: none"> -shall be taken perpendicular to the dam axis at every 20m for the stations with a swath width of 100m - 3m to 5m side shot interval 	
	River		<p>Ground Conventional Survey Method</p> <ul style="list-style-type: none"> -survey shall be extended 20 meters from the centerline of the river bed and shall extend 1km for both U/S and D/S - 3m to 5m side shot interval 	

	Main Canal Alignment		<p>Ground Conventional Survey Method</p> <p>-taken every 20m interval with a swath width of 50m or as prescribed by the irrigation engineer.</p> <p>- 10m to 20m side shot interval</p>	
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Note: Map test shall be conducted by RIO

**A proposal must be submitted for the conduct of LiDAR, which must be approved by the Regional Office if outsourced or by the Central Office if conducted by the field office.*

Table 2: Surveying and mapping activities for Feasibility Study and Detailed Engineering Design

		Inhouse	In-house/Outsource	
Item of Work		Project ID	FS	DED
1	Establishment of Control Points	a. Data Gathering	- Horizontal (Static Observation)	
		b. Preparation of Location Map	- Vertical - Leveling	
	Impounding Dam >15m	c. Fieldwork Validation	4 Primary Controls	
	Reservoir	- Site Condition - Existence of NAMRIA Reference Control Stations (Horizontal and Vertical)	Primary Control - Minimum of 12 control points	
		- Assessment of capability of the implementing office to conduct surveying and mapping activities for the next phase of the study.	Primary Controls - Established at the beginning and at the end of canal alignment and distributed every 500m interval	
Main Canal Alignment				
Service Area	d. Collection of Final Scheme Components	Less than 100 hectares, a minimum of 6 primary controls.		
	e. Preparation of Final Base Map	For 101-500 hectares, 8 control points		
		For 501-1,000 hectares, 10 control points. An additional pair of primary control points/stations shall be established for every 1,000 hectares.		
2	Topographic Survey			

	Dam site		<p>Ground Conventional Survey Method</p> <ul style="list-style-type: none"> - 500 meters U/S & D/S - 3m to 5m side shot interval -Highest to lowest peak of Left and Right abutment. 	Confirmatory Survey
	Reservoir		<p>Required:</p> <ul style="list-style-type: none"> a. Ground Conventional Survey Method - 10m to 20m side shot interval b. LIDAR* - extracted points 3m to 5m meters interval 	Confirmatory Survey
	Service Area		<p>Required:</p> <ul style="list-style-type: none"> a. Ground Conventional Survey Method - 10m to 20m side shot interval b. LIDAR - extracted points 3m to 5m meters interval 	Confirmatory Survey
3	Profile Survey			
	Proposed Dam Structures		<p>Ground Conventional Survey Method</p> <ul style="list-style-type: none"> - every 10m interval along the center line of the proposed dam structure alignment. 	

	River		<p>Ground Conventional Survey Method</p> <p>- 1km U/S & D/S</p> <p>- every 20m interval along the center line of the river.</p>	
	Main Canal Alignment		<p>a. Ground Conventional Survey Method</p> <p>-every 20m interval along the center line from the proposed head gate to the end check of the proposed main canal and tunnel/link canal.</p>	
4	Cross- Section Survey			
	Dam site		<p>Ground Conventional Survey Method</p> <p>-shall be taken perpendicular to the dam axis at every 10m for the stations with a swath width of 300m</p> <p>- 3m to 5m side shot interval</p>	
	River		<p>Ground Conventional Survey Method</p> <p>-shall be taken at an interval of every 20 meters along the center line of the river bed and shall extend one (1) kilometer for both upstream and downstream from the proposed dam axis with a swath width, or as</p>	

			<p>prescribed by the dam engineer</p> <p>- 3m to 5m side shot interval</p>	
	Main Canal Alignment		<p>Ground Conventional Survey Method</p> <p>-taken every 20m interval with a swath width of 50m or as prescribed by the irrigation engineer along the center line.</p> <p>- 5m to 10m side shot interval</p>	

Note:

For In-house Survey activities, the Map test shall be conducted by RIO and CO

For Outsource Survey activities, the Map test shall be conducted by IMO, RIO and CO

**A proposal must be submitted for the conduct of LiDAR, which must be approved by the Regional Office if outsourced or by the Central Office if conducted by the field office.*

SECTION 5. Supervision

The survey activities must be overseen by a licensed Geodetic Engineer, who will be physically present at the project site throughout the survey process. Additionally, all surveys must be properly coordinated with the local authorities.

SECTION 6. Reference Datum

Refer to the Executive Order 321 series of 2004, amending further E.O. 45 series of 1993, as amended, which prescribes the adoption of the Philippine Reference System of 1992 as the Standard Reference System of Surveying and Mapping activities in the Philippines.

All NIA Geodetic Control Points (GCPs) shall have designation/identification of Northing, Easting, and Elevation data as referred to the Philippine Reference System of 1992 (PRS 92) and Mean Sea Level (MSL), respectively, for ready reference in the succeeding phase of activities.

6.1. Horizontal Control

All survey works shall be referenced and tied to a minimum of three (3) existing NAMRIA-certified horizontal control points (Geodetic Control Points – GCPs). Certification for all NAMRIA horizontal control points utilized shall be secured from the National Mapping and Resource Information Authority (NAMRIA) and submitted as part of the project’s geodetic control documentation. Refer to **Annex I** for the list of certified NAMRIA GCPs authorized for use.

If the required minimum of three (3) NAMRIA-certified control points is not available due to site constraints or unavailability within the project vicinity, supplementary control may be tied to the following existing monuments:

- Bureau of Lands Location Monuments (BLLMs)
- Municipal Boundary Monuments (MBMs)
- Barangay Boundary Monuments (BBMs)
- Other permanent monuments established by authorized government agencies

The use of such alternative control points shall be subject to the submission of a NAMRIA-certified Global Positioning System (GPS) Evaluation Sheet for each monument, confirming its positional accuracy and alignment with the national geodetic reference system.

6.2 Vertical Control

Vertical controls shall be referred to and tied to at least a minimum of two (2) or more existing NAMRIA benchmarks (BM) in Mean Sea Level (MSL). Secure a certification of all reference NAMRIA benchmarks (BM) used in the project. See **Annex II** for Vertical Control NAMRIA Certified GCPs.

Note: During the Feasibility Study, if only one (1) vertical Ground Control Point (GCP) is available, personnel from the Central Office shall conduct a verification of the site condition and the status of the existing GCPs. Upon confirmation, the Central Office shall issue a site instruction authorizing the utilization of the available control point for the project. Additionally, approved ground control points established in previous projects may be utilized, provided that they are located within a distance of 15 kilometers from the proposed project site.

6.3. Validation of Existing NAMRIA Reference Control Station

Locate or find all the existing control that is validated during the Project Identification or Pre-Feasibility Study (*Provide Tabulation of Existing NAMRIA Horizontal and Vertical Control*)

If all the validated NAMRIA GCPs and benchmarks exist on the ground, the consultant must provide NAMRIA Certification.

Note: During the feasibility study, if the validated NAMRIA GCPs and benchmarks are disturbed, the consultant must provide additional research data collection for the GCPs and benchmarks around and near the project area.

SECTION 7. CONTROL SURVEY STANDARD ACCURACY

All project control points must be designated as primary controls and should be referred to NAMRIA GCPs and Benchmarks for Horizontal and Vertical Data. The maximum error of closure shall conform to 2nd order of accuracy.

7.1 Static

The project control stations shall be classified accordingly, the azimuth of which shall be determined to the nearest five arc second or better. The double frequency global positioning system using static observation will be employed in establishing the horizontal controls.

