

**TERMS OF REFERENCE
FOR
THE PROCUREMENT OF CONSULTANCY SERVICES FOR THE
CAMP JOHN HAY FOREST COVER AND STRUCTURES MAPPING THROUGH
LIGHT DETECTION AND RANGING (LIDAR) TECHNOLOGY**

1.0 RATIONALE

As a steward and implementing arm of the BCDA over Camp John Hay (CJH), JHMC is mandated to ensure the sustainable use and development of the forest watershed. To carry this out, it is basic and essential to generate an updated Tree Inventory and Health Assessment Report of all trees within the JHSEZ that shall provide the basis for the sound development and protection of the forest watershed. Comprising 53% of the remaining forest cover of Baguio City, the Camp certainly holds the best Ambient Air Quality Index (PM₁₀) within the entire Baguio, La Trinidad, Itogon, Sablan, Tuba and Tublay areas, making the same the healthiest environment still to unwind to and/or do business.

For JHMC's **land asset management**, the **geodatabase** of all land holdings of the BCDA needs to be developed, maintained, and regularly updated as per approved Development Plan, Land Use Plan, and Zoning Codes. One way to do this is to have a **comprehensive survey map** of all existing structures within the entire 625 hectares of Camp John Hay.

2.0 OBJECTIVES:

This project has two major purposes and objectives, firstly to have a **tree inventory** within the whole area of Camp John Hay and secondly, **generate a geodata base for all existing structures** including road networks, water and electrical utilities and waterways within the John Hay Special Economic Zone (JHSEZ) and John Hay Reservation Area (JHRA).

- 2.1. To generate data on tree locations, species composition and distribution, density and volume, the generated data shall, in turn, be analyzed and utilized to formulate a framework for the holistic approach in protecting and preserving the remaining forest cover vis-a-vis the developments within the JHSEZ.
- 2.2. To determine the present forest cover to development ratio. Although it is only the golf course that was required a 40:60 ratio based on the Environmental Compliance Certificate (ECC) issued for JHSEZ, it is desired that this ratio be maintained even beyond the full development of the economic zone.
- 2.3. To generate a comprehensive and updated map of Camp John Hay that shall be used as a **base map** for a multitude of uses such as:
 - a. Contour mapping
 - b. Road network mapping
 - c. River and waterways mapping

- d. As-built mapping
- e. Land use map
- f. Political boundary mapping of all the 14 barangays within Camp John Hay

3.0 COVERAGE:

The **forest cover and structure mapping** shall cover all the areas within the entire 625 hectares of Camp John Hay.

Please see attached map as annex “A” for the areas covered with Benguet pine stand.

4.0 SCOPE OF SERVICES

The Works shall be executed by the Consultant following the terms, conditions, and requirements as specified herein, at the same time taking into consideration the latest DPWH Design Guidelines, Criteria, and Standards, DENR Administrative Order 2007-29, and other pertinent Executive and Administrative Orders.

This shall govern the implementation of the project, which shall include:

- (1) mobilization,
- (2) research,
- (3) reconnaissance,
- (4) GPS control point establishment,
- (5) aerial LiDAR survey and terrestrial LiDAR survey,
- (6) processing of survey data,
- (7) joint inspection,
- (8) quality control, and
- (9) submission of deliverables.

The implementation of the aforementioned activities shall be in accordance to the acceptable land surveying standards and the technical provisions and specifications detailed in the Terms of Reference (TOR). It shall be conducted in collaboration with Client, Local Project Coordinator and Local Government Unit (LGU).

The Consultant shall perform the following scope of services:

- 4.1. **Demarcation and delimitation survey.** Establishment of a permanent boundary monuments on the ground and delimit the boundary of forestlands and land development areas in accordance with existing survey standards and practices.
- 4.2. **Geo-Tagging and Inventory.** All trees with diameter-at-breast-height (dbh) of fifteen (15) centimeters and above shall be inventoried and tagged based on the procedures established by JHMC using the prescribed tally sheet provided.
- 4.3. **Geo-Tagging and Inventory of all trees below fifteen (15) centimeters** based on the procedures established by JHMC and using the prescribed tally sheet provided.
- 4.4. All data gathered from items 4.1 to 4.3 shall be in print and electronic copy.

