PROCEDURES AND STANDARDS FOR DIGITAL CADASTRAL SURVEYING IN JAMAICA

(Medium Accuracy for Cadastral Mapping)

Prepared for

The Land Administration and Management Program (LAMP)

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1. INTERPRETATION

In these procedures and standards:

"Accuracy" means in exact conformity with given standards.

"Boundary" means either the limits at law of any estate or any physical feature such as a fence erected to mark the limit at law.

"Cadastral map" means a map that shows how a locality is divided into units of ownership. The map may be represented in hard copy or digital form.

"Demarcation" means the marking of the boundaries of land parcels on the ground.

"Land" includes land covered with water.

"Permanent Mark" means any survey mark specified in the Fifth Schedule of The Land Surveyors Regulations, and erected in accordance with provisions of that Schedule.

"Plan" includes a map, plat, or diagram, which shows unit(s) of ownership of land. The plan may be represented in hard copy or digital form.

"Survey" means the taking of measurements and the setting of survey marks for the purpose of defining any boundary of land, but does not include:

(a) the bushing of lines between established survey marks; or
(b) a preliminary lay-out preparatory to a survey.

"Traverse" means an orderly sequence of measurements of angles and distances or bearings and distances between points on the ground made to determine the position of the points.

2. INTRODUCTION

2.1 Cadastral Surveys

The main aim of a cadastral survey is to determine for each parcel of land its location, the extent of its boundaries and its area, and to unambigiously identify the parcel physically on the ground as well as graphically on a map, plan or record.

It also provides information for a land database to assist the process of land administration and management.

The traditional methods of conducting cadastral surveys in Jamaica are by Total Station, Compass and tape, and Theodolite and tape. These methods are generally expensive, especially for lower value land, where the survey has to be tied into the national grid system. This state of affairs calls for surveying solutions that will efficiently, accurately and cost effectively collect parcel data for processing, cataloging and storage in the land database. A survey methodology utilizing Global Positioning System Technology (GPS), Electromagnetic Distance Measurement (EDM) equipment capable of measuring both distance and direction, and the surveyor's tape provides such solution.

2.2 The responsibilities of the surveyor

(a) to adjudicate the boundaries of each parcel of land being surveyed or mapped;
(b) to mark on ground with permanent marks the limits of each parcel of land;
(c) to produce documentary and mathematical evidence which will describe such land parcel unambiguously and which would enable a subsequent land surveyor to re-establish a lost boundary or mark to the precision of the original survey;
(d) to maintain a standard of accuracy consistent with that specified for the survey;
(e) to apply appropriate checks to all aspects of the work;
(f) to carry out the work in accordance with all laws and regulations that govern it;
(g) to ensure that the integrity of the work can be upheld in a court of law;
(h) to prepare a cadastral map in accordance with written instructions given prior to execution of the field work.

2.3 Qualifications required for cadastral surveying to create and maintain cadastral maps:

(a) Land Surveyor's Commission issued by the Land Surveyors Board of Jamaica;
(b) Degree, Diploma or Certificate in Surveying Technology issued by the University of Technology of Jamaica. Holders of these or equivalent qualifications are required to work under the supervision of a Commissioned Land Surveyor.

2.4 Important features of the cadastral maps

(a) The parcels are surveyed within the national grid reference system in order to maintain a uniform location reference and a standardized orientation.
(b) The digital files can be exported directly into the land database.
(c) Cost effective production because of the methodology employed.
(d) The accuracy standard for the surveys to create the maps is more relaxed and the resulting maps carry less information than the typical plan or diagram, e.g. distances and areas are shown, but no traverse lines or bearings. Bearings can be derived from the digital files if required.
(e) The maps can be used for land registration.

2.5 Instrumentation

Global Positioning System (GPS) in conjunction with-
(a) Electronic Distance Measuring (EDM) Equipment;
(b) Tape,
Or any other instrumentation approved by the Director of Surveys.

2.6 Standard of Accuracy for Cadastral Surveying:

All boundary surveys shall be tied into the National Grid, with all corners shown having an absolute positional accuracy better than + or–0.5 metre.

3. SPECIFICATIONS

In order to meet the standard stipulated for cadastral surveying as stated above, the specifications set out in Tables 1a, 1b, 1c and 2a, which relate to equipment, measurement tolerances, field survey, and office computations must be followed.

4. EQUIPMENT CALIBRATION PROCEDURES

4.1 National Calibration Network

The National Calibration Network is located at the National Heroes Park, Kingston. Its purpose is to enable surveyors to get their GPS, EDM device and Tapes checked and approved prior to executing cadastral surveys.

The network consists of ten (10) monumented accurately known coordinated points, located at the northern end of the park. Each point carries an identifying number stamped in a brass disc embedded in the top of the monument. The monuments are set flush with ground level and are easily accessible.

The Network is coordinated in both WGS84 and Jamaica Datum 1969 (JAD69).

The National Heroes Park is in close proximity to the Survey Department, about 5 minutes by car.

4.2 Calibration Requirements

4.2.1 GPS

(1) Every surveyor shall submit any GPS (including receivers, antennae, software and firmware) intended to be used by him in the execution of cadastral surveys to the Director of Surveys for a calibration check against the National Calibration Network, before the first use of such system, and thereafter at least once every twelve months. Further calibration checks of the system are required when:

(a) the version of the processing software is changed
(b) the version of the firmware is changed
(c) any antenna is changed.

(2) On first calibration check, the Director of Surveys shall record the serial number of each component of the system.

(3) Where any system is submitted pursuant to paragraph (1), the Director of Surveys shall cause such system to be checked by some person authorized by him and:

(a) where such system is found to be accurate, approve of and return such system to the surveyor with a certificate of accuracy containing a record number for the check. The surveyor must include the record number on all cadastral surveys done with the approved system; or
(b) where such system is found to be inaccurate, deny approval of and return such system to the surveyor with a statement of inaccuracy.

(4) A system shall be considered inaccurate, where the position that it has determined for a point in the National Calibration Network, differs by more than + or - 0.5 metre from the listed position on the Jamaica Datum 1969 (JAD69). The coordinate values of the calibration points shall be referred to the (JAD69) defined as follows (notwithstanding plan for new datum JAD2001 – Appendix 4 for datum definition):

Zone: JAMAICA
Projection: Lambert Conical Orthomorphic with one Standard Parallel

Spheroid:	Clarke 1866
Unit of Measurement:	Metre
Longitude of Origin:	77 Degrees West of Greenwich
Latitude of Origin:	18 Degrees North of the Equator
False Coordinates of Origin:	250 000m Easting 150 000m Northing
Scale Factor at Origin:	1.000

4.2.2 Electronic Distance Measurement (EDM) Equipment

(1) Every surveyor shall submit any EDM equipment (including Electronic Total Stations, Laser Range Finders) intended to be used by him in the execution of cadastral surveys to the Director of Surveys for a calibration check against the National Calibration Network, before the first use of such equipment, and thereafter at least once every twelve months. Further calibration checks of the system are required when:

(a) the instrument has been adjusted or repaired.
(b) the prism used for the calibration check has been changed.

(2) On first calibration check, the Director of Surveys shall record the serial number of each component of the EDM equipment.

(3) Where any EDM equipment is submitted pursuant to paragraph (1), the Director of Surveys shall cause such equipment to be checked by some person authorized by him and:

(a) where such EDM equipment is found to be accurate, approve of and return such equipment to the surveyor with a certificate of accuracy containing a record number for the check. The surveyor must include the record number on all cadastral surveys done with the approved equipment; or
(b) where such EDM equipment is found to be inaccurate, deny approval of and return such EDM device to the surveyor with a statement of inaccuracy.

An EDM equipment shall be considered inaccurate, where the distance it has measured for a line in the National Calibration Network, differs by more than + or - 0.1 metre from the listed distance on the Jamaica Datum 1969 (JAD69).

4.2.3 Tape

(1) Every surveyor shall submit any Tape intended to be used by him in the execution of cadastral mapping to the Director of Surveys for a calibration check against the National Calibration Network, before his first use of such

tape, and thereafter at least once every twelve months. Further calibration checks of the Tape are required when:

the tape breaks and has been repaired.

(2) On first calibration check, the Director of Surveys shall stamp an identifying number on the tape.

(3) Where any tape is submitted pursuant to paragraph (1), the Director of Surveys shall cause such tape to be checked by some person authorized by him and:

(a) where such tape is found to be accurate, approve of and return such tape to the surveyor with a certificate of accuracy containing a record number for the check. The surveyor must include the record number on all cadastral surveys done with the approved tape; or
(b) where such tape is found to be inaccurate, deny approval of and return such tape to the surveyor with a statement of inaccuracy.

A tape shall be considered inaccurate, where the distance that it has measured for a line in the National Calibration Network, differs by more than + or - 0.1 metre from the listed distance on the Jamaica Datum 1969 (JAD69).

4.3 Calibration Checking Procedure

4.3.1 GPS

(1) The surveyor shall be responsible for the safety and security of his GPS system during the check. He shall observe marks in the Calibration Network under the direction of the person authorized by the Director of Surveys to cause such check. The steps for checking are:

(a) Configure receivers to the settings as set out in the SPECIFICATIONS FOR GPS-BASED CADASTRAL SURVEYING (Table 1a).
(b) Observe a minimum of three (3) calibration points two times in two consecutive circuits. These points are additional to any point used for a base.

4.3.2 Electronic Distance Measurement (EDM) Equipment

(1) The surveyor shall be responsible for the safety and security of his EDM equipment during the check. He shall observe marks in the Calibration Network under the direction of the person authorized by the Director of Surveys to cause such check. The steps for checking are:

(a) Measure 2 different lines. Each line is to be measured 2 times on 2 different vertical angles.

4.3.3 Tape

(1) The surveyor shall be responsible for the safety and security of his tape during the check. He shall measure between marks in the Calibration Network under the direction of the person authorized by the Director of Surveys to cause such check. The steps for checking are:

(a) Measure 2 different lines. Each line is to be measured 2 times on 2 different zeroes.

5. TECHNICAL PROVISIONS

(a) **The position of survey marks** may be determined to an absolute position of + or -0.5 metre in the national grid system, using approved GPS or EDM equipment or by any other method approved by the Director of Surveys.

(b) **Linear measurements** may be made with an approved tape in metres to at least the nearest decimal (tenth) of a metre, or by any other method approved by the Director of Surveys.

(c) **No offset longer than 10 metres** shall be measured only by means of a tape.

(d) **Where boundaries are to be marked** in the course of effecting a survey:

- (i) the surveyor shall be ultimately responsible for the setting of all survey marks;
- (ii) every boundary shall be marked in the most permanent manner practicable in the circumstance;
- (iii) permanent marks shall be of a type specified in the Fifth Schedule of the Land Surveyors Regulations;
- (iv) a permanent mark shall be placed at each change of bearing along the boundary;
- (v) where the distance between any two corners exceeds 180 metres, intermediate marks shall be erected at approximately every 180 metres, and such intermediate marks shall, where possible, be visible from the corner marks and from each other;
- (vi) where practicable, all corner marks shall be placed on the boundary;
- (vii) where it is impracticable to place permanent marks on the boundary, the surveyor shall define such boundary by reference to any permanent marks included in the survey and placed as near as possible to the boundary;

(viii) where a road adjoins any lands to be surveyed, permanent marks shall be placed at intervals of not more than 100 metres along the common boundary;

(ix) all survey marks shall be placed as near vertical as is practicable and shall be fixed securely;

(x) where a corner is defined by a permanent building or a well defined concrete structure, no mark need be used.

(e) **Where a surveyor opens old boundary lines** of land in respect of which:

(i) there is an existing plan; and

(ii) such plan is available for his scrutiny; or

(iii) there are marks on the ground,

such surveyor shall not depart from the original lines shown in the existing plan or on the ground unless he shows upon the map prepared by him the position of the original lines and states thereon the reason for departing from such original lines.

(f) **No surveyor shall move any boundary mark** unless he:

(i) obtains the consent of all interested parties; and

(ii) accurately records upon the map prepared by him the position of the original boundary mark.

(g) **Where survey marks and lines on the ground differ** from survey marks and lines appearing upon any existing plan which is available for his scrutiny, a surveyor shall show upon the map prepared by him both sets of marks and lines, and shall state specifically which marks and lines have been adhered to, and his reasons for so doing.

(h) **Notwithstanding paragraphs (e), (f) and (g) above**, parcels for which certified survey plans exist shall not be resurveyed, save and except for boundaries adjoining parcels being surveyed.

However, such certified plans shall be tied into the national grid system and included in the map, and will be identified by title number in the case of registered parcels or Survey Department examination number in the case of unregistered parcels.

Lands previously surveyed but subsequently subdivided and not certified by the Director of Surveys will be surveyed in respect of the new internal boundaries, and to the standard of accuracy for cadastral mapping. Subdivision approval may be necessary.

Initial coordinates and bearings may be obtained by means of the National Control Network.

6. PLANNING AND PREPARATION FOR FIELD OPERATIONS

(a) Use Ephemeris data to identify times of day with good conditions for GPS observations, i.e Position Dilution of Precision (PDOP) is below 6 with more than 4 satellites available at elevation greater than 15 Degrees above the horizon.
(b) Identify a minimum of two control points in the area to be mapped to facilitate pre- and post-survey checks.
(c) Identify location and operational status of Base Stations.
(d) Acquire cadastral index map and survey records affecting parcels to be mapped.
(e) Configure the Rover Receiver in accordance with Table 1a. The settings in the table are designed to ensure that the Rover does not track any satellite that the Base Receiver does not track.
(f) Upload Data Dictionary from computer to datalogger. The data dictionary is a catalogue of information which is used to structure and guide the data collection process. Each dictionary consists of a list of features , a list of attributes for each feature, and values for each attribute.

7. PROCEDURES FOR FIELD OPERATIONS

(a) Reconnoitre the area to be mapped using the Cadastral Index Map as a guide. Update or clarify the map with field sketches of the parcels where necessary. This will facilitate the systematic identification of all parcel corners, which will contribute to a more organized and productive effort.
(b) Group parcels in manageable blocks for survey.
(c) Serve Notice of survey. Notice will alert adjoining land owners/ occupiers of a pending survey and to solicit their assistance in confirming boundaries.
(d) Adjudicate , monument and clear boundaries. The clearing of all boundary lines is the responsibility of land owners as part of their contribution to the project. If the boundaries are well defined and the property owners are in complete agreement, the boundaries can be cleared prior to any adjudication and monumentation. If the boundaries are ill defined or the property owners are not in agreement, then they will be cleared during or after adjudication and monumentation if the matter is resolved. As a policy, boundary lines will be cleared and monumented prior to any field survey.
(e) Where GPS is used in the survey the following procedure should be adopted:
    I) Differential Pseudo-Range Positioning. At the start of the day's operation observe two control points with known JAD69 coordinates for the pre-survey check.
    II) Real Time Kinematic (RTK). Calibrate the Rover on four to five control points on the site.
    III) Differential Pseudo-Range Positioning. Observe all change of bearing on parcel boundaries at 5 seconds interval for 12 epochs. Observe each point twice at least one hour apart. Where important

features such as building corners will help in identifying parcel boundaries, observe them once.

IV) Real Time Kinematic (RTK). Observe all change of bearing on parcel boundaries at minimum 1 second interval for a minimum of 5 epochs. Observe each point twice at least one hour apart.