The baseline processing report for the GPS static observation must have the statistics, as provided below:

Table 3 GNSS Static Observation Statistics

DESCRIPTION/CRITERIA	VALUE
NRF	1
Chi Square Test	Pass
Redundancy Number	Maximum
Priori Scalar	Less than 20
PPM	1PPM to 0.1 PPM

7.2

Leveling

- a. Conduct a leveling on at least two (2) benchmarks to verify and validate the correctness of the elevation of the two (2) established benchmarks.
- b. If the calculated error on the leveling of two (2) benchmarks is not within the allowable error, additional leveling must be conducted on alternative benchmarks.
- c. All vertical control stations should be tied up to the nearest NAMRIA benchmarks (mean sea level datum) within the project area. These benchmarks shall be used as a take-off using a digital level or electronic level/dumpy level. The digital level or electronic level must undergo a periodic “peg-test” to ensure the accuracy and reliability of the instrument.
- d. The level run closing error (forward and backward direction) should not be greater than 8.4 mm multiplied by the square root of the length of the section in kilometers

$$(8.4 \text{ mm}\sqrt{L})$$

- e. The maximum line of sight shall be 150 meters or less to minimize error due to parallax and refraction.

SECTION 8. DIMENSION OF SURVEY CONTROL MONUMENT

All project control monuments shall be:

- frustum-type concrete;
- 25 cm square on top and 35 cm square at the bottom;
- by 100cm in height, protruding 20 cm above ground level with non-corrosive metal such as brass rods or copper nails embedded at the center; and
- cast in place with class A concrete mix (ratio 1:2:4 of cement, sand, and gravel) and reinforced with steel bar (10 mm vertical bars and 8 mm ties).

The top surface of the monument shall be engraved with the corresponding markings “Control Name, NIA & Year, and Project Name” (See Annex III)

SECTION 9. ESTABLISHMENT OF NIA CONTROL POINTS/STATIONS

9.1 Dam Site

The alignment of the proposed Dam axis shall be marked on the ground by NIA primary control point/station monuments, conveniently established at the left and right top bank of the river, labeled Dam Left (DL #) and Dam Right (DR #), respectively. Additional reference primary control point/station monuments shall also be established inter-visible and ideally at least 150 m apart (or may depend on the actual site condition) with these monuments and labeled as “REF L1” and “REF R1”. (See Annex III)

9.2 Reservoir

A minimum of 12 control points (constituting 6 pairs) shall be established, strategically placed every 30% of the linear distance of the longest river’s length.

9.3 Main Canal Alignment

Primary control points are to be established at the beginning of the canal (Station 0+000) and at the end of the canal, with distribution occurring at intervals of 500 meters, taking into account the actual site conditions, which should not be prone to disturbance during project implementation.

9.4 Service Area

The number of control points to be established within the service area shall depend on the area coverage of each cluster, as provided below:

Table 4 Criteria for the establishment of Control Points

AREA	NUMBER OF CONTROLS
<100 hectares	6 controls (3 pairs)
101-500 hectares	8 controls (4 pairs)
501- 1000 hectares	10 controls (5 pairs)

An additional pair of primary control points/stations shall be established for every 1,000 hectares of area coverage. Each pair of control points/stations shall be positioned at a distance ranging from 50 to 150 meters apart.

9.5 Methodology

All ground control surveys shall be conducted with:

- the PRS92 as the horizontal datum using survey-grade GNSS receivers (static observation at an interval of not more than 5 seconds for a minimum of 1 hour

and a 30-minute break every observation, with due consideration for satellite availability and multipath errors); and

- The mean sea level as the vertical datum using precise automatic or digital levelling instruments.

These surveys shall be conducted by, or under the direct supervision of, a qualified professional pursuant to Republic Act 8560, otherwise known as the Philippine Geodetic Engineering Act of 1998, as amended.

The Registered Licensed Geodetic Engineer shall ensure that all instruments are properly calibrated before the start of any type of ground survey and secure calibration certificates to be included in the final report. (See **Annex IV**)

SECTION 10 TOPOGRAPHIC SURVEY

The survey shall be conducted using the conventional ground survey method with survey-grade instruments such as robotic/smart total stations, GPS RTK, and automatic digital levels.

The identified boundary points shall be tabulated with corresponding geographic and grid coordinates.

Data gathering of Topographic points with proper remarks (See **Annex V**) shall be conducted using survey-grade instruments with the following coverage area and side-shot interval, to wit:

10.1 Dam Site

- a. For Preliminary Feasibility Study**, side shots at the dam site should be taken from the highest and lowest peak of the left and right abutment with intervals of approximately 3-5 meters, covering a stretch of 500 meters both upstream and downstream from the proposed dam axis.
- b. For Detailed Engineering Study**, a confirmatory survey shall be conducted.
- c. For Feasibility Study**, side shots at the dam site should be taken from the highest and lowest peak of the left and right abutment with intervals of approximately 3 to 5 meters, covering a stretch of 500 meters both upstream and downstream from the proposed dam axis.
- d. For Detailed Engineering Design**, side shots at the dam site should be taken at intervals of approximately 3 to 5 meters, covering a stretch of 500 meters both upstream and downstream from the proposed dam axis.

10.2 Reservoir Area (for Impounding Schemes)

- a. For Preliminary Feasibility Study**, the topographic survey shall be conducted using Interferometric Synthetic Aperture Radar (IFSAR) technology to obtain high-resolution elevation data over the proposed project area
- b. For Feasibility Study**, Topographic survey for the reservoir area should be conducted using a combination of LIDAR mapping and the Ground Conventional Survey Method. Extracted points from LiDAR mapping should be approximately

3-5 meters interval, and 10 -20 meters side shots interval for the Conventional Survey Method.

- c. Conduct a topographic survey of the reservoir rims or flanks, showing contour lines with corresponding elevations up to the estimated maximum water level of the reservoir.
- d. **For Detailed Engineering Study/Design (DES/DED)**, confirmatory surveys shall be conducted using conventional methods with side shot intervals of approximately 10-20 meters.

10.3 Service Area

- a. **For Preliminary Feasibility Study**, the topographic survey shall be conducted using Interferometric Synthetic Aperture Radar (IFSAR) technology to obtain high-resolution elevation data over the proposed project area
- b. **For Feasibility Study**, the survey shall be conducted using both conventional/ground survey methods and LIDAR Mapping.
 - i. All side shots for conventional ground methods should be done approximately in every 10-20 meters interval.
 - ii. As for the LIDAR, extracted ground points from the processing software must be 3-5 meters interval.
 - iii. All the natural and man-made features present in the area coverage should be plotted and delineated
- c. **For Detailed Engineering Study/Design (DES/DED)**, confirmatory surveys shall be conducted using conventional methods with side shot intervals of approximately 10-20 meters.

Note:

- *Additional side shots, such as the sudden change in slope or terrain like roads, infrastructures, man-made and natural features, etc., shall be recorded.*
- *The use of LIDAR must be limited to the reservoir and service area during the feasibility study. For an outsourced contract, the consultant shall submit a proposal on the conduct of Lidar Mapping, indicating the methodology to be used, extent of survey work, and equipment to be utilized, including all other documents such as permits, drone and lidar registration certificates, pilot license, etc. Such a proposal must be reviewed by the NIA Central Office prior to approval by the NIA Regional Office. The output map using lidar should be referred to and tied with the existing Ground Control Points (GCPs) in PRS-92 & MSL Elevation within the project area, and must be validated through conventional methods to verify the accuracy of the generated contour through lidar data.*

SECTION 11 PROFILE SURVEY

a. At the Proposed Dam Structure

Side shot interval for the profile survey shall be taken every 10 meters along the center line from the proposed dam structure alignment.

b. At River

The profile of the river bed shall extend one (1) kilometer for both upstream and downstream from the dam axis location at an interval of 20m.

c. At Main Canal and Tunnel/Link Canal Alignment

Side shot intervals for the profile survey shall be taken every 20 meters along the center line from the proposed head gate to the end check of the proposed main canal and tunnel/link canal.

SECTION 12 CROSS-SECTION SURVEY*

a. At the Dam Site

For Dam with **less than 15 meters in height**, shall be taken perpendicular to the dam axis at 20 m interval with a swath width of 100 m, and side shot interval of 3 to 5 meters.

For dams with **greater than 15 meters in height**, shall be taken perpendicular to the alignment at 10-meter interval with swath width of 300 meters, and side shots of 3 to 5 meters.

b. At River

Cross-section survey shall be taken every 20 meters along the center line of the river bed and shall extend one (1) kilometer for both upstream and downstream from the proposed dam axis with a swath width prescribed by the dam engineer.