4.5. **Geo-Tagging of Structures.** All *existing* structures within Camp John Hay shall be inventoried and geo-tagged. The data gathered shall be verified with the existing data of JHMC and will form part of the geodatabase of the **Land and Assest Management System (LAMIS)**.

4.7 Conduct of Terrestrial LiDAR Survey

The conduct of terrestrial scanning as an option when aerial scanning cannot scan the trunk of the trees since aerial scanner is from the top and can scan only the canopies, roof of buildings and the ground points. The terrestrial survey shall be one of the alternative method in determining information of the saplings.

4.8 Survey Operations and Submittal of Plans

- 4.8.1 The LiDAR survey and the preparation of data/maps shall be supervised by a duly licensed/registered engineer.
- 4.8.2 All other survey requirements not expressly specified herein must conform to the provisions of the Manual for Land Surveys in the Pilippines
- 4.8.3 The consultant shall request in writing for a joint inspection composed of representatives from JHMC to verify the actual condition as regards to horizontal and vertical ground controls

4.9 **Post-Data & Information Gathering.** The Consultant shall perform the following services after the field data and information gathering activities:

- 4.9.1 Organize and analyze all raw data and information with the end in view of producing all expected outputs/deliverables required under this TOR for submission to JHMC. All data gathered shall be in print and electronic copy using the prescribed pro-forma forms/templates.
- 4.9.2 **Photo-documentation.** Individual photographs of every tagged/marked tree shall be taken, focusing the tree code/tree tag. And another photograph showing the full or almost-full appearance of every marked tree shall likewise be taken.

5.0 MINIMUM MANPOWER REQUIREMENTS AND QUALIFICATIONS

5.1 The Consultant shall provide **at least** two SURVEY (2) teams to undertake this Project, each **SURVEY Team** shal consist of the following personnel and their qualifications:

Personnel	Qualification	Number
Team Leader/ LiDAR Surveyor	<ul style="list-style-type: none"> • Licensed Geodetic Engineer with relevant experience in LiDAR survey project • A member of good standing in GEP 	1

LiDAR Operator	<ul style="list-style-type: none"> • With a certificate of training in LiDAR operation • At least one (1) year experience in operating LiDAR 	1
GPS Team Leader/ Operator	<ul style="list-style-type: none"> • At least one (1) year experience in managing a GPS Team 	1
GPS Operator	<ul style="list-style-type: none"> • At least one (1) year experience in observation of GPS 	2
CAD Operator	<ul style="list-style-type: none"> • At least one (1) year experience in processing of CAD data and mapping 	1
LiDAR data processor	<ul style="list-style-type: none"> • With a certificate of training in processing LiDAR data • At least one (1) year experience in processing of LiDAR data and mapping 	1

Assigned additional qualified personnel to other positions, work and tasks:

- o Project Manager
- o Researcher / Liaison Officer
- o Safety Officer
- o Data Downloader
- o Service Vehicle Driver

6.0 EQUIPMENT /TOOLS AND OTHER ACCESSORIES AND SUPPLIES/MATERIALS

The Consultant shall be responsible for the provision of all equipment, tools, accessories, office and field supplies and materials needed for the conduct and completion of this Project.

a. LiDAR

The LiDAR equipment shall have the minimum specifications or requirements:

1. Maximum error of 1.5 cm
2. Maximum laser range of 1.3 km
3. Equipment shall be mounted in a helicopter or drone with a flying height of at least 100 meters and a maximum of 200 meters from the ground
4. LiDAR points shall have a minimum density of 25 points per square meter.
5. Capable of corridor mapping
6. Swath width of at least 180 degrees field of view

b. GPS

1. GPS shall have an updated calibration certificate from NAMRIA
2. GPS shall have dual frequency

c. Work Station

1. With **licensed** LiDAR processing software
2. With **licensed** CAD software
3. Wide format printer.

7.0 HEALTH, SAFETY, ENVIRONMENT AND SECURITY (HSES)

Minimum HSES requirements shall be observed:

- ✓ Health – proper hygiene, hand washing, health promotion, hydration, heat stress, heat stroke and sun protection
- ✓ Safety – PPE, proper body mechanics, traffic safety, pedestrian safety, first aid kit, first aid knowledge and skills
- ✓ Environment – area housekeeping, waste segregation, leave no trace philosophy and three (3) Rs of waste hierarchy
- ✓ Security – site reconnaissance, wearing of ID, buddy system, leave protocol, endorsement, permit and coordination
- ✓ Contingency – CoVID-19 pandemic protocol, emergency security protocol, disaster preparation, fire and earthquake safety.

8.0 DURATION OF THE PROJECT

This Project shall have a duration of **(3) months**, commencing from the issuance of the Notice to Proceed.

9.0 DELIVERABLES/EXPECTED OUTPUTS OF THE PROJECT

The Consultant shall submit to JHMC the following deliverables and outputs by the end of the contract period.

9.1 Terminal Report: It shall consist of the inventory method used, description of the area evaluated, discussion and/or analysis of data gathered from a forest management viewpoint, and recommendations, among others.

9.2 The following documentary reports shall be included in the Terminal Report:

9.2.1 Deliverables for Fores Cover Mapping

- a) Survey Maps: It shall show the locations of the forested areas, tying points established, the exact locations of all geo-tagged trees and existing structures, among others.
- b) Original Tally Sheets and the electronic copy containing the records of all trees inventoried and/or marked/geo-tagged, including the information of live and dead trees;
- c) Photographs showing all trees marked and geo-tagged, the interior portion and the panoramic view of the inventoried area.
- d) All data gathered stated in section 4.6 from items a to h.
- e) The Terminal Report shall be submitted in three (3) sets (one original and 2 photocopies) including an electronic copy.
- f) Electronic Copy of the Computer-Aided Design (CAD) file. The CAD File shall be drawn to a scale of 1:1. The sketch Plan shall be on an appropriate scale.

9.2.2 Deliverables for Structures Mapping

- a) High resolution geo-referenced orthophoto map (orthorectified)
- b) Digital Terrain Model (DTM)
- c) Digital Surface Model (DSM)
- d) Digital 3D Model that can be imported to GIS Software and “.dwg” file.
- e) Point cloud data and 3D photo image (embedded on the point cloud) of the project area
- f) The results of the processed data derived from the LiDAR survey must be compatible with the current system used by JHMC, particularly EMD and LAMD
- g) Contour map/Topographic map for geo-hazard mapping
- h) As-built map (Road network, electrical and water utilities, structures, houses, rivers and creeks, and other land features)
- i) List of GPS control stations and its coordinates and sketch map approved by DENR.
- j) List of geo-tagged structures with the John Hay Reservation Area and John Hay Special Economic Zone
- k) Technology transfer to JHMC EMD and LAMD personnel.

10.0 PROJECT MONITORING

- 10.1 **Project Meetings** shall be regularly conducted to monitor progress and ensure the proper implementation of the project and to thresh out problems that may be encountered during its implementation.

A Statement of Work Accomplished (SOWA) shall be submitted every **15 days** for monitoring purposes.

- 10.2 Unreasonable delays in project implementation shall not be condoned as these affects targeted project completion. However, should there be delays in the implementation due to meritorious reasons, the Consultant shall immediately inform JHMC along with the submission of a Catch-Up Plan within the extension period mutually agreed upon as reflected in an Amendment to the Contract to be approved by both parties with no addition in the original contract cost.

- 10.3 JHMC reserves the right to monitor the progress/status of the Project independently as needed and to inform the Consultant of its evaluation for the latter’s appropriate action.