V) Enter attribute data in datalogger for each point observed, and make detailed sketches and notes in the field book of the marks and boundaries surveyed, as well as parcel owners/ occupiers, persons appearing at the survey, and status of parcels, e.g. whether registered, unregistered or previously surveyed. The role of the field book cannot be overstated as it is an invaluable record of the facts gathered on ground. It is the best guide for the connectivity of points and the consequent generation of the maps.

VI) At the end of the day's operation observe two control points with known JAD69 coordinates for the post-survey check as indicated in Section 7e(I) above.

I) Not withstanding the use of dataloggers, record all observations etc. in the field book.

(f) Where EDM is used in the survey the following procedure should be adopted:

II) At the start of each day's operation observe two control points with known JAD69 coordinates for orientation, reference and pre- survey check.

III) At the end of each day's operation observe two control points with known JAD69 coordinates for orientation, reference and post- survey check.

IV) Not withstanding the use of dataloggers, record all observations etc. in the field book.

Where compass based EDM is used, apply the bearing correction derived from the pre-survey check. It shall not be necessary to measure traverse lines in both directions. Avoid using device where the compass may be affected by magnetic attraction.

As a quality control measure, where practicable tape check one (1) boundary line in fifteen (15) and record the measurements in the field book.

8. PROCEDURES FOR OFFICE OPERATIONS

(a) **Transformation Equations:** See Appendix 4. These equations are not absolutely necessary for a mapping operation such as contemplated for LAMP. All site control marks will be coordinated in JAD69, and the procedures at 7(e) will facilitate computation of coordinates in JAD69.

(b) **Backup field data.** At the end of each day's observation, download raw data from datalogger to office computer. Before processing data, copy file to diskette and store in a safe and secure place for future access to the raw data if necessary. This applies to both GPS and EDM data.

(c) **Get Base Station Data.** Use data from the two nearest base stations for Differential Pseudorange post processing.

(d) **Differentially correct Rover Data.** This a technique whereby data from the base station, which is at a known location is used to correct the data from the rover. Special care must be taken to ensure that the reference coordinates, coordinate system and datum of the reference base station are correctly set in the processing software. The reference datum is JAD69.

(e) **Do multiple Base Station Test.** Compute the coordinates for the first observation from each base station for each point. Compare results. If the vector sum of the coordinate differences exceeds + or -0.5m, re-observe. If the vector sum is less than + or -0.5m, accept and calculate the average of the two sets of coordinates. Do the same for the second observation for the point. Remember that each boundary point must be measured two times, at least one hour apart. See Table 3.

(f) **Do Multiple Occupation Test.** This is an independent check on the quality of the observation. Compare the coordinates for the two observations. If the vector sum of the coordinate differences exceeds + or -0.7m, re-observe. If the vector sum is less than + or -0.7m, accept and calculate the average of the two sets of coordinates. These coordinates are regarded as the final coordinates for the point. See Table 4.

(g) **Export Final Coordinates to a suitable CAD software.** Ensure that the coordinates are correct and are in the correct format before export.

(h) **Prepare Digital Map from the coordinates.** Generate paper copy of the map for boundary analysis and confirmation. This is part of the quality control process. Any issue that cannot be resolved in the office must be clarified in the field and the appropriate amendments made to the map to ensure its correctness. This constitutes the draft cadastral map for public display with the list of "Tenure Claims". This is the responsibility of the commissioned land surveyor.

(i) **Submit Completed Map for Approval.** The map (digital file and hard copy), digital raw data files, field books, computations, copies of Notices and Waivers of survey and a brief report signed by the surveyor indicating:

- Purpose of survey
- Dates/Times of survey
- Survey method
- Base stations and controls used
- Serial numbers of GPS system, EDM equipment
- Tape number(s).
- Record numbers for Calibration certificates
- Names and title of all members of field crew
- Boundary inconsistency problems encountered and how resolved,

must be sent to the Project Management Unit for certification prior to transmission to Survey Department for approval by the Director of Surveys and prior to inclusion as a cell in the Cadastral Map.

9. BASE STATIONS

9.1 Community Base Stations (CBS)

A national Continuously Operating Reference Station (CORS) System will be established in Jamaica. This will comprise Community Base Stations (CBSs) at Norman Manley International Airport, Kingston, Mandeville and Montego Bay. The CBS at Norman Manley International Airport has been established and is managed by the Meteorological Department. Those proposed for Kingston, Mandeville and Montego Bay will be managed by the Survey Department (SD). These CBSs will meet post processing requirements of positioning and meteorological users, among others, by providing (GPS) code range and carrier phase observational data. Reference points will also be established in the vicinity of the CBSs and other Reference stations.

Positional coordinates for the reference antennae at the CBS sites will be made available for postprocessing, and will also be used for real-time broadcast correctors.

In areas where additional coverage is needed, groups operating GPS reference stations in those areas will be invited to participate in the SD CORS System. Acceptance for the inclusion of stations to the SD CORS System will be subject to their meeting the SD CORS selection criteria, and agreement that coordinates for the antennae positions of the sites and other data will be made freely available to the SD for distribution to users of the system. The use of mobile base stations will also be encouraged where considered advantageous.

The observational data will be available in the Receiver Independent Exchange (RINEX) format to facilitate the use of these data with data from RINEX compatible GPS receivers and processing software. Additionally the SD will archive the data.

Bi-directional transformation equations for transforming coordinates between JAD69 and ITRF 96 or WGS 84 will be developed.

9.2 Base Station Selection Criteria

9.2.1 Site specifications:

(a) Stable site (minimal local horizontal and vertical movement).

(b) Stable antenna mount (less than 1-cm short-term variability).

(c) Stable power with at least 30 minute battery backup.

(d) Minimum electromagnetic interference.

(e) Relatively clear horizon with any obstructions higher than 10 degrees located as far away from the reference antenna as possible and located to the north of the reference antenna.

(f) Schematic of the antenna support monument/structure

(g) Site obstruction survey

(h) Site sketch

(i) Representative photographs of the facility, including monument, antenna, receiver and related equipment, potential obstructions, and overall site.

(j) CORS provider will submit three consecutive continuous 24-hour data sets to SD to test for site suitability and multipath conditions.

9.2.2 Equipment specifications:

(1) Receiver

(a) Must be at least dual frequency (L1 and L2).

(b) Must be able to track at least 8 satellites above 10 degrees.

(c) Must have automatic switching between operating modes to retain full wavelength L2 when Anti Spoofing is on.

(d) Must be capable of sampling at 1 second interval.

(e) Must provide:

- L1 C/A-code pseudorange or P-code pseudorange.
- L1 full wavelength carrier phase.
- L2 full wavelength carrier phase.
- Pseudorange accurate to better than 0.25 metre RMS.

(2) Antenna

(a) Must be at least dual frequency.

(b) Choke Ring with radome

(c) Capable of maintaining 1 cm stability.

9.2.3 Communications Specifications:

(1) 4 dedicated voice grade telephone lines and a local Internet Service Provider (ISP) account.

(2) 459 Mhz Broadcast frequency for Land Surveying.

9.2.4 Data handling specifications:

(1) Data will be available for distribution.

(2) Data must be converted to RINEX 2 format using an approved software.

(a) CORS will be operated 24 hours/day, 365/366 days/year except during scheduled maintenance periods.

(b) Data will be recorded at 30 second, 20 second, 5 second and 1 second intervals.

(c) Data will be stored on-line on site or at a central facility for 14 days.

(d) Data will be backed up on tape with a 14 day recycle period.

9.2.5 Coordinate system connection:

SD must be able to determine a JAD69 CORS antenna position to an accuracy level of second order standard with 95% confidence. The accuracy of the vertical dimension will be dependent on the accuracy of the Geoid model that will be used for Jamaica.

10. REFERENCES

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APPENDIX 1

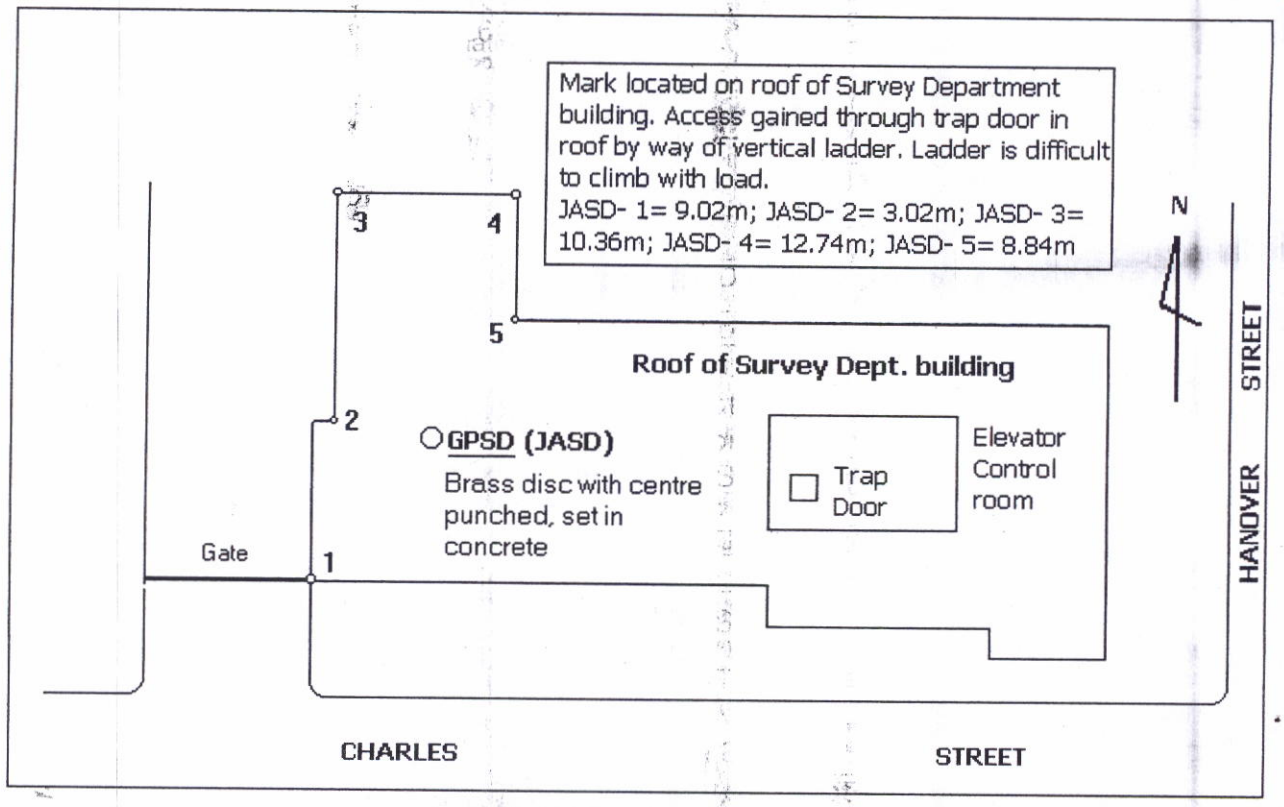
NATIONAL CALIBRATION NETWORK:
Station Descriptions

NATIONAL CALIBRATION NETWORK

Station Identification: GPSD (JASD)

Datum: WGS 84	Datum: JAD69(Clarke 1866)
Coordinates Latitude = 17 58 29.60031 N Longitude = 76 47 19.24794 W Ellipsoidal Ht.= 21.2135 m MSL Ht. = 35.136 m	**Coordinates** Latitude = 17 58 20.2009 N Longitude = 76 47 23.0979 W MSL Ht. = 35.136 m
	N = 146944.520 E = 272270.379 MSL Ht.= 35.136 m

Sketch GPSD (JASD)



Station Identification: JAMA

Datum: WGS 84	Datum: JAD69(Clarke 1866)
Coordinates Latitude = 17 56 20.47210 N Longitude 76 46 51.13579 W Ellipsoidal Ht.= -1.064 m MSL Ht. = 13.127 m	**Coordinates** Latitude = 17 56 11.06574 N Longitude = 76 46 54.98929 W MSL Ht. = 13.127 m
	N = 142975.501m E = 273102.091m MSL Ht.= 13.127 m

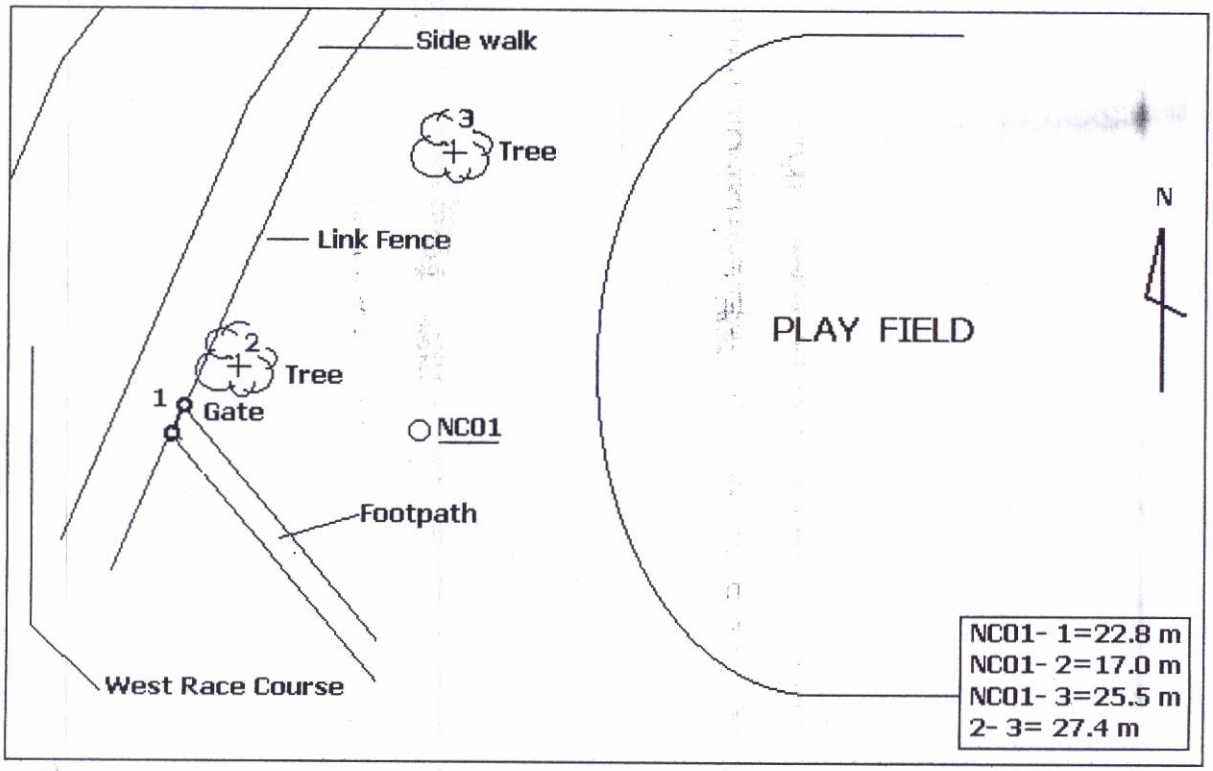
This IGS Tracking Site is located at the Meteorological Office, Norman Manley International Airport in Kingston. This is a Community Base Station (CBS) and is operated 24 hours/day, 365/366 days/year except during scheduled maintenance periods. The Station is located in a secure area to which access is gained by special authorization from the Airport Authority of Jamaica.

Station Identification: NC01	SEE SITE LOCATION MAP

Datum: WGS 84	Datum: JAD69(Clarke 1866)
Coordinates Latitude =17 59 07.77391 N Longitude = 76 47 19.85541 W Ellipsoidal Ht.= 32.216 m MSL Ht. = 45.926 m	**Coordinates** Latitude = 17 58 58.37673 N Longitude = 76 47 23.70521 W MSL Ht. = 45.926 m
	N = 148118.129 m E = 272251.181 m MSL Ht.= 45.926 m

Station is identified by a number stamped in brass disc embedded in top of monument. The monument is set flush with ground level and is easily accessible.