Side shot shall be taken at intervals of approximately 3 to 5 meters, measured perpendicular to the alignment, and shall extend up to 50 meters from the left and right top banks of the river.

c. At Main Canal and Tunnel/Link Canal Alignment

Cross-section survey shall be taken every 20 meters with a swath width of 50 meters (or as prescribed by the Irrigation Engineer) along the centerline.

- a. For the dam with less than 15 meters in height, side shots interval should be approximately 10-20 meters interval.
- b. For the dam with more than 15 meters in height, side shots interval should be approximately 5 to 10 meters for Feasibility Study and Detailed Engineering Design/Study.

SECTION 13. RAW DATA

All field survey data collected and used in data processing and report production, such as the following:

- a. Raw and Rinex Data (Static GPS Observation)
- b. Static Field Sheet
- c. GPS Field Sheet

- d. Side Shot data (Northing, Easting, Elevation & Remarks in Comma Separated Values or CSV Format – Directly downloaded from equipment or encoded from field book)
- e. Profile data (Station, Northing, Easting, Elevation & Remarks in Comma Separated Values or CSV Format)
- f. Cross-Section data (Station, Offset, Elevation & Remarks in Comma Separated Values or CSV format)
- g. Classified Point Cloud Data (LAS Format) – Lidar Data
- h. DEM/DTM arrangement (Raw data, TIFF Format) - Lidar Data
- i. Digital Orthophotos of 10cm GSD resolution (in tiles and seamlessly mosaicked over the capture area)
- j. Raw/Unprocessed image used to produce the Digital Orthophotos
- k. Excel files of the vertical computation/ levelling computation
- l. Civil 3D drawing (DWG) files in 2018 format (exploded and not exploded)
- m. Back-up files compiled on a compact Disk, Google Drive, and/or flash drive

SECTION 14. COMPUTATION

All Survey Data Computation shall be prepared and signed by the Licensed Geodetic Engineer

- a. Network Adjustment Report (GPS Static Observation), which must be certified by NAMRIA
- b. Horizontal Computation
- c. Vertical Computation
- d. Curve Computation

SECTION 15. MAPS

15.1 Base Map Showing the following details: (See Annex VI)

“DENR MC 2010-13, using available NAMRIA Topographic map of the area, the estimated boundary sketch of the project site shall be plotted on an appropriate scale. This shall be used as the base map.”

- a. Recovered NAMRIA Control Points/Station (use as reference for this project)
- b. Dam Axis Location
- c. Service Area
- d. Main Canal Alignment
- e. Drainage/Watershed Area
- f. Reservoir Area
- g. Political Boundaries
- h. Road/Access including Name
- i. River/Creeks including Name, Width, and Direction of Flow
- j. Planimetric Features like Roads, Buildings, and others

15.2 Project Control Network Map showing the following details: (See Annex VII)

- a. Newly established NIA Control Point/Station
- b. Tabulation of Adjusted Coordinates and Elevation
- c. Recovered NAMRIA Control Point/Station (utilized as reference)
- d. Dam Axis Location
- e. Service Area
- f. Main Canal Alignment
- g. Reservoir Area
- h. Political Boundaries
- i. Road/Access including Name
- j. River/Creek including Name, Width, and Direction of Flow
- k. Planimetric Features like Roads, Buildings, and others.

15.3 Topographic Map Index Showing the following details: (See Annex VIII)

- a. Dam and its appurtenant structure Location
- b. Recovered NAMRIA Control Points/Station (*this will serve as a reference for this project*), including newly Established Project Control Points
- c. Tabulation of Adjusted Coordinates and Elevation
- d. Boundary Delineation (Service Area/Reservoir/Dam Site Area)
- e. Main Canal Alignment
- f. Political Boundaries
- g. Road/Access including Name
- h. River/Creeks including Name, Width, and Direction of Flow
- i. Planimetric Features like Roads, Buildings, and others
- j. Sheet Partitions

15.4 Topographic Map showing the following details: (See Annex IX)

- a. Major and minor contours shall be delineated to accurately represent elevations above mean sea level and reflect the actual shape of the ground surface. Topographic contours shall be generated at 1-meter intervals for minor contours and 5-meter intervals for major contours, with major contours shown using thicker lines for distinction.
- b. The topographic points/COGO points shall be classified into point groups according to the topographic features, such as dirt road, concrete road, top and bottom of river bank, buildings/houses, and other topographic features. Each group shall bear the point number as recorded/observed during the survey.
Note: All topographic features present in the project area must be measured.
- c. Topographic Map shall contain Planimetric Features that are visible or identifiable from the ground, including land use such as trails, boundaries of wooded areas, monumented controls, buildings, roads, municipalities, cities, and man-made structures, as well as spot elevations, etc. Additionally, the map shall depict all relevant natural features observable from the ground, including drainage lines of creeks, rivers, and tributary streams, falls and rapids, water bodies, ponds, marshes, flood plains, bluffs, cultural geographical names, and vegetation.

- d. Newly established NIA Control Points/Stations and recovered NAMRIA Control Points/Stations (used as reference for this project) shall be plotted with designated appropriate symbols, name/number, and elevation. The control point shall be denoted by a small dot at the exact position of the control point, enclosed by an equilateral triangle.
- e. Grid Coordinates shall be presented on the maps using solid ticks positioned along the sheet borders. Designation of grid coordinates shall be shown on all sides of the neat lines of each map sheet.
- f. Spot Elevation should be strategically displayed at the peak/summit, depression, and other random locations.
- g. Tabulation of Adjusted Coordinates and Elevation
- h. Dam Axis Location
- i. Boundary Delineation (*Service Area/Reservoir Area/Dam Site Area*)
- j. Main Canal Alignment
- k. Plotting scale shall range from 1:1,000 to 1:4,000 only. For areas with larger coverage, provide a topographic map index.

15.5 Profile Map showing the following details: (See Annex X)

- a. Station and Elevation Labels at every 40m interval.
- b. Station – Horizontal Grid Lines (Major Interval of thick lines every 200m and Minor Interval every 40m)
- c. Elevation – Vertical Grid Lines (Major Interval of thick lines every 5m and Minor Interval every 1m)
- d. Main Canal/River Profile lines with corresponding ordinary or normal water level (OWL/NWL) and maximum flood level (MFL) profile lines with Name of Typhoon and year, properly labeled.
- e. The river profile map begins at Station 0+000, located at the dam axis, with stationing increasing downstream and negative stationing indicating the upstream direction.
- f. Man-made and Natural Features like Roads, Buildings, Bridges, and others, if any.
- g. Horizontal Scale of 1:4,000 and Vertical Scale of 1:100 shall be adopted for both the River and Main Canal Profile.

15.6 Cross-section Map showing the following details: (See Annex XI)

- a. Offset and Elevation Labels at every break/change in slope or man-made and natural features.
- b. Offset – Horizontal Grid Lines (Major Interval of thick lines every 5m and Minor Interval every 1m)
- c. Elevation – Vertical Grid Lines (Major interval of thick lines every 5 m and Minor Interval every 1m)
- d. River cross-sections orientation shall be plotted facing downstream.
- e. Man-made and natural features like Roads, Buildings, Bridges, and others, if any.
- f. Plotting scale shall depend on the width of the cross-section to fit on the sheet, and without vertical exaggeration.

NOTE:

“All Maps shall display the legend; north arrow; grid lines and labels; numerical and graphical scale; general notes (coordinate system, reference datum, etc.); and title block with corresponding date, name, and signature of the Government or Private entity who prepared the map.”

“Map symbols, legends, title block, etc., should be in compliance with NIA MC 36 and NIA MC 59 series of 2016, respectively.” (See Annex XII)

“Map scale for Topographic Map Index and Base maps shall be prepared in an appropriate scale covering all important and relevant data.”

SECTION 16. MONUMENT DESCRIPTION SHEET (Annex XIII)

It shall include the following:

- a. adjusted coordinates (PRS92) and elevation (MSL) in meters;
- b. location sketch map with at least three (3) landmarks for reference;
- c. three (3) photographs of the monument (1 close-up and 2 different angles showing the nearby surroundings); and
- d. proper description of the size, physical references, and location.