11.0 PROJECT COST

The Approved Budget for the Contract (ABC) for this Project is **PhP4,000,000.00 inclusive of all applicable taxes.**

12.0 MANNER OF PAYMENT

- 12.1 Subject to the review and acceptance of milestone accomplishments submitted by the Consultant, JHMC shall pay the former through progress billing in accordance with the following schedule,

Progress Billing	Activities	Weighted Accomplishment	Percentage of Contract cost
First Billing	<ul style="list-style-type: none"> • Upon submission of outputs/deliverables relative to all survey works /activities as defined in the Scope of Services of this TOR, and • Upon submission of all outputs/deliverables and tree measurements relative to Tree Marking/Tagging. 	25%	15%
Second progress billing	<ul style="list-style-type: none"> • Upon submission of all outputs/deliverables relative to Geo-tagging, including photographs of all trees. 	25%	35%
Third progress billing	<ul style="list-style-type: none"> • Upon submission of the <u>initial complete</u> Terminal Report to JHMC for review and perusal. 	25%	10%
Fourth and final billing	<ul style="list-style-type: none"> • Upon submission of the Final Terminal Report to the satisfaction/acceptance of JHMC. 	25%	40%
		100%	100%

12.2 Progress Billings shall be acted upon the submission by the Consultant of a Request for Billing and Statement of Work Accomplished subject to the requisite inspection/s and validation by the implementing unit.

13.0 Other Conditions

13.1 The Consultant shall possess the necessary expertise, manpower, equipment/tools, and materials and supplies to perform all the obligations stated herein and is duly registered entity to conduct land surveys.

13.2 Nothing herein shall be construed as establishing an employer-employee relationship between JHMC and the Consultant. The consultant shall be directly responsible and accountable for its personnel under its employ at all times.

13.3 The consultant shall be bound to answer and/or indemnify JHMC for the cost of any damage to or loss of any JHMC property or property of third parties which is due or sustained through the fault or negligence of its personnel.

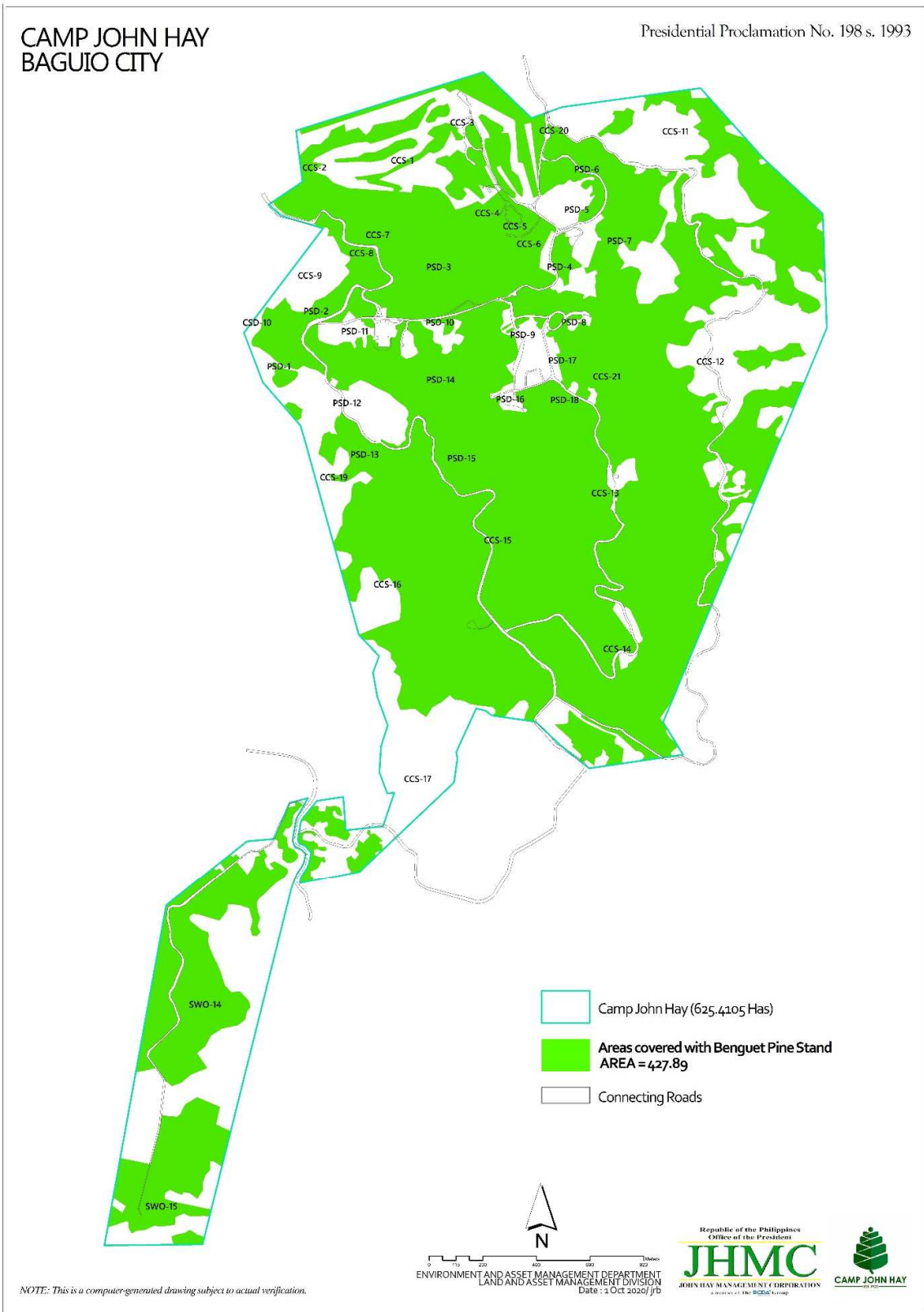
13.4 JHMC may pre-terminate the service Contract for any violation committed by the Consultant in any of the provisions of the Contract.