Sketch: NC01

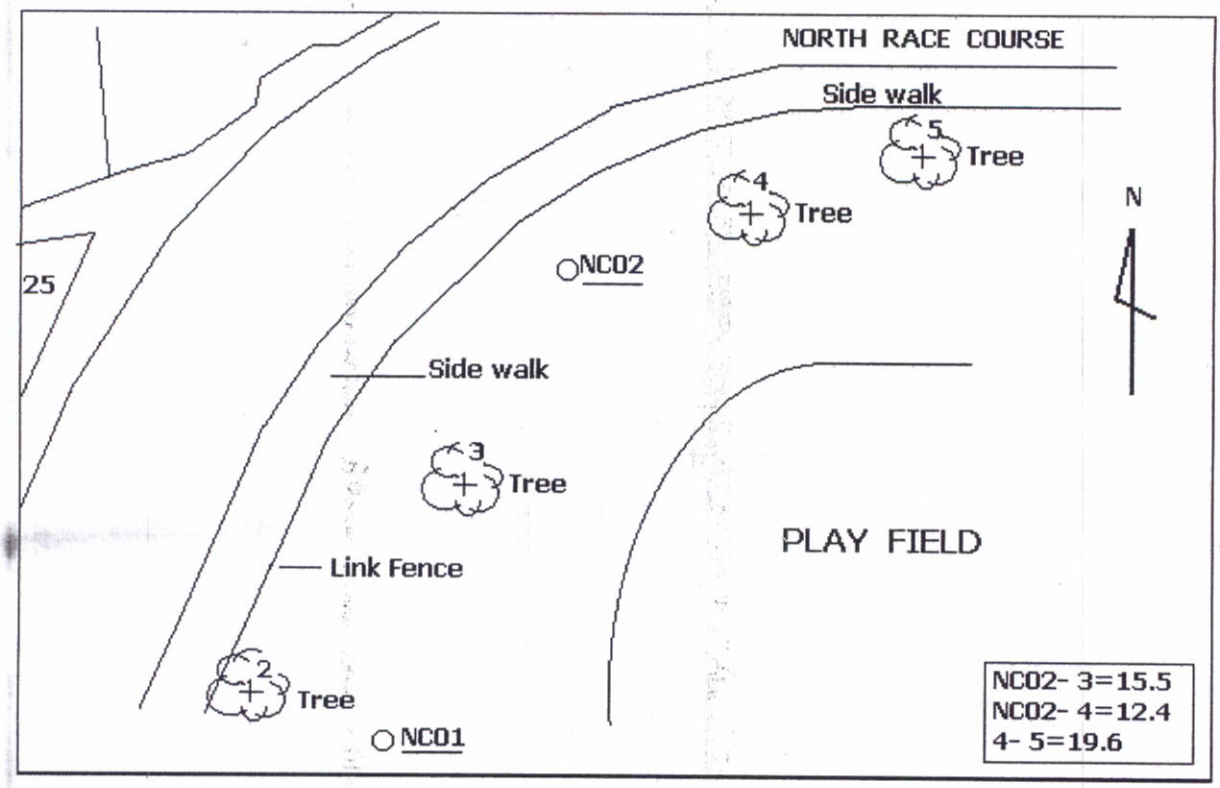


Station Identification: NC02	SEE SITE LOCATION MAP

Datum: WGS 84	Datum: JAD69(Clarke 1866)
Coordinates Latitude =17 59 08.98580 N Longitude = 76 47 19.26789 W Ellipsoidal Ht.= 32.858 m MSL Ht. = 46.580 m	**Coordinates** Latitude = 17 58 59.58867 N Longitude = 76 47 23.11767 W MSL Ht. = 46.580 m
	N = 148155.408 m E = 272268.425 m MSL Ht.= 46.580 m

Station is identified by a number stamped in brass disc embedded in top of monument. The monument is set flush with ground level and is easily accessible.

Sketch: NC02

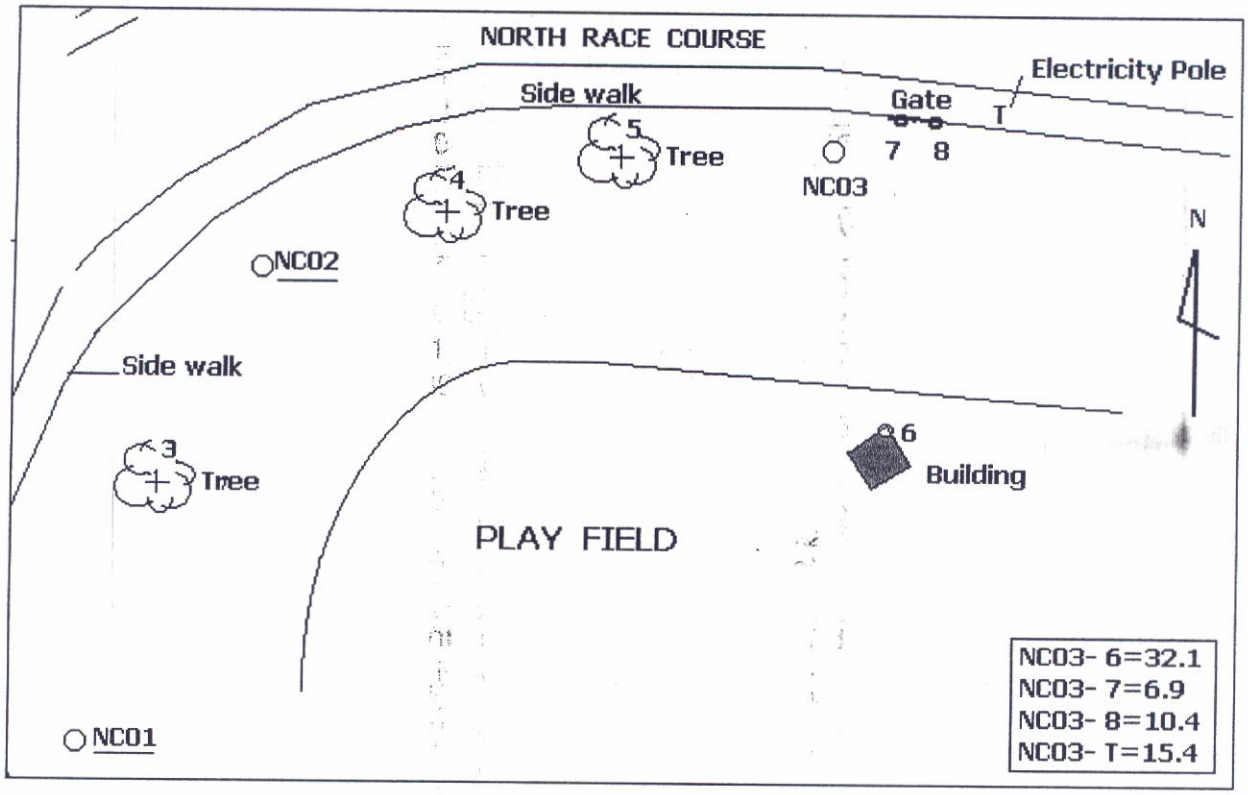


Station Identification: NC03 SEE SITE LOCATION MAP

Datum: WGS 84	Datum: JAD69(Clarke 1866)
Coordinates Latitude =17 59 09.27241 N Longitude = 76 47 17.15124 W Ellipsoidal Ht.= 33.949 m MSL Ht. = 47.685 m	**Coordinates** Latitude = 17 58 59.87527 N Longitude = 76 47 21.00110 W MSL Ht. = 47.685 m
	N = 148164.289 m E = 272330.687 m MSL Ht.= 47.685 m

Station is identified by a number stamped in brass disc embedded in top of monument. The monument is set flush with ground level and is easily accessible.

Sketch: NC03

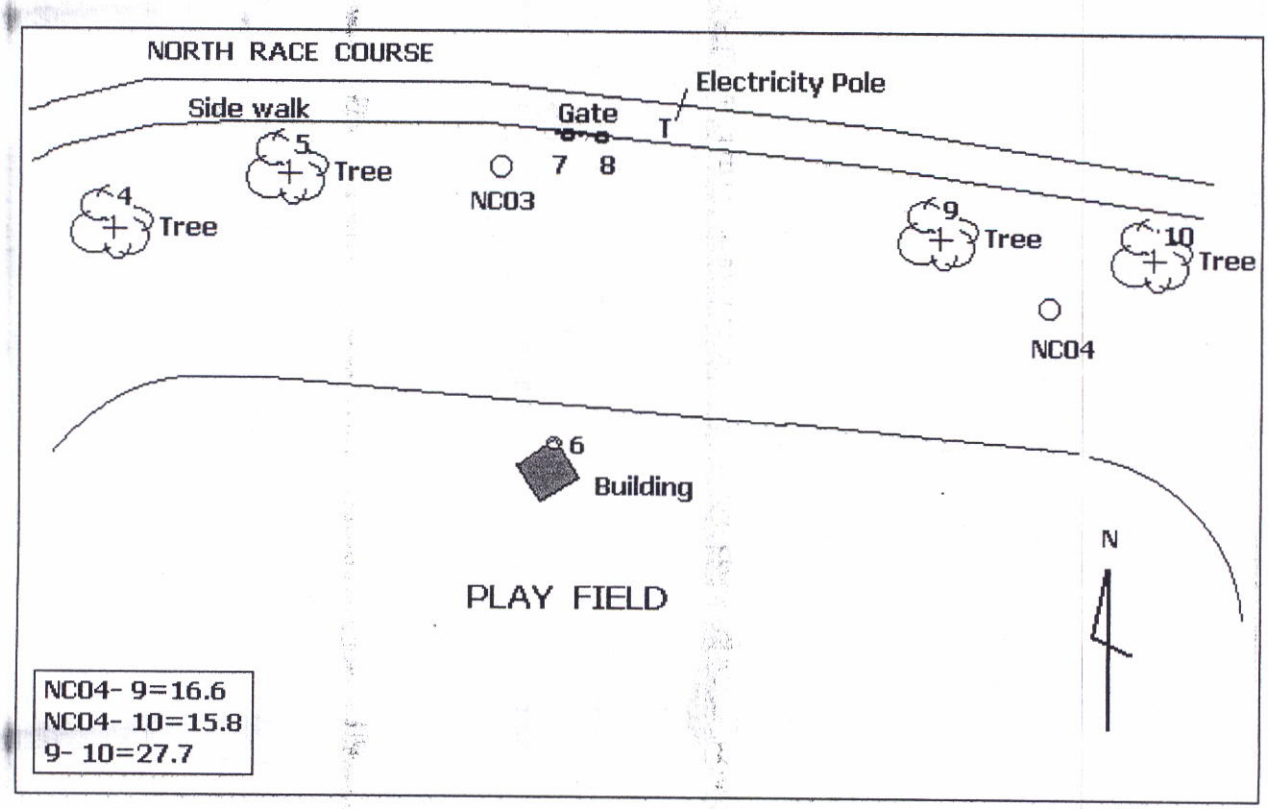


Station Identification: NC04 SEE SITE LOCATION MAP

Datum: WGS 84	Datum: JAD69(Clarke 1866)
Coordinates Latitude =17 59 08.45150 N Longitude = 76 47 14.82395 W Ellipsoidal Ht.= 33.049 m MSL Ht. = 46.778 m	**Coordinates** Latitude = 17 58 59.05424 N Longitude = 76 47 18.67383 W MSL Ht. = 46.778 m
	N = 148139.126 m E = 272399.188 m MSL Ht.= 46.778 m

Station is identified by a number stamped in brass disc embedded in top of monument. The monument is set flush with ground level and is easily accessible.

Sketch: NC04

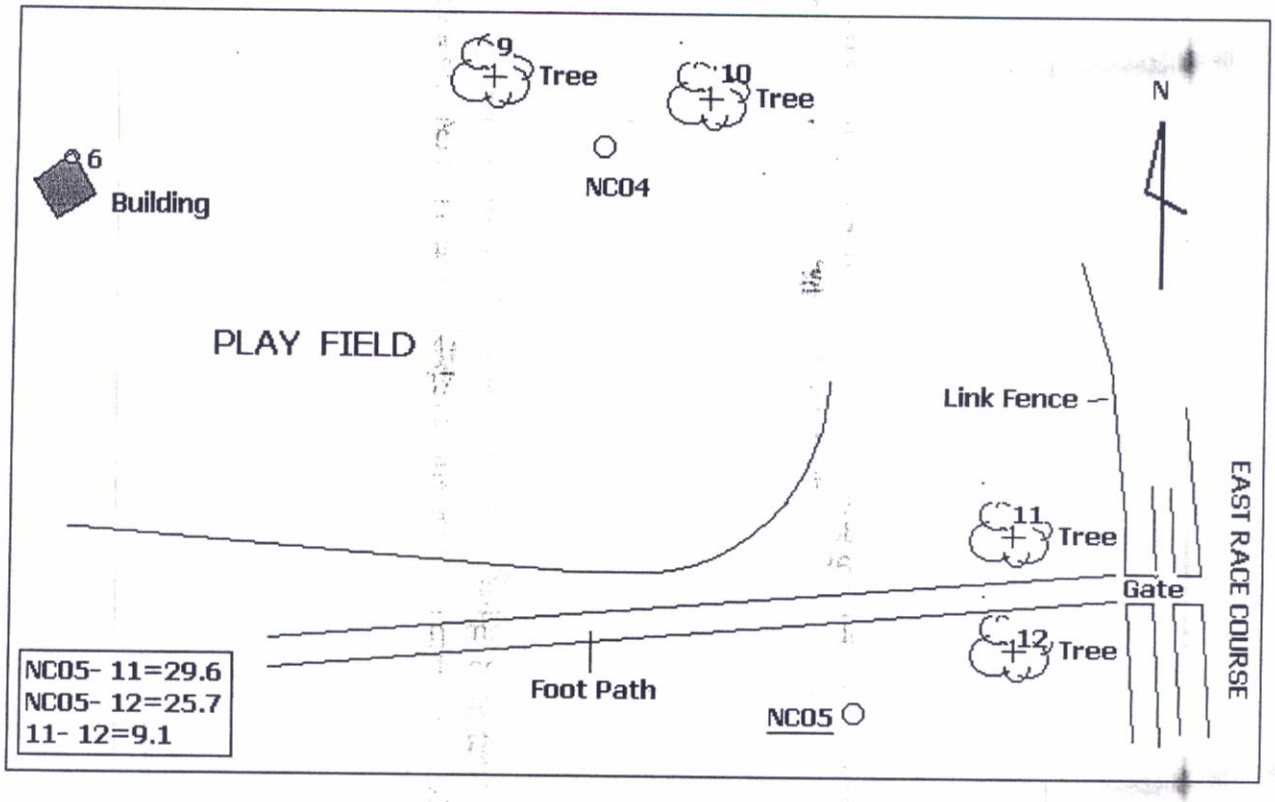


Station Identification: NC05 SEE SITE LOCATION MAP

Datum: WGS 84	Datum: JAD69(Clarke 1866)
Coordinates Latitude =17 59 04.95552 N Longitude = 76 47 13.87062 W Ellipsoidal Ht.= 31.289 MSL Ht. = 45.015 m	**Coordinates** Latitude = 17 58 55.55811 N Longitude = 76 47 17.72065 W MSL Ht. = 45.015 m
	N = 148031.677 m E = 272427.354 m MSL Ht.= 45.015 m

Station is identified by a number stamped in brass disc embedded in top of monument. The monument is set flush with ground level and is easily accessible.