SECTION 17. VALIDATION/MAP TEST

Validation of the accuracy and reliability of all established project controls and topographic maps shall be conducted, especially on all proposed locations of structures. The control validation must be tied to and in reference to NAMRIA control points/stations.

For topographic map validation, a simple profile survey shall be conducted along test lines drawn normal to the map contour. The coordinates and elevation at the intersection points between the test lines and the contour lines shall be extracted and recorded using the instrument data logger. The extracted coordinates shall then be relocated and re-observed to obtain updated elevation data. (Attached Map Test Report / Back to Office Report as **Annex XIV**)

- a. Horizontal and Vertical Accuracy of established control shall not exceed 2nd Order Accuracy.
- b. Vertical Accuracy of Topographic Map Contour, applicable to all publication scales, shall ensure that 90 percent of all tested points fall within one-half (1/2) of the specified contour interval.
- c. If the Root Mean Square Error (RMSE) meets the required standard, which is half of the contour interval, and the number of test points fails, the Map test shall be deemed acceptable.
- d. If the number of test points passes while the Root Mean Square Error (RMSE) fails, it shall be updated.

- e. The number of points may vary depending on the actual site conditions, subject to the discretion of the evaluator.

SECTION 18. TIMELINE AND DELIVERABLES

18.1 FOR OUTSOURCED STUDY

DELIVERABLE	TIMELINE*
Ground Control Survey Report	21 calendar days after issuance of NTP
Topographic Map of Dam and Reservoir	30 Calendar days after acceptance of the Ground Control Survey Report
Topographic Map of Service Area and main canal alignment	30 Calendar days after acceptance of the Map Test of the Dam and Reservoir
Draft Survey Report	14 Calendar days after acceptance of the Topographic Map of the Service Area and main canal alignment
Final Survey Report	14 calendar days after receipt of comments from NIA Central Office

**Timeline of the submission of deliverables shall depend on the size of the area to be surveyed.*

18.2 FOR FORCED ACCOUNT WORKS

DELIVERABLE	TIMELINE
Ground Control Survey Report	21 calendar days after issuance of NTP
Topographic Map of Dam and Reservoir	30 Calendar days after acceptance of the Ground Control Survey Report
Topographic Map of Service Area and main canal alignment	30 Calendar days after acceptance of the Map Test of the Dam and Reservoir
Draft Survey Report	14 Calendar days after acceptance of the Topographic Map of the Service Area and main canal alignment
Final Survey Report	14 calendar days after receipt of comments from NIA Central Office

SECTION 19. REVIEW OF DELIVERABLES

A checklist of deliverables shall be accomplished before issuance of certifications. Said checklist is herein attached as **Annex XVI**

19. 1 PROJECT ID AND PRELIMINARY FEASIBILITY STUDY

The review and monitoring of the deliverables submitted by the field offices (IMOs) shall be conducted by the Geodetic Engineer (GE) of the Regional Office.

In case there is no Geodetic Engineer hired in the IMO, the Regional GE shall conduct the Surveying and Mapping activities subject to review and acceptance by the Central Office.

For the Preliminary Feasibility Study, a ground survey map test shall be performed by the Geodetic Engineer of the Regional Office.

The acceptance and approval of the reports shall be made by the Regional Office.

In the event that no Geodetic Engineer is hired from either IMO and RO, the Geodetic Engineer from CO shall conduct the surveying and mapping activities.

19.2 FEASIBILITY STUDY AND DETAILED ENGINEERING DESIGN

The initial review and monitoring of survey and mapping outputs shall be conducted by the Geodetic Engineer of the Regional Office. The final acceptance and approval of the deliverables shall be made by the Central Office. Furthermore, a Geodetic Engineer from NIA Central Office shall be present during the conduct of the ground survey map test to validate the accuracy of the maps.

SECTION 20 REPEALING CLAUSE

All rules and regulations or parts thereof inconsistent with any of the provisions of this Guidelines are hereby repealed, amended or modified accordingly.

SECTION 21 EFFECTIVITY CLAUSE

This Act shall take effect immediately after approval of the Administrator.

NAMRIA CONTROL CERTIFICATION

b. VERTICAL CONTROL



Republic of the Philippines
Department of Environment and Natural Resources
NATIONAL MAPPING AND RESOURCE INFORMATION AUTHORITY

Date:

CERTIFICATION

To whom it may concern;

This is to certify that according to the records on file in this office, the requested survey information is as follows

Province:		
Station Name:		
Island:	Municipality:	Barangay:
Elevation:	Order:	
Latitude:	Longitude:	Datum: Mean Sea Level

STATION NAME	Location Description
	4.00 m S of centerline of National Highway, 20.00 m W post of Welcome to _____ arch, on top of the E end of the S Sidewalk of _____, at km 351+160. Mark is the head of a 4" copper nail set on a drilled hole, inscribed on top of the 20cm x 20cm cement putty is <u>Station Name NAMRIA</u> .

Requesting Party:
 Purpose: Reference
 OR Number: 00000001
 T.N: 00000001

Director, Mapping and Geodesy Branch



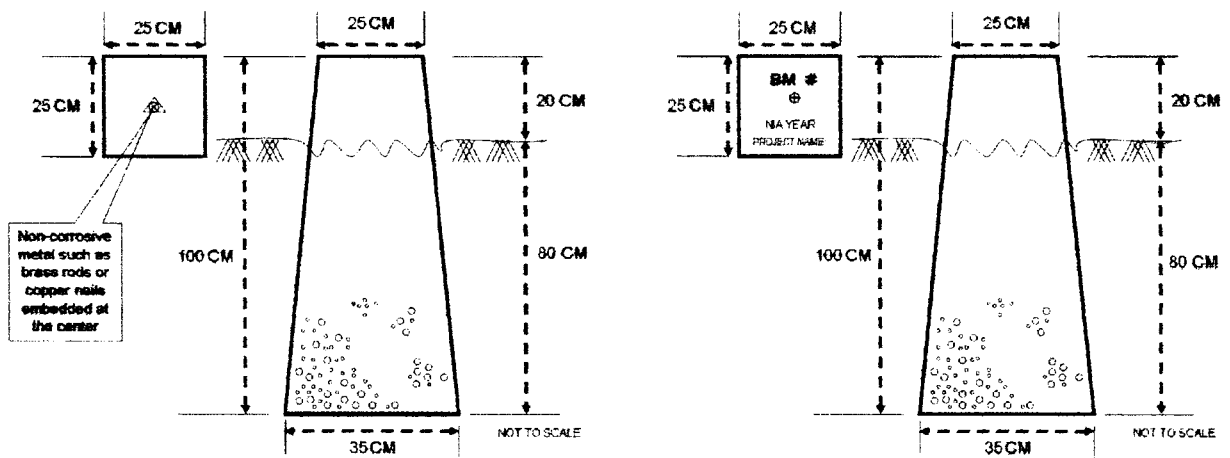
NAMRIA OFFICES
Main: Lawton Avenue, Fort Bonifacio, 1634 Taguig City, Philippines. Tel. No. (832) 810-4821 to 41
Branch: 421 Baraca St. San Nicolas, 1010 Manila, Philippines. Tel. No. (832) 241-3494 to 98
www.namria.gov.ph