13.5 JHMC reserves the right to conduct a performance evaluation on the consultant as it deems necessary. A rating of unsatisfactory performance on the part of the

consultant shall be a ground for termination of the contract, subject to applicable provisions of R.A. 9184 and its 2016 Revised Implementing Rules and Regulations particularly Annex “I” *Guidelines on Termination of Contracts*.

14.0 DUTIES AND RESPONSIBILITIES OF JHMC

- 14.1 Provide the reference maps and other documents needed by the Consultant for the conduct of the said Project.
- 14.2 Ensure free access to the project site to undertake the project.
- 14.3 Conduct meetings with the consultant as necessary towards the smooth implementation and/or when other issues and concerns arise during project implementation.
- 14.4 JHMC reserves the right to identify and designate alternative tree inventory and structure mapping procedures in the event of any problem and constraints within the coverage area stated in item 3.0 of this TOR such that the total coverage area as stated in item 3.0 of this TOR be retained. In no case shall the contract amount be increased.



Annex to the TOR: GUIDELINES FOR THE CONDUCT OF TREE MARKING AND TREE MEASUREMENTS AND USE OF THE STAND AND STOCK TABLE

GUIDELINES FOR THE CONDUCT OF TREE MARKING AND TREE MEASUREMENTS

A. DBH, TOTAL AND MERCHANTABLE HEIGHTS MEASUREMENTS

1. The DBH (in centimeters), total height and merchantable height (in meters) of each tree shall be measured and recorded in the prescribed *Tally Sheet*;
2. The following additional information shall also be taken for all marked trees, and recorded in the Tally Sheet:
 - Tree Code/Tree Number
 - Geo-tag number
3. The volume of every tree recorded shall be computed based on the “Regional Volume Equations for Standing Trees.” For Northern Luzon and for Non-Dipterocarp, the volume equation to be used is: **$V=0.00005109 (D^2 * \text{Height})$** , where: V = tree volume in cubic meters; D= DBH in centimeters; and H= Merchantable height in meters
4. The standard diameter classes are structured in multiples of ten (10) such as 10,20,30,40, etc. Each of these diameter classes includes specific range of diameter sizes hereunder illustrated:

Geo-Tag Number	DBH Classes (cm)	Diameter Ranges (cm)	Remarks
	5	Below 4 cm	Geo-tagged using Terrestrial Survey.
	10	5-14	
	20	15-24	Geo-tagged using Aerial LiDAR Survey.
	30	25-34	
	40	35-44	
	50	45-54	
	60	55-64	
	70	65-74	
	80	75-84	
	90	85-94	
	100	95-104	
	110	105-114	
	120	115-124	