Sketch: NC05

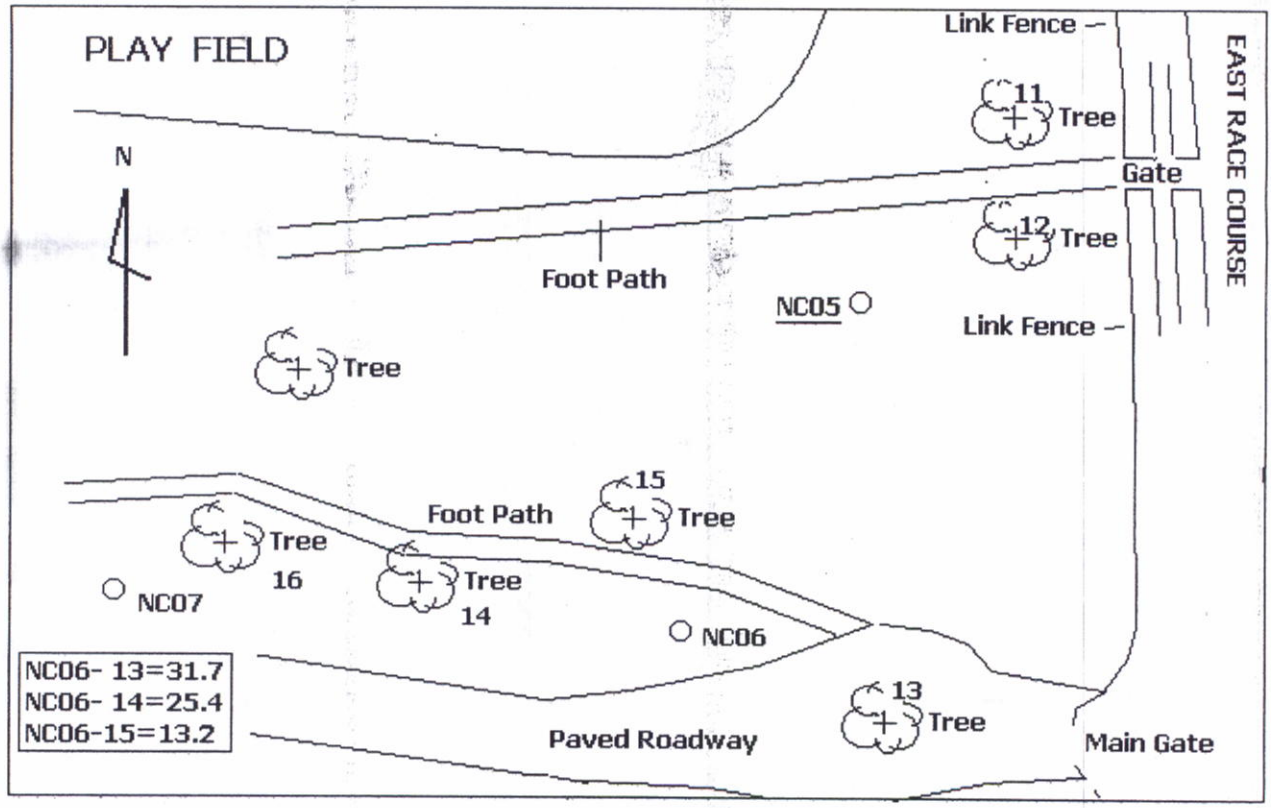


Station Identification: NC06	SEE SITE LOCATION MAP

Datum: WGS 84	**Datum: JAD69(Clarke 1866)**
Coordinates Latitude =17 59 03.43445 N Longitude = 76 47 15.16375 W Ellipsoidal Ht.= 30.117 m MSL Ht. = 43.864 m	**Coordinates** Latitude = 17 58 54.03698 N Longitude = 76 47 19.01376 W MSL Ht. = 43.864 m
	N = 147984.870 m E = 272389.362 m MSL Ht.= 43.864 m

Station is identified by a number stamped in brass disc embedded in top of monument. The monument is set flush with ground level and is easily accessible.

Sketch: NC06

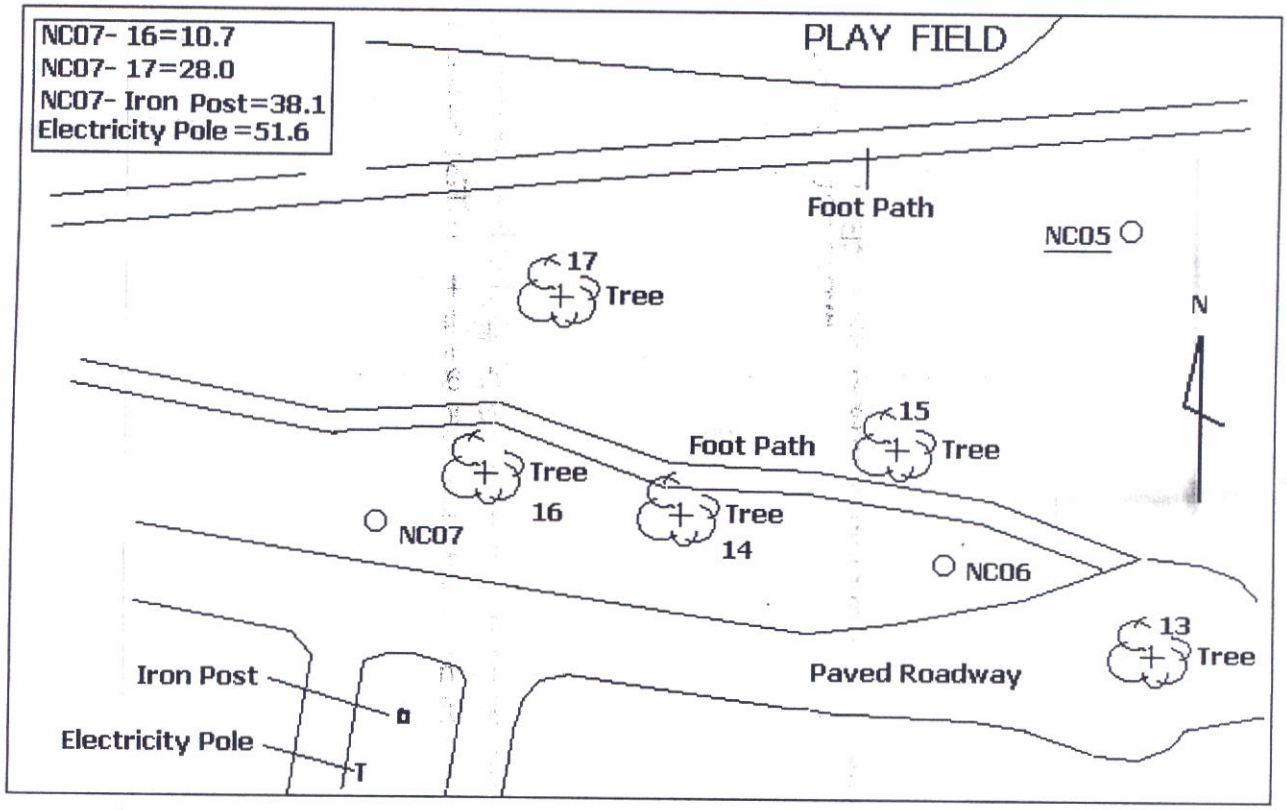


Station Identification: NC07	SEE SITE LOCATION MAP

Datum: WGS 84	**Datum: JAD69(Clarke 1866)**
Coordinates Latitude =17 59 04.03820 N Longitude = 76 47 17.32580 W Ellipsoidal Ht.= 30.443 m MSL Ht. = 44.190 m	**Coordinates** Latitude = 17 58 54.64076 N Longitude = 76 47 21.17570 W MSL Ht. = 44.190 m
	N = 148003.360 m E = 272325.734 m MSL Ht.= 44.190 m

Station is identified by a number stamped in brass disc embedded in top of monument. The monument is set flush with ground level and is easily accessible.

Sketch: NC07

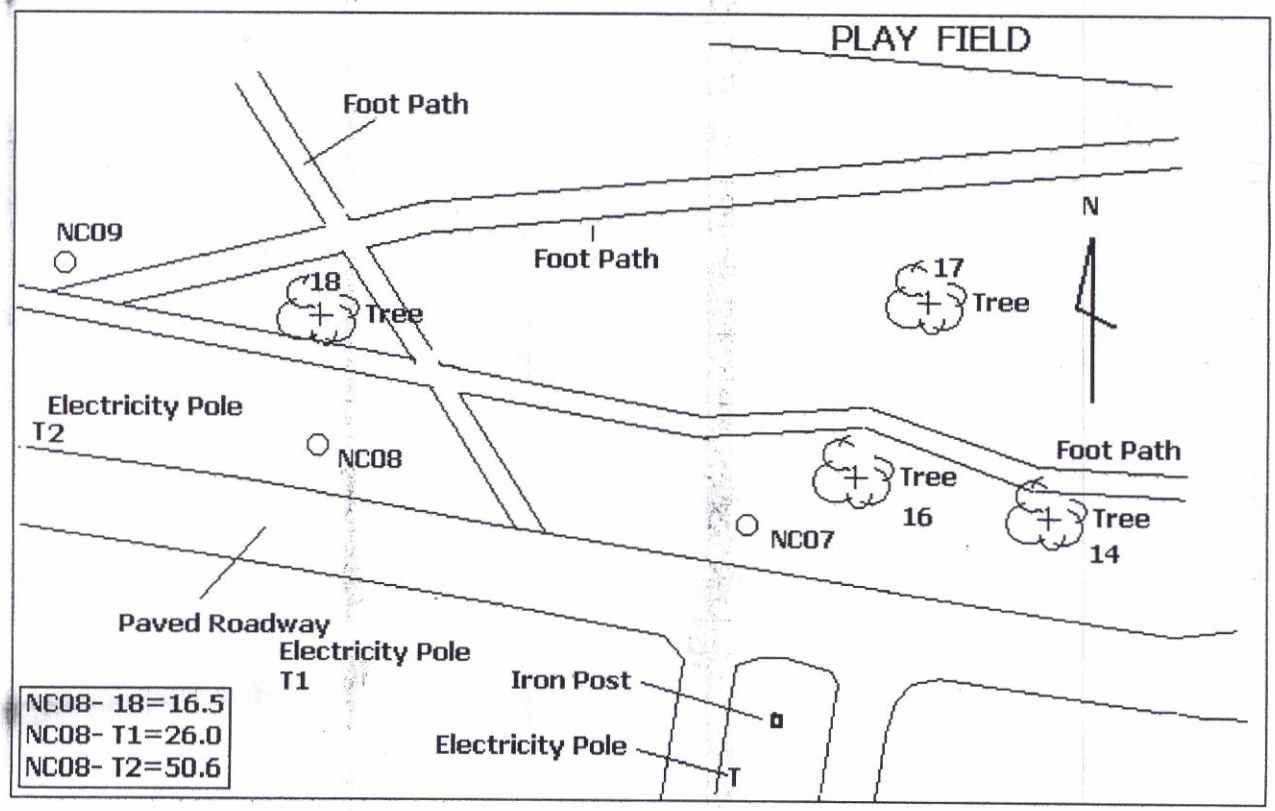


Station Identification: NC08 SEE SITE LOCATION MAP

Datum: WGS 84	Datum: JAD69(Clarke 1866)
Coordinates Latitude =17 59 04.61369 N Longitude = 76 47 19.18002 W Ellipsoidal Ht.= 30.661 m MSL Ht. = 44.406 m	**Coordinates** Latitude = 17 58 55.21633 N Longitude = 76 47 23.02990 W MSL Ht. = 44.406 m
	N = 148020.992 m E = 272271.160 m MSL Ht.= 44.406 m

Station is identified by a number stamped in brass disc embedded in top of monument. The monument is set flush with ground level and is easily accessible.

Sketch: NC08

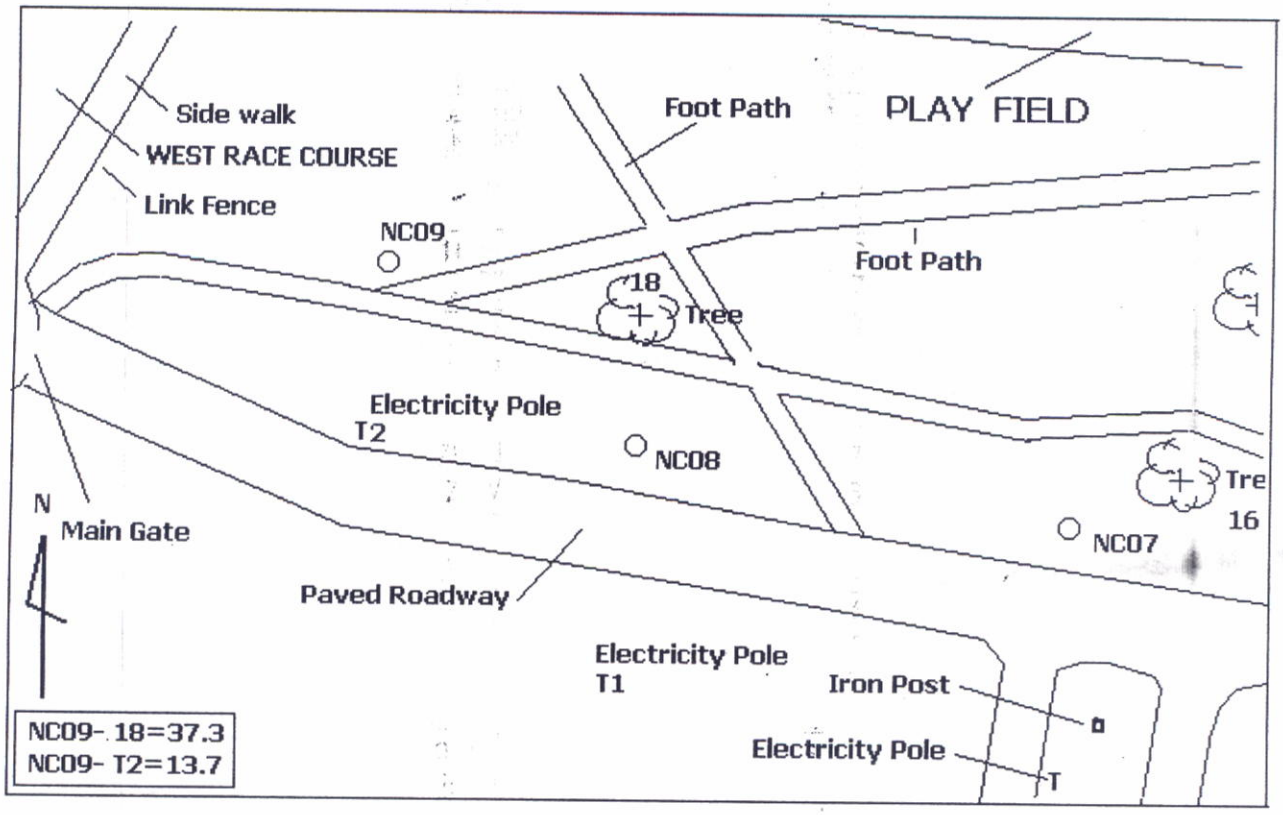


Station Identification: NC09 SEE SITE LOCATION MAP

Datum: WGS 84	Datum: JAD69(Clarke 1866)
Coordinates Latitude =17 59 05.53472 N Longitude = 76 47 20.61838 W Ellipsoidal Ht.= 30.674 m MSL Ht. = 44.423 m	**Coordinates** Latitude = 17 58 56.13744 N Longitude = 76 47 24.46820 W MSL Ht. = 44.423 m
	N = 148049.262 m E = 272228.811 m MSL Ht.= 44.423 m

Station is identified by a number stamped in brass disc embedded in top of monument. The monument is set flush with ground level and is easily accessible.