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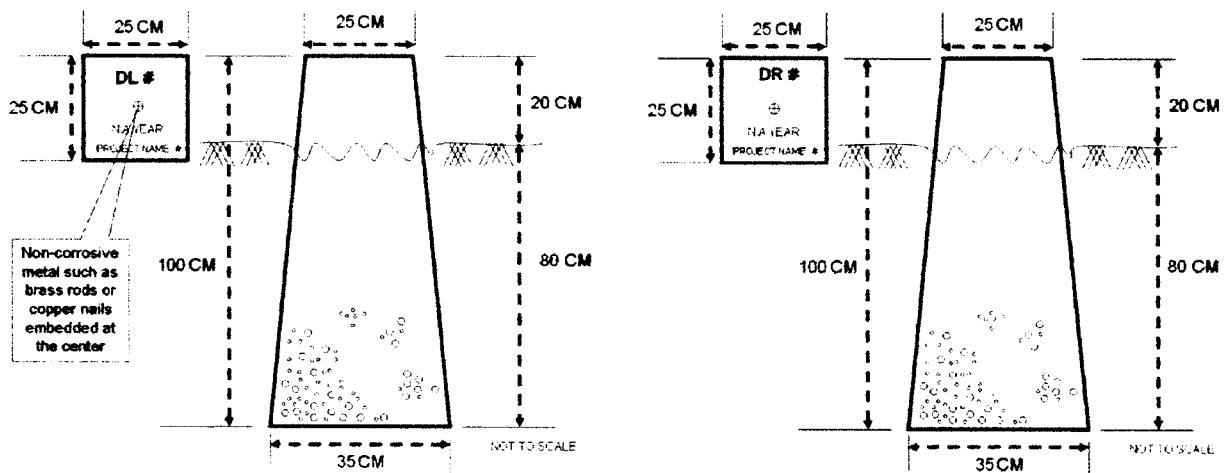
ANNEX III

DIMENSION OF SURVEY CONTROL MONUMENT

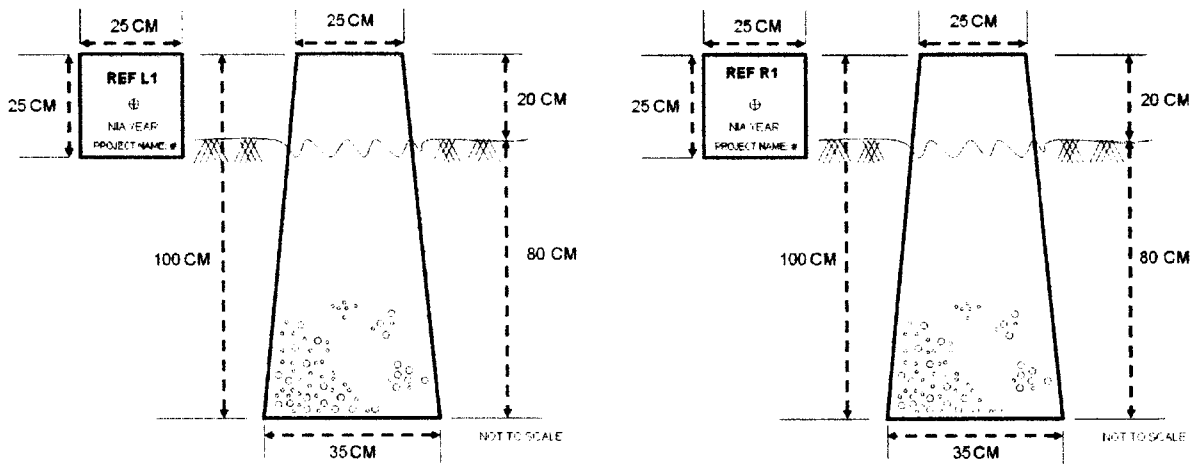
1. Primary Control (Illustration)



b. Dam Left (DL) and Dam Right (DR) Monument (Illustration)



c. Dam Reference (REF L1 and REF R1) Monument (Illustration)



ANNEX IV

SURVEYING INSTRUMENT CALIBRATION CERTIFICATE



Republic of the Philippines
Department of Environment and Natural Resources
NATIONAL MAPPING AND RESOURCE INFORMATION AUTHORITY

Date :

CERTIFICATE OF REGISTRATION AND CALIBRATION

TO WHOM IT MAY CONCERN:

This is to certify that the _____
described herein as:

SURVEYING INSTRUMENT MODEL WITH SERIAL NUMBERS

- 1.
- 2.

of _____ **with office address at** _____
_____ were calibrated and now duly registered with this office.

The _____ was found to meet the accuracy standards set by the International Geodetic Authorities for first order geodetic control positioning and in accordance with the specifications prescribed in the Revised Manual of Land Surveying Regulations in the Philippines (DAO 98-12).

Director, Mapping and Geodesy Branch

Registration No:
O.R. No : _____



NAMRIA OFFICES:
Main : Lawton Avenue, Fort Bonifacio, 1634 Taguig City, Philippines. Tel. No. : (632) 810-4831 to 41
Branch : 421 Barraca St. San Nicolas, 1010 Manila, Philippines. Tel. No. : (632) 241-3494 to 98
www.namria.gov.ph

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ACRONYM AND DESCRIPTION OF SIDE SHOTS

ACRONYM	DESCRIPTION	REMARKS/USAGE
BT	Bunch of Trees	
BH/B.HALL	Barangay Hall	
BLDG	Building	General term for any structure (commercial, public, etc.)
RA	Residential Area	(Used to denote zones with housing or dwellings)
RES/HSE	House/Residence	(Individual dwelling unit)
RBLDG	Residential Building	(Multi-unit housing like apartments or dormitories)
URA	Urban Residential	(For zoning or land use classification)
RSS	Random Side Shot	General abbreviation used in field notes and survey logs
ISS	Irregular Side Shot	(Sometimes used when shots are taken outside standard intervals)
MS	Miscellaneous Shot	(For features not classified under standard categories)
CLVT	Culvert	General abbreviation for any type of culvert
CEC	Culvert End Check	(Used to denote the terminal structure controlling flow)
CLI	Culvert Inlet	(Entry point of the culvert (sometimes used in hydraulic logs))
CLO	Culvert Outlet	(Exit point of the culvert)
CC/C.C.	Center Canal	Used in field notes, traverse sheets, and mapping legends
CCL	Canal centerline	(Sometimes used in CAD/GIS to denote the geometric center of canal alignment)
CF	Corn Field	Common shorthand in field notes, mapping legends, and GIS layers
MA	Maize Area	(Sometimes used in technical reports or crop classification maps)
CP	Corn Plantation	(Used when referring to larger, commercial-scale corn areas)
CR	Center River	Common shorthand in field notes and mapping legends
RCL	River Centerline	(Used in CAD/GIS to denote the geometric center of the river)
CRK	Creek	Standard abbreviation in field notes, mapping legends, and GIS layers
CRCL	Creek Centerline	(Used in CAD/GIS to denote the central flow path of the creek)
TC	Tributary Creek	(Sometimes used when the creek feeds into a larger river or canal)
CL	Centerline	Standard abbreviation in field notes, traverse sheets, and CAD/GIS drawings
CDL	Center Line Drainage	Common shorthand in field notes, traverse sheets, and mapping legends
DCL	Drainage Centerline	(Sometimes used in CAD/GIS to denote the flow axis of a drainage channel)

MDL	Main Drainage Line	(Occasionally used in hydrologic or engineering reports)
CEM	Cemetery	Standard abbreviation in field notes, mapping legends, and GIS layers
PRCEM	Private Cemetery	(For privately owned or memorial park-type cemeteries)
BG	Burial Ground	(Occasionally used in older maps or cultural surveys)
XS/X-Sec	Cross Section	Standard abbreviation in field notes, traverse sheets, and engineering drawings
CXS	Canal Cross Section	(Used when profiling irrigation canals)
RXS	River Cross Section	(Applied in hydrologic and floodplain mapping)
CRXS	Creek Cross Section	(For small tributaries or drainage channels)
SCH	School	Standard abbreviation in field notes, mapping legends, and GIS layers
ESCH	Elementary School	(Used when specifying grade-level institutions)
HSCH	High school	(For secondary education facilities)
PSCH	Public School	(Sometimes used in zoning or government land use maps)
PRSCH	Private School	(For privately operated institutions)
CW	Center Waterway	General shorthand in field notes and mapping legends
WSL	Waterway Centerline	(Used in CAD/GIS to denote the geometric flow axis)
MWA	Main Waterway Axis	(Occasionally used in hydrologic modeling or flood studies)
DPR	Depression	Common shorthand in field notes, mapping legends, and GIS layers
TDPR	Topographic Depression	(Sometimes used in terrain analysis or slope classification)
SA	Sink Area	(Occasionally used when the depression collects runoff or water)
LP	Low point	(Used in elevation profiling or cross-sectioning)
DRN	Drainage	Standard abbreviation in field notes, mapping legends, and GIS layers
DC	Drainage Canal	(Used for man-made channels designed to carry runoff or irrigation return flow)
NDRN	Natural Drainage	(Sometimes used to distinguish creeks or seasonal flow paths)
MDL	Main Drainage Line	(Applied in hydraulic profiles and flood modeling)
ECF	Edge Corn Field	Used in field notes to denote the boundary of a corn-planted area
CFB	Corn Field Boundary	(Sometimes used in mapping legends or GIS layers)
CFE	Corn Field Edge	(Alternative notation, especially in traverse sheets)
ECF-FH	Edge Corn Field Foothill	Denotes the boundary of a corn field adjacent to a foothill