Sketch: NC09

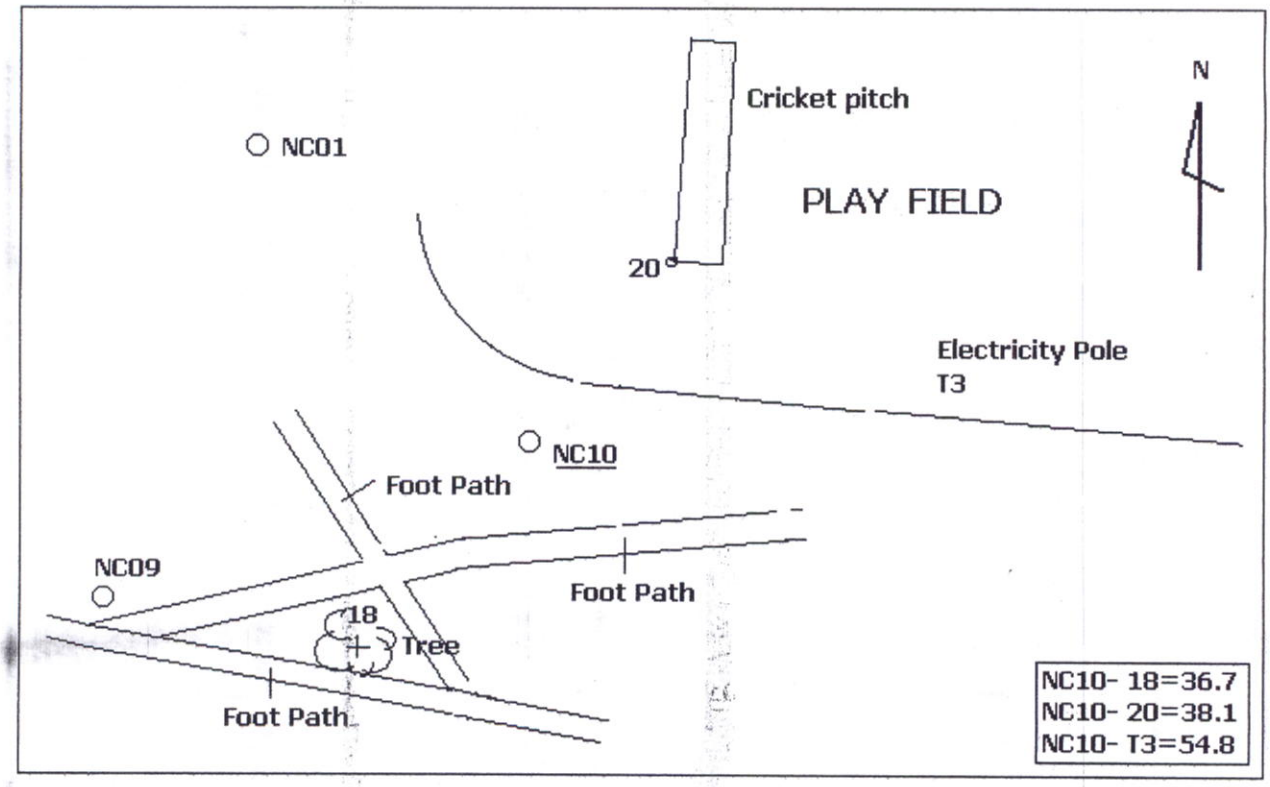


Station Identification: NC10	SEE SITE LOCATION MAP

Datum: WGS 84	**Datum: JAD69(Clarke 1866)**
Coordinates Latitude =17 59 06.07799 N Longitude = 76 47 18.74670 W Ellipsoidal Ht.= 31.748 m MSL Ht. = 45.478 m	**Coordinates** Latitude = 17 58 56.68071 N Longitude = 76 47 22.59657 W MSL Ht. = 45.478 m
	N = 148066.026 m E = 272283.858 m MSL Ht.= 45.478 m

Station is identified by a number stamped in brass disc embedded in top of monument. The monument is set flush with ground level and is easily accessible.

Sketch: NC10



APPENDIX 2

LIST OF TABLES

Summary Tables of Survey and Calibration Specifications

TABLE 1a. Specifications for Digital Cadastral Surveying: GPS

SPECIFICATIONS FOR DIGITAL CADASTRAL SURVEYING: GPS	
Component	**Criterion**
Equipment:	
1. GPS receiver , antenna, firmware and Software	Must satisfy standard by passing calibration Test
2. Base Receiver Configuration	
• PDOP mask	6
• Elevation mask	10 degrees
• SNR mask	6
• Logging interval	5 seconds 4 (3D solution) 1 hour

• Minimum no of satellites • Time interval of individual base files	
3. Rover Receiver Configuration • PDOP mask • Elevation mask • SNR mask • Logging interval • Minimum no of satellites • Minimum no of positions per occupation	6 15 degrees 6 5 secs. (postprocessing), 1 sec. (RT) 4 (3D solution) 12

TABLE 1b. Specifications for Digital Cadastral Surveying: GPS (cont.)

SPECIFICATIONS FOR DIGITAL CADASTRAL SURVEYING: GPS	
Component	**Criterion**
Field Survey: 1. Pre-and Post-Survey Checks 2. Multiple Occupation Test	At least two control points must be occupied At least 1 hour must be allowed between occupations Every point must be occupied at least twice
Office Computations:	

1. Differential Correction 2. Reference Coordinates	At least two base stations must be used Entered to 0.001" If Latitude and Longitude or To 0.01m if Easting and Northing, referenced to JAD69
3. Reference Elevation	Height above ellipsoid (GRS80), entered to 0.1m
Tolerances:	
1. Pre-survey Control Check	Processed position (mean) must be <0.5 metre from known position
2. Post-Survey Control Check	Processed position (mean) must be<0.5 metre from known position
3. Multiple Base Station Test	Difference in positions processed from two (min.) baselines must be <0.5 metre
4. Multiple Occupation Test	Difference in positions from two or more occupations must be <0.7 metre

TABLE 1c. Specifications for Digital Cadastral Surveying: EDM

SPECIFICATIONS FOR DIGITAL CADASTRAL SURVEYING: EDM	
Component	**Criterion**
Field Survey:	
1. Pre-and Post-Survey Checks 2. Range Accuracy 3. Vertical Angle 4. Azimuth	At least two control points must be occupied + or -0.1 metre + or -0.2 Degree + or -0.3 Degree
Office Computations:	
1. Reference Coordinates	Entered to 0.01m Easting and Northing, referenced to JAD69.

2. Reference Elevation	Height above ellipsoid (GRS80)
Tolerances:	
1. Pre-survey Control Check	Must be <0.1 metre from known distance
2. Post-Survey Control Check	Must be <0.1 metre from known distance

TABLE 2. Summary of Specifications for Calibration

SUMMARY OF SPECIFICATIONS FOR CALIBRATION	
Component	**Criterion**

GPS Test:	
1. Calibration Network	The ten calibration points established in the National Heroes Park must be used for calibration.
2. Field Procedure	At least 3 points must be occupied in 2 consecutive circuits.
3. Verification of Precision	Positions for all occupations must be computed with respect to two base stations. Difference in positions processed from minimum of two base stations must be <0.5 metre
4. Test for Systematic Error (bias)	Difference in positions from two or more occupations must be <0.7 metre Mean position of each calibration point from two base stations and four occupations must be <0.5 metre different from known position
EDM Test	Two known lines measured on different Vertical Angles. Difference on each line <0.1 metre
Tape Test	Two known lines measured on different zeroes. Difference on each line <0.1 metre

TABLE 3. Example of Multiple Base Line Test

SESSION 1

Point	From Base-line 1	From Base-line 2	Difference	Vector Sum	Criterion =<0.5m	Mean
S002	148055.408 N 272168.425 E	148055.512 N 272168.205 E	-0.104 0.220	0.243	O.K.	148055.460 N 272168.315 E

S003	148064.289 N 272230.687E	148064.575 N 272230.245 E	-0.286 0.442	**0.526**	**NO**	**Re-observe**
S004	148039.126 N 272299.187 E	148039.026 N 272298.900 E	0.100 0.287	0.304	O.K.	148039.076 N 272299.544 E
S006	147884.370 N 272289.360 E	147984.620 N 272389.265 E	0.250 0.095	0.267	O.K.	147884.495 N 272289.312 E
S007	147903.360 N 272225.734 E	147903.486 N 272225.924 E	0.126 0.190	0.228	O.K.	147903.423 N 272225.829 E

TABLE 4. Example of Multiple Occupation Test

SESSIONS 1 & 2

Point	Mean Base-line 1 Mean Base-line 2	Difference	Vector Sum	Criterion =<0.7m	Final Coordinates (Mean OF Sessions 1 & 2)
S002	148055.460 N 272168.315 E				
S002	148055.565 N 272168.445 E	-0.105 -0.130	0.167	O.K.	148055.513 N 272168.375 E
S003					
S003					
S004	148039.076 N 272299.544 E				
S004	148039.215 N 272299.507 E	-0.139 0.037	0.143	O.K.	148039.146 N 272299.526 E
S006	147884.495 N 272289.312 E				
S006	147884.670 N 272289.460 E	-0.175 -0.148	0.229	O.K.	147884.583 N 272289.386 E
S007	147903.423 N 272225.829 E				
S007	147903.160 N 272225.284 E	0.263 0.545	0.605	O.K.	147903.292 N 272225.557 E

APPENDIX 3

MODEL CALIBRATION CERTIFICATES

1. TAPE

ORIGINAL
No. SD-CM 01/2000

TAPE CHECK CERTIFCATE

This is to certify that Mr. John Jones

.....

Steel Tape No..S.D. 4071 (Yeron 100m)..... has been checked re the Land surveyors' Regulations, 1971, and the results are found to be as follows:-

Line	Network Measurement	Check Measurement	Difference	Remarks
NC01- NC02	41.073	41.071	0.002	O.K.
NC01- NC09	72.410	72.430	-0.020	O.K.
NC01- NC08	99.170	99.194	-0.024	O.K.
NC07- NC06	66.260	66.258	0.002	O.K.
NC08- NC10	46.790	46.798	-0.008	O.K.

Date of Check ..2000/ 03/02.....

Temperature ....N/A.....Fahrt.

Tension.....N/A.....lb

Tape supported throughout during check Max. Error permitted is 0.1m in any line.

.....

for the Director of Surveys

Date.....

DUPLICATE
No. SD-CM 01/2000

TAPE CHECK CERTIFCATE

This is to certify that Mr. John Jones

.....

Steel Tape No..S.D. 4071 (Yeron 100m)..... has been checked re the Land surveyors' Regulations, 1971, and the results are found to be as follows:-

Line	Network Measurement	Check Measurement	Difference	Remarks
NC01- NC02	41.073	41.071	0.002	O.K.
NC01- NC09	72.410	72.430	-0.020	O.K.
NC01- NC08	99.170	99.194	-0.024	O.K.
NC07- NC06	66.260	66.258	0.002	O.K.
NC08- NC10	46.790	46.798	-0.008	O.K.

Date of Check ..2000/ 03/02.....

Temperature ....N/A.....Fahrt.

Tension.....N/A.....lb

Tape supported throughout during check Max. Error permitted is 0.1m in any line.

.....

for the Director of Surveys

Date.....

2. ELECTRONIC DISTANCE MEASURING (EDM) EQUIPMENT

ORIGINAL
No. SD-EDM 01/2000

EDM CHECK CERTIFCATE

This is to certify that Mr. John Jones

.....

EDM No..Serial # 367183 (Leica Total Station)..... has been checked and the results are found to be as follows:-

Line	Network Measurement	Check Measurement	Difference	Remarks
NC01- NC02	41.073	41.067	0.006	O.K.
NC01- NC09	72.410	72.417	-0.007	O.K.
NC01- NC08	99.170	99.176	-0.006	O.K.
NC06- NC07	66.260	66.258	0.002	O.K.
NC08- NC10	46.790	46.794	-0.004	O.K.

Date of Check ..2000/ 03/02.....

Temperature ....N/A.....Fahrt.

Tension.....N/A.....lb

Error permitted is 0.1m in any line.

.....
for the Director of Surveys

Date.....

DUPLICATE
No. SD-EDM 01/2000

EDM CHECK CERTIFICATE

This is to certify that Mr. John Jones
.....

EDM No..Serial # 367183 (Leica Total Station)..... has been checked and the results are found to be as follows:-

Line	Network Measurement	Check Measurement	Difference	Remarks
NC01- NC02	41.073	41.067	0.006	O.K.
NC01- NC09	72.410	72.417	-0.007	O.K.
NC01- NC08	99.170	99.176	-0.006	O.K.
NC06- NC07	66.260	66.258	0.002	O.K.
NC08- NC10	46.790	46.794	-0.004	O.K.

Date of Check ..2000/ 03/02.....

Temperature ....N/A.....Fahrt.

Tension.....N/A.....lb

Error permitted is 0.1m in any line.

.....

for the Director of Surveys

Date.....

ORIGINAL
No. SD-EDM 02/2000

EDM CHECK CERTIFICATE

This is to certify that Mr. Survey Department

.....

.

EDM No..Serial # 010088 (Criterion Laser Ranger)..... has been checked and the results found to be as follows:-

Line	Network Measurement	Check Measurement	Difference	Remarks
NC01- NC02	41.073	41.09	-0.02	O.K.
NC01- NC09	72.410	72.45	-0.04	O.K.
NC01- NC08	99.170	99.21	-0.04	O.K.
NC06- NC07	66.260	66.27	-0.01	O.K.
NC08- NC10	46.790	46.79	0.00	O.K.

Date of Check ..2000/ 03/02.....

Temperature ....N/A.....Fahrt.

Tension.....N/A.....lb

Max. Error permitted is 0.1m in any line.

.....
for the Director of Surveys

Date.....

DUPLICATE
No. SD-EDM 02/2000

EDM CHECK CERTIFICATE

This is to certify that Mr. Survey Department
.....

EDM No..Serial # 010088 (Criterion Laser Ranger)..... has been checked and the results found to be as follows:-

Line	Network Measurement	Check Measurement	Difference	Remarks
NC01- NC02	41.073	41.09	-0.02	O.K.
NC01- NC09	72.410	72.45	-0.04	O.K.
NC01- NC08	99.170	99.21	-0.04	O.K.
NC06- NC07	66.260	66.27	-0.01	O.K.
NC08- NC10	46.790	46.79	0.00	O.K.

Date of Check ..2000/ 03/02.....

Temperature ....N/A.....Fahrt.

Tension.....N/A.....lb

Max. Error permitted is 0.1m in any line.

.....
for the Director of Surveys

Date.....

3. GLOBAL POSITIONING SYSTEM (GPS)

ORIGINAL
No. SD-GPS 01/2000

GPS CHECK CERTIFICATE

This is to certify that Mr. John Jones
.....

Receiver No..Serial # 04333 Ashtech Z-12
Antenna No...Serial #10626 Ashtech L1-L2

Datalogger No..Serial # N/A
Post-processing Software Ashtech WinPrism ..... have been checked and found to be as follows:-

SESSION 1

Point	Network Coordinates	Check Coordinates	Difference	Remarks
NC02	148155.40750 N 272268.42487 E			
NC03	148164.28911 N 272330.68739 E			
NC04	148139.12623 N 272399.18750 E			
NC06	147984.87017 N 272389.36203 E			
NC07	148003.35959 N 272325.73358 E			

SESSION 2

Point	Network Coordinates	Check Coordinates	Difference	Remarks
NC02	148155.40750 N 272268.42487 E			
NC03	148164.28911 N 272330.68739 E			
NC04	148139.12623 N 272399.18750 E			
NC06	147984.87017 N 272389.36203 E			
NC07	148003.35959 N 272325.73358 E			

Date of Check ..2000/ 03/02.....

Temperature ....N/A.....Fahrt.

Max. error permitted is 0.5m in any Session, and 0.7 for multiple Sessions.

.....
for the Director of Surveys

Date.....

DUPLICATE
No. SD-GPS 01/2000

GPS CHECK CERTIFICATE

This is to certify that Mr. John Jones
.....

Receiver No..Serial # 04333 Ashtech Z-12
Antenna No...Serial #10626 Ashtech L1-L2
Datalogger No..Serial # N/A

Post-processing Software Ashtech WinPrism ..... have been checked and found to be as follows:-

SESSION 1

Point	Network Coordinates	Check Coordinates	Difference	Remarks
NC02	148155.40750 N 272268.42487 E			
NC03	148164.28911 N 272330.68739 E			
NC04	148139.12623 N 272399.18750 E			
NC06	147984.87017 N 272389.36203 E			
NC07	148003.35959 N 272325.73358 E			

SESSION 2

Point	Network Coordinates	Check Coordinates	Difference	Remarks
NC02	148155.40750 N 272268.42487 E			
NC03	148164.28911 N 272330.68739 E			
NC04	148139.12623 N 272399.18750 E			
NC06	147984.87017 N 272389.36203 E			
NC07	148003.35959 N 272325.73358 E			

Date of Check ..2000/ 03/02.....

Temperature ....N/A.....Fahrt.

Max. error permitted is 0.5m in any Session, and 0.7 for multiple Sessions.

.....

for the Director of Surveys

Date.....

TRANSFORMATION PARAMETERS: WGS84 – JAD69

ΔX = 33.722 m
ΔY = -153.789 m
ΔZ = - 94.959 m
} Translations

RX = - 8.581 sec.
RY = - 4.478 sec.
RZ = 4.540 sec.
} Rotations

Sc = -8.95 ppm (Scale factor)

JAD69 (Clarke 1866)
a = 6378206.4000 m (Semi-Major Axis)
1/f = 294.9786982000 (Reciprocal flattening)

WGS 84
a = 6378137 m (Semi-Major Axis)
1/f = 298.257223563 (Reciprocal flattening)

Accuracy 0.3 m – 0.5 m

TRANSFORMATION PARAMETERS: WGS84 – JAD2001

ΔX = 0.000 m
ΔY = 0.000 m
ΔZ = 0.000 m
} Translations

RX = 0.000 sec.
RY = 0.000 sec.
RZ = 0.000 sec.
} Rotations

Sc = 0.000 ppm (Scale factor)

JAD2001

a = 6378137 m (Semi-Major Axis)
1/f = 298.257223563 (Reciprocal flattening)

Coordinate System Origin:

Latitude = 18 00 00 N
Longitude = 77 00 00 W

False Coordinates of Origin (Mapping); U TM Coordinates of Origin (Charts):

(a) Mapping

Northing = 650 000 m
Easting =750 000 m

Projection : Lambert Conical Orthomorphic with one standard parallel (18° N)

(b) Hydrographic and Aeronautical Charts:

U TM Coordinates of Origin

Northing = 1991327.9727 m
Easting = 288239.7295 m

Projection: Universal Transverse Mercator (UTM)

APPENDIX 5

(A) SUMMARY OF COMPUTATIONS FOR CALIBRATION NETWORK
(B) SUMMARY OF CALIBRATION CHECKS
(C) SITE LOCATION MAP OF CALIBRATION NETWORK
(D) CALIBRATION NETWORK MAPS

APPENDIX 6

SAMPLE CADASTRAL MAPS

APPENDIX 7

CADASTRAL TARGET AREAS

Survey Department, Jamaica Telephone (876) 9226630-5 Fax (876) 9671010
(Now Surveys and Mapping Division, National Land Agency)

NATIONAL CALIBRATION NETWORK

Project:	Calibration Network
Supervisor:	TLS
Date Created:	2/23/00 20:04
Date Last Accessed:	3/1/00 14:28
Project Directory:	C:\GPSURVEY\projects\Calibrat
Antenna Type:	Compact L1/L2 w/Ground Plane
Antenna Measurement Method:	Measured to bottom of notch on ground plane
Antenna Group:	GPSurvey
Receiver Type:	4700
Coordinate System:	Geographic
Zone:	WGS84
Linear Unit:	Meter
Timezone:	Jamaica : -5:00
Number of Stations:	13
Number of Baselines:	31
No. of Continuous Kinematic Solns:	0

SUMMARY OF COVARIANCES
NETWORK = Calibration
TIME = Wed Mar 1 14:04:58 2000

Definition of precision (E x S)ý = Cý + Pý:
Horizontal:
Precision (P) expressed as: ratio
Propagated linear error (E): U.S.
(standard error of adjusted horizontal distance)
Scalar (S) on propagated linear error: 1.0000
Constant error term (C): 0.0000
3-Dimensional:
Precision (P) expressed as: ratio
Propagated linear error (E): U.S.
(standard error of adjusted slope distance)
Scalar (S) on propagated linear error: 1.0000
Constant error term (C): 0.0000
Using orthometric height errors

FROM/ TO	AZIMUTH/ DELTA H	1.00å 1.00å	DISTANCE/ DELTA h	1.00å 1.00å	HOR PREC/ 3-D PREC
GPSD					
MKJB	-**-	-**-	-**-	-**-	-**-
	-31.8638m	0.0280m	-**-	-**-	-**-
GPSD					
MKJC	-**-	-**-	-**-	-**-	-**-
	-33.7196m	0.0257m	-**-	-**-	-**-
GPSD					
NC01	359ø03'46"	1.16"	1173.766m	0.0066m 1:	177668
	+10.9393m	0.0170m	-**-	-**- 1:	177668
GPSD					
NC02	359ø54'27"	1.27"	1210.889m	0.0072m 1:	167644
	+11.5791m	0.0193m	-**-	-**- 1:	167644
GPSD					
NC03	2ø49'50"	1.25"	1221.259m	0.0073m 1:	166894
	+12.6691m	0.0195m	-**-	-**- 1:	166894

GPSD NC04	6ø09'15" +11.7679m	1.15" 0.0164m	1201.531m -**-	0.0067m 1: -**- 1:	179068 179068
GPSD NC05	8ø12'58" +10.0131m	1.24" 0.0174m	1098.432m -**-	0.0065m 1: -**- 1:	168091 168091
GPSD NC06	6ø31'28" +8.8446m	1.34" 0.0180m	1047.132m -**-	0.0068m 1: -**- 1:	154551 154551
GPSD NC07	2ø59'33" +9.1696m	1.35" 0.0173m	1060.286m -**-	0.0071m 1: -**- 1:	149501 149501
GPSD NC08	0ø02'30" +9.3886m	1.30" 0.0179m	1076.473m -**-	0.0068m 1: -**- 1:	158294 158294
GPSD NC09	357ø50'43" +9.4012m	1.34" 0.0193m	1105.524m -**-	0.0072m 1: -**- 1:	154201 154201
GPSD NC10	0ø41'19" +10.4730m	1.35" 0.0193m	1121.587m -**-	0.0071m 1: -**- 1:	157095 157095
MKJB MKJC	-**- -1.8558m	-**- 0.0112m	-**- -**-	-**- -**-	-**- -**-
MKJB NC01	347ø43'33" +42.8032m	0.22" 0.0226m	6210.794m -**-	0.0067m 1: -**- 1:	930690 930690
MKJB NC02	347ø57'11" +43.4429m	0.25" 0.0241m	6243.603m -**-	0.0072m 1: -**- 1:	862497 862497
MKJB NC03	348ø31'45" +44.5329m	0.24" 0.0241m	6239.610m -**-	0.0074m 1: -**- 1:	842524 842524
MKJB NC04	349ø06'12" +43.6317m	0.22" 0.0233m	6201.638m -**-	0.0068m 1: -**- 1:	912844 912844

MKJB NC05	349ø10'20" +41.8769m	0.22" 0.0219m	6090.806m -**-	0.0066m 1: -**- 1:	916420 916420
MKJB NC06	348ø44'09" +40.7084m	0.23" 0.0228m	6052.145m -**-	0.0069m 1: -**- 1:	880798 880798
MKJB NC07	348ø10'55" +41.0334m	0.23" 0.0233m	6082.991m -**-	0.0072m 1: -**- 1:	841311 841311
MKJB NC08	347ø42'54" +41.2524m	0.23" 0.0228m	6111.630m -**-	0.0069m 1: -**- 1:	889775 889775
MKJB NC09	347ø23'08" +41.2650m	0.24" 0.0239m	6148.364m -**-	0.0072m 1: -**- 1:	850315 850315
MKJB NC10	347ø55'12" +42.3368m	0.25" 0.0241m	6152.970m -**-	0.0072m 1: -**- 1:	860286 860286
MKJC NC01	6ø46'17" +44.6589m	0.26" 0.0197m	5320.038m -**-	0.0066m 1: -**- 1:	811024 811024
MKJC NC02	6ø54'27" +45.2986m	0.29" 0.0214m	5359.104m -**-	0.0072m 1: -**- 1:	742014 742014
MKJC NC03	7ø33'17" +46.3887m	0.28" 0.0213m	5375.753m -**-	0.0073m 1: -**- 1:	737506 737506
MKJC NC04	8ø18'58" +45.4875m	0.26" 0.0205m	5360.287m -**-	0.0067m 1: -**- 1:	800234 800234
MKJC NC05	8ø47'21" +43.7327m	0.26" 0.0188m	5258.221m -**-	0.0065m 1: -**- 1:	805084 805084
MKJC NC06	8ø27'17" +42.5642m	0.27" 0.0199m	5206.247m -**-	0.0068m 1: -**- 1:	769620 769620
MKJC	7ø44'00"	0.28"	5215.594m	0.0070m 1:	740771

NC07					
	+42.8892m	0.0204m	-**-	-**- 1:	740771
MKJC					
NC08	7ø06'52"	0.27"	5226.028m	0.0068m 1:	773084
	+43.1081m	0.0199m	-**-	-**- 1:	773084
MKJC					
NC09	6ø37'03"	0.29"	5249.032m	0.0071m 1:	737312
	+43.1208m	0.0211m	-**-	-**- 1:	737312
MKJC					
NC10	7ø11'27"	0.29"	5272.292m	0.0071m 1:	738271
	+44.1926m	0.0214m	-**-	-**- 1:	738271
NC01					
NC02	24ø49'25"	15.64"	41.073m	0.0033m 1:	12436
	+0.6397m	0.0095m	-**-	-**- 1:	12436
NC01					
NC03	59ø51'41"	7.33"	91.934m	0.0033m 1:	28006
	+1.7297m	0.0100m	-**-	-**- 1:	28006
NC01					
NC04	81ø55'32"	5.95"	149.488m	0.0033m 1:	44709
	+0.8285m	0.0079m	-**-	-**- 1:	44709
NC01					
NC05	116ø08'18"	1.54"	196.241m	0.0015m 1:	130923
	-0.9262m	0.0059m	-**-	-**- 1:	130923
NC01					
NC06	133ø57'41"	2.44"	191.969m	0.0023m 1:	83324
	-2.0947m	0.0068m	-**-	-**- 1:	83324
NC01					
NC07	146ø59'35"	4.66"	136.858m	0.0046m 1:	29602
	-1.7698m	0.0078m	-**-	-**- 1:	29602
NC01					
NC08	168ø22'40"	4.47"	99.170m	0.0022m 1:	45280
	-1.5508m	0.0063m	-**-	-**- 1:	45280
NC01					
NC09	197ø59'43"	9.14"	72.410m	0.0031m 1:	23522
	-1.5381m	0.0097m	-**-	-**- 1:	23522
NC01					
NC10	147ø54'21"	12.03"	61.503m	0.0027m 1:	22377
	-0.4663m	0.0095m	-**-	-**- 1:	22377

NC03 NC08	202ø33'31" -3.2805m	5.14" 0.0112m	155.169m -**-	0.0037m 1: -**- 1:	41454 41454
NC03 NC09	221ø31'49" -3.2679m	4.02" 0.0089m	153.656m -**-	0.0030m 1: -**- 1:	51372 51372
NC03 NC10	205ø28'51" -2.1961m	8.48" 0.0134m	108.851m -**-	0.0045m 1: -**- 1:	24056 24056
NC04 NC05	165ø18'40" -1.7548m	6.00" 0.0082m	111.079m -**-	0.0044m 1: -**- 1:	25208 25208
NC04 NC06	183ø38'40" -2.9233m	5.46" 0.0096m	154.569m -**-	0.0046m 1: -**- 1:	33935 33935
NC04 NC07	208ø24'53" -2.5983m	5.04" 0.0068m	154.363m -**-	0.0032m 1: -**- 1:	47595 47595
NC04 NC08	227ø18'06" -2.3793m	5.70" 0.0094m	174.203m -**-	0.0037m 1: -**- 1:	46796 46796
NC04 NC09	242ø11'27" -2.3667m	5.74" 0.0119m	192.623m -**-	0.0043m 1: -**- 1:	44501 44501
NC04 NC10	237ø37'54" -1.2949m	7.83" 0.0120m	136.545m -**-	0.0047m 1: -**- 1:	29202 29202
NC05 NC06	219ø03'54" -1.1685m	7.58" 0.0065m	60.285m -**-	0.0022m 1: -**- 1:	27683 27683
NC05 NC07	254ø25'44" -0.8435m	8.92" 0.0081m	105.492m -**-	0.0032m 1: -**- 1:	32766 32766
NC05 NC08	266ø05'12" -0.6246m	2.91" 0.0066m	156.559m -**-	0.0022m 1: -**- 1:	70688 70688
NC05	275ø03'41"	3.21"	199.320m	0.0032m 1:	61662

NC09	-0.6119m	0.0097m	-**-	-**- 1:	61662
NC05	283ø27'42"	4.53"	147.549m	0.0034m 1:	43642
NC10	+0.4599m	0.0102m	-**-	-**- 1:	43642
NC06	286ø12'11"	13.61"	66.260m	0.0044m 1:	14957
NC07	+0.3250m	0.0095m	-**-	-**- 1:	14957
NC06	286ø59'35"	2.98"	123.598m	0.0018m 1:	68712
NC08	+0.5440m	0.0050m	-**-	-**- 1:	68712
NC06	291ø51'15"	4.38"	172.982m	0.0038m 1:	45651
NC09	+0.5566m	0.0110m	-**-	-**- 1:	45651
NC06	307ø34'06"	6.23"	133.106m	0.0036m 1:	36924
NC10	+1.6284m	0.0112m	-**-	-**- 1:	36924
NC07	287ø54'21"	15.48"	57.351m	0.0044m 1:	12899
NC08	+0.2190m	0.0094m	-**-	-**- 1:	12899
NC07	295ø20'32"	8.99"	107.242m	0.0052m 1:	20712
NC09	+0.2316m	0.0118m	-**-	-**- 1:	20712
NC07	326ø14'53"	12.75"	75.370m	0.0053m 1:	14190
NC10	+1.3034m	0.0119m	-**-	-**- 1:	14190
NC08	303ø43'28"	14.78"	50.917m	0.0037m 1:	13630
NC09	+0.0126m	0.0109m	-**-	-**- 1:	13630
NC08	15ø44'49"	16.80"	46.790m	0.0037m 1:	12509
NC10	+1.0844m	0.0110m	-**-	-**- 1:	12509
NC09	73ø03'44"	14.62"	57.543m	0.0047m 1:	12213
NC10	+1.0718m	0.0132m	-**-	-**- 1:	12213