CFE-FH	Corn Field Foothill Edge	(Alternative notation used in slope-sensitive mapping)
FHB	Foothill Corn Boundary	(Sometimes used in terrain-integrated land use maps)
ECP	Edge of Corn Plantation	Common shorthand in field notes and mapping legends
CPB	Corn Plantation Boundary	(Used in GIS layers or land use classification maps)
CFE	Corn Field Edge	(Alternative notation, especially in traverse sheets)
EOS	Edge of School	Common shorthand in field notes and mapping legends
SB	School Boundary	(Used in GIS layers or zoning maps)
SP	School Perimeter	(Occasionally used in structural or fencing documentation)
EOH	Edge of Hill	Common shorthand in field notes and mapping legends
HB	Hill Boundary	(Used in slope classification maps or terrain overlays)
HFL	Hill Foot line	(Occasionally used to denote the base or toe of a hill)
EMP	Edge of Mango Plantation	Common shorthand in field notes and mapping legends
MPB	Mango Plantation Boundary	(Used in GIS layers or land use classification maps)
MFE	Mango Field Edge	(Alternative notation, especially in traverse sheets)
RE	Road End	Standard shorthand in field notes and mapping legends
EOR	End Road	(Alternative notation, especially in traverse sheets)
TP	Terminal Point	(Occasionally used in engineering drawings or access planning)
TRE	Trail Road End	Common shorthand in field notes and mapping legends
ERT	End of Trail End	(Alternative notation used in traverse sheets)
TTP	Trail Terminal Point	(Occasionally used in engineering layouts or slope-sensitive mapping)
EOSP	End of Siphon	Common shorthand in field notes and mapping legends
SPN-OUT	Siphon Outlet	(Used in hydraulic profiles and structural drawings)
STP	Siphon Terminal Point	(Occasionally used in engineering documentation)
EOR	Edge of Road	Marks the boundary of paved or unpaved road segments; used in traverse sheets and access planning
ERF	Edge of Rice Field	Denotes the perimeter of rice-planted areas; useful for irrigation layout and crop disturbance analysis

ECF	Edge of Corn Field	Identifies the boundary of corn cultivation; used in land use classification and buffer zone planning
ERL	Edge of Residential Land	Marks the limit of residential lots or built-up areas; critical for setback compliance and zoning
TRD	Trail Road	Common shorthand in field notes and mapping legends
FTRD	Farm Trail Road	Used when the trail serves agricultural access
MTRD	Mountain Trail Road	Occasionally used in slope-sensitive terrain mapping
EORV	Edge of River	Common shorthand in field notes and mapping legends
RB	Riverbank	Used in slope classification and erosion studies
RM	River Margin	Occasionally used in hydrologic modeling or zoning maps
ETRD	End of Trail Road	Common shorthand in field notes and mapping legends
TRB	Trail Road Boundary	Occasionally used in access planning or GIS overlays
TRM	Trail Road Margin	Used when emphasizing buffer zones or slope transitions
FH	Foothill	Standard shorthand in field notes and mapping legends
FHZ	Foothill Zone	Occasionally used in slope-sensitive terrain mapping
FHA	Foothill Area	Used in land classification or hazard overlays
SF	Shed of Farmer	Common shorthand in field notes and mapping legends
FS	Farm Shed	Used in land use maps and structural overlays
AGS	Agricultural Shed	Occasionally used in feasibility reports or zoning maps
LE	Left Edge	Used to denote the left boundary of a feature relative to alignment or flow direction
LER	Left Edge of River	Specifies the left bank or margin of a river; critical for setback and erosion planning
CHK	Check Structure	Refers to canal check gates or flow control structures; used in hydraulic profilin
RIV	River	General river feature; often tagged with flow direction and slope class
LRD	Left Road	Road feature located on the left side of the alignment or canal centerline
RRD	Right Road	Road feature located on the right side of the alignment or canal centerline
LTB	Left Top Bank	Refers to the upper edge of the canal or river on the left side of alignment
LTB-CHK	Left Top Bank with Check	Combined notation when a check structure is located at the left top bank

LTBC	Left Top Bank of Creek	Standard shorthand in field notes and mapping legends
CLB	Creek Left Bank	Used in hydraulic and slope classification maps
CML	Creek Margin (Left)	Occasionally used in zoning or hazard overlays
LTBR	Left Top Bank of River	Standard shorthand in field notes and mapping legends
LTBW	Left Top Bank of Waterway	Used when referring to non-river channels (e.g., creeks, irrigation waterways)
RLTB	River Left Top Bank	Occasionally used in hydraulic and slope-sensitive terrain mapping
MC	Main Canal	Standard shorthand in field notes, mapping legends, and engineering drawings
MCA	Main Canal Alignment	Used when referring to the surveyed centerline or layout of the canal
MCS	Main Canal Structure	Occasionally used in structural documentation or feasibility reports
RCP	Reinforced Concrete Pipe	Standard shorthand in field notes, mapping legends, and engineering drawings
RCP-IN	RC Pipe Inlet	Used to mark the entry point of the pipe
RCP-OUT	RC Pipe Outlet	Used to mark the discharge point
RD	Road	Standard shorthand in field notes and mapping legends
PRD	Paved Road	Used when specifying concrete or asphalt surface
GRD	Gravel Road	Denotes unpaved, compacted surface
ERD	Earthen Road	Refers to basic dirt tracks, often in rural areas
RP	Reference Point	Commonly used for geodetic or traverse benchmarks
RM	Reference Marker	Used for physical markers (e.g., concrete monuments, steel pins)
RS	Reference Station	Occasionally used in RTK or GPS-based surveys
RELV	Reference Elevation	Used in hydraulic profiling or slope classification
RERIV	Right Edge of River	Standard shorthand in field notes and mapping legends
RRB	River Right Bank	Commonly used in hydraulic and slope-sensitive terrain mapping
RRM	Right River Margin	Occasionally used in zoning or hazard overlays
RF	Rice Field	Standard shorthand in field notes and mapping legends
IRF	Irrigated Rice Field	Used when the field is served by canal or turnout
RRF	Rainfed Rice Field	Used for upland or non-irrigated rice areas
RL	Residential Land	Standard shorthand in field notes and mapping legends
BUR	Built-Up Residential	Occasionally used when emphasizing structural density

RTBD	Right Top Bank of Drainage	Standard shorthand in field notes and mapping legends
DRB	Drainage Right Bank	Used in hydraulic and slope-sensitive terrain mapping
RDM	Right Drainage Margin	Occasionally used in zoning or hazard overlays
FNC	Fence	Standard shorthand in field notes and mapping legends
BWF	Barbed Wire Fence	Used for agricultural or livestock enclosures
CFNC	Concrete Fence	Used for residential or institutional boundaries
WFNC	Wooden Fence	Occasionally used in rural or farm settings
SDP	Side Depression	Standard shorthand in field notes and mapping legends
DPA	Depression Area	Occasionally used in terrain or hazard overlays
LLZ	Low-Lying Zone	Used in slope-sensitive or flood-prone terrain mapping
SHL	Side Hill	Standard shorthand in field notes and mapping legends
SHS	Side Hill Slope	Used when specifying slope class or gradient
SHT	Side Hill Terrain	Occasionally used in feasibility or hazard overlays
TB	Top Bank	General shorthand for any top bank feature
LTB	Left Top Bank	Used when feature lies on the left side of alignment
RTB	Right Top Bank	Used when feature lies on the right side of alignment
TBR	Top Bank of River	Occasionally used in hydraulic terrain mapping
TBD	Top Bank of Drainage	Used in slope-sensitive drainage profiling
THL	Top Hill	Standard shorthand in field notes and mapping legends
HCL	Hill Crest	Used when emphasizing the peak or ridgeline
THP	Topographic High Point	Occasionally used in elevation profiling or hazard overlays
TSRD	Top Section of Road	Standard shorthand in field notes and mapping legends
RCP	Road Crest Point	Used when emphasizing the highest elevation or turning point
RHP	Road High Point	Occasionally used in elevation profiling or slope-sensitive terrain
TRD	Trail Road	Standard shorthand in field notes and mapping legends
LTRD	Left Trail Road	Used when the trail is on the left side of canal/alignment
RTRD	Right Trail Road	Used when the trail is on the right side
UL	Uncultivated Land	Standard shorthand in field notes and mapping legends
IDL	Idle Land	Used when land is temporarily unused but potentially arable

FLA	Fallow Area	Refers to land left unplanted for soil recovery
NVZ	Natural Vegetation Zone	Occasionally used in environmental overlays
WW	Waterway	General shorthand for any water-conveying feature
NWW	Natural Waterway	Used for rivers, creeks, or estuaries
MWW	Man-made Waterway	Used for canals, ditches, or engineered channels
DWW	Drainage Waterway	Used in slope-sensitive or flood-prone terrain mapping
CSR	Cross Section Road	Standard shorthand in field notes and mapping legends
RCG	Road Crossing	Used when emphasizing the intersection with canal
RCPR	Road-Cut Profile	Occasionally used in elevation and slope analysis
CST	Cross Section Trail	Standard shorthand in field notes and mapping legends
TCG	Trail Crossing	Used when emphasizing the intersection with canal
TCPR	Trail-Cut Profile	Occasionally used in elevation or slope-sensitive terrain
CWW	Cross Waterway	Standard shorthand in field notes and mapping legends
WWC	Waterway Crossing	Used when emphasizing the intersection and required structure
HYC	Hydraulic Crossing	Occasionally used in engineering or feasibility reports
YSR	Y Section of River	Standard shorthand in field notes and mapping legends
RFP	River Fork Point	Used when emphasizing the split or convergence zone
RJ	River Junction	Occasionally used in hydraulic modeling or terrain overlays
YSRD	Y Section of Road	Standard shorthand in field notes and mapping legends
RFP	Road Fork Point	Used when emphasizing the split or convergence zone
YJR	Y Junction Road	Occasionally used in access and traffic flow mapping
YSTBW	Y Section Top Bank of Waterway	Standard shorthand in field notes and mapping legends
TBWF	Top Bank at Waterway Fork	Used when emphasizing the crest at the split or junction
YJTB	Y Junction Top Bank	Occasionally used in hydraulic terrain overlays
YSTR	Y Section Trail	Standard shorthand in field notes and mapping legends
TFP	Trail Fork Point	Used when emphasizing the split or convergence zone
YJT	Y Junction Trail	Occasionally used in access and mobility overlays

YSWW	Y Section Waterway	Standard shorthand in field notes and mapping legends
WFP	Waterway Fork Point	Used when emphasizing the split or convergence zone
HJ	Hydraulic Junction	Occasionally used in engineering overlays
BRC	Bridge Crossing	For canal, river, or road crossings with bridge structures
BCV	Box Culvert	Used in hydraulic crossings under roads or trails
RCP	RC Pipe Crossing	Reinforced concrete pipe used in trail/road/waterway crossings
TOS	Turnout Structure	For irrigation turnouts or canal outlets
CGT	Check Gate / Control Gate	Hydraulic control structure for flow regulation
SPW	Spillway / Overflow Structure	For excess water discharge in canals or reservoirs
SLP	Slope Protection	Riprap, vegetation, or concrete slope stabilization
EMB	Embankment	Raised earth structure along canals or rivers
BPT	Borrow Pit	Excavated area for fill material, often near embankments
SBT	Settling Basin / Sediment Trap	For sediment control in waterways or drainage paths
VBZ	Vegetated Buffer Zone	Environmental buffer between canal and adjacent land use
FLN / PBV	Fence Line / Property Boundary	For delineating ownership or access restrictions
UTL / PPL	Utility Line / Power Pole	For mapping electrical or communication infrastructure
PST	Pump Station	For irrigation or drainage systems
RES / HPD	Reservoir / Holding Pond	Water storage features
CNJ	Canal Junction	Where two canals meet or diverge
SBP	Slope Break / Bench Point	Used in steep terrain or side hill stabilization
ROC / BZ	Rock Outcrop / Boulder Zone	Terrain features affecting excavation or alignment
FPZ	Floodplain / Inundation Zone	Areas prone to seasonal flooding

TITLE BLOCK: BASE MAP STANDARD

NIA TITLE

SCALE BAR

IN-HOUSE JOURNAL CONSULTANT'S LOGO, NAME AND ADDRESS

NAME	ADDRESS	CITY	STATE	COUNTRY
------	---------	------	-------	---------

DATE: _____ SCALE: _____

CROSS-SECTION MAP

Form for a cross-section map, including a legend, scale bar, and administrative information.

LEGEND

- ROADS
- RAILROADS
- WATER
- UNIMPAVED
- PAVED
- CONCRETE
- ASPHALT
- GRAVEL
- DIRT
- GRAVEL
- DIRT
- GRAVEL
- DIRT

SCALE

0 100 200 300 400 500 600 700 800 900 1000

GENERAL NOTES

1. THIS MAP IS A CROSS-SECTION MAP OF THE ROADWAY SHOWN ON THE ATTACHED PLAN.

2. THE ROADWAY SHOWN ON THIS MAP IS THE ROADWAY SHOWN ON THE ATTACHED PLAN.

3. THE ROADWAY SHOWN ON THIS MAP IS THE ROADWAY SHOWN ON THE ATTACHED PLAN.

4. THE ROADWAY SHOWN ON THIS MAP IS THE ROADWAY SHOWN ON THE ATTACHED PLAN.

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9. THE ROADWAY SHOWN ON THIS MAP IS THE ROADWAY SHOWN ON THE ATTACHED PLAN.

10. THE ROADWAY SHOWN ON THIS MAP IS THE ROADWAY SHOWN ON THE ATTACHED PLAN.

NATIONAL INVESTIGATION ADMINISTRATION

NAME AND ADDRESS

NAME OF PROJECT










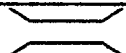

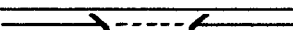
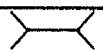




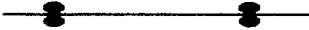

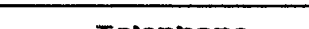
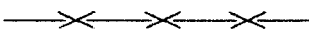

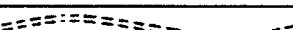



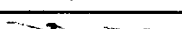
PROJECT NO.

DATE

SCALE


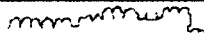


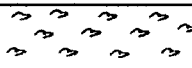



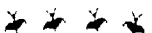
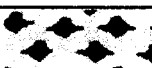



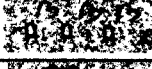


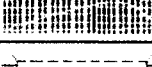



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MAP LEGENDS


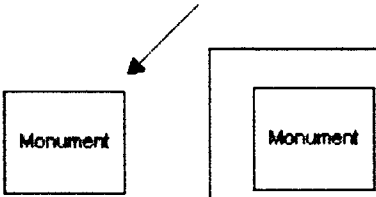
Hard surface, heavy duty road	
Hard surface, medium duty road	
Improved light duty road	
Unimproved dirt road	
Trail	
National highway system	
Provincial highway system	
Railroad, single track	
Railroad, double or multiple track	
Bridge	
Drawbridge	
Tunnel	
Footbridge	
Overpass, Underpass	
Reinforced Concrete Box Culvert (RCBC)	
Reinforced Concrete Pipe Culvert (RCPC) - Mitered End Section, Straight Endwall, U-Type Endwall	
Ferry	
Power transmission line	
Pipeline (Label)	
Telephone Line	
Fence Line	
River	
River bank	
Dam with lock	
Canal with lock	
Large dam	
Small dam - masonry, earth	