NATIONAL CALIBRATION NETWORK

**** Reference Coordinates ****

Station Short Name	Station ID	Latitude	Longitude	Height	Station Quality
NC05	NC05	17°59'04.95552" N	076°47'13.87062" W	31.28879	Network Adjustment
NC01	NC01	17°59'07.77391" N	076°47'19.85541" W	32.21598	Network Adjustment
MKJC	1907MKJC	17°56'15.96262" N	076°47'41.37110" W	-12.71400	Fixed Control
MKJB	6072MKJB	17°55'50.32829" N	076°46'35.22066" W	-10.86000	Fixed Control
NC07	6072NC07	17°59'04.03820" N	076°47'17.32580" W	30.44272	Network Adjustment
NC09	6072NC09	17°59'05.53472" N	076°47'20.61838" W	30.67397	Network Adjustment
NC10	6072NC10	17°59'06.07799" N	076°47'18.74670" W	31.74783	Network Adjustment
GPSD	6072GPSD	17°58'29.60031" N	076°47'19.24794" W	21.21350	Fixed Control
NC06	6072NC06	17°59'03.43445" N	076°47'15.16375" W	30.11723	Network Adjustment
NC08	6072NC08	17°59'04.61369" N	076°47'19.18002" W	30.66071	Network Adjustment
NC04	1907NC04	17°59'08.45150" N	076°47'14.82395" W	33.04943	Network Adjustment
NC03	NC03	17°59'09.27241" N	076°47'17.15124" W	33.94936	Network Adjustment
NC02	1907	17°59'08.98580" N	076°47'19.26789" W	32.85790	Network Adjustment

**** Adjusted Coordinates ****

Projection Group: Geographic
Zone Name: Global
Linear Units: meter
Angular Units: degrees
Datum Name: JAD69

Station Short Name	Station ID	Latitude	Longitude	Ortho. Height	Ellip. Height
GPSD	6072GPSD	17°58'20.20101" N	076°47'23.09794" W	0.00000	21.21350
MKJB	6072MKJB	17°55'40.92038" N	076°46'39.07494" W	0.00000	-10.65033
MKJC	1907MKJC	17°56'06.55679" N	076°47'45.22314" W	0.00000	-12.50608
NC01	NC01	17°58'58.37673" N	076°47'23.70521" W	0.00000	32.15284
NC02	1907	17°58'59.58867" N	076°47'23.11769" W	0.00000	32.79256
NC03	NC03	17°58'59.87527" N	076°47'21.00110" W	0.00000	33.88257
NC04	1907NC04	17°58'59.05424" N	076°47'18.67383" W	0.00000	32.98137
NC05	NC05	17°58'55.55811" N	076°47'17.72065" W	0.00000	31.22662
NC06	6072NC06	17°58'54.03698" N	076°47'19.01376" W	0.00000	30.05809
NC07	6072NC07	17°58'54.64076" N	076°47'21.17570" W	0.00000	30.38307
NC08	6072NC08	17°58'55.21633" N	076°47'23.02990" W	0.00000	30.60206
NC09	6072NC09	17°58'56.13744" N	076°47'24.46820" W	0.00000	30.61469
NC10	6072NC10	17°58'56.68071" N	076°47'22.59657" W	0.00000	31.68651

NATIONAL CALIBRATION NETWORK

From Station Short Name	To Station Short Name	Solution Type	Slope	Ratio	Reference Variance	Entered Ant. Ht. (From)	Entered Ant. Ht. (To)
MKJB	MKJC	L1 fixed	2100.210	34.6	1.847	1.565	1.497
MKJC	NC05	L1 fixed	5258.407	21.2	4.780	1.497	1.512
NC01	GPSD	L1 fixed	1173.824	12.1	8.602	1.554	1.172
NC01	NC03	L1 fixed	91.952	13.5	2.903	1.512	1.550
NC01	NC04	L1 fixed	149.492	15.5	2.961	1.512	1.549
NC01	NC06	L1 fixed	191.975	25.7	2.215	1.512	1.561
NC01	NC07	L1 fixed	136.869	17.6	2.693	1.512	1.581
NC01	NC08	L1 fixed	99.199	52.2	1.209	1.466	1.520
NC01	NC08	L1 fixed	99.174	82.2	2.123	1.512	1.502
NC01	NC09	L1 fixed	72.426	13.4	2.338	1.512	1.582
NC02	NC01	L1 fixed	41.079	16.9	2.070	1.469	1.512
NC02	NC05	L1 fixed	201.419	22.1	2.617	1.469	1.601
NC04	GPSD	L1 fixed	1201.589	237.7	6.322	1.538	1.172
NC05	MKJC	L1 fixed	5258.405	13.9	7.255	1.512	1.497
NC05	NC01	L1 fixed	196.244	34.9	1.213	1.601	1.512
NC05	NC01	L1 fixed	196.242	27.0	3.868	1.512	1.554
NC05	NC01	L1 fixed	196.245	132.7	0.787	1.512	1.554
NC05	NC03	L1 fixed	164.127	29.5	2.886	1.601	1.550
NC05	NC04	L1 fixed	111.092	52.6	3.631	1.601	1.549
NC05	NC06	L1 fixed	60.296	64.4	2.248	1.601	1.561
NC05	NC07	L1 fixed	105.495	12.6	3.151	1.601	1.581
NC05	NC08	L1 fixed	156.558	31.2	2.942	1.601	1.502
NC05	NC09	L1 fixed	199.322	32.5	2.590	1.601	1.582
NC06	NC05	L1 fixed	60.294	41.6	1.723	1.554	1.537
NC07	NC04	L1 fixed	154.386	23.1	1.105	1.581	1.549
NC08	NC06	L1 fixed	123.603	184.9	0.717	1.520	1.554
NC08	NC06	L1 fixed	123.597	155.6	1.001	1.502	1.561
NC09	NC03	L1 fixed	153.691	50.4	1.202	1.582	1.550
NC10	NC01	L1 fixed	61.504	18.8	2.061	1.602	1.512
NC10	NC02	L1 fixed	90.711	28.5	1.141	1.602	1.469
NC10	NC05	L1 fixed	147.549	22.5	2.476	1.602	1.601

NATIONAL CALIBRATION NETWORK

**** SSF/SSK Solution Output Files For Selected Baselines ****

.ssf/.ssk Solution Output File	From Station Short Name	To Station Short Name	Solution Type	Slope	Ratio	Reference Variance
00000631.ssf	MKJB	MKJC	L1 fixed	2100.210	34.6	1.847
00000635.ssf	MKJC	NC05	L1 fixed	5258.407	21.2	4.780
00000655.ssf	NC01	GPSD	L1 fixed	1173.824	12.1	8.602
00000614.ssf	NC01	NC03	L1 fixed	91.952	13.5	2.903
00000622.ssf	NC01	NC04	L1 fixed	149.492	15.5	2.961
00000627.ssf	NC01	NC06	L1 fixed	191.975	25.7	2.215
00000618.ssf	NC01	NC07	L1 fixed	136.869	17.6	2.693
00000537.ssf	NC01	NC08	L1 fixed	99.199	52.2	1.209
00000626.ssk	NC01	NC08	L1 fixed	99.174	82.2	2.123
00000610.ssf	NC01	NC09	L1 fixed	72.426	13.4	2.338
00000581.ssf	NC02	NC01	L1 fixed	41.079	16.9	2.070
00000577.ssf	NC02	NC05	L1 fixed	201.419	22.1	2.617
00000643.ssf	NC04	GPSD	L1 fixed	1201.589	237.7	6.322
00000671.ssf	NC05	MKJC	L1 fixed	5258.405	13.9	7.255
00000585.ssf	NC05	NC01	L1 fixed	196.244	34.9	1.213
00000639.ssf	NC05	NC01	L1 fixed	196.242	27.0	3.868
00000667.ssf	NC05	NC01	L1 fixed	196.245	132.7	0.787
00000593.ssf	NC05	NC03	L1 fixed	164.127	29.5	2.886
00000601.ssf	NC05	NC04	L1 fixed	111.092	52.6	3.631
00000609.ssk	NC05	NC06	L1 fixed	60.296	64.4	2.248
00000597.ssf	NC05	NC07	L1 fixed	105.495	12.6	3.151
00000605.ssf	NC05	NC08	L1 fixed	156.558	31.2	2.942
00000589.ssf	NC05	NC09	L1 fixed	199.322	32.5	2.590
00000545.ssf	NC06	NC05	L1 fixed	60.294	41.6	1.723
00000561.ssf	NC07	NC04	L1 fixed	154.386	23.1	1.105
00000541.ssf	NC08	NC06	L1 fixed	123.603	184.9	0.717
00000565.ssf	NC08	NC06	L1 fixed	123.597	155.6	1.001
00000557.ssf	NC09	NC03	L1 fixed	153.691	50.4	1.202
00000573.ssf	NC10	NC01	L1 fixed	61.504	18.8	2.061
00000553.ssf	NC10	NC02	L1 fixed	90.711	28.5	1.141
00000569.ssf	NC10	NC05	L1 fixed	147.549	22.5	2.476

Calibration Network

**** Reference Coordinates ****

Station Short Name	Station ID	Latitude	Longitude	Height	Station Quality
NC05	NC05	17°59'04.95552" N	076°47'13.87062" W	31.28879	Network Adjustment
NC01	NC01	17°59'07.77391" N	076°47'19.85541" W	32.21598	Network Adjustment
MKJC	1907MKJC	17°56'15.96262" N	076°47'41.37110" W	-12.71400	Fixed Control
MKJB	6072MKJB	17°55'50.32829" N	076°46'35.22066" W	-10.86000	Fixed Control
NC07	6072NC07	17°59'04.03820" N	076°47'17.32580" W	30.44272	Network Adjustment
NC09	6072NC09	17°59'05.53472" N	076°47'20.61838" W	30.67397	Network Adjustment
NC10	6072NC10	17°59'06.07799" N	076°47'18.74670" W	31.74783	Network Adjustment
GPSD	6072GPSD	17°58'29.60031" N	076°47'19.24794" W	21.21350	Fixed Control
NC06	6072NC06	17°59'03.43445" N	076°47'15.16375" W	30.11723	Network Adjustment
NC08	6072NC08	17°59'04.61369" N	076°47'19.18002" W	30.66071	Network Adjustment
NC04	1907NC04	17°59'08.45150" N	076°47'14.82395" W	33.04943	Network Adjustment
NC03	NC03	17°59'09.27241" N	076°47'17.15124" W	33.94936	Network Adjustment
NC02	1907	17°59'08.98580" N	076°47'19.26789" W	32.85790	Network Adjustment

**** Adjusted Coordinates ****

Projection Group: User-defined Lambert
Zone Name: JAD69_co
Linear Units: meter
Angular Units: degrees
Datum Name: JAD69

Station Short Name	Station ID	North	East	Ortho. Height	Ellip. Height
GPSD	6072GPSD	146944.52000	272270.37900	0.00000	21.21350
MKJB	6072MKJB	142049.30780	273571.54630	0.00000	-10.65033
MKJC	1907MKJC	142835.20060	271623.91120	0.00000	-12.50608
NC01	NC01	148118.12946	272251.18140	0.00000	32.15284
NC02	1907	148155.40750	272268.42487	0.00000	32.79256
NC03	NC03	148164.28911	272330.68739	0.00000	33.88257
NC04	1907NC04	148139.12623	272399.18750	0.00000	32.98137
NC05	NC05	148031.67737	272427.35386	0.00000	31.22662
NC06	6072NC06	147984.87017	272389.36203	0.00000	30.05809
NC07	6072NC07	148003.35959	272325.73358	0.00000	30.38307
NC08	6072NC08	148020.99240	272271.16023	0.00000	30.60206
NC09	6072NC09	148049.26175	272228.81130	0.00000	30.61469
NC10	6072NC10	148066.02589	272283.85839	0.00000	31.68651

Calibration Network

From Station Short Name	To Station Short Name	Solution Type	Slope	Ratio	Reference Variance	Entered Ant. Ht. (From)	Entered Ant. Ht. (To)
MKJB	MKJC	L1 fixed	2100.210	34.6	1.847	1.565	1.497
MKJC	NC05	L1 fixed	5258.407	21.2	4.780	1.497	1.512
NC01	GPSD	L1 fixed	1173.824	12.1	8.602	1.554	1.172
NC01	NC03	L1 fixed	91.952	13.5	2.903	1.512	1.550
NC01	NC04	L1 fixed	149.492	15.5	2.961	1.512	1.549
NC01	NC06	L1 fixed	191.975	25.7	2.215	1.512	1.561
NC01	NC07	L1 fixed	136.869	17.6	2.693	1.512	1.581
NC01	NC08	L1 fixed	99.199	52.2	1.209	1.466	1.520
NC01	NC08	L1 fixed	99.174	82.2	2.123	1.512	1.502
NC01	NC09	L1 fixed	72.426	13.4	2.338	1.512	1.582
NC02	NC01	L1 fixed	41.079	16.9	2.070	1.469	1.512
NC02	NC05	L1 fixed	201.419	22.1	2.617	1.469	1.601
NC04	GPSD	L1 fixed	1201.589	237.7	6.322	1.538	1.172
NC05	MKJC	L1 fixed	5258.405	13.9	7.255	1.512	1.497
NC05	NC01	L1 fixed	196.244	34.9	1.213	1.601	1.512
NC05	NC01	L1 fixed	196.242	27.0	3.868	1.512	1.554
NC05	NC01	L1 fixed	196.245	132.7	0.787	1.512	1.554
NC05	NC03	L1 fixed	164.127	29.5	2.886	1.601	1.550
NC05	NC04	L1 fixed	111.092	52.6	3.631	1.601	1.549
NC05	NC06	L1 fixed	60.296	64.4	2.248	1.601	1.561
NC05	NC07	L1 fixed	105.495	12.6	3.151	1.601	1.581
NC05	NC08	L1 fixed	156.558	31.2	2.942	1.601	1.502
NC06	NC09	L1 fixed	199.322	32.5	2.590	1.601	1.582
NC07	NC05	L1 fixed	60.294	41.6	1.723	1.554	1.537
NC08	NC04	L1 fixed	154.386	23.1	1.105	1.581	1.549
NC08	NC06	L1 fixed	123.603	184.9	0.717	1.520	1.554
NC09	NC06	L1 fixed	123.597	155.6	1.001	1.502	1.561
NC10	NC03	L1 fixed	153.691	50.4	1.202	1.582	1.550
NC10	NC01	L1 fixed	61.504	18.8	2.061	1.602	1.512
NC10	NC02	L1 fixed	90.711	28.5	1.141	1.602	1.469
	NC05	L1 fixed	147.549	22.5	2.476	1.602	1.601