Built-up area	
City, town, village (generalized)	
Detailed street layout	
Buildings (dwelling, place of employment, etc)	
School, church, cemeteries	
Buildings (barn, warehouses, etc)	
Tanks, oil, water, etc. (label only if water)	
Well other than water	
Quarry, gravel pit	
Shaft, tunnel entrance	
Campsite, Picnic area	
North arrow	
Fish trap	
Rocks, coral reef	
Shoreline	
Rock, bare or awash	
Exposed Wreck	
National Boundary	
Provincial Boundary	
City or Municipal Boundary	
Barrio / barangay	
Reservation	
Boundary of small park, cemetery, airport, etc.	
Boundary monuments	
Horizontal control station, 3 rd order or higher, Primary GPS control	
Horizontal control station lower than 3 rd order	
Vertical control station (permanent), Benchmark (BM)	

Vertical control station (supplementary), intermediate control (IBM)	
Northing / Easting	
Lot Corner Monuments	
Borehole	
Kilometer post	
Matchline	Matchline Sta. 0+000
Principal point	
Road fork-section corner with elevation	
Check spot elevation	
Unchecked spot elevation	
Index contour	
Intermediate contour	
Supplementary contour	
Depression contour	
Cut, fill	
Levee	
Large wash	
Dune area	
Sand area	
Gravel beach	
Low cliff	
Intermittent streams	
Perennial streams	
Water well, spring	
Falls	
Rapids	
Intermittent lake	
Channel	

Swamp / Marsh	
Inundated area (label)	INUNDATED
Edge of timber	
Coconut	
Rice field	
Shrub	
Orchard	
Building area	
Mangrove	
Sugar cane	
Submerged marsh	
Wooded marsh	
Woodland	
Broadleaf	
Mixed scrub & broadleaf	
Grass	
Nipa	
Vineyard	
Aqueduct tunnel	
Located or landmark object, windmill	
Sawmill	

MONUMENT DESCRIPTION SHEET

NATIONAL IRRIGATION ADMINISTRATION LOCATION: REGION:		DESIGNATION:	NIA Project Name: Number:
THE POINT IS MEASURED AND PERMANENTLY MARKED IN YEAR _____		Page :	
PRS 92		Zone: _____	Elev. (MSL): _____
GEOGRAPHIC COORDINATES: $\phi =$ $\lambda =$		GRID COORDINATES: N = E =	
CONTROL POINT / BENCH MARK			
ISLAND:		CITY / MUNICIPALITY:	
PROVINCE:		BARANGAY:	
 STA. MARK : ACCESS :			
SURVEYED / DESCRIBED BY:		DATE ESTABLISHED:	
SKETCH OF VICINITY		PHOTO / SKETCH	
			

MAP TEST REPORT OUTLINE

- 1. INTRODUCTION**
- 2. OBJECTIVE**
- 3. INSTRUMENTATION**
- 4. APPROACHES AND METHODOLOGY**
- 5. SURVEY RESULT**
- 6. FINDINGS AND CONCLUSIONS**
- 7. RECOMMENDATION**

**SURVEYING AND MAPPING REPORT
Outline Template**

1. RECONNAISSANCE

- 1.1 Location Map
- 1.2 Site Condition (Accessibility, Security and Terrain) with Photo Documentation

2. INITIAL SURVEYING AND MAPPING DATA

- 2.1 Base Map
- 2.2 NAMRIA/ DENR Reference Control
- 2.3 Survey Reports and Maps
- 2.4 Gantt Chart of Activities

3. CONTROL SURVEY

- 3.1 Methodology
- 3.2 Control Network Map
- 3.3 Control Reference Certification
- 3.4 Photograph of Recovered Reference Control Points
- 3.5 Instrument Calibration Certificate
- 3.6 Network Adjustment Report and Result
- 3.7 Horizontal Computation
- 3.8 Vertical Computation
- 3.9 Monument Description Sheet

4. TOPOGRAPHIC SURVEY

- 4.1 Methodology
- 4.2 Side Shots Data
- 4.3 Index Map
- 4.4 Topographic Map (Dam Site Area, Service Area, Main Canal & Reservoir Area)
- 4.5 Site Photograph with Index

5. PROFILE SURVEY

- 5.1 Methodology
- 5.2 Profile Data
- 5.3 Profile Map (Dam Site & Main Canal)

6. CROSS-SECTION SURVEY

- 6.1 Methodology
- 6.2 Cross-Section Data
- 6.3 Cross-Section Map (Dam Site & Main Canal)

ANNEX XVI

CHECKLIST OF DELIVERABLES

PROJECT NAME:					
DURATION:					
DELIVERABLES		STATUS			REMARKS
		COMPLETE	INCOMPLETE	NOT APPLICABLE	
SURVEYING & MAPPING					
FINAL SURVEY REPORT					
1	Reconnaissance				
1.1	Location Map				
1.2	Site Condition (Accessibility, Security and Terrain w/ Photo Documentation)				
2	Initial Surveying and Mapping Data				
2.1	Base Map				
2.2	NAMRIA Reference Control				
2.3	Survey reports and Maps				
2.4	Gantt Chart of Activities				
3	Control Survey				
3.1	Methodology in accordance to NIA Standard and Specifications of Surveying and Mapping aspect				
3.2	Control Network Map				
3.3	Control Reference Certification				
3.4	Photograph of Recovered Reference Control Points				
3.5	Instrument Calibration Certificate				
3.6	Network adjustment Report				
3.7	Horizontal Computation				
3.8	Vertical Computation				

	3.9	Monument Description				
4	Topographic Survey					
	4.1	Methodology in accordance to NIA Standard and Specifications of Surveying and Mapping aspect				
	4.2	Side Shots Data				
	4.3	Index Map				
	4.4	Topographic Map (Damsite, Service Area, Main Canal & Reservoir Area)				
	4.5	Site Photograph with Index				
5	Profile Survey					
	5.1	Methodology in accordance to NIA Standard and Specifications of Surveying and Mapping aspect				
	5.2	Profile Data				
	5.3	Profile Map (Damsite & Main Canal)				
6	Cross-Section Survey					
	6.1	Methodology in accordance to NIA Standard and Specifications of Surveying and Mapping aspect				
	6.2	Cross-Section Data				
	6.3	Cross-Section Map (Damsite & Main Canal)				
ATTACHMENTS TO SURVEY REPORT						
	1	Control Reference Certification				
	2	Photograph of Recovered Reference Control Points				
	3	Instrument Calibration Certificates				
	4	GNSS Evaluation Sheet from NAMRIA				
	5	Vertical Computation				

6	Monument Description Sheet				
FINAL MAPS					
1	Location Map				
2	Base Map				
3	Control Network Map				
4	Index Map				
5	Topographic Map (Damsite, Service Area, Main Canal & Reservoir Area)				
6	Profile Map (Damsite & Main Canal)				
7	Cross-Section Map (Damsite & Main Canal)				
ELECTRONIC FILES					
1	Final Survey Report in "PDF or Word File Format"				
2	Final Maps in "DWG File Format" and "PDF File Format"				
3	Final Civil 3D drawing files in "DWG File Format" showing COGO points, DTM Surface, Alignment, Sample Lines, Profile, Cross-section, etc., used.				
4	Raw and Rinex Data (GPS Static Observation)				
5	Side Shot of Topographic, Profile and Cross-section Survey data in "CSV File Format"				
DRONE WITH LIDAR SURVEY REQUIREMENTS					
1	Classified Points Cloud Data (LAS Format)				
2	DEM/DSM Arrangement (Raw Data, TIFF Format)				
3	Raw/ Unprocessed image used to produce the Digital Orthophotos				

**NIA Guidelines on the Conduct
of Surveying and Mapping Activities**

4	Digital Orthophotos of 10cm Ground Sampling Distance (GSD) (In tiles and seamlessly mosaicked over the captured area)				
5	Copies of the Aircraft CAAP certificates/licenses (i.e. Operator, Controller, Aircraft Unit)				
6	Copies of permit to conduct aerial mapping as secured from CAAP, LGUs and other related agencies.				
7	Survey report directly downloaded on the processing software				