Calibration Network

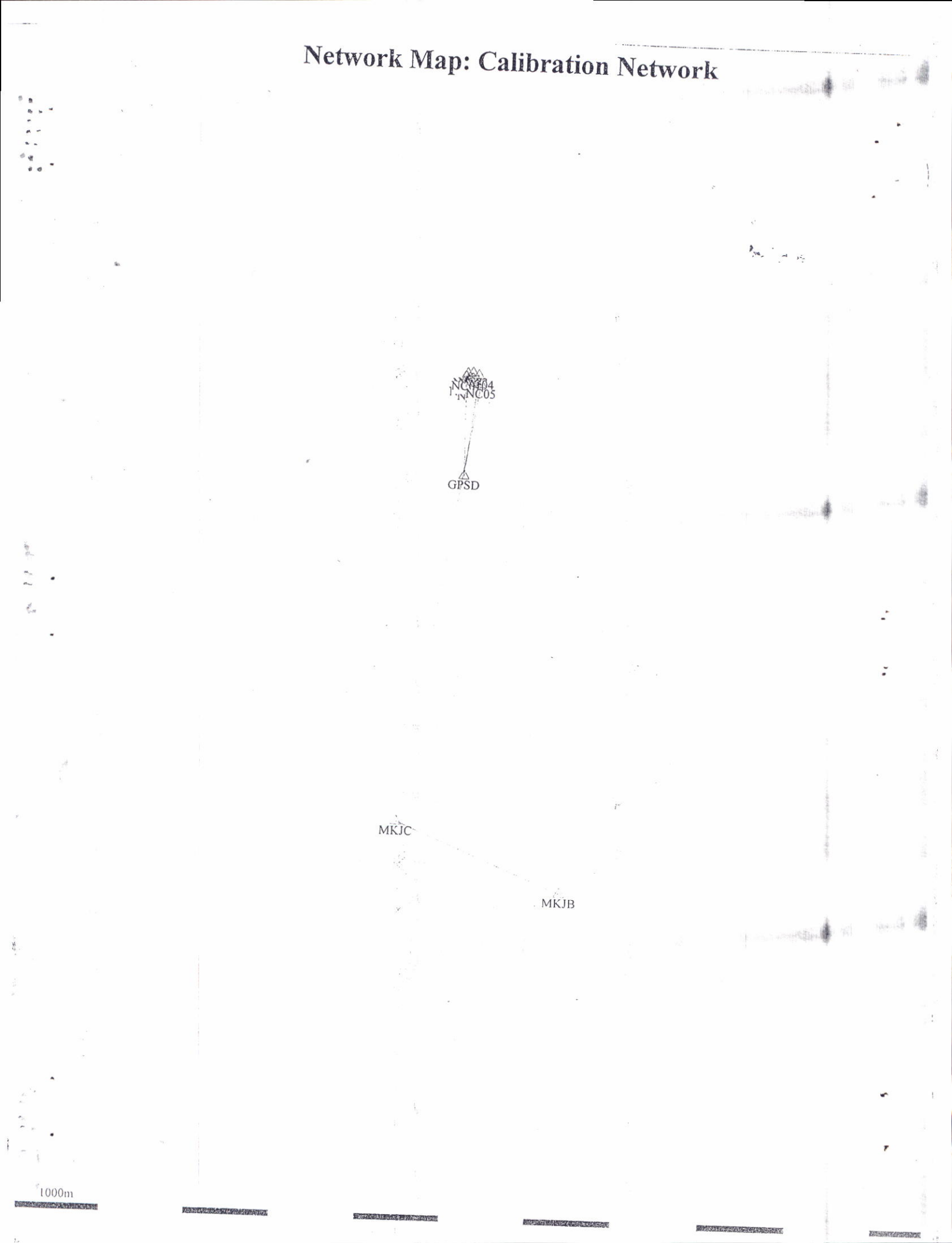
**** SSF/SSK Solution Output Files For Selected Baselines ****

.ssf/.ssk Solution Output File	From Station Short Name	To Station Short Name	Solution Type	Slope	Ratio	Reference Variance
00000631.ssf	MKJB	MKJC	L1 fixed	2100.210	34.6	1.847
00000635.ssf	MKJC	NC05	L1 fixed	5258.407	21.2	4.780
00000655.ssf	NC01	GPSD	L1 fixed	1173.824	12.1	8.602
00000614.ssf	NC01	NC03	L1 fixed	91.952	13.5	2.903
00000622.ssf	NC01	NC04	L1 fixed	149.492	15.5	2.961
00000627.ssf	NC01	NC06	L1 fixed	191.975	25.7	2.215
00000618.ssf	NC01	NC07	L1 fixed	136.869	17.6	2.693
00000537.ssf	NC01	NC08	L1 fixed	99.199	52.2	1.209
00000626.ssk	NC01	NC08	L1 fixed	99.174	82.2	2.123
00000610.ssf	NC01	NC09	L1 fixed	72.426	13.4	2.338
00000581.ssf	NC02	NC01	L1 fixed	41.079	16.9	2.070
00000577.ssf	NC02	NC05	L1 fixed	201.419	22.1	2.617
00000643.ssf	NC04	GPSD	L1 fixed	1201.589	237.7	6.322
00000671.ssf	NC05	MKJC	L1 fixed	5258.405	13.9	7.255
00000585.ssf	NC05	NC01	L1 fixed	196.244	34.9	1.213
00000639.ssf	NC05	NC01	L1 fixed	196.242	27.0	3.868
00000667.ssf	NC05	NC01	L1 fixed	196.245	132.7	0.787
00000593.ssf	NC05	NC03	L1 fixed	164.127	29.5	2.886
00000601.ssf	NC05	NC04	L1 fixed	111.092	52.6	3.631
00000609.ssk	NC05	NC06	L1 fixed	60.296	64.4	2.248
00000597.ssf	NC05	NC07	L1 fixed	105.495	12.6	3.151
00000605.ssf	NC05	NC08	L1 fixed	156.558	31.2	2.942
00000589.ssf	NC05	NC09	L1 fixed	199.322	32.5	2.590
00000545.ssf	NC06	NC05	L1 fixed	60.294	41.6	1.723
00000561.ssf	NC07	NC04	L1 fixed	154.386	23.1	1.105
00000541.ssf	NC08	NC06	L1 fixed	123.603	184.9	0.717
00000565.ssf	NC08	NC06	L1 fixed	123.597	155.6	1.001
00000557.ssf	NC09	NC03	L1 fixed	153.691	50.4	1.202
00000573.ssf	NC10	NC01	L1 fixed	61.504	18.8	2.061
00000553.ssf	NC10	NC02	L1 fixed	90.711	28.5	1.141
00000569.ssf	NC10	NC05	L1 fixed	147.549	22.5	2.476

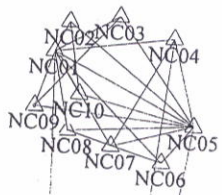
LOCATION MAP: NATIONAL CALIBRATION NETWORK
SCALE 1: 2000

SOURCE: MAPPING OF KINGSTON - SHEET 18G43 (1991 PHOTOGRAPHY)
SURVEY DEPARTMENT, KINGSTON, JAMAICA

Network Map: Calibration Network

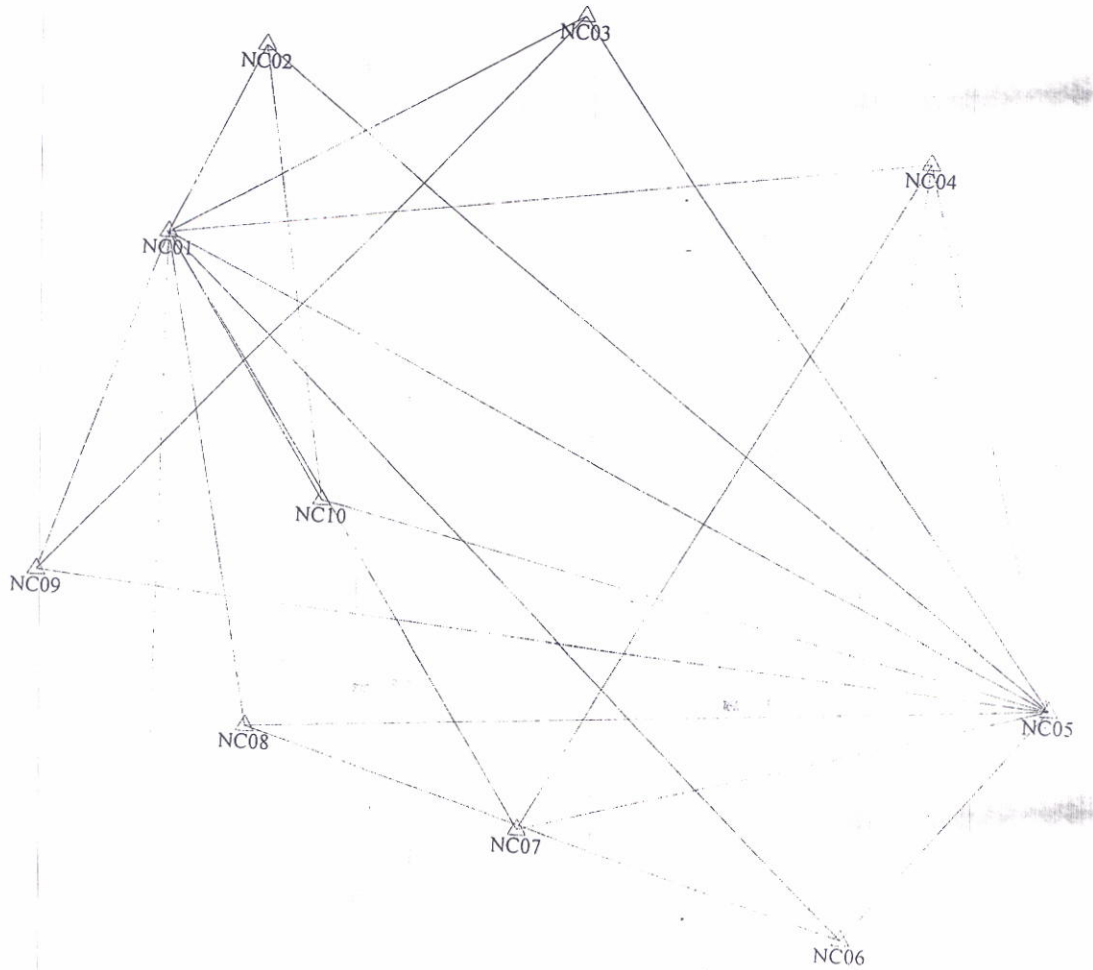


Network Map: Calibration Network



200m

Network Map: Calibration Network



20m

APPENDIX 6

SAMPLE CADASTRAL MAPS

SAMPLE MAP: EXTRACT OF CADASTRAL MAP

(PART OF ELTHAM AND ENVIRONS, ST. CATHERINE, JAMAICA)

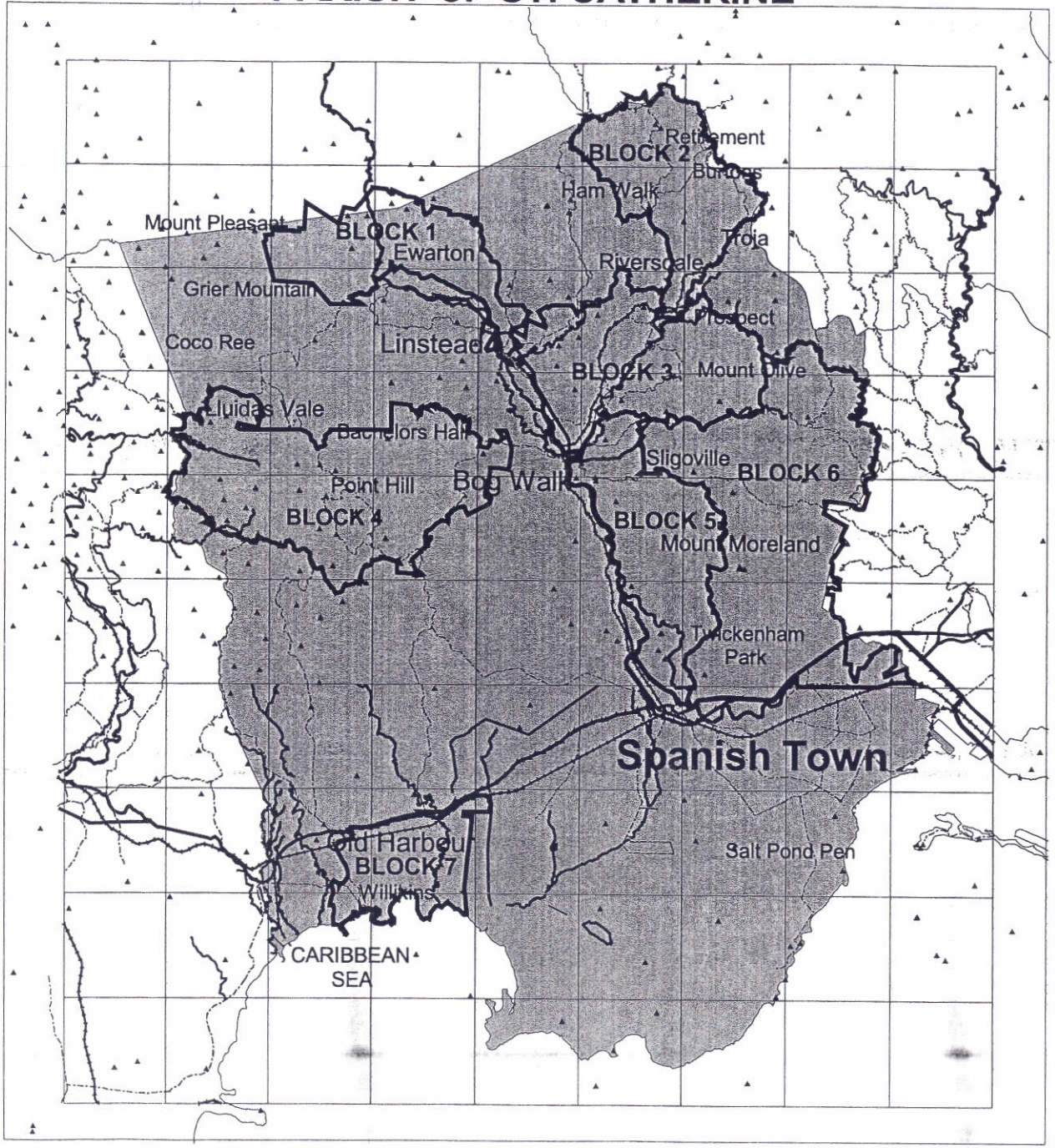
SCALE 1:1000

PREPARED BY SURVEY DEPARTMENT, JAMAICA

SAMPLE MAP: EXTRACT OF CADASTRAL MAP

(PART OF ELTHAM AND ENVIRONS, ST. CATHERINE, JAMAICA)

PARISH of ST. CATHERINE



LAND ADMINISTRATION AND MANAGEMENT PROGRAMME (LAMP)

LAND REGISTRATION COMPONENT

LEGEND

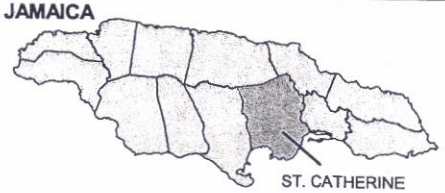
N W E S

- Control Point
- Class A Road
- Class B Road
- Railway
- River

CADASTRAL TARGET AREAS

Blocks	*Total Parcels per Block*
1	*2510*
2	*4603*
3	*5209*
4	*6651*
5	*7004*
6	*6554*
7	*1834*
Total Parcels	**34365**

JAMAICA



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